# *Regional Assessment*

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## 12.0 REGIONAL ASSESSMENT

This section presents the monitoring data and findings from regionally applicable programs listed in the permit for the 2008–2009 Monitoring Season. The following subsections are presented in compliance with the Receiving Waters and Urban Runoff Monitoring Program in San Diego Regional Water Quality Control Board (RWQCB) Order R9-2007-0001 (Permit) to address core management questions listed in the Permit. The organization of this Regional Assessment section is presented to report on the following Permit elements:

- Subsection 12.1—Synthetic Pyrethroid Monitoring.
- Subsection 12.2—MS4 Outfall Monitoring.
- Subsection 12.3—Source Identification Monitoring.

For specific assessments on individual sample locations or and relation to the watershed level, the reader is referred to individual WMA sections in the report.

## 12.1 Synthetic Pyrethroid Monitoring

Section II.A.7 of the Permit requires: "The Copermittees shall collaborate to develop and implement a monitoring program to measure and assess the presence of pyrethroids in receiving waters. This program shall be implemented within each watershed and shall begin no later than 2007–2008 Monitoring Year" (RWQCB, 2007). The Copermittees developed the Monitoring Work Plan for the Assessment of Synthetic Pyrethroids in San Diego County (WESTON, 2007). The work plan was developed in response to the permit requirements outlined in Section II.A.7 of the Order. The work plan specified that water samples would be collected and analyzed as part of the standard analytical list for storm water sampling events. Because pyrethroids are associated with sediments typically related to high-velocity flows (e.g., during storm events) dry weather ambient flows were not analyzed for pyrethroids; however, post-storm sediment samples were collected after the first major storm event of the season to assess the presence of synthetic pyrethroids in receiving waters.

To measure and assess the presence of synthetic pyrethroids, the following questions were developed in the workplan:

*Q1. Are synthetic pyrethroids being detected in San Diego County Watersheds and if so, at what concentrations?*

This question was addressed by collection and analysis of sediment samples at the mass loading stations (MLS) and temporary watershed assessment stations (TWAS) one time during the monitoring season on a rotational basis. Water column samples were also collected during storm events only from the existing MLS and TWAS as part of the Regional Monitoring Program analytical constituent list. Water column analyses during storm events provided information on the spatial distribution of synthetic pyrethroids within the watershed during storm events.

*Q2. If detected, are synthetic pyrethroids in San Diego County Watersheds causing toxicity to aquatic organisms in the water column or detected at equal to or above published LC50s for Hyalella azteca in sediment?*

This question was addressed by comparing water column synthetic pyrethroid sample results collected during storm events to water column toxicity results. Water column toxicity was performed as part of the standard Permit monitoring requirements. Detected concentrations of synthetic pyrethroids in sediment were compared to published literature values for $LC_{50}$s for the test organism *Hyalella azteca (H. azteca).* Additionally, total organic carbon and grain-size distribution data were collected to provide relevant information for assessing synthetic pyrethroid concentrations in sediment.

Over the previous three years of monitoring, review of technical papers, and topics discussed at storm water conferences, elevated synthetic pyrethroid pesticide concentrations have been associated with toxicity to *H. azteca* (TDC Environmental, 2008) Since 2005, the concentration of Diazinon in samples collected in San Diego County has decreased or has not been detected since a regulatory decision was made to ban the production and sale of Diazinon to the public. After the decision, retail stores could no longer sell Diazinon-containing products. However, it may still be used for agricultural or limited professional purposes only, or by citizens still possessing and using products containing the substance. The San Diego Municipal Copermittees 2007–2008 Urban Runoff Monitoring Report (Weston Solutions, Inc., 2009) indicated that residential land uses in urban areas commonly had detections of elevated concentrations of synthetic pyrethroid pesticides in storm water, and in some instances, results were associated with toxicity to *H. azteca*. However, post-storm sediment results were rarely detected in concentrations above the sediment $LC_{50}$ for a given pyrethroid.

The Synthetic Pyrethroid Monitoring Program included monitoring for water and/or sediment quality at MLS and TWAS monitoring locations during the 2007–2008 and 2008–2009 Monitoring Seasons. In addition, synthetic pyrethroids were also added to the constituent list for the SMC Regional Bioassessment Survey, the Bight ’08 Lagoon Monitoring Program, and the RHMP Program. Synthetic pyrethroids were also analyzed for the 2008–2009 Source Identification Monitoring Program conducted for dry weather residential runoff from La Mesa and Del Mar.

Water quality samples are collected during storm events at the MLS and TWAS as flow-weighted composites. Post storm sediment samples are then collected at the same locations greater than 72 hours, but less than two weeks following the first storm event of the season. Since the majority of pesticide applications occur during late summer to early fall, samples were collected following the “first flush” of the wet season to capture the greatest effects of dry season pesticide applications. A review of the San Diego County historical monitoring data showed that the first storms of the season typically had the highest concentrations of organophosphate pesticides which are believed to represent similar characteristics for currently available synthetic pyrethroids (Weston Solutions, 2007).

Water and sediment sample results were compared to the following benchmarks (Table 12-1) which identify the $LC_{50}$ values for *H. azteca* in the water column and in the sediment. The

Stormwater Monitoring Coalition suggests that the synthetic pyrethroid analytical method may be highly variable (Schiff, 2009). Therefore, pyrethroid benchmarks presented in this document are for comparison purposes only and for further assessment with toxicity results.

**Table 12-1. Synthetic Pyrethroid $LC_{50}$ Values for *Hyalella azteca* in the Water Column and Sediment**

| Test Chemical | Exposure Period | $LC_{50}$ (µg/L water) | $LC_{50}$ (µg/kg sediment) | $LC_{50}$ (µg/g Organic Carbon) or Percent *OC* | Reference |
|---|---|---|---|---|---|
| Bifenthrin | 10 days | - | 3.0 - 8.2 | 0.52 | Amweg et al. 2005 |
| Bifenthrin | 96 hr | 0.0093 | - | NA | Anderson et al. in press |
| Bifenthrin | 96 hr | 0.013 | - | NA | Weston Solutions, 2006 |
| Bifenthrin | 96 hr | - | - | 0.52 | Amweg et al. 2005 |
| Cyfluthrin | 10 days | - | 12.5 - 14.9 | 1.08 | Amweg et al. 2005 |
| Deltamethrin | 10 days | - | 9.8 - 10.0 | 0.79 | Amweg et al. 2005 |
| Esfenvalerate | 10 days | - | 10.4 - 48.3 | 1.54 | Amweg et al. 2005 |
| Lambda-Cyhalothrin | 10 days | - | 5.2 - 6.0 | 0.45 | Amweg et al. 2005 |
| Cypermethrin | 10 days | - | - | 0.38 | Amweg et al. 2005 |
| Cypermethrin | 10 days | - | 3.6 | *1%* | Maund et al. 2002 |
| Cypermethrin | 10 days | - | 18 | *3%* | Maund et al. 2002 |
| Cypermethrin | 10 days | - | 23 | *13%* | Maund et al. 2002 |
| Permethrin | 10 days | - | 57 - 112 | 10.83 | Amweg et al. 2005 |
| Permethrin | 96 hr | 0.039 - 0.047 | - | NA | Wheelock et al. 2005 |
| Permethrin | 96 hr | 0.021 | - | NA | Anderson et al. 2006 |

Although not specified in the Synthetic Pyrethroid Monitoring Workplan, new programs that have been implemented by the Copermittees have included synthetic pyrethroids as an analyte of interest. This includes the Bight ’08 sediment sampling in San Diego’s Lagoons which occurred during Summer 2008. The RHMP monitoring occurred in Oceanside Harbor, Mission Bay, and San Diego Bay. The two programs provide an assessment of synthetic pyrethroids, toxicity, and overall sediment quality. These results also build on the spatial representation of the watershed and the receiving waters.

Ambient monitoring was conducted under the SMC Regional Bioassessment monitoring program on various dates from mid-May to mid-June 2009. This data provides information on ambient receiving water concentrations that were not assessed as part of the Synthetic Pyrethroid Workplan. The SMC Monitoring Program is an annual program that is expected to continue through the duration of the Permit.

Lastly, the 2008 Source Identification Program Monitoring provides dry weather runoff assessment of synthetic pyrethroids from single-family residential runoff areas. Again, this data was not part of the Synthetic Pyrethroid Monitoring workplan, but demonstrates the Copermittees interest in assessing the impacts during different conditions and from various land uses.

For the purposes of assessing the relative impacts of synthetic pyrethroids within the Region, the following summaries are provided in an effort to address the workplan questions. Specific information on individual sample stations and programs are provided in the watershed management area sections or within the individual monitoring program sections (e.g., Bight '08 or RHMP).

**Wet Weather Monitoring Summary**

Wet weather monitoring results demonstrate that Bifenthrin is the most common synthetic pyrethroid detected in storm water samples. During the 2007–2008 Monitoring Season, samples were collected from MLS and TWAS sites primarily in the North County and at one station in Chollas Creek. Samples were collected during two storm events. Bifenthrin was the most commonly detected pyrethroid and was found in 25 of 30 (83.3%) samples tested (Table 12-2). Bifenthrin was detected above the $LC_{50}$ in 22 of the 30 (73.3%) samples collected. L-cyhalothrin, Permethrin, and Cypermethrin were also detected above the $LC_{50}$. Toxicity to *H. azteca* was observed in 19 of the 30 (63%) samples collected.

During the 2008–2009 Monitoring Season, samples were collected from historical MLS sites during one storm event only due to the Bight '08 monitoring schedule. Bifenthrin was the most commonly detected pyrethroid and was found in six of 11 (54.5%) samples tested (Table 12-3). Bifenthrin was detected above the $LC_{50}$ in six of the 11 samples collected. Permethrin was also detected above the $LC_{50}$ in two of 11 samples. Toxicity to *H. azteca* was observed in four of 11 (36.3%) samples collected.

Samples where pyrethroids were detected and where toxicity to *H. azteca* was observed primarily occurred in drainage areas consisting of urban land uses (e.g., residential, commercial, or industrial land uses). Pyrethroids were generally not detected in areas consisting primarily of open space and parks.

**Table 12-2. 2007–2008 Storm Water Monitoring Synthetic Pyrethroid Assessment (North County Rotation*, Mass Loading Station and Temporary Watershed Assessment Station during Two Storms)**

| Analyte | Units | Number of Samples | Number of Detects | Number of Results Above $LC_{50}$ | No. of results with any pyrethroid + *H. azteca* toxicity |
|---|---|---|---|---|---|
| Allethrin | µg/L | 30 | 0 | 0 | 19 |
| Bifenthrin | µg/L | 30 | 25 | 22 | |
| Cyfluthrin | µg/L | 30 | 18 | 0 | |
| Cypermethrin | µg/L | 30 | 5 | 1 | |
| Danitol | µg/L | 30 | 7 | 0 | |
| Deltamethrin | µg/L | 30 | 0 | 0 | |
| Esfenvalerate | µg/L | 30 | 9 | 0 | |
| L-Cyhalothrin | µg/L | 30 | 18 | 4 | |
| Permethrin | µg/L | 30 | 2 | 2 | |
| Prallethrin | µg/L | 30 | 0 | 0 | |

*MLS includes 1 South County Station in Chollas Creek

**Table 12-3. 2008–2009 Storm Water Monitoring Synthetic Pyrethroid Assessment (Historical Mass Loading Station during One Storm)**

<table>
<tr><th>Analyte</th><th>Units</th><th>Number of Samples</th><th>Number of Detects</th><th>Number of Results Above $LC_{50}$</th><th>Number of Results with Pyrethroids + H. azteca toxicity</th></tr>
<tr><td>Allethrin</td><td>µg/L</td><td>11</td><td>0</td><td>0</td><td rowspan="10">4</td></tr>
<tr><td>Bifenthrin</td><td>µg/L</td><td>11</td><td>6</td><td>6</td></tr>
<tr><td>Cyfluthrin</td><td>µg/L</td><td>11</td><td>4</td><td>0</td></tr>
<tr><td>Cypermethrin</td><td>µg/L</td><td>11</td><td>3</td><td>0</td></tr>
<tr><td>Danitol</td><td>µg/L</td><td>11</td><td>0</td><td>0</td></tr>
<tr><td>Deltamethrin</td><td>µg/L</td><td>11</td><td>0</td><td>0</td></tr>
<tr><td>Esfenvalerate</td><td>µg/L</td><td>11</td><td>4</td><td>0</td></tr>
<tr><td>L-Cyhalothrin</td><td>µg/L</td><td>11</td><td>2</td><td>0</td></tr>
<tr><td>Permethrin</td><td>µg/L</td><td>11</td><td>2</td><td>2</td></tr>
<tr><td>Prallethrin</td><td>µg/L</td><td>11</td><td>0</td><td>0</td></tr>
</table>

## Post Storm Sediment Monitoring Summary

Post storm sediment monitoring results demonstrate that Bifenthrin is also the most common synthetic pyrethroid detected in sediments at the MLS or TWAS. During the 2007–2008 Monitoring Season, 16 post-storm sediment samples were collected from the MLS and TWAS sites (primarily in North County and one MLS in Chollas Creek). Bifenthrin was detected in 10 of 16 (62.5%) samples collected (Table 12-4). Bifenthrin was detected above the sediment $LC_{50}$ for *H. azteca* in 5 of 16 (31%) samples collected. Cyfluthrin and Cypermethrin were also detected above the sediment $LC_{50}$ in 1 of 16 (6%) samples collected.

During the 2008–2009 Monitoring Season, 15 post-storm sediment samples were collected from the bases of the major watersheds (historical MLS and Buena Vista, Loma Alta, Rose Creek, and Otay). Bifenthrin was detected in 6 of 15 (40%) samples collected (Table 12-5). Bifenthrin was detected above the sediment $LC_{50}$ for *H. azteca* in 3 of 15 (20%) samples collected. Cyfluthrin (1 of 15), Cypermethrin (2 of 15), and Permethrin (1 of 15) were also detected above the sediment $LC_{50}$.

Though sediment toxicity was not tested in the post-storm sediment samples, there is evidence suggesting some sites have the potential to induce toxicity to sediment dwelling organisms sensitive to synthetic pyrethroids. However, there was no toxicity observed to *H. azteca* in ambient water toxicity tests conducted during fall 2007 or spring 2008 at any MLS or TWAS. This suggests that sediment related effects may be localized and are not causing water column impacts.

**Table 12-4. 2007–2008 Post-Storm Sediment Synthetic Pyrethroid Assessment (North County Rotation*, Mass Loading Station and Temporary Watershed Assessment Station)**

| Analyte | Number of Samples | Number of Detects | Number of Results Above $LC_{50}$ |
|---|---|---|---|
| Allethrin | 16 | 0 | 0 |
| Bifenthrin | 16 | 10 | 5 |
| Cyfluthrin | 16 | 2 | 1 |
| Cypermethrin | 16 | 2 | 1 |
| Danitol | 16 | 0 | 0 |
| Deltamethrin | 16 | 0 | 0 |
| Esfenvalerate | 16 | 0 | 0 |
| L-Cyhalothrin | 16 | 0 | 0 |
| Permethrin | 16 | 1 | 0 |
| Prallethrin | 16 | 0 | 0 |

*MLS includes 1 South County Station in Chollas Creek

**Table 12-5. 2008–2009 Post-Storm Sediment Synthetic Pyrethroid Assessment (Bight '08 Year, Base of Major Watersheds*)**

| Analyte | Number of Samples | Number of Detects | Number of Results Above $LC_{50}$ |
|---|---|---|---|
| Allethrin | 15 | 0 | 0 |
| Bifenthrin | 15 | 6 | 3 |
| Cyfluthrin | 15 | 1 | 1 |
| Cypermethrin | 15 | 2 | 2 |
| Danitol | 15 | 0 | 0 |
| Deltamethrin | 15 | 0 | 0 |
| Esfenvalerate | 15 | 1 | 0 |
| L-Cyhalothrin | 15 | 1 | 0 |
| Permethrin | 15 | 1 | 1 |
| Prallethrin | 15 | 0 | 0 |

* Includes Buena Vista TWAS, Loma Alta TWAS, Rose Creek TWAS, and Otay TWAS)

**Conclusions**

To address the questions developed in the workplan, the following conclusion are presented:

*Q1. Are synthetic pyrethroids being detected in San Diego County Watersheds and if so, at what concentrations?*

Synthetic pyrethroids are being detected in San Diego County Watersheds both in the storm water and to a lesser degree in sediments within the receiving waters. Storm water quality concentrations are being detected primarily in urban areas with residential, commercial, and industrial land uses. Over the past two years of monitoring, sites with storm water pyrethroid results above $LC_{50}$s included the following sites:

- Santa Margarita MLS-new
- San Luis Rey MLS
- San Luis Rey TWAS-1
- Loma Alta TWAS-1
- Buena Vista Creek TWAS-1
- Agua Hedionda MLS
- Agua Hedionda-TWAS-1
- Escondido Creek-MLS
- Escondido Creek-TWAS-1
- San Dieguito Creek-MLS
- San Dieguito Creek-TWAS-1
- Los Peñasquitos Creek-MLS
- Los Peñasquitos Creek-TWAS-1
- Los Peñasquitos Creek-TWAS-2
- Tecolote Creek-MLS
- Chollas Creek-MLS
- Tijuana River-MLS

Concentrations tend to increase with an increasing presence of urbanized land use. Synthetic pyrethroids are also being detected in receiving water sediments, but concentrations tend to be low and near the detection limit of the method. Over the past two years of monitoring, sites with sediment pyrethroid results above sediment LC50s included the following sites:

- Escondido Creek-MLS
- Buena Vista Creek TWAS-1
- San Dieguito Creek-MLS
- Los Peñasquitos Creek-MLS
- Rose Creek (MB-TWAS-1)
- Chollas Creek-MLS
- Tijuana River-MLS

Synthetic pyrethroids were infrequently detected in San Diego's bays and lagoons/estuaries and did not exhibit toxicity to *E. estuarius* in the sites where detections occurred above the sediment $LC_{50.}$ Only 4 of 111 samples collected as part of the San Diego County Bight 08 estuary sampling or as part of RHMP monitoring had a Bifenthrin concentration above the sediment $LC_{50.}$ However, none of the samples exhibited toxicity to *E. estuarius* at these sites.

*Q2. If detected, are synthetic pyrethroids in San Diego County Watersheds causing toxicity to aquatic organisms in the water column or detected at equal to or above published $LC_{50}$s for Hyalella azteca in sediment?*

Pyrethroids detected in storm water samples above the $LC_{50}$ are often associated with toxicity to *H. azteca* in storm water column toxicity tests. However, during ambient receiving water monitoring, no toxicity was observed to *H. azteca* at the MLS or TWAS. Though sediment toxicity was not tested in the post-storm sediment samples, there is evidence suggesting some sites have the potential to induce toxicity to sediment dwelling organisms sensitive to synthetic pyrethroids at these sites.

As mentioned above, lagoon and embayment sediments also had infrequent detections and were generally trace amounts near the method detection limits. Only 4 of 111 samples collected had a

Bifenthrin concentration above the sediment $LC_{50.}$ However, none of the samples exhibited toxicity to *E. estuarius* at these sites.

## 12.2 MS4 Outfall Monitoring

In accordance with RWQCB Order R9-2007-0001, the Copermittees developed the MS4 Outfall Monitoring Program workplan through a collaborative effort in 2007–2008 and submitted the final workplan on June 25, 2008 (County of San Diego Copermittees, 2008). The MS4 Outfall Monitoring Workplan is the framework for random and targeted monitoring during both dry weather and wet weather conditions. The workplan details the wet weather random sampling approach and elements.

The MS4 outfall data collected for each individual WMA are discussed in the individual WMA sections of this report. The goal of this subsection is to characterize pollutant discharges from MS4 outfalls and their relative contributions to the high-priority water quality problems identified as regional issues common to most WMAs. This information will help to answer Core Management Question 3—What is the relative urban runoff contribution to the receiving water problem(s)?

