

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

**Progress Report
March 2023**

Report Period: January – December 2022

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. As detailed in this and prior reports, the deployment of both the SBOO and PLOO moorings have encountered numerous challenges related to COVID-19 supply chain disruptions, equipment loss, equipment damage, sensor problems, and more, all of which have impacted the ability of the City of San Diego (City; CSD) to follow the original schedule outlined in the 2018 PTMP. Through the end of 2022, three PLOO RTOMS deployments have been completed and four SBOO RTOMS deployments have been completed, with PLOO RTOMS currently deployed for a fourth time. The SBOO RTOMS was lost during rough sea conditions in November 2022, thus the next deployment has been delayed and is currently planned for mid-2023. This Progress Report also details the current timeline of activities for the next year of sampling, including expected RTOMS deployment and recovery dates.

Activities Completed (2022)

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 2022, see the SIO website (PLOO-03: https://mooring.ucsd.edu/ploo/ploo_03/; SBOO-04: https://mooring.ucsd.edu/sboo/sboo_04/).

2021

November

- Third PLOO RTOMS and fourth SBOO RTOMS deployments (11/03/21)

2022

February

- SBOO Static instruments recovered and redeployed (02/28/22)

March

- 2021 PTMP Progress Report submitted to the Regional Board.
- PLOO Static instruments recovered and redeployed (03/02/22)

April

- Completed QA/QC review and assigned qualifiers for RTOMS data through 2021.
- Completed initial QA/QC review of ROTV data collected through 2021.

June

- 2020-2021 Biennial Receiving Waters Monitoring & Assessment Report submitted, including new Plume Dispersion chapter that included RTOMS and ROTV results

September

- ROTV towed in PLOO region. One 100m transect was completed. A serial data communication failure, occurring around mid-day, caused cessation of sampling (09/14/22).
- ROTV towed in PLOO region. Two 100m transects were completed. A crash occurred around 10:30 am, sampling was resumed after inspection. A serial data communication failure, occurring at the start of an attempt to capture the 80m transect, caused cessation of sampling (09/15/22).
- Static instruments recovered and redeployed at SBOO (9/19/22) and PLOO (9/21/22)

November

- SBOO RTOMS mooring wire broke and the buoy, along with several attached instruments, drifted directly to shore in Mexico (11/03/22). Retrieval was not possible due to rough sea conditions, and the drifting equipment was lost to sea. A recovery attempt for the anchor and any remaining sensors is planned for 2023.
- Retrieval of third PLOO RTOMS (11/22/22)

December

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

Overview of 2022 Activities and Changes to Project Plan

The 2021 PTMP Progress Report, submitted in March 2022, detailed significant issues the City experienced with COVID-related supply chain disruptions and deployment challenges, which resulted in the delayed servicing of a number of essential oceanographic sensors, subsequently delaying the deployment of the RTOMS. In similar fashion, 2022 presented a host of challenges for the deployment and operation of the RTOMS and the ROTV including the complete loss of the South Bay RTOMS. Furthermore, as detailed in last year's report, the City is still operating with only one functional vessel, which has significantly hampered operations and our ability to deploy, retrieve, and service either RTOMS. In August 2022, the City informed the Regional Board of ongoing attempts to establish a contract for boat maintenance services to get both vessels operational again. However, as of submitting this report, no resolution has yet been found. Thus, issues are expected to persist throughout early 2023.

Despite continued challenges with the RTOMS for much of 2022, the City continued to operate static moorings in both the PLOO and SBOO regions to act as data backups for the RTOMS. These static moorings are more limited in their data collection, which only includes temperature and current data, but as they are much smaller and logistically less challenging to retrieve and deploy, they are much less likely to experience any notable challenges that would impact their continued operation. Additionally, these static moorings are serviceable from the City's smaller vessel, the Monitor III.

Sampling with the City's ROTV has proven to be quite challenging for a number of reasons related to technical issues and deployment challenges, as described in prior year reports, which may also

hinder the future usefulness of this technique for plume tracking purposes. In 2022, ROTV operations were significantly hobbled by the loss of the City's primary monitoring vessel (the Oceanus) due to engine failure. As a result, other sampling activities took priority, which left little time to deploy the ROTV. Additionally, ongoing issues with serial communication caused frequent sampling interruptions. ROTV operators suspect that past body damage caused by obstacles and abandoned fishing gear (see prior Progress Reports for details) resulted in decreased flight stability, which may be a root cause of communication failure. Furthermore, technical challenges related to software and access to replacement parts delayed operations, as there is no local support available. Therefore, only one partial survey was completed in 2022, which took place in the PLOO region in September. Data from this survey will be included in the 2022-2023 Biennial Report and the ROTV Pilot Study Report.

