SECTION 14

Conclusions and Recommendations

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LIST OF TABLES

14.0 CONCLUSIONS AND RECOMMENDATIONS

14.1 Conclusions

This report provides a summary of the 2006-2007 Receiving Waters Monitoring Program for the Copermittees identified as dischargers of urban runoff in Order No. 2001-01 (the permit) of the RWQCB. Due to the delay in the issuance of the new permit (Order No. R9-2007-0001), the 2006-2007 monitoring was conducted to fulfill the requirements of Order No. 2001-01 Attachment B, IV, *Submittal of Receiving Waters Monitoring Requirements*. This report marks the final year of monitoring under Order No. 2001-01 and the transition to the monitoring program under the new permit Order No. R9-2007-0001.

The current monitoring program has allowed the region to gain an understanding of wet weather conditions at the base of the watersheds throughout the County. In addition, this Urban Runoff Monitoring Report provides insight into the biological and ambient conditions of the watersheds of San Diego County. Watershed water quality monitoring is performed by the Copermittees during wet weather rain events, dry weather field screening and IC/ID investigations are performed, and limited third party data are included. These water quality data results are incorporated with annual stream bioassessment data to provide a holistic approach to assessing each watershed and the region. Watershed assessments are performed following the Watershed Data Assessment Framework (Weston, 2004). Watershed area assessments are prepared on an annual basis and are compared to the baseline water quality priority ratings that assist in guiding watershed management activities. The monitoring program has provided both long-term trend analyses at historic stations, and continues to build the foundation for long-term trends throughout the County. Additionally, programmatic changes with the new permit cycle will provide additional spatial data, wet and dry weather condition assessments, and will maintain the long term record set for the region. The Copermittees planned participation in the Southern California Bight Monitoring Program during the 2008-2009 monitoring year will provide valuable insight into the conditions of San Diego's estuaries and the regional marine environment.

14.1.1 Watershed Water Quality Monitoring Conclusions

14.1.1.1 Wet Weather Monitoring Conclusions

Watersheds were compared by examining key constituents across watersheds and through time to determine similarities among the areas. Key constituents were defined as having either been rated as a potential concern based on the frequency and magnitude of concentrations above the applicable benchmark water quality objective (WQO) and/or being an indicator of water quality within a constituent group (e.g., total phosphorus is an indicator constituent in the nutrient group).

A comparison of the regional data results and highlighted values for the 2006-2007 wet season are presented by constituent group:

- Bacteria – Bacterial concentrations were elevated throughout the region for all three of the bacterial indicators. Fecal coliform concentrations were above the benchmark WQO in 25 of the 30 samples collected during the season. The highest concentrations were observed at the Tijuana River MLS, which can be expected given the reported discharges of untreated sewage to the river.

- Total Dissolved Solids (TDS) – TDS concentrations were observed above the benchmark WQO during all storm events sampled in the San Luis Rey River, Carlsbad, San Dieguito River, and Los Peñasquitos WMAs. Concentrations fluctuated in the Mission Bay, Sweetwater River, and San Diego River WMAs. In contrast, concentrations of TDS in all wet weather samples were below the benchmark WQO at the Chollas Creek and Tijuana River MLS. Higher TDS concentrations may indicate greater contributions from higher dissolved mineral salts from groundwater/base flow or imported water stored in local reservoirs.

- Total Suspended Solids (TSS) - Comparing TSS concentrations regionally, concentrations were consistently above benchmark WQOs in samples collected from Agua Hedionda Creek, Chollas Creek, and the Tijuana River. TSS concentrations were below the benchmark WQO during all three storm events at the San Luis Rey River, Los Peñasquitos Creek, and the Sweetwater River. Other watersheds had either one or two values above the benchmark WQO. High concentrations of TSS indicate potential sedimentation issues and transport of organic constituents. The intensity and duration of storm events can affect the level of TSS concentrations. Similar patterns were observed for turbidity results.

- Nutrients –Phosphorus, Nitrate, and Nitrite – Total phosphorus concentrations were above the benchmark WQO during two of the three wet weather events at the Tijuana River, and close to the benchmark WQO during the other one event. All other WMAs were below the benchmark WQO for total phosphorus. It should be noted that the Basin Plan benchmark WQO are intended for ambient conditions and are not directly applicable to storm water. Nitrate and nitrite concentrations were not observed above the benchmark WQO during any of the 2006-2007 storm events.

- Pesticides – Diazinon and malathion were both detected at concentrations above the benchmark WQO during the first rainfall event of the season (10/14/06) at Agua Hedionda and Chollas Creek. Diazinon was above the benchmark WQO during all three storm events at the Tijuana River MLS and malathion was above the benchmark WQO during two events. Diazinon was rarely detected in the remaining watersheds and was well below the benchmark WQO. Chlorpyrifos was not detected in any of the watersheds tested. Synthetic pyrethroids were detected at Agua Hedionda, Chollas Creek, and Tecolote Creek at levels likely to cause an effect to *Hyalella azteca* based on published literature values. Toxicity was observed to *Hyalella azteca* during all three events at Agua Hedionda Creek and Chollas Creek, but was not observed during any event in Tecolote Creek samples.

- Total Metals – Cadmium, Copper, Lead and Zinc – Cadmium concentrations were above the benchmark WQO for two storm events in Chollas Creek (one CCC and one CMC exceedance), and one storm event in Tecolote Creek (one CMC exceedance). Copper, lead, and zinc concentrations were above the benchmark WQO during all three storm events in Chollas Creek and Tijuana River, and during one event in Tecolote Creek. Copper and zinc were above the CMC during all events monitored in Chollas Creek and the Tijuana River, and during one event in Tecolote Creek. Lead was above the benchmark WQO during all three storm events in Chollas Creek (two CCC and one CMC exceedance) and the Tijuana River (CCC only), and during one event in Tecolote Creek (one CCC exceedance). Copper and lead concentrations were above the benchmark WQO at the San Diego River MLS (CCC exceedance only). Copper concentrations were above the benchmark WQO for two of three events at Agua Hediona Creek (CCC exceedances only), and for one event at Escondido Creek (one CCC exceedance). For the 2006-2007 wet season, water quality issues regarding total metals were limited to these MLS.

- Dissolved Metals – Dissolved copper was found above the benchmark WQO during all three storm events at Chollas Creek (two CMC and one CCC exceedance), while lead concentrations were above the benchmark WQO during one event (one CCC exceedance). While the concentrations of the dissolved metals were low, the low hardness values that occur in the Chollas Creek watershed as a likely result of the high percentage of impervious area, typically result in low benchmark WQO for metals. The benchmark WQO are calculations based on the hardness values found. No other watershed had dissolved metals results above the benchmark WQO.

- Toxicity – Toxicity results were similar to previous years at the Tijuana River MLS where all three sample events were toxic for *Ceriodaphnia dubia* and *Hyalella azteca*. Toxicity to *Hyalella azteca* was observed for all three events in Chollas Creek and Agua Hedionda and is likely attributable to the presence of synthetic pyrethroids. Toxicity to *Ceriodaphnia dubia* was also observed during the first storm event in Chollas Creek and Agua Hedionda where Diazinon and malathion were detected. Single toxic episodes to either *Ceriodaphnia dubia* and/or *Hyalella azteca* were also noted at San Luis Rey River, San Dieguito River, Los Peñasquitos, San Diego River, and Sweetwater River. Toxicity to *Selenastrum capricornutum* was only observed during one event at the San Dieguito River MLS.

The results for the 2006-2007 monitoring period were combined with the previous years' results, and were statistically compared to further identify spatial and temporal differences, commonalities, and trends between watersheds. Shown in Table 14-1 are the high frequency of occurrence constituents of concern identified through the WMA assessments and the observed significant Mann-Kendall statistical trends. Wet weather samples were not collected by the Navy for the Santa Margarita River during the 2006-2007 monitoring period.

Table 14-1. Mass Loading Station Persistent Wet Weather Constituents and Trends.

Mass Loading Station	Persistent Wet Weather Constituents of Concern	Significant Trends Observed
Santa Margarita	Fecal Coliform Turbidity	Increasing total coliform and Enterococci Decreasing fecal coliform
San Luis Rey	Total Dissolved Solids Fecal Coliform	Increasing nitrate, biochemical oxygen demand, total coliform, fecal coliform and Enterococci
Agua Hedionda Creek	Total Dissolved Solids Total Suspended Solids Turbidity Total Coliform Fecal Coliform Enterococci	Increasing ammonia, chemical oxygen demand, total suspended solids, turbidity, dissolved phosphorus, total coliform, fecal coliform, total copper, total lead, total nickel and *Hyalella* 96-hour survival Decreasing Diazinon and dissolved arsenic
Escondido Creek	Total Dissolved Solids Turbidity Total Coliform Fecal Coliform	Increasing total coliform, total copper and total zinc Decreasing Diazinon
San Dieguito River	Total Dissolved Solids	Increasing total suspended solids, total phosphorus, TKN and total nickel
Los Peñasquitos Creek	Total Dissolved Solids Fecal Coliform	Increasing total nickel
Tecolote Creek	Turbidity Total Coliform Fecal Coliform	Increasing Enterococci Decreasing nitrate, oil and grease, fecal coliform and Diazinon
San Diego River	Turbidity Fecal Coliform	Increasing total suspended solids and turbidity Decreasing nitrate, dissolved copper and dissolved arsenic
Chollas Creek	Total Suspended Solids Turbidity Total Coliform Fecal Coliform Enterococci Total Copper Total Lead Total Zinc	Increasing nitrite, turbidity, total copper, total zinc and *Hyalella* 96-hour survival Decreasing total dissolved solids, MBAS, Diazinon, *Ceriodaphnia* 7-day reproduction, *Ceriodaphnia* 7-day survival, and *Ceriodaphnia* 96-hour survival
Sweetwater River	Fecal Coliform Enterococci	Increasing pH and dissolved phosphorus Decreasing biochemical oxygen demand and *Selenastrum* 96-hour survival
Tijuana River	Ammonia Total Suspended Solids Turbidity Total Coliform Fecal Coliform Enterococci Diazinon	Increasing total suspended solids, turbidity, total organic carbon, nitrate, total coliform, fecal coliform, total arsenic, total lead, total zinc and *Hyalella* 96-hour survival Decreasing conductivity, total dissolved solids, Diazinon, dissolved arsenic and dissolved nickel

Significant Mann-Kendall statistical trends are listed in Table 14-1 and include:

- Bacteria - Results of trend analysis of wet-weather data for bacteriological indicators demonstrated increasing trends for total coliform in Santa Margarita River, San Luis Rey River, Agua Hedionda Creek, Escondido Creek, and Tijuana River; for fecal coliform in the San Luis Rey River, Agua Hedionda Creek and Tijuana River; and for Enterococci in the Santa Margarita River, San Luis Rey River, and Tecolote Creek. Concentrations of fecal coliform have generally been detected above the benchmark WQO.