This program collects samples from storm drain systems and does not collect samples in receiving waters. However, storm drain sample data was compared to receiving water benchmarks to determine if storm drain runoff has the potential to contribute to receiving water quality problems.

Under the MS4 Outfall Monitoring Program, random samples were collected during both dry weather and wet weather periods. Targeted samples were collected during dry weather only for the 2008 – 2009 Monitoring Season. Wet weather targeted sample collection is scheduled for implementation during the 2009 – 2010 Monitoring Season. According to the Permit, the dry weather period is from May 1st through September 30th and the wet weather period is from October 1st through April 30th.

**Random sampling** was conducted to address the following subquestions identified in the MS4 Outfall Workplan:

1. What are the characteristics of the discharges from MS4 outfalls in regard to high-priority pollutants?

2. Are constituent loadings changing over time?

The workplan used a probability-based design to randomly locate monitoring sites. Random stations provided the ability to draw statistically valid inferences regarding the region as a whole, rather than just the site itself. In the proposed design the region was divided into nine strata (each WMA represented a different region) and up to six samples were selected randomly within each region/WMA per year and per season. This random selection process translated to up to 54 samples per year (regionally) and up to 30 samples per WMA over the entire 5-year monitoring program. These sample sets were determined to provide a more confident statistical analysis to determine if trends are evident.

**Targeted sampling** was conducted to address the following subquestions:

1. Which of the targeted MS4 outfalls have the greatest pollutant loading?
2. Are the pollutant loadings decreasing over time from these MS4 outfalls?

Targeted sampling was conducted to assess the relative contribution of a particular constituent discharged from MS4 outfalls to the high-priority problems of the receiving waters. The site-specific station design of the targeted program generated information to support source prioritization in each WMA and assessed constituent trends over time. The regional high-priority pollutants included nutrients (total nitrogen and total phosphorus), TSS, and indicator bacteria (total coliforms, fecal coliforms, and enterococcus). Each regional WMA also collected samples for WMA specific pollutants.

### 12.2.1 Random Dry Weather

The random dry weather MS4 monitoring activities were conducted on the dates presented in Table 12-6. During dry weather monitoring, several sites visited were determined to have insufficient flow for sampling. As a result, field staff selected the next random site on the random inventory in an attempt to obtain six samples per WMA. Up to twelve sites, maximum, were visited per WMA. In 2008–2009, a total of four WMA's had sufficient dry weather flow for sampling all six sites.

Many of the locations had ponded conditions which indicated previous intermittent discharges or perched groundwater. Instantaneous loading calculations could not be calculated for locations with ponded conditions; however, the ponded water was sampled and could be compared to water quality benchmarks, as shown and summarized in Table 12-7. No significant difference was found for pollutant concentrations for ponded versus flowing sites. The results suggest that nitrogen and phosphorus compounds and indicator bacteria (enterococcus) in MS4 dry weather runoff from random monitoring sites may have the potential to contribute to receiving water problems.

**Table 12-6. Random Dry Weather Monitoring and Flow Status Summary**

| Watershed Management Area | Monitoring Date | Sites Visited | Sites Dry / Not Sampled | Sites Sampled | Flow Status | |
|---|---|---|---|---|---|---|
| | | | | | Ponded | Flowing |
| Carlsbad | 5/20/2009 | 12 | 6 | 6 | 4 | 2 |
| Los Peñasquitos | 6/9/2009 | 9 | 3 | 6 | 3 | 3 |
| Mission Bay and La Jolla | 5/28/2009 | 13 | 4 (a) | 3 | 0 | 3 |
| San Diego Bay | 6/9/2009 | 12 | 5 (b) | 3 | 3 | 0 |
| San Dieguito River | 5/26/2009 | 6 | 0 | 6 | 2 | 4 |
| San Diego River | 6/08/2009 | 13 | 8 (c) | 4 | 1 | 3 |
| San Luis Rey | 5/21/2009 | 12 | 9 | 3 | 2 | 1 |
| Santa Margarita | 5/21/2009 | 10 | 3 (d) | 6 | 2 | 4 |
| Tijuana River | 6/10/2009 | 11 | 8 | 3 | 3 | 0 |
| **TOTAL** | **-** | **98** | **46** | **40** | **20** | **20** |

(a) One site was tidally influenced; two sites were not located; two sites were inaccessible; one site was in the San Diego River watershed.
(b) Four sites were tidally influenced.
(c) One site was inaccessible. As a result, thirteen sites were visited in the San Diego River WMA.
(d) One site could not be located.

**Table 12-7. Random Dry Weather Sampling Summary and Comparison to Receiving Water Benchmarks**

| Analyte | Benchmark | Units | Number Samples | Number Detects | Min | Max | Average Concentration | Number (%) Above Benchmark |
|---|---|---|---|---|---|---|---|---|
| Total Coliforms | N/A | MPN/100 mL | 40 | 40 | 220 | 1,600,000 | 112,818 | N/A |
| Fecal Coliforms | 400 | MPN/100 mL | 40 | 37 | ND | 240,000 | 18,285 | 19 (48%) |
| Enterococcus | 151 | MPN/100 mL | 40 | 40 | 20 | 220,000 | 9,176 | 35 (89%) |
| Total Phosphorus | 0.1* | mg/L | 40 | 37 | ND | 2.04 | 0.42 | 31 (78%) |
| Total Nitrogen | 1* | mg/L | 40 | 39 | ND | 27 | 4.31 | 37 (93%) |
| Nitrate as N | 10 | mg/L | 40 | 33 | 0 | 23.1 | 2.31 | 1 (10%) |
| TSS | 58 | mg/L | 40 | 12 | 0 | 1190 | 61.08 | 10 (17%) |

*The benchmarks for total phosphorus and total nitrogen are narrative standards with these values as goals.

### 12.2.2 Random Wet Weather

Regionally, thirty-eight random MS4 outfall wet weather events were monitored in 2008–2009, as shown in Table 12-8. The majority of WMAs were monitored at four locations. The San Dieguito WMA was monitored at five locations. Due to insufficient rainfall events during the 2008–2009 Monitoring Season, only five locations were monitored in the Los Peñasquitos WMA and four locations in the remaining WMAs, rather than the desired goal of six locations.

The following table summarizes the water quality benchmark exceedances for the random wet weather monitoring sites (Table 12-8). The results suggest that nitrogen and phosphorus compounds, and indicator bacteria (fecal coliforms) in MS4 wet weather runoff from random monitoring sites may have the potential to contribute to receiving water problems.

**Table 12-8. Random Wet Weather Sampling Summary and Comparison to Receiving Water Benchmarks**

| Analyte | Benchmark | Units | Number Samples | Number Detects | Min | Max | Average Concentration | Number (%) Above Benchmark |
|---|---|---|---|---|---|---|---|---|
| Total Coliforms | N/A | MPN/100 mL | 39 | 39 | 1,400 | 800,000 | 119,345 | N/A |
| Fecal Coliforms | 400 | MPN/100 mL | 39 | 39 | 40 | 230,000 | 19,361 | 32 (82%) |
| Enterococcus | N/A | MPN/100 mL | 39 | 39 | 1,700 | 500,000 | 45,930 | 0 (0%) |
| Total Phosphorus | 0.1* | mg/L | 39 | 37 | ND | 1.91 | 0.43 | 32 (82%) |
| Total Nitrogen | 1* | mg/L | 39 | 39 | 0.7 | 8.7 | 3.08 | 36 (92%) |
| Nitrate as N | 10 | mg/L | 21 | 21 | 0.07 | 2.83 | 1.03 | 0 (0%) |
| TSS | 100 | mg/L | 39 | 25 | ND | 1,070 | 91.26 | 9 (9%) |

*The benchmarks for total phosphorus and total nitrogen are narrative standards with these values as goals.

### 12.2.3 Targeted Dry Weather

A summary of analytes with water quality benchmarks and the number of detections and benchmark exceedances is provided in Table 12-9. The results suggest that nitrogen compounds and indicator bacteria (enterococcus) in MS4 dry weather runoff from targeted monitoring sites may have the potential to contribute to receiving water problems.

**Table 12-9. Targeted Dry Weather Sampling Summary and Comparison to Receiving Water Benchmarks**

| Analyte | Benchmark | Units | Number Samples | Number Detects | Min | Max | Average Concentration | Number (%) Above Benchmark |
|---|---|---|---|---|---|---|---|---|
| Total Coliforms | N/A | MPN/100 mL | 190 | 173 | ND | 1,600,000 | 68,993 | N/A |
| Fecal Coliforms | 400 | MPN/100 mL | 190 | 164 | ND | 170,000 | 5,541 | 103 (54%) |
| Enterococcus | 151 | MPN/100 mL | 190 | 172 | ND | 120,000 | 8,309 | 153 (81%) |
| Total Phosphorus | 0.1* | mg/L | 132 | 113 | ND | 3.97 | 0.28 | 75 (57%) |
| Total Nitrogen | 1.0* | mg/L | 134 | 127 | ND | 106 | 6.98 | 120 (90%) |
| Nitrate as N | 1.0 | mg/L | 42 | 38 | ND | 17.3 | 4.31 | 5 (12%) |
| TSS | 58 | mg/L | 124 | 74 | ND | 330 | 14.22 | 6 (48%) |

*The benchmarks for total phosphorus and total nitrogen are narrative standards with these values as goals.

### 12.2.4 Targeted Wet Weather

There was no targeted wet weather monitoring in 2008–2009. The program was developed in 2008–2009 and will be implemented in 2009-2010.

## 12.3 Source ID

The Source Identification Program is a requirement of San Diego Regional Water Quality Control Board (RWQCB) Order R9-2007-0001 (Section B.2 of the Receiving Waters and Urban Runoff Monitoring and Reporting Program). The Copermittees provided a framework for source identification studies entitled "Urban Runoff Source Identification Program in San Diego County Watersheds" (County of San Diego Copermittees, 2008). This framework described the conceptual monitoring to be conducted over the course of the Permit. One change occurred since the framework was submitted; the City of Carlsbad study area was changed to the City of Del Mar. The Copermittees subsequently developed a workplan for implementation during the 2008–2009 Permit Year. The workplan, "2008–2009 Source Identification Monitoring, Residential Area Runoff Assessment was designed to assess dry weather runoff from single family residences.

The goal of this study was to collect dry weather residential land use discharge data for application to regional assessments since residential land uses comprise the most common land uses in urban areas. A secondary goal of collecting the data was to compare data collected in San Diego County to data collected from an intensive residential land use runoff study under a Proposition 50 Grant in Orange and Sacramento Counties (Haver, 2007[1]).

Primary study questions from the 2008–2009 Source Identification Workplan are as follows:

1. **When are the dry weather or nuisance flows detected from single-family residences (during what part of the day/week)?**
2. **What is the water quality and load of constituents of dry weather or nuisance flows from single-family residences?**
3. **What are the potential sources of dry weather flows from single-family residences?**

### 12.3.1 Sampling Locations

The residential runoff monitoring assessment was conducted in two separate residential areas. One study area was located in the City of Del Mar and one in the City of La Mesa (Figure 12-1).

[1] The results of the Proposition 50 Nonpoint Source Pollution Control Program Grant entitled "Evaluating Best Management Practices (BMPs) Effectiveness to Reduce Volumes of Runoff and Improve the Quality of Runoff from Urban Environments" is being conducted by Dr. Darren Haver of the UC Davis. Dr. Haver is coordinating the collection of wet and dry samples from four residential communities in Sacramento and four residential communities in Orange County. Work currently is suspended at the request of the State of California.

The Del Mar location provides information on coastal communities and the La Mesa location provides information on inland communities.


**Figure 12-1. Monitoring Program Study Areas**

The Del Mar monitoring location discharges directly to the Pacific Ocean and is composed of 38.4 acres (Table 12-10). One monitoring location was sufficient to capture runoff directly from a residential only land use area. This sampling location was selected as a coastal residential drainage area (Figure 12-2). Continuous flow monitoring was conducted between April 30, 2009 and July 22, 2009.

**Table 12-10. Del Mar Source ID Site Summary**

| Site | Drainage Area (acres) | Start date | End date | Total time interval (Days) | Measured volume (cubic ft (cf)) |
|---|---|---|---|---|---|
| DM-SID-1 | 38.4 | 04/30/2009 | 07/22/2009 | 83.16 | 15.7 |

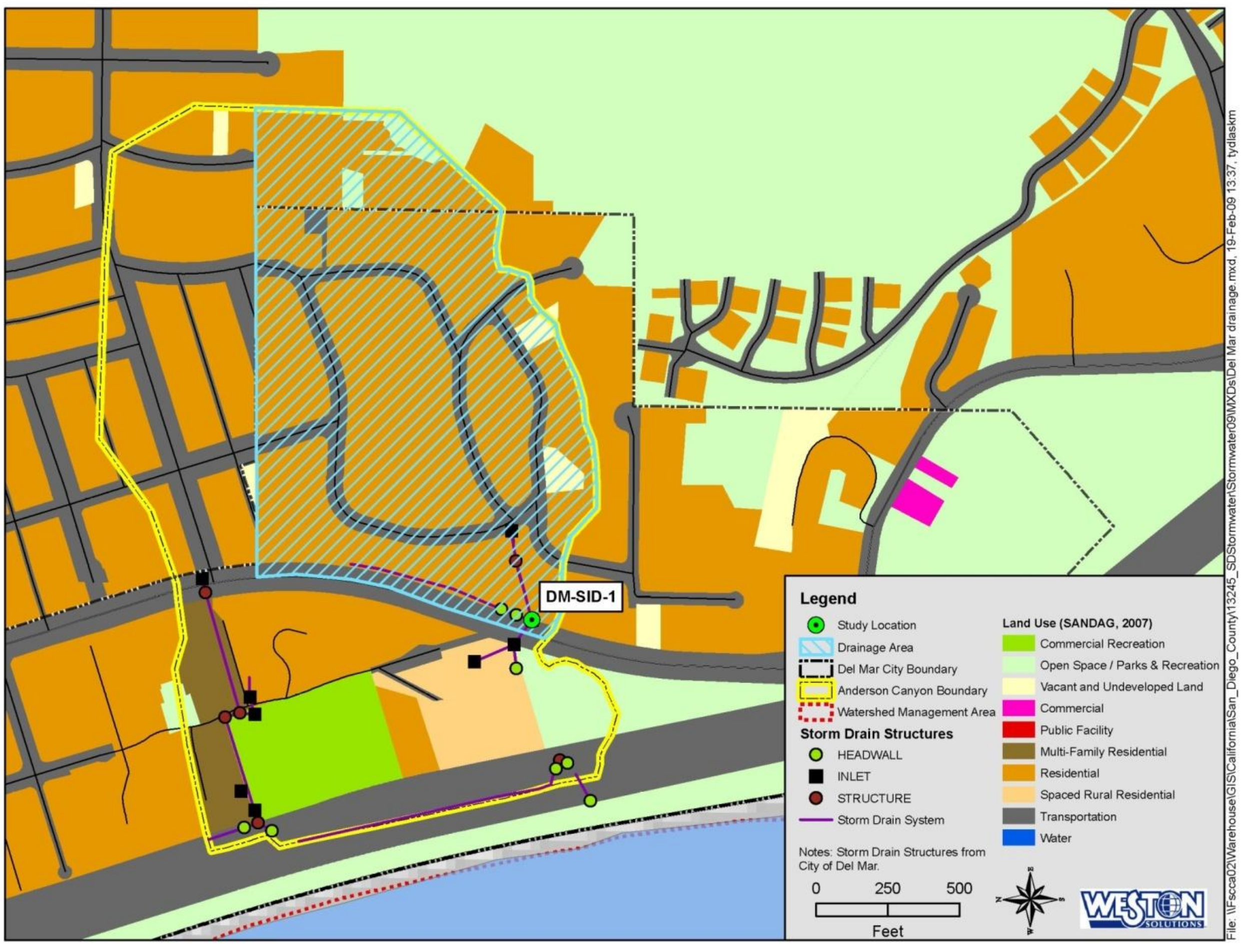



**Figure 12-2. Map of Del Mar Monitoring Area and Monitoring Location**

At the La Mesa Study Area, the targeted drainage area discharges to Chollas Creek which eventually drains to San Diego Bay and was approximately 313 acres in size. Three continuous flow monitoring locations were installed to measure runoff from targeted residential areas (Figure 12-3). The LM-SID-2 and LM-SID-3 sampling locations isolate flow and pollutant loading from mixed land uses in the upper drainage area and includes residential, commercial, and industrial areas (Table 12-11). Contributions from these areas were subtracted from the total study area flow and pollutant loading measured downstream at LM-SID-1 to assess loads per acre based on residential discharge only.

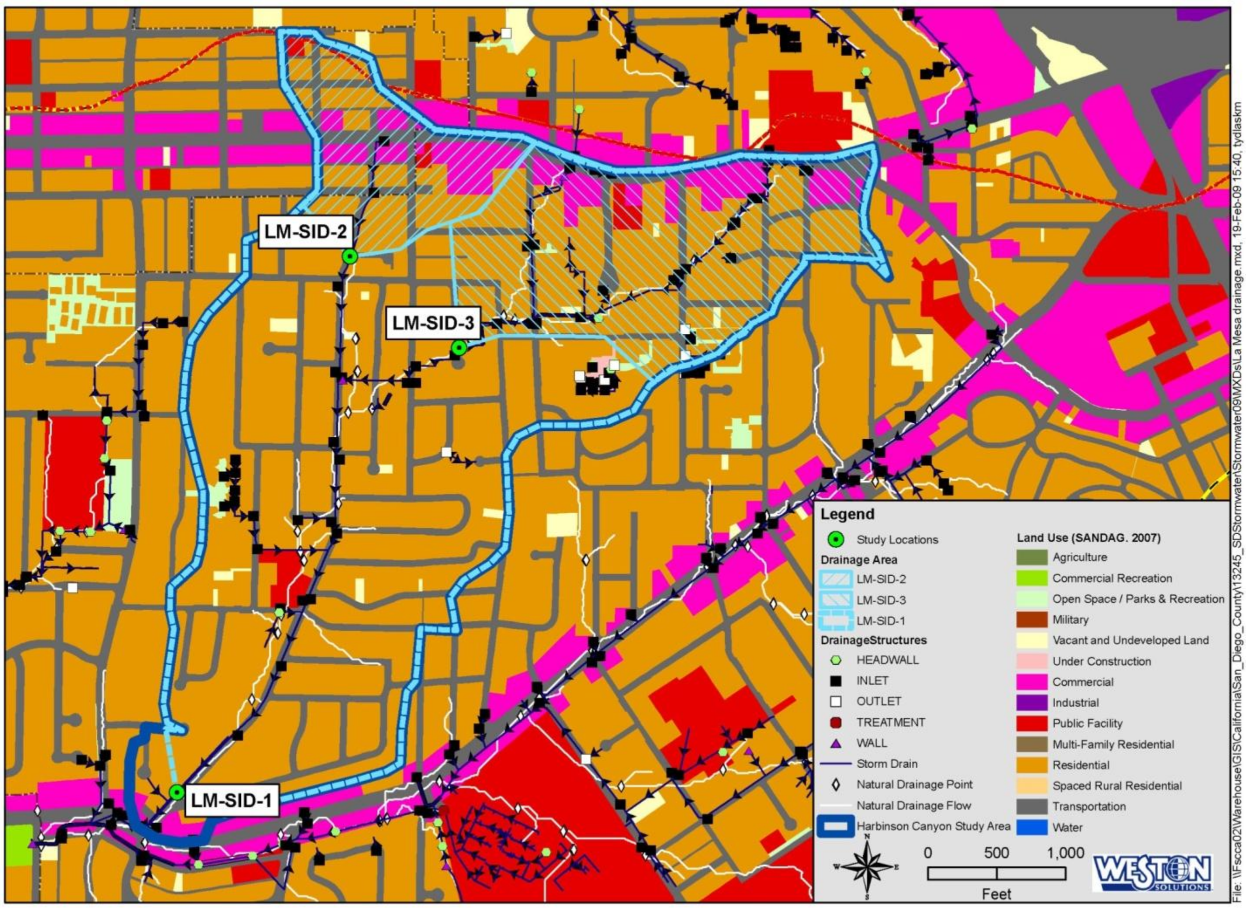



**Figure 12-3. Location of La Mesa Sampling Sites**

**Table 12-11. La Mesa Source ID Site Summary**

| Site | Drainage Area (Acres) | Start date | End date | Total time interval (Days) | Measured volume (cf) |
|---|---|---|---|---|---|
| LM-SID-1 (total measured) | 313 | 04/20/2009 | 07/14/2009 | 84.60 | 192,610 |
| LM-SID-2 | 34.7 | 04/20/2009 | 07/21/2009 | 91.80 | 25,501 |
| LM-SID-3 | 81.4 | 04/20/2009 | 07/21/2009 | 91.77 | 26,171 |
| LM-SID-1 (Residential Area Only, = SID-1 Minus SID-2 and SID-3) | 196.9 | 04/20/2009 | 07/14/2009 | 84.60 | 140,938 |

Three monitoring events were conducted at the Del Mar and La Mesa sites on May 14, 2009, June 30, 2009, and July 21, 2009. The Del Mar monitoring location did not have sufficient flow for sampling on May 14, 2009 and July 21, 2009, therefore samples were collected one time at Del Mar on June 30, 2009. The LM-SID-1 location had continuous flow for all three events while LM-SID-2 had insufficient flow during the last event and LM-SID-3 had insufficient flow for monitoring during the first two events (Table 12-12).

