Revised

RECEIVING WATER MONITORING REPORT

San Elijo Ocean Outfall

Submitted in Compliance with Receiving Water Monitoring Requirement IV.E.1 of Order Nos. R9-2018-0002 and R9-2018-0003

Submitted by:
San Elijo Joint Powers Authority
City of Escondido

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List of Abbreviations

ADCP	acoustic Doppler current profiler
ATL	Advisory Tissue Level
AUV	autonomous underwater vehicle
Basin Plan	*Water Quality Control Plan, San Diego Region*
CDOM	colored dissolved organic matter
CIU	Categorical Industrial User
CIWQS	California Integrated Water Quality System
cm	centimeters
CTD	conductivity/temperature/depth
DNQ	detected not quantified
EOO	Encina Ocean Outfall
EPA	United Stated Environmental Protection Agency
EWA	Encina Wastewater Authority
fDOM	fluorescent dissolved organic matter
HAB	harmful algae bloom
HARRF	City of Escondido Hale Avenue Resource Recovery Facility
kg	kilograms
lbs/day	pounds per day
mgd	million gallons per day
mg/L	milligrams per liter
ml	milliliters
ml/L	milliliters per liter
MRP	Monitoring and Reporting Program
NA	not applicable
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
Ocean Plan	*Water Quality Control Plan, Ocean Waters of California*
ppb	parts per billion
psu	practical salinity units
PTMP	Plume Tracking Monitoring Plan
REC-1	body contact recreation
ROTV	remotely operated towed vehicle
RTOMs	real-time oceanographic mooring system
RWMR	Receiving Water Monitoring Report
RWQCB	Regional Water Quality Control Board, San Diego Region
SCB	Southern California Bight
SCCWRP	Southern California Coastal Water Research Project
SEJPA	San Elijo Joint Powers Authority
SEOO	San Elijo Ocean Outfall
SEWC	San Elijo Water Campus (formerly San Elijo Water Reclamation Facility)
SIU	Significant Industrial User
SMCA	State Marine Conservation Area
SNR_{fDOM}	Signal to noise ratio for fluorescent dissolved organic matter (fDOM)
SWRCB	State Water Resources Control Board
TST	Test of Significant Toxicity
µg/L	micrograms per liter
WET	whole effluent toxicity
ZID	Zone of Initial Dilution

Section 1
Introduction

Purpose of Submittal. Regional Water Quality Control Board (RWQCB) Order No. R9-2018-0002 (NPDES CA0107981) regulates the discharge of wastewater from the City of Escondido Hale Avenue Resource Recovery Facility (HARRF) to the San Elijo Ocean Outfall (SEOO). RWQCB Order No. R9-2018-0003 (NPDES CA0107999) regulates the discharge from the San Elijo Joint Powers Authority (SEJPA) San Elijo Water Campus (SEWC) to the SEOO. Order Nos. R9-2018-0002 and R9-2018-0003 expire on May 31, 2023.

Receiving Water Monitoring Report Requirements. Receiving Water Monitoring Requirement IV.E of Order Nos. R9-2018-0002 and R9-2018-0003 require SEJPA and the City of Escondido to submit a Receiving Water Monitoring Report (RWMR) to the RWQCB no later than 180 days in advance of this expiration date. The RWMR is required to cover the following areas of water quality and habitat monitoring:

- Shoreline, nearshore and offshore water quality.
- Sediment assessment for physical and chemical properties.
- Sediment toxicity.
- Benthic community condition.
- Demersal fish and macroinvertebrate diver surveys.
- Rig fishing.
- Plume tracking.

Order Nos. R9-2018-0002 and R9-2018-0003 require that the RWMR address:

- A description of climatic and receiving water characteristics at the time of sampling.
- A description of sampling stations.
- A description of the sample collection and preservation procedures.
- A description of the specific methods used for laboratory analysis;
- An in-depth discussion, evaluation (e.g., detailed statistical analyses), interpretation and tabulation of the data including interpretations and conclusions as to whether applicable receiving water limitations have been attained at each station.
- An in-depth discussion addressing questions proposed within the Monitoring and Reporting Programs (MRPs) of Order Nos. R9-2018-0002 and R9-2018-0003.

Overview of SEOO Receiving Water Monitoring. Order Nos. R9-2018-0002 and R9-2018-0003 establish receiving water, benthic and rig fishing monitoring requirements for specific SEOO monitoring stations. The Orders, however, also require SEOO discharge agencies to participate in a regional monitoring effort coordinated by the Southern California Coastal Water Research Project (SCCWRP).

To this end, Order Nos. R9-2018-0002 and R9-2018-0003 allow the RWQCB to reallocate receiving water sampling efforts from specified SEOO monitoring stations to the SCCWRP Southern California Bight (SCB) regional monitoring program. In accordance with this approach, the RWQCB has approved reallocating sediment chemistry, sediment toxicity, benthic community, demersal fish/macroinvertebrate and rig fishing requirements from selected SEOO stations to the SCCWRP regional monitoring effort. As part of this RWQCB-authorized "in lieu" monitoring, SEJPA executed a contract with SCCWRP for:

- Collection of sediment, benthic and fish data from select SEOO monitoring stations.
- Collection of sediment chemistry, benthic community, fish, and bioaccumulation data from Bight ’18 regional monitoring stations near the SEOO.[1]
- Allocating monitoring resources from more distant SEOO stations to fund monitoring at regional monitoring stations used within SCCWRP’s comprehensive Bight ’18 regional studies.[1]

Figure 1-1 presents the location of SEOO receiving water monitoring stations. Shore “S” stations are along the shoreline, nearshore “N” stations are 3000 feet[2] offshore, and offshore “A” stations are located along the 120-foot depth contour. Trawl “T” transects are located parallel to the SEOO at 20, 40, 60 and 80-foot depths.

Figure 1-1 SEOO Receiving Water Monitoring Stations

[1] The 2018 Southern California Bight Regional Monitoring Survey (Bight ’18) is part of a large-scale, integrated assessment of the Southern California Bight (SCB). The Bight ’18 survey is a continuation of previous regional monitoring surveys conducted on a five-year cycle since 1994. The Bight ’18 program, led and coordinated by SCCWRP, is a collaboration of efforts from 46 organizations.

[2] Because this report is submitted in accordance with Order Nos. R9-2018-0002 and R9-2018-0003, mixed English and Metric units are used herein to be consistent with units utilized in Order Nos. R9-2018-0002 and R9-2018-0003. Specifically, units of distance, flow and mass emissions are expressed in terms of English Units (e.g., feet, miles, million gallons per day, pounds per day) and units of concentration, temperature and fish size/biomass are expressed in Metric units (e.g., milligrams per liter, degrees Celsius, centimeters, kilograms).

Table 1-1 summarizes receiving water data collection efforts at the SEOO during the effective terms of Order Nos. R9-2018-0002 and R9-2018-0003. This RWMR addresses (1) data collected by SEJPA at SEOO monitoring stations, (2) data collected by SCCWRP at SEOO monitoring stations, and (3) where applicable, regional SCB monitoring data collected by SCCWRP. Data assessed and summarized in this RWMR have previously been submitted to the RWQCB via the California Integrated Water Quality System (CIWQS) or addressed in SCCWRP reports or publicly available data bases. The CIWQS and SCCWRP data bases are summarized and assessed herein and are incorporated by reference as part of this report. The CIWQS and SCCWRP data bases, however, are not reproduced herein.

Table 1-1
SEOO Receiving Water Monitoring and Implementing Agencies

Monitoring Category	Stations	Monitoring Frequency	Implementing Agency [A]
Bacteriological Monitoring (total & fecal coliform, enterococcus)	Shore Stations [B]	Weekly	SEJPA [E]
	Nearshore Stations [C] Offshore Stations [D]	Quarterly	SEJPA [E]
Visual observations, temperature and depth, dissolved oxygen, pH, light transmittance, salinity	Nearshore Stations [C] Offshore Stations [D]	Quarterly	SEJPA [E]
Sediment Grain Size	A-1-S, A-0.5-S, A-1-N Other regional SCB stations [F]	Once per 5-year NPDES term	SCCWRP [F]
Sediment Chemistry (toxic organic and inorganic compounds)	Regional SCB Stations [F,G]	Once per 5-year NPDES term	SCCWRP [F]
Sediment Toxicity	A-1-S, A-0.5-S, A-1-N Other regional SCB stations [F]	Once per 5-year NPDES term	SCCWRP [F]
Benthic Community Monitoring [H]	A-1-S, A-0.5-S, A-1-N Other regional SCB stations [F]	Once per 5-year NPDES term	SCCWRP [F]
Demersal fish, macroinvertebrates [I]	T-0.5-S [J] Other regional SCB stations [J]	Once per 5-year NPDES term	SCCWRP [F]
Rig Fishing and Bioaccumulation Analysis	Regional SCB stations [F]	Once per 5-year NPDES term	SCCWRP [F]

Table 1-1 Notes:

[A] Under Order Nos. R9-2018-0002 and R9-2018-0003, SEJPA and the City of Escondido are responsible for collecting and reporting required receiving water monitoring. Through interagency agreement, SEJPA is responsible for organizing and collecting SEOO receiving water data and both agencies submit the data to the RWQCB. In accordance with RWQCB authorization per Order Nos. R9-2018-0002 and R9-02018-0003, SEJPA contracts with SCCWRP to collect requisite sediment, benthic community fish/invertebrate and bioaccumulation monitoring. As part of this RWQCB authorization, SCCWRP is allowed to reallocate monitoring from some SEOO stations to regional stations monitored by SCCWRP as part of the Southern California Bight (SCB) regional monitoring program.

[B] Shore stations include Stations S-1 through S-5, S-7 and S-8. See Figure 1-1 for station locations.

[C] Nearshore Stations include Stations N-1 through N-7. See Figure 1-1 for station locations.

[D] Offshore stations include Stations A-14-S, A-4-S, A-2-S, A-1-S, A-0.5-S, A-1-N and A-2-N. See Figure 1-1 for station locations.

[E] As owner and operator of the SEOO and through agreement with the City of Escondido, SEJPA is responsible for collecting shore, nearshore and offshore receiving water data for bacteriological parameters and physical parameters. As detailed in Footnotes F and G, SEJPA contracts with SCCWRP for sediment, benthic, fish and bioaccumulation monitoring.

[F] In accordance with requirements of Order Nos. R9-2018-0002 and R9-2018-0003, the RWQCB authorized SEJPA to reallocate monitoring from more distant SEOO stations to the SCCWRP SCB regional monitoring program. As part of the overall SCB regional monitoring program, SCCWRP collected data at SEOO stations A-1-S, A-0.5-S and A-1-N and provided the monitoring results from Stations A-1-S, A-0.5-S and A-1-N to SEJPA. SCB regional monitoring conducted by SCCWRP (in lieu of monitoring conducted at or near the SEOO) is reported in the SCCWRP Bight '18 reports.

[G] Sediment chemistry data for toxic organic and toxic inorganic compounds were collected by SCCWRP and incorporated into the SCB regional monitoring reports prepared by SCCWRP. Data for individual SEOO stations were not provided by SCCWRP to SEJPA.

[H] Identification and enumeration of encountered benthic species and benthic community structure.

[I] Identification and enumeration of encountered fish/macroinvertebrates at trawl stations.

[J] In accordance with requirements of Order Nos. R9-2018-0002 and R9-2018-0003, the RWQCB authorized SEJPA to reallocate trawl monitoring from more distant SEOO stations to the SCCWRP SCB regional monitoring program. As part of this SCB regional monitoring program, SCCWRP also collected data at SEOO trawl station T-05-S and provided the monitoring results from Station T-0.5-S to SEJPA.

Organization of RWMR. To address the RWMR requirements of Order Nos. R9-2018-0002 and R9-2018-0003, this RWMR includes:

- A summary of effluent monitoring data to characterize the quality of the SEOO discharge to the ocean (Section 2).
- Presentation, analysis and interpretation of receiving water quality data collected at SEOO receiving water monitoring stations during the terms of Order No. R9-2018-0002 and R9-2018-0003 (Section 3).
- Presentation, analysis and interpretation of sediment quality and sediment toxicity data collected by SCCWRP at SEOO stations and at nearby Bight ’18 regional monitoring stations (Section 4).
- Presentation, analysis and interpretation of benthic community, fish and macroinvertebrate data collected by SCCWRP at SEOO stations and at nearby Bight ’18 regional monitoring stations (Section 5).
- A summary of the SEOO plume tracking study (Section 6).
- Receiving water compliance conclusions (Section 7), including addressing questions posed within the MRPs of Order Nos. R9-2018-0002 and R9-2018-0003.

RWMR Preparation and Submittal. This RWMR is prepared by SEJPA (operator of the SEOO) and is jointly submitted by SEJPA and the City of Escondido.

Section 2
SEOO Discharge

Overview of SEOO Discharges. The SEOO is jointly owned by the SEJPA and City of Escondido. As shown in Table 2-1, a total of four NPDES-regulated dischargers contribute flow to the SEOO. A majority of the outfall flow is from the City of Escondido Hale Avenue Resource Recovery Facility (HARRF). HARRF has an average monthly secondary treatment capacity of 18 million gallons per day (mgd). HARRF also features 9 mgd of tertiary treatment capacity which produces recycled water that is distributed to users via the City's non-potable ("purple pipe") conveyance network. HARRF recycled water treatment and reuse operations are regulated by RWQCB Order No. R9-2010-0032 and Addendum No. 1 thereto.

The SEJPA San Elijo Water Campus (SEWC)[3] has an average monthly secondary treatment capacity of 5.25 mgd. The SEWC also features tertiary treatment facilities that can produce up to 3.02 mgd of tertiary disinfected recycled water. SEWC recycled water treatment and reuse operations are regulated by RWQCB Order No. R9-2000-10 and Addendum No. 1 thereto.

Table 2-1
Permitted NPDES Discharges - San Elijo Ocean Outfall

Discharger (Permittee)	Regulated Facility	NPDES Permit	Type of Discharge	Monthly Average Permitted Discharge
San Elijo Joint Powers Authority (SEJPA)	San Elijo Water Campus (SEWC)	Order No. R9-2018-0003 NPDES CA0107999	Treated municipal wastewater and reverse osmosis brine	5.25 mgd [A]
City of Escondido	Hale Avenue Resource Recovery Facility (HARRF) [B]	Order No. R9-2018-0002 NPDES CA0107981	Treated municipal wastewater and reverse osmosis brine	18 mgd [B,C,D]
San Diego Gas & Electric (SDG&E)	Palomar Energy Center	Order No. R9-2018-0062 NPDES CA0109215	Cooling tower blowdown and low volume wastes	
Liquid Stone Holdings, LLC	Stone Brewery	Order No. R9-2018-0063 NPDES CA0109258	Reverse osmosis reject and cooling tower blowdown	
Totals				23.25 [E]

Table 2-1 Notes:

A Monthly average SEOO discharge from the SEWC allowed under Order No. R9-2018-0003. Peak day discharges in excess of 5.25 mgd may occur during wet weather conditions. During wet weather periods, SEJPA coordinates with the City of Escondido to ensure that the 25.5 mgd hydraulic capacity of the SEOO is not exceeded.

B Order No. R9-2018-0002 also addresses the proposed discharge of reverse osmosis brine from the City of Escondido Membrane Filtration/Reverse Osmosis (MFRO) Facility. The MFRO facility is scheduled to come on line in 2023.

C Monthly average SEOO discharge allowed from the City of Escondido under Order R9-2018-0002. Peak day discharges in excess of 18 mgd may occur during wet weather conditions. During wet weather periods, City of Escondido coordinates with SEJPA to ensure that the 25.5 mgd hydraulic capacity of the SEOO is not exceeded.

D Pursuant to Effluent Limitation IV.A.1.b of Order No. R9-2018-0002, combined discharge flows to the SEOO from HARRF, the SDG&E Palomar Energy Center, and Stone Brewing Company are to not exceed a monthly average of 18 mgd. Pursuant to Discharge Prohibition III.E of Order No. R9-2018-0062, discharge flows from the SDG&E Palomar Energy Center to the SEOO are to not exceed 1.4 mgd. Order No. R9-2018-0063 limits Stone Brewing Company discharge flows to 0.1 mgd.

E Monthly average SEOO discharge flows allowed under existing NPDES permits. The SEOO has the hydraulic capacity to handle peak flows of 25.5 mgd.

[3] The SEWC was formerly known as the San Elijo Water Reclamation Facility.

HARRF and SEWC recycled water is primarily used as an irrigation supply, and recycled water demands vary seasonally. Excess HARRF and SEWC secondary effluent (flows above recycled water demands) are discharged to the SEOO. Because of the seasonally varying recycled water demands, HARRF and SEWC flows discharged to the SEOO are lowest during summer months, and higher during winter months of reduced recycled water demand. Table 2-2 summarizes HARRF and SEWC flows discharged to the SEOO during 2019-2021.[4] Table 2-2 also presents the portions of HARRF and SEWC inflows that are beneficially reused.

Table 2-2
SEOO Discharge Flows and Percent Reuse

Year	San Elijo Water Campus (SEWC) [A]			Hale Avenue Resource Recovery Facility (HARRF) [A]		
	Average Annual Discharge to SEOO (mgd)	Net Percent of SEWC Inflow Reused [B,C]		Average Annual Discharge to SEOO (mgd)	Net Percent of HARRF Inflow Reused [B,C,D]	
		Annual Average	Maximum Day		Annual Average	Maximum Day
2019	1.45	45 %	97 %	11.7	16 %	28 %
2020	1.33	55 %	99 %	11.5	16 %	31 %
2021	1.20	53 %	99 %	11.1	9 %	20 %
2022 E	0.90	71 %	100 %	10.5	9 %	24 %

Table 2-2 Notes:

A HARRF and SEWC effluent flows directed to the SEOO are from monthly reports submitted by SEJPA and the City of Escondido to the RWQCB via the California Integrated Water Quality System (CIWQS).

B During periods of peak irrigation demand, SEJPA diverts a portion of the HARRF flow discharged to the ELO treats the diverted Escondido flow to augment SEJPA recycled water supplies. This additional reuse is not reflected in the numbers above.

C Computed as the net difference between treatment facility influent flows and effluent flows discharged to the SEOO. Computed percent reuse values shown are lower than actual recycled water production flows due to secondary and tertiary treatment return flows directed back to the treatment facility headworks or primary treatment processes.

D Actual reuse flows are greater. The City of Escondido reuse totals are skewed by reuse at the Palomar Energy Center which is the City's largest reuse customer. HARRF recycled water is used at evaporative cooling towers at the Palomar Energy Center, and a portion of the cooling water tower flow is returned to the Escondido Land Outfall (ELO) for discharge to the SEOO. This returned flow is not accounted for in the numbers above.

E Data for January through September 2022 are included to indicate current year 2020 trends.

As shown in Table 2-2, a significant portion of the SEWC influent flow is beneficially reused, resulting in reduced discharge flows to the SEOO. Presently, a smaller percentage of HARRF influent is recycled, but the City of Escondido is in the process of implementing significant upgrades to its recycled water operations, including completing construction of a Membrane Filtration/Reverse Osmosis (MFRO) facility, which will produce high quality recycled water that will be purveyed to agricultural customers who grow salt-sensitive crops. The 2.0 mgd MFRO facility (which after blending with conventional recycled water will generate 3.0 mgd of highly treated product water) is scheduled to come on line in 2023. With online storage facilities, the MFRO is expected to operate on a year-round basis.

Performance of Wastewater Treatment Facilities. Both SEWC and HARRF achieve exceptional secondary treatment performance and both facilities consistently comply with all NPDES permit limits.

Physical/Chemical Constituents. Table 2-3 (page 2-3) summarizes percent removal values for total suspended solids (TSS) and carbonaceous biochemical oxygen demand (CBOD) for the SEWC and HARRF during 2019-2021.[4] Table 2-4 (page 2-3) summarizes SEWC and HARRF effluent quality for other physical/chemical parameters. As shown in Tables 2-3 and 2-4, the SEWC and HARRF discharges complied with applicable effluent concentration limitations by a significant margin.

4 Data are presented for calendar years 2019 through 2021. Calendar year 2019 is the first complete 12-month calendar year after the adoption of Order Nos. R9-2018-0002 and R9-2018-0003. At the time of preparation of this report, calendar year 2021 is the most recent calendar year for which a complete 12 months of yearly data are available.

Table 2-3
SEOO Discharge, 2019-2021
TSS and CBOD

Year	Total Suspended Solids (TSS)				Carbonaceous Biochemical Oxygen Demand (CBOD)			
	Average Annual Effluent Concentration (mg/L) [A]		Average Annual Percent Removal [B]		Average Annual Effluent Concentration (mg/L) [A]		Average Annual Percent Removal [B]	
	SEWC	HARRF	SEWC	HARRF	SEWC	HARRF	SEWC	HARRF
2019	5.9	5.7	98 %	98 %	4.9	6.7	98 %	98 %
2020	3.8	5.5	99 %	98 %	3.9	5.2	98 %	98 %
2021	3.9	7.1	99 %	97 %	4.1	6.2	98 %	98 %
Ave. Monthly Limit	30		85 %		25		85 %	

Table 2-3 Notes:

A Data from monthly reports submitted by SEJPA and the City of Escondido to the RWQCB for the period January 2019 to December 2021 via the California Integrated Water Quality System (CIWQS). Calendar year 2021 is the most recent year for which a complete 12-months of data are available at the time of preparation of this report.

B Average annual percent removal computed on basis of daily influent and effluent concentrations during the listed year.

Table 2-4
SEOO Discharge, 2019-2021
Settleable Solids, Grease & Oil, Turbidity and Ammonia

	Average Annual Settleable Solids (ml/L) [A]		Average Annual Grease & Oil Concentration (mg/L) [A]		Average Annual Turbidity (NTU) [A]		Average Annual Ammonia (mg/L) [A]	
	SRWC	HARRF	SEWC	HARRF	SEWC	HARRF	SEWC	HARRF
2019	< 0.1	< 0.1	< 1	< 1	2.5	2.8	30.3	15.1
2020	< 0.1	< 0.1	< 1	< 1	2.0	2.3	36.5	15.5
2021	< 0.1	< 0.1	< 1	1.1	2.5	2.6	44.9	15.9
Ave. Monthly Limit	1.0 [B]		25 [B]		75 [B]		NA [C]	
6-month Median	NA [C]		NA [C]		NA [C]		143 [D]	

Table 2-4 Notes:

A Data from monthly reports submitted by SEJPA and the City of Escondido to the RWQCB for the period January 2019 through December 2021 via CIWQS. Calendar year 2021 is the most recent year for which a complete 12-months of data are available at the time of preparation of this report.

B Monthly average effluent concentration limit established in Order Nos. R9-2018-0002 and R9-2018-0003.

C NA indicates that no effluent limitation or performance goal is established within Order Nos. R9-2018-0002 and R9-2018-0003.

D 6-month median performance goal established in Order Nos. R9-2018-0002 and R9-2018-0003.

Figures 2-1 and 2-2 (page 2-4) compares SEWC and HARRF CBOD and TSS concentrations within NPDES assigned concentration limits. Both treatment plants consistently complied with applicable NPDES permit limits for TSS and BOD. The SEWC discharge consistently achieved TSS and CBOD concentrations below 5 mg/L. Additionally, the combined SEOO and HARRF discharge is well oxygenated. Dissolved oxygen concentrations in the SEWC and HARRF effluent are typically on the order of 7.0 mg/L.

Toxic Constituents. As part of each NPDES renewal, SEJPA completes a user survey within the SEWC service area which documents a lack of industries that contribute flow to the SEWC sewer system. As per the most recent survey, no Categorical Industrial Users (CIUs) exist within the SEWC service area that are subject to federal categorical pretreatment regulations and no other industries exist that are classified under U.S. Environmental Protection Agency (EPA) regulations as Significant Industrial Users (SIUs).

Five CIUs and two SIUs exist within the HARRF service area, but the City of Escondido maintains an EPA-approved industrial waste pretreatment program which regulates the industries and enforces applicable sewer discharge standards. As a result of the above, concentrations of toxic compounds within the SEWC and HARRF influent are minimal. Demonstrating this, Table 2-5 summarizes concentrations of toxic inorganic constituents detected in the SEOO discharge. As shown in Table 2-5, copper and zinc were the only two metals detected above reporting levels in the HARRF and SEWC effluent during 2019-2021. Maximum observed copper and zinc concentrations during 2019-2021 were more than a factor of 20 below the 6-month median performance goal established in Order Nos. R9-2018-0002 and R9-2018-0003.

