

Aquatic Life Toxicity in Stormwater Runoff to Upper Newport Bay, Orange County, California: Initial Results¹

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Executive Summary

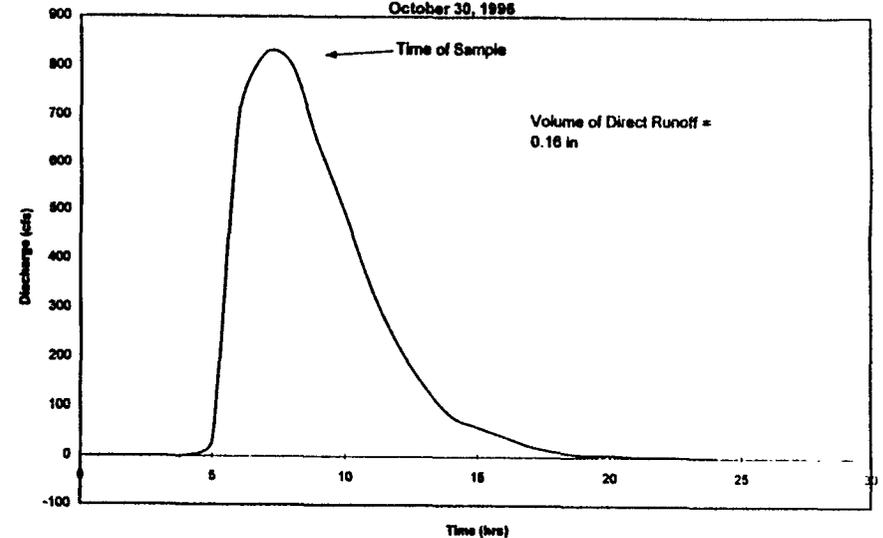
An Evaluation Monitoring based water quality evaluation and management Demonstration Project has found that stormwater runoff during the fall of 1996 that entered Upper Newport Bay in Orange County, California via San Diego Creek was highly toxic to *Ceriodaphnia*. Approximately half of this toxicity is apparently due to diazinon, chlorpyrifos and methomyl. The remainder is due to unidentified constituents present in the runoff waters. The dry weather flow in San Diego Creek during early November 1996 was non-toxic to *Ceriodaphnia*.

The water quality significance of this toxicity in terms of adversely impacting the designated beneficial uses of San Diego Creek and Upper Newport Bay is poorly understood. There is sufficient toxicity to be potentially adverse to aquatic life within the Creek and Bay. Beginning July 1, 1997, a US EPA 205(j) grant will provide funds to enable studies to be conducted of the fate/persistence of diazinon, chlorpyrifos and methomyl toxicity in Upper Newport Bay waters. The results of these studies will provide the database upon which to make a decision on whether the toxic pulses of stormwater that enter Upper Newport Bay are likely significantly adverse to the aquatic life resources of the Bay.

Approximately 63,000 pounds of diazinon and chlorpyrifos are used each year in Orange County by commercial pesticide applicators. Most of this use is for urban structural and landscape purposes. In addition, another 60,000 pounds of diazinon and chlorpyrifos purchased over the counter are estimated to be used by homeowners for around the home and

¹ Reference as: Lee, G.F. and Taylor, S. "Aquatic Life Toxicity in Stormwater Runoff to Upper Newport Bay, Orange County, California: Initial Results," Report to Silverado, Irvine, CA Submitted by G. Fred Lee & Associates, El Macero, CA, June (1997).

