11.0 REGIONAL MONITORING AND SPECIAL STUDIES

11.1 Summary of Regional Monitoring

The following subsection provides a summary of Regional Monitoring that are required under the current Los Angeles Regional Water Quality Control Board National Pollution Discharge and Elimination Stormwater Permit. These studies include the Bioassessment Study conducted throughout Los Angeles County, and the Estuary Sampling completed under the Bight 03 program.

11.1.1 Bioassessment

11.1.1.1 Introduction

Beginning in October of 2003, County of Los Angeles Department of Public Works (LADPW) initiated a monitoring program to assess the biological integrity of the benthic macroinvertebrate communities in receiving waters throughout Los Angeles County. The objectives of the study are to evaluate the effects of urban discharges on macroinvertebrates and monitor trends in ecological conditions and responses to pollution. The study also provides compliance with the Los Angeles Regional Water Quality Control Board National Pollution Discharge and Elimination Stormwater Permit. Additionally, data from this study may be used in the development of a regional Southern California Index of Biotic Integrity. Information for this section is contained in the two annual bioassessment reports that were submitted to LACDPW (BonTerra 2004, Weston 2005). A third year of monitoring is scheduled for July and October 2005. Four sites in the San Gabriel River Watershed will be monitored in July to facilitate implementation of the San Gabriel River Regional Monitoring Program.

The use of benthic macroinvertebrates to monitor the effects of urban runoff has become a widely used tool in California. Organisms may reside in streams for periods ranging from a month to several years, and have varying sensitivities to the many constituents present in urban runoff. By assessing the structure of the benthic community, a long-term measure of the cumulative effects of runoff on habitat health may be quantified and monitored.

11.1.1.2 Study Area Overview and Methods

The monitoring reaches assessed in the bioassessment surveys were located in five watersheds throughout Los Angeles County, including the Santa Clara River Watershed, the Santa Monica Bay Watershed (Ballona Creek Watershed and Malibu Creek Watershed), the Dominguez Channel Watershed, the Los Angeles River Watershed, and the San Gabriel River Watershed. The monitoring reaches are described in Table 11-2, and the rationale for monitoring each site is included. A map of the monitoring locations is shown in Figure 11-1.

Six of the monitoring reaches (Stations 2, 12, 13, 14, and 19) were located in concrete lined channels, and one (Station 11) was partially lined with concrete. Three of the monitoring reaches (Stations 4, 13, and 17) were considered reference sites that had minimal upstream urban development.

