California Regional Water Quality Control Board
San Diego Region

Technical Report
for
Total Maximum Daily Load for Diazinon in Chollas Creek Watershed San Diego County

Final

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Executive Summary

Chollas Creek is an urban creek located within the County of San Diego. The Chollas Creek watershed, which is relatively small and highly urbanized, drains a portion of downtown San Diego and is directly tributary to San Diego Bay. See Attachment A for Chollas Creek vicinity and watershed maps. The predominant land use in the watershed is residential. Flows in Chollas Creek are highly variable and storm dependent.

There is conclusive evidence that diazinon is causing acute and chronic toxicity to aquatic life in Chollas Creek. Municipal storm water is believed to be the primary source of diazinon entering Chollas Creek. Diazinon is a highly effective organophosphate pesticide common in indoor residential, landscape, and agricultural applications. Urban storm water flows are the primary source of diazinon to Chollas Creek . The average current concentration of diazinon in Chollas Creek during storm events is 0.46 µg/L.

Toxicity in Chollas Creek due to diazinon occurs predominantly during storm events and was in part the basis for the 1996 Clean Water Act Section 303(d) listing of Chollas Creek for "toxicity in storm water". A portion of the toxicity in Chollas Creek during storm events is due to metals. Federal law requires the Regional Board to develop a Total Maximum Daily Load (TMDL) for waters on the Section 303(d) list. The purpose of a TMDL is to attain applicable water quality objectives and restore the beneficial uses of "impaired" waters. A separate TMDL is being developed to address metal induced storm water toxicity in Chollas Creek.

The purpose of this TMDL is to reduce diazinon concentrations in Chollas Creek as needed to attain the narrative Basin Plan water quality objectives for "Toxicity" and "Pesticides" and to restore the "warm freshwater habitat" (WARM) and "wildlife habitat" (WILD) beneficial uses of Chollas Creek.

Because aquatic toxicity is the most significant adverse effect of diazinon and because aquatic toxicity is a function of water column concentrations, this TMDL is a concentration-based, rather than mass emission-based, TMDL. The Numeric Targets, TMDL (Loading Capacity), and Waste Load and Load Allocations are all defined in terms of concentrations.

The Regional Board has set the Numeric Targets and the TMDL (Loading Capacity) equal to the California Department of Fish and Game's Water Quality Criteria for the protection of freshwater aquatic organisms from diazinon. The acute Water Quality Criterion of 0.08 µg/L protects aquatic life from short-term exposure to diazinon, while the chronic criterion of 0.05 µg/L protects aquatic life from long-term diazinon exposure.

The Regional Board has applied the concentration-based Waste Load and Load Allocations of this TMDL equally to all diazinon discharge sources in the Chollas Creek watershed. All allocations are set at 90% of the Numeric Targets resulting in a diazinon allocation equal to 0.072 µg/L under acute exposure conditions and a diazinon allocation of 0.045 μg/L under chronic exposure conditions. These allocations include an explicit 10 % margin of safety to account for uncertainties in the TMDL analysis. This concentration-based TMDL and its allocations apply year-round and will be protective during all flow conditions and seasons.

An 84% reduction of current diazinon loads in Chollas Creek is needed to attain the acute diazinon allocations set forth in this TMDL. A 90% reduction of current diazinon loads is needed to attain the chronic diazinon allocations set forth in this TMDL.

As dischargers of diazinon in urban storm water flows to Chollas Creek, the City of San Diego, City of Lemon Grove, City of La Mesa, San Diego Unified Port District, County of San Diego and the California Department of Transportation (CalTrans) are responsible for implementation of this TMDL. These entities are regulated as municipal Copermittees under the San Diego Municipal Storm Water Permit (San Diego MS4 Permit) or the statewide municipal CalTrans Storm Water Permit (CalTrans MS4 Permit).

The three most important mechanisms to implement the diazinon waste load reductions required by this TMDL are: (1) USEPA's ongoing diazinon phase-out and elimination program; (2) modification of the San Diego Municipal Storm Water Permit (MS4 Permit) as needed for consistency with this TMDL; and (3) activities by the municipal Copermittees in the Chollas Creek watershed to reduce diazinon discharges pursuant to the MS4 Permit and Water Code Section 13267. Such activities will include (1) enforce existing local ordinances and adopt new legal authority as needed;(2) implement a "Diazinon Toxicity Control Plan"; and (3) conduct a focused Public Outreach / Education program (which may be incorporated into the "Diazinon Toxicity Control Plan".

Compliance with numeric limitations for diazinon will be required in accordance with a phased schedule of compliance. The compliance schedule will be jointly developed by the Regional Board and the Chollas Creek stakeholders and will be finalized no later than one year following adoption of this TMDL by the Regional Board. The phased compliance schedule will apply only to attainment of numeric limitations for diazinon. All other requirements of this TMDL will be immediately effective upon incorporation into applicable NPDES permits.

In the Chollas Creek watershed, USEPA's ongoing phase-out is expected to significantly reduce current source loadings of diazinon, and the resulting aquatic toxicity, to negligible levels over time. Implementation mechanisms specified in this TMDL will reduce diazinon discharges during, and immediately following, the phase-out and may also be effective in reducing alternative pesticide use in the long-term.

With respect to diazinon, this TMDL will result in the attainment of the "Toxicity" and "Pesticide" water quality objectives and the restoration of the WARM and WILD beneficial uses in the Chollas Creek watershed[1]. This is because the numeric targets are set equal to the diazinon Water Quality Criteria which are based on toxicity testing and are specifically established at levels to ensure the protection of aquatic life from acute and chronic exposure to diazinon. The Water Quality Criteria protects all aquatic life stages including the most sensitive stages.

The scientific basis of this TMDL has undergone external peer review pursuant to Health and Safety Code Section 57004. The Regional Board has considered and responded to all comments submitted by the peer review panel.

The Regional Board adopted Resolution No. R9-2002-0123, incorporating this Total Maximum Daily Load for diazinon in the Chollas Creek watershed, into the Basin Plan during a public meeting on August 14, 2002.

As with any Basin Plan amendment involving surface waters, once adopted by the Regional Board, this TMDL will not take effect until it has undergone subsequent agency approvals by the State Water Resources Control Board (SWRCB), the Office of Administrative Law (OAL), and the United States Environmental Protection Agency (USEPA).

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[1] **MULTIPLE POLLUTANTS:** The attainment of water quality standards is qualified with the words "with respect to diazinon" because there are multiple pollutants causing toxicity. Toxicity conditions in Chollas Creek are caused by metals and diazinon. Successful implementation of both the Chollas Creek diazinon TMDL and the Chollas Creek metals TMDL is expected to result in full attainment of the "Toxicity" water quality objectives, and of the WARM and WILD beneficial uses.

Technical Report for Total Maximum Daily Load for Diazinon in Chollas Creek Watershed, San Diego County

1.0 Total Maximum Daily Load Fundamentals

Section 303(d)(1)(A) of the Clean Water Act requires that "Each State shall identify those waters within its boundaries for which the effluent limitations…are not stringent enough to implement any water quality standard applicable to such waters." The Clean Water Act also requires states to establish a priority ranking for waters on the section 303(d) list of impaired waters and to establish Total Maximum Daily Loads (TMDLs) for such waters.

The purpose of a total maximum daily load (TMDL) is to attain water quality objectives and restore and protect the beneficial uses of an impaired water body. A TMDL is defined as "the sum of the individual waste load allocations for point sources and load allocations for nonpoint sources and natural background (40 CFR 130.2) such that the capacity of the water body to assimilate pollutant loadings (i.e., the Loading Capacity) is not exceeded.

The TMDL process begins with the development of a technical TMDL which includes the following 8 components: (1) A **Problem Statement** describing which water quality objectives are not being attained and which beneficial uses are impaired; (2) identification of **Numeric Targets** which will result in attainment of the water quality objectives and protection of beneficial uses; (3) A **Source Analysis** to identify all of the point and nonpoint sources in the watershed and estimate the current pollutant loading from each; (4) a calculation of the maximum **Loading Capacity**, or TMDL, of the waterbody for the pollutant; i.e., the maximum amount of the pollutant that may be discharged to the water body without causing exceedances of water quality objectives and impairment of beneficial uses; (5) a **Linkage Analysis** to confirm that the TMDL, or Loading Capacity, will result in the attainment of the water quality objectives; (6) the division and **Allocation** of the total Loading Capacity amongst each of the contributing sources in the watershed, waste load allocations (WLA) for point sources and load allocations (LA) for non point sources; (7) a **Margin of Safety** (MOS) to account for uncertainties in the TMDL analysis; and (8) a description of how **Seasonal Variation and Critical Conditions** are accounted for in the TMDL. The document containing the above components is generally referred to as the Technical TMDL.

Upon completion of the Technical TMDL, a plan to implement the TMDL is developed along with a plan to monitor the results. The **Implementation Plan** describes the actions needed by each of the point and nonpoint source dischargers in the watershed to meet the load reductions specified in the TMDL and a time schedule taking such actions. The Implementation Plan also identifies all agencies with authority to take pollutant reducing actions and describes such actions. The purpose of the Monitoring Plan is to assess the effectiveness of the load reduction activities in attaining water quality objectives and restoring beneficial uses and to document progress towards same.

Upon completion, the regulatory provisions of the TMDL, Implementation Plan, and Monitoring Plan are incorporated into the Region's Water Quality Control Plan, or Basin Plan. This is accomplished via a formal action by the Regional Board to amend its Basin Plan in a public hearing process. As with any Basin Plan amendment involving surface waters, a TMDL adopted by the Regional Board will not take effect until it has undergone subsequent agency approvals by the State Water Resources Control Board (SWRCB), the Office of Administrative Law (OAL), and the United States Environmental Protection Agency (USEPA).

Total maximum daily loads are not self implementing; nor are they enforceable simply by incorporation into the Basin Plan. Rather a TMDL must be made enforceable by the Regional Board in one of two ways: (1) the TMDL and load allocations are incorporated into waste discharge requirements and NPDES permits; or (2) a formal prohibition against a particular discharge of waste is established in the Basin Plan. The TMDL must then be implemented by the responsible point and nonpoint source dischargers of the pollutant within the watershed. In other words, each responsible party must take any load reduction actions necessary to comply with its assigned load or waste load allocation as specified in the TMDL.

2.0 Problem Statement

From 1994 until May 2001, storm water has been tested for toxicity at a station on the north fork of Chollas Creek called "SD8(1)". Toxicity testing is an accepted method for assessment of the potential impact of complex mixtures of pollutants (such as urban storm water runoff) on aquatic life in receiving waters. The water flea *Ceriodaphnia dubia* is an indicator test organism for examination of freshwater samples. Toxicity to reproduction and survival of the water flea has been found in storm water sampled at this station. Eighty-seven percent (87%)(16/18) of the '7-day No Observable Effects Concentration' tests have showed toxicity (see Attachment B-1). Furthermore, storm water flows from this station have been found to negatively affect growth in the indicator organism known as the fathead minnow, *Pimephales promelas.* Storm water was found to be toxic to the fathead minnow in sixty-seven percent (67%) (6/9) of the '7-day No Observable Effects Concentration' tests. Consequently, Chollas Creek storm water has not met the applicable water quality objective for toxicity. The toxicity of Chollas Creek storm water to aquatic test organisms indicates that the "warm freshwater habitat" and "wildlife habitat" beneficial uses of Chollas Creek have not been adequately protected.

A toxicity identification evaluation (TIE) has been conducted to determine the cause of the toxicity in Chollas Creek storm water (See Attachment C). Results from the TIE indicate that the insecticide diazinon has caused the toxicity to the water flea. Since the storm water toxicity has been caused by diazinon, Chollas Creek has not met the applicable water quality objective for pesticides and toxicity. Results from the TIE also indicate metals in Chollas Creek storm water are toxic to a marine invertebrate indicator species. A separate TMDL is being developed for metals in Chollas Creek.

2.1 Diazinon

Diazinon is a widely used organophosphate insecticide that is a common pollutant in urban storm water runoff and dry weather flows. It is used in home, garden and commercial applications in urban areas of the Chollas Creek watershed.

On a national basis, diazinon is one of the most commonly found pesticides in air, rain, and drinking and surface water. Over 13,000,000 pounds of diazinon are applied in the United States annually. It is used on a variety of agricultural crops and livestock (about 20% of usage), on turf and for residential control of various insects, indoors and outdoors (about 80% of usage). For non-agricultural use the largest share is in homeowner outdoor insect control for turf and gardens (39%). Other large usage is in lawn care operators (19%) and pest control operators (11%). Indoor homeowner use is also registered. California, Texas and Florida are states with the most significant usage.

Diazinon is known by the formula names:

- *O,O*-diethyl *O*-[6-methyl-2-(1-methylethyl)-4-pyrimidinyl]ester (9CI);
- *O,O,*diethyl-2-isopropyl-4-methyl-6-pyrimidinyl-phosphorothionate;
- O, O-diethyl O-(2-isopropyl-6-methyl-4-pyrimidinyl) phosphorothioate;
- O,O-diethyl O-(2-isopropyl-6-methyl-4-pyrimidinyl) ester;
- Diethyl 2-isopropyl-4-methyl-6-pyrimidinyl phosphorothionate;
- Diethyl 2-isopropyl-4-methyl-6-pyrimidyl thionophosphate;
- Diethyl 4-(2-isopropyl-6-methylpyrimidinyl) phosphorothionate;
- Isopropylmethylpyrimidyl diethyl thiophosphate; and
- O-(2-Isopropyl-4-methylpyrimidyl) O,O-diethyl phosphorothioate <www.pesticideinfo.org>.

Diazinon is also known by the synonyms: Phosphorothioic acid, Alfa-Tox, Spectracide, Basudin, Sarolex, Antigal, Dacutox, Dassitox, Dazzel, Dianon, Diaterr-Fos, Diazajet, Diazide, Diazitol, Diazol, Dizinon, Dimpylate, Dimpylatum, Dipofene, Dyzol, Exodin, Flytrol, Galesan, Gardentox, Kayazinon, Kayazol, Neocidol, Nipsan, Nucidol, Sandoz, Diagran, Drawizon, D.z.n., Fezudin, Sarolex, Dymet, Diazinão and other synonyms <www.pesticideinfo.org>.

