Ventura Countywide Stormwater Quality Management Program

Stormwater Monitoring Program
2009/2010 Water Quality Monitoring Report
December 2010

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 2009/10 monitoring season.

The underpinning of the increased monitoring effort prescribed in the new NPDES permit was 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 new component of the Stormwater Monitoring Program, are located in watersheds representative of a particular Permittee's contribution to downstream waters. The first four of these were constructed in Ojai, Meiners Oaks, Ventura and Camarillo. (The seven remaining stations were bought online during the summer of 2010 and will be included in the Stormwater Monitoring Program during the 2010/11 monitoring season.)

Water chemistry samples were collected at Mass Emission and Major Outfall stations during three rainfall events (October 13, 2009, December 7, 2009, and February 5, 2010), and also at Mass Emission and Major Outfall stations during one dry event during the wet season (March 17, 2010). Toxicity samples were collected during the first two events of the season. A smaller subset of water chemistry samples was collected at each of the Major Outfall stations (or similar replacement location) on June 28, 2010, and August 24, 2010, as part of the dry -season, dry-weather monitoring prescribed in the NPDES permit.

During the first two storms, several problems were discovered with new the sampling equipment that were undocumented in the vendor's literature. Stormwater Monitoring Program staff were able to circumvent those problems and obtain adequate volumes of water for chemical analysis.

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 96.1% success rate in meeting program data quality objectives.

Aluminum, *E. coli* and fecal coliforms were routinely found at elevated levels at all sites during wet-weather events, but rarely during dry-weather events. Other constituents that were found at elevated levels during the 2009/10 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).

Bioassessment sampling was performed at 15 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). Sampling was conducted May 14, 2009, through June 17, 2009, and the following year from June 9, 2010, through July 12, 2010.

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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-MEI	Major Outfall monitoring station – Meiners Oaks
MO-MEI	Major Outfall monitoring station – Ojai
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 readopted 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 (VCSQMP) and the Stormwater Monitoring Program during the 2009/10 monitoring season. Pursuant to NPDES Permit No. CAS0040002, the VCSQMP 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 impact of stormwater discharges. The monitoring also aids in the identification of pollutant sources, as well as the assessment of VCSQMP effectiveness. Evaluating program effectiveness allows for changes to be made in the Stormwater Monitoring Program in order to resolve any problems that may exist. This adaptive management strategy improves stormwater monitoring program effectiveness. 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 discharges, 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 2009/10 monitoring season, water quality samples from three wet-weather events and one dry-weather event were collected for water chemistry analysis at the Mass Emission stations, as required by the NPDES permit. Also, aquatic toxicity samples were collected at each Mass Emission station during Event 1 (October 13, 2009) and Event 2 (December 7, 2009). 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.

1.2 Major Outfall Monitoring

A new component to the Stormwater Monitoring Program this year was the requirement to sample at one station representative of each Permittee's land use. 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. Station selection of these new sampling locations is described in Section 2.2.

During the 2009/10 monitoring season, water quality samples from three wet-weather events and one dry-weather event were collected for water chemistry analysis at the four Major Outfall stations, as required by the NPDES permit. Also, aquatic toxicity samples were collected at these Major Outfall stations during Event 1 (October 13, 2009) and Event 2 (December 7, 2009). 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 VCSQMP 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 VCSQMP implementation and provide Permittees with real data on which to base future management decisions.

1.3 Dry-Season, Dry-Weather Analytical Monitoring

Another new component to the Stormwater Monitoring Program this reporting period was the requirement to characterize 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

Under the previous NPDES permit, 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 throughout the County. This sampling was performed in the late spring of 2009 and 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 Sanitation 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.

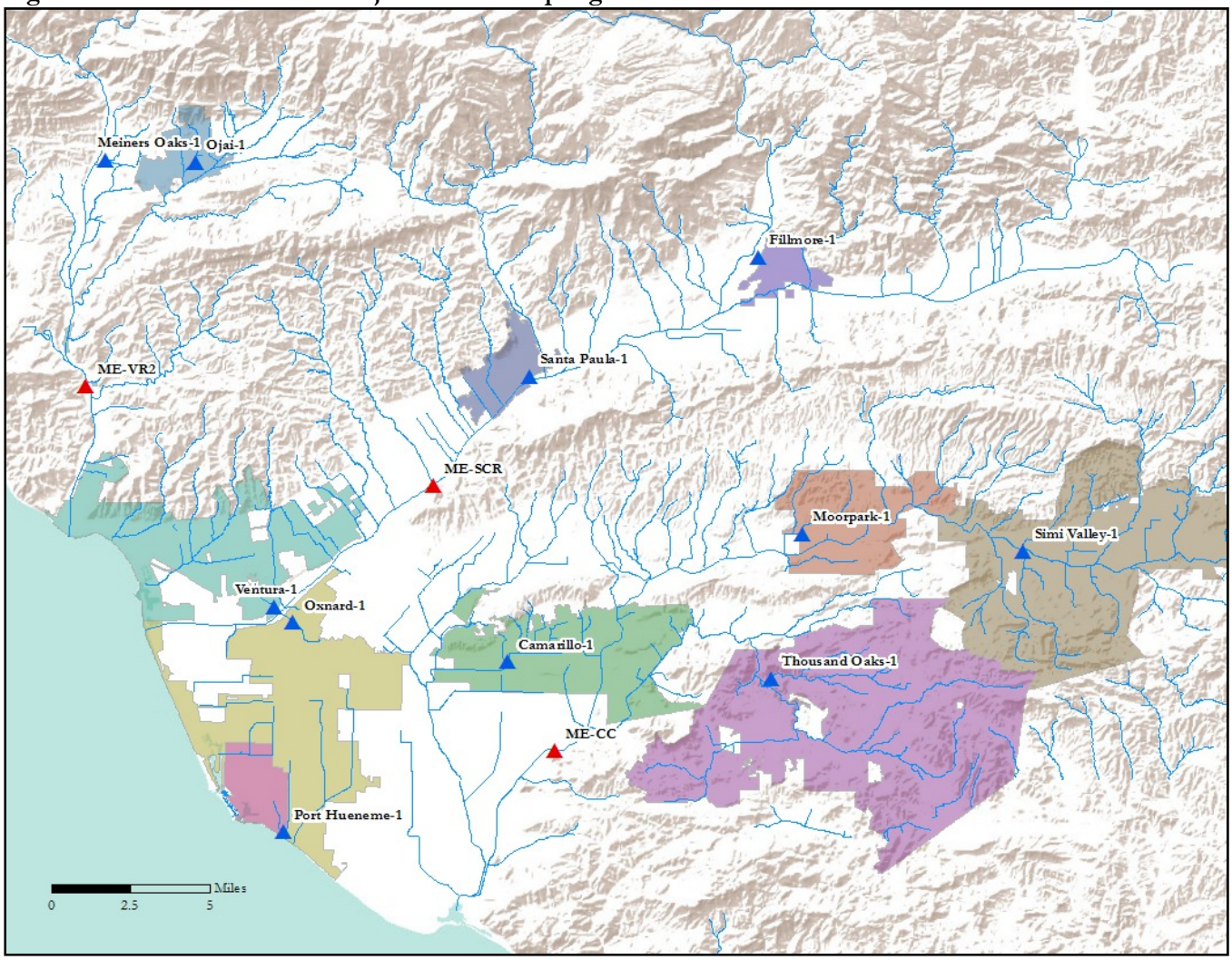
2.2 Major Outfall Stations

Four new Major Outfall stations were added to the Stormwater Monitoring Program this year. As directed by the NPDES permit, these stations were to represent the runoff from each city (Permittee) in which they were 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 seven remaining stations were bought online during the summer of 2010 and will be included in the Stormwater Monitoring Program during

[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 with Camarillo-1, MO-OJA with Ojai-1, MO-MEI with Meiners Oaks-1, and MO-VEN with Ventura-1.

the 2010/11 monitoring season. 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.

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.

Figure 1 shows the location of Major Outfall stations, not only for those locations that were sampled this year, but for those that will be included in the sampling program next year.

