EXECUTIVE SUMMARY

ES.1 Monitoring Program Objectives

The Monitoring and Reporting Program for the Municipal Stormwater Permit recites the following as the primary objectives of the Monitoring Program:

- Assess compliance with the Municipal Stormwater Permit CAS004001 (Permit).
- Measure and improve the effectiveness of the Stormwater Quality Management Program (SQMP).
- Assess the chemical, physical, and biological impacts of receiving waters resulting from urban runoff.
- Characterize stormwater discharges.
- Identify sources of pollutants.
- Assess the overall health in receiving water quality, and evaluate long-term trends.

The Monitoring Program also provides that, ultimately the results of the monitoring requirements should be used to refine the SQMP for the reduction of pollutant loads and the protection and enhancement of the beneficial uses of the receiving waters in Los Angeles County.

ES.2 Summary of Monitoring Results

The Monitoring Program consisted of core monitoring, regional monitoring, and special studies. The core monitoring contained the following elements:

- Mass emission monitoring.
- Water column toxicity.
- Tributary monitoring.
- Shoreline monitoring.
- Trash monitoring.

ES.2.1 Mass Emission Monitoring

The Monitoring Program recites the following as the goals of the mass emission monitoring:

- Estimate the mass emissions from the municipal separate storm sewer system (MS4).
- Assess trends in the mass emissions over time.
- Determine whether the MS4 is contributing water quality impacts by comparing results to applicable standards in the Water Quality Control Plan for the Los Angeles Region (Basin Plan), the California Toxics Rule (CTR), and emissions from other discharges.

Flows were measured and water quality samples were taken at the following seven mass emission stations (MES):

- Ballona Creek (S01).

- Malibu Creek (S02).
- Los Angeles River (S10).
- Coyote Creek (S13).
- San Gabriel River (S14).
- Dominguez Channel (S28).
- Santa Clara River (S29).

All MES, except the Santa Clara River MES, are equipped with automated samplers with integral flow meters for collecting flow composite samples. A minimum of five storm events, including the first storm and two dry weather events were sampled at each MES. Total suspended solids (TSS) were collected from five storm events at the Santa Clara River MES, and from 13 storm events from Ballona Creek MES, San Gabriel River MES, and Dominguez Channel MES. Twelve storm events were sampled for TSS at Malibu Creek and Coyote Creek. Eleven storm events were sampled for TSS at the Los Angeles River MES.

Based on results of the mass emission monitoring, the following three water quality analyses were conducted:

- A comparison to applicable water quality standards.
- An analysis of pollutant loads and trends.
- An evaluation of the correlation between constituents of concern and TSS.

The following subsections summarize the analyses.

ES.2.1.1 Comparison Study for Mass Emission Water Quality

Monitoring results were compared to water quality indicators based on water quality objectives (WQOs) established in the Los Angeles Basin Plan (Basin Plan) and the California Toxics Rule, 40 CFR Part 131 (CTR). The Basin Plan is designed to enhance water quality and protect the beneficial uses of all regional waters. The CTR promulgates criteria for priority toxic pollutants in the State of California for inland surface waters and enclosed bays and estuaries.

Applicable water quality objectives were identified (see table below) for which no uncertainty regarding the applicable objectives, or the implementation with respect to frequency and duration was found. The numeric objectives in the table below that are listed as ranges are calculated values based on site-specific conditions. Ammonia concentrations were calculated using measured pH and Table 3-1 of the Basin Plan. Dissolved metals concentrations were calculated using measured hardness and procedures set forth in the CTR.