Diazinon is moderately persistent and mobile in the environment (USEPA, 2000). Diazinon degrades primarily by microbial metabolism with an average half life of about 38 days in laboratory soil metabolism studies (USEPA, 2000). Hydrolysis half lives are 23, 138 and 77 days at pH 5, 7 and 9 respectively. Photolysis half lives are about 15 days on soil and 26 days in water (USEPA, 2000) <www.epa.gov/pesticides/op/diazinon/risk_Oct2000.pdf>.

Diazinon degradates include diazoxon, isopropyl diazoxon, and oxypyrimidine (USEPA, 2000). Diazoxon is an intermediate degradate which degrades into oxypyrimidine. Oxypyrimidine is the primary degradate and appears to be more persistent than diazinon (USEPA, 2000)

<www.epa.gov/pesticides/op/diazinon/risk_Oct2000.pdf>. Though diazoxon was detected in field studies, it's persistence is unclear, since it is not reported to be a major degradate in laboratory studies (USEPA, 2000).

Diazinon acts as an anticholinesterase agent by phosphorylating acetylcholinesterase (AChE) (Menzer, 1991 in USEPA, 2000). Diazinon interferes with the metabolism of the neurotransmitter acetycholine (ACh) (USEPA, 2000). This results in accumulation of ACh in nerve and tissue effortor organs and causes a broad spectrum of clinical effects (e.g., central nervous system effects)(USEPA, 2000). Nevertheless, although diazinon's primary mode of action is characterized as inhibiting AChE, the parent compound itself cannot inhibit AChE but requires preliminary oxidation to diazoxon (Keiger et. al., 1995 in USEPA, 2000) to inhibit AChE.

Diazinon oxidizes to diazoxon (diethyl 2-isopropyl-6-methylpyrimidin-4-yl phosphate) (Wahia et. al., 1976 in Novartis Crop Protection, Inc., 1997) and also isopropyl diazoxon (USEPA, 2000). Evidence indicates diazoxon and isopropyl diazoxon are approximately 10,000 times more toxic than diazinon (Fujii and Asaka, 1982 in USEPA, 2000). Diazoxon is more effective than diazinon in inhibiting AChE activity (Fujii and Asaka, 1982 in Novartis Crop Protection, Inc., 1997). Diazoxon is believed to be the dominant *toxic* component of diazinon in surface waters (USEPA, 2000).

The concentration of the diazinon degradates diazoxon and isopropyl diazoxon is linked to the concentration of the parent diazinon. On average, diazoxon has been found in streams and rivers in California in concentrations that are 2.5% of the parent concentration (USEPA, 2000). While there is data on the parent diazinon, there is a paucity of data on the degradate diazoxon (USEPA, 2000). It is believed that reducing the concentration of the parent diazinon reaching storm water will reduce the amount of diazinon degradates. A correlation has been found between toxicity to *Ceriodaphnia dubia* and concentrations of diazinon in Chollas Creek storm water samples. A correlation coefficient of 0.7032 was obtained after analysis of 34 storm water samples collected during the period 1999 through 2001 (MEC, 2002).

Diazinon has a relatively high solubility and low adsorbtive capacity and tends to move into the liquid phase in a wet environment and tends to remain in that phase. Storm and irrigation water runoff is an efficient transport mechanism for diazinon. According to USEPA (2000), there is high certainty in all urban and suburban areas where diazinon is applied outdoors, and where there is sufficient irrigation or rainfall to cause runoff, there will be negative impacts on aquatic biota from the diazinon use.

Diazinon-induced toxicity in storm water has been found in the:

- San Diego Creek area, California (USEPA, 2002);
- San Francisco Bay area, California (Alameda County Flood Control and Water Conservation District, 1997);
- Sacramento-San Joaquin Valley, California (Menconi and Cox, 1994);

- Castro Valley Creek watershed in Alameda County, California (Hansen et. al., 1994);
- Crandall Creek and the Demonstration Urban Stormwater Treatment (DUST) Marsh system in Alameda County, California (Woodward-Clyde Consultants, 1995);
- Urban creeks (e.g., Arcade Creek and Elder Creek) in Sacramento, California (Bailey et. al., 2000); and
- Urban creeks (e.g., Mosher Slough) in Stockton, California (Bailey et. al., 2000).

In studies in Alameda County, California, diazinon was often detected in water and sediments of urban creeks throughout the year, not only during wet weather (URS Greiner Woodward Clyde, 1999). Diazinon has been found in dry weather flows in Alameda County, California creeks (Katznelson and Mumley, 1977). Dry weather samples collected in urban creeks in Sacramento, California (e.g., Arcade Creek) also contained diazinon(Katznelson and Mumley, 1977).

2.2 Creek and Watershed Description

The Chollas Creek watershed is located in the County of San Diego in the San Diego region as shown in the vicinity map contained in Attachment A-1. A more detailed map of the Chollas Creek watershed is described in Attachment A-2. For the purposes of this TMDL, the Chollas Creek watershed includes only those lands draining to Chollas Creek (i.e., those lands draining to Switzer Creek are not included in this TMDL). The watershed of Chollas Creek encompasses 16,273 acres. (Note: This acreage excludes Switzer Creek). The area of the north fork of the watershed (9,276 acres) is somewhat larger than that of the south fork (6,997 acres). As Table 2-1 indicates, the watershed is highly urbanized. Land use is predominantly residential, with some commercial and industrial use. A significant portion of the watershed consists of roadways. The remaining land in the watershed is open space. Approximately 84%, 8%, and 8% of the land within the watershed is contained within the cities of San Diego, Lemon Grove, and La Mesa, respectively. Less than 1% of the land within the watershed is unincorporated (SANDAG, 2002). A small portion of the watershed consists of "tidelands" immediately adjacent to San Diego Bay. Tidelands under the jurisdiction of the San Diego Unified Port District is also less than 1% of the watershed; the remainder is under the jurisdiction of the United States Navy.

Chollas Creek is an urban creek with highly variable flows. The highest flow rates are associated with storm events. During dry weather, there are often extended periods of no surface flows in the creek, although pools of standing water may be present. Much of the creek has been channelized and concrete lined, but some sections of earthen creek bed remain. The mouth of the creek is located on the eastern shoreline of the central portion of San Diego Bay.

The annual average rainfall in the Chollas Creek watershed (for the period October 1948 through February 2002 at La Mesa, California) is about 12.1 +/- 4.6 inches (Western Regional Climate Center, 2002). Rainfall statistics for the San Diego International Airport (a.k.a. Lindberg Field, located about 4 miles northwest of Chollas Creek, near San Diego Bay) indicate that an average of 18 storms occur each year (URS Greiner Woodward-Clyde, 1999).

Table 2-1
Land Use in the Chollas Creek Watershed
(Woodward-Clyde International-Americas, 1998)

Land Use	Percent of Total Area (Entire Watershed)	Percent of Sampled Area (North Fork Watershed)
Residential	67%	62%
Commercial	5%	9%
Industrial	7%	10%
Roadways	4%	5%
Open Space	16%	14%

2.3 Sampling History in the Watershed

2.31 Municipal Storm Water NPDES Permit Sampling

During the monitoring period between 1998 to 2001 the average concentration of diazinon in Chollas Creek during storm events was 0.46 µg/L. Monitoring of storm water in Chollas Creek began in the 1993-94 rainy season pursuant to the municipal storm water National Pollutant Discharge Elimination System (NPDES) permit for the County of San Diego. Each rainy season, storm water samples are collected during two or three storms at a station located on the north fork of Chollas Creek, upstream of the confluence of the north and south forks of the creek, near the intersection of 33rd and Durant Streets. This location was selected to avoid tidal influence. Runoff from approximately 57 percent of the entire watershed is sampled at this monitoring site. Storm water samples collected at this location are considered to be representative of runoff from the entire watershed because the land use mix in the north fork portion of the watershed is similar to the land use mix of the entire watershed, as Table 2-1 indicates.

Since the 1993-94 rainy season, storm water samples have been analyzed for general physical constituents, nutrients, biochemical oxygen demand, chemical oxygen demand, bacteriological constituents, organic constituents, and total recoverable metals. Some samples are also analyzed for dissolved metals. Toxicity testing began with the 1994-95 rainy season and is conducted using the fish commonly known as the fathead minnow (*Pimephales promelas*) and the water flea (*Ceriodaphnia dubia*). Testing using the fathead minnow has shown little, if any, adverse effect (URS Greiner Woodward Clyde, 1999). In contrast, every test using the water flea has found toxicity, as indicated by mortality (URS Greiner Woodward Clyde, 1999). Storm water toxicity testing in the San Francisco Bay area revealed a very similar pattern, where diazinon was discovered to be the major cause of toxicity to the water flea (URS Greiner Woodward Clyde, 1999). Chollas Creek storm water flows were not analyzed for diazinon until the 1998-99 rainy season, when concentrations of diazinon ranging from 0.46 µg/l to 0.53 µg/l were reported (URS Greiner Woodward Clyde, 1999). See Attachments B-1 and B-2 for a “Summary of Surface Water Monitoring for Diazinon, Chlorpyrifos and Toxicity”.

2.32 Toxicity Identification Evaluation (TIE)

A toxicity identification evaluation (TIE) is a procedure to determine the cause of toxicity. A TIE was conducted to determine the cause of the toxicity in Chollas Creek storm water flows. The TIE was conducted by the Southern California Coastal Water Research Project (SCCWRP) and Ogden Environmental, Energy, and Remediation Division (Ogden) under an agreement between the San Diego Regional Water Quality Control Board (SDRWQCB), the City of San Diego, the San Diego Unified Port District, and the California Department of Transportation (CalTrans) (See Attachment C). The TIE effort was initiated in March of 1999 and a final report was completed in November 1999 (SCCWRP 1999). Chollas Creek storm water from three storms in 1999 was evaluated in the TIE. The first task was to compare toxic responses of three commonly used test organisms; one freshwater species (the water flea *Ceriodaphnia dubia*) and two marine species (the purple sea urchin *Strongylocentrotus purpuratus* and the mysid shrimp *Mysidopsis bahia*). The salinity of storm water samples tested using the marine species was adjusted to approximate seawater salinity levels. A Phase I TIE was conducted to ascertain the class or group of constituents responsible for the observed toxicity. A Phase II TIE was conducted in an effort to determine the primary constituent(s) responsible for the observed toxicity. A Phase III TIE was conducted to confirm the primary constituent(s).

Water from the first two storms was found to be toxic to the water flea. Water from the third storm was not found to be toxic to the water flea. Water from all three storms was found to be toxic to the purple sea urchin. Water from all three storms was not found to be toxic to the mysid shrimp. The TIE results indicate that the toxicity to the water flea was caused by diazinon, which was found in concentrations from 0.32 µg/l to 0.54 µg/l. Consequently, this TMDL focuses on diazinon. The TIE results also indicate that toxicity to the purple sea urchin was caused by zinc. Work is underway on a separate TMDL for metals (including zinc) in storm water runoff from the Chollas Creek watershed.

2.4 Applicable Water Quality Standards (Water Quality Objectives and Beneficial Uses)

Water quality standards consist of beneficial uses and water quality objectives. The Water Quality Control Plan for the San Diego Basin (9) (Basin Plan) (SDRWQCB, 1994) specifies water quality standards for all waters in the San Diego Region, including Chollas Creek and San Diego Bay. The water quality standards that are applicable to this TMDL are the narrative water quality objectives for toxicity and pesticides in Chollas Creek and the beneficial uses of Chollas Creek that are adversely affected by toxicity and pesticides.

The following Basin Plan narrative water quality objective for toxicity is applicable to all inland surface waters (including Chollas Creek), enclosed bays (including San Diego Bay) and estuaries, coastal lagoons, and ground waters of the San Diego region.

> **Toxicity Objective**: *"All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that 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, bioassays of appropriate duration, or other appropriate methods as specified by the Regional Board."*
>
> *"The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors, 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 requirements specified in US EPA, State Water Resources Control Board or other protocol authorized by the Regional Board. As a minimum, compliance with this objective as stated in the previous sentence shall be evaluated with a 96-hour acute 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 will be encouraged."*

The following Basin Plan narrative water quality objective for pesticides is applicable to all inland surface waters (including Chollas Creek), enclosed bays (including San Diego Bay) and estuaries, coastal lagoons, and ground waters of the San Diego region.

> **Pesticide Objective:** *"No individual pesticide or combination of pesticides shall be present in the water column, sediments, or biota at concentration(s) that adversely affect beneficial uses. Pesticides shall not be present at levels which will bioaccumulate in aquatic organisms to levels which are harmful to human health, wildlife or aquatic organisms."*

The beneficial uses of Chollas Creek (and, for comparison, those of San Diego Bay) specified in the Basin Plan are listed in Table 2-2.

The occurrence of toxicity in Chollas Creek storm water indicates that the water quality objective for toxicity was not met in Chollas Creek. Since the toxicity was caused by the insecticide diazinon, the water quality objective for pesticides was not met in Chollas Creek. The "warm freshwater habitat" and "wildlife habitat" beneficial uses of Chollas Creek are adversely affected by toxicity and/or pesticides.

The water flea *Ceriodaphnia* that is used in toxicity tests serves as an indicator or surrogate for the aquatic life in Chollas Creek. Diazinon concentrations that cause toxicity to the water flea Ceriodaphnia may also cause toxicity to other aquatic life, such as aquatic insects. As a case in point, diazinon levels of **0.30 µg/L** in an experimental stream resulted in a 5 to 8 times decrease in sensitive aquatic insect (e.g., mayfly and caddisfly) emergence within three weeks of exposure; after twelve weeks, sensitive aquatic insects (e.g., mayflies, damselflies and caddisflies) and sensitive crustaceans (e.g., amphipods) were no longer detected in benthic samples (Arthur et. al., 1983). Toxicity of the storm water to aquatic insects or other aquatic life is of concern because the function of the stream for supporting life is reduced. Aquatic insects and other invertebrates are necessary to support and maintain ecosystem balance. Fish, frogs, birds, and other creatures rely on aquatic insects for food. To the extent that diazinon-induced toxicity reduces the abundance or diversity of aquatic insects in Chollas Creek, the food supply of fish, frogs, birds, and other creatures is correspondingly reduced and the "warm freshwater habitat" and "wildlife habitat" beneficial uses of Chollas Creek are impaired. The average current concentration of diazinon in Chollas Creek during storm events is **0.46 µg/L.** According to USEPA (2000), there is high certainty in all urban and suburban areas where diazinon is applied outdoors, and where there is sufficient irrigation or rainfall to cause runoff, there will be negative impacts on aquatic biota from the diazinon use.

