

SECTION C-11

WATER QUALITY MONITORING

PROGRAM EFFECTIVENESS ASSESSMENT





SECTION C-11, Water Quality Monitoring

C-11.0 WATER QUALITY MONITORING

C-11.1 Introduction (LIP Section A-11.1)

The countywide monitoring program is conducted on behalf of Permittees by the County as the Principal Permittee. The countywide monitoring program consists of two separate programs to address the respective requirements of the Third Term Permits. The monitoring program for the new permit in the San Diego Region has been implemented. Implementation of the program to address the new permit in the Santa Ana Region is pending approval of the monitoring program proposal by the Executive Officer.

C-11.1.1 County of Orange Water Quality Monitoring in the San Diego Region

The countywide monitoring program consists of several distinct program elements. In response to the permit from the San Diego Region the following elements have been implemented.

- Mass Emissions Monitoring to determine year-to-year trends in pollutant loads from major storm channels,
- Coastal Stormdrain Outfall Monitoring to assess the impacts of dry-weather urban runoff on recreational uses along the coast,
- Urban Stream Bioassessments to determine the biological health of the storm channels,
- Ambient Coastal Receiving Water monitoring to determine the impacts of urban runoff on the ecologically sensitive areas along the coast, and
- Dry-weather monitoring of stormdrain discharges to identify and eliminate illegal discharges and illicit connections (ID/ICs) to the stormdrain system.

All five of these program elements have monitoring sites within Unincorporated County areas.

Mass Emissions Monitoring

The Mass Emissions element has a monitoring location on Aliso Creek in Aliso/Wood Canyon Wilderness Park (ACJ01). Three storms per year are monitored for water chemistry and aqueous toxicity. Automatic samplers are used to collect stormwater runoff for these analyses. The suite of analytes to assess water chemistry include nutrients (nitrate, ammonia, Total Kjeldahl Nitrogen, total phosphate, orthophosphate, total suspended solids, volatile suspended solids, and turbidity), total and dissolved metals (Cu, Cd, Cr, Ni, Pb, Ag, and Zn), and organophosphate pesticides (diazinon, chlorpyrifos, malathion, and dimethoate). Since the ultimate fate of urban runoff is the coastal receiving waters, aqueous toxicity is evaluated using marine organisms, *Mysidopsis bahia* (mysid shrimp) and *Strongylocentrotus purpuratus* (sea urchin).



SECTION C-11, Water Quality Monitoring

Three storms were sampled during the year for water chemistry and aqueous toxicity. Two additional storms were monitored for just water chemistry. The first toxicity evaluation was made on a sample collected during the first hour ("first flush") of the first storm of the season. The next two toxicity assessments were made on 24-hr composite samples collected at the beginning of each respective storm. Toxicity testing involved exposure of the test organisms to several concentrations of a storm sample. The concentration series for these tests was 100, 50, 25, 12.5, and 6.25%. The No Effects Concentration (NOEC) for each test was calculated from a statistical evaluation of the organism responses observed at each concentration of the sample relative to those observed with laboratory control water. A NOEC of 100% means that no observable effect was seen in the undiluted sample relative to the effects seen in laboratory control water. An NOEC of 50% means that the sample had to be diluted by a factor of two before no effects could be seen.

The first storm of the season showed slight toxicity effects in the sea urchin fertilization (NOEC=50%) and sea urchin embryo development (NOEC=50%) tests. No effects were seen on the mysids (NOEC=100%). The second storm showed higher toxicity with the sea urchin fertilization test (NOEC=6.25%), and no effects on the mysids. The third storm showed an impact (NOEC=12.5%) greater than the first storm but less than second storm in the sea urchin embryo development test. As in the other two storms the sample from the third storm showed no effects in the mysid test.

The chemistry data from the three storms suggest that the levels of dissolved metals (specifically copper and zinc) may be responsible for the level of inhibition seen in the sea urchin tests but this cannot be confirmed with the information available to date. The early stages of the sea urchin life cycle (egg fertilization and embryo development) are very sensitive to low concentrations of dissolved metals. The concentrations of metals in the samples did not, however, exceed any of the California Toxics Rule (CTR) criteria for acute toxicity to freshwater aquatic life.