Water Quality Objectives

Constituent	Water Quality Objective	Unit	Reference	Beneficial Use
Chloride	Ballona Creek (S01) None Malibu Creek (S02) < 500 Los Angeles River (S10) < 150 Coyote Creek (S13) None San Gabriel River (S14) < 150 Dominguez Channel (S28) None Santa Clara River (S29) < 150	mg/L	Basin Plan	Groundwater recharge (GWR) and general water quality indicators
Sulfate	Ballona Creek (S01) None Malibu Creek (S02) < 500 Los Angeles River (S10) < 350 Coyote Creek (S13) None San Gabriel River (S14) < 300 Dominguez Channel (S28) None Santa Clara River (S29) < 600	mg/L	Basin Plan	
Total dissolved solids (TDS)	Ballona Creek (S01) None Malibu Creek (S02) < 2,000 Los Angeles River (S10) < 1,500 Coyote Creek (S13) None San Gabriel River (S14) <750 Dominguez Channel (S28) None Santa Clara River (S29) < 1,200	mg/L	Basin Plan	
pH	6.5–8.5	None	Basin Plan	Aquatic life habitat (WARM and COLD)
Dissolved oxygen (DO)	(All) > 5 (WARM) (Malibu Creek) > 7 (COLD & SPAWN)	mg/L	Basin Plan	Aquatic life habitat
Fecal coliforms	Ballona Creek (S01) < 4,000 Malibu Creek (S02) < 400 Los Angeles River (S10) < 400 Coyote Creek (S13) <4,000 San Gabriel River (S14) <400 Dominguez Channel (S28) <4,000 Santa Clara River (S29) < 400	MPN/ 100 mL	Basin Plan	Water contact recreation (REC-1) Non-contact water recreation (REC-2)

MPN = most probable number.

Water Quality Objectives (continued)

Constituent	Water Quality Objective	Unit	Reference	Beneficial Use
Ammonia	Based on pH	mg/L	Basin Plan	Aquatic life habitat (acute exposure)
Cyanide	0.022	mg/L	CTR	
Dissolved arsenic	340	µg/L	CTR	
Dissolved cadmium	Hardness based	µg/L	CTR	
Dissolved chromium +6	Hardness based	µg/L	CTR	
Dissolved chromium	Hardness based	µg/L	CTR	
Dissolved copper	Hardness based	µg/L	CTR	
Dissolved lead	Hardness based	µg/L	CTR	
Dissolved nickel	Hardness based	µg/L	CTR	
Dissolved silver	Hardness based	µg/L	CTR	
Dissolved zinc	Hardness based	µg/L	CTR	

mg/L = milligram per liter.
MPN = most probable number.
mL = milliliter.
µg/L = microgram per liter.

Constituents that Did Not Meet Water Quality Objectives at Mass Emission Stations

At the MES located in urbanized watersheds (i.e., Ballona Creek, Los Angeles River, and Dominguez Channel), dissolved copper did not meet the water quality objectives during all of the monitored wet weather events. At Los Angeles River MES and Dominguez Channel MES, dissolved zinc did not meet the water quality objectives during all of the monitored wet weather events. At Ballona Creek MES, dissolved zinc did not meet the water quality objectives during three of the four monitored wet weather events. Dissolved lead was above the water quality objective at Los Angeles River MES during two of the five wet weather events and at Dominguez Channel MES, was above the water quality objective at one of the four monitored wet weather events. Fecal coliform did not meet the water quality objective for one of the five wet weather monitoring events at Los Angeles River MES. At Ballona Creek MES, pH was above the water quality objective range during one of the four monitored wet weather events.

During dry weather conditions, pH was measured above water quality objectives during all events at the three urbanized watershed MES (Ballona Creek, Los Angeles River, and Dominguez Channel).

Among the four less urbanized watersheds (i.e., Malibu Creek, Coyote Creek, San Gabriel River, and Santa Clara River), fecal coliform concentrations were above water quality objectives during all five wet weather events monitored at Malibu Creek MES and Santa Clara River MES, the two stations where the high-flow suspension of the fecal coliform water quality objective does not apply. Dissolved copper exceeded the hardness-based water quality objective during all four of the monitored wet weather events at Coyote Creek MES, one of the four monitored wet weather events at San Gabriel River MES, and four of the five monitored wet weather events at Santa

Clara River MES. Dissolved zinc exceeded the hardness-based water quality objective during three of the four monitored wet weather events at Coyote Creek MES, one of the four monitored at San Gabriel River MES, and two of the five monitored at Santa Clara River MES. Sulfate concentrations were above the water quality objective at Malibu Creek MES during three of the five monitored wet weather events.

During dry weather monitoring, one of the four stations in less urbanized watersheds, Santa Clara River MES met all applicable water quality objectives. In Malibu Creek MES, Coyote Creek MES, and San Gabriel River MES, fecal coliform concentrations exceeded the water quality objective during one of the two dry weather monitoring events. In Malibu Creek MES, sulfate concentrations exceeded the water quality objective for both dry weather events and TDS exceeded the applicable water quality benchmark during one of the dry weather events. In Ballona Creek MES, Los Angeles River MES and Dominguez Channel MES, pH exceeded the applicable water quality benchmark during both of the dry weather events. In Coyote Creek MES, pH was outside the water quality objective range during one of the two dry weather events. The results are summarized in the table below.