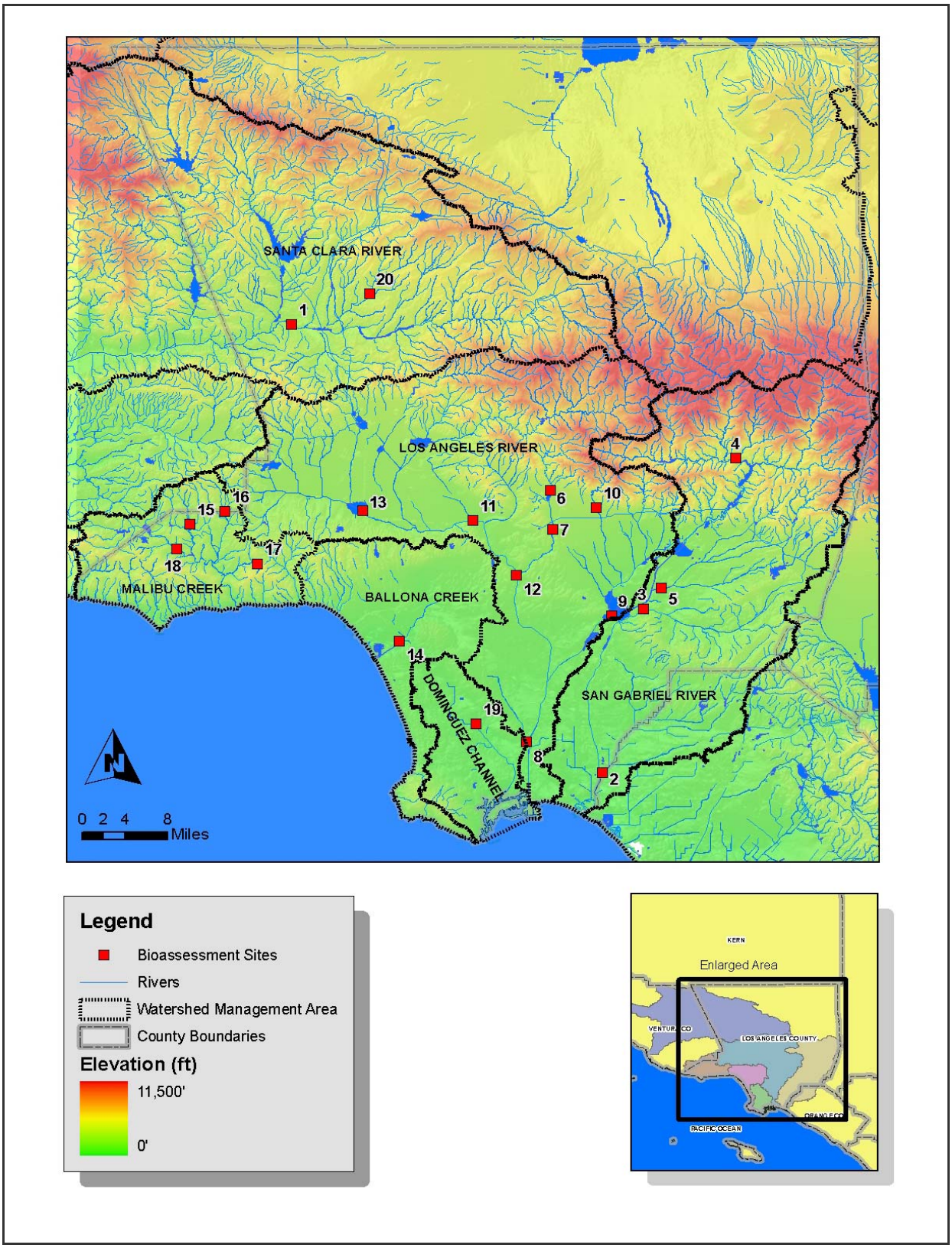

Figure 11-1. Location of Bioassessment Monitoring Locations.

Table 11-1. LACDPW stream bioassessment monitoring sites. October 2004.

Station	Receiving Water Body	Location	Coordinates	Justification
San Gabriel River Watershed				
2	Coyote Creek Lined channel	Coyote Creek downstream of Willow Street	N 33º 47.719' W 118º 05.361'	Los Angeles County Sanitation District baseline site
3	San Jose Creek Unlined channel	San Jose Creek downstream of Workman Mill Rd	N 34º 02.260' W 118º 01.494'	Los Angeles County Sanitation District baseline site
4	San Gabriel River Unlined channel	San Gabriel River upstream of the San Gabriel Dam	N 34º 14.692' W 117º 51.947'	Upstream reference site
5	Walnut Channel Unlined channel	Walnut Channel downstream of N. Baldwin Park Blvd	N 34º 03.674' W 117º 59.847'	Assess impacts of upstream land uses; nursery and residential area
Los Angeles River Watershed				
6	Arroyo Seco Unlined channel	Upstream of Arroyo Seco Spreading Grounds	N 34º 11.977' W 118º 10.257'	Assess impacts in upper to mid watershed from residential land use; not sampled due to dry conditions in 2003 and 2004
7	Arroyo Seco Unlined channel	Arroyo Seco at I-134	N 34º 08.686' W 118º 09.987'	Assess impacts of residential land use
8	Compton Creek Unlined channel	Compton Creek upstream of the confluence with the Los Angeles River	N 33º 50.784' W 118º 12.528'	Assess impacts of urban pollution in Compton Creek
9	Zone 1 Ditch / Whittier Narrows Dam Unlined channel	Zone 1 Ditch at Whittier Narrows Dam	N 34º 1.452' W 118º 4.250'	Los Angeles County Sanitation District baseline site; not sampled due to dry conditions in 2004
10	Eaton Wash Unlined channel	Upstream of Eaton Wash Canyon Reservoir at New York Drive	N 34º 10.538' W 118º 5.707'	Assess impacts of tributary to Los Angeles River; not sampled due to dry conditions in 2003 and 2004
11	Los Angeles River Partially lined channel	Los Angeles River at Victory Blvd	N 34º 09.360' W 118º 17.672'	Assess impacts of adjacent equestrian area
12	Los Angeles River Lined channel	Los Angeles River near confluence with Arroyo Seco Channel	N 34º 05.083' W 118º 13.695'	Main river channel
13	Los Angeles River Lined channel	Los Angeles River upstream of Sepulveda Dam	N 34º 10.181' W 118º 28.548'	Upstream reference site
Ballona Creek Watershed				
14	Ballona Creek Lined channel	Ballona Creek at I-405 and S. Sepulveda Blvd	N 34º 00.444' W 118º 23.757'	Original location relocated due to tidal influence
Malibu Creek Watershed				
15	Medea Creek Unlined channel	Medea Creek at Thousand Oaks Blvd. and Kanan Rd.	N 34º 08.969' W 118º 45.453'	Assess impacts of Medea Creek to Malibu Creek
16	Las Virgenes Creek Unlined Channel	Las Virgenes Creek near the Los Angeles County line	N 34º 10.103' W 118º 42.112'	Assess impacts from tributary to Malibu Creek; not sampled due to dry conditions in 2003 and 2004
17	Cold Creek Unlined channel	Cold Creek at Stunt Rd. at Cold Creek Preserve	N 34º 05.648' W 118º 38.884'	Upstream reference site
18	Triunfo Creek Unlined channel	Triunfo Creek downstream of Troutdale Dr. and nursery	N 34º 6.882' W 118º 46.746'	Assess impacts of nursery; not sampled in 2004 due to dry conditions
Dominguez Channel Watershed				
19	Dominguez Channel Lined channel	Dominguez Channel and Vermont Ave	N 33º 52.257' W 118º 17.418'	Original location relocated due to tidal influence
Santa Clara River Watershed				
1	Santa Clara River Unlined channel	Santa Clara River at The Old Road	N 34º 25.843' W 118º 35.652'	Location of DPW mass emission monitoring site
20	Bouquet Canyon Unlined channel	Bouquet Canyon Wash below Vasquez Canyon Road	N 34º 28.422' W 118º 28.023'	Assess conditions upstream of Diazinon findings; not sampled due to dry conditions in 2003 and 2004