**Table 12-12. Sampling Event Summary and Flow Condition**

| Site ID | Total Number of Sampling Events | Monitoring Event Dates | | |
|---|---|---|---|---|
| | | May 14, 2009 | June 30, 2009 | July 21, 2009 |
| DM-SID-1 | 3 | Insufficient Flow | X | Insufficient Flow |
| LM-SID-1 | 3 | X | X | X |
| LM-SID-2 | 3 | X | X | Insufficient Flow |
| LM-SID-3 | 3 | Insufficient Flow | Insufficient Flow | X |

### 12.3.2 Flow

Flow was measured continuously for an approximate three-month time period during the spring and early summer from mid-April through mid-July 2009. Flow data were analyzed weekly, by weekday, and over the duration of the monitoring season to determine total runoff and also to determine if there was any discernable pattern of flow each day of the week. Flow levels were below, at, and above the level of detection (LOD) of the flow sensor depending on the conditions of runoff at each site. Figure 12-4 presents actual measured volumes and estimated volumes which account for flows below the flow meters LOD.

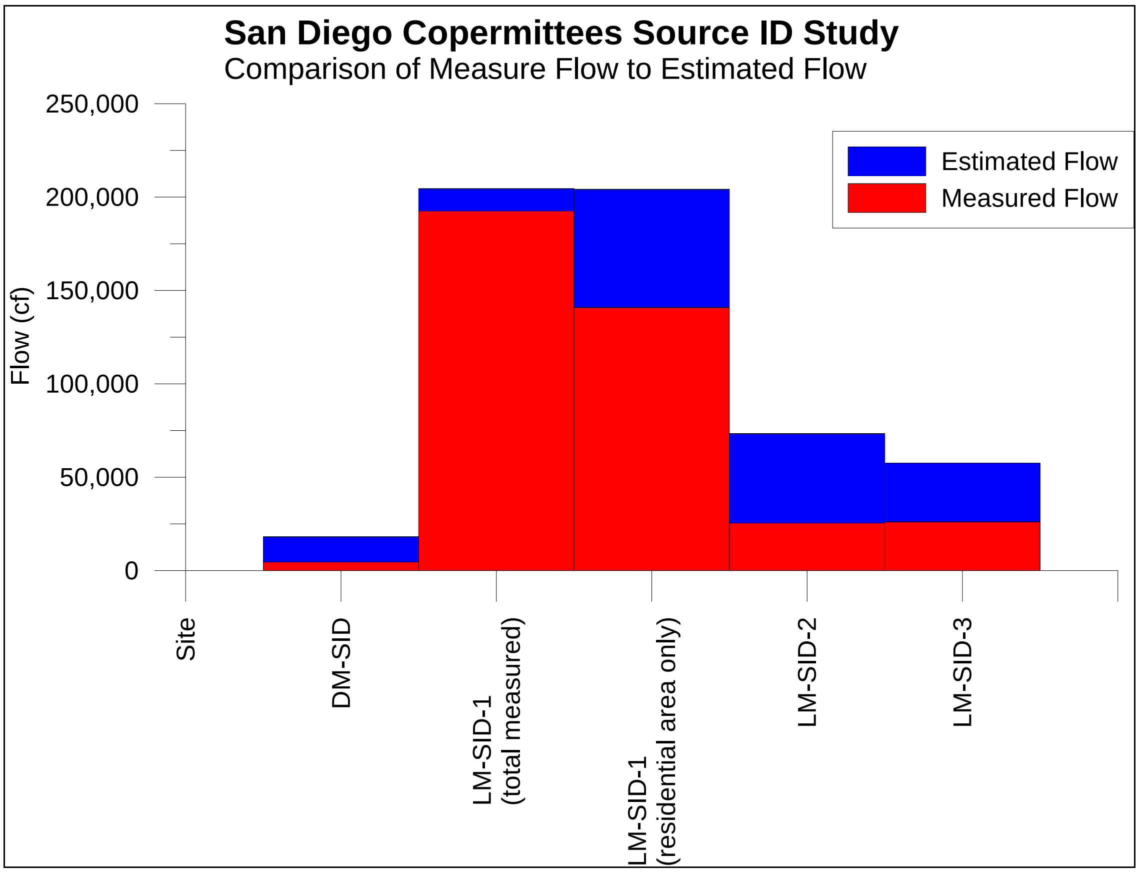



**Figure 12-4. Actual Measured Volumes and Estimated Volumes at Each Monitored Site**

**Del Mar Flow Analysis**

Flow at the Del Mar monitoring location (DM-SID-1) was generally below the level of instrument detection and was mostly dry during inspections. Flow monitoring recorded 4,700 cubic ft (cf) for the duration of the monitoring season (Figure 12-5). The largest flow event was recorded on July 17, 2009, near the end of the monitoring period. During this event, a total of 3,689 cf was measured, accounting for 78% of the flow measured during the entire monitoring season.

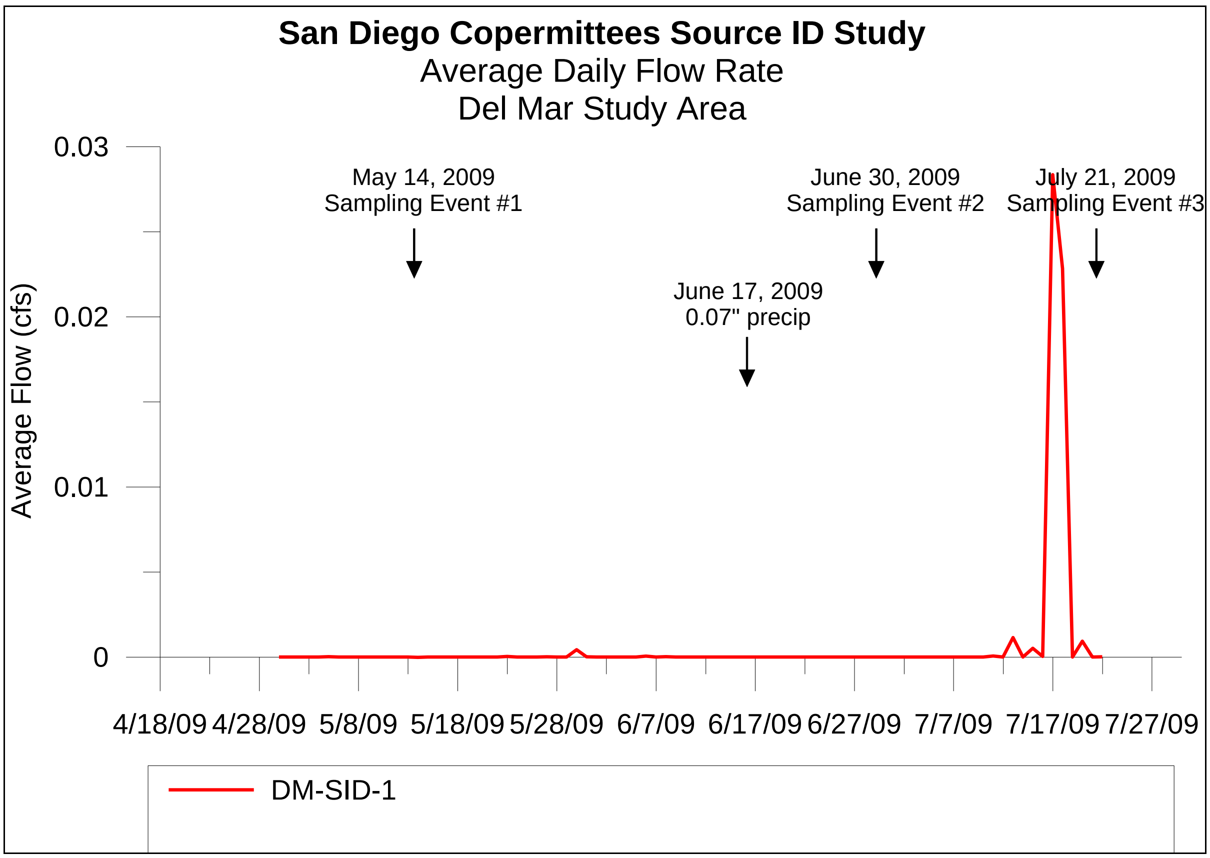



**Figure 12-5. Daily Flow Rate for Del Mar Study Area**

From the cumulative monthly volumes, July was the month with the most flow in Del Mar, while June had the least flow of the three months. The total flow measured in July was approximately 100 times more than the flow measured in June (Figure 12-6). This result is due to a single day in the month of July when there was a large discharge event, accounting for the majority of the flow during that month.

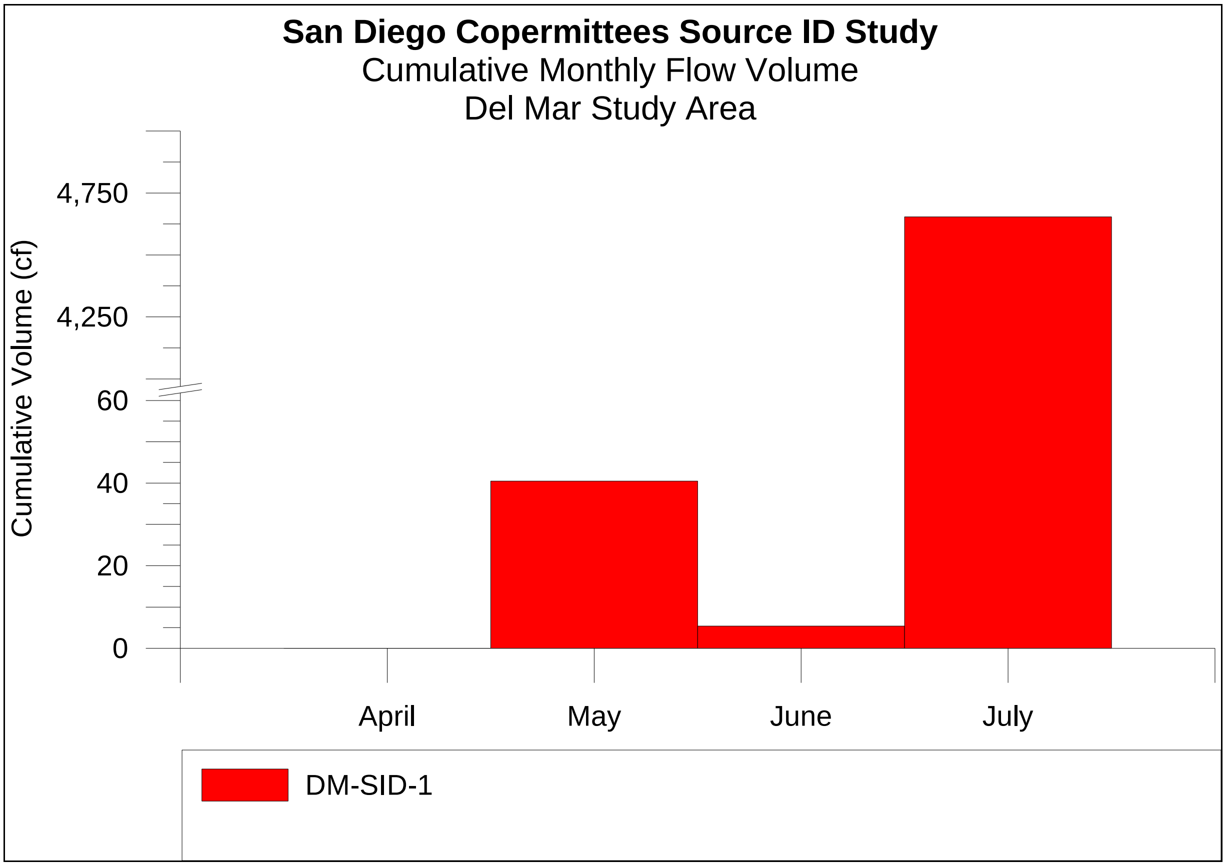



**Figure 12-6. Cumulative Monthly Flow Volumes for the Del Mar Study Area**

The weekday flow totals showed that Friday and Saturday were the days with the most flow (Figure 12-7). Again this result is skewed by the discharge event which occurred between 22:00 on July 17, 2009 (a Friday) until 03:00 on July 18, 2009 (a Saturday). Outside of the single discharge event, Mondays also showed an increase in flow compared to the other days of the week.

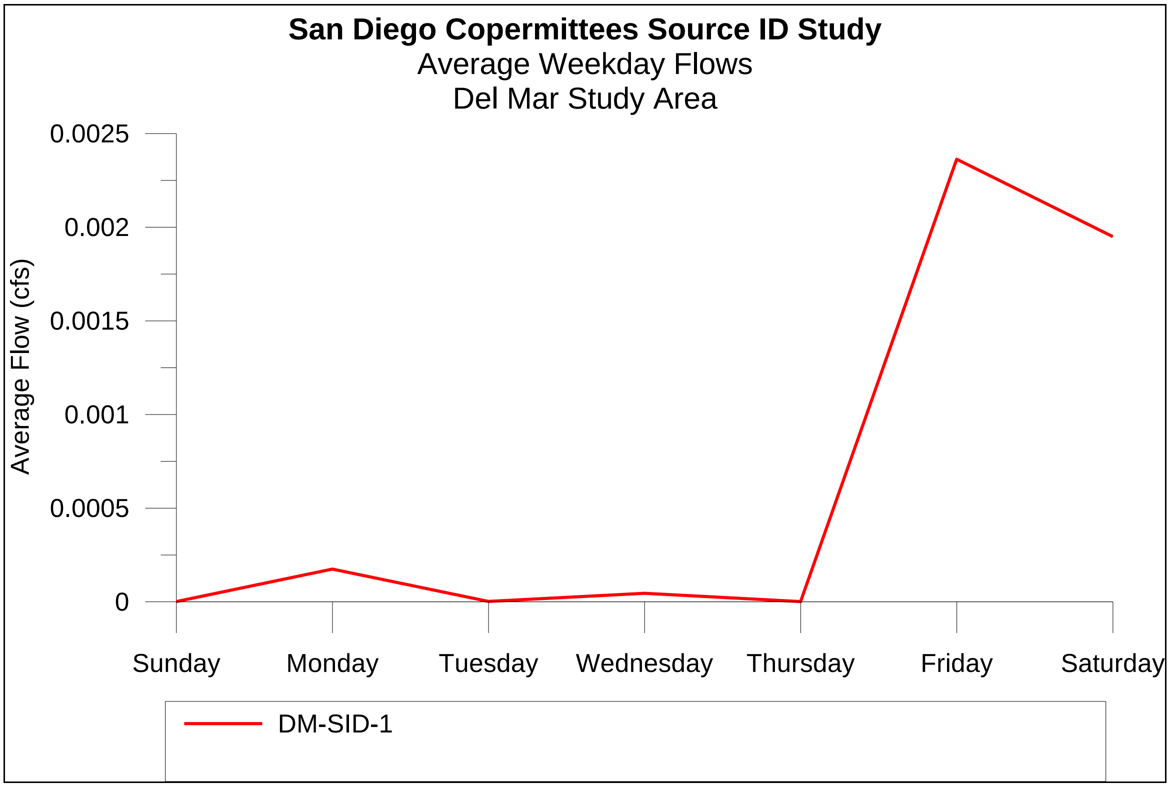



**Figure 12-7. Average Weekday Flow for Del Mar Study Area**

**La Mesa Flow Analysis**

Total runoff measured at Site LM-SID-1 during the monitoring season was 192,610 cf. Flows at Site LM-SID-1 reduced to nearly their lowest levels around the beginning of July (Figure 12-8). It should be noted that countywide water use restrictions and conservation programs were initiated on July 1, 2009. The total runoff from sites LM-SID-2 and LM-SID-3 (combined) during the same period was calculated to be 51,472 cf, meaning that the total runoff volume from residential sources within this watershed was approximately 141,138 cf (Figure 12-9).

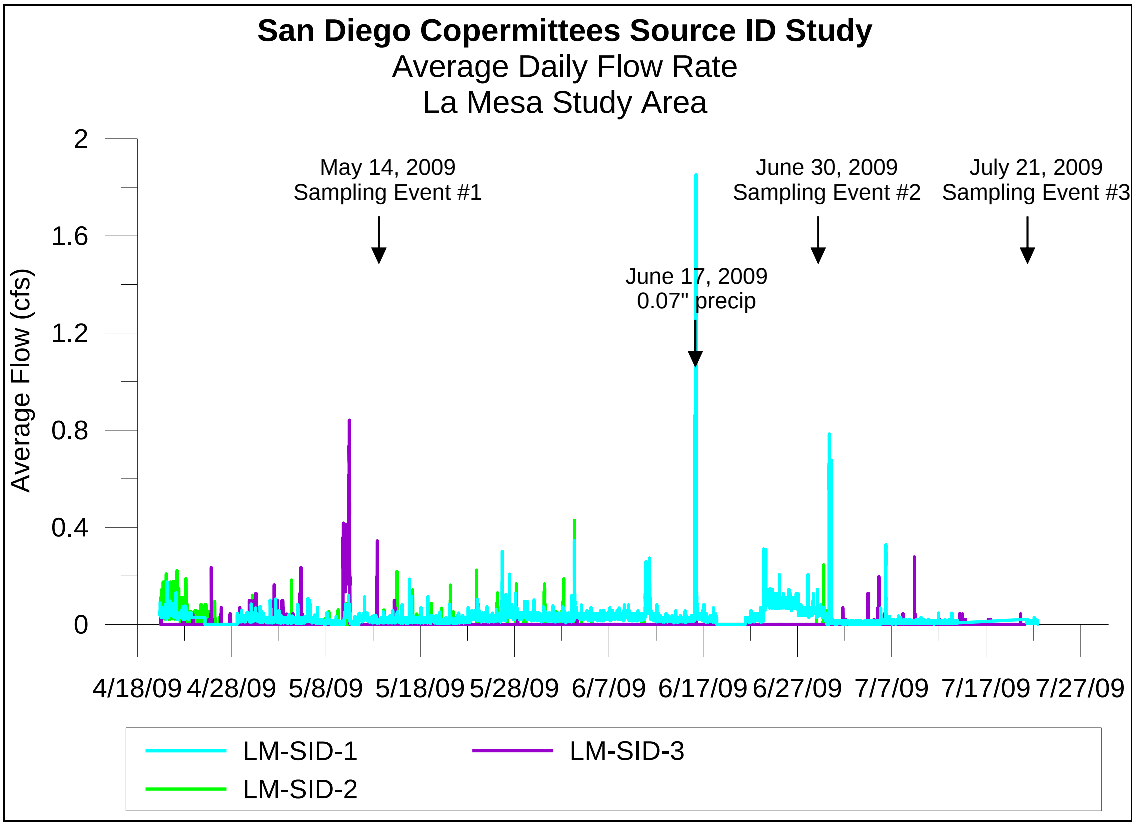



**Figure 12-8. Daily Flow Rates for La Mesa Study Area**

Flows were not continuous at sites LM-SID-2 and LM-SID-3 (Figure 12-8). These sites had more episodic/infrequent discharges indicating sources of flow were likely discharges from overland flow sources. Based upon land uses, source of flow may include irrigation, nuisance flows, and runoff from commercial/industrial operations. Flows at Site LM-SID-1 were essentially continuous with only two periods where flows were at the limit of detection. During site visits, there were no evident overland flows, indicating groundwater influences via pipe seeps was likely and was also observed during confined space installation of the monitoring equipment.