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 compositing all of the sub-samples (aliquots) into one bottle, each constituent only needs to be analyzed once to determine its concentration. 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.

At only one site is flow-paced sampling not technically feasible. 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.

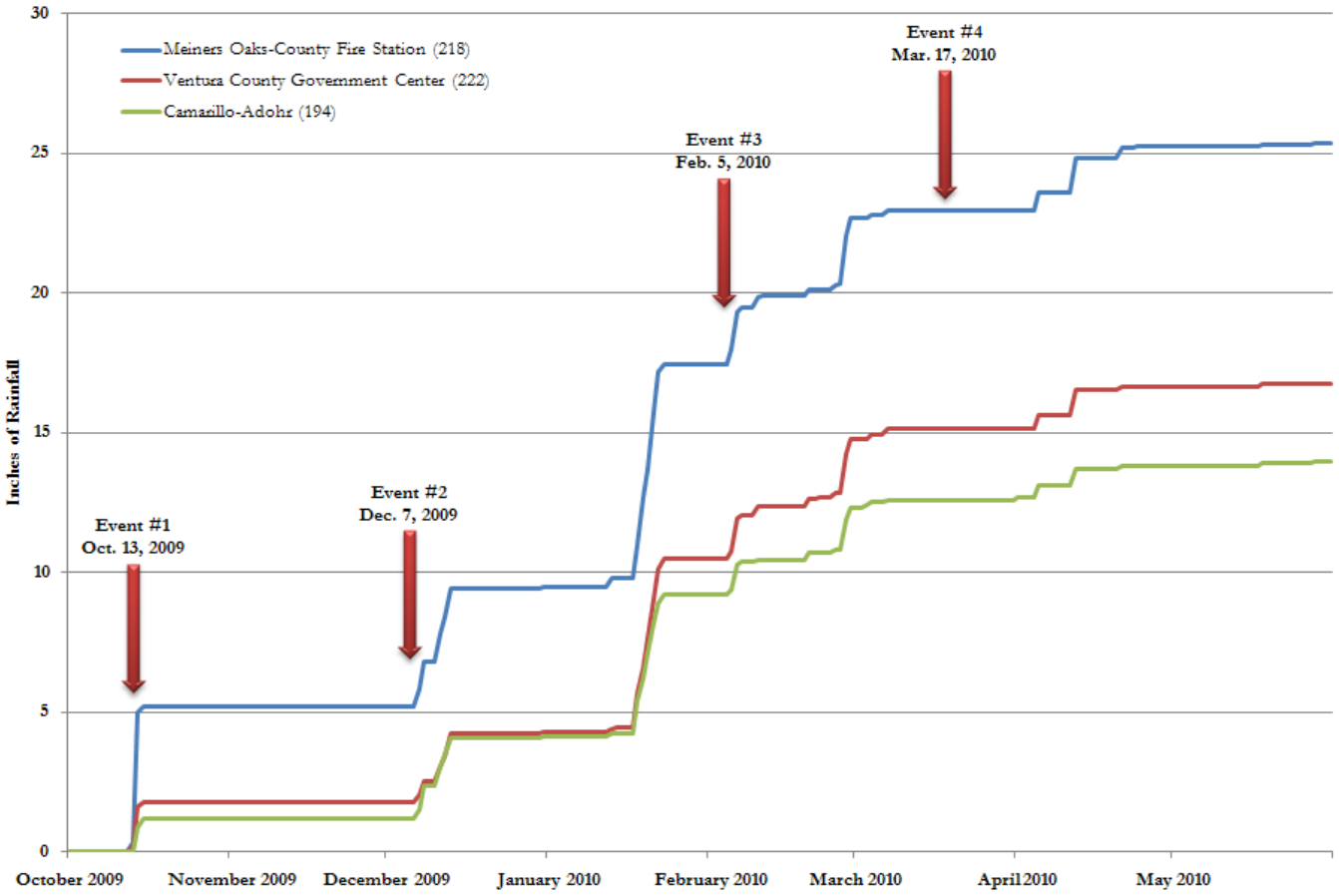
3.1 Precipitation

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.

In the smaller watersheds, with newly constructed Major Outfall stations, the rainfall records are either nonexistent or substantially less extensive than those in the larger watersheds. For this reason, tipping bucket rainfall gauges (0.01" per tip) were installed at most monitoring station locations. The exception is at the MO-OJA station where an extensive tree canopy over the site makes adequate computation of rainfall impossible. At this location, a surrogate gauge maintained by the VCWPD's Hydrology section (part of the Automated Local Evaluation in Real Time (ALERT) network) was used to determine rainfall amounts for each storm.

While rainfall gauges purchased and maintained by the Stormwater Monitoring Program are of high quality, the data generated by these gauges are subjected to less 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. 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. Rainfall data gathered at specific monitoring stations can be found in Appendix B.