A field reconnaissance of the monitoring reaches with LADPW staff occurred prior to program initiation in 2003 to determine the suitability of the twenty proposed sites. The region experienced extended drought conditions in both 2003 and 2004. In 2003, four of the sites could not be sampled due to lack of stream flow, including Stations 6, 10, 16, and 20. In 2004, these four sites were again dry, as well as Stations 9 and 18. Monitoring reaches that were sampled in 2004 were located as closely as possible to the sites described in the 2003 study (BonTerra 2004).

The sampling points specified in the California Stream Bioassessment Procedure (Harrington 1999) are located in a stream feature known as a riffle. Riffles typically support the greatest diversity of invertebrates in a stream, but for some of the monitoring sites, optimal riffle habitat was not always available and "best available" habitat was sampled.

Benthic invertebrates were collected using a 1-ft wide, 0.5-mm mesh D-frame kick-net. Three 2-ft^2 areas were sampled along each transect and combined into 1 composite sample representing approximately 6 ft^2 of substrate area. Three separate replicate samples were collected from each monitoring reach.

For each monitoring reach sampled, the physical habitat of the stream and its adjacent banks were assessed using U.S. EPA Rapid Bioassessment Protocols. Parameters such as channel alteration, frequency of riffles, width of riparian zones, and vegetative cover help to provide a more comprehensive understanding of the condition of the stream as well as limitations on macroinvertebrate colonization. Additionally, specific characteristics of the sampled riffles were recorded, including riffle length, depth, gradient, velocity, substrate complexity, and substrate composition.

Water quality measurements were taken at each of the monitoring sites. Measurements included water temperature, specific conductance, pH, dissolved oxygen, turbidity, and hardness (2004 only).

In the laboratory, sample material was examined under a stereomicroscope and the macroinvertebrates were removed and placed in vials containing 70% ethanol. The process removed 300 organisms from each sample. All organisms were identified to a standard taxonomic level as specified in the *CAMLNet List of Californian Macroinvertebrate Taxa and Standard Taxonomic Effort*.

Taxonomic data was entered into an electronic file using Microsoft Word and converted into a SAS database for QA/QC and data reduction. Benthic macroinvertebrate community-based metric values were calculated from the database. In addition to the individual metric values, a multi-metric Index of Biotic Integrity (IBI) was calculated for each monitoring reach (Ode et al. In Press). The IBI is a quantitative scoring system for assessing the quality of benthic macroinvertebrate assemblages, and is currently our most powerful tool in reducing a complex macroinvertebrate data set to a qualitative rating for each monitoring reach.

11.1.1.3 Results and Discussion

Regional Macroinvertebrate Community Structure

Over the entire survey region, the five most abundant taxa in both survey years were Chironomid midges, the Amphipod crustacean *Hyalella*, Oligochaete earthworms, Ostracod crustaceans, and the Baetid mayfly *Baetis* (BonTerra 2004, Weston 2005). All of these taxa are moderately to highly tolerant to habitat impairment, and are in the collector-gatherer feeding group. Collector-gatherers feed on organic detritus, algae, and various micro-organisms (Pennak 2001, Usinger 1956) and are general indicators of urbanization of a watershed.

The order Diptera (true flies) had the greatest number of unique taxa identified in both survey years. Chironomid midges were the only taxon present at all of the monitoring sites. Organisms in the intolerant order Plecoptera (stoneflies) were collected only at Station 17-Cold Creek, a designated reference site, and most of the Coleoptera (beetle) taxa were collected only at reference sites (BonTerra 2004, Weston 2005). *Hyalella* was most abundant at the three Los Angeles River sites located in fully or partially lined channels. Chironomid midges were most abundant at sites that had soft bottom channels in heavily urbanized areas (Station 3-San Jose Creek, Station 5-Walnut Channel, and Station 8-Compton Creek), and also at two lined channel sites, Station 14-Ballona Creek and Station 19-Dominguez Channel.

A species cluster analysis of the 2004 results showed unique species assemblages for all of the concrete lined channel sites (two unique species clusters), all of the soft bottom non-reference sites, and the two natural channel reference sites.

Regional Macroinvertebrate Community Metrics

Taxa richness is the total number of unique taxa in a sample, and the number generally increases in higher quality conditions. Taxa richness was highest at Station 18-Triunfo Creek, and at reference sites Station 4-San Gabriel River and Station 17-Cold Creek (BonTerra 2004, Weston 2005). Although taxa richness was highest at Station 18-Triunfo Creek, there were no highly intolerant taxa (tolerance value 0, 1, or 2) present, and 25 of the 32 taxa were either non-insect or Dipteran (true flies) taxa. Overall, sites with concrete lined channels had the lowest taxa richness.

