

## **SECTION FOUR**

## **Results, Analysis, and Recommendations**

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This section describes the results, data analysis, and recommendations for the 2002-2003 Monitoring Program.

### **4.1 HYDROLOGY: PRECIPITATION AND FLOW**

The monthly rainfall during the 2002-2003 storm season was compared to the long-term pattern of rainfall in Figure 4-1. During this storm season, the total rainfall was about 15.45 inches, which is about three times more than the rainfall recorded during the 2001-2002 storm season. Figure 4-2 shows that the total annual rainfall of 15.45 inches during the 2002-2003 storm season in Los Angeles County was very close and just below the average annual rainfall. The average annual rainfall over 130 years at Station # 716, Ducommun Street in downtown Los Angeles is about 15.51 inches.

Table 4-1 summarizes the hydrologic and meteorologic conditions of each station-event monitored during this storm season. A collection of 2002-2003 season hydrographs for each storm event from the monitored sites is included in Appendix A. Each hydrograph includes the time of the first and last composite sample aliquot collection, the number of aliquots per composite, the sample volume interval, and the percent of storm sampled.

### **4.2 STORM WATER QUALITY**

An inventory of the composite and grab samples taken for the chemical and biological analysis and toxicity analysis during the 2002-2003 monitoring season is included in Tables 4-2, 4-2a, and 4-3.

#### **4.2.1 Mass Emission Analysis**

This section provides a description of wet weather and dry weather mass emission results generated during the 2002-2003 monitoring season.

The County analyzes for an extensive number of individual water quality constituents, the results of which are included in Appendix B. A comparison was made between mass emission water quality results and the water quality objectives outlined in the Ocean Plan, the Basin Plan, and the CTR. The freshwater final acute criteria set by the California Department of Fish and Game was also used to provide water quality standards for chlorpyrifos and diazinon. The Municipal Storm Water Permit specifically requires the County to assess the pollutant loading for the sampling events that are analyzed for the complete list of constituents following the 2002-2003 storm season. In addition, the Municipal Storm Water Permit requires the identification and analysis of any long-term trends in storm water or receiving water runoff. An analysis of the correlation between pollutants of concern (metals and PAHs) and TSS loadings for the sampling events was also performed.

#### **4.2.1.1 Comparison Study**

As required by the Municipal Storm Water Permit, a comparison to the applicable water quality standards from the Basin Plan, the Ocean Plan, or the CTR for mass emission monitoring was conducted. The lowest possible standard of the three documents was used for the comparison study. The California Department of Fish and Game provided freshwater final acute criteria water quality standards for chlorpyrifos and diazinon. The Basin Plan is designed to enhance water quality and protect the beneficial uses of all regional waters. The Ocean Plan is applicable to point source discharges to the ocean. The CTR promulgates criteria for priority toxic pollutants in the State of California for inland surface waters and enclosed bays and estuaries. Constituents that exceeded the applicable water quality standards are highlighted in Appendix B and Table 4-4. Table 4-4 and Figure 4-3 summarize this comparison analysis.

The following conclusions were drawn from the mass emission comparison study:

##### **Wet Weather**

- The monitoring program has identified the nearly ubiquitous existence of bacteria in wet weather for all seven of the mass emission monitoring stations. Densities of total coliform, fecal coliform, and fecal enterococcus exceeded the public health criteria of the Basin Plan for each storm at each monitoring station 100% of the time, with the exception of Malibu Creek, which only exceeded the total coliform objective half of the time. As during the 2001-2002 storm season, the Malibu Creek station shows generally lower indicator bacteria counts than the other mass emission stations.
- The ratio of fecal coliform to total coliform Basin Plan standard was exceeded 75% of the time in all watersheds, except in Ballona Creek and Dominguez Channel where it was exceeded 100% of the time.
- For all monitoring stations, there was no clear trend between bacteria densities and storm events. However, Ballona Creek, Malibu Creek, San Gabriel River, Dominguez Channel, and Santa Clara River monitoring stations each had the highest total coliform density during the March 15, 2003 storm.
- For all monitoring stations except Malibu Creek, 50-100% of the total copper samples exceeded the Ocean Plan water quality standard.
- Coyote Creek, San Gabriel River, and Santa Clara River exceeded the California Department of Fish and Game's water quality criteria for diazinon 50% of the time.
- 50% of the dissolved copper samples taken at the Los Angeles River and Coyote Creek monitoring stations and 100% of the dissolved copper samples taken at the Dominguez Channel monitoring station exceeded the CTR water quality standard.
- 50% of the dissolved lead samples collected at the Dominguez Channel monitoring station exceeded the CTR water quality standard. This is the only monitoring station that showed exceedances.