Figure 2. Precipitation at Selected Sites



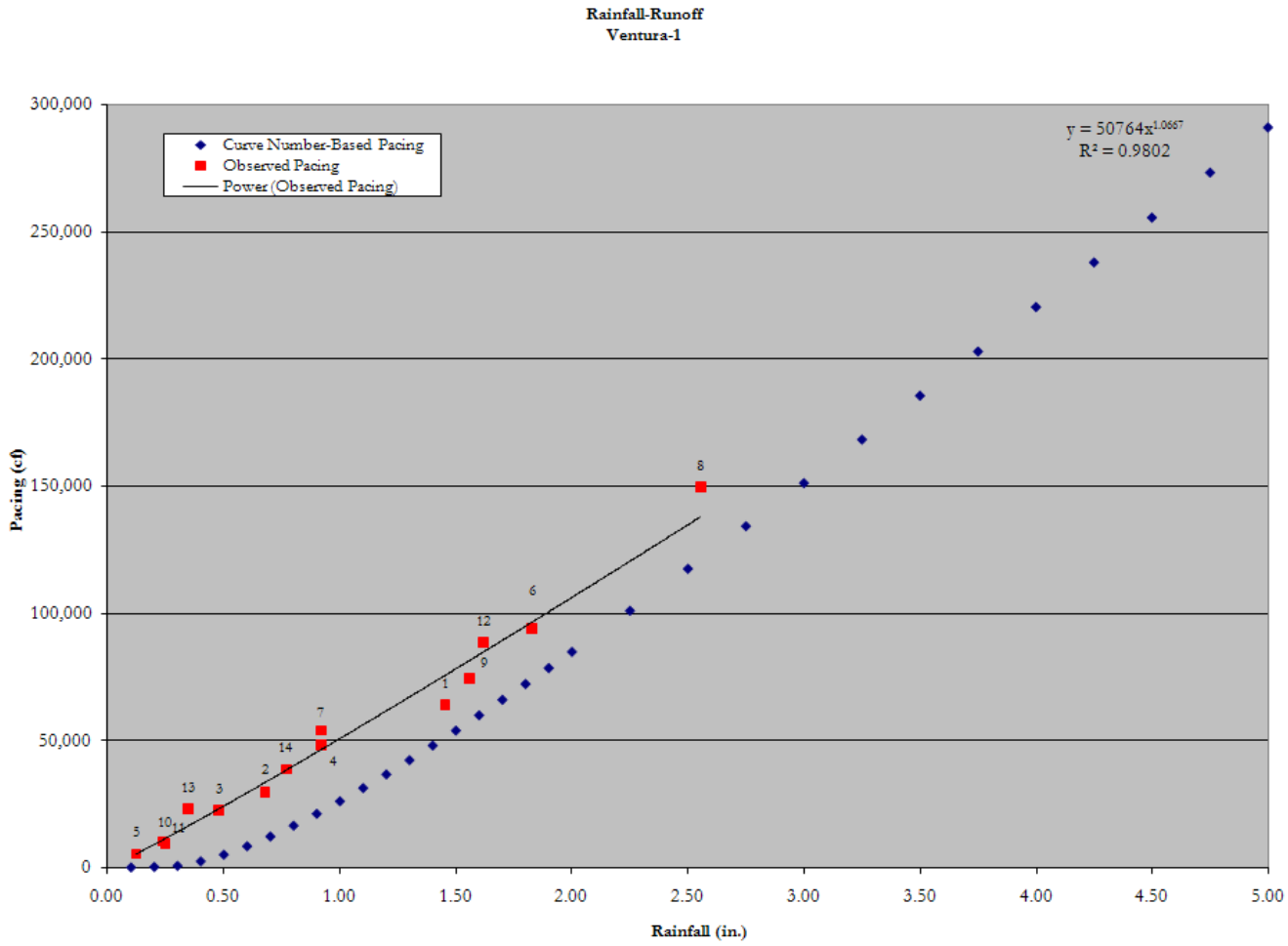
3.2 Rainfall-to-Runoff Ratios

Prior to the start of the monitoring season, the Stormwater Monitoring Program enlisted the VCWPD's Hydrology section to assist in modeling the expected 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 year, the Stormwater Monitoring Program refined these model results by comparing the rainfall generated by each of 14 storms to the runoff generated by those storms. 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 4230 bubblers were installed at all locations (except at the aforementioned ME-SCR station). By measuring pressure head and relating it to a rating table, ISCO 4230s are capable of calculating instantaneous discharge. These types of flow meters are extremely low maintenance and highly reliable and were, therefore, chosen over other contact (area-velocity) and non-contact (ultrasonic) types of flow measuring devices.

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 1.5" rainfall event would generate about 2.3 million cubic feet of runoff (see data point #1). 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 65,000 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 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

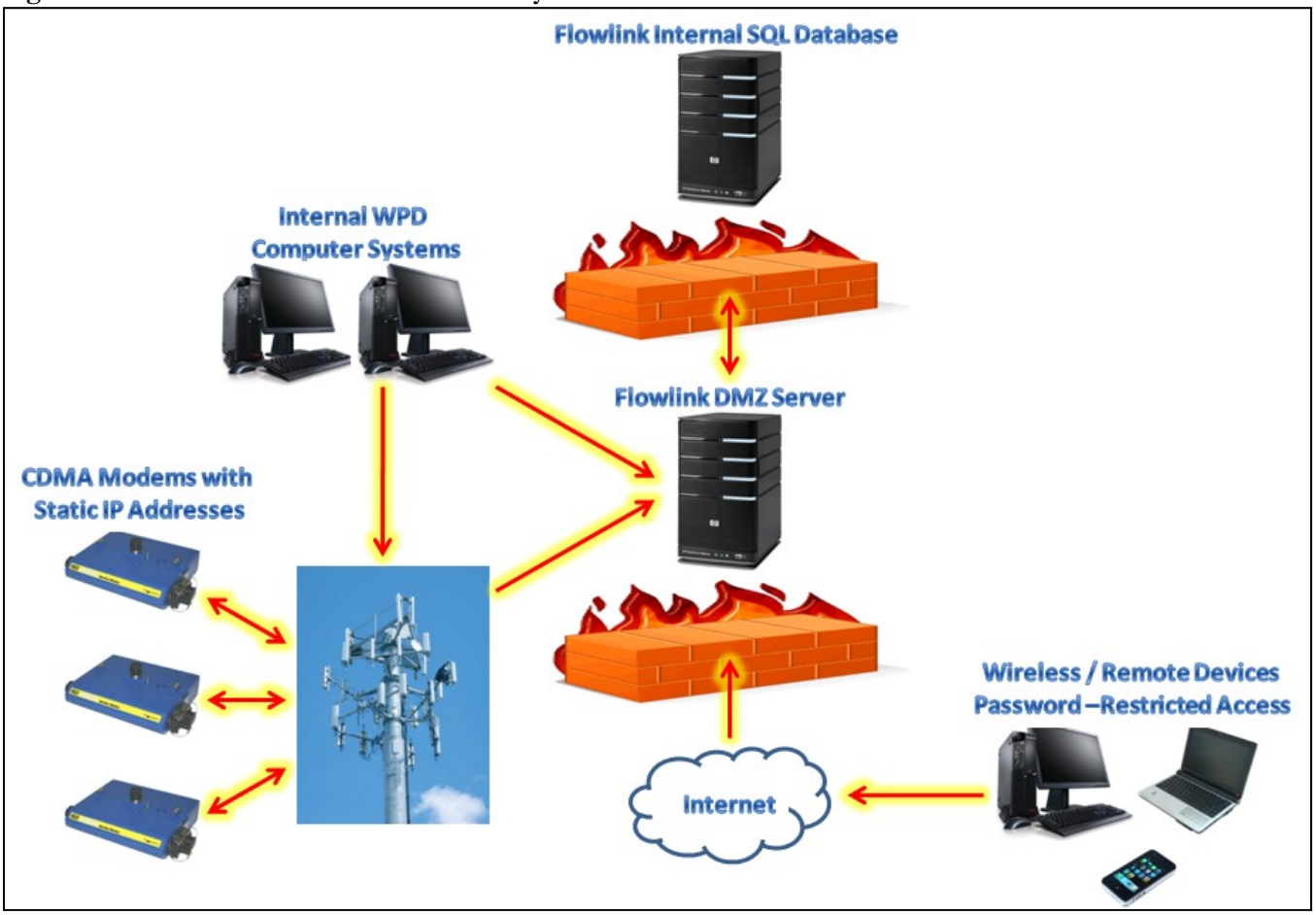


Figure 5. Real-Time Data Available in Storm Control Center

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 baseflow preceded by at least 7 days of dry weather(<0.10" each day), and one dry-weather event. 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 1).

In Table 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 baseflow, which took 0.10" to 0.25" of rainfall, depending on the sampling location.[2] Furthermore, flow often continued after the automated sampler had completed its sampling program, because of the Stormwater Monitoring Program's desire to ensure that enough aliquots were taken to perform the required analyses. Because of this desire, the Stormwater Monitoring Program erred 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

[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."

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 2009/10 monitoring year are described in *Ventura Countywide Stormwater Monitoring Program: Water Quality Monitoring Standard Operating Procedures, 2009-2014*.

Table 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	10/13/2009	134.72	10/13/2009 10:02	10/14/2009 6:32	20:30
	2	12/7/2009	665.60	12/7/2009 11:40	12/7/2009 18:17	6:37
	3	2/5/2010	455.35	2/5/2010 10:37	2/6/2010 4:48	18:11
	4	3/17/2010	15.62	3/17/2010 11:07	3/18/2010 9:46	22:39
ME-VR2	1	10/13/2009	7.64	10/13/2009 10:01	10/14/2009 4:26	18:25
	2	12/7/2009	3.54	12/7/2009 10:06	12/8/2009 8:41	22:35
	3	2/5/2010	201.50	2/5/2010 10:51	2/5/2010 18:36	7:45
	4	3/17/2010	47.96	3/17/2010 9:45	3/18/2010 8:50	23:05
ME-SCR	1	10/13/2009	[c]	10/13/2009 9:58	10/14/2009 9:12	23:14
	2	12/7/2009	[c]	12/7/2009 6:01	12/8/2009 5:15	23:14
	3a	2/19/2010	[c]	2/19/2010 20:01	2/20/2010 19:15	23:14
	4	3/17/2010	[c]	3/17/2010 7:18	3/18/2010 6:47	23:29
MO-CAM	1	10/13/2009	25.58	10/13/2009 17:57	10/14/2009 12:16	18:19
	2	12/7/2009	30.40	12/7/2009 11:15	12/7/2009 15:58	4:43
	3	2/5/2010	76.10	2/5/2010 11:15	2/5/2010 18:15	7:00
	4	3/17/2010	0.50	3/17/2010 12:48	3/18/2010 10:39	21:51
MO-MEI	1	10/13/2009	11.10	10/13/2009 15:24	10/13/2009 21:48	6:24
	2	12/7/2009	12.09	12/7/2009 9:37	12/7/2009 13:50	4:13
	3	2/5/2010	13.50	2/5/2010 6:46	2/5/2010 21:17	14:31
	4	3/17/2010	0.50	3/17/2010 9:37	3/18/2010 8:10	22:33
MO-OJA	1	10/13/2009	8.12	10/13/2009 14:40	10/14/2009 12:48	22:08
	2	12/7/2009	11.73	12/7/2009 9:16	12/7/2009 15:22	6:06
	3	2/5/2010	6.67	2/5/2010 6:16	2/5/2010 18:53	12:37
	4	3/17/2010	0.50	3/17/2010 8:34	3/18/2010 7:48	23:14
MO-VEN	1	10/13/2009	8.09	10/13/2009 23:21	10/14/2009 6:05	6:44
	2	12/7/2009	24.47	12/7/2009 7:26	12/7/2009 14:56	7:30
	3	2/5/2010	45.91	2/5/2010 6:36	2/5/2010 15:51	9:15
	4	3/17/2010	0.50	3/17/2010 11:30	3/18/2010 9:30	22:00

[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] 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.