The limited ROTV sampling that occurred in September 2022 captured ocean conditions that generally agreed with what was observed by CTD instrumentation around that time. The ROTV's WetLabs Wetstar colored dissolved organic matter (CDOM) sensor logged a weak CDOM signature, indicating a possible detection of a diffuse and submerged plume. However, calibration of that sensor was performed several months prior to deployment (July 2021), and as a result, the data appear to be significantly offset from the normal range for CDOM in the PLOO region, with the range including negative values, thus indicating significant sensor drift. A post-cruise calibration in December of 2022 improved the range, but negative values remain in the dataset. Future ROTV efforts will include more frequent calibration of the CDOM sensor, taking care that the "blank" calibration is done with lab-grade "millipure" water. Patterns in optical brighter results observed in the September survey also showed a weak effluent plume signature, but the spatial patterns in optical brightener data and the CDOM maxima only partially overlapped. Since 2021, the ROTV has shown potential for accurately characterizing the effluent plume at PLOO, despite the challenges of developing these novel methods. Its ongoing utility in effluent plume characterization will be further assessed when final analysis and interpretations are completed for the upcoming ROTV Pilot Study Report and the revised plume tracking work plan.

Equipment Issues from Current Reporting Period: 2022

PLOO-03

- *January – November 2022:* Pro-Oceanus pCO₂ sensor @ 1 m (surface): began showing faulty data after three weeks of deployment and reported reasonable data only every twelve hours during the internal blank zero calibration cycle. Sensor also exhibited suspect downward trend in pCO₂ values that did not appear to match other data (e.g. pH and DO). In addition, no values reported near the end of the deployment due to a failure with the solar power system (10/07/22).
- *January – November 2022:* Sea-Bird Deep SeapHOx pH sensor @ 75 m: failed prematurely and began reporting noisy and bad low pH values down to 3.7 pH after two weeks deployed. The SBE37-ODO continued to report good temperature, salinity, and dissolved oxygen data throughout the deployment.
- *January 2022:* Sea-Bird SeapHOx pH sensor @ 1 m (surface): batteries for the SBE37-ODO part of the package ran out prematurely after two months deployed, and the

problem fixed remotely by sending a command to switch power source to controller batteries.

- *January 2022*: Chelsea Uvilux BOD sensor @ 75 m: instrument reset and lost memory of calibration coefficients (01/18/22). BOD data was fixed in post-processing and correct coefficients were applied.
- *January 2022*: Communication to mooring lost and data stopped reporting to website (01/23/22). Surface controller manually reset on buoy and real-time data began reporting again (01/28/22). ADCP current profiler operation stopped during this time and instrument had to be restarted and logging was reinitialized.
- *February 2022*: GPS beacon on the surface buoy failed (02/12/22) and a new beacon was installed on the buoy while deployed.
- *March – August 2022*: Sea-Bird ECO triplet sensor @ 1 m: CDOM and turbidity data channels became noisy (03/04/22 and 03/11/22; respectively) and suspect values continued through the end of August.
- *April – November 2022*: Sea-Bird SUNA nitrate sensor @ 75 m: instrument failed (03/31/22) and reported primarily null values through the end of the deployment, with sparse reasonable data collected intermittently.
- *June 2022*: Communication to mooring lost and data stopped reporting to website (06/06/22). Surface controller manually reset on buoy and real-time data began reporting again (06/08/22).
- *July – November 2022*: Sea-Bird SBE37IM sensor @ 21 m: instrument began reporting faulty salinity data (07/19/22) and noted on recovery that the conductivity cell guard had fallen off and cell was damaged.
- *September – November 2022*: Solar power system failure due to vessel collision and batteries for operating pCO₂ sensor and AIS unit stopped providing sufficient power (09/04/22). Cable for solar system repaired on the buoy (09/12/22) and pCO₂ and AIS began sampling again, but the solar power connections failed again (09/30/22) and pCO₂ and AIS stopped for remainder of deployment.
- *October – November 2022*: Sea-Bird Deep SeapHOx pH sensor and SBE37-ODO temperature, salinity, oxygen sensor @ 1 m (surface): instruments failed and stopped reporting data (10/09/22).