- Sedimentation - Increasing trends for TSS are evident in Agua Hedionda Creek, San Dieguito River, San Diego River and Tijuana River. The highest TSS concentrations occurred at the Tijuana River MLS during the 2006-2007 season. Concentrations in San Diego River have been below the benchmark WQO.

- Nutrients – Trend analysis indicates increasing nitrate concentrations in the San Luis Rey River and Tijuana River. Increasing dissolved phosphorus concentrations in Agua Hedionda Creek and Sweetwater River and increasing total phosphorus and TKN concentrations in San Dieguito River. However, concentrations of these nutrients at all of the MLS with increasing trends were below the benchmark WQO.

- Pesticides - Diazinon concentrations indicate a significant decreasing trend for Agua Hedionda Creek, Escondido Creek, Tecolote Creek, Chollas Creek and Tijuana River. Concentrations have decreased from above to below the benchmark WQO at Agua Hedionda Creek, Escondido Creek, Tecolote Creek, and Chollas Creek. Only Tijuana River continues to have concentrations above the benchmark WQO.

- Metals - Trend analysis of the wet-weather data indicate significant increasing trends for total copper in Agua Hedionda Creek, Escondido Creek and Chollas Creek; for total lead in Agua Hedionda Creek and Tijuana River; for total nickel in Agua Hedionda Creek, San Dieguito River, and Los Peñasquitos River; for total zinc in Escondido Creek, Chollas Creek and Tijuana River. A decreasing trend for dissolved arsenic was noted in Agua Hedionda Creek, San Diego River and Tijuana River; for dissolved copper in San Diego River, and for dissolved nickel in Tijuana River.

The single event and annual mean concentrations for key constituents and toxicity at the Tijuana River MLS were statistically different and had higher magnitude of exceedances of benchmark WQO compared to all the other MLS, particularly those associated with untreated wastewater and highly urbanized land use. The constituents that consistently exceeded the benchmark WQO include fecal coliform, TSS, turbidity, BOD, ammonia, total phosphorus, and Diazinon. This is a finding that has been consistent throughout the past six years of monitoring. This MLS has also had the most consistent toxicity results with toxic reactions for all tests except those for *Selenastrum*.

On a regional basis, TSS annual mean concentrations have exceeded the benchmark WQO in 8 of the 11 MLS over the last six years indicating that TSS, which is an indicator of sediment loading, is a regional water quality issue. Across watersheds (except Tijuana River), the highest exceedances were generally observed for the 2004-2005 period which corresponds to the year of greatest precipitation of the study years. Larger and greater intensity storm events will mobilize a greater amount of sediment which would then correlate to greater TSS concentrations. Higher TSS may be associated with an increase in land disturbance activities in the watershed and increased impervious areas upstream of creek and river sections that may be subject to bank erosion from greater and more sustained peak flows. Temporal patterns in TSS concentrations indicate higher concentrations during greater intensity storm events.

Cluster analysis identified seven major clusters of station/date, and four major clusters of constituents. The results of the cluster analysis show one cluster group consisting almost exclusively of the Tijuana River MLS; the rest of the cluster groups are initially divided by monitoring year. As in prior years, within each of these annual clusters there are two main subgroups that represent differences in concentrations of total hardness, TDS, and conductivity. The MLS with consistently higher results for these three constituents are San Luis Rey River, Los Peñasquitos Creek, San Dieguito River, Tecolote Creek, and Sweetwater River. Agua Hedionda Creek and Chollas Creek are consistently lower in these constituents while the remainder of the MLS, Escondido Creek, and San Diego River are more variable.

14.1.1.2 Dry Weather Monitoring Conclusions

During the 2006 dry weather monitoring program, out of 9,526 individual field and analytic samples, 865 samples had results measured above the dry weather action levels. The constituent with the greatest number of detections above the action level for all land uses and conveyance types, and the highest rate of detections above the action level for 2006, was total coliform.

Analysis of the several years of dry weather data (2002-2006), as related to land use, shows that total coliform has been the constituent with the greatest rate of detections above the action level. Turbidity ranked second and Enterococcus third. This pattern is relevant for the entire County of San Diego, and for the five years of dry weather data evaluation.

14.1.1.3 Third Party Data Conclusions

The SWAMP data show persistent problems with sulfate and manganese in most of the watersheds, particularly at the base of the watershed. Dissolved minerals are typically associated with naturally occurring processes. However, land use activities may result in increased concentrations of these constituents. Of interest is the decrease in Diazinon detections above the benchmark WQO in the 2003 and 2004 data; this constituent was frequently found above the benchmark WQO in the 2002 data.

The 2005 Padre Dam data provide some additional information for the water quality assessment of the San Diego River WMA. This program provided measurement of TDS which was not measured in the SWAMP program. This constituent was the one most frequently found in concentrations above the benchmark WQO at all six sites sampled, followed by dissolved oxygen which was low during the summer months at all sites except Forrester Creek.

The City of La Mesa Field and Water Quality data provided additional information for the Chollas, Sweetwater, and San Diego River watersheds. Again, TDS was the constituent most often above the benchmark WQOs, followed by fecal coliform. Two of the field results also showed low levels of dissolved oxygen.

The Sweetwater Authority ambient monitoring data provided by the City of La Mesa (1997-2004), showed that TDS exceeded the benchmark WQO in 434 of 443 samples. Only one other sample for fecal coliform was above the benchmark WQO, all other constituents were below the benchmark WQOs.

Carlsbad Watershed Copermittee Grant Data provided additional ambient monitoring information for the Carlsbad Hydrologic Unit. Of the 96 samples collected over the monitoring period (December 2004-October 2006), only nitrate and fecal coliform results exceeded any benchmark WQOs. Nitrate exceeded the benchmark WQO twice during the monitoring period, and fecal coliform exceeded 25 of the 96 samples. At least one sample from each site exceeded the fecal coliform benchmark WQO over the monitoring period.

Carlsbad Watershed Copermittee Escondido Creek-Hale Avenue data were provided, and are assumed to be grab samples collected from the receiving water. Again, TDS was the constituent most often above the benchmark WQO (all 2006 samples and 17 of 24 samples in 2007). Chloride, sulfate, and dissolved oxygen results were often outside benchmark WQOs during 2006 and 2007. Fecal coliform results were also often above the benchmark WQO.

14.1.2 Stream Bioassessment Conclusions

A total of 25 different stream monitoring reaches were assessed in San Diego County in the surveys of October 2006 and May 2007. Three of these sites were considered to represent reference conditions. A total of 51 different monitoring reaches have been sampled since May 2001.

Taxonomic identification of samples collected in October 2006 produced 104 taxa from a total of 11,774 individuals. The May 2007 samples produced 102 taxa from 12,193 individuals.

The most abundant organisms in October 2006 in the study region were *Hyalella* (Amphipoda: Hyalellidae), chironomid midges (Diptera: Chironomidae), *Gammarus* (Amphipoda: Gammaridae), *Corbicula* (Bivalvia: Corbiculidae), and *Simulium* (Diptera: Simuliidae). The most abundant organisms in May 2007 in the study region were chironomid midges, *Simulium*, *Baetis* (Ephemeroptera: Baetidae), *Hyalella*, and Ostracods. The majority of organisms from the urban affected sites were moderately or highly tolerant to stream impairments. Organisms highly sensitive to impairments were encountered infrequently at the urban affected sites, but their presence even in low numbers was significant. Non-reference sites that supported highly sensitive organisms included Campo Creek in Campo and Escondido Creek in Elfin Forest.

The Index of Biotic Integrity ratings of the monitoring sites ranged from Very Good to Very Poor in both October 2006 and in May 2007. IBI scores for the reference sites were higher than all urban influenced sites in the October 2006 survey, and Campo Creek in Campo was the only urban site that scored higher than a reference site in May 2007. The May 2007 survey produced consistently lower IBI scores across the entire region than the October 2006 survey, with 19 of the 24 sites scoring lower in May.

Analysis of the ratio of observed organisms to expected organisms (O/E) indicated that most of the urban sites were moderately to highly degraded. This analysis was mostly in agreement with the IBI scores in determining impairment of the benthic communities. For the 2006/2007 surveys, there were several sites that the O/E analysis rated above the impairment threshold while the IBI rated the site as impaired. These included Escondido Creek in Elfin Forest, San Diego River in Mission Trails Park, and Santa Margarita River on Camp Pendleton.

Of all of the watersheds in San Diego County, the Santa Margarita River watershed had the least impaired benthic macroinvertebrate communities. Campo Creek in the upper Tijuana River WMA was also relatively unimpaired, as evidenced by the presence of highly intolerant organisms. The remaining watersheds have substantially greater amounts of urbanization, and the IBI results generally indicate that greater water quality impairment occurs in the lower portions of the watersheds as the impacts of urban runoff become cumulative and/or the stream type becomes warmer and more depositional.

After 6½ years of bioassessment surveys, there has been little trend towards degradation or improvement at any of the monitoring sites. Regionally, the county average IBI scores for most of the San Diego sites for May surveys have been quite consistent while there has been a slow and moderate decline for October surveys. Individual seasons or years have produced better conditions for the macroinvertebrates, and many of the monitoring sites have shown a consistent response to the variability of ecological conditions.

14.1.3 Ambient Bay and Lagoon Program Conclusions

The Ambient Bay, Lagoon, and Coastal Receiving Water Monitoring Program (ABLM) completed three years of monitoring during the summer of 2005. Monitoring for ABLM was not part of the scope of work during the 2006-2007 monitoring year.

14.1.4 Watershed Assessment Conclusions

14.1.4.1 Santa Margarita River Watershed Management Area

The Santa Margarita River Watershed is the second largest in the San Diego hydrologic region. The primary land uses within the contributing runoff area are undeveloped (66%), agricultural (18%), and military (8%).

For the Santa Margarita River WMA, turbidity and fecal coliform were identified as high frequency of occurrence COC, TSS was identified as a medium frequency of occurrence COC, and TDS and total copper were identified as low frequency of occurrence COC. There was no evidence of persistent toxicity found in Santa Margarita River. However, toxicity was observed for *Hyalella azteca* during the one event monitored during the 2005-2006 wet weather season. In addition, the ability to evaluate this watershed monitoring data is difficult due to the limited data collected over the past two monitoring seasons. Statistically significant increasing trends are observed for total coliform and Enterococci and significant decreasing trends are observed for fecal coliform.

Loading analysis was not performed since no storms were monitored during the 2006-2007 wet weather monitoring period.