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 rocked in a sample-pouring stand 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 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 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 2009/10 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 2009/10 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 2009/10 monitoring season are presented in Appendix E.

While defined before the beginning of the wet season, the appurtenant QA/QC sampling schedule was designed to change as conditions warrant. This flexibility was utilized on several occasions during this wet season 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. While rainfall-to-runoff tables have been developed for a variety of soil moisture conditions, the ongoing drought has created an environment in which a larger-than-predicted amount of rainfall infiltrates into the ground, thereby reducing modeled flow conditions. Finally, the operation of the diversion canal at ME-SCR by UWCD caused the sampler to fail to take a number of aliquots on multiple occasions. Operation of this structure during sampling events will often 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. 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. In situations where insufficient sample volume was obtained, QA/QC sample analysis was switched from sites with insufficient volume to one with surplus volume.

3.4.1 Event 1 (Wet)

The first rainfall event of the year began early in the morning on October 13, 2009. Preliminary estimates of 0.75" to 1.5" on the coast and in the valleys and 1.5" to 4.0" in the mountains were doubled just hours before the storm by the

National Weather Service (NWS). By the time the storm had moved through the area 40 hours later, approximately 5" of rain had fallen in the Ojai Valley and 1.0" to 1.5" of rain had fallen on the Oxnard Plain.[3]

The Stormwater Monitoring Program did not have time to install the new remote communication units (ISCO 2105s) at the three Mass Emission stations prior to the onset of the storm. Sampler activation and pacing were, therefore, executed as they had been prior to this season – an estimated start time based on predicted onset of rain and pacing based on predicted rainfall amounts – neither or which could be changed without a visit to the site.

At the Major Outfall stations, the new ISCO 2105 units had be installed with the intent of activating the samplers once a 20% rise in baseflow had been actualized, which would have removed the guesstimate of the onset of rainfall from the equation. However, problems with the new ISCO 2105 units forced field crews to activate the sampling programs manually onsite. After the monitoring event was complete, Stormwater Monitoring Program staff were able to recreate the activation problems in the lab and re-programmed the ISCO 2105 units accordingly. It is important to note that the problems encountered and corrected were not documented in the user's guide for these pieces of equipment.

3.4.2 Event 2 (Wet)

The second rainfall event of the year also turned out to be the second monitoring event of the year. Rain began falling around midnight on the morning of December 7, 2009. Rainfall estimates of 0.5" to 1.5" on the coast and in the valleys and 1.5" to 3.0" in the mountains turned out to be reasonably accurate. The approximate duration of the storm, from the onset of rain to a return to baseflow within the channels, was approximately 20 hours for the Major Outfall stations and 35 to 48 hours for the Mass Emission stations.

Prior to the arrival of this storm, all sites had been outfitted with ISCO 2105 units. However, computational problems with those units led to samples being taken at incorrect times. ISCO customer service was contacted regarding the problem, which was rectified after the monitoring event. Again, the problems encountered and corrected were not documented in the user's guide for these pieces of equipment.

3.4.3 Event 3 (Wet)

The third monitoring event took place on February 5, 2010, just less than two weeks after the previous rainfall. Rainfall predictions of 0.5" to 1.0" on the coast turned out to be very accurate, but only half of the 1.5" to 3.0" predicted rainfall in the mountains occurred. Sampling times ranged from 7 hours (MO-CAM) to 18 hours (ME-CC).

Corrections to the programming of sampler enabling and pacing were completed prior to the storm and accurate flow-paced sampling was achieved during this event, as shown in Appendix B. Unfortunately, the silicon line leading from the sampler to the composite bottle at the ME-SCR station came loose and the sample aliquots were deposited on the floor of the refrigerator rather than in the bottle. This necessitated an additional sampling event at this site.

[3] The rain gauges in the Ojai Valley are located near the MO-OJA and MO-MEI stations and upstream of the ME-VR2 station, although a surface hydrologic connection between this Mass Emission station and the upper watershed is only established after a significant amount of rain has fallen on the watershed (something which tends to occur not until the later part of winter); therefore, it is doubtful that the monitoring results at ME-VR2 for this event contain any contribution from the MO-OJA or MO-MEI stations.

3.4.4 Event 3A (Wet)

The only site sampled during this event was the ME-SCR location. Since the last sampled rainfall event two weeks prior, no rain had fallen on the watershed. Rainfall predictions of 0.33" to 0.75" at the coast and 1.0" to 1.5" in the mountains were inaccurate, as only approximately 0.25" was uniformly distributed across all areas of the county over 5 hours. All sampling equipment functioned properly and the correct time-paced sample was captured.

3.4.5 Event 4 (Dry)

The only wet-season, dry-weather sampling event took place on March 17, 2010, a week and a half after the previous rainfall. During this sampling event, Stormwater Monitoring Program staff deployed sand-weighted silicone dams 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 ranged from 22 to 23.5 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 2 shows those analytes that were gathered as discrete samples. Table 3 shows those analytes that were gathered as composite samples. All laboratory chemical analyses of environmental samples were performed by Weck Laboratories, with the exception of analyses for indicator bacteria, which were performed by the Ventura County Public Health Lab, and preseason equipment blank samples, which were performed by CRG Marine Laboratories.

Table 2. 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 3. 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
	Antimony (Dissolved)	EPA 200.8
	Antimony (Total)	EPA 200.8

Classification	Constituent	Method
	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
	2,6-Dinitrotoluene	EPA 625
	2-Chloronaphthalene	EPA 625
	2-Chlorophenol	EPA 625, EPA 8270Cm

Classification	Constituent	Method
	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
	Phenol	EPA 625, EPA 8270Cm
	Pyrene	EPA 625, EPA 8270Cm
PCB	PCB Aroclor 1016	EPA 608
	PCB Aroclor 1221	EPA 608

Classification	Constituent	Method
	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
	Dichlorvos	EPA 525.2
	Dieldrin	EPA 608
	Dimethoate	EPA 525.2
	Dinoseb	EPA 515.3
	Diphenamid	EPA 525.2

Classification	Constituent	Method
	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 2009/10 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 2009/10 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 2009/10 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 2009/10 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 cleaned using a very weak nitric acid solution (1% dilution) and distilled water. A dedicated sampling crew was provided by VCWPD 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 2009/10 monitoring season include field duplicates and equipment blanks. Unlike past years, no field blanks were collected during the 2009/10 monitoring season. Equipment blanks are typically prepared prior to the start of the monitoring season to check that tubing, strainers, and sample containers – especially composite bottles – aren't sources of contamination for the Stormwater Monitoring Program's environmental samples. Equipment blanks were collected by passing blank water through cleaned tubing and into brand new sample bottles. 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., jars, bottles, carboys, etc.) 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 carboys 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.

The Stormwater Monitoring Program reviewed the results of its tubing blank analyses performed almost three months (July 22, 2009) prior to monitoring of the Event 1 (October 13, 2009) of the 2009/10 monitoring season. Several constituents were detected, as shown in Table 4. The organic constituents naphthalene and phenol were detected, but were not found in stormwater sampling throughout the course of the monitoring season. Lead, mercury and the organic diethyl phthalate were also detected in the tubing blank, but at levels often far below that typically found in stormwater. The only constituent that was detected in the same range as that found in stormwater was total zinc; however the Ocean Plan standard for this constituent is 80 µg/L, which is far greater than any contamination that might be occurring from the sampling equipment. 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.