The cumulative number of EPT taxa (taxa in the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), Trichoptera (caddisflies) generally decreases with habitat impairment. The number of EPT taxa ranged from 0 EPT taxa at Station 19-Dominguez Channel to 14 EPT taxa at Station 4-San Gabriel River (cumulative for both surveys) (BonTerra 2004, Weston 2005). Nearly all of the urban sites had cumulative EPT taxa of 4 or less.

For most stream macroinvertebrates, a tolerance value has been determined for each taxon through prior research on the animals' life history. Tolerance values range from 0 for organisms highly sensitive to impairments, to 10 for organisms that are highly tolerant to impairments. The presence of impairment tolerant organisms does not necessarily imply impairment (SDRWQCB 2001), but more importantly, the presence of sensitive organisms (low tolerance value) is unlikely when a stream is impaired. For a community assemblage, the average tolerance value may give an overall indication of water quality conditions.

Monitoring sites with the highest average tolerance values included Station 11-Los Angeles River (7.60), Station 15-Medea Creek (7.56) (BonTerra 2004, Weston 2005). The reference sites of Cold Creek and the San Gabriel River had the lowest average tolerance values, ranging from 4.34 to 4.98.

Functional feed group designations refer to the type of feeding strategy utilized by each macroinvertebrate taxon. The percent composition of the functional feeding groups provides useful information about benthic community function, and some feeding groups contain greater numbers of sensitive organisms. The information from feeding group composition may be particularly useful in detecting physical habitat degradation and impacts from urbanization. Collector filterers and collector gatherers may indicate higher levels of suspended solids, while a diversity of predators, shredders, and herbivores generally indicate higher quality habitat conditions.

All of the concrete lined channel sites had greater than 90 percent community composition of collector gatherers plus collector filterers (CF+CG) (BonTerra 2004, Weston 2005). The soft bottom urban sites were generally between 70% and 90% CF+CG, while the Cold Creek and San Gabriel River sites were variable, with Cold Creek supporting relatively few CF+CG taxa, and San Gabriel supporting as much a 94%. Cold Creek had the most even distribution of the various feeding groups, indicating a dynamically functioning community.

Water quality measures taken at the time of bioassessment sampling were limited, and did not include any specific chemical measures. Specific conductance, a measure of dissolved solids (e.g., metals), pH, and hardness were the most relevant indicators of water quality impairment. Temperature may limit certain taxa, as some prefer cooler temperatures. Many of the concrete lined channels had elevated temperatures due to a lack of riparian canopy and riffle turbulence. Dissolved oxygen (DO) was moderate to high at all sites, with the exception of Station 8-Compton Creek in 2003, which had a reading of 1.19 mg/l (BonTerra 2004). Excessive algae growth may increase DO levels during the day, but may deplete DO levels at night; all of the DO readings were taken during the day.

Specific conductance was very high at Station 15-Medea Creek, with readings above 3.0 for both years (BonTerra 2004, Weston 2005). This site also had very high hardness, >1200 mg/L $CaCO_3$, and the two are likely related. Most of the concrete lined sites had moderately elevated specific conductance, with values between 1.0 and 2.0. The Cold Creek and San Gabriel River reference sites had specific conductance below 1.0, as did some of the soft bottom urban sites (Stations 5-Walnut Channel, Station 7-Arroyo Seco, Station 8-Compton Creek).

Values for pH were fairly low (acidic) at Station 8-Compton Creek and Station 18-Triunfo Creek in 2003 (BonTerra 2004, Weston 2005). Station 3-San Jose Creek was quite variable between years, with a value of 6.77 in 2003 and 8.50 in 2004. Station 19 had the highest pH of all of the sites in both years, with values of 9.22 and 9.01 in 2003 and 2004, respectively.

Index of Biotic Integrity

To easily assess the overall quality of the benthic macroinvertebrate communities, a regionally specific CFG Index of Biotic Integrity (IBI) was utilized. The IBI gives a single quantified score to a site based on a multi-metric evaluation technique, and the scores may be compared across seasons and years of a monitoring program to give an indication of trends over time. The IBI is

based on expected macroinvertebrate assemblages that exist in Southern California in the absence of water quality and physical habitat impairment.

Seven metrics were selected to calculate the IBI that showed a strong and predictable response to ecological impacts and stressors. The seven metrics include % collector-filterers plus collector-gatherers, % non-insect taxa, % tolerant taxa, number Coleoptera taxa, number predator taxa, % intolerant individuals, and EPT taxa. Each metric value is given a score from 0 to 10, and the scores added to give a final IBI score; the highest possible total score is 70. Each final score is then classified into rating categories ranging from Very Poor to Very Good.

Figure 11-2 presents the total IBI scores for each monitoring site for the 2003 and 2004 survey years. There were essentially three categories of sites: The Cold Creek and San Gabriel reference sites that were rated Fair or Good, Station 18-Triunfo Creek, Station 1-Santa Clara River, and Station 9-Zone 1 Ditch which were rated Poor, and the remaining sites that were rated Very Poor. It is notable that IBI scores were quite consistent for the two survey years, with most sites differing by only two or three points. Although not quantified here, these sites may also be categorized by the amount of urbanization upstream of the monitoring site that contributed runoff to the receiving waters, with a correlation between high amounts of urbanization and low IBI scores.