Bioassessment monitoring in the Santa Margarita River WMA occurred at a total of three monitoring sites, including a reference site in Sandia Creek. All of the sites had mostly undisturbed habitat conditions, and the Index of Biotic Integrity quality ratings ranged from Very Poor to Good. The Willow Glen Road site was rated Very Poor for both surveys by the IBI and observed to expected (O/E) taxa ratios were also below the impairment threshold for both surveys. The Camp Pendleton site was rated Poor for both surveys by the IBI but was slightly above the O/E impairment threshold for May 2007. Neither the IBI nor O/E implicated any impairment at the Sandia Creek reference site.

As in past surveys, the monitoring sites in Santa Margarita River were among the highest rated of the urban affected sites in San Diego County, with lower IBI scores in May. This was the first year that an IBI rating of Very Poor was given to a site in the Santa Margarita River. However, biological metric values and water quality measures indicated that this watershed is still one of the least impacted in San Diego County. Since the beginning of the program, the Willow Glen Road site has had a mean IBI score of 18.3 and a mean observed over expected (O/E) ratio of 0.70. The O/E ratio was above the impairment threshold for four of the ten surveys. The Camp Pendleton site has had a mean IBI score of 22.2 and a mean O/E ratio of 0.70. The O/E ratio was above the impairment threshold for three of the nine surveys.

In addition to the WMA assessment findings, the water quality priority ratings for the overall Santa Margarita River WMA identified only dissolved minerals as a high priority (A) rated constituent. Several B ratings were identified which include heavy metals, sediments, pesticides, nutrients, gross pollutants, bacteria, benthic alterations, and toxicity. The two remaining constituent groups (organics and oil & grease) were assigned the lowest priority (D) rating.

The information provided from the triad matrix results used in conjunction with the water quality priority ratings can assist the jurisdictions in making informed decisions in developing their WURMP programs. The two assessments also allow for an evaluation of where data gaps exist and where efforts may be targeted.

The recommendations for this watershed are to continue monitoring at the MLS to determine long-term trends, continue monitoring for toxic and benthic impacts and to identify upstream sources of constituents of concern. The implementation of the new monitoring permit cycle will allow for assessing the watershed during both dry weather and wet weather conditions. With the monitoring efforts to be conducted for the Lagoon TMDL Monitoring, additional valuable information will be available in future years for the Santa Margarita River WMA.

14.1.4.2 San Luis Rey River Watershed Management Area

The San Luis Rey River Watershed is the largest watershed management area contained entirely within San Diego County, and at 359,887 acres is the third largest of any watershed within or partially within the county. The contributing runoff area consists of more than 224,000 acres, which covers over 62% of the San Luis Rey Watershed. The major land uses representative of the MLS drainage area are undeveloped (38.7%), residential (22.2%), and agriculture (21.6%).

For the San Luis Rey River WMA, TDS and fecal coliform were the only high frequency of occurrence COC followed by turbidity, nitrate, and total coliform which were all low frequency of occurrence COC. There was no evidence of persistent toxicity in San Luis Rey River; however, the benthic community appeared to be limited by unknown factors. A review of the scatterplots and trends shows statistically significant increasing trends for fecal coliform, total coliform, enterococci, BOD, and nitrate. Of these significant trends, only fecal coliform is above the benchmark WQO. All other trends are below the benchmark WQO (or do not have a benchmark WQO) and do not appear to be an immediate concern. Turbidity is the only constituent with values detected above the benchmark WQOs for wet weather data, dry weather action levels, and ambient third party data. The cause of occasional, infrequent toxicity during mass loading station monitoring is unknown.

Measured storm event loads were compared to loading values derived from the National Stormwater Quality Database (NSQD) (Pitt et al., 2004). Measured loads for total dissolved solids and bacterial indicators were greater than expected for all three storm events sampled. Most of the constituents measured were within the expected range or lower than expected. In particular, metals consistently showed lower than expected loads for all the storm events sampled.

Bioassessment monitoring in the San Luis Rey River WMA occurred at three sites, two urban affected sites in the San Luis Rey River and one reference site in Doane Creek, a small tributary on.Palomar Mountain. The San Luis Rey River sites had Index of Biotic Ratings of Very Poor for both sites and both surveys. The in-stream physical habitat of these sites was marginal, which could limit macroinvertebrate colonization, but it may be noted that the sites have a similar habitat other sites with substantially higher IBI scores. The reference site in Doane Creek was the highest rated site in the county program, with the greatest taxonomic diversity and many highly sensitive, infrequently encountered organisms. Since the beginning of the program, the upstream San Luis Rey River site has had a mean IBI score of 6.7 and a mean O/E ratio of 0.50. The downstream San Luis Rey site has had a mean IBI score of 4.7 and a mean O/E ratio of 0.39. The mean O/E ratio represents a 50% and 61% loss of expected taxa respectively for each site.

In addition to the WMA assessment findings which indicate TDS and fecal coliform as constituents of concern, the 2001-2006 water quality priority ratings found no high priority (A) ratings for the San Luis Rey River WMA. Several B priority ratings were identified and include dissolved minerals, bacteria and benthic alteration. All other constituents were given either a C or D rating.

The information provided from the triad matrix results used in conjunction with the water quality priority ratings can assist the jurisdictions in making informed decisions in developing their WURMP programs. The two assessments also allow for an evaluation of where data gaps exist and where efforts should be targeted.

Utilizing the BLTEA rating methods for future data evaluations may allow for long-term BMP effectiveness assessment. Incorporation of additional useable data from other third party monitoring programs may help to increase the confidence of the water quality priority ratings and overall WMA assessments.

The recommendations for this watershed are to continue monitoring at the MLS to determine long-term trends, continue monitoring for toxic and benthic impacts and to identify upstream sources of constituents of concern. The new permit monitoring order (R9-2007-0001) will add a temporary watershed assessment station in this watershed. The additional upstream station has been located at the Camino Del Rey Bridge in the San Luis Rey River. This station will provide the ability to evaluate the spatial and temporal distribution of chemical and biological conditions in the watershed. Additionally, the new permit calls for the evaluation of dry (ambient) conditions. Ambient data will provide data that will allow for the determination of annual loads and the evaluation of seasonal differences within the watershed.

14.1.4.3 Carlsbad Watershed Management Area

The Carlsbad WMA is the second most densely populated watershed in the San Diego region. The most common land use within the watershed management area is residential (35%), followed by undeveloped (21%), parks (14%), transportation (12%), and agriculture (7%). Monitoring occurs in two of the four watersheds (Agua Hedionda and Escondido Creek). The Agua Hedionda Creek and Escondido Creek sub-watersheds were each assessed for wet and dry weather water quality, toxicity, and the benthic in-stream habitat. In addition to watershed-specific COC and trends, each of the sub-watersheds assessed were found to have persistent detections above the benchmark WQOs or action levels for turbidity, TDS, total coliform and fecal coliform.

<u>Agua Hedionda</u>

The Agua Hedionda Creek sub-watershed accounts for 10% of the Carlsbad Watershed. Land use within the contributing runoff area is primarily residential (38%), undeveloped (23%), and parks (13%). TSS, TDS, turbidity, total coliform, fecal coliform, and enterococci were identified as high frequency of occurrence constituents of concern; Diazinon was identified as medium frequency of occurrence COC, while ammonia, COD, nitrate, and total copper were identified as low frequency of occurrence COC.

A review of the trend analysis shows statistically significant increasing trends for ammonia, chemical oxygen demand, TSS, turbidity, dissolved phosphorus, fecal coliform, total coliform, total copper, total lead, total nickel, and toxicity to *Hyalella azteca*. Of these increasing trends, COD, TSS, turbidity, and toxicity to *Hyalella azteca* have exceeded the benchmark WQO. Significant decreasing trends were evident for Diazinon and dissolved arsenic.

Measured storm event loads were compared to loading values derived from the National Stormwater Quality Database (NSQD) (Pitt et al., 2004). Measured loads for ammonia, total nitrogen and bacterial indicators were greater than expected for a majority of the storm events sampled. In particular, metals consistently showed lower than expected loads for all the storms events sampled.

Dry weather monitoring was conducted at 37 sites in the Agua Hedionda Creek Watershed. Of these, 23 sites are located upstream of the Agua Hedionda Creek MLS. Constituents detected above the wet weather benchmark WQO during the 2006-2007 storm season and above the 2006 dry weather action levels include fecal coliform and turbidity. Fecal coliform results were above the water quality objective at the MLS during all three storms in 2006-2007 and were above the dry weather action levels four times. Turbidity was above the water quality objective at the MLS during all three storms in 2006-2007 and above the dry weather action level in 14 of 36 samples collected.

Two bioassessment monitoring sites on Agua Hedionda Creek were sampled, one at Melrose Drive and one at El Camino Real. Index of Biotic Integrity scores rated the benthic communities Very Poor at both sites, with slightly higher scores at the El Camino Real site. The O/E ratios also indicated a degraded benthic community at both sites. Since the beginning of the program, the Melrose Drive site has had a mean IBI score of 8.2 and a mean O/E ratio of 0.55. The downstream site at El Camino Real has had a mean IBI score of 10.1 and a mean O/E ratio of 0.58. Neither index rated either site above the impairment threshold for any of the surveys. Of particular interest at the El Camino Real Site, is the prevalence of *Hyalella azteca* populations while this site has observed toxicity during all three storms to *Hyalella azteca.* The Buena Vista Creek monitoring site at College Blvd. was sampled as a replacement site for the Tijuana River site which was dry in October 2006. Index of Biotic Integrity scores rated the benthic communities Very Poor at this site.

Based on the triad matrix, there was evidence of persistent detections above water quality objectives, evidence of persistent toxicity, and indications of benthic alteration for Agua Hedionda Creek. The recommended actions for Agua Hedionda Creek are to continue monitoring for all elements of the program to gather additional data for assessment and long-term trend analysis, initiate upstream source identification to determine sources of constituents of concern, and conduct TIEs to identify contaminants of concern.

Escondido Creek

For the Escondido Creek sub-watershed which accounts for approximately 33% of the Carlsbad Watershed, land use within the contributing runoff area is predominantly undeveloped (32%), residential (29%), and parks (16%). TDS, turbidity, total coliform and fecal coliform, were identified as high frequency of occurrence constituents of concern; enterococcus was identified as a medium frequency of occurrence COC, while TSS and nitrate were identified as low frequency of occurrence COC.

A review of the trend analysis shows statistically significant increasing trends for total coliform, total copper and total zinc, while a significant decreasing trend was observed for Diazinon.

Measured storm event loads were compared to loading values derived from the National Stormwater Quality Database (NSQD) (Pitt et al., 2004). Measured loads of total dissolved solids, BOD_5, ammonia, total nitrogen and bacterial indicators were greater than expected for a majority of the storm events sampled. Metals, primarily chromium, lead, nickel and zinc, were within the expected range or lower than expected.