Mysids are sensitive to organophosphate pesticides, as shown by literature values of LC₅₀s (concentration which was shown to be lethal to 50% of the test organisms). The LC₅₀s for diazinon and chlorpyrifos (Dursban) are 4,500 and 35 ng/L (nanograms per liter or parts per trillion). The concentrations of diazinon in the three storm samples were <10, 135, and 242 ng/L respectively. The concentrations of chlorpyrifos were all <10 ng/L.

Coastal Storm Drain Monitoring

In the Coastal Stormdrain Outfall program the bacteriological quality of the stormdrain discharge and surfzone at El Morro Canyon (ELMORO) is monitored on a weekly basis. Monitoring entails weekly sampling, during dry-weather conditions, of the stormdrain and the surfzone 25 yards upcoast and 25 yards downcoast of the stormdrain /ocean interface. Samples are analyzed for concentrations of total coliform, fecal coliform, and Enterococcus bacteria. Temperatures of the stormdrain discharge and ocean are also recorded.

The objective of this program is to determine the impacts of urban runoff on the recreational uses of the coastal zone. Monitoring was initiated during the last week of January 2003.



SECTION C-11, Water Quality Monitoring

Assessment of beneficial use impact was made from analysis of bacteriological data from the surfzone. The surfzone data was evaluated relative to the REC-1 objectives from the Basin Plan and State's Ocean Water Contact Standards. If exceedances of these applicable criteria were observed, the corresponding stormdrain data and other pertinent information (e.g. rainfall records) were evaluated to verify that dry-weather urban runoff was the probable cause.

During this monitoring period 20 pairs (25 yards upcoast and 25 yards downcoast) of samples were collected from the surfzone. No exceedances of the REC-1 objective from the Basin Plan were observed. Only one sample, collected upcoast of the El Morro Creek-ocean interface, on April 29, 2003, exceeded the single sample, ocean water contact standard for Enterococcus. The concentration of Enterococcus in the stormdrain discharge for that day however, was lower than the concentration in the surfzone. The data to date, indicate that dry-weather urban runoff from El Morro Creek does not impair the water contact recreation beneficial use of the ocean near the discharge.

Urban Stream Bioassessment

Urban Stream Bioassessments using California Department of Fish and Game protocols are conducted semiannually on Aliso Creek in Aliso/Wood Canyon Wilderness Park (AC-ACP), Arroyo Trabuco Creek at Alder Spring (REF-TCAS), Bell Creek at Starr Ranch Audubon Sanctuary (REF-BC), and San Juan Creek at Cold Spring (REF-CS). Because of the extremely dry water year preceding the Fall 2002 sampling, Silverado Creek in the Santa Ana Region was used as a reference site. Wood Canyon Creek was sampled during the Fall 2002 as a substitute for another site that was dry during this period.

The bioassessment monitoring is conducted pre and post storm season and includes not only taxonomic analysis of the macro-invertebrates at the sampling location but also an analysis of water chemistry and aqueous toxicity. Samples are collected for analysis of nutrients, dissolved metals, and organophosphate pesticides. Aqueous toxicity is evaluated using *Ceriodaphnia dubia* (water flea), *Selanastrum capricornutum* (freshwater algae), and *Hyalella azteca* (freshwater amphipod).

Of the six sites in the Unincorporated County that were monitored, four are reference sites which experience little or no urban influence. The results from each of the site assessments were compared to the Indices of Biological Integrity (IBI), developed for the San Diego Region by the California Department of Fish and Game. The results of these comparisons are summarized below.