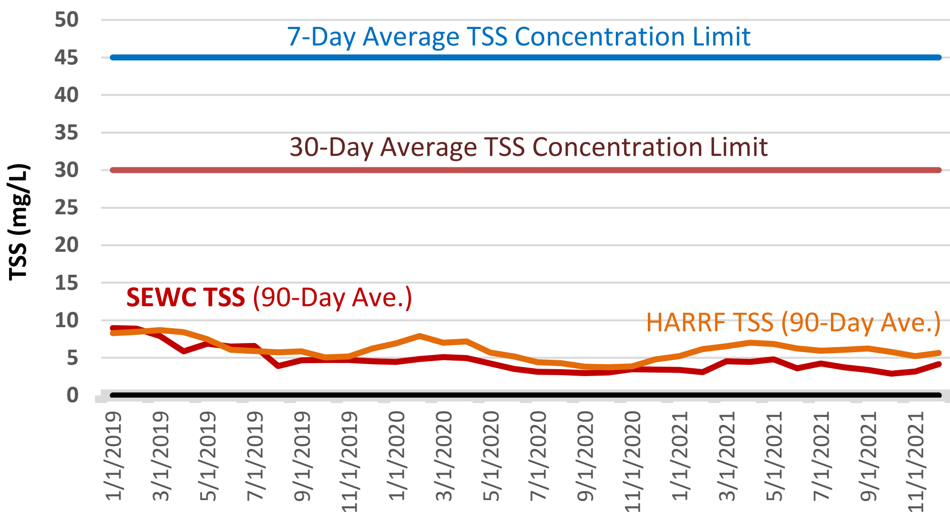

Figure 2-1 SEWC and HARRF TSS, 2019-2021

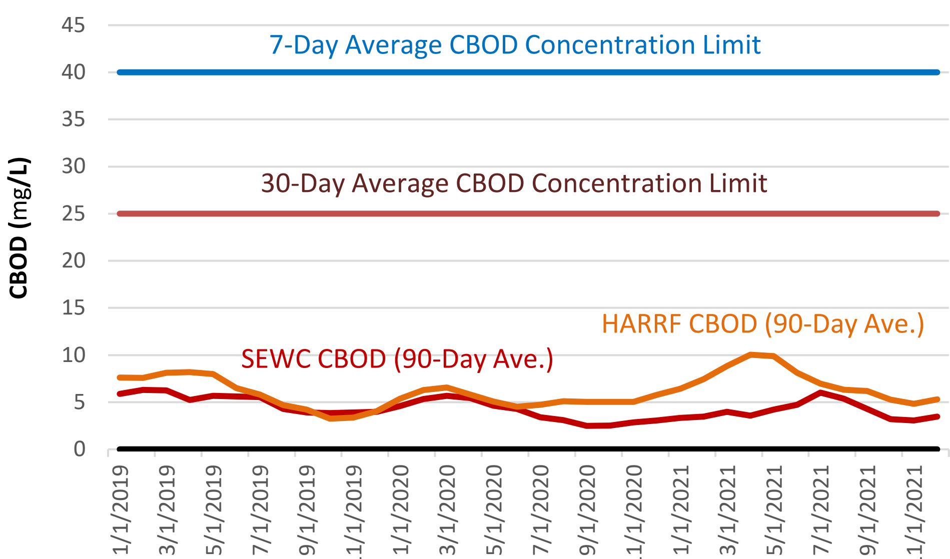

Figure 2-2 SEWC and HARRF CBOD, 2019-2021

Table 2-5
SEOO Discharge, 2019-2021
Toxic Inorganic Compounds

Toxic Inorganic Constituent	Concentration (µg/L)		
	Maximum SEWC Effluent Value [A] 2019-2021	Maximum HARRF Effluent Value [A] 2019-2021	6-Month Median NPDES Performance Goal [B]
Antimony	ND	ND	386,000
Arsenic	ND	ND	1,190
Beryllium	ND	ND	7.9
Cadmium	ND	ND	238
Chromium	ND	ND	45,200,000
Chromium (hexavalent)	ND	ND	476
Copper	12	8.1	240
Lead	ND	ND	476
Mercury	ND	ND	9.4
Nickel	ND	ND	1,190
Selenium	ND	ND	3,570
Silver	ND	ND	129
Thallium	ND	ND	476
Zinc	32	41	2,860
Cyanide	ND	ND	238

Table 2-5 Notes:

A Data from monthly reports submitted by SEJPA and the City of Escondido to the RWQCB for the period January 2019 through December 2021 via CIWQS. Calendar year 2021 is the most recent year for which a complete 12-months of data are available at the time of preparation of this report.

B Monthly average performance goal established for the City of Escondido in Order No. R9-2018-0002 and for the SEWC in Order No. R9-2018-0003.

Table 2-6 (page 2-6) summarizes toxic organic compounds detected in the SEWC or HARRF effluent in concentrations above reporting limits. Chloroform (a common household chemical) was the only compound detected above reporting limits in multiple samples in both the SEWC and HARRF effluent. As shown in Table 2-6, both the SEWC and HARRF effluent complied with all applicable NPDES effluent limitations and performance goals established in Order Nos. R9-2018-0002 and R9-2018-0003, as maximum observed daily concentrations were far below monthly average and 6-month median performance goals.

Table 2-6
SEOO Discharge, 2019-2021
Toxic Organic Compounds

Category	Toxic Organic Parameter	Concentration (µg/L)			
		Maximum SEWC Effluent Value [A] 2019-2021	Maximum HARRF Effluent Value [A] 2019-2021	NPDES Monthly Average Performance Goal	NPDES 6-Month Median Performance Goal
Volatile Organic Compounds (VOCs)	Chloroform	3.6	1.8	30,900 [B]	NA [C]
	All other VOCs	None Detected	None Detected	NA [C]	NA [D]
Acid extractable compounds (phenolic compounds)	All acid extractable compounds	None Detected	None Detected	NA [C]	NA [D]
Base Neutral Compounds	Di-n-butyl phthalate	4.9	< 1.3	83,300 [B]	NA [C]
	Nitrosodimethylamine (NDMA)	0.76	< 0.94	1,740 [B]	NA [C]
	All other base neutral compounds	None Detected	None Detected	NA [D]	NA [C]
Chlorinated Pesticides	Endosulfan	0.05	< 0.013	NA [C]	2.14
	Dieldrin	< 0.0014	0.0065 DNQ [D]	0.00952 month	NA [C]
	All other chlorinated pesticides	None Detected	None Detected	NA [D]	NA [D]
Poly chlorinated biphenyls (PCBs)	PCB isomers	None Detected	None Detected	NA [D]	NA [D]
Dioxins and Furans	All dioxins and furan compounds	None Detected	None Detected	NA [D]	NA [D]

Table 2-6 Notes:

A Data from monthly reports submitted by SEJPA and the City of Escondido to the RWQCB for the period January 2019 through December 2021 via CIWQS. Calendar year 2021 is the most recent year for which a complete 12-months of data are available at the time of preparation of this report.

B Monthly average performance goal established for the City of Escondido in Order No. R9-2018-0002 and for the SEWC in Order No. R9-2018-0003.

C Order Nos. R9-2018-0002 and R9-2018-0003 do not establish a performance goal for the listed category and compound.

D Order Nos. R9-2018-0002 and R9-20178-0003 establish numerous performance goals for individual compounds within the listed category. See Table 6 of Order Nos. R9-2018-0002 and R9-2018-0003 for performance goals for individual compounds within the listed category.

E The constituent is detected not quantifiable, and was detected above the Method Detection Limit but not detected above the Reporting Limit.

Ammonia. Table 2-7 (page 2-7) summarizes ammonia concentrations and mass emissions for the SEWC and HARRF secondary effluent during 2019-2021. Both the HARRF and SEWC discharges complied with NPDES concentration and mass emission performance goals for ammonia established in Table 6 of Order Nos. R9-2018-0002 and R9-2018-0003.

Order Nos. R9-2018-0002 and R9-2018-0003 establish a combined 6-month median ammonia mass emission discharge performance goal of 27,650 pounds per day (lb/day) for the combined HARRF/SEWC discharge.[5] Figure 2-3 compares the combined HARRF and SEWC ammonia mass emissions during 2019-2021 with this combined 6-month median ammonia mass emission performance goal. As shown in Figure 2-3, total SEOO ammonia mass emissions during 2019-2021 were approximately a factor of 10 below the combined HARRF and SEWC 27,650 lb/day 6-month median ammonia performance goal[5] for discharges to the SEOO.

Table 2-7
SEOO Discharge, 2019-2021
Ammonia

Facility	Parameter (units)	Maximum Observed Daily Value [A] 2019-2021	Daily Maximum Performance Goal	Maximum 6-Month Median Value 2019-2021 [A]	6-Month Median Performance Goal
HARRF	Concentration (mg/L)	31.4	143 [B]	23.3	57.1 [B]
	Mass Emissions (lbs/day)	2,802	85,700 [B]	1,824	21,400 [B]
SEWC	Concentration (mg/L)	74	143 [C]	47.5	57.1 [C]
	Mass Emissions (lbs/day)	1,196	25,000 [C]	556	6,250 [C]

Table 2-7 Notes:

A Data from monthly reports submitted by SEJPA and the City of Escondido to the RWQCB for the period January 2019 through December 2021 via CIWQS. Calendar year 2021 is the most recent year for which a complete 12-months of data are available at the time of preparation of this report.

B Performance goal established in Table 6 of Order No. R9-2018-0002.

C Performance goal established in Table 6 of Order No. R9-2018-0003.

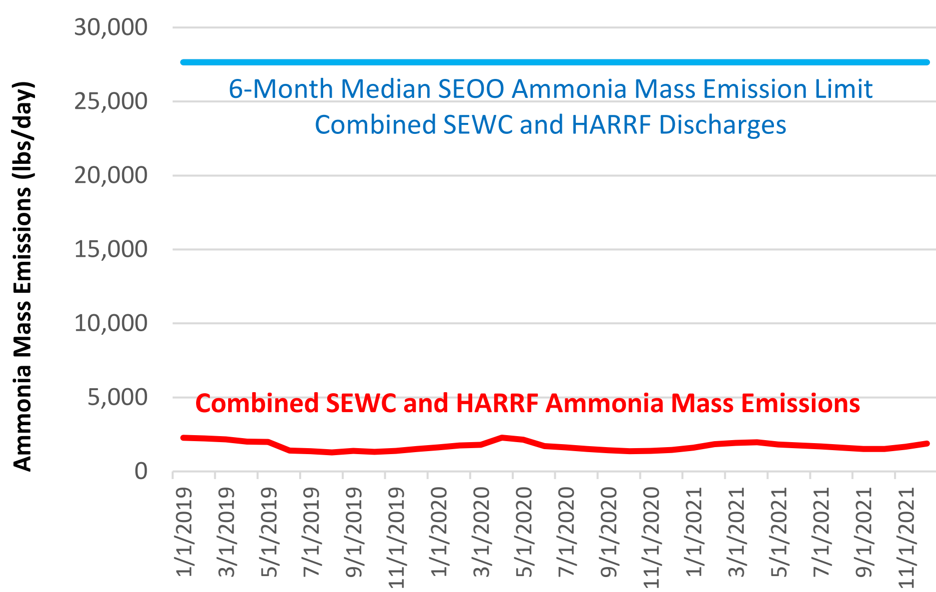

Figure 2-3 Combined HARRF and SEWC Ammonia Mass Emissions, 2019-2021

5 The 6-month median HARRF ammonia mass emission goal is 21,400 lbs/day, and the SEWC 6-month median ammonia mass emission goal is 6250 lbs/day. The combined HARRF/SEWC performance goal is thus 27,650 lbs/day.

Whole Effluent Toxicity. Order Nos. R9-2018-0002 and R9-2018-0003 establish requirements for whole effluent toxicity (WET) monitoring. The multi-day WET tests are conducted to identify any adverse effects of discharged effluent on organism health, growth and reproduction. WET tests represent a "catch all" method for evaluating effects due to:

- Known, regulated and routinely monitored toxic compounds.
- Unknown, unregulated and unmonitored compounds.
- Aggregate, combined, synergistic or antagonistic effects from multiple pollutants.

Three test species are utilized as part of the WET tests, and screening is performed on a biannual basis to identify the most sensitive species. Tests implement the "Test of Significant Toxicity" (TST) methodology established by EPA. The TST statistical methodology is based on the principle that effluent is "toxic" unless proven to be non-toxic. Test results are expressed in terms of "Pass" of "Fail."

Table 2-8 summarizes the results of WET tests performed on the SEWC and HARRF effluent during 2019-2021. As shown in Table 2-8, none of the SEWC or HARRF effluent samples resulted in toxicity for any of the test species or test end points. During 2018-2021, *Macrocystis pyrifera* (giant kelp) was deemed to be the most sensitive species in SEWC screening tests. *Atherinops affinis* (Pacific topsmelt) and *Strongylocentrotus purpuratus* (purple sea urchin) were most sensitive in WET screening tests performed on the HARRF effluent.

Table 2-8
SEOO Discharge, 2019-2021
Whole Effluent Toxicity

Test Species	Test Endpoint	Number of Whole Effluent Toxicity (WET) Tests, 2019-2021 [A]		Percent of Tests that Achieve "Pass" [A]	
		SEWC	HARRF	SEWC	HARRF
Macrocystis pyrifera (giant kelp)	Germination	36	2	100 %	100 %
	Tube Length Growth	36	2	100 %	100 %
Atherinops affinis (Pacific topsmelt)	Growth	2	25	100 %	100 %
	Survival	2	25	100 %	100 %
Strongylocentrotus purpuratus (purple sea urchin)	Fertilization	2	13	100 %	100 %

Table 2-8 Notes:

A Data from monthly reports submitted by SEJPA and the City of Escondido to the RWQCB for the period January 2019 through December 2021 via CIWQS. Calendar year 2021 is the most recent year for which a complete 12-months of data are available at the time of preparation of this report.

Section 3
Receiving Water Quality

Overview of SEJPA Receiving Water Monitoring. The SEOO is located off the coast from San Elijo Lagoon and Cardiff State Beach in Cardiff by the Sea (see Figure 1-1 on page 1-2). Table 3-1 summarizes design parameters for the SEOO. The SEOO is oriented perpendicular to the shoreline and to isobaths. The SEOO diffuser is also oriented perpendicular to isobaths in accordance with pre- and post-discharge ocean current monitoring data which demonstrated that net mid-depth and deep ocean currents near the SEOO are oriented parallel (upcoast and downcoast direction) to the coastline and to isobaths.

Table 3-1
SEOO Design Parameters

Parameter	Value
Approximately Overall Length	8,000 feet [A]
Diffuser Orientation	Perpendicular to shore & isobaths
Diffuser Length	1,180 feet [A]
Diffuser Diameter	48 inches
Diffuser Ports	200 ports [B]
Discharge Distance Offshore	8,000 feet (offshore end of diffuser) [A] 6,820 feet (inshore end of diffuser) [A]
Discharge Depth	150 feet (offshore end of diffuser) [A] 110 feet (inshore end of diffuser) [A]
Minimum Month Initial Dilution	237:1 [C]

Table 3-1 Notes:

- A Listed depths and distances offshore are based on mean sea level and will vary depending on tidal conditions.
- B SEOO ports include two hundred 2-inch-diameter ports. SEOO ports are located on alternating sides of the diffuser and ports are spaced at approximate 12-foot intervals on each side of the diffuser.
- C The minimum month initial dilution for the SEOO is designated at 237:1 within RWQCB Order Nos. R9-2018-0002 and R9-2018-0003, based on an average monthly outfall discharge flow of 23.25 mgd.

As operator of the SEOO, SEJPA collects receiving water monitoring data on a quarterly basis at each of the SEOO receiving water monitoring stations designed within Order Nos. R9-2018-0002 and R9-2018-0003. Table 3-2 (page 3-2) summarizes the SEJPA receiving water monitoring collection effort. The surf zone ("S") stations are used to assess conditions along the coast, while offshore ("A") stations assess conditions in the immediate area of the SEOO and in the upcurrent and downcurrent direction. Nearshore ("N") stations assess conditions in the area between coastal and offshore waters and are useful in confirming that conditions that are observed along the shore are not related to the outfall discharge.

Table 3-2
SEOO Receiving Water Quality Monitoring

Receiving Water Monitoring	Monitoring Frequency	Location	Depth
• Visual Observations [A] • Temperature • Total and Fecal Coliform [B] • Enterococcus	Quarterly	Surf Zone ("S") Stations	Surface
• Visual Observations [A] • Total and Fecal Coliform [B] • Enterococcus	Quarterly	Nearshore ("A") Stations Offshore ("N") Stations	Surface and Mid-Depth Samples
• Temperature • Dissolved Oxygen • Light Transmittance • pH • Salinity	Quarterly	Nearshore ("A") Stations Offshore ("N") Stations	Continuous Depth Profile [C]

Table 3-2 Notes:

A Visual observations of the surface water conditions at the time of monitoring, including observations of any floating material of wastewater origin or any ocean conditions of an unusual nature.

B Order Nos. R9-2018-0002 and R9-2018-0003 require monitoring for both total and fecal coliform. The current (2019) version of the *Water Quality Control Plan, Ocean Waters of California* (Ocean Plan) establishes receiving water requirements only for fecal coliform and enterococcus.

C Data are collected using a conductivity, temperature, depth (CTD) profiler that assesses depth, temperature, dissolved oxygen, light transmittance, pH and salinity through the entire water column (surface to near-bottom).

Visual Observations. In accordance with requirements of Order Nos. R9-2018-0002 and R9-2018-0003, visual observations 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 (from the outfall or any other sources), including floating material, discoloration, grease and oil, turbidity or odor.[6] No such conditions were identified in any of the visual observations at SEOO monitoring stations that were conducted during the current terms of Order Nos. R9-2018-0002 and R9-2018-0003.

Bacteriological Compliance. Statewide ocean receiving water standards for body-contact recreation (REC-1) are established within the *Water Quality Control Plan, Ocean Waters of California* (Ocean Plan). Ocean Plan REC-1 standards apply to waters within 1000 feet of the shore, within waters less than 30 feet deep, and in other areas "used for water contact sports, as determined by the Regional Water Board."[7] Historically, the RWQCB had implemented the REC-1 standards in areas within 1000 feet of the shore or within the 30-foot depth contour. In the early 2000s, however, EPA interpreted the REC-1 standards as applying to all state-regulated waters within the San Diego Region.[8] As a result, Order Nos. R9-2018-0002 and R9-2018-0003 apply Ocean Plan REC-1 beach bacteriological receiving water standards in all waters of all depths outside the SEOO Zone of Initial Dilution (ZID).

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6 In the event that any phenomena are noted that may be associated with wastewater discharges, additional visual observations that are logged include information related to water movement, which includes wind, weather, tides, currents, etc.

7 See Section II.B.1 of the Ocean Plan (SWRCB, 2019).

8 In accordance with the Ocean Plan, the original 1976 version of the *Water Quality Control Plan, San Diego Basin* (Basin Plan) noted that within the San Diego Region, REC-1 standards applied within 1000 feet of the shore or in waters within the 30-foot depth contour. The original version of the Bain Plan also identified specific beaches within the San Diego Region where REC-1 uses occur. The subsequent 1994 version of the Basin Plan eliminated any specific references to where ocean REC-1 uses applied, and instead relied on the Ocean Plan definition (e.g., 1000 feet of the shore and within the 30-foot depth contour). Support documents developed and approved by the RWQCB as part of approving the 1994 Basin Plan mentioned no intent to propose change in REC-1 designations for offshore waters. Nevertheless, EPA subsequently interpreted the 1994 version of the Basin Plan as designating REC-1 uses within all depths of all state-regulated ocean waters. This interpretation is based on the fact that the Basin Plan generically identifies REC-1 use as one of the beneficial uses for the Pacific Ocean without specifically identifying where such uses occur. As a result, the San Diego Region is the only Region within California where ocean outfall NPDES permits implement Ocean Plan REC-1 bacteriological receiving water standards in all depths of all state-regulated ocean waters.

Despite the fact that the SEWC and HARRF discharges are not disinfected, the SEOO discharge has consistently complied with Ocean Plan REC-1 bacteriological receiving water standards in all state-regulated ocean waters.[9] During 2018-2022 (see Table 3-3), all SEOO offshore and nearshore receiving water monitoring stations achieved 100 percent compliance with Ocean Plan REC-1 single sample maximum standards for fecal coliform.

Table 3-3
SEOO Receiving Water Quality, 2018-2022
Fecal Coliform at Offshore "A" Stations and Nearshore "N" Stations

Station	Depth	Number of Samples	Percent Compliance with Single Sample Maximum Limit [A]	Fecal Coliform Concentration [B] (Number per 100 ml)	
				Median Value	90th Percentile Value
A-14-S	Surface	19	100%	< 1.8	< 1.8
	Mid-Depth	19	100%	< 1.8	2
A-4-S	Surface	19	100%	< 1.8	1.8
	Mid-Depth	19	100%	< 1.8	< 1.8
A-2-S	Surface	19	100%	< 1.8	2
	Mid-Depth	19	100%	< 1.8	2
A-1-S	Surface	19	100%	< 1.8	< 1.8
	Mid-Depth	19	100%	< 1.8	2
A-0.5-S	Surface	19	100%	< 1.8	< 1.8
	Mid-Depth	19	100%	< 1.8	2
A-1-N	Surface	19	100%	< 1.8	< 1.8
	Mid-Depth	19	100%	< 1.8	2
A-2-N	Surface	19	100%	< 1.8	< 1.8
	Mid-Depth	19	100%	< 1.8	2
N-1	Surface	19	100%	2	2
	Mid-Depth	19	100%	4.5	4.5
N-2	Surface	19	100%	< 1.8	< 1.8
	Mid-Depth	19	100%	2	2
N-3	Surface	19	100%	2	2
	Mid-Depth	19	100%	2	2
N-4	Surface	19	100%	< 1.8	< 1.8
	Mid-Depth	19	100%	2	2
N-5	Surface	19	100%	2	2
	Mid-Depth	19	100%	2	2
N-6	Surface	19	100%	< 1.8	< 1.8
	Mid-Depth	19	100%	2.8	2.8
N-7	Surface	19	100%	2	2
	Mid-Depth	19	100%	2	2
Ocean Plan Fecal Coliform Single Sample Maximum Standard [C]				400 [C]	

Table 3-3 Notes:

A Percent compliance with the Ocean Plan fecal coliform single sample maximum standard of 400 per 100 mL and the 400 per 100 ml fecal coliform single sample maximum limitation established in Order Nos. R9-2018-0002 and R9-2018-0003.

B Data from SEOO monthly reports submitted to the RWQCB for the period January 2018 through September 2022 via CIWQS.

C The Ocean Plan fecal coliform single sample maximum standard of 400 per 100 ml is implemented within Order Nos. R9-2018-0002 and R9-2018-0003.

[9] The SEWC and HARRF discharges are not disinfected in order to reduce the potential for harm to the ocean environment. The use of chlorine as a disinfectant can result in chlorine-related toxicity in disinfected effluents as well as the formation of a variety of toxic chlorinated byproducts.

Additionally (see Table 3-4), all SEOO offshore and nearshore receiving water monitoring stations achieved 100 percent compliance with Ocean Plan enterococcus Statistical Threshold Value (90th percentile) standards.

Table 3-4
SEOO Receiving Water Quality, 2018-2022
Enterococcus at Offshore "A" Stations and Nearshore "N" Stations

Station	Depth	Number of Samples	Percent Compliance with Ocean Plan STV Limit [A]	Enterococcus Concentration [B] (Number per 100 ml)	
				Median Value	90th Percentile Value
A-14-S	Surface	17 [C]	100% [C]	< 10	< 10
	Mid-Depth	18	100%	< 10	< 10
A-4-S	Surface	18	100%	< 10	< 10
	Mid-Depth	18	100%	< 10	< 10
A-2-S	Surface	18	100%	< 10	< 10
	Mid-Depth	18	100%	< 10	< 10
A-1-S	Surface	18	100%	< 10	< 10
	Mid-Depth	18	100%	< 10	< 10
A-0.5-S	Surface	18	100%	< 10	< 10
	Mid-Depth	18	100%	< 10	< 10
A-1-N	Surface	18	100%	< 10	< 10
	Mid-Depth	18	100%	< 10	< 10
A-2-N	Surface	18	100%	< 10	< 10
	Mid-Depth	18	100%	< 10	< 10
N-1	Surface	19	100%	< 10	< 10
	Mid-Depth	19	100%	< 10	< 10
N-2	Surface	19	100%	< 10	< 10
	Mid-Depth	19	100%	< 10	< 10
N-3	Surface	19	100%	< 10	< 10
	Mid-Depth	19	100%	< 10	< 10
N-4	Surface	19	100%	< 10	< 10
	Mid-Depth	19	100%	< 10	< 10
N-5	Surface	19	100%	< 10	< 10
	Mid-Depth	19	100%	< 10	< 10
N-6	Surface	19	100%	< 10	< 10
	Mid-Depth	19	100%	< 10	< 10
N-7	Surface	19	100%	< 10	< 10
	Mid-Depth	19	100%	< 10	< 10
Ocean Plan Statistical Threshold Value (90th Percentile) Standard [D]				110 [D]	

Table 3-4 Notes:

A Percent compliance with the Ocean Plan enterococcus Statistical Threshold Value (STV) limit not to be exceeded in more than 10 percent of the samples. It should be noted that the Ocean Plan enterococcus STV limit was established subsequent to the adoption of Order Nos. R9-2018-0002 and R9-2018-0003.

B Data from SEOO monthly reports submitted to the RWQCB for the period January 2018 through September 2022 via CIWQS.

C Omits one apparent contaminated sample at Station A-14-S which is 2.7 miles south of the SEOO discharge. If this suspect value is included, Station A-14-S remains 100 percent compliant with the STV 90th percentile requirement.

D Order Nos. R9-2018-0002 and R9-2018-0003 establish an enterococcus single sample maximum limit of 104 per 100 ml.