There are 57 sites in the Escondido Creek Watershed where water quality is monitored during dry weather. Of these, 40 sites are located upstream of the Escondido Creek MLS. Constituents detected above the wet weather benchmark WQO during the 2006-2007 storm season and above the 2006 dry weather action levels include fecal coliform and turbidity. Fecal coliform was above the water quality objective at the MLS during all three storms in 2006-2007 and was above the dry weather action level two times. Turbidity was above the water quality objective at the MLS during all storms sampled in 2006-2007 and above the dry weather action level nine times in 2006.

Two bioassessment monitoring sites on Escondido Creek were sampled, one at the Harmony Grove Bridge and one in Elfin Forest. Index of Biotic Integrity scores rated the benthic communities Very Poor at both sites, although the October survey in Elfin Forest had an O/E ratio that was very near the impairment threshold. The site also had relatively good taxonomic diversity including one highly intolerant organism, *Tinodes*. Since the beginning of the program, the Harmony Grove Bridge site has had IBI scores and O/E values indicating a high level of impairment. The Elfin Forest site has had O/E ratios above the impairment threshold in two surveys, and the mean ratio for October surveys indicates a seasonally low level of impairment at the site.

Third party data collected in 2006 and 2007 along Escondido Creek indicated that total dissolved solids, total suspended solids, turbidity, dissolved oxygen, chloride, sulfate, nitrate, and fecal coliform were detected above the benchmark WQOs in various locations.

For Escondido Creek, based on the triad matrix, there was evidence of persistent detections above water quality objectives, no evidence of persistent toxicity, and indications of benthic alteration. The recommended actions for Escondido Creek are to continue monitoring for all elements of the program to gather additional data for assessment and long-term trend analysis, initiate upstream source identification to determine sources of constituents of concern and consider evaluating different or additional test organisms. In addition, the role of physical habitat disturbance should be investigated.

In addition to the dry weather monitoring discussed previously for Agua Hedionda Creek and Escondido Creek sub-watersheds, dry weather monitoring was conducted for the entire Carlsbad WMA. There are 232 sites in the Carlsbad WMA that were monitored during dry weather. Constituents detected above action levels included conductivity, oil and grease, pH, enterococci, fecal coliform, total coliform, ammonia, orthophosphate, nitrate, MBAS, turbidity, dissolved cadmium, dissolved copper, dissolved lead and dissolved zinc. Constituents detected above the wet weather benchmark WQOs at the Agua Hedionda Creek and Escondido Creek MLS during the 2006-2007 storm season and above the action levels during the 2006 dry weather program include fecal coliform and turbidity. Fecal coliform results were above the water quality objective at both MLS during all three storms in 2006-2007 and were above the dry weather action levels 16 times. Turbidity was above the water quality objective at both MLS during all three storms in 2006-2007 and was above the dry weather action level 48 times.

Third party data collected from 12 locations within the Carlsbad Watershed from December 2004 through October 2006 indicate that nitrate and fecal coliform were detected above water quality objectives. Nitrate was detected above the benchmark WQO of 10 mg/L in two samples collected from Buena Vista Creek in November 2005. Samples were collected from BV01 and BV02 with values of 13.4 mg/L and 13.2 mg/L, respectively. Fecal coliform was detected above the benchmark WQO of 400 MPN/100 mL in 25 out of 96 samples collected. At least one sample from each site was detected above the benchmark WQO. Concentrations ranged from 500 MPN/100 mL to 5,000 MPN/100 mL.

The WMA assessment findings agreed with the water quality rating priorities (with the exception of nutrients), which found dissolved minerals, sediments, nutrients, and bacteria as high priority (A) rated constituents for the overall Carlsbad WMA. The high priority (A) rating for nutrients is primarily driven by the 303(d) listing in watersheds that are not currently monitored under this program and was not supported by the WMA assessment data. Benthic alteration and toxicity were assigned B ratings. All other constituents were given either a C or D rating.

The information provided from the triad matrix results used in conjunction with the water quality priority ratings can assist the jurisdictions in making informed decisions in developing their WURMP programs. The two reports also allow for an evaluation of where data gaps exist and where efforts should be targeted.

Utilizing the BLTEA rating methods for future data evaluations would allow for long-term BMP effectiveness assessment. Incorporation of additional usable data from other third party sources such as POTWs and non-profit organizations would also help to increase the confidence of the water quality priority ratings and overall WMA assessments.

The recommendations for this watershed are to continue monitoring at the MLS to determine long-term trends, continue monitoring for toxic and benthic impacts and to identify upstream sources of constituents of concern. In addition, the role of physical habitat disturbance should be investigated. The implementation of the new monitoring permit cycle will allow for assessing the watershed during both dry weather and wet weather conditions. Monitoring to be conducted at four temporary watershed assessment stations (TWAS) for this WMA (Loma Alta Creek, Buena Vista Creek, Agua Hedionda Creek, and Escondido Creek) will begin in the 2007-2008 season. The location of these four stations will help to evaluate the spatial distribution of dissolved minerals, sediments, nutrients and bacteria within the WMA. With the monitoring efforts to be conducted for the Lagoon TMDL Monitoring, additional valuable information will be available in future years for the Agua Hedionda WMA.

14.1.4.4 San Dieguito River Watershed Management Area

The San Dieguito River MLS run-off area accounts for only 8% of the overall San Dieguito WMA. Approximately 86% of the watershed lies behind dams. The major land uses within the contributing runoff area are parks (25%), residential (25%), undeveloped (24%), and agricultural (12%).

The primary water quality concerns within the watershed appear to be total dissolved solids and elevated levels of bacterial indicators, specifically fecal coliform. Toxicity was also observed during two of the three monitoring events during the 2006-2007 monitoring period. A review of the trend analysis shows statistically significant increasing trends for total suspended solids, total phosphorus, TKN, and total nickel.

Measured storm event loads were compared to loading values derived from the National Stormwater Quality Database (NSWD) (Pitt et al., 2004). Measured loads for total dissolved solids, total nitrogen and bacterial indicators were greater than expected for the majority of storm events sampled. Most of the constituents measured were within the expected range or lower that expected. In particular, metals consistently showed lower than expected loads for all the storms events sampled.

Bioassessment sampling occurred at two sites in the San Dieguito River WMA. Samples were collected from Green Valley Creek at West Bernardo Drive and San Dieguito River below Lake Hodges Dam in October 2006 and May 2007. The macroinvertebrate community of Green Valley Creek had an Index of Biotic Integrity rating of Poor in October and Very Poor in May. The San Dieguito River site was also rated Poor in October and Very Poor in May. Both sites had IBI score ranges with statistically significant seasonal differences. The O/E ratios concurred with this for the Green Valley Creek site, but the ratios were seasonally similar for the San Dieguito River site. Since the beginning of the program, the Green Valley Creek site has had a mean IBI score of 9.7 and a mean O/E ratio of 0.54. The O/E rated the site above the impairment threshold for the October 2004 survey. San Dieguito River has had a mean IBI score of 12.9 and a mean O/E ratio of 0.62. The O/E rated the site above the impairment threshold for the October surveys of 2002, 2003, and 2004.

For the San Dieguito River WMA, total dissolved solids was identified as a high frequency COC, fecal coliform was identified as a medium frequency COC, and turbidity, total coliform, and enterococcus were identified as low frequency COCs. Based on the triad decision matrix, there was no evidence of persistent detections above the benchmark WQO, no evidence of persistent toxicity, but there was evidence of benthic alteration. In addition to the WMA assessment findings, the water quality priority ratings did not find any high priority (A) rated constituents for the San Dieguito River WMA. Several constituents received B ratings which include dissolved minerals, gross pollutants, bacteria, benthic alteration, and toxicity. All other constituents were given either a C or D priority rating.

The information provided from the triad matrix results used in conjunction with the water quality priority ratings can assist the jurisdictions in making informed decisions in developing their WURMP programs. The two reports also allow for an evaluation of where data gaps exist and where efforts should be targeted. Utilizing the BLTEA rating methods for future data evaluations would allow for long-term BMP effectiveness assessment. Incorporation of additional useable data from other third party sources such as POTWs and non-profit organizations would also help to increase the confidence of the water quality priority ratings and overall WMA assessments.

The recommendations for this watershed are to continue monitoring at the MLS to determine long-term trends and to continue monitoring for toxic and benthic impacts. In addition, the role of physical habitat disturbance should be investigated. The implementation of the new monitoring permit cycle will allow for assessing the watershed during both dry weather and wet weather conditions. Monitoring at two temporary watershed assessment stations (TWAS) will begin in the 2007-2008 season. These two stations will provide information on the spatial distribution of dissolved minerals, gross pollutants, bacteria, and nutrients within the San Dieguito River WMA.

14.1.4.5 Los Peñasquitos Creek Watershed Management Area

The Los Peñasquitos Creek WMA is the second smallest watershed in San Diego County. The Los Peñasquitos Creek WMA total land area is 60,418 acres of which 60% of the area contributes runoff to the MLS. The major land uses within the watershed are residential (26.7%), vacant/undeveloped

(15.0%), and parks and recreation (29.7%). The major land uses within the contributing runoff area are parks (28.6%), residential (30.7%), and undeveloped (21.4%).

Within the Los Peñasquitos Creek WMA, TDS and fecal coliform were the only high frequency of occurrence constituents of concern (COC) followed by turbidity, total coliform and enterococci which were all low frequency of occurrence COC. There was no evidence of persistent toxicity in Los Peñasquitos Creek WMA; however, the benthic community appeared to be limited by unknown factors. A statistically significant increasing trend was noted only for total nickel. However, total nickel concentrations are well below, and have never exceeded the benchmark WQO.

Measured storm event loads were compared to loading values derived from the National Stormwater Quality Database (NSQD) (Pitt et al., 2004). Measured loads for total dissolved solids and bacterial indicators were greater than expected for a majority of the storm events sampled. Most of the constituents measured were within the expected range or lower than expected. In particular, metals consistently showed lower than expected loads for all the storms events sampled.

Three sites were sampled under the SWAMP program within Los Peñasquitos Watershed in 2002, including Los Peñasquitos Creek, Soledad Canyon Creek and Poway Creek. At the station located in Los Peñasquitos Creek in the same vicinity as the mass loading station, parameters with results above the benchmark WQO included turbidity, pH, sulfate, Diazinon, methyl parathion and toxicity. Results from the other two stations within the Los Peñasquitos Watershed were similar to those found near the MLS site. Sulfate, manganese and toxicity were above the benchmark WQO at all sites. Turbidity and Diazinon concentrations were above the benchmark WQO sporadically. It should be noted that Diazinon has not been detected at the MLS since the 2003-2004 season.