Table 4. Constituents Detected in Tubing Blanks

Constituent	Concentration (µg/L)	Stormwater Range (µg/L) (when detected)
Lead	0.13	0.22 - 13
Zinc	8.6	6.9-150
Diethyl phthalate	0.285	4.4-5.0
Naphthalene	0.0133	None detected
Phenol	0.219	None detected
Mercury	0.0017	0.050-0.086

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. 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 2 and Event 3. Laboratory-initiated laboratory duplicate samples were analyzed during all sampling events. Results are shown in Table 5 and Table 6. With one exception, all

DQOs for field and laboratory duplicate samplers were met by laboratories during the 2009/10 monitoring season, as shown in Table 6.

Table 5. 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	1	0	100
Conventional	Cyanide	EPA 335.4	2	0	100
Conventional	pH	SM 4500-H+ B	2	0	100
Hydrocarbon	Oil and grease	EPA 1664A	4	0	100
Metal	Mercury	EPA 245.1	2	0	100
Organic	Various	EPA 524.2	4	0	100

Table 6. Laboratory Duplicate Success Rates

Classification	Constituent	Method	Total Samples	Samples Outside DQO	Success Rate
Conventional	Volatile Suspended Solids	EPA 160.4	5	0	100
Conventional	Turbidity	EPA 180.1	10	0	100
Conventional	Alkalinity as CaCO3	SM 2320 B	9	0	100
Conventional	Hardness	SM 2340 B	1	0	100
Conventional	Specific Conductance	SM 2510 B	7	0	100
Conventional	Total Dissolved Solids	SM 2540 C	7	0	100
Conventional	Total Suspended Solids	SM 2540 D	7	0	100
Conventional	pH	SM 4500-H+ B	8	0	100
Metal	Mercury	EPA 1631Em	1	0	100
Metal	Multiple	EPA 200.8m	11	1	90.9
Metal	Chromium VI	EPA 218.6/ SM 3500-Cr D	3	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.[4] 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 considered to exceed the Stormwater Monitoring Program's DQO for this QA/QC sample type. With one exception, all holding times were met by laboratories during the 2009/10 monitoring season, as show in Table 7.

[4] 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.

Table 7. Holding Time Exceedances

Classification	Total Samples	Samples Outside DQO	Success Rate
Anion	84	0	100
Bacteriological	103	0	100
Cation	56	0	100
Conventional	415	1	99.8
Hydrocarbon	60	0	100
Metal	944	0	100
Nutrient	222	0	100
Organic	2354	0	100
PCB	257	0	100
Pesticide	2905	0	100

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 5,991 environmental samples were analyzed during the 2009/10 monitoring season. Of these, 5,760 were accepted as unqualified, meaning all DQOs were met for that particular sample. The Stormwater Monitoring Program's QA/QC evaluation process identified 231 environmental samples in need of qualification, which translates into the Stormwater Monitoring Program achieving a 96.1% 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 during the 2009/10 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 four monitoring events during the 2009/10 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 1-3), 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. The CTR Human Health (Organisms Only) objectives were used here 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 4), 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. The CTR Human Health (Organisms Only) objectives were used here 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 2009/10 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 2009/10 at the ME-CC and ME-VR2 stations lasted from just under 7 hours (Event 2 at ME-CC) to just under one day (Event 4 at ME-VR2). 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 8). These mass loading estimates are presented in Table 9 and Table 10.

Table 8. Example Mass Loading Calculation

Event 1 at ME-CC
Chloride concentration: 190 mg/L Event duration: 20 hours, 30 minutes = 20.5 hours
Average flow rate: 134.72 cfs 134.72 x 7.48 gal/cf x 3.785 L/gal = 3814.2 L/sec
Load = concentration x volume 3814.2 L/sec x 190 mg/L = 724,698 mg/sec 724,698 mg/sec x 60 sec/min x 60 min/hr x 20.50 hr/event x 1 kg/10^6 mg x 2.2 lb/kg = **117,661 lb/event**

Table 9. Estimated Mass Loadings at ME-CC

Classification	Constituent	Event 1 (Wet) 10/13/2009 20.50 hrs. (lbs/event)	Event 2 (Wet) 12/7/2009 6.62 hrs. (lbs/event)	Event 3 (Wet) 2/5/2010 18.18 hrs. (lbs/event)	Event 4 (Dry) 3/17/2010 22.65 hrs. (lbs/event)
Anion	Chloride	118000	78100	111000	17500
Anion	Fluoride	272	237	408	34.9
Cation	Calcium (Total)	56400	51400	89100	8730
Cation	Magnesium (Total)	32200	27700	46400	4760
Conventional	BOD	17300	17800	9840	103*
Conventional	COD	51400	61300	66800	1350
Conventional	MBAS	ND	18.8*	ND	ND
Conventional	Phenolics	27.9	79.0	ND	3.2
Conventional	Total Chlorine Residual	ND	ND	68.7*	0.32*
Conventional	Total Dissolved Solids	594000	445000	631000	87300
Conventional	Total Organic Carbon	11800	10900	8540	373
Conventional	Total Suspended Solids	322000	613000	1710000	1190
Conventional	Volatile Suspended Solids	52600	119000	186000	0
Metal	Aluminum (Total)	2540	6420	16700	14.3
Metal	Antimony (Total)	0.93	0.79	1.5*	0.04*
Metal	Arsenic (Total)	3.2	5.4	10.0	0.29
Metal	Barium (Total)	42.7	95.8	204	3.4
Metal	Beryllium (Total)	0.10	0.33	0.82	ND
Metal	Cadmium (Total)	0.37	0.99	1.9	0.02
Metal	Chromium (Total)	13.0	19.8	44.5	0.09
Metal	Chromium VI	ND	0.31	0.48*	0.03
Metal	Copper (Total)	8.1	28.7	55.7	0.36
Metal	Iron (Total)	4770	10900	26000	23.8
Metal	Lead (Total)	2.3	12.8	17.3	0.03
Metal	Mercury (Total)	ND	0.04*	0.16	0.03*
Metal	Nickel (Total)	14.2	22.7	44.5	0.57
Metal	Selenium (Total)	2.4	3.3	3.2	0.13
Metal	Silver (Total)	ND	0.19*	0.17*	0.001*
Metal	Thallium (Total)	ND	0.14*	0.22*	0.002*
Metal	Zinc (Total)	26.0	89.9	147	1.3

(continued on next page)

Classification	Constituent	Event 1 (Wet) 10/13/2009 20.50 hrs. (lbs/event)	Event 2 (Wet) 12/7/2009 6.62 hrs. (lbs/event)	Event 3 (Wet) 2/5/2010 18.18 hrs. (lbs/event)	Event 4 (Dry) 3/17/2010 22.65 hrs. (lbs/event)
Nutrient	Ammonia as N	297	415	278	10.3
Nutrient	Nitrate + Nitrite as N	5570	4050	4640	785
Nutrient	Nitrate as N	5510	4050	4640	777
Nutrient	Phosphorus as P (Total)	1490	2270	3340	143
Nutrient	TKN	1920	3260	7240	33.3
Organic	2,4,6-Trichlorophenol	ND	0.79*	1.5*	ND
Organic	2,4-Dichlorophenol	ND	0.56*	ND	ND
Organic	3-/4-Methylphenol	ND	ND	0.69*	ND
Organic	Benzo(a)pyrene	ND	ND	ND	0.04
Organic	Bis(2-ethylhexyl)adipate	ND	2.1*	ND	0.05*
Organic	Bis(2-ethylhexyl)phthalate	13.6	3.4	ND	0.52
Organic	Butyl benzyl phthalate	ND	ND	ND	0.08
Organic	Diethyl phthalate	ND	0.28*	ND	ND
Organic	Di-n-butylphthalate	ND	ND	1.4*	0.05*
Pesticide	2,4'-DDT	ND	0.02	0.02	ND
Pesticide	4,4'-DDE	ND	0.09	0.06*	ND
Pesticide	4,4'-DDT	ND	0.04	0.04	ND
Pesticide	DCPA (Dacthal)	1.9	4.0	4.6	0.79
Pesticide	Dimethoate	ND	0.02	ND	ND
Pesticide	Glyphosate	19.2	18.8	10.6	ND
Pesticide	Malathion	ND	3.5	0.16	ND
Pesticide	Prometryn	0.68	ND	0.28	1.6

