Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Watershed Monitoring and Assessment Program

Integrated Monitoring Report

Part A: Low Impact Development (LID) Monitoring Status Report

Water Years 2023-2025

Submitted in compliance with provisions C.8.h.iii.(3) and C.8.h.v of NPDES Permit No. CAS612008, Order No. R2-2022-018

March 31, 2026

This report is submitted by the agencies participating in the

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

City of Campbell
City of Cupertino
City of Los Altos
Town of Los Altos Hills
Town of Los Gatos
City of Milpitas
City of Monte Sereno
City of Mountain View
City of Palo Alto
City of San José
City of Santa Clara
City of Saratoga
City of Sunnyvale
County of Santa Clara
Valley Water

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ACCWP	Alameda Countywide Clean Water Program
BAMSC	Bay Area Municipal Stormwater Collaborative
BMP	Best Management Practices
BSM	Bioretention Soil Media/Mix
CCCWP	Contra Costa Clean Water Program
CEC	Constituent of Concern
CEDEN	California Environmental Data Exchange Network
CTR	California Toxics Rule
DMA	Drainage Management Area
DNQ	Detected Not Quantified
DQO	Data Quality Objective
EDD	Electronic Data Deliverable
EPA	U.S. Environmental Protection Agency
ER	Efficiency Ratio
ESL	Environmental Screening Levels
GSI	Green Stormwater Infrastructure
HDPE	High Density Polyethylene
IMR	Integrated Monitoring Report
KEI	Kinnetic Environmental, Inc.
LER	Loads Efficiency Ratio
LID	Low Impact Development
MQO	Measurement Quality Objective
MDL	Method Detection Limit
MRP	Municipal Regional Permit
MS4	Municipal Separate Storm Sewer System
ND	Non-Detect
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and Maintenance
PAW	Plant Available Water
PCBs	Polychlorinated Biphenyls
PFAS	Per- And Polyfluoroalkyl Substances
QA	Quality Assurance
QAPP	Quality Assurance Project Plan

RE	Removal Efficiency
RL	Reporting Limit
RMC	Regional Monitoring Coalition
RMP ECWG	Regional Monitoring Program, Emerging Contaminants Working Group
RPD	Relative Percent Difference
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SFEI	San Francisco Estuary Institute
SM	Standard Methods
SMCWPPP	San Mateo Countywide Water Pollution Prevention Program
SSA	Solano Stormwater Alliance
SWAMP	Surface Water Ambient Monitoring Program
TAG	Technical Advisory Group
TMDL	Total Maximum Daily Load
TOP	Total Oxidizable Precursors
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
UCMR	Urban Creeks Monitoring Report
VER	Volume Efficiency Ratio
WQO	Water Quality Objectives
WY	Water Year

1.0 INTRODUCTION

This *Integrated Monitoring Report (IMR) Part A: Low Impact Development (LID) Monitoring Status Report*, *Water Years (WY) 2023-2025* was prepared by the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP or Program), on behalf of its 15 member agencies (13 cities/towns, the County of Santa Clara, and Valley Water), which are subject to the National Pollutant Discharge Elimination System (NPDES) stormwater permit for Bay Area municipalities referred to as the Municipal Regional Permit (MRP).

The MRP was first adopted by the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB or Regional Water Board) on October 14, 2009, as Order R2-2009-0074 (SFBRWQCB 2009; referred to as MRP 1.0), and was updated and reissued on November 19, 2015, as Order R2-2015-0049 (SFBRWQCB 2015; referred to as MRP 2.0). The current and third version of the MRP (i.e., MRP 3.0; SFBRWQCB 2022) was issued by the Regional Water Board as Order R2-2022-0018 and became effective July 1, 2022. The next iteration of the MRP (MRP 4.0) is anticipated to be adopted in July 2027.

This report fulfills the requirements of Provision C.8.h.iii.(1) and Provision C.8.h.v of MRP 3.0 for summarizing LID monitoring accomplishments from the preceding water year (i.e., WY 2025) conducted in compliance with Provision C.8.d (LID Monitoring) of the MRP. Additionally, in compliance with Provision C.8.h.v, this report summarizes the methods and study designs; lessons learned; and data, results, analyses, and conclusions for all samples collected during the Permit term to date, as well as providing recommendations for changes to Provision C.8.d in future permits. For the LID Monitoring IMR, this range covers all data and analysis from WY 2024 and WY 2025; all data covered here have also been submitted to the California Environmental Data Exchange Network (CEDEN). A budget summary of Provision C.8.d monitoring, also required per Provision C.8.h.v, has been submitted as a separate “Part” of the IMR.

2.0 BACKGROUND

Low Impact Development (LID) is a land planning and engineering design approach with a goal of reducing stormwater runoff and mimicking a site’s predevelopment hydrology by minimizing disturbed areas and impervious cover and infiltrating, storing, detaining, evapotranspiring, and/or biotreating stormwater runoff close to its source, or onsite (EOA 2019). Incorporation of post-construction LID measures into new development and redevelopment projects has been a key aspect of SCVURPPP stormwater management for nearly 20 years, and each iteration of Provision C.3 of the MRP has prescribed progressively more specific and stringent LID design and siting criteria.

During WY 2023, following adoption of MRP 3.0 and the new requirement to conduct LID effectiveness monitoring, the Bay Area Municipal Stormwater Collaborative (BAMSC)[1] formed the LID Monitoring Workgroup to assist all MRP Permittees with compliance with Provision

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[1] The Bay Area Stormwater Management Agencies Association (BASMAA) recently dissolved as a formal non-profit organization, but its members continue to meet as an informal organization called the Bay Area Municipal Stormwater Collaborative (BAMSC).

C.8.d. In WY 2025, the Workgroup was absorbed into the BAMSC Regional Monitoring Coalition (RMC). In addition to SCVURPPP, other members of the RMC include:

- Alameda Countywide Clean Water Program (ACCWP)
- Contra Costa Clean Water Program (CCCWP)
- San Mateo Countywide Water Pollution Prevention Program (SMCWPPP)
- Solano Stormwater Alliance (SSA)

Throughout WYs 2023 through 2025, SCVURPPP continued to work with other countywide stormwater programs as part of the BAMSC LID Monitoring Workgroup (now RMC). The BAMSC RMC meets every other month to discuss implementation of LID monitoring, sampling and equipment issues, revisions to the LID monitoring plans and the Regional Quality Assurance Project Plan (QAPP), and to plan Technical Advisory Group (TAG) meeting. The BAMSC RMC also facilitates ongoing discussions with Water Board staff and TAG members.

2.1 LID Monitoring Requirements

MRP 3.0 is the first version of the MRP to specifically require LID effectiveness monitoring for all Permittees. Provision C.8.d directs Permittees to conduct LID monitoring during the permit term, and identifies specific parameters and monitoring frequencies that must be achieved to address the following management questions:

1. What are the pollutant removal and hydrologic benefits, such as addressing impacts associated with hydromodification, of different types of LID facilities, systems, components, and design variations, at different spatial scales (e.g., single control vs watershed or catchment scale), and how do they change over time?
2. What are the minimum levels of operations and maintenance (O&M) necessary to avoid deteriorated LID facilities, systems, and components that reduce pollutant removal and hydrologic performance?

In Santa Clara County, a minimum of 25 water quality sampling events must be conducted during the MRP 3.0 permit term, with an annual minimum of three events beginning in WY 2024. Each sampling event must consist of paired flow- (or time) weighted composite samples of the LID facility influent and effluent collected with automated samplers. Provision C.8.d.iv of the MRP specifies that all composite samples must be analyzed for total mercury, total polychlorinated biphenyls (PCBs) [2], total suspended solids (TSS), per- and polyfluoroalkyl substances (PFAS), total petroleum hydrocarbons (TPH), total and dissolved copper, total hardness, and hydrogen ion concentration (pH). In addition, flow must be measured at both influent and effluent sampling locations. Through ongoing discussions with Water Board staff and Technical Advisory Group (TAG) members, additional analytes were incorporated into the

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[2] Total PCBs are calculated as the sum of the Regional Monitoring Program (RMP) 40 congeners which include: PCB-8, PCB-18, PCB-28, PCB-31, PCB-33, PCB-44, PCB-49, PCB-52, PCB-56, PCB-60, PCB-66, PCB-70, PCB-74, PCB-87, PCB-95, PCB-97, PCB-99, PCB-101, PCB-105, PCB-110, PCB-118, PCB-128, PCB-132, PCB-138, PCB-141, PCB-149, PCB-151, PCB-153, PCB-156, PCB-158, PCB-170, PCB-174, PCB-177, PCB-180, PCB-183, PCB-187, PCB-194, PCB-195, PCB-201, PCB-203.

monitoring design, which include dissolved mercury and dissolved and total zinc. Permittees also agreed to measure flow continuously throughout the wet season at both influent and effluent sampling locations.

Permittees were required to develop LID Monitoring Plans at the regional or countywide level that demonstrate how the requirements in Provision C.8.d.iii-iv will be met. Permittees were required to submit their Monitoring Plans to the Water Board Executive Officer for approval by May 1, 2023, and begin implementation of their approved or conditionally approved Monitoring Plans by October 1, 2023 (WY 2024). Permittees continue to implement approved or conditionally approved Monitoring Plans, with monitoring data now available through WY 2024 and WY 2025.

2.2 Technical Advisory Group

To assist development and implementation of scientifically-sound LID Monitoring Plans, to facilitate regional consistency with respect to sampling and analytical methodology, and to make recommendations about allocation of samples between and within different sites, Provision C.8.d.ii required Permittees to form and convene a Technical Advisory Group (TAG). The TAG includes impartial science advisors and Water Board staff. The TAG must meet biannually prior to approval or conditional approval of the LID Monitoring Plans, and annually thereafter.

During WY 2023, the BAMSC LID Monitoring Workgroup formed and convened a TAG, which included the following science advisors and Water Board staff:

- Keith Lichten, Division Chief at the San Francisco Bay Regional Water Board.
- Alicia Gilbreath, Environmental Scientist at the San Francisco Estuary Institute (SFEI).
- Dipen Patel, Research Engineer at the Office of Water Programs at Sacramento State.
- Eric Strecker, Professional Engineer in California and Oregon and principal investigator of the International BMP Database for over 20 years.
- Michael K. Stenstrom, Distinguished Professor at UCLA Civil and Environmental Engineering Department.

During WY 2024, the LID TAG met once, on April 19, 2024. The focus of that meeting was discussion related to revisions of LID Monitoring Plans, as described in Section 2.3.2 below.

During WY 2025, the LID TAG met once on May 9, 2025. The focus of that meeting was to review additional understanding gained and challenges encountered through WY 2025 monitoring efforts, consider proposed changes to monitoring protocols to be incorporated in advance of WY 2026 monitoring, and discuss data analysis and reporting options to be reflected in this IMR.

2.3 LID Monitoring Plans and QAPP

The LID Monitoring Plans must explain how the monitoring will address the management questions, describe the LID facilities that will be monitored, list monitoring parameters and analytical methods, describe monitoring equipment and methods, establish a monitoring schedule, describe data evaluation methods, include a QAPP, provide annual cost estimates for implementation of the plan, and explain how sampling and analytical methods will be regionally consistent.

2.3.1 LID Monitoring Plan and QAPP Submitted During WY 2023

SCVURPPP Permittees submitted their LID Monitoring Plan and a regional QAPP to the Water Board on May 1, 2023. The Water Board conditionally approved the regional QAPP and all of the LID Monitoring Plans submitted by MRP Permittees in a letter sent to the BAMSC stormwater programs on August 23, 2023. The Conditional Approval added several new and potentially significant monitoring requirements and required development and submittal of a revised monitoring plan and QAPP to provide expanded discussion and/or clarification of selected topics. However, Water Board staff agreed that monitoring in WY 2024 could follow the approaches described in the May 1, 2023 LID Monitoring Plan and QAPP (i.e., SCVURPPP 2023 and BAMSC 2023).

2.3.2 LID Monitoring Plan and QAPP Revisions During WY 2024

In the conditional approval of the LID Monitoring Plans and regional QAPP submitted in WY 2023, Water Board staff requested additional meetings with the BAMSC programs to discuss and resolve all remaining issues. The BAMSC LID Monitoring workgroup held a series of meetings with Water Board staff beginning in September 2023 to propose responses to Water Board comments and find resolution prior to developing and submitting revised LID Monitoring Plans. These discussions continued throughout the fall season and were able to resolve a number of the issues raised in the Conditional Approval letter. However, there were several remaining issues that required TAG input. Discussion of these remaining issues was the primary focus of the LID TAG meeting that was held on April 19, 2024. Some of the issues that were discussed with the TAG included the addition of continuous turbidity monitoring, analysis of dissolved mercury, field filtering (vs. lab filtering) for dissolved parameters, addition of influent/effluent sample tubing field blanks at the end of each wet season, and refinement of storm criteria. Following the April 2024 TAG meeting, the BAMSC LID Monitoring Workgroup summarized the TAG and Water Board comments and proposed revisions to the LID Monitoring Plans and regional QAPP to address all remaining issues and reflect improved understanding gained during the initial year of monitoring implementation. In August 2024, a final meeting with Water Board staff was held to discuss the proposed LID Monitoring Plan and QAPP updates and revisions.

Working in collaboration with BAMSC LID Monitoring Workgroup, the SCVURPPP LID Monitoring Plan and regional QAPP were revised to reflect better understanding of facility functioning and issues faced during WY 2024 monitoring, and to address all Water Board comments on the documents submitted in May 2023. Per agreement with Water Board staff, revised versions of the LID Monitoring Plan and regional QAPP were submitted to the Water Board on October 31, 2024 (SCVURPPP 2024, BAMSC 2024). All new elements in the revised LID Monitoring Plan and QAPP were implemented starting in Water Year 2025.

2.3.3 LID Monitoring Plan and QAPP Revisions During WY 2025

During WY 2025, Version 1.1 of the approved QAPP (BAMSC 2024) was revised to incorporate proposed modifications to the LID monitoring program that had been subject of discussion with Water Board staff and TAG members. Changes to the QAPP included edits to site descriptions to reflect structural modifications made to specific sites since issue of Version 1.0, changes to field and laboratory blanking protocols to reflect findings from first two years of monitoring implementation, edits to multiple sections of the QAPP to reflect changes associated with the finalization of EPA method 1633 for analysis of PFAS, and changes to reporting of PFAS data to maintain consistency with revised CEDEN controlled vocabulary. The revised QAPP (Version 2.0; BAMSC 2025) was reviewed and tentatively approved by Water Board on October 10, 2025 and was submitted to the Water Board by BAMSC in November 2025.

Several of the QAPP modifications required revisions to the SCVURPPP LID Monitoring Plan (SCVURPPP 2024). These changes are documented in an Addendum, dated October 2025, which is submitted with this IMR as Appendix A. The Addendum also documents design changes to one of the SCVURPPP LID facilities selected for monitoring. During WY 2024, effluent was not observed at the TCM4 Bioretention Facility despite mid-year patches to leaks in the overflow vault. Although this suggests that 100% treatment may have been achieved through infiltration, it prevented collection of paired influent/effluent samples as required under MRP Provision C.8.d. In May 2024, the City of San José's construction contractor implemented more extensive repairs to the facility to prevent leaks, but effluent was still not observed during the WY 2025 rainy season. Consequently, monitoring equipment was removed from this device and TCM4 will not be used for monitoring moving forward, beginning in WY 2026.

2.4 Reporting Requirements

Permittees are required to submit annual LID Monitoring Status Reports no later than March 31 with each Urban Creeks Monitoring Report (UCMR), reporting on all data collected during the foregoing water year. Provision C.8.h.iii.(1) requires that LID Monitoring Status Reports include the information listed below.

(a) A summary of the LID Monitoring Methods and study designs used in the preceding water year, at each sampled LID component, facility or system.

(b) A summary table that lists monitoring samples collected during the preceding water year during the Permit term, including at a minimum, the following information for each sample location: Site ID; the name or ID of the LID component, facility or system name; latitude and longitude of the LID component, facility or system; type of LID component, facility or system (e.g., bioretention); characteristics and land use of the tributary drainage area of the LID component, facility or system; other management actions and controls present in the tributary drainage area of the LID component, facility or system; sample dates; and concentrations of parameters measured.

(c) A summary of lessons learned, progress made, and interim conclusions, for all samples collected during the previous water year.

(d) For all data generated during the preceding water year, a statement of data quality.

(e) The raw data generated by the preceding water year, made available to the Water Board and third parties.

(f) An outline of steps (including but not limited to study designs, methods and sites) for the upcoming water year.

(g) An analysis of the data, including the following:

    a. Identification and analysis of any trends in stormwater or receiving water quality.
    b. A discussion of the data for each monitoring program component, which includes:

i. Monitoring data relative to prior conditions, beneficial uses and applicable water quality standards as described in the Basin Plan, the Ocean Plan, the California Toxics Rule, and other applicable water quality control plans;

ii. Where appropriate, hypotheses to investigate regarding pollutant sources, trends, and BMP effectiveness;

iii. Identification and prioritization of water quality problems;

iv. Identification of potential sources of water quality problems;

v. Description of follow-up actions;

vi. Evaluation of the effectiveness of existing control measures; and

vii. Identification of management actions needed to address water quality problems.

In lieu of the WY 2025 UCMR detailed above, Permittees are required to submit a comprehensive Integrated Monitoring Report (IMR) no later than March 31, 2026. This IMR reports on all of the data collected since the previous IMR. For LID Monitoring, this report covers planning actions conducted in WY 2023, data collected in WYs 2024 and 2025, and includes the information listed below.

(1) The information described in Provisions C.8.h.iii. (1)-(3), pertaining to the monitoring data collected during the preceding (third) water year of the Permit term;

(2) A comprehensive analysis of all data collected pursuant to Provision C.8. since the previous Integrated Monitoring Report, and may include other pertinent studies.

For LID monitoring, this shall additionally include a summary of the methods and study designs used in all preceding water years, at each sample location. And, a summary of lessons learned, progress made, data, results, analyses, and conclusions, for all samples collected during all prior water years during the Permit term;

(3) For POCs, methods, data, calculations, load estimates, and source estimates for each POC parameter, as applicable;

(4) A budget summary for each monitoring requirement (for each year of the Permit term); and

(5) With cause and justification, recommendations for changes to any of the elements of Provision C.8 in future Permit terms.

The remainder of this report presents the required reporting information since the last IMR was issued for WYs 2014-2019 (SCVURPPP 2020) and includes WY 2023 through WY 2025 LID Monitoring actions conducted by SCVURPPP on behalf of all SCVURPPP Permittees.

3.0 STUDY DESIGN AND METHODS

The study design and monitoring methods used during WY 2024 were based on the conditionally approved LID Monitoring Plan that was submitted to the Water Board in May 2023 (SCVURPPP 2023). The study design and monitoring methods used during WY 2025 were based on October 2024 revisions to that monitoring plan (SCVURPPP 2024), incorporating lessons learned in WY 2024 and additional discussions with the Water Board and TAG. The monitoring approach, methods used and sampling locations are summarized in this section. For SCVURPPP, the Project Team consisted of Program Staff and their consultants, and the monitoring contractor hired to conduct all LID monitoring (Kinnetic Environmental Inc., KEI, known as Integral Consulting from early 2025).

3.1 Overall Monitoring Approach

Two main monitoring tasks were implemented to address the management questions identified in Section 2.1.

- Task 1. Stormwater sampling - Stormwater sampling of paired influent and effluent water quality and flow volume was initiated at two LID facilities during multiple storm events and will continue at 1-2 facilities throughout the permit term. Stormwater sampling provides data on individual bioretention facilities treating defined drainage areas to evaluate the pollutant removal and hydrologic benefits of these facilities and changes over time (Management Question 1). Flow-weighted composite samples have been, and will continue to be, used to estimate pollutant treatment effectiveness by comparing influent vs. effluent water quality at each monitoring location. Hydrology has been, and will continue to be, evaluated by identifying sources and sinks of water flow into and out of each facility and directly measuring each where possible. Specific monitoring questions that can be addressed by the water quality and hydrologic monitoring described here include:
    1. Are there significant differences between influent water quality and effluent water quality for individual analytes?
    2. How does pollutant treatment effectiveness for sediment-associated pollutants (i.e., TSS) compare with those that are not sediment-associated (i.e., dissolved copper)?
    3. Does the facility effluent achieve water quality goals?
    4. How much does the treatment facility reduce runoff volumes?
    5. How does the combined effect of treatment (i.e., pollutant concentration reduction/enhancement and runoff volume reduction) affect loads to receiving waters?
    6. How much runoff is treated vs. bypasses the facility?
    7. How much does the treatment facility decrease peak runoff rates?

    For the Project, the stormwater monitoring data collected in WY 2024 and WY 2025 have been used to estimate pollutant treatment effectiveness by comparing influent vs. effluent streams at each monitoring location and comparing effluent concentrations to receiving water quality objectives. Sampling has attempted to represent the entire storm duration using flow-weighted composite autosamplers so that event mean concentrations (EMCs) for each analyte can be estimated.

    In addition to measurement of pollutant concentrations at influent and effluent points for each facility, hydrology has been monitored by identifying sources and sinks of water flow into and out of each facility and directly measuring each where possible. Each facility was equipped with continuous flow measurements collected at influent and effluent points. The Project has also estimate in-basin bypass, or flow that is only partially treated by detention within the facility but not fully treated by filtration through soil media[3]. Beginning with WY 2025, shallow groundwater wells within unlined facilities (including TCM6) were also monitored to measure exfiltration to native soil.

- Task 2. Assessing O&M Impacts - Ongoing O&M actions at monitored LID facilities have been documented during periodic site assessments to evaluate the necessary level of O&M required to maintain proper functioning of the facilities (Management Question 2). Documenting O&M actions provides qualitative and quantitative data. Maintenance-related monitoring questions include:

    1. Is the manufacturer / designer recommended level of maintenance sufficient to achieve optimal system performance?
    2. Do the results suggest needed changes to the recommended inspection and maintenance protocols and/or facility design?
    3. How does flow into the facilities vary as a function of time elapsed from previous maintenance?
    4. How do pollutant concentrations vary as a function of time elapsed from previous maintenance?
    5. What were the catchment conditions that may have affected observed variations in flow?

    The SCVURPPP efforts began by focusing on monitoring two similarly constructed bioretention facilities in similar catchments with similar levels and types of O&M actions throughout the length of the study, with maintenance assessments conducted periodically throughout each rainy season to document the maintenance status of each facility over the course of the permit term and provide data to evaluate if the necessary level of O&M to maintain proper functioning of the facilities was accomplished during the Project. Due to the incomplete data collection available at TCM4, maintenance assessments have focused on TCM6, with maintenance results pooled with data from facilities monitored by regional partners that had different levels and types of ongoing O&M during the Project.

3.2 LID Monitoring Sites

The two LID facilities selected for monitoring during this Project include Treatment Control Measure 4 (TCM4) and Treatment Control Measure 6 (TCM6) located in the public right-of-way at the Top Golf Public Green Streets Project in the City of San José (Figure 3.1). Each facility, constructed in 2022, is a concrete flow-through bioretention planter box with a partially open bottom. The facilities are located within a 240-acre catchment in the Alviso neighborhood as shown on Figure 3.1. The catchment is at the downstream end of the much larger (181 square-mile) Guadalupe River watershed. Stormwater in the catchment flows roughly to the north-east and drains to the Alviso Pump Station, where the flows are pumped directly into the Guadalupe River just upstream of where the river connects to the Alviso Slough and drains into the Bay. Land uses in the catchment include approximately 30 acres of old industrial, 20 acres of old

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[3] There are two types of bypass that are possible with typical bioretention facility design: (1) street bypass that does not enter the treatment facility due to limited capacity and/or obstructions, and (2) in-basin bypass that enters the cell but exceeds the facility's filtration capacity and flows directly to an overflow drain. This Project will only measure in-basin (i.e., overflow) bypass at each of the facilities in this Project.

commercial/old transportation, 100 acres of old residential, 41 acres of new urban, and the remaining areas are open space. Land uses within the TCM4 and TCM6 drainage areas consist of public streets. The immediate project area underwent major redevelopment in recent years including redevelopment of the 30-acre area adjacent to the project site with the Top Golf venue and major roadway improvements on North First Street that included widening, regrading and repaving of the street, and construction of new sidewalks and curbs and gutters. Because the major roadway improvement project on North First Street met the definition of a provision C.3 regulated project under the previous MRP[4], bioretention facilities were constructed to treat drainage from North First Street as part of this project following all C.3 regulated project requirements.

Table 3.1. Basic Characteristics of the two Santa Clara County Bioretention Facilities Targeted for Monitoring

Site	Site ID	Lat/Long	Drainage Area (acres)	Facility Size (sf)	Drainage Area Land Use	Other Management Actions in Drainage Area
First Street San José-TCM #6 (SCC-TCM6)	TCM6	37.42423 / -121.96959	0.304	285	Transportation	None other than programmatic actions such as public outreach and twice-monthly street sweeping on N First St. Drainage area consists of public streets.
First Street San José-TCM #4 (SCC-TCM4)	TCM4	37.424734 / -121.97159	0.194	180	Transportation	None other than programmatic actions such as public outreach and twice-monthly street sweeping on N First St. Drainage area consists of public streets.

Each facility has two primary sampling stations: (1) an influent sampling station, and (2) an effluent sampling station. The locations of these sampling stations at TCM6 are shown in Figure 3.2. Each facility has two trench drain curb openings to allow inflow to the units. At each facility, the influent sampling station is configured with a tray between the two inlets to allow flows from both inlets to comingle prior to sampling. The influent sampling station set-up at TCM4 is shown in Figure 3.3. The effluent sampling station at each facility is located within the underdrain pipe as it discharges into the overflow riser vault. In-basin bypass that enters each facility but exceeds the facility’s filtration capacity and flows directly to the overflow drain is measured with a water-level sensor installed at the overflow vault. In-basin bypass is partially treated by detention within the facility but not fully treated by filtration through soil media. The in-basin bypass and effluent sampling station set-ups at TCM6 are shown in Figure 3.4.