For each of the La Mesa monitoring locations, a different month recorded the highest flows. For LM-SID-1, June had the most flow. At LM-SID-2, April recorded the most flow and at LM-SID-3, May was the month with the most flow. When calculated for only the residential flows, June had the greatest flow volume throughout the study duration. During the month of June, 61% of the total flow from the monitoring season was recorded.

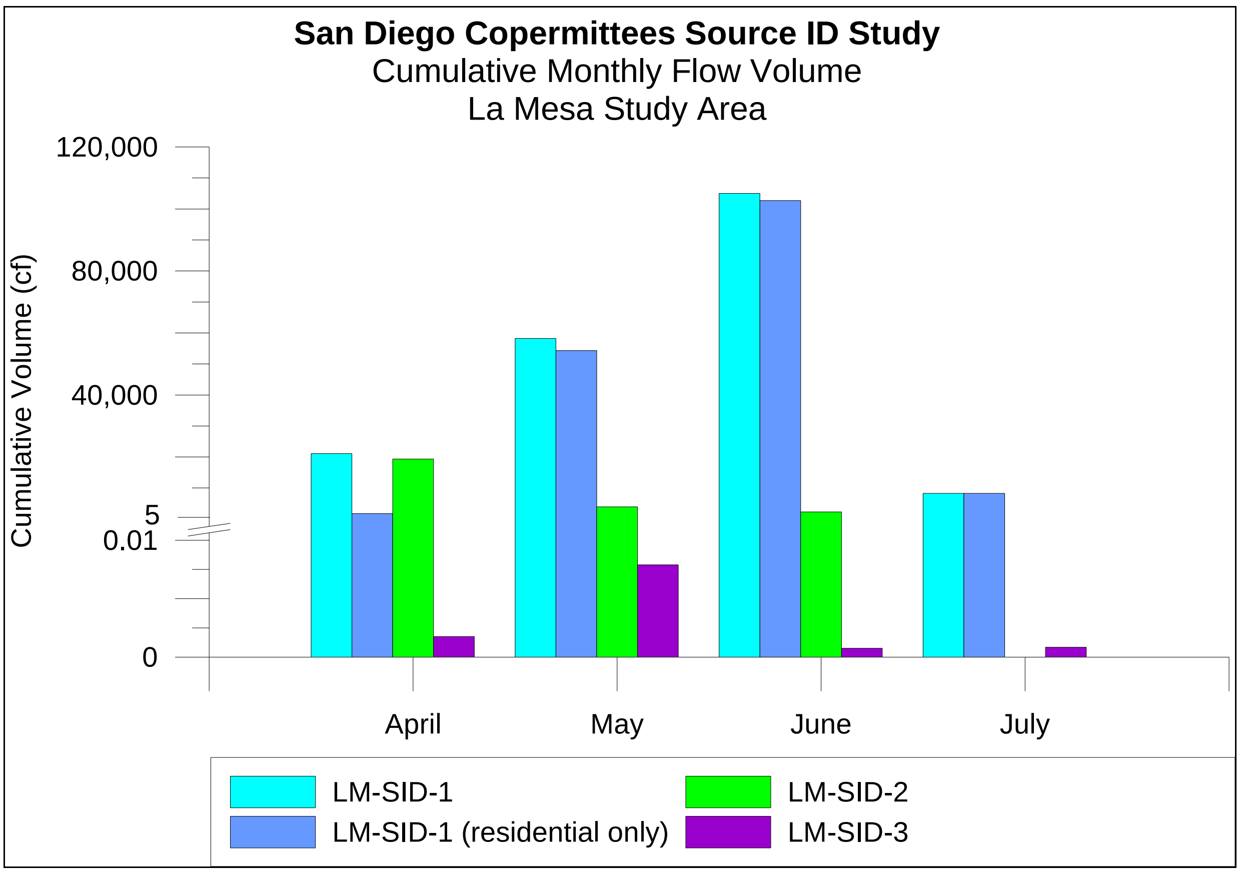



**Figure 12-9. Cumulative Monthly Flow Volume for La Mesa Study Area**

Average weekday flows were also assessed for each site (Figure 12-10). Flow at the residential downstream monitoring site (LM-SID-1) was highest on Tuesday and reduced incrementally each following day through the weekend. LM-SID-2 followed a similar pattern of higher flows on Tuesday and incremental reduction in flow the following days through the weekend. LM-SID-3 followed a different pattern, with the highest flows being recorded on Saturday and Sunday.

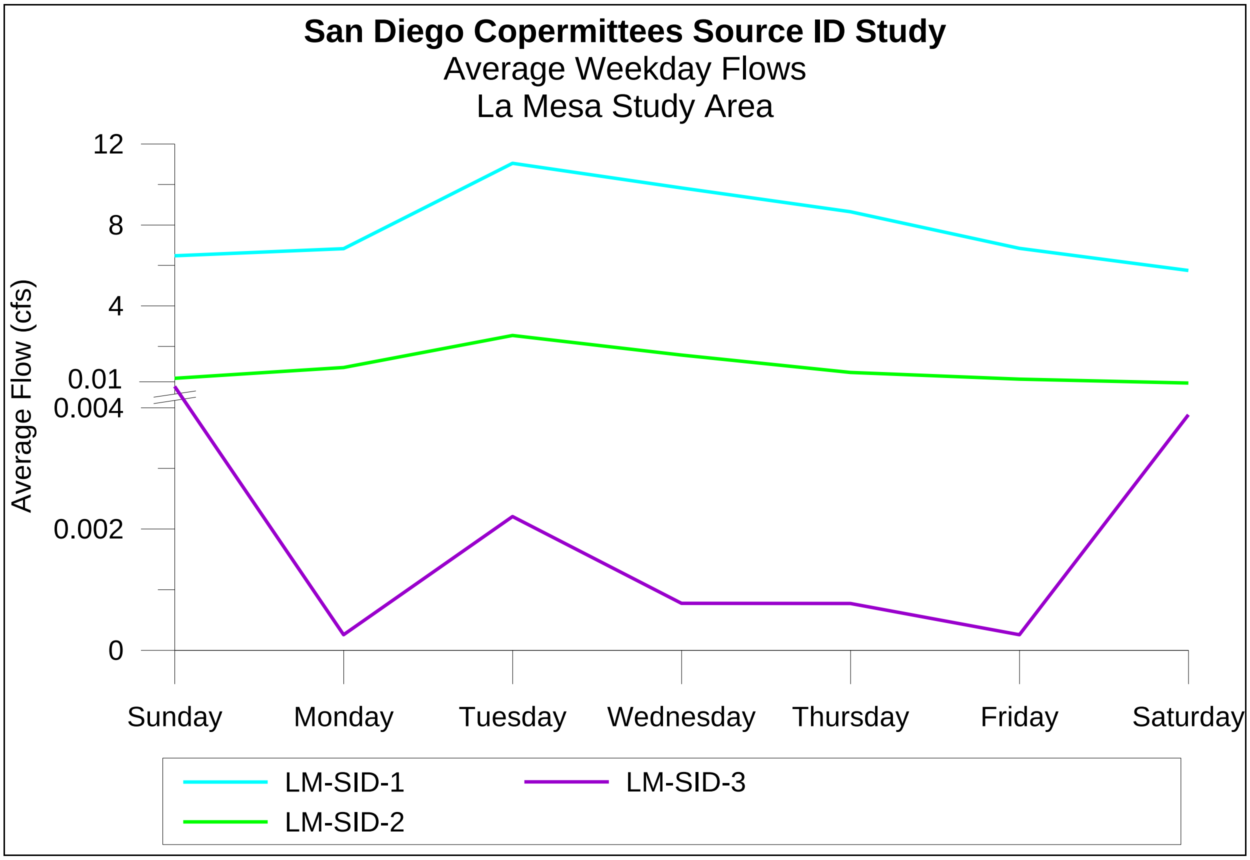



**Figure 12-10. Average Weekday Flow for La Mesa Study Area**

### 12.3.3 Analyte Concentrations

A summary of the analyte concentrations collected during each of the monitoring season, at each of the sampling locations, are presented in Table 12-13. It should be noted that no organophosphorus pesticides were detected during the sampling events.

**Table 12-13. Analyte Concentrations for the Source ID Sampling Sites**

| Analyte | | Units | DM-SID-1 | LM-SID-1 | LM-SID-1 | LM-SID-1 | LM-SID-2 | LM-SID-2 | LM-SID-3 |
|---|---|---|---|---|---|---|---|---|---|
| | | | 6/30/2009 | 5/14/2009 | 6/30/2009 | 7/21/2009 | 5/14/2009 | 6/30/2009 | 7/21/2009 |
| General Chemistry | Bromide by IC | mg/L | 0.239 | 4.525 | 6.134 | 5.436 | 0.133 | 0.118 | 0.186 |
| | Chloride by IC | mg/L | 250.81 | 1631.16 | 1707.66 | 1879.63 | 104.75 | 106.88 | 108.09 |
| | Dissolved Organic Carbon | mg/L | 9.7 | 10.1 | 9.7 | 10.9 | 5.4 | 9.3 | 9.9 |
| | Nitrate-N | mg/L | 0.27 | 8.02 | 8.79 | 8.9 | 0.45 | 1.5 | 0.2 |
| | Nitrite-N | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | 0.06 | 0.1 | <0.01 |
| | Total Dissolved Solids | mg/L | 1354 | 3730 | 4014 | 4044 | 622 | 720 | 704 |
| | Total Hardness as CaCO3 | mg/L | 406.6 | 1451.7 | 1400.9 | 1589.5 | 232.2 | 216.2 | 268.5 |
| | Total Kjeldahl Nitrogen | mg/L | 1.1 | 0.84 | 1.5 | 0.98 | 1.2 | 1.8 | 1.4 |
| | Total Nitrogen | mg/L | 1.37 | 8.86 | 10.29 | 9.88 | 1.71 | 3.4 | 1.6 |
| | Total Organic Carbon | mg/L | 8.7 | 11.5 | 9.4 | 10.3 | 5.3 | 9.3 | 9.1 |
| | Total Orthophosphate as P | mg/L | 0.4 | 0.29 | 0.29 | 0.28 | 0.26 | 0.8 | 0.5 |
| | Total Phosphorus-Low Range | mg/L | 0.429 | 0.265 | 0.287 | 0.274 | 0.279 | 0.611 | 0.685 |
| | Total Suspended Solids | mg/L | 28.3 | 37.3 | 6 | 6.2 | 32 | 84 | 6 |
| | Turbidity | NTU | 9.5 | 6.4 | <1 | <1 | 14.6 | 54 | 7.2 |
| Bacteriological | Total Coliforms | MPN/100 mL | 80,000 | 2,300 | 14,000 | 11,000 | 500,000 | 9,000,000 | 300,000 |
| | Fecal Coliforms | MPN/100 mL | 3,000 | 40 | 20 | 80 | 170,000 | 800,000 | 70,000 |
| | E. coli | MPN/100 mL | 487 | 20 | 20 | <10 | 8,876 | 13,135 | 18,600 |
| | Enterococci | MPN/100 mL | 50,000 | 1,700 | 110 | 900 | 80,000 | 300,000 | 500,000 |
| Organophosphorus Pesticides | Azinphos Methyl | ng/L | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| | Bolstar (Sulprofos) | ng/L | <2 | <2 | <2 | <2 | <2 | <2 | <2 |
| | Chlorpyrifos | ng/L | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| | Demeton | ng/L | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| | Diazinon | ng/L | <2 | <2 | <2 | <2 | <2 | <2 | <2 |
| | Dichlorvos | ng/L | <3 | <3 | <3 | <3 | <3 | <3 | <3 |
| | Dimethoate | ng/L | <3 | <3 | <3 | <3 | <3 | <3 | <3 |
| | Disulfoton | ng/L | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| | Ethoprop (Ethoprofos) | ng/L | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| | Ethyl Parathion | ng/L | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| | Fenchlorphos (Ronnel) | ng/L | <2 | <2 | <2 | <2 | <2 | <2 | <2 |
| | Fenitrothion | ng/L | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| | Fensulfothion | ng/L | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| | Fenthion | ng/L | <2 | <2 | <2 | <2 | <2 | <2 | <2 |
| | Malathion | ng/L | <3 | <3 | <3 | <3 | <3 | <3 | <3 |
| | Merphos | ng/L | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| | Methamidophos (Monitor) | ng/L | <50 | <50 | <50 | <50 | <50 | <50 | <50 |
| | Methidathion | ng/L | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| | Methyl Parathion | ng/L | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| | Mevinphos (Phosdrin) | ng/L | <8 | <8 | <8 | <8 | <8 | <8 | <8 |
| | Phorate | ng/L | <6 | <6 | <6 | <6 | <6 | <6 | <6 |
| | Phosmet | ng/L | <50 | <50 | <50 | <50 | <50 | <50 | <50 |
| | Tetrachlorvinphos (Stirofos) | ng/L | <2 | <2 | <2 | <2 | <2 | <2 | <2 |
| | Tokuthion | ng/L | <3 | <3 | <3 | <3 | <3 | <3 | <3 |
| | Trichloronate | ng/L | <1 | <1 | <1 | <1 | <1 | <1 | <1 |

**Table 12-13. Analyte Concentrations for the Source ID Sampling Sites**

| Analyte | | Units | DM-SID-1 | LM-SID-1 | LM-SID-1 | LM-SID-1 | LM-SID-2 | LM-SID-2 | LM-SID-3 |
|---|---|---|---|---|---|---|---|---|---|
| | | | 6/30/2009 | 5/14/2009 | 6/30/2009 | 7/21/2009 | 5/14/2009 | 6/30/2009 | 7/21/2009 |
| Synthetic Pyrethroids | Allethrin | ng/L | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| | Bifenthrin | ng/L | 9.1 | 2 | <0.5 | <0.5 | 5.1 | 33.4 | 4.3 |
| | Cyfluthrin | ng/L | <0.5 | 4.5 | <0.5 | <0.5 | 6.5 | 136.7 | 2 |
| | Cypermethrin | ng/L | <0.5 | 4.1 | 3.5 | <0.5 | <0.5 | 33.4 | <0.5 |
| | Danitol | ng/L | 0.9J | <0.5 | <0.5 | <0.5 | <0.5 | 30.2 | <0.5 |
| | Deltamethrin | ng/L | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| | Esfenvalerate | ng/L | <0.5 | <0.5 | 0.6J | <0.5 | <0.5 | 1.7J | <0.5 |
| | Fenvalerate | ng/L | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | 2.3 | <0.5 |
| | Fluvalinate | ng/L | 3.8 | <0.5 | 1.6J | <0.5 | <0.5 | <0.5 | <0.5 |
| | L-Cyhalothrin | ng/L | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | 5.3 | <0.5 |
| | Permethrin | ng/L | <5 | <5 | <5 | <5 | <5 | 5118.7 | <5 |
| | Prallethrin | ng/L | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| | Resmethrin | ng/L | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| Trace Metals | Cadmium (Cd) | µg/L | <0.2 | 0.3J | 0.3J | 0.3J | <0.2 | <0.2 | <0.2 |
| | Copper (Cu) | µg/L | 4.6 | 4.9 | 4.2 | 4.2 | 2.4 | 2.4 | 3.6 |
| | Lead (Pb) | µg/L | <0.05 | <0.05 | <0.05 | <0.05 | 1.03 | 0.65 | 0.09J |
| | Zinc (Zn) | µg/L | 8.7 | 38.9 | 36.1 | 32.6 | 15.5 | 13 | 85.5 |

Sites were sampled yielding concentrations of general chemistry constituents, indicator bacteria, pyrethroids, and trace metals. Specifically, for the general chemistry constituents, Site LM-SID-1 had the highest levels for some of the constituents, including chloride, nitrate, total nitrogen, total dissolved solids (TDS), and total hardness (Figure 12-11). The high levels of these constituents compared to the other sites with periodic flows, indicate that groundwater influences are likely at this location which were supported by field observations and flow monitoring data.