- San Gabriel River exceeded the cyanide Ocean Plan water quality standard in 75% of the samples. Ballona Creek, Los Angeles River, Coyote Creek, and Santa Clara River exceeded the standard in 50% of the samples.
- 75% of the total zinc samples from the Dominguez Channel monitoring station exceeded the Ocean Plan water quality standard. All the other stations except Ballona Creek had exceedances in 25% of the samples. Dominguez Channel also exceeded the CTR water quality standard for dissolved zinc in 50% samples.
- Sulfate and TDS were each exceeded in 50% of the samples at the Malibu Creek monitoring station. No other monitoring stations had any exceedances for these constituents.
- The Ocean Plan water quality standard for turbidity was exceeded in 50% of the samples at the San Gabriel River monitoring station.
- 50% of the total aluminum samples at the Santa Clara River monitoring station exceeded the Basin Plan water quality standard.
- Nitrite-N exceeded the Basin Plan water quality standard in 50% of the samples at the Coyote Creek monitoring station.

## **Dry Weather**

Since the Municipal Storm Water Permit requires only two dry weather samples at each monitoring station, a 50% exceedance indicates only one sample exceeded the water quality standard and a 100% exceedance indicates both samples exceeded the water quality standard.

- There were no exceedances for any of the dissolved metals or diazinon during dry weather.
- Overall, there were a smaller percentage of exceedances for total coliform, fecal coliform, and fecal enterococcus during dry weather at all seven of the monitoring stations. Also, for most of the dry weather samples, the coliform densities were significantly lower than the densities for the wet weather samples. The total coliform criteria set in the Basin Plan was exceeded in 100% of the samples at the San Gabriel River and Dominguez Channel monitoring stations and in 50% of the samples at the Malibu Creek and Los Angeles River monitoring stations. No other monitoring station exceeded the total coliform criteria. The fecal coliform criteria was exceeded in 50% of the samples for all of the monitoring stations except San Gabriel River which exceeded the criteria in 100% of the samples. Fecal enterococcus criteria was exceeded in 100% of the samples at the Los Angeles River, Coyote Creek, and Dominguez Channel monitoring stations and in 50% of the samples at the other four monitoring stations.
- The ratio of fecal coliform to total coliform Basin Plan standard was exceeded in 50% of the samples at all of the monitoring stations except at Los Angeles River and Dominguez Channel, which had no exceedances.
- Unlike the wet weather samples, the Basin Plan water quality criteria for chloride was exceeded at three of the mass emission stations during dry weather. San Gabriel River and Dominguez Channel exceeded in 50% of the samples and Santa Clara River exceeded in 100% of the samples.

- 50% of the total copper samples exceeded the Ocean Plan water quality standard at the Ballona Creek, Malibu Creek, Los Angeles River, and Dominguez Channel monitoring stations. The San Gabriel River exceeded the standard in 100% of the samples.
- Ballona Creek, Malibu Creek, Los Angeles River, and Dominguez Channel were not within the pH water quality standard limits for 50% of the samples and Coyote Creek was not within the pH water quality standard limits for 100% of the samples. All of samples not within the pH limits showed high alkalinity. During wet weather, only 25% of the pH samples showed exceedances at Ballona Creek and Los Angeles River monitoring stations.
- The Ocean Plan water quality standard for total zinc was exceeded in 50% of the samples at the Malibu Creek, Los Angeles River, Coyote Creek, and Dominguez Channel monitoring stations.
- 100% of the total nickel samples exceeded the Ocean Plan water quality standard at the San Gabriel River monitoring station. 50% of the total nickel samples exceeded the standard at Ballona Creek, Los Angeles River, and Santa Clara River monitoring stations.
- Los Angeles River, Coyote Creek, and San Gabriel River exceeded the Ocean Plan water quality standard for cyanide in 50% of the samples.
- 50% of the dissolved oxygen samples at the Santa Clara River monitoring station were below the minimum water quality objective in the Basin Plan.
- Malibu Creek exceeded the Basin Plan water quality objective for sulfate in 50% of the samples.