Summary of Constituents that Did Not Meet Water Quality Objectives at Mass Emission Stations during 2011–2012 for One or More Events

Mass Emission/Watershed	Wet	Dry
Ballona Creek (S01)[1,2]	pH[3] Dissolved zinc Dissolved copper	pH[3]
Malibu Creek (S02)	Fecal coliforms Sulfate	Fecal coliforms Sulfate TDS
Los Angeles River (S10)[1,2]	Fecal coliforms[4] Dissolved copper Dissolved lead Dissolved zinc	pH[3]
Coyote Creek (S13)[2]	Dissolved copper Dissolved zinc	Fecal coliforms pH[3]
San Gabriel River (S14)[2]	Dissolved copper Dissolved zinc	Fecal coliforms
Dominguez Channel (S28)[1,2]	Dissolved copper Dissolved lead Dissolved zinc	pH[3]
Santa Clara River (S29)	Fecal coliforms Dissolved copper Dissolved zinc	

[1]More urbanized watersheds.

[2]Subject to the fecal coliform water quality objective high-flow suspension (LARWQCB, 2003).

[3] pH was evaluated outside of holding time

[4]The high flow suspension did not apply to Event07 at Los Angeles River because the rainfall during this event was less than 0.5 inches.

ES.2.2 Water Column Toxicity Analysis

Water column toxicity monitoring was performed at all MES in accordance with the Municipal Stormwater Permit. In total, four samples were analyzed for toxicity at each station (i.e., two wet weather samples and two dry weather samples). Dry weather samples were collected on September 20, 2011 (2011–12Event04), and January 10, 2012 (2011–12Event12). Wet weather samples were collected during the first rain event of the season on October 5, 2011 (2011–12Event05) and on March 16, 2012 (2011–12Event18) at all MES. The toxicity results from these samples are provided in Table 4-10a (dry weather) and Table 4-10b (wet weather).

One freshwater species (water flea) and one marine species (sea urchin) were used for toxicity testing. The water flea, *Ceriodaphnia dubia*, was used in chronic 7-day reproduction and survival bioassays, and the sea urchin, *Strongylocentrotus purpuratus*, was used in chronic fertilization bioassays.

ES.2.2.1 Toxicity Results by Station – Wet Weather

Bioassay tests exposing *C. dubia* to wet weather effluent samples from each of the seven MES indicated that no toxicity was observed for either the survival or reproduction endpoints.

When the observable effect is sublethal (e.g., mean young per female), the term inhibitory concentration (IC) is used. For example, IC_{50} is the concentration that causes a 50% reduction in the selected sublethal biological response (e.g., reproduction). The IC_{25} and IC_{50} values were greater than 100% test substance for each of the MES wet weather samples. This indicates that the undiluted sample did not cause sublethal inhibition of reproduction in *C. dubia*.

The *C. dubia* survival and reproduction toxicity tests resulted in <1 toxicity unit (TU) for survival and <1 TU for reproduction for each of the MES. A TU is defined in the National Pollutant Discharge Elimination System (NPDES) Municipal Permit as 100 divided by the calculated median test response (e.g., LC_{50} or effective concentration $[EC]_{50}$). A TU value greater than or equal to 1 is considered substantially toxic and requires a Phase I toxicity identification evaluation (TIE).

Toxicity tests measuring *S. purpuratus* fertilization in exposures to wet weather effluent samples from six of the seven MES, the exception being Santa Clara River, indicated that no toxicity to *S. purpuratus* fertilization was observed in the test samples. At all MES, except Santa Clara River, the IC_{25} and IC_{50} values were greater than 100% test substance and TUs were <1. Results from Santa Clara River MES indicated potential toxicity, and triggered a TIE study. The initial component of the TIE process is to conduct a "baseline" test to determine the final TIE test dilutions. The baseline test conducted on this sample showed that fertilization was not adversely affected, the no-observed-effect concentration (NOEC) was 100%. Therefore, there was no reason to continue the TIE. The initial toxicity may have been caused by volatile compounds that dissipated to non toxic levels during the baseline TIE.

