

**PLUME TRACKING MONITORING PLAN FOR THE
POINT LOMA AND SOUTH BAY OCEAN OUTFALL REGIONS,
SAN DIEGO, CALIFORNIA**

**Progress Report
March 2024**

Report Period: January – December 2023

City of San Diego Point Loma Wastewater Treatment Plant
(NPDES CA0107409; Order No. R9-2017-0007 as amended by Order No. R9-2022-0078)

City of San Diego South Bay Water Reclamation Plant
(NPDES CA0109045; Order No. R9-2021-0011)

U.S. IBWC South Bay International Wastewater Treatment Plant
(NPDES CA0108928; Order No. R9-2021-0001)

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Background

The Plume Tracking Monitoring Plan (PTMP) was designed to develop new and effective procedures for enhanced water quality monitoring and adaptive plume tracking in the San Diego region. These procedures included: (a) the deployment of real-time oceanographic mooring systems (RTOMS) located near the terminal diffuser wye structures of the Point Loma Ocean Outfall (PLOO) and the South Bay Ocean Outfall (SBOO); (b) deployment of static Acoustic Doppler Current Profiler (ADCP) and thermistor moorings; and (c) deployment and testing of a remotely operated towed vehicle (ROTV; i.e., ScanFish III).

Detailed here are significant activities that have been completed during the past year to achieve the objectives outlined in the PTMP. This Progress Report also details the current timeline of activities for the next year of sampling, including expected RTOMS deployment and recovery dates.

The original scope of the PTMP outlined activities through 2023 and the City is continuing to operate under these guidelines until a new work plan is in place. We are currently in the process of proposing a new workplan for the next 5 years which we plan to submit to the Regional Board for consideration by Dec 31, 2024.

Activities Completed (2023)

For detailed information regarding events prior to the current reporting year, please refer to previously submitted Progress Reports. Further, for real-time data plots from RTOMS deployments in 2023, see the SIO website (PLOO-04: https://mooring.ucsd.edu/ploo/ploo_04/; SBOO-05: https://mooring.ucsd.edu/sboo/sboo_05/).

2022

December

- PLOO RTOMS - Fourth deployment of PLOO RTOMS (12/08/22)

2023

January

- PLOO RTOMS - Inspection and attempted repair of the buoy solar panel to restore power for the AIS and pCO₂ sensor (01/20/23)

February

- ROTV - Damaged ScanFish shell replaced.

March

- 2022 PTMP Progress Report submitted to the Regional Board (03/01/23)
- Completed QA/QC review and assigned qualifiers for RTOMS data through 2022.
- PLOO RTOMS - Completed repair at sea and installed new solar panels on the buoy to restore power for the AIS and pCO₂ sensor (03/13/23)
- SBOO RTOMS – Searched for SBOO RTOMS anchor and bottom cage for 5 hours with Remotely Operated Vehicle (ROV). Visibility was very low; anchor was found but unsuccessfully recovered before the ROV was pulled off location by ocean current

(03/17/2023)

- SBOO static mooring – ADCP and thermistor string recovered and redeployed (03/27/23)
- PLOO static mooring - Failed attempt to recover the PLOO static moorings due to weather conditions (03/29/22)

April

- SBOO RTOMS - SBOO RTOMS bottom cage, mini controller, and anchor was recovered using the ROV (04/06/23). These were the remaining components of the fourth SBOO deployment, including the buoy, that were previously lost to sea in November 2022 after the mooring inductive wire broke free in a storm.
- PLOO static mooring - Failed attempt to recover the PLOO static moorings due to weather conditions (04/07/23).

May

- PLOO static mooring – ADCP recovered using the ROV; unable to recover thermistor strings (05/8/2023)
- PLOO static mooring - ADCP deployment (05/19/2023)

June

- 2022 Annual Interim Receiving Waters Monitoring Report submitted, including RTOMS and ROTV results.
- SBOO RTOMS - Fifth deployment of RTOMS (06/29/2023)
- ROTV - Scheduled ScanFish survey cancelled to accommodate SBOO RTOM deployment, outfall inspections, and Bight-related bongo net sampling.

May

- PLOO static mooring - ADCP recovered using the ROV (05/8/2023)
- PLOO static mooring - ADCP deployment (05/19/2023)

October

- PLOO RTOMS - Recovery of RTOMS (10/26/2023). Mooring sensors severely fouled with commercial fishing drift and hagfish nets. All components throughout the entire water column were entangled in nets and heavy line. Instruments were recovered but unable to recover anchor due to a crack in the A-frame of M/V *Oceanus* that occurred during recovery due to the increased load.
- Failed attempt to recover the PLOO static moorings due to weather conditions (10/31/2023)
- PLOO static mooring - Deployment of a spare thermistor array in place of the thermistors that were unable to be recovered (10/31/2023)

November

- ROTV – Select ScanFish sensors sent to manufacturer for recalibration.

