Ventura Countywide Stormwater Quality Management Program

Stormwater Monitoring Program
2010/2011 Water Quality Monitoring Report
December 2011

Executive Summary

As required by Order R4-2010-0108 (issued July 8, 2010), the Ventura Countywide Stormwater Quality Management Program successfully monitored water chemistry, toxicity and biologic function of creeks, rivers, and channels within Ventura County during the 2010/11 monitoring season.

The increased monitoring effort required in the NPDES permit was achieved through the upgrading of all monitoring stations and the data collection platform. New and existing monitoring stations were upgraded to allow remote communication by Stormwater Monitoring Program staff. This allowed sampling program initiation and sampler pacing to be modified as rainfall predictions changed before and throughout the storm. As an added benefit, data handling was significantly reduced, thereby decreasing both staff time and the likelihood of errors.

Monitoring locations for water chemistry and toxicity included Mass Emission stations and Major Outfall stations. Mass Emission stations are located in the lower reaches of the three major watersheds in Ventura County (Ventura River, Santa Clara River, and Calleguas Creek). Major Outfall stations, a component of the Stormwater Monitoring Program since 2009, are located in watersheds representative of each particular Permittee's contribution to downstream waters. The first four of these were constructed in 2009 in Ojai, Meiners Oaks, Ventura, and Camarillo. The seven remaining stations were brought online in Fillmore, Moorpark, Oxnard, Port Hueneme, Santa Paula, Simi Valley, and Thousand Oaks during the summer of 2010.

Water chemistry samples were collected at Mass Emission and Major Outfall stations during four rainfall events, with each site being sampled during three of the events. The rain events occurred on October 6, 2010 (all sites), October 30, 2010 (all sites except MO-MEI and MO-OJA due to insufficient runoff), November 20, 2010 (MO-OJA and MO-MEI), and February 16, 2011 (all sites). Samples were collected at Mass Emission and Major Outfall stations during one dry event during the wet season, which was split into two days (April 19 and April 28, 2011). Toxicity samples were collected during the first event of the season for the seven established sites, and the first two events of the season for the seven new sites. A smaller subset of water chemistry samples was collected at each of the Major Outfall stations (or similar alternate location if no flow was observed) on August 17, 2011, and August 18, 2011, as part of the dry -season, dry-weather monitoring prescribed in the NPDES permit.

Through rigorous adherence to the Stormwater Monitoring Program's sampling protocols and through selection of a high-quality analytical laboratory, the Stormwater Monitoring Program was able to achieve a 97.3% success rate in meeting program data quality objectives.

Aluminum, *E. coli* and fecal coliforms were commonly found at elevated levels at most sites during wet-weather events, but rarely during dry-weather events. Other constituents that were found at elevated levels during the 2010/11 monitoring season include the following: chloride (predominantly during the dry-weather event); DDT and its breakdown products (ME-CC and MO-CAM only); mercury (ME-CC, ME-SCR and MO-CAM only during one or more wet-weather events); and dissolved copper (MO-VEN only, but during all events). The Program is using this information to identify pollutants of concern and direct efforts to reduce their discharge from the storm drain system.

Bioassessment sampling was performed at fifteen random [probabilistic (P)] and three targeted [trend (T)] sites throughout Ventura County, divided among each of the three major watersheds (six P and one T in the Ventura River Watershed, six P and one T in the Calleguas Creek Watershed, and three P and one T in the Santa Clara River Watershed). Sampling was conducted over seven days between June 29, 2011, and July 21, 2011.

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Acronyms and Abbreviations

ABC Labs	Aquatic Bioassay and Consulting Laboratories
ALERT	Automated Local Evaluation in Real Time
cf	cubic feet (volume)
cfs	cubic feet per second (flow rate)
CTR	California Toxics Rule
DQO	data quality objective
EMC	event mean concentration
IC_{50}	inhibitory concentration (50%)
LARWQCB	Los Angeles Regional Water Quality Control Board
ME-CC	Mass Emission monitoring station – Calleguas Creek
ME-SCR	Mass Emission monitoring station – Santa Clara River
ME-VR2	Mass Emission monitoring station – Ventura River
MS4	Municipal Separate Storm Sewer System
MO-CAM	Major Outfall monitoring station – Camarillo
MO-FIL	Major Outfall monitoring station – Fillmore
MO-MEI	Major Outfall monitoring station – Meiners Oaks (County Unincorporated)
MO-MPK	Major Outfall monitoring station – Moorpark
MO-OJA	Major Outfall monitoring station – Ojai
MO-OXN	Major Outfall monitoring station – Oxnard
MO-HUE	Major Outfall monitoring station – Port Hueneme
MO-SPA	Major Outfall monitoring station – Santa Paula
MO-SIM	Major Outfall monitoring station – Simi Valley
MO-THO	Major Outfall monitoring station – Thousand Oaks
MO-VEN	Major Outfall monitoring station – Ventura
MS/MSD	matrix spikes and matrix spike duplicates
NPDES	National Pollutant Discharge Elimination System
NWS	National Weather Service
RL	reporting limit
RTR	rainfall-to-runoff
QA/QC	Quality Assurance/Quality Control
SCCWRP	Southern California Coastal Water Research Project
SMC	Stormwater Monitoring Coalition
TIE	Toxicity Identification Evaluation
TUc	chronic toxicity unit
UWCD	United Water Conservation District
VCSQMP	Ventura Countywide Stormwater Quality Management Program
VCWPD	Ventura County Watershed Protection District
WWTP	wastewater treatment plant

1.0 Introduction

In 2009, the Los Angeles Regional Water Quality Control Board (LARWQCB) issued a National Pollutant Discharge Elimination System (NPDES) permit – Order R4-2009-0057 – for Ventura County (Permit No. CAS004002). Included in this permit was a prescriptive monitoring program (No. CI 7388), which stipulated types of monitoring that were to be undertaken. The permit and monitoring program were remanded and consequently adopted on July 8, 2010, as Order R4-2010-0108 (Permit). All references to the permit requirements and due dates are to this final version of the permit.

This report summarizes the effort undertaken by the Ventura Countywide Stormwater Quality Management Program (Program) and the Stormwater Monitoring Program during the 2010/11 monitoring season. Pursuant to NPDES Permit No. CAS0040002, the Program must submit a Stormwater Monitoring Report annually by December 15th, and include the following:

- Results of the Stormwater Monitoring Program
- General interpretation of the results
- Tabular and graphical summaries of the monitoring data obtained during the previous year

Analysis of samples collected at various stations throughout the watershed gives an overall representation of the quality of stormwater discharges. The monitoring also aids in the identification of pollutant sources, as well as the assessment of Program effectiveness. Feedback provided by the monitoring program allows for changes to be made in the implementation of other Program aspects in order to resolve any problems and reduce pollutants that may exist. This adaptive management strategy should eventually show improved water quality through the stormwater monitoring program.. The pertinent parts of the Stormwater Monitoring Program include the following components.

1.1 Mass Emission Monitoring

Mass Emission stations are located in the lower reaches of the three major watersheds in Ventura County (Ventura River, Santa Clara River, and Calleguas Creek). As such, the Mass Emission drainage areas are much larger than the drainage areas associated with Major Outfall stations (described in Section 1.2), and include large contributions from other sources of discharge, such as wastewater treatment plants, agricultural runoff, non-point sources, and groundwater discharges.

The purpose of mass emission monitoring is to identify pollutant loads to the ocean and identify long-term trends in pollutant concentrations. This type of monitoring, in conjunction with the Major Outfall monitoring, is also useful in helping to determine if the Municipal Separate Storm Sewer System (MS4) is contributing to exceedances of water quality objectives by comparing results to applicable water quality objectives in the Los Angeles Region Water Quality Control Plan (Basin Plan) and the California Toxics Rule (CTR).

During the 2010/11 monitoring season, water quality samples from three wet-weather events and one dry-weather event were collected for water chemistry analysis at each Mass Emission station, as required by the NPDES permit. Also, aquatic toxicity samples were collected at each Mass Emission station during Event 1 (October 6, 2010) and tested with the species that was determined to be the most sensitive to contaminants for each station, based on the results from the 2009/10 monitoring year.

1.2 Major Outfall Monitoring

A new component of the R4-2010-0108 Permit is the requirement to sample at one representative station of each Permittee's municipal separate storm sewer system (MS4). Many of the monitoring requirements for Major Outfall stations are similar to those for the Mass Emission stations, as are the reasons for undertaking this monitoring. Four of the stations were monitored beginning with the 2009/10 monitoring season and seven of the stations were new to the 2010/11 monitoring season. Station selection of these new sampling locations is described in Section 2.2.

During the 2010/11 monitoring season, water quality samples from three wet-weather events and one dry-weather event were collected for water chemistry analysis at each of the eleven Major Outfall stations, as required by the NPDES permit. Aquatic toxicity samples were collected at each of the four previously established Major Outfall stations during Event 1 (October 6, 2010) and tested with the species that was determined to be the most sensitive to contaminants for that station, based on the results from the 2009/10 monitoring year. Aquatic toxicity samples were collected at the seven new Major Outfall stations during Event 1 (October 6, 2010) and Event 2 (October 30, 2010). The results from this first year of aquatic toxicity monitoring will be used to determine which species is the most sensitive to contaminants at each station, with toxicity testing in subsequent years focusing on that particular species during the first event of each year.

Using the data from the Major Outfall monitoring in conjunction with the Mass Emission monitoring, the Stormwater Monitoring Program will help the Program determine if the MS4 is potentially contributing to exceedances of water quality objectives by comparing results to applicable water quality objectives in the Basin Plan and the CTR. And, over the course of many years, the data will be able to describe trends in waters from the Major Outfall stations over time. This information will be useful in evaluating the effectiveness of the Program implementation and provide Permittees with real data on which to base future management decisions.

1.3 Dry-Season, Dry-Weather Analytical Monitoring

The Permit requires the analysis of pollutant discharges from representative MS4 outfalls in each municipality and in the unincorporated County area during dry-weather. The Stormwater Monitoring Program met this requirement by sampling once during the summer at or near Major Outfall stations, or at another representative site if flow was insufficient at the Major Outfall station.

1.4 Bioassessment Monitoring

Prior to the adoption of the new Orders (No. 09-0057 in 2009 and its replacement, R4-2010-0108 in 2010), the Stormwater Monitoring Program performed bioassessment monitoring in the Ventura River watershed at fixed locations. That sampling effort was terminated in favor of a new program working to standardize bioassessment monitoring throughout Southern California undertaken by the Stormwater Monitoring Coalition of Southern California (SMC) and led by the Southern California Coastal Water Research Project (SCCWRP). The Stormwater Monitoring Program was instructed to participate in this new program by performing sampling at 15 random sites and three targeted sites throughout the County annually, for the duration of the five year study. The sampling for this report year was performed in early summer of 2010.

2.0 Monitoring Station Locations and Descriptions

2.1 Mass Emission Stations

Mass Emission stations are located in the three major Ventura County watersheds: Ventura River (ME-VR2), Santa Clara River (ME-SCR), and Calleguas Creek (ME-CC). In locating these stations, every effort was made to position the station as low as possible in the watershed to capture as much of the runoff as possible, while still remaining above tidal influence. See Figure 1 for the location of Mass Emission stations.

The ME-VR2 station is located at the Ojai Valley Sanitary District's wastewater treatment plant (WWTP) near Canada Larga Road and captures runoff from the city of Ojai, several unincorporated communities (e.g., Meiners Oaks, Casitas Springs), and a large portion of undeveloped landscape, the latter of which comprises the bulk of the watershed. Monitoring at the ME-VR2 station was initiated during the 2004/05 monitoring season after landslide activity at the original Ventura River Mass Emission station, ME-VR, precluded further sampling at that location.

The ME-CC station is located along University Drive near California State University at Channel Islands and captures runoff from the cities of Camarillo, Thousand Oaks, Moorpark and Simi Valley. This watershed has the largest urban influence (roughly 30% urbanized), but also includes significant contributions from agricultural runoff found predominantly in the lower two-thirds of the watershed. Monitoring at the ME-CC station was initiated during the 2000/01 monitoring season.

The ME-SCR station is located at the United Water Conservation District's (UWCD) Freeman Diversion Dam east of Saticoy and captures runoff from the cities of Santa Paula and Fillmore, communities upstream in Los Angeles County, agricultural fields, and a large amount of undeveloped landscape. Monitoring at the ME-SCR station was initiated during the 2001/02 monitoring season. Unlike at the other two Mass Emission stations, accurate measurement of flow at this location is not possible due to the configuration and operation of the diversion structure. In dry conditions, the river is usually diverted to groundwater infiltration ponds. In wet-weather conditions, the Santa Clara River can also flow past the diversion dam through two other routes. One route is through the river diversion gate structure where the majority of wet-weather flow passes. The other route is over the diversion dam, a situation which occurs only during high flows generated by large storm events. Wet-weather flow can only be measured at the diversion dam because there is no flow meter installed at the river diversion gate. There are technical challenges involved with measuring flow at the river diversion gate since floating debris and sediment can interfere with flow measurement and the large fluctuation in water level due to gate operation makes non-contact stage measurement difficult.

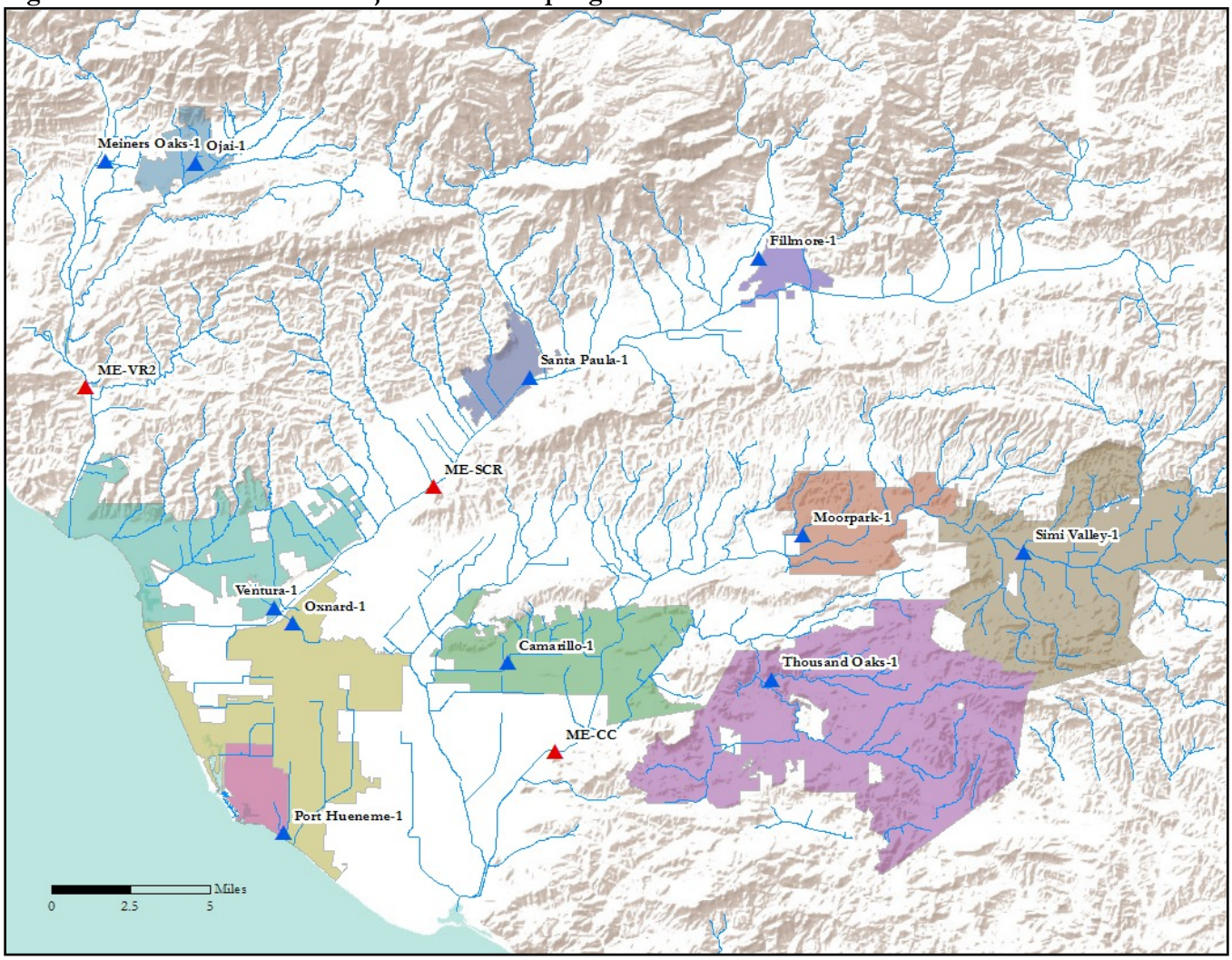
2.2 Major Outfall Stations

Seven new Major Outfall stations were added to the Stormwater Monitoring Program this year, which when added to the four Major Outfall stations added last year (2009), makes a total of eleven Major Outfall stations. As directed by the NPDES permit, these stations represent the runoff from each city/unincorporated county (Permittee) in which they are located. Municipalities selected for inclusion in the 2009/10 Stormwater Monitoring Program include Camarillo (MO-CAM), Ojai (MO-OJA), unincorporated Meiners Oaks (MO-MEI) and Ventura (MO-VEN).[1] The

[1] Site names shown on the map reflect the names given to each site in the NPDES permit; site names throughout this report are shortened to those shown on chains-of-custody (COCs) for brevity. Under this naming convention, MO-CAM is synonymous

stations in the seven remaining municipalities brought online for the 2010/11 Stormwater Monitoring Program include Fillmore (MO-FIL), Moorpark (MO-MPK), Oxnard (MO-OXN), Port Hueneme (MO-HUE), Santa Paula (MO-SPA), Simi Valley (MO-SIM), and Thousand Oaks (MO-THO). Details of the land use of each city and the representative watershed can be found in Appendix A.

Figure 1. Mass Emission and Major Outfall Sampling Locations



The MO-CAM station is located on Camarillo Hills Drain (a tributary of Revolon Slough) just north of Daily Drive in Camarillo. The predominant land use in the watershed is residential. Less than 8% of the watershed is commercial and less than 1% is agricultural.

with Camarillo-1, MO-FIL with Fillmore-1, MO-HUE with Port Hueneme-1, MO-OJA with Ojai-1, MO-OXN with Oxnard-1, MO-MEI with Meiners Oaks-1, MO-MPK with Moorpark-1, MO-SPA with Santa Paula-1, MO-SIM with Simi Valley-1, MO-THO with Thousand Oaks-1, and MO-VEN with Ventura-1.

The MO-OJA station is located on Fox Canyon Barranca (a tributary of San Antonio Creek) near the Ojai Valley Athletic Club in Ojai. Almost half of the watershed is classified as vacant, with residential land use comprising about 40%. About 3% of the watershed is commercial and about 5% is agricultural.

The MO-MEI station is located on Happy Valley Drain (a tributary of the Ventura River) near Rice Road in Meiners Oaks. Almost half of the watershed is classified as residential. Another quarter of the watershed is classified as vacant. About 3% of the watershed is commercial and about 15% is agricultural.

The MO-VEN station is located on Moon Ditch (a tributary to the Santa Clara River) near the US101-Johnson Drive interchange in Ventura. Over half of the watershed is residential and a quarter is commercial. Industrial land uses account for almost 7% of the watershed, while agriculture comprises less than 1% of the watershed.

The MO-FIL station is located on the North Fillmore Drain (a tributary of Sespe Creek) near Shiells Park in Fillmore. Almost half the watershed is residential and just over a third is classified as vacant. Agriculture land uses account for almost 7% of the watershed, while commercial comprises less than 1% of the watershed.

The MO-MPK station is located on the Gabbert Canyon Drain (a tributary to Arroyo Las Posas) near the intersection of Los Angeles Avenue and Mira Sol Drive. Over half the watershed is classified as vacant, less than 10% of the land is residential, and almost 13% of the watershed is used for agriculture.

The MO-OXN station is located on El Rio Drain (a tributary to the Santa Clara River) near the corner of Buckaroo Avenue and Winchester Drive. Most of the watershed is classified as residential, however almost 20% is commercial and less than 2% is agricultural.

The MO-HUE station is located on Hueneme Drain (a tributary of the J Street Drain at the Pacific Ocean) southeast of Bubbling Springs Park. The land use is predominantly residential, with commercial and vacant land uses accounting for only 3% each.

The MO-SPA station is located on the 11th Street Drain where it enters the Santa Clara River, east of the Santa Paula airport. About half of the watershed is classified as residential, less than 15% as commercial, and schools and transportation account for about 10% each.

The MO-SIM station is located on Bus Canyon Drain (a tributary of the Arroyo Simi) near the intersection of 5th Street and Los Angeles Avenue. Over half (57%) of the watershed is classified as vacant and about one third is residential. All other land uses account for less than 1% of the watershed each.

The MO-THO station is located on the North Fork Arroyo Conejo (a tributary to Conejo Creek) in the Hill Canyon WWTP. The main land uses in the watershed are residential (56%) and vacant land (31%).

Figure 1 shows the location of the eleven Major Outfall and three Mass Emission stations.

3.0 Methods

The NPDES permit requires flow-paced sampling at monitoring stations where technically feasible. The reason for this type of sampling is two-fold. First, by collecting sub-samples (aliquots) based on flow, a more accurate representation of each constituent in the runoff can be achieved. Second, by multiplying the concentration by the total flow, a mass of each constituent for each storm can be determined. These benefits are discussed further below.

Flow-paced sampling is not technically feasible at three sites, ME-SCR, MO-FIL, and MO-HUE. Since its installation in 2001, the monitoring station at ME-SCR has been monitored on a time-paced basis, as allowed by the RWQCB. This site is located at the UWCD's Freeman Diversion Dam, where irregular operation of the gates associated with the diversion dam makes it impossible to calculate flow. During most of the year, water is sent through a canal in which it is easy to calculate flow. However, during rainfall events and periodically throughout the year, the UWCD will close the gates to the diversion canal, allowing water to go through a high-velocity bypass or spill over the dam itself. Computing flow over the latter is difficult, given the breadth of the dam, which spans the entire river bottom. Computing flow through the bypass is impossible due to the wide ranges in water surface elevation and velocity. The MO-FIL station is located at an outfall into Sespe Creek and is subject to backwater due to plant growth and sediment deposition, which makes accurate flow determination impossible. The MO-HUE station is located in a canal which is drained via pumps that are triggered based on water surface elevation. The pumps are operated intermittently which makes flow-paced sampling inappropriate.