ES.2.2.2 Toxicity Results by Station – Dry Weather

Bioassay tests exposing *C. dubia* to dry weather effluent samples from each of the seven mass MES indicated that toxicity to *C. dubia* was observed in dry weather samples collected from Malibu Creek and Santa Clara River for reproduction. At Malibu Creek during 2011-2012Event04, the IC_{25} value was 5.78, indicating that at 5.78% concentration, a 25% reduction in reproduction was observed. The IC_{50} value was 92.54, indicating that at 92.54% concentration, a 50% reduction in reproduction was observed and the NOEC was 50%. The TU was calculated to be 1.08, triggering a TIE. The baseline TIE test conducted on this sample showed that reproduction was not adversely affected, the NOEC was 100%. Therefore, there was no reason to continue the TIE. The initial toxicity may have been caused by volatile compounds that dissipated to non toxic levels during the baseline TIE. At Santa Clara River MES during 2011-12Event12, the IC_{25} value was 65.38, indicating that at 65.38% concentration, a 25% reproduction was observed. The IC_{50} value was >100 and the NOEC was 50%. The TU was calculated to be <1, therefore a TIE was not necessary.

Toxicity tests measuring *S. purpuratus* fertilization in exposures to dry weather effluent samples from each of the seven MES indicated that no toxicity to *S. purpuratus* fertilization was observed in any of the test samples. The IC_{25} and IC_{50} values were greater than 100% test substance and TUs were <1 for each of the MES.

ES.2.3 Tributary Monitoring

The Monitoring Program provides that there shall be tributary monitoring to identify sub-watersheds where stormwater discharges are causing or contributing to exceedances of water quality standards and to prioritize drainage and sub-drainage areas that need management actions.

Sampling for the 2011–2012 Monitoring Season was conducted at six tributary monitoring stations in the Malibu Creek Watershed. A total of four storm events, including the first storm of the season, and two dry events were sampled at each tributary monitoring station.
The tributaries monitored included the following:

- **Upper Las Virgenes Creek (TS25) –** Tributary station is located south of Parkmor Road, east of the intersection with Las Virgenes Road (County Highway N1) in the City of Calabasas.
- **Cheseboro Canyon (TS26)** –Tributary station is located south of Agoura Road to the southwest of the intersection of Agoura Road and Cornell Road in the City of Agoura Hills.
- **Lower Lindero Creek (TS27) –** Tributary station is located south of Agoura Road to the west of Kanan Road. (County Highway N9) in the City of Agoura Hills.
- **Medea Creek (TS28)** – Tributary station is located south of Agoura Road to the southwest of the intersection of Agoura Road and Cornell Road in the City of Agoura Hills.
- **Liberty Canyon Channel (TS29) –**Tributary station is located east of Liberty Canyon Road, south of the intersection with Park Vista Road in the City of Agoura Hills.

- **PD 728 at Foxfield Drive (TS30)** – Tributary station is located south of Lindero Canyon Road east of Foxfield Dr in the City of Westlake Village.

Constituents that Did Not Meet Water Quality Objectives at Tributary Stations

This subsection summarizes the constituents that were measured above Basin Plan water quality objectives at the tributary monitoring stations during the 2011–2012 Monitoring Season. During wet weather, fecal coliform concentrations were above the water quality objective at all tributary stations for every event, as was also the case for Malibu Creek MES. Sulfate exceeded the water quality objectives at five of the six stations during at least one wet weather monitored event (Upper Las Virgenes, Cheseboro Canyon, Lower Lindero Creek, Medea Creek, and Liberty Canyon Channel) which is similar to results seen in Malibu Creek MES. pH was above the water quality objective range during at least one wet weather event at Upper Las Virgenes Creek, Cheseboro Canyon, and PD 728 at Foxfield Drive. Dissolved copper and dissolved zinc exceeded the hardness-based water quality objectives at Lower Lindero Creek, Liberty Canyon Channel, and PD 728 at Foxfield Drive during at least one of the monitored wet weather events. At Cheseboro Canyon, the concentration of TDS was slightly above the water quality objective during two of the four monitored wet weather events. There were no wet weather exceedances for pH, TDS, or sulfate at Malibu Creek MES.