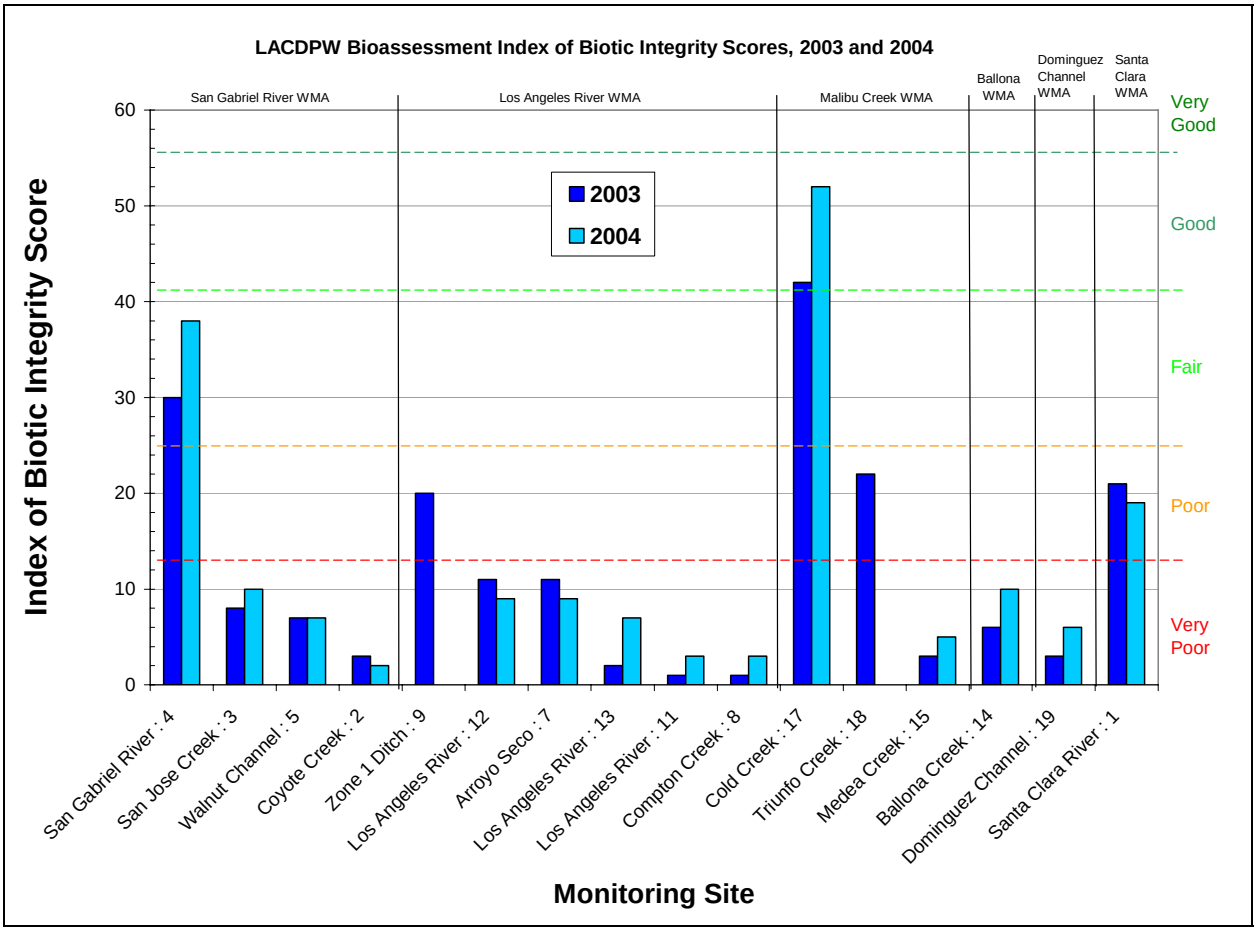

Figure 11-2. Index of Biotic Integrity Score for Los Angeles County Bioassessment Sites – 2003-2004.

The sites scoring in the Very Poor range do not show a correlation between physical habitat quality and IBI score. An analysis of variance (ANOVA) between lined and non-lined channels did not show a trend between the two habitat factors and IBI scores. Station 12-Los Angeles River (concrete lined) was the highest rated of the Very Poor sites and Station 8-Compton Creek and Station 8-Medea Creek (soft bottom) were rated much lower than many of the lined channel sites.

11.1.1.4 Conclusion

Twenty bioassessment monitoring sites were established for benthic macroinvertebrate and physical habitat quality analysis. Sixteen of these sites were sampled in October/November 2003 and fourteen were sampled in October 2004. Dry conditions prevented sampling at the remaining sites. Seven of the monitoring sites were located in highly modified, concrete-lined channels in heavily urbanized areas, and three of the sites were designated reference sites.

Regionally, the most abundant organisms were midges in the family Chironomidae. The majority of organisms collected were moderately to highly tolerant to stream impairments, and all of the urban sites were dominated by organisms in the collector gatherer feeding guild. Organisms highly intolerant to impairment were collected at Station 4-San Gabriel River, Station 17-Cold Creek, and Station 1-Santa Clara River.