Effluent was not observed or recorded at TCM4 during WY 2024. In WY 2025, monitoring equipment was not reinstalled at this site; however, field crews occasionally made visual

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[4] MRP 2.0 (Order No. R2-2015-0049; Permit No. CAS612008) provision C.3.b.ii(4) defines road widening projects that add new traffic lanes and create 10,000 SF or more of newly constructed contiguous impervious surfaces as C.3 regulated projects subject to the LID and numeric sizing criteria requirements in provisions C.3.c and C.3.d.

observations with the same findings. Although this suggests that 100% treatment may have been achieved through infiltration, it prevented collection of paired influent/effluent samples as required under MRP Provision C.8.d. Patchwork repairs to prevent leaks were completed during WY 2024 that did not resolve this issue, and in May of 2024, the City of San José's construction contractor completed more extensive repairs to prevent leaks. Once again, no effluent was observed at TCM4 during WY 2025; consequently, monitoring equipment has not been re-installed in TCM4 following the WY 2025 rainy season and TCM4 will not be monitored moving forward. SCVURPPP staff will assess sample collection at TCM6 during WY 2026 and will prepare a new LID monitoring facility for WY 2027 (in addition to continued monitoring at TCM6) if needed to meet MRP 3.0 monitored storm event requirements.

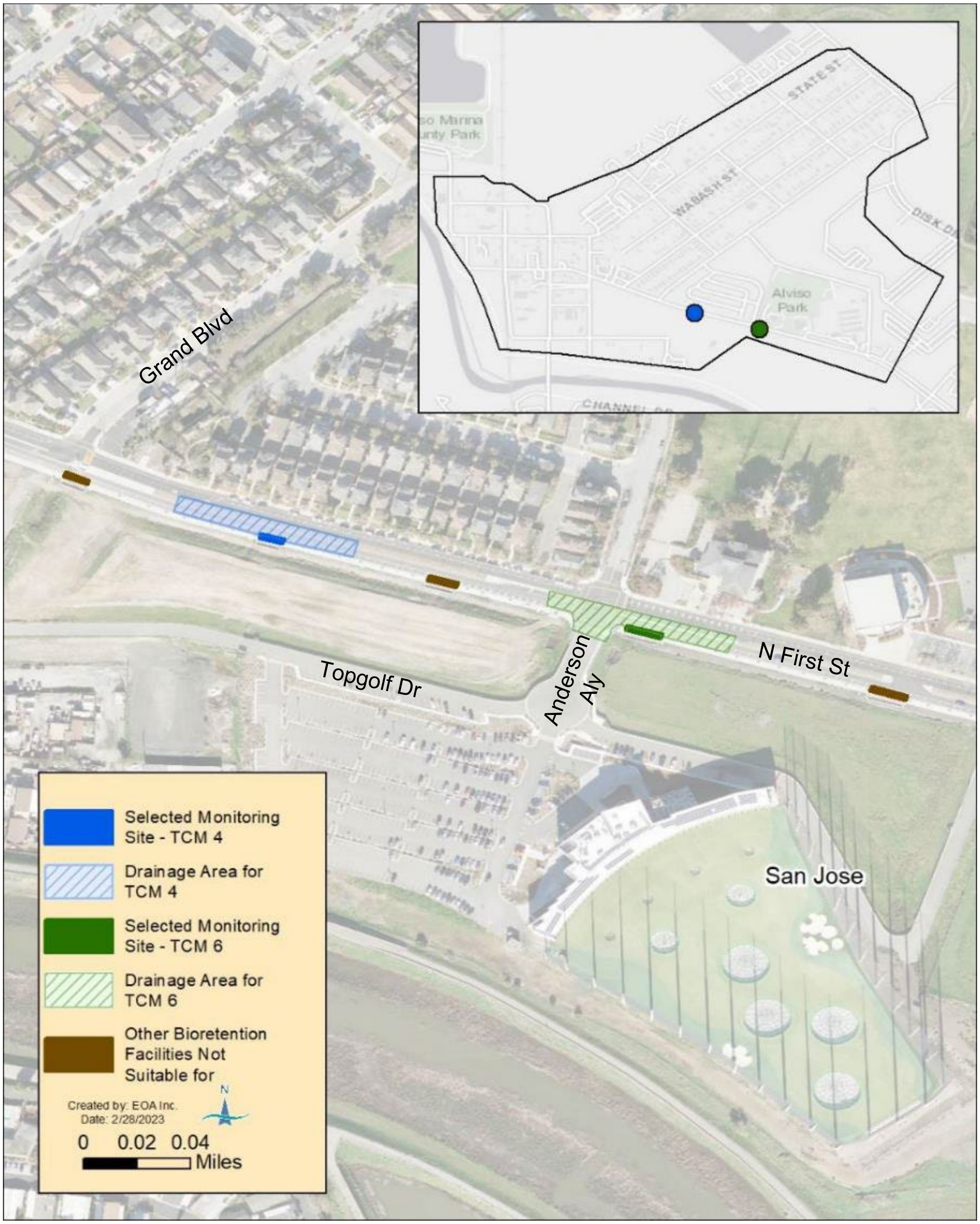

Figure 3.1. Location and drainage areas of two LID monitoring sites at the Top Golf Public Green Streets Project in San José, CA.

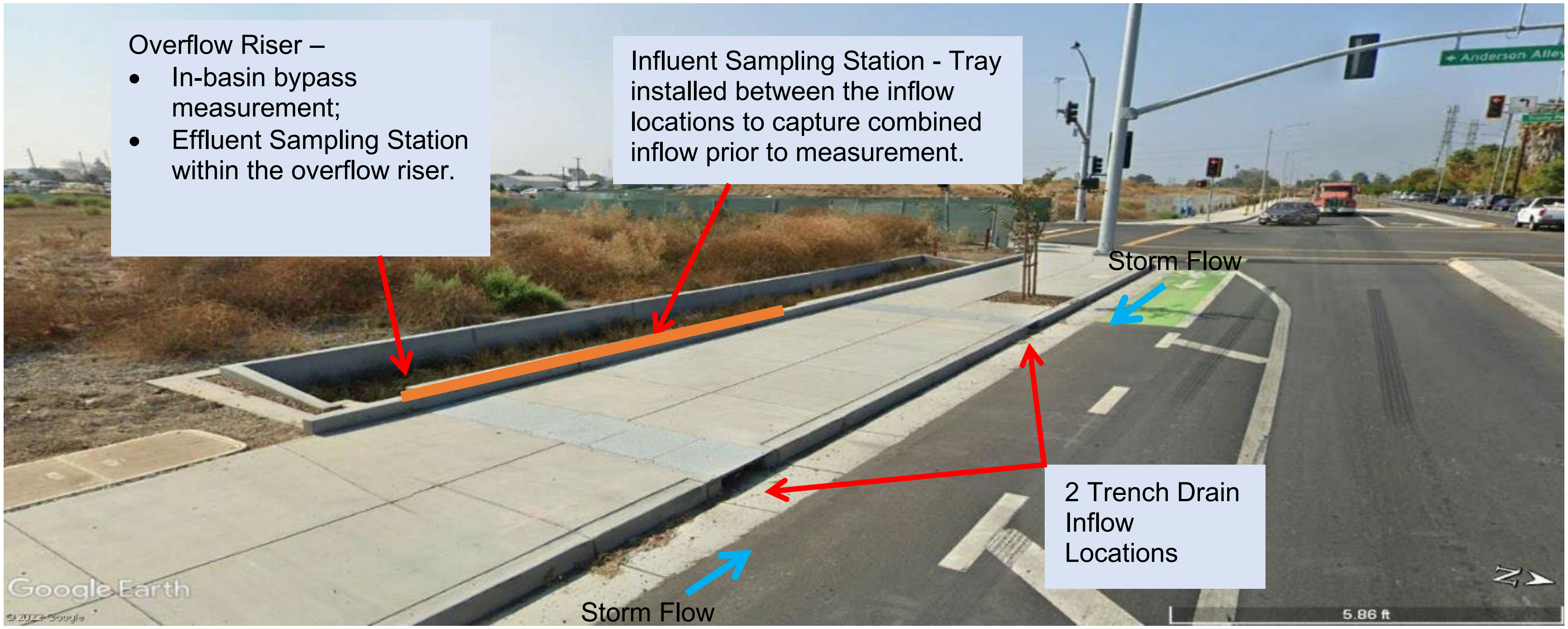

Figure 3.2. Approximate locations of influent and effluent sampling stations and in-basin bypass measurement location at TCM6 at the Top Golf Public Green Streets Project in San José, CA.

Figure 3.3. Influent collection device, weir, and ISCO enclosure at TCM4 at the Top Golf Public Green Streets Project in San José, CA.

Figure 3.4. Effluent measurement device installed within the overflow vault (left), and the in-basin bypass measurement device installed outside the overflow vault (right) at TCM6 at the TopGolf Public Green Streets Project in San José, CA.

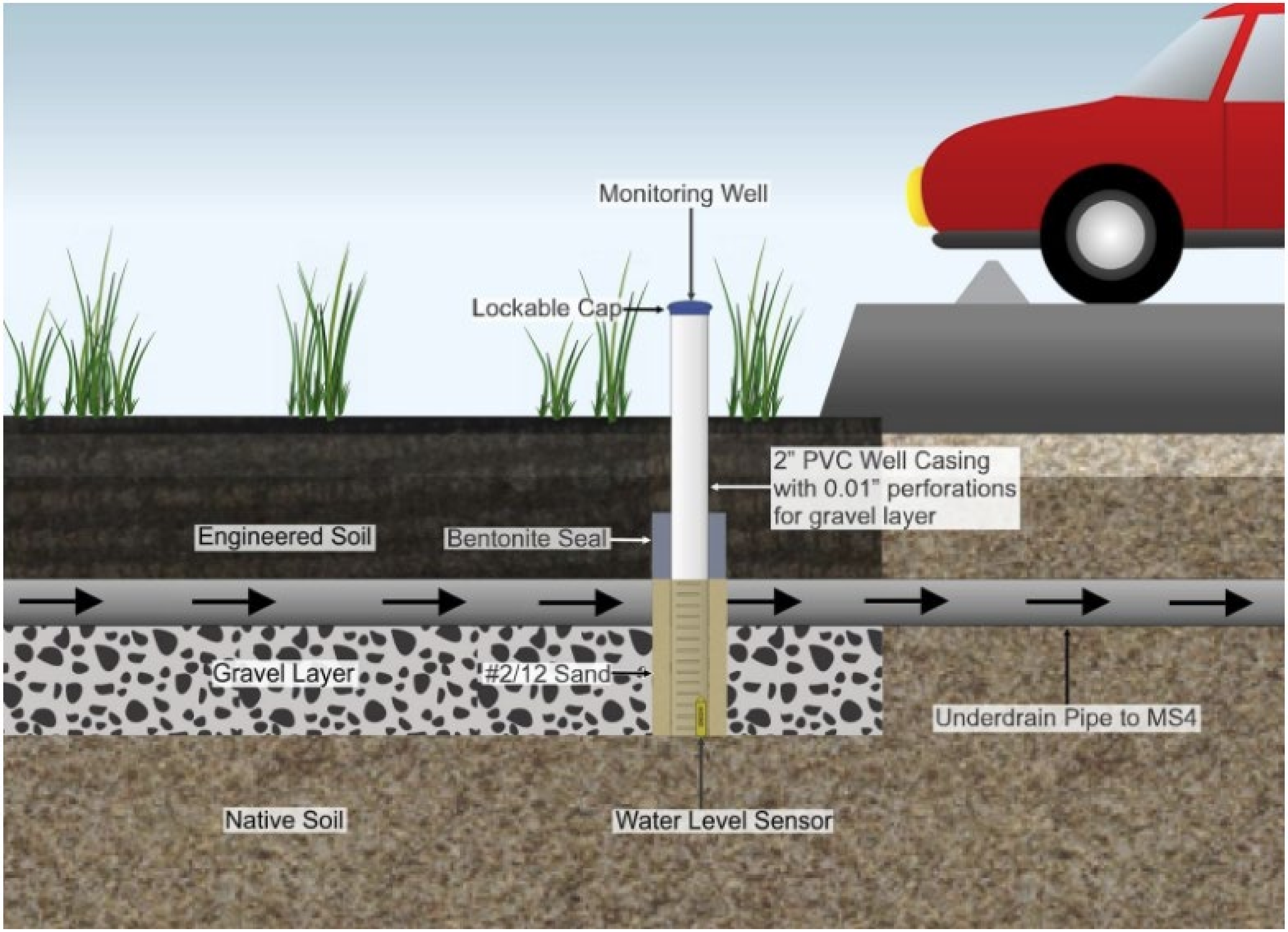

Figure 3.5. General bioretention facility monitoring well (piezometer) design.

3.3 Monitoring Methods

3.3.1 Flow Monitoring

The influent flow to each facility is directly measured with a compound vee-notch weir primary flow device located at the end of the influent collection tray constructed to combine flows from the two trench drain inlets to each bioretention facility (Figure 3.3). Secondary flow measurement devices include a bubbler water level sensor that is connected to a programmable, remotely operated datalogger / controller. In-basin bypass within each facility is measured with a bubbler water level sensor located next to the overflow riser (Figure 3.4).

The effluent flow is measured with a compound vee-notch weir that is installed at the end of the underdrain pipe as it discharges into the overflow riser vault (Figure 3.4). A shallow monitoring well with a pressure transducer (piezometer) was added in the approximate center of TCM6 to measure exfiltration to native soil, with these measurements commencing in WY 2025 (Figure 3.5). No piezometer was added to TCM4 due to the lack of effluent observed at that site and the attempted repairs occurring at TCM4 around the time of the piezometer installation in TCM6.

Flow monitoring equipment is active throughout the wet-weather season so that flow rates and storm volume may be documented for sampled events, as well as for non-sampled events, to the maximum extent practicable

All flow and water quality monitoring equipment was installed at both Project sites prior to the start of the WY 2024 rainy season. Under agreement with Water Board staff, the initial storm events in WY 2024 were used by SCVURPPP monitoring staff to observe the effect of monitoring-related modifications made to the facilities upon site hydrology and to better understand the relationship between rainfall and runoff to set pacing values for autosamplers. Water level sensors were removed at the end of the WY 2024 rainy season for calibration by the manufacturer and subsequent verification and then re-installed at TCM6 prior to the start of the WY 2025 rainy season.

3.3.2 Definition of a Storm

Discussions with TAG members have indicated a preference for conducting water quality monitoring under a variety of storm types to better understand performance of monitored facilities under representative environmental conditions. As part of monitoring plan development, the BAMSC Programs developed the following guidelines for consistency in defining storms while allowing flexibility for Programs to tailor monitoring efforts to site-specific conditions, which were utilized during WY 2024:

“A storm with precipitation of 0.10 inches or greater that produces measurable discharge and that occurs at least 72 hours from the previous measurable (greater than 0.10-inch precipitation) storm event, however the 72-hour antecedent dry period requirement may be waived at times to ensure that Project data sets are not biased with antecedent dry periods consistently greater than 72 hours (Caltrans 2020, USEPA 2018). The storm event begins with a period of six consecutive hours with cumulative precipitation of at least 0.10 inches (Caltrans 2020). The storm event ends with a period of 6 consecutive hours, each hour with precipitation less than or equal to 0.01 inches."

During WY 2024, storm observations and review of monitoring data confirmed that in multiple cases viable storms were not sampled (or served as false starts) due to storms not meeting the requirements above. Specifically, storms often did not present as more uniform intensity storms over a given duration. Instead, storms often presented in a series of fronts with dry gaps greater than 6 hours. This was often due to a small front passing that did not produce sufficient rainfall followed by a larger front that occurred more than six hours but less than 24 hours after the end of initial precipitation.

To address this situation, BAMSC Programs incorporated a slight change into their respective monitoring plans to expand the definition of a storm and reviewed with Water Board staff prior to finalizing. Beginning with WY 2025 monitoring, the storm event end criterion was adjusted so that it ends “with a period of ***between 6 and 24*** consecutive hours, each hour with precipitation less than or equal to 0.01 inches.”

3.3.3 Precipitation Monitoring

A calibrated tipping-bucket rain gauge was installed at the monitoring location to estimate rainfall within the Drainage Management Areas (DMA) of both sites. The rain gauge is re-calibrated at least annually.

3.3.4 Shallow Groundwater Monitoring

Beginning in WY 2025, water storage within the facility and exfiltration to native soil (i.e., discharge to groundwater) was measured at TCM6 using a shallow monitoring well. A shallow monitoring well outfitted with a water-level piezometer was installed prior to the rainy season in early WY 2025. The well was placed in the approximate geographical center of the facility. The equipment measures hydrostatic water pressure and records water depth once per minute throughout the wet weather season. Storage volume and exfiltration rate are calculated from the monitoring well data and these metrics are used to better support an assessment of the water balance at the facility. No monitoring well was installed at TCM4.

3.3.5 Water Quality Sample Collection

Water quality sample collection is automated and triggered by water level sensors in the influent and effluent points for each monitoring facility. This ensures samples are collected at equal volume intervals for the influent station and separate equal volume intervals for the effluent station. The equal volume intervals, or pacing values, for the influent station and the effluent station were selected for each monitoring event based on the following factors: DMA, runoff coefficient (average percent imperviousness), quantitative precipitation forecast (QPF), probability of precipitation (POP), antecedent dry period, volume of each aliquot (1 L), and the minimum sample volume required for laboratory analysis (approximately 10 L, increased from 6 L as a result of WY 2024 findings). A pacing value spreadsheet is maintained for each station, and over time, a rating curve is continually refined based on empirical data of runoff (e.g., the ratio of discharge volume to rainfall). Water quality sampling equipment was selected to best ensure compliance with MRP 3.0 permit conditions, and to the maximum extent practicable, to be consistent with standard sample collection and analysis methods. Key components of the sampling equipment employed include:

- Programmable autosamplers (Teledyne ISCO®)

- Styrene-ethylene-butylene-styrene (SEBS) pump roller tubing, replaced each event
- High density polyethylene (HDPE) intake tubing, recleaned each monitoring season
- Stainless steel intake strainer, recleaned each monitoring season
- Borosilicate glass carboys, recleaned each event
- Dual carboy stainless steel solenoid valve, recleaned each monitoring season

Specific compromises were made in sample collection techniques in order to best achieve the overall goals of the sampling design while maintaining permit compliance. These compromises included use of autosamplers for some analytes that are typically sampled manually, delaying filtering past typical requirements for some analytes, and use of alternative materials (e.g., monitoring for PFAS precluded use of Teflon® tubing, which is typical for PCBs analysis). A full list of variations from standard methods is detailed in the Monitoring Plan (SCVURPPP 2023).

3.3.6 Sample Handling

At the conclusion of each sampling event, field staff decommissioned sampling stations and transferred sample media to Caltest Laboratories (Caltest) for processing and analysis. As part of this process, field staff capped and removed individual carboys from job boxes, completed labeling, replenished ice, and transferred all carboys to Caltest. Upon receipt, Caltest staff filled analyte-specific sample containers from the carboys, processed samples intended for internal analysis, and distributed sample material to subcontract / collaborating laboratories (i.e., Pace Analytical for TPH in WY 2024; Moore Twining for TPH in WY 2025; and Enthalpy Analytical for PCBs and PFAS).

3.3.7 Laboratory Analyses

WY 2024 and WY 2025 samples were analyzed for the following parameters: pH, hardness, TSS, TPH as diesel and motor oil, total and dissolved copper, total and dissolved mercury, total and dissolved zinc, PCB congeners and PFAS analytes, using the methods shown in Table 3.2. Table 3.2 also shows analytical method detection limits (MDLs), reporting limits (RLs), and sample holding times. As mentioned previously, BAMSC Programs changed the analytical laboratory subcontracted for analysis of TPH prior to WY 2025 monitoring from Pace Analytical to Moore Twining in hopes of achieving greater sensitivity and fewer reported non-detectable concentrations in these analyses.

Table 3.2. LID monitoring analytes, analytical methods, target method detection limits, reporting limits and holding times.

Water Analytical Test	Method	Method Detection Limit	Reporting Limit	Holding Time
pH				Immediate
Hardness as CaCO3	SM 2340 C	1.7 mg/L	5.0 mg/L	6 months
Total Suspended Solids (TSS)	SM 2540 D	1.0 mg/L	3.0 mg/L	7 days
TPH as Diesel C12-C24	EPA 8015	74 µg/L (WY 2024) 42 µg/L (WY 2025) [a]	200 µg/L (WY 2024) 50 µg/L (WY 2025) [a]	7 days until extraction, 40 days to analyze
TPH as Motor Oil C24-C36	EPA 8015	160 µg/L (WY 2024) 25 µg/L (WY 2025) [b]	500 µg/L (WY 2024) 100 µg/L (WY 2025) [b]	7 days until extraction, 40 days to analyze
Total Copper	EPA 200.8	0.36 µg/L	0.50 µg/L	6 months following acidification
Total Mercury	EPA 1631E	0.00019 µg/L	0.0005 µg/L	90 days following acidification
Total Zinc	EPA 200.8	0.78 µg/L	1.0 µg/L	6 months following acidification
Dissolved Copper	EPA 200.8	0.36 µg/L	0.50 µg/L	Filter immediately, 6 months following acidification
Dissolved Mercury	EPA 1631E	0.00019 µg/L	0.0005 µg/L	Filter immediately, 90 days following acidification
Dissolved Zinc	EPA 200.8	0.78 µg/L	1.0 µg/L	Filter immediately, 6 months following acidification
PCBs (RMP 40 congeners) [c]	EPA 1668C	1.97 – 31.9 pg/L[d]	9.75 – 40.6 pg/L[d]	1 year until extraction, 1 year after extraction to analyze
PFAS [e]	EPA 1633	0.22 – 9.55 ng/L[d]	1.42 – 56.4 ng/L[d]	28 days until extraction, when stored at 0 - 6°C

EPA U.S. Environmental Protection Agency

SM Standard Methods for the Examination of Water and Wastewater, American Public Health Association

[a] Starting in WY 2025, TPH as Diesel has an MDL of 42 µg/L and an RL of 50 µg/L.

[b] Starting in WY 2025 TPH as Motor Oil has an MDL of 25 and an RL of 100 µg/L.

[c] San Francisco Bay Regional Monitoring Program (RMP) 40 PCB congeners include PCB-8, 18, 28, 31, 33, 44, 49, 52, 56, 60, 66, 70, 74, 87, 95, 97, 99, 101, 105, 110, 118, 128, 132, 138, 141, 149, 151, 153, 156, 158, 170, 174, 177, 180, 183, 187, 194, 195, 201, and 203.

[d] A range is given for reporting limits (RLs) due to varying values for the individual congeners.

[e] Analysis included the following 40 PFAS: Perfluorobutanoate, Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid, 11-, Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid, 9-, Dioxa-3H-Perfluorononanoate Acid, 4,8-, Ethyl Perfluorooctane Sulfonamido Acetic Acid, N-, Ethyl-perfluorooctanesulfonamidoethanol, N-, Fluorotelomer Carboxylic Acid, 3:3-, Fluorotelomer Carboxylic Acid, 5:3-, Fluorotelomer Carboxylic Acid, 7:3-, Fluorotelomer Sulfonate, 4:2-, Fluorotelomer Sulfonate, 6:2-, Fluorotelomer Sulfonate, 8:2-, Methyl Perfluorooctane Sulfonamido Acetic Acid, N-, Methyl Perfluorooctane Sulfonamido Acetic Acid, N-, Methyl-perfluorooctanesulfonamide, N-, Methyl-perfluorooctanesulfonamidoethanol, N-, Perfluoro(2-ethoxyethane)sulfonic acid, Perfluoro-2-Propoxypropanoic Acid, Perfluoro-3,6-dioxaheptanoate, Perfluoro-3-methoxypropanoate, Perfluoro-4-methoxybutanoate, Perfluorobutanesulfonate, Perfluorodecanesulfonate, Perfluorodecanoate, Perfluorododecanesulfonate, Perfluorododecanoate, Perfluoroheptanesulfonate, Perfluoroheptanoate, Perfluorohexanesulfonate, Perfluorohexanoate, Perfluorononanesulfonate, Perfluorononanoate, Perfluorooctanesulfonamide, Perfluorooctanesulfonate, Perfluorooctanoate, Perfluoropentanesulfonate, Perfluoropentanoate, Perfluorotetradecanoate, Perfluorotridecanoate, Perfluoroundecanoate.

3.4 Data Analysis Approach

The following sections describe how data are reviewed and analyzed to address the Management Questions listed in Section 2.1.

3.4.1 Approach to Water Balance

A water balance analysis of an LID facility identifies the inputs, facility storage, and outputs of water throughout the system, as shown in Figure 3.6. The water balance approach provides a quantitative evaluation of the hydrologic functioning of the LID system. The water balance can indicate the relative values of the inputs, storage, and outputs within the system, and changes to these values over varying storm conditions and over time. This is helpful to understand if the system is functioning as designed, to identify potential data gaps (e.g., missing input or output variables), and to provide an estimation of variables that are more challenging to measure directly.