Sites in Unincorporated County	Site Code	IBI Rating	
		Fall 2002	Spring 2003
Bell Creek at Starr Ranch	REF-BC	not sampled	Good
Silverado Canyon d/s Belha Way	REF-SVC	Very Good	not sampled
Arroyo Trabuco at Alder Spring	REF-TCAS	not sampled	Good
San Juan Creek at Cold Spring	REF-CS	Fair	Fair
Wood Creek on Wood Cyn Trail	WC-WCT	Fair	not sampled
Aliso Creek in Aliso/Wood Canyon	AC-ACP	Very Poor	Fair



SECTION C-11, Water Quality Monitoring

In all, fifteen sites in Orange County are monitored each spring and each fall as part of the San Diego Region program. These fifteen sites include three reference sites and twelve streams, creeks, or channels that have varying degrees of urban influence. During this monitoring year the ratings from all of the non-reference sites ranged from very poor to good with these in unincorporated County rated either fair or very poor. The habitat at the Aliso Creek in Aliso/Wood Canyon Wilderness Park may have been severely impacted by an early season storm last November and the rating in the Fall of 2002 may be reflective of this disturbance. This site was subsequently rated the highest of all non-reference sites in the Spring 2003 sampling.

Ambient Coastal Receiving Waters Monitoring

Dana Point Harbor and Dana Cove, within the Unincorporated County, are monitored as part of the Ambient Coastal Receiving Waters Program. During the past year the main harbor was monitored at two points, near the outlets of stormdrains in the East (DAPTEB) and West (DAPTWB) Basins. Dana Cove was monitored near the outlet of a stormdrain (DP-OCI) from the Ocean Institute parking lot.

On June 30, 2003, samples were collected from Dana Point Harbor and analyzed for water chemistry and aqueous toxicity. The sampling points were near the outlet of the 51" stormdrain in the West Basin (DAPTWB), near the outlet of the 60" stormdrain in the East Basin, and near the outlet of the stormdrain from the Ocean Institute Parking Lot.

The same toxicity tests used in the Mass Emissions Program (see above) were used to evaluate the local impacts of dry-weather urban runoff. The sample from the East Basin showed slight inhibition (NOEC=50%) in the sea urchin embryo development test. Concentrations of copper and zinc in this sample were 9.5 µg/L and 30 µg/L, respectively, and may have accounted for the inhibition of the organisms in that test. The sea urchin fertilization and mysid survival/growth tests at the sites showed no toxic effects. Organophosphate pesticide concentrations (diazinon, chlorpyrifos, malathion, and dimethoate) at all three sites were below the detection limits (<10 ng/L) of the laboratory.

Dry-Weather Monitoring Program

The Dry-weather ID/IC Program has monitoring locations within Unincorporated County, on El Morro Stormdrain (H04S01), two stormdrains (L02P25 and L02P45) discharging to Trabuco Creek in the Ladera planned community, and an un-named stormdrain (COM02XXX) discharging to the Segunda Deshecha Channel. These sites are monitored three times annually during the period from May 1st through September 30th.

The monitoring includes measurements of physical characteristics (flowrate, turbidity, temperature, specific conductance, pH, and dissolved oxygen), field analyses of nitrate, ammonia, orthophosphate, surfactants (MBAS), phenols, total chlorine, and hardness. Samples are also collected and submitted for analysis of dissolved metals (Cu, Cd, Cr, Ni, Pb, Ag, and



SECTION C-11, Water Quality Monitoring

Zn), oil & grease, bacteria (total coliform, fecal coliform, and Enterococcus), total suspended solids (TSS), and organophosphate pesticides.

The objectives of the program include assessing the average characteristics of dry-weather urban runoff in the San Diego Region of Orange County and to identify and eliminate illegal discharges and illicit connections to the stormdrain system. To accomplish the first objective the Permittees randomly selected 30 stormdrains ("random sites") in South Orange County to build a database from which the average conditions could be statistically determined. To address the second objective the Permittees collaborated to compile a list of 26 drains ("targeted sites") where illegal discharges or illicit connections were suspected. This random site database would be used to establish triggers for initiating reconnaissance in the watersheds of the targeted drains.