Bioassessment monitoring in the Los Peñasquitos WMA was conducted at two sites. The upstream site was in Los Peñasquitos Creek in Poway, and the downstream site was in Los Peñasquitos Creek adjacent to the MLS. Both of the sites had Index of Biotic Integrity ratings that were in the Very Poor category for both surveys, and had O/E ratios that also indicated degraded biotic conditions. Since the beginning of the program, the upstream Los Peñasquitos Creek site has had a mean IBI score of 9.6 and a mean O/E ratio of 0.67. The O/E rated the site above the impairment threshold for the October 2001 and October 2005 surveys. The downstream Los Peñasquitos watershed site has had a mean IBI score of 11.7 and a mean O/E ratio of 0.58. The O/E rated the site slightly above the impairment threshold for the October 2002 and October 2004 surveys.

In addition to the WMA assessment findings, the water quality priority ratings identified high priority (A) ratings for dissolved minerals, sediments, bacteria and benthic alteration. However, the bacteria finding is based on the 2002 303(d) list which has since been delisted. All other constituents were given either a C or D priority rating. The information provided from the triad matrix results used in conjunction with the water quality priority ratings can assist the jurisdictions in making informed decisions in developing their WURMP programs. The two assessments also allow for an evaluation of where data gaps exist and where efforts should be targeted.

Utilizing the BLTEA rating methods for future data evaluations may allow for long-term BMP effectiveness assessment. Incorporation of additional usable data from other third party monitoring programs may help to increase the confidence of the water quality priority ratings and overall WMA assessments.

The recommendations for this watershed are to continue monitoring to gather long-term trend information, identify where data gaps exist that do not allow for informed decision making, and consider where watershed resources may be more effectively targeted to reduce dissolved minerals, sediments, bacterial indicators, and impacts to the physical stream habitats. Assessment of water quality priority ratings should be continued on an annual basis. Storm water managers should be aware that changes to the water quality priority ratings may occur based on the changes noted in the 2006 303(d) list.

The new permit monitoring order (R9-2007-0001) calls for two temporary watershed assessment stations (TWAS) for this watershed. One is located in the Carroll Creek drainage area and one is located upstream of the historical MLS. These new stations will provide additional data to evaluate the spatial distribution of constituents within the watershed during both wet and dry (ambient) conditions. These data will allow for the estimation of annual loading within the watershed. Data will also be gathered to comply with the lagoon Investigative Order No. R9-2006-076 during the 2007-2008 monitoring period that will provide valuable information related to sedimentation characteristics at various stations within Los Peñasquitos Lagoon.

14.1.4.6 Mission Bay Watershed Management Area

The Mission Bay WMA is the smallest watershed in San Diego County. The contributing runoff area to the Tecolote Creek MLS is approximately 14% of the Mission Bay Watershed land area. The major land uses within the contributing runoff area residential (44%), parks (19%) and transportation (18%).

For the Mission Bay WMA, turbidity, total coliform, fecal coliform were identified as high frequency of occurrence COCs; while TSS, enterococcus, and total lead, were identified as a medium frequency of occurrence COCs. A review of the scatterplots and trends indicate significant downward trends for BOD, Diazinon, nitrate, and oil and grease concentrations. A significant increasing trend for enterococcus concentrations was also observed. Third party data collected under the SWAMP program in 2002 were collected at two sites within the Mission Bay Watershed, one in Tecolote Creek near the mass loading station and the other in Rose Canyon Creek. At Tecolote Creek, sulfate, manganese, and toxicity were measured above their respective benchmark WQOs. Constituents with results above the benchmark WQO at Rose Canyon Creek included sulfate, manganese, turbidity, pH, Diazinon and toxicity. However, Diazinon has not been detected above the benchmark WQO at the Tecolote MLS during the past three monitoring seasons.

Measured storm event loads were compared to loading values derived from the National Stormwater Quality Database (NSQD) (Pitt et al., 2004). Measured loads for total dissolved solids and bacterial indicators were greater than expected for a majority of the storm events sampled. Most of the constituents measured were within the expected range or lower that expected. In particular, several metals consistently showed lower than expected loads for all the storms events sampled.

Two stream bioassessment monitoring sites were sampled in the Mission Bay WMA. One site was in Rose Creek, downstream of Highway 52, and the other site was in Tecolote Creek in the lower reach of Tecolote Canyon Natural Park. The macroinvertebrate community of both sites had Index of Biotic Integrity ratings of Very Poor in the October and May surveys. The O/E ratios were in general agreement with the IBI scores, indicating degraded biotic conditions at the sites. The Tecolote Creek site had substantial seasonal variation in the total IBI score, which was even more pronounced with the O/E ratio, a pattern that has been consistent for this site throughout the duration of the program. These two sites also had some of the highest specific conductance readings of all of the county monitoring sites. Though synthetic pyrethroids were detected during all three monitoring events, *Hyalella azteca*, a species sensitive to synthetic pyrethroids, were found to be the most abundant species during the October surveys.

Since the beginning of the program, the Rose Creek site has had a mean IBI score of 12.5 and a mean O/E ratio of 0.58. The O/E rated the site above the impairment threshold for the October 2002 and October 2005 surveys. Tecolote Creek has had a mean IBI score of 16.2 and a mean O/E ratio of 0.52. Both indices rated the site below the impairment threshold for all surveys.

In addition to the WMA assessment findings, the water quality priority ratings found high priority (A) ratings for the heavy metals, dissolved minerals, nutrients, bacteria, and toxicity categories and found a B priority rating for the sediments category.

The information provided from the triad matrix results used in conjunction with the water quality priority ratings can assist the jurisdictions in making informed decisions in developing their WURMP programs. The two reports also allow for an evaluation of where data gaps exist and where efforts should be targeted.

Utilizing the BLTEA rating methods for future data evaluations would also allow for long-term BMP effectiveness assessment. Incorporation of additional usable data from other third party sources such as POTWs and non-profit organizations would also help to increase the confidence of the water quality priority ratings and overall WMA assessments.

The recommendations for this watershed are to continue monitoring to gather long-term trend information, identify where data gaps exist and do not allow for informed decision making, and consider where watershed resources may be more effectively targeted to reduce heavy metals, dissolved minerals, nutrients, bacterial indicators, toxicity, and impacts to the physical stream habitats. The implementation of the new monitoring permit cycle will allow for assessing the watershed during both dry weather and wet weather conditions. Monitoring at two temporary watershed assessment stations (TWAS) (Rose Canyon and Tecolote Creek) will begin during the 2009-2010 season. These two stations will assist in addressing the spatial distribution of heavy metals, dissolved minerals, nutrients, bacteria, and toxicity. Future monitoring stations associated with the outfall monitoring and source identification studies should be located with respect to assessing the spatial distribution of constituents of concern and with respect to watershed priority activities.

14.1.4.7 San Diego River Watershed Management Area

The San Diego River Watershed is the second largest watershed in San Diego County. The contributing runoff area to the MLS is approximately 39% of the San Diego River Watershed land area. The major land uses within the contributing runoff area are residential (30%), parks (25%), and undeveloped (19%).

For the San Diego River WMA, turbidity and fecal coliform were identified as high frequency of occurrence COCs followed by TDS as a medium frequency COC, and total coliform, and enterococcus, which were identified as low frequency of occurrence COCs. TDS during wet weather monitoring and monthly monitoring within the watershed by Padre Dam showed a medium frequency of occurrence but appears to be related to groundwater influences and local conditions. A review of the scatterplots and trends shows statistically significant decreasing trends for dissolved arsenic, dissolved copper, and nitrate. Turbidity and TSS had statistically significant increasing trends.

Measured storm event loads were compared to lading values derived from the National Stormwater Quality Database (NSQD) (Pitt et al., 2004). Measured loads for total dissolved solids and bacterial indicators were greater than expected for a majority of the storm events sampled. Most of the constituents measured were within the expected range or lower than expected. In particular, metals consistently showed lower than expected loads for all the storm events sampled.

Third party data provided by Padre Dam showed dissolved oxygen results did not meet the benchmark WQO standard of > 5.0 mg/l 43% of the time, while pH was outside the benchmark WQO standards in 3% of all samples. Third party data results from the San Diego River Watershed under the Surface Water Ambient Monitoring Program (SWAMP) in May 2004 found turbidity, sulfate, and manganese above the benchmark WQO. Results from the analyses of pesticides, herbicides, PAHs and PCBs were all below their respective benchmark WQO with only a few detections of herbicides and one pesticide compound.

Bioassessment monitoring in the San Diego River WMA occurred at three monitoring sites, including two urban sites and one reference site. The urban sites were in Mission Trails Regional Park and near Morena Blvd. in Mission Valley. The Mission Trails site had an Index of Biotic Integrity rating of Very Poor for both the October 2006 and May 2007 surveys; the Mission Valley site had an IBI rating of Very Poor for both the October 2006 and May 2007 surveys. The reference site on Boulder Creek had IBI ratings of Fair for both the October 2006 and May 2007 surveys. The reference site's O/E ratio indicated that the benthic community was unimpaired and that the water quality was likely very good.

In addition to the WMA assessment findings, the water quality priority ratings found a high priority (A) rating for bacteria and found a B priority rating for the sediments and dissolved minerals categories. All other constituents were given either a C or D priority rating which means the constituents were low priorities or lacked sufficient data to support a higher priority rating. In the Stressor Groups category, benthic alterations were also given an A priority rating.

The information provided from the triad matrix results used in conjunction with the water quality priority ratings can assist the jurisdictions in making informed decisions in developing their WURMP programs. The two assessments also allow for an evaluation of where data gaps exist and where efforts should be targeted.

Utilizing the BLTEA rating methods for future data evaluations would also allow for long-term BMP effectiveness assessment. Incorporation of additional useable data from other third party sources such as POTWs and non-profit organizations would also help to increase the confidence of the water quality priority ratings and overall WMA assessments.

The recommendations for the San Diego River Watershed are to continue monitoring to gather long-term trend information, identify where data gaps exist and do not allow for informed decision making, and consider where watershed resources may be more effectively targeted to reduce turbidity, bacterial indicators, and impacts to the physical stream habitats. The new permit monitoring order (R9-2007-0001) calls for three temporary watershed assessment stations (TWAS) for this watershed. The additional upstream station will provide the ability to evaluate the spatial distribution of TDS, nutrients and bacteria. Additionally, the new permit calls for the evaluation of dry (ambient) conditions. This data will allow for the estimation of annual loading within the watershed.

14.1.4.8 San Diego Bay Watershed Management Area

The San Diego Bay WMA covers over 282,580 acres is the most densely populated watershed management area in the San Diego region. The San Diego Bay Watershed Management Area (WMA) consists of three major watersheds: The Pueblo San Diego Watershed (HU 908.00), Sweetwater Watershed (HU 909.00), and Otay Watershed (HU 910.00). San Diego Bay is the largest estuary in San Diego County and has been extensively developed as a port. It covers 10,532 acres of water and 4,419 acres of tidelands.