More than 50 years of receiving water data collected at SEOO offshore and nearshore stations demonstrate that the SEOO discharge is rapidly diluted and discharged water is dispersed upcoast or downcoast by prevailing ocean currents. Offshore "A" stations (located along the 120-foot depth contour) and Nearshore "N" stations (located between the shoreline and the SEOO diffuser) show consistent compliance with Ocean Plan REC-1 bacteriological standards and serve to confirm that occasional shoreline bacteriological exceedances are caused by shore-based sources. The plume tracking study required under Order Nos. R9-2018-0002 and R9-2018-0003 (summarized in Section 6) provide final proof that the SEOO discharge does not influence water quality along the Cardiff/San Elijo shoreline.

Table 3-5 summarizes the results of bacteriological monitoring at the shore "S" stations during 2018-2022. As shown in Table 3-5, none of the "S" station samples collected during 2018-2022 exceeded the Ocean Plan REC-1 single sample maximum limits for fecal coliform. During 2018-2022, a total of nine enterococcus samples exceeded 100 per 100 mL. Four of these exceedances occurred at Stations S7 and S8 (located 4000 and 8000 feet north of the outfall at San Elijo State Beach), and each of these exceedances occurred after storm runoff events. It is noteworthy that all San Elijo State Beach stations received an "A+" or "A" report card in the Heal the Bay 2020-2021 Beach Report Card. (Heal the Bay, 2021)

Five enterococcus samples at Station S-1 (Fletcher Cove Park) exceeded a concentration of 100 per 100 ml and only one of these samples were collected directly after storm events. The Heal the Bay 2020-2021 report card, however gave an "A" rating to Station S-1 under dry conditions and a "B" grade for wet weather conditions, so storm runoff is likely linked to the S-1 exceedances.

Table 3-5
Receiving Water Quality at Shoreline "S" Stations, 2018-2022 [A]

Station	Number of Samples	Fecal Coliform [A]			Enterococcus [A]		
		Percent Compliance with Single Sample Maximum Limit [B]	Median Concentration (Number per 100 ml)	90th Percentile Concentration (Number per 100 ml)	Percent of Samples with Concentrations Less than 100 per 100 ml [C]	Median Concentration (Number per 100 ml)	90th Percentile Concentration (Number per 100 ml)
S-1	57	100 %	8	56	91%	20	89
S-2	56	100 %	7	32	100%	10	42
S-3	57	100 %	5	13	100%	10	20
S-4	57	100 %	4	19	100%	10	20
S-5	57	100 %	7	26	96%	10	45
S-7	56	100 %	5	17	96%	10	31
S-8	56	100 %	5	23	100%	10	36

Table 3-5 Notes:

A Data from SEOO monthly reports submitted to the RWQCB for the period January 2018 through September 2022 via CIWQS.

B Percent compliance with the Ocean Plan fecal coliform single sample maximum standard of 400 per 100 mL and the 400 per 100 ml fecal coliform single sample maximum limitation established in Order Nos. R9-2018-0002 and R9-2018-0003.

C The Ocean Plan establishes an enterococcus Statistical Threshold Value (STV) limit of 110 per 100 mL that is not to be exceeded in more than 10 percent of the samples. Order Nos. R9-2018-0002 and R9-2018-0003 establish a single sample maximum limit (based on the prior version of the Ocean Plan) of 104 per 100 ml. For comparison, this column shows the percent of shoreline receiving water samples with enterococcus concentrations less than 100 per 100 mL.

While the above tables focus on Ocean Plan fecal coliform single sample maximum limits and enterococcus STV limits, the Ocean Plan also establishes a 30-day geometric mean standard for fecal coliform (200 per 100 mL) and a 6-week geometric mean standard (30 per 100 mL) for enterococcus. The Ocean Plan geometric mean metrics are a measure of consistency of exceedance, and will be exceeded only when a string of samples consistently show high values. It is thus difficult to exceed the geometric mean standards when multiple samples are collected within any given geometric mean time period and any of the samples are "clean." Demonstrating this, Table 3-6 documents how compliance with the 30-day geometric mean fecal coliform standard is still achieved if:

- 80 percent of the samples in any given month are at the fecal coliform single sample maximum limit of 400 per 100 mL (Case 1).
- 60 percent of the samples in any given 30-day period show concentrations 10 times above the single sample maximum limit (Case 2).
- 40 percent of the samples in any given 30-day period show concentrations 100 times above the single sample maximum limit.

Since typical SEOO receiving water fecal coliform concentrations are less than 2 and typical enterococcus concentrations are less than 10, it can be concluded that none of the SEOO receiving water stations would ever exceed the Ocean Plan 30-day fecal coliform or 6-week enterococcus geometric mean standards.

Table 3-6
Geometric Mean Compliance Examples

Parameter	Fecal Coliform Concentration (No. per 100 milliliters)		
	Case 1: 80% of Samples Exceed the Single Sample Maximum Limit of 400 per 100 mL [A]	**Case 2:** 60% of Samples Exceed 10X the Single Sample Maximum Limit [A]	**Case 3:** 40% of Samples Exceed 100X the Single Sample Maximum Limit [A]
Sample 1	400	4,000	40,000
Sample 2	400	4,000	40,000
Sample 3	400	4,000	2 [B]
Sample 4	400	2 [B]	2 [B]
Sample 5	2 [B]	2 [B]	2 [B]
Geometric Mean [C]	139	191	105

Table 3-6 Notes:

A Ocean Plan single sample maximum limit for fecal coliform is 400 per 100 milliliters

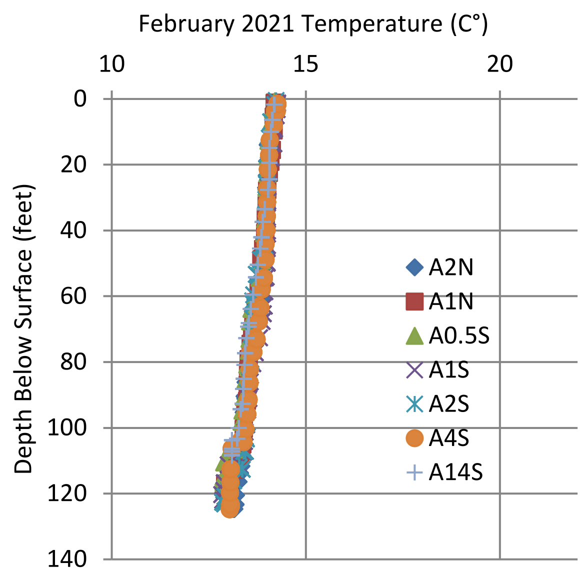
B The median fecal coliform value at SEOO receiving waters stations is < 2 per 100 mL.

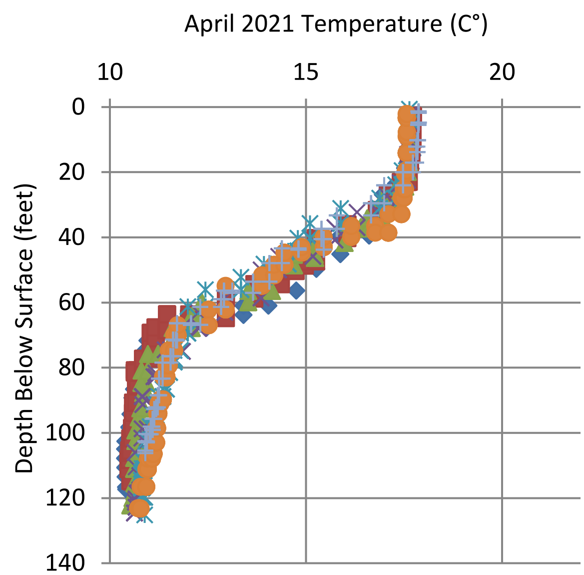
C The Ocean Plan 30-day geometric mean limit (minimum 5 samples) for fecal coliform is 200 per 100 mL.

Physical/Oceanographic Parameters. In addition to receiving water monitoring for bacteriological parameters, SEOO receiving water stations are also monitored on a quarterly basis using conductivity, temperature, depth (CTD) profilers that collect data on temperature, depth, dissolved oxygen, light transmittance, pH and salinity. More than a half century of receiving water data have been collected at the SEOO stations to characterize receiving water temperature, salinity and density. Ocean water temperature is the dominant factor affecting ocean water density and stratification. As shown in Figure 3-1 (page 3-7), deeper ocean water maintain a relatively stable temperature that typically ranges from 11 C° to 14 C° (50 F° to 57 F°). Temperatures in surface waters, on the other hand, can range from approximately 14 C° to over 24 C° (57 F° to over 75 F°).

As ocean waters warm during spring months, a thermocline forms that physically separates warmer upper waters (epilimnion) from cooler deeper waters (hypolimnion). The thermocline strengthens and deepens as surface waters warm during summer months. Thermal stratification is typically strongest during fall months as epilimnion temperatures reach their maximum. The thermocline weakens during winter months when surface temperatures cool.

This thermal stratification acts to form a barrier that traps the upward movement of less dense (slightly warmer and less saline) SEOO discharge flows. Initial dilution is the rapid dilution of discharged water that occurs as a result of entrainment of ambient ocean water due to the momentum of the outfall discharge jets and buoyance of the discharge relative to ambient waters. Initial dilution can vary significantly during the year, depending on discharge flows (which are typically highest in winter months) and thermocline trapping levels (which are typically strongest in summer/fall months).





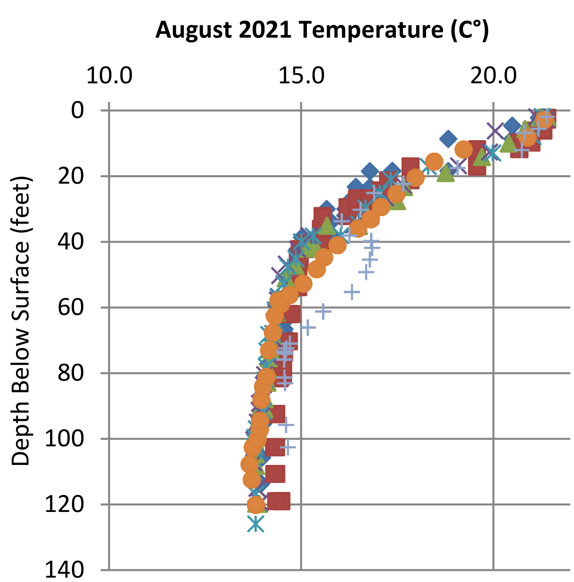


Figure 3-1 Temperature vs. Depth during 2021 San Elijo Ocean Outfall

As a result of this thermal stratification, the SEOO discharge remains trapped below the surface for almost all of the year. Figure 3-2 depicts the typical seasonal thermocline cycle that restricts the rise of water discharged from the SEOO.

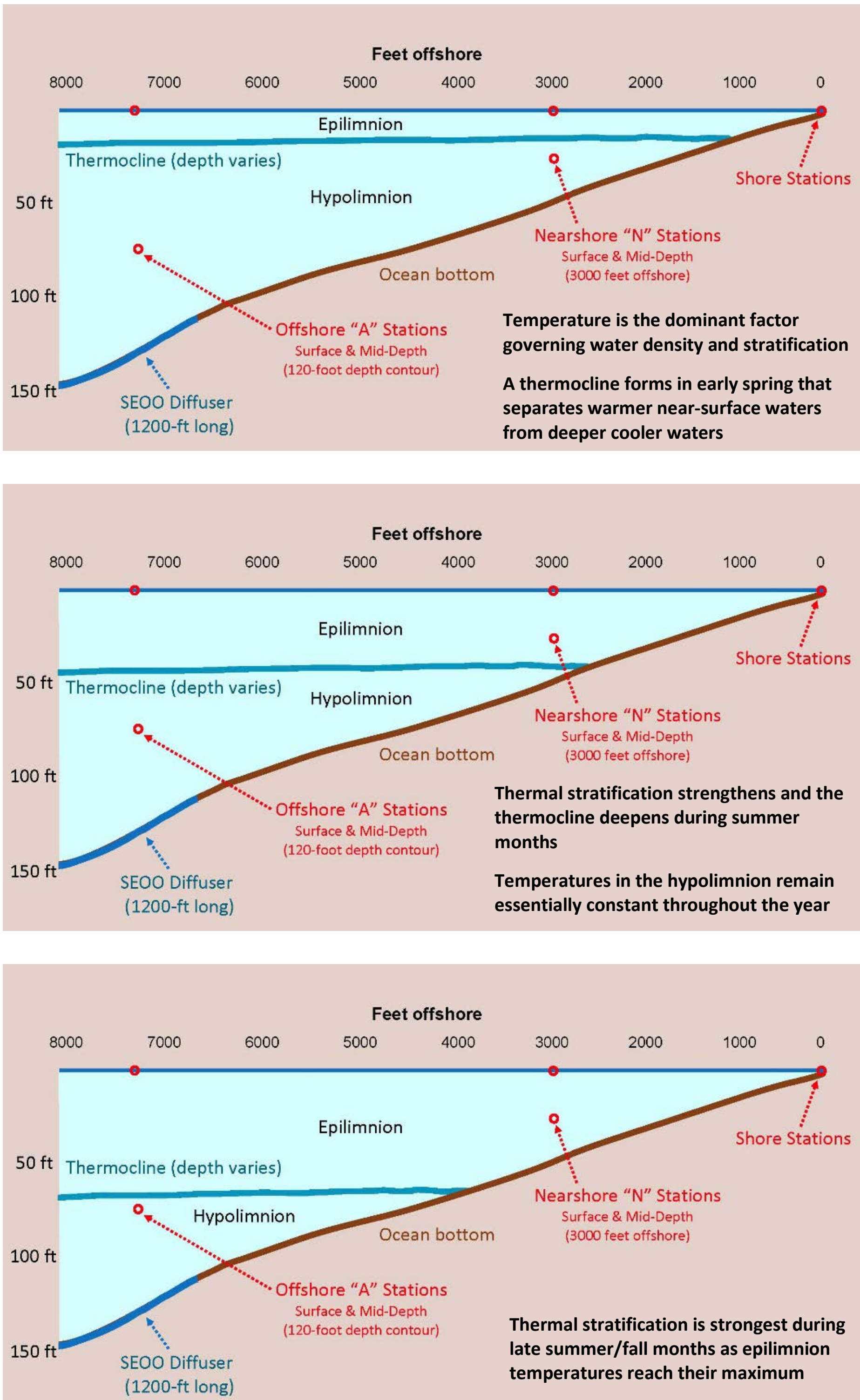
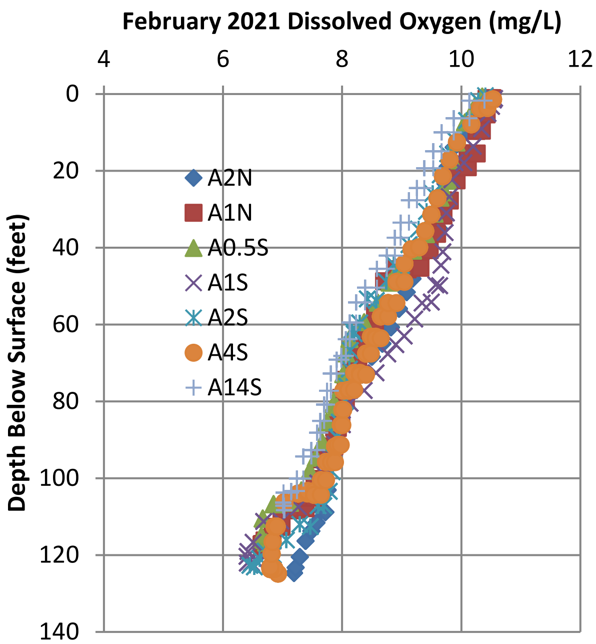
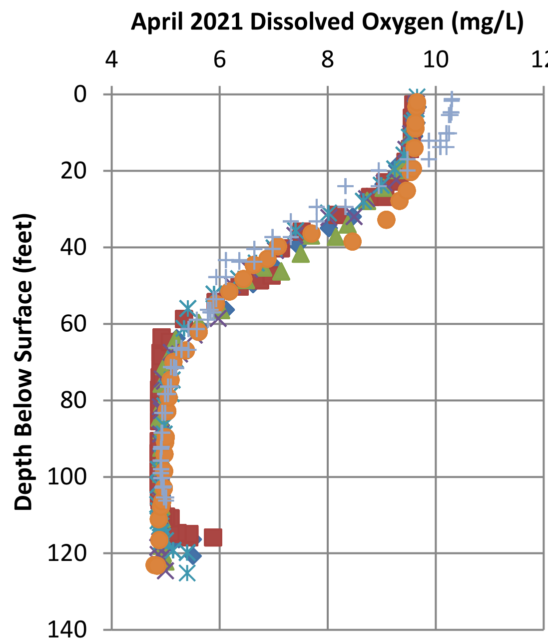


Figure 3-2 Typical Seasonal Progression of the SEOO Thermocline

High dilution combined with the high quality SEOO discharge results in no discernible impact on receiving water dissolved oxygen, pH or water clarity. Figure 3-3 depicts seasonal dissolved oxygen profiles at the SEOO during 2021. As shown in the figures, high dissolved oxygen concentrations exist throughout the depth profile, and no discernible difference exists between dissolve oxygen profiles at stations near the SEOO and reference stations.





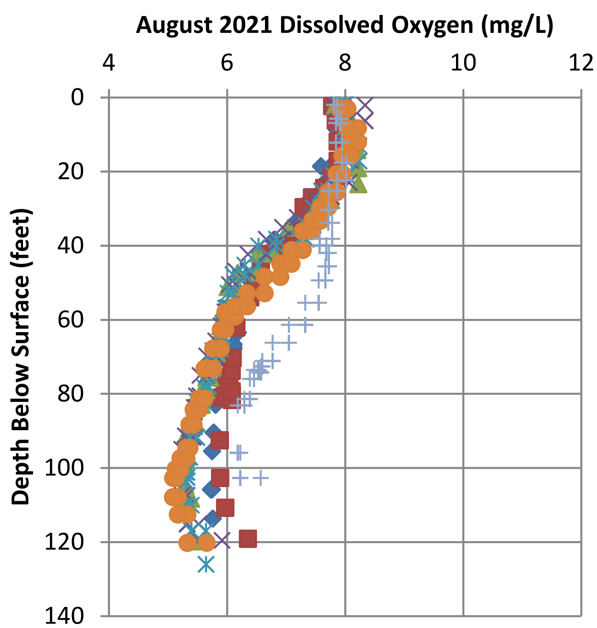


Figure 3-3 Dissolved Oxygen vs. Depth during 2021
San Elijo Ocean Outfall

Figure 3-4 depicts maximum and minimum pH values at all SEOO offshore stations during 2018-2022. Figure 3-4 also compares receiving water pH at all SEOO offshore stations with the reference station A-14-S (located 2.7 miles south of the SEOO). As shown in the figure, the SEOO discharge complies with all Ocean Plan and NPDES limits for receiving water pH. Additionally, no discernible difference exists between pH profiles at SEOO offshore stations and Reference Station A-14-S.

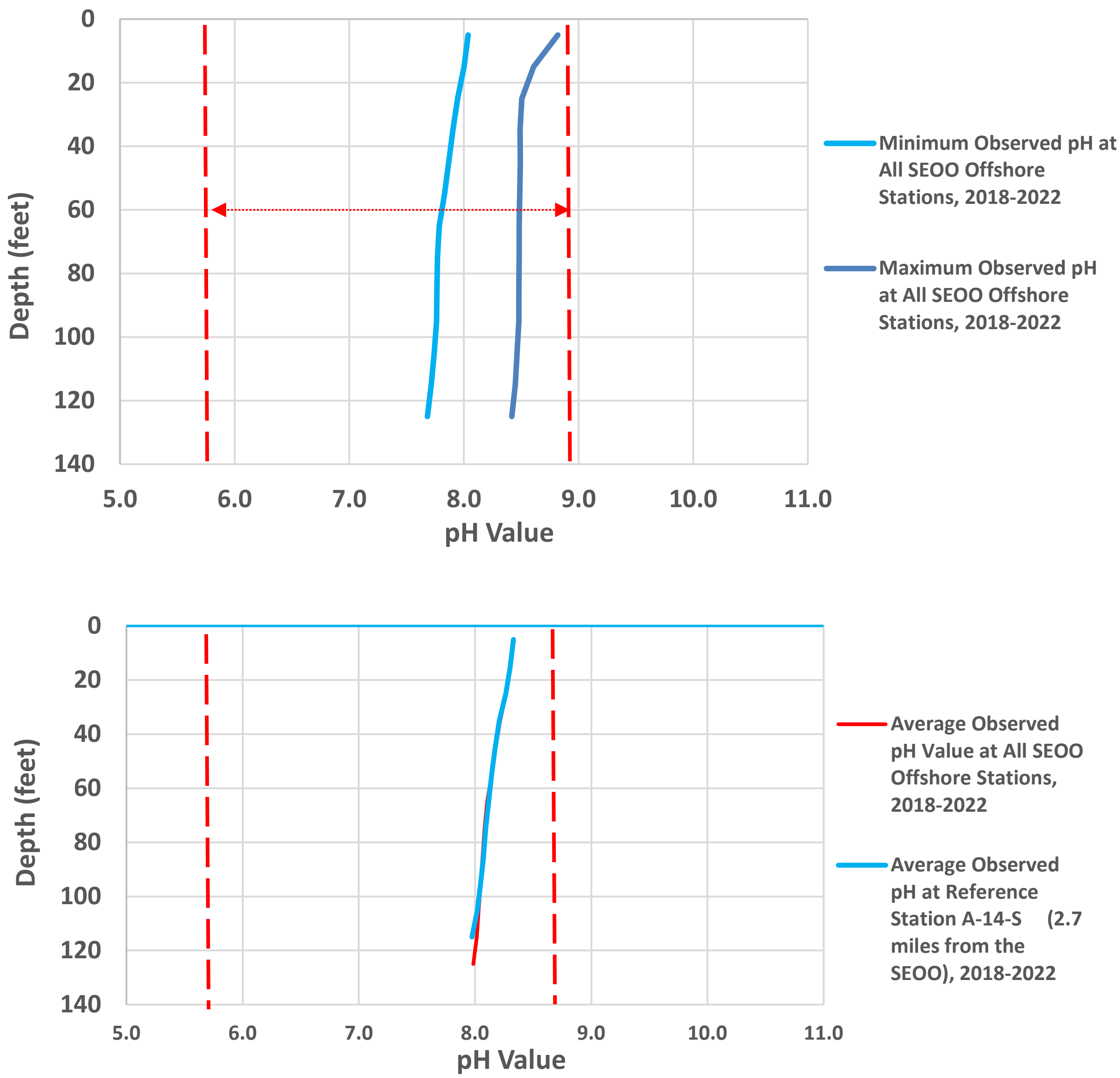


Figure 3-4 pH vs. Depth at SEOO Stations, 2018-2022

As documented in Table 2-4 (page 2-3), average annual turbidity values in the SEOO discharge are less than 3.0 NTU. Since a turbidity of 15 NTU in receiving water is typically associated with "ultraclear" water, it would be expected that the SEOO discharge has no discernible adverse impact on water clarity. Demonstrating this, Figure 3-5 (page 3-11) compares light transmittance between SEOO offshore stations and Reference Station A-14-S (located 2.7 miles south of the SEOO).

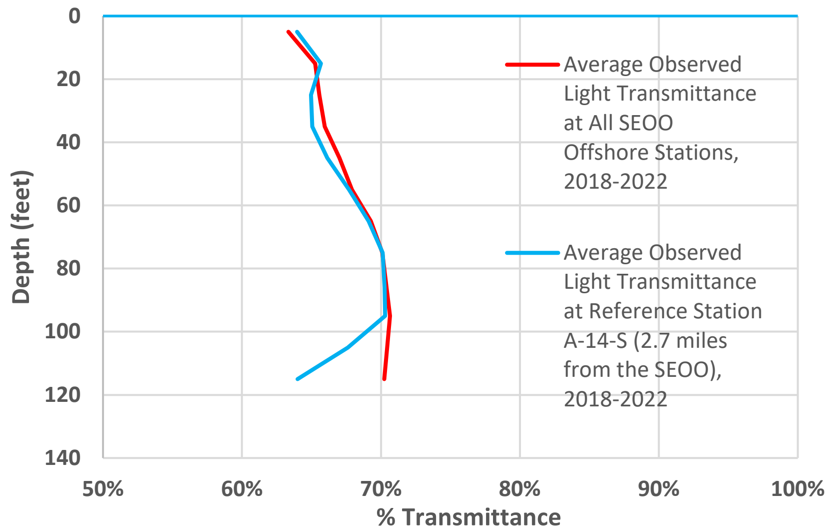


Figure 3-5 Light Transmittance vs. Depth at SEOO Stations, 2018-2022

Receiving Water Quality Conclusions. Based effluent and receiving water quality data collected during the effective periods of Order Nos. R9-2018-0002 and R9-2018-0003, it can be concluded that the SEOO discharge complies with all receiving water requirements established in the Ocean Plan and all receiving water requirements established in the SEOO NPDEs permits:

- The SEOO discharge complies with Ocean Plan bacteriological standards for the protection of body-contact recreation (REC-1) throughout all state-regulated waters at all depths beyond the SEOO ZID.
- The SEOO discharge is well oxygenated and contains extremely low concentrations of oxygen demanding materials.[10] As a result, the SEOO discharge has no discernible adverse effect on dissolved oxygen in receiving waters and the SEOO discharge complies with Ocean Plan and NDPES requirements for dissolved oxygen in both the epilimnion and hypolimnion.[11]
- The SEOO discharge has no discernible effect on receiving water pH and the discharge complies with all Ocean Plan and NDPES receiving water standards for ph.[12]
- The SEOO discharge is clear (typically with turbidity values of less than 3.0 NTU), has no discernible adverse effect on receiving water light transmittance, and complies with all Ocean Plan and NPDES receiving water standards for light transmittance.[13]

[10] CBOD concentrations in the SEWC and HARRF effluent are typically below 6 mg/L. Dissolved oxygen concentrations in the combined SEWC/HARRF discharge average slightly below 7.0 mg/L.