December

- PLOO RTOMS - Recovery of the RTOMS chain and anchor that could not be retrieved in October (12/15/2023). Components severely fouled with commercial fishing nets.
- PLOO RTOMS - Fifth deployment of RTOMS (12/20/2023)
- ROTV - Scheduled ScanFish survey cancelled to accommodate regular sampling and RTOMS deployment (delayed due to cracked A-frame). Planned training with OARS Group ScanFish liaison rescheduled for late February/early March 2024.

Overview of 2023 Activities and Changes to Project Plan

The 2022 PTMP Progress Report, submitted in March 2023, detailed significant issues the City experienced with RTOMS deployment, including delays to servicing several essential oceanographic sensors that subsequently delayed deployment of the RTOMS. Similarly, several challenges to RTOMS deployments and ROTV operations occurred in 2023. Due to the complete loss of the South Bay RTOMS in November 2022 following a mooring wire break during a storm, equipment and instruments required replacement with long lead times. Even when spare parts were available, modifications were required to update to current configurations. In addition, the anchor and bottom controllers needed to be recovered with a remotely operated vehicle prior to redeploying the SBOO mooring. Staffing and other project challenges at the Send lab at the Scripps Institution of Oceanography resulted in delays of buoy assembly and servicing controllers and other components. Given these challenges, the SBOO RTOMS deployment was delayed to the end of June 2023. The recovery of the Point Loma RTOMS in October 2023 presented unique challenges because the mooring was entangled in commercial fishing nets that made recovery difficult. While crew were able to safely recover all instrumentation after a long recovery time, the M/V *Oceanus* suffered damage to the A-frame due to the increased load and the vessel was put out of service for two months. The damage to the A-frame also prevented the recovery of the anchor and chain the same day, so the crew returned later to recover the fouled anchor once the vessel A-frame was repaired.

Lastly, instrument manufacturers have discontinued servicing and production of two instruments. Sea-Bird, the manufacturer of the pH instruments, has been unable to service or produce SeaFET pH instruments since fall 2022, which has hindered our ability to conduct accurate pH monitoring. Sea-Bird was not able to return our deep SeaFET instrument in time for the fifth PLOO RTOMS deployment, so bottom pH data will be absent in 2024. Sea-Bird anticipates resuming service and production of SeaFETs in 2024, though the future of these sensors is unknown. In addition, Chelsea Technologies has discontinued the Uvilux BOD sensor and will no longer service existing sensors. Thus, BOD sensors will not be used on RTOMS going forward.

When possible, the City continued to operate static moorings in both the PLOO and SBOO regions to act as data back-ups for the RTOMS. Although these static moorings are limited in their data collection to temperature and current profiles, they are much smaller and logistically less challenging to retrieve and deploy. However, in 2023, recovery of the static moorings was problematic because several of the bottom-mounted moorings did not surface due to acoustic release failure. This equipment failure resulted in the need to recover the static mooring using the ROV. To date, one static ADCP and two thermistor arrays still need to be recovered as schedule and conditions allow.

Sampling with the City's ROTV has been challenging for several reasons related to technical issues and deployment challenges, as described in prior year reports and above, which may hinder the future usefulness of this technique for plume tracking purposes. In 2023, ROTV operations were not possible due to scheduling conflicts related to Bight '23 sampling, understaffing, and delayed regular sampling caused by the lapse in availability of the City's primary monitoring vessel (M/V *Oceanus*) after it suffered a cracked A-frame. In that time, progress was made toward resolving some of the technical concerns outlined in the 2022 progress report. A new shell was

installed on the ScanFish in February 2023 to address issues with flight thought to be caused by damage stemming from previous equipment crashes and entanglement with fishing gear. New sensors, including a Sea-Bird SeaOwl (CDOM, Chl-*a*, turbidity), a transmissometer, and a pH sensor were purchased with installation planned for 2024. City staff are currently working with the company EIVA (through the company OARS) on City-funded enhancements to the ScanFish software including the integration of real-time sensor calibration calculations and spatial interpolation of the data. Both upgrades are intended to facilitate in-field, real-time assessment and decision making, and to anticipate and reduce the loss of survey time due to technical issues through improved data visualization tools. An issue with a crash of the serial communication system that put a stop to ROTV surveying in 2022 appears to have been resolved in recent dry-land testing. Sea testing is planned to coincide with scheduled training by an OARS-EIVA representative in early March 2024. Concerns about the feasibility of sampling in kelp-dense areas, around shellfish traps, and in the shallow South Bay persist. Feasibility of flying the ScanFish in these areas will be re-assessed during and following the OARS training surveys in early 2024.