The Index of Biotic Integrity scores of the monitoring reaches ranged from 1 to 52 out of a possible 70 points, and the benthic macroinvertebrate communities were rated Very Poor to Good. Two of the reference sites, Station 4-San Gabriel River and Station 17-Cold Creek were rated substantially higher than all of the other sites. Three urban sites, Station 1-Santa Clara River, Station 9-Zone 1 Ditch, and Station 18-Triunfo Creek were rated Poor, and the remaining sites were rated Very Poor, including all of the sites located in concrete-lined channels. Comparison of the 2003 and 2004 IBI scores did not indicate any substantial degradation of the benthic community at any of the sites, and most of the sites had slightly higher IBI scores in 2004.

11.1.2 Estuary Sampling – Bight 03

11.1.2.1 Introduction

In compliance with Section II.F of the stormwater monitoring requirements, LACDPW is participating in the estuary monitoring program, which is a component of the coastal ecology committee of the Bight 2003 project coordinated by the Southern California Coastal Waters Research Project (SCCWRP). The two primary objectives of Bight ‘03 are to estimate the extent and magnitude of ecological change in the Southern California Bight (SCB) and to determine the mass balance of pollutants that currently reside within the SCB. The goal of the estuary monitoring program is to sample estuaries for sediment chemistry, sediment toxicity, and benthic macroinvertebrate diversity to determine the spatial extent of sediment fate from stormwater, and the magnitudes of its effects. San Gabriel River, Los Angeles River, Dominguez Channel, Ballona Creek and Malibu Lagoon are the estuaries in Los Angeles County that are being monitored. Sampling was done in the summer of 2003.

11.1.2.2 Methods

The methods for estuary monitoring were followed in accordance with the Southern California Bight 2003 Field Operations Manual (SCCWRP, 2003).

Samples were collected in the summer of 2003 by various participants in the Bight '03 program. Benthic infauna and sediment toxicity samples were analyzed by Weston Solutions, Inc.; chemical analyses were performed by CRG Marine Laboratories, Inc. and the City of San Diego; particle size analysis was provided by the City of San Diego and the City of Los Angeles Environmental Monitoring Division, and total organic carbon analyses were done at SCCWRP and the City of San Diego. All data were submitted to SCCWRP; data used in this report were obtained from the SCCWRP database. Data are currently undergoing QA review and those presented here are preliminary.

11.1.2.3 Data Analysis

Sediment Chemistry

The Effect Range Low (ER-L) and Effect Range Median (ER-M) values were used to evaluate the potential for sediment to cause adverse biological effects (Long et al. 1995) (Table 11-2). The guidelines were intended to provide informal (non-regulatory) effects-based benchmarks of sediment chemistry data (Long et al. 1998). Two effects categories have been identified:

ER-L – Effects Range-Low: concentrations below which adverse biological effects are rarely observed; and

ER-M – Effects Range-Median: concentrations above which adverse biological effects are more frequently, though not always observed.

Sediment chemistry data from samples collected from each of the estuaries were compared to the ER-L and or the ER-M data.

Table 11-2. Sediment Effects Guideline Values.

Parameter	Effects Range-Low (ER-L)	Effects Range-Median (ER-M)
Metals (mg/Kg)		
Arsenic	8.2	70
Cadmium	1.2	9.6
Chromium	81	370
Copper	34	270
Lead	46.7	218
Mercury	0.15	0.71
Nickel	20.9	51.6
Silver	1	3.7
Zinc	150	410
Organics (µg/Kg)		
Total Detectable DDT	1.58	46.1
Total Detectable Chlordane	0.6	6
Total Detectable PAHs	4,022	44,800
Total Detectable PCBs	22.7	180

Source: Long et al. 1995
ER-L = Concentration at lower tenth percentile at which adverse biological effects were observed or predicted.
ER-M = Concentration at which adverse biological effects were observed or predicted in 50% of test organisms.
mg/Kg = milligrams per kilogram.
µg /Kg = micrograms per kilogram.

In addition, for each estuary ER-M values were used to calculate a mean ER-M quotient (ERM-Q). The concentration of each COC was divided by its ER-M to produce a quotient, or proportion of the ER-M equivalent to the magnitude by which the ER-M value is exceeded or not exceeded. The mean ERM-Q for each estuary was then calculated by summing the ERM-Qs for each COC and then dividing by the total number of ERM-Qs assessed. ERM-Qs were not calculated for COCs below the detection limit and thus were not used in the generation of the mean ERM-Q. The mean ERM-Q thus represents an assessment for each estuary of the cumulative sediment chemistry relative to the threshold values. In this way, the cumulative risks of effect to the benthic community can provide a mechanism to compare estuaries. This method has been used and evaluated by several researchers (Hyland et al. 1999, Carr et al. 1996, Chapman 1996, and Long et al. 1995) throughout the country.

Sediment Toxicity

Sediment toxicity results were obtained from the exposure of the test species (*E. estuarius*) to sediments collected from each of the estuaries. The percent survival of test organisms in sediments from the embayments was compared to percent survival in a control sample to assess benthic infaunal toxicity levels from each of the estuaries sampled.