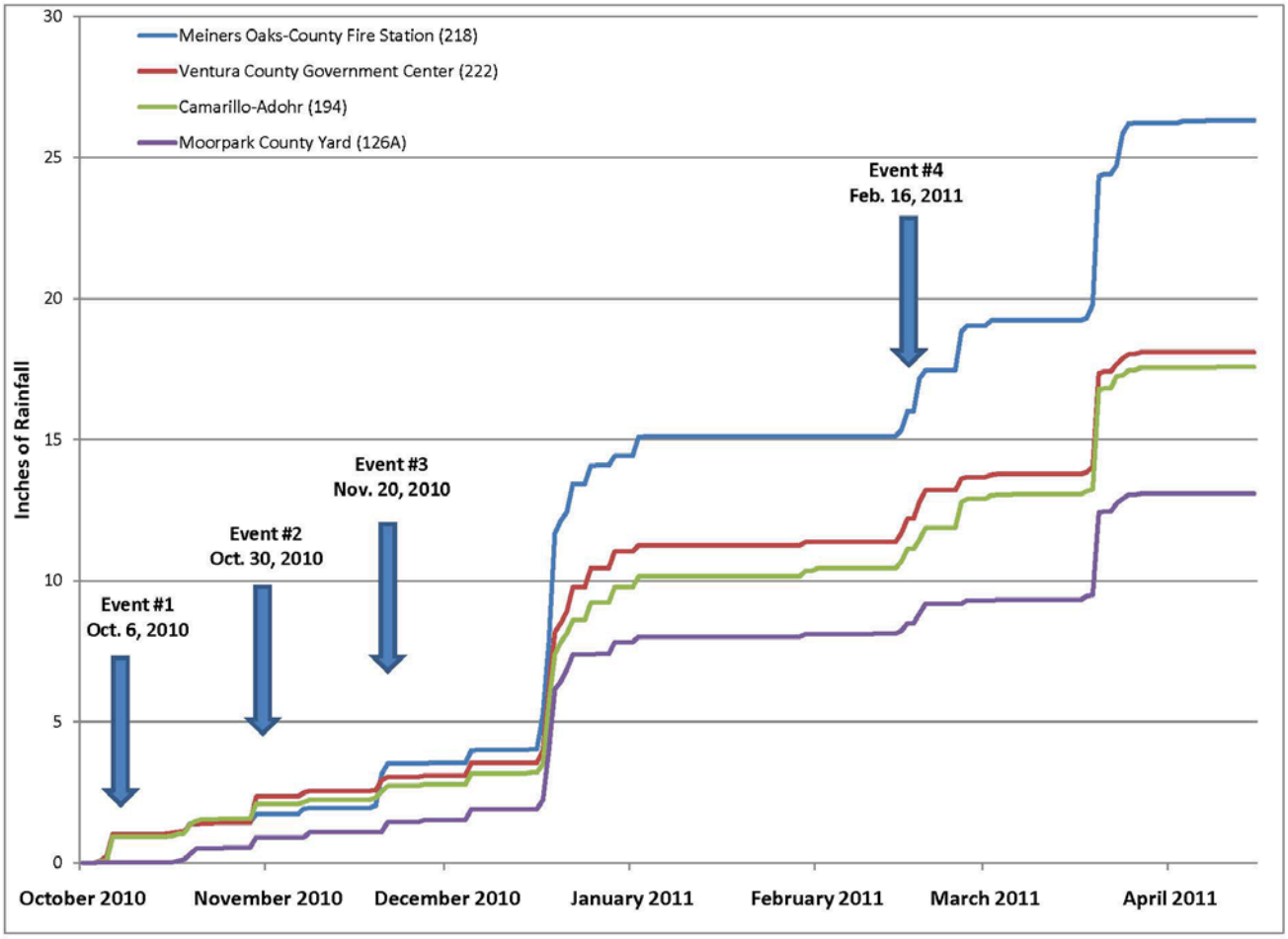
3.1 Precipitation

Precipitation amounts, both historical and predicted, are integral to performing flow-weighted sampling. Historical precipitation data is necessary to determine the relationship between rainfall and runoff. In the major watersheds with long-term Mass Emission stations, the rainfall-to-runoff (RTR) ratio is based on over 65 years of data and takes into account antecedent soil moisture conditions. These RTR tables have been used and refined by the Stormwater Monitoring Program for over 10 years.

At the time the Major Outfall stations were installed, the Stormwater Monitoring Program had access to real time precipitation data from the VCWPD's Hydrology section [part of the Automated Local Evaluation in Real Time (ALERT) network]; however it was not in a form that was usable by the Program. Changes to the processing of the ALERT data allowed the Program to capitalize on the already installed and maintained ALERT rainfall gauges. Most of the monitoring stations were able to use data from nearby ALERT gauges. Those monitoring stations that do not have nearby ALERT gauges (ME-SCR, ME-VR2, MO-CAM, MO-MEI, MO-VEN, and MO-HUE) have tipping bucket rainfall gauges (0.01" per tip) installed instead.

While the rainfall gauges purchased and maintained by the Stormwater Monitoring Program are of high quality, the data generated by these gauges are subjected to less stringent quality control measures than the "official" gauges maintained by the Hydrology section. Therefore, the Stormwater Monitoring Program has opted to show cumulative totals from representative ALERT gauges when indicating dates that actual sampling events occurred, as shown in Figure 2 Precipitation at Selected Sites. Gauge 218 is located in the Ojai Valley near the MO-MEI station. Gauge 222 is located at the County Government Center near the MO-VEN station. Gauge 194 is located at the base of the Conejo Grade, somewhat equidistant from the ME-CC and MO-CAM stations. Gauge 126A is located at the Moorpark County Yard near the MO-MPK station. Rainfall data gathered at specific monitoring stations can be found in Appendix B.

Figure 2: Precipitation at Selected Sites



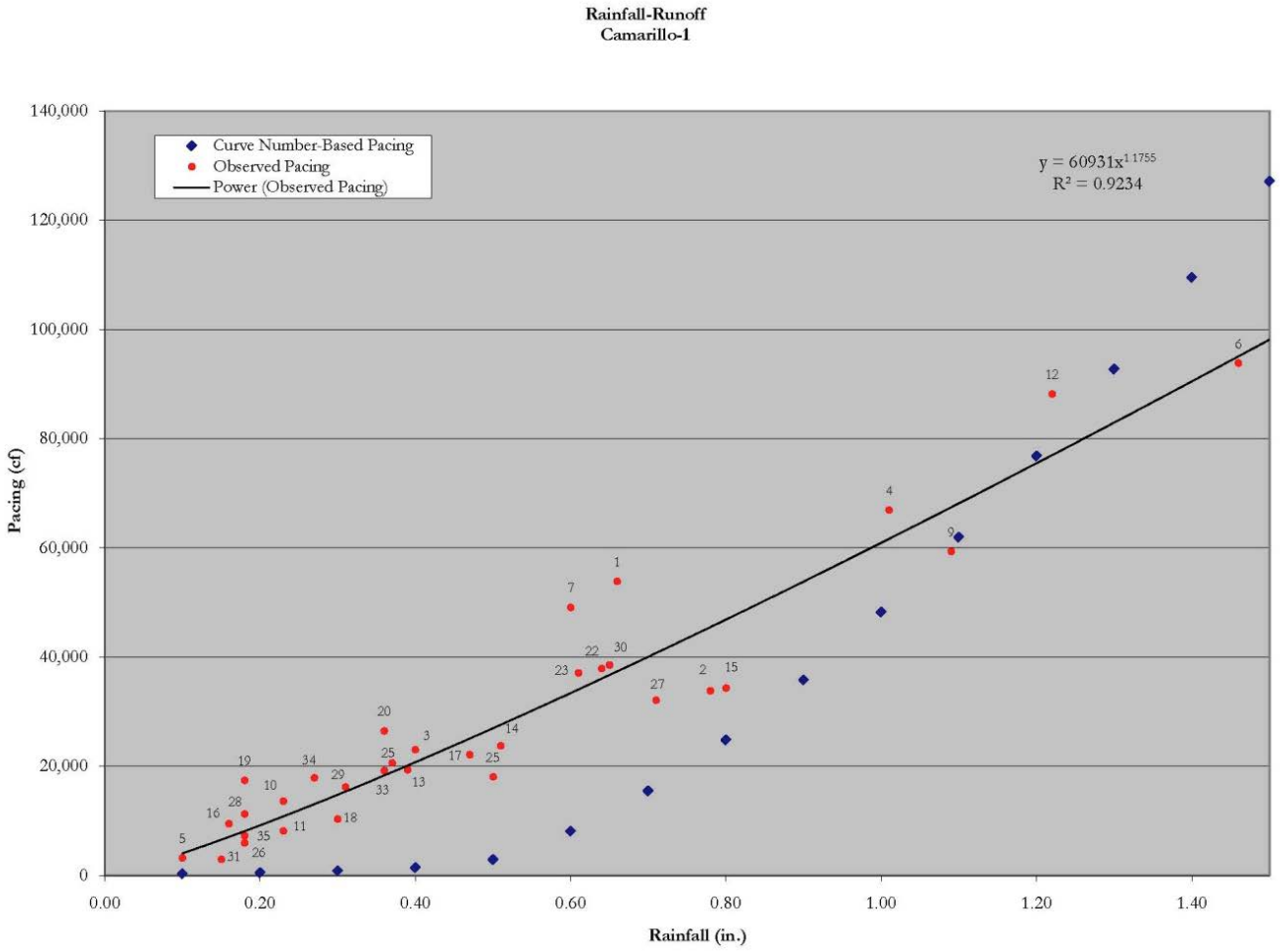
3.2 Rainfall-to-Runoff Ratios

Prior to the start of the 2009/10 monitoring season, the Stormwater Monitoring Program enlisted the VCWPD's Hydrology section to assist in modeling the expected rainfall-to-runoff (RTR) ratio for each new Major Outfall station. The Hydrology section used the NRCS Curve Number approach that is commonly used in hydrologic modeling. This model takes into account land use and soil types within each watershed, but relies on using a wetter soil moisture condition than actually exists for all but the largest of rainfall events. Despite these known limitations, these RTR ratios represented a good beginning point for flow-weighted sampler pacing. A further description of the methods and limitations of this approach, as described by the Hydrology section, can be found in Appendix C.

Over the course of the 2009/10 and 2010/11 monitoring years, the Stormwater Monitoring Program refined these model results by comparing the runoff generated at each site with the corresponding rainfall, where runoff was sufficient to be detected by the equipment and rainfall was greater than 0.1 inch. Figure 3 shows these two pieces of information, as a function of the proper pacing of the automated sampler (see Section 3.3 for a further description of sampler pacing).

Figure 3 shows all rainfall events together, regardless of antecedent soil moisture conditions. However, as more data becomes available, the RTR ratios will be divided into dry, moderate and wet antecedent soil moisture conditions as has been done for the Mass Emission stations. This will allow the Stormwater Monitoring Program to more accurately pace automated samplers based on the predicted size of each storm.

Figure 3. Example of Rainfall-to-Runoff Modeling Versus Actual Rainfall Events



3.3 Flow-Paced Sampling

To compute flow, ISCO flow meters were installed at all locations (except at the aforementioned ME-SCR, and at MO-HUE, where the pump station prevents flow from being able to be measured accurately). ISCO 4230 bubblers were installed at all other stations except MO-FIL and MO-SPA, which received ISCO 4250 area-velocity meters instead. By measuring pressure head and relating it to a rating table, ISCO 4230s are capable of calculating instantaneous discharge. Measurement accuracy of the 4230 is not affected by wind, steam, foam, turbulence, suspended solids, or rapidly changing head heights. These types of flow meters are extremely low maintenance and highly reliable and were, therefore, chosen over other contact (ISCO 4250 area-velocity) and non-contact (ISCO 4210 ultrasonic) types of flow measuring devices when possible. ISCO 4250 area-velocity meters use Doppler technology to directly measure average velocity in the flow stream, while the integral pressure transducer measures liquid depth to

determine flow area. The 4250 then calculates flow rate by multiplying the area of the flow stream by its average velocity. The 4250 is best for applications where weirs or flumes are not practical, or where submerged, full pipe, surcharged, and reverse flow conditions may occur, such as at the MO-FIL and MO-SPA monitoring sites.

Flow-paced sampling involves collecting sub-samples (aliquots) on a volumetric flow interval basis, with a set aliquot volume collected at passage of each equal, pre-set flow volume, and then compositing these aliquots into one sample for analysis. In its simplest terms, flow-paced sampling can be achieved by estimating the total flow that will pass a sampling location (which, itself, is dependent on predicted rainfall amounts and intensities) and dividing that by the number of aliquots to be taken. Using Figure 3 above as an example, an approximate 1.0" rainfall event would generate about 2.3 million cubic feet of runoff (see data point #4). When divided by 35 (the number of aliquots the Stormwater Monitoring Program attempts to take per event at each site), the proper pacing is around 67,000 cubic feet per aliquot. As mentioned above, this pacing volume is highly dependent on other variables such as intensity and antecedent soil moisture conditions.

Although composite samplers are automated, Stormwater Monitoring Program staff actively monitored storm and flow conditions during each event in order to adaptively adjust the sampler to capture the best representation of storm flow. This was made possible by the new telemetry capabilities of the Stormwater Monitoring Program. Previously, Stormwater Monitoring Program staff members were required to visit each site as the timing and amounts of predicted rainfall changed. This year, each site was equipped with a cellular modem that made communication and changes to sampler pacing and timing possible. Furthermore, the data from each of these sites was pushed via a static IP address to a centrally located SQL server and was accessible in near real-time format. Due to this new set-up, site visits were only necessary to set up the site initially, take grab samples, collect composite sample bottles, and correct physical problems with the site. A schematic of this set-up is shown in Figure 4. An example of the data available to Stormwater Monitoring Program staff in the Storm Control Center is shown in Figure 5.

Figure 4. Schematic of Remote Data Delivery and Access

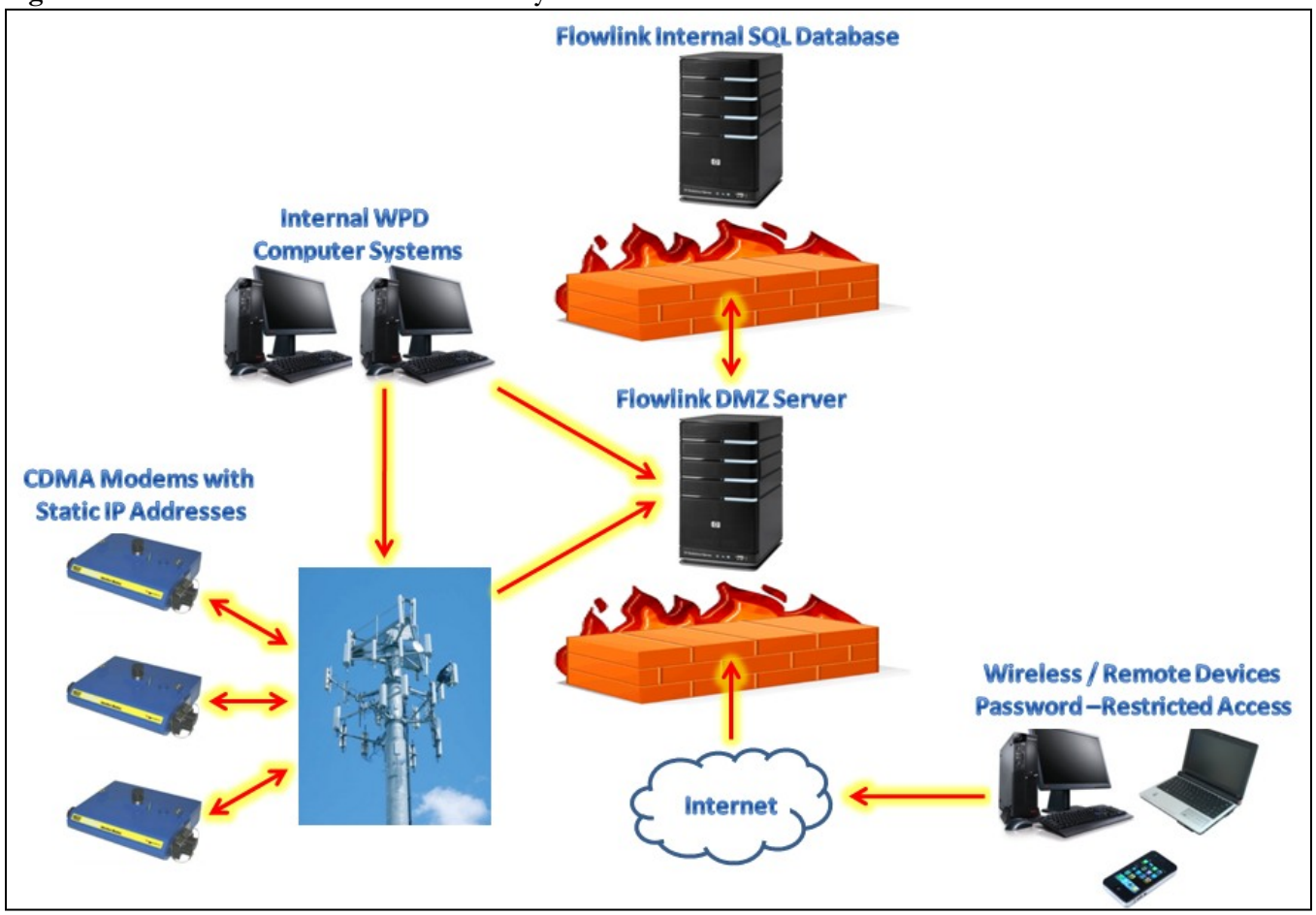


Figure 5. Real-Time Data Available in Storm Control Center

3.4 Sample Collection

As detailed in the NPDES permit, the Stormwater Monitoring Program was to sample three wet-weather events, described as a greater than 20% increase in base flow preceded by at least 7 days of dry weather(<0.10" each day), and one dry-weather event during each Permit year. Emphasis was placed on capturing the first event of the year, as well as the first part of each storm, both of which can be described as the first flush. The Stormwater Monitoring Program was able to successfully sample the necessary quantity and type of events as dictated by the NPDES permit (see Table 3-1).

In Table 3-1, Start Date/Time and End Date/Time describe the length of time the automated sampler was actually taking samples. The true time of the rainfall and related runoff event was always longer, since the samplers only began taking samples after flow had risen to greater than 20% of base flow, which took 0.10" to 0.25" of rainfall, depending on the antecedent conditions and sampling location.[2] Furthermore, flow often continued after the automated sampler had completed its sampling program, because of the Stormwater Monitoring Program's goal to ensure that enough aliquots were taken to perform the required analyses. Because of this goal, the Stormwater Monitoring Program erred

[2] This range represents the amount of rainfall needed to generate measurable flow at the monitoring station. Smaller amounts of rainfall generated positive flow in watersheds with proportionally more impervious area. All automated sampling programs were designed to begin when the water in the creek or channel exceeded the elevation of the intake strainer by more than a couple hundredths of an inch, effectively capturing the "first flush."

on the conservative side, pacing the samplers a bit quicker than the RTR tables dictated. As the RTR tables are refined, this error will become smaller, but will never completely disappear due to the inherent error in rainfall predictive abilities by both commercial and public weather forecasters. The relative timing of the onset of rainfall, commencement of the sampling program and duration of the flow for each site can be found in the event hydrographs located in Appendix B and described further in Section 3.4.1 through Section 3.4.4.

The sampling methods and sample handling procedures used during the 2010/11 monitoring year are described in *Ventura Countywide Stormwater Monitoring Program: Water Quality Monitoring Standard Operating Procedures, 2009-2014*.

Table 3-1: Site Flow Data and Event Durations

Site ID	Event No.	Event Date[a]	Average Flow (CFS)	Start Date, Time[b]	End Date, Time[b]	Event Duration
ME-CC	1	10/6/2010	232.44	10/6/2010 2:47	10/6/2010 19:29	16:42
	2	10/30/2010	105.41	10/30/2010 2:56	10/30/2010 10:21	7:25
	3	-	-	-	-	-
	4	2/15/2011	36.59	2/15/2011 14:39	2/16/2011 23:03	32:24
	5	4/27/2011	7.01	4/27/2011 9:35	4/28/2011 8:48	23:13
ME-VR2	1	10/6/2010	9.60	10/6/2010 2:42	10/6/2010 12:37	9:55
	2	10/30/2010	14.38	10/30/2010 1:27	10/30/2010 4:52	3:25
	3	-	-	-	-	-
	4	2/16/2011	22.30	2/16/2011 6:12	2/16/2011 11:40	5:28
	5	4/18/2011	17.04	4/18/2011 10:18	4/19/2011 9:50	23:32
ME-SCR	1	10/6/2010	[c]	10/6/2010 2:06	10/7/2010 1:20	23:14
	2	10/30/2010	[c]	10/30/2010 4:16	10/31/2010 3:30	23:14
	3	-	-	-	-	-
	4	2/15/2011	[c]	2/15/2011 22:55	2/16/2011 22:08	23:13
	5	4/27/2011	[c]	4/27/2011 8:50	4/28/2011 8:04	23:14
MO-CAM	1	10/6/2010	48.73	10/6/2010 0:52	10/6/2010 5:27	4:35
	2	10/30/2010	129.22	10/30/2010 1:42	10/30/2010 2:27	0:45
	3	-	-	-	-	-
	4	2/15/2011	48.28	2/15/2011 23:10	2/16/2011 3:15	4:05
	5	4/27/2011	0.25[d]	4/27/2011 9:21	4/28/2011 8:35	23:14
MO-MEI	1	10/6/2010	8.96	10/6/2010 4:45	10/6/2010 6:53	2:08
	2	-	-	-	-	-
	3	11/20/2010	11.98	11/20/2010 4:52	11/20/2010 8:51	3:59
	4	2/16/2011	2.76	2/16/2011 6:45	2/16/2011 13:58	7:13
	5	4/18/2011	0.25 [d]	4/18/2011 9:51	4/19/2011 9:05	23:14
MO-OJA	1	10/6/2010	18.58	10/6/2010 5:10	10/6/2010 6:53	1:43
	2	-	-	-	-	-
	3	11/20/2010	14.37	11/20/2010 4:56	11/20/2010 8:38	3:42
	4	2/15/2011	4.45	2/15/2011 23:45	2/16/2011 10:37	10:52
	5	4/18/2011	1.00 [d]	4/18/2011 9:10	4/19/2011 8:24	23:14

MO-VEN	1	10/6/2010	24.50	10/6/2010 0:06	10/6/2010 6:10	6:04
	2	10/30/2010	209.66	10/30/2010 1:19	10/30/2010 1:46	0:27
	3	-	-	-	-	-
	4	2/15/2011	24.60	2/15/2011 22:38	2/16/2011 4:28	5:50
	5	4/18/2011	0.25 [d]	4/18/2011 12:59	4/19/2011 12:13	23:14
MO-OXN	1	10/5/2010	26.74	10/5/2010 23:48	10/6/2010 3:32	3:44
	2	10/30/2010	44.79	10/30/2010 1:12	10/30/2010 1:54	0:42
	3	-	-	-	-	-
	4	2/15/2011	28.92	2/15/2011 22:57	2/16/2011 2:35	3:38
	5	4/27/2011	0.10 [d]	4/27/2011 9:57	4/28/2011 9:10	23:13
MO-HUE	1	10/5/2010	[c]	10/5/2010 23:38	10/6/2010 22:51	23:13
	2	10/30/2010	[c]	10/30/2010 1:48	10/30/2010 13:42	11:54
	3	-	-	-	-	-
	4	2/16/2011	[c]	2/16/2011 2:16	2/16/2011 14:10	11:54
	5	4/18/2011	[c]	4/18/2011 11:26	4/19/2011 10:40	23:14
MO-SPA	1	10/6/2010	14.77	10/6/2010 1:48	10/6/2010 3:09	1:21
	2	10/30/2010	14.74	10/30/2010 1:38	10/30/2010 3:03	1:25
	3	-	-	-	-	-
	4	2/15/2011	11.10	2/15/2011 22:24	2/16/2011 1:02	2:38
	5	4/27/2011	0.05 [d]	4/28/2011 1:00	4/28/2011 3:49	2:49
MO-FIL	1	10/6/2010	[c]	10/6/2010 2:31	10/7/2010 2:19	23:48
	2	10/30/2010	[c]	10/30/2010 2:08	10/30/2010 14:01	11:53
	3	-	-	-	-	-
	4	2/16/2011	[c]	2/16/2011 3:14	2/16/2011 15:08	11:54
	5	4/27/2011	[c]	4/27/2011 7:09	4/28/2011 6:23	23:14
MO-SIM	1	10/6/2010	14.63	10/6/2010 3:02	10/6/2010 9:48	6:46
	2	10/30/2010	70.06	10/30/2010 2:23	10/30/2010 3:28	1:05
	3	-	-	-	-	-
	4	2/15/2011	21.90	2/15/2011 23:33	2/16/2011 3:49	4:16
	5	4/27/2011	3.00 [d]	4/27/2011 7:57	4/28/2011 7:11	23:14
MO-MPK	1	10/6/2010	6.48	10/6/2010 1:48	10/6/2010 5:46	3:58
	2	10/30/2010	6.79	10/30/2010 2:31	10/30/2010 3:53	1:22
	3	-	-	-	-	-
	4	2/16/2011	3.15	2/16/2011 0:24	2/16/2011 6:04	5:40
	5	4/27/2011	0.10 [d]	4/28/2011 7:20	4/29/2011 6:34	23:14
MO-THO	1	10/6/2010	82.41	10/6/2010 1:53	10/6/2010 3:37	1:44
	2	10/30/2010	119.73	10/30/2010 3:04	10/30/2010 4:12	1:08
	3	-	-	-	-	-
	4	2/16/2011	17.80	2/16/2011 1:27	2/16/2011 7:26	5:59
	5	4/27/2011	1.55	4/27/2011 8:33	4/28/2011 7:53	23:20

*** All times PST**

[a] Event Date describes the date on which composite sampling began for a particular monitoring event.
[b] Start Date/Time and End Date/Time describe the duration samples were actually taken.
[c] Time-paced as flows cannot be accurately measured at these sites. ME-SCR: During wet weather the Santa Clara River flows through the river diversion gate and over the diversion dam. Currently, there is no flow meter installed at the river diversion gate where a majority of the wet weather flow passes. MO-FIL: Site experiences ponding and backwater effects due to natural bottom channel. MO-HUE: Flow is dependent on the release of water at the Hueneme pump station.
[d] Flow is estimated as dry weather flows are below the threshold levels for measurement.