During dry weather, sulfate did not meet the water quality objectives during all dry weather events at all of the tributary stations. TDS was above the water quality objective during at least one of the two dry weather events at all of the stations, with the exception of PD 728 at Foxfield Drive. Results for sulfate and TDS were consistent with results from Malibu Creek MES. Fecal coliforms did not meet the water quality objective during at least one of the two dry weather sampling events at all of the stations, with the exception of Medea Creek. These results are consistent with results from Malibu Creek MES. At Liberty Canyon during 2011-12Event04, dissolved cadmium, dissolved copper and dissolved zinc all exceeded the hardness-based water quality objectives. There were no dry weather metals exceedances in Malibu Creek MES. The results are summarized in the table below.

Summary of Constituents that Did Not Meet Water Quality Objectives at Tributary Stations during 2011–2012 for One or More Events

Tributary/Sub-Watershed	Wet	Dry
Upper Las Virgenes Creek (TS25)	Fecal coliforms pH[1] Sulfate	Fecal coliforms Sulfate TDS
Cheseboro Canyon (TS26)	Fecal coliforms pH[1] Sulfate TDS	Fecal coliforms Sulfate TDS
Lower Lindero Creek (TS27)	Fecal coliforms Sulfate Dissolved copper Dissolved zinc	Fecal coliforms Sulfate TDS
Medea Creek (TS28)	Fecal coliforms Sulfate	Sulfate TDS
Liberty Canyon Channel (TS29)	Fecal coliforms Sulfate Dissolved copper Dissolved zinc	Fecal coliforms Sulfate TDS Dissolved cadmium Dissolved copper Dissolved zinc
PD 728 @ Foxfield Dr. (TS30)	Fecal coliforms pH[1] Dissolved copper Dissolved zinc	Fecal coliforms Sulfate

[1] pH was evaluated outside of holding time

ES.2.4 Priority Constituents and Correlation to Total Suspended Solids

Wet Weather – Mass Emission Stations

Consistent relationships were not observed in correlations between TSS and priority constituents (those constituents that did not meet water quality objectives in one or more monitoring events) across MES during wet weather. However, positive correlations were seen at six of the seven MES between TSS and at least one of the metal constituents. The results of the correlation analysis are summarized in the table below. At Ballona Creek MES, Malibu Creek MES, and Coyote Creek MES, arsenic was positively correlated with TSS. Barium and pH were also positively correlated with TSS at Ballona Creek MES. At Malibu Creek MES and Los Angeles River MES aluminum, barium, dissolved aluminum, dissolved barium, dissolved chromium, dissolved copper, dissolved lead, iron, nickel, and volatile suspended solids (VSS) were all positively correlated with TSS. Chromium, dissolved arsenic, dissolved iron, dissolved nickel, and turbidity were also positively correlated with TSS at Malibu Creek MES. Cadmium, dissolved cadmium, and lead were also positively correlated with TSS at Los Angeles River MES. At Coyote Creek MES additional positive correlations with TSS were found with dissolved arsenic, dissolved lead, iron, and lead. At San Gabriel River MES, cadmium and total organic carbon (TOC) were positively correlated with TSS. At Dominguez Channel MES, dissolved phosphorus and turbidity were positively correlated with TSS and at Santa Clara River MES, dissolved lead, lead, total phosphorus, and VSS were all positively correlated with TSS.

Negative correlations with TSS were found at Santa Clara River MES for alkalinity as $CaCO_3$, chloride, fluoride, hardness as $CaCO_3$, specific conductance, sulfate, and TDS.

Many constituents have a strong binding affinity for sediment particles in stormwater effluent, particularly metals, organics, and TOC. Bacteria also have a strong binding affinity for sediment particles in stormwater effluent, although correlations were not observed between bacteria and TSS at the MES stations in the 2011-2012 monitoring year. It is important to note that the correlations discussed above were based on a very small data set and may not be representative of true conditions during a storm. Analysis of a larger data set would help determine the validity of these correlations.