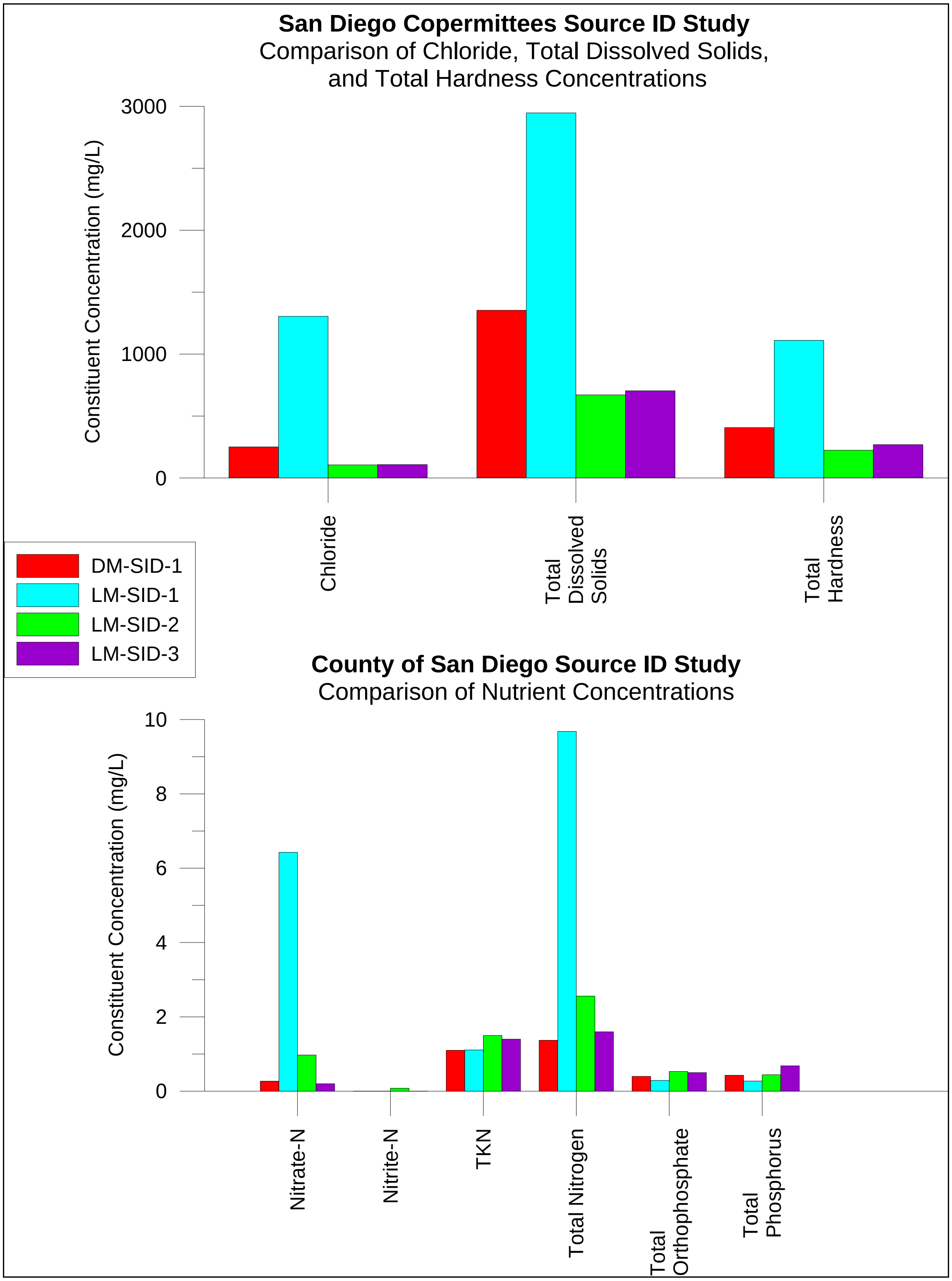
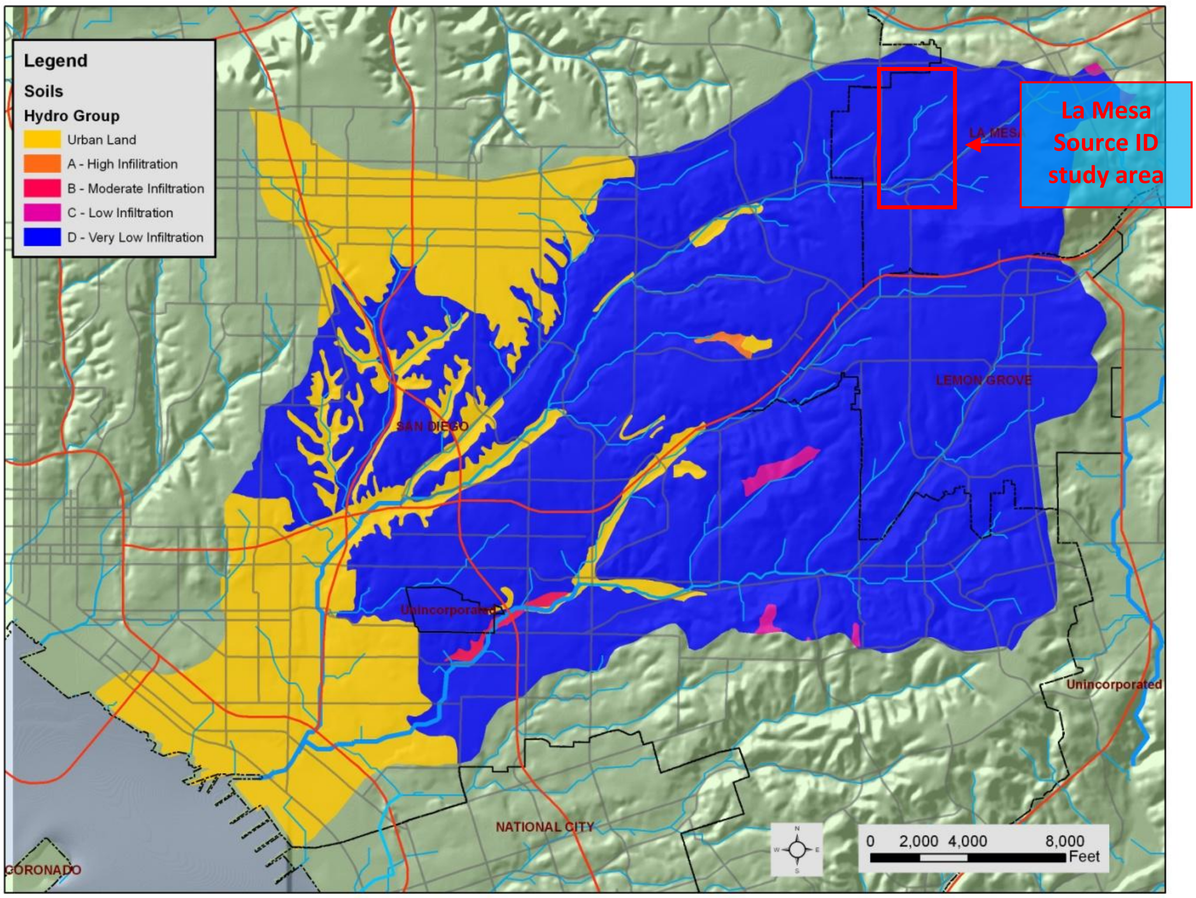



**Figure 12-11. Comparison of General Chemistry and Nutrient Concentrations**

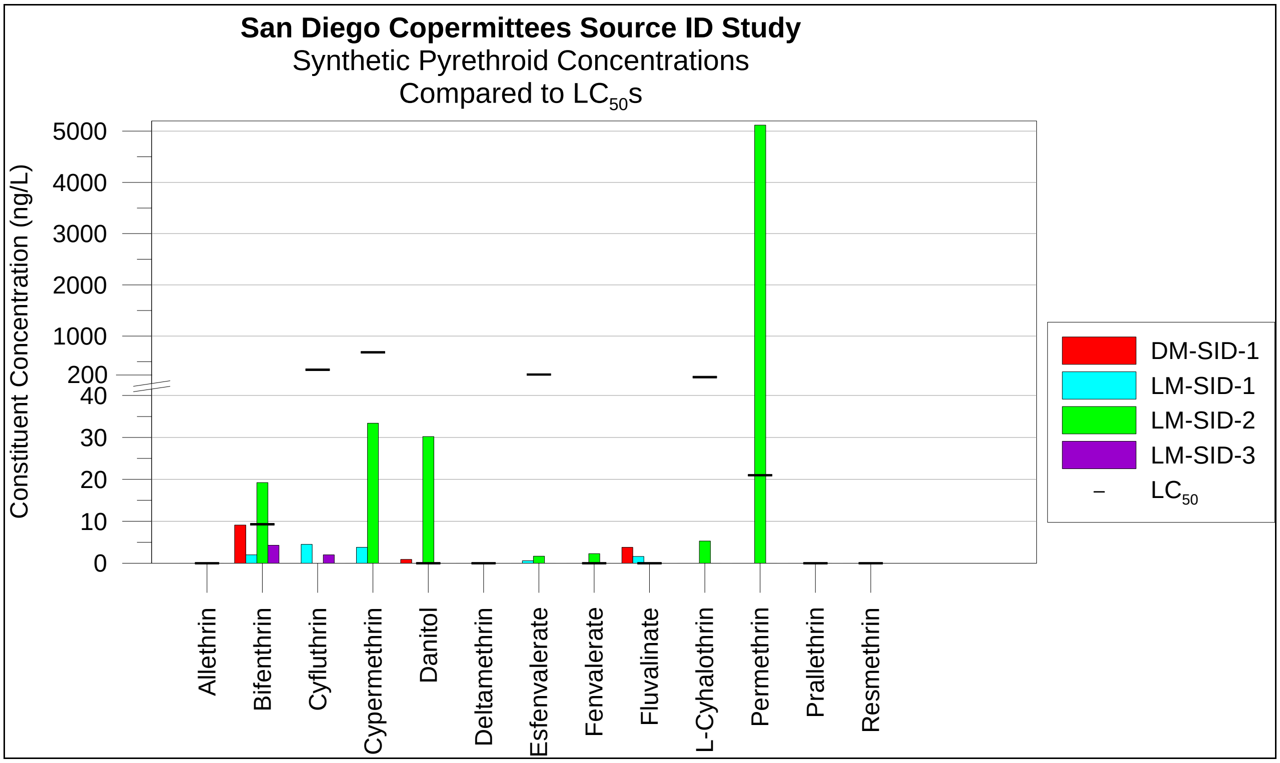
The results also support findings from the *Chollas Creek TMDL Source Loading, Best Management Practices, and Monitoring Strategy Assessment* (WESTON, 2006). Based on the soil permeability characterization done, most of the soil in the Chollas Creek watershed is poorly draining soils with very low infiltration (Figure 12-12). Therefore, if over-irrigation or discharges are occurring in this area, instead of infiltrating into the soil, this runoff is likely to seep into the underground pipe structure through the pipe seams, which was also observed during the field visits.




Soil Permeability in Chollas Creek Watershed

**Figure 12-12. Chollas Creek Watershed Soil Permeability**

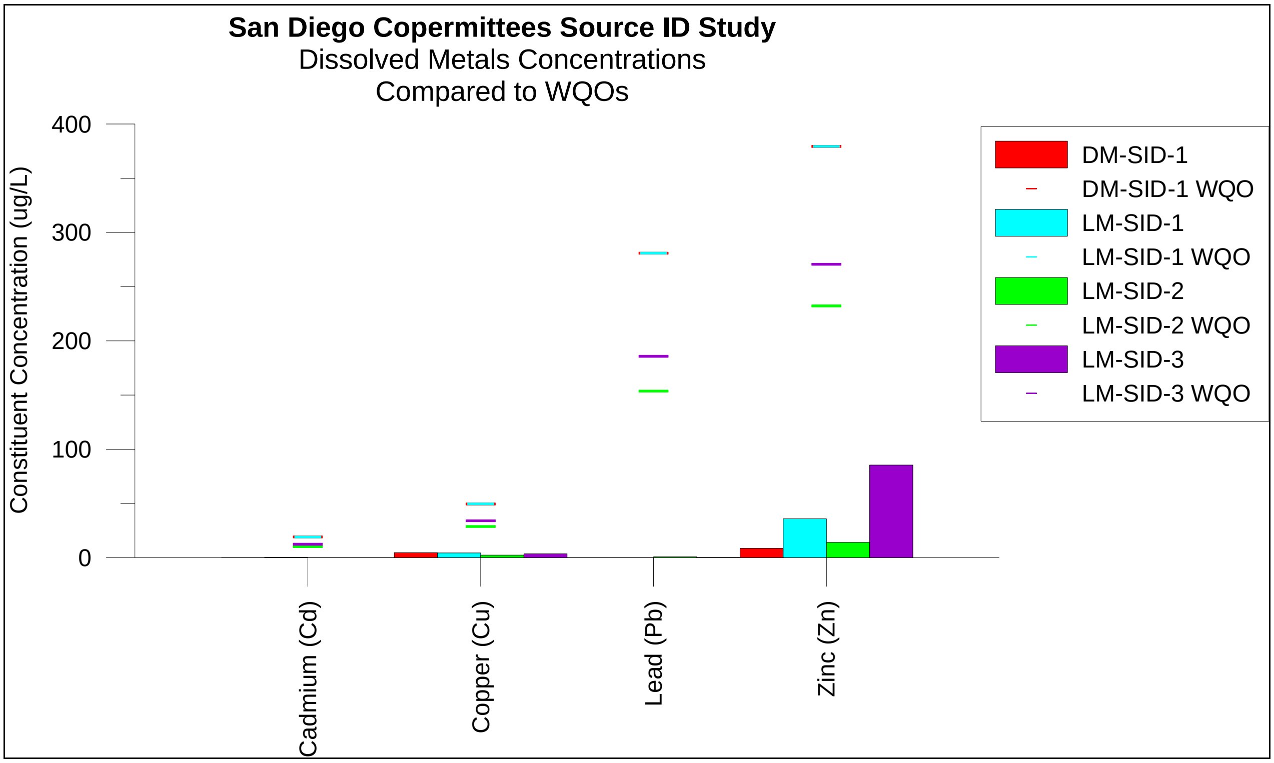
Synthetic pyrethroids were detected in 6 of the 7 samples collected over the course of monitoring. Bifenthrin was detected in 5 of 7 samples collected but was lowest at Site LM-SID-1. Bifenthrin was highest in the samples collected from the areas identified with direct discharges. Of the synthetic pyrethroids with $LC_{50}$s established, Bifenthrin and Permethrin results were above the $LC_{50}$ once each during the monitoring and occurred only at site LM-SID-2 (Figure 12-13). The results suggests that synthetic pyrethroids are likely to be detected in dry weather runoff from single family residential land uses and may also occur in commercial and industrial land uses, based on the concentrations observed from LM-SID-2.




Note: $LC_{50}$ Benchmarks are used for answering the question "Does the MS4 contribute to receiving waters problems?" and do not apply to the MS4.

**Figure 12-13. Synthetic Pyrethroid Concentrations Compared to $LC_{50}$s**

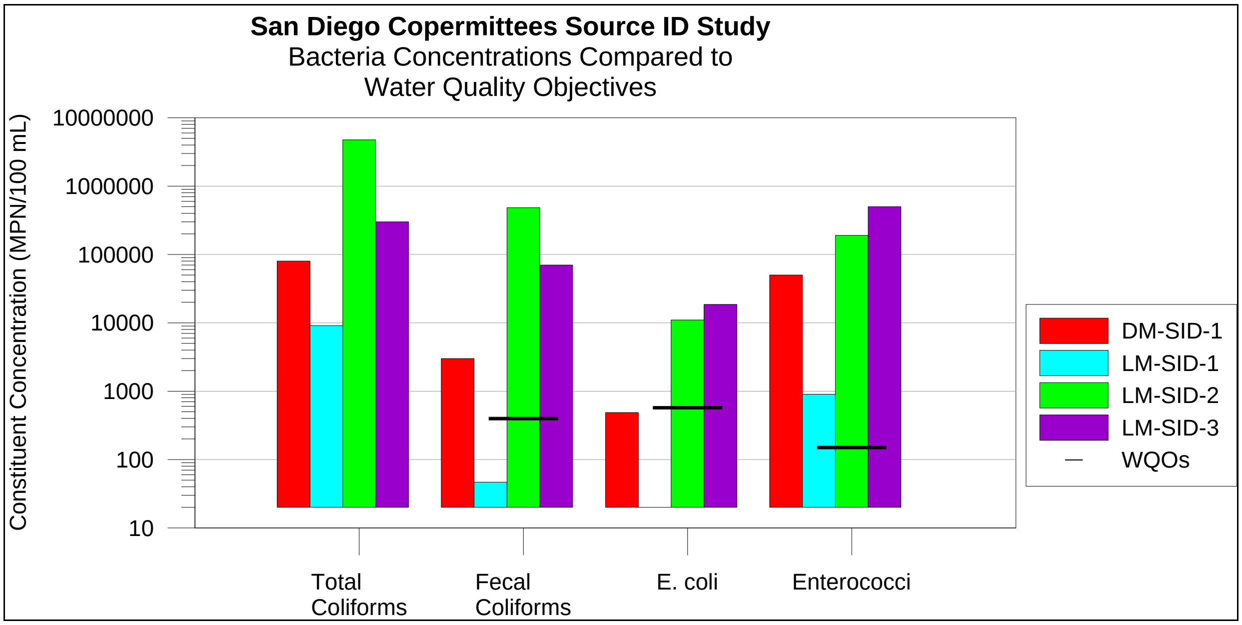
Of the metals concentrations, all of the results measured were below the water quality objectives (WQOs) (Figure 12-14). The results from the La Mesa study area also confirms that dissolved metals are primarily a wet weather runoff concern within the Pueblo San Diego Watershed, and that dry weather residential land use runoff is not a likely source of dissolved metals to the receiving waters.




Note: WQO benchmarks are used for answering the question "Does the MS4 contribute to receiving waters problems?" and do not apply to the MS4.

**Figure 12-14. Dissolved Metals Concentrations Compared to Water Quality Objectives**

Bacteria results showed the same pattern among each of the four sampling locations, with total coliforms having the highest results, then fecal coliforms, enterococci, and finally *E. coli*. Benchmarks were established for fecal coliforms, enterococci, and *E. coli*. Of the two residential locations, results were above the benchmarks at Del Mar for all three of the indicator bacteria (i.e., fecal coliforms, enterococci, and *E. coli*). In La Mesa, only enterococci was above the benchmark. At the two non-residential locations in La Mesa, both of those location were above all three of the benchmarks (Figure 12-15). Overall, results were highest at the flowing sites from the smaller drainage areas. LM-SID-1, identified as influenced from groundwater, had the lowest results for indicator bacteria.




Note: WQO benchmarks are used for answering the question "Does the MS4 contribute to receiving waters problems?" and do not apply to the MS4.

**Figure 12-15. Bacteria Concentrations Compared to Water Quality Objectives**

### 12.3.4 Loads per Acre

In addition to sample concentrations, the loads from each of the sampling locations were estimated. An analyte load is obtained by multiplying the analyte concentration with the flow volume at the time of sampling. For this analysis, the concentrations of analytes were used in conjunction with the recorded flows at each site and then normalized based on acreage. To calculate the loads for the residential areas in La Mesa, LM-SID-2 and LM-SID-3 were subtracted from the loads calculated at LM-SID-1. Table 12-14 presents a comparison of instantaneous loads per acre. It should be noted that no orthophosphorus pesticides were detected during the monitoring and therefore no loads could be calculated for these constituents.

Flow volumes at LM-SID-1 were higher than those observed at DM-SID-1 (141,138 cf and 4,700 cf, respectively) over the 86-day monitoring season. Loads per acre for the La Mesa drainage area were therefore larger than those for the Del Mar drainage area for most of the constituents measured. The exception to this being that the loads per acre for Bifenthrin, Danitol, and Fluvalinate (all pyrethroids) were higher at Del Mar (Figure 12-16).