Table 2-2
Beneficial Uses of Chollas Creek and San Diego Bay

Beneficial Use	Chollas Creek	San Diego Bay
Industrial service supply		•
Navigation		•
Contact water recreation	O	•
Non-contact water recreation	•	•
Commercial and sport fishing		•
Preservation of biological habitats of special significance		•
Estuarine habitat		•
Warm freshwater habitat	•	
Wildlife habitat	•	•
Rare, threatened, or endangered species		•
Marine habitat		•
Migration of aquatic organisms		•
Shellfish harvesting		•

• Existing beneficial use
O Potential beneficial use

3.0 Numeric Targets

The TMDL Numeric Targets, which are derived from the water quality objectives, identify the specific water column, sediment, or tissue concentrations (or other endpoints) which equate to attainment of the Basin Plan water quality objectives and the protection of designated beneficial uses. Therefore, if the Numeric Targets are appropriately selected, attainment of the Numeric Targets will result in attainment of the underlying water quality objectives and beneficial use protection.

Where the applicable Basin Plan water quality objectives are expressed in numeric terms, the Numeric Targets for the TMDL are simply set equal to the water quality objectives. However, when the Basin Plan water quality objectives are narrative, such as with this TMDL, the numeric targets must quantitatively interpret the narrative water quality objectives. In other words the targets serve as numeric surrogates for the narrative water quality objectives. Numeric water quality objectives are expressed as water column concentrations. TMDL numeric targets are usually, but not always, also expressed as water column concentrations.

For the Chollas Creek diazinon TMDL the Regional Board has set the numeric targets equal to the California Department of Fish and Game (CDFG) Water Quality Criteria for the protection of freshwater aquatic organisms from diazinon (Menconi and Cox 1994) as shown in Table 3-1 below. The acute Water Quality Criterion protects aquatic life from short-term exposure to diazinon, while the chronic criterion protects aquatic life from long-term diazinon exposure.

Table 3-1
Numeric Targets for Diazinon in Chollas Creek [2]

Exposure Duration	Numeric Target	Averaging Period	Frequency of Allowed Exceedance
Acute	0.08 µg/L	One-hour average	Once every three years on the average
Chronic	0.05 µg/L	Four-day average	Once every three years on the average

By setting the numeric targets equal to the CDFG Water Quality Criteria for diazinon, the Regional Board is quantitatively interpreting the narrative water quality objective of "no toxics in toxic amounts" to mean "no diazinon concentrations in Chollas Creek in excess of 0.08 µg/L for any 1 hour period or in excess of 0.05 µg/L for any 4-day period". The pesticide water quality objective is interpreted in the same way.

Furthermore by selecting the water quality criteria as Numeric Targets for this TMDL, the Regional Board is asserting that attainment of the water quality criteria (or numeric targets) will result in attainment of the water quality objectives. This assertion is scientifically sound since,

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[2] For the purpose of evaluating if the Numeric Targets have been attained, sample results shall be used as follows:

1. If only one sample is collected during the time period associated with the numeric target (e.g., one-hour average or four-day average), the single measurement shall be used to determine attainment of the numeric target for the entire time period.
2. The one-hour average shall be the moving arithmetic mean of grab samples over the specified one-hour period.
3. The four-day average shall apply to flow-weighted composite samples for the duration of a storm, or shall be the moving arithmetic mean of flow weighted 24-hour composite samples or grab samples.

Water Quality Criteria are derived on the basis of toxicity tests, and are by definition established at diazinon levels which will ensure protection of aquatic life.

4.0 Source Analysis

4.1 Diazinon Uses

The purpose of the Source Analysis is to identify all the point and nonpoint sources in the watershed and to estimate the current pollutant loading from each.

Diazinon is available in many different formulations (e.g., concentrated liquid, ready-to-use liquid, dust, granules, pressurized sprays, etc.) (Cooper, 1996) and is used on a broad spectrum of target pests. Because of the many possible combinations of diazinon formulations, application methods, and target pests, there are many potential pathways, both indirect and direct, by which diazinon reaches surface water. These pathways include runoff from rain, runoff from landscape irrigation, spills, improper disposal, and aerial deposition. Diazinon may enter surface water as a result of use in accordance with label instructions as well as use not in accordance with label instructions. Municipal storm water is believed to be the primary source of diazinon entering Chollas Creek.

In terms of environmental fate and transport, diazinon is relatively persistent in aquatic environments. It tends to be fairly soluble compared to other pesticides, and has a half-life of approximately 6 months under neutral pH conditions (EXTOXNET, 1996). Diazinon has a soil half-life of approximately 2-4 weeks (Siepmann, S. and B. Finlayson, 2000).

In a preliminary experiment done in the Castro Valley Creek watershed, in Alameda County, California, diazinon was applied according to label instructions to control ants on a specific property. Two days later, it rained, and runoff samples were collected within that property during that small rain event. The runoff samples contained up to 1,200 µg/L of diazinon (Scanlin and Feng, 1997). The City of Palo Alto, California found diazinon concentrations of 0.1 to 0.4 µg/L in the water in its creeks and discovered that less than a tablespoon of diazinon in “a day’s worth of creek flow” during a storm event was needed to create these concentrations (Cooper, 1996). One study suggests that ordinary use (not just misuse or dumping) could release sufficient diazinon into the environment to account for concentrations and toxicity measured in urban storm water runoff (Cooper, 1996). In most flow conditions, less than a tablespoon of diazinon in a day’s worth of creek flow during a storm event can exceed chronic and acute concentrations (See Attachment B-3).

The amount of diazinon actually discharged to surface waters from various sources is not well documented. In order to estimate the relative amounts of diazinon discharged from various sources to Chollas Creek, it was assumed that the amount of diazinon discharged from any use category was proportional to the amount of diazinon used in the watershed in the same use category. The actual relationship between the amount of diazinon used and the amount discharged to surface water is not known at this time.

Diazinon used in the Chollas Creek watershed consists of reported use and unreported use. Both reported and unreported uses of diazinon in the watershed were estimated using available data.

4.11 Reported Use of Diazinon

Since 1990, the California Department of Pesticide Regulation (DPR) has required reporting of pesticide use by agriculture and other commercial applicators. Reported uses include all uses for agriculture, parks, golf courses, rights-of-way, cemeteries, landscape maintenance, and structural pest control. Reporting of home and garden use and most industrial and institutional use is not required. DPR compiles all of the reported use information into the Pesticide Use Report database. Pesticide use reports include location, amounts applied, number of acres, and types of crops or places (e.g., structures and roadsides) treated. Commercial applications, including structural fumigation, structural pest control, and turf applications, must also be reported.

Reported diazinon use was calculated using the DPR Pesticide Use Report database for 1997 (DPR, 1997b). Pesticide use is generally expressed in terms of the amount of active ingredient, i.e. the component in the pesticide product that actively kills or otherwise controls the target pest. "Diazinon active ingredient" is pure diazinon with no inert substances. "Diazinon product" includes the inert substances that are mixed with the diazinon. Expressing pesticide use in terms of active ingredient enables meaningful comparisons of different products to be made. There are a variety of pesticide products that contain different concentrations of active ingredient and inert substances.

Table 4-1 shows the reported amount of diazinon used in California, as obtained from the "Summary of Pesticide Use Report Data" for 1993, 1994, 1995, 1996, and 1997 (DPR 1993, 1994, 1995, 1996 and 1997a). During this period, the maximum annual reported amount of diazinon used was approximately 2.5 times the minimum annual reported amount of diazinon used.

Table 4-1
Reported Diazinon Active Ingredient Use in California

Year	Amount Used (pounds)
1993	1,491,709
1994	1,387,854
1995	2,376,882
1996	1,093,120
1997	955,108

Table 4-2 shows reported diazinon use data for San Diego County as obtained from the Pesticide Use Report database for 1997 (DPR, 1997b). This database groups diazinon use into three use categories: agriculture, landscape maintenance, and structural pest control. For each category, the pounds of diazinon active ingredient, pounds of diazinon product, and the number of applications are shown. Diazinon products used for agricultural purposes are generally more concentrated than diazinon products used for structural pest control. Diazinon products used for landscape maintenance are less concentrated than those used for agricultural or structural pest control purposes. The predominant reported use of diazinon in San Diego County in 1997 was for structural pest control. Structural pest control may be defined as the control of pests infesting a structure or its contents, and in general requires a structural pest control applicator license.

Table 4-2
Reported Diazinon Use in San Diego County (1997)

Use Category	Diazinon Active Ingredient (pounds)	Diazinon Product (pounds)	Number of Applications	Percent of Active Ingredient in Product
Agriculture	2,505	8,022	618	31%
Landscape Maintenance	850	9,205	2,191	9%
Structural Pest Control	24,240	96,730	43,553	25%
Total	27,595	113,957	46,362	

Information on the reported use of diazinon in the Chollas Creek watershed is not available. Therefore, the Regional Board estimated reported use for each use category identified in Table 4-2.

A survey of diazinon use in the Chollas Creek watershed was conducted by the Regional Board as part of the development of this TMDL. The survey focused on schools, city parks, cemeteries, kennels, the California Department of Transportation (CalTrans), and nurseries. A representative of each agency or facility was telephoned and surveyed on diazinon use. Generally, the telephone contact was followed up with a letter or other written information.

The same agencies and facilities were also surveyed on Integrated Pest Management (IPM), which is an ecosystem-based strategy that focuses on long-term control of pests or their damage through a combination of techniques, such as biological control, habitat manipulation, modification of cultural practices, and use of pest resistant plant varieties. In general, IPM provides for pesticide use only after monitoring indicates that, based on established guidelines, pesticides are actually needed. Under IPM, treatments are made with the goal of removing only the target organism, and pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and non-target organisms, and the environment. The findings of the survey are summarized below.

Schools – The San Diego Unified School District (school district) manages the public schools in the watershed. The school district has had an IPM plan since 1991. Of the approximately 165 public schools managed by the school district, 58 are in the Chollas Creek watershed. The school district reports that it used a total of 70 fluid ounces of a pesticide product containing diazinon from about mid-1997 through about mid-1999. Assuming the density of the diazinon product was the same as that of water (8.34 pounds per gallon) and assuming the diazinon product contained 25% diazinon active ingredient (see Table 4-2, structural pest control use category), this represents use of less than one pound of diazinon active ingredient per year.

City Parks – Portions of the cities of San Diego, Lemon Grove, and La Mesa are located in the Chollas Creek watershed. These cities own the main parks in the Chollas Creek watershed. All of these cities report that diazinon is not used on park landscaping. They also report that structural pest control is done by outside contract and no estimates of diazinon use were available. The cities of San Diego and Lemon Grove reported that they were developing an IPM plan. The City of La Mesa reported that it had an IPM plan.

Cemeteries – Four large cemeteries in the Chollas Creek watershed were contacted about diazinon usage: Cypress View-Bonham Brothers Mortuary, Greenwood Memorial Park and Mortuary, Holy Cross Catholic Cemetery and Mausoleum, and Mount Hope Cemetery. A fifth cemetery, the Home of Peace Cemetery, could not be reached. Only one cemetery indicated that it had used diazinon for landscape maintenance. That cemetery indicated that 9.25 gallons – of the pesticide Sunbugger (0.5% diazinon) was used for landscape maintenance from about mid-1997 through about mid-1999. Assuming the density of the diazinon product was the same as that of water (8.34 pounds per gallon), this represents use of less than one pound of diazinon active ingredient per year. The cemeteries reported that all structural pest control was done under outside contract and no estimates of diazinon use were available. The cemeteries had little or no knowledge of IPM and did not have IPM plans.

Kennels – Only one kennel is located in the Chollas Creek watershed and it reported no use of diazinon.

CalTrans – CalTrans is responsible for the major freeways that run through the watershed. Roadways make up about 4% of the land in the watershed. However, CalTrans reports that diazinon is not used on its facilities. CalTrans reported that it has an IPM plan.

Nurseries – There are four nurseries in the Chollas Creek watershed. Three of these nurseries reported using no diazinon onsite. One nursery reported onsite use of about one gallon per year of a pesticide product containing diazinon. Assuming the density of the diazinon product was the same as that of water (8.34 pounds per gallon) and assuming the diazinon product contained 31% diazinon active ingredient (see Table 4-2, agriculture use category), this represents use of less than three pounds of diazinon active ingredient.

Nurseries are the only potential diazinon users in the Chollas Creek watershed included in the agriculture use category. Based on the results of this survey summarized above, reported agricultural diazinon use in the watershed was estimated to be negligible.

Reported diazinon use for landscape maintenance and structural pest control was estimated assuming that all such use in San Diego County occurred in urban land use settings. Since the Chollas Creek watershed contains approximately 5% of the total urban land use area in San Diego County, reported diazinon use for landscape maintenance and structural pest control in the watershed was estimated to be 5% of the total reported diazinon use in those categories in San Diego County. For purposes of this TMDL, urban land uses were defined to consist of residential, commercial, and industrial uses. Roadways and open space were not considered urban land uses because diazinon is generally not used in these areas. As Table 4-3 indicates, structural pest control was estimated to be the predominant reported use of diazinon in the Chollas Creek watershed in 1997.