Land use in the San Diego Bay WMA as a whole is primarily comprised of undeveloped land (30.5%), parks (27.3%), and residential (22.8%) land uses. However there are significant differences among the three watersheds with the Pueblo San Diego Watershed being highly urbanized (residential and transportation land uses equal nearly 70% of the total) and the Sweetwater and Otay Watersheds each being mostly undeveloped and park land uses (greater than 60% combined in each watershed). The Pueblo San Diego and Sweetwater Watersheds were each assessed for wet and dry weather water quality, toxicity, and benthic in-stream habitat. Statistical analysis of the wet weather historical data relationships, trends, and constituent loading was also performed. These data were used to identify high, medium and low frequency constituents of concern for the Pueblo San Diego and Sweetwater Watersheds. The Otay Watershed was also assessed for dry weather water quality.

Pueblo San Diego

In the Pueblo San Diego Watershed, the constituents TSS, turbidity, total and fecal coliform, enterococcus, total copper, total lead and total zinc were all identified as high frequency COCs. The constituents COD, Diazinon, and dissolved copper were identified as medium frequency COCs. The constituents pH and conductivity were identified as low frequency COCs. The pesticides found above benchmark WQOs in the watershed are frequently detected in storm water runoff. Malathion is frequently above the benchmark WQO and the data suggests that synthetic pyrethroids are the causative agent of persistent toxicity to *Hyalella azteca.*

A review of the statistical trends for constituents in the Pueblo San Diego Watershed shows statistically significant increasing trends for nitrite, turbidity, total copper, total zinc, and *Hyalella azteca* acute toxicity. The increasing trend for *Hyalella azteca* survival indicates an increase in the frequency of toxicity to this species. Statistically significant decreasing trends are evident for TDS, MBAS, Diazinon, and *Ceriodaphnia* acute, chronic and reproductive toxicity endpoints.

Since the EPA has banned the retail sale of Diazinon and Chlorpyrifos, and with the increased public outreach and education regarding the handling of pesticides in general, a decreasing trend for these compounds should continue. Diazinon was previously identified as a high frequency COC, was down-graded to a low frequency COC after the 2005-2006 monitoring season and is currently rated a medium frequency COC due to one exceedance observed during the first monitoring event of the 2006-2007 season. Continued monitoring of the organophosphate compounds should show an overall decrease in the number of benchmark WQO exceedances and concentrations over time with the expectation that residual public supply and use will eventually be exhausted. However, the shift in use patterns from Diazinon to synthetic pyrethroids by pesticide manufacturers is evident in water quality impacts will likely continue but with different toxic effects. Continued monitoring of synthetic pyrethroids is recommended.

Results of the TIE investigations indicate that synthetic pyrethroids are the causative agent of toxicity towards *Hyalella azteca* in Chollas Creek storm water samples collected during the 2005-2006 and 2006-

2007 monitoring seasons. Synthetic pyrethroids were detected in every storm event in Chollas Creek during the 2006-2007 monitoring season.

Measured storm event loads at the Chollas Creek MLS site were compared to loading values derived from the EMC National Stormwater Quality Database (NSQD) (Pitt et al., 2004). This comparison shows that mean EMC loads were greater than the expected loads in all three monitored events for the modeled constituents TSS, TKN, dissolved phosphorus, total phosphorus, total copper, and total and fecal coliform. EMC loads were greater than expected loads in two of the three monitored events for the constituents TDS, BOD, COD, total cadmium, dissolved copper, total lead, and total zinc. Storm event constituent loads were within the expected load in three out of three wet weather events for oil and grease and two out of three events for nitrate and nitrite.

Dry weather water quality monitoring was performed at 93 locations in the Pueblo San Diego Watershed during the 2006 dry weather monitoring program. Constituent results that were above the dry weather action level at the dry weather monitoring sites include conductivity, oil & grease, pH, enterococcus, total and fecal coliform, ammonia, orthophosphate, nitrate, surfactants (MBAS), and turbidity. Fecal coliform results were above the benchmark WQO at the MLS during two of three storms in 2006-2007 and were above the dry weather action levels 10 out of 38 (26%) of samples. Ammonia results were above the benchmark WQO at the MLS during two of three storms in 2006-2007 and were above the dry weather action levels in 4 out of 87 (5%) samples. Turbidity results were above the benchmark WQO at the MLS during all three storms in 2006-2007 and were above the dry weather action levels in 35 out of 86 (41%) of samples.

Bioassessment monitoring was conducted at one monitoring site in the Pueblo San Diego Watershed, located in Chollas Creek at Federal Blvd. The Chollas Creek site had Index of Biotic Integrity ratings of Poor to Very Poor. The O/E ratios of the site also indicated that the site had degraded macroinvertebrate communities.

Based on the triad matrix, there was evidence of persistent detections above water quality objectives, evidence of persistent toxicity, and indications of benthic alteration for the Pueblo San Diego Watershed. The recommendations for the Pueblo San Diego Watershed are to continue monitoring to gather long-term trend information, identify upstream sources of synthetic pyrethroids. The Copermittees have developed a monitoring workplan for the assessment of synthetic pyrethroids in the San Diego region (Weston, 2007). Additional TIEs are not recommended at this time as the TIEs performed during the 2005-2006 and 2006-2007 monitoring seasons have suggested synthetic pyrethroids as the causative agent of toxicity.

Sweetwater River

In the Sweetwater Watershed, the constituents fecal coliform, and enterococcus were identified as high frequency COCs. TDS was identified as a medium frequency COC. The constituents conductivity, turbidity, nitrate, and total coliform were identified as low frequency COCs.

A review of the statistical trends for constituents in the Sweetwater Watershed indicates statistically significant increasing trend for pH and dissolved phosphorus. However, neither of these constituents has exceeded the benchmark WQO at the Sweetwater River MLS in the past six years of monitoring.

Measured storm event loads at the Sweetwater River MLS site were compared to the expected loading values derived from the EMC National Stormwater Quality Database (NSQD) (Pitt et al., 2004). Measured loads of total dissolved solids and bacterial indicators were greater than expected for a majority of the storm events sampled. Most of the constituents measured were within the expected range or lower than expected. In particular, metals consistently showed lower than expected loads for all storm events.

Dry weather water quality monitoring was performed at 26 locations in the Sweetwater Watershed during the 2006 dry weather monitoring program. Constituent results that were above the dry weather action level at the dry weather monitoring sites include conductivity, pH, enterococcus, total and fecal coliform, nitrate, and turbidity. During the 2006-2007 wet weather monitoring, fecal coliform results were above the benchmark WQO at the MLS during two of three storms and were above the dry weather action levels in 2 out of 29 (7%) samples. Turbidity results were above the benchmark WQO at the MLS during two of three storms and were above the dry weather action levels in 9 out of 51 samples (18%).

Stream bioassessment monitoring occurred at two sites in the Sweetwater Watershed. The Sweetwater River monitoring sites were in low-gradient, depositional reaches of the river. Each of the Sweetwater River sites had IBI scores rated Very Poor in both surveys. The O/E ratios also indicated a degraded biological community at the sites. Since the beginning of the program, the upstream Sweetwater River site has had a mean IBI score of 9.3 and a mean O/E ratio of 0.56. The downstream Sweetwater River site had a mean IBI score of 6.1 and a mean O/E ratio of 0.47. Both indices rated each site below the impairment threshold for all surveys.

Based on the triad matrix, there was no evidence of persistent detections above water quality objectives, no evidence of persistent toxicity, and indications of benthic alteration for the Sweetwater Watershed. The recommendations for the Sweetwater Watershed are to continue monitoring to gather long-term trend information and investigate the role of physical habitat disturbances in relation to water quality.

Otay River

As indicated in the 2001-2002 Urban Runoff Monitoring Report, the MLS at Otay River never received any runoff; therefore, this station was removed from the 2002-2003 monitoring program. Sampling has not been conducted at the Otay River MLS since 2001-2002 due to limited/intermittent flow occurring downstream of the Otay Reservoirs. Third party data collected under the SWAMP program in 2003 was conducted at one sample location in the Otay Watershed during three monitoring events from Jamul Creek. Summary results of the 2003 SWAMP dataset can be found in the 2005-2006 Urban Runoff Monitoring Report.

Dry weather water quality monitoring was performed at 83 locations in the Otay Watershed during the 2006 dry weather monitoring program. Constituent results that were above the dry weather action level at the dry weather monitoring sites included conductivity, pH, enterococcus, total and fecal coliform, ammonia, orthophosphate, nitrate, surfactants (MBAS), turbidity, and dissolved copper. Results for these constituents were above dry weather action levels between 5% (1 of 22 samples for MBAS) and 36% (8 of 22 samples for total coliform). Dry weather results for the Otay Watershed for the 2006 program had similar patterns to those observed in the Pueblo San Diego Watershed.

For the San Diego Bay WMA, there were no high priority (A) ratings based on the water baseline long-term effectiveness assessment water quality priority ratings. Only dissolved minerals, bacteria, and toxicity were designated with B priority ratings. The WMA assessment for the Chollas sub-watershed is relatively comparable to the water quality priority rating for the Pueblo San Diego Watershed but is not representative of the overall WMA. Specific water quality issues are likely related to the land use found in this highly urbanized setting. Turbidity, TSS, bacteria, and total copper, lead and zinc had a high frequency of occurrence in the Pueblo San Diego Watershed, while only fecal coliform and enterococcus had a high frequency of occurrence in the Sweetwater Watershed. There was evidence of benthic alteration in both watersheds. In comparison, the water quality priority ratings found a D rating for the heavy metals category, a C rating for the sediment category, and a B priority rating for the bacteria category, for the overall WMA, suggesting that the major water quality concerns are primarily focused in the lower and more urbanized areas of the watershed.

The information provided from the triad matrix results used in conjunction with the water quality priority ratings can assist the jurisdictions in making informed decisions in developing their WURMP programs. The two assessments also allow for an evaluation of where data gaps exist and where efforts should be targeted.

Utilizing the BLTEA rating methods for future data evaluations would also allow for long term BMP effectiveness assessment. Incorporation of additional applicable data from other third party sources may also help to increase the confidence of the water quality priority ratings and overall WMA assessments.

Several considerations should be made with respect to the findings provided in this watershed management area. The recommendations for this WMA are to continue monitoring to gather long-term trend information, identify where data gaps exist and do not allow for informed decision making, and consider where watershed resources may be more effectively targeted to reduce heavy metals, sediments, pesticides, bacterial indicators, toxicity, and impacts to the physical stream habitats. Development of a water effects ratio for the Chollas Creek Watershed may also be useful for reducing the number of dissolved metals exceedances and would be directly beneficial to the dissolved metals TMDL in Chollas Creek. The current monitoring order (R9-2007-0001) calls for two temporary watershed assessment stations (TWAS) for this WMA (one in the Sweetwater Watershed and one in the Otay Watershed). Based on recent site visits to the Otay Watershed, it is evident that storm water flows are present and may be due to increased residential development in the lower watershed areas. This data will allow for additional spatial data for assessing the WMA. Additionally, the new permit calls for the evaluation of dry (ambient) conditions. This data will allow for the evaluation of seasonal conditions within the watershed.