**Table 12-14. Summary of Loads per Acre from Del Mar and La Mesa Residential Areas**

| Group | Analytes | Units | DM-SID-1 | LM-SID-1 | LM-SID-2 | LM-SID-3 | LM-SID-1 |
|---|---|---|---|---|---|---|---|
| | | | | Total Area | | | Residential Area Only |
| **Area** | Area | Acres | 38.4 | 313 | 34.7 | 81.4 | 196.9 |
| **Volume** | Volume | CF | 4,700 | 192,610 | 25,501 | 26,171 | 141,138 |
| General Chemistry | Bromide by IC | lbs/acre | 1.82E-03 | 1.54E-01 | 5.74E-03 | 3.72E-03 | 2.42E-01 |
| | Chloride by IC | lbs/acre | 1.91E+00 | 4.99E+01 | 4.84E+00 | 2.16E+00 | 7.76E+01 |
| | Dissolved Organic Carbon | lbs/acre | 7.38E-02 | 2.94E-01 | 3.36E-01 | 1.98E-01 | 3.26E-01 |
| | Nitrate-N | lbs/acre | 2.06E-03 | 2.46E-01 | 4.46E-02 | 4.00E-03 | 3.82E-01 |
| | Nitrite-N | lbs/acre | 0.00E+00 | 0.00E+00 | 3.66E-03 | 0.00E+00 | -6.44E-04 |
| | Total Dissolved Solids | lbs/acre | 1.03E+01 | 1.13E+02 | 3.07E+01 | 1.41E+01 | 1.68E+02 |
| | Total Kjeldahl Nitrogen | lbs/acre | 8.37E-03 | 3.18E-02 | 6.86E-02 | 2.80E-02 | 2.68E-02 |
| | Total Nitrogen | lbs/acre | 1.04E-02 | 2.78E-01 | 1.17E-01 | 3.20E-02 | 4.08E-01 |
| | Total Organic Carbon | lbs/acre | 6.62E-02 | 2.99E-01 | 3.34E-01 | 1.82E-01 | 3.41E-01 |
| | Total Orthophosphate as P | lbs/acre | 3.05E-03 | 8.23E-03 | 2.42E-02 | 1.00E-02 | 4.68E-03 |
| | Total Phosphorus-Low Range | lbs/acre | 3.27E-03 | 7.90E-03 | 2.03E-02 | 1.37E-02 | 3.32E-03 |
| | Total Suspended Solids | lbs/acre | 2.15E-01 | 4.74E-01 | 2.65E+00 | 1.20E-01 | 2.36E-01 |
| Bacteria | Total Coliforms MPN/100 mL | MPN/acre | 2.77E+09 | 1.19E+09 | 9.87E+11 | 2.73E+10 | 1.62E+10 |
| | Fecal Coliforms MPN/100 mL | MPN/acre | 1.04E+08 | 6.09E+06 | 1.01E+11 | 6.36E+09 | 6.08E+08 |
| | *E. coli* MPN/100 mL | MPN/acre | 1.69E+07 | 1.74E+06 | 2.29E+09 | 1.69E+09 | 9.87E+07 |
| | Enterococci MPN/100 mL | MPN/acre | 1.73E+09 | 1.18E+08 | 3.95E+10 | 4.55E+10 | 1.01E+10 |
| Pyrethroids | Allethrin | lbs/acre | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | Bifenthrin | lbs/acre | 6.93E-08 | 1.91E-08 | 8.80E-07 | 8.60E-08 | 0.00E+00 |
| | Cyfluthrin | lbs/acre | 0.00E+00 | 4.31E-08 | 3.27E-06 | 4.00E-08 | 0.00E+00 |
| | Cypermethrin | lbs/acre | 0.00E+00 | 7.27E-08 | 7.63E-07 | 0.00E+00 | 0.00E+00 |
| | Danitol | lbs/acre | 6.85E-09 | 0.00E+00 | 6.90E-07 | 0.00E+00 | 0.00E+00 |
| | Deltamethrin | lbs/acre | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | Esfenvalerate | lbs/acre | 0.00E+00 | 1.53E-08 | 3.89E-08 | 0.00E+00 | 1.75E-08 |
| | Fenvalerate | lbs/acre | 0.00E+00 | 0.00E+00 | 5.26E-08 | 0.00E+00 | 0.00E+00 |
| | Fluvalinate | lbs/acre | 2.89E-08 | 1.53E-08 | 0.00E+00 | 0.00E+00 | 2.43E-08 |
| | L-Cyhalothrin | lbs/acre | 0.00E+00 | 0.00E+00 | 1.21E-07 | 0.00E+00 | 0.00E+00 |
| | Permethrin | lbs/acre | 0.00E+00 | 0.00E+00 | 1.17E-04 | 0.00E+00 | 0.00E+00 |
| | Prallethrin | lbs/acre | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | Resmethrin | lbs/acre | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Trace Metals | Cadmium (Cd) | lbs/acre | 0.00E+00 | 8.61E-06 | 0.00E+00 | 0.00E+00 | 1.37E-05 |
| | Copper (Cu) | lbs/acre | 3.50E-05 | 1.27E-04 | 1.10E-04 | 7.20E-05 | 1.53E-04 |
| | Lead (Pb) | lbs/acre | 0.00E+00 | 0.00E+00 | 3.84E-05 | 1.80E-06 | 0.00E+00 |
| | Zinc (Zn) | lbs/acre | 6.62E-05 | 1.03E-03 | 6.51E-04 | 1.71E-03 | 8.15E-04 |

*Note: Organophosphate pesticides were not detected. Therefore, no load is presented in this table.

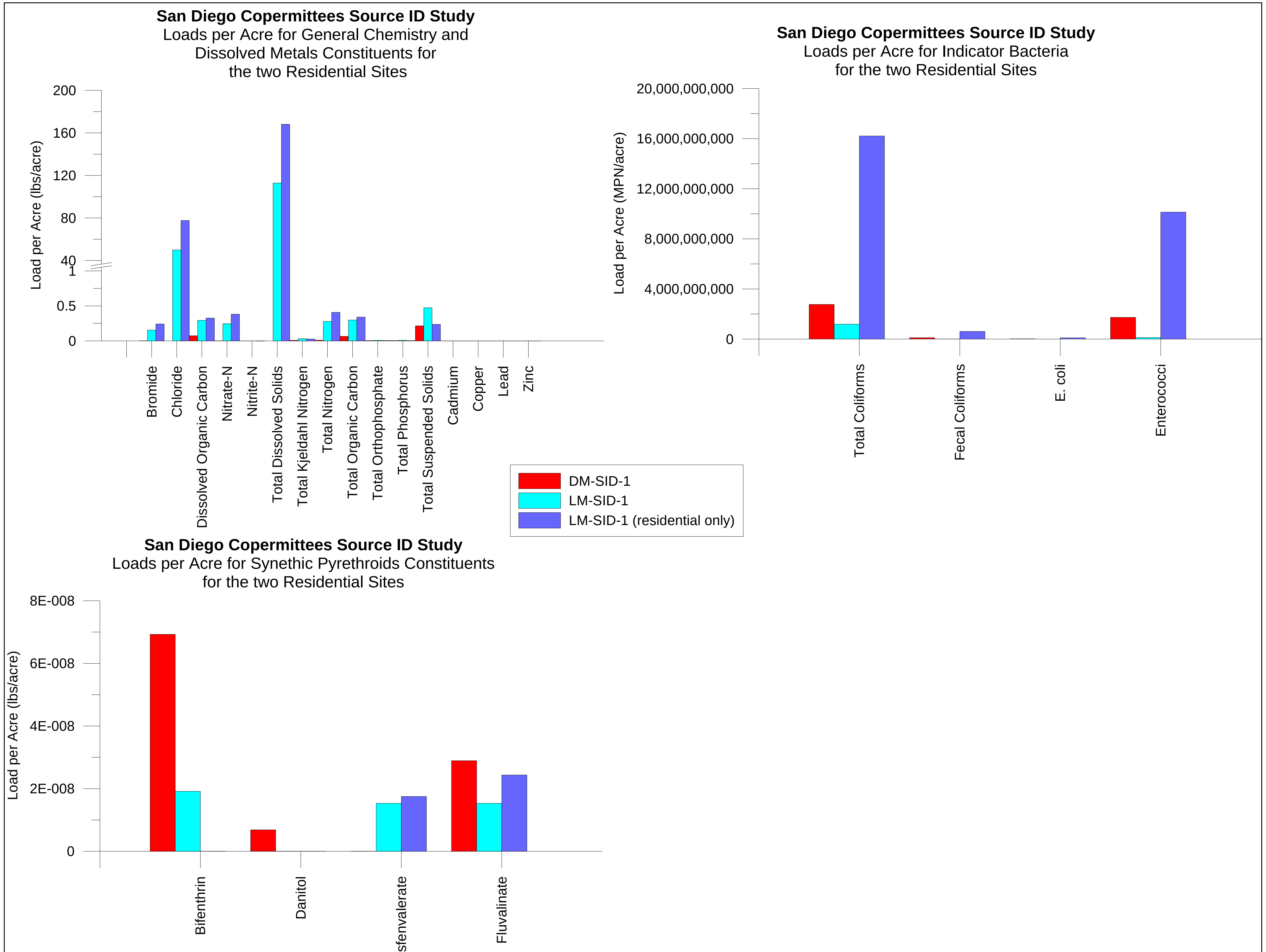



**Figure 12-16. Loads per Acre for the Residential Sites**

### 12.3.5 Conclusions

In accordance with the Permit, the Copermittees developed the 2008–2009 Source Identification Workplan with respect to collecting data useful in addressing the goals and management questions listed in the Permit. The Permit provided flexibility in developing their Source Identification Study and the questions were tailored to fit the Copermittees' needs. To address the study questions the following information is presented:

**1. When are the dry weather or nuisance flows detected from single-family residences (during what part of the day/week)?**

In general, peak discharge times varied amongst all sites. It is likely that individual residences water use activities occur at different times and at different schedules. Based on a review of the data, residential flow in La Mesa was highest during the week, specifically on Tuesdays. However, flows at the lower site in La Mesa were indicative of groundwater influences and may be associated with a lag time from residential water uses over the weekend. In Del Mar, flow was highest on the weekend, specifically on Saturday.

**2. What is the water quality and load of constituents of dry weather or nuisance flows from single-family residences?**

Overall, concentrations from the general chemistry constituents were below the WQOs, with the exceptions of total nitrate and total phosphorus, which were above their respective WQOs for all samples measured. The highest loads were from TDS and chloride and were measured at LM-SID-1." Based on the levels of the general chemistry constituents, it is possible that Site LM-SID-1 has a groundwater influence, explaining the continuous flow at this location and the high TDS, chloride, and nitrate levels.

Organophosphorus pesticides were not detected in either of the drainage areas monitored. Synthetic pyrethroids were detected in 6 of the 7 samples collected. Of the samples which did have detectable pyrethroid results, Bifenthrin was above the $LC_{50}$ in the Del Mar study area and Permethrin was above the $LC_{50}$ in the La Mesa study area. The Permethrin result was recorded at Site LM-SID-2, during the second sampling event. But, of the pyrethroid load per acre results for the entire monitoring season, Site DM-SID-1 had the higher results. This also suggests that single-family residences present a likely source of synthetic pyrethroids in urban runoff. The results are also consistent with the findings from the *Characterization and Assessment of Storm Drain Sediments from Switzer Creek* (WESTON, 2009). Synthetic pyrethroids were most commonly detected in the sediments in storm drains which drained residential areas, and specifically in the upper reaches of the drainage areas studied.

Dissolved metals (i.e., cadmium, copper, lead, and zinc) were not detected above the benchmarks from any of the residential runoff samples collected. The loads per acre were slightly higher in the La Mesa study area, but loads for these constituents were generally very low. These low load results, especially in the Chollas Creek subwatershed, where dissolved metals are constituents of concern, may be reflective of the small commercial and industrial land use in the upper drainage areas included in the study.

Indicator bacteria (i.e., total coliforms, fecal coliforms, *E.coli*, and enterococci) were highest in the smaller drainage areas monitored in La Mesa study area (i.e., LM-SID-2 and LM-SID-3) and also in the Del Mar site. Between the two residential sites, DM-SID-1 had the greater bacterial concentrations. Site DM-SID-1 also was above the benchmark for fecal coliforms whereas the Site LM-SID-1 was not. However, due to the larger flow volume, greater bacterial loads were observed for the LM-SID-1 residential runoff site.

**3. What are the potential sources of dry weather flows from single-family residences?**

Flows from single-family residences occur from various activities. In general, it was evident that dry weather flows from the upper sites in La Mesa and the Del Mar site likely occurred from residential lawn watering which were observed periodically during the sampling events or from random discharges associated with urban areas. However, flows from the lower site at La Mesa appear to be from groundwater sources, which may be associated with residential over-irrigation and low permeability soils.

This study was also designed to be comparable to the Prop 50 Non-Point Source Grant Study being conducted by Dr. Darrin Haver from UC Davis. However, due to the current State of California economic conditions, the State has withheld funding for this study. Therefore, at this time, the results of Dr. Haver's study are not available for comparison.

## 12.4 Regional Assessment Conclusions

### 12.4.1 Ambient Monitoring Conclusions

Ambient weather condition monitoring was conducted in San Diego County in accordance with the Permit where applicable. Due to the participation in Bight ’08, ambient monitoring was not required as part of the core monitoring program. Ambient conditions in the receiving waters of San Diego County were assessed using data collected as part of the SMC Regional Monitoring Program. The program uses the following three major components of the assessment triad to evaluate the receiving waters: water quality, toxicity, and rapid stream bioassessment. Samples were randomly selected from three strata including open space, agriculture, and urban areas. Ambient weather water quality samples were collected as grab samples in accordance with the SMC Regional Monitoring Workplan. The results of the ambient monitoring event were summarized in the individual watershed management area (WMA) sections. Watersheds were compared by examining key constituents within the watersheds to determine similarities among the areas, land use, and watershed characteristics. Key constituents were defined either as a potential concern based on the frequency and magnitude of concentrations above the applicable ambient weather water quality benchmark (benchmark) and/or an indicator of water quality within a constituent group (e.g., total phosphorus is an indicator constituent in the nutrient group).

Water samples collected from each site were monitored for the following water quality constituents (as summarized in Appendix B and detailed in the SMC Regional Monitoring Workplan) (WESTON, 2008):

- Physical chemistry.
- Nutrients.
- Total suspended solids (TSS).
- Synthetic pyrethroids.
- Total and dissolved metals.
- Toxicity

Water quality results were compared to the benchmarks provided in each table and are based on published values applicable to this monitoring program. These benchmarks were selected by the Copermittee Monitoring Workgroup based on the sources provided in the results table and referenced citations.

A comparison of the regional ambient weather condition data results and highlighted values for the 2008–2009 Monitoring Season are presented by constituent group as follows:

**Physical chemistry** – The physical parameters measured during the ambient monitoring were conductivity, pH, and water temperature. Conductivity, which is a measure of the dissolved solutes in the water, was relatively high at 15 of the 16 sites monitored. However, each of the 15 sites occur in relatively urbanized portions of their respective watersheds, and the range of conductivity values (1,200 to 4,421 µS/cm) are typical of urbanized streams during ambient conditions. The site with the lowest conductivity value (384 µS/cm) occurred in the upper portion of the Sweetwater River, well above urban land use influences. The pH values for all 16 sites fell within the range identified in the Basin Plan (6.5–9 pH units). There is no benchmark established for temperature and results ranged from 16.53 to 22.14˚C.

**Nutrients –** Several nutrients were monitored as part of the ambient monitoring analyte list, including ammonia, nitrate, nitrite, total kjeldahl nitrogen (TKN), total nitrogen, and total phosphorus. Of the 16 sites sampled, none were above the established benchmark values for ammonia, nitrate, nitrite, TKN, and total orthophosphate. However, total nitrogen concentrations were above the benchmark value of 1 mg/L at 12 of the 16 sites sampled and were primarily driven by nitrate results above 1.0 mg/L. Similarly, nine of the 16 sites sampled were above the established total phosphorus benchmark concentration of 0.1 mg/L. Of interest is the fact that eight of the nine sites above the benchmark for total phosphorus were also above the benchmark for total nitrogen. It should be noted that the State of California is currently developing nutrient numeric endpoints for assessment of beneficial use impacts from nutrients and the current benchmarks for total nitrogen and total phosphorus may not necessarily indicate a biostimulatory response in the watershed.

**Total suspended solids** – TSS is an important parameter for estimating the relative amount of sediment carried by a stream. Sample results indicated that in ambient weather conditions TSS concentrations were generally low in San Diego watersheds, which is typical of low flow conditions. TSS concentrations were below the benchmark value of 58 mg/L at all sites except at Site SMC-00473 in San Dieguito River. Site SMC-00473 is located two miles downstream of Lake Hodges.

**Synthetic pyrethroids** – In recent years there has been an observed shift in pesticide usage to synthetic pyrethroids, which have become increasingly detected in urban watershed assessments (WESTON, 2009). These pesticides are relatively toxic at low levels and tend to be associated more with sediment than with water in environmental samples. Thirteen synthetic pyrethroids were monitored in water column samples as part of the ambient monitoring program. Concentrations of all 13 synthetic pyrethroids were below their respective benchmark limits at 15 of the 16 sites sampled. Site SMC-01606, located in the Miramar HA, was above the benchmark concentration for the synthetic pyrethroid Bifenthrin. Although synthetic pyrethroid concentrations were generally low, Bifenthrin, Cypermethrin, and Fluvalinate were the most commonly detected pyrethroids in the county during ambient conditions.

**Total and dissolved metals** – The total and dissolved fractions of eight metals were assessed at each of the 16 sites monitored in the SMC Program. Total metal concentrations at a site were compared to Basin Plan standards (except for selenium), and dissolved metal concentrations were compared to standards based on the hardness of the site water. Concentrations of both total and dissolved metals were generally low at all sites sampled. Of all the metals analyses performed, only one site, SMC-01990 (Mission San Diego), was found to be above benchmark standards. Site SMC-01990 (Murphy Canyon) was found to have a selenium concentration slightly above the benchmark concentration of 0.005 mg/L. The area surrounding Site SMC-01990 has a considerable amount of commercial and industrial land uses in the drainage area.

**Toxicity** – The ambient receiving water samples collected as part of the SMC Monitoring Program were also analyzed for toxicity to *Ceriodaphnia dubia*. Three toxicity tests were conducted for each site monitored, including 96 hour survival, 7-day survival, and 7-day reproduction, and all were conducted as screening tests in the 100% sample.

Of the 16 sites monitored, toxicity was observed in three samples. Sites SMC-01158 (McGonigle Canyon, Los Peñasquitos Creek WMA), SMC-01258 (Sweetwater River), and SMC-1046 (Tecolote Creek, Mission Bay and La Jolla WMA) demonstrated a significantly different percent survival, as well as a significant difference in the reproductive test as compared to the control organisms.

Overall, the samples collected in San Diego County will be incorporated with the SMC Regional Monitoring Program Data to provide an assessment of Southern California watersheds. The data will be analyzed to provide an assessment of three strata that include open space, agriculture, and urban land uses.

### 12.4.2 Wet Weather Monitoring Conclusions

Wet weather monitoring was conducted at the 11 MLSs in San Diego County in accordance with the Permit. Storm event samples were collected using flow-weighted composite techniques and using grab samples for those parameters not conducive to compositing. The results of each storm event were summarized in the individual WMA sections. Watersheds were compared by examining key constituents across watersheds and over time to determine similarities among the areas, land use, and watershed characteristics. Key constituents were defined as having either been rated as a potential concern based on the frequency and magnitude of concentrations above the applicable wet weather benchmark and/or being an indicator of water quality within a constituent group (e.g., total phosphorus is an indicator constituent in the nutrient group).

A comparison of the regional wet weather condition results and highlighted values for the 2008–2009 Monitoring Season are presented by constituent group as follows:

**Bacteria** – Bacterial concentrations were elevated throughout the region for all three of the indicator bacteria. Fecal coliform concentrations were above the benchmark in all of the wet weather samples collected during the season. The highest fecal coliform concentrations were observed at the Tijuana River MLS Site (9,000,000 most probable number (MPN)/100 mL). The Tijuana River bacterial concentrations are higher than in any other watershed in the monitored region.

**Total dissolved solids** – TDS concentrations were generally elevated throughout San Diego County during monitored storm events. Nine of the 11 MLS stations were greater than their respective benchmarks, suggesting a region-wide concern. Higher TDS concentrations may indicate greater contributions from higher dissolved mineral salts from groundwater/base flow or imported water stored in local reservoirs. TDS is a known issue related to importation of municipal water supplies, over-irrigation, and documented recycled water use. The San Diego Regional 303(d) Workgroup developed an issue paper titled, *An Analysis of the Proposed 303(d) Listings for Total Dissolved Solids in San Diego County Watersheds* (San Diego Regional 303(d) Workgroup, 2002). This report noted that many of the dissolved solids in surface water in San Diego County are derived from imported water used in agriculture and other applications within the basins. Furthermore, many of the watersheds monitored are downstream of local reservoirs supplied by Colorado River water.

**Total suspended solids** – As mentioned above, TSS is an important parameter for estimating the relative amount of sediment carried by a stream. TSS concentrations were above the benchmark in three of 11 samples tested. These three samples were collected at the Santa Margarita MLS, Chollas Creek MLS, and the Tijuana River MLS. Of interest is that at each of the three sites that were above the TSS benchmark value (100 mg/L) were also the only three sites above the benchmark for turbidity. These TSS data, in conjunction with the turbidity data, suggest that sedimentation during wet weather is an issue of concern at these sites. High concentrations of TSS indicate the potential for hydromodification and transport of organic constituents. The intensity and duration of storm events can affect TSS concentrations.

**Nutrients (i.e., phosphorus, nitrate, and nitrite)** – Total phosphorus concentrations were below the wet weather benchmark in all but one site (Tijuana River MLS), which had results above the benchmark during the one monitored storm event. Historically, phosphate concentrations have been above the wet weather benchmark at the Tijuana River MLS in 68% of the monitored storms at this site. During the 2008–2009 Wet Weather Monitoring Season there were no nitrate or nitrite results above the wet weather benchmark. It should be noted that the State of California is currently developing nutrient numeric endpoints for assessment of beneficial use impacts from nutrients and the current benchmarks for total nitrogen and total phosphorus may not necessarily indicate a biostimulatory response in the watershed.

