

## **EXECUTIVE SUMMARY**

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The Orange County Sanitation District (District) conducted extensive ocean monitoring to evaluate potential environmental and public health effects from the discharge of treated wastewater off of Huntington Beach and Newport Beach, California. The data were used to determine compliance with receiving water conditions as specified in the District's National Pollution Discharge Elimination System (NPDES) permit, which was jointly issued in 2004 by the U.S. Environmental Protection Agency, Region IX (EPA) and the Regional Water Quality Control Board, Region 8 (RWQCB). The monitoring program was designed to determine compliance with permit criteria and to maintain the District's long-term data collection used for trend analyses. This report focuses on monitoring results and conclusions from July 2007 through June 2008.

Results continued to show that ocean depth is the primary determinant of the distribution of organisms within the monitoring area. Minor changes to receiving waters and sediment quality were identified, predominantly near the outfall. These changes were typically small and not suggestive of potential for adverse effects on biota. Biological communities outside the zone of initial dilution (ZID) were generally healthy, diverse, and comparable to those occurring at similar depths and bottom types throughout the Southern California Bight. A trend of decreasing diversity has occurred for the infaunal (small invertebrates) communities within the ZID, but not in other parts of the monitoring area. The 2007-08 results demonstrate that the District's wastewater treatment and discharge practices meet permit limits and protect beneficial uses of the marine environment in the monitoring area.

### **WATER QUALITY**

Natural water quality conditions during 2007-08 were typical of previous years with ocean waters characterized by temperature stratification (strong layering) of the water column throughout most of the year. Together, currents and stratification are two primary factors in determining the location of the discharged wastewater plume. Predominant alongshore current flows and strong temperature stratification (in three of the four quarters) kept the plume below the ocean surface and away from shore. Even when strong stratification was not present, as was the case for the winter quarter, there was evidence that the wastewater plume remained at depth.

Dissolved oxygen, pH, and salinity had both natural and plume associated patterns. Natural changes were associated with depth (a decrease in oxygen and pH and an increase in salinity) and with the transport of a lower salinity water or the upwelling of low oxygen water into the local study area. Plume-related changes in temperature, salinity, dissolved oxygen, pH, and transmissivity were measurable beyond the initial mixing zone, but they usually extended only into the near field stations and remained below about 15 m depth. Many changes in temperature and oxygen were considered indirect effects as they were due to deeper (colder, oxygen poor) water being entrained

by the buoyant discharge plume. Regardless of whether the effect was direct or indirect, the plume-related changes were well within the range of natural variability, and there were no significant effects observed from the offshore discharge

The District had two direct measures of the plume, nutrients (ammonium) and bacteria; constituents that you would expect not to be present or present in very low concentrations, naturally. Ammonium values for 2007-08 were at least 20 times less than California Ocean Plan receiving water objectives for toxicity and, when detected, typically found below the surface and the near the outfall. Since disinfection began in August 2002, offshore bacterial concentrations have been predominately undetected with all detected values located below 15-m depth. The low concentrations, limited distributions, and no observed associations with phytoplankton or water contact zones for both ammonium and bacteria led to the conclusion that there were no environmental or human health impacts.

Permit compliance criteria for oxygen, pH, and transmissivity were met more than 91% of the time. All measured values for these parameters were within natural historical ranges measured for the program, and would not be expected to cause significant environmental effects. Permit compliance criteria were fulfilled 100% of the time for surface observations related to water clarity, water color, and floatables. No grease particles were observed at any of the shoreline stations. Compliance with recreational bathing standards for bacteria was met 100% of the time for offshore waters and over 90% for the nearshore (surf zone) waters. The vast majority ( $\geq 87\%$ ) of the values that exceeded California Ocean Plan bacteria standards occurred at five stations associated with the Santa Ana River or a chronically impacted stretch of Huntington Beach.

## **SEDIMENT QUALITY**

Results of sediment quality measurements during 2007-08 were consistent with results and conclusions from previous years. The District's wastewater discharge did not have an appreciable effect on sediment characteristics or the accumulation rate of inert solids near the outfall, and the sediments in the monitoring area are not degraded.

The wastewater discharge caused minimal organic loading and other physicochemical changes in sediment characteristics. The organic loading did not create anaerobic sediment conditions or exceed thresholds that promoted a shift towards declining conditions beyond the ZID.