Table 4-3
Estimated Reported Diazinon Use in the Chollas Creek Watershed (1997)

Use Category	Diazinon Active Ingredient (pounds*)	Diazinon Product (pounds*)
Agricultural	Negligible	Negligible
Landscape Maintenance	42	460
Structural Pest Control	1,200	4,800
Total (*rounded to two significant figures)	1,200	5,300

4.12 Unreported Use of Diazinon

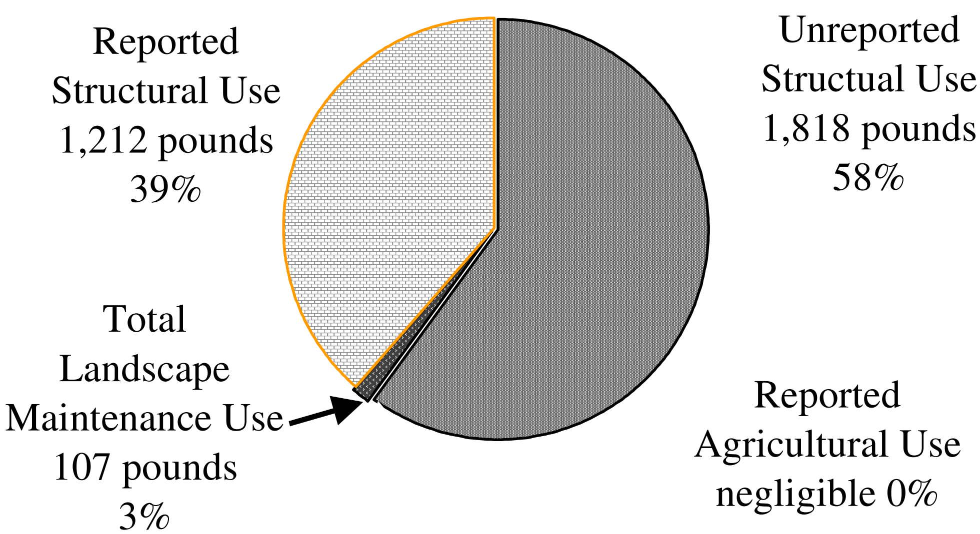
Unreported uses include home, garden, industrial, and institutional uses of over-the-counter diazinon products. The amount of unreported diazinon use in residential, commercial, industrial, and institutional settings is not well documented. According to the DPR 1997 Summary of Pesticide Use Report Data (DPR 1997a), about two-thirds of pesticide active ingredient sold in a given year is used for unreported uses. In a study of an urban area in Palo Alto California, unreported uses accounted for approximately 60% of total use of diazinon active ingredient (Cooper 1996). Therefore, assuming that diazinon is discharged from various use categories to Chollas Creek in proportion to the amounts used in those categories, it appears that more diazinon is discharged to Chollas Creek from unreported uses than from reported uses.

The 1997 unreported use of diazinon active ingredient in the Chollas Creek watershed was estimated to be approximately 1,800 pounds. This estimate was calculated based on the assumption that 60% of the total use was unreported use and the estimate (from Table 4-3) of 1,200 pounds of reported use in the watershed in 1997.

Figure 4-1 depicts the estimated reported uses and unreported use of diazinon in the Chollas Creek watershed.

Figure 4-1
Estimated Total Diazinon Use in Chollas Creek Watershed in 1997

Category	Reported Use (active ingredient)	Unreported Use (active ingredient)	Total (pounds)
Agriculture	N/A	N/A	N/A
Landscape Maintenance	43	64	107
Structural Pest Control	1212	1818	3030
		Grand Total	3137



The most common location of insecticide applications in the insecticide use survey were around foundation of house (49%), in the garden (34%), on trees or shrubs (31%), on a patio or walkway (22%), on the lawn (22%), inside the house (16%), on the side or eves of the house (9%), or other (22%). The insecticide use survey indicated that discount stores (e.g., Home Depot, Home Base, Target, Kmart, and Wal-Mart) were the largest suppliers of insecticides in San Diego County.

NPDES Permittees – Discharges regulated by an NPDES permit can be considered a potential source of diazinon. There are several NPDES permits that regulate discharges that enter Chollas Creek directly or indirectly. Four of these permits are "storm water" permits, i.e. permits for discharges of runoff. These permits are listed in Table 4-4 and discussed below.

Table 4-4
NPDES Permits Regulating Point Source Discharges

NPDES permit
San Diego Municipal Storm Water Permit (aka MS4 Permit)
Statewide General Industrial Storm Water Permit
Statewide General Construction Storm Water Permit
Statewide Municipal Storm Water Permit for California Department of Transportation (aka CalTrans MS4 Permit)
General Permit for Utility Vault Discharges

The Regional Board has issued and oversees compliance with the San Diego Municipal Storm Water permit, aka the MS4 Permit. This permit regulates all discharges to and from the storm water conveyance systems of all the cities in San Diego County, as well as the County of San Diego, and the San Diego Unified Port District. Storm water conveyance systems are transmission routes through which pollutants enter surface waters. Storm water NPDES permits are intended to reduce or eliminate the discharge of pollutants to and from storm water conveyance systems. The local agencies, or municipal Copermittees, named in the municipal storm water NPDES permits are responsible for everything that is discharged to and from their storm water conveyance systems. The municipal Copermittees are responsible for isolating and controlling sources of pollutants within their jurisdictions, even if the municipal Copermittees do not actually use the pollutants. The municipal Copermittees regulated by this permit that have jurisdiction in the Chollas Creek watershed are the City of San Diego, the City of Lemon Grove, the City of La Mesa, County of San Diego, and the San Diego Unified Port District. These municipal Copermittees have responsibility for virtually all discharges to and from the municipal storm water conveyance system in the watershed.

The State Water Resources Control Board (State Board) has issued a statewide NPDES General Industrial Storm Water Permit site runoff discharges. The Regional Board oversees compliance with this permit in the San Diego Region. The municipal storm water Copermittees also have responsibility for runoff from industrial sites within their jurisdiction. The maximum number of sites in the Chollas Creek watershed to which this permit applies is estimated to be 87 sites.[S1] Industrial sites could be significant sources of diazinon discharges, compared to other areas of similar size. However, land use in the watershed is predominantly residential (Table 2-1).

The State Board has also issued a statewide General Construction Storm Water Permit. The Regional Board oversees compliance with this permit in the San Diego Region. The municipal storm water Copermittees also have responsibility for runoff from construction sites within their jurisdiction. The maximum number of sites in the Chollas Creek watershed to which this permit currently applies is estimated to be 30 sites. Construction sites would not seem to be likely sources of significant discharges of diazinon.

The State Board has also issued a statewide Municipal Storm Water permit to the California Department of Transportation (CalTrans). This permit regulates all runoff discharges from CalTrans roads and highways, rights-of-way, maintenance yards, and other sites and facilities. However, CalTrans reports that no diazinon is used on such areas. Therefore, such areas would not seem to be likely sources of significant discharges of diazinon to Chollas Creek.

The SWRCB has also issued a statewide NPDES general permit for utility vault discharges. The SDRWQCB oversees compliance with this permit in the San Diego region. Several utilities in the San Diego region are regulated under this permit.

4.13 Phase-Out of Diazinon

In January 2001, USEPA reached an agreement with registrants of diazinon to phase out most home uses, including all indoor uses and outdoor non-agricultural uses (USEPA 2001). After December 31, 2002 retail sales for indoor home uses will be stopped. Product registrations will (expire) be canceled, with no provision for existing stocks on December 31, 2004. Also, technical registrants will buy back existing products form retailers commencing December 31, 2004. Provisions of the agreement and associated USEPA actions are listed below in Table 4-5.

Table 4-5
Provisions of the USEPA Agreement with Registrants of Diazinon

Home Uses		
Site	**Mitigation Measures**	**Effective Dates**
Indoor Uses All uses inside any structure, vehicle, vessel, aircraft, or enclosed area and/or on any contents therein (except mushroom houses), including residences, food/feed handling establishments, schools, museums, stores, hospitals, sport facilities, warehouses, and greenhouses. All indoor pet uses including pet collars.	Product registrations are being cancelled or amended to delete indoor uses from end use product labels (except use in mushroom houses). USEPA's Federal Register notice of January 10, 2001 proposed to delete these uses.	Cancellations became effective after the USEPA 30-day public comment, upon issuance of a cancellation order in February 2001. As of March 1, 2001, manufacturing use products may no longer be used to formulate end use products for indoor uses. Retailers stop sale December 31, 2002.
Outdoor Non-Agricultural Uses Home lawn, garden, and any other outdoor residential or outdoor non-agricultural uses	Production will phase down Uses will be phased out Uses will be phased out Technical registrants will buy back existing products from retailers	Technical registrants reduce amount of diazinon produced by 50% or more by 2003. Stop formulation of products June 30, 2003. Stop sale to retailers August 31, 2003. Commencing December 31, 2004

Home Uses		
Site	**Mitigation Measures**	**Effective Dates**
	Product registrations will (expire) be canceled, with no provision for existing stocks.	December 31, 2004

As a result of the phase out, USEPA estimates that current uses of diazinon will be reduced by over 90%. In the Chollas Creek watershed, since agricultural use is negligible, the phase out should reduce current source loading to negligible levels over time.

4.2 Recommendations and Plans for Further Source Analysis

Because of the limited amount of information concerning sources of diazinon in the Chollas Creek watershed, additional source analysis activities are recommended. Some additional source analysis activities are currently ongoing or planned.

Additional monitoring has been sponsored by the City of San Diego, State Water Resources Control Board and the Department of Pesticide Regulation to evaluate diazinon concentrations in Chollas Creek. Sampling was conducted at nine locations along the creek during storm events. Results indicate a statistically significant correlation of elevated diazinon concentrations with aquatic toxicity (MEC Analytical Systems, 2002). No single tributary or source was identified as a major contributor, indicating the ubiquitous nature of the pollutant.

The Regional Board understands that the Department of Pesticide Regulation (DPR) is planning to conduct some urban source analysis monitoring programs in the next few years. These DPR monitoring programs will be designed to better identify the products and uses which cause the highest diazinon concentrations in urban runoff. The results of these DPR urban monitoring programs are intended to be applicable statewide, regardless of where the monitoring is actually conducted.

The monitoring program for the municipal storm water NPDES permit for San Diego County has been modified to address some source analysis questions. A pesticide use survey was conducted to characterize the use of diazinon by residential and commercial applicators in San Diego County, results are available in Attachment I, "Insecticide Use and Telephone Survey 1999-2000". Also, additional monitoring for diazinon in Chollas Creek has been conducted, and results are available in Attachments B-1 and B-2.

Further investigation is needed to determine whether runoff from industrial sites, runoff from construction sites, and utility vault discharges may be significant sources of diazinon discharges to Chollas Creek. Such investigation may include surveys of diazinon use at industrial and construction sites and in utility vaults and monitoring of industrial and construction site runoff and utility vault discharges.

5.0 TMDL or Loading Capacity

The terms total maximum daily load (TMDL), Loading Capacity, and assimilative capacity are all synonymous. All refer to the maximum amount of a pollutant that a waterbody can receive and still attain water quality objectives and protection of designated beneficial uses.

An important step in the development of a TMDL is the calculation of the Loading Capacity of the waterbody for the pollutant of concern. A variety of methods are available to calculate Loading Capacities which range from complex predictive models to simple estimates. A particularly critical decision is the selection of units in which the loading capacity will be defined for any particular TMDL. Loading Capacities are typically expressed as mass emissions (mass per unit time), concentrations (weight per unit volume) or in toxicity units or toxicity equivalent units. The choice of units depends upon the physical and chemical nature of the pollutant and on the resulting impairments of concern.

For pollutants which are persistent (long-lived) in the environment due to their physical and chemical properties or are known to accumulate in bottom sediments, bioaccumlate in living tissues, or biomagnify in the food chain, the Loading Capacities are typically expressed in terms of mass emissions rather than in terms of concentrations. This is because attaining a particular water column concentration of a pollutant may protect aquatic organisms from toxicity, but may not protect a benthic organism that lives in and eats the bottom sediments or a predatory fish or bird that eats the benthic organism, or a human that ultimately consumes the fish. For such a TMDL, it will typically be necessary to convert the concentration-based numeric targets into mass emission-based loading capacities using available flow data.

On the other hand if the pollutant of concern in the TMDL is short-lived, not known to accumulate in sediments or bioaccumulate in tissues, and the impairment of concern is limited to aquatic toxicity, the establishment of a concentration-based Loading Capacity is the most logical choice. For this type of TMDL, the concentration-based calculations will be relatively simple.

The Chollas Creek diazinon TMDL is an example of a relatively simple TMDL. Diazinon is an organophosphate pesticide which causes adverse effects on aquatic life through relatively short-term exposures. Diazinon is considered to be moderately persistent. Although there is evidence of diazinon accumulating in creek bed sediments, such accumulation is generally not believed to pose the environmental threat of greatest concern. This is because diazinon has a relatively short half-life in the environment before degrading into less toxic forms. Diazinon does not bioaccumulate in tissues or biomagnify through higher trophic levels. Consequently it is the water column concentrations of diazinon, and resulting aquatic toxicity, that are of greatest concern in preventing adverse ecosystem effects. For all of these reasons, the Loading Capacity, and its component waste load and load allocations, are defined in terms of concentrations rather than in mass emissions.

The Regional Board has defined the concentration-based Loading Capacity for diazinon in Chollas Creek to be exactly the same concentrations as the numeric targets, see Table 5-1 below. Like the numeric targets, the loading capacity for Chollas Creek has two components, the maximum 1-hour average or acute concentration and the chronic or 4-day average concentration.

Table 5-1
TMDL (Loading Capacity) for Diazinon in Chollas Creek

Exposure Duration	TMDL	Averaging Period
Acute	0.08 µg/L	One-hour average
Chronic	0.05 µg/L	Four-day average

By establishing this TMDL or Loading Capacity for Chollas Creek, the Regional Board is asserting that if the concentrations of diazinon in the creek do not exceed the TMDL, the aquatic life in the creek will be protected against both short and long-term exposure to diazinon.

6.0 Linkage Analysis

The purpose of the linkage analysis is to confirm that the TMDL or Loading Capacity will result in the attainment of applicable water quality objectives and beneficial use protection. With respect to diazinon, this TMDL will result in the attainment of the "Toxicity" and "Pesticide" water quality objectives and the restoration of the WARM and WILD beneficial uses in the Chollas Creek watershed[3]. This is because the Numeric Targets are set equal to the diazinon Water Quality Criteria which are based on toxicity testing and are specifically established at levels to ensure the protection of aquatic life from acute and chronic exposure to diazinon. The Water Quality Criteria protect all aquatic life stages including the most sensitive stages.

7.0 Waste Load and Load Allocations

The following discussion makes most sense in the context of a mass-based TMDL. Once the TMDL or Loading Capacity of a waterbody for a particular pollutant has been determined, the next step is to divide and allocate the TMDL amongst each of the contributing sources in the watershed. Waste Load Allocations (WLA) are assigned to point sources and Load Allocations (LA) are assigned to nonpoint sources.

[3] **MULTIPLE POLLUTANTS:** The attainment of water quality standards is qualified with the words "with respect to diazinon" because there are multiple pollutants causing toxicity. Toxicity conditions in Chollas Creek are caused by metals and diazinon. Successful implementation of both the Chollas Creek diazinon TMDL and the Chollas Creek metals TMDL is expected to result in full attainment of the "Toxicity" water quality objectives, and of the WARM and WILD beneficial uses.

Additionally a margin of safety (MOS) is incorporated into each TMDL in order to account for uncertainties in the analysis including, in particular, the uncertainty in the relationship between pollutant loads and water quality effects. The margin of safety can be implicit or explicit. For this TMDL the Regional Board has included an explicit 10% margin of safety which will be discussed in section 10.0 of this document.