[11] The Ocean Plan requires that dissolved oxygen concentrations shall not be depressed more than 10 percent from that which occurs naturally as the result of the discharge of oxygen demanding wastes.

[12] The Ocean Plan requires that pH shall not be changed at any time more than 0.2 pH units from that which occurs naturally.

[13] The Ocean Plan requires that natural light shall not significantly be reduced at any point outside the initial dilution zone as a result of the discharge of wastewater.

Section 4
Sediment Chemistry and Toxicity

SEOO Sediment Monitoring Requirements. Order Nos. R9-2018-0002 and R9-2018-0003 require sediment monitoring at SEOO offshore stations to assess compliance with Ocean Plan narrative standards and characterize the quality and health of bottom conditions. Sediment samples are collected and analyzed in accordance with Monitoring Requirement IV.C.1 of Order Nos. R9-2018-0002 and R9-2018-0003. Sediment samples are analyzed for grain size, physical parameters, toxic inorganic compounds, toxic organic compounds, and sediment toxicity.

In accordance with requirements established in Order Nos. R9-2018-0002 and R9-2018-0003, the RWQCB authorized SEJPA (operator of the SEOO) to contract with SCCWRP and allocate some of the required monitoring at SEOO stations to the SCCWRP regional monitoring program. Such “in lieu” monitoring provides significant benefit, as historic sediment monitoring at SEOO stations had shown no discernible effects from the SEOO discharge, and allocating some of the SEOO monitoring resources toward the SCCWRP regional monitoring program allows SCCWRP to focus monitoring resources on other areas within the SCB where water quality concerns may exist.

To this end, sediment samples at SEOO stations were collected by SCCWRP at stations near the SEOO (A-1-N, A-0.5-S, A-1-S) and resources were allocated for SCCWRP “in lieu” collection of regional monitoring data at other locations throughout the SCB. SCCWRP sediment monitoring at the SEOO stations focused on grain size, physical characteristics and sediment toxicity. SCCWRP sediment monitoring at regional stations (which included two sites in the general vicinity of the SEOO included comprehensive assessments for toxic inorganic compounds, toxic organic compounds, and sediment toxicity. Sediment sample collection and analysis methodology for the monitoring effort are detailed in:

- *Sediment Quality Assessment Field Operations Manual, Southern California Bight Regional Monitoring Survey* (SCCWRP, 2018a).
- *Quality Assurance Manual, Southern California Bight Regional Monitoring Survey* (SCCWRP, 2018b).
- *Bight ’18 Toxicology Laboratory Manual* (SCCWRP, 2018d).

Figure 4-1 (page 4-2) presents the location of SCCWRP regional sampling stations. Two of the Bight ’18 regional sediment monitoring stations for mid-shelf depths (100 to 400 feet deep) are within five miles of the SEOO, including:

- Station B18-10233, located approximately 4.2 miles north of the SEOO at a depth of 100 feet.
- Station B18-10270, located approximately 3.0 miles south of the SEOO at a depth of 165 feet.

General Physical Sediment Characteristics Near the SEOO. As documented in numerous studies (including plume tracking work discussed in Section 7), net ocean currents in the vicinity of the SEOO are upcoast and downcoast (parallel to the shore). Additionally, as presented within Section 2 of this RWMR, the SEOO discharge contains negligible concentrations of suspended solids, almost non-existent amounts of settleable solids, and low turbidity (high water clarity). Given these characteristics, it would be expected that SEOO sediments show no discernible evidence of effects associated with the SEOO discharge.

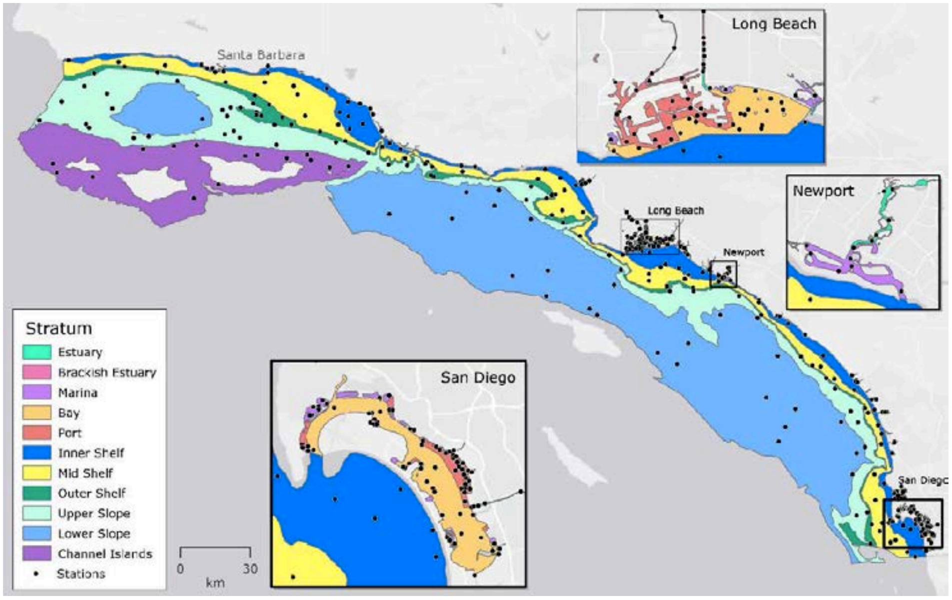


Figure 4-1 Location of Bight '18 Regional Monitoring Program Stations[14]

Table 4-1 presents general sediment characteristics at SEOO offshore stations immediately upcoast and downcoast from the SEOO diffuser. As shown in Table 4-1, sediments at the SEOO offshore stations are comprised of coarse to very coarse sands. No detectable concentrations of fine particulates (e.g., particles smaller than 63 µm) are in evidence at the SEOO stations. The absence of such fine particulates in the SEOO sediments (combined with the lack of settleable material in the SEOO discharge) offers strong evidence that the SEOO discharge is not depositing any settleable material to the ocean environment.

As part of the Bight '18 Regional Monitoring Program, SCCWRP performed comprehensive sediment quality assessments at two mid-shelf[15] monitoring stations near the SEOO. Table 4-2 (page 4-3) summarizes general sediment characteristics at these two regional stations.

Table 4-1
Sediment Grain Size at SEOO Monitoring Stations [A]

SEOO Offshore Station	Percent Fines [B] (Average Value)	Grain Size Classification
A-1-N	< 0.1 %	Coarse Sand to Very Coarse Sand [C]
A-0.5-S	< 0.1 %	Coarse Sand to Very Coarse Sand [C]
A-1-S	< 0.1 %	Coarse Sand to Very Coarse Sand [C]

Table 4-1 Notes:

- A Sediment toxicity provided to SEJPA by SCCWRP as part of the SCCWRP Bight ' 18 SCB regional monitoring program.
- B Defined as the percent of material in a sample by weight that has a particle size of less than 63 microns (µm) or percent of particles smaller than smaller than a Phi scale value of 4.
- C Sediment grain size analysis showed that more than 99 percent of particles had a grain size of greater than 0.5 millimeters (Phi scale of less than 1.0), which classifies as coarse stand to very coarse sand.

14 Figure 4-1 is from *Sediment Chemistry, Southern California Bight 2018 Regional Monitoring Program* (SCCWRP, 2018b).

15 SCCWRP defines mid-shelf stations as having depths of 100 to 400 feet. Station B18-10233 is the nearest Bight '18 mid-shelf station upcoast from the SEOO, and Station B18-10270 is the nearest Bight '18 mid-shelf station downcoast from the SEOO.

Table 4-2
Summary of Sediment Chemistry Monitoring, SCCWRP Bight ’18 Stations Near the SEOO
Percent Fines, Nitrogen and Carbon

Constituent	Sediment Concentration (percent dry weight)			
	SCCWRP Mid-Shelf Station B18-10233 [A]	SCCWRP Mid-Shelf Station B18-10270 [B]	Mean Value in Southern California Bight [C]	Mean Value at Mid-Shelf Stations [D] (100-400 feet deep)
Percent Fines [E]	11.2 %	60.9 %	62 %	35 %
Total Nitrogen	0.058 %	0.044 %	0.22 %	0.06 %
Total Organic Carbon	0.738 %	0.56 %	2.2 %	0.74 %

Table 4-2 Notes:

A SCCWRP Station B18-10233 is located at latitude 30.03599N, 117.312W, approximately 4.2 miles north of the SEOO and 1.1 miles offshore from H Street in Encinitas (immediately north of Swami’s Beach). Station depth is approximately 100 feet. Sample was collected on July 10, 2018. Data from SCCWRP Bight ’18 website portal, located at: https://bight-sccwrp.opendata.arcgis.com/datasets.

B SCCWRP Station B18-10270 is located at latitude 29.96762N, 117.300W, approximately 3.0 miles south of the SEOO (immediately south of the mouth of San Dieguito Lagoon) and 1.6 miles offshore from 21st Street in Del Mar. Station depth is approximately 165 feet. Sample was collected on July 10, 2018. Data from SCCWRP Bight ’18 website portal, located at: https://bight-sccwrp.opendata.arcgis.com/datasets.

C Bight-wide mean sediment concentration at all SCB stations. From Table IV-1 of *Bight ’18, Sediment Chemistry* (SCCWRP, 2020).

D Mean sediment concentration values at SCB mid-shelf stations (100-400 feet deep). From Table IV-2 of *Bight ’18, Sediment Chemistry* (SCCWRP, 2020).

E Defined as the percent of material in a sample by weight that has a particle size of less than 63 microns (µm) or percent of particles smaller than a Phi scale value of 4.

As would be expected, the station offshore from the mouth of San Dieguito Lagoon (Station B18-10270) contained significant number of fine particulates. Both stations, however, showed low concentrations of total nitrogen and total organic carbon, demonstrating that the stations are not subject to any significant source of enrichment from natural or man-induced sources (including atmospheric or shore-based sources).

Sediment Quality - Toxic Compounds. As part of the RWQCB-authorized “in lieu” allocation of SEOO monitoring resources, SCCWRP conducted comprehensive sediment quality evaluations at numerous stations throughout the SCB. Table 4-3 (page 4-4) presents sediment concentrations of toxic inorganic compounds at the two mid-shelf[16] stations nearest the SEOO.

As documented in Section 2, the SEOO discharge contains predominantly non-detectable concentrations of toxic inorganic compounds. Further, the SEOO discharge has consistently achieved 100 percent compliance with whole effluent toxicity standards. As a result, it can be concluded that the SEOO discharge would have no discernible effect on concentrations of toxic inorganic compounds in receiving waters or sediments.

16 Bight ’18 studies identify ocean stations with depths ranging from 100 to 400 feet as “mid-range” stations.

Table 4-3
Summary of Sediment Chemistry Monitoring, SCCWRP Bight ’18 Station Near the SEOO
Toxic Inorganic Constituents

Constituent	Sediment Concentration (micrograms per gram, µg/g)				
	SCCWRP Mid-Shelf Station B18-10233 [A]	SCCWRP Mid-Shelf Station B18-10270 [B]	Mean Value in Southern California Bight [C]	Mean Value at Mid-Shelf Stations [D] (100-400 feet deep)	SWRCB Reference Concentrations for Minimal Exposure (SWRCB 2008) [E]
Aluminum	6,610	11,500	15,000	9,600	--
Antimony	0.899	1.52	0.96	1.2	--
Arsenic	1.79	3.3	5.3	4.4	--
Barium	38.5	61.4	240	170	--
Beryllium	0.103	0.21	0.46	0.38	--
Cadmium	ND [F]	0.064 DNQ [G]	0.87	0.56	--
Chromium	12.1	18.6	45	28	--
Copper	1.11	2.68 DNQ [G]	19	6.8	52.8
Lead	1.32	2.61	9.4	6.4	26.4
Mercury	ND [F]	0.006 DNQ [G]	0.07	0.05	0.09
Nickel	3.53	5.59	26	12	--
Selenium	0.483	0.539	2.3	0.75	--
Silver	ND [F]	ND [F]	0.23	0.08	--
Zinc	20.7	32.9	72	45	223

Table 4-3 Notes:

A SCCWRP Station B18-10233 is located at latitude 30.03599N, 117.312W, approximately 4.2 miles north of the SEOO and 1.1 miles offshore from H Street in Encinitas (immediately north of Swami’s Beach). Station depth is approximately 100 feet. Sample was collected on July 10, 2018. Data from SCCWRP Bight ’18 website portal, located at: https://bight-sccwrp.opendata.arcgis.com/datasets.

B SCCWRP Station B18-10270 is located at latitude 29.96762N, 117.300W, approximately 3.0 miles south of the SEOO (immediately south of the San Dieguito Lagoon) and 1.6 miles offshore from 21st Street in Del Mar (immediately south of the mouth of San Dieguito Lagoon). Station depth is approximately 165 feet. Sample was collected on July 10, 2018. Data from SCCWRP Bight ’18 website portal, located at: https://bight-sccwrp.opendata.arcgis.com/datasets.

C Bight-wide mean sediment concentration at all SCB stations. From Table IV-1 of *Bight ’18, Sediment Chemistry* (SCCWRP, 2020).

D Mean sediment concentration at SCB mid-shelf stations (100-400 feet deep). From Table IV-2 of *Bight ’18, Sediment Chemistry* (SCCWRP, 2020).

E Listed reference concentrations (e.g., concentration below “low risk”) presented within Table 6 of the *Water Quality Control Plan for Enclosed Bays and Estuaries, Part 1 Sediment Quality* (SWRCB, 2008).

F Not detected.

G Detected not quantifiable. Concentration was above the Method Detection Limit but below the Reporting Limit.

Consistent with this conclusion, concentrations of toxic inorganic compounds at SCCWRP Bight ’18 stations located upcurrent and downcurrent from the SEOO were lower (see Table 4-3) than typical values within other areas within the SCB. Further, the toxic inorganic concentrations at Stations B18-10233 and B18-10270 were significantly lower than reference concentrations identified by the SWRCB (2008) as being less than the “low” category of disturbance.[17]

[17] The *Water Quality Control Plan for Enclosed Bays and Estuaries, Part 1 Sediment Qualit*y (SWRCB, 2008) establishes criteria for interpreting sediment chemistry results. Table 6 of the Sediment Quality Plan lists concentrations for ranges of disturbances along with “reference” concentrations that represent conditions below a “low” category of disturbance.

Table 4-4 presents sediment concentrations of toxic organic compounds at the two mid-shelf stations nearest the SEOO. As shown in Table 4-4, no detectable concentrations of chlordane, DDT, polynuclear aromatic compounds (PAHs) or polychlorinated biphenyls (PCBs) were identified in sediments at Station B18-10233 (north of the SEOO). DDT and PAHs were detected at Station B18-10270 (offshore from the mouth of San Dieguito Lagoon), but at concentrations near detection limits.

Table 4-4
Summary of Sediment Chemistry Monitoring, SCCWRP Bight '18 Station Near the SEOO
Toxic Organic Constituents

Constituent	Sediment Concentration (nanograms per gram)				
	SCCWRP Mid-Shelf Station B18-10233 [A]	SCCWRP Mid-Shelf Station B18-10270 [B]	Median Value in Southern California Bight [C]	Median Value at Mid-Shelf Stations [D] (100-400 feet deep)	SWRCB Reference Concentrations for Minimal Exposure (SWRCB 2008) [E]
Total Chlordanes [F]	ND [G]	ND [G]	0.08	ND [G]	540 [H]
Total DDT [I]	0.151 DNQ [J]	0.553 DNQ [J]	70	13	500 [K]
Total PAHs [L]	ND [G]	11.8	100	67	85,400
Total PCBs [M]	ND [G]	ND [G]	13	4.3	11,900

Table 4-4 Notes:

A SCCWRP Station B18-10233 is located at latitude 30.03599N, 117.312W, approximately 4.2 miles north of the SEOO and 1.1 miles offshore from H Street in Encinitas. Station depth is approximately 100 feet. Sample was collected on July 10, 2018. Data from SCCWRP Bight '18 website portal, located at: https://bight-sccwrp.opendata.arcgis.com/datasets.

B SCCWRP Station B18-10270 is located at latitude 29.96762N, 117.300W, approximately 3.0 miles south of the SEOO (immediately south of the San Dieguito Lagoon) and 1.6 miles offshore from 21st Street in Del Mar. Station depth is approximately 165 feet. Sample was collected on July 10, 2018. Data from SCCWRP Bight '18 website portal, located at: https://bight-sccwrp.opendata.arcgis.com/datasets.

C Bight-wide mean sediment concentration at all SCB stations. From Table IV-1 of Bight '18, Sediment Chemistry (SCCWRP, 2020).

D Mean sediment concentration at SCB mid-shelf stations (100-400 feet deep). From Table IV-2 of Bight '18, Sediment Chemistry (SCCWRP, 2020).

E Listed reference concentrations (e.g., concentration below "low risk") presented within Table 6 of the *Water Quality Control Plan for Enclosed Bays and Estuaries, Part 1 Sediment Quality* (SWRCB, 2008).

F Sum of alpha chlordane, gamma chlordane, cis-nonachlor, trans nonachlor and oxychlordane.

G Not detected.

H Includes < 500 nanograms per kilogram (ng/kg) value for alpha chlordane and < 540 ng/kg value for gamma chlordane.

I Sum of dichlorodiphenyltrichloroethane DDT/DDD/DDE isomers: 4,4'-DDT, 2.4'-DDT, 4,4'-DDD, 2.4'-DDD, 4,4'-DDE and 2,4'-DDE.

J Detected not quantifiable. Concentration was above the Method Detection Limit but below the Reporting Limit.

K Includes < 500 ng/kg value for total DDDs, < 500 ng/kg for total DDEs and < 500 ng/kg for total DDTs.

L Sum of 43 polynuclear aromatic hydrocarbons (PAHs), in part including acenaphthylene, anthracene, benzo(a)pyrene, benzo(b) fluoranthene, benzo(e)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, biphenyl, chrysene, dibenzo(a,h) anthracene, fluoranthene, fluorene, ideno(1,2,3-c,d)pyrene, naphthalene, perylene, phenanthrene and pyrene.

M Sum of 43 polychlorinated biphenyl isomers.

Sediment Toxicity. Table 4-5 (page 4-6) presents the results of sediment toxicity tests performed at stations near the SEOO during the current NPDES permit term. As shown in Table 4-5, sediments at the SEOO stations are characterized as non-toxic. Table 4-6 (page 4-6) presents the results of sediment toxicity tests performed at nearby regional Bight '18 stations located 4.2 miles upcoast from the SEOO (1.1 miles offshore from Leucadia) and 3.0 miles downcoast from the SEOO (1.6 miles off the coast of the San Dieguito Estuary).

Table 4-5
Sediment Toxicity at SEOO Monitoring Stations [A]

SEOO Offshore Station	Number of Samples	No. Samples with 100% Survival	Percent Survival over 10-Day Test [B]	
			Median Value	Minimum Observed Value
A-1-N	5	5	100 %	100 %
A-0.5-S	5	5	100 %	100 %
A-1-S	5	4	100 %	95 %
Toxicity categorization [C]			90-100 % = Non-Toxic 82-89 % = Low Toxicity 59-81 % = Moderate Toxicity	

Table 4-5 Notes:

A Data provided to SEJPA by SCCWRP as part of the SEJPA/SCCWRP "in lieu" sampling agreement. Under this agreement, SCCWRP monitors selected SEOO monitoring stations and allocates remaining resources to assess regional SCB monitoring stations selected by SCCWRP as part of the SCCWRP Bight '18 Regional Monitoring Program.

B Ten-day survival chronic toxicity tests performed using the amphipod *Eohaustorius estuaries.*

C Sediment Toxicity Categorization Ranges (statistically significant), as presented within *Sediment Quality Provisions, Water Quality Control Plan for Enclosed Bays and Estuaries*, SWRCB, 2018)

Table 4-6
Sediment Toxicity Monitoring, SCCWRP Bight '18 Station Near the SEOO [A]

SEOO Mid-Range Offshore Station	Number of Samples	No. Samples with 100% Survival	Percent Survival over 10-Day Test [B]	
			Median Value	Minimum Observed Value
B18-10233 [C] (1.1 mi. offshore from Swami's Beach)	5	2	95 %	95 %
B18-10270 [D] (1.6 mi. offshore from San Dieguito Lagoon)	3	2	100 %	85 %
Toxicity categorization [E]			90-100 % = Non-Toxic 82-89 % = Low Toxicity 59-81 % = Moderate Toxicity	

Table 4-6 Notes:

A Sediment toxicity provided to SEJPA by SCCWRP as part of the SCCWRP Bight ' 18 SCB regional monitoring program.

B Ten-day survival chronic toxicity tests performed using the amphipod *Eohaustorius estuaries.*

C SCCWRP Station B18-10233 is located at latitude 30.03599N, 117.312W, approximately 4.2 miles north of the SEOO and 1.1 miles offshore from H Street in Encinitas. Station depth is approximately 100 feet.

D SCCWRP Station B18-10270 is located at latitude 29.96762N, 117.300W, approximately 3.0 miles south of the SEOO (immediately south of the San Dieguito Lagoon) and 1.6 miles offshore from 21st Street in Del Mar. Station depth is approximately 165 feet.

E Sediment Toxicity Categorization Ranges (statistically significant), as presented within *Sediment Quality Provisions, Water Quality Control Plan for Enclosed Bays and Estuaries*, SWRCB, 2018)

Conclusions. Effluent, sediment analyses for toxic compounds, and sediment analyses from SEOO offshore stations and nearby Bight '18 stations demonstrate no discernible effect of the SEOO discharge on receiving water sediments or sediment quality. No accumulation of settleable material is present near the outfall. Concentrations of toxic organic and inorganic compounds in sediments near the SEOO are lower than are typical within the SCB and are within ranges associated with negligible or minimal risk. Further, sediment toxicity tests at SEOO offshore stations and nearby Bight '18 stations show no significant effect on the survival or growth of test species.

Section 5
Benthic Community/Fish/Bioaccumulation

Overview of SEOO Benthic Community, Fish and Bioaccumulation Monitoring. Order Nos. R9-2018-0002 and R9-2018-0003 establish monitoring requirements to assess the health of aquatic habitat, including:

- Benthic community sediment monitoring to identify species and enumerate abundance of benthic organisms.
- Diver surveys to identify demersal fish and macroinvertebrate species and enumerate abundance.
- Rig fishing to catch fish for assessment of muscle tissue for pollutant uptake and bioaccumulation effects.

As noted in Section 4, the RWQCB authorized SEJPA (operator of the SEOO) to contract with SCCWRP and allocate some of the required monitoring at SEOO stations to the SCCWRP regional monitoring program. In accordance with this authorized approach, benthic samples were collected by SCCWRP at SEOO stations near the SEOO (A-1-N, A-0.5-S, A-1-S) and resources were allocated for SCCWRP "in lieu" collection of regional benthic monitoring data at other locations throughout the SCB. Benthic sample collection and analysis methodology for such infaunal monitoring are detailed in:

- *Sediment Quality Assessment Field Operations Manual, Southern California Bight Regional Monitoring Survey* (SCCWRP, 2018a).
- *Quality Assurance Manual, Southern California Bight Regional Monitoring Survey* (SCCWRP, 2018b).
- *Macrobenthic (Infaunal) Sample Analysis Laboratory Manual, Southern California Bight Regional Monitoring Survey* (SCCWRP 2018c).

Benthic Community Sampling. In accordance with this methodology, sediments at SEOO stations and Bight '18 benthic stations in the vicinity of the SEOO were collected using a 0.1 square meter Van Veen grab sampler. Collected samples were sieved using 1 millimeter mesh screen and collected organisms were chemically preserved. Preserved organisms were than evaluated by marine biologists who identified collected organisms to the lowest possible taxon. Results were then reported in terms of number of species, abundance (population) of each species, and benthic health diversity indices.

As noted in Section 4, SEOO stations are characterized by coarse to very coarse sand, indicating no discernible effects associated with organic enrichment or settling of fine particles. Table 5-1 (page 5-2) presents the results of benthic samples reported by SCCWRP for SEOO Station Nos. A-1-S, A-0.5-S, and A-1-N. As shown in Table 5-1, a significant number of species occur at each of the SEOO stations, and organism populations were spread out over numerous species. Identified organisms are common to sandy bottom and pollution-free environments. Shannon-Weiner Index (H') values at each of the stations were in excess of 3.5, indicating a high diversity of organisms. Pielou Evenness Index (J') values at each station were near 1.0, 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 20.