14.1.4.9 Tijuana River Watershed Management Area

The Tijuana River WMA is the largest of the San Diego watersheds covering over 1.1 million acres. Mexico governs the majority of the Tijuana River Watershed (73%) with the remaining areas belonging to the United States. Undeveloped areas account for 58% of U.S. lands, with another 25% devoted to parks. The Tijuana River flows through Tijuana, Mexico and runoff contributions come from both Mexico and the United States.

For the Tijuana River WMA, ammonia, all three bacterial indicators, TSS, turbidity, and Diazinon were identified as high frequency of occurrence COC. Medium frequency COC were identified as BOD, COD, total phosphorus, total copper and total lead. The constituents MBAS, dissolved phosphorus, Malathion, total zinc, and dissolved copper were identified as low frequency of occurrence COC. The elevated densities of all three bacterial indicators and elevated levels of BOD, COD, un-ionized ammonia, and nutrients (total phosphorus) are indicative of raw wastewater discharges. Pesticides (primarily Diazinon) are also persistently found above benchmark WQOs in the watershed and are likely the major cause of toxicity observed towards the freshwater amphipods *Ceriodaphnia dubia* and *Hyalella azteca.*

Conclusions and Recommendations

A review of the trends shows statistically significant increasing trends for nitrate, TOC, TSS, turbidity, total and fecal coliform, total arsenic, total lead, and total zinc and the acute survival endpoint for *Hyalella azteca*. The increasing trend for *Ceriodaphnia dubia* survival indicates an increase in the toxicity to this species. Statistically significant decreasing trends are evident for conductivity, TDS, Diazinon, dissolved arsenic, and dissolved nickel.

Measured storm event loads at the Tijuana River MLS site were compared to the loading values derived from the EMC National Stormwater Quality Database (NSQD) (Pitt et al., 2004). Measured loads of most of the constituents were greater than expected for a majority of the storm events sampled. Only cadmium and dissolved lead were consistently within the expected range or lower than expected.

Two stream bioassessment monitoring sites were sampled in the Tijuana River WMA. One site in Campo Creek was sampled in October 2006 and May 2007 and one site in the Tijuana River at the border fence was sampled in May 2007 only. The Index of Biotic Integrity rating for the Campo Creek site was Very Poor for the October 2006 survey and Fair for the May 2007 survey. The results of the O/E analysis show that the Campo Creek monitoring site had observed to expected taxa ratios of 0.37 and 0.62. This implies that the benthic community has lost an estimated 63 to 38 percent of the biodiversity expected to occur at the site. These results indicate that for the May survey, the site was above the impairment threshold according to the IBI, but was below the O/E impairment threshold. The Tijuana River site was rated Poor, but based on an assessment of individual metrics and observations made in the field, the investigators in this study feel that this rating is much higher than indicated by the actual benthic community quality.

The water quality priority ratings agreed with the WMA assessment findings for the Tijuana Valley sub-watershed but since this sub-watershed is only 7% of the entire Tijuana River WMA, it suggests that the high priorities and COCs may be more localized to the area near the MLS. The overall Tijuana River WMA did not have any high priority (A) ratings. The highest rated constituents were heavy metals, sediments, pesticides, bacteria, benthic alteration, and toxicity which were all assigned a B priority rating. All other categories received either a C or D priority rating.

The information provided from the triad matrix results used in conjunction with the water quality priority ratings can assist the jurisdictions in making informed decisions in developing their WURMP programs. The two reports also allow for an evaluation of where data gaps exist and where efforts should be targeted.

One issue to be considered is the contribution of runoff and potential COCs from the portion of the watershed outside the jurisdiction of the United States. To this end, it is recommended that a liason process with cross-border agencies be implemented to address water quality concerns in the Tijuana River WMA. A second consideration for the Tijuana River WMA is the consistent measurement of Diazinon concentrations above the benchmark WQO and persistent observed toxicity to *Ceriodaphnia* organisms in storm water samples collected over the past six years of monitoring. TIEs perfomed in previous years have indicated that Diazinon is the causative agent of toxicity in these samples. The triad assessment process (Section **Error! Reference source not found.**) developed as part of the San Diego Regional Storm Water Monitoring Program provides standardized guidelines for recommendations based on wet and dry weather, toxicity and bioassessment monitoring efforts in conducted watersheds covered under the Program. Based on the 2006-2007 monitoring results, the triad matrix recommends the performance of a TIE to identify the source of toxicity. However, the triad assessment process does not at this time provide specific recommendations for addressing consistent toxicity that has been previously linked to specific COCs through previous TIEs, as is the case with the constituent Diazinon in the Tijuana

River WMA. In the case of the Tijuana WMA, it is not recommended to perform TIEs for future monitoring seasons in the Tijuana River MLS samples unless notable declines in the concentration of diazinon are observed and toxicity remains persistent.

The recommendations for this watershed are to continue monitoring at the MLS to determine long-term trends, continue monitoring for toxic and benthic impacts and to identify upstream sources of constituents of concern. The implementation of the new monitoring permit cycle will allow for assessing the watershed during both dry weather and wet weather conditions. Additionally, two watershed assessment stations (TWAS) upstream of the current MLS will provide water quality data on the United States side of the international border in upstream locations. Additionally, the City of Imperial Beach is in the process of obtaining Clean Beaches Initiative (CBI) funding for a microbial source tracking study within the U.S. jurisdiction of the Tijuana River Watershed. The data collected from this study will identify potential sources of bacteriological contaminants and their loads. These and other monitoring efforts will provide additional valuable management information for future years in the Tijuana River WMA.

14.2 Program Review

During the 2001-01 permit issue process, the Copermittees were required to review historical data and develop future recommendations. This was developed in the "San Diego Region Previous Storm Water Monitoring and Future Recommendations Report" (MEC, 2001). This report presented monitoring objectives for the 2001-01 permit term. The overall goal of monitoring expressed in the report was to "understand conditions of receiving waters within each watershed, identify water quality problems within each watershed, and take actions to correct those problems so that beneficial uses are not degraded or impaired." The design of the program included core monitoring, regional monitoring, and special studies.

The intent of the monitoring design was to identify watersheds with water quality problems using the information collected during wet weather events at the base of the watershed, benthic community information, and information collected in the lagoons and embayments. This "prioritization" of watersheds was intended to provide a mechanism to focus special studies and upstream investigations into identification of the contributing sources to the water quality problems, as well as to provide additional characterization of those watersheds.

The program design that was implemented in the 2001-2002 permit year was intended to provide:

- Information relating to chemical, physical, and biological impacts to receiving waters resulting from urban runoff,
- Indication of the overall health and long-term trends in water quality in the receiving waters.

To date these two over-arching goals have been met by the monitoring design, however, additional questions resulting from the collected data have yet to be answered. Such questions include a temporal question "What are the dry weather (ambient) concentrations of the urban runoff constituents?" and a spatial question "How do the constituents of concern vary throughout the watershed?"

In 2004, the Storm Water Monitoring Coalition (SMC) developed a Model Storm Water Monitoring Guidance Document. San Diego Region Copermittees had representatives who participated in the development of the guidance document. The SMC developed the guidance by framing five management questions which urban runoff monitoring programs should consider. The SMC acknowledged that these questions may not all be of equal importance to jurisdictions, but rather can assist jurisdictions and jurisdictional groups in refining their monitoring programs. The five questions are:

1. What are the water quality conditions in the watershed?
2. Are water quality conditions in the watershed getting better or worse?
3. Are beneficial uses being impacted?
4. What is the relative contribution of urban runoff to the conditions in the watershed?
5. What are the sources to urban runoff that contribute to water quality conditions?

Order No. 2001-01 was scheduled to expire on February 21, 2006. The draft tentative order for the next permit cycle was released by the RWQCB (Order R9-2006-0011) on March 10, 2006. A second revision was prepared in June 2006. A revised draft order was then released on August 30, 2006, following comments received during the public comment period. With the delays in finalizing the new permit, the Copermittees were required to perform an additional year of monitoring under the guidelines of Order No. 2001-01. Therefore, the monitoring conducted in 2006-2007 continued the monitoring program initiated in the 2001-2002 storm season. The RWQCB adopted the new permit (Order R9-2007-0001) on January 24, 2007. Monitoring under the new permit will begin during the 2007-2008 monitoring period.

The following describes the degree to which the monitoring program presented in this report addresses each question:

Question 1: What are the water quality conditions in the watershed? This question is partially addressed through the current NPDES program, but a comprehensive watershed assessment is not provided by the current program. The current monitoring program evaluates wet weather discharges at the base of the watershed for toxicity effects to freshwater organisms and chemical, bacterial, and general physical parameters. Monitoring conducted through the 2006-2007 monitoring season included bacterial monitoring at coastal outfalls, dry weather illicit discharge and illegal connection investigations, benthic community assessment at several locations within the watershed, and chemistry and toxicity analyses at limited locations within the watershed's MS4 system.

Question 2: Are water quality conditions in the watershed getting better or worse? This question is partially addressed in the following ways:

- Long-term trend assessment at the mass loading stations can provide an indication of improvements in the watershed.
- Long-term trend assessment of the quality of the benthic community within the watershed.

Question 3: Are beneficial uses being impacted? This question is only addressed in the monitoring program through comparison to water quality objectives and benchmarks. For example, bacterial counts exceeding water quality objectives indicate an impact to recreational beneficial use. This question may also be partially addressed through jurisdictional and watershed urban runoff management programs (e.g. number of beach closures, sewage spills, and reporting of impacts to sensitive habitats).

Question 4: What is the relative contribution of urban runoff to the conditions in the watershed? To answer the question of "relative" contribution requires knowledge of baseline conditions or a reference (non-urbanized) area for comparison. This question is partially addressed by comparing the normalized storm event loading within the watershed to loading values derived from the National Stormwater Quality Database (NSQD) (Pitt et al., 2004).

The rapid stream bioassessment program provides a comparison of reference sites to urbanized areas. While the bioassessment surveys do not directly measure constituents directly, it does provide a relative assessment of ecological health of a watershed. The current program also provides comparison between watersheds. This comparison of watersheds together with an assessment of different land use characteristics and an evaluation of concentrations of constituents of concern, occurrence and magnitude of toxic effects, and benthic community health yields an understanding of the impacts related to urbanization and various land uses.