At all monitoring stations, both composite and grab samples were collected. Composite samples were collected in glass containers and then delivered to the lab, where they were split by agitating the bottle, pouring off the necessary volume into a sample bottle, and repeating as necessary. When the splitting of a composite sample was performed, the composite sample was continually agitated to provide as much "non-invasive" mixing as possible. Sample splitting allowed homogeneous aliquots of a single, large water sample to be divided into several smaller sub-samples for different analyses. The volume of sample collected depended upon the volume required by the lab to perform requested water quality and QA/QC analyses.

Grab samples were taken as close to mid-stream, mid-depth as possible by immersing the sample bottle directly in the water (see Figure 6). In some situations, site conditions precluded such sampling and alternative sampling techniques were used. At the larger, deeper Mass Emission stations, grab samples were often gathered near the bank, but still in positive flow, often with the help of a long, extended swing sampler (see Figure 7). This technique was also employed at some of the Major Outfall stations where getting into the channel would have compromised personnel safety.

Figure 6. Grab Sampling at Mid-Stream, Mid-Depth

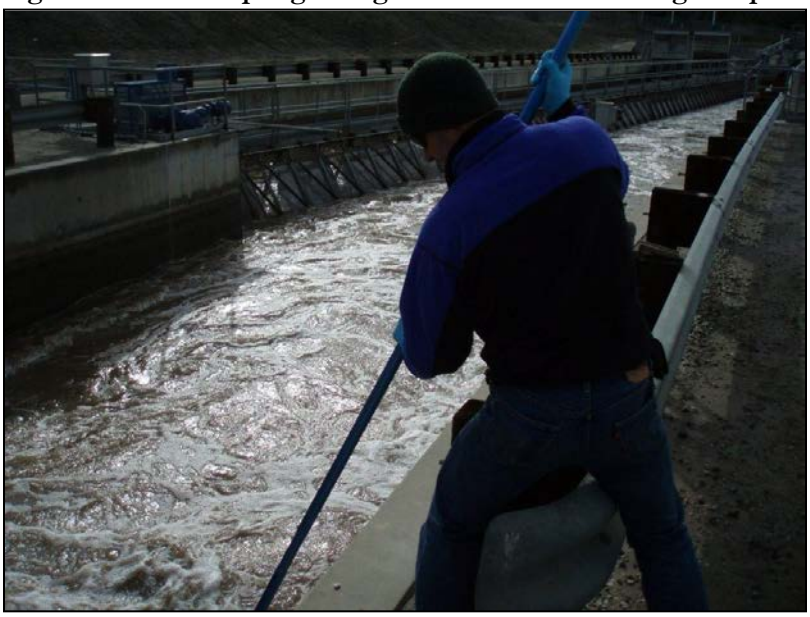
For constituents analyzed from samples required to be collected as "grabs," samples were ideally taken at the peak runoff flow to provide the best estimate for an event mean concentration (EMC). In practice, it was difficult to both predict the peak flow for each site and to allocate manpower such that all sites were grab-sampled at the storm event peak flow. It should be noted that peak flow times varied for each monitoring station due to the size and inherent characteristics of the watershed in which the site was located, as well as varying durations and intensities of rainfall. All grab and composite wet weather samples collected during the 2010/11 monitoring season are considered best available estimates of storm EMCs.

The chemical analysis of some constituents is not possible in a laboratory setting and must be performed in the field. These constituents were analyzed using pre-calibrated field meters. All field meters were calibrated according to manufacturers' directions, using vendor-supplied calibration solutions where applicable

In an effort to maintain quality control for the sampling program, the sampling crew, in cooperation with the analytical laboratories, has minimized the number of laboratories and sample bottles used for analysis. This has minimized bottle breakage, increased efficiency, and reduced the chances for contamination of the samples. Also, a dedicated monitoring team was used to provide consistent sample collection and handling.

As a means of documenting all preparatory, operational, observational, and concluding activities of a monitoring event, the Stormwater Monitoring Program produced an event summary for each monitoring event. These event summaries include, but are not limited to, information related to event duration, predicted and actual precipitation, weather conditions, the programming of sampling equipment, equipment malfunctions, sample collection and handling, and sample tracking with respect to delivery to analytical laboratories. All event summaries associated with the 2010/11 monitoring season are presented in Appendix D.

Figure 7. Grab Sampling Using Extended-Reach Swing Sampler



The Stormwater Monitoring Program also documented the actual samples it collected at each monitoring site – and the date and time of collection – during the course of an event by completing a chain of custody (COC) form for each sampling event. The COC form not only documented sample collection, but also notified an analytical laboratory that a particular sample should be analyzed for a certain constituent or group of constituents, oftentimes specifying the analytical method to be employed. Finally, the COC form acted as an evidentiary document noting how many samples were relinquished – and at what date and time – to a particular laboratory by the Stormwater Monitoring Program. All chain of custody forms associated with the 2010/11 monitoring season are presented in Appendix E.

The QA/QC sampling schedule was designed to be flexible in response to changing conditions, with the analytical chemistry laboratory being instructed to utilize VCWPD samples for MS/MSD and laboratory duplicate analyses when sample volume was sufficient, rather than for specific sites for each event. This flexibility is of benefit for several reasons. First, as is often the case, rainfall duration and intensity were difficult to predict, especially in the early part of the season. Second, extremely dry antecedent conditions made forecasting flow conditions at the various monitoring locations complicated. Finally, site-specific complications can affect sample volume. An example of this is the operation of the diversion canal at ME-SCR by UWCD, which can leave the primary intake line of the sampler out

of the water, thereby causing insufficient sample volume as the sampler pulls air instead of river water. While the Stormwater Monitoring Program has installed multiple intake lines to deal with this situation, the time at which UWCD opens the gates to the diversion structure must be known and since UWCD's operation of this structure depends on turbidity in the river, it is extremely difficult to predict when the primary intake line ceases to become useful and the sampler needs to be switched over to the secondary intake line. The flexibility in QA/QC sampling station selection allows the laboratory more options for using VCWPD samples for QA/QC tests than would otherwise be possible, due to the ability to select sites with surplus volume.

3.4.1 Event 1 (Wet)

The first rainfall event of the year began late at night on October 5, 2010, with the bulk of the rain falling during the day on October 6, 2010. The amount of rain was noted to be difficult to predict by the National Weather Service (NWS), which estimated rainfall amounts of 0.25" to 0.5" on the coast and in the valleys and 0.5" to 0.75" in the mountains. By the time the storm had moved through the area 15 hours later, approximately 1" of rain had fallen in the Ojai Valley and 0.75" of rain had fallen on the Oxnard Plain.

For two sites, ME-CC and MO-SIM, the 6712 programs ended prematurely, which resulted in a lower volume of sample than desired, but sufficient to run the analyses. It was determined that although the samplers were programmed following the manufacturer and equipment user's guide, this resulted in unintended consequences due to inadequate information provided in the guides. The sampler programming was changed for subsequent events based on the understanding of the programming at the time, which has since been adjusted to correct for additional omissions from the user's guide.

3.4.2 Event 2 (Wet)

The second rainfall event of the year began around midnight on the morning of October 30, 2010. Rainfall estimates of 0.25" to 0.67" for the coast and valleys and near 1.0" for the mountains turned out to be reasonably accurate. The storm was of short duration, with rain only falling for two to six hours at most sites, with rainfall amounts between 0.25" and 1".

The storm generated only small amounts of runoff at MO-OJA and MO-MEI, resulting in the samplers only being enabled to collect seven and three aliquots respectively, so this event was ruled invalid for those two sites. The second rain event for these sites was Event 3.

3.4.3 Event 3 (Wet)

The third monitoring event was a make-up event for MO-OJA and MO-MEI, so only these two stations were sampled during this event and it is the second wet event of the season for these sites. Sampling began on November 20, 2010, three weeks after Event 2. Rainfall predictions of 0.5" to 1.25" for the coast and valleys and 1-2" in the mountains were reasonably accurate, with 1.11' of rain falling in Meiners Oaks. Sampling times were short, 3.5 hours at MO-OJA and 4 hours at MO-MEI.

3.4.4 Event 4 (Wet)

Event 4 was almost canceled as there were a few drizzly days leading up to the event. Fortunately, the drizzle did not broach the 0.1" threshold and the rain event that began overnight on February 15-16 was able to be captured as Event

4 for all sites. The NWS predicted rainfall at 0.5-1.0" and then scaled back to 0.25-0.5". Rain quantity and duration varied across the county, with 0.8 inches in falling at Meiners Oaks and the County Government Center, and 0.5" in Moorpark over 10-13 hours.

The rain gauge at MO-VEN was not recording rainfall due to a spider and web preventing the bucket from tipping. The gauge was cleaned and the bucket manually tipped at 10:47 a.m. PST.

3.4.5 Event 5 (Dry)

The wet-season, dry-weather sampling event took place over two days, on April 18 and April 27, 2011, approximately one month after the previous rainfall. Five west county sites were sampled on April 18 (ME-VR2, MO-MEI, MO-OJA, MO-VEN, MO-HUE) and the remaining six sites were sampled on April 27 (ME-CC, ME-SCR, MO-CAM, MO-OXN, MO-SPA, MO-FIL, MO-SIM, MO-MPK, and MO-THO). During these sampling events, Stormwater Monitoring Program staff deployed sand-weighted silicone dams where necessary, to allow very low flows to pool up, thereby allowing the automated samplers the water depth necessary to take samples (see Figure 8). The innovative techniques employed during this sampling event are further discussed in *Ventura Countywide Stormwater Monitoring Program: Water Quality Monitoring Standard Operating Procedures, 2009-2014*. Sampling duration was typically about 23 hours, with the exception being MO-SPA, which is known to have short durations of runoff during dry weather and was programmed to allow for this resulting in a sampling duration of approximately three hours.

Figure 8. Typical Wet-Season, Dry-Weather Sampling Configuration

4.0 Analyses Performed

Attachment G of the NPDES permit lists the constituents to be analyzed for each event. In addition to this broad suite of analytes, Attachment B specifies other site-specific analytes that have been identified as problematic pollutants in previous years of water quality sampling. These, and any unrequested analytes for which results are obtained during method analysis, were incorporated into the sampling program and appear in the tables below. Table 4-1 shows those analytes that were gathered as discrete samples. Table 4-2 shows those analytes that were gathered as composite samples. All laboratory chemical analyses of environmental samples and preseason equipment blank samples were performed by Weck Laboratories, with the exception of analyses for indicator bacteria, which were performed by the Ventura County Public Health Lab.

Table 4-1. Analytes Derived from Discrete Samples

Grab Samples (Classification)	Field Meter Analytes (Classification)
pH (conventional)	pH (conventional)
Oil and grease (hydrocarbon)	Temperature (conventional)
Total Petroleum Hydrocarbons (hydrocarbon)	Dissolved oxygen (conventional)
Mercury (metal)	Conductivity (conventional)
2-Chloroethyl vinyl ether (organic)	Specific conductance (conventional)
Methyl tertiary butyl ether (MTBE) (organic)	Salinity (conventional)
Cyanide (conventional)	
E. coli (bacteriological)	
Enterococcus (bacteriological)	
Fecal Coliform (bacteriological)	
Total Coliform (bacteriological)	

Table 4-2. Analytes Derived from Composite Samples

Classification	Constituent	Method
Anion	Chloride	EPA 300.0
	Fluoride	EPA 300.0
	Perchlorate	EPA 314.0
Cation	Calcium (Total)	EPA 200.7
	Magnesium (Total)	EPA 200.7
Conventional	Alkalinity as CaCO3	SM 2320 B
	BOD	SM 5210 B
	COD	EPA 410.4
	Hardness as CaCO3 (Total)	EPA 200.7
	MBAS	SM 5540 C
	Phenolics	EPA 420.4
	Specific Conductance	SM 2510 B
	Total Chlorine Residual	SM 4500-Cl G
	Total Dissolved Solids	SM 2540 C
	Total Organic Carbon	SM 5310 C
	Total Suspended Solids	SM 2540 D
	Turbidity	EPA 180.1
	Volatile Suspended Solids	EPA 160.4
Metal	Aluminum (Dissolved)	EPA 200.8
	Aluminum (Total)	EPA 200.8

Classification	Constituent	Method
	Antimony (Dissolved)	EPA 200.8
	Antimony (Total)	EPA 200.8
	Arsenic (Dissolved)	EPA 200.8
	Arsenic (Total)	EPA 200.8
	Barium (Dissolved)	EPA 200.8
	Barium (Total)	EPA 200.8
	Beryllium (Dissolved)	EPA 200.8
	Beryllium (Total)	EPA 200.8
	Cadmium (Dissolved)	EPA 200.8
	Cadmium (Total)	EPA 200.8
	Chromium (Dissolved)	EPA 200.8
	Chromium (Total)	EPA 200.8
	Chromium VI (n/a)	EPA 218.6
	Copper (Dissolved)	EPA 200.8
	Copper (Total)	EPA 200.8
	Iron (Dissolved)	EPA 200.8
	Iron (Total)	EPA 200.8
	Lead (Dissolved)	EPA 200.8
	Lead (Total)	EPA 200.8
	Mercury (Dissolved)	EPA 245.1
	Mercury (Total)	EPA 245.1
	Nickel (Dissolved)	EPA 200.8
	Nickel (Total)	EPA 200.8
	Selenium (Dissolved)	EPA 200.8
	Selenium (Total)	EPA 200.8
	Silver (Dissolved)	EPA 200.8
	Silver (Total)	EPA 200.8
	Thallium (Dissolved)	EPA 200.8
	Thallium (Total)	EPA 200.8
	Zinc (Dissolved)	EPA 200.8
	Zinc (Total)	EPA 200.8
Nutrient	Ammonia as N	EPA 350.1
	Nitrate + Nitrite as N	EPA 353.2
	Nitrate as N	EPA 353.2
	Phosphorus as P (Dissolved)	EPA 365.1
	TKN	EPA 351.2
Organic	1,2,4-Trichlorobenzene	EPA 625
	1,2-Dichlorobenzene	EPA 625
	1,2-Diphenylhydrazine	EPA 625
	1,3-Dichlorobenzene	EPA 625
	1,4-Dichlorobenzene	EPA 625
	2,4,5-Trichlorophenol	EPA 625, EPA 8270Cm
	2,4,6-Trichlorophenol	EPA 625, EPA 8270Cm
	2,4-Dichlorophenol	EPA 625, EPA 8270Cm
	2,4-Dimethylphenol	EPA 625, EPA 8270Cm
	2,4-Dinitrophenol	EPA 625, EPA 8270Cm
	2,4-Dinitrotoluene	EPA 625

Classification	Constituent	Method
	2,6-Dinitrotoluene	EPA 625
	2-Chloronaphthalene	EPA 625
	2-Chlorophenol	EPA 625, EPA 8270Cm
	2-Methylphenol	EPA 625, EPA 8270Cm
	2-Nitrophenol	EPA 625, EPA 8270Cm
	3,3'-Dichlorobenzidine	EPA 625
	3-/4-Methylphenol	EPA 625, EPA 8270Cm
	4,6-Dinitro-2-methylphenol	EPA 625, EPA 8270Cm
	4-Bromophenyl phenyl ether	EPA 625
	4-Chloro-3-methylphenol	EPA 625, EPA 8270Cm
	4-Chlorophenyl phenyl ether	EPA 625
	4-Nitrophenol	EPA 625, EPA 8270Cm
	Acenaphthene	EPA 625, EPA 8270Cm
	Acenaphthylene	EPA 625, EPA 8270Cm
	Anthracene	EPA 625, EPA 8270Cm
	Benz(a)anthracene	EPA 625, EPA 8270Cm
	Benzidine	EPA 625
	Benzo(a)pyrene	EPA 525.2
	Benzo(b)fluoranthene	EPA 625, EPA 8270Cm
	Benzo(g,h,i)perylene	EPA 625, EPA 8270Cm
	Benzo(k)fluoranthene	EPA 625, EPA 8270Cm
	Bis(2-chloroethoxy)methane	EPA 625
	Bis(2-chloroethyl)ether	EPA 625
	Bis(2-chloroisopropyl)ether	EPA 625
	Bis(2-ethylhexyl)adipate	EPA 525.2
	Bis(2-ethylhexyl)phthalate	EPA 525.2
	Butyl benzyl phthalate	EPA 625
	Chrysene	EPA 625, EPA 8270Cm
	Dibenz(a,h)anthracene	EPA 625, EPA 8270Cm
	Diethyl phthalate	EPA 625
	Dimethyl phthalate	EPA 625
	Di-n-butylphthalate	EPA 625
	Di-n-octylphthalate	EPA 625
	Fluoranthene	EPA 625, EPA 8270Cm
	Fluorene	EPA 625, EPA 8270Cm
	Hexachlorobenzene	EPA 625
	Hexachlorobutadiene	EPA 625
	Hexachlorocyclopentadiene	EPA 625
	Hexachloroethane	EPA 625
	Indeno(1,2,3-cd)pyrene	EPA 625, EPA 8270Cm
	Isophorone	EPA 625
	Naphthalene	EPA 625, EPA 8270Cm
	Nitrobenzene	EPA 625
	N-Nitrosodimethylamine	EPA 625
	N-Nitrosodi-N-propylamine	EPA 625
	N-Nitrosodiphenylamine	EPA 625
	Phenanthrene	EPA 625, EPA 8270Cm

Classification	Constituent	Method
	Phenol	EPA 625, EPA 8270Cm
	Pyrene	EPA 625, EPA 8270Cm
PCB	PCB Aroclor 1016	EPA 608
	PCB Aroclor 1221	EPA 608
	PCB Aroclor 1232	EPA 608
	PCB Aroclor 1242	EPA 608
	PCB Aroclor 1248	EPA 608
	PCB Aroclor 1254	EPA 608
	PCB Aroclor 1260	EPA 608
Pesticide	2,4,5-T	EPA 515.3
	2,4,5-TP	EPA 515.3
	2,4-D	EPA 515.3
	2,4-DB	EPA 515.3
	2,4'-DDD	EPA 608
	2,4'-DDE	EPA 608
	2,4'-DDT	EPA 608
	3,5-Dichlorobenzoic acid	EPA 515.3
	4,4'-DDD	EPA 608
	4,4'-DDE	EPA 608
	4,4'-DDT	EPA 608
	Acifluorfen	EPA 515.3
	Alachlor	EPA 525.2
	Aldrin	EPA 608
	alpha-BHC	EPA 608
	alpha-Chlordane	EPA 608
	Atrazine	EPA 525.2
	Azinphos methyl	EPA 525.2
	Bentazon	EPA 515.3
	beta-BHC	EPA 608
	Bolstar	EPA 525.2
	Bromacil	EPA 525.2
	Butachlor	EPA 525.2
	Captan	EPA 525.2
	Chloramben	EPA 515.3
	Chlordane (technical)	EPA 608
	Chloropropham	EPA 525.2
	Chlorpyrifos	EPA 525.2
	Coumaphos	EPA 525.2
	Cyanazine	EPA 525.2
	Dalapon	EPA 515.3
	DCPA (Dacthal)	EPA 515.3
	delta-BHC	EPA 608
	Demeton-O	EPA 525.2
	Demeton-S	EPA 525.2
	Diazinon	EPA 525.2
	Dicamba	EPA 515.3
	Dichlorprop	EPA 515.3

Classification	Constituent	Method
	Dichlorvos	EPA 525.2
	Dieldrin	EPA 608
	Dimethoate	EPA 525.2
	Dinoseb	EPA 515.3
	Diphenamid	EPA 525.2
	Disulfoton	EPA 525.2
	Endosulfan I	EPA 608
	Endosulfan II	EPA 608
	Endosulfan sulfate	EPA 608
	Endrin	EPA 608
	Endrin aldehyde	EPA 608
	EPTC	EPA 525.2
	Ethoprop	EPA 525.2
	Ethyl parathion	EPA 525.2
	Fensulfothion	EPA 525.2
	Fenthion	EPA 525.2
	gamma-BHC (Lindane)	EPA 608
	gamma-Chlordane	EPA 608
	Glyphosate	EPA 547
	Heptachlor	EPA 608
	Heptachlor epoxide	EPA 608
	Malathion	EPA 525.2
	Merphos	EPA 525.2
	Methoxychlor	EPA 608
	Methyl parathion	EPA 525.2
	Metolachlor	EPA 525.2
	Metribuzin	EPA 525.2
	Mevinphos	EPA 525.2
	Mirex	EPA 608
	Molinate	EPA 525.2
	Naled	EPA 525.2
	Pentachlorophenol	EPA 515.3
	Phorate	EPA 525.2
	Picloram	EPA 515.3
	Prometon	EPA 525.2
	Prometryn	EPA 525.2
	Ronnel (Fenchlorphos)	EPA 525.2
	Simazine	EPA 525.2
	Stirophos (Tetrachlorvinphos)	EPA 525.2
	Terbacil	EPA 525.2
	Thiobencarb	EPA 525.2
	Tokuthion	EPA 525.2
	Toxaphene	EPA 608
	Trichloronate	EPA 525.2
	Trithion	EPA 525.2

5.0 Quality Assurance / Quality Control

The following is a discussion of the results of the quality assurance and quality control (QA/QC) analysis performed on the 2010/11 stormwater quality monitoring data. The data were evaluated for overall sample integrity, holding time exceedances, contamination, accuracy, and precision using field- and lab-initiated QA/QC sample results according to the Stormwater Monitoring Program's *Data Quality Evaluation Plan* and *Data Quality Evaluation Standard Operating Procedures*. The *Data Quality Evaluation Plan* (DQEP) describes the process by which water chemistry data produced by the Stormwater Monitoring Program are evaluated. Data quality evaluation is a multiple step process used to identify errors, inconsistencies, or other problems potentially associated with Stormwater Monitoring Program data. The DQEP contains a detailed discussion of the technical review process, based on U.S. Environmental Protection Agency (EPA) guidance and requirements set forth by the Stormwater Monitoring Program used to evaluate water quality monitoring data. The DQEP provides a reference point from which a program-consistent quality assurance/quality control (QA/QC) evaluation can be performed by the Stormwater Monitoring Program. The *Data Quality Evaluation Standard Operating Procedures* (SOPs) document provides a set of written instructions that documents the process used by the Stormwater Monitoring Program to evaluate water quality data. The SOPs describe both technical and administrative operational elements undertaken by the Stormwater Monitoring Program in carrying out its DQEP. The SOPs act as a set of prescriptive instructions detailing in a step-by-step manner how District staff carry out the data evaluation and data quality objectives set forth in the DQEP. QA/QC sample results from the 2010/11 monitoring season are presented in Appendix F.