#### **4.2.1.2 Loading and Trend Analysis**

An estimation of the total pollutant loads due to storm water and urban runoff for each mass emission station is shown on Table 4-11. As required by the Municipal Storm Water Permit, samples were collected and analyzed for TSS at all mass emission stations equipped with automated samplers for all storm events that resulted in at least 0.25 inches of rainfall. The concentrations for TSS for each storm is shown on Table 4-9 and the total pollutant loading for TSS for each mass emission station is shown on Table 4-10. By analyzing the pollutant loading at each mass emission station, it is possible to see if there is any correlation between storm events and the amount of pollutant loading. An analysis of trends in storm water or receiving water quality is represented in Figure 4-4. Although it is difficult to see any sustained trends at this time, they will become more apparent in years to come as sampling continues.

The following conclusions were deduced from the loading analysis:

- The total runoff volume at the Los Angeles River monitoring station was consistently higher than at the other monitoring stations. Los Angeles River also has approximately two times or more surface runoff area than the other watersheds. This creates more potential for surface runoff pollution and likely explains, in part, the increased loading of constituents at the Los Angeles River monitoring station when compared to the other monitoring stations.
- The storm on March 15, 2003 at the Ballona Creek, Malibu Creek, and Los Angeles River monitoring stations produced TSS loadings of 9,619 tons, 5,236 tons, and 53,027 tons,

respectively. Ballona Creek and Los Angeles River also produced loadings of 6,395 tons and 12,181 tons, respectively, during the February 11, 2003 storm. The loading during all other storm events at all the monitoring stations was below 4,000 tons.

- The Los Angeles River is the largest contributor of TSSs out of the seven mass emission stations monitored.
- San Gabriel River, Dominguez Channel, and Santa Clara River had generally lower TSS and metals loadings than the other monitoring sites.
- The February 11, 2003 storm produced the highest TDSs loadings at the Malibu Creek, Coyote Creek, Dominguez Channel, and Santa Clara River monitoring stations. The storm on December 16, 2002 produced the lowest TDS loading at all stations.
- Metal loading was the greatest for the Los Angeles River.
- Total and dissolved zinc appear to have the greatest loading during the February 11, 2003 storm at all of the monitoring stations except San Gabriel River.

The following conclusions were drawn from the trend analysis:

- The high levels of zinc found at monitoring stations between 1994-2000 were not present in the samples taken during the 2001-2002 storm season. During the 2002-2003 storm season the high levels of zinc were not present again, except for several exceedances at the Dominguez Channel monitoring station.
- The rainfall during the 2002-2003 storm season was only 0.06 inches below the annual rainfall average. However, it was about three times higher than amount of rainfall recorded during the 2001-2002 storm season. This may explain, in part, the increased loading as compared to the 2001-2002 storm season.

### **Pollutant Loading Example**

At the request of the RWQCB, below is an example of the pollutant loading calculation:

Site: Malibu Creek Mass Emission Station

Storm event: 12/16/2002

Constituent: Nitrate

Concentration: 4.6 mg/L

Runoff Volume: 36.5 acre-ft (Runoff = 28.4 acre-ft + Base Flow = 8.1 acre-ft)

1lb = 454 g

1g = 1,000 mg =  $1 \times 10^6$   $\mu$ g

1L = 0.03531467 ft<sup>3</sup>

1 ft<sup>3</sup> =  $2.2957 \times 10^{-5}$  acre-ft

Pollutant Loading = (Pollutant Concentration)(Runoff Volume)

$$\text{Pollutant Load} = (4.6 \text{ mg/L})(36.5 \text{ acre-ft})(1 \text{ g}/1,000 \text{ mg})(1 \text{ lb}/454 \text{ g})(1 \text{ ft}^3/2.2957 \times 10^{-5} \text{ acre-ft})($$

**Pollutant Load = 456.2**

Conversion factors

#### 4.2.1.3 Correlation Study

An analysis of the correlation between metals and TSS levels for the mass emission monitoring was performed. The study was only conducted on metals because the PAH samples at all of the monitoring stations were non-detects.