Question 5: What are the sources to urban runoff that contribute to water quality conditions? There are a variety of approaches to answer this question. The current program provides a mechanism to understand potential sources in urbanized watersheds. For example, Diazinon in urban watersheds comes from residential, commercial, or agricultural pest control. Where further source characterization and identification is required, a more focused study would be needed to answer the question. Additionally, the Copermittees report on potential water quality pollutant sources through industrial permit inspections, illicit discharge and illegal connection investigations, and through developing source inventories and threat to water quality tables as exemplified in the Baseline Long Term Effectiveness Assessment Report (Weston, MOE,& LWA, 2005).

Under Order 2001-01, Copermittee monitoring program's ability to fully answer the five management questions was limited by the prescriptive requirements of the NPDES permit. Currently the watershed data assessment uses the wet weather monitoring data at the mass loading stations, the benthic community assessments within the watersheds, dry weather information, limited third party data, and the Clean Water Act 303(d) listing to provide management recommendations to stakeholders.

Up to this monitoring year, 2006-2007, the Copermittee monitoring program has set the stage for answering these questions with gathering basic status and trend information. The program was initially designed to be adaptive through time and focus efforts toward identifying water quality problems in watersheds. Once watersheds with problems were identified, the adaptive part of the program is intended to move monitoring and assessment upstream in those priority watersheds to fully answer the management questions (MEC, 2001). This adaptive philosophy is the same philosophy presented in the Model Monitoring Document. The SMC did not intend that permit monitoring would comprehensively address all five questions, nor was the intent that the stepwise approach as presented in the Model Monitoring Document would be followed in a linear, stepwise fashion, but rather that monitoring would be conducted based upon a prioritization of needs (SMC, 2004).

Monitoring conducted under Order 2001-01 has provided advancement in understanding water quality conditions throughout San Diego County's watersheds by providing monitoring at the base of 11 watersheds throughout the region. The current data from the monitoring program provides a strong foundation to form the basis of existing knowledge about water quality that was not available for all watershed management areas prior to 2001-2002. Using this information, the Copermittees can refine their monitoring program to better address specific management questions and yield more baseline information against which improvements in water quality can be measured. Copermittees presented their recommended approach toward program evolution in the Report of Waste Discharge presented in 2005.

The adoption of the new permit (Order R9-2007-0001) on January 24, 2007 has resulted in many new changes and program enhancements. The new program focuses the regional monitoring program into a more condensed watershed approach by evaluating the watersheds spatially (through the implementation of temporary watershed assessment stations upstream or in areas that have not been studied) and temporally (by conducting two ambient and two storm water monitoring events per year). The ambient bay and lagoon monitoring program is required to be revised. New programs are also required to be implemented to assess emerging pollutants and pollutants that have not been recently addressed (e.g. synthetic pyrethroids and trash). A new requirement to assess periphyton will provide additional useful data to bolster the rapid stream bioassessment program. The new permit also requires the Copermittees to develop source identification and MS4 outfall monitoring programs.

As of the writing of this report, the Copermittees have developed several workplans and are in the process of developing programs to comply with these new permit requirements as listed below:

- Monitoring Workplan for the Assessment of Synthetic Pyrethroids in San Diego County (County of San Diego, 2007).
- Monitoring Workplan for the Assessment of Trash in San Diego County (County of San Diego, 2007).
- Periphyton (algae) monitoring and ash-free dry mass (AFDM) and chlorophyll-A analyses will be conducted in accordance with the EPA's Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers.
- The Copermittee Monitoring Workgroup submitted a revised ABLM monitoring workplan on September 1, 2007. However, with the implementation of the Lagoons Investigative Order (R9-2006-0076) and the Bight '08 program, this program may receive amendments based on correspondence with the Regional Water Quality Control Board.
- The Copermittee Monitoring Workgroup is currently developing MS4 Outfall and Source Identification workplans. These workplans will be submitted by July 1, 2008.

Based on the review of the information obtained from the new monitoring permit, the previous 2001-01 monitoring program, and historical monitoring data, recommendations are presented in the next subsections for the next iteration of the monitoring program as the San Diego Region moves forward with continuing to understand urban runoff and its impacts.

14.3 Recommendations

14.3.1 2007-2008 Recommendations

The recommended actions from the triad assessments are summarized in Table 14-2 and include continuing water quality monitoring in all watersheds to gather long-term trend information, investigating upstream sources of contaminants, and conducting TIEs in Agua Hedionda Creek storm water samples.

Since the EPA has banned the retail sale of Diazinon and Chlorpyrifos, and with the increased public outreach and education regarding the handling of pesticides in general, a decreasing trend for the organophosphate pesticide compounds is evident and should continue. Continued monitoring of the organophosphate compounds should show an overall decrease in the number of benchmark WQO exceedances and concentrations over time with the expectation that residual public supply and use will eventually be exhausted. However, the pesticide manufacturer's shift to synthetic pyrethroids does warrant concern. As previously mentioned, the Copermittees have implemented a new workplan to assess the presence of synthetic pyrethroids in the San Diego Region. Based on the findings of the recent TIE investigations performed in Chollas Creek and the detections of several pyrethroid compounds in every storm event monitored in Chollas Creek, analyses of this compound class were added to the constituent list for Agua Hedionda Lagoon, Tecolote Creek, and Chollas Creek. Based on the detections of these compounds, confirmatory TIEs are recommended for Agua Hedionda Creek only.

Table 14-2. Recommended Actions From the Triad Assessment.

Watershed	Chemistry	Toxicity	Benthic Alteration	Possible Conclusion(s)	Possible Actions or Decisions
Santa Margarita	Persistent exceedances of water quality objectives (high frequency COC identified)	No persistent evidence of toxicity	No Indications of alteration	Limited dataset makes conclusions difficult. Test organisms not sensitive to problem pollutants. Contaminants are not bioavailable.	1) Continue monitoring to gather long-term trend information. 2) Continue monitoring for toxic and benthic impacts. Consider whether different or additional test organisms should be evaluated. 3) Initiate upstream source identification as a low priority. 4) TIE would not provide useful information with no evidence of toxicity.
San Luis Rey	No persistent exceedances of water quality objectives	No evidence of persistent toxicity	Indications of alteration	Alteration may be due to physical impacts, not toxic contamination Test organisms not sensitive to problem pollutants	1) No action necessary based on toxic chemicals. 2) Consider whether different or additional test organisms should be evaluated. 3) Consider potential role of physical habitat disturbance.
Agua Hedionda	Persistent exceedances of water quality objectives (high frequency COC identified)	Evidence of persistent toxicity	Indications of alteration	Strong evidence of pollution-induced degradation	1) Continue monitoring to gather long-term trend information. 2) Evaluate upstream source identification as a high priority. 3) Toxicity tests at higher dilutions to better quantify toxicity. 4) Consider potential role of physical habitat disturbance. 5) Use TIE to identify contaminants of concern.
Escondido Creek	Persistent exceedances of water quality objectives (high frequency COC identified)	No evidence of persistent toxicity	Indications of alteration	Benthic impact due to habitat disturbance, not toxicity. Test organisms not sensitive to problem pollutants.	1) Continue monitoring to gather long-term trend information. 2) Evaluate upstream source identification as a high priority. 3) Consider whether different test organisms should be evaluated. 4) Consider potential role of physical habitat disturbance. 5) TIE would not provide useful information with no evidence of toxicity.
San Dieguito River	No persistent exceedances of water quality objectives	No evidence of persistent toxicity	Indications of alteration	Alteration may be due to physical impacts, not toxic contamination Test organisms not sensitive to problem pollutants	1) No action necessary based on toxic chemicals. 2) Consider whether different or additional test organisms should be evaluated. 3) Consider potential role of physical habitat disturbance.
Los Peñasquitos	No persistent exceedances of water quality objectives	No evidence of persistent toxicity	Indications of alteration	Alteration may be due to physical impacts, not toxic contamination Test organisms not sensitive to problem pollutants	1) No action necessary based on toxic chemicals. 2) Consider whether different or additional test organisms should be evaluated. 3) Consider potential role of physical habitat disturbance.

Table 14-2. Recommended Actions From the Triad Assessment.

Watershed	Chemistry	Toxicity	Benthic Alteration	Possible Conclusion(s)	Possible Actions or Decisions
Mission Bay	Persistent exceedances of water quality objectives (high frequency COC identified)	No evidence of persistent toxicity	Indications of alteration	Benthic impact due to habitat disturbance, not toxicity. Test organisms not sensitive to problem pollutants.	1) Continue monitoring to gather long-term trend information. 2) Evaluate upstream source identification as a high priority. 3) Consider whether different test organisms should be evaluated. 4) Consider potential role of physical habitat disturbance. 5) TIE would not provide useful information with no evidence of toxicity.
San Diego River	Persistent exceedances of water quality objectives (high frequency COC identified)	No evidence of persistent toxicity	Indications of alteration	Test organisms not sensitive to problem pollutants Benthic impact due to habitat disturbance, not toxicity	1) Continue monitoring to gather long-term trend information. 2) Evaluate upstream source identification as a high priority. 3) Consider whether different or additional test organisms should be evaluated. 4) Consider potential role of physical habitat disturbance. 5) TIE would not provide useful information with no evidence of toxicity.
Chollas Creek	Persistent exceedance of water quality objectives	Evidence of persistent toxicity	Indications of alteration	Evidence of current pollution-induced degradation	1) Perform confirmatory TIE to verify contaminant(s) of concern based on TIE metric. (only if changes in constituent trends are noted, as synthetic pyrethroids have been identified as the recent causative agent of toxicity). 2) Continue monitoring to gather long-term trend information.
Sweetwater River	No persistent exceedances of water quality objectives	No evidence of persistent toxicity	Indications of alteration	Alteration may be due to physical impacts, not toxic contamination Test organisms not sensitive to problem pollutants Synergistic effects of multiple chemicals at low levels causing toxicity	1) No action necessary based on toxic chemicals. 2) Consider whether different or additional test organisms should be evaluated. 3) Consider potential role of physical habitat disturbance.
Tijuana River	Persistent exceedance of water quality objectives high frequency COC identified)	Evidence of persistent toxicity	No indications of alteration	Toxic contaminants are bioavailable, but in situ effects are not demonstrable Benthic analysis not sensitive enough to detect impact Potentially harmful pollutants not yet concentrated enough to change community	1) Determine if chemical and toxicity tests indicate persistent degradation. 2) Recheck benthic analyses; consider additional data analyses. 3) Toxicity tests at higher dilutions to better quantify toxicity: • If recheck indicates benthic alteration, perform TIE to identify contaminants of concern, based on TIE metric. Evaluate/investigate upstream source as a high priority. • If recheck shows no effect, use TIE to identify contaminants of concern, based on TIE metric. Evaluate/investigate upstream source identification as a medium priority.