As shown in the equation below, a TMDL is defined as the sum of the individual waste load allocations for point sources and load allocations for nonpoint sources and natural background (40 CFR 130.2) such that the capacity of the water body to assimilate pollutant loadings (i.e., the Loading Capacity) is not exceeded. In this TMDL, because diazinon is anthropogenic in origin, there are no natural background concentrations to be considered.

$$TMDL = WLA + LA + MOS$$

For concentration-based TMDLs, allocations to point and nonpoint sources are not additive. Instead when establishing concentration-based allocations, one makes the assumption that if the Numeric Targets are achieved in all contributing discharges into the watershed, the Numeric Target will also be achieved in the receiving waterbody. Accordingly, concentration-based allocations are applied equally to all discharge sources in the watershed.

The Regional Board has initially set all concentration-based waste load and load allocations equal to the Numeric Targets. However, after applying the 10% margin of safety, the allocations are calculated as 90% of the Numeric Target under acute and chronic exposure conditions. In other words, although the Numeric Target for diazinon under short-term acute exposure conditions is 0.08 µg/L, the Waste Load and Load Allocations are set at 0.072 µg/L after subtraction of the 0.008 µg/L (10%) margin of safety as shown in Table 7-1 below.

Table 7-1
Waste Load and Load Allocations
for Diazinon in Chollas Creek

Exposure Duration	Numeric Targets	Margin of Safety	Waste Load and Load Allocations
Acute	0.08 µg/L	0.008 µg/L	0.072 µg/L
Chronic	0.05 µg/L	0.005 µg/L	0.045 µg/L

Since all wet and dry weather runoff flows and other discharges which enter Chollas Creek directly or indirectly are regulated by the San Diego MS4 Permit or other NPDES permit (as noted in the Source Analysis above), there are no true nonpoint source discharges of diazinon to the creek. Never-the-less, we have provided load allocations in this TMDL in order to account for any unknown or future sources of diazinon that may not be regulated by an NPDES permit.

8.0 Diazinon Load Reductions Needed

Table 8-1 below summarizes the estimated needed (concentration-based) load reductions for diazinon in order to achieve the TMDL Numeric Targets in Chollas Creek. The difference between the current load and the allocation is the needed reduction. To date, there are no clear indications of declining trends in diazinon usage in the Chollas Creek watershed. This table indicates the estimated needed reduction during average storm flows. The average concentration of diazinon in Chollas Creek during storm events was 0.46 µg/L during the monitoring period 1998 through 2001. As discussed above, the majority of the diazinon load derives from storm flows.

Table 8-1
Needed Load Reductions in Chollas Creek

	Allocation		**Reduction Needed**	
Average Diazinon Concentration (µg/L)	Chronic (µg/L)	Acute (µg/L)	Chronic (µg/L)	Acute (µg/L)
0.46	0.045	0.072	**90%**	**84%**

As discussed in the Implementation Plan, section 11.0 below, USEPA has recently reached an agreement with the registrants (manufacturers) to phase-out most diazinon uses over the next few years. While it is expected that this agreement will result in very significant decreases in the use of diazinon in the Chollas Creek watershed and resulting discharge concentrations to the creek over time, additional measures appear to be necessary to achieve the reductions set forth above. This is particularly true during, and immediately following, the phase-out (due to ongoing and residual diazinon sales, stock piling, usage, and disposal).

9.0 Seasonal Variations and Critical Conditions

Clean Water Act Section 303(d) and the regulations at 40 CFR 130.7 require that: "TMDLs shall be established at levels necessary to attain and maintain the applicable narrative and numerical water quality standards with seasonal variations and a margin of safety that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality." (emphasis added.)

TMDLs must describe the methods used to account for seasonal variations and critical conditions (e.g., stream flows, pollutant loadings, and other water quality parameters). In the semi-arid climate of Southern California there are two seasons-dry weather during most of the years and intermittent wet weather events typically between November and March. This two-season climate creates significant differences in flows through creeks and streams. In general, 90% of the water flow occurs during less than 10% of the year, i.e., the most significant storm events and associated high flows usually occur during the months of December, January and February.

Diazinon usage in the Chollas Creek watershed correlates roughly with the season. There is a considerable increase in diazinon usage during the dry season (warmer months) due to increased pest activity. However, aquatic impairment due to the diazinon occurs during wet weather events as surface runoff pollutes the freshwater tributaries. Runoff into Chollas Creek is greatest during the wet season, and higher diazinon concentrations are observed during storm events. These higher diazinon concentrations account for the toxicity observed in storm water samples collected in the watershed.

There is not sufficient information available to characterize critical conditions in Chollas Creek. Because the Chollas Creek watershed is small and there are significant seasonal differences in rainfall in the watershed, there are significant seasonal differences in runoff from the watershed to the creek, and, hence, significant seasonal differences in flow rates in the creek. There is significant flow in Chollas Creek only during and immediately following rainfall events, which occur primarily from November through April. Other factors being equal, flow rates are highest during and immediately following major rainfall events. During the dry season, there are often extended periods of no surface flow, although some pools of standing water may be present in the creek bed. Because the TMDL is expressed as a concentration, a more detailed analysis of critical condition is unnecessary.

In summary, the chronic water quality criteria used as the basis for the diazinon Numeric Targets are designed to ensure protection of aquatic life during all stages of life including the most sensitive stages. Accordingly the concentration–based diazinon allocations established by this TMDL apply year-round throughout the Chollas Creek watershed and will be protective during all flow conditions and seasons.

Additional considerations regarding seasonal variation and critical condition are discussed below. Studies conducted in Alameda County, California found that diazinon was often detected in water and sediments of urban creeks throughout the year, not only during wet weather flows (Scanlin, J. and S. Gosselin, 1997). These studies also suggest that diazinon in creek bed sediments is released to creek water (Scanlin, J. and S. Gosselin, 1997). Consequently, creek bed sediments represent a potential reservoir from which diazinon can enter flowing water in a creek (or standing water in pools) even when no runoff enters the creek. These studies also suggest that diazinon toxicity is higher at higher temperatures (Scanlin, J. and S. Gosselin, 1997).

Runoff is believed to be the primary pathway by which diazinon enters both the water and the sediments of the creek. Runoff may be categorized as either storm water runoff or nuisance water runoff (e.g., from landscape irrigation). In any twelve-month period, by far the majority of runoff entering the creek is storm water runoff. Therefore, in the absence of information indicating otherwise, storm water runoff is believed to contain most of the mass of diazinon that enters the creek.

It is possible that "first flush" phenomena may influence diazinon concentrations in storm water runoff. Higher diazinon concentrations may result in the first runoff from rain following extended periods without rainfall (e.g., early season and out of season rainfall). Also, higher diazinon concentrations may occur in runoff from the first increment (e.g., ¼ inch) of rainfall from a particular storm. The Chollas Creek storm water flow monitoring for diazinon that has been conducted to date has not been sufficient to draw any conclusions about the presence or absence of "first flush" phenomena.

Although storm water runoff is likely to contain most of the mass of diazinon on an annual basis, nuisance water runoff (e.g., from landscape irrigation) may also contain diazinon. Although the annual volume of nuisance water runoff entering the creek is small in comparison to the annual volume of storm water runoff, nuisance water runoff enters the creek year-round. Consequently, at times of the year when there is little or no flow in the creek (i.e., during dry weather), nuisance water runoff may be of seasonal importance to diazinon concentrations and toxicity in low flows and standing water. The potential significance of diazinon in nuisance water runoff is underscored by the apparent greater toxicity of diazinon at higher temperatures (Scanlin, J. and S. Gosselin, 1997) and the generally higher Chollas Creek water temperatures in the May through October dry season than in the November through April wet season.

10.0 Margin of Safety

A margin of safety is incorporated into each TMDL in order to account for uncertainty in the analysis. The margin of safety can either be incorporated implicitly through conservative analytical approaches and assumptions used to develop the TMDL or added explicitly as a separate component of the TMDL, or a combination of both.

For this TMDL an explicit 10% margin of safety was incorporated into the allocations. This explicit margin of safety is intended to account for uncertainties in TMDL calculation methods concerning pesticide effects such as potential additive and synergistic impacts from exposure to multiple organophosphate pesticides (e.g., chlorpyrifos) that may aggravate water quality impacts due to diazinon in the watershed.

In addition to the explicit margin of safety, conservative assumption were used in applying the numeric targets within the watershed. These conservative assumptions serve as implicit margins of safety to provide additional protection for aquatic life and minimize aquatic toxicity.

1. No adjustment was made to reflect the possibility of pesticide breakdown from the point of discharge to Chollas Creek. Scientists have measured that the half-life of diazinon in water ranges from a few days up to six months; therefore some degradation is likely to be occurring after application and within flowing waters. Assuming discharges are within the specified concentration-based allocations, and that such degradation (via biotic and abiotic processes) occurs, there will be sufficient protection for aquatic life.

2. No adjustment was made to reflect the possibility of mixing and dilution within the drainage channels. In particular, the dilution capacity provided by groundwater seepage has not been factored into the TMDL.

3. The selected numeric targets for diazinon are the most stringent concentration-based values for freshwater. The Regional Board has selected the lowest recommended values from the California Department of Fish and Game water quality criteria as the best water quality indicator for diazinon. An additional margin of safety is also built into the water quality criteria themselves (Siepmann and Finlayson, 2000).

11.0 Implementation Plan

State law requires that TMDLs be included in water quality control plans. Therefore, TMDLs are adopted as basin plan amendments. A plan of implementation, as well as an assessment of economic and environmental impact must be considered when adopting a TMDL.

The CWC [Section 13242] requires an implementation program for achieving water quality objectives to include, at a minimum, a:

- Description of the nature of actions which are necessary to achieve the water quality objectives, including any recommendations for appropriate action by any entity, public or private;

- Time schedule for actions to be taken; and

- Description of surveillance to be undertaken to determine compliance with the objectives.

Additional guidance regarding implementation is provided in Federal and State law. 40 CFR 130.6(c)(6) calls for identification of implementation measures necessary to carry out a Water Quality Control Plan, including addressing financing, the time needed to implement the plan, and economic, social and environmental impacts of carrying out the plan. State law requires the Regional Board to consider economic factors in relation to environmental analysis of the reasonably foreseeable methods of compliance when adopting a performance standard [Public Resources Code 21159], and identify the total cost of the program and potential sources of financing when implementing an agricultural water quality control program [CWC 13141].

11.10 Responsible Parties

Municipal Copermittees
As dischargers of diazinon in urban storm water flows to Chollas Creek, the City of San Diego, City of Lemon Grove, City of La Mesa, San Diego Unified Port District, County of San Diego and the California Department of Transportation (CalTrans) are responsible for implementation of this TMDL. These entities are regulated as municipal Copermittees under the San Diego

Municipal Stormwater Permit (aka San Diego MS4 Permit)[4] or the statewide CalTrans MS4 permit[5]. Although CalTrans operations were not identified as a significant source of diazinon, the MS4 may transport pollutants, including diazinon. CalTrans is responsible for ensuring that future operations do not contribute to the impairment of Chollas Creek.

Regulation of Pesticides

Pesticides are regulated in California by the United States Environmental Protection Agency (USEPA) and the California Department of Pesticide Regulation (DPR). The State and Regional Water Boards do not directly regulate the use and licensing of pesticides. For example, effective March 2001, the USEPA cancelled the registration for the indoor household uses of diazinon. USEPA reached agreement with the manufacturers, Syngenta and Makhteshim Agan, that all retail sales of diazinon for indoor household use are to stop by December 2002. Furthermore, the manufacturing of diazinon for all lawn, garden and turf uses will stop in June 2003, and all sales and distribution to retailers ends in August 2003.

As a result of this phase-out the current role of USEPA and DPR with respect to diazinon will diminish over time. A brief discussion of USEPA and DPRs regulatory role with respect to pesticide regulation in general is provided below.

USEPA

Pesticide products must be registered federally before distribution or sale to any person under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Registration includes:

- submission of required data by the person seeking the registration, evaluation, and acceptance of these data by the USEPA;
- submission of a proposed label by the registrant;
- review and acceptance of the final labeling by USEPA,
- establishment of a tolerance (maximum residue level) for pesticides used on food or feed commodities; and
- the classification by USEPA of the pesticide product for restricted use or general use as appropriate.

Department of Pesticide Regulation

The Department of Pesticide Regulation (DPR) has primary responsibility for regulating all aspects of pesticide (e.g., diazinon) sales and use in California through state and federal

[4] Order No. 2001-01, NPDES No. CAS0108758, *'Waste Discharge Requirements for Discharges of Urban Runoff from the Municipal Separate Storm Sewer System (MS4s) Draining the Watersheds of the County of San Diego, the Incorporated Cities of San Diego County, and the San Diego Unified Port District*

[5] Order No. 99-06-DWQ, NPDES No. CAS000003, *'National Pollutant Discharge Elimination System (NPDES) Permit Statewide Storm Water Permit and Waste Discharge Requirements (WDRs) for the State of California, Department of Transportation (CalTrans)*

authorities. Through the state authorities (Food and Agriculture Code and Title 3 California Code of Regulations), DPR is enabled to:

- evaluate and register pesticide products before their use in the State;
- monitor the sales within the State;
- regulate and record the use;
- protect workers who might come into contact with pesticides;
- identify pesticides with high risk to human health or the environment and regulate these in special manners;
- develop and implement reduced risk pest management strategies;
- restrict the use of pesticides that pose an unreasonable risk;
- implement on-going and new regulations
- oversee and coordinate regulatory programs of the California Agricultural Commissioner; and
- enforce the laws and regulations and take appropriate enforcement action when necessary.

Management Agency Agreement

The Management Agency Agreement (MAA) between the DPR and State Board was approved in 1997. It is the functional agreement between DPR and the State Board on pesticide and water quality issues. The purpose of the MAA (see Attachment J) is to:

- Enter into a voluntary agreement between two agencies having discretionary and complementary authority regarding pesticides.
- Ensure that all pesticides registered in California are used in a manner that protects water quality and beneficial uses of water while providing effective, environmentally sound pest management.
- Identify roles and responsibilities of the two agencies regarding both water quality protection and pesticide regulation, and to describe how the agencies will work cooperatively to protect water quality in these areas.
- Coordinate respective authorities in a cohesive manner to eliminate duplication of effort and inconsistency of action.
- Coordinate respective authorities to solve water quality problems related to pesticide use by promoting the development and use of preventive practices through self-regulatory and regulatory efforts.

