Encina Ocean Outfall

STATE OF THE OCEAN REPORT

Submitted in Compliance with
Receiving Water Monitoring Requirement IV.E.3 of
Order No. R9-2018-0059

Summary of Receiving Water Findings and Conclusions from the
2023 Encina Ocean Outfall Receiving Water Report

Submitted by:
Encina Wastewater Authority

ENCINA
WASTEWATER
AUTHORITY

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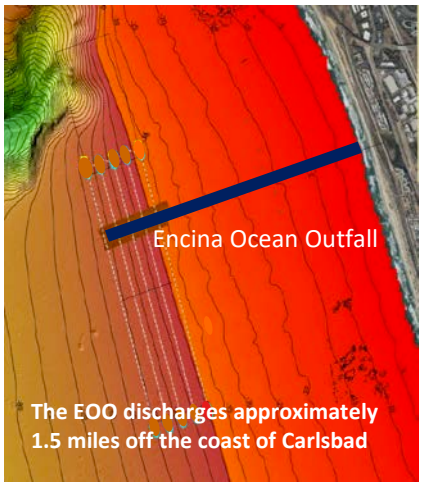
Table of Contents

Section 1
Overview

Encina Ocean Outfall Discharge. Regional Water Quality Control Board (RWQCB) Order No. R9-2018-0059 (NPDES CA0107395) regulates the discharge of wastewater by the Encina Wastewater Authority (EWA) to the Pacific Ocean via the Encina Ocean Outfall (EOO). The 7800-foot-long EOO discharges at depths ranging from 135 to 168 feet. The final 800 feet of the outfall is comprised of a diffuser with 138 discharge ports.



The EOO discharge is almost exclusively comprised of secondary effluent from the Encina Water Pollution Control Facility (EWPCF). Order No. R9-2018-0059 also allows discharges from the Meadowlark Water Reclamation Facility and Carlsbad Water Reclamation Facility, but flows from these facilities are rarely discharged to the EOO.

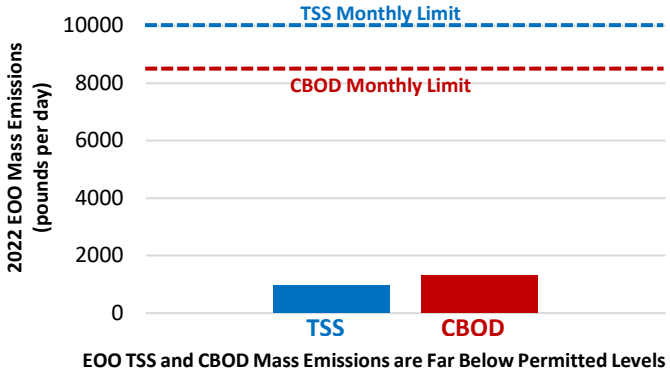
During days of peak recycled water demand, EOO ocean discharge flows can be reduced by up to 20 mgd as a result of recycled water use.

Order No. R9-2018-0059 allows for the discharge of up to 43.3 million gallons per day (mgd) during May through October and up to 52.6 mgd during November through April. Typical EOO discharge flows, however, are on the order of 20 mgd.

Purpose of Submittal. Monitoring and Reporting Requirements IV.E.1 and IV.E.2 of Order No. R9-2018-0059 require EWA to present an in-depth analysis of receiving water data collected since Order No. R9-2018-0059 became effective in November 2019. Monitoring and Reporting Requirement IV.E.3 of Order No. R9-2018-0059 requires EWA to submit a "State of the Ocean" report which summarizes the conclusions of the receiving water monitoring report.

In compliance with this requirement, this State of the Ocean report summarizes data from 2019-2022 that was presented and evaluated within 2023 *Encina Ocean Outfall Receiving Water Monitoring Report* (EWA, 2023). This State of the Ocean report also presents plume tracking results and receiving water findings presented in the *Encina Ocean Outfall Receiving Water Monitoring Report*. Compliance monitoring data collected during the effective period of Order No. R9-2018-0059 have been previously submitted to the RWQCB via the California Integrated Water Quality System.

Effluent Quality. Monthly average concentrations of total suspended solids (TSS) and carbonaceous biochemical oxygen demand (CBOD) in the highly-treated EOO discharge usually range from 5 to 7 milligrams per liter (mg/L). These effluent concentrations are similar to TSS and CBOD background concentrations that typically occur in ocean receiving waters within the Southern California Bight.



EOO TSS and CBOD Mass Emissions are Far Below Permitted Levels

Turbidity levels in the EOO discharge average 2.4 Nephelometric Turbidity Units, which indicates that the water clarity of the EOO discharge may be classified as "ultraclear." Mass emissions of ammonia are typically a factor of ten less than performance goals established in Order No. R9-2018-0059. When combined with the high dilution achieved by the EOO, these low mass emissions result in receiving water concentrations of nitrogen in the vicinity of the EOO that are not discernibly different than ambient receiving water.

During the effective period of Order No. R9-2018-0059, the EOO discharge achieved 100 percent compliance with all water quality-based effluent standards and performance goals for the protection of aquatic habitat and human health. During this period, it was rare to detect concentrations of toxic organic and inorganic compounds in the EOO discharge above reportable levels.

No toxic organic compounds were detected above reporting limits within the EOO discharge during 2022.

Whole effluent toxicity tests represent a "catch-all" means of evaluating the effect of both known and regulated compounds and unknown and unregulated compounds. Additionally, the toxicity tests assess whether any adverse aggregate, combined, synergistic or antagonistic effects occur from combinations of multiple pollutants.