A trend line was projected on each of the metals-versus-TSS plots and the coefficient of determination ( $R^2$ ) was calculated to see if there was any correlation between the concentrations for each metal and TSSs for the mass emission monitoring stations (Figure 4-5). The closer the value of  $R^2$  is to the number one, the stronger the correlation of the two variables.

The following conclusions were deduced from the correlation study analysis:

- Unlike other watersheds, the Malibu Creek and San Gabriel River watersheds showed no strong correlation between metals and TSSs, except for dissolved arsenic and in the case of Malibu, dissolved zinc. Besides the  $R^2$  values for dissolved arsenic and dissolved zinc, all of Malibu Creek's and San Gabriel River's  $R^2$  values were below 0.3852 and below 0.5823, respectively.
- There were no strong correlations from any of the watersheds for the following constituents: total arsenic, total chromium, dissolved lead, and total nickel.
- Excluding Malibu Creek and San Gabriel River, all of the monitoring sites showed a strong correlation between total copper and TSSs, with  $R^2$  values ranging from 0.4445 to 0.9856 (most of them closer to the upper range).
- Three of the mass emission monitoring sites, Ballona Creek, Coyote Creek, and Dominguez Channel, showed a correlation between total aluminum and TSSs, with  $R^2$  values of 0.9158, 0.8199, and 0.8294, respectively.
- Five of the mass emission stations showed a strong correlation between dissolved antimony and TSSs. Ballona Creek and Los Angeles River showed a negative correlation, with  $R^2$  values of 0.5347 and 0.799, respectively. Coyote Creek, Dominguez Channel, and Santa Clara River showed positive correlations, with  $R^2$  values of 0.8151, 0.9777, and 0.7409, respectively.

#### 4.2.2 Tributary Monitoring Analysis

This section provides a description and analysis of wet weather and dry weather tributary results generated during the 2002-2003 monitoring season.

Though only a requirement for the first storm of the season, tributary monitoring analyzes included all of the water quality constituents monitored under the mass emission monitoring program, the results of which are included in Appendix B. Flow was also measured and is reported as hydrographs, which can be found in Appendix A. In order to identify the sub-

watersheds where storm water discharges are causing or contributing to exceedances of water quality standards, a comparison was made between tributary water quality results and the water quality objectives outlined in the Ocean Plan, the Basin Plan, and the CTR. The lowest possible standard of the three documents was used for the comparison study. The freshwater final acute criteria set by the California Department of Fish and Game was also used to provide water quality standards for chlorpyrifos and diazinon.

Since the tributary monitoring stations collect samples from sub-watersheds within the Los Angeles River watershed, the results from the Los Angeles River mass emission station were also used in the analysis. It was not possible to accurately identify any problems based on dry weather results since only one sample was taken at each tributary monitoring station, as required by the Municipal Storm Water Permit. Constituents that exceeded the applicable water quality standards are highlighted in Appendix B and Table 4-5. Table 4-5 and Figure 4-3 summarize this comparison analysis.

The following conclusions were drawn from the wet weather tributary comparison study:

- As with the mass emission monitoring program, the tributary monitoring program identified the nearly ubiquitous existence of bacteria during wet weather at all six stations. Densities of total coliform, fecal coliform, and fecal enterococcus exceeded the public health criteria of the Basin Plan for each storm at each monitoring station 100% of the time. This corresponds to the results obtained from the Los Angeles River mass emission station.
- The ratio of fecal coliform to total coliform Basin Plan water quality standard was exceeded 80-100% of the time in all sub-watersheds, except Bull Creek which only exceeded in 40% of the samples.
- Bull Creek and Verdugo Wash exceeded the Ocean Plan water quality standard for turbidity in 80% of the samples. Rio Hondo exceeded the turbidity standard in 40% of the samples.
- Diazinon criteria was exceeded at each tributary monitoring station. 60% of the samples were exceeded at Aliso Creek monitoring station, 40% of the samples were exceeded at Arroyo Seco Channel and Rio Hondo Channel monitoring stations, and 20% of the samples were exceeded at Bull Creek, Burbank Western Channel, and Verdugo Wash monitoring stations. Los Angeles River only exceeded the diazinon criteria in 25% of the samples.
- 60% of the samples at the Verdugo Wash monitoring station exceeded the Basin Plan water quality standard for total aluminum. There were no exceedances at Los Angeles River monitoring station.
- Total Copper exceeded the Ocean Plan water quality standard in more than 60% of the samples at all of the tributary stations except Bull Creek, which exceeded the standard in 20% of the samples.
- Total Zinc exceed the Ocean Plan water quality standard in 40-60% of the samples at Burbank Western Channel, Verdugo Wash, Arroyo Seco Channel, and Rio Hondo Channel.

- 80%, 50%, and 40% of the total lead samples exceeded the Ocean Plan water quality standard at Verdugo Wash, Arroyo Seco Channel, and Burbank Western Channel, respectively.
- Rio Hondo Channel exceeded the CTR water quality standard for dissolved copper in 100% of the samples. Burbank Western Channel exceeded in 80% of the samples, Aliso Creek exceeded in 50% of the samples, and Arroyo Seco Channel exceeded in 25% of the samples. The other tributary monitoring stations exceeded the standard in 20% of the samples.
- 40% of the samples at Burbank Western System and Rio Hondo Channel exceeded the Ocean Plan water quality standard for cyanide.
- Though there were no dissolved oxygen or nitrite-N exceedances at Los Angeles River monitoring station, 20% of the samples at Burbank Western Channel and Arroyo Seco Channel exceeded the Basin Plan criteria for each constituent.
- Burbank Western Channel and Verdugo Wash exceeded the CTR water quality standard for dissolved lead in 40% of the samples and Rio Hondo Channel exceeded in 20% of the samples. There were no exceedances at the Los Angeles River monitoring station.

#### **4.2.3 Water Column Toxicity Analysis**

This section describes the water column toxicity results generated during the 2002-2003 storm season. Water column toxicity monitoring was performed at all mass emission site in accordance with the Municipal Storm Water Permit. In total, four samples were analyzed for toxicity at each site. Dry weather samples were collected on October 9, 2002, and April 23, 2003. The results obtained from these samples are found in Table 4-8a. Wet weather samples were collected during the first rain event of the season on November 8, 2002, and also on December 12, 2002. The results obtained from these samples are found in Table 4-8b.

A minimum of one freshwater and one marine species was used for toxicity testing, specifically *Ceriodaphnia dubia* (water flea) 7-day survival/reproduction and *Strongylocentrotus purpuratus* (sea urchin) fertilization. The sea urchin fertilization test could not be performed on the October 9, 2002 wet weather sample because the purple sea urchin did not spawn due to seasonal variability.

Results calculated from the *Ceriodaphnia dubia* and sea urchin tests included the No Observed Effect Concentration (NOEC), 50% Lethal Concentration (LC50), 50% Inhibitory Concentration (IC50), and toxicity unit (TU). NOEC is the highest concentration causing no effect on the test organisms. LC50 is the concentration that produces a 50% reduction in survival. IC50 is the concentration causing 50% inhibition in growth or reproduction. TU is defined in the permit as 100/(LC50 or IC50). A TU value greater than or equal to one is considered substantially toxic and requires a toxicity identification evaluation (TIE).