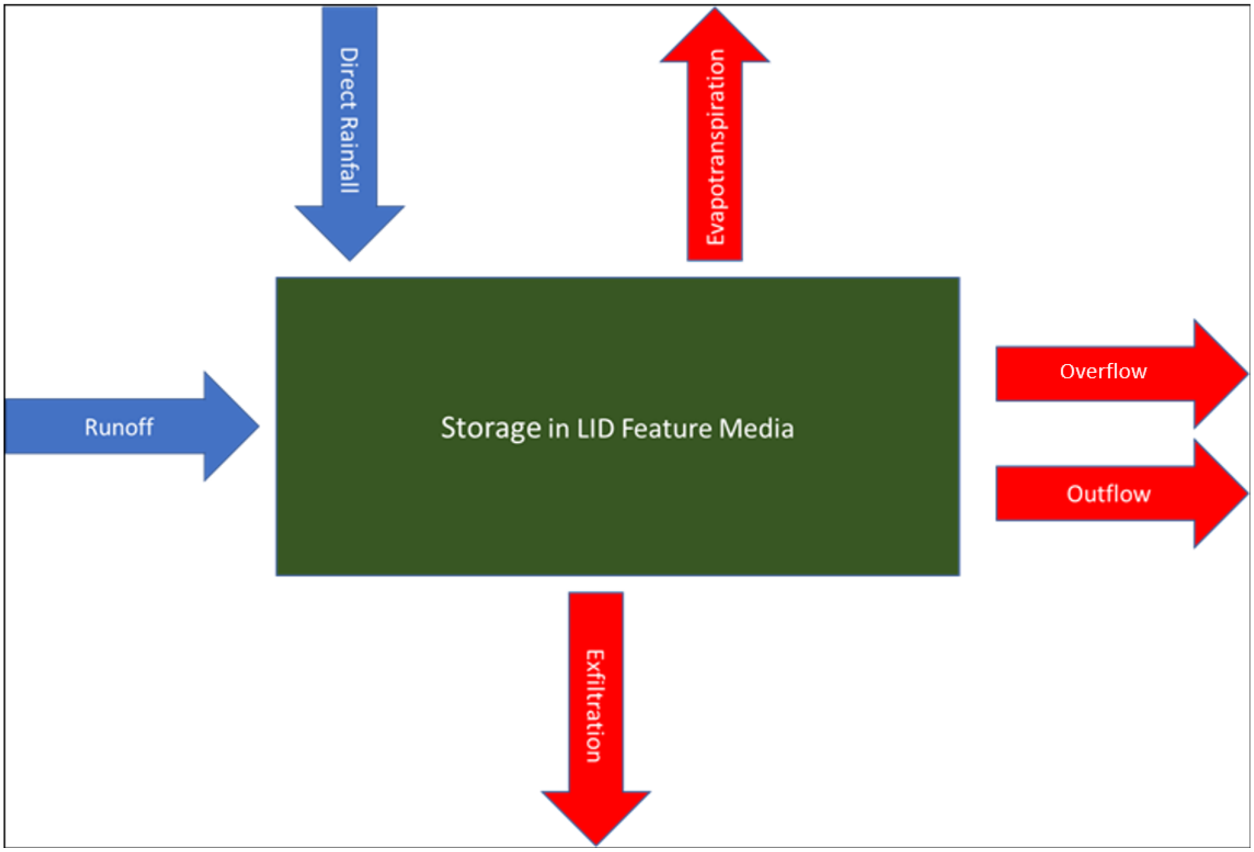

Figure 3.6. Diagram of water balance inputs, storage, and outputs at a Low Impact Development (LID) facility.

The water balance is evaluated through analysis of measured flow data and through hydrologic modeling of measured and estimated variables according to this formula:

$V_{in} + \Delta \text{ Storage} = V_{out}$

Where,

V_{in} = the input water volume to the facility during a targeted storm;

Δ Storage = the initial storage volume of water within the facility before the targeted storm minus the final storage volume of water within the facility at the end of a targeted storm; and

V_{out} = water losses from the facility during the targeted storm.

The water balance variables include the following:

- Runoff (V_{in}): The measured volume of influent stormwater entering the facility from the DMA. Volume was determined using a primary flow measurement device (weir or flume) and a secondary flow measurement device (bubbler water level sensor). Data were collected at 1-minute intervals.
- Direct Rainfall (V_{in}): The calculated volume of rainwater entering the facility as direct rainfall. Volume was calculated from the facility footprint area times the rainfall depth measured with a 0.01-inch tipping bucket rain gauge located within or in close proximity to the facility.
- Storage in LID Feature Media (Storage): The estimated volume of stormwater stored in the soil media. Bioretention soil storage was estimated as 20% of soil volume using the range of plant available water (PAW) for fine sands (8-11%) and the effect on PAW of adding compost to soil (UC Agriculture and Natural Resources, 2025). The addition of 24% compost by volume to sandy serpentine soil resulted in a 2-fold increase in PAW (Curtis and Claasen, 2005). Gravel was assumed to store no volume of water. Under these assumptions, soil media storage at the TCM6 site is 114 cubic feet (cf).
- Evapotranspiration (V_{out}): The combination of water loss from evaporation and plant transpiration. The evapotranspiration rate for the Bay Area region was assumed to be <0.07 inches per day during winter months according to the California Irrigation Management Information System (Hart et al. 2008). No evapotranspiration was assumed over the short period of storm events when relative humidity was generally 100%.
- Overflow (V_{out}): The measured volume of water discharged from the facility through the overflow structure. Overflow occurs when maximum ponding depth is exceeded. Overflow was not observed during any of the WY 2024 or WY 2025 monitored storm events.
- Outflow (V_{out}): The measured volume of effluent stormwater discharged from the facility underdrain to the MS4. Volume is determined by using a primary flow measurement device (weir) and a secondary flow measurement device (bubbler water level sensor). Data were collected at 1-minute intervals.
- Exfiltration (V_{out}): The calculated water lost from the facility through infiltration into the native soil. For each unlined facility, instances of receding water level concurrent with no influent or effluent flow were used to calculate an average recession rate. The average recession rate was scaled using an estimated gravel pore space of 40%. The rate of exfiltrated volume was calculated using the estimated surface area of native soil that is in contact with the gravel layer. The rate of exfiltrated volume was multiplied on an event-basis to all time periods when water was present in the gravel layer to yield the volume of water exfiltrated per event.

For storms monitored in WY 2024 prior the installation of monitoring wells, the start and stop times for exfiltration were modeled using WY 2025 data.

3.4.2 Treatment of Censored Data

Upon receipt of laboratory deliverables, SCVURPPP conducts a detailed review of data quality associated with each Electronic Data Deliverable (EDD). Consistent with the Regional Project QAPP (BAMSC 2025), SCVURPPP separates datapoints into those that achieve specified measurement quality objectives (MQOs) and those that do not. Those that fall in the latter category are identified as such on laboratory EDDs submitted as part of Project deliverables and potentially excluded from any interpretive use depending upon the type and degree of data quality deviation. See Section 3.5 for the Statement of Data Quality.

LID monitoring results have also generated data that comes with a degree of uncertainty due to analytical results reported at or below derived method detection limits (MDLs) and method reporting limits (RLs). This is especially true of results reported for individual PCB and PFAS analytes. As described in the monitoring plan (SCVURPPP 2024), BAMSC Programs have adopted a substitution technique of ND=0 in calculation of total PCBs and total PFAS (or PFAS subgroups) for interpretive purposes. In addition, as discussed with the TAG and consistent with previous BAMSC monitoring and data analysis efforts, results reported above the MDL and below the RL (i.e., laboratory-flagged as DNQ or J-flagged) are estimated as the reported result for data analysis and interpretation.

3.4.3 Loadings and Summary Statistics

As described in the Monitoring Plan (SCVURPPP 2024), to assess the performance of each LID facility, the following metrics were calculated:

1. Removal Efficiency (RE) = X_{inf} – X_{eff} / X_{inf}

The Removal Efficiency (RE) metric evaluates the change in the effluent relative to the influent for a given parameter for each storm event at each site. Note that this is a per storm event statistic. This is also referred to as the Concentration % Reduction in this report.

2. Efficiency Ratio (ER) = Mean X_{eff} / Mean X_{inf}

The Efficiency Ratio (ER) metric evaluates the relative change in average influent and effluent among storm events for a given parameter for each site. Note that this is derived from an ensemble of storm event statistics.

In this report, we are using Total Concentration % Reduction, calculated as Mean X_{inf} – Mean X_{eff} / Mean X_{inf} rather than ER, as this is a more intuitive way to communicate the same result (e.g., an 88% Total Concentration % Reduction makes more sense than a 0.12 ER).

3. Loads (or Volume) Efficiency Ratio (LER) = Sum $Load_{eff}$ /Sum $Load_{inf}$.

The Loads (or Volume) Efficiency Ratio (LER or VER) evaluates the relative change in the total influent and effluent storm loads or runoff volumes for each site. This is calculated on a per storm basis.

In this report, we are using Load % Reduction rather than LER, as it is a more intuitive way to communicate the same result. Load % Reduction is calculated as Sum Load_{inf} – Sum Load_{eff} / Sum Load_{inf}.

In addition to these metrics that were calculated for the SCVURPPP LID facilities, an analysis was conducted to assess LID performance across the region. In the regional analysis, regional summary statistics and box and whisker plots of storm-based load efficiency ratios (LERs) for each of the monitored LID facilities are compared to illustrate similarities and differences that may be attributed to differences in design variation, spatial scales, and system ages.

3.4.4 PFAS Analysis

Per- and polyfluoroalkyl substances (PFAS) represent tens of thousands of distinct chemical compounds, often with distinct physical and chemical properties affecting their fate, transport, and toxicity. Of these tens of thousands of compounds, 40 individual compounds are subject to testing and detection under EPA Method 1633.

While other analyses sometimes group these 40 analytes into several categories based on chemical composition, this analysis found no significant differences in LID performance between these groupings. Therefore, for ease of analysis and understanding of results, this report uses Total PFAS Analytes - the sum of the 40 PFAS analytes - as the most frequent metric of PFAS concentrations, loads, and trends. Consistent with other analytes in this report, non-detects are treated as 0 and J-flagged results are included. Program-wide PFAS results are discussed in Section 4.2.1 and regionwide results discussed in Section 4.4.5, along with additional discussion given to PFAS precursor analytes (which may undergo transformations in natural settings such as in stormwater) and terminal analytes (which will not transform in natural settings) in Section 5.1.2. The full list of PFAS analytes, along with their acronyms and Precursor or Terminal status, is included in Appendix E.

Individual PFAS analytes are discussed under relevant circumstances, such as when discussing water quality objectives (which exist for only a small subset of the 40 PFAS analytes) or comparing load reductions and trends across individual analytes.

3.4.5 Comparison to Water Quality Objectives

MRP Provision C.8.h.iii.(1)(g) requires all data collected pursuant to Provision C.8 to be analyzed relative to prior conditions, beneficial uses, and applicable Water Quality Objectives (WQOs) from the Basin Plan, Ocean Plan, California Toxics Rule (CTR), and other applicable water quality control plans. While these Plans establish WQOs that are not directly applicable to stormwater runoff or LID sample monitoring, in compliance with the MRP, LID monitoring data collected in WY 2024 and WY 2025 by SCVURPPP was compared to benchmark numeric WQOs that apply to waters in other contexts. See Table 3.3 for the WQOs used here and Table 4.9 for the numeric results of this comparison.

This comparison to WQOs considers the following:

- **Discharge vs. Receiving Water.** WQOs generally represent the maximum concentration of a pollutant that can be present in the water column without adversely affecting organisms using the aquatic system as habitat, people consuming those organisms or water, and/or other current or potential beneficial uses. WQOs apply to receiving waters, not discharges such as LID facility effluent or stormwater runoff. Therefore, the WQOs shown in Table 3.3 are considered benchmarks for comparison purposes only. Comparison of water quality concentrations in the LID facility effluent with benchmark WQOs facilitates analysis of the potential for the treated effluent to result in exceedances of receiving water quality standards that may adversely affect beneficial uses or otherwise degrade receiving waters.

- **Freshwater vs. Saltwater.** Freshwaters are those in which the salinity is equal to or less than 1 part per thousand (ppt) 95% of the time. Marine waters are those in which the salinity is equal to or greater than 10 ppt 95% of the time. Because the City of San José's MS4 discharges to the South San Francisco Bay, which is considered saltwater, the marine WQOs are used as benchmarks in this analysis.

- **Acute vs. Chronic Objectives/Criteria.** All LID monitoring events were conducted during episodic storm events: mean rainfall duration during the 11 monitored storm events in WY 2024 – WY 2025 was just over 20 hours, whereas chronic water quality objectives in the CTR apply to 4-day (96 hour) exposures. Therefore, since storm monitoring results likely do not represent long-term concentrations of the monitored constituents in receiving waters, LID monitoring data were compared to acute WQOs for aquatic life that represent the highest concentrations of a pollutant to which an aquatic community can be exposed for a short period of time (e.g., one hour) without resulting in an unacceptable effect.

- **Aquatic Life vs. Human Health.** Comparisons were primarily made to WQOs for the protection of aquatic life, not WQOs for the protection of human health to support the consumption of water or organisms.

- **Basin Plan WQOs.** The Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan; SFBRWQCB 2024) lists beneficial uses and provides numeric and narrative criteria for a range of water quality constituents applicable to certain receiving water bodies and groundwater basins within the San Francisco Bay region, many of which reference the CTR. Specific criteria are provided for the larger, designated water bodies within the region, as well as general criteria or guidelines for ocean waters, bays and estuaries, inland surface waters, and ground waters. Those waters not specifically listed (generally smaller tributaries) are assumed to have the same beneficial uses as the streams, lakes, or reservoirs to which they are tributary. In general, the narrative criteria require that degradation of water quality does not occur due to increases in pollutant loads that will adversely impact the designated beneficial uses of a water body. The LID facilities monitored by SCVURPPP discharge to the City of San José MS4, which outfalls to the South San Francisco Bay (the portion of the Bay south of Dumbarton Bridge) and are part of the Santa Clara Basin. The existing beneficial uses listed in the Basin Plan for the Santa Clara Basin include:

  - IND: Waters that support industrial activities that do not depend primarily on water quality.

  - COMM: Waters that support commercial or recreational collection of fish, shellfish, or other organisms, including, but not limited to, organisms intended for human consumption or bait purposes.

- SHELL: Waters that support habitats suitable for the collection of crustaceans and filter-feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sport purposes.
- EST: Waters that support estuarine ecosystems, including preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds), and the propagation, sustenance, and migration of estuarine organisms.
- MIGR: Habitats necessary for migration, acclimatization between fresh water and salt water, and protection of aquatic organisms that are temporary inhabitants of waters within the region.
- RARE: Waters that support rare, threatened, or endangered species and associated habitats.
- SPWN: Waters that support high quality aquatic habitats suitable for reproduction and early development of fish.
- WILD: Waters that support wildlife habitats.
- REC-1: Water contact recreation involving body contact with water and ingestion is reasonably possible.
- REC-2: Non-contact water recreation for activities in proximity to water, but not involving body contact.
- NAV: Shipping, travel, or other transportation by private, military, or commercial vessels.

Table 3.3 lists the numeric and narrative WQOs benchmarks utilized in this analysis. Of the WY 2024 and WY 2025 LID monitoring analytes, Basin Plan numeric WQOs for the protection of aquatic life in marine waters exist for total mercury, dissolved copper, dissolved zinc, and pH and Basin Plan narrative WQOs exist for TPH and TSS. EPA recommended Benchmarks for the Protection of Aquatic Life in Estuarine/Marine Waters exist for two PFAS analytes, PFOA and PFOS (EPA 2024). Additionally, Water Board's recommended groundwater Environmental Screening Levels (ESLs) for saltwater ecotoxicity exist for several PFAS analytes[5]. Although these ESLs are applicable only to groundwater screening at potentially contaminated sites and do not apply to stormwater runoff, they are utilized here for comparison purposes due to the current lack of more applicable PFAS standards or enforceable regulations.

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[5] https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/ESL/ESL_Summary_Tables_Rev3.pdf

Table 3.3. Numeric and narrative WQOs used as benchmarks for comparison of SCVURPPP LID effluent monitoring data.

Analyte	Units	Acute Water Quality Criteria/WQO	Reference
pH	Units	pH shall not be depressed below 6.5 nor raised above 8.5	Basin Plan
Total Suspended Solids (TSS)	mg/L	Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.	Basin Plan
TPH	µg/L	Waters shall not contain oils, greases, waxes, or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.	Basin Plan
Copper, Dissolved	µg/L	10.8	Basin Plan / CTR [a]
Mercury, Total	µg/L	2.1	Basin Plan / EPA [b]
Zinc, Dissolved	µg/L	90	Basin Plan / CTR [c]
Perfluorooctanoic Acid (PFOA)	µg/L	7,000	EPA Aquatic Life Criteria – PFOA
	µg/L	3.2	Groundwater ESL
Perfluorooctanesulfonic Acid (PFOS)	µg/L	550	EPA Aquatic Life Criteria - PFOS
	µg/L	0.017	Groundwater ESL
Perfluorobutanoic acid (PFBA)	µg/L	120	Groundwater ESL
Perfluorohexanoic acid (PFHxA)	µg/L	540	Groundwater ESL
Perfluorononanoic acid (PFNA)	µg/L	0.12	Groundwater ESL
Perfluorodecanoic acid (PFDA)	µg/L	0.094	Groundwater ESL
Perfluorobutanesulfonic Acid (PFBS)	µg/L	210	Groundwater ESL
Perfluorohexanesulfonic Acid (PFHxS)	µg/L	14	Groundwater ESL

a Copper, Dissolved Fraction has a saltwater acute objective of 4.8 µg/L set by the California Toxics Rule. The Basin Plan criteria for the South San Francisco Bay (10.8 µg/L) is used here instead, as this objective already incorporates the appropriate Water Effects Ratio for this segment of the Bay. See the Basin Plan for further details (SFBRWQCB 2024)

b The Basin Plan (SFBRWQCB 2024) references the USEPA Ambient Water Quality Criteria for Mercury (1984) for total mercury WQOs applicable to San Francisco Bay.

c The Basin Plan (SFBRWQCB 2024) references the California Toxics Rule (CTR) for dissolved zinc WQOs.

3.5 Statement of Data Quality

A comprehensive quality assurance/quality control (QA/QC) program was implemented by SCVURPPP covering all aspects of LID monitoring. Monitoring for LID analytes was performed according to protocols specified or referenced in the BAMSC LID Quality Assurance Project Plan (QAPP; BAMSC 2023, BAMSC 2024). The LID influent and effluent sampling data were collected and evaluated as governed by the LID Monitoring Plan (SCVURPPP 2023) and QAPP (BAMSC 2024). Details of the QA/QC reviews for SCVURPPP LID monitoring conducted in WY 2025 are presented below; WY 2024 details were presented previously (SCVURPPP 2025).

3.5.1 Hydrology

Quality assurance procedures for hydrologic data include annual calibration of the tipping bucket rain gauge, periodic cleaning of debris from within the rain gauge funnel, annual maintenance and calibration of bubbler and pressure transducer sensors, and as-needed clearing of debris (sediment, leaf litter, and trash) from the influent primary flow device. As described in Section 4.1 below, a 10-inch weir was installed at the influent location prior to the beginning of WY 2025. The 10-inch weir provided greater flow capacity than the 8-inch weir that was used during WY 2024, which was overwhelmed by peak flow rates on very rare occasions.

Quality control procedures for hydrologic data include periodic field testing of the tipping bucket rain gauge for proper response to input of water and pre-storm and during-storm water level calibration checks of the bubbler and pressure transducer sensors.

With one exception, WY 2025 hydrology data was deemed acceptable for interpretation. The exception occurred during the February 13th, 2025 monitoring event when the influent storm volume was slightly biased high due to sediment clogging of the bubbler sensor during the second half of the storm (refer to footnote "d" in Table 4-1).

3.5.2 Blank Testing

Blank testing is conducted using protocols described in the SCVURPPP Monitoring Plan (SCVURPPP 2024). Because it is not easy to run laboratory-provided blank water through the automated sampling equipment when installed in the field (i.e., *field* blanks), the Project primarily uses *equipment* blanks which are collected when the equipment is in the Subcontractor’s laboratory. Consistent with the SCVURPPP Monitoring Plan (SCVURPPP 2024) and QAPP (BAMSC 2024), SCVURPPP collected pre-season *equipment* blanks on all sample collection materials (carboys and tubing) in WY 2024 and WY 2025. In addition, end-of-season *field* blanks were collected in WY 2024. The results of the equipment and field blanks from all BAMSC partner agencies were reviewed in mid-WY 2025 with Water Board staff and TAG members, and a determination was made that end-of-season field blanks were no longer necessary. Accordingly, end-of-season field blanks were not conducted following WY 2025 and are not planned for future water years. However, as part of this determination, a one-time collection and analysis of end-of-season *peristaltic* tubing blanks was conducted for WY 2025. The results of the WY 2025 pre-season and end-of-season equipment blanks are shown in Table 3.4. The results of the WY 2024 pre-season equipment blanks and end-of-season field blanks were presented previously (SCVURPPP 2025).

Table 3.4. Analytical results for WY 2025 pre-season and end-of-season equipment blanks for San José TCM6.

Analyte	Unit	Pre-season		End-of-season
		Carboy-02	Tubing [a]	Tubing [a]
Conventional, Physical, and Synthetic Organics				
Hardness as CaCO3	mg/L	<1.7	<1.7	<1.7
Total Suspended Solids	mg/L	<1	<1	<1
TPH as Diesel C12-C24	µg/L	<42	<42	<42
TPH as Motor Oil C24-C36	µg/L	<26.1	<26.1	29 J
Total Metals				
Copper	µg/L	<0.36	<0.36	<0.36
Mercury	µg/L	<0.00019	<0.00019	<0.00019
Zinc	µg/L	<0.78	<0.78	<0.78
PCB Congeners				
Total RMP 40 PCB Congeners	ng/L	ND	ND	ND
PFAS				
All 40 PFAS Analytes	ng/L	ND	ND	ND

ND = No analytes in sample detected at or above the Method Detection Limit (MDL)

[a] The pre-season tubing blank includes HDPE intake tubing and SEBS peristaltic pump-roller tubing. The WY 2025 end-of-season tubing blank includes peristaltic pump-roller tubing only.

[b] “J” qualifier applies to values that fall between the reporting limit (RL) and the MDL; these values are considered estimated values.

3.5.3 Laboratory Analyses

Data were assessed for representativeness, comparability, completeness, sensitivity, contamination, accuracy, and precision. These seven attributes are compared to data quality objectives (DQOs), which were established to ensure that data collected are of adequate quality and sufficient for the intended uses. DQOs address both quantitative and qualitative assessment of the acceptability of data. Representativeness and comparability are qualitative while completeness, sensitivity, contamination, accuracy, and precision are quantitative assessments. Specific DQOs are based on Measurement Quality Objectives (MQOs) for each analyte.

In general, the laboratory analyses conducted in support of WY 2024 and WY 2025 LID monitoring achieved data quality objectives except for minor instances. Those instances are detailed in Table 3.5 for WY 2025 and were reported previously for WY 2024 (SCVURPPP 2025). While some data were flagged by the QA Officer based on the MQOs and DQOs identified in the QAPP, all of the laboratory data was of acceptable quality to be included in this report’s dataset.

Note on TPH Analyses. In WY 2024, reporting limits for analysis of both TPH as diesel and TPH as motor oil were consistently above QAPP targets. In WY 2025, this issue was addressed by contracting with a different analytical laboratory for TPH analyses (i.e., Pace Analytical was replaced with Moore Twining). While sensitivities associated with analysis of TPH as diesel and TPH as motor oil were improved relative to WY 2024 monitoring, there were still some data quality concerns noted for WY 2025 laboratory reports as detailed in Table 3-5. Specifically, surrogate recoveries in some of the analytical samples and in LCS samples were low which could indicate biased low results reported for these samples and batches. Additionally, some LCS samples also demonstrated high recovery which could indicate that sample results in these batches are biased high. The results were flagged appropriately by the QA Officer with no further actions required and still deemed of acceptable quality for use. However, the Program along with the other countywide stormwater programs are continuing to work with the laboratories to improve on these data quality issues.

Note on PFAS Analyses. In January 2024, the EPA finalized Method 1633 for the analysis of 40 PFAS analytes. As this method came into wider use, CEDEN Controlled Vocabulary for naming the compounds went through some minor changes. All WY 2024 PFAS data previously submitted to CEDEN have been updated to reflect the current Controlled Vocabulary. Likewise, the Project QAPP (Version 2.0; BAMSC 2025) was updated to document the current terminology. Further, with the transition to the final method 1633 protocols in WY 2025, centrifuging of samples is added as an option beyond subsampling, which will facilitate analyses of samples up to 2.5% solids without subsampling. This may serve to decrease the proportion of samples that were reported with elevated MDLs and RLs relative to results of WY 2024 samples. Centrifuging, however, is not expected to be as effective in samples with a high degree of dissolved solids, as the pores on Solid Phase Extraction cartridges can clog and thereby limit sample volume able to be passed through the cartridges.

Table 3.5. Quality control issues and analysis for WY 2025 SCVURPPP LID monitoring analytical laboratory data.