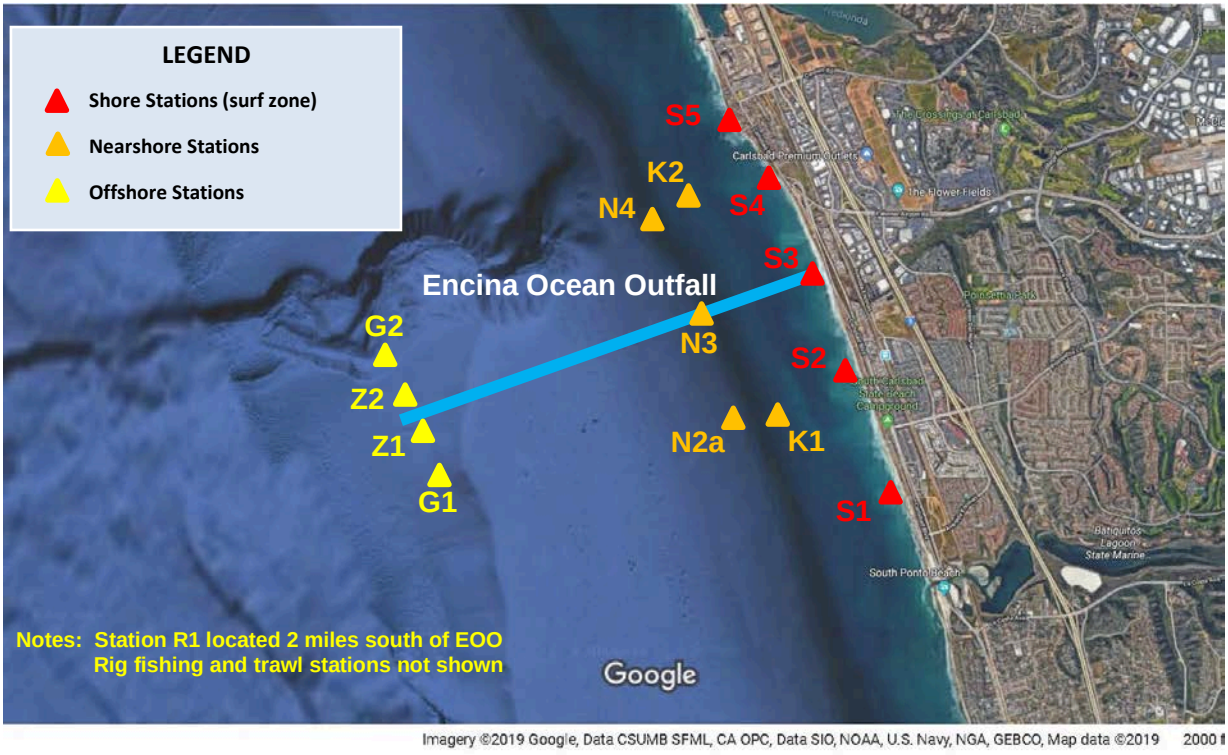
Whole effluent toxicity tests are multi-day tests used to identify adverse effects of the effluent on the health, growth, and reproduction of multiple species. Test protocols require an effluent to be declared "toxic" unless proven otherwise. During the period of Order No. R9-2018-0059, 100 percent of the EOO chronic toxicity tests (representing over 120 tests) passed the testing protocols and thus were deemed nontoxic.

Receiving Water Monitoring Program. To further assess the possible effects of the EOO discharge on receiving waters, Order No. R9-2018-0059 requires EWA to implement a comprehensive receiving water monitoring program. A key objective of the EOO receiving water monitoring program is to measure and document compliance with NPDES and California Ocean Plan standards and to assess possible impacts of the discharge on coastal water quality, seafloor sediments and marine life.

The EOO receiving water monitoring program is designed to address a series of questions posed within the NPDES permit related to whether beneficial uses are adversely affected. The 2023 *Encina Ocean Outfall Receiving Water Monitoring Report* evaluated each of the questions posed in the NPDES permit and concluded that the EOO discharge is not discernibly affecting water quality, sediments, marine life or beneficial uses.

This receiving water monitoring program includes weekly monitoring at shore (S) stations for visual observations, temperature, total coliform, fecal coliform, and enterococcus. Quarterly monitoring for these parameters at the surface and at mid-depth are required at the nearshore (K and N) stations and offshore (G, Z and R) stations. Additionally, temperature, dissolved oxygen, light transmittance, pH and salinity data are collected throughout the depth profiles at each of the nearshore and offshore stations.

Once per NPDES permit term, offshore (G, Z and R) stations are monitored for sediment grain size, sediment chemistry, sediment toxicity and benthic community structure. Further, fish and macroinvertebrates are collected and catalogued at four trawl stations and three rig-fishing stations and fish tissue is evaluated for the bioaccumulation of toxins.

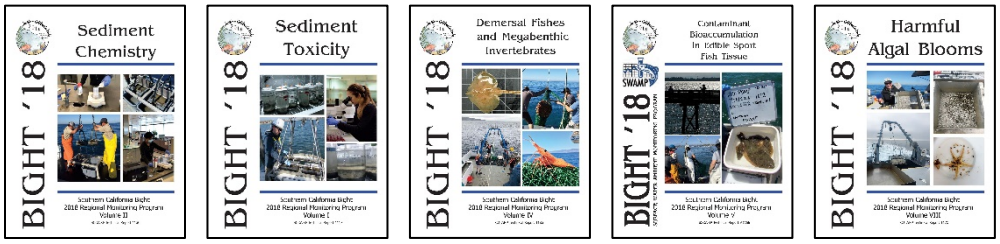


EOO Receiving Water Monitoring Stations

Monitoring Coordination within the Southern California Bight. Order No. R9-2018-0059 requires EWA to participate in regional monitoring efforts conducted by the Southern California Water Research Project (SCCWRP). Due to the timing of the adoption of Order No. R9-2018-0059, it was not possible for EWA to participate in the data collection portion of the most recent SCCWRP bight-wide regional survey (Bight '18). EWA, however, contributed financially in the Bight '18 effort even though EWA did not request a corresponding reduction in EOO monitoring. EWA has participated in planning meetings for the upcoming bight-wide regional survey (Bight '23), and data collected as part of the EOO receiving water program have been made available to SCCWRP for use in Bight '23.