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 10. Estimated Mass Loadings at ME-VR2

Classification	Constituent	Event 1 (Wet) 10/13/2009 18.42 hrs. (lbs/event)	Event 2 (Wet) 12/7/2009 22.58 hrs. (lbs/event)	Event 3 (Wet) 2/5/2010 7.75 hrs. (lbs/event)	Event 4 (Dry) 3/17/2010 23.08 hrs. (lbs/event)
Anion	Chloride	1890	986	14700	9680
Anion	Fluoride	13.3	6.81	109	109
Cation	Calcium (Total)	3790	1970	34000	27300
Cation	Magnesium (Total)	1010	574	10500	7690
Conventional	BOD	139	53.8	770	169*
Conventional	COD	820	176	3500	2460
Conventional	MBAS	ND	0.36*	ND	ND
Conventional	Phenolics	1.4	1.2	10.9	11.2
Conventional	Total Dissolved Solids	21500	12200	186000	166000
Conventional	Total Organic Carbon	186	57.4	1330	372
Conventional	Total Suspended Solids	442	215	66500	ND
Conventional	Volatile Suspended Solids	189	108	7700	ND

(continued on next page)

Classification	Constituent	Event 1 (Wet) 10/13/2009 18.42 hrs. (lbs/event)	Event 2 (Wet) 12/7/2009 22.58 hrs. (lbs/event)	Event 3 (Wet) 2/5/2010 7.75 hrs. (lbs/event)	Event 4 (Dry) 3/17/2010 23.08 hrs. (lbs/event)
Metal	Aluminum (Total)	7.9	2.7	1580	7.7
Metal	Antimony (Total)	0.03	0.004*	0.11*	0.03*
Metal	Arsenic (Total)	0.03	0.01	0.77	0.08*
Metal	Barium (Total)	1.9	ND	ND	ND
Metal	Beryllium (Total)	ND	ND	0.07	ND
Metal	Cadmium (Total)	ND	0.001*	0.13	0.01*
Metal	Chromium (Total)	0.03	0.01	4.6	0.05*
Metal	Chromium VI	ND	0.003*	0.05*	0.06*
Metal	Copper (Total)	0.08	0.03	4.6	0.21
Metal	Iron (Total)	13.6	7.0	2450	16.9
Metal	Lead (Total)	0.01	0.005	1.09	0.01*
Metal	Mercury (Total)	0	0.0001*	0.01*	0.01*
Metal	Nickel (Total)	0.15	0.08	7.7	0.47
Metal	Selenium (Total)	0.04	0.02	0.74	0.42
Metal	Silver (Total)	ND	0.0002*	ND	ND
Metal	Zinc (Total)	0.29	0.07*	9.45	0.23*
Nutrient	Ammonia as N	ND	ND	18.9*	14.6*
Nutrient	Nitrate + Nitrite as N	27.1	28.7	560	241
Nutrient	Nitrate as N	27.1	28.7	560	241
Nutrient	Phosphorus as P (Total)	4.1	1.54	140	5.0
Nutrient	TKN	19.6	ND	385	62.1
Organic	3-/4-Methylphenol	ND	ND	0.13*	ND
Organic	Di-n-butylphthalate	ND	ND	0.23*	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 11 presents water quality objective exceedances at Mass Emission stations based on an analysis of the 2009/10 wet-weather stormwater monitoring data. Constituents that were found at elevated levels[5] at sites upstream (i.e., related Major Outfall stations) are shown in bold and highlighted (see Section 6.5 through Section 6.7 for a discussion of the relationship between the Mass Emission and Major Outfall stations). Table 12 presents the elevated levels of constituents at Major Outfall stations based on an analysis of the 2009/10 wet-weather 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 6.5 through Section 6.7 for a discussion of the relationship between the Mass Emission and Major Outfall stations).

6.3 Urban Runoff Impacts on Receiving Waters

Pursuant to Part 2 (Receiving Water Limitations) of the Countywide NPDES Permit (Order R410-0108, Permit No. CAS004002), the Permittees are required to determine whether discharges from their municipal separate storm sewer

[5] "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.

systems are causing or contributing to a violation or 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 2009/10 season.

6.4 "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 11. Water Quality Objective Exceedances at Mass Emission Stations

Site	2009/10-1 (Wet)		2009/10-2 (Wet)		2009/10-3 (Wet)		2009/10-4 (Dry)		Applicable Standard
	Constituent	Value	Constituent	Value	Constituent	Value	Constituent	Value	
ME-CC	Chloride	150					**Chloride**	**220**	150 mg/L (Basin Plan)
	E. coli	**388**	***E. coli***	**3,873**	***E. coli***	**1,046**			235 MPN/100 mL (Basin Plan)
	Fecal Coliform	**500**	**Fecal Coliform**	**9,000**	**Fecal Coliform**	**3,000**			400 MPN/100 mL (Basin Plan)
	Total Dissolved Solids	960					**Total Dissolved Solids**	**1,100**	850 mg/L (Basin Plan)
	Aluminum	**4,100**	**Aluminum**	**6,500**	**Aluminum**	**9,000**			1,000 µg/L (Basin Plan)
					Mercury	**0.071**			0.051 µg/L (CTR)
			4,4'-DDE	0.09					0.00059 µg/L (CTR)
			DDT	0.149	DDT	0.036			0.00017 µg/L (CTR)
							Benzo(a)pyrene	0.49	0.049 µg/L (CTR)
ME-SCR	***E. coli***	**3,873**	***E. coli***	**1,553**	***E. coli***	**857**			235 MPN/100 mL (Basin Plan)
	Fecal Coliform	**9,000**	**Fecal Coliform**	**2,200**	**Fecal Coliform**	**2,400**			400 MPN/100 mL (Basin Plan)
	Aluminum	**10,000**	**Aluminum**	**6400**					1,000 µg/L (Basin Plan)
	Mercury	0.066							0.051 µg/L (CTR)
							Benzo(a)pyrene	1.1	0.049 µg/L (CTR)
ME-VR2	***E. coli***	**15,531**	***E. coli***	**4,611**	***E. coli***	**857**			235 MPN/100 mL (Basin Plan)
	Fecal Coliform	**16,000**	**Fecal Coliform**	**3,500**	**Fecal Coliform**	**500**			400 MPN/100 mL (Basin Plan)
					Aluminum	**4,500**			1,000 µg/L (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 12. Elevated Levels at Major Outfall Stations