County Agricultural Commissioner

The County Agricultural Commissioner (CAC) acts as the DPR's agent in enforcing all laws and regulations pertaining to pesticides. The CAC is appointed by the county Board of Supervisors and works with authority granted by the California Food and Agricultural Code. Although state law offers various enforcement options to the CAC, compliance is often encouraged through educational programs. These may include informal or formal compliance actions (e.g., warning letters), corrective interviews, presentations to community and industry groups, and training sessions for pesticide users.

The CAC issues permits to pest control businesses, pesticide dealers, agricultural pest control advisors and pest control operators. Part of the CAC's duty in issuing a permit is to decide the need for a particular pesticide and whether a safer pesticide or better method of application can be used and still prove effective. The CAC regulates pesticide use to prevent misapplication or drift, and possible contamination of people or the environment. Although called the County Agricultural Commissioner, CAC employees may check upon pesticides applied in non-agricultural or urban settings. For example, they may check maintenance gardeners to ensure they are licensed to apply pesticides and that their pesticides are labeled for professional landscaping. Also, CAC biologists inspect home pesticide applications, such as structural fumigations for termites, and check structural pest control employees for proper training and equipment. Furthermore, the CAC employees work with the state agencies (e.g. State Water Resources Control Board and California Regional Water Quality Control Board) to protect surface and ground water from pesticide contamination. CAC staff enforce regulations to protect surface and ground water from pesticide contamination.

It is the responsibility of the CAC to:

- inspect the operations and records of pest control businesses, pesticide dealers, and agricultural pest control advisors;
- register licensed pest control businesses, agricultural pest control advisors, and pest control operators (these individuals and/or businesses must obtain statewide licenses from DPR and register in each county where they operate);
- conduct pesticide incident investigations; and
- provide training to pesticide users.

With the exception of the CAC, local governments are prohibited from regulating pesticide use by section 11501.1 of the California Code of Regulations. However, storm drain system operators have the authority to regulate the disposal of pesticides to the storm drain system.

Pest Control Operator (PCO)

The Pest Control Operator (PCO) is the state licensed professional applicator of pesticides at commercial and residential sites. There is currently no requirement for the PCO to have Integrated Pest Management (IPM) training to obtain or renewal their license. The Pest Control Advisor advises the PCO.

Pest Control Advisor (PCA)

Pest Control Advisor (PCA) is a state licensed pest control professional that Chollas Creek watershed stakeholders may contact for pest control decisions. The PCA monitors the site utilizing numerous IPM practices to facilitate a decision on whether a treatment strategy is necessary. A PCA identifies pest pressures, provides advice on the need for control measures, writes a recommendation, and orders, warehouses, and delivers the control products. Therefore, the PCA is the key link to advise and recommend alternative pest control methods.

Every licensed PCA is required, as a condition to renewal of a license, to certify that he or she has completed the continuing education requirements. The number of hours required depends on the number of branches of pest control in which the licenses are held. The continuing education credit may be assigned for accredited college courses, adult education courses, professional seminars or meetings, technical seminars or meetings, operators' courses and/or correspondence courses approved by the Structural Pest Control Board. In lieu of continuing education, a licensed operator or field representative may qualify for renewal by taking and passing an examination designed to cover developments in the field of pest control. <www.dca.gov/pestboard/overview.htm>.

11.20 TMDL Implementation Plan

The three most important mechanisms to implement the diazinon waste load reductions required by this TMDL are (1) USEPA's ongoing diazinon phase-out and elimination program; (2) modification of the San Diego Municipal Storm Water Permit (MS4 Permit) as needed for consistency with this TMDL; and (3) activities by the municipal Copermittees in the Chollas Creek watershed to reduce diazinon discharges pursuant to the MS4 permit and Water Code Section 13267.

1. USEPA's Diazinon Phase-Out and Elimination Program

The single most important action to implement this TMDL is USEPA's national ongoing Diazinon Phase-Out and Elimination Program. In January 2001, USEPA reached an agreement with registrants (manufacturers) of diazinon to phase-out most uses (USEPA 2001). Under the agreement, all indoor uses will be terminated, and all outdoor non-agricultural uses will be phased-out over the next few years. Retail sales of diazinon will be banned after December 31, 2002.

Specifically, the terms of the agreement implement the following phase-out schedules:

- For the indoor household use, the registration was canceled on March 2001, and all retail sales will stop by December 2002.

- For all lawn, garden and turf uses, manufacturing stops in June 2003; all sales and distribution to retailers ends in August 2003. Further, the manufacturers will implement a product recovery program in 2004 to complete the phase-out of the product.

- Additionally, as part of the phase-out, for all lawn, garden, and turf uses, the agreement ratchets down the manufacturing amounts. Specifically, for 2002, there will be a 25 percent decrease in production; and for 2003, there will be a 50 percent decrease in production.

- Also, the agreement begins the process to cancel around 20 different uses on food crops.

In summary, the phase-out is designed to reduce diazinon use, sales and availability, and to increase proper disposal. As a result of the phase-out, USEPA expects, on a national basis, that these actions will end over 90% of current diazinon uses. In the Chollas Creek watershed, since agricultural use is negligible, the phase-out should reduce current source loadings of diazinon, and the resulting aquatic toxicity, to negligible levels over time. For these reasons, the diazinon phase-out is by far the single most significant mechanism by which this TMDL will be implemented. The remaining TMDL implementation actions described below are designed to reduce the discharge of diazinon in the Chollas Creek watershed due to interim (during the phase-out) and residual (post phase-out) diazinon sales, use, and disposal. It should be noted that actions taken by the municipalities and other stakeholders to reduce diazinon discharges in the Chollas Creek watershed will likely be effective in reducing the discharges of alternative pesticides in the long-term.

2. **Modification of Existing Waste Discharge Requirements / NPDES Permits**

The Regional Board's San Diego Municipal Storm Water Permit, also known as the San Diego MS4 permit is the primary broad-based NPDES permit which directly regulates most pollutant discharges, including diazinon, in the Chollas Creek watershed. Federal regulations require that NPDES permits contain effluent limitations that are consistent with waste load allocations developed under a TMDL (40CFR 122.44 (d)(vii)(B)). The Regional Board will revise existing waste discharge requirements / NPDES permits to incorporate effluent limitations in conformance with the Waste Load Allocations for diazinon as specified in Table 7-1 of this document. Modifications to the MS4 Permit can occur when the permit is reopened or during scheduled permit reissuance.

3. **Activities By Municipal Copermittees Pursuant to MS4 Permit and CWC Section 13267**

Pursuant to the MS4 Permit and under the authority of Water Code Section 13267, the Regional Board will direct the municipal Copermittees in the Chollas Creek watershed to do the following:

a. *Legal Authority*
Enforce existing local ordinances, or adopt new legal authority, as needed to ensure Copermittee compliance with the waste load allocations specified in this TMDL;

b. *Diazinon Toxicity Control Plan*
Develop and implement a "Diazinon Toxicity Control Plan" to promote Copermittee compliance with the waste load allocations specified in this TMDL. The Plan should consist of pollution prevention and source control best management practices designed to reduce the discharge of diazinon to Chollas Creek. The "pesticide component" of the education program currently under development by the Copermittees pursuant to the MS4 permit, can serve as the Diazinon Toxicity

Control Plan required under this TMDL.

c. *Diazinon Public Outreach / Education Program*
Develop and implement a focused Public Outreach / Education program designed to reduce the discharge of diazinon in the Chollas Creek watershed. By reducing the discharge of diazinon the Program will promote Copermittee compliance with the waste load allocations specified in this TMDL. The Program should contain the components described in Attachment M of this document, or equivalent component. The Program should also contain an evaluation plan for determining the efficacy of the Public Outreach / Education Program. The *Diazinon Public Outreach / Education Program* may be incorporated into the Diazinon Toxicity Control Plan.

4. **Compliance with MS4 Permit**

The municipal Copermittees in the Chollas Creek watershed shall implement the requirements of the applicable MS4 Permit.

5. **Compliance with Existing Waste Discharge Prohibitions**

Prohibitions against discharges of waste that cause pollution or nuisance, described in the Basin Plan, including discharges of diazinon that cause or contribute to violation of water quality objectives are applicable to the urban land users and land owners in the Chollas Creek watershed. Dischargers of diazinon in the watershed shall also comply with all other applicable waste discharge prohibitions contained in the Basin Plan.

6. **Enforcement Authority of Regional Board**

The Regional Board will use its enforcement authority as necessary to ensure compliance with applicable waste discharge requirements and Basin Plan waste discharge prohibitions.

7. **Modification of Other Existing Waste Discharge Requirements**

The State Water Resources Control Board (State Board) has issued three additional NPDES storm water permits that regulate the discharge of pollutants including diazinon in the Chollas Creek watershed. These permits are the statewide CalTrans Municipal Storm Water Permit[6], the statewide General Industrial Storm Water Permit[7], and the

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[6] Order No. 99-06-DWQ NPDES No. CAS 000003 *Caltrans Municipal Storm Water Permit*

[7] Order No. 99-08-DWQ NPDES No. CAS 000001 *General Industrial Storm Water Permit*

statewide General Construction Storm Water Permit[8] which directly regulate discharges from CalTrans owned and operated facilities, and from industrial and construction site respectively located within the Chollas Creek watershed. Discharges from industrial and construction sites in the Chollas Creek watershed are also indirectly regulated under the MS4 Permit which holds each municipal Copermittee ultimately responsible for all discharges from industrial and construction sites within its jurisdiction. The Regional Board will request the State Board to amend each of these three statewide permits as needed for consistency with this TMDL. Modifications to waste discharge requirements can occur when permits are reopened or reissued.

In addition to the broad-based regulation of discharges under the MS4 permit, the discharge of pollutants, including diazinon, from utility companies and utility vaults is directly regulated under the State Board's General Permit for Utility Vaults[9]. The Regional Board will request the State Board to revise the General Permit for Utility Vaults as needed for consistency with this TMDL.

8. **Adoption of New Waste Discharge Requirements / NPDES Permits**

The Regional Board may adopt new waste discharge requirements / NPDES permits for any significant source(s) of diazinon identified by the municipal Copermittees during the conduct of the comprehensive Diazinon Source Analysis of Chollas Creek watershed.

9. **Promotion of Integrated Pest Management (IPM) Training**

The Regional Board will request the State Water Resources Control Board to encourage the Department of Pesticide Regulation (DPR) and the State Structural Pest Control Board to incorporate integrated pest management (IPM) into training programs for all Pest Control Advisors and Pest Control Operators. Likewise the Regional Board will encourage the County Agricultural Commissioner (CAC) to also provide IPM training. At a minimum the training should include the following:

a. Identification and quantification of the sources and pathways by which diazinon and other insecticides enter urban runoff;

b. environmental significance (or potential impact) of diazinon and other insecticides in urban runoff;

c. use of IPM including alternatives to insecticides; and

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[8] Order No. 99-08-DWQ NPDES No. CAS 000002 *General Construction Storm Water Permit*

[9] Order No. 2001-11-DWQ NPDES No. CAG 99002 *General Utility Vault Storm Water Permit*

d. least toxic methods of pest control for specific insect pests.

10. **Additional Investigations and Reports Pursuant to CWC Section 13225**

The Regional Board may use its authority under California Water Code Section 13225 to request the municipalities in the Chollas Creek watershed to conduct additional investigations which are beyond the purview of the MS4 Permit and to report on the findings of such investigations. Any such investigations will address diazinon-related issues in the Chollas Creek watershed for the ultimate purpose of reducing diazinon discharges in the watershed.

11.30 Monitoring Plan and Objective

Pursuant to the MS4 permit and under the authority of Water Code Section 13267, the Regional Board will direct the municipal Copermittees in the Chollas Creek watershed to develop and implement a Monitoring Plan. The objective of the Plan shall be to assess the effectiveness of this TMDL, its implementation measures, and progress towards the attainment of applicable water quality standards in the Chollas Creek watershed.

This TMDL does not require the development of a new and separate monitoring program. Rather these requirements are intended to **augment** the Copermittees existing monitoring activities in the Chollas Creek watershed pursuant to the MS4 permit. Monitoring in Chollas Creek can be used to fully or partially satisfy the monitoring requirement of both the MS4 permit as well as the TMDL.

At a minimum, the Plan shall include measures of water column diazinon concentrations and Ceriodaphnia dubia bioassays to measure toxicity. At a lower frequency, Chollas Creek sediments shall also be monitored for diazinon. Appropriate procedures and methods, as outlined in the following sections, are to be used for all sampling and analysis. Under this same authority, the Regional Board may also direct the Copermittees to conduct additional Toxicity Identification Evaluations (TIEs) if toxicity remains after diazinon and metal concentrations meet their respective TMDLs.

Sections 11.31 – 11.36 below contain further detail on the minimum required components of the monitoring plan as well as the Regional Board's recommendation for sampling frequency and number and location of sampling stations. The Copermittees are encouraged to design and propose the monitoring plan (to augment their existing activities) which they believe makes the most effective use of their monitoring dollars and which meets the stated objective above. The Regional Board must approve the proposed plan prior to implementation. Approval will likely be concurrent with the Regional Board's revision of the MS4 permit.

11.31 Sample Collection

Storm water samples shall be collected using a flow-weighted composite sampling strategy during wet-weather season identical to the current municipal storm water monitoring program[10]. The municipal storm water permit wet weather season is defined as October 1 through April 30 of each year. The monitoring program should include sampling at the stations identified in Table 11-1 during three (3) storm events. Sampling is suggested during the first two (2) storm events of the wet weather season which meet the United States Environmental Protection Agency's (USEPA's) criteria as described in 40 CFR §122.21(g)(7)[11]. For the third storm event, sampling is suggested during the first event after February 1 which meets the US EPA's criteria. The key components of USEPA's storm event criteria [§122.21(g)(7)] are summarized below.

- A rainfall of at least one-tenth (0.1) inch in the drainage area.
- No storm event in excess of one-tenth (0.1) inch in the drainage for at least seventy-two (72) hours prior to the sampled storm event.
- A storm event within plus or minus fifty (50) percent (%) of the average or median storm volume and duration for the region.