Additionally, as part of completing the *2023 Encina Ocean Outfall Receiving Water Report*, EWA assessed SCCWRP data from the Bight '18 regional survey and compared the SCCWRP data with results from the EOO receiving water monitoring effort conducted during 2019-2020 pursuant to Order No. R9-2018-0059.

Every five years, SCCWRP coordinates with regional partners to implement a comprehensive regional monitoring data collection and assessment program within the Southern California Bight. SCCWRP's Bight '18 program is the most recent bight-wide monitoring effort that has been completed. The Bight '23 regional effort is currently underway.



SCCWRP Publishes the Results of the Bight '18 Regional Monitoring Effort in a Series of Comprehensive Reports

Section 2
Ocean Conditions

Data collected during the effective period of Order No. R9-2018-0059 demonstrates that the EOO discharge achieves 100 percent compliance with California Ocean Plan receiving water standards for dissolved oxygen, pH, water clarity, temperature and salinity. This compliance is demonstrated through the quarterly collection of depth profiles of temperature, dissolved oxygen, light transmittance, pH and salinity at EOO monitoring stations and reference stations. The quarterly depth profile data are collected using boat-based conductivity/temperature/density (CTD) sensors.

Visual Observations. Visual observations and ocean conditions are logged and reported each time water quality samples are collected. Observations are directed toward noting any phenomena that may be associated with wastewater discharges, including floating material, discoloration, grease and oil, turbidity or odor. No visual observations related to the EOO discharge were identified in any of the observations at EOO monitoring stations that were conducted during the current term of Order No. R9-2018-0059.

Boat-Based CTD Sensor

Dissolved Oxygen. Dissolved oxygen concentrations in the EOO discharge average approximately 5 mg/L, while CBOD concentrations in the discharge average approximately 7 mg/L. The EOO discharge has no discernible effect on receiving water dissolved oxygen as a result of the combination of high dilution, high effluent dissolved oxygen, and low effluent oxygen demand renders. Dissolved oxygen depth profiles at EOO stations were not discernibly different than profiles at reference stations and were consistent with dissolved oxygen concentrations throughout the Southern California Bight as reported within the Bight '18 studies.

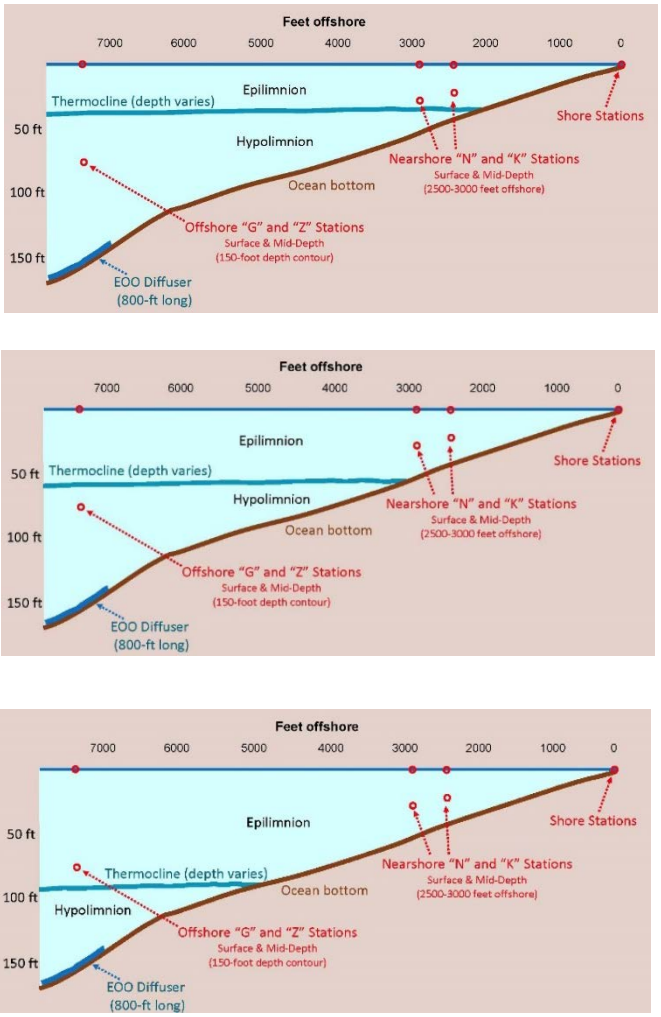
pH. The pH of the EOO discharge (typically on the order of 7.5) is not significantly different than the pH of receiving waters (typically near 8.0). Receiving water depth profiles of pH collected during the effective period of Order No. R9-2018-0059 demonstrate no discernible difference in pH depth profiles between EOO monitoring stations and reference stations throughout the Southern California Bight.

Water Clarity. The EOO discharge flow is visually clear, and the low concentrations of TSS and turbidity in the EOO discharge are similar to (and often lower than) concentrations in ambient ocean water. Data collected during the effective period of Order No. R9-2018-0059 confirm that no difference is seen between water clarity depth profiles at EOO stations and reference stations. While water clarity levels vary in accordance with natural phenomena (upwelling, wind, storm conditions), the EOO discharge has no discernible effect on water clarity.

As a result of the low turbidity concentrations in the EOO discharge, the EOO discharge can be characterized as an "ultraclear" discharge into an "ultraclear" receiving water.

Temperature and Salinity. Temperature and salinity monitoring conducted during the effective period of Order No. R9-2018-0059 demonstrate that the EOO discharge has no discernible effect on ocean temperature and salinity.