QA/QC sample collection and analysis relies upon QA/QC samples collected in the field (such as equipment blank, field duplicate, and matrix spike samples), as well as QA/QC samples prepared and analyzed by the analytical laboratory (i.e., lab-initiated samples, such as method blanks, filter blanks, and laboratory control spikes) performing the analysis. The actual chemical analysis of field-initiated and lab-initiated QA/QC samples is conducted in an identical manner as the analysis of field-collected environmental samples. After all analyses are complete, the results of the field-initiated and lab-initiated QA/QC sample results are compared to particular data quality objectives (DQOs), also commonly referred to as "QA/QC limits." These limits are typically established by the analytical laboratory based on EPA protocols and guidance. However, in some cases, the Stormwater Monitoring Program will set a particular DQO, such as the QA/QC limit for field duplicate results.

QA/QC sample results are evaluated in order to compare them to their appropriate QA/QC limits and identify those results that fall outside of these limits. The QA/QC evaluation occurs in two separate steps as the laboratory will review those results that fall outside of its QA/QC limits and typically label these results with some type of qualification or note. If a QA/QC sample result falls grossly outside of its associated QA/QC limit, and thus indicates that there is a major problem with the lab's instrumentation and/or analytical process, then the laboratory should re-run both the affected QA/QC and environmental samples as necessary. The second step in the QA/QC evaluation process occurs when the Stormwater Monitoring Program performs an overall sample integrity evaluation, as well as specific holding time, contamination, accuracy, and precision checks. This second evaluation step provides an opportunity to thoroughly review the Stormwater Monitoring Program's data to identify potential errors in a laboratory's reporting of analytical data and/or recognize any significant data quality issues that may need to be addressed. After this evaluation the Stormwater Monitoring Program is ready to qualify their environmental data as necessary based on the findings of the QA/QC assessment.

Data qualification occurs when the Stormwater Monitoring Program assigns a particular program qualification to an analytical result as a means to notify data users that the result was produced while one or more DQOs or QA/QC limitations were exceeded. Environmental sample results are qualified in order to provide the user of these data with information regarding the quality of the data. Depending on the planned use of the data, qualifications may help to determine whether or not the data are appropriate for a given analysis. In general, data that are qualified with anything other than an "R" (used to signify a rejected data point) are suitable for most analyses. However, the qualifications assigned to the data allow the user to assess the appropriateness of the data for a given use. The Stormwater Monitoring Program used its NDPES Stormwater Quality Database to conduct a semi-automated QA/QC evaluation of the current season's data contained in the database. The use of the database allows the Stormwater Monitoring Program to expedite and standardize the QA/QC evaluation of its monitoring data in conjunction with the use of the DQEP and SOPs. After reviewing the qualifications assigned to each qualified data point in the 2010/11 monitoring year data set, the environmental data are considered to be of high quality and sufficient for all future general uses. However, all data qualifiers should be reviewed and considered prior to the use of the data in a specific analysis or application. Environmental data from the 2010/11 monitoring season are presented in Appendix G.

Both environmental and field-initiated QA/QC samples were collected in the field using clean sampling techniques. To minimize the potential for contamination, Weck Laboratories cleaned all bottles used for composite samples. Only new containers were used for grab sample collection, with the appropriate preservative added to grab bottles by Weck. Intake lines for the automated samplers were flushed using distilled water. Designated sampling crew leaders were used to ensure that consistent sample collection and handling techniques were followed during every monitoring event.

Field-initiated QA/QC samples performed by the Stormwater Monitoring Program during the 2010/11 monitoring season included field blanks, field duplicates, and equipment blanks. Equipment blanks are typically prepared prior to the start of the monitoring season to check that tubing, strainers, and sample containers aren't sources of contamination for the Stormwater Monitoring Program's environmental samples. Tubing equipment blanks were collected from the sampling equipment by passing blank water through cleaned tubing and into brand new sample bottles. Composite bottle equipment blanks were collected by adding blank water to a composite bottle and allowing it to sit at <4°C for 24 hours before being split into brand new sample bottles for analysis. After collection, equipment blanks were submitted to the analytical laboratory and analyzed using the same methods as those employed for routine environmental sample analysis.

5.1 Equipment Blanks

Equipment blanks, often referred to as pre-season blanks, were collected prior to the monitoring season to test for contamination in sample containers (e.g., composite bottles) and sample equipment (e.g., intake lines, tubing, and strainers). This process consists of running laboratory-prepared blank water through sampler tubing to identify potential contamination of field-collected samples as a result of "dirty" tubing. The blank water (deionized water) used to evaluate contamination of composite bottles and tubing can also be analyzed in order to check for contamination of this analytical sample medium. Equipment blank "hits" or measured concentrations above the laboratory's quantitation limit (RL, PQL, etc.) for a constituent are assessed and acted upon using the guidelines listed below:

1. The Stormwater Monitoring Program requests that the laboratory confirm the reported results against lab bench sheets or other original analytical instrument output. Any calculation or reporting errors should be corrected and reported by the laboratory in an amended laboratory report.
2. If the previous step does not identify improperly reported results, then the analytical laboratory should be asked to identify any possible sources of contamination in the laboratory.
3. If no laboratory contamination is identified, then a note should be made that documents that the equipment blank results indicate that the sample equipment may have introduced contamination into the blank samples.

When practical, remedial measures are initiated by the Stormwater Monitoring Program to replace or re-clean sampling equipment and re-analyze equipment blank samples in an effort to eliminate field contamination. Only the results of field-initiated and laboratory-initiated QA/QC samples associated with the environmental samples collected for any given monitoring event are used to qualify Stormwater Monitoring Program environmental samples. However, pre-season analyses provide useful information regarding possible sources of environmental sample contamination and insight into how contamination issues might be resolved.

This year, the Stormwater Monitoring Program performed multiple tubing blanks at the MO-MEI site to test different cleaning methods. Three types of cleaning methods were used: distilled water only (distilled), 1% nitric acid with a deionized water rinse (nitric), and 1% nitric acid with a deionized water rinse followed by a concentrated, laboratory-grade methanol flush (methanol). Tubing blank samples were collected on September 29, 2010 for Preseason 1, prior to monitoring Event 1 (October 6, 2010) of the 2010/11 monitoring season. An additional methanol-cleaned blank was collected on October 29, 2010, for Preseason 2, concurrent with Event 2 (October 29, 2010) of the 2010/11 monitoring season. Two composite bottle blanks were collected to test the effectiveness of cleaning the composite bottles with methanol. The first was collected on September 30, 2011 for Preseason 1, prior to monitoring Event 1 (October 6, 2010) of the 2010/11 monitoring season, and the second was collected on October 30, 2011 for Preseason 2, concurrent with Event 2 (October 29, 2010) of the 2010/11 monitoring season.

The blanks for Preseason 1 on September 29-30 were each analyzed by EPA 200.8 for total metals, EPA 625 for semi-volatile organics, and EPA 353.2 for nitrate + nitrite as nitrogen, with the exception of the nitric-cleaned tubing blank, which was only tested by EPA 625. The blanks for Preseason 2 on October 29-30 were each analyzed by EPA 200.8 for total metals, EPA 625 for semi-volatile organics, EPA 200.7 for iron, and EPA 245.1 for total mercury.

For Preseason 1, no contaminants were found above the reporting limit in the nitric-treated tubing blank. Several constituents were detected above the reporting limits in the other Preseason 1 blanks, as shown in Table 5-1. Aluminum and copper were detected in the distilled and methanol tubing blanks, and chromium was detected in the distilled tubing blank, but all were at levels below that typically found in stormwater, including levels detected in Event 1. Similarly, aluminum and copper were detected in the composite bottle blank, but at levels below that typically found in stormwater, including Event 1. Nitrate-nitrite was not detected in either of the tubing blanks, but it was detected in the composite bottle blank, where it was the only constituent that was detected in the same range as that found in stormwater. The Basin Plan does not include a limit for nitrate-nitrite, but the nitrate limit is 10 mg/L (10,000 µg/L), which is far greater than any contamination that might be occurring from the sampling equipment, especially considering that all other samples tested during Preseason 1 and 2 did not detect nitrate-nitrite above the reporting limit.

For Preseason 2, nitrate-nitrate was not detected in the tubing blank or the composite blank. The organic constituents diethyl phthalate and isophorone were detected in the methanol tubing blank, but were either (isophorone) not found above the reporting limit in stormwater sampling throughout the course of the monitoring season, or were found at levels below that of the tubing blank (diethyl phthalate).
Aluminum was detected in the tubing blank and copper was detected in the composite bottle blank, but at levels far below that typically found in stormwater.

Based on these results, the Stormwater Monitoring Program determined that cleaning procedures were adequate and no follow-up was necessary. Furthermore, no environmental samples were qualified by the Stormwater Monitoring Program based on the results of pre-season equipment blank analyses. The additional cleaning steps tested during Preseason 1 and 2 do not appear to provide sufficient improvement of contaminant removal to justify the use of the additional cleaning materials at this time. The cleaning procedures will be reexamined during the preseason tests prior to the 2011/12 monitoring season.

Table 5-1. Constituents Detected in Equipment Blanks Before Event 1

Constituent	Tubing Blank: Distilled Only Concentration (µg/L)	Tubing Blank: Distilled, Nitric, Methanol Concentration (µg/L)	Composite Blank: Distilled, Nitric, Methanol Concentration (µg/L)	Reporting Limit (µg/L)	Stormwater Range (when detected) Concentration (µg/L)
Preseason 1					**Event 1**
Aluminum	21	9.3	5.2	5	290 – 22,000
Chromium	-	0.37	-	0.2	0.88 – 34
Copper	1.5	0.87	1.5	0.5	3.8 – 70
Nitrate+Nitrite as N	-	-	690	100	300 – 2200

Constituent	Tubing Blank: Distilled Only Concentration (µg/L)	Tubing Blank: Distilled, Nitric, Methanol Concentration (µg/L)	Composite Blank: Distilled, Nitric, Methanol Concentration (µg/L)	Reporting Limit (µg/L)	Stormwater Range (when detected) Concentration (µg/L)
Preseason 2					**Event 2**
Aluminum	-	8.1	-	5	100 – 15,000
Copper	-	-	0.96	0.5	1.5 – 83
Diethyl phthalate	-	9.6	-	2	ND – 3.2
Isophorone	-	1.6	-	1	ND

5.2 Field and Laboratory Duplicates

Duplicate samples – both field duplicates and lab duplicates – are collected in the field using the same techniques as used for all environmental sample collection. For composite samples a larger volume of water is collected during the monitoring event, and then the duplicates are split in the field (when generating a field duplicate) or in the lab (when generating a lab duplicate) while constantly mixing the contents of the composite containers to ensure the production of homogeneous duplicate samples. The Stormwater Monitoring Program does not collect field duplicates for composite samples as samples are not split in the field due to the risk of sample contamination and breakage. In the case of grab samples, two samples are collected side-by-side or in immediate succession into separate sample bottles

when collecting an environmental sample and its field duplicate. Depending on the volume of water required to perform a particular analysis, a lab duplicate analysis of a grab sample may require the collection of a separate sample, or may be run on a single environmental sample.

Field duplicate grab samples were collected during Event 1 and Event 3. Laboratory-initiated laboratory duplicate samples were analyzed during all sampling events. Results are shown in Table 5-2 and Table 5-3. All DQOs for field and laboratory duplicate samplers were met by laboratories during the 2010/11 monitoring season, as shown in Table 5-2 and Table 5-3.

Table 5-2. Field Duplicate Success Rates

Classification	Constituent	Method	Total Samples	Samples Outside DQO	Success Rate
Bacteriological	Total coliform / *E. coli*	MMO-MUG	2	0	100
Bacteriological	Fecal coliform	SM 9221 E	2	0	100
Conventional	Cyanide	EPA 335.4	2	0	100
Hydrocarbon	Oil and grease/TPH	EPA 1664A		0	100
Metal	Mercury	EPA 245.1	1	0	100
Organic	Various	EPA 524.2		0	100

Table 5-3. Laboratory Duplicate Success Rates

Classification	Constituent	Method	Total Samples	Samples Outside DQO	Success Rate
Conventional	Volatile Suspended Solids	EPA 160.4	9	0	100
Conventional	Turbidity	EPA 180.1	10	0	100
Conventional	Alkalinity as CaCO3	SM 2320 B	10	0	100
Conventional	Chemical Oxygen Demand	EPA 410.4	5	0	100
Conventional	Specific Conductance	SM 2510 B	9	0	100
Conventional	Total Dissolved Solids	SM 2540 C	14	0	100
Conventional	Total Suspended Solids	SM 2540 D	10	0	100
Metal	Chromium VI	EPA 218.6	1	0	100

5.3 Holding Time Exceedances

The large majority of analytical methods used to analyze water quality samples specify a certain time period in which an analysis must be performed in order to ensure confidence in the result provided from the analysis.[3] A holding time can be either the time between sample collection and sample preparation (the preparation holding time limit) or between the sample preparation and sample analysis (the analysis holding time limit). If a particular sample doesn't require any pre-analysis preparation, then the analysis holding time is the time between sample collection and sample analysis.

These elapsed times are compared to holding time values (typically provided in EPA guidance for analytical methods) to determine if a holding time exceedance has occurred. Elapsed times greater than specified holding time limits are

[3] A sample that remains unanalyzed for too long a period of time sometimes shows analytical results different from those that would have been observed had the sample been analyzed earlier in time. This difference is due to the breakdown, transformation, and/or dissipation of substances in the sample over time.

considered to exceed the Stormwater Monitoring Program's DQO for this QA/QC sample type. All holding times were met by laboratories during the 2010/11 monitoring season, with the exceptions as shown in Table 5-4.

Table 5-4. Holding Time Exceedances

Classification	Total Samples	Samples Outside DQO	Success Rate
Anion	252	0	100
Bacteriological	183	0	100
Cation	168	0	100
Conventional	1084	4[a]	99.5
Hydrocarbon	116	0	100
Metal	2626	0	100
Nutrient	698	0	100
Organic	7424	29[b]	99.4
PCB	588	0	100
Pesticide	8414	0	100

[a] Total chlorine residual is a Pollutant of Concern for ME-CC due to the contributions of wastewater treatment plants. The method requires that this constituent be analyzed "immediately" and the permit requires that it be sampled as a composite sample, which combined result in an exceedance of the hold time for each event.
[b] The sample was received by the laboratory and extracted within the seven day holding time but the original extraction was not reportable due to a dirty sample matrix resulting in no recovery of surrogates or internal standards. The laboratory re-extracted the sample outside of the seven day holding time and performed the analysis, which met the method's recovery requirements.

5.4 Other QA/QC Methods and Analyses

A variety of other QA/QC methods are used by the Stormwater Monitoring Program and associated laboratories to determine the quality of the data. These include method blanks, matrix spikes and matrix spike duplicates (MS/MSD), surrogate spikes, and laboratory control spikes. For many of these, the relative percent difference between two separate samples is computed to determine whether or not the laboratory has achieved the necessary DQO, as described in Section 5.0. Results of QA/QC analyses performed on individual samples can be found in Appendix F and Appendix G.

5.5 QA/QC Summary

In summary, a total of 11,985 environmental samples were analyzed during the 2010/11 monitoring season. Of these, 11,662 were accepted as unqualified, meaning all DQOs were met for that particular sample. The Stormwater Monitoring Program's QA/QC evaluation process identified 323 environmental samples in need of qualification, which translates into the Stormwater Monitoring Program achieving a 97.3% success rate in meeting program data quality objectives. No samples were rejected from the dataset.

Overall, the three wet-weather and one dry-weather events monitored per site during the 2010/11 monitoring season produced a high quality data set in terms of the low percentage of qualified data, as well as the low reporting levels achieved by all laboratories analyzing the Stormwater Monitoring Program's water quality samples.

6.0 Water Quality Results

The NDPES permit requires the Stormwater Monitoring Program to report the results of stormwater monitoring to the Regional Board in two ways. First, within 90 days of a monitoring event, analytical results must be submitted electronically and must highlight elevated constituent levels relative to Basin Plan and CTR acute criteria. The Stormwater Monitoring Program met this requirement for all monitoring events during the 2010/11 season. Second, an Annual Storm Water Report must be submitted by December 15th, and must highlight those same elevated levels relative to applicable water quality objectives. The contents of this report fulfill that requirement.

For the analysis of wet-weather data (Events 1-4), the Basin Plan objectives and the acute, freshwater objectives in the CTR were used. For some constituents, the California Toxics Rule does not contain acute objectives. In these cases, the California Toxics Rule Human Health (Organisms Only) objectives were used in the wet-weather comparison because these constituents have no other objectives for comparison. These objectives were used even though they are based on long-term risks to human health that cannot be directly correlated to stormwater discharges. CTR chronic criteria were not used for wet-weather analyses because acute criteria better reflect the short-term storm event exposure experienced by organisms, as compared to the long-term exposure considered by chronic criteria.

For the analysis of dry-weather data (Event 5), the Basin Plan objectives and the chronic, freshwater objectives in the CTR were used. For some constituents, the CTR does not contain chronic objectives. In these cases, the CTR Human Health (Organisms Only) objectives were used in the dry-weather comparisons because these constituents have no other objectives for comparison.

For all events, objectives in the CTR for metals were calculated based on the hardness of the water. This analysis used the hardness value measured at a particular site during a particular monitoring event for calculating a certain metals objective, except when the measured hardness was greater than 400 mg/L. The CTR sets a hardness cap of 400 mg/L for calculating the objectives, so any measured hardness value above 400 mg/L was set equal to 400 mg/L for the purposes of the calculation.

6.1 Mass Emission Calculations

Mass loadings were estimated for constituents detected at the ME-CC and ME-VR2 Mass Emission stations during the 2010/11 monitoring season. Mass loadings could not be calculated at the ME-SCR station because total flow could not be accurately measured, as described in Section 2.1.

Mass loads were calculated by using the average flow (measured in cubic feet per second, cfs) estimated over the duration of a monitoring event and the concentrations of detected constituents. Event duration was defined as the number of hours elapsed between the collection of the first and the final aliquots by the composite sampler at each site. Storm events monitored during 2010/11 at the ME-CC and ME-VR2 stations lasted from just over 3 hours (Event 2 at ME-VR2) to just over 30 hours (Event 4 at ME-CC). Based on the average flow rate for an event, loadings were calculated in lbs/event to allow for comparisons between sites as well as between events (see example in Table 6-1). These mass loading estimates are presented in Table 6-2 and Table 6-3.

Table 6-1. Example Mass Loading Calculation

Event 1 at ME-CC
Chloride concentration: 72 mg/L Event duration: 16 hours, 42 minutes = 16.70 hours
Average flow rate: 232.44 cfs 232.44 x 7.48 gal/cf x 3.785 L/gal = 6580.8 L/sec
Load = concentration x volume 6580.8 L/sec x 72 mg/L = 473818 mg/sec 473818 mg/sec x 60 sec/min x 60 min/hr x 16.70 hr/event x 1 kg/10^6 mg x 2.2 lb/kg = **62,670 lb/event**

Table 6-2. Estimated Mass Loadings at ME-CC

Classification	Constituent	Event 1 (Wet) 10/06/2010 16.70 hrs. (lbs/event)	Event 2 (Wet) 10/30/2010 7.42 hrs. (lbs/event)	Event 4(Wet) 2/16/2011 32.40 hrs. (lbs/event)	Event 5 (Dry) 4/27/2011 23.22 hrs. (lbs/event)
Anion	Chloride	62700	13300	37200	6930
Anion	Fluoride	226	42.1	101	19.7
Cation	Calcium (Total)	36600	9120	19400	3210
Cation	Magnesium (Total)	21800	5440	10600	2150
Conventional	BOD	11300	1750	1670	54.7*
Conventional	COD	56600	14900	6650	ND
Conventional	MBAS	ND	ND	ND	1.0*
Conventional	Phenolics	74.9	6.7	8.5	1.5
Conventional	Total Chlorine Residual	113*	21.0	3.5*	1.3*
Conventional	Total Dissolved Solids	348000	71900	197000	36500
Conventional	Total Organic Carbon	11300	1490	1590	139
Conventional	Total Suspended Solids	244000	64900	25800	255
Conventional	Volatile Suspended Solids	43500	8770	3460	ND
Metal	Aluminum (Total)	5570	2630	558	3.5
Metal	Antimony (Total)	0.66	0.10	0.14	0.01*
Metal	Arsenic (Total)	3.7	1.2	0.96	0.14*
Metal	Barium (Total)	54.0	24.6	11.4	1.2
Metal	Beryllium (Total)	0.18	0.09	0.02*	ND
Metal	Cadmium (Total)	0.53	0.28	0.09	0.01
Metal	Chromium (Total)	17.4	8.2	2.0	0.02
Metal	Chromium VI	0.05*	0.02*	0.06*	0.01*
Metal	Copper (Total)	17.4	7.7	2.5	0.13
Metal	Iron (Total)	8090	4740	851	5.1
Metal	Lead (Total)	5.1	3.0	0.66	0.01*
Metal	Mercury (Total)	0.05	0.01	0.01*	ND
Metal	Nickel (Total)	18.3	7.9	2.6	0.18
Metal	Selenium (Total)	1.4	0.33	0.51	0.09
Metal	Silver (Total)	0.09*	0.05	0.01*	0.001*
Metal	Thallium (Total)	0.07*	0.04	0.01*	ND

Classification	Constituent	Event 1 (Wet) 10/06/2010 16.70 hrs. (lbs/event)	Event 2 (Wet) 10/30/2010 7.42 hrs. (lbs/event)	Event 4(Wet) 2/16/2011 32.40 hrs. (lbs/event)	Event 5 (Dry) 4/27/2011 23.22 hrs. (lbs/event)
Metal	Zinc (Total)	49.6	24.6	7.4	0.44
Nutrient	Ammonia as N	296	93.0	39.9	4.0
Nutrient	Nitrate + Nitrite as N	1910	438	1860	307
Nutrient	Nitrate as N	1910	386	1810	307
Nutrient	Phosphorus as P (Total)	1130	474	505	58.4
Nutrient	TKN	2790	912	346	21.5
Organic	2,4,6-Trichlorophenol	ND	ND	0.11*	0.01*
Organic	Diethyl phthalate	ND	0.25*	0.45*	0.08
Pesticide	4,4'-DDE	0.01*	0.03	0.01*	ND
Pesticide	4,4'-DDT	0.005*	0.01	0.002*	ND
Pesticide	Chlorpyrifos	0.01	0.01	ND	ND
Organic	Phenol	ND	ND	ND	0.02*
Pesticide	DCPA (Dacthal)	0.73	0.19	0.36*	0.07
Pesticide	Diazinon	ND	0.003	ND	0.0002*
Pesticide	Glyphosate	17.4	0.63*	0.53*	ND
Pesticide	Malathion	0.15	0.04	0.15	ND

ND – Constituent not detected, and, therefore, no estimated mass loading was calculated.