Obstacles remain regarding the implementation of an adaptive ROTV sampling program. As the City works to develop an in-house data management system for RTOMS data (currently managed by SIO), a system for automated data flagging and notification is in discussion. However, ROTV surveys on the M/V *Oceanus* require preparations (e.g., winch-spool changeover to a ScanFish compatible wire) that are not easily implemented in a short timeframe. The addition of a new, larger vessel to the City's fleet (planned for end of 2026) may alleviate some of this challenge.

Equipment Issues from Current Reporting Period: 2023

M/V OCEANUS

- *November - December 2023*: Redesign and fabrication of the vessel's A-frame after damage caused during the recovery of the PLOO-4 RTOMS (10/26/23).

PLOO-04

- *January – December 2023*: Entire mooring, specifically from 10 m to the bottom, became severely fouled in a commercial drift fishing net and at least 8 hagfish nets and buckets. In addition to an extremely difficult recovery, this likely resulted in many sensor problems that began early in the deployment (01/09/23). The fishing net was thickly wrapped around several sensors, and it may have caused damage and restricted flushing of sensor flow paths. Data quality will be carefully reviewed for problems due to the nets.
- *January – December 2023*: Pro-Oceanus pCO₂ sensor @ 1 m (surface): after one month deployed, no values reported for the remainder of the deployment due to a lack of power. The solar panels had broken free or were stolen (01/09/23). Repair and replacement of the solar panels were completed at sea (03/16/23); however, a solar panel was lost again before the batteries had been sufficiently charged to power the pCO₂ sensor (03/21/23).
- *January – December 2023*: Sea-Bird SeapHOx pH sensor @ 75 m: salinity (conductivity) measurements for the SBE37-ODO part of the package were faulty upon

deployment (12/08/22) and external pH was not calculated due to missing salinity data. Conductivity sensor problem resolved itself and appeared to report reasonable salinity and external pH values (12/17/22). However, the instrument began reporting low out of range oxygen values (02/03/23) and pH values subsequently drifted low. Upon recovery of the instrument, it was noted that the intake was still taped, which would interfere with the flow and flushing of the salinity, oxygen, and pH values. Unfortunately, these data are all suspect for the duration of the deployment due to the taped flow path.

- *January – December 2023*: Sea-Bird SBE37-ODO sensor @ 90 m: sensor communications failed prematurely and unable to receive data or communicate with sensor (01/09/23). Upon recovery, a cable locking sleeve was found loose and a bulkhead was loose on the mini controller, resulting in flooding of the controller. Stress was likely put on the connections due to the entanglement in fishing nets. Data recovery will be attempted directly from the sensor internal memory for the duration of the deployment where the sensor had sufficient internal power for sampling.
- *January – December 2023*: Sea-Bird pump @ 30 m: after mooring recovery and during disassembly, pins broke off the bulkhead connector for the pump, likely due to corrosion and water leakage into the connector. Data collected in the pumped flow path (nitrate and BOD measurements) will be carefully reviewed for possible flushing problems due to possible premature pump failure.
- *March 2023*: Communication to mooring temporarily lost and data stopped reporting to website from all depths (03/06/23). Surface controller manually reset on buoy and real-time data began reporting again (03/13/22).
- *June 2023*: Data stopped reporting to website from all depths (06/17/23). Server issue at UCSD resolved and real-time data began reporting again (06/23/22).
- *June – September 2023*: Sea-Bird SUNA nitrate sensor @ 75 m: instrument began reporting negative and noisy values (06/13/23) and noise continued through the beginning of September (09/02/23). Values reported appear in reasonable range for remainder of deployment and data will be compared to nitrate water sample results.
- *January – December 2023*: Sea-Bird ECO triplet sensor @ 1 m and 30 m: chlorophyll, CDOM, and turbidity data channels reported intermittently high and noisy values on the surface and mid-depth sensors (01/11/23 and 02/25/23; respectively) through much of the deployment. In addition to typical biofouling of sensors, the entanglement of the fishing nets likely interfered with sensor measurements.
- *January 2023*: Teledyne RDI ADCP instrument @ 1 m: current and backscatter data values were noisy and showed atypical patterns (01/11/23 – 01/15/23) and subsequently recovered to reasonable values. Due to the timing with other sensor problems, the entanglement of fishing nets likely interfered with sensor measurements.