The data, however, show that ocean water temperature and salinity can vary significantly as a result of variations in seasonal climatic conditions and regional oceanographic conditions (e.g., El Niño and La Niña). Depth vs. temperature profiles throughout the California Bight show strong seasonal density stratification throughout much of the year where deeper colder waters are physically separated from warmer near-surface waters by a thermocline or pycnocline. This thermal stratification significantly restricts the upward movement of the EOO buoyant discharge and results in the discharge being trapped below the thermocline. EOO temperature and salinity data indicate that thermocline trapping depths can range from less than 40 feet during spring months to 100 feet or more during the fall.



Temperature is the dominant factor governing water density and stratification

A thermocline forms in early spring that separates warmer near-surface waters from deeper cooler waters

Thermal stratification strengthens and the thermocline deepens during summer months

Temperatures in the hypolimnion remain essentially constant throughout the year

Thermal stratification is strongest during late summer/fall months as epilimnion temperatures reach their maximum

Typical Seasonal Progression of the EOO Thermocline

The trend of seasonal warming of coastal ocean waters during spring and summer months can sometimes be temporarily interrupted by upwelling events where cold waters from deep offshore canyons move upward and toward the coastal shelf. Such an upwelling event was captured by the EOO monitoring data in 2022, where temperature vs. depth data showed considerably colder ocean waters throughout the depth profile in April 2022 compared to March 2022.

Section 3
Receiving Water Quality

Order No. R9-2018-0059 applies statewide ocean receiving water standards for body-contact recreation (REC-1) to all depths of ocean waters within the state-regulated three-nautical-mile limit. The EOO discharge has consistently complied with these recreational body-contact standards.

Shore Stations. Weekly monitoring at five shore stations are conducted as part of the EOO receiving water monitoring program. Samples are collected for total coliform, fecal coliform and enterococcus. Consistent compliance with the body-contact recreational standards has been maintained throughout the effective period of Order No. R9-2018-0059.

Sample Collection at EOO Shore Stations

During 2022, for example, median concentrations of fecal coliform and enterococcus at each of the five stations were ≤1 per 100 milliliters, and were predominantly a factor of 100 below the standards. Consistent with the EWA-collected bacteriological data at EOO shore stations, the *Heal the Bay 2021-2022 Beach Report Card* identified all five Carlsbad beaches inshore from the EOO as achieving consistent "A+" ratings and "honor roll" status.

Offshore Stations. The EOO discharge has achieved 100 percent compliance with Ocean Plan recreational body-contact bacteriological receiving water standards at all nearshore and offshore ocean waters at all monitored depths. During the effective period of Order No. R9-2018-0059, median fecal coliform concentrations were ≤1 per 100 milliliters at all nearshore and offshore stations at all depths. During this period, the highest observed concentration of fecal coliform at the EOO nearshore and offshore stations was more than a factor of six lower than the Ocean Plan single sample maximum objective.

Similarly, median enterococcus concentrations were <1 per 100 milliliters at all EOO nearshore and offshore stations at all depths. The highest observed enterococcus concentration at the EOO nearshore and offshore stations was more than a factor of six lower than the Ocean Plan 90th percentile objective. Further, enterococcus concentrations in each collected sample were lower than the Ocean Plan 6-week median standard.

EWA Water Quality Laboratory

Overall, the EOO receiving water monitoring program demonstrates that receiving water is of high quality at all depths in the vicinity of the EOO. The EOO discharge consistently complies with all receiving water requirements established in the Ocean Plan and all receiving water requirements established in Order No. R9-2018-0059.

Section 4
Sediment Chemistry and Toxicity

Order No. R9-2018-0059 requires sediment monitoring at five EOO offshore stations to assess compliance with Ocean Plan narrative objectives and to characterize the quality and health of bottom conditions. Sediment samples are analyzed for grain size and physical parameters, toxic inorganic and organic compounds and sediment toxicity.

Lack of Outfall-Related Sedimentation. Sediment monitoring at the EOO offshore stations demonstrate that sediments in the vicinity of the EOO are predominantly comprised of fine to very fine sands. The predominance of sand-sized particulates in the EOO sediments (combined with the lack of settleable material in the EOO discharge) offers strong evidence that the EOO discharge is not depositing any settleable material to the ocean environment. This conclusion is consistent with effluent quality monitoring which demonstrate virtually no settleable solids in the EOO discharge, high water clarity (low turbidity) and low concentrations of TSS.

Sediment Chemistry. Consistent with these findings, sediment chemistry monitoring also demonstrates that sediment concentrations of nitrogen and total organic carbon in the vicinity of the EOO are low, with nitrogen comprising less than 0.04 percent and total organic carbon comparing less than 0.5 percent of sediment by weight. Concentrations of nitrogen and total organic carbon in sediments near the EOO are consistent with concentrations found at EEO and Bight '18 reference stations. Additionally, concentrations of nitrogen and total organic carbon in EOO sediments are less than mean values seen in sediments at similar depths within the Southern California Bight. Based on these multiple lines of evidence, the EOO sediments show no discernible evidence of nutrient enrichment, either from the EOO discharge or from natural or man-induced sources (including atmospheric or shore-based sources).

Sediment chemistry monitoring at the EOO stations also demonstrates that concentrations of toxic inorganic and organic constituents in sediments near the EOO are comparable to concentrations at reference stations, and are significantly lower than sediment concentrations seen throughout the Southern California Bight. Additionally, sediment concentrations of almost all toxic constituents near the EOO are substantially lower than concentrations cited within the Bight '18 studies as representing undisturbed conditions. An exception to this is that concentrations of polynuclear aromatic hydrocarbon (PAH) compounds at the EOO stations were slightly higher than SCCWRP Bight '18 reference stations. The reason for this is unknown, as the EOO discharge typically does not contain detectable concentrations of PAH compounds. Observed concentrations of PAHs near the EOO, however, were substantially lower than reference threshold values used in Bight '18 to indicate undisturbed benthic conditions.