The dry-weather monitoring program was initiated in the last week of May 2003. One round of sampling of the random sites was completed before the end (June 30, 2003) of the reporting period. The results from the monitoring in unincorporated County show two potential areas of concern. The concentration of diazinon (988 nanograms/liter) in the sample collected from COL02P45 on June 25, 2003 was approximately twice the LC₅₀ for Ceriodaphnia. The concentrations of nickel and cadmium (760 and 54 micrograms/liter, respectively) in the discharge from COM02XXX on June 23, 2003 were unusually high. Once the data from the remainder of the first dry-season are compiled it will be determined if the values these two drains represent a chronic or acute condition.

C-11.1.2 County of Orange Water Quality Monitoring in the Santa Ana Region

Unincorporated County areas monitored in the Santa Ana Region include Bolsa Bay and a small portion of the Upper Newport Bay.

Two sites are monitored in Bolsa Bay: just downstream of the tide gates at the mouth of the East Garden Grove Wintersburg Channel (TGDC05) and at the pier in the south end of the Bolsa Chica Ecological Reserve (BBOLR). Monitoring in the Bolsa Bay included sampling the effects of two storms and a semi-annual (before and after storm season) assessment of the chemistry of the benthic sediments. Aside from the dilution of the salinity, the samplings of the Bay during the two storms did not show any major impacts with respect to nutrients and heavy metals. The concentrations of copper were actually slightly higher during the dry weather semiannual samplings. A more thorough evaluation of habitat impact from urban runoff will be made during the next year when the Permittees add toxicity testing, and benthic infaunal analyses as assessment tools (see C-11.2).

Four sites are monitored in the Upper Newport Bay as part of the Nutrient TMDL program and the NPDES program. As part of the TMDL program, dry-weather monitoring is conducted monthly. This monitoring includes measurement of the physical characteristics of the water column, collection of samples at the surface, mid-depth, and bottom for nutrient levels, and collection of sediments from the bottom for analyses of total nitrogen and phosphorus. Algal



SECTION C-11, Water Quality Monitoring

biomass sampling is conducted at nine sites monthly during the summer (April – September) and every other month during the winter (October – March).

Section C-11 of the 2002/03 Unified Annual Progress Report should be consulted for details of the monitoring conducted in these areas.

C-11.1.3 Other Studies

In response to a 13225 Directive from the San Diego Regional Water Quality Control Board, the County and cities within the Aliso Creek Watershed initiated a water quality monitoring program in April 2001 to track the sources of bacteria in the watershed. Monitoring has been conducted weekly at approximately 35 stormdrains and in each of their respective receiving waters. Samples for bacteriological analyses (total coliform, fecal coliform, and *Enterococcus*) are collected from the drains and in the receiving waters 25 feet upstream and 25 downstream of the stormdrain-receiving water interface.

Within the unincorporated County the Directive monitoring program includes three stormdrains discharging to Wood Canyon Channel, and three points on Aliso Creek at the lower end of watershed in Aliso Wood/Canyon Wilderness Park. Details of the Directive monitoring conducted during this PEA reporting period can be found in the 6th, 7th, 8th, and 9th Quarterly Progress Reports on the County's Watersheds website (www.ocwatersheds.com).

C-11.2 Water Quality Monitoring Program Modifications

The Third Term Permit monitoring program for the San Diego Region was initiated during the 2002-03 reporting period and no modifications are proposed at this time. The County will focus on the Dry-Weather Monitoring Program results for COL02P45 and COM02XXX to determine if any additional monitoring steps are needed.

The monitoring program in the Santa Ana Region will undergo significant modifications following approval of the Executive Officer. As proposed, in the Bolsa Bay and Upper Newport Bay this will include monitoring not only the chemistry but also the toxicity of stormwater runoff in those receiving waters. The semiannual sampling of benthic sediments will also include an assessment of sediment toxicity (10-day amphipod survival test with *Eohaustorius estuarius*) and benthic infaunal analyses using methods developed by the Southern California Association of Marine Invertebrate Taxonomists (SCAMIT). The benthic infaunal data will be compared to the Benthic Response Index currently being developed by SCCWRP.