* - Calculation of mass loading derived from result flagged as DNQ - constituent detected but not quantified (MDL < result < RL).

Table 6-3. Estimated Mass Loadings at ME-VR2

Classification	Constituent	Event 1 (Wet) 10/06/2010 9.92 hrs. (lbs/event)	Event 2 (Wet) 10/30/2010 3.42 hrs. (lbs/event)	Event 4(Wet) 2/16/2011 5.47 hrs. (lbs/event)	Event 5 (Dry) 4/18/2011 23.53 hrs. (lbs/event)
Anion	Chloride	1600	783	1450	4140
Anion	Fluoride	8.3	4.2	12.0	41.4
Anion	Perchlorate	ND	0.03	ND	ND
Cation	Calcium (Total)	2780	1210	3010	10800
Cation	Magnesium (Total)	897	331	903	2970
Conventional	BOD	137	50.7	118	98.9*
Conventional	COD	470	79.4	194	1440
Conventional	MBAS	0.56*	0.42*	0.60*	ND
Conventional	Phenolics	1.3	0.82	1.2	3.8
Conventional	Total Dissolved Solids	18400	7830	20000	68300
Conventional	Total Organic Carbon	149	45.2	68.4	171
Conventional	Total Suspended Solids	363	243	465	ND
Conventional	Volatile Suspended Solids	128	44.1*	ND	ND
Metal	Aluminum (Total)	6.2	3.0	4.9	0.90
Metal	Antimony (Total)	0.005*	0.002*	0.004*	0.01*
Metal	Arsenic (Total)	0.05	0.01	0.01	0.03*
Metal	Cadmium (Total)	0.003	0.001	0.002*	0.01*

Classification	Constituent	Event 1 (Wet) 10/06/2010 9.92 hrs. (lbs/event)	Event 2 (Wet) 10/30/2010 3.42 hrs. (lbs/event)	Event 4(Wet) 2/16/2011 5.47 hrs. (lbs/event)	Event 5 (Dry) 4/18/2011 23.53 hrs. (lbs/event)
Metal	Chromium (Total)	0.02	0.01	0.02	0.02*
Metal	Chromium VI	ND	0	0.004*	0.01*
Metal	Copper (Total)	0.08	0.03	0.04	0.09
Metal	Iron (Total)	34.2	8.3	10.4	3.9
Metal	Lead (Total)	0.01	0.004	0.01	0.002*
Metal	Mercury (Total)	0.001*	0.0003*	0.0005*	0.003*
Metal	Nickel (Total)	0.14	0.05	0.09	0.23
Metal	Selenium (Total)	0.02	0.02	0.05	0.19
Metal	Silver (Total)	ND	0	0.001*	0.002*
Metal	Zinc (Total)	0.26	0.05*	0.07*	0.07*
Nutrient	Ammonia as N	0.003	0.001*	ND	ND
Nutrient	Nitrate + Nitrite as N	6.4	2.8	35.6	144
Nutrient	Nitrate as N	6.4	2.8	35.6	144
Nutrient	Phosphorus as P (Total)	4.1	1.9	1.5	1.5
Nutrient	TKN	15.6	5.6	9.6	ND
Organic	Bis(2-ethylhexyl)phthalate	ND	0.02*	ND	ND
Pesticide	Chlorpyrifos	ND	0.004	ND	ND
Pesticide	Diazinon	0.001*	ND	ND	ND
Pesticide	Heptachlor	0.0001*	ND	ND	ND
Pesticide	Malathion	0.002	ND	ND	ND

ND – Constituent not detected, and, therefore, no estimated mass loading was calculated.

* - Calculation of mass loading derived from result flagged as DNQ - constituent detected but not quantified (MDL < result < RL).

6.2 Water Quality Objective Exceedances and Elevated Levels

Table 6-5 presents water quality objective exceedances at Mass Emission stations based on an analysis of the 2010/11 wet-season stormwater monitoring data. Constituents that were found at elevated levels[4] at sites upstream (i.e., related Major Outfall stations) are shown in bold and highlighted (see Section 6.6 through Section 6.8 for a discussion of the relationship between the Mass Emission and Major Outfall stations). Table 6-6 presents the elevated levels of constituents at Major Outfall stations based on an analysis of the 2010/11 wet-season stormwater monitoring data. Constituents that exceeded the water quality objective at sites downstream (i.e., related Mass Emission stations) are shown in bold and highlighted (again, see Section 6.6 through Section 6.8 for a discussion of the relationship between the Mass Emission and Major Outfall stations).

6.3 Ventura River Mass Emission Station (ME-VR2) Water Quality Objective Exceedances and Elevated Levels Corrections

The Ventura River Mass Emission station (ME-VR2) was installed during the 2004/05 monitoring year when the original station, ME-VR was decommissioned due to safety concerns as a result of landslide activity. The station was

[4] "Elevated levels" is used to describe those concentrations that are above a particular water quality standard. These amounts are not referred to as "exceedances," as has been done for the Mass Emission stations, since, technically, those standards are only applicable to receiving waters, not to the outfalls that were monitored.

moved approximately one mile downstream to a safe location, which was still representative of the runoff of the Ventura River watershed. The new location for the station put it into a different reach of the river according to the Basin Plan (between the confluence with Weldon Canyon and Main Street rather than between Casitas Vista Road and the confluence with Weldon Canyon), with higher limits for total dissolved solids (TDS), sulfate, chloride, boron, and nitrogen. Of these limits, TDS, chloride, and nitrogen are monitored as part of the NPDES permit by the Stormwater Monitoring Program. The Program's database was not updated to reflect the different limits for this reach.

The database has now been updated and the following corrections are required for past reports for these constituents. No changes to the reported exceedances of nitrogen (defined in the basin plan as nitrate-nitrogen plus nitrite-nitrogen, or NO3-N + NO2-N) are necessary, as no exceedances occurred based on the previous limit. The results in Table 6-4 show the results affected by the change in water quality objectives. Those results with "No" in the "Current Limit Exceedance" column should not be considered exceedances based on the corrected water quality objectives listed for this reach. The reporting of elevated levels for the two Major Outfall stations in the Ventura River watershed, MO-MEI and MO-OJA, remain unchanged and unaffected by the update to the limits for ME-VR2.

Table 6-4: Effect of Updated Limits on ME-VR2 Exceedances

Constituent	SiteID	EventID	Result	Units	ME-VR Limit (Old)	ME-VR2 Limit (Actual)	Current Limit Exceedance
Chloride	ME-VR2	2004/05-5	160	mg/L	60	300	No
Chloride	ME-VR2	2005/06-3	66.5	mg/L	60	300	No
Chloride	ME-VR2	2006/07-1	256.02	mg/L	60	300	No
Chloride	ME-VR2	2006/07-2	123.195	mg/L	60	300	No
Chloride	ME-VR2	2006/07-3	62.92	mg/L	60	300	No
Chloride	ME-VR2	2006/07-4	78.72	mg/L	60	300	No
Chloride	ME-VR2	2007/08-1	135.9	mg/L	60	300	No
Chloride	ME-VR2	2007/08-2	301.56	mg/L	60	300	Yes
Total Dissolved Solids	ME-VR2	2005/06-3	1004	mg/L	1000	1500	No
Total Dissolved Solids	ME-VR2	2006/07-1	1123	mg/L	1000	1500	No
Total Dissolved Solids	ME-VR2	2007/08-1	1139	mg/L	1000	1500	No
Total Dissolved Solids	ME-VR2	2007/08-2	1326	mg/L	1000	1500	No

6.4 Urban Runoff Impacts on Receiving Waters

Pursuant to Part 2 (Receiving Water Limitations) of the Countywide NPDES Permit (Order R4-2010-0108, Permit No. CAS004002), the Permittees are required to determine whether discharges from their municipal separate storm sewer systems are causing or contributing to a violation of water quality standards (WQS). Additionally, Permittees are responsible for preventing discharges from the MS4 of stormwater or non-stormwater from causing or contributing to a condition of nuisance. Specifically, the Order contains the two following Receiving Water Limitations:

1. Discharges from the MS4 that cause or contribute to a violation of water quality standards are prohibited.
2. Discharges from the MS4 of stormwater, or non-stormwater, for which a Permittee is responsible, shall not cause or contribute to a condition of nuisance.

Compliance with the above Receiving Water Limitations is achieved by the Permittees through implementation of control measures and other actions to reduce pollutants in stormwater and non-stormwater discharges in accordance

with the requirements of Countywide NPDES Permit. The following section presents a discussion of WQS exceedances that occurred during the three wet-weather and one dry-weather monitoring events during the 2010/11 wet season.

6.5 "Cause or Contribute" Evaluation Methodology

The evaluation used to determine if a pollutant is persistently causing or contributing to the exceedance of a WQS in receiving waters consists of three steps:

1. The water quality data collected at a downstream receiving water site were compared to relevant WQS contained in the CTR and Basin Plan.
2. When a receiving water concentration exceeded a WQS for a particular constituent, the upstream urban runoff concentration of said constituent measured at a Major Outfall (i.e. outfall $\geq$ 36 inches) was compared to the WQS. If an elevated level relative to the associated WQS for said constituent was observed in both urban runoff and the receiving water, then the WQS exceedance in the receiving water was determined "likely caused or contributed to by urban runoff." However, this comparison does not consider the frequency or persistence of WQS exceedances for a given constituent.
3. The persistence of a WQS exceedance was determined by evaluating the number of times (frequency) that a constituent was observed at an elevated level in urban runoff and in excess of the WQS for the receiving water for a particular type of monitoring event (wet or dry) over the course of the monitoring season. If two or more elevated levels in urban runoff and WQS exceedances in the receiving water were observed for a particular constituent over the course of the monitoring season, then the WQS exceedances of said constituent were determined to be persistent. Ideally, an assessment of persistency would be based on a larger data set (e.g., 10 events or more) and an assumed percentage of exceedances (e.g., 50%), but given the need for an annual assessment two or more exceedances from the existing, limited data set were used as the criterion to determine persistence.

Table 6-5. Water Quality Objective Exceedances at Mass Emission Stations

Site	2010/11-1 (Wet)		2010/11-2 (Wet)		2010/11-4 (Wet)		2010/11-5 (Dry)		
	Constituent	Value	Constituent	Value	Constituent	Value	Constituent	Value	Applicable Standard
ME-CC							**Chloride**	**190**	150 mg/L (Basin Plan)
							Total Dissolved Solids	**1,000**	850 mg/L (Basin Plan)
	E. Coli	**8,664**	***E. Coli***	**6,131**	***E. Coli***	**2,481**			235 MPN/100 mL (Basin Plan)
	Fecal Coliform	**16,000**	**Fecal Coliform**	**24,000**	**Fecal Coliform**	**5,000**			400 MPN/100 mL (Basin Plan)
	Aluminum	**6,400**	**Aluminum**	**15,000**	**Aluminum**	**2,100**			1,000 µg/L (Basin Plan)
	Mercury	**0.053**	**Mercury**	**0.076**					0.051 µg/L (CTR)
			4,4'-DDE	**0.15**					0.00059 µg/L (CTR)
ME-SCR					Fluoride	3.2			1.4 mg/L (Basin Plan)
	E. Coli	**359**	***E. Coli***	**512**	***E. Coli***	**1,658**			235 MPN/100 mL (Basin Plan)
			Fecal Coliform	**500**	**Fecal Coliform**	**1,700**			400 MPN/100 mL (Basin Plan)
	Aluminum	**22,000**			**Aluminum**	**16,000**	Aluminum	2,300	1,000 µg/L (Basin Plan)
	Mercury	**0.079**			Mercury	0.059			0.051 µg/L (CTR)
ME-VR2									
	E. Coli	**399**	***E. Coli***	**6,131**	***E. Coli***	**384**			235 MPN/100 mL (Basin Plan)
	Fecal Coliform	**500**	**Fecal Coliform**	**5,000**	**Fecal Coliform**	**900**			400 MPN/100 mL (Basin Plan)

Note: All metals are total unless otherwise stated

Highlighted: Elevated level of same constituent in one or more related upstream site(s) (major outfalls)

Table 6-6. Elevated Levels at Major Outfall Stations

Site	2010/11-1 (Wet)		2010/11-2 (Wet)		2010/11-3 (Wet)		2010/11-4 (Wet)		2010/11-5 (Dry)		Standard for Comparison
	Constituent	Value	Constituent	Value	Constituent	Value	Constituent	Value	Constituent	Value	
MO-CAM			pH	8.8					pH	8.89	8.5 pH units (Basin Plan)
									Total Dissolved Solids	**730**	500 mg/L (Basin Plan)
	E. Coli	**24,192**	***E. Coli***	**9,804**			***E. Coli***	**3,448**	*E. Coli*	697	235 MPN/100 mL (Basin Plan)
	Fecal Coliform	**46,000**	**Fecal Coliform**	**30,000**			**Fecal Coliform**	**5,000**	Fecal Coliform	460	400 MPN/100 mL (Basin Plan)
	Aluminum	**2,000**	**Aluminum**	**1,900**							1,000 µg/L (Basin Plan)
	Copper, dissolved	13	**Copper, dissolved**	**7.5**			Copper, dissolved	5.1			7.65 µg/L, 4.19 µg/L, 3.78 µg/L (CTR)*
			Mercury	**0.063**							0.051 µg/L (CTR)
			4,4'-DDE	**0.063**							0.00059 µg/L (CTR)
MO-FIL									DO	4.56	5 mg/L (Basin Plan)
	E. Coli	**5,717**	***E. Coli***	**19863**			***E. Coli***	**2,613**	*E. Coli*	1,259	235 MPN/100 mL (Basin Plan)
	Fecal Coliform	30,000	**Fecal Coliform**	**24,000**			**Fecal Coliform**	**3,000**	Fecal Coliform	3,000	400 MPN/100 mL (Basin Plan)
	Aluminum	**2,500**									1,000 µg/L (Basin Plan)
									Selenium	7.6	5 µg/L (CTR)
MO-HUE	DO	4.91	DO	4.77							5 mg/L (Basin Plan)
	E. Coli	24,192	*E. Coli*	14,136			*E. Coli*	8,164	*E. Coli*	318	235 MPN/100 mL (Basin Plan)
	Fecal Coliform	24000	Fecal Coliform	9,000			Fecal Coliform	24,00	Fecal Coliform	500	400 MPN/100 mL (Basin Plan)
MO-MEI									Chloride	100	60 mg/L (Basin Plan)
									pH	8.66	5 mg/L (Basin Plan)
									Total Dissolved Solids	980	800 mg/L (Basin Plan)
	E. Coli	**104,620**			***E. Coli***	**11,199**	***E. Coli***	**14,136**	*E. Coli*	1,376	235 MPN/100 mL (Basin Plan)
	Fecal Coliform	**110,000**			**Fecal Coliform**	**9,000**	**Fecal Coliform**	**9,000**	Fecal Coliform	3,000	400 MPN/100 mL (Basin Plan)
	Aluminum	4,400			Aluminum	4,300	Aluminum	1,900			1,000 µg/L (Basin Plan)
	Mercury	0.059									0.051 µg/L (CTR)
	Mercury	0.067									0.051 µg/L (CTR)

Site	2010/11-1 (Wet)		2010/11-2 (Wet)		2010/11-3 (Wet)		2010/11-4 (Wet)		2010/11-5 (Dry)		Standard for Comparison
	Constituent	**Value**	**Constituent**	**Value**	**Constituent**	**Value**	**Constituent**	**Value**	**Constituent**	**Value**	
MO-MPK									**Chloride**	**390**	150 mg/L (Basin Plan)
									Total Dissolved Solids	**1,800**	850 mg/L (Basin Plan)
	E. Coli	**10,462**	***E. Coli***	**2,282**			***E. Coli***	**1,529**	*E. Coli*	15,531	235 MPN/100 mL (Basin Plan)
	Fecal Coliform	**30,000**	**Fecal Coliform**	**5,000**			**Fecal Coliform**	**3,000**	Fecal Coliform	30,000	400 MPN/100 mL (Basin Plan)
	Aluminum	**3,700**	**Aluminum**	**4,300**			**Aluminum**	**4,300**			1,000 µg/L (Basin Plan)
			Mercury	**0.058**							0.051 µg/L (CTR)
									Bis(2-ethylhexyl)phthalate	9.4	4 µg/L (Basin Plan)
	Pentachlorophenol	13	Pentachlorophenol	4.6			Pentachlorophenol	2.3			1 µg/L (Basin Plan)
MO-OJA									Chloride	150	60 mg/L (Basin Plan)
									Total Dissolved Solids	1,300	800 mg/L (Basin Plan)
	E. Coli	**14,136**			***E. Coli***	**12,033**	***E. Coli***	**7,701**			235 MPN/100 mL (Basin Plan)
	Fecal Coliform	**50,000**			**Fecal Coliform**	**17,000**	**Fecal Coliform**	**5,000**			400 MPN/100 mL (Basin Plan)
	Aluminum	7,300			Aluminum	2,200	Aluminum	1,800			1,000 µg/L (Basin Plan)
	Mercury	0.071									0.051 µg/L (CTR)
MO-OXN									pH	8.82	8.5 pH units (Basin Plan)
									Total Dissolved Solids	670	500 mg/L (Basin Plan)
	E. Coli	**19,863**	***E. Coli***	**11,199**			***E. Coli***	**2,014**			235 MPN/100 mL (Basin Plan)
	Fecal Coliform	24,000	**Fecal Coliform**	**11,000**			**Fecal Coliform**	**3,000**			400 MPN/100 mL (Basin Plan)
	Aluminum	**2,000**	Aluminum	3,200							1,000 µg/L (Basin Plan)
	Copper, dissolved	12	Copper, dissolved	11			Copper, dissolved	7.7	Copper, dissolved	33	8.05 µg/L , 7.39 µg/L , 3.23 µg/L , 18.25 µg/L (CTR)
	Mercury	**0.06**									0.051 µg/L (CTR)
	Zinc, dissolved	76					Zinc, dissolved	39			73.83 µg/L, 32.48 µg/L (CTR)
									Bis(2-ethylhexyl)phthalate	11	4 µg/L (Basin Plan)
MO-SIM									**Chloride**	**190**	150 mg/L (Basin Plan)
									Nitrate + Nitrite as N	11	10 mg/L (Basin Plan)
									Total Dissolved Solids	**2,400**	850 mg/L (Basin Plan)

	E. Coli	**10,462**	***E. Coli***	**48,840**			***E. Coli***	**2,143**			235 MPN/100 mL (Basin Plan)
	Fecal Coliform	**90,000**	**Fecal Coliform**	**30,000**			**Fecal Coliform**	**2,400**	Fecal Coliform	500	400 MPN/100 mL (Basin Plan)
	Aluminum	**2,500**	**Aluminum**	**2100**							1,000 µg/L (Basin Plan)
									Selenium	42	5 µg/L (CTR)
MO-SPA	***E. Coli***	**17,329**	***E. Coli***	**17,329**			***E. Coli***	**850**	E. Coli	631	235 MPN/100 mL (Basin Plan)
	Fecal Coliform	50,000	**Fecal Coliform**	**50,000**			**Fecal Coliform**	**900**	Fecal Coliform	2,400	400 MPN/100 mL (Basin Plan)
	Aluminum	**3,500**	Aluminum	2400			**Aluminum**	**1,500**			1,000 µg/L (Basin Plan)
	Copper, dissolved	13	Copper, dissolved	11			Copper, dissolved	7.5			11.53 µg/L, 6.07 µg/L, 6.6 µg/L (CTR)
	Mercury	**0.058**	Mercury	0.061							0.051 µg/L (CTR)
	Zinc, dissolved	120	Zinc, dissolved	58							102.08 µg/L, 57.33 µg/L (CTR)
MO-THO									**Chloride**	**220**	150 mg/L (Basin Plan)
									Total Dissolved Solids	**1,200**	850 mg/L (Basin Plan)
	E. Coli	**43,520**	***E. Coli***	**19,863**			***E. Coli***	**12,033**			235 MPN/100 mL (Basin Plan)
	Fecal Coliform	**90,000**	**Fecal Coliform**	**24,000**			**Fecal Coliform**	**17,000**			400 MPN/100 mL (Basin Plan)
	Aluminum	**6,000**	**Aluminum**	**13,000**			**Aluminum**	**1,200**			1,000 µg/L (Basin Plan)
	Mercury	0.062	**Mercury**	**0.09**							0.051 µg/L (CTR)
MO-VEN									Chloride	270	150 mg/L (Basin Plan)
									pH	9.89	8.5 pH units (Basin Plan)
									Total Dissolved Solids	4,800	500 mg/L (Basin Plan)
	E. Coli	**24,192**	***E. Coli***	**17,329**			***E. Coli***	**1,616**			235 MPN/100 mL (Basin Plan)
	Fecal Coliform	30,000	**Fecal Coliform**	**24,000**			**Fecal Coliform**	**1,100**			400 MPN/100 mL (Basin Plan)
									Copper, dissolved	41	29.29 µg/L (CTR)
	Aluminum	**2,000**	Aluminum	4,300							1,000 µg/L (Basin Plan)
	Mercury	**0.055**	Mercury	0.061							0.051 µg/L (CTR)
									Selenium	11	5 µg/L (CTR)
			4,4'-DDE	0.051							0.00059 µg/L (CTR)

Note: All metals are total unless otherwise stated.