Sediment Toxicity. While sediment chemistry analyses showed low concentrations of toxic compounds in the EOO sediments, sediment toxicity monitoring was conducted to evaluate the overall toxicity of sediment samples. Sediment toxicity was evaluated using the marine amphipod *Eohaustorius estuarius* and a 10-day solid-phase test for survival and reburial. Percent survival data from the 10-day tests demonstrated that sediments were non-toxic in all EOO sediment samples. In combination with the lack of toxic compounds in the EOO effluent and low levels of toxic compounds in sediments near the EOO, the sediment toxicity monitoring represents an additional line of evidence that the EOO discharge is not adversely affecting sediment quality.

Section 5
Benthic Communities and Demersal Fish

Order No. R9-2018-0059 establishes monitoring requirements to assess the health of aquatic habitat. This monitoring includes identifying species and enumerating abundance of (1) benthic organisms in sediment samples collected from five offshore stations and (2) fish and benthic invertebrates in trawl samples collected from four trawl stations.

Benthic Community Analyses from Sediment Samples. In accordance with requirements of Order No. R9-2018-0059, sediment samples at EOO stations were collected and samples were sieved using a 1-millimeter mesh screen. Organisms were preserved and evaluated by marine biologists who identified collected organisms to the lowest possible taxon. Results were reported in terms of number of species, abundance (population) of each species, and benthic community indices.

Organisms found in the EOO sediment samples were common to sandy bottom and pollution-free ocean environments. Over 150 species were identified within the EOO sediment samples, including 87 species of polychaetes, 25 species of molluscs, 19 species of crustaceans, 7 species of sea urchin and 15 species of worms. In terms of abundance, polychaetes comprised 68 percent of the total number of organisms. Crustaceans and molluscs respectively comprised 13 percent and 9 percent of the total number of organisms. Polychaetes and molluscs comprised a significant majority of the biomass of collected organisms.

All benthic community indices at the EOO offshore stations were indicative of a healthy and diverse benthic community. Shannon-Weiner Index (H') values at each of the stations were in excess of 3.5, indicating a high diversity of organisms and healthy community. Pielou Evenness Index (J') values at each station were in excess of 0.9, indicating that populations were spread out among numerous species. Swartz Dominance Index values (number of qualifying species that comprise 75 percent of the total organism population) were in excess of 40 at each of the EOO offshore stations, indicating a high degree of species diversity. Benthic Response Index (BRI) values were also indicative of a diverse, healthy benthic habitat.

Benthic Response Index (BRI) values were below 15 at each of EOO offshore stations. BRI values below 25 are considered indicative of reference (unimpacted) conditions, while BRI values above 34 represent increasing levels of disturbance or environmental degradation.

The results of benthic community monitoring at the EOO stations were consistent with nearby benthic monitoring conducted as part of the SCCWRP Bight '18 studies. Overall, the EOO and Bight '18 benthic monitoring demonstrates that the EOO discharge has no discernible impacts on the benthic community. Benthic habitats at the EOO stations and nearby Bight '18 stations show a high degree of species diversity and abundant populations. Benthic community metrics and indices show no evidence of habitat degradation, and benthic data collected at EOO stations are at least as good (often better) than data collected at regional Bight '18 mid-shelf monitoring stations. The benthic community data, along with sediment chemistry results and sediment toxicity results, combine to present multiple lines of evidence to demonstrate that benthic communities are not adversely impacted by the EOO discharge.

Fish. Fish and invertebrate trawls were conducted at four EOO offshore trawl stations. A total of 23 species of fish were collected at the trawl stations, with at least 16 species being present at each station. Fish species caught at the EOO trawl stations are common throughout the Southern California Bight. Longfin sanddab, yellowchin sculpin, Pacific sanddab, Dover sole and pink seaperch comprised more than 85 percent of trawl-caught fish. Most collected fish were 6 to 10 centimeters (2.4 to 3.9 inches) in length.

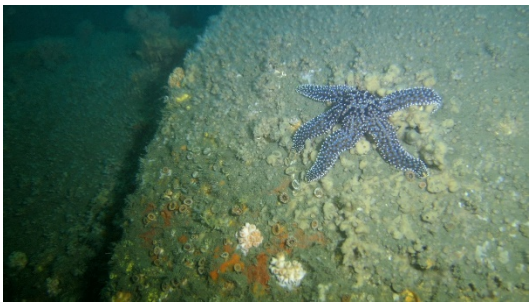
English sole comprised approximately 34 percent of the fish biomass caught at the trawl stations. Pink seaperch, California tonguefish, Pacific sanddab, California scorpionfish and vermillion rockfish comprised an additional 38 percent of the fish biomass. The fish abundance and biomass data from the EOO trawl stations indicate a healthy and diverse populations of fish.

Of the 1446 fish captured during the EOO trawl events, 6 exhibited some form of abnormity. One fish had lesions, two fish had parasites, and three fish had tumors. Each of the fish exhibiting tumors were Dover sole. The incidence of abnormalities in fish caught at the EOO trawl stations was consistent with the incidence of abnormalities found in the Southern California Bight as part of the regional Bight '18 monitoring effort.

Benthic Invertebrates. A total of 15 benthic invertebrate species were collected at the trawl stations, which is indicative of a balanced and healthy benthic invertebrate community. Free-floating colonial tunicates and target shrimp comprised nearly 90 percent of the benthic invertebrate organisms caught at the EOO trawl stations. Nearly 95 percent of the benthic invertebrate biomass at the EOO trawl stations was from pelagic tunicates, target shrimp and armed box crab.

Benthic Invertebrates at the EOO

No anomalies were observed in benthic invertebrates captured by the trawl monitoring at the EOO offshore stations.