Correlations Between Constituents and Total Suspended Solids at Mass Emission Stations

Mass Emission/Watershed	Wet	
	Positively Correlated with TSS	Negatively Correlated with TSS
Ballona Creek (S01)	Arsenic, Barium, pH	
Malibu Creek (S02)	Aluminum, Arsenic, Barium, Chromium, Dissolved aluminum, Dissolved arsenic, Dissolved barium, Dissolved chromium, Dissolved copper, Dissolved iron, Dissolved lead, Dissolved nickel, Iron, Nickel, Turbidity, VSS	
Los Angeles River (S10)	Aluminum, Barium, Cadmium, Dissolved aluminum, Dissolved barium, Dissolved cadmium, Dissolved chromium, Dissolved copper, Dissolved lead, Iron, Lead, Nickel, VSS	
Coyote Creek (S13)	Arsenic, Dissolved arsenic, Dissolved lead, Iron, Lead	
San Gabriel River (S14)	Cadmium, TOC	
Dominguez Channel (S28)	Dissolved phosphorus, Turbidity	
Santa Clara River (S29)	Dissolved lead, Lead, Total Phosphorus, VSS	Alkalinity as $CaCO_3$, Chloride, Fluoride, Hardness as $CaCO_3$, Specific conductance, Sulfate, TDS

Wet Weather – Tributary Stations

No correlations were found between TSS and priority constituents at tributary stations (those that did not meet water quality objectives at tributary stations for one or more events).

At Upper Las Virgenes Creek alkalinity as $CaCO_3$ and fluoride were positively correlated with TSS. Ammonia, total Kjeldahl nitrogen (TKN), and NH_3 as N were all positively correlated with TSS at Cheseboro Canyon, whereas zinc was negatively correlated. Positive correlations with TSS were found with dissolved oxygen and VSS at Lower Lindero Creek, whereas a negative correlation with TSS was found with pH. VSS was also positively correlated with TSS at Medea Creek and alkalinity as $CaCO_3$ was negatively correlated. At Liberty Canyon Channel, dissolved arsenic, fecal enterococcus, fecal streptococcus, specific conductance, and VSS were all positively correlated with TSS, whereas dissolved phosphorus and pH were negatively correlated with TSS. Aluminum, ammonia, iron, and NH_3 as N were negatively correlated with TSS at PD728 at Foxfield Drive.

Correlations Between Constituents and Total Suspended Solids at Tributary Stations

Tributary Station/Watershed	Wet	
	Positively Correlated with TSS	Negatively Correlated with TSS
Upper Las Virgenes Creek (TS25)	Alkalinity as CaCO3, Fluoride	
Cheseboro Canyon (TS26)	Ammonia, total Kjeldahl Nitrogen (TKN), NH_3 as N	Zinc
Lower Lindero Creek (TS27)	Dissolved oxygen (DO), VSS	pH
Medea Creek (TS28)	VSS	Alkalinity as $CaCO_3$
Liberty Canyon Channel (TS29)	Dissolved arsenic, Fecal enterococcus, Fecal streptococcus, Specific conductance, VSS	Dissolved phosphorus, pH
PD 728 @ Foxfield Drive (TS30)	Aluminum, Ammonia, Iron, NH3 as N	

ES.2.5 Wet Weather and Dry Weather Constituent Loads for Each Mass Emission Station

Constituent loads at each MES were calculated for each sampling event based on flow rates and constituent concentrations during the 2011-2012 monitoring year, as shown in Table 4-9. The TSS load for each MES is shown in Table 4-8. Calculated loads varied between stations and storm events. First-flush loading signatures (i.e. higher loads during the first monitored storm of the season than would be expected based on rainfall totals) were observed at five of the seven MES stations for at least one constituent. First-flush signatures were not observed at Malibu Creek MES and Coyote Creek MES.

During dry weather, constituent loads varied between stations and among sampling events, in general the highest variability was observed in nutrient loads. TSS loads calculated for Los Angeles River MES were substantially higher than TSS loads at the other stations during both dry weather events. Overall, constituent loads were substantially lower at Santa Clara River MES than at all other MES.

ES.2.6 Total Suspended Solids Trend Analysis

TSS concentrations from 2000 to 2012 were evaluated for normality and log-normal distributions separately for wet and dry weather at each MES. If the TSS concentrations were normal or log-normally distributed, then a regression analysis was used to evaluate trends. Multiple samples during each monitoring year were treated as replicates. If a normal or log-normal distribution was not found, then it was determined that the distribution of the data was not known. These results were evaluated for trends using the Mann-Kendall non-parametric method. The summary table below presents the method used for trend evaluation and the statistical trend information on TSS data collected at each MES over the past 12 years. The data are shown graphically on Figures 4-13.1 through 4-13.4.