Table 5-1
Diversity of Benthic Species at SEOO Stations

Taxonomic Category (Phylum)	Description/Examples	Number of Species and Abundance in 0.1 m^2 Sediment Samples [A]					
		Station A-1-S		Station A-0.5-S		Station A-1-N	
		Number of Species [B]	Abundance [C]	Number of Species [B]	Abundance [C]	Number of Species [B]	Abundance [C]
Annelida	Polychaetes	39	162	37	93	47	239
Arthropoda	Crustaceans	12	44	6	16	9	53
Brachiopoda	Primitive shellfish	1	3	1	3	1	2
Cnidaria	Anemones	2	14	2	3	2	35
Echinodermata	Brittle stars Sea urchins	3	3	0	0	1	2
Hemichordata	Acorn worm	0	0	1	1	0	0
Mollusca	Bivalve shellfish	16	31	9	17	17	42
Nemertea	Ribbon worms	2	4	1	1	4	11
Phoronida	Tube filter feeders	0	0	0	0	0	0
Platyhelminthes	Flatworm	1	6	1	2	1	2
Sipuncula	Peanut worm	0	0	1	1	1	4
Totals		76	267	59	137	83	390
Maximum abundance of any single species		--	13	--	9	--	42
Shannon-Wiener Diversity Index (H’) [D] (Values > 3.5 indicate “very high” diversity)		3.8		3.6		3.6	
Pielou Evenness Index (J’) [E] (Values near 1.0 indicate a diverse and equally distributed community)		0.91		0.93		0.85	
Swartz 75% Dominance Index (SDI) [F]		26		23		23	

Table 5-1 Notes:

A Data provided to SEJPA by SCCWRP as part of the SEJPA/SCCWRP “in lieu” sampling agreement. Under this agreement, SCCWRP monitors selected SEOO monitoring stations and allocates remaining resources to assess regional SCB monitoring stations selected by SCCWRP as part of the SCCWRP Bight ‘18 Regional Monitoring Program.

B Number of different species within the phylum. Includes some species that are excluded from diversity computations based on the taxonomist’s recommendation that the taxa may not be identified down to the species level or the reported taxon is represented at the station by another group. See Section 3.1 of *Microbenthic Infaunal Sample Analysis Laboratory Manual* (SCCWRP, 2018c).

C Total population of individual organisms encountered in the sediment samples within the listed phylum.

D Shannon-Wiener Diversity Index (H’) is computed as: H’ = Σ P(i)*ln[P(i)], where P(i) is the abundance of each species “i” divided by the total abundance of all species. Value computed excluding species not on the SCCWRP taxa list (see Note B above). Computed H’ values are approximately 0.1 units higher than those shown above if the index is computed using all identified species (including species not on the SCCWRP taxa list).

E Pielou Evenness index (J’) is computed as: J’ = H’/ln(s), where s is the total number of species. Value computed excluding species not on the SCCWRP taxa list (see Note B above). Computed J’ values are approximately 0.01 units higher than those shown above if the index is computed using all identified species (including species not on the SCCWRP taxa list).

F Number of species that account for 75 percent of abundance of all species. Value computed excluding species not on the SCCWRP taxa list (see Note B above). Computed SDI values are approximately 5 units higher than those shown above if the index is computed using all identified species (including species not on the SCCWRP taxa list).

Three SCCWRP regional mid-shelf stations[18] are located in the general vicinity of the SEOO, including:

- Station B18-10233, located approximately 4.2 miles north of the SEOO, approximately 1.1 miles off the coast of Leucadia State Beach.
- Station B18-20876, located approximately 1.5 miles off the coast of San Elijo Lagoon near the SEOO diffuser.
- Station B18-10270, located approximately 3.0 miles south of the SEOO, approximately 1.6 miles off the coast of San Dieguito Lagoon.

Table 5-2 (page 5-4) presents the results of benthic community analyses for the SCCWRP Bight ’18 stations in the vicinity of the SEOO. As shown in Table 5-2, each of the stations feature a high number of species and diverse populations of benthic organisms. Station B18-10270 (located offshore from San Dieguito Lagoon) exhibits a slightly larger number of species, organisms, and diversity than Stations B18-10233 and B18-10876. This slight difference may be attributed to the finer bottom sediments at Station B18-10270. Overall, however, each of the stations indicate similar species present, similar populations of each species, and similar species diversity. Benthic community indices at the SEOO stations and nearby stations upcoast and downcoast are characteristic of healthy and diverse benthic habitats.

Regional trends in benthic conditions are best documented by the City of San Diego monitoring program, which is the most comprehensive program in the San Diego Region.[19] Through more than a half century of benthic monitoring, the San Diego monitoring data base shows that benthic community parameters routinely (and significantly) change on both a short-term and long-term basis with changing oceanographic conditions, including:

- Large-scale climatic processes such as El Niño and La Niña conditions and large-scale oscillations in Pacific Ocean currents.
- The California current system and local gyres that transport water into and out of the SCB.
- Seasonal changes in weather patterns.
- Seasonal upwelling.
- Seasonal thermal stratification patterns.[19]

Despite the usual short-term and long-term changes in regional climatic conditions, parameters evaluated as part of Bight ’18 were reasonably consistent with benthic parameters evaluated as part of the Bight ’13 study. Bight ’13 Station B13-9087, for example, is at the same location as the Bight ’18 Station B18-10876 (located 1.5 miles off the coast from San Elijo Lagoon near the SEOO diffuser). For comparison, major diversity and evenness indices at these stations (near the SEOO diffuser) are as follows:

Station B13-9087/B18-10876	Bight ’13	Bight ‘18
Shannon Wiener Diversity Index (H’)	3.2	3.3
Pielou Evenness Index (J’)	0.50	0.58
Swartz 75% Dominance Index	12	15

[18] SCCWRP defines mid-shelf stations as stations in nearshore waters 100 to 400 feet deep. See Figure 4-1 on page 4-2. For comparison, the SEOO diffuser discharges at a 6800-8000 distance offshore at depths ranging from 110 feet to 150 feet.

[19] The City of San Diego operates the most comprehensive ocean monitoring program in the San Diego Region. This program monitors benthic conditions at 49 local and 80 regional sampling stations that encompass several dozen miles of San Diego County coastline. Through this comprehensive program, the City has developed more than a half-century of data on benthic trends. These data (along with regional oceanographic trends) are presented by the City in biannual reports, the most recent of which is *Biennial Receiving Waters Monitoring and Assessment Report for the Point Loma and South Bay Ocean Outfalls* (City of San Diego, 2022). The City of San Diego biannual reports document current and past regional climatic trends that affect benthic community conditions.

Table 5-2
Diversity of Benthic Species at Nearby Bight ’18 Regional Stations

Taxonomic Category (Phylum)	Description/Examples	Number of Species and Abundance in 0.1 m^2 Sediment Samples [A]					
		Station B18-10233 [B]		Station B18-10876 [C] (Near the SEOO Diffuser)		Station B18-10270 [D]	
		Number of Species [E]	Abundance [F]	Number of Species [E]	Abundance [F]	Number of Species [E]	Abundance [F]
Annelida	Polychaetes	34	211	38	213	52	220
Arthropoda	Crustaceans	7	23	4	18	8	11
Brachiopoda	Primitive shellfish	1	2	0	0	1	1
Cnidaria	Anemones	2	5	4	4	0	0
Echinodermata	Brittle stars, sea urchins	4	16	1	1	5	18
Hemichordata	Acorn worm	2	3	1	2	2	2
Mollusca	Bivalve shellfish	9	17	5	14	9	39
Nemertea	Ribbon worms	6	13	6	17	2	4
Phoronida	Tube filter feeders	2	9	1	1	0	0
Platyhelminthes	Flatworm	0	0	1	1	0	0
Sipuncula	Peanut worm	1	1	3	9	2	4
Totals		68	300	64	280	81	299
Maximum abundance of any single species		--	53	--	43	--	33
Shannon-Wiener Diversity Index (H’) [G] (Values > 3.5 indicate “very high” species diversity)		3.4		3.3		3.7	
Pielou Evenness Index (J’) [H] (Values near 1.0 indicate a diverse and equally distributed community)		0.59		0.58		0.65	
Swartz 75% Dominance Index (SDI) [I]		17		12		22	

Table 5-2 Notes:

A Data provided to SEJPA by SCCWRP as part of the SEJPA/SCCWRP “in lieu” sampling agreement for SCCWRP to utilize SEOO monitoring resources to assess select SEOO monitoring stations and regional SCB monitoring stations selected by SCCWRP as part of the SCCWRP Bight ‘18 Regional Monitoring Program.

B The listed three stations are the closest Bight ’18 benthic monitoring mid-shelf stations to the SEOO. Station B18-10233 is located at latitude 33.03999N, longitude 117.31188, approximately 4.2 miles north of the SEOO and 1.1 miles off the coast of Leucadia State Beach.

C Bight ’18 Station B18-10876 is located at latitude 32.96762N, longitude 117.29975, approximately 1.5 miles off the coast of San Elijo Lagoon mouth, near the SEOO discharge point.

D Bight ’18 Station B18-10270 is located at latitude 33.00712N, longitude 117.29793, approximately 3.0 miles south of the SEOO, 1.6 miles off the coast of Del Mar (near 21st Street).

E Number of different species within the phylum. Includes species that are excluded from diversity computations based on the taxonomist’s recommendation that the taxa may not be identified down to the species level or the reported taxon is represented at the station by another group. See Section 3.1 of *Microbenthic Infaunal Sample Analysis Laboratory Manual* (SCCWRP, 2018c).

F Total population of individual organisms encountered in the sediment samples within the listed phylum.

G Shannon-Wiener Diversity Index (H’) is computed as: $H' = \Sigma P(i)*\ln[P(i)]$, where P(i) is the abundance of each species “i” divided by the total abundance of all species. Value computed using identified species except those excluded by taxonomists (see Note E above) from diversity computations.

H Pielou Evenness index (J’) is computed as: $J' = H'/\ln(s)$, where s is the total number of species. Value computed using identified species except those excluded (see note E above) by taxonomists from diversity computations.

I Number of species that account for 75 percent of abundance of all species. Value computed using all identified species except those excluded by taxonomists (see note E above) from diversity computations.

Overall, benthic habitats and associated biological communities assessed at the SEOO and nearby Bight ’18 regional stations show that the ecological status of benthic habitats remains stable with no evidence of adverse impact associated with the SEOO discharge. Major benthic community metrics and indices show no evidence of habitat degradation, and benthic data collected at SEOO stations are at least as good (often better) than regional mid-shelf monitoring stations.

Macrobenthic Species and Abundance. Since the SEOO discharges within Swami’s State Marine Conservation Area, trawl surveys are not used for assessing fish and invertebrates. As part of the “in lieu” regional monitoring conducted by SCCWRP, macrobenthic species were evaluated via diver surveys at SEOO Station T-05-S. Additionally, trawls were conducted at Bight ’18 Station B18-10269, located approximately 4.0 miles north of the SEOO.

Table 5-3 (page 5-6) summarizes the results of diver surveys of megabenthics at SEOO Station T-0.5-S. As shown in Figure 1-1, this transect is located immediately south of the SEOO. The transect at Station T-0.5-S is characterized by coarse to very coarse sands, and features organisms suited to that type of habitat. Macrobenthic organisms noted in the survey of SEOO Station T-0.5-S included sea stars, spiny brittle stars, sea urchins, sea porcupines and a spiny scallop.

Table 5-4 (page 5-6) summarizes the results of trawl surveys conducted at Bight ’18 Station B18-10269, which is located approximately 1.6 miles off the coast of Leucadia. This station is deeper than Station T-0.5-S, and is characterized by sediments that include finer particle sizes. Macrobenthic species identified at this Bight ’19 station included painted urchins, crabs, spiny brittle stars, several species of crab and numerous octopi and prawns.

Fish Species and Abundance. Table 5-5 (page 5-7) summarizes fish species documented at SEOO Station T-0.5-S. A total of ten fish species were identified at the station, with California lizardfish, longfin sanddab and specked sanddab being the most populous fish.

In addition to assessing fish populations at SEOO Station T-0.5-S, regional monitoring conducted as part of Bight ’18 also assessed fish populations at Bight ’18 Station B18-10269, which is located approximately four miles north of the SEOO off the coast of Leucadia. Table 5-6 (page 5-7) summarizes fish species and abundance at Bight ’18 Station B18-10269. As shown in Table 5-6, more than 1700 fish were documented at Station B18-10269 from 17 different fish species.

Bioaccumulation Monitoring. As part of the “in lieu” monitoring agreement between SEJPA and SCCWRP, SCCWRP conducted bioaccumulation monitoring at 27 stations (identified as fishing zones) throughout the SCB. Contaminant bioaccumulation results and sample analyses were published by SCCWRP in:

> *Bight ’18, Southern California Bight Regional Monitoring Program, Volume V, Contaminant Bioaccumulation in Edible Fish Tissue, SCCWRP Technical Report 1155* (SCCWRP, 2020a).

Sample collection in each fishing zone occurred between April and November 2018 using seines, trawls, hook and line, trap and spear. Fish species were targeted on the basis of popularity for consumption, distribution, and potential exposure pathways. Fish tissue were assessed for toxic metals, PCBs, DDT and its isomers and degradation products, chlordanes, and PAHs.

The SEOO discharge is located in Fishing Zone 7, which stretches from La Jolla to San Onofre. Table 5-7 (page 5-8) the results of fish bioaccumulation monitoring conducted in Fishing Zone 7. Fish tissue results are compared with fish Advisory Tissue Levels (ATLs) to assess relative risk to fish consumers. ATLs are established for mercury, selenium, PCBs and DDT compounds.

Table 5-3
Macrobenthic Species and Abundance at SEOO Station T-0.5-S [A]

Species Name	Class	Common Name	Abundance (population)	Biomass (kilograms)	Number of Organisms with Anomalies [B]
Astropecten sp	Aseroidea	Sea star	2	< 0.1	0
Chlamys hastata	Bivalvia	Spiny scallop	1	< 0.1	0
Lovenia cordiformis	Echinoidea	Sea porcupine	2	< 0.1	0
Lytechinus sp	Echinoidea	Sea urchin	2	< 0.1	0
Ophiopteris papillosa	Ophiuroidea	Brittle star	1	< 0.1	0
Ophiothrix spiculata	Ophiuroidea	Spiny brittle star	12	< 0.1	0

Table 5-3 Notes:

A Data provided to SEJPA by SCCWRP as part of the SEJPA/SCCWRP "in lieu" sampling agreement. Under this agreement SCCWRP monitors selected SEOO monitoring stations and allocates remaining resources to assess regional SCB monitoring stations selected by SCCWRP as part of the SCCWRP Bight '18 Regional Monitoring Program.

B Number of fish with observable anomalies, including tumors, lesions, parasites, etc.

Table 5-4
Macrobenthic Species and Abundance at Bight '18 Station B18-10269 [A,B]

Species Name	Class	Common Name	Abundance (population)	Biomass (kilograms)	Number of Organisms with Anomalies [C]
Astropecten californicus	Asteroidea	Spiny sand star	1	< 0.1	0
Doryteuthis opalescens	Cephalopoda	Opalescent inshore squid	7	< 0.1	0
Lytechinus pictus	Echinoidea	Painted Urchin	23	< 0.1	0
Metacarcinus anthonyi	Malacostraca	Yellow rock crab	1	0.8	0
Octopus rubescens	Cephalopoda	East Pacific red optopus	31	0.1	0
Ophiothrix spiculata	Ophiuroidea	Spiny brittle star	4	< 0.1	0
Platymera gaudichaudii	Malacostraca	Armed box crab	2	0.3	0
Romaleon antennarium	Malacostraca	California rock crab	1	0.1	0
Sicyonia ingentis	Sicyonidae	Ridgeback prawn	81	0.5	0

Table 5-4 Notes:

A Bight '18 Station B18-10269 is the closest mid-shelf Bight '18 trawl station in the vicinity of the SEOO, and is located at latitude 33.078N, longitude 117.345, approximately 4 miles north of the SEOO 1.6 miles off the coast of Leucadia State Beach.

B From SCCWRP Bight '18 data portal website, located at: https://bight-sccwrp.opendata.arcgis.com/datasets

C Number of fish with observable anomalies, including tumors, lesions, parasites, etc.

Table 5-5
Fish Species and Abundance at SEOO Station T-0.5-S [A]

Species	Common Name	Abundance	Size range (cm)	Most Dominant Size (cm)	Biomass (kilograms)	Number of Anomalies Found
Citharichthys stigmaeus	Speckled sanddab	12	7 - 11	8	< 0.1	0
Citharichthys xanthostigma	Longfin sanddab	57	4 - 17	6	0.9	0
Paralichthys californicus	California halibut	3	21 - 35	NA [B]	1	0
Paralabrax nebulifer	Barred sand bass	1	24	NA [B]	0.3	0
Parophrys vetulus	English sole	1	18	NA [B]	< 0.1	0
Pleuronichthys verticalis	Hornyhead turbot	2	13 - 14	NA [B]	0.1	0
Scorpaena guttata	California scorpionfish	1	14	NA [B]	< 0.1	0
Symphurus atricaudus	California tonguefish	1	12	NA [B]	< 0.1	0
Synodus lucioceps	California lizardfish	134	9 - 11	10	0.7	0
Xystreurys liolepis	Fantail flounder	1	17	NA [B]	0.1	0

Table 5-5 Notes:

A Data provided to SEJPA by SCCWRP as part of the SEJPA/SCCWRP "in lieu" sampling agreement for SCCWRP to utilize SEOO monitoring resources to assess select SEOO monitoring stations and regional SCB monitoring stations selected by SCCWRP as part of the SCCWRP Bight '18 Regional Monitoring Program.

B Not applicable, only one fish occurred in each 1-centimeter size category.

Table 5-6
Fish Species and Abundance at Bight '18 Station B18-10269 [A,B]

Species	Common Name	Abundance	Size range (cm)	Most Dominant Size (cm)	Biomass (kg)	Number of Anomalies Found
Citharichthys sordidus	Pacific sanddab	463	4 - 10	5	3.7	0
Citharichthys xanthostigma	Longfin sanddab	19	5 - 17	13	0.7	0
Engraulis mordax	Northern anchovy	836	6 - 9	7	2	0
Icelinus quadriseriatus	Yellowfih scumpin	1	7	NA [C]	< 0.1	0
Lyconema barbatum	Bearded eelpout	1	16	NA [C]	< 0.1	0
Microstomus pacificus	Pacific Dover sole	163	6 - 18	8	2.1	6 [D]
Odontopyxis trispinosa	Pygmy poacher	1	8	NA [C]	< 0.1	0
Pleuronichthys verticalis	Hornyhead turbot	2	10 - 13	NA [C]	< 0.1	1 [D]
Porichthys notatus	Plainfin midshipman	1	8	NA [C]	< 0.1	0
Sebastes dallii	Calico rockrish	3	3 - 6	NA [C]	< 0.1	0
Sebastes saxicola	Stripetail rockfish	90	4 - 6	6	0.2	0
Sebastes semicinctus	Half-banded rockfish	19	4 - 6	5	< 0.1	0
Sebastes sp	Rockfish	2	4 - 6	NA [C]	< 0.1	0
Synodus lucioceps	California lizardfish	22	9 - 25	11	0.4	0
Zalembius rosaceus	Pink surfperch	8	7 - 11	9	0.1	0
Zaniolepis frenata	Shortspine combfish	1	14	NA [C]	< 0.1	0
Zaniolepis latipinnis	Longspine combfish	92	5 - 15	6	0.2	0

Table 5-6 Notes:

A Bight '18 Station B18-10269 is the closest mid-shelf Bight '18 trawl station in the vicinity of the SEOO, and is located approximately 4 miles north of the SEOO at latitude 33.078N, longitude 117.345W, approximately 1.6 miles off the coast of Leucadia State Beach.

B From SCCWRP Bight '18 data portal website, located at: https://bight-sccwrp.opendata.arcgis.com/datasets.

C Not applicable. Only one fish occurred in each 1-centimeter size category

D Number of fish with observable anomalies, including tumors, lesions, parasites, etc.

Two categories of ATLs were addressed in the SCCWRP bioaccumulation study:

- Children under the age of 17 and adult women of child bearing age (less than 49).
- Men of any age and adult women older than 49.

The ATLs 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. As shown in Table 5-7, contaminant levels in fish caught within Fishing Zone 7 are significantly lower than fish contaminant goals for consuming 8-ounces of sport fish weekly for life.

Mercury was the most sensitive bio-contaminant found in Fishing Zone 7. Concentrations of mercury in fish tissue were sufficiently low that vulnerable groups (children and women of child-bearing age) can eat 8-ounces of sport fish twice weekly for life with safety, while men and older women can consume 8-ounces of sport fish four times weekly for life.

Table 5-7
Summary of Fish Bioaccumulation Monitoring, Bight '18 Regional Monitoring

Species/Parameter	Bight '18 Regional Monitoring Fishing Zone 7 – La Jolla to San Onofre [A,B] Mean Fish Tissue Concentration (mg/kg)			
	Mercury	**Selenium**	**PCBs**	**DDT**
Barred Sand Bass	52.8	389	0.17	7.7
Kelp Bass	133	378	NA	1.0
Pacific Chub Mackerel	28.3	374	NA	4.6
Yellowfin Croaker	34.5	318	NA	12.8
Fish Contaminant Goal (safe to eat 8 ounces of sport fish every week for a lifetime) [C]	220	1000	3.6	21
Recommended maximum annual number of 8-ounce servings of sportfish over an entire lifetime	104/208 [D]	365+ [E]	365+ [E]	365+ [E]

Table 5-7 Notes:

A See SCCWRP (2020a) for a description of bioaccumulation monitoring and interpretation of results. Data are from the SCCWRP Bight '18 data portal website, located at: https://bight-sccwrp.opendata.arcgis.com/datasets.

B Data are from Fishing Zone 7, which stretches from La Jolla to San Onofre.

C Advisory Tissue Level (ATL) associated with eating 8 ounces of sport fish every week for a lifetime.

D Based on contaminant levels found within Fishing Zone 7, children and women less than 49 years of age are advised to eat no more than 104 8-ounce servings of sport fish each year. Men and women over the age of 49 are advised to eat no more than 208 8-ounce servings of sport fish per year.

E Based on contaminant levels found within Fishing Zone 7, men over the age of 18 and women over the age of 49 can eat 8 ounces of sport fish daily over their life without any adverse effects associated with selenium, PCBs and DDT.

Section 6
Plume Tracking Conclusions

Development of the SEOO Plume Tracking Monitoring Plan. Order Nos. R9-2018-002 and R9-2018-0003 established plume tracking monitoring requirements to assess the dispersion and fate of wastewater discharged from the SEOO. The Orders also established a process for developing and implementing the plume tracking program. As part of the requisite Plume Tracking Monitoring Plan effort, Order Nos. R9-2018-0002 and R9-2018-0003 required SEJPA and the City to prepare and submit:

- A PTMP Work Plan that sets forth tasks, responsibilities, and a schedule for preparing the PTMP, implementing PTMP monitoring, and reporting PTMP results to the RWQCB.
- A PTMP designed to implement a program for monitoring and evaluating the dispersion and fate of wastewater discharged from the SEOO.

PTMP Work Plan and Conceptual Site Model. Order Nos. R9-2018-0002 and R9-2018-0003 required that the PTMP Work Plan include a conceptual site model, which is a description of what is known (in the absence of planned plume tracking work) about the fate and transport of the SEOO discharge. SEJPA and the City of Escondido submitted the requisite PTMP Work Plan in November 2018. The conceptual site model presented within the Work Plan emphasized that fate and transport of the SEOO is well characterized by more than a half century of SEOO receiving water data and multiple oceanographic studies and modeling efforts in the North San Diego County area. The conceptual site model detailed:

- The thermal stratification cycle that results in entrapment of discharged wastewater below the thermocline throughout almost the entire year.
- Ocean current studies that documented the net upcoast/downcoast movement of ocean currents, the range of net ocean current speeds that occur in the vicinity of the SEOO, how the currents differ in velocity with depth, and the lack of sustained cross-current transport.
- Ocean current metering studies that documented strong correlation between longshore currents at metering points 1-2 miles apart, and little correlation between observed cross-shore currents at metering points a few hundred feet apart.
- Bacteriological data which demonstrated (through consistent low bacteriological concentrations in nearshore "N" stations) that the SEOO discharge is not transported toward shore or effect shore water quality.
- A lack of cumulative or combined effects of the SEOO discharge with other regional point or non-point sources, as documented by lack of bacteriological evidence of the presence of SEOO wastewater several hundred feet from the SEOO diffuser.

In addition to presenting the concept model, the PTMP Work Plan outlined proposed PTMP development and implementation tasks and presented a schedule for completing the tasks before December 2022, as required by Order Nos. R9-2018-0002 and R9-2018-0003.

Coordination with Encina Wastewater Authority (EWA). In accordance with the work tasks set forth in the SEOO PTMP Work Plan, SEJPA and the City of Escondido began addressing PTMP requirements and developing a proposed PTMP for RWQCB consideration. With encouragement of the RWQCB, however, SEJPA and the City subsequently coordinated with the Encina Wastewater Authority (who had prepared and submitted a similar PTMP Work Plan for the Encina Ocean Outfall) to prepare and implement a joint PTMP for the SEOO and Encina Ocean Outfall (EOO). The SEOO/EOO joint implementation offered the advantages of improved cost-effectiveness. Additionally, given the similarities between outfalls and receiving water conditions at the two sites, AUV deployments at one outfall site were likely to yield data and conclusions that are of value in assessing conditions at the other outfall.