Sea Star on the Outfall Pipe

Overall, EOO trawl data demonstrate that demersal fish and benthic invertebrate communities continue to be diverse and healthy. Fish and invertebrate species in the vicinity of the EOO are consistent with fish and invertebrate species seen throughout the Southern California Bight.

Section 6
Bioaccumulation

While the EOO discharge does not contain detectable concentrations of toxic inorganic or organic compounds, tissue monitoring of rig-caught fish was conducted under Order No. R9-2018-0059 to assess whether concentrations of pollutants in fish and benthic organisms bioaccumulate to harmful levels.

As part of this monitoring, three replicate composite samples of fish tissue were prepared from fish collected at three rig fishing zones, with each sample being comprised of a minimum of three fish. Fish species were targeted based on popularity for consumption, distribution, and potential exposure pathways, and included longfin sanddab and English sole. Samples were analyzed for toxic metals and a range of toxic organic compounds, including DDT isomers, chlorinated pesticides, polynuclear aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs).

Toxic Metals. No detectable concentrations of cadmium, chromium, lead, nickel, or silver were found in any of the EOO fish tissue samples. Detectable concentrations of arsenic, copper, mercury, selenium and zinc were found in each of the samples, but these concentrations were consistent with concentrations that occur in fish caught in other areas of the Southern California Bight.

Fish at the Outfall Pipe

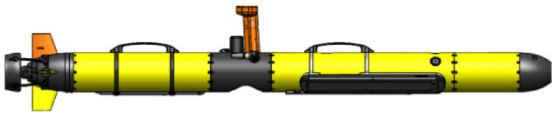
Sample results were compared with Advisory Tissue Levels (ATLs) established by the California Environmental Protection Agency which are designed to encourage the consumption of fish in quantities likely to provide significant health benefits, while discouraging consumption of fish in quantities that risk health consequences associated with contaminant concentrations. Maximum observed fish tissue concentrations in all samples at each EOO station were below ATL concentrations for the weekly consumption (over a lifetime) of 8-ounce servings of sportfish.

Toxic Inorganic Compounds. No detectable concentrations of chlorinated pesticides or PAHs were observed in the EOO fish tissue samples. While detectable concentrations of 4,4'-DDE (a DDT isomer) and PCBs were found in each of the fish tissue samples, maximum observed concentrations were far below ATLs for the daily consumption (over a lifetime) of 8-ounce servings of sportfish.

Overall, bioaccumulation findings from the EOO monitoring were consistent with data collected by SCCWRP as part of the regional Bight '18 effort. Fish in the vicinity of the EOO are safe to eat, and there is no evidence of contaminant accumulation in fish that are associated with wastewater discharges.

Section 7
Dilution and Dispersion

Plume Tracking Study. Order No. R9-2018-0059 established plume tracking monitoring requirements to assess the dispersion and fate of wastewater discharged from the EOO. To comply with the plume tracking requirements, EWA coordinated with other regional dischargers and RWQCB staff to design a study to assess the transport and fate of the EOO discharge using an approach pioneered by the Scripps Institution of Oceanography. As part of this approach, sensors mounted in autonomous underwater vehicles (AUVs) were used to assess movement of discharged wastewater using the parameter CDOM (colored dissolved organic matter) or fDOM (fluorescent dissolved organic matter). AUV deployment routes and depths were programmed based on data collected from boat-based CTD casts and boat-based ocean current monitoring devices. As part of the tracking study, AUV deployments were targeted to assess plume fate and transport during periods of maximum stratification, minimum stratification, and atypical post-storm conditions.