Site	2009/10-1 (Wet)		2009/10-2 (Wet)		2009/10-3 (Wet)		2009/10-4 (Dry)		Standard for Comparison
	Constituent	Value	Constituent	Value	Constituent	Value	Constituent	Value	
MO-CAM							**Chloride**	**340**	250 mg/L (Basin Plan)
							pH	9.88	8.5 pH units (Basin Plan)
							Total Dissolved Solids	**1,500**	500 mg/L (Basin Plan)
	E. coli	**34,480**	***E. coli***	**9,804**	***E. coli***	**3,873**			235 MPN/100 mL (Basin Plan)
	Fecal Coliform	**22,000**	**Fecal Coliform**	**16,000**	**Fecal Coliform**	**3,000**			400 MPN/100 mL (Basin Plan)
	Aluminum, total	**4,100**	**Aluminum, total**	**4,800**	**Aluminum, total**	**1,600**			1,000 µg/L (Basin Plan)
	Mercury, total	0.077			**Mercury, total**	**0.055**			0.051 µg/L (CTR)
	4,4'-DDE	0.12							0.00059 µg/L (CTR)
MO-MEI							Chloride	100	60 mg/L (Basin Plan)
	E. coli	**8,230**	***E. coli***	**14,136**	***E. coli***	**4,884**			235 MPN/100 mL (Basin Plan)
	Fecal Coliform	**30,000**	**Fecal Coliform**	**160,000**	**Fecal Coliform**	**5,000**			400 MPN/100 mL (Basin Plan)
	Aluminum, total	1,200	Aluminum, total	1,300	**Aluminum, total**	**4,400**			1,000 µg/L (Basin Plan)
MO-OJA	Chloride	100	Chloride	74	Chloride	130	Chloride	170	60 mg/L (Basin Plan)
	E. coli	**241,920**	***E. coli***	**8,164**	***E. coli***	**1,576**	*E. coli*	2,014	235 MPN/100 mL (Basin Plan)
	Fecal Coliform	**160,000**	**Fecal Coliform**	**30,000**	**Fecal Coliform**	**3,000**	Fecal Coliform	1,400	400 MPN/100 mL (Basin Plan)
							Total Dissolved Solids	1200	800 mg/L (Basin Plan)
	Aluminum, total	2,000	Aluminum, total	1,700	**Aluminum, total**	**2,100**			1,000 µg/L (Basin Plan)
MO-VEN							Chloride	300	250 mg/L (Basin Plan)
							pH	9.53	8.5 pH units (Basin Plan)
	E. coli	**14,140**	***E. coli***	**8,664**	***E. coli***	**2,851**			235 MPN/100 mL (Basin Plan)
	Fecal Coliform	**24,000**	**Fecal Coliform**	**16,000**	**Fecal Coliform**	**3,000**			400 MPN/100 mL (Basin Plan)
							Total Dissolved Solids	5,200	500 mg/L (Basin Plan)
	Aluminum, total	**1,200**	**Aluminum, total**	**1,600**	**Aluminum, total**	**1,100**			1,000 µg/L (Basin Plan)
	Copper, dissolved	14	Copper, dissolved	11	Copper, dissolved	8.2	Copper, dissolved	45	11.27 µg/L, 8.05 µg/L, 7.78 µg/L, 29.29 µg/L (CTR)*
							Selenium, total	11	5 µg/L (CTR)
			Bis(2-ethylhexyl)phthalate	4.3					4 µg/L (Basin Plan)

* 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")

6.5 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 2009/10 season: 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. 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 13 and Table 14, respectively.

Table 13: 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)	
Event 1 (Wet) – Oct. 13, 2009					
E. coli (MPN/100 mL)	No data	8,230	15,531	235	BP
Fecal Coliform (MPN/100 mL)	No data	30,000	16,000	400	BP
Event 2 (Wet) – Dec. 7, 2009					
E. coli (MPN/100 mL)	No data	14,136	4,611	235	BP
Fecal Coliform (MPN/100 mL)	No data	160,000	3,500	400	BP
Event 3 (Wet) – Feb. 5, 2010					
E. coli (MPN/100 mL)	No data	4,884	857	235	BP
Fecal Coliform (MPN/100 mL)	No data	5,000	500	400	BP
Aluminum, Total (µg/L)	No data	4,400	4,500	1,000	BP

Table 14: 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)	
Event 1 (Wet) – Oct. 13, 2009					
E. coli (MPN/100 mL)	No data	241,920	15,531	235	BP
Fecal Coliform (MPN/100 mL)	No data	160,000	16,000	400	BP
Event 2 (Wet) – Dec. 7, 2009					
E. coli (MPN/100 mL)	No data	8,164	4,611	235	BP
Fecal Coliform (MPN/100 mL)	No data	30,000	3,500	400	BP
Event 3 (Wet) – Feb. 5, 2010					
E. coli (MPN/100 mL)	No data	1,576	857	235	BP
Fecal Coliform (MPN/100 mL)	No data	3,000	500	400	BP
Aluminum, Total (µg/L)	No data	2,100	4,500	1,000	BP

6.6 Santa Clara River Watershed

Urban stormwater runoff and urban non-stormwater flows were evaluated at one Major Outfall in the Santa Clara River Watershed during the 2009/10 season: Ventura-1 (MO-VEN). MO-VEN is located downstream of the ME-

SCR Mass Emission station (see Figure 1). Because the ME-SCR station is located upstream of the MO-VEN station, 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 MO-VEN and 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-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-VEN station. Elevated levels of constituents in urban runoff and those exceeding WQS in the "downstream" receiving water are shown in Table 15 for the MO-VEN station.

Table 15: 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)	
Event 1 (Wet) – Oct. 13, 2009					
E. coli (MPN/100 mL)	3,873	14,140	No data	235	BP
Fecal Coliform (MPN/100 mL)	9,000	24,000	No data	400	BP
Aluminum, Total (µg/L)	10,000	1,200	No data	1,000	BP
Event 2 (Wet) – Dec. 7, 2009					
E. coli (MPN/100 mL)	1,553	8,664	No data	235	BP
Fecal Coliform (MPN/100 mL)	2,200	16,000	No data	400	BP
Aluminum, Total (µg/L)	6,400	1,600	No data	1,000	BP
Event 3 (Wet) – Feb. 5, 2010					
E. coli (MPN/100 mL)	857	2,851	No data	235	BP
Fecal Coliform (MPN/100 mL)	2,400	3,000	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.

6.7 Calleguas Creek Watershed

Urban stormwater runoff and urban non-stormwater flows were evaluated at one Major Outfall in the Calleguas Creek Watershed during the 2009/10 season: Camarillo-1 (MO-CAM). 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 in Table 16 for the MO-CAM station.

Table 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)	
Event 1 (Wet) – Oct. 13, 2009					
E. coli (MPN/100 mL)	388	34,480	No data	235	BP
Fecal Coliform (MPN/100 mL)	500	22,000	No data	400	BP
Aluminum, Total (µg/L)	4,100	4,100	No data	1,000	BP
Event 2 (Wet) – Dec. 7, 2009					
E. coli (MPN/100 mL)	3,873	9,804	No data	235	BP
Fecal Coliform (MPN/100 mL)	9,000	16,000	No data	400	BP
Aluminum, Total (µg/L)	6,500	4,800	No data	1,000	BP
Event 3 (Wet) – Feb. 5, 2010					
E. coli (MPN/100 mL)	1,046	3,873	No data	235	BP
Fecal Coliform (MPN/100 mL)	3,000	3,000	No data	400	BP
Aluminum, Total (µg/L)	9,000	1,600	No data	1,000	BP
Mercury, Total (µg/L)	0.086	0.055	No data	0.051	CTR
Event 4 (Dry) – Mar. 17, 2010					
Chloride (mg/L)	220	340	No data	150[b]/250[c]	BP
Total Dissolved Solids (mg/L)	1,100	1,500	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.

6.8 Discussion of WQS Exceedances

6.8.1 Aluminum and Mercury

Urban runoff and receiving water concentrations of aluminum were above the 1,000 µg/L Basin Plan objective at all Major Outfall/receiving water combinations for one or more events monitoring during the 2009/10 season. These elevated levels were limited to wet weather Event 3 in the Ventura River Watershed at the MO-MEI and MO-OJA stations, and in the receiving water measured at the ME-VR2 station. Concentrations above the aluminum objective occurred during wet weather Events 1 and 2 in the Santa Clara River Watershed at the MO-VEN station and in the receiving water as measured at the ME-SCR station. All three wet weather events showed elevated levels of the aluminum objective at the MO-CAM and ME-CC stations. Additionally, a concentration above the 0.051 µg/L CTR criterion for mercury was observed during wet weather Event 3 in both the urban runoff (MO-CAM) and receiving water (ME-CC) stations. Based on this one pair of mercury elevated concentrations observed during the 2009/10 monitoring season, the Program does not consider mercury at this time to constitute a persistent pollutant in urban runoff that is causing or contributing to the exceedance of a WQS.

Since the Program began monitoring for aluminum in 2004, it has frequently observed exceedances of the Basin Plan objective for the metal at all Program monitoring sites. Aluminum is found as a ubiquitous natural element in sediments throughout Ventura County geology. These sediments are mobilized during stormwater runoff events and

concentrations of aluminum in excess of the Basin Plan objective are commonly measured during wet weather monitoring events. This is clearly shown by the upstream site in the Calleguas Creek watershed (ME-CC) which recorded aluminum concentration of 9,000 mg/L. During the past six years that the Program has monitored aluminum, dry weather exceedances were rarely observed. Total mercury concentrations in excess of the 0.051 µg/L CTR criterion are regularly detected at the ME-CC station during wet weather monitoring events, but 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.