Sample ID/ Type	Issue	Analysis
Conventional, Physical, and Synthetic Organics		
B4K1419-BLK1/Terphenyl(Surrogate) B4K1419-BSD1/Terphenyl(Surrogate) B4K1419-BS1/Terphenyl(Surrogate)	Surrogate recovery below the DQO of 50% for LCS.	Analytical samples in batch MTA_B4K1419_W_SVOC likely biased low as a result of low surrogate recovery in the LCS. TPH results in batch were flagged by the QA officer; no further corrective action was required.
TCM4-I-20241111/TPH diesel/TPH motor oil TCM6-I-20241111/TPH diesel/TPH motor oil TCM6-E-20241111/TPH diesel/TPH motor oil TCM6-I-20241212/TPH diesel/TPH motor oil TCM6-E-20241212/TPH diesel/TPH motor oil TCM6-E-20250213/TPH diesel/TPH motor oil	Hold time between sample collection and sample extraction exceeded the 7-day hold time after sample collection.	Hold times exceeded by several hours. TPH sample results were flagged by the QA officer; no further corrective action was required.
TCM6-D-20241214/Terphenyl(Surrogate) TCM6-I-20241214/Terphenyl(Surrogate) TCM6-E-20241214/Terphenyl(Surrogate)	Surrogate recovery is below the DQO of 50%.	TPH sample results are likely biased low based on low surrogate recovery. Results and associated non-surrogate results were flagged by the QA officer; no further corrective action was required.
B5B2004-BS1/TPH diesel B5B2004-BSD2/TPH motor oil	LCS blind spike sample recovery above the DQO of 130%.	TPH sample results are likely biased high based on high spike recovery. Results for the analytical batch were flagged by the QA officer; no further corrective action was required.
LCS for HBN 26892 [WGR/3003] /TSS LCS for HBN 28014 [WGR/3084] /TSS LCS for HBN 28175 [WGR/3097] /TSS LCS for HBN 30114 [WGR/3256] /TSS LCS for HBN 31147 [WGR/3331] /TSS LCS for HBN 34513 [WGR/3574] /TSS	Reporting limits elevated due to sample dilution.	The elevated reporting limit is two orders of magnitude below the reported results. No effect on the usability of the data. Results were flagged by the QA officer; no further corrective action was required.
Metals		
TCM4-I-20241111/ Dissolved Cu TCM6-I-20241111/ Dissolved Cu TCM6-E-20241111/ Dissolved Cu TCM6-I-20241214/ Dissolved Cu TCM6-E-20241214/ Dissolved Cu TCM6-D-20241214/ Dissolved Cu	Hold time between sample collection and sample filtration exceeded the 24 hours hold time.	Hold times exceeded. Data was flagged by the QA officer; no further corrective action was required.
TCM6-I-20250313/ Total Cu	Reporting limits elevated due to sample dilution.	The elevated reporting limit is two orders of magnitude below the reported results. No impact on the usability of the data. Data was flagged by the QA officer; no further corrective action was required.
TCM6-E-20241111/ Dissolved Hg TCM6-E-20250213/ Dissolved Hg TCM6-E-20250312/ Dissolved Hg	Hold time between sample collection and sample filtration exceeded the 24 hours hold time.	Hold times exceeded. Data was flagged by the QA officer; no further corrective action was required.
TCM4-I-20241111/ Total Hg TCM6-I-20241111/ Total Hg TCM6-E-20241111/ Total Hg TCM6-I-20250313/ Total Hg	Reporting limits elevated due to sample dilution.	The elevated reporting limit is an order of magnitude below the reported results. No impact on the usability of the data. Data was flagged by the QA officer; no further corrective action was required.
TCM6-E-20241111/Dissolved Zn TCM4-I-20241111/Dissolved Zn TCM6-I-20241214/Dissolved Zn TCM6-E-20241214/Dissolved Zn TCM6-D-20241214/Dissolved Zn TCM6-I-20241111/Dissolved Zn TCM6-E-20241111/Dissolved Zn	Hold time between sample collection and sample filtration exceeded the 24 hours hold time.	Hold times exceeded. Data was flagged by the QA officer; no further corrective action was required.
TCM6-I-20241111/ Total Zn TCM6-I-20250313/ Total Zn	Reporting limits elevated due to sample dilution.	The elevated reporting limit is two orders of magnitude below the reported results. No impact on the usability of the data. Data was flagged by the QA officer; no further corrective action was required.
PFAS		
B25B239-BS1/Ethyl Perfluorooctanesulfonamide-d5, N-(IsoDilAnalogue)	LCS blind spike sample recovery below DQO percent recovery of 40%.	Analytical results of /Ethyl Perfluorooctanesulfonamide-d5, N-(IsoDilAnalogue) in batch B25B239 likely biased low as a result of low LCS recovery. Results in batch were flagged by the QA officer; no further corrective action was required.

4.0 WY 2024 – WY 2025 LID MONITORING RESULTS

During WY 2024, SCVURPPP began conducting LID Monitoring at TCM4 and TCM6 at the Top Golf Public Green Streets Project in San José, CA. Monitoring at TCM4 was discontinued due to lack of measurable effluent despite attempted repairs, in total producing analytical results for influent in one storm event each for WY 2024 and WY 2025. Monitoring at TCM6 was continued through WY 2025, with a total of 6 monitored storm events in WY 2024 and another 5 events in WY 2025, and additional monitoring planned to continue through the MRP permit term.

The hydrologic and water quality results of these 11 TCM6 WY 2024 and WY 2025 monitored storm events and their comparison to WQOs, maintenance activities, and LID monitoring data from other BAMSC counties are presented below. The storm event characteristics and water quality results of the two TCM4 storm event influents are also presented below but excluded from further comparison and analysis due to the limited data available.

4.1 Hydrologic Monitoring

Hydrologic monitoring consisted of continuous data collection of rainfall depth, influent flow rate, effluent flow rate, and ponding depth. Water-level bubblers used to determine influent and effluent flows were procured, bench-tested, and installed in late WY 2023, prior to the WY 2024 rainy season. The first storm event of WY 2024 took place on October 17, 2023. Only hydrologic monitoring was conducted during this event. However, these original Teledyne ISCO bubblers were found to fail under field conditions due to a design flaw and were subsequently replaced with bubblers from another manufacturer (Campbell Scientific Instruments). Troubleshooting and equipment replacement delayed full hydrologic monitoring until January 2, 2024. All flow data collected prior to installation of the replacement bubblers are considered highly uncertain and were rejected. After the replacement bubblers were installed, influent and effluent were successfully measured throughout the remainder of the rainy season during WY 2024 and all of the rainy season during WY 2025 at TCM6. The hydrologic equipment was removed from the sites in late-May 2024 for dry season storage, maintenance, and pre-season bench testing, and re-installed in September 2024, prior to the WY 2025 rainy season.

At TCM4, only influent was observed, with a gap between February and March when the influent bubbler was temporarily removed to support LID monitoring at a site in San Mateo County so at least one site per county was operational while waiting for all the replacement bubblers to arrive. One issue that was noted at TMC4 was that influent volume was low for the expected drainage area. The Project Team theorized that relatively small storms were likely 100% infiltrated, resulting in no observed effluent flow. However, in subsequent larger storm events, the Project Team also discovered leaks in the overflow vault which caused any effluent to bypass the flow monitoring equipment. Initially the Project Team attempted to patch these leaks, however the patches proved insufficient. The City of San José construction contractor was required to conduct a more extensive repair of the system to stop the leaks, which was done at the end of the rainy season (May 2024). Therefore, no effluent flow was observed at TCM4 during the entirety of the WY 2024 monitoring period. Once again, effluent was not observed at TCM4 during the WY 2025 monitoring period; having already addressed identified remedies, monitoring at TCM4 was discontinued.

Statistics for each TCM6 monitored storm event in WY 2024 and WY 2025 are shown in Table 4.1. Statistics for the TCM4 monitored storm events – one per water year and each with no observed effluent – are shown in Table 4.2. An annual hydrograph for rainfall and flow monitoring during WY 2025 at TCM6 is shown on Figure 4.1. Hydrographs for each WY 2025 monitored storm event at both TCM4 and TCM6 are shown in Figure 4.2. Hydrographs for WY 2024 monitored storm events were presented previously (SCVURPPP 2025) and are included in Appendix B.

Figure 4.1 provides an overview of the storms monitored by SCVURPPP in WY 2025 and illustrates that a variety of storm sizes and antecedent dry periods were monitored. For TCM6, the total rainfall measured for WY 2025 monitored storms ranged from 0.35 inches on November 11, 2024 to 1.73 inches on February 13, 2025. Figure 4.2 shows more details about the rainfall, influent and effluent hydrographs for the monitored storms in WY 2025, including where on the hydrograph the aliquots for the composite influent and effluent samples were collected. These figures illustrate that SCVURPPP was successful in collecting flow-weighted composite samples. Figures 4.1 and 4.2 also show that the ponding overflow stage for TCM6 was not exceeded in WY 2025 storm events, and no treatment bypasses were observed.

Table 4.1 shows that WY 2024 and WY 2025 measured influent volumes (which ranged from 243 cf during the January 14, 2024 storm event to 2,315 cf during the February 13, 2025 storm event) always exceed measured effluent volumes (which ranged from 6 cf during the January 14, 2024 storm event to 1,377 cf during the December 14, 2024 storm event). Influent and effluent volumes were used to calculate the storm event volume reduction in Table 4.1 as well as the pollutant load percent reductions shown in Tables 4.6 and 4.7. The WY 2024 – WY 2025 percent volume reduction calculated for TCM6 ranged from 27% during the storm event on December 14, 2024 to 98% during the storm event on January 14, 2024. The differences between influent and effluent metrics are discussed in more detail in Section 4.1.1 of this report.

Table 4.1. Water Year 2024 and Water Year 2025 water quality storm event statistics at TCM6, San José, CA.

Storm Number	Storm End Date	Antecedent Dry Period (hours)	Total Rainfall (inches)	Rainfall Duration (hours)	Maximum Rainfall Intensity (in/hr) [a]	Influent Total Storm Volume (cf)	Effluent Total Storm Volume (cf)	Max Ponding Stage (in)	No. of Influent / Effluent Aliquots	% Storm Capture Influent / Effluent	% Volume Reduction
1	01/03/2024	75	0.41	9	0.18	457	234	0.0	12 / 16	66/90	49%
2	01/14/2024	71	0.31	12	0.08	243	6	1.3	16 / 0	100/NA[b]	98%
3	02/01/2024	174	1.11	8	0.38	1,344	904	4.9	27 / 31	100/100	33%
4	02/14/2024	169	0.25	5	0.17	370	146	NM[c]	21 / 8	100/80	61%
5	03/02/2024	256	0.47	33	0.13	583	49	NM[c]	24 / 6	100/86	92%
6	03/23/2024	249	0.58	11	0.18	655	236	0.0	21 / 15	100/100	64%
7	11/11/2024	225	0.35	3	0.15	320	205	0.0	23 / 12	100/100	36%
8	12/12/2024	395	0.45	21	0.13	994	281	0.0	15 / 8	100/100	72%
9	12/14/2024	42	1.21	13	0.29	1,882	1,377	6.8	18 / 20	100/100	27%
10	02/13/2025	132	1.73	30	0.24	2,315 [d]	1,374	0.0	29 [d] / 19	100/100	41%
11	03/13/2025	168	0.53	26	0.16	295	75	0.0	8 / 3	100/100	75%

[a] Maximum Rainfall Intensity (in/hr) is calculated over 60-minute integration intervals.

[b] Not Applicable – no effluent sample was collected due to low storm volume.

[c] NM = Not Measured due to equipment issues or insufficient flow.

[d] Influent total storm volume and number of samples are slightly biased high due to sediment clogging of the bubbler sensor during the second half of the storm.

Table 4.2. Water Year 2024 and Water Year 2025 water quality storm event statistics at TCM4, San José, CA.

Storm Number	Storm End Date	Antecedent Dry Period (Hours)	Total Rainfall (inches)	Rainfall Duration (hours)	Maximum Rainfall Intensity (in/hr)[a]	Influent Total Storm Volume (cf)	Effluent Total Storm Volume (cf)	Max Ponding Stage (in)	No. of Influent / Effluent Samples	% Storm Capture Influent / Effluent	% Volume Reduction
1	1/14/2024	71	0.31	12	0.08	114	0	NM	10 / 0	100 / NA[b]	100%
2	11/11/2024	225	0.35	3	0.15	120	0	0.0	25 / 0	100 / NA[b]	100%

[a] Maximum Rainfall Intensity (in/hr) is calculated over 60-minute integration intervals.

[b] Not Applicable – no effluent sample was collected due to low storm volume.

[c] NM = Not Measured due to equipment issues or insufficient flow.

[d] No effluent flow observed at this site; influent sample still analyzed by lab.

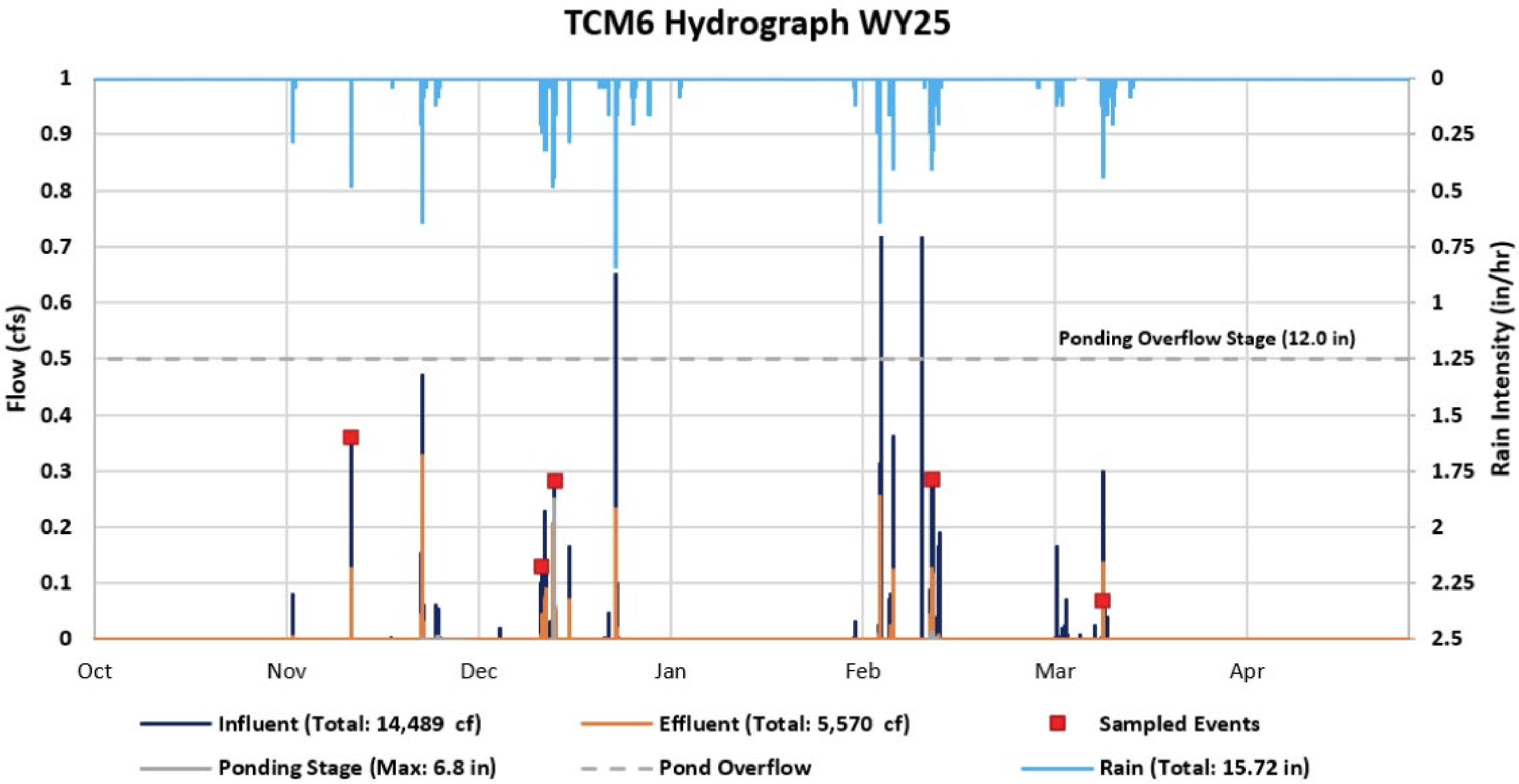

Figure 4.1. WY 2025 hydrology data measured at the TCM6 facility in San José, CA.

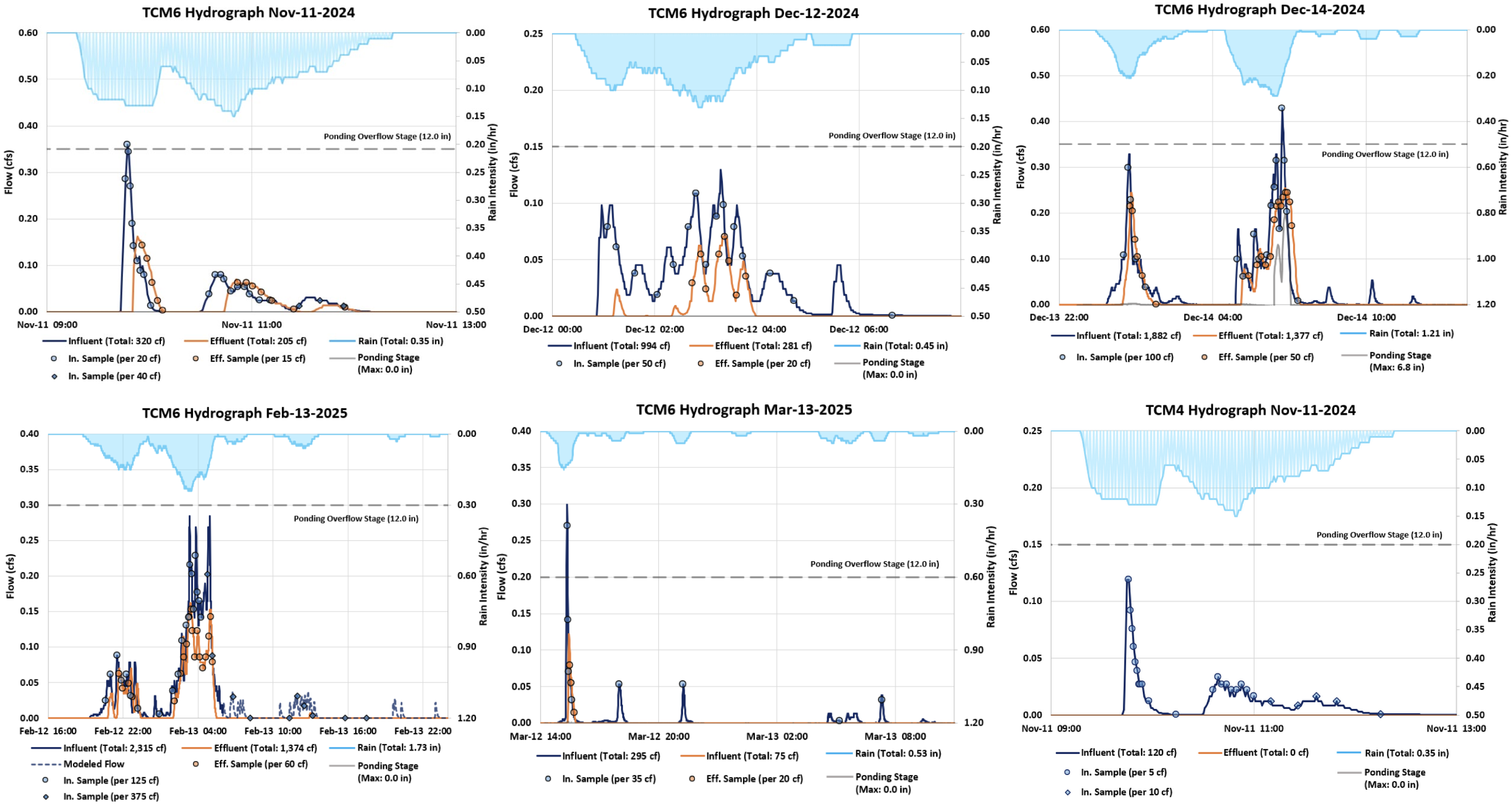

Figure 4.2. Rainfall, flow and sample collection for individual WY 2025 monitored storm events at the TCM4 and TCM6 bioretention facilities in San José, CA. Top row left to right: TCM6 storm event 7 (November 11, 2024); TCM6 storm event 8 (December 12, 2024); TCM6 storm event 9 (December 14, 2024). Bottom row left to right: TCM6 storm event 10 (February 13, 025); TCM6 storm event 11 (March 13, 2025); TCM4 storm event 2 (November 11, 2024). Hydrographs for individual WY 2024 monitored storm events were previously reported (SCVURPPP 2025) and are included in Appendix B.

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4.1.1 Water Balance

Water balance results for 11 monitored storms at TCM6 are presented in Table 4.3. Each component of the water balance was measured and/or estimated as described in Section 3.4.1. Water balance results are not calculated for TCM4 due to the limitations of sampling at that facility, as discussed in Section 4.1.

- **Inputs.** The input of water to the facility (runoff and direct rainfall) varied widely between the 11 events, from 250 to 2,356 cf, due to widely varying rainfall depths among the 11 events.
- **Storage.** For each event, the volume of water stored in the soil media was assumed to be the maximum modeled water capacity of the soil (114 cf) and did not take into account decreased capacity due to residual soil moisture that may have been present at the start of a storm. This assumption likely caused a high bias for the estimation of storage in the soil media since it is likely that some water was already stored in the soil at the outset of some of the monitored storms, particularly those with short antecedent dry periods.
- **Outputs.** As described in Section 3.4.1, evapotranspiration was considered negligible over the relatively short duration of the storms. Ponded water levels within the facility did not exceed the maximum ponding depth of 12 inches at any time during any of the storms, therefore the overflow value for each storm event is zero. For most rain events, a dominant output component was outflow through the facility underdrain. Similarly to water inputs, outflow measures varied greatly, ranging from 6 to 1,377 cf for outflow. Exfiltration output varied greatly as well but generally tracked with outflow volume as expected.

The final water balance component is shown in Table 4.3, “Unknown losses & measurement/estimation errors” is a correction factor that allows the total inputs and total outputs to balance each other. Somewhat minor factors that fall into this category include inherent flow measurement errors, assumption and modeling errors, and the propagation of these errors to calculated values. Potentially larger correction factors include water losses from the facility through unknown preferential pathways. These pathways can include lateral advection of water into surrounding soils, leaks in the overflow structure that allow effluent flow to join the MS4 without passing through the underdrain pipe, etc. The sum of unknown factors per event ranged from -15 to 725 cf, a considerable volume for most monitored storm events and accounting for about 25% of the total outputs for the combined water years. Although this component is unknown, it is worth noting that the real portion of the unknown outputs (e.g. ignoring measurement or modelling errors) is most likely due to preferential pathways within and exiting the LID facility. This is runoff that has entered the LID facility and been treated by it, so the water quality of these flows is likely to have been improved to a comparable degree as the outputs measured at the outflow (see Section 4.2 for water quality monitoring results).

Figure 4.3 presents a stacked bar chart of the cumulative inputs and outputs of all 11 monitored storms. Overall, runoff accounted for 98% of the total inputs, with the remaining 2% due to direct rainfall landing on the facility. Combined outputs included outflow (51%), storage in soil media (13%), exfiltration (11%), and unknown losses and measurement/estimation errors (25%). As described above, the soil media storage percentage is likely high-biased (i.e., likely less than 13% of the total). Note that a high bias in the soil media storage translates to a low bias in the correction factor (i.e., as soil media storage goes down, unknown losses and measurement/estimation errors go up). The remaining 14 storm events that are targeted for monitoring in WYs 2026 and 2027 should help to refine our understanding of the overall water balance at TMC6.

Table 4.3. Water balance inputs and outputs for monitored storm events during Water Years 2024 and 2025 at the TCM6 bioretention facility, San José, CA.

Storm Date	Water Balance Component (cubic feet): San José TCM6								Total Inputs = Total Outputs
	Inputs		Outputs						
	Runoff	Direct Rainfall	Storage in Soil Media	Evapotranspiration	Overflow	Outflow	Exfiltration	Unknown losses & measurement/ estimation	
01/03/2024	457	10	114	0	0	234	64	55	467
01/14/2024	243	7	114	0	0	6	145	-15	250
02/01/2024	1,344	25	114	0	0	904	91	260	1,369
02/14/2024	370	6	114	0	0	146	41	75	376
03/02/2024	583	11	114	0	0	49	194	236	594
03/23/2024	655	13	114	0	0	236	193	125	668
11/11/2024	320	8	114	0	0	205	0	9	328
12/13/2024	994	14	114	0	0	281	57	556	1,008
12/15/2024	1,882	29	114	0	0	1,377	101	319	1,911
02/13/2025	2,315 [a]	41	114	0	0	1,374	143	725	2,356
03/13/2025	295	13	114	0	0	75	36	83	308
WY 24 - WY 25 Total	9,458	177	1,254	0	0	4,887	1,065	2,428	9,635

[a] Influent total storm volume slightly biased high due to sediment clogging of the bubbler sensor during the second half of the storm.