SBOO-05

- *July 2023*: Sea-Bird ECO triplet sensor @ 26 m: sensor stopped reporting data and lost all communication (07/03/23). Problem will be investigated on recovery.
- *July 2022*: Chelsea Uvilux BOD sensor @ 26 m: instrument reset and lost memory of calibration coefficients (07/05/23). Data can be corrected in post-processing; however, sensor began recording null values more frequently.

- *July – December 2023*: Scripps custom-built controller @ 26 m: controller stopped working and stopped sending data (07/28/23). Controller gave error messages and unable to resume sampling remotely. After the mooring is recovered in summer 2024, attempts will be made to recover the SeapHox data (temperature, salinity, oxygen, and pH) recorded internally in the instrument. However, the other instruments (nitrate, chlorophyll, CDOM, turbidity, and BOD) require a functional controller to collect data, so those parameters are a complete loss for the remainder of the deployment at the bottom depth.
- *August 2023*: Sea-Bird ECO triplet sensor @ 1 m: turbidity channel began reporting noisy and high values intermittently (08/30/23) through the remainder of the year, possibly due to bubbles or fouling in the flow path. However, the chlorophyll and CDOM channels had much higher data quality than prior deployments, likely due to the addition of a flow cell for the surface instrument.
- *September 2023*: Sea-Bird SUNA nitrate sensor @ 1 m: instrument began reporting noisy and out of range values (09/03/23 - 09/17/23), possibly due to fouling of flow path. Values reported appear in reasonable range for remainder of deployment and data will be compared to nitrate water sample results.
- *November – December 2023*: Pro-Oceanus pCO₂ sensor @ 1 m: instrument stopped reporting data; suspected due to power loss from failure of solar charging system (11/04/23). Upon visual inspection of buoy, no obvious problems were noted.
- *November – December 2023*: Sea-Bird SeapHox pH sensor @ 1 m (surface): pH values dropped significantly low out of range (11/24/24) and noise occurred in both internal and external electrodes. Values are suspect for the remainder of the deployment.

PLOO-05

- *December 2023*: Sea-Bird ECO triplet sensor @ 1 m: initial CDOM and turbidity values were high, likely due to bubbles in the flow path of the surface flow chamber (12/20/23). After one day, data returned to reasonable values (12/21/23).
- No other issues noted for the current PLOO RTOMS deployment.

ROTV

- *January – December 2023*: ROTV operations not completed due to a need to prioritize other regulatory requirements (i.e. Southern California Regional Bight 2023 sampling, RTOMS deployments, ROV outfall inspections, regular sampling, equipment recovery), and due to the M/V Oceanus being out of service with a cracked A-frame (from late October through late December 2023)

Planned Activities (2024)

The City continues to assess the effectiveness of the PTMP to develop a revised workplan for future mooring deployments to assist in wastewater plume tracking. A revised work plan will be presented to the Regional Board for consideration by December 31, 2024, but in the meantime, the City will continue to implement the *2018 Plume Tracking Monitoring Plan for the Point Loma and South Bay Ocean Outfall Regions*.

2024*January*

- Assess future of Adaptive Plume Tracking for PLOO and SBOO. Develop work plan for future effort.

February

- Complete analysis of data from PLOO and SBOO RTOMS for inclusion in the City's 2022 – 2023 Biennial Receiving Waters Monitoring and Assessment Report.
- ROTV - Install Sea-Bird Sea-Owl onto the scanfish

March

- Submit 2023 PTMP Progress Report.
- ROTV - training and complete ROTV surveys in PLOO and assessment of feasibility of operations
- Complete QA/QC review and assign qualifiers for RTOMS data through 2023.

April

- PLOO static moorings - ROV recovery attempt of missing static moorings
- SBOO static moorings – retrieval and redeployment of static ADCP and thermistor moorings

May

- ROTV - Tentative ScanFish survey following quarterly water quality sampling

June

- Submit 2022 – 2023 Biennial Receiving Waters Monitoring and Assessment Report, including results from RTOMS and RTOV
- SBOO RTOMS - Retrieval of fifth RTOMS

August

- ROTV - Backup dates for ScanFish survey following quarterly water quality sampling

September

- SBOO RTOMS - Deployment of sixth SBOO RTOMS
- PLOO/SBOO static moorings - Retrieval and redeployment of static ADCP and thermistor moorings in both regions.

November

- PLOO RTOMS - Retrieval of fifth PLOO RTOMS

December

- PLOO RTOMS - Deployment of sixth PLOO RTOMS