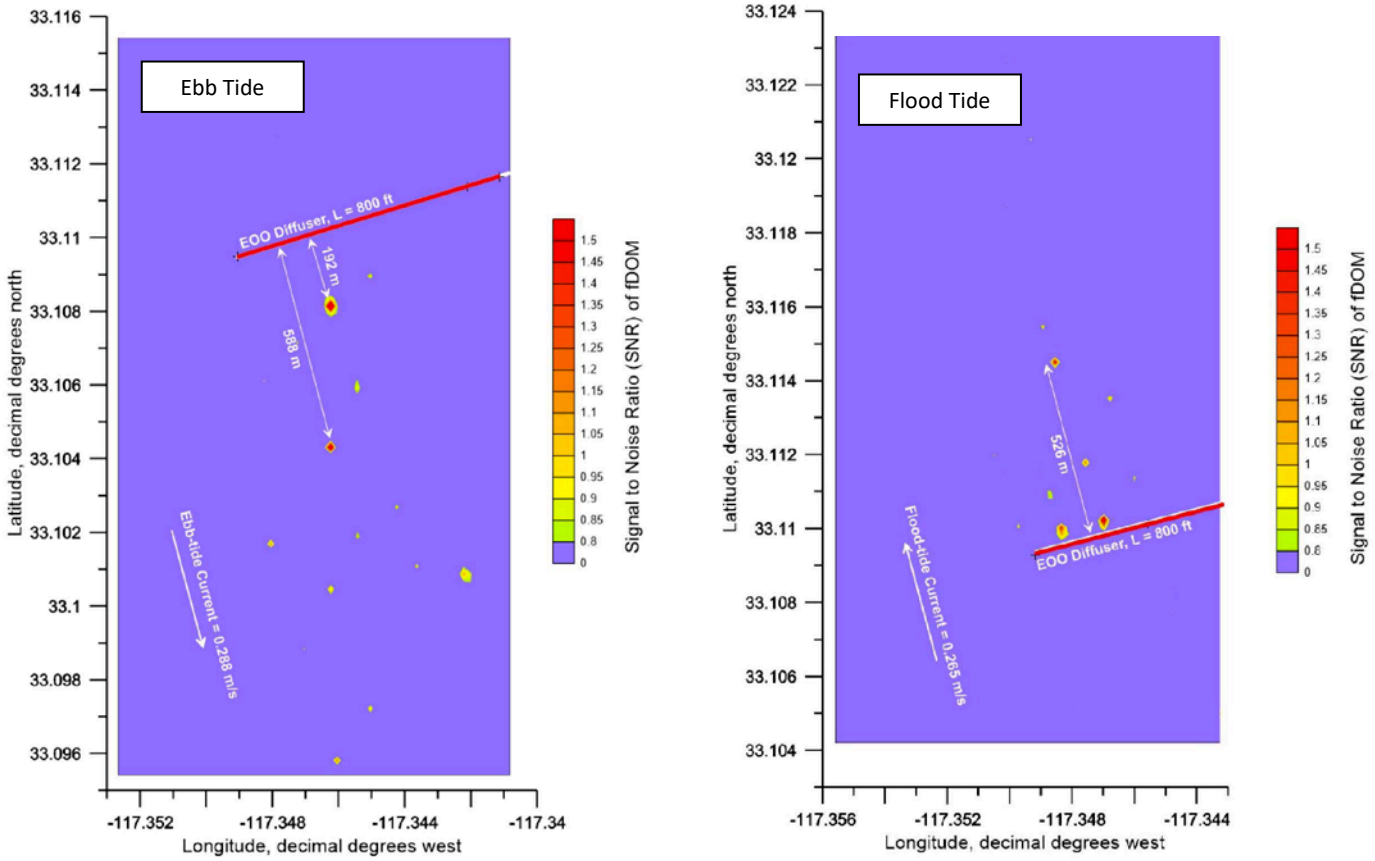
Autonomous Underwater Vehicle

The use of CDOM or fDOM to track discharges of highly treated wastewater is complicated by the fact that CDOM/fDOM exists naturally in seawater and concentrations can vary significantly from location to location. To address this issue, a "signal to noise" approach was utilized to differentiate between "noise" (natural variation) in the ambient receiving water data and concentrations that may be indicative of the presence of the EOO discharge.

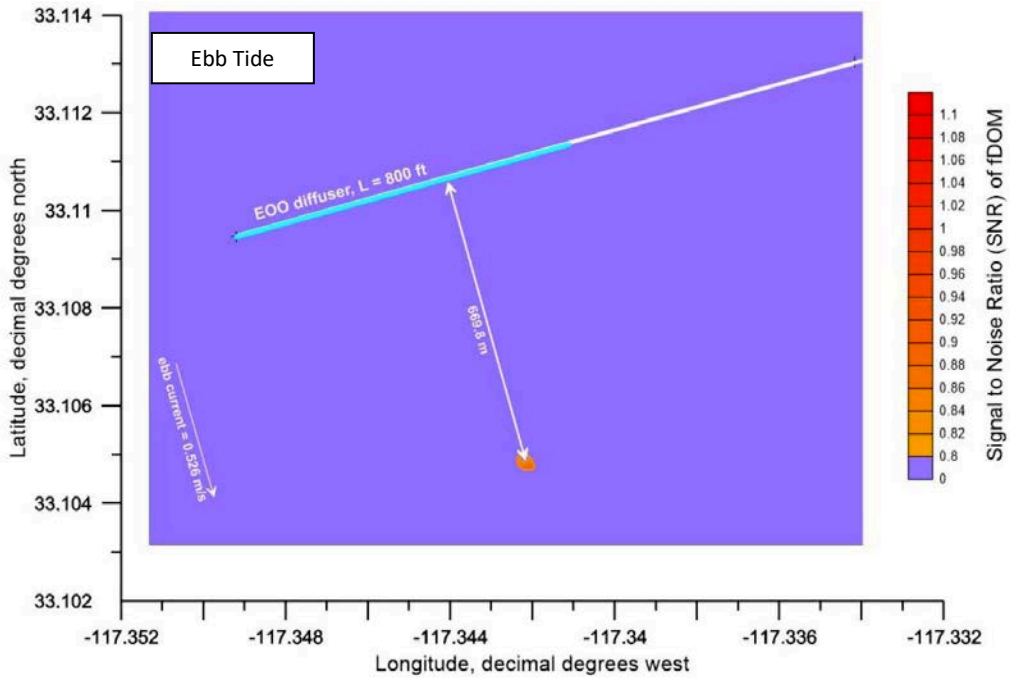
As part of the approach, fDOM concentrations in the EOO discharge and in ambient seawater were measured, and it was presumed that any receiving water concentration observed above ambient "noise" (allowing for natural variation) was due to the EOO discharge.

AUV Deployments. AUV deployments were conducted in September 2021 (maximum stratification), December 2021 (post-storm conditions) and March 2022 (minimum stratification). AUVs were programmed to assess a grid pattern downcurrent from the EOO both during ebb tide and flood tide conditions. Using the signal-to-noise approach, data from the AUV deployments were evaluated to assess where and when the EOO discharge may be detectable.

Under all three sets of conditions, net plume movement during ebb tide conditions was parallel to the coastline and in a southerly direction, while net plume movement during flood tide conditions was parallel to the coastline in a northerly direction. Under all observed conditions, it was found that the EOO discharge does not remain as a "plume" *per se* after discharge. Instead, short-term back-and-forth cross-shore oscillations in ocean currents, while producing no net drift of the EOO discharge, served to break off pieces of the discharge into remnants or pockets that are rapidly diluted and dispersed to the point of becoming indistinguishable from ambient receiving water. As a result of this phenomena, only a few tiny pocket or remnants of the EOO discharge were detected during the AUV deployments. Maximum distances at which these tiny plume remnants were detected during ebb tide conditions was 2200 feet south of the EOO. Maximum distances at which remnants were detected during flood tide conditions were 1725 feet north of the EOO. The minimum dilution in the center of any of the detected fragments during the three AUV deployments was 215:1, while dilutions near the edges of these remnants exceeded 10,000:1.