Benthic Infauna

The benthic infauna data from each of the estuaries was assessed using a variety of indices common to ecological community structure evaluations. Some of the tools that were employed in the assessment include relative abundance, species richness, Shannon-Wiener Species Diversity Index, evenness and dominance.

11.1.2.4 Results and Discussion

San Gabriel River Estuary

There were a total of five exceedances of the ER-L among four out of the seven monitoring stations within the San Gabriel River Estuary, including nickel and total detectable DDT. Nickel exceeded the ER-L at one station and total detectable DDT exceeded the ER-L at four out of seven stations. ERM-Q values were all below the threshold of 0.10 for all seven stations monitored in the San Gabriel River Estuary. The mean percent survival of *E. estuarius* exposed to San Gabriel Estuary sediments was high, suggesting that the sediments were not toxic to the test organisms. Overall, San Gabriel River Estuary had one of the highest diversity and evenness indices and the greatest dominance index among all five estuaries monitored.

Los Angeles River Estuary

There were a total of twelve exceedances of the ER-L among two out of the five stations within the Los Angeles River Estuary. Four metals, including cadmium, copper, silver and zinc exceeded the ER-L at one station; total detectable PAHs exceeded the ER-L at both stations and total detectable DDT, total detectable chlordane and total detectable PCBs exceeded the ER-M at both stations. The same two stations had mean ERM-Q values above the 0.10 threshold. The sediments were identified as moderately toxic to the test organisms at two of the stations. Total abundance and total number of species was among one of the highest at one of the five stations compared to the other estuaries.

Dominguez Channel Estuary

There were a total of fifty-eight exceedances of the ER-L among the six monitoring stations within the Dominguez Channel Estuary. Nine metals, including arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver and zinc exceeded either the ER-L or ER-M at the majority of the stations, as well as total detectable DDT, total detectable chlordane, total detectable PAHs and total detectable PCBs. ERM-Q values were all above the threshold of 0.10 for all six stations monitored in the Dominguez Channel Estuary. The sediments among three stations within the estuary were identified as highly toxic to the test organisms, while sediments at the other three stations were not toxic to the test organisms. The benthic community structure was intermediate compared to the other estuaries.

Ballona Creek Estuary

There were a total of eleven exceedances of the ER-L among four out of the five monitoring stations within Ballona Creek Estuary. Three metals, including copper, lead and zinc and total detectable DDT and total detectable chlordane exceeded either ER-L or ER-M values. ERM-Q values were above the 0.10 threshold at three out of the five stations. The sediments at four stations were identified as either moderately or highly toxic to the test organisms, while sediments at one station were not toxic to the test organisms. Overall, the Ballona Creek Estuary had the most number of species and individuals and the highest diversity indices compared to the other estuaries.

Malibu Lagoon

There were a total of nine exceedances of the ER-L among four of the five monitoring stations within Malibu Lagoon. Four metals, including cadmium, copper, nickel and zinc exceeded ER-L values. ERM-Q values were above the 0.10 threshold at three stations within the lagoon. The percent survival of *E. estuarius* was high at all stations, suggesting that the sediments in this lagoon were not toxic to the test organism. Malibu Lagoon had the least number of species and individuals compared to the other estuaries.

11.1.2.5 Conclusion

The San Gabriel River, Los Angeles River, Dominguez Channel, Ballona Creek and Malibu Estuaries were monitored to estimate the extent and magnitude of ecological change in the SCB and to determine the mass balance of pollutants that currently reside within the SCB. Sediments were analyzed for chemistry, toxicity and benthic macroinvertebrate diversity. There were exceedances of sediment quality objectives at all five estuaries. Dominguez Channel Estuary had the most number of exceedances, with fifty-eight, and San Gabriel River Estuary had the least, with only five exceedances. In general, the constituents that often exceeded objectives at the majority of the estuaries included four metals (cadmium, copper, nickel, and zinc) and total detectable DDT and total detectable chlordane. Mean ERM-Q values were above the 0.10 threshold in at least two stations within each estuary except San Gabriel River Estuary, which had ERM-Q values all below the threshold. The sediments at all stations within San Gabriel River Estuary and Malibu Lagoon were identified as not toxic to the test organisms, while sediments in some stations within the other three estuaries were either identified as moderately toxic or highly toxic. It appeared that San Gabriel River Estuary was the least impacted as it had the least amount of exceedances, low ERM-Q values and high survival rate of *E. estuarius*. Dominguez Channel Estuary appeared to be the most impacted estuary due to the high number of exceedances, high ERM-Q values at all stations and toxic sediments.

11.2 Summary of Special Studies

As required by the 2001 Municipal Stormwater Permit, LACDPW is conducting special monitoring programs, including the BMP Effectiveness Study, the Peak Discharge Impact Study and the New Development Impacts Study. Each study is summarized below.