PTMP Requirements. Order Nos. R9-2018-0002 and R9-2018-0003 required that the PTMP include the following elements:

- A feasibility analysis, including an assessment of advantages, disadvantages, cost, usefulness, and effectiveness for the installation and operation by the discharger of a permanent, real-time oceanographic mooring system (RTOMS) located near the terminal diffuser structure of the SEOO to measure (at minimum) direction and velocity of subsurface currents and ocean stratification.
- A feasibility analysis, including an assessment of advantages, disadvantages, cost, usefulness, and effectiveness for the development of a work plan or pilot study (special study) for utilizing advanced oceanographic sampling technologies such as an autonomous underwater vehicle (AUV) or remotely operated towed vehicle (ROTV) to collect of water quality data in real-time and provide high resolution maps of plume location and movement.
- Any alternative approach proposed by the Discharger to address questions posed in the PTMP Work Plan.
- A proposed plan for implementing the proposed PTMP tasks and completing required plume tracking. work.

Technology Feasibility Assessment. The joint SEOO/EOO PTMP assessed RTOMS technology, and concluded that RTOMs were impractical and uneconomical for application at the SEOO or EOO.[20] Prime reason for this impracticality are that RTOMS data (1) would not address most of the RWQCB-posed plume tracking questions and (2) would be applicable only to a specific location and could not be used to track plume movement. Finally, RTOMS data would provide little additional information on ocean current behavior and ocean profile/stratification conditions beyond what is already known.[21,22]

The use of advanced sampling techniques such as AUVs, however, were determined to be technically feasible, and data from AUV surveys could provide detailed information on ocean mechanics associated with the SEOO and EOO discharges. Additionally, data collected from AUV deployments could be used to address plume tracking questions posed within Order Nos. R9-2018-0002 and R9-2018-0003. Further, AUVs offer an advantage of being able to run pre-programmed track lines to efficiently cover a large

[20] RTOMS implementation at the SEOO was estimated to involve initial capital costs of $0.75 million to $1.25 million, and three-year implementation costs of 0.9 million to $1.5 million.

[21] As noted, prior ocean current monitoring studies in the area had established general statistical profiles for ocean currents in the EOO and SEOO locale, and had determined that little correlation existed in measured cross-shore currents between meters located only a few hundred feet apart. An RTOMS system thus would not provide any useful information on cross-shore currents, as the cross-shore current data from the system would only be applicable to that specific coordinate. When maintenance complications and costs (such as those experienced by the City of San Diego who have implemented moored stations) are included, the joint SEOO/EOO PTMP concluded that RTOMS technology is not practical or economical for outfall discharges like the SEOO or EOO.

[22] RTOMS were also determined to be of limited usefulness in addressing key questions set forth in the NPDES permits, including evaluating the fate of discharged wastewater, identifying which parameters are most useful in identifying the presence of discharged wastewater, identifying when the plume is no longer distinguishable from ambient receiving water, and assessing the variability of dilution under typical and atypical conditions.

survey area. When coupled with boat-based monitoring to assess thermal stratification and ocean current conditions, AUV tracks can be programmed to directly target areas most likely to contain diluted quantities of the SEOO discharge.

Use of Colored Dissolved Organic Matter (CDOM) for Tracking Discharged Wastewater. The proposed AUV program addressed in the SEOO/EOO PTMP was based on the work of Rogowski et al. (2012) who successfully used AUV-based sensors to track the Point Loma Ocean Outfall discharge[23] using colored dissolved organic matter (CDOM) and salinity. As part of the proposed PTMP approach, it was understood that CDOM contributions from outfall discharges vary with the type of treatment provided. CDOM signatures from facilities that achieve high TSS and CBOD removal (such as SEWC and HARRF), for example, have significantly weaker CDOM "signals" to differentiate discharged water from ambient ocean water. While these limitations were noted, the SEOO/EOO PTMP was based on the belief that SEWC and HARRF CDOM signatures would be sufficiently distinct from seawater for use in detecting discharged wastewater immediately during and perhaps after initial dilution.

It is recognized that CDOM, by itself, is not a reliable parameter for identifying the presence of discharged wastewater. CDOM exists naturally in seawater as a result natural decomposition of organic material, organic material derived from aquatic habitats, or shore-based discharge sources. As a result, CDOM concentrations in seawater can vary significantly from location to location, and an increase of CDOM at any particular location cannot automatically be attributed to wastewater. When combined with CTD and ocean current data, however, areas can be identified where diluted effluent is likely to occur. CDOM data, however, can be used to infer the possible presence of diluted wastewater when elevated CDOM concentrations are detected in areas downcurrent from the SEOO and at depths below the thermal trapping level.

Targeted AUV Deployments. In consultation with scientists at the Scripps Institution of Oceanography and with guidance from RWQCB staff, SEJPA, the City of Escondido and EWA developed a proposed PTMP program that involved three separate days of AUV deployment. Proposed AUV deployments were targeted to assess:

- Typical conditions under periods of maximum stratification.
- Typical conditions under periods of minimum stratification.
- Atypical (post-storm) conditions that may feature higher-than-normal or unusual ocean currents, higher-than-normal winds, and/or higher-than-normal tides.

Under the proposed approach, AUV deployments would be supported by the collection of:

- Ocean currents vs. depth data using boat-based Acoustic Doppler Current Profilers (ADCPs).
- Real-time Conductivity/Temperature/Depth data using boat-based CTD sensors.
- Physical ocean monitoring conducted by SEJPA at or near the AUV deployment dates.

PTMP Implementation and Methodology. The joint SEOO/EOO PTMP was submitted to the RWQCB in June 2020. To implement the proposed PTMP work scope, SEJPA, Escondido and EWA issued a request for proposals, and selected Michael Baker International (MBI) to implement the PTMP work tasks, in part on the basis of MBI's proposed approach for coupling computer models with collected data. The MBI plume tracking methodology, field studies, and results are presented in Appendix A (MBI joint plume tracking report for both the SEOO and EOO) and summarized below.

[23] The Point Loma Ocean Outfall discharge is comprised of wastewater that is treated using chemically enhanced primary treatment and typically contains TSS concentrations of approximately 35 mg/L, CBOD concentrations of approximately 130 mg/L and average turbidity levels of approximately 40 NTU.

Use of fDOM as a Tracer. As detailed in Appendix A, MBI proposed the use of fDOM (fluorescent dissolved organic matter) as a surrogate for CDOM. fDOM is the portion of CDOM that fluoresces and on average comprises 85 to 91 percent of CDOM in ocean waters. As a result, fDOM concentrations are representative of CDOM concentrations.

In advance of AUV deployments, fDOM in the combined SEWC and HARRF effluent was monitored and fDOM concentrations in the combined SEWC/HARRF discharge were determined to range from 200 to 300 parts per billion (ppb). At a presumed initial dilution of 237:1 fDOM concentrations in the SEOO discharge upon completion of initial dilution were estimated to be on the order of 1 ppb. This would make it difficult to detect the SEOO discharge during times when natural ambient fDOM concentrations are near this 1 ppb concentration. During times when natural fDOM concentrations are significantly lower than 1 ppb and outfall dilutions are closer to the 237:1 NPDES value, it should be possible to use fDOM to detect (or infer detection of) the clear, low-TSS and low-BOD SEOO discharge outside the ZID.

Field Studies and Equipment. MBI utilized the Iver3 AUV (see Figure 6-1) for all AUV surveys of the SEOO. The Iver3 AUV was deployed for one full day during each of the three deployments to assess the variability of oceanographic conditions. Total survey track length was held constant at the longest possible track length that could be safely achieved within the battery life of the AUV. Survey depth was variable, and programmed AUV tracks were selected on the basis of collection of pre-deployment CTD data which assessed the thermocline depth. Each track-line in the AUV survey was flown out and back (see Figure 6-2) along a series of parallel tracks. The AUV programmed track also featured an oscillating dive profile between the seabed and immediately above the thermocline, as shown in Figure 6-3 (page 6-5). On the return leg of the track-line, the AUV proceeded at constant depth a couple of meters below the thermocline (trapping level).

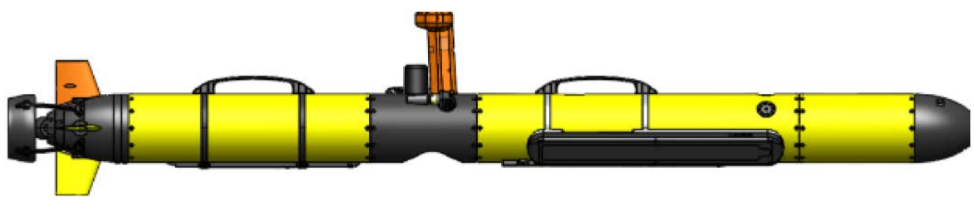


Figure 6-1 Iver3 Autonomous Underwater Vehicle

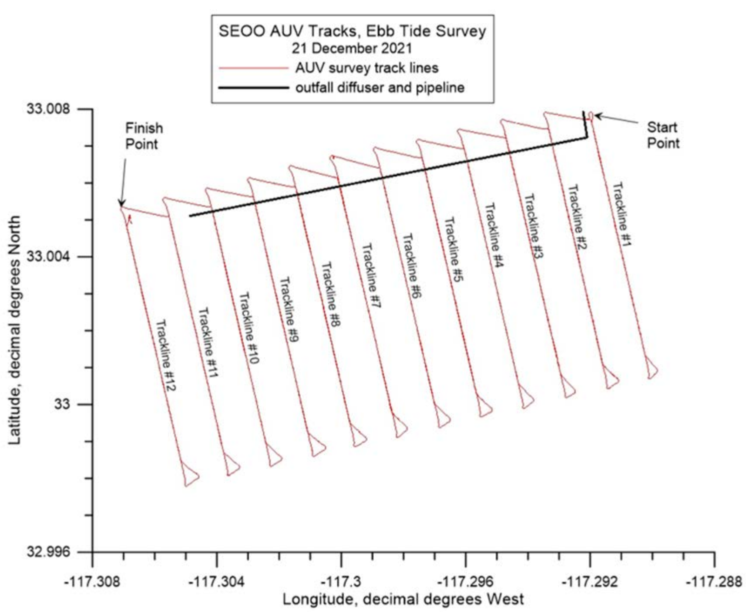
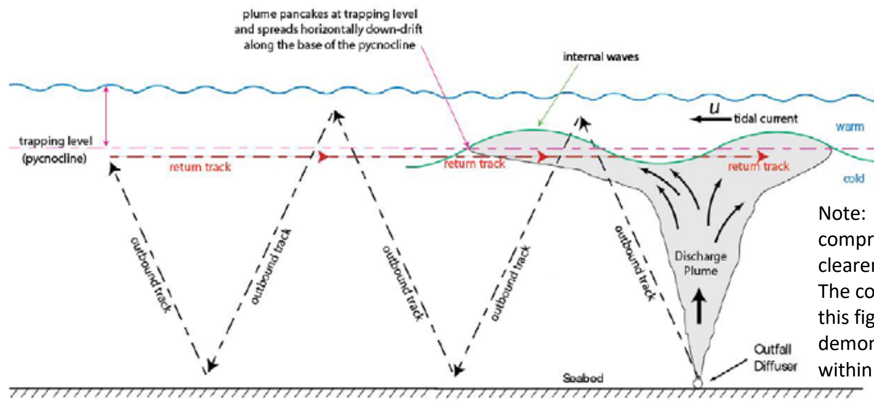


Figure 6-2 Example AUV Programmed Tracks



Note: The actual SEOO discharge is comprised of clear water, sometimes clearer than ambient ocean water. The colored discharge plume shown in this figure is for purposes of demonstrating the potential area within which initial dilution occurs.

Figure 1.2.2: Schematic of AUV out and return legs along any given track line in the AUV survey pattern, in order to capture the vertical structure of the plume while maximizing transit time in regions of maximum horizontal spreading.

Figure 6-3 Example AUV Depth Profile Tracks

Plume tracking monitoring with the AUV occurred over a one-day period for each of three seasonal deployment scenarios (summer-fall, winter-spring, and post-storm). A specific AUV survey plan was developed for each survey based on pre-deployment ocean current and stratification data, but general mission parameters remained constant for each of the AUV surveys.

Boat-Based Support Monitoring. In support of the AUV deployments, multiple (15 to 18) water column monitoring stations in the far-field area of the SEOO were sampled during each of the AUV deployments to establish natural ocean background conditions and ambient currents. The monitoring stations were sampled twice during each tide for a total of four grid set control samples during each AUV deployment event.

These monitoring stations utilized the Sea-bird SBE 19*plus*V2 CTD (Figure 6-4) and the 2 MHz Nortek Acoustic Doppler Current Profiler or ADCP (shown in Figure 6-5). The ADCP was deployed at the far-field monitoring station from the Research Vessel Benthic Cat, which is equipped with a station keeping system that allows the boat to automatically stay on a fixed location for the time needed to acquire CTD and ADCP current data.

Figure 6-4 SBE 19plusV2 Conductivity, Temperature, Depth Sensor

Figure 6-5 Nortec Acoustic Doppler Current Profiler

Each daily AUV survey produced from 64,000 to 68,000 separate measurements of fDOM and salinity. Data were fed into a three-dimensional data model to allow for visual interpretation of plume tracking results.

AUV Deployments and Results. To select actual deployment dates, the MBI team (see Appendix A) assessed seasonal ocean conditions, weather patterns and oceanographic conditions. Target deployment dates were selected in coordination with input from SEJPA, Escondido, EWA and the RWQCB. The following three monitoring event dates were selected to characterize a range of typical and atypical oceanographic conditions:

September 2021	Typical Fall conditions, maximum stratification.
December 2021	Atypical conditions, post-storm, high discharge flows and runoff.
March 2022	Typical Spring conditions, minimal stratification.

To capture the widest range of conditions, each of these three monitoring events included two AUV deployments, one deployment during ebb tide conditions and one deployment during flood tide conditions.

September 23, 2021. The September 23, 2021 AUV deployments involved one survey during ebb site conditions (where currents were predominantly to the south) and one survey during flood tide conditions (where currents were predominantly to the north). The total area surveyed during both ebb and flood tide was approximately 988.4 acres.

At the time of the ebb tide AUV survey, the SEOO discharge flow was 10.44 mgd and the average fDOM concentration in the SEOO discharge was 206.04 ppb. During the flood tide AUV survey, the SEOO discharge flow was 9.47 mgd and the fDOM concentration was unchanged from the ebb tide survey. Natural depth-averaged background fDOM measured during flood tide ranged from 0.770 ppb and 0.776 ppb, while depth-average fDOM concentrations during ebb tide range from 0.665 ppb and 0.673 ppb. Since the SEOO is expected to provide initial dilution in excess of 237:1, it was anticipated that fDOM concentrations in the SEOO discharge on this date would be close to background levels after initial dilution.

AUV-derived fDOM results from the September 2021 deployment demonstrated the difficulty in identifying the highly diluted SEOO discharge during times when ambient receiving water fDOM concentrations are elevated. MBI (see Appendix A) reported that the highest observed fDOM signal to noise ratio (SNR_{fDOM}) occurred immediately below the trapping level, but his signal to noise ratio was only 0.68, a value that is less than the $SNR_{fDOM} \geq 1$ value used by MBI as a threshold for filtering out fDOM noise.[24] As a result, MBI concluded that none of the fDOM values during the September 2021 deployment (both the ebb tide and flood tide surveys) rose to levels that indicated detection of the diluted SEOO discharge.

MBI reported that profiles of fDOM concentrations measured during both ebb and flood tide conditions showed some apparent vertical structure, with slightly higher concentration near the bottom that declined near the surface. The standard deviations around the depth-averaged fDOM concentrations were small, however, ranging between 0.11 ppb to 0.15 ppb, indicating that profile-related differences in fDOM are too small to be of consequence in tracking the SEOO discharge. Overall, the fDOM data from the September 23, 2021 AUV deployments indicate that the SEOO discharge during this period was sufficiently diluted and dispersed to be indistinguishable from ambient ocean water.

MBI (see Appendix A) also noted that flood tide currents during the September 2021 deployment averaged 0.63 knots toward the northwest, which conveyed the SEOO discharge in a net shore-parallel direction. Other short-lived cross-shore current oscillations reaching 1.75 knots, however, were observed during flood tide, likely as a result of shoaling internal waves. Because of the oscillatory nature of these current spikes, the short-term cross-shore currents produced no net drift of the SEOO discharge, but served to break the SEOO discharge into remnants and disperse the pieces in the cross-shore direction, resulting in further dilution and dispersion that added to the difficulty in detecting the SEOO discharge.

December 21, 2021. The December 21, 2021 AUV survey assessed atypical post-storm conditions (winds and ocean currents). During this deployment, SEOO discharge flows were higher than during the September 2021 AUV deployment. Based on information gained from the first deployment, the December 21, 2021 survey focused on AUV survey area of approximately 494 acres. As with the first AUV deployment, the December 21, 2021 deployment included a flood tide survey and an ebb tide survey (see Figure 6-6 on page 6-8). In support of the AUV surveys, a total of 18 stationary water column monitoring stations were utilized for CTD casts and ADCP velocity profiles.

At the time of the ebb tide AUV survey, the SEOO discharge flow was 12.63 mgd with an average salinity of 1.097 psu and an average fDOM concentration of 232.8 ppb. Vertical depth-averaged background fDOM concentrations during ebb tide ranged from 0.301 ppb to 0.305 ppb. Mean ebb tide currents were 0.51 knots toward the southeast, resulting in a shore-parallel drift of the SEOO discharge. Other transient short-lived cross-shore current oscillations reaching 1.42 knots occurred during ebb tide conditions. As in the September 2021 AUV deployment, these short-term cross-shore oscillations produced no net drift of the SEOO discharge, but served to break off pieces from the main body of the discharge during and after initial dilution into remnants that were subsequently diluted and dispersed.

While the short-term current oscillations increased dilution and dispersion of the SEOO discharge, fDOM values immediately downcurrent from the SEOO diffuser were distinguishable over background fDOM concentrations. Figure 6-7 (page 6-8) presents fDOM concentrations as a function of signal to noise ratio (SNR_{fDOM}) As shown in the figure, the primary elevated fDOM feature was centered approximately 1080 feet downcurrent from the SEOO diffuser. The SNR_{fDOM} value within this feature ranged from 1.0 (the signal to noise threshold for detection) along the outer perimeter to 2.46 in the center. Based on a detection metric of $SNR_{fDOM} \geq 1$, MBI (see Appendix A) concluded that the feature shown on Figure 6-7 is a fragment of the diluted SEOO discharge.

[24] As noted, fDOM concentrations in ambient seawater can vary from location to location, depending on organic sources and oceanographic conditions. The use of "signal to noise" filtering allows these random or natural variations of fDOM to be filtered out. The MBI plume tracking study used a signal to noise threshold of 1.0 to filter out such random and natural variations of fDOM. Under this premise, fDOM signals with a $SNR_{fDOM} \geq 1.0$ were assumed to be indicative of a level of fDOM above the fDOM in the natural environment. Such signals (if they occurred in locations and depths where the SEOO discharge could potentially be located) could be used as an indicator of the possible presence of diluted SEOO water.

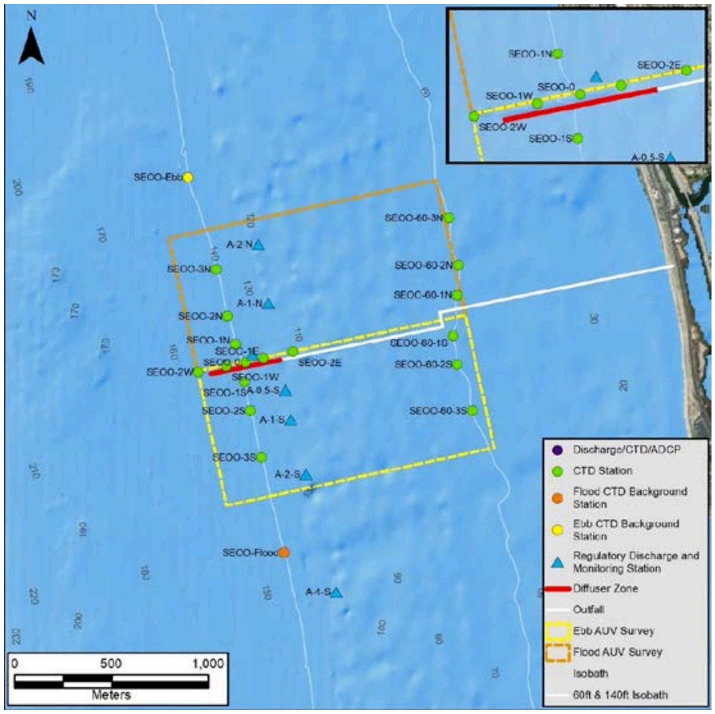


Figure 6-6 AUV Deployment Zones during Ebb and Flood Tides, December 21, 2021

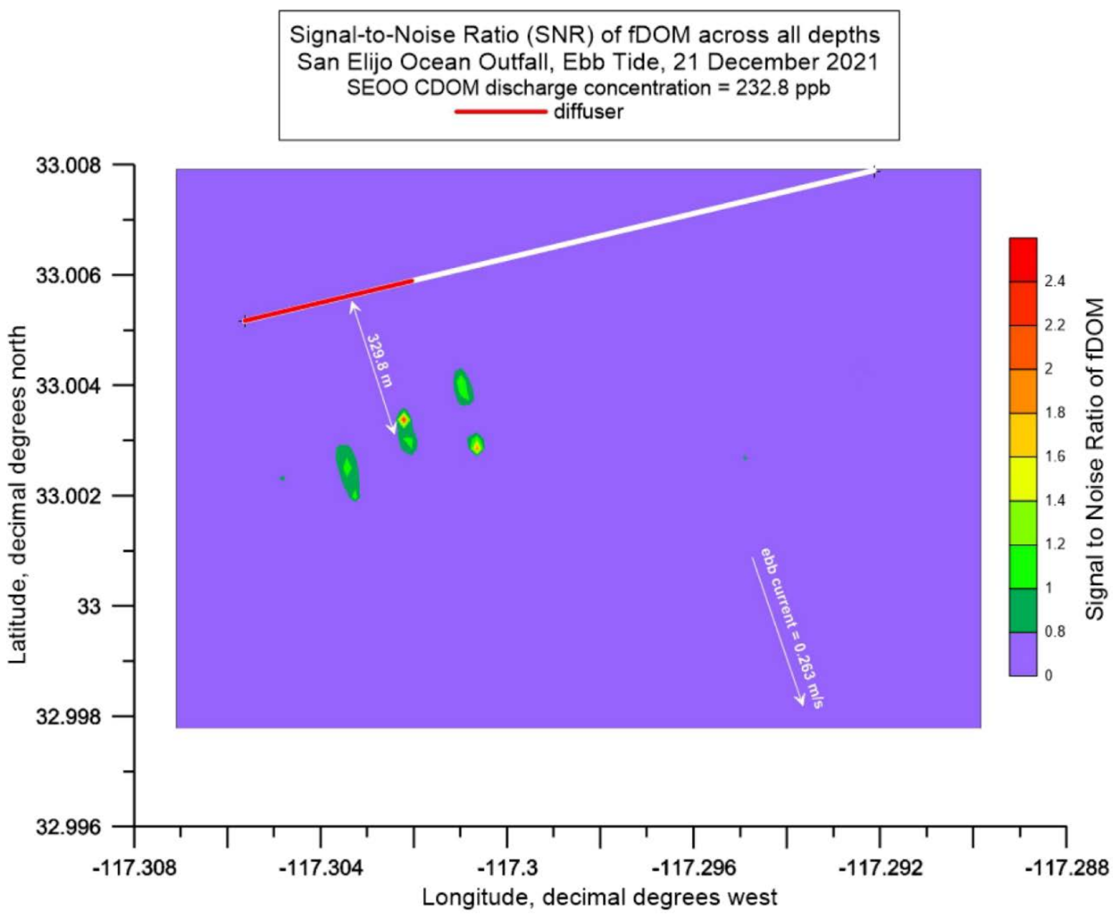


Figure 6-7 fDOM Signal to Noise Ratio – Ebb Tide Conditions of December 21, 2021

MBI (see Appendix A) utilized AUV-derived fDOM concentrations from the December 2021 AUV deployments in order to assess dilution within the SEOO discharge fragments shown in Figure 6-7. MBI computed minimum dilution values of 312:1 in the center of the fragments. Dilution values at the edge of the fragments ranged from 766:1 to over 40,000:1. Elsewhere in the wake of the SEOO diffuser, MBI estimated dilutions to range from 50,000:1 to 70,000:1. Such high dilutions suggest that chaotic ocean current conditions (such as the post-storm conditions of the December 2021 AUV deployment) can result in rapid and significant dilution and dispersion of the SEOO discharge immediately after initial dilution has been completed.