11.32 Location of Monitoring Stations

The monitoring program should include the eight stations identified in Table 11-1, below. There are two major forks of Chollas Creek, the northern branch of Chollas Creek which is known as North Chollas Creek or "Main Chollas Channel" and the southern branch of Chollas Creek which is known as South Chollas Creek.

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[10] Order No. 2001-01, NPDES No. CAS0108758, *'Waste Discharge Requirements for Discharges of Urban Runoff from the Municipal Separate Storm Sewer System (MS4s) Draining the Watersheds of the County of San Diego, the Incorporated Cities of San Diego County, and the San Diego Unified Port District*

[11] For the purpose of the Monitoring and Reporting Program the requirement that there be a one (1) month separation between storm event samples has been deleted.

Table 11-1.
Location and Description of Monitoring Stations within Chollas Creek

Station name	Location and description of monitoring station
SD8(1)	North Chollas Creek near Durant and 33rd Street. This station is also known as SD8 – Chollas, and was later renamed SD8 (1)-Chollas. This is the storm water monitoring program wet-weather mass loading station. The station is located in a concrete-lined section of the creek at the end of the 3300 block of Durant Street, near the intersection of 33rd Street, in the City of San Diego. The wet weather sampling from this station includes monitoring for diazinon, chlorpyrifos, and chronic 96-hour toxicity bioassays with the water flea, Ceriodaphnia dubia.
SD8(2)	Wabash Avenue Branch of North Chollas Creek. This station is also known as the Wabash Avenue (I-15) branch of the Main Chollas Channel. This is a City of San Diego field-screening site and an existing wet-weather mass loading station for the storm water program. The station is located just north of the Highway 94 and Interstate 15 interchange. Some of the vegetation in this portion of the watershed is protected under the Multiple Species Conservation Plan.
SD8(3)	Home Avenue Branch of North Chollas Creek. This is a City of San Diego field screening site and a wet-weather mass loading station for the storm water program. It is located next to the San Diego Police Department canine training field and the Police Pistol Range and is downstream from residential areas. This area tends to remain wet year-round as a result of irrigation runoff from upstream residential areas. This portion of the creek is channeled, but has a natural bottom.
SD8(4)	South Chollas Creek at 38th Street. This is an existing wet-weather mass loading station for the CalTrans storm water program. The station is located in Chollas Creek at the 38th Street bridge just north of Beta Street and several blocks east of Interstate 5. The station is located in a channelized portion of the creek and has a natural bottom. It is approximately 4 blocks upstream of the confluence with the north fork of Chollas Creek. This station is located within a designated open space area and the wetland water quality study area for the Chollas Creek Enhancement Project. This site is located near SD8 (10).
SD8(5)	Federal Boulevard Branch of South Chollas Creek. This is an existing wet-weather mass loading station for the Storm Water Program, added in January 2000. The funding for installation of the autosampler is from the City of Lemon Grove and La Mesa. This site is located next to State Route-94, west of 60th Street and Federal Boulevard. It is located in a light industrial/commercial area near the edge of San Diego City limits. Discharges from the City of Lemon Grove pass through here.
SD8(6)	Jamacha Road Branch of South Chollas Creek. This station is located just south of Jamacha Road at the 69th Street crossing of South Chollas Creek. The station is a City of San Diego field screening site and an existing wet-weather mass loading station for the storm water program. The station is located just downstream from Lemon Grove and upstream of designated open space. The station is along a natural portion of the creek within a residential area and is typically wet all year long.
DPR(1), SD8(9)	South Chollas Creek just west of Euclid Avenue and north of San Diego and Arizona Eastern train tracks. The nearest major cross street to Euclid Avenue is Market Street. This is the location of a DPR station established in 1999-2000.
DPR(2), SD8(10)	South Chollas Creek at the 38th Street bridge. This station is located just north of Alpha Street and a few blocks east of Interstate-5. National Avenue, a few blocks north of the site, is the nearest major cross street to 38th Street. This is the location of a DPR station established in 1999-2000, located near SD8(4).

11.33 Diazinon Test Method

The monitoring program should include diazinon testing of ambient water in Chollas Creek during each of three (3) storm events at the eight (8) stations identified in Table 11-1. The analytical method shall achieve the diazinon reporting limit of 0.05 µg/L (see Table 11-2).

Table 11-2
Test Method, Detection Limit and Reporting Limits for Diazinon in the Monitoring Program

Parameter	Method	Detection limit	Reporting limit
Diazinon	EPA 8141A	0.20 µg/L	0.05 µg/L

The monitoring program shall use the USEPA analytical chemistry method for diazinon (e.g., EPA 8141A). If desired, an equivalent test method may be used in conjunction with the USEPA analytical chemistry method. The diazinon analytical chemistry method EPA 8141A has a detection limit of 0.20 µg/L, so when using this method, it will be necessary to extract diazinon from a sufficient volume of sample to reach the 0.05 µg/L reporting limit.

11.34 Enzyme-Linked Immunosorbant Assay (ELISA)

If an equivalent test method (ELISA) is used for diazinon testing of ambient water in Chollas Creek, an external standard is to be quantified during every field survey. Split samples for quality assurance must document acceptable accuracy and precision of the alternate test method. At least 10% of the samples measured with ELISA kits are to be measured with EPA analytical chemistry methods for quality assurance comparisons.

11.35 Quality Assurance/Quality Control (QA/QC)

All field and laboratory handling must be conducted using "clean techniques." The monitoring program shall develop and implement a QA/QC plan for field and laboratory operations. The QA/QC plan for field operations shall cover the following, at a minimum:

- Quality assurance objectives;
- Sample container preparation, labeling and storage;
- Chain-of-custody tracking;
- Field setup;
- Sampler equipment check and setup;
- Sample collection;
- Use of field blanks to assess field contamination;
- Use of field duplicate samples;
- Transportation to the laboratory;
- Training of field personnel; and
- Evaluation, and enhancement if needed of the QA/QC plan.

The QA/QC plan for laboratory operations shall cover the following, at a minimum:

- Quality assurance objectives;
- Organization of laboratory personnel, their education, experience, and duties;
- Sample procedures;
- Sample custody;
- Calibration procedures and frequency;
- Analytical procedures;
- Data reduction, validation, and reporting;
- Internal quality control procedures;
- Performance and system audits;
- Preventive maintenance;
- Assessment of accuracy and precision;
- Correction actions; and a
- Quality assurance report.

11.36 Ambient Water Toxicity

The monitoring and reporting program shall include, at a minimum, one (1) 96-hour acute and one (1) 7-day chronic toxicity bioassay of ambient water in Chollas Creek using the water flea, *Ceriodaphnia dubia* during each of three (3) storm events at the mass loading station SD8(1).

The method to be used in the chronic toxicity testing is "Survival and Reproduction Test Method 1002.0, Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, EPA/600/4-91/002"[1] for *Ceriodaphnia dubia.*

The method to be used in the acute toxicity testing will be those outlined for a 96-hour acute test in "Methods for Measuring the Acute Toxicity of Effluents and Receiving Water to Freshwater and Marine Organisms, EPA/600/4-90/027F."[1]

The results of ambient chronic and acute water toxicity testing shall be reported as shown in Table 11-3, below:

Table 11-3
Ambient Water Toxicity Testing Results to be Reported

Description of Reporting Values	96-hour Acute	7-day Chronic
Mean % survival for control	Yes	Yes
% Survival in 100% concentration	Yes	Yes
Lethal concentration 50% (LC_{50}) - The toxicant concentration that would cause death in fifty percent (50%) of the test population.	Yes	Yes

Description of Reporting Values	96-hour Acute	7-day Chronic
No-Observed-Effect-Concentration (NOEC reproduction) –This is the highest concentration of toxicant to which organisms are exposed in a full life-cycle or partial life-cycle (short-term) test, that causes no observable effect on survival ($NOEC_{survival}$); and no observable effect on growth and reproduction ($NOEC_{growth}$) of the test population. This would mean that there is no significant difference between the test solution and the control, as determined by hypothesis testing.	Not Applicable	Yes
Lowest-Observed-Effect-Concentration (LOEC) - This is the lowest concentration of toxicant to which organisms are exposed in a full life-cycle or partial life-cycle (short-term) test, which causes adverse effects on the test organisms. The $LOEC_{survival}$ is the lowest toxicant concentration that causes adverse effects on survival; and the $LOEC_{growth/ reproduction}$ is the lowest toxicant concentration that causes effects on growth and reproduction. This would mean that there is no significant difference between the test solution and the control, as determined by hypothesis testing.	Yes	Yes
Toxic-Unit for acute effects (TU_a) – The TU_a equals $100/NOEC_{survival}$. A TU_a value of 1 indicates that no toxicity was observed.	Yes	Not Applicable
Toxic-Unit for chronic effects (TU_c) – The duration of exposure (in the original, 100% sample) that causes mortality in fifty percent (50%) of the test population.	Not Applicable	Yes
TU_c sublethal (reproduction) - A chronic or sublethal effect would include having an effect on reproduction or growth. The TU_c equals $100/NOEC_{reproduction/growth}$. A TU_c value of 1 indicates that no toxicity was observed.	Not Applicable	Yes
Lethal-Time for 50% mortality (LT_{50})	Yes	Yes

11.40 Reporting Requirements

There will be two reporting requirements associated with the implementation of this TMDL: Annual Effectiveness Report and Annual Monitoring Report.

Effectiveness Report
Pursuant to the MS4 Permit and under the authority of Water Code Section 13267, the Regional Board will, direct each municipal Copermittee in the Chollas Creek watershed to describe the implementation schedule and effectiveness of: a) Legal Authority, b) Diazinon Toxicity Control Plan, and c) Diazinon Public Outreach/Education Program.

Monitoring Reports
Pursuant to the MS4 Permit and under the authority of Water Code Section 13267, the Regional Board will direct each municipal Copermittee to implement and report on the findings of the Monitoring Plan as described in section 11.30 above.

Annual Reports

Annual reports shall cover the reporting or monitoring period of October 1 – September 30. . The reports shall be submitted to the Regional Board by January 31 of the following year.

11.50 Schedule of Implementation

As previously described, compliance with numeric limitations for diazinon will be required in accordance with a phased schedule of compliance. All other requirements of this TMDL will be immediately effective upon incorporation into applicable NPDES permits as shown below.

Action	Description	Responsible Parties	Due Date
USEPA cancels registration for indoor household uses of diazinon		USEPA	March 31, 2001
IPM Workshop(s)	Conduct first workshop	Chollas Creek Watershed Municipal Copermittees	and annually thereafter
Monitoring Plan	Initiate Monitoring Plan	Chollas Creek Watershed Municipal Copermittees	30-days after US EPA approves of TMDL
Diazinon Toxicity Control Plan	Initiate DTCP	Chollas Creek Watershed Municipal Copermittees	30-days after US EPA approves of TMDL
Retail sales of diazinon (indoor uses) end		USEPA	December 31, 2002
Manufacturing of diazinon for all lawn, garden and turf uses end		USEPA	June 31, 2003
Sales and distribution to retailers ends		USEPA	August 31, 2003
Phase out and eliminate diazinon usage and sales in the Chollas Creek Watershed. Ensure proper disposal		USEPA	2003 for non-agriculture uses.
Modify MS4 Permit for consistency with TMDL		Regional Board	No later than 2006
Implement legal authority to reduce diazinon discharges reduction activities in Chollas Creek watershed.		Chollas Creek Watershed Municipal Copermittees	6 months after US EPA approval of TMDL

Action	Description	Responsible Parties	Due Date
Compliance with MS4 Permit		Chollas Creek Watershed Municipal Copermittees	Ongoing
Compliance with Existing Waste Discharge Prohibitions		Diazinon Dischargers	Ongoing
Enforcement Authority of Regional Board		Regional Board	Ongoing
Modification of Other Existing Waste Discharge Requirements		Regional Board	No later than next reissuance
Adoption of New Waste Discharge Requirements / NPDES Permits	For significant diazinon sources only.	Regional Board	As needed
Additional Investigations and Reports Pursuant to CWC Section 13255		Diazinon Dischargers	As needed
Submit Annual Reports	Effectiveness Reports and Monitoring Reports	Chollas Creek Watershed Municipal Copermittees	January 31 of each year

12.0 Environmental Review

The California Regional Water Quality Control Board, San Diego Region (hereinafter referred to as the Regional Board) is the Lead Agency for evaluating the environmental impacts of the proposed amendment to the "Water Quality Control Plan for the San Diego Basin (9)" (Basin Plan) to incorporate the Total Maximum Daily Load and Water Quality Attainment Strategy for Chollas Creek Diazinon. The Secretary of Resources has certified the basin planning process as exempt from certain requirements under the California Environmental Quality Act (CEQA), including preparation of an initial study, a negative declaration, and environmental impact report (California Code of Regulations, Title 14, Section 15251). As this proposed amendment to the Basin Plan is part of the basin planning process, the amendment process is considered 'functionally equivalent' to an initial study, negative declaration, and environmental impact report.

Any regulatory program of the Regional Board certified as functionally equivalent however, must satisfy the documentation requirements of California Code of Regulations, Title 23, Section 3777(a) which requires the following:

- A description of the proposed activity;
- An environmental checklist (Attachment K);
- A determination with respect to significant environmental impacts (Attachment K);
- A description of reasonable alternatives; and
- A description of mitigation measures to minimize any significant adverse impacts.

The environmental checklist, technical report and resolution to incorporate the Chollas Creek Diazinon Total Maximum Daily Load into the Basin Plan fulfill the requirements specified under section 3777.

12.10 Description of Proposed Activity

As required by Section 303(d) of the federal Clean Water Act, the Regional Board has prepared a Total Maximum Daily Load for Diazinon in Chollas Creek.

The Total Maximum Daily Load (TMDL) for diazinon is proposed in order to attain water quality objectives for toxicity and pesticides, and protect (from diazinon) the warm freshwater and wildlife habitat beneficial uses of Chollas Creek. Numeric targets, waste load allocations and load allocations are assigned to reduce diazinon inputs to the creek. Proposed implementation measures to meet the TMDL include implementation of best management practices (BMPs) and public outreach by the dischargers. Dischargers are responsible for taking measures, such as implementing BMPs, to reduce and manage their input of diazinon.

The adoption of a Basin Plan amendment to incorporate a TMDL and a TMDL implementation plan for Chollas Creek will not in itself have a significant adverse effect on the environment.