* CTR objectives for dissolved metals are based on hardness and are, therefore, different for each storm

Highlighted: Exceedance of same constituent in related downstream site ("receiving water")

6.6 Ventura River Watershed

Urban stormwater runoff and urban non-stormwater flows were evaluated at two Major Outfall locations in the Ventura River Watershed during the 2010/11season: Meiners Oaks-1 (MO-MEI) and Ojai-1 (MO-OJA). Both of these Major Outfalls are located upstream of the ME-VR2 Mass Emission station (see Figure 1), and therefore water quality data collected at ME-VR2 were used to represent receiving water quality in the "cause or contribute" evaluation conducted for both Major Outfalls. The second sampled rain event of the year [October 30 (2010/11-2)] only generated enough flow to collect three samples at MO-MEI and seven samples at MO-OJA, which was insufficient for chemistry analysis, so the event was aborted for those two sites. The sites were then successfully re-sampled during the storm on November 20 (2010/11-3). The elevated levels at MO-MEI and MO-OJA from 2010/11-3 are compared to the exceedances at ME-VR2 from 2010/11-2 for informational purposes, but they are different storms and so not directly comparable. Elevated levels of constituents in urban runoff and those exceeding WQS in the downstream receiving water are shown for Major Outfalls MO-MEI and MO-OJA in Table 6-7 and Table 6-8, respectively.

Table 6-7: Comparison of MO-MEI and ME-VR2 Relative to Water Quality Standards

Constituent (Unit)	Upstream Receiving Water	Meiners Oaks-1 Major Outfall (MO-MEI)	Downstream Receiving Water (ME-VR2)	Water Quality Standard (Basin Plan or CTR)	
2010/11-1 (Wet) – Oct. 6, 2010					
E. coli (MPN/100 mL)	No data	104,620	399	235	BP
Fecal Coliform (MPN/100 mL)	No data	110,000	500	400	BP
2010/11-2 (Wet) – Oct 30, 2010 and 2010/11-3 (Wet) – Nov 20, 2010					
E. coli (MPN/100 mL)	No data	11,199	6,131	235	BP
Fecal Coliform (MPN/100 mL)	No data	9,000	5,000	400	BP
2010/11-4 (Wet) – Feb. 16, 2011					
E. coli (MPN/100 mL)	No data	14,136	384	235	BP
Fecal Coliform (MPN/100 mL)	No data	9,000	900	400	BP

Table 6-8: Comparison of MO-OJA and ME-VR2 Relative to Water Quality Standards

Constituent (Unit)	Upstream Receiving Water	Ojai-1 Major Outfall (MO-OJA)	Downstream Receiving Water (ME-VR2)	Water Quality Standard (Basin Plan or CTR)	
2010/11-1 (Wet) – Oct. 6, 2010					
E. coli (MPN/100 mL)	No data	14,136	399	235	BP
Fecal Coliform (MPN/100 mL)	No data	50,000	500	400	BP
2010/11-2 (Wet) – Oct 30, 2010 and 2010/11-3 (Wet) – Nov 20, 2010					
E. coli (MPN/100 mL)	No data	12,033	6,131	235	BP
Fecal Coliform (MPN/100 mL)	No data	17,000	5,000	400	BP
2010/11-4 (Wet) – Feb. 16, 2011					
E. coli (MPN/100 mL)	No data	7,701	384	235	BP
Fecal Coliform (MPN/100 mL)	No data	5,000	900	400	BP

6.7 Santa Clara River Watershed

Urban stormwater runoff and urban non-stormwater flows were evaluated at four Major Outfalls in the Santa Clara River Watershed during the 2010/11season: Fillmore-1 (MO-FIL), Santa Paula-1 (MO-SPA), Oxnard-1 (MO-OXN), and Ventura-1 (MO-VEN). Two of these stations, MO-FIL and MO-SPA, are located upstream of the ME-SCR Mass Emission station (see Figure 1), and therefore water quality data collected at ME-SCR were used to represent receiving water quality in the "cause or contribute" evaluation conducted for both Major Outfalls. The other two stations, MO-OXN and MO-VEN, are located downstream of the ME-SCR Mass Emission station (see Figure 1). Because the ME-SCR station is located upstream of MO-OXN and MO-VEN, an assumption was required so that water quality data collected at ME-SCR could be considered to adequately represent Santa Clara River water quality downstream of the confluence of both MO-OXN and MO-VEN with the river. It was assumed that pollutant concentrations in the Santa Clara River downstream of ME-SCR remain the same as those measured at ME-SCR to a hypothetical compliance point below the confluence of MO-OXN and MO-VEN and the Santa Clara River. With this assumption in effect, water quality data collected at ME-SCR were used to represent receiving water quality in the "cause or contribute" evaluation conducted for the MO-OXN and MO-VEN stations. Elevated levels of constituents in urban runoff and those exceeding WQS in the "downstream" receiving water for the MO-FIL, MO-SPA, MO-OXN, and MO-VEN stations are shown in Table 6-12 below.

Table 6-9: Comparison of MO-FIL and ME-SCR Relative to Water Quality Standards

Constituent (Unit)	Upstream Receiving Water	Fillmore-1 Major Outfall (MO-FIL)	Downstream Receiving Water (ME-SCR)	Water Quality Standard (Basin Plan or CTR)	
2010/11-1 (Wet) – Oct. 6, 2010					
E. coli (MPN/100 mL)	No data	5,717	359	235	BP
Aluminum, Total (µg/L)	No data	2,500	22,000	1,000	BP
2010/11-2 (Wet) – Oct 30, 2010					
E. coli (MPN/100 mL)	No data	19,863	512	235	BP
Fecal Coliform (MPN/100 mL)	No data	24,000	500	400	BP
2010/11-4 (Wet) – Feb. 16, 2011					
E. coli (MPN/100 mL)	No data	2,613	1,658	235	BP
Fecal Coliform (MPN/100 mL)	No data	3,000	1,700	400	BP

Table 6-10: Comparison of MO-SPA and ME-SCR Relative to Water Quality Standards

Constituent (Unit)	Upstream Receiving Water	Santa Paula-1 Major Outfall (MO-SPA)	Downstream Receiving Water (ME-SCR)	Water Quality Standard (Basin Plan or CTR)	
2010/11-1 (Wet) – Oct. 6, 2010					
E. coli (MPN/100 mL)	No data	17,329	359	235	BP
Aluminum, Total (µg/L)	No data	3,500	22,000	1,000	BP
Mercury, Total (µg/L)	No data	0.058	0.079	0.051	CTR
2010/11-2 (Wet) – Oct 30, 2010					
E. coli (MPN/100 mL)	No data	17,329	512	235	BP
Fecal Coliform (MPN/100 mL)	No data	50,000	500	400	BP
2010/11-4 (Wet) – Feb. 16, 2011					
E. coli (MPN/100 mL)	No data	850	1,658	235	BP
Fecal Coliform (MPN/100 mL)	No data	900	1,700	400	BP
Aluminum, Total (µg/L)	No data	1,500	22,000	1,000	BP

Table 6-11: Comparison of MO-OXN and ME-SCR Relative to Water Quality Standards

Constituent (Unit)	Upstream Receiving Water (ME-SCR)[a]	Oxnard-1 Major Outfall (MO-OXN)	Downstream Receiving Water	Water Quality Standard (Basin Plan or CTR)	
2010/11-1 (Wet) – Oct. 6, 2010					
E. coli (MPN/100 mL)	359	19,863	No data	235	BP
Aluminum, Total (µg/L)	22,000	2,000	No data	1,000	BP
Mercury, Total (µg/L)	0.079	0.060	No data	0.051	CTR
2010/11-2 (Wet) – Oct 30, 2010					
E. coli (MPN/100 mL)	512	11,199	No data	235	BP
Fecal Coliform (MPN/100 mL)	500	11,000	No data	400	BP
2010/11-4 (Wet) – Feb. 16, 2011					
E. coli (MPN/100 mL)	1,658	2,014	No data	235	BP
Fecal Coliform (MPN/100 mL)	1,700	3,000	No data	400	BP
2010/11-5 (Dry) – Apr 27, 2011					
Total Dissolved Solids (mg/L)	No data	670	1,000	1,300[b]/500[c]	BP

[a] Water quality monitoring data collected at ME-SCR were used in the receiving water "cause or contribute" evaluation as downstream surrogate data to represent the water quality in the Santa Clara River at a compliance point below the confluence of MO-OXN and the Santa Clara River.

[b] Site-specific Basin Plan objective for reach of Santa Clara River where ME-SCR is located.

[c] Recommended objective (MUN drinking water objective, USEPA secondary MCL) for sites without a site-specific Basin Plan objective.

Table 6-12: Comparison of MO-VEN and ME-SCR Relative to Water Quality Standards

Constituent (Unit)	Upstream Receiving Water (ME-SCR)[a]	Ventura-1 Major Outfall (MO-VEN)	Downstream Receiving Water	Water Quality Standard (Basin Plan or CTR)	
2010/11-1 (Wet) – Oct. 6, 2010					
E. coli (MPN/100 mL)	359	24,192	No data	235	BP
Aluminum, Total (µg/L)	22,000	2,000	No data	1,000	BP
Mercury, Total (µg/L)	0.079	0.055	No data	0.051	CTR
2010/11-2 (Wet) – Oct 30, 2010					
E. coli (MPN/100 mL)	512	17,329	No data	235	BP
Fecal Coliform (MPN/100 mL)	500	24,000	No data	400	BP
2010/11-4 (Wet) – Feb. 16, 2011					
E. coli (MPN/100 mL)	1,658	1,616	No data	235	BP
Fecal Coliform (MPN/100 mL)	1,700	1,100	No data	400	BP

[a] Water quality monitoring data collected at ME-SCR were used in the receiving water "cause or contribute" evaluation as downstream surrogate data to represent the water quality in the Santa Clara River at a compliance point below the confluence of MO-VEN and the Santa Clara River.

6.8 Calleguas Creek Watershed

Urban stormwater runoff and urban non-stormwater flows were evaluated at four Major Outfalls in the Calleguas Creek Watershed during the 2010/11 season: Camarillo-1 (MO-CAM), Moorpark-1 (MO-MPK), Simi Valley-1 (MO-SIM), and Thousand Oaks-1 (MO-THO). Three of these Major Outfalls (MO-MPK, MO-SIM, and MO-THO) are located upstream of the ME-CC Mass Emission station (see Figure 1), and therefore water quality data collected at ME-CC were used to represent receiving water quality in the "cause or contribute" evaluation conducted for these Major Outfalls. As stated earlier, MO-CAM is located in a different subwatershed than the closest receiving water location, the ME-CC station, monitored by the Program (see Figure 1). MO-CAM is tributary to Revolon Slough, which is tributary to Calleguas Creek several miles downstream of ME-CC. Similar to the ME-SCR station in the Santa Clara River watershed, an assumption was made so that water quality data collected at ME-CC could be considered to adequately represent Calleguas Creek water quality downstream of the confluence of Revolon Slough and the creek. It was assumed that pollutant concentrations in Calleguas Creek downstream of ME-CC remain the same as those measured at ME-CC to a hypothetical compliance point below the confluence of Revolon Slough and Calleguas Creek. With this assumption in effect, water quality data collected at ME-CC were used to represent receiving water quality in the "cause or contribute" evaluation conducted for the MO-CAM Major Outfall. Elevated levels of constituents in urban runoff and those exceeding WQS in the "downstream" receiving water are shown for the MO-MPK, MO-SIM, MO-THO, and MO-CAM stations in Table 6-13, Table 6-14, Table 6-15, and Table 6-16 below.

Table 6-13: Comparison of MO-MPK and ME-CC Relative to Water Quality Standards

Constituent (Unit)	Upstream Receiving Water	Moorpark-1 Major Outfall (MO-MPK)	Downstream Receiving Water (ME-CC)	Water Quality Standard (Basin Plan or CTR)	
2010/11-1 (Wet) – Oct. 6, 2010					
E. coli (MPN/100 mL)	No data	10,462	8,664	235	BP
Fecal Coliform (MPN/100 mL)	No data	30,000	16,000	400	BP
Aluminum, Total (µg/L)	No data	3,700	6,400	1,000	BP
2010/11-2 (Wet) – Oct 30, 2010					
E. coli (MPN/100 mL)	No data	2,282	6,131	235	BP
Fecal Coliform (MPN/100 mL)	No data	5,000	24,000	400	BP
Aluminum, Total (µg/L)	No data	4,300	15,000	1,000	BP
Mercury, Total (µg/L)	No data	0.058	0.076	0.051	CTR
2010/11-4 (Wet) – Feb. 16, 2011					
E. coli (MPN/100 mL)	No data	1,529	2,481	235	BP
Fecal Coliform (MPN/100 mL)	No data	3,000	5,000	400	BP
Aluminum, Total (µg/L)	No data	4,300	2,100	1,000	BP
2010/11-5 (Dry) – Apr 27, 2011					
Chloride (mg/L)	No data	390	190	150	BP
Total Dissolved Solids (mg/L)	No data	1,800	1,000	850	BP

Table 6-14: Comparison of MO-SIM and ME-CC Relative to Water Quality Standards

Constituent (Unit)	Upstream Receiving Water	Simi Valley-1 Major Outfall (MO-SIM)	Downstream Receiving Water (ME-CC)	Water Quality Standard (Basin Plan or CTR)	
2010/11-1 (Wet) – Oct. 6, 2010					
E. coli (MPN/100 mL)	No data	10,462	8,664	235	BP
Fecal Coliform (MPN/100 mL)	No data	90,000	16,000	400	BP
Aluminum, Total (µg/L)	No data	2,500	6,400	1,000	BP
2010/11-2 (Wet) – Oct 30, 2010					
E. coli (MPN/100 mL)	No data	48,840	6,131	235	BP
Fecal Coliform (MPN/100 mL)	No data	30,000	24,000	400	BP
Aluminum, Total (µg/L)	No data	2,100	15,000	1,000	BP
2010/11-4 (Wet) – Feb. 16, 2011					
E. coli (MPN/100 mL)	No data	2,143	2,481	235	BP
Fecal Coliform (MPN/100 mL)	No data	2,400	5,000	400	BP
2010/11-5 (Dry) – Apr 27, 2011					
Chloride (mg/L)	No data	190	190	150	BP
Total Dissolved Solids (mg/L)	No data	2,400	1,000	850	BP

Table 6-15: Comparison of MO-THO and ME-CC Relative to Water Quality Standards

Constituent (Unit)	Upstream Receiving Water	Thousand Oaks-1 Major Outfall (MO-THO)	Downstream Receiving Water (ME-CC)	Water Quality Standard (Basin Plan or CTR)	
2010/11-1 (Wet) – Oct. 6, 2010					
E. coli (MPN/100 mL)	No data	43,520	8,664	235	BP
Fecal Coliform (MPN/100 mL)	No data	90,000	16,000	400	BP
Aluminum, Total (µg/L)	No data	6,000	6,400	1,000	BP
2010/11-2 (Wet) – Oct 30, 2010					
E. coli (MPN/100 mL)	No data	19,863	6,131	235	BP
Fecal Coliform (MPN/100 mL)	No data	24,000	24,000	400	BP
Aluminum, Total (µg/L)	No data	13,000	15,000	1,000	BP
Mercury, Total (µg/L)	No data	0.090	0.076	0.051	CTR
2010/11-4 (Wet) – Feb. 16, 2011					
E. coli (MPN/100 mL)	No data	12,033	2,481	235	BP
Fecal Coliform (MPN/100 mL)	No data	17,000	5,000	400	BP
Aluminum, Total (µg/L)	No data	1,200	2,100	1,000	BP
2010/11-5 (Dry) – Apr 27, 2011					
Chloride (mg/L)	No data	220	190	150	BP
Total Dissolved Solids (mg/L)	No data	1,200	1,000	850	BP

Table 6-16: Comparison of MO-CAM and ME-CC Relative to Water Quality Standards

Constituent (Unit)	Upstream Receiving Water (ME-CC)[a]	Camarillo-1 Major Outfall (MO-CAM)	Downstream Receiving Water	Water Quality Standard (Basin Plan or CTR)	
2010/11-1 (Wet) – Oct. 6, 2010					
E. coli (MPN/100 mL)	8,664	24,192	No data	235	BP
Fecal Coliform (MPN/100 mL)	16,000	46,000	No data	400	BP
Aluminum, Total (µg/L)	6,400	2,000	No data	1,000	BP
2010/11-2 (Wet) – Oct 30, 2010					
E. coli (MPN/100 mL)	6,131	9,804	No data	235	BP
Fecal Coliform (MPN/100 mL)	24,000	30,000	No data	400	BP
Aluminum, Total (µg/L)	15,000	1,900	No data	1,000	BP
Mercury, Total (µg/L)	0.076	0.063	No data	0.051	CTR
4,4'-DDE (µg/L)	0.15	0.063	No data	0.00059	CTR
2010/11-4 (Wet) – Feb. 16, 2011					
E. coli (MPN/100 mL)	2,481	3,873	No data	235	BP
Fecal Coliform (MPN/100 mL)	5,000	3,000	No data	400	BP
2010/11-5 (Dry) – Apr 27, 2011					
Total Dissolved Solids (mg/L)	1,000	730	No data	850[(b)]/500[(c)]	BP

[a] Water quality monitoring data collected at ME-CC were used in the receiving water "cause or contribute" evaluation as downstream surrogate data to represent the water quality in Calleguas Creek at a compliance point below the confluence of Revolon Slough and Calleguas Creek. The MO-Cam station is tributary to Revolon Slough.

[b] Site-specific Basin Plan objective for reach of Calleguas Creek where ME-CC is located.

[c] Site-specific Basin Plan objective for Revolon Slough.

6.9 Coastal Watershed

Urban stormwater runoff and urban non-stormwater flows were evaluated at one Major Outfall station that does not have an associated Mass Emissions station located within the watershed. The MO-HUE station is located in Port Hueneme and discharges to the J Street Drain just upstream of where the drain enters the Ormond Beach lagoon. The elevated levels seen at MO-HUE are listed in Table 6-6 and not in a separate table as there is not a Mass Emission station nearby to which comparisons would be relevant.

6.9.1 Discussion of Results Above Water Quality Standards

6.9.1.1 Trace Metals

Aluminum

Urban runoff and receiving water concentrations of aluminum were found above the 1,000 µg/L Basin Plan objective at the majority of Major Outfall stations for one or more wet weather monitoring events during the 2010/11 season. Similarly, aluminum concentrations above the Basin Plan objective were measured at the ME-CC and ME-SCR receiving water stations during one or more wet events. Receiving water station ME-SCR yielded a result of the aluminum above WQO during the one dry weather monitoring event (Event 5) conducted during the current

monitoring season. Major Outfall stations not showing wet weather aluminum above the WQS in the Calleguas Creek Watershed include MO-CAM (Event 4) and MO-SIM (Event 4); and in the Santa Clara River Watershed include MO-FIL (Event 2, 4), MO-OXN (Event 4), and MO-THO Event 4). Receiving water stations not showing wet weather exceedances for aluminum include ME-SCR (Event 1, 2) and ME-VR2 (all wet events). A summary of those monitoring sites were aluminum concentrations were observed above the Basin Plan objective is shown in Table 6-17.

Since the Program began monitoring for aluminum in 2004, it has frequently observed elevated levels of the Basin Plan objective for the metal at all Program monitoring sites (receiving water and land use). Aluminum is found as a ubiquitous natural element in sediments throughout Ventura County geology. These sediments are mobilized during stormwater runoff events from urban, agriculture, and natural sources resulting in concentrations of aluminum in excess of the Basin Plan objective. This is clearly shown by the highly elevated wet weather concentrations of the metal measured in all three watersheds monitored by the Program. Similar to the current season, dry weather aluminum concentrations observed above WQS during the past seven years have only been observed a limited number of times. With elevated levels of aluminum co-occurring in both urban runoff and receiving waters within the same watershed during the same monitoring event, it is likely that concentrations of aluminum in urban runoff can be considered contributing to the elevated level observed in receiving waters.

Aluminum is the third most common element on the planet and the most abundant metal in the earth's crust comprising over 8% of its chemistry. Aluminum is released to the environment mainly by natural processes, though acid environments caused by acid mine drainage or acid rain can cause an increase in the dissolved aluminum content of the surrounding waters (ATSDR, 1992; WHO, 1997). There are no know sources of acid mine drainage in Ventura County watersheds that could account for the aluminum detected, so the sources are likely natural.

Table 6-17 Aluminum detected above Basin Plan Objective

Aluminum detected above Basin Plan Objective					
Site	Event 1 (Wet)	Event 2 (Wet)	Event 3 (Wet)	Event 4 (Wet)	Event 5 (Dry)
Calleguas Creek Watershed					
ME-CC	X	X	*	X	
MO-CAM	X	X	*		
MO-MPK	X	X	*	X	
MO-SIM	X	X	*		
MO-THO	X	X	*	X	
Santa Clara River Watershed					
ME-SCR	X		*	X	X
MO-FIL	X		*		
MO-OXN	X	X	*		
MO-SPA	X	X	*	X	
MO-VEN	X	X	*		
Ventura River Watershed Outfalls not causing or contributing to exceedance					
ME-VR2			*		
MO-OJA	X	*	X	X	
MO-MEI	X	*	X	X	
* Not sampled during this event					

Copper

Based on the "cause or contribute" methodology copper from urban outfalls was not determined to be a persistent cause or contribution to WQS. Elevated levels compared to the hardness-based CTR objective for dissolved copper were observed at Major Outfall stations during both wet and dry monitoring events: MO-CAM (Events 1, 2, and 4), MO-OXN (Events 1,2, 4, and 5), MO-SPA (Events 1, 2, and 4), and MO-VEN (Event 5). No results above the CTR criterion for dissolved copper were observed at the receiving water stations during the 2010/11 season. Because results for copper were not observed above the CTR criterion in receiving waters (i.e., measured at the receiving water stations), there is no evidence to conclude that copper in urban runoff appreciably impacted receiving water beneficial uses during the 2010/11 monitoring season.

This conclusion does not mean these data will be ignored by the Program as it is actively addressing copper. Permittees supported the Brake Pad Partnership and Senate Bill (SB) 346 adopted September 27, 2010 – that authorized legislation to phase out the copper contained in vehicle brake pads. SB 346, authored by Senator Christine Kehoe (D-San Diego), requires brake pad manufacturers to reduce the use of copper in brake pads sold in California to no more than 5% by 2021 and no more than 0.5% by 2025. This true source control action will help significantly reduce copper in urban runoff. Several of the Major Outfall sites are next to freeways or railroad lines (MO-CAM, MO-OXN, and MO-VEN)) where copper-containing dust from vehicles and trains is continually produced and deposited; the SB346 legislation will help address this issue. In the future, similar legislation to address train brake pads may help to further reduce copper in runoff.

Table 6-18 Dissolved Copper detected above CTR Objective

Copper detected above CTR Objective					
Site	Event 1 (Wet)	Event 2 (Wet)	Event 3 (Wet)	Event 4 (Wet)	Event 5 (Dry)
Calleguas Creek Watershed Outfalls not causing or contributing to exceedance					
ME-CC			*		
MO-CAM	X	X	*	X	
MO-MPK			*		
MO-SIM			*		
MO-THO			*		
Santa Clara River Watershed Outfalls not causing or contributing to exceedance					
ME-SCR			*		
MO-FIL			*		
MO-SPA	X	X	*	X	
MO-OXN	X	X	*	X	X
MO-VEN			*		X
Ventura River Watershed Outfalls not causing or contributing to exceedance					
ME-VR2			*		
MO-MEI			*		
MO-OJA			*		
Coastal Outfalls not causing or contributing to exceedance					
MO-HUE			*		
* Not sampled during this event					

Selenium

Selenium from urban outfalls was not determined to be a persistent cause or contribution to WQS exceedences. One Major Outfall in the Calleguas Creek Watershed (MO-SIM) and two Major Outfalls in the Santa Clara River Watershed (MO-SPA and MO-VEN) exhibited total selenium concentrations in excess of the 5.0 µg/L CTR criterion during the one dry weather event monitored by the Program. No such elevated levels were observed at any of the receiving water stations during the same event, resulting in the finding that selenium concentrations in urban runoff are not causing or contributing to concentrations observed above a water quality standard for the constituent in receiving waters.