11.2.1 BMP Effectiveness Study

11.2.1.1 Introduction

The current 2001 NPDES municipal stormwater permit requires the County of Los Angeles to conduct an evaluation of structural and treatment control BMPs. The goal of the study was to investigate a minimum of five BMPs and to determine their effectiveness in removing various pollutants of concern in stormwater. A key product expected from this project will be a matrix describing the effectiveness of various BMPs. These data will be of high value to agencies statewide in their effort to develop and implement watershed management plans. The objectives of this study include:

- monitoring of at least 5 BMPs during the wet weather season in order to determine the reduction of pollutants of concern in stormwater;
- evaluation of maintenance issues for each of the selected BMPs; and,
- Evaluation of BMPs for the reduction of pollutants of concern in stormwater in Los Angeles County.

11.2.1.2 Methods

BMP's

Existing BMP types with the potential for implementation and effectiveness in various land use types in Los Angeles County have been selected and monitored, including, enhanced manholes, hydrodynamic separators, wet vaults, infiltration trenches, storm drain catch basin inserts and bioswales. Enhanced manholes and wet vaults divert pollutants such as oil and suspended solids to a separation/holding chamber where they are stored and later removed as part of routine maintenance of the device.

In order to evaluate the effectiveness of the BMPs, the log normal transformation of data and various statistical methods were used to compare event mean concentrations of constituents of concern between stormwater entering and exiting the BMPs. Methods used for the collection of samples, quality control/quality assurance for sampling and analysis, and data representativeness are in accordance with guidelines stated in the Protocol for Stormwater Best Management Practice Demonstrations prepared by the Technology Acceptance Reciprocity Partnership (TARP) of which California is a member.

11.2.1.3 Summary Report of BMP Effectiveness Study

The monitoring study included collection of stormwater runoff samples and evaluation of six BMPs during the 2004-2005 storm season. The results and conclusion of the study to date are presented in the BMP Effectiveness Study Report provided in Appendix H. Recommendations for future work are also discussed in the report provided in Appendix H.

11.2.2 Peak Discharge Impact Study

11.2.2.1 Introduction

The Peak Discharge Impact Study was conducted to assess the potential connection between stream erosion and urbanization. The main objectives of the study were to:

- establish a stream channel classification system for southern California streams;
- assess stream channel response to watershed change; and
- attempt to develop predictive relationships between changes in impervious cover and stream channel enlargement; and to provide a conceptual model of stream channel behavior that will assist the development of a future numeric model.

11.2.2.2 Methods

Eleven sites with varying degrees of urbanization in southern California were selected within five watersheds, including Santa Clara River, Santa Monica Bay, San Diego Creek, Santa Ana River and Calleguas Creek, for evaluation of their morphometric attributes. The reaches were selected to represent the various geomorphic channel types in the study area and were used to help establish baseline conditions for each stream class. The focus of the study was to evaluate the changes in stream channel configuration over time and compare them to the changes in total basin impervious cover over the same time period. Background and historic information was gathered on each site and its contributing drainage area. Field data was then collected on the geomorphic condition of each study area. This information was then used to develop relationships between changes in impervious cover and channel form.

11.2.2.3 Results and Discussion

The Peak Discharge Impact Study resulted in the following findings:

(1) Channel width increases as the discharge rate increases.
(2) Ephemeral streams in southern California appear to be more sensitive to changes in the percent of impervious cover than streams in other areas: enlargement of streams occurs at a lower value of impervious surface area.
(3) There is a natural level of channel degradation occurring in all stream channels investigated, even in the absence of development within then drainage area.
(4) Streams appear to be sensitive to changes in flow rates associated with increased impervious cover and they appear to have a low resistance to erosion, which results in increased channel enlargement.

11.2.2.4 Conclusions

The relationships established in this investigation can be used to evaluate potential effects of development on the stability of natural streams. Three general strategies should be considered when attempting to manage increases in peak flow, including limiting impervious area, controlling runoff and allowing for channel movement. It is important to note that stream channels respond to changes differently, and specific responses will depend on the characteristics of each stream and watershed. This investigation presents an important step in understanding the relationship between channel response and changes in impervious cover. The entire technical report is available at ftp://ftp.sccwrp.org/pub/download/pdfs/450_peak_flow.pdf.

11.2.3 New Development Impacts Study in the Santa Clara River Watershed

11.2.3.1 Introduction

To evaluate the possible changes that Standard Urban Stormwater Management Plan (SUSMP) implementation might have on stormwater quality, the Los Angeles Regional Water Quality Control Board mandated a "New Development Impact Study" in the Santa Clara River Watershed. The permit originally required the County of Los Angeles, with support from the City of Santa Clarita, to sample stormwater runoff from two similar watersheds, one developed with SUSMP and the other without, to measure SUSMP effectiveness. However, a comparable pair of watersheds that met all the conditions for sampling could not be found. As a result, the Regional Board modified the Study's requirements to allow for the simulation of expected changes due to implementation of the SUSMP regulation with help of a computer water quality model.

11.2.3.2 Methods

The EPA SWMM model was selected to model the hydrology and a spreadsheet approach to model the water quality. The drainage area of a specific development will be selected for modeling and monitoring. Regional data will used to calibrate the water quality calculations. The model will be validated with site specific water quality monitoring data. The monitoring approach will involve monitoring the selected development site during three storms by collecting and analyzing flow-weighted composite samples.

11.2.3.3 Current Status of Work

Work on the modeling plan is on going. Water quality monitoring is scheduled to occur during the 2005-2006 wet weather season.