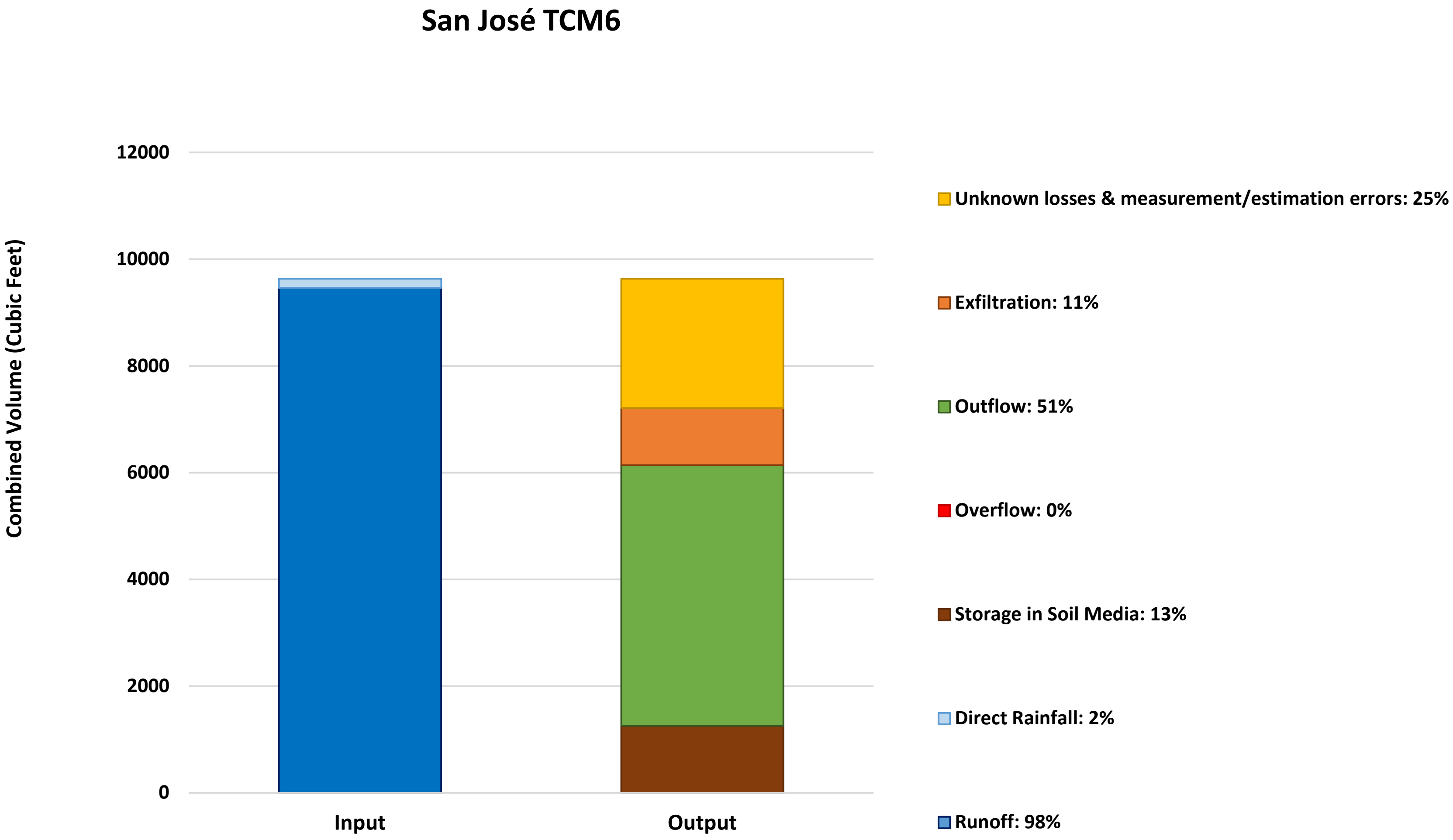

Figure 4.3. Cumulative water balance for all monitored WY 2024 – WY 2025 storm events, TCM6 bioretention facility, San José, CA.

4.2 Water Quality Monitoring

The Program successfully completed seven water quality sampling events during WY 2024 (one at TCM4 and six at TCM6) and another six sampling events in WY 2025 (one at TCM4 and five at TCM6). No paired influent-effluent samples were collected from TCM4 and the two monitored events at that facility represent influent only, due to facility challenges described in Section 4.1, so TCM4 results are excluded from further analysis except where otherwise specified. The WY 2024 – WY 2025 TCM6 sampling events generated between four and 11 quantified datapoints for each Project analyte at the influent and effluent points associated with the facility. Additionally, modifications to analytical programs incorporated by BAMSC Programs for WY 2025 resulted in a greater proportion of quantified analytical results for WY 2025 monitoring. This is especially relevant for TPH and PFAS, the two analyte types that exhibited the highest proportion of non-detectable results in WY 2024.

4.2.1 Analytical Results and Loadings Analysis

Analytical results for WY 2024 and WY 2025 are summarized in Tables 4.4 through 4.7. For each analyte or analyte class, Table 4.4 displays TCM6 WY 2024 and WY 2025 influent and effluent concentrations per storm event and the arithmetic means and average concentration percent reductions across the two-year study period. Table 4.5 displays the same information for the monitored storm events for TCM4, but since these events were influents only, all other analysis (including summary statistics, analyte load reductions, figures, and results discussions) utilize only TCM6 data unless otherwise specified. Table 4.6 displays influent-to-effluent concentration percent reductions and load percent reductions for each analyte and storm event, and for the total two-year study period. Table 4.7 displays summary statistics for each analyte or analyte class across the two-year study period. All PCB data displayed or discussed here refer to a sum of the RMP 40 PCB Congeners. Similarly, “Total PFAS Analytes” used here refers to a sum of all 40 detected PFAS analytes analyzed with the EPA 1633 methodology, with non-detects treated as 0 and J-flagged results included. Results and MDLs for individual PCB congeners and individual PFAS analytes are available from CEDEN and upon request.

Table 4.4. Summary of Water Year 2024 and Water Year 2025 water quality data collected at the San José TCM6 bioretention facility, San José, CA.

Analytes	Units	WY 2024 Storm End Date												WY 2025 Storm End Date										WY 2024 - WY 2025 Influent Mean	WY 2024 - 2025 Effluent Mean
		1/2/2024		1/14/2024		2/1/2024		2/14/2024		3/2/2024		3/23/2024		11/11/2024		12/12/2024		12/14/2024		2/14/2025[d]		3/13/2025[e]			
		Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent		
Conventional, Physical, and Synthetic Organics																									
pH	none	7.0	7.0	7.5	NA	7.1	7	7.3	7.2	7.3	7.3	7.2	7.1	6.9	7.1	7.3	7.1	7.4	7.2	7.1	7.0	7.1	6.8	7.2	7.1
Hardness as CaCO3	mg/L	40	30	24	NA	18	16	20	42	30	40	18	30	108	48	20	26	16	14	20	14	20	26	30.4	28.6
Total Suspended Solids	mg/L	310	15	48	NA	53	8.6	87	11	68	8.4	81	9.2	113	20	38.4	7.4	58.2	17.3	22	4.5	128	20	91.5	12.1
TPH as Diesel C12-C24	µg/L	< 74	< 74	310	NA	< 74	< 74	< 74	< 74	< 74	< 74	< 74	< 74	1200	530	370	160	69	< 42	180	< 42	350	NA	433.8[a]	172.5[a]
TPH as Motor Oil C24-C36	µg/L	< 160	< 160	420 J	NA	< 160	< 160	< 160	< 160	< 160	< 160	< 160	< 160	660	250	340	< 25	68 J	< 25	310	< 25	470	NA	369.6[a]	62.5[a]
Total Metals																									
Copper	µg/L	33	8.3	8.6	NA	8.4	4.7	10	5.5	9.8	6.7	12	7.8	26	16	8	5.9	7	5.3	4.7	3.2	19	8.2	13.3	7.2
Mercury	µg/L	0.053	0.012	0.012	NA	0.016	0.008	0.019	0.009	0.013	0.009	0.010	0.009	0.016	0.010	0.007	0.004	0.008	0.006	0.008	0.004	0.018	0.005	0.016	0.008
Zinc	µg/L	338	8.8	103	NA	100	6.2	117	7.4	129	10	159	8.8	286	17	104	6.2	82	8.6	52	4.5	247	20	156.1	9.8
Dissolved Metals																									
Copper	µg/L	3.4	6.6	2.9	NA	1.5	3.7	1.8	4.2	3.4	5.4	3.8	6.2	12	12	3.7	5.6	1	3.3	1.9	2.5	3.4	6.1	3.5	5.6
Mercury	µg/L	0.002	0.001	0.002	NA	0.003	0.005	0.001	0.004	0.002	0.005	0.002	0.005	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.003	0.002	0.003
Zinc	µg/L	32	2.9	37	NA	15	1.5	12	2.6	51	4	35	4.3	149	6.4	40	1.7	25	2.2	24	2.6	25	5	40.5	3.3
PCB Congeners																									
Total RMP 40 PCB Congeners	ng/L	0.23	0.42	1.7	NA	1.8	0.27	3.6	0.23	2.2	0.28	1.70	0.14	9.69	0.41	1.66	0.20	2.49	0.38	1.58	0.17	4.03	NA	2.8	0.3
PFAS																									
Total PFAS Analytes[b]	µg/L	0.01262	0.02859	0.00724	NA	0.00092	0.01012	0[c]	0.02221	0.00646	0.02790	0.00230	0.02875	0.04213	0.14852	0.01438	0.02584	0.00032	0.01690	0.00441	0.00408	0.00729	0.02945	0.00891	0.03424

NC Not calculated.
NA Not analyzed due to low sample volume.
J Analyte was detected; value is considered an estimate since it falls between the MDL and the reporting limit.
< Analyte not detected at or above the associated method detection limit (MDL).
a Influent and Effluent Mean and Total Concentration % Reduction for TPH is calculated using only WY 2025 data due to the high degree of TPH non-detects from the analytical method used in WY 2024.
b Total PFAS Analytes is the sum of all 40 detected PFAS analytes analyzed with the EPA 1633 methodology. Non-detects are treated as 0 for the purposes of this calculation and individual J-flagged results are included.
c MDLs vary by PFAS analyte. For the February 14th, 2024 influent sample, all PFAS analytes were non-detect, with MDLs ranging from 0.279 – 8.46 µg/L.
d For the storm event ending on February 14th, 2025, influent sample was collected on February 14th and effluent sample collected on February 13th.
e For the storm event ending on March 13th, 2025, influent sample was collected on March 13th and effluent sample collected on March 12th.

Table 4.5. Summary of Water Year 2024 and Water Year 2025 water quality data collected at the San José TCM4 bioretention facility, San José, CA

Analytes	Units	WY 2024 Storm End Date		WY 2025 Storm End Date		WY 2024 - WY 2025 Influent Mean
		1/14/2024		11/11/2024		
		Influent	Effluent	Influent	Effluent	
Conventional, Physical, and Synthetic Organics						
pH	none	7.5	NA	7	NA	7.3
Hardness as CaCO3	mg/L	32	NA	96	NA	64
Total Suspended Solids	mg/L	56	NA	101	NA	79
TPH as Diesel C12-C24	µg/L	< 74	NA	1100	NA	550
TPH as Motor Oil C24-C36	µg/L	< 160	NA	630	NA	315
Total Metals						
Copper	µg/L	8.4	NA	22	NA	15
Mercury	µg/L	0.033	NA	0.024	NA	0.029
Zinc	µg/L	80	NA	192	NA	136
Dissolved Metals						
Copper	µg/L	1.8	NA	10	NA	5.8
Mercury	µg/L	0.002	NA	0.001	NA	0.002
Zinc	µg/L	12	NA	75	NA	44
PCB Congeners						
Total RMP 40 PCB Congeners	ng/L	6.4	NA	4	NA	5.1
PFAS						
Total PFAS Analytes[a]	µg/L	0.00670	NA	0.03828	NA	0.02249

NA Not analyzed due to low sample volume.
< Analyte not detected at or above the associated method detection limit (MDL).
a Total PFAS Analytes is the sum of all 40 detected PFAS analytes analyzed with the EPA 1633 methodology. Non-detects are treated as 0 for the purposes of this calculation and individual J-flagged results are included.

Table 4.6. Concentration and load percent reductions per analyte and storm event, Water Year 2024 and Water Year 2025, for water quality data collected at the San José TCM6 bioretention facility, San José, CA. Negative results indicate increases in pollutant concentration or load.

Analyte (units)	WY 2024 Storm End Date												WY 2025 Storm End Date										Total (WY 2024 - WY 2025)	
	1/2/2024		1/14/2024		2/1/2024		2/14/2024		3/2/2024		3/23/2024		11/11/2024		12/12/2024		12/14/2024		2/14/2025		3/13/2025			
	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction [a]	Total Concentration % Reduction	Total Load % Reduction
Conventional, Physical, and Synthetic Organics																								
pH	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	**NC**	**NC**
Hardness as CaCO3	25%	62%	NC	NC	11%	40%	-110%	17%	-33%	89%	-67%	40%	56%	72%	-30%	63%	13%	36%	30%	58%	-30%	67%	**6%**	**56%**
Total Suspended Solids	95%	98%	NC	NC	84%	89%	87%	95%	88%	99%	89%	96%	82%	89%	81%	95%	70%	78%	80%	88%	84%	96%	**87%**	**91%**
TPH as Diesel C12-C24	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	56%	72%	57%	88%	100%	100%	100%	100%	NC	NC	**60%**	**88%**
TPH as Motor Oil C24-C36	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	62%	76%	100%	100%	100%	100%	100%	100%	NC	NC	**83%**	**96%**
Total Metals																								
Copper	75%	87%	NC	NC	44%	62%	45%	78%	32%	94%	35%	77%	38%	61%	26%	79%	24%	45%	32%	60%	57%	89%	**46%**	**71%**
Mercury	80%	88%	NC	NC	50%	66%	50%	81%	0%	94%	0%	68%	38%	60%	40%	84%	25%	45%	56%	70%	72%	93%	**52%**	**74%**
Zinc	97%	99%	NC	NC	94%	96%	94%	98%	92%	99%	94%	98%	94%	96%	94%	98%	90%	92%	91%	95%	92%	98%	**94%**	**97%**
Dissolved Metals																								
Copper	-94%	1%	NC	NC	-147%	-66%	-133%	8%	-59%	87%	-63%	41%	0%	36%	-51%	57%	-230%	-141%	-32%	22%	-79%	54%	**-58%**	**16%**
Mercury	50%	74%	NC	NC	-67%	-12%	-300%	-58%	-150%	79%	-150%	10%	0%	36%	-25%	72%	0%	27%	-90%	-19%	-45%	62%	**-78%**	**21%**
Zinc	91%	95%	NC	NC	90%	93%	78%	91%	92%	99%	88%	96%	96%	97%	96%	99%	91%	94%	89%	94%	80%	95%	**92%**	**96%**
PCB Congeners																								
Total RMP 40 PCB Congeners	NC	NC	NC	NC	85%	90%	94%	97%	87%	99%	92%	97%	96%	97%	88%	97%	85%	89%	89%	94%	NC	NC	**90%**	**94%**
PFAS Analytes																								
Total PFAS Analytes [b]	-127%	-8%	NC	NC	-995%	-585%	↑	↑	-332%	66%	-1150%	-319%	-253%	-110%	-80%	53%	-5247%	-3536%	7%	49%	-304%	4%	**-284%**	**-68%**

Concentration % Reduction is calculated as $(\text{Concentration}_{inf} – \text{Concentration}_{eff})/\text{Concentration}_{inf}$ for each storm event. Total Concentration % Reduction is calculated from the means with the same formula.

Load % Reduction is calculated as $(\text{Sum}_{inf} – \text{Sum}_{eff})/\text{Sum}_{inf}$ for each storm event. Total Load % Reduction is calculated from the sums across both WY 2024 and WY 2025 with the same formula. Total Load % Reduction only includes storm events where both influent and effluent were analyzed for a given constituent.

NC = Not calculated due to the high number of non-detects in the storm-specific influent and effluent data or other sample considerations. TPH calculations are frequently NC for WY 2024 data due to high degree of non-detects from the analytical method used in WY 2024.

↑ Influent was non-detect but Effluent was detected, indicating a concentration and load increase.

[a] Total Influent Storm Volume for the February 13th/14th, 2025 event is potentially biased slightly high due to sediment clogging of the bubbler sensor during the second half of the storm, which may impact load reduction calculations.

[b] Total PFAS Analytes is the sum of all 40 detected PFAS analytes analyzed with the EPA 1633 methodology. Non-detects are treated as 0 for the purposes of this calculation and individual J-flagged results are included.

Table 4.7. Descriptive statistics of Water Year 2024 and Water Year 2025 water quality data collected at the San José TCM6 bioretention facility, San José, CA. Negative results indicate increases in pollutant concentration or load.

Analyte (units)	Sample Count		Interquartile Range (25th-75th percentiles)		Median		Mean		Total Load % Reduction
	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	
Conventional, Physical, and Synthetic Organics									
pH	11	10	7.1 - 7.3	7.0 - 7.2	7.2	7.1	7.2	7.1	NC
Hardness as CaCO3 (mg/L)	11	10	19 - 27	19 - 38	20	28	30	29	56%
Total Suspended Solids (mg/L)	11	10	50.5 - 100	8.5 - 16.7	68	10.1	91.5	12.1	91%
TPH as Diesel C12-C24 (µg/L) [a]	5	4	180 - 370	0 - 252.5	350	80	434	173	88%
TPH as Motor Oil C24-C36 (µg/L) [a]	5	4	310 - 470	0 - 62.5	340	0	370	63	96%
Total Metals									
Copper (µg/L)	11	10	8.2 - 15.5	5.35 - 8.1	9.8	6.3	13.3	7.2	71%
Mercury (µg/L)	11	10	0.009 - 0.017	0.005 - 0.009	0.013	0.009	0.016	0.008	74%
Zinc (µg/L)	11	10	101.5 - 203	6.5 - 9.7	117	8.7	156.1	9.8	97%
Dissolved Metals									
Copper (µg/L)	11	10	1.85 - 3.55	3.83 - 6.18	3.40	5.50	3.53	5.56	16%
Mercury (µg/L)	11	10	0.002 - 0.002	0.002 - 0.005	0.002	0.003	0.002	0.003	21%
Zinc (µg/L)	11	10	24.5 - 38.5	2.3 - 4.2	32.0	2.8	40.5	3.3	96%
PCB Congeners									
Total RMP 40 PCB Congeners (ng/L)	11	9	1.68 - 3.05	0.2 - 0.38	1.80	0.27	2.79	0.28	94%
PFAS									
Total PFAS Analytes (µg/L) [b]	11	10	0.00161 - 0.00995	0.01823 - 0.02871	0.00646	0.02687	0.00891	0.03424	-68%

Sample Count is the total number of viable samples for WY 2024 and WY 2025.

Total Load % Reduction is calculated from the sums across both WY 2024 and WY 2025 as $(Sum_{inf} – Sum_{eff})/Sum_{inf.}$ Total Load % Reduction only includes storm events where both influent and effluent were analyzed for a given constituent.

a TPH calculations exclude WY 2024 data due to high degree of non-detects and/or uncertainty from the analytical method used in WY 2024.

b Total PFAS Analytes is the sum of all 40 detected PFAS analytes analyzed with the EPA 1633 methodology. Non-detects are treated as 0 for the purposes of this calculation and individual J-flagged results are included.

As identified in the SCVURPPP Monitoring Plan (SCVURPPP 2023, revised SCVURPPP 2024), the Project analytes that are considered sediment-associating include total PCBs, total fraction trace metals (mercury, copper, zinc), and TSS. At the San José TCM6 bioretention facility, only hardness (5 of 10 sampling events); dissolved copper (9 of 10 sampling events); dissolved mercury (7 of 10 sampling events); and total PFAS (9 of 10 sampling events) exhibited lower concentrations in influent relative to effluent (Tables 4.4 and 4.6). All other analytes had higher influent than effluent concentrations for all WY 2024 and WY 2025 sampling events, indicating removal within the bioretention facility. Concentrations of all constituents except dissolved copper, dissolved mercury, and total PFAS were lower in effluent than influent when averaged across the 11 monitored storms, showing overall contaminant reductions in the sediment-associated contaminants of concern as well as in both measures of TPH and dissolved zinc.

Significantly, changes in analyte loads between influent and effluent (Load % Reductions, calculated for the first time in this report) provide a stronger signal of contaminant removal in bioretention facilities compared to metrics based on pollutant concentrations alone. Table 4.6 shows that individual storm event effluent loads were consistently and substantially lower than influent loads for all analytes other than dissolved copper, dissolved mercury, and total PFAS, for which loads increased in some monitored storm events and decreased in others. Total effluent loads across the two-year monitoring period were substantially reduced for all analytes except total PFAS: the sediment-associated analytes, both categories of TPH, and dissolved zinc saw total load reductions of 71-97%. Even dissolved copper and dissolved mercury – which had total concentration increases – showed modest but positive total load reductions (58% total concentration increase and 16% total load decrease for dissolved copper; 78% total load increase and 21% total load decrease for dissolved mercury). Total PFAS, which still increased in loads, performed better when looking at the more-representative loads calculation compared to concentrations, with a 284% concentration increase compared to a 68% load increase, as well as load reductions in four monitored storm events.

The importance of calculating load reductions as opposed to relying solely on concentration changes is demonstrated in Figure 4.4, which compares both metrics for dissolved copper in each monitored storm event: although results are still mixed, loads reductions are higher than concentration reductions in every storm event, and positive load reductions are often seen even in individual storm events with concentration increases. LID's high overall contaminant removal efficacy is visualized in Figure 4.5, which uses TSS as a proxy for sediment-bound contaminants to display concentration and load reduction percentages for each monitored storm event.

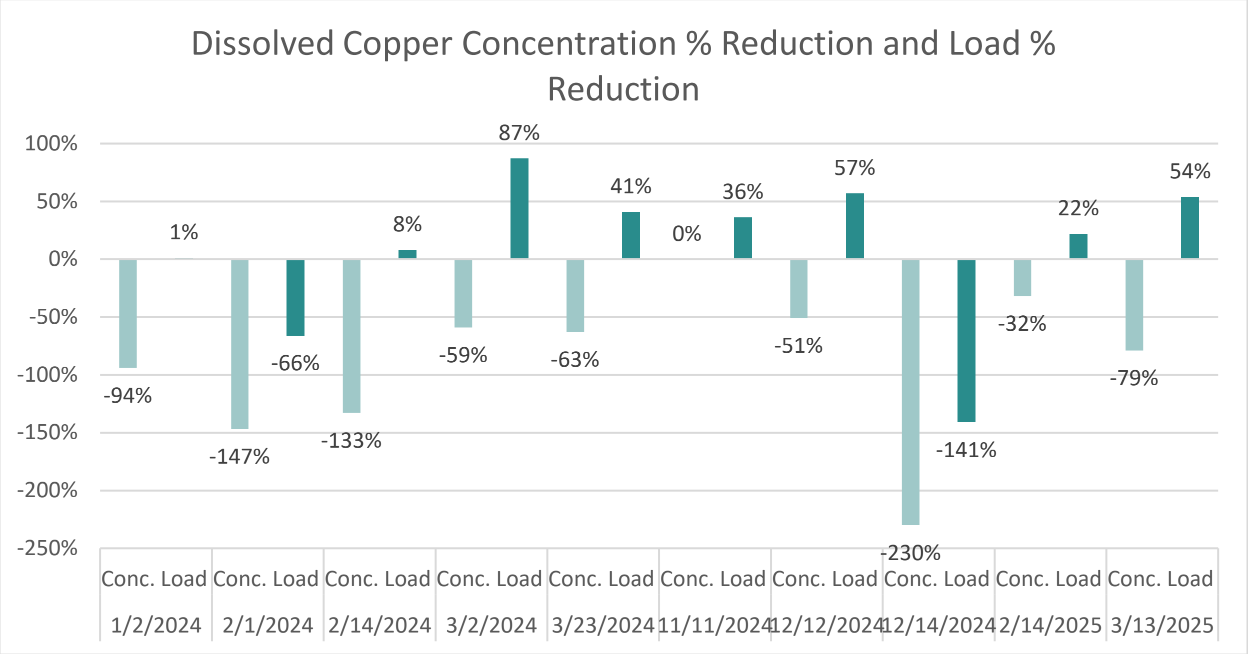

Figure 4.4. Dissolved copper Concentration vs Load % Reductions per storm event (WY 2024 – 2025), San José TCM6 bioretention facility, San José, CA. Note the January 14, 2024 storm event is excluded due to lack of effluent measurements. Negative results indicate increases in pollutant concentration or load.

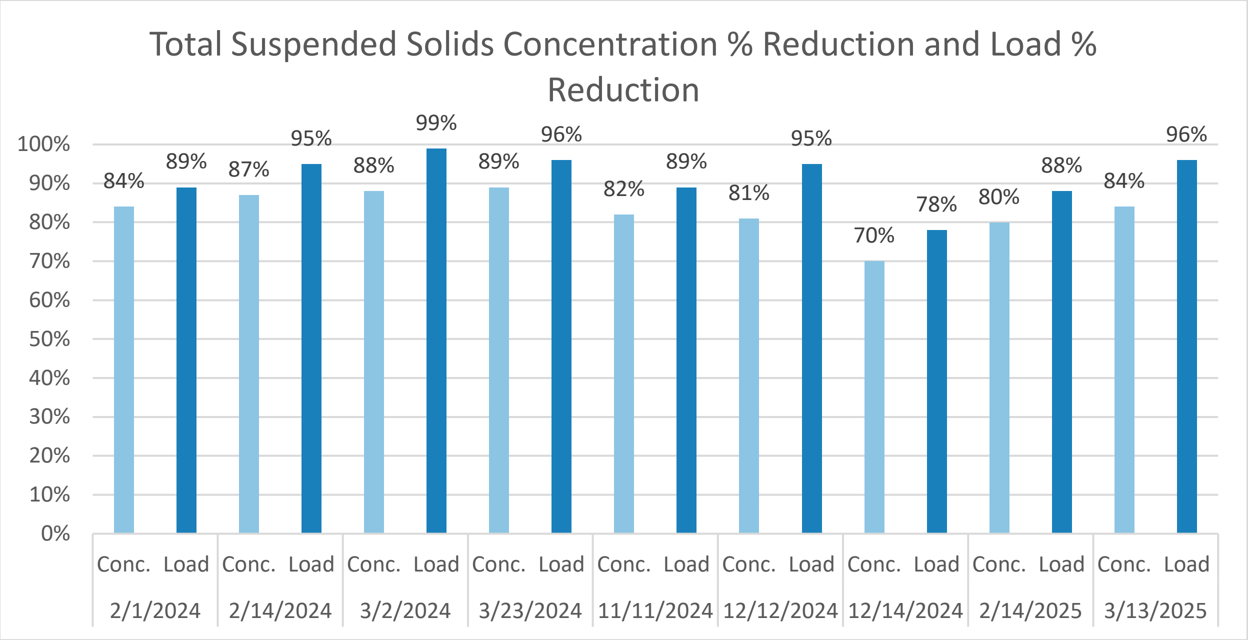

Figure 4.5. TSS Concentration vs Load % Reductions per storm event (WY 2024 – 2025), San José TCM6 bioretention facility, San José, CA. Note the January 14th, 2024 storm event is excluded due to lack of effluent measurements.