The following conclusions were deduced from water column toxicity testing:



- Ceriodaphnia dubia survival was only significantly affected by exposure to the wet weather samples collected from the Coyote Creek and Dominguez Channel mass emission stations on November 8, 2002. These samples from Coyote Creek and the Dominguez Channel had a TU value equal to 4.40 and 1.33, respectively. In accordance with the Permit, a TIE was performed on these samples. The TIE for the sample collected from Coyote Creek found that the toxicity was due to one or more non-polar organic compounds as well as metabolically-activated organophosphates. The TIE for the sample collected from the Dominguez Channel found that the toxicity was due to one or more non-polar organic compounds and cationic metals as well as metabolically-activated organophosphates. The remaining samples were not substantially toxic to Ceriodaphnia dubia survival.
- Ceriodaphnia dubia reproduction was only significantly affected by exposure to the wet weather samples collected from the Coyote Creek and Dominguez Channel mass emission stations on November 8, 2002. These samples from Coyote Creek and the Dominguez Channel had a TU value equal to 3.65 and 1.33, respectively. In accordance with the Permit, a TIE was performed on these samples. The TIE for the sample collected from Coyote Creek found that the toxicity was due to one or more non-polar organic compounds as well as metabolically-activated organophosphates. The TIE for the sample collected from the Dominguez Channel found that the toxicity was due to one or more non-polar organic compounds and cationic metals as well as metabolically-activated organophosphates. The remaining samples were not substantially toxic to Ceriodaphnia dubia reproduction.
- Sea urchin fertilization was only significantly affected by exposure to the wet weather samples collected from the Coyote Creek and Ballona Creek mass emission stations on November 8, 2002. These samples from Coyote Creek and Ballona Creek had TU values equal to 1.16 and 1.45, respectively. In accordance with the Permit, a TIE was performed on these samples. The TIE for the sample collected from Coyote Creek found that the toxicity was due to one or more non-polar organic compounds and cationic metals as well as metabolically-activated organophosphates. The TIE for the sample collected from Ballona Creek found that the toxicity was due to particulate-bound toxicants, one or more non-polar organic compounds and cationic metals. The remaining samples were not substantially toxic to sea urchin fertilization.

#### **4.2.4 Trash Monitoring Analysis**

This section describes the trash monitoring results generated during the 2002-2003 storm season. For each catch basin insert and Continuous Deflective System (CDS) devices, the anthropogenic trash was separated from the sediment and vegetation and weights were recorded per device. The land uses monitored were commercial, high density single family residential, industrial, low density single family residential, and open space/parks. Three CDS units were installed during the 2002-2003 storm season and monitoring of two additional CDS units will commence during the 2003-2004 storm season. Table 4-12 summarizes the results of the sampling events with totals for the collected anthropogenic trash and the sediment/vegetation per land use. The Municipal Storm Water Permit requires a minimum of one photograph at each mass emission station after the first storm event and three additional storm events per year. Pictures can be found in Appendix C.

The following conclusions were drawn from the sampling results for anthropogenic trash:

- The amount of trash collected for the first storm event of the season constituted 39.4% of the total trash collected during the entire season for the Los Angeles River and the Ballona Creek watersheds combined.
- In the Los Angeles River watershed, the commercial landuse was the largest contributor of trash during the first storm of the season with 40.5%. The industrial landuse was the second largest contributor with 35.8% of the total trash collected. Open Space/Parks, High Density Single Family Residential, and Low Density Single Family Residential combined to produce 23.7 % of the trash with Low Density Single Family Residential producing only 2.6%.
- In the Ballona Creek watershed, the Low Density Single Family Residential was the largest contributor of trash during the first storm of the season with 32.1%. The remaining landuses combined for the remaining 67.9% with a relatively even distribution of approximately 17% each, on average.
- Based on the total amount of trash collected for the Los Angeles River watershed during the 2002-2003 storm season, the largest contributors by landuse were the industrial and the commercial landuses with 46.4%, and 33.9 %, respectively, for a combined 80.3% of the total trash collected. High Density Single Family Residential and Open Space/Parks contributed 8.6% and 8.8%, respectively. Low Density Single Family Residential produced only 2.3%.
- Based on the total amount of trash collected for the Ballona Creek watershed during the 2002-2003 storm season, the Low Density Single Family Residential and the commercial landuses combined to produce about half of the total trash collected. Low Density Single Family Residential produced 26.0% and the commercial landuse produced 25.1%. Open Space/Parks and industrial produced 17.8% and 16.5%, respectively. High Density Single Family Residential produced the least trash with 14.5% of the total.