March 2022. The third SEOO AUV deployment occurred on March 2, 2022 and featured deployments during both ebb and flood tide conditions. The March 2022 deployment characterized typical spring conditions. For this deployment, the design of the SEOO survey boxes was slightly modified (based on experiences from Deployments #1 and #2) to increase the resolution of suspected plume remnants. This resulted in a survey area of 459 acres. To support the AUV deployments, 18 stationary water column monitoring stations were used to collect information on vertical profiles of salinity, temperature, and fDOM.

At the time of the March 2022 ebb tide AUV survey, 2022, SEOO discharge flows were 8.806 mgd with an average salinity of 0.71 psu and average fDOM concentration of 204.34 ppb. During flood tide, the SEOO discharge flow was 11.851 mgd with salinity and fDOM concentrations unchanged from ebb tide conditions. Depth-averaged natural background fDOM during ebb tide ranged from 0.277 ppb and 0.279 ppb. In the upper 10 feet of the water column, however, fDOM concentrations ranged from 0.475 ppb to 0.520 ppb. This rise in ambient fDOM in surface waters coincided with monitoring observations of red tide conditions along the shore that extended seaward toward some of the nearshore “N” stations.

Mean ebb tide currents during the March 2022 deployment were strong at 0.92 knots toward the southeast (parallel to the shoreline). Such current speeds are not typical of tidal currents in the SCB, and this current speed may have resulted from a wind-driven component associated with an approaching storm. Mean flood tide currents were considerably less than the mean ebb tide currents, reaching only 0.58 knots toward the northwest (parallel to shore). This lower flood tide current may have been due to the direction of the wind or the fact that SCB currents along the coastline are ebb-tide dominant.

During the March 2, 2022 survey, the AUV collected 65,770 separate measurements of salinity and fDOM along a total distance surveyed of 21.2 km. No elevated concentrations of fDOM were observed near the SEOO diffuser or downcurrent from the SEOO. Two reasons may exist as to why the March 2022 fDOM data do not show any sign of remnants of the SEOO discharge. First, SEOO flow rates (8.806 mgd) were relatively low. Second, transient surges of ocean currents (with velocities of up to 2.62 knots) likely exposed the SEOO discharge zone to high shearing rates which would rapidly break up the SEOO discharge into highly diluted and dispersed fragments which contained fDOM concentrations indistinguishable from ambient ocean water.

Figure 6-8 presents a map depicting fDOM signal to noise values during ebb tide conditions. Figure 6-8 is not scaled to filter out noise, and shows SNR_{fDOM} values ranging from zero to 2.0 or more. As shown in the figure, signal to noise ratios downcurrent from the SEOO diffuser were less than 0.2, indicating no presence of any discernible plume remnant downstream from the diffuser.

While no evidence of the SEOO discharge was found, a large mass of elevated fDOM was detected along the coast, extending outward toward the 60-foot depth contour. Maximum fDOM concentrations within this feature were as much as 330 percent higher than the depth-averaged natural background fDOM concentrations. Further, no other fDOM features having this high a concentration were noted in any of the other SEOO AUV surveys. By contrast, fDOM concentrations seaward of the fDOM feature (toward the SEOO diffuser) were lower and were consistent with ambient fDOM concentrations seen throughout all offshore waters.

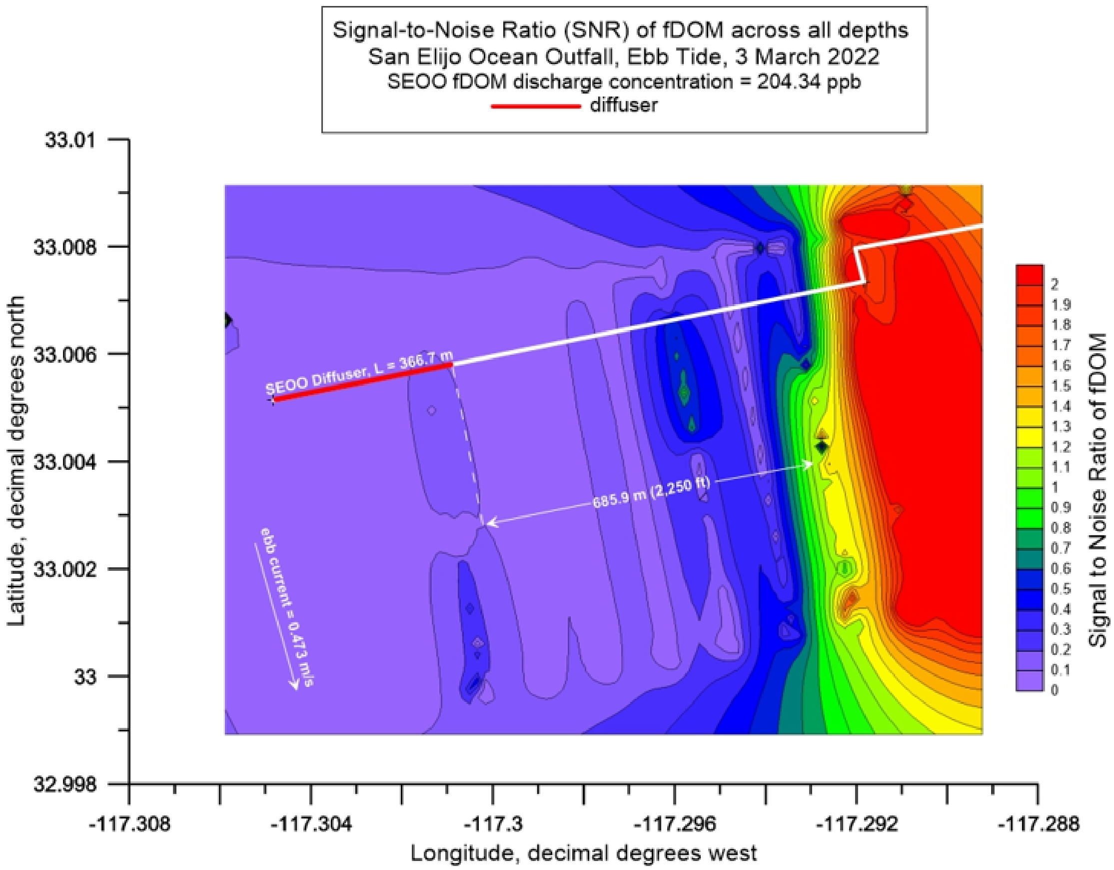


Figure 6-8 fDOM Signal to Noise Ratio – Ebb Tide Conditions of March 2, 2022

It is apparent that the SEOO discharge has no connection to this shoreline fDOM feature, as SEOO dilution ratios along the outer perimeter of the fDOM feature range from over 3,000:1 to over 100,000:1. Given the observations of red tide conditions along the shore that extended seaward toward the nearshore "N" stations, tidal discharges from San Elijo Lagoon were concluded as representing the likely source of the fDOM feature.

To determine if the large shoreline fDOM feature during ebb tide could be due to tidal discharges from the San Elijo Lagoon, MBI (see Appendix A) applied the CORMIX v-11 mixing model to simulate the tidal discharge plume from the lagoon. MBI performed successive iterations with CORMIX v-11 to back-calculate the probable fDOM concentration within the lagoon required to form the fDOM feature observed in the March 2022 AUV deployment. The lagoon fDOM concentration that gave the closest match to the AUV measurements was 198 ppb, which is comparable to the SEOO fDOM concentration of 204.34 ppb.

The resulting CORMIX-v11 simulation of the San Elijo Lagoon discharge plume is presented in Figure 6-9. The simulation indicates that shore-based sources (such as San Elijo Lagoon tidal flushing, which can be as high as 600 million gallons per tidal cycle) can significantly influence shoreline and nearshore water quality at Cardiff State Beach. None of the SEOO AUV deployments, on the other hand, indicated that the SEOO discharge had any discernible effect on receiving water quality near the shore.

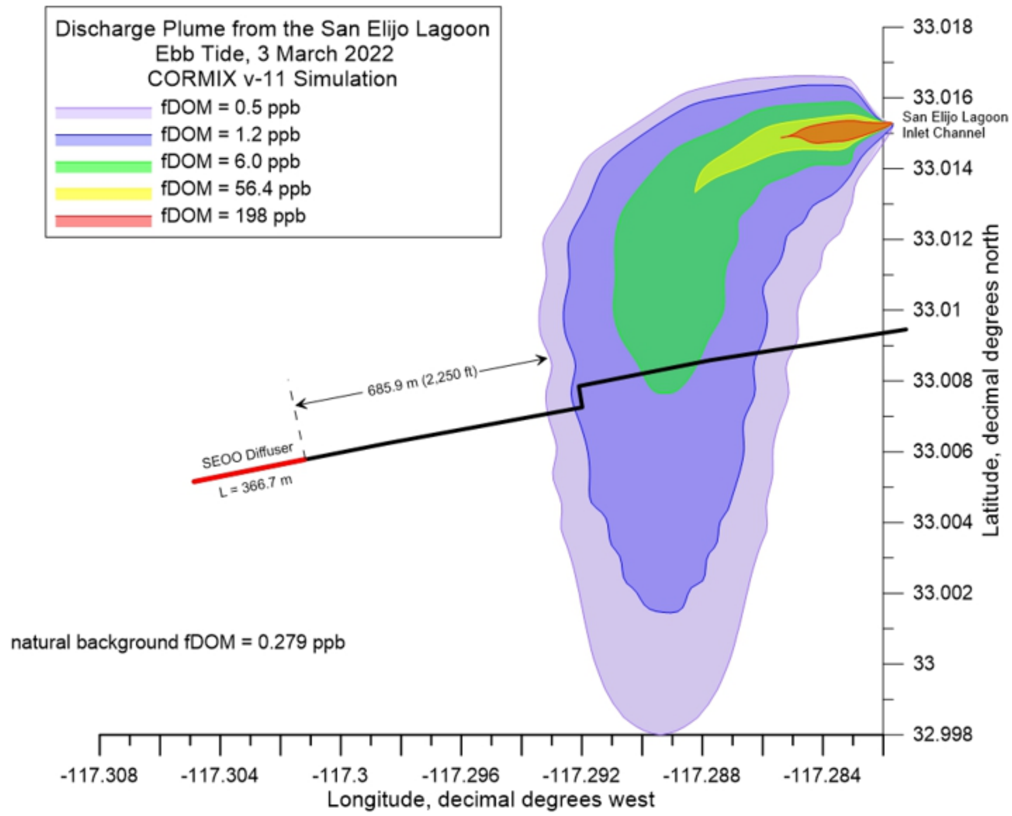


Figure 6-9 Influence of Tidal Flushing from San Elijo Lagoon on Nearshore Waters

Plume Tracking and Initial Dilution Conclusions. Plume tracking studies conducted pursuant to Special Studies Requirement VI.C of the MRPs of Order Nos. R9-2018-0002 and R9-2018-0003 confirm the SEOO "concept model" conclusions developed from prior studies and from more than a half century of receiving water monitoring. The plume studies (in conjunction with ongoing SEOO receiving water monitoring) confirm that:

1. Upon discharge, diluted SEOO water moves parallel to the shore in an upcoast or downcoast direction, depending on tides and regional conditions.
2. The SEOO discharge is not transported to the shore.
3. The SEOO discharge is very quickly diluted by a lengthy and highly efficient diffuser.
4. Initial dilution is consistently greater than the RWQCB assigned dilution value.
5. Under typical fall and spring oceanographic conditions, the SEOO 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 SEOO discharge upon completion of initial dilution.

6. Under conditions in which the SEOO discharge is detectable, the SEOO discharge becomes indistinguishable from ambient ocean waters soon after completion of initial dilution.
7. Increased recycled water use and decreased SEOO discharge flows result in improved dilution and dispersion.
8. The existing receiving water monitoring stations are excessive for demonstrating compliance with receiving water narrative and numerical standards.
9. Some of the existing (and more distant) SEOO monitoring stations are of little value in assessing the SEOO discharge and can be eliminated without consequence.
10. The plume tracking work confirmed historical data findings that the aquatic life and environment is not being adversely impacted by the SEOO discharge.

Responses to NPDES Questions on Plume Tracking. Plume tracking requirements established in Reporting Requirement VII.C of Order Nos. R9-2018-0002 and R9-2018-0003 identify a series of questions to be addressed within the SEOO plume tracking effort. Responses to the plume tracking questions posed in Order Nos. R9-2018-0002 and R9-2018-0003 are presented below. More detailed responses are presented within MBI (2022b).

(1) Are the current monitoring locations and methods adequate to determine whether the wastewater plume is encroaching on water recreational areas, including, but not limited to, areas used for swimming, scuba diving, surfing, and fishing? If not, what monitoring locations and/or methods are more appropriate?

Based on the findings of the plume tracking field studies in September 2021, December 2021 and March 2022, the wastewater plumes were never found inshore of the shoreward end of the SEOO diffuser. What is discharged offshore remains offshore.

The present-day monitoring stations for the SEOO are more than adequate (to the point of being excessive) to confirm that the SEOO discharge does not encroach on water recreational areas. No additional monitoring stations are required for that purpose. Further, evidence that the outfall discharges remain offshore is sufficiently strong as to question why shore-based monitoring is required. The lack of need for such shore-based bacteriological monitoring as part of the SEOO NPDES permit is supported by the fact that the existing offshore "A" stations and near-shore "N" monitoring stations (located between the shore and the outfall discharge point) consistently show compliance with Ocean Plan REC-1 bacteriological standards.

SEOO plume tracking measurements using AUV sensors and fDOM never produced evidence of remnants of the SEOO discharge further than 1,080 feet from the SEOO diffuser, and these remnants were immediately downcurrent from the SEOO in a shore parallel direction.[25] As a result, it may be concluded that the SEOO shore "S" monitoring stations are best suited for monitoring effects caused by shoreline discharges. In support of this conclusion, the inshore AUV survey plume tracking measurements in March 2022 detected the discharge of the San Elijo Lagoon whose frontal boundary was between the shore and the 60- foot depth contour in the vicinity the nearshore "N" monitoring stations. Finally, the plume tracking results indicate that eliminating offshore sampling points greater than 2,000 feet away from the outfall is warranted, as no evidence of the discharge was observed further than 1,080 feet from the outfall.

(2) Is the removal of the SEOO Surf Zone monitoring location S-6 (historical) still appropriate?

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[25] This finding is based on criteria for plume detection that requires a signal to noise ratio of at least unity ($SNR_{fDOM} \geq 1.0$) in order to identify the potential presence of diluted water that is likely originated from the SEOO discharge.

Based on the findings of the plume tracking field studies in September 2021, December 2021 and March 2022, removal of SEOO Surf Zone Station S-6 (historical) remains appropriate. Further, as documented above, available evidence indicates that the SEOO discharge is rapidly diluted and dispersed, and remnants of the highly diluted discharged water remain offshore and are carried upcoast/downcoast and quickly disappear. Shore based discharges, on the other hand, remain near the shore and are carried upcoast/downcoast. As a result, SEOO shore stations appear to be of little value in assessing outfall discharge effects. Removal of SEOO Surf Zone Station S-6 is appropriate.

(3) How does the brine discharge from the MFRO Facility and San Elijo Water Reclamation Facility and future brine discharges (along with increased recycled water use and decreased outfall discharge flows) affect the dynamics of the wastewater plume and initial dilution?

In addition to requiring implementation of plume tracking technology, Order Nos. R9-2018-0002 and R9-2018-0003 required SEJPA and the City of Escondido to prepare a Minimum Initial Dilution Factor Re-Evaluation Study (Initial Dilution Study). In response to this requirement, MBI prepared a study entitled *Minimum Initial Dilution Re-Evaluation Analysis of the San Elijo Ocean Outfall* (MBI, 2022a).[26] The objective of the study was to assess whether brine discharges from the MFRO and SEWC (along with future planned brine discharges) would affect the dynamics or dilution of the SEOO discharge.

As documented previously in this section, the Initial Dilution Study (MBI, 2022a) assessed a range of scenarios that included maximum and minimum projected brine flows superimposed on maximum and minimum SEWC and HARRF discharge flows. Even under conditions of maximum brine flow and minimum SEOO flows, maximum projected brine discharges were determined to result in only a modest increase in SEOO discharge salinity to approximately 1.88 practical salinity units (psu).[27] This slight increase in SEOO salinity was determined to have no adverse discernible effect on SEOO performance or projected initial dilution. SEOO discharge flows, on the other hand, were found to significantly influence initial dilution. Under conditions of maximum trapping and stratification, the maximum SEOO discharge flows of 23.25 mgd were determined to result in an initial dilution of 237:1 – the initial dilution value assigned in Order Nos. R9-2018-0002 and R9-2018-0003.

Significant increases in projected initial dilution occurred for discharge scenarios where HARRF and SEWC discharge flows were at minimum (5.0 mgd) and brine flows were at maximum (2.2 mgd of brine from various sources. Under these conditions, (total SEOO flow of 7.2 mgd and combined salinity of 1.88 psu), SEOO initial dilutions were computed to range from approximately 300:1 to in excess of 500:1.[28]

Overall, the Initial Dilution Study determined that salinity effects from planned increases in brine discharges would have minimal effect on SEOO initial dilution, and the actual initial dilutions under almost all anticipated combinations of discharge flows and oceanographic conditions would be significantly in excess of the 237:1 dilution value assigned within Order Nos. R9-2018-0002 and R9-2018-0003. Further, the more recycled water use is increased by SEJPA and Escondido and the more SEOO discharge flows are reduced, the higher the projected SEOO initial dilution, despite proposed increased brine contributions.

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[26] *Minimum Initial Dilution Re-Evaluation Analysis of the San Elijo Ocean Outfall* (MBI, 2022a) was prepared pursuant to Special Studies Requirement VI.B of Order Nos. R9-2018-0002 and R9-2018-0003, and was submitted to the RWQCB by SEJPA and the City of Escondido in November 2022.

[27] For comparison, typical ocean water salinity is approximately 33 psu, and the present-day SEOO discharge salinity is on the order of 1.2 psu. At standard temperature, freshwater has a density of 0.9998 g/mL and seawater has as a density of approximately 1.025 g/mL. Since these values are so close to 1.0, units of psu (which are dimensionless) are roughly equivalent to grams per liter (which are units of density).

[28] See Table 3, Scenarios 3 and 4 from MBI (2022a).

(4) Does the wastewater plume have the potential to interact with wastewater plumes from other ocean outfalls or other sources of pollution, such as storm water and outflows from the San Elijo Lagoon?

Based on the findings of the plume tracking field studies of September 2021, December 2021, and March 2022, highly diluted wastewater discharged from the SEOO rapidly becomes indistinguishable from ambient ocean water several hundred feet downcurrent from the ZID and has no potential to interact with wastewater plumes from other sources of pollution, such as storm water discharges or lagoon outflows. The SEOO plume tracking measurements (over 66,000 measurement points) found no evidence of the SEOO discharge further downcurrent (parallel to the shore) than 1,080 ft from the SEOO diffuser. Further, waters identified as containing diluted discharge from the SEOO were never detected inshore of the shoreward end of the SEOO diffuser. AUV survey plume tracking measurements of fDOM in March 2022 presented convincing evidence of the shore-based discharge from the San Elijo Lagoon that extended from the shore seaward for 2,250 feet to near the 60-foot depth contour. The lagoon discharge, however, did not impinge on the SEOO discharge.

(5) What is the fate of the wastewater plume in typical and atypical oceanographic conditions, and when and under what conditions is the wastewater plume no longer distinguishable from ambient receiving water?

The SEOO discharge does not remain as a "plume" *per se* after discharge. Under typical minimum and maximum thermal stratification conditions, the SEOO discharge is rapidly diluted and dispersed into remnants or pockets of ocean water that contain sufficiently low concentrations of SEOO water that the remnants quickly become indistinguishable from ambient receiving water. This occurs even more rapidly under storm or post-storm conditions, where the SEOO discharge is sheared into disjointed and unattached fragments of highly diluted water that rapidly disperse and become indistinguishable from ambient receiving water.

These conclusions are supported by results of SEOO plume tracking field studies (MBI, 2022b). The SEOO plume tracking field studies were designed to utilize three AUV deployments to assess the fate of SEOO discharge under both typical and atypical oceanographic conditions. AUV deployments conducted in September 2021 addressed typical late summer/fall oceanographic conditions when the water column was strongly stratified with a well-defined thermocline at a depth of approximately 26 feet. Ambient background concentrations of fDOM were relatively high at the time. Under such typical summer oceanographic conditions, the SEOO discharge could not be distinguished from ambient fDOM concentrations in the receiving water. Additionally, salinity was found to be useless as a tracer of the SEOO discharge due to its low signal to noise ratio at the point of discharge.

An AUV deployment was conducted in December 2021 after the passage of a dry cold front to characterize atypical post-storm oceanic conditions. At this time, a cold, nearly homogeneous surface layer existed down to a depth of 83 feet. Consequently, the water column during December 2021 was only weakly stratified and the trapping level rose to within 13 feet of the sea surface. Ambient background concentrations of fDOM at this time were relatively low, averaging 0.294 ppb to 0.310 ppb. As a result of these low ambient fDOM concentrations, the highly diluted discharge from the SEOO could be distinguished from the ambient receiving water using fDOM. Maximum fDOM values were observed to have a signal to noise ratio reaching 2.46, and the fDOM data showed likely evidence of SEOO discharge at distances approximately of 1,080 feet downcurrent (parallel to the coast) from the SEOO diffuser. The fDOM data, however, also shows that the SEOO discharge remnants were quickly diluted and dispersed, rendering them indistinguishable from ambient water much beyond that point.

An AUV deployment in March 2022 was conducted to characterize typical late winter/early spring conditions. The March 2022 conditions included a cold bottom layer and a density profile of continuously stratified water, as opposed to the epilimnion/hypolimnion layer conditions that existed during the September and December 2021 AUV deployments. Consequently, the trapping level during March 2022 was deep (approximately 88 feet), which would cause worst-case dilution conditions.

In spite of the worst-case dilution conditions and low ambient background concentrations of fDOM during the March 2022 deployment, the SEOO discharge remained difficult to distinguish from ambient receiving water. Strong currents parallel to the shore, in combination with oscillating cross-shore currents, exposed the SEOO discharge to high velocity shear rates which broke up the discharged wastewater into small and highly diluted disjointed fragments that quickly became indistinguishable from ambient ocean water.

(6) What parameters are most useful for assessing the presence of a wastewater plume?

The AUV deployments indicated that, during times of low overall receiving water fDOM concentrations, fDOM can be an effective parameter in indicating the possible or probable presence of remnants of the SEOO discharges. Bacteriological parameters (e.g., fecal coliform and enterococcus) can be combined with fDOM to provide additional evidence of the presence of the outfall discharges.

At present, small, low-power electronic sensors capable of being carried aboard an AUV can only measure tracers such as salinity and fDOM. For assessing SEOO conditions, salinity was found to be ineffective as a tracer. Signal to noise ratios of salinity measurements during the SEOO plume tracking study never exceeded 0.008. This is likely due to the high dilution achieved by the SEOO discharge. Concentrations of fDOM in the SEOO discharge, on the other hand, are typically on the order of 200 to 300 ppb.[29] Upon initial dilution, fDOM concentrations at the edge of the ZID would thus typically be on the order of 1 ppb. Natural background concentrations of fDOM typically range from 0.3 to 1 ppb. When background fDOM is on the lower end of this range, fDOM can be effective in identifying the potential presence of the outfall discharge. When background fDOM is near 1 ppb, however, the outfall fDOM "signature" is difficult to discern from the background concentration. Even under such conditions, however, the AUV-based fDOM measurements were valuable in confirming that the SEOO discharge achieves high dilution rates and is quickly dispersed and becomes indistinguishable from ambient ocean water.

(7) What is the variability in the degree of initial dilution that occurs under typical and atypical oceanographic conditions?

Initial dilution varies with discharge flows and oceanographic conditions such as thermal stratification and ocean currents. Plume tracking field studies that were conducted in September 2021 (typical late summer oceanographic conditions) were unable to detect the wastewater plume from the SEOO due to high ambient concentrations of fDOM. As a result, no quantitative conclusion could be drawn regarding the degree of initial dilution that occurs under typical late summer oceanographic conditions (other than the qualitative conclusion that dilution values were very high).

The plume tracking field studies conducted in December 2021 under dry weather winter oceanographic conditions) detected fDOM features of the SEOO wastewater plume remnants. Minimum dilutions in the center of these fragments were 311:1, or a factor of 1.3 times greater than the minimum month dilution of 237:1 assigned in Order Nos. R9-2018-0002 and R9-2018-0003. Dilutions near the edges of these plume remnants exceeded 1000:1. Plume tracking field studies conducted in March 2022 (maximum trapping depth) oceanographic conditions were unable to detect the wastewater plume from the SEOO due to high ambient currents and surges that sheared the plume into small undetectable fragments that resulted in

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[29] The SEOO discharge contains concentration of TSS (typically 5-6 mg/L in the combined SEOO discharge) that similar to ambient TSS concentrations that exist in natural seawater. Some of the organic particles in the SEOO discharge, however, are colloidal (extremely small) and are sufficiently numerous so that fDOM concentrations of the undiluted SEOO discharge are significantly higher than fDOM concentrations in ambient seawater, even though both have similar water clarity and both contain low concentrations of TSS.

extremely high dilutions. Dilutions during this March 2022 deployment could not be quantified, but were thus very high.