PFAS stands out as the exception to these strong contaminant reduction results. Total PFAS concentrations increased between influent and effluent in nine of 10 monitored storm events for which this calculation is available, with only a slight reduction in the remaining storm event. Total PFAS concentrations across WY 2024 and WY 2025 increased by 284% (Table 4.6). Other than the overall pattern of concentration increases, total PFAS concentrations varied widely, with sometimes drastic percentage increases and a wide range of total PFAS analyte concentrations, as shown in Tables 4.4 and 4.6 and visualized in Figure 4.6. Total PFAS loads performed better but still poorly, increasing in six of the 10 monitored storm events and by 68% across both WY 2024 and WY 2025. The picture for PFAS is even more complex and inconsistent when looking at loads for individual PFAS analytes (Table 4.8): excluding non-detects, nearly every monitored storm event had some individual PFAS analytes increase while others decreased; most individual analytes increased in some storm events and decreased in others; and total loads across both monitored water years decreased for four individual PFAS analytes while increasing for 13 others (the rest were non-detect across all storm events).

No significant differences were detected when grouping individual PFAS analytes into precursor compounds – which may undergo transformations into intermediary or terminal PFAS compounds in natural settings – and terminal compounds, which will not undergo degradation or transformation in natural settings. Both groups had high rates of non-detects; similar frequencies of load increases or decreases in individual storm events; and similar ranges of total load reductions (Table 4.8). Additional PFAS knowledge base and regional results are discussed in Section 4.4.5.

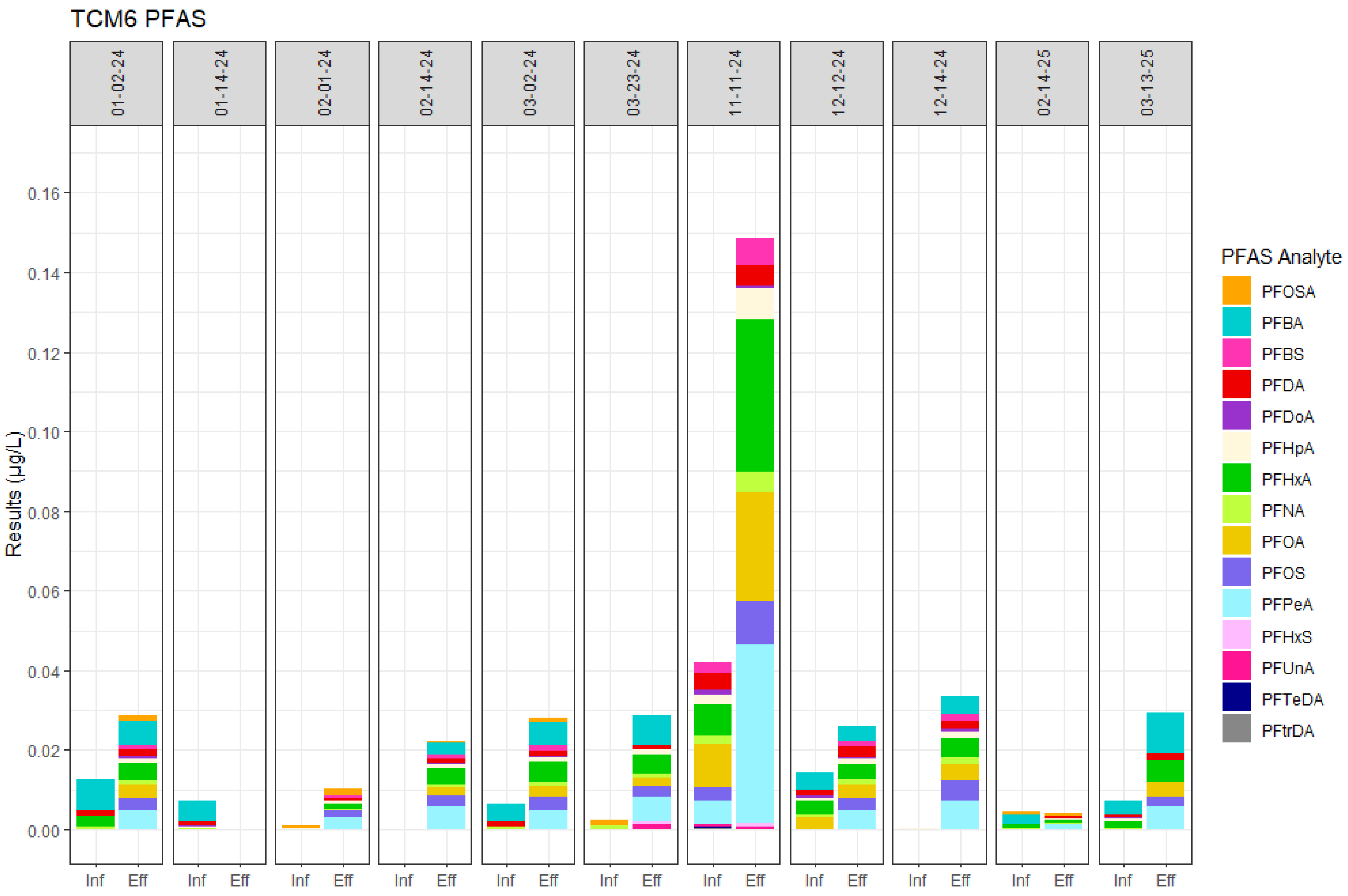

Figure 4.6. PFAS concentrations in influent and effluent samples collected during 11 storm events in WY 2024 and WY 2025 from the San José TCM6 bioretention facility, San José, CA. PFOSA is a precursor; all others are terminal products.

Table 4.8. PFAS Load % Reductions per Storm Event for Water Year 2024 and Water Year 2025 at the San José TCM6 bioretention facility, San José, CA. Negative percent changes and ↑ indicate load increases, which are highlighted in red; positive percent changes indicate load decreases and are highlighted in green; blue NC cells indicate that the values were not calculated; and blue ND cells indicate that the analyte was not detected in both influent and effluent samples.

PFAS Analyte	WY 2024 Storm End Date						WY 2025 Storm End Date					Total WY 2024 - WY 2025 Load % Reduction
	1/2/2024	1/14/2024	2/1/2024	2/14/2024	3/2/2024	3/23/2024	11/11/2024	12/12/2024	12/14/2024	2/14/2025	3/13/2025	
	Load % Reduction	Load % Reduction	Load % Reduction	Load % Reduction	Load % Reduction	Load % Reduction	Load % Reduction	Load % Reduction	Load % Reduction	Load % Reduction	Load % Reduction	
PFOSA (precursor)	↑	NC	-75%	↑	↑	ND	ND	ND	ND	48%	ND	**-7%**
PFBA	63%	NC	ND	↑	90%	↑	ND	78%	↑	100%	29%	**53%**
PFBS	↑	NC	↑	↑	↑	ND	-42%	↑	↑	ND	ND	**-331%**
PFDA	38%	NC	↑	↑	91%	↑	25%	57%	↑	↑	46%	**-25%**
PFDoA	↑	NC	ND	↑	94%	ND	70%	69%	↑	ND	100%	**21%**
PFHpA	↑	NC	15%	↑	↑	↑	-73%	62%	-81%	↑	100%	**-51%**
PFHxA	16%	NC	↑	↑	↑	↑	-193%	69%	↑	57%	17%	**-69%**
PFHxS	ND	NC	ND	ND	ND	↑	↑	ND	ND	ND	ND	**↑**
PFNA	43%	NC	↑	↑	86%	↑	-46%	54%	↑	51%	100%	**-34%**
PFNS	ND	NC	ND	ND	ND	ND	ND	ND	ND	ND	ND	**↑**
PFOA	↑	NC	ND	↑	↑	45%	-54%	71%	↑	ND	↑	**-47%**
PFOS	↑	NC	↑	↑	↑	7%	-83%	↑	↑	ND	↑	**-438%**
PFPeA	↑	NC	↑	↑	↑	↑	-353%	↑	↑	↑	↑	**-1092%**
PFPeS	ND	NC	ND	ND	ND	ND	ND	ND	ND	ND	ND	**↑**
PFTeDA	ND	NC	ND	ND	ND	ND	100%	ND	ND	ND	ND	**100%**
PFtrDA	ND	NC	ND	ND	ND	ND	100%	ND	ND	ND	ND	**100%**
PFUnA	ND	NC	ND	ND	ND	↑	59%	ND	ND	ND	ND	**-56%**
Total PFAS Analytes	**-8%**	**NC**	**-585%**	**↑**	**66%**	**-338%**	**-110%**	**53%**	**-35%**	**54%**	**4%**	**-68%**

ND	Influent and Effluent samples were both non-detect.
↑	Influent was non-detect but Effluent was detected, indicating a concentration and load increase.
NC	Not calculated due to missing or rejected data.

PFAS analytes not marked as "precursor" are terminal PFAS compounds.

Total Load % Reduction is calculated from the sums across both WY 2024 and WY 2025 as $(\text{Sum}_{\text{inf}} - \text{Sum}_{\text{eff}})/\text{Sum}_{\text{inf}}$

Individual PFAS analytes are not shown here if they were non-detect in every influent and effluent sample:

- The following individual precursor analytes were included in sample analysis but not detected in any sample: EtFOSAA, meFOSAA, EtFOSA, EtFOSE, 3:3FTCA, 5:3FTCA, 7:3FTCA, 4:2FTS, 6:2FTS, 8:2FTS, meFOSA, meFOSE.
- The following individual terminal analytes were included in sample analysis but not detected in any sample: 11Cl-PF3OUdS, 9Cl-PF3ONS, ADONA, PFEESA, HFPO-DA, NFDHA, PFMPA, PFPeS, PFNS, PFDoS, PFDS, PFMBA.

PFAS Total Load % Reductions exclude the January 14, 2024 storm event due to lack of effluent sample analysis.

Non-detects are treated as 0 for the purposes of calculation; therefore an Influent detection and Effluent non-detection for a given analyte and storm event will result in a calculation of 100% load reduction.

4.2.2 Comparison to WQO Benchmarks

All LID monitoring samples collected by SCVURPPP in WY 2024 and WY 2025 are influent and effluent stormwater samples, not receiving waters, and are therefore not directly comparable to WQOs. Nonetheless, informative comparisons may be made using WQOs as benchmarks to contextualize LID monitoring results for pH, total mercury, dissolved copper, dissolved zinc, and eight PFAS analytes. These benchmark selection criteria are discussed in Section 3.4.5 and the results of this comparison are displayed in Table 4.9. Effluent concentrations for all monitored TCM6 storm events are lower than their benchmarks except for dissolved copper in a single storm event. No concentration data is available for TCM4 effluent, but the analyzed TCM4 influent concentrations are also lower than these WQO benchmarks. Additionally, some measured constituents have qualitative water quality objectives, including narrative WQOs for TPH and TSS and a Total Maximum Daily Load (TMDL) for total PCBs (which does not have a water concentration criteria). Although these WQOs elude quantitative comparison to stormwater samples, LID monitoring results still show relevant concentration and load reductions for these analytes, such as the concentration and load reductions for total PCBs shown in Figure 4.7.

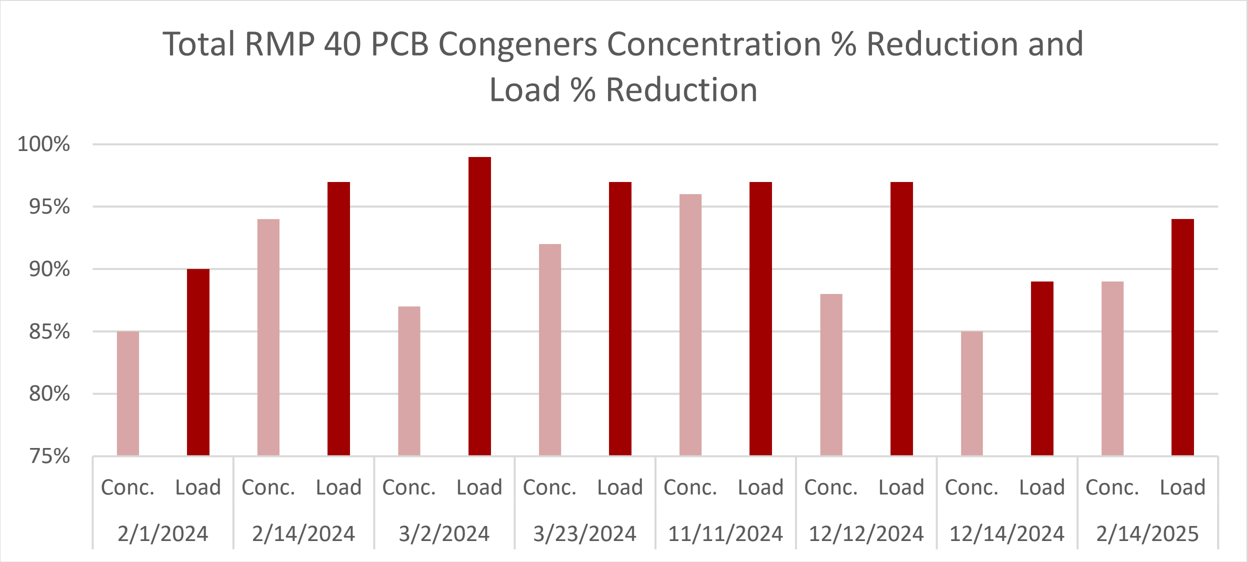

Figure 4.7. Total PCBs Concentration vs Load % Reductions per storm event (WY 2024 – 2025), San José TCM6 bioretention facility, San José, CA. Note the January 2, 2024; January 14, 2024; and March 13, 2025 storm events is excluded due to lack of effluent measurements of QA flags.

Table 4.9. Comparison of LID monitoring data to Water Quality Objective (WQO) benchmarks, WY 2024 – WY 2025, for water quality data collected at the San José TCM6 bioretention facility effluent station, San José, CA. Bold effluent results indicate exceedances of WQO benchmarks, but note that WQOs do not apply to effluent MS4 samples. PFOS and PFOA each have two WQOs for comparison; the most stringent of these are shown here.

Analyte	Units	Most Stringent Acute Water Quality Criteria / WQO / Benchmark	Measured Analyte for Storm End Date, Effluent											WY 2024 - WY 2025 Effluent Mean
			WY 2024						WY 2025					
			1/2/2024	1/14/2024	2/1/2024	2/14/2024	3/2/2024	3/23/2024	11/11/2024	12/12/2024	12/14/2024	2/14/2025	3/13/2025	
Conventional, Physical, and Synthetic Organics														
pH	Units	pH shall not be depressed below 6.5 nor raised above 8.5	7.0	NM	7.0	7.2	7.3	7.1	7.1	7.1	7.2	7.0	6.8	7.1
Metals														
Copper, Dissolved Fraction	µg/L	10.8 [a]	6.6	NM	3.7	4.2	5.4	6.2	**12**	5.6	3.3	2.5	6.1	5.6
Mercury, Total Fraction	µg/L	2.1	0.012	NM	0.008	0.009	0.009	0.009	0.010	0.004	0.006	0.004	0.005	0.008
Zinc, Dissolved Fraction	µg/L	90	2.9	NM	1.5	2.6	4.0	4.3	6.4	1.7	2.2	2.6	5.0	3.3
PFAS Analytes														
Perfluorooctanoic Acid (PFOA)	µg/L	3.2 [b]	0.00352	NM	ND	0.00206	0.00276	0.00206	0.0276	0.00344	0.00214	ND	0.00377	0.00473
Perfluorooctanesulfonic Acid (PFOS)	µg/L	0.017 [c]	0.00283	NM	0.00164	0.00293	0.00343	0.00105	0.0107	0.00318	0.00268	ND	0.00248	0.00333
Perfluorobutanoic Acid (PFBA)	µg/L	120	0.00614 J	NM	ND	0.00301 J	0.00583 J	ND	ND	0.00371 J	0.00210 J	ND	0.0103	0.00333
Perfluorohexanoic Acid (PFHxA)	µg/L	540	0.00458	NM	0.00144 J	0.00408	0.00533	0.00156	0.0382	0.00397	0.00218	0.00088 J	0.00538	0.00702
Perfluorononanoic Acid (PFNA)	µg/L	0.12	0.00089 J	NM	0.00047 J	0.00070 J	0.00087 J	0.00459 J	0.00513	0.00110 J	0.00085 J	0.00028 J	ND	0.00156
Perfluorodecanoic Acid (PFDA)	µg/L	0.094	0.00171	NM	0.00078 J	0.00109 J	0.00124 J	0.00090 J	0.00535	0.00249	0.00121 J	0.00050 J	0.00180	0.00248
Perfluorobutanesulfonic Acid (PFBS)	µg/L	210	0.00123 J	NM	0.00073 J	0.00101 J	0.00159	ND	0.00671	0.00145 J	0.00089 J	ND	ND	0.00145
Perfluorohexanesulfonic Acid (PFHxS)	µg/L	14	ND	NM	ND	ND	ND	0.00066 J	0.00125 J	ND	ND	ND	ND	0.00013

J Results with this flag are above the analyte's Method Detection Limit (MDL) but below the Reporting Limit (RL) and have laboratory DNQ flags or quality assurance J flags. These results are estimated but included here for calculations and comparative analysis.

NA Not analyzed due to low sample volume.

[a] Copper, Dissolved Fraction has a saltwater acute objective of 4.8 µg/L set by the California Toxics Rule. The Basin Plan criteria for the South San Francisco Bay (10.8 µg/L) is used here instead, as this objective already incorporates the appropriate Water Effects Ratio for this segment of the Bay. See the Basin Plan for further details (SFBRWQCB 2024)

[b] Perfluorooctanoic Acid (PFOA) also has an EPA Aquatic Life Criteria objective of 7000 µg/L. No effluent sample result exceeded this objective.

[c] Perfluorooctanesulfonic Acid (PFOS) also has an EPA Aquatic Life Criteria objective of 550 µg/L. No effluent sample result exceeded this objective.

4.3 Maintenance Assessments

MRP Provision C.8.d specifies minimum monitoring requirements to assess LID effectiveness and, as discussed previously, identifies two management questions underlying monitoring design (see Section 2.1). The second of these two questions is specifically to investigating the level of effort associated with maintenance of the monitored facilities:

MQ #2: What are the minimum levels of O&M necessary to avoid deteriorated LID facilities, systems, and components that reduce pollutant removal and hydrologic performance?

To address this management question, SCVURPPP developed specific plans to monitor and assess O&M activities and their possible connection to LID device functionality (SCVURPPP 2023, 2024). SCVURPPP also developed monitoring questions to be assessed throughout Project implementation, which are similar in nature to those posed by collaborating BAMSC Programs:

1. Is the recommended level of maintenance associated with the targeted LID facilities sufficient to ensure optimal system performance?
2. How does facility hydrology vary with time elapsed from previous maintenance?
3. How does pollutant removal vary as a function of maintenance practice(s)?

During WY 2024 and WY 2025, SCVURPPP began collecting data and information to support evaluation of these three questions. Because the number of relevant datapoints is relatively small, BAMSC Programs are pooling data and information regionwide to enable a more robust regional-scale assessment. This regional analysis is described in Section 4.4.7, which evaluates the performance of a range of efforts based on specific facility attributes that may influence hydrology or pollutant removal effectiveness. The following section describes the SCVURPPP monitoring facilities within the context of the regional analysis.

4.3.1 Maintenance Activities

Both SCVURPPP LID monitoring facilities are located within the City of San José and are maintained by the City and/or City contractors. The following O&M activities are conducted regularly and described in more detail in Table 3.2 of the Monitoring Plan (SCVURPPP 2024):

- Whole-system evaluations annually, prior to the start of the rainy season, for vegetation health, obstructions in inlets and outlets, cobblestones/energy dissipation, accumulated sediment, and mulch condition;
- Quarterly inspections for trash, weeds, obstructions, erosion, vegetation health, and standing water; and
- Annual inspections at the end of the rainy season and after large storm events for erosion, mulch condition, obstructions or standing water, weeds, trash, and structural integrity.

In addition, SCVURPPP’s monitoring contractor Integral (known as KEI during WY 2024) conducts periodic maintenance assessments before each rainy season and immediately before or after each monitored storm event and conducts O&M activities as needed to ensure that hydrology and water quality monitoring equipment are fully functional. These assessments are documented using the BAMSC Maintenance Assessment Form and are summarized in Table

4.10. Because water quality monitoring events were primarily conducted at TCM6 during WY 2024 and WY 2025, the maintenance assessments focused primarily on this facility. In general, the assessments noted occasional maintenance issues such as trash or weeds within the facility; gaps in plant or mulch cover; and signs of erosion and/or sedimentation; however, other than clearing the inlets to maintain sample collection integrity, TCM6 has not needed major service or remediation of issues that are believed to impact the effectiveness of treatment.

It is important to note that the minimum maintenance activities carried out at the monitored LID facilities may be higher than what is regularly conducted at non-monitored facilities around the region, due to the additional maintenance (particularly clearing of inlets) necessary to ensure that stormwater samples can be collected and analyzed. Therefore, although this maintenance frequency can be compared to water quality and hydrology data, the results may be more informative for assessing whether or not the monitored maintenance is sufficient than for determining the true relationship between maintenance and water treatment in non-monitored facilities.

Table 4.10. Summary of WY 2024 - WY 2025 maintenance assessments at the TCM6 bioretention facility in San José, CA.

Monitoring Site		TCM6 WY, 2024					TCM6, WY 2025							
Assessment Date		**10/9/2023**	**1/30/2024**	**2/14/2024**	**2/28/2024**	**3/29/2024**	**10/7/2024**	**10/11/2024**	**12/11/2024**	**12/12/2025**	**12/13/2024**	**1/30/2025**	**2/11/2025**	**3/7/2025**
Category	**Assessment Type**	Dry Weather Assessment	Pre-Storm Monitoring	Pre-Storm Monitoring	Pre-Storm Monitoring	Pre-storm	Pre-storm	Pre-storm	Post-storm	Pre-storm	Pre-storm	Pre-storm	Pre-storm	Pre-storm
	Was follow-up maintenance needed?	N	Y	Y	Y	N	N	N	N	N	N	N	N	N
Trash or debris	Is trash or debris present in the treatment area?	N	Y	N	N	Y	N	Y	Y	N	Y	Y	Y	Y
	Are one or more inlets, outlets or overflow structures obstructed?	N	N	N	N	N	N	N	N	N	N	N	N	N
Weeds	Are weeds present in the treatment area?	N	N	N	N	N	N	N	N	N	Y	Y	N	N
	Are invasive plants present?	N	N	U	U	N	N	N	N	N	Y	Y	N	N
	Are weeds about to or currently going to seed?	N	N	Y	Y	N	N	U	U	N	U	Y	U	U
Plant Health	Are all plants healthy, thriving, and aesthetically pleasing?	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Are there signs of diseased or distressed plants in the treatment area?	N	N	Y	Y	N	N	N	N	N	N	N	N	N
Pruning	Is the system well-manicured & properly pruned, trimmed, dead headed and thinned?	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Are plants over pruned or overgrown in the treatment area?	N	N	N	N	N	N	N	N	N	N	N	N	N
Plant Density	Are plants overcrowded?	N	N	N	N	N	N	N	N	N	N	N	N	N
	Are there bare spots in the treatment area?	N	N	N	N	N	N	N	N	Y	Y	Y	N	N
	Are plants obstructing one or more inlets/overflows/irrigation system?	N	N	Y	Y	N	N	N	N	N	N	N	N	N
Mulch	Is there full coverage of at least 3" of composted arbor mulch?	N	Y	N	Y	Y	Y	N	N	N	Y	N	N	N
	Is the mulch free of sediment and not clumped together?	N	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y
Cobble & Flow Dissipation	Is appropriately sized cobble placed at all inlets/outlets/splash pads?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Is the cobble free of sediment, debris, and clogging?	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Are there signs of erosion at any inlets, outlets, or splash pads?	N	N	N	N	N	N	N	N	N	N	N	N	N
Erosion & Sedimentation	Are there signs of erosion or sedimentation in the treatment area?	N	N	Y	Y	N	N	N	N	Y	N	Y	N	N
	Are the treatment area and adjacent areas protected from erosion?	Y	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Are there signs of erosion at any inlets, outlets, or splash pads?	N	N	N	N	N	N	N	N	N	N	N	N	N
	Are there signs of channelization and scour or loss of soil?	N	N	Y	Y	N	N	N	N	N	N	N	N	N
Standing Water & Vector Control	Is all water drained from treatment system within 72 hours from rain?	U	Y	N	N	U	U	U	Y	U	U	N	U	U
	Is there evidence of mosquitoes in the treatment area?	N	N	N	N	N	N	N	N	N	N	N	N	N
	Is there evidence of rodent activity in the treatment area?	N	N	N	N	N	N	N	N	N	N	Y	N	N
Structural Damage	Is there structural damage to the treatment system?	N	N	Y	Y	N	N	N	N	N	N	N	N	N
Irrigation	Is the irrigation system functioning properly with no leaks, breaks, etc.?	U	Y	Y	Y	Y	Y	N	U	N	Y	N	Y	Y
	Are all landscaped portions of the treatment area receiving proper irrigation?	N	Y	Y	Y	Y	Y	U	Y	Y	Y	Y	Y	Y
Contamination	Is there evidence of contamination in the treatment area?	N	N	U	N	N	N	N	N	N	N	N	N	N
	Are any BMPs implemented to prevent contamination?	N	N	N	N	Y	Y	Y	Y	U	U	U	Y	Y
Vandalism	Are there any signs of vandalism or graffiti?	N	N	N	N	N	N	N	N	N	N	N	N	N
Other	Amount of material (trash, debris, sediment) collected: (number of bags, pounds, or gallons/bag):	0	5 Pounds	1 Gallon Bag	1/10 Gallon	3 pieces trash	None	Wrappers and tissue	6 cigarette butts, plastic, wrappers, tissue.	None	1 gal debris	small amounts	3 pieces trash	3 pieces trash
	General Observations/Maintenance Performed	None	Inlets free of obstructions	None	None	None	None	High vehicle traffic to Top Golf	None	Ground mostly covered with sedge/grass	Paper, aluminum, cigarette butt, beer (glass), wrappers. Did not remove tumble weed.	Large opossum and baby opossum.	None	None

N = no
Y = yes
U = unknown

4.4 Regional Analysis

Across the five Bay Area counties, LID monitoring has been conducted at a total of eight sites during the permit term. Table 4.11 presents a summary of these site locations, LID facility characteristics, and site-specific study design variation applicable at a given site.

