Executive Summary

The City of San Diego (City) conducts an extensive ocean monitoring program to evaluate potential environmental effects from the discharge of treated wastewater to the Pacific Ocean via the Point Ocean Outfall (PLOO). The data collected are used to determine compliance with receiving water conditions as specified in the NPDES regulatory permit for the City's Point Loma Wastewater Treatment Plant (PLWTP).

The primary objectives of the ocean monitoring efforts for the Point Loma outfall region are to: (a) measure compliance with NPDES permit requirements and 2005 California Ocean Plan (Ocean Plan) water-contact standards, (b) monitor changes in ocean conditions over space and time, and (c) assess any impacts of wastewater discharge or other man-made or natural influences on the local marine environment, including effects on water quality, sediment conditions and marine life. The regular fixed-grid monitoring area encompasses approximately 184 km^2 of coastal waters centered around the PLOO discharge site, which is located approximately 7.2 km offshore of the PLWTP at a depth of nearly 100 m. Shoreline monitoring extends from Mission Beach to the tip of Point Loma, while regular offshore monitoring occurs in adjacent waters overlying the continental shelf at depths of about 9 to 116 m.

Prior to the initiation of wastewater discharge at the present deepwater location in late 1993, the City conducted a 2½-year baseline study at regular fixed stations designed to characterize background conditions in the region. Additionally, a broader regional survey of benthic conditions is conducted each year at randomly selected sites that range from northern San Diego County to the USA/Mexico border and that extend further offshore to waters as deep as 500 m. These regional surveys are useful for evaluating patterns and trends over a larger geographic area, and thus provide additional information for distinguishing reference from impacted areas. Results of the 2011 regional survey off San Diego are included in the annual receiving waters monitoring report for the South Bay outfall region.

The results and conclusions of all ocean monitoring activities conducted for the Point Loma outfall region from January through December 2011 are organized into seven chapters in this report. Chapter 1 presents a general introduction and overview, while chapters 2–7 include results of all fixed site monitoring conducted during the year. In Chapter 2, data characterizing oceanographic conditions and water mass transport for the region are evaluated. Chapter 3 presents the results of shoreline and offshore water quality monitoring, including measurements of fecal indicator bacteria to determine compliance with Ocean Plan standards. Assessments of benthic sediment quality and the status of macrobenthic invertebrate communities are presented in Chapters 4 and 5, respectively. Chapter 6 presents the results of trawling activities designed to monitor communities of bottom dwelling (demersal) fishes and megabenthic invertebrates. Bioaccumulation assessments to determine contaminant loads present in the tissues of local fishes are presented in Chapter 7. In addition to the above activities, the City supports other projects relevant to assessing the quality of ocean waters in the region. One such project involves satellite imaging of the San Diego coastal region, the 2011 results of which are incorporated into Chapters 2 and 3 herein. A summary of the main findings for each of the above components is included below.

OCEANOGRAPHIC CONDITIONS

Oceanographic data collected in the PLOO region support reports that describe 2011 as a La Niña year characterized by the early onset of relatively strong upwelling. Conditions indicative of local upwelling off Point Loma were most evident during May.

Additionally, satellite images revealed colder-than-normal surface waters during the summer as would be expected during a La Niña. As is typical for the area, maximum stratification of the water column occurred in mid-summer, while reduced stratification occurred during the winter and fall. The only indication of the wastewater plume based on oceanographic data was relatively low water clarity (transmissivity) and high CDOM (colored dissolved organic matter) values measured near the discharge site. Changes in temperature, salinity, pH, and dissolved oxygen levels relative to the outfall were not discernible. Satellite imagery results also revealed no evidence that the plume surfaced or was transported inshore into recreational waters. Overall, ocean conditions during the year were consistent with well documented patterns for southern California. These findings suggest that natural factors such as the upwelling of cool, deep ocean waters and effects of widespread climatic events such as El Niño-La Niña oscillations explain most of the temporal and spatial variability observed in the coastal waters off Point Loma.

WATER QUALITY

Water quality conditions were excellent in the Point Loma region during 2011. Overall compliance with Ocean Plan water-contact standards was greater than 99%. There was also no evidence from the bacteriological results that the PLOO wastewater plume reached the shoreline or nearshore recreational waters, which is consistent with the satellite imagery observations mentioned above. Elevated fecal indicator bacteria (FIB) counts were detected at only three shoreline and one kelp bed station during the year. FIB densities were also low at all offshore stations during each quarterly sampling event (February, May, August and November), with only six samples having elevated enterococcus levels. Each of these high enterococcus counts was collected from depths $\geq$60 m at stations located beyond State waters boundaries. These results are consistent with other data that indicate the wastewater plume remains restricted to relatively deep, offshore waters throughout the year.