#### **4.2.5 Identification of Possible Sources**

This section describes the possible sources of the constituents that did not meet the water quality standards during the 2002-2003 monitoring season in all or most of the watersheds, as discussed above in Section 4.2.1 and 4.2.2.

The source of bacteria is hard to pinpoint. According to the *Draft Total Maximum Daily Load to Reduce Bacterial Indicator Densities at Santa Monica Bay Beaches* published on November 8, 2001 by the California Regional Water Quality Control Board, Los Angeles Region, urban runoff from the storm drain system may have elevated levels of bacterial indicators due to sanitary sewer leaks and spills, illicit connections of sanitary lines to the storm drain system, runoff from homeless encampments, illegal discharges from recreational vehicle holding tanks, and malfunctioning septic tanks among other things. Fecal matter from animals and birds can also elevate bacteria levels.

An article titled *Residential Sources of Contamination* on EPA's website states that elevated levels of chloride may be a result of fertilizers, animal sewage, industrial wastes, minerals, or seawater. It also shows that many metals, such as aluminum, silver, iron, and zinc, could be a result of natural deposits.

According to the report *Regulating Copper in Urban Stormwater Runoff* by G. Fred Lee, PhD and Anne Jones-Lee, PhD, copper can come from brake pads or industrial (such as the textile industry) and mining sources. A metals source study is discussed in the article *Loadings of Lead, Copper, Cadmium, and Zinc in Urban Runoff from Specific Sources* by A.P. Davis, M. Shokouhian, and S. Ni. The study concludes that significant levels of metals were found from urban areas, especially in highway runoff. The abstract identifies important sources, such as building siding for lead, copper, cadmium, and zinc, vehicle brake emissions for copper and tire wear for zinc. Atmospheric deposition was also identified as an important source of cadmium, copper, and lead.

#### **4.2.6 Recommendations**

New monitoring components conducted during the 2002-2003 monitoring season included tributary monitoring and trash monitoring at mass emission stations. The Santa Clara River mass emission monitoring station was also added to the monitoring program. In addition, all required samples were taken, including dry weather and toxicity samples. Below are some recommendations that were identified based on results from the 2002-2003 monitoring season.

The Municipal Storm Water Permit requires only one dry weather sample to be taken at each tributary monitoring station. Although it was possible to see the various concentrations from each subwatershed, these values may not be entirely reliable due to the inherent variability of many constituents, especially bacteria. LACDPW recommends taking at least two dry weather samples at each tributary station to better characterize the concentrations of each constituent and verify the accuracy of the results of the first sample.

Many of the polychlorinated biphenyls, SOVs, and chlorinated pesticides cannot be compared to the water quality standards because there are no standards listed in the Basin Plan, Ocean Plan, or CTR. However, even if there were water quality standards, all of these constituents were not detected at any of the mass emission or tributary monitoring stations. We recommend sampling for these constituents for one more year. If they are not detected, we recommend to discontinue sampling for these constituents, except during the first storm event of every year.

Some constituents sampled at the tributary stations showed exceedances of water quality standards. The Municipal Storm Water Permit requires the initiation of a focused effort to identify sources of pollutant within that subwatershed when a constituent exceeds a water quality standard in three out of four samples. We recommend looking at the landuse make up of the watersheds and use water quality data collected from the landuse monitoring stations to begin identifying possible trends or correlations based on landuse. We also recommend using water quality data collected by SCCWRP in their landuse studies.

We collected valuable data from the first year of the tributary monitoring in the Los Angeles River Watershed. We believe that one year worth of data is not sufficient as there can be variability from year to year. Based on discussions with staff from the RWQCB, we recommend

performing a second year of monitoring in the Los Angeles River Watershed in order to make better use of the data we collect in order to assist us in prioritizing drainage and sub-drainage areas that need management actions.

In order to identify and better understand the source(s) of pollution, mass emission monitoring, toxicity monitoring, trash monitoring, and tributary monitoring will be continued in the future in addition to the regional monitoring and special studies, as required by the Municipal Storm Water Permit.