The trend analysis for both wet and dry weather data sets did not find any significant trends for TSS, either increasing or decreasing (based on an alpha of 0.05.).

Trend Analysis of Wet Weather Total Suspended Solids Concentrations at Mass Emission Stations from 2000–2012

Station	p-value	Method	Trend
Ballona Creek at Sawtelle (S01)	0.120	Mann-Kendall	Not significant
Malibu Creek at Piuma (S02)	0.055	Regression	Not significant
Los Angeles River at Wardlow (S10)	0.670	Regression	Not significant
Coyote Creek at Spring (S13)	0.370	Mann-Kendall	Not significant
San Gabriel River (S14)	0.353	Regression	Not significant
Dominguez Channel at Artesia (S28)	0.330	Mann-Kendall	Not significant
Santa Clara River (S29)	0.430	Mann-Kendall	Not significant

Trend Analysis of Dry Weather Total Suspended Solids Concentrations at Mass Emission Stations from 2000–2012

Station	p-value	Method	Trend
Ballona Creek at Sawtelle (S01)	0.605	Regression	Not significant
Malibu Creek at Piuma (S02)	0.101	Regression	Not significant
Los Angeles River at Wardlow (S10)	0.626	Regression	Not significant
Coyote Creek at Spring (S13)	0.181	Regression	Not significant
San Gabriel River (S14)	0.436	Regression	Not significant
Dominguez Channel at Artesia (S28)	0.451	Regression	Not significant
Santa Clara River (S29)	0.097	Mann-Kendall	Not significant

ES.2.7 Trash Monitoring

The objectives of trash monitoring are as follows:

- Assess the quantities of trash in receiving waters after storm events.
- Identify areas impaired for trash.

Visual observations of trash were made, and at least one photograph was taken at each MES after the first storm event and at least five additional storm events.

Results of trash compliance monitoring can be found in Appendix C (photographs), Appendix I (*Ballona Creek Watershed Trash Compliance Monitoring Report*), and Appendix J (*Los Angeles River Watershed Trash Compliance Monitoring Report*).

ES.3 Recommendations

The following recommendations for improving monitoring techniques are presented below.

- The 2011-2012 monitoring year was the first year that tributary monitoring was conducted in the Malibu Creek watershed. Therefore, it is recommended that tributary monitoring continue in the Malibu Creek watershed in order to gather additional data.

- Sample analysis of *E. coli* is recommended for future monitoring, based on the recently adopted Resolution No. R10-005. Currently, fecal coliform are analyzed for both storm water and dry conditions at the MES. However, because bacteria standards have been changed to require *E. coli* monitoring, *E. coli* should be monitored. The current fecal bacteria indicators may continue to be analyzed for a period of time after initiation of the *E. coli* analysis for the purpose of comparing long-term trends using both sets of data depending on available resources.

- The correlation analysis of TSS and other constituents is limited to one year of monitoring data, and it is recommended that the past five to ten years of data be included in next year's evaluation to determine whether or not TSS and other monitored constituents are often correlated.

- It is recommended that pH levels should be monitored in the field to limit effects of water hardness and alkalinity on changes to the pH levels measured in the analytical laboratory. The holding time for pH is approximately 10-15 minutes, and so composite samples may be out of holding time when the sample arrives at the laboratory.

- Due to the observed wet weather dissolved copper, lead, and zinc exceedances found during the 2011-2012 monitoring season, as well as during prior monitoring seasons, it is recommended that an evaluation of the bioavailable fraction of dissolved metals (including the copper, lead, and zinc dissolved metals) should be estimated by using the biotic ligand model (BLM) as a data evaluation exercise of available data. The BLM is a model used to estimate the amount of bioavailable dissolved metals taking into consideration dissolved organic carbon and physical water chemistry. Because the dissolved metals water quality objectives are low, due to low hardness levels, and the toxicity results are also low, it is possible that the measured dissolved metals concentrations are not negatively impacting aquatic life.

- It is recommended that an analysis of non-detect constituents (most recent 4 years) be performed. The current permit states that in the event constituents are not detected in 75% of samples, that monitoring for the constituents need not proceed.