**Pesticides** – The organophosphate pesticides (Chlorpyrifos, Diazinon, and Malathion) were below the wet weather benchmark at all sites monitored except at the Tijuana River MLS. Diazinon concentrations were nearly four times higher than the benchmark concentration (0.08 mg/L) during the December 16, 2008 storm at the Tijuana River MLS. Aside from Diazinon in the Tijuana River, Chlorpyrifos and Diazinon were below the detection limit at remaining ten sites monitored during 2008–2009. Of the three organophosphate pesticides analyzed, Malathion was most frequently reported above the detection limit (six of 11 samples), yet at no sites was it reported above the benchmark. It is evident that Diazinon use and detections have dramatically decreased since the first restriction date in 2002. An example of Diazinon usage detections is presented for the Chollas Creek historical monitoring location in Figure 12-17. However, a shift in pesticide use to readily available synthetic pyrethroids has been noted in urban land use drainage areas. Synthetic pyrethroid assessments are presented further in a separate section in accordance with the Permit requirements.

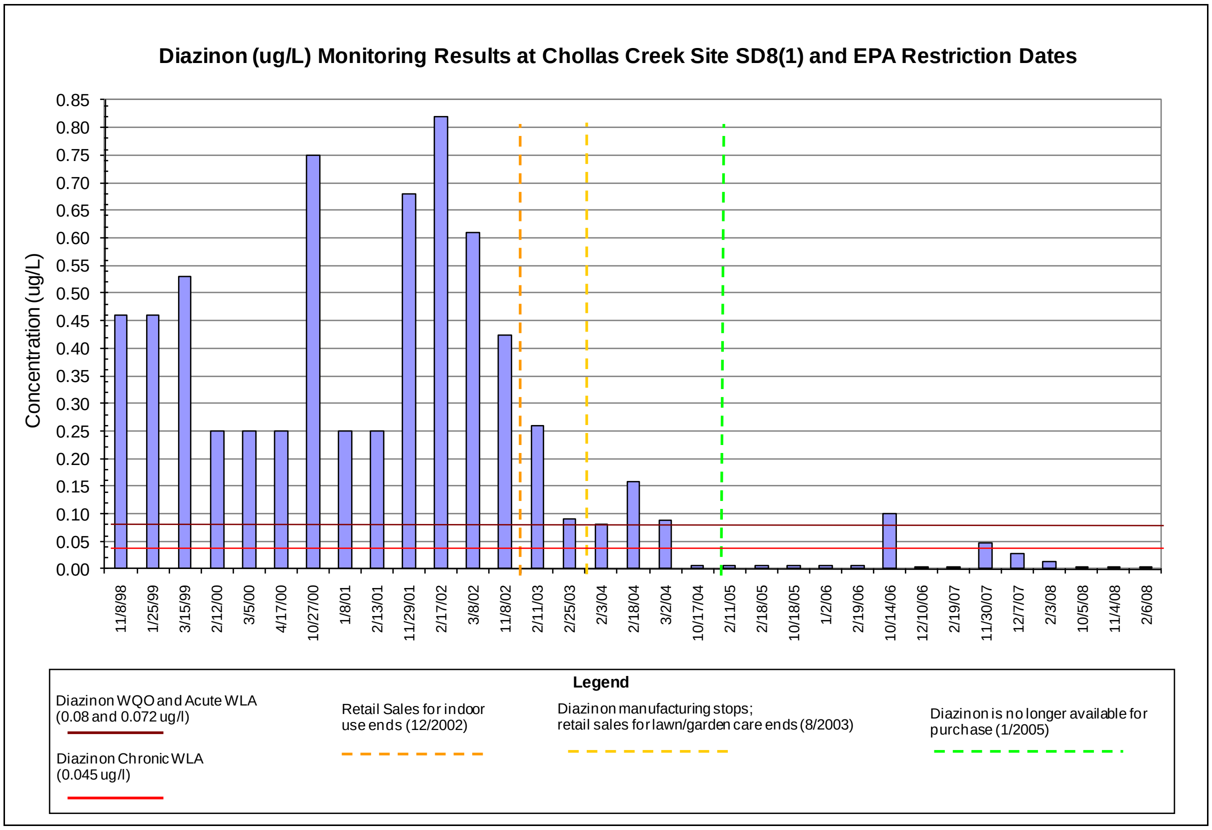



**Figure 12-17. Historical Diazinon Concentrations at Site SD8(1) with Restriction Dates**

**Metals** – There were few results above the metals benchmarks during the 2008–2009 Monitoring Season. Chollas Creek was the only watershed with results above the dissolved metals wet weather benchmarks, which are based on the California Toxics Rule (CTR) hardness based acute criteria. Dissolved copper and dissolved zinc were detected above the CTR acute criteria during wet weather monitoring events. Chollas Creek has a TMDL for dissolved copper, dissolved lead, and dissolved zinc. There are known issues related to atmospheric deposition, high impervious area, and low hardness results. As a result, Chollas Creek has the lowest benchmark criteria compared with all other watersheds.

**Toxicity** – Toxicity testing was conducted using three test species (*C. dubia*, *Hyalella azteca*, and *Selenastrum capricornutum*). Toxicity was observed at one of 11 sites monitored during wet weather for the acute or chronic survival endpoints for *C. dubia*, which occurred at the Tijuana River MLS. Toxicity was observed to the *C. dubia* reproductive endpoint in four of 11 samples collected (one sample each from Santa Margarita River MLS, Chollas Creek MLS, Sweetwater River MLS, and Tijuana River MLS). Toxicity to *H. azteca* was observed in four of 11 wet weather monitoring samples (one sample each from Santa Margarita River MLS, Tecolote Creek MLS, Chollas Creek MLS, and Tijuana River MLS). Toxicity to the test organism *S. capricornutum* was observed in two of 11 samples (one each at San Luis Rey MLS and Sweetwater River MLS).

Every sample where toxicity was observed to *H. azteca* was associated with a detection of the synthetic pyrethroid Bifenthrin above the published water $LC_{50}$ for *H. azteca*. Toxicity to *H. azteca* as a result of synthetic pyrethroids is a region-wide and state-wide problem and is currently being addressed by the Department of Pesticide Regulation (DPR). The California Stormwater Quality Association (CASQA) Pesticide Subcommittee is actively working with DPR during the re-registration period for these compounds. The CASQA Pesticide Subcommittee is also a valuable resource for information sharing on synthetic pyrethroids and other pesticides.

### 12.4.3 Toxicity Identification Evaluation

TIEs were not conducted as part of the MLS monitoring during the 2008–2009 Monitoring Season. However, TIEs have been conducted on storm water samples collected from Agua Hedionda Creek using *H. azteca* during the 2007–2008 Monitoring Season and in Chollas Creek during the 2006–2007 Monitoring Season. Both results confirmed that synthetic pyrethroids were the likely causative agent of toxicity which was also supported by the chemistry samples collected.

TIEs were also conducted on three separate sediment samples as part of the Bight'08 monitoring program in San Diego County lagoons/estuaries. TIEs were conducted for sediment samples that exhibited significant toxicity to the species *Mytilus galloprovincialis* in one sample each from Batiquitos Lagoon, San Diego River Estuary, and Tijuana River Estuary. The results of the TIE confirmed that toxicity was due to naturally occurring ammonia and not likely due to contaminants of concern (COCs), which were also supported by chemistry results. In accordance with the SQO Guidelines, which have a provision for naturally occurring conditions, the results of the three samples overall assessment would change from likely impacted to likely unimpacted. It should be noted that the results of the paired toxicity tests with *Eohaustorius estuarius* were determined to be non-toxic at these sites.

### 12.4.4 Rapid Stream Bioassessment Monitoring

RSB monitoring was conducted in accordance with Permit year two. The Fall 2008 bioassessment sampling was not required as a result of Addendum No. 2 of the Permit, which specified that fall bioassessment surveys would not be required if the Copermittees participated in the SMC Spring 2009 Regional Sampling Program. During the 2008–2009 Monitoring Season, the Copermittees elected to participate in the SMC Monitoring Program, and therefore, only conducted the RSB Program survey during Spring 2009. Samples were collected from 16 randomly selected sites in accordance with the SMC Regional Monitoring Workplan. Due to the Bight '08 monitoring year, RSB monitoring was not conducted at the MLS or TWAS during the 2008–2009 Monitoring Season.

RSB monitoring was conducted pursuant to California Department of Fish and Game (CDFG) RSB monitoring procedures to provide a measure of stream health. During the RSB surveys, periphyton monitoring was conducted in accordance with the United States Environmental Protection Agency (USEPA) Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers (EPA 841-B-99-002, Section 6.2).

Results of the Spring 2009 bioassessment survey are summarized in Table 12-15. Results show that all urban or agriculture sites were rated Poor or Very Poor, while the single site from open space sampled above urban influences in the upper Sweetwater River was rated Good.

**Table 12-15. Summary of Index of Biotic Integrity Scores and Ratings from Spring 2009 Bioassessment Survey**

| Watershed | SMC Site | SMC Strata | Total IBI Score | IBI Rating |
|---|---|---|---|---|
| San Diego Bay | 00282 | Open Space | 42 | Good |
| San Luis Rey | 00457 | Agriculture | 26 | Poor |
| San Luis Rey | 01909 | Agriculture | 22 | Poor |
| San Diego River | 04054 | Urban | 12 | Very Poor |
| San Diego Bay | 01258 | Urban | 10 | Very Poor |
| San Luis Rey | 00153 | Urban | 9 | Very Poor |
| Los Peñasquitos Creek | 00198 | Urban | 9 | Very Poor |
| Mission Bay and La Jolla | 01046 | Urban | 8 | Very Poor |
| San Diego River | 01990 | Urban | 8 | Very Poor |
| Carlsbad | 00729 | Urban | 7 | Very Poor |
| San Luis Rey | 01717 | Agriculture | 7 | Very Poor |
| Los Peñasquitos Creek | 00710 | Urban | 6 | Very Poor |
| San Dieguito Creek | 00473 | Urban | 5 | Very Poor |
| Mission Bay and La Jolla | 01606 | Urban | 5 | Very Poor |
| San Luis Rey | 00153 DUP | Urban | 4 | Very Poor |
| San Diego River | 02006 | Urban | 3 | Very Poor |
| Los Peñasquitos Creek | 01158 | Agriculture | 1 | Very Poor |

IBI – Index of Biotic Integrity

### 12.4.5 Receiving Water Persistent Constituents of Concern and Trends

The results for the 2008–2009 Monitoring Season were combined with historical results, and were compared statistically to identify temporal trends within each watershed. The high frequency of occurrence COCs identified through the WMA assessment process and the observed significant Mann-Kendall statistical trends are shown in Table 12-16.

## Table 12-16. Mass Loading Station or Base Temporary Watershed Assessment Station Persistent Constituents and Trends

| Mass Loading Station | Persistent Ambient Weather Constituents of Concern | Persistent Wet Weather Constituents of Concern | Significant Wet Weather Trends Observed[1] |
|---|---|---|---|
| Santa Margarita River | TDS | Fecal coliform<br>Bifenthrin | Decreasing – fecal coliform[2] |
| San Luis Rey River | TDS<br>Total nitrogen<br>Enterococci | TDS<br>Fecal coliform | Decreasing – TDS, total hardness<br>Increasing – dissolved phosphorus, turbidity, total coliform, fecal coliform, enterococci |
| Loma Alta Creek | TDS | TSS<br>Turbidity<br>Fecal coliform<br>Enterococci | Insufficient data to conduct trend analysis |
| Buena Vista Creek | TDS<br>Enterococci | TSS<br>Turbidity<br>Total coliform<br>Fecal coliform<br>Enterococci | Insufficient data to conduct trend analysis |
| Agua Hedionda Creek | TDS<br>Fecal coliform<br>Enterococci | TSS<br>Turbidity<br>Total coliform<br>Fecal coliform<br>Enterococci<br>Bifenthrin | Decreasing – dissolved arsenic, Diazinon<br>Increasing – chemical oxygen demand (COD), TSS, turbidity, total copper, total lead, total nickel, total zinc, total coliform, fecal coliform |
| Escondido Creek | TDS<br>Enterococci | TDS<br>Turbidity<br>Total coliform<br>Fecal coliform<br>Enterococci<br>Bifenthrin | Decreasing – dissolved nickel, Diazinon<br>Increasing – total zinc |
| San Dieguito River | TDS<br>Chloride<br>Sulfate<br>Total nitrogen | TDS | Increasing – conductivity, TKN, total phosphorus |
| Los Peñasquitos Creek | TDS<br>Chloride<br>Sulfate<br>Enterococci | TDS<br>Fecal coliform<br>Bifenthrin | Decreasing – total lead<br>Increasing – fecal coliform |
| Tecolote Creek | Total nitrogen | Turbidity<br>Total coliform<br>Fecal coliform<br>Enterococci<br>Bifenthrin | Decreasing – TSS, Diazinon<br>Increasing – total hardness, enterococci |
| San Diego River | TDS<br>Chloride<br>Total nitrogen<br>Enterococci | Turbidity<br>Fecal coliform | Decreasing – nitrate, dissolved copper |
| Chollas Creek | TDS<br>Turbidity<br>Total coliform<br>Fecal coliform<br>Enterococci<br>Dissolved copper | TSS<br>Turbidity<br>Total coliform<br>Fecal coliform<br>Enterococci<br>Bifenthrin | Decreasing – TDS, Diazinon, toxicity to *H. azteca*<br>Increasing – turbidity, nitrite, TKN, total copper, total zinc |
| Sweetwater River | No persistent COC | Fecal coliform<br>Enterococci | Decreasing – total lead<br>Increasing – pH |

**Table 12-16. Mass Loading Station or Base Temporary Watershed Assessment Station Persistent Constituents and Trends**

| Mass Loading Station | Persistent Ambient Weather Constituents of Concern | Persistent Wet Weather Constituents of Concern | Significant Wet Weather Trends Observed[1] |
|---|---|---|---|
| Tijuana River | No ambient weather monitoring to date | TSS<br>Turbidity<br>Total coliform<br>Fecal coliform<br>Enterococci<br>Diazinon<br>Bifenthrin<br>Permethrin | Decreasing – conductivity, TDS, Diazinon, dissolved nickel<br>Increasing – TSS, turbidity, nitrate, total arsenic, total copper, total lead, total zinc, total coliform, fecal coliform |

1. Only one year of ambient weather analyses conducted; therefore, only wet weather trends are presented.
2. Based on historical trend from 2007–2008 Monitoring Season. A new site was located upstream in the County's jurisdiction and trends cannot be analyzed at this time.

### 12.4.6 Jurisdictional Dry Weather Monitoring Conclusions

Each jurisdiction conducts a separate Dry Weather Monitoring (DWM) Program described in each Jurisdictional Urban Runoff Management Program (JURMP) Annual Report. Dry weather samples are collected from the jurisdictions' MS4 to detect and eliminate illegal connections and illicit discharges (ICIDs). Samples are collected from May 1 through September 30 each Permit year. The results of the 2008 DWM Program were included in this report's data assessment and provide a comparison of urban runoff in the MS4 to the ambient weather and storm event receiving water condition. The DWM Program primarily answers two core management questions, which address urban runoff discharges in the MS4: 3) What is the relative urban runoff contribution to the receiving water problem(s)? and 4) What are the sources of urban runoff that contribute to receiving water problem(s)?

During the 2008 DWM Program, out of 8,655 individual field and analytic samples, 661 samples had results measured above the dry weather action levels (Table 12-17) for an exceedance rate of only 7.6%. Table 12-17 also shows the exceedance rate for each analyte measured under the DWM Program. The analyte with the highest rate of results above the action level for 2008 was total coliforms (29.1%). Conductivity had the second highest exceedance rate (18.3%), which is consistent with the known regional issues related to TDS. Out of 389 dry weather samples collected from the region and analyzed for Diazinon, there were no dry weather action level exceedances. Of 387 dry weather samples collected and analyzed for Chlorpyrifos, only one sample (in Point Loma) was reported as an action level exceedance. Among the four dissolved metals for which analyses were conducted (i.e., cadmium, lead, copper, and zinc), dissolved copper had the greatest number of reported exceedances (12 exceedances in 380 samples). Dissolved lead was found to be above the dry weather action level in five of 376 samples and dissolved cadmium exceeded the action level in one of 380 samples. No exceedances were reported for dissolved zinc in the region. The dissolved metals action levels are based on the CTR hardness based criteria.

**Table 12-17. 2008 Jurisdictional Dry Weather Monitoring Data Summary of Action Level Exceedances**

| Constituent Group | Analyte | Number of Dry Weather Samples Collected Regionally | Number of Dry Weather Action Level Exceedances | Percentage of Action Level Exceedances (%) |
|---|---|---|---|---|
| General chemistry | pH | 824 | 27 | 3.3 |
| | Conductivity* | 829 | 152 | 18.3 |
| | Oil & grease | 264 | 1 | 0.4 |
| | Ammonia ($NH_3$-N) | 807 | 39 | 4.8 |
| | Methylene blue active substance (MBAS) | 12 | 0 | 0 |
| | Turbidity** | 807 | 110 | 13.6 |
| Nutrients | Orthophosphate ($PO_4$-P) | 808 | 33 | 4.1 |
| | Nitrate ($NO_3$-N) | 807 | 59 | 7.3 |
| Metals | Cadmium (dissolved) | 380 | 1 | 0.3 |
| | Copper (dissolved) | 380 | 12 | 3.2 |
| | Lead (dissolved) | 376 | 5 | 1.3 |
| | Zinc (dissolved) | 380 | 0 | 0 |
| Pesticides | Chlorpyrifos | 387 | 1 | 0.3 |
| | Diazinon | 389 | 0 | 0 |
| Bacteria | Total coliforms | 402 | 117 | 29.1 |
| | Fecal coliforms | 402 | 40 | 10.0 |
| | Enterococci | 401 | 64 | 16.0 |
| **Grand Total** | | **8,655** | **661** | **7.6** |

* The action levels were adopted by the Dry Weather Workgroup and are based on best professional judgment (BPJ).
** The turbidity action level is BPJ, however, the Basin Plan WQO was used for the interim watershed assessments.
Results are reported as provided by the Dry Weather Workgroup.

When the Regional Monitoring Program implemented the analysis of organophosphate pesticides in 2001, it is was based on the threat of these pesticides entering the region's receiving waters, evidence of persistent exceedances of Diazinon and Chlorpyrifos, and evidence of pesticide-induced acute and chronic toxicity to *C. dubia*. DWM results for Chlorpyrifos and Diazinon over the past six years are shown in Table 12-18. The dry weather exceedance rates for Diazinon and Chlorpyrifos have steadily declined over the past six years of monitoring and have been less than 1% in each year over the past four years. With respect to the USEPA ban on the pesticides Diazinon and Chlorpyrifos and the infrequent (or lack of) detections for these analytes in the DWM Program, this analysis could be justifiably removed from monitoring program requirements.