Figure 4. Hydrograph of San Diego Creek at Culver D
October 30, 1996



US EPA Standard Three Species Aquatic Life Toxicity Tests

Ceriodaphnia - Zooplankton - fish food

Pimephales - Fish Larva

Selenastrum - Algae

Toxicity Test Results for San Diego Creek: Standard Three Species Test Sample Collected on 10/30/96

7-day *Ceriodaphnia* Test

Treatment	Reproduction (neonates/adult)		% Mortality
	mean	standard error	
Lab Control	24.6	0.93	0.0
San Diego Creek	0.0	0.00	100 (24 hr)

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**Toxicity Test Results for San Diego Creek:
Standard Three Species Test (continued)
Sample Collected on 10/30/96**

7-day *Pimephales* Test

Treatment	Growth (mg)		Mortality (%)	
	mean	standard error	mean	standard error
Lab Control	0.470	0.01	0.0	0
San Diego Creek	0.473	0.02	0.0	0

**Toxicity Test Results for San Diego Creek:
Standard Three Species Test (continued)
Sample Collected on 10/30/96**

96-hour *Selenastrum* Test

Treatment	Cell Count (x 10 ⁴)	
	mean	standard error
Lab Control	138.2	10.6
San Diego Creek	450.3	7.3

**Toxicity Test Results for San Diego Creek:
Additional *Ceriodaphnia* Testing
Sample Collected on 10/30/96**

96-Hour *Ceriodaphnia* Dilution Series

Treatment	% Mortality for each day of the test			
	1	2	3	4
Lab Control	0	0	0	0
Lab Control + 100 µg/L PBO	0	0	5	20
Lab Control + 200 µg/L PBO	0	0	53	84
San Diego Creek 100%	100	100	100	100
San Diego Creek 50%	100	100	100	100

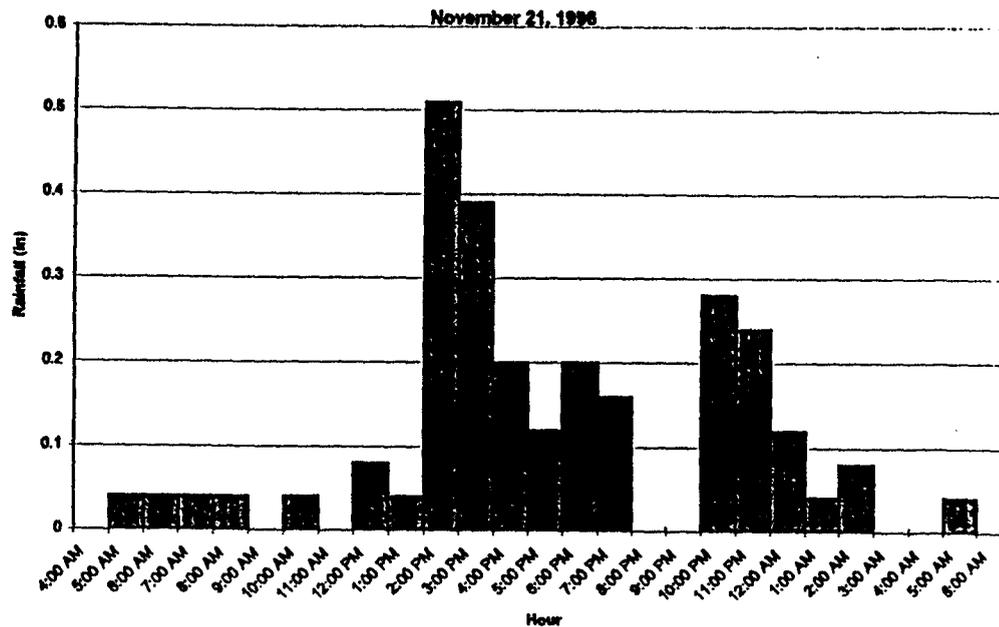
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**Toxicity Test Results for San Diego Creek:
Additional *Ceriodaphnia* Testing (continued)
Sample Collected on 10/30/96**

96-Hour *Ceriodaphnia* Dilution Series

Treatment	% Mortality for each day of the test			
	1	2	3	4
San Diego Creek 50% + 100 µg/L PBO	0	0	0	5
San Diego Creek 50% + 200 µg/L PBO	0	0	5	5
San Diego Creek 25%	0	100	100	100
San Diego Creek 25% + 100 µg/L PBO	0	0	0	0
San Diego Creek 25% + 200 µg/L PBO	0	0	60	60
San Diego Creek 12.5%	0	0	0	5