Elevated concentrations observed for selenium in dry weather are not surprising because selenium is naturally found in the groundwater of Ventura County. Groundwater infiltrating into storm drains is likely the source of the selenium found in these major outfalls. Additionally, selenium introduced and transported by landscape irrigation water from ground water wells is being addressed by water conservation efforts of the Permittees. There is currently a TMDL addressing selenium in the Calleguas Creek watershed which will address this issue. Initial studies are showing that the levels of selenium detected are not affecting beneficial uses. More information will be available as the TMDL process continues.

Table 6-19 Sites with Selenium detected above CTR Objective

Selenium detected above CTR Objective					
Site	Event 1 (Wet)	Event 2 (Wet)	Event 3 (Wet)	Event 4 (Wet)	Event 5 (Dry)
Calleguas Creek Watershed Outfalls not causing or contributing to exceedance					
ME-CC			*		
MO-CAM			*		
MO-MPK			*		
MO-SIM			*		X
MO-THO			*		
Santa Clara River Watershed Outfalls not causing or contributing to exceedance					
ME-SCR			*		
MO-FIL			*		X
MO-SPA			*		
MO-OXN			*		
MO-VEN			*		X
Ventura River Watershed Outfalls not causing or contributing to exceedance					
ME-VR2			*		
MO-MEI		*			
MO-OJA		*			
Coastal Outfalls not causing or contributing to exceedance					
MO-HUE			*		
* Not sampled during this event					

Zinc

Zinc from urban outfalls was not determined to be a persistent cause or contribution to concentrations observed above the hardness-based CTR objective for dissolved zinc. Elevated levels were observed at two Major Outfall stations during wet weather monitoring events: MO-OXN (Event 1 and 4) and MO-SPA (Events 1 and 2). No elevated levels were observed for Major Outfall stations during the one dry weather event monitored by the Program. More importantly, no exceedances of the CTR criterion for dissolved zinc were observed at any of the receiving water stations during the 2010/11 season. The lack of concentrations observed above water quality standards for zinc at the receiving water stations indicates that zinc concentrations in urban runoff did not affect the beneficial uses in the receiving water.

Table 6-20 Zinc detected above CTR Objective

Zinc detected above CTR Objective					
Site	Event 1 (Wet)	Event 2 (Wet)	Event 3 (Wet)	Event 4 (Wet)	Event 5 (Dry)
Calleguas Creek Watershed - Outfalls not causing or contributing to exceedance					
ME-CC			*		
MO-CAM			*	X	
MO-MPK			*		
MO-SIM			*		
MO-THO			*		
Santa Clara River Watershed - Outfalls not causing or contributing to exceedance					
ME-SCR			*		
MO-FIL			*		
MO-SPA	X	X	*		
MO-OXN	X		*	X	
MO-VEN			*		
Ventura River Watershed - Outfalls not causing or contributing to exceedance					
ME-VR2			*		
MO-MEI		*			
MO-OJA		*			
Coastal Outfalls not causing or contributing to exceedance					
MO-HUE			*		
* Not sampled during this event					

Mercury

No mercury elevated levels were observed at the Ventura River receiving water station (ME-VR2) during the 2010/11 season. Within the Santa Clara River Watershed, elevated mercury concentrations in urban runoff (MO-SPA, MO-VEN,) were observed during in one event at the same time a result above the CTR mercury criterion was seen in the receiving water. Based on the findings of this one wet weather event, the Program does not consider mercury at this time to constitute a persistent pollutant in urban runoff that is causing or contributing to impairments of beneficial uses in the Santa Clara River Watershed.

Concentrations above the 0.051 µg/L CTR criterion for mercury were observed during two or more wet weather events at both the urban runoff monitoring locations (MO-CAM, MO-MPK, MO-SIM, MO-THO, MO-MEI, MO-OJA) and the Calleguas Creek receiving water station. Based upon the various co-occurrences of elevated levels of mercury in both the receiving waters and urban runoff as measured at Major Outfalls, it is determined that mercury in urban runoff likely contributed to concentrations observed above the CTR criterion for mercury in the Calleguas Creek Watershed during Events 1 and 2. Because these co-occurring concentrations occurred for two or more monitoring events, the Program's 'cause or contribute' evaluation methodology considers the concentrations observed above the CTR mercury criterion in the Calleguas Creek Watershed to be persistent.

While total mercury concentrations in excess of the 0.051 µg/L CTR criterion for mercury are regularly detected at the ME-CC and ME-SCR stations during wet weather monitoring events, they have yet to be observed during a dry

weather monitoring event. Similar to aluminum, mercury concentrations above the CTR criterion are observed almost exclusively during stormwater runoff events. Mercury has also historically been observed in rare cases during wet weather monitoring events in the Ventura River Watershed which has less than 5% of the watershed developed. Atmospheric mercury deposition is a likely source of the detected mercury since there is no known local industrial sources or mercury mining operations in Ventura County.

Table 6-21 Mercury detected above CTR Objective

Mercury detected above CTR Objective					
Site	Event 1 (Wet)	Event 2 (Wet)	Event 3 (Wet)	Event 4 (Wet)	Event 5 (Dry)
Calleguas Creek Watershed					
ME-CC	X	X	*		
MO-CAM		X	*		
MO-MPK		X	*		
MO-SIM			*		
MO-THO	X	X	*		
Santa Clara River Watershed Outfalls not causing or contributing to exceedance					
ME-SCR	X		*	X	
MO-FIL			*		
MO-SPA	X	X	*		
MO-OXN			*		
MO-VEN	X	X	*		
Ventura River Watershed Outfalls not causing or contributing to exceedance					
ME-VR2			*		
MO-MEI	X	*			
MO-OJA	X	*			
Coastal Outfalls not causing or contributing to exceedance					
MO-HUE			*		
* Not sampled during this event					

6.9.1.2 Efforts to reduce metals in urban runoff

Because metals are associated with sediment, the Stormwater Program has a number of control measures and BMPs that address metals in general, and sediment specifically. These control measures include steps to remove sediment from the storm drain system through street sweeping, catch basin cleaning, debris basin maintenance and publicly owned BMPs. A thorough discussion of these programs is provided in Section 7 Public Agency Activities. Preventing sediments containing metals from entering the storm drain system is just as, if not more important than removing them after they enter the storm drain system. Industrial and commercial inspections, construction inspection, and illicit discharge response and elimination, are significant efforts targeted at eliminating the discharge ofmetals. These are covered respectively in Sections 4 Industrial/Commercial Facilities Programs, Section 6 Development Construction, and Section 8 Illicit Connections and Illicit Discharges Elimination.

In addition, the construction program element is structured to address sediment from construction sites and includes review of grading plans, requirements for sediment and erosion control BMPs, and field inspections to confirm BMP implementation. More recently the State Water Resources Control Board adopted WDR Order 2009-0009 DWQ, the Construction General Permit, which covers all construction sites with greater than one acre of active land disturbance. This new Order incorporates a risk-based approach to address pollutants from construction sites including sediments and associated metals. The General Permit includes rigorous site planning, numeric effluent and action limits, and minimum BMPs as a function of the site risk for discharging sediment. It is expected that this new Order will provide further control of sediment from construction sites within Ventura County.

Although the transport of metals is not usually through direct actions of the public, public education of stomwater pollution prevention can provide assistance the efforts of the other programs and future efforts can be tailored to address sources of metals such as promoting household hazardous waste collection events to dispose of mercury containing compact fluorescent light bulbs. Other efforts include the Brake Pad Partnership and Senate Bill (SB) 346, legislation that authorizes the phase out copper from vehicle brake pads discussed above.

Beyond these efforts conducted under the municipal stormwater programs, certain metals (copper, nickel, selenium, and mercury) are being addressed under the TMDL program. These constituents have been identified as causing impairment in Calleguas Creek, its tributaries, and Mugu Lagoon. As a result a Metals Work Plan has been developed and is currently being implemented[5]. This multiple year plan provides the framework to (1) determine whether or not metals impairments still exist in the watershed, (2) develop site-specific objectives for copper and nickel, and (3) if necessary, identify the control measures needed to meet the TMDLs. It is expected that the control measures identified under this effort will inform the efforts to address aluminum and mercury in the Callegaus Creek and Santa Clara River watersheds.

6.9.1.3 Pathogen Indicators

Urban runoff and receiving water concentrations of *E. coli* and fecal coliform bacteria were detected above their respective Basin Plan objectives during all four wet weather events at all of the Major Outfall and at all but one of the receiving water stations monitored during the 2010/11 season. The single exception to these results was a non-exceedance for fecal coliform at the ME-SCR station during Event 1. These indicator bacteria are routinely measured at concentrations in excess of WQS during wet weather event. The story is different, however, with regard to dry weather monitoring during the 2010/11 season, no dry weather bacteria exceedances were observed at any of the receiving water stations. The majority of Major Outfall stations exhibited concentrations of indicator species above Basin Plan objectives during dry weather monitoring. The exceptions include no elevated levels observed for MO-THO, MO-OXN, and MO-VEN during Event 5.

However, these results are not reflected in the water quality of the beaches. The results of the Beach Water Quality Monitoring Program in Ventura County has been outstanding with Heal the Bay's *2011 End of Summer Beach Report Card* stating "Overall water quality at beaches throughout Ventura County remains among the best in the state. All monitored beaches received A grades in this report."

[5] http://www.calleguascreek.org/ccwmp/4d.asp November 3, 2011.

Table 6-22 Pathogen indicators detected above Basin Plan Objective

Pathogen indicators detected above Basin Plan Objective					
Site	Event 1 (Wet)	Event 2 (Wet)	Event 3 (Wet)	Event 4 (Wet)	Event 5 (Dry)
Calleguas Creek Watershed Outfalls not causing or contributing to exceedance in dry weather					
ME-CC	X	X	*	X	
MO-CAM	X	X	*	X	X
MO-MPK	X	X	*	X	X
MO-SIM	X	X	*	X	Fecal only
MO-THO	X	X	*	X	
Santa Clara River Watershed Outfalls not causing or contributing to exceedance in dry weather					
ME-SCR	*E. coli* only	X	*	X	
MO-FIL	X	X	*	X	X
MO-SPA	X	X	*	X	X
MO-OXN	X	X	*	X	X
MO-VEN	X	X	*	X	
Ventura River Watershed Outfalls not causing or contributing to exceedance in dry weather					
ME-VR2	X	X	*	X	
MO-MEI	X	*	X	X	X
MO-OJA	X	*	X	X	
Coastal					
MO-HUE	X	X	*	X	X
* Not sampled during this event					

The stormwater program has in place control strategies that directly address indicator bacteria concentrations in urban runoff. The existing Program includes a comprehensive residential public outreach program that utilizes radio, newspaper, online banners, outdoor bulletins, and transit shelters to educate the public about preventing animal waste from entering storm drains. The Program estimates that the outreach efforts achieved more than 2.7 million gross impressions (over three times the population of Ventura County) during the permit year. The pollutant outreach campaign was expanded 2009 to include the mailing of a brochure to horse owners, equestrians and horse property owners. The brochure identified BMPs that horse owners should take to reduce bacteria in stormwater runoff. Finally, the Program also conducts outreach to reduce bacteria and nutrients in runoff from pet waste. The Program installs dispensers for pet waste pickup bags at beaches, parks and trail heads. It is estimated that over 2 million pet waste bags are given out each year and there are now close to 400 pet waste bag dispensers throughout the County encouraging pet owners to pick up after their pets.

The efforts of the Illicit Discharges/Illicit Connections Program also help to reduce bacteria in stormwater runoff by identifying and stopping illicit wastewater discharges. Eliminating illicit discharges not only protects water quality by eliminating the bacteria in the discharge, but also eliminates the ability for the discharge to pick up and transport bacteria on its way to the storm drain system. The indicator bacteria are also found to thrive in natural environments and sediments. The prevention of the transport of sediments is discussed in Section 9.3.1.6 and include steps to remove sediment from the storm drain system through street sweeping, catch basin cleaning, debris basin

maintenance and publicly owned BMPs. Industrial and commercial inspections, construction inspection, and illicit discharge response and elimination represent significant efforts to eliminating the discharge metals. These are covered respectively in sections Section 7 Public Agency Activities, 4 Industrial/Commercial Facilities Programs, Section 6 Development Construction, and Section 8 Illicit Connections and Illicit Discharges Elimination.

In addition to the municipal stormwater program, bacteria are being addressed through the TMDL programs in Calleguas Creek and soon the Santa Clara River. Various reaches of Calleguas Creek are listed on the Section 303(d) list due to fecal coliform bacteria. A Bacteria Work Plan has been developed to addresses this problematic pollutant. Addressing bacteriological impairments in the watershed is a challenging task. Bacteriological contamination is a common occurrence throughout California and the United States. However, only a few TMDLs have been developed to control this pollutant, partially due to the many complexities associated with this task. Bacteria TMDLs are complicated by the fact that the standards are based on indicator organisms, not the actual pathogenic bacteria. As a result, it is difficult to ascertain whether a particular water concentration of non-pathogenic indicator bacteria will cause human illness. Adding to the complexity is the fact that wildlife and other naturally occurring sources contribute to bacterial sources. Naturally occurring sources of bacteria have the potential to impact human health, but are extremely difficult to control. Additionally, the warm waters of southern California provide ideal conditions for supporting bacteria populations naturally present in creek bed sediments. Finally, bacteria are ubiquitous throughout the watershed at levels that significantly exceed water quality standards.

Developing control measures to reduce observed bacteria concentrations to meet water quality standards is challenging. Treatment measures to address bacteria are likely to be costly and difficult to implement (especially with respect to infrequent and short-term, but high volume events that compose stormwater runoff). As a result, implementing measures that will result in compliance with the existing water quality objectives at all times will be extremely difficult. Consequently, the tasks in the Bacteria Work Plan are designed to address these complexities to the extent possible and provide mechanisms for protecting the identified beneficial uses in the watershed as is feasible. The strategy outlined in this work plan will assess the beneficial uses and risks to human health from bacteria and use that information to develop a TMDL to address bacteriological impairments. In the near-term an educational program focusing on the requirements of local domestic animal waste ordinances and the effects of domestic animal waste on the watershed is being considered[6]. Like the metals TMDL, it is expected that the results from the bacteria TMDL will assist the municipal stormwater program in addressing this problematic pollutant because the successful efforts in Calleguas Creek can be applied throughout the County to address indicator bacteria.

As a means to better refine the implementation of BMPs that might result in additional reductions of indicator bacteria, the Permittees are evaluating source identification monitoring at Major Outfalls. This may include source tracking through additional sampling for indicator species or using Bacteroidales genetic markers to identify the source(s) of fecal bacteria. Such an approach was used in the Calleguas Creek watershed as part of the TMDL monitoring effort. Knowing what bacteria sources – agriculture (horse and/or cow), humans, dogs, and birds – are responsible for the high levels of indicator bacteria measured during storm events will assist in the selection of BMPs better suited to control a particular bacteria source.

[6] http://www.calleguascreek.org/ccwmp/4f.asp November 3, 2011.

6.9.1.1 Organics and Pesticides

Only a single organic compound, Bis(2-ethylhexyl)phthalate, was detected during the course of the 2010/11 season, but was determined not to be a persistent cause or contribution to concentrations observed above WQS. This chemical, found in plastics and considered a common laboratory contaminant, was detected above both the Basin Plan (4 µg/L) and CTR (5.9 µg/L) objectives at the MO-MPK and MO-OXN Major Outfall stations during the dry weather monitoring event (Event 5). No Bis(2-ethylhexyl)phthalate elevated levels were observed in receiving waters. The lack of elevated levels for this constituent at the receiving water stations indicates that Bis(2-ethylhexyl)phthalate concentrations in urban runoff did not affect beneficial uses in the receiving water. Bis(2-ethylhexyl)phthalate is ubiquitous in plastics and is therefore a common sampling and laboratory contaminant. The Program will be running equipment blanks to determine if contamination of sampling equipment is a possible source of these detections.

Concentrations observed above WQS for pesticides were limited to Pentachlorophenol and 4,4'-DDE. Pentachlorophenol was only detected at only one Major Outfall (MO-MPK; Events 1, 2 and 4) above its relevant criteria, which include a Basin Plan objective of 1 µg/L and a pH-based CTR criterion. No Pentachlorophenol exceedances were observed in receiving waters. The lack of exceedances for this pollutant at the receiving water station indicates that Pentachlorophenol concentrations in wet weather urban runoff did not affect downstream receiving water beneficial uses with regard to this chlorinated hydrocarbon. The Watershed Protection District and the City of Moorpark worked in a joint effort to identify the source of Pentachlorophenol. A special inspection was performed on the SoCal Edison Transfer Station along with special monitoring of the runoff. SoCal Edison has responded by increasing BMPs on the site and changing some of their material handling procedures. Subsequent sampling events have shown a steady decrease in the amount of Pentachlorophenol detected with the goal of eliminating this organic compound in the next permit year.

It should be noted that toxicity evaluations of water collected from the MO-MPK station during Event 2 found chronic toxicity at 4.0 TUc. A Toxicity Identification Evaluation (TIE) performed on the water sample revealed that metabolically-activated organophosphate compounds are a possible source of the observed toxicity, and to a lesser degree, non-polar organic compounds and chlorine also could have contributed to the observed toxicity. While the 4.6 µg/L concentration of Pentachlorophenol measured in the MO-MPK sample during Event 2 marked an exceedance of the Basin Plan objective for Pentachlorophenol, it is unlikely that the compound was responsible for the observed chronic toxicity. A review of the EPA ECOTOX Database found that Pentachlorophenol mortality effects on Selenastrum occur at concentrations over three times greater than the concentration measured in the MO-MPK sample. Additionally, while Chlorpyrifos, Dacthal, and Malathion were also detected in the sample, the concentrations of these constituents were one-to-many orders of magnitude below the concentrations anticipated to result in the observed chronic toxicity as per the ECOTOX Database. The most likely candidate as the causative agent of the observed chronic toxicity is Bromacil. This herbicide was measured at a concentration of 42 µg/L in the MO-MPK sample, and the ECOTOX Database lists the compound as having an EC50 value of 6.8 µg/L. Bromacil currently lacks a water quality standard that could be used to compare ambient water concentrations of the herbicide to concentrations known to produce ecological effects.

Table 6-23: Pentachlorophenol Results at MO-MPK

Constituent	SiteID	EventID	Sign	Result	Units
Pentachlorophenol	MO-MPK	2010/11-1	=	13	µg/L
Pentachlorophenol	MO-MPK	2010/11-2	=	4.6	µg/L
Pentachlorophenol	Edison RC pipe at MPK	2010/11-4	=	17	µg/L
Pentachlorophenol	MO-MPK	2010/11-4	=	2.3	µg/L
Pentachlorophenol	MO-MPK	2010/11-5	<	0.04	µg/L

The other pesticide observed during the 2010/11 wet weather events were limited to 4,4-DDE. Concentrations observed above the 0.00059 µg/L CTR Human Health objective for 4,4'-DDE were observed only during Event 2 at the MO-CAM (Calleguas Creek Watershed) and MO-VEN (Santa Clara River Watershed) Major Outfall stations and at the Calleguas Creek receiving water station (ME-CC). Based upon the co-occurrence of 4,4'-DDE in both receiving waters (ME-CC) and urban runoff as measured at the Major Outfall MO-CAM, there is concern that 4,4'-DDE in urban runoff likely may be affecting the beneficial uses of the Calleguas Creek Watershed during Event 2, however, because this was a single event it was determined not to be a persistent cause or contribution to concentrations observed above WQS.. No such 4,4'-DDE result was observed in receiving waters in the Santa Clara River Watershed during Event 2.

The two DDT-related compounds for which concentrations observed above CTR Human Health have been recorded by the Program during past monitoring efforts are the legacy pesticides 4,4'- DDD and 4,4'-DDE. These legacy pesticides are associated with Ventura County's extensive farming history. Because these chemicals are associated with soil and sediments the same efforts for metals discussed in **Section 9.3.1.6** will help to reduce the mobilization of this legacy pesticide and its breakdown products. These compounds are currently being addressed in the Calleguas Creek Watershed through the implementation of the Calleguas Creek Watershed OC Pesticides and PCBs Total Maximum Daily Load (TMDL), adopted by the Los Angeles Regional Water Quality Control Board in July 2005. The Ventura Countywide co-permittees located in the Calleguas Creek watershed were actively involved in the TMDL development and are participating in its implementation. Legacy pesticides, such as the DDT-related compounds, will be further monitored over the course of the TMDL's implementation phase, and if high concentration areas (i.e., "hotspots") of these pesticides are identified, special studies will be implemented to address these hotspots.

Table 6-24 Organics and Pesticides detected above Basin Plan and CTR Objectives

Organics and Pesticides detected above Basin Plan and CTR Objectives					
Site	Event 1 (Wet)	Event 2 (Wet)	Event 3 (Wet)	Event 4 (Wet)	Event 5 (Dry)
Calleguas Creek Watershed					
ME-CC		4,4'-DDE	*		
MO-CAM		4,4'-DDE	*		
MO-MPK	Pentachlorophenol	Pentachlorophenol	*	Pentachlorophenol	Bis(2-ethylhexyl)phthalate
MO-SIM			*		
MO-THO			*		
Santa Clara River Watershed Outfalls not causing or contributing to exceedance					
ME-SCR			*		
MO-FIL			*		
MO-SPA			*		
MO-OXN			*	Bis(2-ethylhexyl)phthalate	
MO-VEN		4,4'-DDE	*		
Ventura River Watershed Outfalls not causing or contributing to exceedance					
ME-VR2			*		
MO-MEI		*			
MO-OJA		*			
Coastal Outfalls not causing or contributing to exceedance					
MO-HUE			*		
* Not sampled during this event					

6.9.1.1 Salts

Concentrations observed above WQS for salts in the three watersheds monitored by the Program were limited to dry weather and elevated levels of chloride and total dissolved solids objectives have been historically observed during dry weather events when flows are comprised of a larger groundwater component. Concentrations observed above the Basin Plan site-specific objective of 60 mg/L for chloride at the MO-MEI and MO-OJA Major Outfalls were seen during dry weather Event 5, however the Ventura River at the ME-VR2 receiving water station did not have an exceedance of the site-specific objective of 100 mg/L for its sampling location. During this same dry weather event, a result above the Basin Plan 800 mg/L objective for total dissolved solids was also observed at the MO-MEI station with no exceedance of TDS at the receiving water site ME-VR2. Dry weather chloride and TDS concentrations in the Santa Clara River Watershed were limited to an elevated level above the Basin Plan objective of 250 mg/L for chloride at the MO-VEN Major Outfall station and an elevated level above the Basin Plan objective of 500 mg/L for TDS at the MO-VEN and MO-OXN stations. Because urban runoff elevated levels of salts did not co-occur with such elevated levels in receiving waters in the Ventura and Santa Clara River watersheds, the Program concludes that urban runoff monitored during both wet and dry discharge events did not affect receiving water beneficial uses with regard to salts in these watersheds during the 2010/11 season.