All the facilities selected for monitoring are bioretention facilities, which is the most common type of LID facility constructed to date in the Bay Area. While most facilities are unlined, the Oakland facilities (Alameda County) are lined and the Mariposa Street facility (Downtown Site) in Brisbane (San Mateo County) was lined at the end of WY 2025. Facility construction dates range from new construction (Solano County, constructed in 2024) to facilities that are approximately 10 years old (Contra Costa), with most facilities built in the last five to six years. The monitored facilities drain catchments with various land uses, including industrial, transportation, residential, commercial, and open space. Drainage Management Area (DMA) sizes range from 0.13 acres (site SMC-SMD) to about 1.4 acres (site SSA-LOTZ). Facility sizing ratios (i.e., Facility Size: DMA Size) range from approximately 2% to 7.5%. Some of the facilities are smaller due to space-constraints and utility conflicts common to public green street retrofit projects, while other facilities were oversized. Ponding depths range from 6 inches to 12 inches, while all facilities include 18 inches of bioretention soil media (BSM) overlain on 12 inches of permeable drain rock. Underdrains are present in all monitored facilities (underdrains are present in most bioretention facilities around the region) and located at the approximate middle or bottom of the permeable rock drainage layer. The water table for the Solano site lies above the underdrain, while underdrains at all remaining sites are dry outside of storm events.

In combination, the sites selected for LID monitoring provide valuable data on a range of different types of LID facilities, systems, components, design variations, and spatial scales for evaluation that will address the broad MRP management questions, while also being broadly representative of the LID technology being utilized by governments and private property owners throughout the region.

This regional analysis compares monitoring results for the eight LID sites. This analysis includes evaluation and analysis of the following required components:

- Difference in design variations
- Differences in spatial scales
- Differences in system ages

The regional analysis also includes a comparison of treatment results for groups of sites based on a variety of characteristics, including how differences in influent quality are accounted for when drawing conclusions about performance.

Further, this regional analysis includes a comparison of the results from each site with the results of other sites that are implementing different maintenance practices and/or schedules. The frequency and/or level of maintenance conducted at LID monitoring sites varies, and this variability may provide information that can be used to better understand the minimum level of maintenance required to maintain the proper functioning of these systems.

Table 4.11. Bay Area Municipal Stormwater Collaborative (BAMSC) Low Impact Development (LID) monitoring sites across five Bay Area counties: Alameda, Contra Costa, San Mateo, Santa Clara and Solano, CA.

County	Site Location / (Site ID)	Facility Type	Lined / Unlined	Under-drain	Soil Type (Unlined Facilities)	Year Built	# inlets	Facility Drainage Management Area (acres)	Facility Size (sf)	Meets C.3.d Sizing Criteria	Sizing Method	Ponding Depth (inches)	Mulch Depth (inches)	Soil Mix Depth (inches)	Gravel Layer Depth (inches)	Location of Underdrain	DMA Land Use	DMA % Impervious	Primary Land Use Types in Vicinity of Facility
Alameda	Admiral Toney Way Oakland (Site #18W) (AC-OAB18W)	Bioretention Planter Box	L	Yes	na	2019	5	0.22	325	Yes	Flow-Volume Combo	6	0	18	12	~middle of gravel layer (4" perforated PVC)	Street	100%	Old Industrial
Alameda	Admiral Toney Way Oakland (Site #18E) (AC-OAB18E)	Bioretention Planter Box	L	Yes	na	2019	3	0.35	286	Yes	Flow-Volume Combo	6	0	18	12	~middle of gravel layer (4" perforated PVC)	Street	100%	Old Industrial
Contra Costa	Fairmount Ave/ Ohlone Greenway El Cerrito (CCC-Ohlone)	Bioretention	U	Yes	D	2014	2	1.70	2,460	Yes	Flow-volume combo	6	3 (wood) or 5 (rock)	18	12	~middle of gravel layer (6" perforated PVC)	Street and pedestrian/ bicycle path	70%	Old Residential and Old Commercial
Santa Clara	First Street San José-TCM #6 (SCC-TCM6)	Bioretention	U	Yes	D	2022	2	0.304	285	Yes	Flow-Volume Combo	12	3	18	12	~bottom of gravel layer	Street	70%	Residential and Open Space
Santa Clara	First Street San José-TCM #4 (SCC-TCM4)	Bioretention	U	Yes	D	2022	2	0.194	180	Yes	Flow-Volume Combo	12	3	18	12	~bottom of gravel layer	Street	70%	Residential and Open Space
San Mateo	Mariposa Street (Downtown Site) Brisbane (SMC-SMD)	Bioretention	U [a]	Yes	D	2020	4	0.132	225	Yes	Flow-Volume Combo	6	3	18	12	6" from bottom of permeable rock layer	Street	30%	Commercial
San Mateo	Santa Clara Street (School Site) Brisbane (SMC-SMS)	Bioretention	U	Yes	D	2020	2	0.34	350	Yes	Flow-Volume Combo	6	3	18	12	6" from bottom of permeable rock layer	Street	30%	Residential
Solano	Lotz Way & Civic Center Drive Suisun City (SSA-LOTZ)	Bioretention	U	Yes	D	2024	1 inlet to water quality monitoring cell (9 total to feature)	~1.4 ac (total drainage to feature is ~4.3 ac)	~1,000 sf (entire feature 4,856 sf)	Yes	Flow-Volume Combo	6	0	18	12	6" minimum from bottom of permeable rock layer	Amtrak Park & Ride Parking Lot, and Highway 12 off ramp	70%	Transportation

[a] The Downtown Site in Brisbane (San Mateo County) was lined at the end of WY 2025.

Table 4.12 summarizes influent and effluent concentration statistics (sample count, interquartile range, median, and mean), along with total concentration and load percent reductions, for five of the eight regional LID monitoring sites. Comparable data for the SCVURPPP TCM6 site – the basis of the program-specific analysis in this report - are presented in Table 4.7 and the concentrations, load reductions, and descriptive statistics for all of the monitoring sites in the BAMSC region are included in Appendix C. The results incorporated into this regionwide analysis include all of the BAMSC data except as follows:

- The Santa Clara County TCM4 Site and the San Mateo County Downtown Site were excluded from the regional analysis because of limited or missing data. The Solano County Site was excluded because the site configuration is fundamentally different from the other sites; it represents a facility with a water table above the underdrain.
- Water Year 2024 TPH concentration and load data for all facilities were excluded due to the high degree of non-detects from the analytical method used on those samples.
- Effluent volumes were too low to be sampled in the OAB-18E 11/21/2024 storm event and the OAB-18W 3/13/2025 storm event. These effluents were excluded from concentration calculations and were estimated to have 100% load reductions.
- Both OAB-18E and OAB-18W experienced overflows during the 2/13/2025 storm event. For these two events, load reduction calculations assume full treatment for the effluent volume and no treatment for the overflow volume, using the formula $\text{Load}_{\text{effluent}} = (\text{Volume}_{\text{effluent}} \text{ X } \text{Concentration}_{\text{effluent}}) + (\text{Volume}_{\text{overflow}} \text{ X } \text{Concentration}_{\text{influent}})$
- Several individual analytes are excluded from concentration calculations due to uncertain or missing concentration data:
    - Total PCBs for San Mateo School Site effluent on 4/14/2024
    - pH and both TPH analytes for San Mateo School Site influent and effluent on 2/1/2025
    - Total PCBs for Santa Clara TCM6 influent and effluent on 1/2/2024
    - All analytes for Santa Clara TCM6 effluent on 1/14/2024
    - Total PCBs and both TPH analytes for Santa Clara TCM6 effluent on 3/13/2025
    - Total PCBs for Alameda OAB-18W effluent on 4/14/2024
- Several individual analytes and storm events are excluded from load reduction calculations due to uncertain or missing concentration or flow data:
    - All analytes for San Mateo School Site storm events on 3/2/2024 and 2/13/2025
    - Total PCBs for San Mateo School Site on 4/14/2024
    - All analytes for Santa Clara TCM6 on 1/14/2024
    - Total PCBs for Santa Clara TCM6 on 1/2/2024
    - Total PCBs and both TPH analytes for Santa Clara TCM 6 on 3/13/2025
    - All WY 2024 storm events for Alameda OAB-18E and Alameda OAB-18W

Analyte-specific load reductions for each site are shown as box-and-whisker plots in Appendix D and selectively in the following text. These plots allow for convenient visual comparison of the distribution and variability of storm-based load percent reductions across sites for different analytes. In each box-and-whisker figure, the lower and upper edges of each box represent the 25th and 75th percentiles of the storm-based load percent reduction data, respectively, and the line within each box represents the median (50th percentile). Whiskers and outliers, when present, indicate the range and extreme values of the data. Negative results indicate net increases in pollutant load. The regional results summarized in Table 4.12 and comparative results shown in the box-and-whisker plots provide the basis for the discussion below.

Table 4.12. Summary of LID Effectiveness across Bay Area Counties, WY 2024 – WY 2025.

Analyte (units)	Sample Count [a]		Interquartile Range (25th-75th percentiles)		Median		Mean		Total Load % Reduction [d, e]
	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	
Conventional, Physical, and Synthetic Organics									
pH	44	41	7 - 7.3	6.8 - 7.3	7.2	7.0	7.2	7.1	NC
Hardness as CaCO3 (mg/L)	45	42	20 - 40	26.5 - 43.5	28.0	34.0	35.1	40.2	21%
Total Suspended Solids (mg/L)	45	42	43.6 - 130	5.1 - 12.1	68.0	8.4	99.6	9.2	88%
TPH as Diesel C12-C24 (µg/L) [b]	21	18	180 - 480	54.5 - 132.5	330.0	94.5	349.2	123.1	82%
TPH as Motor Oil C24-C36 (µg/L) [b]	21	18	310 - 630	11.5 - 145	440.0	74.5	462.1	96.7	88%
Total Metals									
Copper (µg/L)	45	42	12 - 19	6.6 - 9.3	16.0	7.9	18.9	8.7	68%
Mercury (µg/L)	45	42	0.010 - 0.058	0.005 - 0.013	0.020	0.009	0.047	0.010	80%
Zinc (µg/L)	45	42	67 - 169	6.6 - 16.8	102.0	10.0	148.9	13.7	86%
Dissolved Metals									
Copper (µg/L)	45	42	3.4 - 7.1	5.1 - 7.4	5.2	6.3	5.8	6.7	33%
Mercury (µg/L)	45	42	0.002 - 0.004	0.002 - 0.005	0.003	0.004	0.003	0.005	9%
Zinc (µg/L)	45	42	17 - 32	2.5 – 8.0	23.0	5.0	28.7	5.8	80%
PCB Congeners									
Total RMP 40 PCB Congeners (ng/L)	44	38	2.418 - 14.073	0.246 - 1.508	5.330	0.395	11.725	0.980	85%
PFAS Analytes									
Total PFAS Analytes (µg/L) [c]	45	44	0.001 - 0.030	0.025 - 0.070	0.013	0.040	0.018	0.049	-4%

a Sample Count is the total number of viable samples for WY 2024 and WY 2025 used for concentration calculations; Total Load % Reduction has a slightly smaller sample count. See text in Section 4.4 for details.

b TPH calculations exclude WY 2024 data due to high degree of non-detects from the analytical method used in WY 2024. See text in Section 4.4 for further details.

c Total PFAS Analytes is the sum of all 40 detected PFAS analytes analyzed with the EPA 1633 methodology. Non-detects are treated as 0 for this calculation and J-flagged results are included.

d Load % Reduction is calculated from the sums across both WY 2024 and WY 2025 as (Sum_{inf} – Sum_{eff})/Sum_{inf}. Loads for events with overflows were calculated assuming no treatment of the overflow volume; see text in Section 4.4 for details.

e Negative results indicate net increases in pollutant load.

4.4.1 Sediment

Sediment is a key constituent of interest from a water quality perspective, not only because of its direct physical impacts on aquatic life and aesthetics, but also because sediment in urban runoff is often associated with other pollutants. Pollutants, including pesticides; non-polar organics; metals such as copper, zinc, cadmium, chromium, lead, and nickel; and PCBs may adsorb onto the surface of sediment, especially clay and organic particles in runoff. Biofilters are designed to remove particulate matter either on the surface of the filter through surficial straining or within the filter through depth filtration (WRF 2020).

The 2020 International BMP Database summary statistics report (WRF 2020) found the following for TSS removal in bioretention:

- Median influent TSS concentrations generally range between 26 and 77 mg/L.
- All BMPs with sufficient data for analysis show statistically significant reductions.
- The best performing BMPs are bioretention, media filters, and high-rate biofiltration with effluent TSS concentrations ranging from 4 to 10 mg/L.

Water Year 2024 and 2025 TSS observations across the region were broadly in line with the International BMP Database results:

- Influent TSS concentrations were slightly higher for the region, ranging generally from 44 to 130 mg/L.
- All monitored facilities showed high TSS reductions in both concentrations and loads for all storm events and as a regional total. Individual storm event concentration reductions regionwide ranged from 63% to >99%; individual storm event load reductions ranged from 41% to >99%; and the region as a whole saw very high total TSS concentration reductions of 91% and total load reductions of 88%. See Figure 4-8 for the distribution of TSS load reductions across each LID monitoring site, which show consistently high results except for the two Alameda County storm events with overflow events.
- TSS results were broadly similar to those of the other sediment-bound pollutants assessed here – PCBs and total copper, zinc, and mercury - as well as both measures of TPH, validating the use of TSS as a rough proxy for sediment-bound constituents.

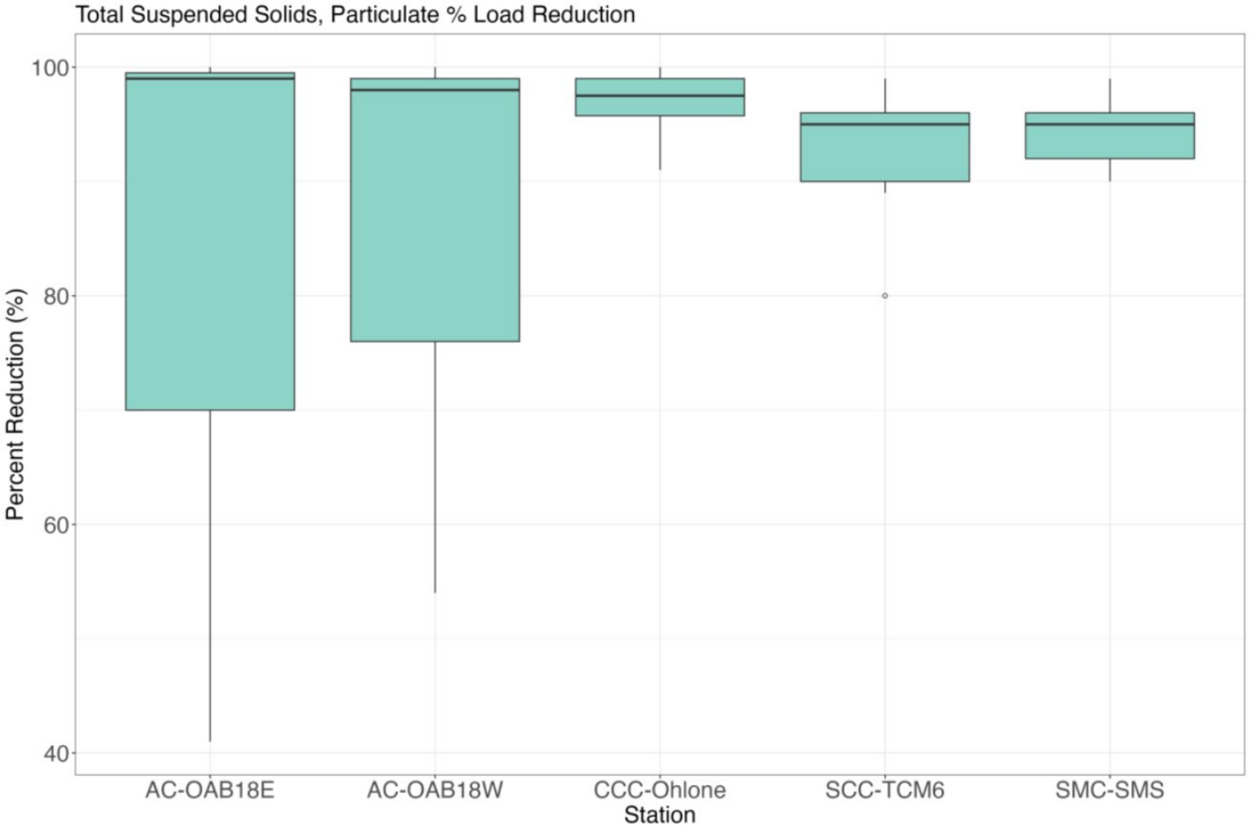

Figure 4.8. Box and whisker plots showing distribution of TSS Load % Reductions at five BAMSC LID monitoring sites, WY 2024 – WY 2025.

4.4.2 Total Petroleum Hydrocarbons (TPH)

Oil is made up of many types of hydrocarbons with various molecular structures and properties. TPH are a summation of the identifiable hydrocarbon compounds in the oil. TPH as Diesel includes a mixture of medium-length hydrocarbon compounds, typically with 12 to 24 carbon atoms, which make up diesel fuel. TPH as Motor Oil includes the mixture of longer-length hydrocarbon compounds that make up motor oil. The sources of petroleum hydrocarbons in urban areas include spillage fuels and lubricants, discharge of domestic and industrial wastes, atmospheric deposition, and runoff. Also, do-it-yourself auto mechanics may dump used oil and other automobile-related fluids directly into storm drains (WRF 2020).

Total Petroleum Hydrocarbons are not assessed in the 2020 International BMP Database summary statistics report (WRF 2020), and due to challenges with laboratory analysis discussed previously in Section 3.5.3, this regional analysis includes only WY 2025 data. Nonetheless, WY 2025 results show consistently high load reductions:

- TPH as Diesel influent concentrations generally ranged from 180 – 480 µg/L.
- TPH as Diesel measured individual storm event concentration reductions ranging from 5% to >99%, with total regionwide concentration reductions of 65%.

- TPH as Diesel load reductions ranged from 32% to >99% for individual storm events, with total load reductions of 83% regionwide.
- TPH as Motor Oil influent concentrations generally ranged from 310 – 630 µg/L.
- TPH as Motor Oil measured individual storm event concentration reductions ranging from 45% to >99%, with total regionwide concentration reductions of 79%.
- Given its longer and heavier chemical structure, TPH as Motor Oil had even higher load removal rates than TPH as Diesel, with individual storm event load reductions ranging from 36% to >99% and total load reductions of 88% regionwide.
- Both measures of TPH had relatively low spatial variability, with cumulative WY 2025 facility load reductions ranging from 69% to 89% for TPH as diesel and 63% to 97% for TPH as motor oil.

4.4.3 Metals

Metals concentrations above natural background levels in urban stormwater are often associated with automobile-related sources such as roads and parking lots and from building materials (e.g., galvanized roofs, gutters, downspouts, and fencing) exposed to rain. Treated wood is also a common source of metals in residential and commercial areas. Industrial areas may be “hot spots” for certain metals, depending on the industrial process and materials management practices (WRF 2020). Copper, lead, and zinc are the most prevalent metals typically found in urban runoff. Metals are of concern because of the potential for toxic effects on aquatic life. High metal concentrations can lead to bioaccumulation in fish and shellfish and affect beneficial uses of receiving waters. The CTR, which is referenced in the Basin Plan (SFBRWQCB 2024), establishes WQOs for metals in California receiving waters.

Dissolved metals (more correctly referred to as “filtered” metals) are metals present in a water quality sample that has been filtered through a 0.45 µm to 2 µm filter, acidified to a pH of 2, then analyzed in a laboratory. A “true” dissolved sample requires field-filtering; however, in practice, dissolved metals samples are often filtered and acidified in a laboratory. Total metals are metals present in a non-filtered sample after the sample is “digested” in an acidic solution until essentially all the metals are extracted into soluble forms for analysis.

Metals removal is a function of partitioning (particulate vs. dissolved) (WRF 2020). If dissolved, treatability is a function of concentration and speciation, and if particulate-bound, treatability is a function of association of metals to various particle sizes. Most stormwater treatment systems are passive; therefore, sedimentation and filtration are considered the dominant mechanisms for total metals removal. Dissolved metals can be removed from water mainly by sorption and precipitation processes. Adsorption – the binding of aqueous species to surfaces – is the most important mechanism in the removal of dissolved metals in stormwater BMPs. Of the metal analytes assessed here, particulate copper and, more strongly, mercury may bind with dissolved organic carbon present in soil media, partitioning copper and mercury from the particulate phase into the dissolved phase and increasing concentrations of their dissolved phases. Dissolved zinc, on the other hand, is likely to see reduced concentrations due to a stronger tendency for sorption driven by cation exchange processes within the soil media.

MERCURY

Mercury is a naturally occurring chemical element found in rock in the earth's crust. Elemental or metallic mercury is a shiny, silver-white metal, historically referred to as quicksilver, and is liquid at room temperature. It is used in older thermometers, fluorescent light bulbs, and some electrical switches. When dropped, elemental mercury breaks into smaller droplets which can pass through small cracks or become strongly attached to certain materials. At room temperature, exposed elemental mercury can evaporate to become an invisible, odorless toxic vapor. If heated, it is a colorless, odorless gas. In its inorganic form, mercury occurs abundantly in the environment and as impurities in other minerals. Mercury can readily combine with chlorine, sulfur, and other elements, and subsequently weather to form inorganic salts that can be transported in water and occur in soil. Dust containing these salts can enter the air from mining deposits of ores that contain mercury. Emissions of both elemental and inorganic mercury can occur from coal-fired power plants, burning of municipal and medical waste, and from factories that use mercury. Inorganic mercury can also enter water or soil from the weathering of rocks that contain inorganic mercury salts, and from factories or water treatment facilities that release water contaminated with mercury. Inorganic mercury salts can also become attached to airborne particles and subsequently deposited onto land by rain and snow. Even after mercury gets deposited on land, it often returns to the atmosphere, as a gas or associated with particles, and then redeposits elsewhere. As it cycles between the atmosphere, land, and water, mercury undergoes a series of complex chemical and physical transformations, many of which are not completely understood. Microscopic organisms can combine mercury with carbon, thus converting it from an inorganic to an organic form. Methylmercury is the most common organic mercury compound found in the environment and is highly toxic. Dissolved mercury is mercury that has been converted into a soluble form and is dispersed in water. Dissolved mercury can include dissolved inorganic mercury compounds and dissolved elemental mercury (WRF 2020).

Although the 2020 International BMP Database summary statistics report (WRF 2020) did not specifically address mercury removal in bioretention basins, the BAMSC programs found the following for WY 2024 – WY 2025:

- Total mercury influent concentrations generally ranged from 0.010 – 0.058 µg/L in the region.
- Total mercury was reduced in LID samples. Though concentration reductions in individual regionwide storm events varied widely (from 0% to >99%), load reductions were higher and more consistent (36% to >99% load reductions per storm event; 80% total regional load reduction).
- Total mercury had a relatively low level of spatial variation, with load reductions ranging from 64-85% per facility across both water years.
- Dissolved mercury concentrations were low, generally ranging from 0.002 – 0.004 µg/L in influent regionwide.
- Dissolved mercury was the poorest-performing analyte assessed in this program and results varied widely by storm event, with concentrations increasing in 34 out of 42 regionwide samples and more than doubling in 11 of the samples (the remaining sampled storm events saw concentration reductions of 22% to >99%). Regionwide, dissolved mercury concentrations increased by 47%.

- Load reductions were more favorable: loads were reduced in 26 of the 37 individual storm event samples for which load reductions could be calculated. Total loads were reduced in four of the five monitored facilities, and total regional dissolved mercury load reductions were a modest but positive 9%.
- Dissolved mercury also presented a high level of geographic variation: total WY 2024 – WY 2025 dissolved mercury loads increased by 7% in Contra Costa County and decreased by 61% in San Mateo County, with more modest decreases of 27% - 41% in Santa Clara County and the two monitored Alameda County facilities. Unlike many analytes, dissolved mercury load reductions do not appear to be consistently correlated with influent concentrations.