Sediment chemistry monitoring showed that effects of the wastewater discharge on sediment metal concentrations varied for individual metals. Some metals, such as cadmium, copper, mercury, and silver were elevated several-fold in sediments near the outfall compared to farfield sites, while concentrations of other metals were less than or equal to twice the respective concentrations at farfield/upcoast sites. Sediment quality guidelines (SQG) were used as benchmarks in evaluating the potential for degradation by chemical contaminants. Although some metals concentrations were elevated at

some stations, no metal exceeded the effects-threshold indicating very low potential for sediment toxicity. Concentrations of polychlorinated biphenyls (PCBs) were higher in sediments near the outfall as compared to some 60-m stations and the mean concentration at ZID Station 0 exceeded the Effects-Range-Low (ERL). Sediment dichloro-diphenyl-trichloroethane (DDT) concentrations exceeded the ERL at most 60-m sites, but did not exhibit any patterns related to the outfall. DDT is considered a legacy contaminant that is wide spread throughout the Southern California Bight (SCB). Polycyclic aromatic hydrocarbons (PAH) were higher at the outfall compared to farfield sites, but at concentrations well below the ERL.

Mean Effects-Range Median Quotient (mERMq) analysis indicated a very low probability of sediment toxicity based on sediment contaminant levels, while whole-sediment toxicity testing at the quarterly 60-m stations showed no measurable toxicity.

While some minor discharge-related changes in sediment quality were measured in and near the ZID, the magnitude of these changes did not significantly degrade sediment quality nor associated biological communities or resources.

## **BIOLOGICAL COMMUNITIES**

### **Infaunal Invertebrate Communities**

Similar to previous years, the 2007-08 results showed that natural features of the study region, including bottom depth, sediment grain size, and complex bathymetry (e.g., submarine canyon habitats), primarily accounted for the spatial patterns for infaunal communities.

Invertebrate communities outside the ZID appeared normal and most could be characterized as representing reference conditions. For example, no station beyond the ZID had depressed values of species richness, diversity, dominance, nor for either of the community index values (Infaunal Trophic Index or Benthic Response Index). Similar to previous years, the 2007-08 monitoring results showed some localized outfall effects within the ZID and at several stations close to the outfall. However, the stations beyond the ZID show only marginal deviation from reference condition. Overall, the infaunal community in the monitoring area appears healthy supporting the conclusion that permit criteria regarding sediment quality were met.

### **Demersal Fishes and Macroinvertebrates**

Results for demersal fish and macroinvertebrates were consistent with past findings. Bottom depth and regional influences (e.g., El Niño, La Niña, and normal oceanographic cycles) were more important than the effluent discharge in affecting the distribution and abundance of fish in the study area.

Fish communities near the outfall were comparable to those at farfield and regional reference stations. There was no indication that the wastewater discharge caused adverse effects on the fish community near the outfall.

Macroinvertebrate communities near the outfall were comparable to local and regional reference stations. Macroinvertebrate community measures were within the range of values for both large publicly owned treatment works (POTW) and non-POTW sites throughout the SCB. The results indicated that the outfall area was not degraded and that it represented a normal population.

### **Tissue Contaminants in Fish**

The accumulation of contaminants by fish can occur due to direct exposure to the water and sediments, and the ingestion of contaminated prey. Findings for 2007-08 were representative of previous years. Contaminants were examined in fish muscle, liver, and whole fish tissue. Contaminant concentrations were low and no significant spatial differences were found in the muscle tissues of target fish species that could be attributed to the District's discharge. Concentrations of PCBs and chlorinated pesticides in all edible fish tissues collected at near-outfall and farfield locations were below federal and state action levels and/or health advisory limits.

### **Fish Health**

The types and frequencies of external health problems for fish can be important indicators of environmental health. Examinations of fish for ectoparasites, tumors, fin erosion, and skin lesions showed that fish in the monitoring area were generally healthy. External parasites and other external abnormalities occurred in less than 1% of the fish collected, with no outfall influence evident. These results are consistent with previous years and indicate that the outfall is not an epicenter of disease.

## **CONCLUSION**

The findings and conclusions for the 2007-08 monitoring effort were consistent with previous years, showing limited impacts to the receiving water and sediment. Plume-related changes in temperature, salinity, dissolved oxygen, pH, and transmissivity observed beyond the ZID were well within the range of natural variability. Low concentrations of bacteria in water contact zones, in concert with the limited distributions of ammonia and absence of associations of the wastewater plume with phytoplankton blooms, suggest that the present discharge has no discernable impact on environmental or human health. The limited nature of these impacts was reflected in the healthy and diverse infauna, fish, and macroinvertebrate communities seen in the monitoring area outside the ZID. Invertebrate communities outside the ZID are normal similar to reference areas in the SCB. The low levels of contaminants in fish tissues and the low incidents of external abnormalities and diseases in fish demonstrated that the outfall was not an epicenter of disease.