However, implementation of the TMDL will involve projects, which may have environmental impacts. The precise nature, location, and significance of these impacts cannot be determined at this time, since the implementation program establishes a process for identifying subsequent projects rather than specifying particular remedial projects at specific locations. Additionally, actions that result from the implementation of this TMDL may require separate environmental review. Therefore, impacts from these projects are considered indirect to this action and are discussed only as potential actions.

12.20 Alternatives

This section describes a range of reasonable alternatives to the project, and evaluates the comparative merits of the alternatives. The alternatives include:

- No Action;
- Regulatory Approach to TMDL Implementation;
- Adopting a Site-Specific Water Quality Objective; and/or
- Wait for the Phase Out of Diazinon.

12.21 No Action

The "no action" alternative is not to adopt the Basin Plan amendment to incorporate the diazinon TMDL and implementation plan. Selection of the "no action" alternative would mean the continuation of existing programs and operations in compliance with the general municipal storm water permit. There are currently no formal management or public outreach measures for control of diazinon occurring in the watershed. Previous community outreach efforts, developed during a 319(h) grant, encouraged nonpoint source control to middle school students, watershed residents, and high school mentors. These activities are no longer funded and have not been continued.

If the TMDL is not implemented in this watershed, implementation of BMPs will eventually be required for control of surface water runoff under the Nonpoint Source Plan, which could lead to some improvement in the water quality of the creek. However, until control of diazinon sources to surface water occurs, Chollas Creek will likely remain in violation of water quality objectives and the impairment of aquatic habitat will likely continue.

Ultimately, if the State does not adopt the proposed a TMDL and implementation plan, the USEPA is required to develop and adopt a TMDL pursuant to Section 303(d) of the Clean Water Act. Under revisions to the federal TMDL regulations, which are scheduled to take effect in April 2003, the USEPA would also adopt an implementation program. Thus, the "no action" alternative could eventually lead to federal, rather than state requirements for implementation projects with environmental impacts similar to those discussed in this Technical Report.

12.22 Regulatory Approach to TMDL Implementation

This alternative is a variation on the proposed action. This alternative would adopt the proposed TMDL but would use a regulatory approach to implement remedial water quality control (e.g., Waste Discharge Requirements, Enforcement Orders, and so on) instead of a primarily community-based watershed management approach. The regulatory approach would involve evaluating compliance of individual dischargers with waste discharge prohibitions in the Basin Plan. If violations of existing permits are found, enforcement actions would be initiated to reduce the discharges of diazinon to within acceptable limits. The regulatory approach could hasten implementation and ensure more rapid improvements in water quality and beneficial uses. However, this alternative would require a larger allocation of Regional Board resources for permit writing and enforcement, and it may not be well received by dischargers or the local community.

12.23 Wait for the Phase-Out of Diazinon

This alternative would delay the implementation of diazinon reduction education and outreach BMPs. The recommended TMDL contains a combination of two approaches. The first is legal restrictions on the availability and uses of diazinon which became effective March 2001, when the United States Environmental Protection Agency (USEPA) cancelled the registration for the indoor household uses of diazinon. USEPA reached agreement with the manufacturers, Syngenta and Makhteshim Agan, that all retail sales of diazinon for indoor household use are to stop by December 2002. The manufacturing of diazinon for all lawn, garden and turf uses will stop in June 2003, and all sales and distribution to retailers ends in August 2003.

The second approach involves education and outreach with the aim of reducing diazinon use, preventing improper disposal of diazinon, and encouraging alternative non-toxic pest control methods. In order for either approach (or any combination thereof) to be effective, similar measures are also likely to be necessary for other problematic pesticides (e.g., chlorpyrifos). In the absence of such measures, reductions in diazinon use may be offset by increased use of other pesticides. It is unknown to what degree these other pesticides will effect the aquatic community.

12.24 Mitigation Measures

The proposed action will not have any direct adverse environmental impacts. The implementation of the TMDL will in effect lead to an overall improvement in the quality of water and therefore the quality of the environment. Potential or indirect impacts could arise from the establishment of Best Management Practices that result from TMDL Implementation, however these projects and their impacts are speculative at this time. Additionally, subsequent environmental documents prepared for specific implementation projects will identify site-specific mitigation needs. Therefore, no mitigation or mitigation monitoring is currently required.

13.0 Economic Considerations

13.1 Introduction

State law requires the Regional Board to consider economic factors in relation to environmental analysis of the reasonably foreseeable methods of compliance when adopting a performance standard. A TMDL, in combination with the load allocations, may be considered a performance standard [Govt. Code § 11342(d)].

The purpose of this cost consideration is to provide the Regional Board with information concerning the potential cost of implementing this TMDL. This section takes into account a reasonable range of economic factors in fulfillment of the applicable provisions of the California Environmental Quality Act (Public Resources Code Section 21159.)

An evaluation of the costs of implementing this TMDL amounts to evaluating the costs of preventing diazinon from getting into the storm drains to the creek and the costs of monitoring and reporting diazinon concentrations in the creek. This report gives a summary overview of the costs associated with the most likely ways the municipal Copermittees will achieve the required reduction in discharges to the storm drain system and the costs of developing and implementing a Monitoring Plan. The following cost estimates of implementation are based on cost estimates provided by municipal Copermittees in the San Francisco bay area costs will vary widely depending on the methods selected.

13.2 Interagency Collaboration

Preventing diazinon from getting into the creek and its tributaries and is a costly endeavor and will take the combined efforts of dischargers including the City of San Diego, Lemon Grove and La Mesa, and the San Diego Unified Port District. Interagency collaboration is viewed as imperative due to the scope and duration of the Implementation Plan. The Implementation Plan seeks long-term behavior and habit changes through the education and outreach program; and through storm water policies, procedures and/or ordinances. Also, interagency collaboration is imperative for implementing the long-term monitoring plan that will assess the effectiveness of the diazinon reduction efforts. Furthermore, interagency collaboration should be done to help maximize available program funds and to share knowledge and resources.

13.3 Phase-out of Diazinon

Phase-out of diazinon will be the most effective TMDL implementation measure. The costs associated with this phase-out are unknown at this time.

13.4 Reductions in Diazinon Loadings through Integrated Pest Management (IPM)

Municipal Copermittees in the Chollas Creek watershed may consider Integrated Pest Management (IPM) in reducing diazinon loadings and ultimately improving water quality. A summary and overview of those costs estimates is presented below.

An IPM is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms and the environment.

The main component of an IPM is a Public Relations Campaign focusing on education and outreach. Several staff would be required to develop and implement this campaign. Total estimated staff salaries for a Public Relations Coordinator, Storm water Coordinator, Master Gardener, Web Master, Demonstration Garden Caretaker, BMP Coordinator and Municipal Pesticide Storage and Application Coordinator is $216,300 to $251,6000 per year.

Campaign elements would consist of public service announcements, newspaper articles, printed information distribution and training / classes. These elements would be targeted toward all households, businesses, municipalities, construction and industrial stakeholders in the watershed. The 2000 Census lists the total number of occupied housing units in the Chollas Creek watershed at 111,112 (SourcePoint, 2000). An additional 10% of this number will be added to account for the other land users, for a total of 122,500 stakeholders to be targeted. Based on this target number, first year cost estimates for all campaign elements range from $450,000 to $1,107,000. The success of the first year, inflation and the degree of interagency collaboration will determine subsequent year costs.

13.5 Prevention of Illicit and Illegal Discharges of Diazinon and other Pesticides

Municipal Copermittees in the Chollas Creek watershed may consider mechanisms to describe the current and future steps each discharger will take to prevent illicit/illegal discharges of diazinon and other pesticides to the storm water conveyance system, including inspection and enforcement activities. This is already a required component of the *'San Diego Municipal Storm Water Permit'*, Section F.5. '*Illicit Discharge Detection and Elimination Component*' (See Attachment G). Therefore this activity/requirement does not incur additional cost to the dischargers.

13.6 Storage and Application of Pesticides at Municipal Areas

Municipal Copermittees in the Chollas Creek watershed may consider including a program to quantitatively identify their pesticide use/storage by preparing a periodically updated inventory of pesticides currently used and/or stored by all internal departments, divisions, and other operational units as applicable to each discharger. Municipal Copermittees in the Chollas Creek watershed may describe pesticides currently stored and/or applied at municipal areas and the structural and non-structural BMPs currently being implemented and those being planned to ensure that the discharge of pesticides to the storm water conveyance system is prevented. Important municipal areas include municipal facilities, maintenance yards, public rights-of-way, park and ride facilities, weigh stations, parks, recreational facilities, golf courses, cemeteries, botanical or zoological gardens and exhibits, landscaped areas, and so on. Municipal Copermittees in the Chollas Creek watershed may include goals and implementing actions to replace pesticide use (especially diazinon use) with least toxic alternatives. The salary for the 'Municipal Pesticide Storage and Application Coordinator' is included in the estimated salaries of section 13.40.

13.7 Collection and Proper Disposal of Unused Diazinon and Other Pesticides

The County of San Diego Hazardous Materials Management already has a program in place for the collection and disposal of expired and/or unwanted hazardous materials (e.g., diazinon). Household hazardous waste collection is required by Assembly Bill 939 Public Resources Code, Chapter 3.5 Section 41750 and Section 41500. The estimate of the cost to educate and inform stakeholders in the Chollas Creek watershed about the household hazardous waste collection program is included in the total cost estimates presented in section 13.40.

13.8 Cost Estimates For Monitoring Plan

13.81 Wet Weather Monitoring Stations

The long-term monitoring plan includes wet weather sampling and analytical testing at eight (8) monitoring stations located at the following sites:

- SD8 (1) Main Chollas Channel
- SD8 (2) Wabash Avenue
- SD8 (3) Home Avenue
- SD8 (4) 38th Street
- SD8 (5) Federal Blvd.
- SD8 (6) Jamacha Road
- DPR (1) Euclid Avenue
- DPR (2) Beta Street

Costs for collecting and composting wet weather grab water samples from these stations in a storm event is shown in Table 13-13. Costs include providing four two-person field teams to monitor the eight stations during one storm event, perform grab sampling [between three (3) and five (5) grabs] throughout the course of the storm to provide a "flow weighted sample", and costs for delivery of the samples to the laboratory.

13.82 Analytical Testing

Table 13-13 also shows the costs for collecting composite wet weather grab samples, analytical testing for diazinon, and conducting 96-hour and 7-day toxicity tests of the sample from station SD8(1) using *Ceriodaphnia dubia*.

Table 13-13
Costs for Wet Weather Sampling, Analytical and Toxicity Testing

Analytical Test	Item Costs	# Per Storm	Subtotal Costs for a Storm Event	Notes
Wet weather sampling	$21,268	1	$21,268	8 stations
Chronic toxicity test	$1,200	1	$1,200	1 station (96 hour test)
Acute toxicity test	$700	1	$700	1 station (7 day test)
Diazinon EPA 8141A	$240	8	$1,920	8 stations (Requires a reporting limit of 0.05 µg/L)
ELISA (optional)	$120	Varies	$0	Optional test method
Shipping to laboratory	$70	8	$560	8 stations
Report	$5,600	1	$5,600	1 report per wet weather season
Subtotal			$31,248	For one storm event
Totals			$93,744	For 3 storm events

14.0 Public Participation

TMDLs are subject to public review (40 CFR 130.7). Legal public notice requirements have been fully satisfied and numerous opportunities for public participation have been provided as described below.

14.10 Public Notice Requirements

Federal Clean Water Act regulations (40 CFR 25.5) require the Regional Board to mail notice of a proposed Basin Plan amendment to all interested parties at least 45 days in advance of the public hearing. State CEQA regulations (23 California Code of Regulations Section 3777) require the Regional Board to make a draft TMDL report (which is a CEQA substitute) available for public comment for at least 45 days in advance of the public hearing. The Notice of Public Hearing for this Basin Plan amendment was posted 54 days in advance of the public hearing (April 19 to June 12). The draft technical report (including the draft Resolution and draft Basin Plan amendment) was available to the public for 45 days in advance of the public hearing (April 28 to June 12). The following actions were taken to fully satisfy all public notice requirements:

Notice of Public Hearing and Notice of Filing

- Mailed to RWQCB agenda mailing list on April 19, 2002
- Posted on RWQCB website on April 19, 2002
- Published in San Diego Union Tribune on April 24, 2002
- Mailed to interested parties list on April 24, 2002

Draft Technical Report (including Draft Resolution and Basin Plan Amendment)

- Posted on RWQCB website on April 28, 2002
- E-mailed to interested parties list on April 29, 2002
- Mailed to interested parties list on April 29, 2002

14.20 Chronology of Public Participation (See Attachment P)

Five public workshops were conducted by the Regional Board on March 17, 1999, August 3, 1999, December 17, 1999, May 17, 2000 and May 17, 2002 and have served to encourage public participation. Between the fourth and fifth workshop Regional Board staff occasionally met with City staff to discuss the City's Integrated Pest Management Program for potential application to the Chollas Creek watershed and progress on the TMDL. In addition, starting in 1999, the RWQCB began posting various elements of the draft TMDL as they were completed on the RWQCB's website for public review.

More recently, RWQCB staff conducted a series of four meetings (May 27, June 4, June 5, and June 10, 2002) with representatives of the Cities of San Diego, La Mesa and Lemon Grove, the County of San Diego, BayKeeper, the Sierra Club, the Port District of San Diego, Caltrans, the Navy and NASSCO. (Environmental Health Coalition was invited but was unable to attend.) These meetings were designed to afford all interested parties and stakeholders the chance to communicate their concerns with the proposed TMDL. As a consequence of these meetings, all parties have agreed to work collaboratively in developing a phased compliance schedule for meeting numeric limitations for diazinon.

On June 12, 2002 the RWQCB conducted a public hearing on the draft Chollas Creek diazinon TMDL and extended the written public comment period for fifteen days. Following the public hearing, on June 20, 2002, RWQCB staff met again with the City of San Diego and other key stakeholders to discuss and clarify late proposed changes to the draft. The RWQCB has reviewed comments submitted during the extended comment period. The RWCB has heard and considered all public comments on this matter.

Additionally, routine updates on TMDL development activities are provided in the monthly Executive Officer Reports prepared for the Regional Board. These reports, as well as other TMDL information, is available on the SDRWQCB website, <www.swrcb.ca.gov/rwqcb9/>.

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List of Attachments

Attachment K. Environmental Checklist Form

Attachment L. Glossary

Attachment M. Diazinon Public Outreach and Education Program

Attachment N. Funding Sources

Attachment O. Notice of Public Hearing

Attachment P. Chronology of Public Participation