EOO Discharge Remnants Detected during the AUV Deployment of 21 September 2021



EOO Discharge Remnants Detected during Ebb Tide Conditions of 2 March 2022

Section 8
Conclusions

Plume Tracking and Initial Dilution Conclusions. Plume tracking studies conducted pursuant to requirements of Order No. R9-2018-0059 confirm that:

- Upon discharge, diluted EOO water moves parallel to the shore in an upcoast or downcoast direction, depending on tides and regional conditions.
- The EOO discharge is not transported to the shore. Monitoring data from the EOO shore "S" stations are of no value in assessing performance of the EOO.
- The EOO discharge is quickly diluted by an efficient diffuser.
- Initial dilution is consistently greater than the initial dilution value assigned by the RWQCB.
- Under typical fall and spring oceanographic conditions, the EOO discharge is difficult to detect because of lower-than-average discharge flows, high initial dilutions, and ambient water fDOM concentrations that are comparable to the diluted EOO discharge upon completion of initial dilution.
- After completion of initial dilution, diluted wastewater can be further diluted and dispersed by short-term oscillations in ocean currents (both longshore and cross-shore), creating small remnants of highly diluted water which rapidly become indistinguishable from ambient seawater.
- Under conditions in which remnants of the EOO discharge are detectable, the remnants are detectable only in limited areas, and the remnants become indistinguishable from ambient ocean waters soon after completion of initial dilution.
- Increased recycled water use and decreased EOO discharge flows result in improved dilution and dispersion.
- The existing offshore receiving water monitoring stations are ample for demonstrating compliance with receiving water narrative and numerical standards.
- Stations located more than 2500 feet from the EOO are of little value in assessing the EOO discharge and may be eliminated without consequence.
- The plume tracking work confirmed historical findings that the aquatic life and the ocean environment is not being adversely impacted by the EOO discharge.
- Plume tracking study results confirm prior understanding of the EOO discharge. As a result, no additional plume tracking studies are required.

State of the Ocean Conclusions. Based on recent and past monitoring data conducted at the EOO and at regional SCCWRP Southern California Bight monitoring stations, the following are concluded relative to the EOO discharge:

- Treatment facilities discharging to the EOO achieve high efficiencies in removing TSS, CBOD and other physical/chemical compounds.
- The EOO discharge is free from almost all toxic compounds. Most toxic constituents are below detection limits in the EOO discharge, and the few compounds that are detected are near detection limits and significantly below performance goal concentrations.
- The EOO discharge achieves 100 percent compliance with whole effluent toxicity tests, thus ensuring that unregulated, unknown or unmonitored compounds are not causing toxicity.
- A significant portion of the wastewater within the EWA service area can be diverted to reuse, resulting in reduced EOO discharge flows.
- EOO mass emissions of physical/chemical constituents are reduced from historical values as a result of improved treatment, reduced flows and increased recycled water use.
- The EOO discharge consistently achieves compliance with NDPES effluent limitations, performance goals and effluent toxicity standards.
- The EOO discharge consistently achieves compliance with State of California Ocean Plan receiving water standards for the protection of aquatic habitat and the protection of public health, and the EOO discharge zone is characterized by high-quality ocean water
- While the EOO effluent contains concentrations of nitrogen in excess of ambient receiving water, the EOO discharge is unlikely to directly contribute to algae blooms. As a result of high dilution and dispersion, nutrient concentrations in the discharge zone quickly become indistinguishable from ambient concentrations. Further, during months when algal blooms are most prevalent in the Southern California Bight, thermal stratification is strongest and plume trapping depths are greatest, preventing the EOO discharge from contributing nutrients to the epilimnion. Additionally, EOO nitrogen mass emissions are at their lowest during months when the potential for algae blooms are present due to recycled water production.
- The EOO discharge is trapped below the ocean surface throughout a significant majority of the year by thermal stratification.
- Plume tracking monitoring demonstrates that the EOO discharge is rapidly diluted and dispersed, and upon initial dilution becomes indistinguishable from ambient ocean water within several hundred feet of the ZID.
- During and after the initial dilution process, shear currents can transform the discharge into small fragments which are quickly dispersed and diluted, significantly increasing the overall degree of dilution.
- The EOO discharge contains negligible (typically non-detectable) amounts of settleable material and has no discernible effect on receiving water sediments.

- Sediment concentrations of toxic inorganic and organic compounds at EOO offshore stations are less than or equivalent to concentrations at other regional Bight ’18 stations, and below SWRCB “reference” values characteristic of undisturbed habitat.

- Benthic community monitoring data demonstrate that biological communities in the vicinity of the EOO are in excellent condition with a high degree of species diversity, species richness, abundance and evenness. The EOO discharge has no discernible adverse effects on benthic species populations or diversity.

- Trawl monitoring demonstrates that fish and benthic invertebrate populations are diverse, balanced, and abundant, and show no evidence of discernible adverse impact from the EOO discharge.

- Fish populations in the vicinity of the EOO are abundant, diverse and healthy, and are comprised of species common to the Southern California Bight including longfin sanddab, yellowchin sculpin, Pacific sanddab, Dover sole, pink seaperch and white seaperch.

- Populations of benthic invertebrates are abundant in the vicinity of the EOO discharge, and include common mid-shelf invertebrates such as tunicates, shrimp, sea urchins, crabs and sea stars.

- Anomalies in fish (tumors, lesions, etc.) are rare and occur on percentage basis that is consistent with anomalies found throughout the Southern California Bight.

- No anomalies in benthic invertebrate organisms were observed at the EOO monitoring stations.

- The existing EOO monitoring program is adequate for assessing receiving water quality, sediment quality and receiving water habitats, but some existing effluent and receiving water monitoring may be superfluous or unnecessary.