Dry weather elevated level above salts objectives in the Calleguas Creek watershed did show co-occurring excursions above the Basin Plan site-specific objective of 150 mg/L for chloride at the MO-MPK, MO-SIM, and MO-THO Major Outfall stations, as well as at the ME-CC receiving water station. Similarly, dry weather concentrations observed above the Basin Plan site-specific (850 mg/L) and recommended (500 mg/L; used for MO-CAM) objectives for TDS were observed at the MO-CAM, MO-MPK, MO-SIM, and MO-THO Major Outfall stations, and at the ME-CC receiving water station. Within the Calleguas Creek Watershed, elevated salts concentrations in urban runoff is determined to have likely contributed to the concentrations observed above the Basin Plan objectives for chloride and TDS in the receiving water during dry weather Event 5. The Program is unable to evaluate whether or not elevated level above salts objectives within the watershed are a persistent issue during any given monitoring season because the Program is limited to a single wet season-dry weather monitoring event. Additionally, the other dry weather event, the dry season-dry weather monitoring event, required to be conducted by the Program represents grab sampling (as opposed to composite sampling) and does not include a requirement to evaluate chloride and TDS. The Program can only state that historic monitoring data collected during wet season-dry weather sampling events show regular elevated levels of chloride and total dissolved solids objectives in the Calleguas Creek Watershed.

Table 6-25 Salts detected above Basin Plan Site-specific Objectives

Salts detected above Basin Plan Site-specific Objectives					
Site	Event 1 (Wet)	Event 2 (Wet)	Event 3 (Wet)	Event 4 (Wet)	Event 5 (Dry)
Calleguas Creek Watershed					
ME-CC			*		Chloride, TDS
MO-CAM			*		TDS
MO-MPK			*		Chloride, TDS
MO-SIM			*		Chloride, TDS
MO-THO			*		Chloride, TDS
Santa Clara River Watershed Outfalls not causing or contributing to exceedance					
ME-SCR			*		
MO-FIL			*		
MO-SPA			*		
MO-OXN			*		TDS
MO-VEN			*		Chloride, TDS
Ventura River Watershed Outfalls not causing or contributing to exceedance					
ME-VR2			*		
MO-MEI		*			Chloride, TDS
MO-OJA		*			Chloride, TDS
Coastal Outfalls not causing or contributing to exceedance					
MO-HUE			*		
* Not sampled during this event					

Boron, chloride, sulfate, and total dissolved solids ("salts") are currently being addressed in the Calleguas Creek Watershed through the implementation of the Calleguas Creek Salts Total Maximum Daily Load (TMDL), adopted by

the Los Angeles Regional Water Quality Control Board in October 2007. The CCW Salts TMDL only applies during dry weather and applies to the receiving water, not at tributary outfalls. During the first three years of the TMDL implementation plan for the watershed, the primary implementation action is water conservation, which all of the Permittees have done. The ultimate goal of the TMDL is to bring the watershed into "salt balance" where the inputs of salts are equal to or less than the amount of salts exported out of the watershed during dry weather. Water conservation of the part of municipalities reduces the input side of the equation. The salts loading calculation is performed on an annual basis and wet weather exports are not considered in the analysis. Beyond water conservation, the proposed implementation plan does not include many options for MS4 dischargers. Most of the planned actions are construction of groundwater desalters and wastewater treatment plants reverse osmosis as these are considered to be the major source of the salts. Municipal stormwater actions to control salts are limited due to the fact that most salts in runoff come from source water supplies. The primary course of action for municipalities is to reduce outdoor water use, thereby limiting the amount of runoff that may contain high salts from entering urban tributaries and receiving waters. Permittees have also taken steps to the prohibition of discharges from Salt Water pools. Camarillo has conducted outreach to pool service companies and provided articles in their local newsletter to residents alerting them that they cannot discharge salt water pools to the storm drain system. The City of Thousand Oaks and Simi Valley also banned the discharge of salt water pools to the storm drain system. Self regenerating water softeners are a source of salts in the watershed, though not commonly to the storm drain system. Permittees have prohibited their use at commercial and industrial facilities, while education is provided to discourage their use by residents. These are all efforts that should assist with reducing salts in the watershed.

6.9.1.2 Nutrients

An urban runoff concentration for Nitrate plus Nitrite was recorded at the MO-SIM Major Outfall above the 10 mg/L Basin Plan objective during the dry weather monitoring event (Event 5). No such co-occurring elevated levels were observed for the nutrient at the receiving water monitoring station (ME-CC). elevated levels of nutrient objectives occasionally have been recorded by the Program, but currently nutrients in urban runoff are not determined to likely contribute to concentrations observed above WQS for nutrients in receiving waters.

Table 6-26 Nutrients detected above Basin Plan Objective

Nutrients detected above Basin Plan Objective					
Site	Event 1 (Wet)	Event 2 (Wet)	Event 3 (Wet)	Event 4 (Wet)	Event 5 (Dry)
Calleguas Creek Watershed Outfalls not causing or contributing to exceedance					
ME-CC			*		
MO-CAM			*		
MO-MPK			*		
MO-SIM			*		Nitrate + Nitrite as N
MO-THO			*		
Santa Clara River Watershed Outfalls not causing or contributing to exceedance					
ME-SCR			*		
MO-FIL			*		
MO-SPA			*		
MO-OXN			*		
MO-VEN			*		
Ventura River Watershed Outfalls not causing or contributing to exceedance					
ME-VR2			*		
MO-MEI		*			
MO-OJA		*			
Coastal Outfalls not causing or contributing to exceedance					
MO-HUE			*		
* Not sampled during this event					

6.9.1.3 Other Constituents

No other constituents were found to cause or contribute to exceedances of water quality objectives. Dissolved oxygen concentrations below the Basin Plan 5 mg/L objective were measured at the Major Outfalls MO-HUE (Events 1 and 2) and MO-FIL (Event 5). This is not unexpected at these two sites as the conditions at both locations create standing water where the water is not agitated or aerated to provide addition of oxygen as would be the case in a flowing storm drain or receiving water. At Port Hueneme the flow from the major outfall must be pumped out to the receiving water, the pumps are intermittent and the flow backs up until they are triggered. It has been noted that dissolved oxygen levels rise quickly when the pumps are operating. At Fillmore the outfall is covered by a flap valve to protect the city from high flows in the receiving water backing up the storm drain; correspondingly dry weather flow in the storm drain backs up until there is enough weight to open the flap. No exceedances of the Basin Plan objective for dissolved oxygen were observed at any of the Receiving water stations during the 2010/11 season. The lack of exceedances for dissolved oxygen at the receiving water stations indicates that dissolved oxygen concentrations in urban runoff did not significantly affect receiving water quality with regard to this parameter. The Program also measure pH levels above the Basin Plan's 6.5 – 8.5 standard unit range at the MO-CAM (Events 2 and 5), MO-MEI (Event 5), MO-OXN (Event 5), and MO-VEN (Event 5) Major Outfall stations. No exceedances of the Basin Plan pH range objective were observed at any of the receiving water stations during the 2010/11 season. The lack of exceedances for pH at the receiving water stations indicates that pH levels in urban runoff did not affect receiving water beneficial uses with regard to this parameter.

Table 6-27 Other constituents detected above Basin Plan Objective

Other constituents detected above Basin Plan Objective					
Site	Event 1 (Wet)	Event 2 (Wet)	Event 3 (Wet)	Event 4 (Wet)	Event 5 (Dry)
Calleguas Creek Watershed Outfalls not causing or contributing to exceedance					
ME-CC			*		
MO-CAM		pH	*		pH
MO-MPK			*		
MO-SIM			*		
MO-THO			*		
Santa Clara River Watershed Outfalls not causing or contributing to exceedance					
ME-SCR			*		
MO-FIL			*		Dissolved Oxygen
MO-SPA			*		
MO-OXN			*		pH
MO-VEN			*		pH
Ventura River Watershed Outfalls not causing or contributing to exceedance					
ME-VR2			*		
MO-MEI		*			pH
MO-OJA		*			
Coastal Outfalls not causing or contributing to exceedance					
MO-HUE	Dissolved Oxygen	Dissolved Oxygen	*		
* Not sampled during this event					

6.10 Aquatic Toxicity Results

The Stormwater Monitoring Program's NPDES permit specifies that chronic toxicity monitoring must be conducted on all Mass Emission and Major Outfall stations. The permit requires that for the first year a station is online for the permit cycle, chronic toxicity testing is to be conducted using three species during two storm events, the first of the season plus one other. For the remainder of the permit term, toxicity testing is to be conducted for the first storm of the season for each station using the most sensitive species determined during the initial year of sampling. For Mass Emission stations, the tests included three marine and estuarine species: topsmelt, giant kelp, and purple sea urchin. For the Major Outfall stations, the tests included three freshwater species: fathead minnow, water flea, and green algae.

Fourteen stations were monitored in the 2010/11 monitoring year, seven of which whose most sensitive species were determined during the 2009/10 monitoring year (ME-CC, ME-SCR, ME-VR2, MO-CAM, MO-MEI, MO-OJA, and MO-VEN), and seven of which were newly installed for the 2010/11 monitoring year and whose most sensitive species were determined from the 2010/11 monitoring year analyses (MO-FIL, MO-HUE, MO-MPK, MO-OXN, MO-SIM, MO-SPA, and MO-THO).

Toxicity sampling was conducted during Event 1 (October 6, 2010) and Event 2 (October 30, 2010), the results of which are summarized in Table 6-29 and Table 6-30. The seven sites monitored during the 2009/10 monitoring year were sampled for toxicity analysis during the first rainfall event of 2010/11, using the previously determined most sensitive species for each site[7]. The seven new sites for 2010/11 were monitored during the first and second monitored rainfall events of the year, using all three freshwater test species. The most sensitive species for each site are shown in Table 6-28, and will be used for toxicity analysis during the first rainfall event of future years, as required by the NPDES permit.

Table 6-28: Most Sensitive Species Selected for Annual Toxicity Testing

Site	Most Sensitive Species
ME-CC	Topsmelt*
ME-SCR	Purple sea urchin
ME-VR2	Topsmelt*
MO-CAM	Fathead minnow
MO-OJA	Fathead minnow
MO-MEI	Fathead minnow
MO-VEN	Water flea
MO-FIL	Water flea
MO-HUE	Water flea
MO-MPK	Green alga
MO-OXN	Fathead minnow
MO-SIM	Water flea
MO-SPA	Fathead minnow
MO-THO	Water flea

[7] Several days in advance of Event 1 (October 6, 2010), the Stormwater Monitoring Program requested that Aquatic Bioassay and Consulting Laboratories (ABC Labs) obtain the necessary organisms for analysis at each site. However, topsmelt were unavailable due to the large number of sampling programs using these organisms nationwide and the fact that there is only one supplier in the nation. This problem also occurred in the 2009/10 monitoring year, which prompted the Stormwater Monitoring Program to request permission from the RWQCB to use a substitute organism that is more readily available than topsmelt, the inland silverside (*Menidia beryllina*), for analysis. The RWQCB denied the request for 2009/10 Event 1, but later granted permission to perform side-by side comparisons of topsmelt and inland silverside (to see if a similar response to toxicity is observed in both organisms) for two future events when topsmelt is available (Event 2 of 2009/10 and one event from 2010/11), as shown in Appendix H. Permission to substitute inland silverside in future monitoring events is pending, due to continued insufficient supplies of topsmelt needed to run the comparison.

Table 6-29. Chronic Toxicity Results from Mass Emission Stations

			Topsmelt (*Atherinops affinis*)								Inland silverside (*Menidia beryllina*)							
			Survival				Biomass				Survival				Biomass			
Site	Event	Event Date	NOEC (%)	Tuc	IC25 (%)	IC50 (%)	NOEC (%)	Tuc	IC25 (%)	IC50 (%)	NOEC (%)	Tuc	IC25 (%)	IC50 (%)	NOEC (%)	Tuc	IC25 (%)	IC50 (%)
ME-CC	Event 1 (Wet)	10/06/2010	-	-	-	-	-	-	-	-	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00
ME-SCR	Event 1 (Wet)	10/06/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ME-VR2	Event 1 (Wet)	10/06/2010	-	-	-	-	-	-	-	-	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00

			Giant kelp (*Macrocystis pyrifera*)								Purple sea urchin (*Strongylocentrotus purpuratus*)			
			Germination				Tube Length				Fertilization			
Site	Event	Event Date	NOEC (%)	Tuc	IC25 (%)	IC50 (%)	NOEC (%)	Tuc	IC25 (%)	IC50 (%)	NOEC (%)	Tuc	IC25 (%)	IC50 (%)
ME-CC	Event 1 (Wet)	10/06/2010	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.0	1.00	>100.00	>100.00
ME-SCR	Event 1 (Wet)	10/06/2010	-	-	-	-	-	-	-	-	100.0	1.00	>100.00	>100.00
ME-VR2	Event 1 (Wet)	10/06/2010	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.0	1.00	>100.00	>100.00

Table 6-30. Chronic Toxicity Results from Major Outfall Stations

			Fathead minnow (*Pimephales promelas*)								Water flea (*Ceriodaphnia dubia*)							
			Survival				Reproduction				Survival				Reproduction			
Site	Event	Event Date	NOEC (%)	Tuc	IC25 (%)	IC50 (%)	NOEC (%)	Tuc	IC25 (%)	IC50 (%)	NOEC (%)	Tuc	IC25 (%)	IC50 (%)	NOEC (%)	Tuc	IC25 (%)	IC50 (%)
MO-CAM	Event 1 (Wet)	10/06/2010	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	-	-	-	-	-	-	-	-
MO-OJA	Event 1 (Wet)	10/06/2010	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	-	-	-	-	-	-	-	-
MO-MEI	Event 1 (Wet)	10/06/2010	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	-	-	-	-	-	-	-	-
MO-VEN	Event 1 (Wet)	10/06/2010	-	-	-	-	-	-	-	-	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00
MO-FIL	Event 1 (Wet)	10/06/2010	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00
	Event 2 (Wet)	10/30/2010	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00
MO-HUE	Event 1 (Wet)	10/06/2010	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00
	Event 2 (Wet)	10/30/2010	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00
MO-MPK	Event 1 (Wet)	10/06/2010	100.00	1.00	>100.00	>100.00	25.00	4.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00
	Event 2 (Wet)	10/30/2010	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00
MO-OXN	Event 1 (Wet)	10/06/2010	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00
	Event 2 (Wet)	10/30/2010	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00
MO-SIM	Event 1 (Wet)	10/06/2010	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00
	Event 2 (Wet)	10/30/2010	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00
MO-SPA	Event 1 (Wet)	10/06/2010	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00
	Event 2 (Wet)	10/30/2010	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00
MO-THO	Event 1 (Wet)	10/06/2010	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00
	Event 2 (Wet)	10/30/2010	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00

			Green alga (*Selenastrum capricornutum*)			
			Growth			
Site	**Event**	**Event Date**	**NOEC (%)**	**Tuc**	**IC25 (%)**	**IC50 (%)**
MO-CAM	Event 1 (Wet)	10/06/2010	-	-	-	-
MO-OJA	Event 1 (Wet)	10/06/2010	-	-	-	-
MO-MEI	Event 1 (Wet)	10/06/2010	-	-	-	-
MO-VEN	Event 1 (Wet)	10/06/2010	-	-	-	-
MO-FIL	Event 1 (Wet)	10/06/2010	100.00	1.00	>100.00	>100.00
	Event 2 (Wet)	10/30/2010	100.00	1.00	>100.00	>100.00
MO-HUE	Event 1 (Wet)	10/06/2010	100.00	1.00	>100.00	>100.00
	Event 2 (Wet)	10/30/2010	100.00	1.00	>100.00	>100.00
MO-MPK	Event 1 (Wet)	10/06/2010	100.00	1.00	>100.00	>100.00
	Event 2 (Wet)	10/30/2010	25.00	4.00	27.63	41.08
MO-OXN	Event 1 (Wet)	10/06/2010	100.00	1.00	>100.00	>100.00
	Event 2 (Wet)	10/30/2010	100.00	1.00	>100.00	>100.00
MO-SIM	Event 1 (Wet)	10/06/2010	100.00	1.00	>100.00	>100.00
	Event 2 (Wet)	10/30/2010	100.00	1.00	>100.00	>100.00
MO-SPA	Event 1 (Wet)	10/06/2010	100.00	1.00	>100.00	>100.00
	Event 2 (Wet)	10/30/2010	100.00	1.00	>100.00	>100.00
MO-THO	Event 1 (Wet)	10/06/2010	100.00	1.00	>100.00	>100.00
	Event 2 (Wet)	10/30/2010	100.00	1.00	>100.00	>100.00

According to the NPDES permit, a Toxicity Identification Evaluation (TIE) must be performed on samples exhibiting significant toxicity, defined in the permit as at least 50% mortality. For tests with only one endpoint where survival is not measured, such as the purple sea urchin or green alga, a TIE is triggered when the primary endpoint of the test has greater than 50% effect. For the purple sea urchin, this equates to a fertilization rate of less than 50%. For the green alga, it equates to growth that is less than half of that of the control sample.

Only one sample, the green alga test for MO-MPK in Event 2, exhibited significant toxicity (using growth as the endpoint) with a TUc of 4.00 and an IC50 of less than 100% (i.e. growth was less than half that of the control sample). No survival or reproductive toxicity was observed for MO-MPK for the fathead minnow or water flea in Event 2. ABC Labs initiated the Phase1 TIE process for this sample to identify which group of compounds appear to be causing the toxicity. The toxicant groups targeted were volatile or oxidizable compounds, particulate-bound toxins, cationic metals, non-polar organics, and organophosphates. The manipulations included C_{18}-Solid Phase extraction for non-polar organic compounds and certain metals or metal chelates; the addition of piperonyl butoxide (PBO) to block the action of metabolically-activated organophosphate compounds; and sodium thiosulfate addition for the neutralization of chemicals used in disinfection, chlorination, and some electrophilic organic chemicals. The concentrations used are dependent on the sample's initial 96-hour IC50. Final analysis of results compared 96-hour IC50s from manipulated samples to that of the unaltered effluent baseline. Based on the results of all sample manipulation, toxicity was reduced by the addition of PBO more significantly than the other treatments; therefore, metabolically-activated organophosphate compounds are suspect. C_{18} extraction and sodium thiosulfate additions also reduced toxicity but to a lesser degree, therefore non-polar organic compounds and chemicals used in disinfection and chlorination are also indicated as sources of toxicity. As mentioned in Section 6.10.3 this site also had elevated levels pentachlorophenol with the potential source already identified and steps taken eliminate any further discharge. It is possible that this is also the source of the identified toxicity.

A closer inspection of Table 6-29 and Table 6-30 reveals that there was one other instance in which the TUc exceeded 1.00, that of MO-MPK in Event 1 for fathead minnow reproduction. A TIE was not run on this sample because a TUc greater than one for reproduction metrics does not necessitate a TIE analysis, according to the NPDES permit. More detailed results are available in Appendix I.

7.0 Dry-Season, Dry-Weather Analytical Monitoring

A new component to the Stormwater Monitoring Program during this permit cycle was the inclusion of dry-weather monitoring. As described in the NPDES permit, the sites were selected to be representative of runoff from each of the Permittees jurisdictions (each city and the county unincorporated area) in Ventura County. For most jurisdictions, monitoring occurred at the associated Major Outfall monitoring station; however, as anticipated, inadequate flow was encountered at four of the Major Outfall stations prompting the relocation of these sampling sites.

The eight jurisdictions with sampleable dry-season, dry-weather Major Outfall locations were: Camarillo, Fillmore, Moorpark, Ojai, Oxnard, Simi Valley, Thousand Oaks, and Ventura. For the remaining three jurisdictions, the list of alternate sites was used to select a location with adequate flow. For Santa Paula, the site was moved from the 11th Street Drain to Fagan Canyon, for Port Hueneme, the site was moved upstream to Bubbling Springs Park, and the County Unincorporated site was moved from Happy Valley Drain in Meiners Oaks to Medea Creek in Oak Park.

Sampling took place on three days. Fillmore-1 (MO-FIL), Ojai-1 (MO-OJA), Oxnard-1 (MO-OXN), Santa Paula-2 (Fagan Canyon), and Ventura-1 (MO-VEN) were sampled on August 17, 2011. Camarillo-1 (MO-CAM), Moorpark-1 (MO-MPK), Port Hueneme-3 (Bubbling Springs Park), Simi Valley-1 (MO-SIM), and Thousand Oaks-1 (MO-THO) were sampled on August 18, 2011. The final site, Unincorporated-2 (Medea Creek in Oak Park), was sampled on August 23, 2011. There was at least 72 hours of dry weather preceding each sampling event.

As required by the NPDES permit, grab samples were collected and analyzed for total coliform, *E. coli*, total hardness, total organic carbon, and the dissolved metals copper, lead, and zinc. Field observations and measurements were also taken. The results are included in Appendix J.

8.0 Bioassessment Monitoring

As instructed in the new NPDES permit, the Stormwater Monitoring Program participated in the Southern California Regional Bioassessment program. This program was run by the Southern California Coastal Water Research Project (SCCWRP) and included participation from multiple agencies and organizations. The Stormwater Monitoring Program was responsible for sampling 15 qualified probabilistic sites throughout Ventura County, divided among each of the three major watersheds (six in the Ventura River Watershed, six in the Calleguas Creek Watershed, and three in the Santa Clara River Watershed). Probabilistic site locations were randomly generated by SCCWRP and evaluated by District staff to ensure each site met the requirements of the program (e.g. accessible, perennial, permission granted etc.). Sites that did not meet the requirements of the program were rejected and evaluation of sites continued until the required number of sites were qualified. The Stormwater Monitoring Program was also responsible for sampling three trend sites, one in each of the three watersheds. Trend sites were selected for their location and are to be monitored each year for the duration of the study.

With help from ABC Labs, sampling was conducted June 29, 2011, through July 21, 2011. The reconnaissance, chemistry, California Rapid Assessment Method (CRAM), physical habitat (P-HAB), and toxicity data has been submitted electronically to SCCWRP for inclusion in the 2011 update and full term study report. Taxonomic identification of invertebrates and algae is being undertaken by outside laboratories is not under the jurisdiction of the Stormwater Monitoring Program. This data is currently due to SCCWRP by February 28, 2012.

A technical and non-technical report summarizing the first year's data (2009) was released earlier this year (2011) and is available at SCCWRP's website www.sccwrp.org. Reports for the second and third years (2010 and 2011) of the study are still pending and links to these documents will be included in future Annual Water Quality Monitoring Reports, as they become available.

Appendix A: Major Outfall Station Fact Sheets

Appendix B. Event Hydrographs

Appendix C. NRCS Curve Number Methodology Discussion

Appendix D. Event Summaries

Appendix E. Chain-of Custody Forms

Appendix F. Laboratory QA/QC Analysis Results

Appendix G. Laboratory Environmental Analysis Results

Appendix H. RWQCB Permission of Toxicity Species Substitution

Appendix I. Aquatic Toxicity Testing Lab Results

Appendix J. Dry-Weather Analytical Monitoring Results