**Table 12-18. Jurisdictional Dry Weather Monitoring Results for Chlorpyrifos and Diazinon for the Period 2003–2008**

| Monitoring Year | Analyte | Number of Dry Weather Samples Collected Regionally | Number of Dry Weather Action Level Exceedances | Percentage of Action Level Exceedances (%) |
|---|---|---|---|---|
| 2003 | Chlorpyrifos | 373 | 117 | 31.4 |
| 2004 | Chlorpyrifos | 241 | 1 | 0.4 |
| 2005 | Chlorpyrifos | 285 | 0 | 0 |
| 2006 | Chlorpyrifos | 382 | 1 | 0.3 |
| 2007 | Chlorpyrifos | 333 | 0 | 0 |
| 2008 | Chlorpyrifos | 387 | 1 | 0.3 |
| 2003 | Diazinon | 373 | 129 | 34.6 |
| 2004 | Diazinon | 240 | 6 | 2.5 |
| 2005 | Diazinon | 286 | 2 | 0.7 |
| 2006 | Diazinon | 377 | 2 | 0.5 |
| 2007 | Diazinon | 333 | 0 | 0 |
| 2008 | Diazinon | 389 | 0 | 0 |

### 12.4.7 Bight 2008 Coastal Ecology Monitoring in San Diego Lagoons/Estuaries

The Copermittees participated in the Bight ’08 Program in lieu of conducting the complete regional storm water monitoring requirements during the 2008–2009 monitoring season as allowed in the Permit. The Copermittees contributed in-kind services and funds for three separate Bight ‘08 studies (Sediment Quality, Coastal Wetland Eutrophication, and Coastal Microbiology). The San Diego County Municipal Copermittees developed a San Diego Regional Bight 2008 Coastal Estuary Workplan. The Copermittees also supported the coastal wetland study in lieu of 2007–2008 Ambient Bay and Lagoon Monitoring (ABLM) as permitted by the June 12, 2008, letter to the County of San Diego from Mr. John Robertus of the SDRWQCB. The Coastal Microbiology Workplan was still under development during the 2008–2009 Monitoring Season. For the purposes of this report, the Copermittees are reporting on Sediment Quality from the region’s lagoons/estuaries.

The Copermittees selected eight lagoons/estuaries in the San Diego Region for inclusion in the Bight ’08 program as follows:

- Santa Margarita Lagoon
- Agua Hedionda Lagoon
- Batiquitos Lagoon
- San Elijo Lagoon
- Los Peñasquitos Lagoon
- San Diego River Estuary
- Sweetwater River Estuary
- Tijuana River Estuary

# Regional Assessment

The Copermittees Bight '08 Workplan was designed to provide data needed to answer questions related to the Southern California Bight, the San Diego Region, and the individual lagoons of study. San Diego Copermittees used a longitudinal-transect study to investigate changes in sediment conditions with greater distances from freshwater-input areas of lagoons. Lagoons were partitioned into five segments and sampling stations were located using a tessellated random sampling design consistent with Bight protocols. Sediment samples were collected and analyzed for chemistry, toxicity, and benthic community assemblages. Data were assessed using the recently developed SQOs. Surface water quality monitoring of bacteria and TSS during sediment sampling events also provide an assessment of ambient water quality in the lagoons during the summer months. The lagoon sediment sampling commenced in July 2008 and continued through September 2008 for consistency with the SCCWRP Bight '08 Program.

Sediment quality in the San Diego County's lagoons/estuaries was generally found to be unimpacted (eight of 40 samples) or likely unimpacted (20 of 40 samples) based on the SQO Guidelines (Table 12-19). A total of seven of 40 sites were identified as possibly impacted and three of 40 sites were likely impacted. No sites were identified as clearly impacted and two of 40 sites were identified as inconclusive.

**Table 12-19. Regional Sediment Quality Objective Assessment Summary for San Diego Lagoons/Estuaries**

| Final Site Assessment Category | Total Number of Sites in All Lagoons | Number of Sites in Category |
|---|---|---|
| Unimpacted | 40 | 8 |
| Likely Unimpacted | 40 | 20 |
| Possibly Impacted | 40 | 7 |
| Likely Impacted | 40 | 3 |
| Clearly Impacted | 40 | 0 |
| Inconclusive | 40 | 2 |

When evaluating the lines of evidence supporting the overall sediment quality results, it is evident that the benthic community results are the primary driver of possibly impacted or likely impacted site results (Table 12-20). A total of 29 of 40 results had moderate or high benthic community impact results. However, the result often did not indicate that chemically mediated effects were related to the overall assessment finding. There were no high impacts found for the chemistry line of evidence and only four of 40 moderate impacts. Thirty-six of 40 chemistry assessments were either low or minimal.

**Table 12-20. Regional Line of Evidence Summary for San Diego Lagoons/Estuaries**

| LOE Category | Number of Sites | Impact Category | | | |
|---|---|---|---|---|---|
| | | Minimal, Reference, or Nontoxic | Low | Moderate | High |
| Sediment Chemistry Exposure | 40 | 28 | 8 | 4 | 0 |
| Benthic Community Condition Impact | 40 | 3 | 8 | 19 | 10 |
| Sediment Toxicity | 40 | 25 | 11 | 4 | 0 |

Chemical assessments were also compared to the sediment Effects Ratio-Low (ER-L), Effects Ratio-Mean (ER-M), and $LC_{50}$s, where applicable (Table 12-21). Metals were all below the ER-M and only eight of 40 samples had results above the ER-L. One sample had total dichlorodiphenyltrichloroethane (DDTs) above the ER-M and 26 sites had results above the ER-L. Chlordane was also detected above the ER-M in two of 40 samples, but was only above the ER-L in four of 40 samples. This suggests that legacy pesticides are still being detected in lagoons sediments. The currently available synthetic pyrethroids were detected in nine of 40 samples, and only one sample was detected above the $LC_{50}$. However, no toxicity was observed to *E. estuarius* in this sample. Polychlorinated biphenyl (PCB) congeners were rarely detected. One sample had results above the ER-L and none were above the ER-M. There were no polycyclic aromatic hydrocarbons (PAHs) detected above the ER-L or ER-M.

Likewise, toxicity was rarely observed and 25 of 40 results were identified as non-toxic. Eleven of 40 were identified as low toxicity, and four sites were identified with moderate toxicity. The four moderate toxicity results were identified to be the result of naturally occurring ammonia that induced toxicity to one of the two species tested (*M. galloprovincialis*). TIEs were conducted on these samples and recommendations for re-assessment were made to the Bight Committee.

**Table 12-21. Regional Sediment Chemistry Results for San Diego Lagoons/Estuaries**

| Chemical Analyte | Total Number of Sites | Number of Sites with Detections | Number of Sites with Detections above ER-L | Number of Sites with Detections above ER-M | Number of Sites with Detections above $LC_{50}$ |
|---|---|---|---|---|---|
| Metals | 40 | 40 | 8 | 0 | NA |
| Total DDTs | 40 | 26 | 26 | 1 | NA |
| Total Chlordanes | 40 | 4 | 4 | 2 | NA |
| Pyrethroids | 40 | 9 | NA | NA | 1 |
| Total PCBs | 40 | 7 | 1 | 0 | NA |
| Total PAHs | 40 | 30 | 0 | 0 | NA |

NA = Not Applicable

# Regional Assessment

The following summarizes the results presented above with respect to addressing the core management questions:

1. **Are conditions in receiving waters protective, or likely to be protective, of beneficial uses?**

Based on the monitoring and data analyses conducted on samples collected as part of the Bight '08 Program, the data suggest that conditions are generally protective of the beneficial uses. Seventy percent of sites were identified as unimpacted or likely unimpacted based on the SQO guidelines. However, in some lagoons, site specific variations were noted. Additionally, water quality samples collected for fecal indicator bacteria and TSS were below Basin Plan standards in all lagoons. These two analytes were analyzed in water column samples to assess these regionally problematic constituents.

2. **What is the extent and magnitude of the current or potential receiving water problems?**

The Copermittees developed their Bight '08 Monitoring Program to provide spatial characterization of the lagoon using a transect design with five samples. The lagoon was segmented into five equidistant portions, and samples were selected randomly following the Bight '08 sampling protocols. There were no clear patterns evident in any lagoon/estuary that suggests the watershed inputs are related to issues identified in any lagoon. Since most impacts were driven by either moderate or low benthic community scores, results may reflect the variability of physical characteristics within the lagoon. Because these are marginal and transitional environments, factors such as predation, temperature, depth, organic matter, and salinity all play a role in the benthic community condition.

3. **What is the relative urban runoff contribution to the receiving water problem(s)?**

The inputs of sediment to a lagoon originate from watershed sources, local drainages, erosion of local sediments, and tidal inputs from the ocean inlet. Because pesticides originate from anthropogenic sources only, the results suggest that urban runoff may have contributed minor concentrations of legacy organochlorine pesticides (e.g., DDT isomers) and more recent (i.e., currently used) synthetic pyrethroid pesticides. The relative urban runoff contribution cannot be fully assessed using sediment quality data alone. However, it is anticipated that future studies will provide more insight into each lagoons dynamics (e.g., Total Maximum Daily Load (TMDL) modeling efforts or future ambient bay and lagoon monitoring.

4. **What are the sources of urban runoff that contribute to receiving water problem(s)?**

This question can be partially answered by assessing the nature of contaminants found in the lagoon/estuary sediments. For instance, pesticides (e.g., organochlorines, organophosphates, and synthetic pyrethroids) do not occur naturally in the environment. Thus, if they are found in the receiving waters, the likely sources originate from watershed inputs, but may occur via different transport mechanisms. The result varied by each lagoon. However, many indications of particular constituents were reflective of the land uses represented in the immediate area.

5. **Are conditions in receiving waters getting better or worse?**

The Bight '08 studies conducted in the region's lagoons/estuaries provide valuable baseline data for comparing the SQO results in future sediment surveys. In comparison to previous ambient bay and lagoon surveys and the Bight '03 sediment survey, similar results were observed in the sediment samples collected. Chemistry results were generally low, toxicity results were also low or non-toxic, and benthic community assessments varied between reference conditions to high impacts and varied by site.

### 12.4.8 Coastal Storm Drain Monitoring

Each coastal jurisdiction conducts a separate CSDM Program. The purpose of the CSDM Program is to detect and eliminate ICIDs resulting in coastal beach closures for bacteria. Samples are collected from outfalls and receiving waters and are analyzed for fecal indicator bacteria (i.e., total coliforms, fecal coliforms, and enterococci) in accordance with the CSDM Program Work Plan (SDCRC, 2007).

The results from the CSDM Program are provided annually as a separate report in Appendix N. The reporting period of the CSDM Program occurs from October 1 through September 30 of each monitoring year.

The CSDM Program primarily answers two core management questions, which address urban runoff discharges in coastal areas and the relation to receiving water impairments: 3) What is the relative urban runoff contribution to the receiving water problem(s)? and 4) What are the sources of urban runoff that contribute to receiving water problem(s)?

### 12.4.9 Municipal Separate Storm Sewer System Outfall Monitoring

During the 2007–2008 Monitoring Season, the Copermittees collaboratively developed the MS4 Outfalls Monitoring Program in San Diego County WMAs (SDCRC, 2008). The purpose of MS4 Outfall Monitoring Program is to characterize pollutant discharges from MS4 outfalls in each watershed during wet weather and dry weather, as required by the Permit (Section II.B.1 of the Order). The collection and analysis of water samples discharging from MS4 outfalls to receiving waters will be used to address Core Management Question 3:

**What is the relative urban runoff contribution to the receiving water problem(s)?**

The design of the MS4 Outfall Monitoring Program is based on a combination of random and targeted samples to be collected during dry weather and wet weather periods. The program has the following four monitoring components: random dry weather, random wet weather, targeted dry weather, and targeted wet weather. The first three elements were conducted for the first time in 2008–2009 as the first phase of the program. Targeted wet weather monitoring will be implemented in 2009–2010.

**Dry Weather MS4 Outfall Monitoring**

The Random Dry Weather MS4 Outfall Monitoring Program was developed to deduce statistically valid inferences regarding the region as a whole, rather than analyzing each isolated MS4 station. Outfalls without dry weather flows were documented, and the next outfall on the randomized list was sampled. A maximum of 12 sites were visited in each WMA, but in some cases, fewer than six storm drains were flowing at the time of the site visit. Where flowing or ponded water was observed, samples were taken and analyzed for the regional high-priority water quality pollutants (TSS, indicator bacteria, total nitrogen, and total phosphorus).

In addition to addressing Core Management Question 3, random sampling was conducted to address the following subquestions:

1. What are the characteristics of the pollutants discharged from the MS4?
2. Are pollutant loadings changing over time?

Question 1 is best answered in a regional context, based on the study design for the random dry weather program. The regional assessment is presented in Section 12. Question 2 will be addressed in subsequent years of the program when additional data are available for temporal comparisons.

**Random Dry Weather MS4 Outfall Monitoring**

Results from the random DWM revealed that 53% of the visited sites were dry. The remaining sites were either ponded or flowing. Instantaneous loading calculations could not be calculated for locations with ponded conditions; however, the ponded water was sampled and could be compared to benchmarks. The results suggest that nitrogen and phosphorus compounds and indicator bacteria (i.e., enterococci) in MS4 dry weather runoff from random monitoring sites may have the potential to contribute to receiving water problems. Results were variable and no statistically relevant patterns were observed at this time. Future years will likely provide a more robust data set for analysis.

**Random MS4 Wet Weather Monitoring**

The protocol for the random wet weather monitoring is analogous to that of the random dry weather sampling program, but the sampling is conducted during a storm event in the Wet Weather Season (October 1 through April 30). Regionally, 38 random MS4 outfall wet weather events were monitored in 2008–2009. The majority of WMAs were monitored at four locations. Results from the random wet weather monitoring suggest that total nitrogen, total phosphorus, and fecal coliform concentrations from the MS4 may potentially contribute to receiving water problems. As with the random dry weather data, results were variable and no statistically relevant patterns were observed at this time. Future years will likely provide a more robust data set for analysis.

**Targeted MS4 Outfall Monitoring**

The targeted MS4 Outfall Monitoring Program was implemented during Summer 2009. Targeted sampling was conducted to address the following subquestions:

1. Which of the targeted MS4 outfalls have the greatest pollutant loading?
2. Are the pollutant loadings decreasing from these MS4 outfalls?

**Targeted Dry MS4 Outfall Monitoring**

The targeted dry portion of the MS4 Outfall Monitoring Program focuses monitoring efforts on those MS4 outfalls that are most likely to contribute to receiving water problems (e.g., largest potential pollutant loading). As part of the program, sampling is to occur once each year at pre-selected outfalls during the dry season (May 1 through September 30). Sampling is conducted by each individual jurisdiction.

The results suggest that nitrogen compounds and indicator bacteria (i.e., enterococci) in MS4 dry weather runoff from targeted monitoring sites may have the potential to contribute to receiving water problems. Because the targeted monitoring portion of MS4 Outfall Monitoring Program addresses watershed specific issues, the results and recommendations are discussed in each individual WMA section.

**Targeted Wet Weather Monitoring**

Targeted wet weather monitoring was not conducted as part of the 2008–2009 monitoring Scope of Work. The program was developed in 2008–2009 and will be implemented during the 2009–2010 Monitoring Season.

The MS4 Outfall Monitoring Program employs random and target monitoring of MS4 outfalls throughout the county to determine the characteristics, loading, and changes in loading over time. Monitoring and sampling occur at random and targeted locations during both dry and wet weather. Water quality samples are collected and instantaneous flow measurements are collected to allow instantaneous pollutant loading. Ultimately, relative loads are determined to identify the highest relative loading at the outfalls which may then be used to prioritize follow-up activities.

This was the first year of monitoring for the MS4 Outfall Monitoring Program; the preliminary results noted in each sectional WMA write-up should be compared to subsequent data (three years) before meaningful trends may be developed.

### 12.4.10 Source Identification Monitoring

During the 2008–2009 Monitoring Season, the Copermittees developed and implemented their Source Identification Monitoring Program to assess dry weather runoff from single family residences. The goal of this study was to collect dry weather residential land use discharge data for application to regional assessments since residential land uses comprise the most common land uses in urban areas. A secondary goal of collecting the data was to compare data collected in San Diego County to data collected from an intensive residential land use runoff study under a Proposition 50 Grant in Orange County and Sacramento County (Haver, 2007) when it becomes available.

Primary study questions from the 2008–2009 Source Identification Workplan are as follows:

1. When are the dry weather or nuisance flows detected from single-family residences (during what part of the day/week)?
2. What is the water quality and load of constituents of dry weather or nuisance flows from single-family residences?
3. What are the potential sources of dry weather flows from single-family residences?

In accordance with the Permit, the Copermittees developed the 2008–2009 Source Identification Workplan with respect to collecting data useful in addressing the goals and management questions listed in the Permit. The Permit provided flexibility in developing their Source Identification Study and the questions were tailored to fit the Copermittees' needs. To address the study questions the following conclusions are presented:

**1. When are the dry weather or nuisance flows detected from single-family residences (during what part of the day/week)?**

In general, peak discharge times varied amongst all sites. It is likely that individual residences water use activities occur at different times and at different schedules. Based on a review of the data, residential flow in La Mesa was highest during the week, specifically on Tuesdays. However, flows at the lower site in La Mesa were indicative of groundwater influences and may be associated with a lag time from residential water uses over the weekend. In Del Mar, flow was highest on the weekend, specifically on Saturday.

**2. What is the water quality and load of constituents of dry weather or nuisance flows from single-family residences?**

Overall, concentrations from the general chemistry constituents were below the WQOs, with the exceptions of total nitrate and total phosphorus, which were above their respective WQOs for all samples measured. The highest loads were from TDS and chloride and were measured at LM-SID-1. Based on the levels of the general chemistry constituents, it is possible that Site LM-SID-1 has a groundwater influence, explaining the continuous flow at this location and the high TDS, chloride, and nitrate levels.

Organophosphorus pesticides were not detected in either of the drainage areas monitored. Synthetic pyrethroids were detected in six of the seven samples collected. Of the samples which did have detectable pyrethroid results, Bifenthrin was above the $LC_{50}$ in the Del Mar study area and Permethrin was above the $LC_{50}$ in the La Mesa study area. The Permethrin result was recorded at Site LM-SID-2 during the second sampling event. But, of the pyrethroid load per acre results for the entire monitoring period, Site DM-SID-1 had the higher results. This also suggests that single-family residences present a likely source of synthetic pyrethroids in urban runoff. The results are also consistent with the findings from the *Characterization and Assessment of Storm Drain Sediments from Switzer Creek* (WESTON, 2009). Synthetic pyrethroids were most commonly detected in the sediments in storm drains which drained residential areas, and specifically in the upper reaches of the drainage areas studied.

Dissolved metals (i.e., cadmium, copper, lead, and zinc) were not detected above the benchmarks from any of the residential runoff samples collected. The loads per acre were slightly higher in the La Mesa study area, but loads for these constituents were generally very low. These low load results, especially in the Chollas Creek subwatershed, where dissolved metals are constituents of concern, may be reflective of the small commercial and industrial land use in the upper drainage areas included in the study.

Indicator bacteria (i.e., total coliforms, fecal coliforms, *E.coli*, and enterococci) were highest in the smaller drainage areas monitored in La Mesa study area (i.e., LM-SID-2 and LM-SID-3) and also in the Del Mar site. Between the two residential sites, DM-SID-1 had the greater bacterial concentrations. Site DM-SID-1 also was above the benchmark for fecal coliforms whereas the Site LM-SID-1 was not. However, due to the larger flow volume, greater bacterial loads were observed for the LM-SID-1 residential runoff site.

**3. What are the potential sources of dry weather flows from single-family residences?**

Flows from single-family residences occur from various activities. In general, it was evident that dry weather flows from the upper sites in La Mesa and the Del Mar site likely occurred from residential lawn watering which were observed periodically during the sample events or from random discharges associated with urban areas. However, flows from the lower site at La Mesa appear to be from groundwater sources, which may be associated with residential over-irrigation and low permeability soils.

This study was also designed to be comparable to the Prop 50 Non-Point Source Grant Study being conducted by Dr. Darrin Haver from UC Davis. However, due to the current State of California economic conditions, the State has withheld funding for this study. Therefore, at this time, the results of Dr. Haver's study are not available for comparison.

The San Diego County Water Authority and most water districts in the County of San Diego have implemented water use restrictions due to the current drought conditions. The outreach and enforcement programs sponsored by these agencies aim to reduce water consumption and water waste through several different means, though better management of irrigation runoff is most applicable to storm water management.