SBOO-04

- *January 2022*: Sea-Bird SeapHOx pH sensor @ 26 m (bottom): batteries for the SBE37-ODO part of the package ran out prematurely after two months deployed (01/06/22), and problem fixed remotely by sending a command to switch power source to controller batteries (01/20/22).
- *February 2022*: Sea-Bird SeapHOx pH sensor @ 1 m (surface): batteries for the SBE37-ODO part of the package ran out prematurely (02/16/22), and problem fixed remotely by sending a command to switch power source to controller batteries (02/25/22).
- *March 2022*: Sea-Bird SBE37-ODO sensor @ 18 m: batteries failed prematurely (03/16/22) and problem fixed by sending a command to switch power source to controller batteries (03/25/22).

- *April 2022*: Chelsea Uvilux BOD sensor @ 26 m: instrument reset and lost memory of calibration coefficients (04/21/22).
- *July 2022*: Solar power system failure and batteries for operating Pro-Oceanus pCO₂ sensor and AIS unit stopped providing sufficient power (07/05/22), due to presumed vessel collision. Cable for solar system repaired on the buoy (07/20/22) and pCO₂ and AIS began sampling again after batteries sufficiently charged (07/25/22).
- *October 2022*: Pro-Oceanus pCO₂ sensor @ 1 m: instrument stopped reporting data; suspected due to power loss from solar charging system failure (10/24/22).
- *November 2022*: Surface buoy broke free from the anchor during a storm with high winds and large swells (11/03/22). Crew attempted to recover on the same day it broke, but conditions were too poor and unsafe to conduct any ocean operations. Crew attempted recovery the following week after the storm, but buoy had washed ashore along rocky cliffs in Mexico and safe recovery was not possible. Buoy and associated equipment lost to sea. Due to where the real-time data stream was lost, suspected that mooring cable broke between the 10 and 18 m instrument packages. Lower half of mooring instruments and anchor remain on the ocean floor, and recovery of remaining equipment will be attempted via ROV when feasible.

PLOO-04

- *December 2022*: 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 began reporting reasonable salinity and external pH values (12/17/22).

ROTV

- *January – August 2022*: The Oceanus vessel was unavailable for ROTV operation due to engine failure (though April, 2022), a need to prioritize other regulatory requirements (i.e. regular sampling and ROV outfall inspections), and a need to complete sea trials of the new Oceanus engine (through July, 2022).
- *September 2022*: RS-232 communication with the SBE 25+ failed (9/14/22). ROTV brought on board for diagnostics. Communication was re-established but sampling was cancelled for the day in order to address other concerns about battery life and cabling issues. *September 2022*: ROTV flipped and crashed mid-flight (9/15/22). Suspect a run-in with a kelp patty. ROTV brought on board for inspection. Systems appeared unaffected and sampling was resumed.
- *September 2022*: RS-232 communication with the SBE 25+ failed (9/15/22).
- *November 2022*: ROTV sampling was unable to go ahead due to other permit-required sampling needs.

Planned Activities (2023)

Now that the City has completed the original planned term of the Plume Tracking Monitoring Plan (2018-2022), we are actively working on a revised work plan to present to the Board for future plume tracking efforts. A full assessment of the past 5 years of these data collection efforts is ongoing to evaluate the future effectiveness of the equipment and techniques trialed during this term to determine the most effective path forward. A revised work plan will be presented to the Board for consideration, 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*.

2023

January

- Assess future of Adaptive Plume Tracking for PLOO and SBOO – consult with SIO and Regional Board for direction. Develop work plan for future effort.

February

- Complete analysis of data from PLOO and SBOO RTOMS for inclusion in the City's 2022 Interim Receiving Waters Monitoring and Assessment Report.

March

- Submit 2022 PTMP Progress Report.
- Retrieval and redeployment of static ADCP and thermistor moorings in PLOO and SBOO regions.
- Complete QA/QC review and assign qualifiers for RTOMS data through 2022.
- ROV recovery attempt of SBOO-03 anchor and remaining attached sensors.

June

- Submit 2022 Interim Receiving Waters Monitoring and Assessment Report, including results from RTOMS.
- Fourth deployment of SBOO RTOMS
- ROTV Survey in PLOO and investigation of SBOO surface or near-surface transects

September

- Retrieval and redeployment of static ADCP and thermistor moorings in PLOO and SBOO regions.

November

- Fourth retrieval of PLOO RTOMS.

December

- ROTV Survey in PLOO and investigation of SBOO surface transects or near-surface transects