6.8.2 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 three wet weather events at all Major Outfall and Mass Emission stations monitored during the 2009/10 season. These indicator bacteria are frequently measured at concentrations in excess of WQS during wet weather events in Ventura County. Dry weather events monitored at the ME-CC Mass Emission station also have historically shown some exceedances for these indicator bacteria.

6.8.3 Other Constituents

Concentrations of chloride and total dissolved solids were detected above their site-specific Basin Plan objectives in Revolon Slough (MO-CAM) and Calleguas Creek (ME-CC), respectively, during dry weather Event 4. Based on these two pairs of elevated levels observed during the 2009/10 monitoring season, the Program does not consider chloride and total dissolved solids at this time to constitute a persistent pollutant in urban runoff that is causing or contributing to the exceedance of a WQS.

6.9 Aquatic Toxicity Results

The Stormwater Monitoring Program's NPDES permit specifies that chronic toxicity monitoring must occur during the first rainfall event of the year and another subsequent rainfall event. 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.

Several days in advance of Event 1 (October 13, 2009), 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. The Stormwater Monitoring Program requested permission to use a substitute organism that is more easily obtained than topsmelt, the inland silverside (*Menidia beryllina*), for analysis. The RWQCB denied the request for 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.

Toxicity sampling was conducted during Event 1 (October 13, 2009) and Event 2 (December 17, 2009), the results of which are summarized in Table 17 and Table 18 According to the NPDES permit, a Toxicity Identification Evaluation (TIE) must be performed on samples exhibiting significant mortality, something that occurred in only one

Table 17. 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)	10/13/2009																
	Event 2 (Wet)	12/7/2009	<50.00	>2.00	60.42	>100.00	<50.00	>2.00	42.84	79.91	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00
ME-SCR	Event 1 (Wet)	10/13/2009																
	Event 2 (Wet)	12/7/2009	100.00	1.00	>100.00	>100.00	100.00	1.00	53.70	76.55	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00
ME-VR2	Event 1 (Wet)	10/13/2009																
	Event 2 (Wet)	12/7/2009	100.00	1.00	>100.00	>100.00	50.00	2.00	42.84	79.91	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)	10/13/2009	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.0	1.00	>100.00	>100.00
	Event 2 (Wet)	12/7/2009	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	50.0	2.00	>100.00	>100.00
ME-SCR	Event 1 (Wet)	10/13/2009	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.0	1.00	>100.00	>100.00
	Event 2 (Wet)	12/7/2009	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	50.0	2.00	>100.00	>100.00
ME-VR2	Event 1 (Wet)	10/13/2009	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.0	1.00	>100.00	>100.00
	Event 2 (Wet)	12/7/2009	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	50.0	2.00	>100.00	>100.00

Table 18. 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)	10/13/2009	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)	12/7/2009	50.00	2.00	>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-OJA	Event 1 (Wet)	10/13/2009	100.00	1.00	>100.00	>100.00	100.00	1.00	56.23	62.47	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00
	Event 2 (Wet)	12/7/2009	100.00	1.00	>100.00	>100.00	<6.25	>16.00	<6.25	<6.25	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00
MO-MEI	Event 1 (Wet)	10/13/2009	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)	12/7/2009	100.00	1.00	>100.00	>100.00	50.00	2.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00	100.00	1.00	>100.00	>100.00
MO-VEN	Event 1 (Wet)	10/13/2009	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)	12/7/2009	100.00	1.00	>100.00	>100.00	<6.25	>16.00	5.55	>100.00	50.00	2.00	65.74	81.47	50.00	2.00	70.83	91.67

			Green alga (*Selenastrum capricornutum*)			
			Growth			
Site	Event	Event Date	NOEC (%)	Tuc	IC25 (%)	IC50 (%)
MO-CAM	Event 1 (Wet)	10/13/2009	50.00	2.00	79.60	>100.00
	Event 2 (Wet)	12/7/2009	100.00	1.00	>100.00	>100.00
MO-OJA	Event 1 (Wet)	10/13/2009	100.00	1.00	>100.00	>100.00
	Event 2 (Wet)	12/7/2009	100.00	1.00	>100.00	>100.00
MO-MEI	Event 1 (Wet)	10/13/2009	100.00	1.00	>100.00	>100.00
	Event 2 (Wet)	12/7/2009	100.00	1.00	>100.00	>100.00
MO-VEN	Event 1 (Wet)	10/13/2009	100.00	1.00	>100.00	>100.00
	Event 2 (Wet)	12/7/2009	100.00	1.00	>100.00	>100.00

instance during the 2009/10 monitoring season. At MO-VEN during Event 2, a chronic toxicity unit (TUc) of 2.00 and an IC_{50} of less than 100% (i.e., a stormwater sample that has been diluted but still kills more than one-half of the organisms) were observed. As directed by the NPDES permit, ABC Labs began the TIE process for this sample, the initial component of which was to conduct a "baseline" test to determine the final TIE test dilutions. However, during the "baseline" test, the toxicity was reduced to less than 1.00, meaning that no further testing was warranted. Although an undesirable outcome from a diagnostic standpoint, this situation is not uncommon and is indicative of the sample's toxicity dissipating by the time the TIE "baseline" testing was initiated. It is noteworthy that common environmental mechanisms may be causing degradation or loss of toxicant(s) over time, including volatilization, photochemical (light) reactions, chemical reactions (oxidation/reduction, hydrolysis, etc.) or biochemical (microbial) transformations.

A closer inspection of Table 17 and Table 18 reveals that there were other stations in which the TUc exceeded 1.00. TIEs were not run on these samples for one of two reasons. First, the TUc exceeded 1.00 for reproduction or growth metrics, a situation that does not necessitate at TIE analysis, according to the NPDES permit. Second, there were several instances in which the TUc exceeded 1.00 for a survival metric; however, the IC_{50} for these sites was always greater than 100%, meaning the sample would have to be concentrated to kill 50% of the organisms in the sample. More detailed results are available in Appendix I.

At the conclusion of the monitoring year, the most sensitive species (that which displayed the highest mortality or reduction in growth and reproduction) was to be selected at each site and used for the following four years of the permit cycle to determine toxicity. Based on the results shown in Table 17 and Table 18, the species shown in Table 19 were selected for subsequent toxicity testing.

Table 19. Species Selected for Toxicity Testing (Years 2-4)

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

* Dependent on toxicity results from 2010/11 monitoring season.

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. Due to timing issues with the finalization of the NPDES permit, this monitoring was not required until the 2010/11 monitoring season; nonetheless, the first year of monitoring was undertaken and the results included in Appendix J for informational purposes.

As described in the NPDES permit, the sites were supposed to be representative of runoff from each of the cities located in Ventura County.[6] Since a great deal of work had already been done in selecting Major Outfall stations that would have water quality characteristic of each of these entities, the Stormwater Monitoring Program opted to sample at those sites for this component of the monitoring program as well.

As anticipated, inadequate flow was encountered at four of the Major Outfall stations prompting the relocation of samples sites. In most cases sites were moved further upstream within the same watershed. However, sampling was moved from the 11th Street Drain to Fagan Canyon for the Santa Paula site, and from Happy Valley Drain in Meiners Oaks to Medea Creek in Oak Park for the County unincorporated site. Sampling took place on June 28, 2010, and August 24, 2010, with at least 72 hours of dry weather preceding the sample event.

[6] Although this season's wet-weather and dry-weather sampling took place only at four of the new Major Outfall stations, the dry-season, dry-weather monitoring was conducted at all 11 Major Outfall stations.

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 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).

With help from ABC Labs, sampling was conducted May 14, 2009, through June 17, 2009, and the following year from June 9, 2010, through July 12, 2010. The data was submitted to SCCWRP, which has promised a preliminary analysis and draft report near mid-December 2010. A summary of that data will be included in next year's Annual Water Quality Monitoring Report.