SEDIMENT CONDITIONS

Ocean sediments at stations surrounding the PLOO in 2011 were composed primarily of fine sands and coarse silt, which is similar to patterns seen in previous years. There was no evident relationship between sediment grain size distributions and proximity to the discharge site. Instead, most differences may be due to factors such as the presence of outfall construction materials, offshore disposal of dredged sediments from local bays, multiple geological origins of different sediment types, and recent deposits of detrital materials. Sediment quality in the region was similar in 2011 to previous years with overall contaminant loads remaining within the typical range of variability for San Diego and other coastal areas of southern California. There was no clear evidence of significant contaminant accumulation associated with wastewater discharge. For example, the highest concentrations of several organic indicators and trace metals were found in sediments from the northern-most reference stations, while several pesticides, PCBs and PAHs were detected mostly in sediments from stations located south of the outfall. This latter pattern is consistent with other studies that have suggested that sediment contamination in this area is most likely due to short dumps of dredged materials originally destined for the USEPA designated LA5 disposal site. The only evidence of possible organic enrichment was slightly higher sulfide and BOD levels at a few nearfield stations located within 300 m of the discharge zone. Finally, the potential for environmental degradation by the various contaminants was evaluated using the Effects Range Low (ERL) and Effects Range Median (ERM) sediment quality guidelines when available. The only exceedances of either threshold during the year were for lead (one ERL and one ERM in January), silver (one ERL in January), and DDT (one ERL in July).

MACROBENTHIC COMMUNITIES

Benthic macrofaunal communities surrounding the PLOO were similar in 2011 to previous years. These communities remained dominated by polychaete worm and ophiuroid (brittle star) assemblages that occur in similar habitats throughout the Southern California Bight. Specifically, the brittle star *Amphiodia urtica* continued to be the most abundant species even though its overall population abundances were the lowest since monitoring began. The spionid polychaete *Paraprionospio alata* was the most widespread benthic invertebrate, which represented a resurgence of its prominence in the region. There have been some minor changes in assemblages located within ~300 m of the discharge zone that would be expected near large ocean outfalls. For example, some descriptors of benthic community structure (e.g., infaunal abundance, species diversity) or populations of indicator species (e.g., *A. urtica*) have shown changes over time between reference areas and sites located nearest the outfall. Despite these changes, however, results for the benthic response index (BRI) remain characteristic of undisturbed sediments. In addition, documented changes during the year were similar in magnitude to those reported previously for the PLOO region and elsewhere off southern California. Overall, macrofaunal assemblages off Point Loma continue to be characteristic of natural indigenous communities. There was no evidence that wastewater discharge has caused degradation of the marine benthos in the PLOO monitoring region.

DEMERSAL FISHES AND MEGABENTHIC INVERTEBRATES

Comparisons of the 2011 trawl survey results with previous surveys indicate that demersal fish and megabenthic invertebrate communities in the region remain unaffected by wastewater discharge. Although highly variable, patterns in the abundance and distribution of individual species were similar at stations located near the outfall and farther away, suggesting a lack of significant anthropogenic influence. Pacific sanddabs continued to dominate the fish assemblages, occurring at all stations and accounting for 40% of the year's catch. Other common species included California lizardfish, stripetail rockfish, longspine combfish, shortspine combfish, Dover sole, English sole, halfbanded rockfish, pink seaperch, greenstriped rockfish, California tonguefish, plainfin midshipman, and hornyhead turbot. Megabenthic invertebrate assemblages were dominated by the white sea urchin *Lytechinus pictus*, which also occurred in all trawls and accounted for 85% of all invertebrates captured. Other common, but far less abundant invertebrates included the brittle star *Ophiura luetkenii*, the sea stars *Astropecten californicus*, *Luidia asthenosoma* and *L. foliolata*, the sea cucumber *Parastichopus californicus,* the gastropods *Philine auriformis* and *Pleurobranchaea californica*, the octopus *Octopus rubescens*, and the octocoral *Thesea* sp B. Finally, external examinations of all fish captured during trawling activities indicated that fish populations remain healthy, with < 1% of the fish collected having external parasites or evidence of disease (e.g., tumors).

CONTAMINANTS IN FISH TISSUES

The bioaccumulation of chemical contaminants in local fishes was assessed by analyzing liver tissues from trawl-caught flatfish and muscle tissues from rockfish captured by hook and line. Results from both analyses indicated no evidence that contaminant loads in Point Loma fishes were affected by wastewater discharge in 2011. Although several metals, pesticides, and PCB congeners were detected in both tissue types, these contaminants occurred in fishes from throughout the region with no patterns that could be attributed to wastewater discharge. Only a few samples exceeded any state or federal fish contaminant goals or international standards. Furthermore, concentrations of all contaminants were within ranges reported previously for southern California fishes. The occurrence of

some metals and chlorinated hydrocarbons in Point Loma fishes may be due to many factors, including the ubiquitous distribution of many contaminants in southern California coastal sediments. Other factors that can affect the bioaccumulation of contaminants in marine fishes include the different physiologies and life history traits of various species. Additionally, exposure can vary greatly between fish species and even among individuals of the same species depending on migration habits. For example, fish may be exposed to pollutants in a highly polluted area and then migrate to a region that is less contaminated. This is of particular concern for fishes collected in the vicinity of the PLOO, as there are many other point and non-point sources that may contribute to contamination.

CONCLUSIONS

The findings and conclusions for the ocean monitoring efforts conducted for the Point Loma outfall region during calendar year 2011 were consistent with previous years. Overall, there were limited impacts to local receiving waters, benthic sediments, and marine invertebrate and fish communities. Water quality conditions and compliance with Ocean Plan standards were excellent, and there was no evidence that the wastewater plume from the outfall reached surface or nearshore recreational waters during the year. There were also no significant outfall related patterns in sediment contaminant distributions, or in differences between various invertebrate and fish assemblages. The lack of disease symptoms or physical anomalies in local fishes, as well as the low level of contaminants detected in fish tissues, was also indicative of a healthy marine environment. Finally, benthic habitats in the Point Loma region remain in good condition similar to much of the southern California continental shelf.