On the basis of the above, it is concluded that the 237:1 initial dilution assigned in Order Nos. R9-2018-0002 and R9-2018-0003 is conservative and that actual SEOO dilutions can be significantly in excess of this value. This conclusion is supported by bacteriological sampling conducted over the past half century, which is suggestive of much higher dilutions. This conclusion is further supported by findings in the SEOO Minimum Initial Dilution Factor Re-Evaluation Study (MBI, 2022a) which showed that reduced SEOO discharge flows result in increased initial dilution. Since SEOO flows are almost always lower than those used in determining the NPDES-assigned 237:1 initial dilution, it can be presumed that typical SEOO dilutions are significantly in excess of 237:1.

Section 7
NPDES Monitoring Program Questions

Question-Based Monitoring. Order Nos. R9-2018-0002 and R9-2018-0003 implement the "question based" monitoring approach established within *A Framework for Monitoring and Assessment in the San Diego Region*[30] and the *San Diego Water Board Practical Vision.*[31] In accordance with this approach, the Orders establish monitoring questions and monitoring requirements to address the questions. RWMR requirements established in Order Nos. R9-2018-0002 and R9-2018-0003 requires that the RWMR include discussion addressing each of the questions posed in the MRPs of the Orders.

Influent and Effluent. Section III.A through III.C of the MRP of Order Nos. R9-2018-0002 and R9-2018-0003 establish influent, effluent and whole effluent toxicity monitoring requirements to address a series of questions. Table 7-1 identifies influent, effluent and whole effluent toxicity questions posed in the Orders and provides responses based on monitoring conducted by SEJPA and the City of Escondido.

Table 7-1
Responses to MRP Questions on Influent, Effluent and Whole Effluent Toxicity

MRP Section	Category	MRP Questions and Responses
III.A	Influent	Q: *Is the Discharger complying with permit conditions including, but not limited to, carbonaceous biochemical oxygen demand (5-day @ 20 degrees Celsius (°C)) ($CBOD_5$) and total suspended solids (TSS) percent removal limitations?* A: As documented in Section 2 of this RWMR, both the SEWC and HARRF have achieved 100 percent compliance with CBOD and TSS removal requirements. During 2021, SEWC achieved approximately 99 percent removal and HARRF achieved approximately 98 percent removal of both TSS and CBOD.
III.B	Effluent	Q: *Does the effluent comply with permit effluent limitations, performance goals, and other requirements of this Order, thereby ensuring that water quality standards are achieved in the receiving water?* A: As documented in Section 2 of this RWMR, the SEWC and HARRF discharges achieved 100 percent compliance with all effluent limitations and performance goals of Order Nos. R9-2018-0002 and R9-2018-0003.
		Q: *What is the mass of constituents that are discharged daily, monthly, or annually?* A: SEJPA and the City of Escondido document mass emissions for each regulated constituent in monthly and semiannual reports submitted to the RWQCB via CIWQS. Mass emissions for all constituents are significantly below NPDES effluent mass emission limits and NPDES performance goals for mass emissions. This occurs because (1) SEOO flows are typically significantly less than permitted flows, and (2) SEOO discharge concentrations are typically significantly below applicable effluent limits or performance concentration goals.
		Q: *Is the effluent concentration or mass changing over time?* A: Not to any significant degree. While populations have increased slightly in both the SEWC and Escondido service areas, flows discharged to the SEOO have not increased in recent years as a result of increased recycled water use (which diverts flow from the SEOO) and improved water conservation. Additionally, in 2018, the City of Del Mar service area was connected to the SEWC, yet overall SEWC flows discharged to the SEOO were lower in 2021 than in 2016 before the Del Mar connection. Because of the high level of treatment provided at the SEWC and HARRF, mass emissions have not changed significantly from the prior NPDES permit term.
		Q: *Are treatment facilities being properly operated and maintained to ensure compliance with the conditions of this Order?* A: Yes. SEWC and HARRF have achieved consistent 100 percent compliance with all effluent limitations and performance goals during the current NPDES permit term.
III.C	Whole Effluent Toxicity	Q: Does the effluent meet effluent limitations for toxicity thereby ensuring that water quality standards are achieved in the receiving water? A: Yes. The SEWC and HARRF discharges have achieved 100 percent compliance with effluent limitations for toxicity in all monthly effluent toxicity tests. Tests are conducted using the TST methodology which presumes toxicity until proven otherwise. Tests are conducted on the most sensitive species, as determined through biannual sensitivity testing.
		Q: If the effluent does not meet effluent limitations for toxicity, are unmeasured pollutants causing risk to aquatic life? A: Not applicable. The SEWC and HARRF discharges have achieved 100 percent compliance with effluent toxicity limitations.
		Q: If the effluent does not meet effluent limitations for toxicity, are pollutants in combinations causing risk to aquatic life? A: Not applicable. The SEWC and HARRF discharges have achieved 100 percent compliance with effluent toxicity limitations.

[30] As adopted by the RWQCB through Resolution No. R9-2012-0069 (RWQCB, 2012).

[31] Element 2 of the San Diego Water Board Practical Vision (RWQCB, 2021) addresses monitoring and assessment programs to support the RWQCB goals of evaluating, protecting and restoring the health of waters.

As summarized in Table 7-1, both the SEWC and HARRF discharges to the SEOO complied with NPDES effluent limitations and performance goals for all constituents, including physical/chemical parameters, toxic inorganic compounds, toxic organic compounds and chronic toxicity. Copper and zinc were the only two toxic inorganic compounds routinely detected in the HARRF or SEWC SEOO discharge, and both constituents are at concentrations orders of magnitude below NPDES performance goals. Concentrations of toxic organic compounds were rarely detected in the HARRF and SEWC effluent, and both the HARRF and SEWC discharges complied with applicable performance goals for toxic organic compounds by considerable margins of safety.

Receiving Water. Table 7-2 identifies questions posed within the MRPs of Order Nos. R9-2018-0002 and R9-2018-0003 related to receiving water and surf zone conditions. As described in the responses to the receiving water and surf zone questions, the SEOO discharge achieved 100 percent compliance with Ocean Plan receiving water standards at all offshore and nearshore stations.

Table 7-2
Responses to MRP Questions on General Receiving Water and Surf Zone Conditions

MRP Section	Category	MRP Questions and Responses
IV	General	Q: *Does the receiving water meet water quality standards?* A: Yes. SEOO receiving waters comply with applicable narrative and quantitative Ocean Plan receiving water standards. The SEOO discharge has been operational since the 1960s and has a documented history of not impacting water quality. As testimony demonstrating this lack of impact, the California Fish and Game Commission in 2010 created Swami's State Marine Conservation Area (SMCA) to conserve and ensure continued protection of aquatic habitat. The SEOO is thus one of the few outfalls in California that discharge to waters that receive SMCA protection status.
		Q: *Are receiving water conditions getting better or worse over time?* A: Receiving water conditions remain excellent in the vicinity of the SEOO. Receiving waters are clear, have adequate concentrations of dissolved oxygen, and support an abundant population of benthic species, fish and macrobenthic organisms. More than a half century of receiving water monitoring at the SEOO confirms that waters offshore from San Elijo State Beach remain healthy with no significant change over time except for those related to regional climatic trends.
		Q: *What is the relative contribution of the discharge to pollution in the receiving water?* A: As documented above, SEOO receiving waters meet all Ocean Plan water quality objectives, and the SEOO discharge is comprised of clear, high-quality effluent with a high dissolved oxygen concentration and minimal TSS and CBOD. Toxic inorganic and organic compounds are rarely detected in the SEOO effluent, and then typically only at or near detection limits.
		Q: *What are the effects of the discharge on the receiving waters?* A: The SEOO discharge is highly treated, contains no floatable material, no settleable material, extremely low concentrations of TSS and BOD and has low turbidity. TSS, CBOD and turbidity levels in the discharge are frequently lower than in the high-quality receiving water. For virtually all parameters, little discernible difference exists between conditions near the SEOO and more distant receiving water stations.
IV.A	Surf Zone	Q: *Does the effluent cause or contribute to an exceedance of the water quality objectives in the receiving water?* A: Not applicable. No exceedances of water quality objectives occur in the vicinity of the SEOO.
		Q: *Does the effluent reach water contact zones or commercial shellfishing beds?* A: Not applicable. The SEOO discharge is to a SMPA where the taking of shellfish is prohibited. Further, the SEOO discharge does not reach shoreline REC-1 zones (e.g., waters within 1000 feet of the shore or less than 30 feet in depth). SEOO receiving water data at nearshore stations demonstrate the lack of onshore movement of the SEOO discharge. Additionally, plume tracking studies (see Section 6 and Appendix A) have confirmed that what is discharged offshore stays offshore, and that REC-1 waters in nearshore areas are vulnerable to pollution from shore-based source, but are not affected by the SEOO discharge.
		Q: *Are densities of bacteria in water contact areas below levels protective of public health?* A: Yes. As documented by more than 50 years of receiving water data, bacteriological concentrations in SEOO offshore and nearshore stations remain low. The lack of bacteriological exceedances at nearshore stations demonstrates that the SEOO discharge remains offshore and does not impinge on shore waters. Exceedances of bacteriological standards at shore stations can occasionally occur, but such exceedances are due to storm runoff or shore-based sources. Plume tracking studies (see Section 6) have confirmed that the SEOO discharge remains offshore, is rapidly diluted, is rapidly dispersed into fragments and becomes indistinguishable from ambient water within approximately 1000 feet of the SEOO diffuser.

While occasional exceedances of REC-1 bacteriological standards occurred at shore stations, these exceedances are confirmed as not being associated with the SEOO discharge as:

- No exceedances occur at nearshore stations which are located between the SEOO discharge and the shoreline.
- Plume tracking and ocean current studies demonstrate that net currents are upcoast/downcoast, and that what is discharged offshore stays offshore.
- Shore exceedances are most likely to occur during conditions of significant storm runoff and such exceedances can be directly attributed to nearby sources of shore-based runoff.

Table 7-3 (page 7-4) identifies questions posed within the MRPs of Order Nos. R9-2018-0002 and R9-2018-0003 related to offshore and nearshore receiving water receiving water conditions. As documented within Section 6, plume tracking results from the 2020-2022 study confirm the long-standing understanding that:

- Net ocean currents are upcoast/downcoast, parallel to isobaths.
- What is discharged offshore stays offshore and what is discharged onshore stays onshore.
- The SEOO discharge is rapidly dispersed along the lengthy SEOO diffuser.
- The SEOO discharge is trapped below the thermocline for a significant majority of the year.
- Lowest dilutions are associated with maximum trapping depths.

The plume tracking results also infer that, after discharge, diluted wastewater can be further diluted and dispersed by short-term oscillations in cross-currents, creating remnants or "pockets" of highly diluted water which rapidly become indistinguishable from ambient seawater. Such phenomena may also help explain why the undisinfected SEOO discharge achieves consistent compliance with Ocean Plan REC-1 bacteriological standards at the offshore "A" stations. If SEOO dilutions were only on the order of 237:1 (the NPDES-assigned value), it would be expected that receiving water concentrations of fecal coliform and enterococcus would be higher than values typically detected at stations immediately down-current from the SEOO diffuser. Predation and temperature/light inactivation may result in some reduction of bacteriological concentrations. The plume tracking study, however, indicates that dilution and dispersion are likely key influencing factors, as the plume tracking results demonstrate that the SEOO consistently achieves dilutions higher than that assigned in the NDPES permits.

While the SEOO discharge contains concentrations of nitrogen and ammonia in excess of ambient receiving water, the SEOO discharge is unlikely to directly contribute to algae blooms. During spring and summer months when algal blooms are most prevalent in the SCB region, thermal stratification is strongest and plume trapping depths are greatest, preventing the SEOO discharge from contributing nutrients to the epilimnion. Additionally, while annual average SEOO mass emissions of nitrogen are a factor of 10 less than present-day NPDES limits, SEOO discharge flows approach minimum values in summer months, further reducing nutrient mass emissions and increasing dilution during these critical spring/summer periods.[32] As a result, little probability exists that the SEOO could contribute nitrogen to epilimnion waters during times of year when the highest potential exists for algal blooms to occur.

Benthic Community, Fish and Macroinvertebrates. Table 7-4 (page 7-5) identifies questions posed within the MRPs of Order Nos. R9-2018-0002 and R9-2018-0003 related to the health of benthic communities in nearshore and offshore waters. As summarized in Table 7-4, SEOO discharge contains low concentrations of toxics, a clear (low turbidity) effluent with negligible settle solids, and low concentrations of suspended solids. These factors combine to reduce the potential for the SEOO discharge to adversely affect sediments, benthic species and fish. Overall, the number and populations of benthic and fish species in the SEOO area are consistent conditions at other sandy bottom SCCWRP regional monitoring stations.

[32] As documented by MBI (2022a), SEOO initial dilution increases with decreased discharge flow.

Table 7-3
Responses to MRP Questions on Nearshore and Offshore Conditions

MRP Section	Category	MRP Questions and Responses
IV.B	Nearshore and Offshore	Q: *Is natural light significantly reduced at any point outside the ZID as a result of the discharge?* A: The SEOO discharge has no discernible effect on light transmittance. As documented in Section 2 of this RWMR, the SEOO discharge is clear, typically containing only a few mg/l of TSS and turbidity levels of less than 5 NTU. Receiving water light transmittance monitoring (see Section 4) shows no difference between stations near the SEOO and more distant reference stations.
		Q: *Does the discharge cause a discoloration on the ocean surface?* A: Not applicable. As documented in Section 3, the SEOO discharge remains trapped below the ocean surface almost throughout the year. Further, the discharge is clear, with no noticeable color or turbidity.
		Q: *Does the discharge of oxygen-demanding waste cause the dissolved oxygen concentrations to be depressed at any time more than 10 percent which occurs naturally outside the ZID?* A: No. Concentrations of CBOD in the combined SEOO discharge are typically less than 5 or 6 mg/L, and dissolved oxygen concentrations in the discharge are on that same order. Further, under most conditions the discharge achieves dilution rates higher than the 237:1 initial dilution ration assigned under Order Nos. R9-2018-0002 and R9-2018-0003. Finally, no depression of receiving water dissolved oxygen is evident from SEOO receiving water monitoring.
		Q: *Does the discharge of waste cause the pH to change at any time more than 0.2 pH units from that which occurs naturally outside the ZID?* A: No. As documented in Section 2 and 3, the SEOO pH is typically similar to the pH of ambient receiving waters. As a result, receiving water pH values near the SEOO are similar to pH values at more distant stations. The SEOO discharge has no discernible effect on receiving water pH.
		Q: *Does the discharge of waste cause the salinity to become elevated in the receiving water?* A: Not applicable. The combined SEOO discharge contains significantly lower concentrations of salinity than ambient seawater. Even undiluted brine from the SEWC reverse osmosis process and brine from the proposed City of Escondido MFRO facility will contain salinity concentrations less than 1/6 of typical seawater salinity concentrations.
		Q: *Do nutrients cause objectionable aquatic growth or degrade indigenous biota?* A: Sediment analyses (see Section 4) document that the SEOO discharge does not cause any discernible sediment enrichment. Further, benthic fish and macroinvertebrate data do not indicate any degradation of indigenous biota. SEOO bottom sediments are characterized as coarse to very coarse sands, and no objectionable aquatic growth is observed in the benthic community. Within the water column, dissolved oxygen concentrations in offshore waters near the SEOO remain high throughout the year. Effluent concentrations of nitrogen in the HARRF effluent (the dominant discharge to the SEOO) are typically in the range of 20-30 mg/L, and at a typical dilution well in excess of 237:1, concentrations of nitrogen in receiving waters immediately upon discharge would be elevated by only approximately 0.1 mg/L. Additional dilution and dispersion would occur after initial dilution further reducing nutrient concentrations. During spring and summer months when algal blooms are most prevalent in the SCB region, thermal stratification is strongest and plume trapping depths are greatest. Thus, little probability exists that the SEOO could contribute nitrogen to epilimnion waters during the times of year when the highest potential exists for algal blooms to occur. Numerous studies have attempted to understand and predict the occurrence of harmful algae blooms (HABs). As documented by McGowan et al. (2017), attempts to understand blooms by applying correlation to environmental variables have met with little success, and existing models that employ environmental or anthropologic drivers are unsuccessful in accurately predicting HABs, likely due to the need for a combination of variables to coincide to allow HABs to form. Although preliminary (unpublished and unreviewed) work by SCCWRP suggests that anthropogenic nutrient inputs may contribute to algal primary production along the coast, climate change, rainfall events, silica concentrations, and upwelling are more likely to be the major contributing factors to the proliferation of algal blooms (Gershunov et al., 2019; Gobler et al., 2017; Messie and Chavez, 2015; Rykaczewski and Dunne, 2010; Patti et al., 2008). The bottom line is that HABs have been recorded in the SCB for over a century, yet there is no direct evidence to indicate a correlation with wastewater discharge (Horner et al., 1997; Kim et al., 2009; McGowan et al., 2017.)
		Q: *Is the wastewater plume encroaching upon receiving water areas used for swimming, surfing, diving or shellfish harvesting?* A: No. The concept that the SEOO discharge can move toward shore and affect surf zone water quality is unsupported by any fact. More than 50 years of receiving water data show that shore-based bacteriological exceedances are limited to the shore and typically occur during and after storm runoff events. SEOO nearshore and offshore stations have a documented long history of compliance with REC-1 bacteriological standards. As documented in Section 6 of this RWMR, plume tracking studies confirm that the SEOO discharge is rapidly diluted and becomes indistinguishable from ambient ocean water a few hundred feet from the discharge point. Further, prior to becoming indistinguishable from ambient waters, dispersed and highly diluted remnants of the SEOO discharge water are carried upcoast or downcoast by the prevailing net upcoast/downcoast currents, not toward shore.
		Q: *What is the fate of the discharged plume?* A: As documented in Section 6 of this RWMR, the SEOO discharge is rapidly diluted and is indistinguishable from ambient ocean water quickly after discharge. The SEOO discharge flows (typically significantly lower than maximum allowed flows) are distributed over a lengthy outfall diffuser resulting in high initial dilution rates as a result of the discharge buoyancy and momentum. After initial dilution, the diluted discharge typically ceases to be a conjoined "plume" and is ripped apart and dispersed into remnants by short-term oscillations in ocean currents. Net currents carry this blend of ocean water and diluted discharge remnants downcurrent where additional dilution and dispersion occur.

Table 7-4
Responses to MRP Questions on Benthic Conditions, Fish and Macroinvertebrates

MRP Section	Category	MRP Questions and Responses
IV.C	Benthic Conditions	Q: *Is the dissolved sulfide concentrations of waters in sediments significantly increased above that present under natural conditions?* A: Not applicable. Since the SEOO discharge contains negligible concentrations of settleable solids, the discharge does not result in the deposition of sediments in the vicinity of the outfall. The discharge site continues to be characterized by coarse to very coarse sands. Further, the discharge contains minimal concentrations of CBOD while dissolved oxygen concentrations are typically maintained above 5.0 mg/L. As a result, the potential for anaerobic conditions in the sandy sediments are minimal.
		Q: *Is the concentration of substances set forth in Table 1 of the Ocean Plan for the protection of marine aquatic life in marine sediments at levels which would degrade the benthic community?* A: No. The SEOO discharge complies with all Ocean Plan receiving water standards by significant margins. Few toxic inorganic or organic compounds are detected in the SEOO discharge, and detected compounds are detected at near the detection limit. No threat to marine sediments exist and the benthic community is not degraded.
		Q: *Is the concentration of organic pollutants in marine sediments at levels that would degrade the benthic community?* A: No. As documented in Section 2, the SEOO discharge contains virtually no detectable concentrations of organic pollutants. Further (see Section 4), sediment quality monitoring demonstrates non-detectable concentrations of organic compounds at monitored stations. Further, sediment toxicity tests (see Section 4) show no discernible toxicity.
		Q: *Are benthic communities degraded as a result of the discharge?* A: No. As documented in Sections 4 and 5 of this RWMR, the SEOO discharge does not result in the deposition of organics or solids in the vicinity of the discharge, and sediment quality is not degraded. Further, benthic community data (e.g., species dominance, evenness and diversity) show no evidence of degradation or impact. Finally, sediment data at the SEOO stations show no evidence of toxicity or impact.
		Q: *Is the sediment quality changing over time?* A: No. SEOO sediments continue to be characterized by coarse to very coarse sand and an absence of fine particles. Sediment quality continues to meet applicable standards and thresholds and sediment concentrations of toxic compounds continue to trend lower than SCB averages.
IV.D	Fish and Macro Inverte-brates	Q: *Does the concentration of pollutants in fish, shellfish or other marine organisms used for human consumption bioaccumulate to levels that are harmful to human health?* A: No. As documented in Section 6 of this RWMR, concentrations of toxic compounds in fish tissue collected within Fishing Zone 7 are below ATLs, and sportfish caught for consumption in the SEOO area continue to be safe for consumption. It should also be noted that, because of the existence of the Swami's SMCA, fishing in offshore areas near the SEOO are limited to spearfishing of white seabass and pelagic finfish.
		Q: *Does the concentration of pollutants in marine life bioaccumulate to levels that degrade marine communities?* A: As documented in Section 2 of this RWMR, both the SEWC and HARRF have achieved 100 percent compliance with Ocean Plan receiving water standards for the protection of aquatic habitat. Further, bioaccumulation data collected as part of the Bight '18 regional studies show no significant bioaccumulation in marine life within Fishing Zone 7.
		Q: *Are the concentration of pollutants in fish and other marine organisms changing over time?* A: As noted, concentrations of toxic compounds in the SEOO discharge are typically non-detected or when detected negligible. As a result, the SEOO discharge is unlikely to adversely contribute to concentrations of toxic pollutants in fish or marine organisms. On a regional scale, as documented by SCCWRP (2020c), concentrations of contaminants in sport fish have generally decreased since 2009. SCCWRP (2020c) reports regional decreases in mercury, selenium, DDT and PCBS in Pacific Chub Mackeral and Kelp Bass, the two species caught in the largest number of zones in the 2009 and 2018 regional surveys.
		Q: *Is the health of fish changing over time?* A: As discussed in Section 2, the SEOO discharge contains low concentrations of TSS and CBOD, and concentrations of toxic compounds in the SEOO discharge are typically non-detected or, when detected, near detection limits. As a result, the SEOO discharge is unlikely to adversely impact fish health. On a regional scale, SCWRP (2020c) reports a general reduction in toxic compounds in SCB fish tissue over the past decade. Fish abnormalities are sufficiently rare to not allow meaningful statistical analysis of trends, but the regional decline in fish tissue concentrations of metals and toxic organics suggest that fish health may be improving on a regional scale.
		Q: *Are the populations of selected species of fish and invertebrates changing over time?* A: Populations of fish and invertebrates experience natural cycles of growth and decline as a result of changing oceanographic and climatic conditions. The existence of the SEOO discharge does not affect concentrations of organics or toxic compounds in the water column, in sediments or within the food chain, and does not adversely the natural cycles of varying populations of fish or invertebrates.

State of the Ocean Conclusions. A number of long-period data bases are available to assess the SEOO discharge, including: over a half century of effluent monitoring, receiving water monitoring, sediment monitoring, benthic community monitoring, fish monitoring and bioaccumulation monitoring. On the basis of this lengthy record (and in combination with results from the recently completed plume tracking studies), the following are concluded relative to the SEOO discharge:

1. The SEWC and HARRF treatment facilities achieves high efficiencies in removing TSS, CBOD and other physical/chemical compounds.
2. The SEWC and HARRF influents are free from almost all toxic compounds. Most toxic constituents are below detection limits in the SEWC and HARRF discharges, and the few compounds that are detected are near detection limits.
3. The SEWC and HARRF discharges achieve 100 percent compliance with whole effluent toxicity tests using TST methodology (which presumes a sample to be toxic unless proven otherwise), thus ensuring that unregulated, unknown or unmonitored compounds are not causing toxicity.
4. SEWC and HARRF discharge flows are reduced from historical values as a result of increased recycled water use and water conservation.
5. SEWC and HARRF mass emissions of physical/chemical constituents are reduced from historical values as a result of improved treatment and reduced flows.
6. The SEWC and HARRF treatment facilities consistently achieves compliance with NDPES effluent limitations, performance goals and effluent toxicity standards.
7. The combined SEOO 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.
8. The SEOO discharge is trapped below the ocean surface throughout a significant majority of the year by thermal stratification.
9. The SEOO discharge is rapidly diluted and dispersed, and upon initial dilution becomes indistinguishable from ambient ocean water within several hundred feet of the ZID.
10. During and after the initial dilution process, shear currents can transform the discharge into small fragments which are quickly dispersed and diluted, increasing the overall degree of dilution.
11. The combined SEOO discharge contains negligible (typically non-detectable) amounts of settleable material and has no discernible effect on receiving water sediments.
12. The SEOO discharge has no discernible adverse effects on benthic species populations or diversity.
13. The SEOO discharge has no discernible adverse effect on the health of fish.
14. The SEOO discharge zone (which is a marine protected area) is characterized by high quality ocean water and abundant sea life.
15. The existing SEOO monitoring program is adequate for assessing receiving water quality, sediment quality and receiving water habitats, but some existing receiving water monitoring may be superfluous or unnecessary.

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