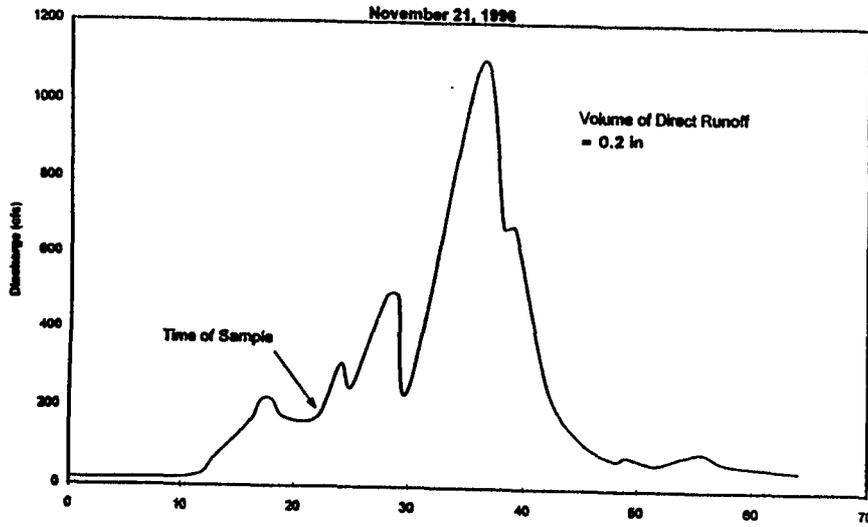
Figure 9. Hyetograph, Sand Canyon Gage, San Diego Creek Watershed



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Figure 8. Hydrograph of San Diego Creek at Campus Drive



**Toxicity Test Results for San Diego Creek:
Additional *Ceriodaphnia* Testing
Sample Collected on 11/21/96**

96-Hour *Ceriodaphnia* Dilution Series

Treatment	% Mortality for each day of the test			
	1	2	3	4
Lab Control	0	0	0	0
Lab Control + 100 µg/L PBO	0	0	0	0
San Diego Creek 100%	100	100	100	100
San Diego Creek 65%	100	100	100	100
San Diego Creek 65%+ 100 µg/L PBO	100	100	100	100

96-Hour *Ceriodaphnia* Dilution Series

Treatment	% Mortality for each day of the test			
	1	2	3	4
San Diego Creek 50%	100	100	100	100
San Diego Creek 25%	100	100	100	100
San Diego Creek 25% + 100 µg/L PBO	0	45	100	100
San Diego Creek 12.5%	0	100	100	100

**Toxicity Test Results for San Diego Creek
Pimephales Testing
Sample Collected on 11/21/96**

7-day *Pimephales* Test

Treatment	Growth (mg)		Mortality (%)	
	mean	standard error	mean	standard error
Lab Control	0.498	0.006	0.0	0.0
San Diego Creek	0.477	0.014	2.5	2.5

San Diego Creek Base Flow Studies

Monitoring San Diego Creek between the Two Monitored Storms Showed That Creek Waters

Were Non-Toxic

Had Low, Non-Toxic Concentrations of OP Pesticides during Dry Weather/Base Flow Conditions

Toxicity Associated with Stormwater Runoff

**Composition of San Diego Creek Stormwater Runoff
Sample Obtained on 11/21/96**

Pesticide	Appl (GC)	UCD (ELISA)
Diazinon	540	359
Chlorpyrifos	130	133
Pendimethalin (Prowl)	450	
Simazine	3200	
Carbaryl	900	
Methomyl	2000	
Malathion	90	

Cause of Toxicity

Based on ELISA, PBO Testing, and Chemical Analysis, Determined Some of the Toxicity Is Due to

- Diazinon - Urban Pesticide
- Chlorpyrifos - Urban Pesticide
- Methomyl - Ag Pesticide

About Half of Toxicity Due to Unknown Causes

Estimated Toxicities of Selected Pesticides (Concentrations in ng/L)

Pesticide	Balley <i>et al.</i> 96-hr LC50	Foe 96-hr LC50
Chlorpyrifos	60	100
Diazinon	450	500
Malathion		1400
Methomyl		5560
Carbaryl		3500 - 5200
Simazine		
Pendimethalin (Prowl)	--	--

Total Pounds of Diazinon Applied, by Use, In Orange County in 1995

	Agriculture	Landscape	Right of Way	Commercial	Structural	Pest Control	Total
January	442.38	19.00	0.00	82.42	91.08	0.00	634.88
February	401.40	20.51	0.75	82.58	1,793.84	0.00	2,279.08
March	157.24	71.89	0.00	72.24	1,390.08	0.00	1,691.45
April	34.53	51.79	0.00	98.87	1,405.64	0.00	1,590.83
May	34.63	293.40	0.00	104.38	1,825.28	0.00	2,257.69
June	331.98	74.58	0.00	115.90	1,812.09	0.00	2,134.55
July	22.11	73.93	0.06	148.30	1,939.89	0.00	2,184.29
August	13.09	65.19	4.99	106.10	2,182.62	0.00	2,371.99
September	13.30	146.40	3.99	78.96	1,840.38	0.00	2,083.03
October	2.29	105.22	48.88	0.00	1,438.45	0.00	1,592.84
November	234.64	80.73	0.00	86.75	979.60	0.00	1,381.72
December	316.39	27.19	0.00	33.71	973.79	0.00	1,351.08
Total	2,003.98	1,029.83	58.87	990.21	17,462.74	0.00	21,543.43

Data from the Department of Pesticide Regulation's Pesticide Use Reporting Database

Total Pounds of Chlorpyrifos Applied, by Use, In Orange County in 1995

	Agriculture	Landscape	Right of Way	Commercial	Structural	Pest Control	Total
January	207.03	27.12	0.00	21.67	601.56	0.00	857.38
February	328.49	42.24	0.00	33.94	2,318.79	0.00	2,723.46
March	69.76	37.17	0.00	66.13	2,922.25	0.00	3,095.31
April	52.50	78.65	0.00	27.75	3,439.35	0.00	3,598.25
May	58.00	89.62	0.00	37.04	2,584.46	0.00	2,767.12
June	0.00	67.52	0.00	64.20	2,535.76	0.00	2,667.48
July	52.95	140.93	8.00	59.66	5,122.89	0.00	5,382.23
August	40.42	506.28	0.00	76.05	2,903.44	0.00	3,526.19
September	145.52	174.79	11.62	57.49	3,243.81	0.00	3,633.23
October	227.00	178.61	12.87	56.17	3,121.21	0.00	3,595.66
November	0.00	65.30	0.00	90.77	5,384.06	0.00	5,540.13
December	210.60	40.03	0.00	60.78	4,085.16	0.00	4,396.57
Total	1,390.27	1,446.26	30.29	651.65	38,262.54	0.00	41,781.01

Data from the Department of Pesticide Regulation's Pesticide Use Reporting Database

Determination of Water Quality Significance of Aquatic Life Toxicity in Stormwater Runoff on Beneficial Uses of Receiving Water

Regional Boards' Basin Plan Objectives
No Discharge of "Toxics" in Toxic Amounts
No Ambient Water Toxicity

Enforced for POTW's & Industrial Wastewater Dischargers

Not Being Enforced for Urban Stormwater Runoff & Non-Point
(Ag) Sources

New State WRCB California Toxics Rule (CTR) Proposed
Requirements

Toxicity Provisions:

Chronic Toxicity Objective

Surface Waters Outside of Any Allowed Mixing Zones Shall Be
Free from Lethal or Sublethal Toxicity at Levels Which Impair
Designated Aquatic Life Beneficial Uses

Water Quality-Based Toxicity Control

A Chronic Toxicity Effluent Limitation Is Required in WDRs for All
Discharges That Will Cause, Have Reasonable Potential to
Cause, or Contribute to Chronic Toxicity in Receiving Waters