COPPER

Copper is an abundant trace element that occurs naturally in the Earth's crust and surface waters. Copper is commonly found in aquatic systems as a result of both natural and anthropogenic sources. Natural sources of copper in aquatic systems include geological deposits, volcanic activity, and weathering and erosion of rocks and soils. Anthropogenic sources of copper include mining activities, agriculture, metal and electrical manufacturing, biosolids from publicly owned treatment works, pesticide use, and more. Copper is an essential nutrient at low concentrations but is toxic to aquatic organisms at higher concentrations. In addition to acute effects such as mortality, chronic exposure of aquatic organisms to copper can lead to adverse effects on survival, growth, reproduction, as well as alterations of brain function, enzyme activity, blood chemistry, and metabolism (WRF 2020).

Findings from the 2020 International BMP Database summary statistics report (WRF 2020) for copper include:

- The median concentration of total copper in bioretention effluent is 7.13 µg/L.
- Bioretention shows statistically significant concentration reductions for total copper but not dissolved copper.
- The relatively poor dissolved copper removal performance for bioretention may be due to leaching of copper from sites in the dataset that included a high percentage of compost in their media mixes. A study in Washington found that dissolved copper export was as high as 600% for bioretention cells containing 40% compost (Herrera Environmental Consultants 2012). While the export of copper is concerning, there is research that indicates that most of the dissolved copper leaching from bioretention systems is strongly bound to dissolved organic matter and is less bioavailable to aquatic organisms (Chahal et al. 2016).

Results for the regional LID Monitoring Program from WY 2024 and 2025 are highly consistent with these International BMP Database statistics, including that:

- The median concentration of total copper in the observed bioretention effluent was 7.9 µg/L regionwide and generally ranged from 6.6 – 9.3 µg/L.
- Concentrations and loads of total copper were significantly reduced, with concentration reductions ranging from 0% (unchanged) to 84% for individual storm events and regionwide concentration reductions of 54%. Total copper load reductions ranged from 28% to >99% for individual storm events and regionwide total copper load reductions were 68%.

- The median concentration of dissolved copper in the observed bioretention effluent was 6.3 µg/L and generally ranged from 5.1 – 7.4 µg/L. Concentrations of dissolved copper often increased, with a 17% total regionwide concentration increase and concentration increases in 31 of 42 analyzed storm events. Dissolved copper concentration changes for individual storm events ranged from a 45% decrease to a 392% increase.
- Dissolved copper loads were still reduced: loads dropped in 30 of the 37 available storms and cumulative dissolved copper loads decreased by 33% across the region. This is somewhat surprising given the increases in dissolved copper concentrations and the potential for dissolved copper leaching from LID components.
- Like dissolved mercury, dissolved copper had a relatively high spatial variation, with total loads decreasing by 21% to 27% in three of the monitored facilities (Santa Clara County's TCM6, Contra Costa County's Ohlone facility, and Alameda OAB18E) and by a substantially higher 45% and 66% in Alameda OAB18W and San Mateo County's School Site, respectively. Some of this variation may be attributed to differences in influent concentrations, with preliminary analysis suggesting a modest positive correlation between influent concentrations and load reductions for dissolved copper, a trend that is also weakly observed in TSS, PCBs, and all three total metals.

Figures 4.9 and 4.10 below show the total load reductions for total and dissolved copper at each facility, showing the generally strong load reductions for both metrics as well as the wide range of results at most of the monitored facilities. Observed load reduction ranges were particularly high for dissolved copper (ranging from >99% decreases to 141% increases for individual storms) and include load increases for some individual storms at four of the five monitoring sites, likely reflecting the relatively limited abilities of bioretention basins to mitigate non-sediment-bound contaminants; the high variability of copper and other contaminant concentrations in stormwater; and the complex fate and transport of contaminants that may be associated with compost or other LID structural elements and can therefore be both mitigated by and exported by bioretention basins.

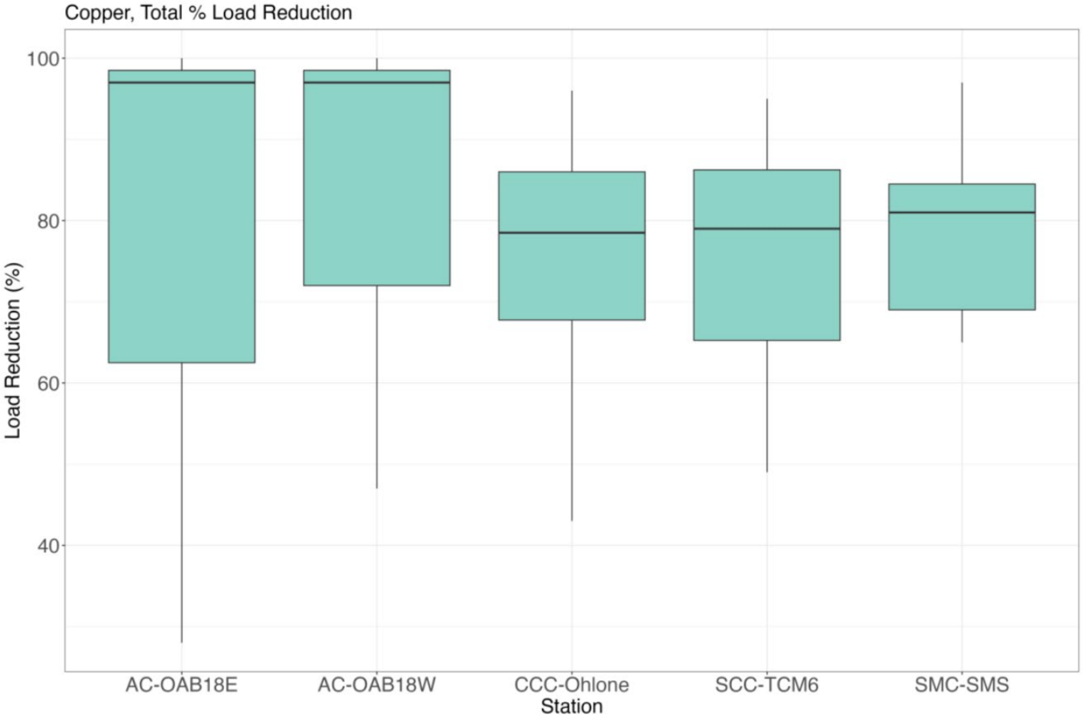

Figure 4.9. Box and whisker plots showing distribution of Total Copper Load % Reductions at five BAMSC LID monitoring sites, WY 2024 – WY 2025.

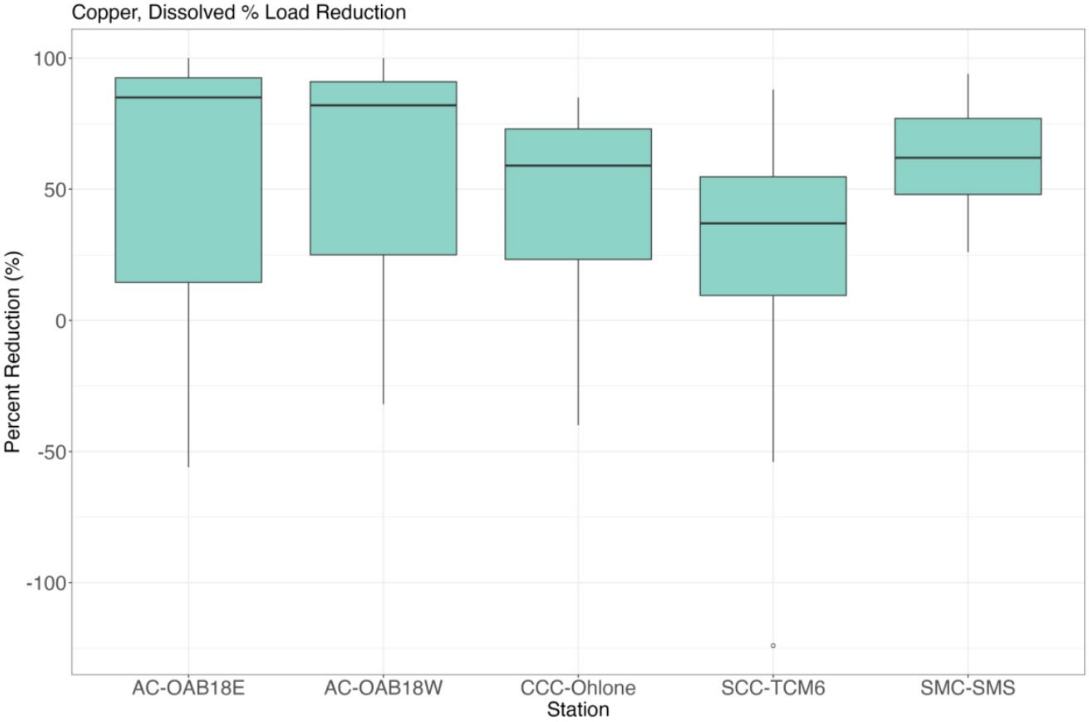

Figure 4.10. Box and whisker plots showing distribution of Dissolved Copper Load % Reductions at five BAMSC LID monitoring sites, WY 2024 – WY 2025.

ZINC

Zinc in stormwater runoff comes from both human-caused sources, like tire wear, brake dust, and galvanized metal (roofs, downspouts, pipes), and natural sources like weathering. This heavy metal is a water pollutant that can be toxic to aquatic life by harming fish gills (WRF 2020).

Findings from the 2020 International BMP Database summary statistics report (WRF 2020) for zinc include:

- The median concentration of total zinc in bioretention effluent is 12.8 µg/L and dissolved zinc is 12.5 µg/L.
- Bioretention shows statistically significant concentration reductions for total and dissolved zinc.

Results for the regional LID Monitoring Program from WY 2024 and 2025 are highly consistent with these International BMP Database statistics, including that:

- The median concentration of total zinc in the observed bioretention effluent was 10 µg/L regionwide, with effluent concentrations generally ranging from 6.6 – 16.8 µg/L. The median concentration of dissolved zinc in monitored effluent was 5.0 µg/L regionwide, with effluent concentrations generally ranging from 2.5 – 8.0 µg/L.
- Concentrations and loads of total zinc were significantly reduced, with concentration reductions ranging from 68% to 97% for individual storm events and regionwide concentration reductions of 91%. Load reductions ranged from 41% to >99% for individual storm events, with total regionwide load reductions of 86%.
- Concentrations and loads of dissolved zinc decreased in every storm event, with concentration decreases of 35% to 96% for individual storm events and by 80% regionwide. Loads of dissolved zinc decreased by 39% to >99% for individual regional storm events and by 80% total regionwide.
- Both total and dissolved zinc showed relatively low spatial variation, with somewhat lower results at Alameda’s OAB-18E facility: WY 2024 – WY 2025 facility load reductions ranged from 72% to 97% for total zinc (65% in OAB-18E) and 71% to 96% for dissolved zinc (47% in OAB-18E).

4.4.4 Polychlorinated biphenyls (PCBs)

PCBs are highly toxic, persistent chemicals that have been historically released into the environment from heavy industrial uses, particularly electronics manufacturing and recycling. PCBs are mixtures of up to 209 individual chlorinated compounds, or congeners; in the Bay Area, PCBs testing and abatement focuses on the 40 congeners most commonly found in the region, known as the Total RMP 40 PCB Congeners. Despite PCBs production being banned in the US in 1979, PCBs are still regularly detected in soil, urban runoff, and fish tissues due to their persistence and ability to bioaccumulate.

The San Francisco Bay Area is highly impacted by historical PCBs contamination and the Bay itself is designated as impaired, with a TMDL for PCBs established in 2008. The PCBs TMDL was developed based on a fish tissue target of 10 ng of PCBs per gram of fish tissue

(SFBRWQCB 2008). A food web model was developed to identify the sediment target concentration that would yield the fish tissue target; this sediment target was found to be 1 µg of PCBs per kg of sediment. Substantial regionwide effort to meet this TMDL is ongoing, including PCBs source property identification and abatement; removal and control of PCBs in electrical utility infrastructure and equipment; prevention of PCB releases from building demolitions and related materials; and containment of and eventual replacement of PCBs in building materials in bridges and infrastructure.

Although the 2020 International BMP Database summary statistics report (WRF 2020) does not specifically address PCBs, PCBs are considered sediment-bound and typically respond well to effective sediment control measures including bioretention basins. Results for the regional LID Monitoring Program from WY 2024 and 2025 support this, including that:

- The median concentration of total PCBs in the observed bioretention effluent was 0.40 ng/L regionwide, and generally ranged from 0.246 – 1.51 ng/L.
- Concentrations and loads of total PCBs were significantly reduced, with concentration reductions of 54% to >99% for individual storm events and 92% regionwide and load reductions of 40% >99% for individual storm events and 85% regionwide.
- PCBs showed low spatial variability; see Figure 4.11 for the distribution of total PCBs load reductions across each LID monitoring site, showing high overall PCBs removal in all facilities along with relatively low results representing the Alameda County overflow events.

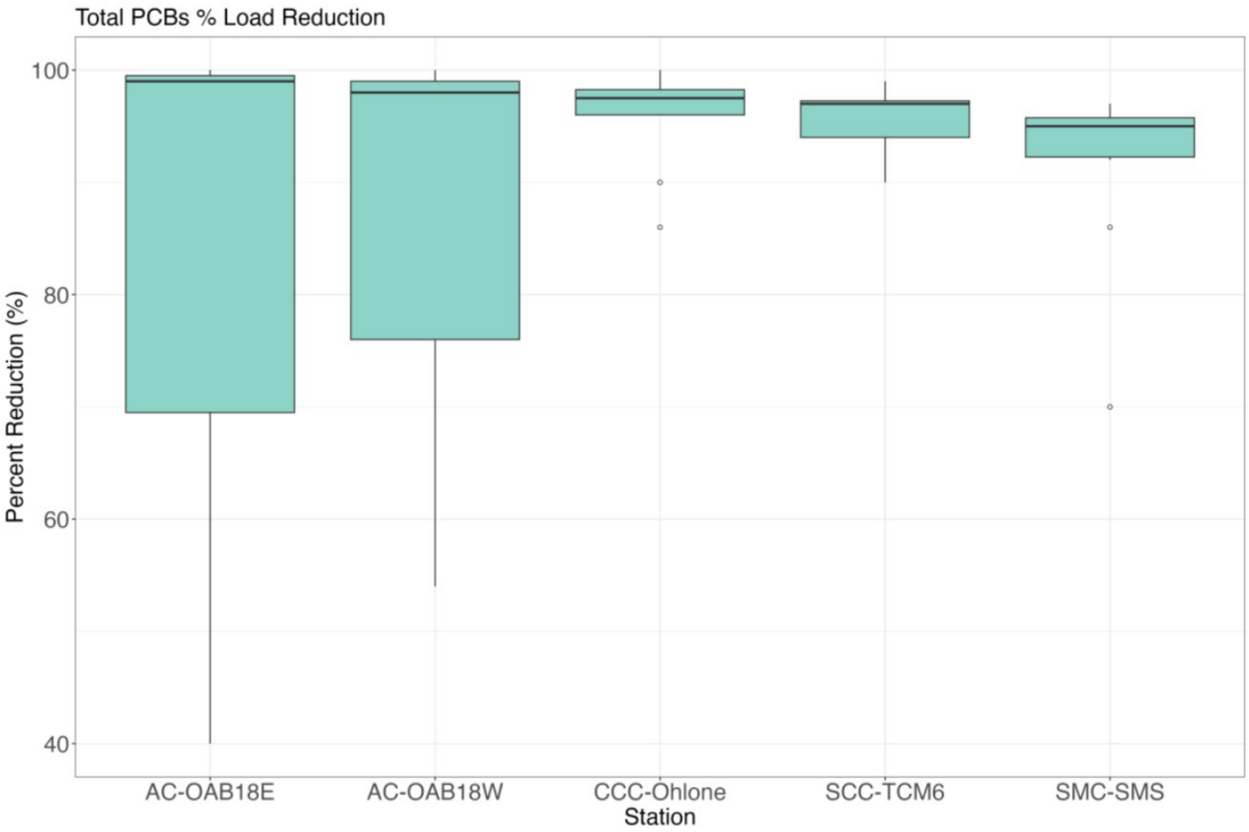

Figure 4.11. Box and whisker plots showing distribution of Total RMP 40 PCBs Load % Reductions at five BAMSC LID monitoring sites, WY 2024 – WY 2025.

4.4.5 Per- and Polyfluoroalkyl Substances (PFAS)

PFAS are a family of widely used, highly persistent chemicals with a range of industrial, consumer, and firefighting purposes and a wide range of physical and chemical properties. Because of their extensive and ongoing manufacture and use; their variety of chemical forms; and their persistence in the environment, many PFAS compounds are found in the blood and body tissues of people and animals all over the world. PFAS are found in water, air, fish, birds, soil, snow, and stormwater runoff at locations across the nation and the globe, as well as in cosmetics, furniture, and food products (Fassman-Beck et al. 2025). Scientific studies have shown that exposure to some PFAS in the environment may be linked to harmful health effects in humans and animals. This range and spread of PFAS compounds make studying their potential human health and environmental risks challenging, while their persistence and ubiquitousness render such studies increasingly important.

Analytical methods add to this challenge: EPA Method 1633 - the sole laboratory methodology currently approved by the EPA – can detect just 40 of the tens of thousands of known PFAS compounds. Although EPA 1633 serves a vital role in standardizing PFAS testing and analysis across regions and stakeholders, the substantial gap between known PFAS compounds and detectable EPA 1633 analytes is not academic: studies have found multi-fold increases in the actual presence of PFAS compared to the results detected with EPA 1633 (Dixit et al. 2024).

PFAS compounds are extremely persistent and do not degrade into component parts under natural conditions, though some may undergo transformations in the right natural conditions. These compounds, known as precursors, can bio- or photo-degrade into other PFAS compounds. Transformations can be complex and may involve multiple intermediary compounds, eventually ending up as extremely stable and persistent PFAS compounds that no longer transform or degrade, known as terminal products. Of the 40 EPA 1633 PFAS analytes, 13 are precursor (or intermediary) compounds and 27 are terminal. Crucially, numerous other precursor chemicals are in use which are not detected by EPA 1633, but which may transform into terminal analytes that are detected.

Although advanced methods of PFAS destruction are in development, there is little reason to expect that PFAS analytes would be removed from runoff by bioretention facilities. PFAS do not break down under natural conditions beyond the transformations already discussed and their sorption rate in normal or sandy soil conditions is minimal. Sorption is possible with granular activated carbon and ion-exchange resins (Fassman-Beck et al. 2025), but neither of these materials is commonly present in LID facilities or incorporated in the bioretention facilities monitored by BAMSC.

The 2020 International BMP Database summary report does not specifically address PFAS, but the BAMSC regionwide results give a place to start:

- The median regionwide concentration of total PFAS analytes in the observed bioretention influent was 0.013 µg/L and generally ranged from 0.001 µg/L to 0.030 µg/L. Total PFAS analyte concentrations increased in nearly all monitored storm events, and the median regionwide concentration in observed bioretention effluent was 0.40 µg/L and generally ranged from 0.025 µg/L to 0.070 µg/L.
- Total regionwide loads across both water years saw a slight increase of 4%, though loads were highly temporally heterogenous: every monitored facility saw individual storm events with load increases and others with load decreases; loads increased in 22 storm events and decreased in 15 storm events; and individual event concentration changes ranged from a >99% decrease to an >10,000% increase and individual event load changes ranged from extremes of a >99% decrease to a >7,000% increase.
- PFAS loads were also highly spatially heterogenous: WY 2024 – WY 2025 total loads increased in three monitored facilities and decreased in two. Monitoring facility total loads across both water years ranged from a 90% decrease in San Mateo County to a 263% increase in Alameda's OAB-18W. The increase in OAB-18W is even more notable when compared to the adjacent Alameda OAB-18E, which saw a total PFAS load decrease of 77%.

4.4.6 Regional Water Balance

For a regional water balance analysis, the percentage of the water balance components for all monitored events at each site in all counties was averaged (see Figure 4-12). Notable results of the regional analysis include:

- Direct rainfall accounted for 3% of the input.
- The greatest percentage of outputs is outflow through the facilities' underdrains (46%).

- The second greatest output is unknown losses and measurement/estimation errors (23%). This component is likely due in large part to water losses from the facilities through unknown preferential pathways. Although unknown, it is worth noting that preferential pathways represent flow that has entered the facilities and has been treated by them. Therefore, water quality of these unknown flows is likely to have been improved to a comparable degree as the outflow water quality.
- Storage in soil was an average of16% of site outputs. As indicated in Section 4.1.1, this percentage is likely biased high due to residual soil moisture that was likely present at the start of some storms.
- Overflows – which bypass treatment and do not improve water quality or hydrology – accounted for an average of 10% of total outputs. However, overflow only occurred during a single monitored event on February 13-14, 2025 in Alameda and Solano counties. This percentage is likely an overestimation, since any vegetation or debris partially obstructing the overflow structures would lead to an inflation of overflow values.
- Exfiltration accounted for 5% of total output on average. When excluding the facilities in Alameda and Solano counties, which do not infiltrate into the native soil, this value increases to 10%.

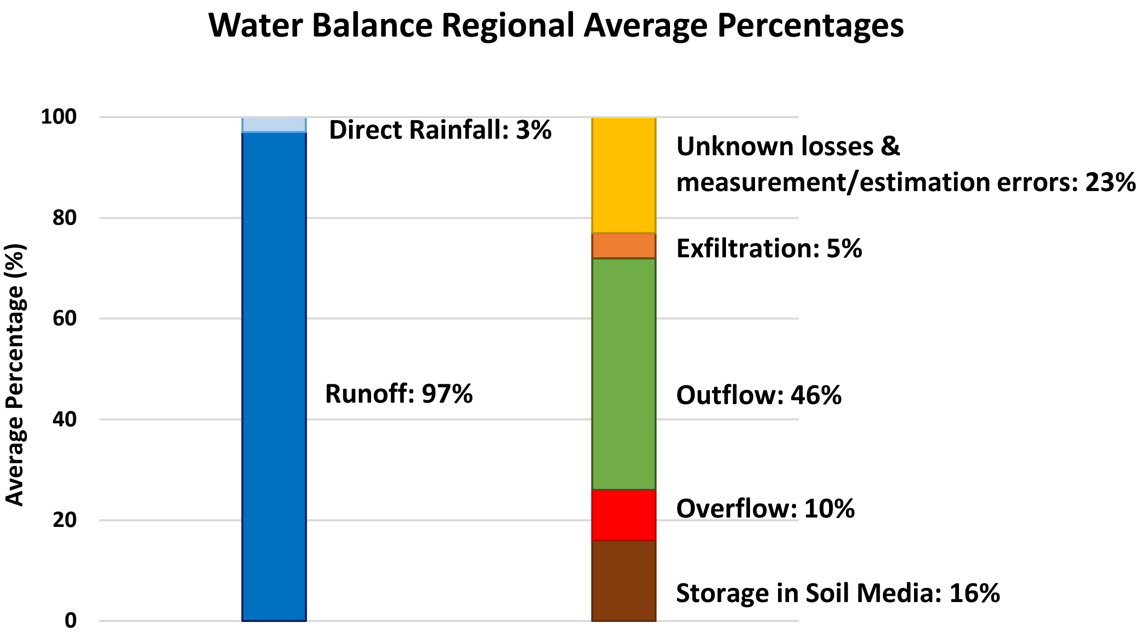

Figure 4.12. Average water balance component percentages of regional LID monitoring sites, WY 2024 - WY 2025

4.4.7 Regional Maintenance Analysis

This section describes analysis of monitoring data collected during WY 2024 and WY 2025 at each BAMSC monitoring station. Only data that passed QA review conducted by each Program is included in the analysis. This section also includes an initial summary of data specific to an ongoing ACCWP special study that is examining two side-by-side bioretention cells that are being manipulated to investigate structural and landscape maintenance practices as potential factors upon facility performance.

Pooled Data

Performance indicators were selected to address the LID Monitoring Management Question #2 (see Section 2.1 and 4.3) regarding potential effects of maintenance on system performance. This analysis focused on indicators associated with facility maintenance that could theoretically "reduce pollutant removal and hydrologic performance". The analysis does not consider other potential benefits of maintenance activities, such as aesthetic improvements, vector control, or trash removal[6] that may provide intangible benefits.

Specific indicators reviewed for this analysis include the following:

- **Ponding depth**. Sediment deposition may reduce available storage capacity, potentially increasing in-basin bypass or decreasing of the proportion of influent treated by the facility.
- **Vegetation density.** Vegetation density in excess of design specifications may have a positive or negative effect on facility performance. Similar to reduced ponding depth, higher vegetation densities may decrease available storage capacity. Conversely, increased densities could theoretically improve water quality or hydrologic benefits through additional uptake and/or filtration by vegetation.
- **Landscape maintenance frequency.** Unlike the other indicators, maintenance frequency is not a physical attribute that directly affects facility performance. However, where observable differences are identified by one of the other variables, maintenance frequency will be investigated to assess potential relationships with the variable(s) of interest.

This analysis deliberately excludes indicators of conditions at LID facility inlets (such as inlet blockage). Structural modifications were made at each monitored facility to accommodate sampling equipment, including focusing influent flows through a single influent point, often by blocking and/or redirecting the multiple influents points (such as curb cuts) that were part of the original facility design. Ongoing maintenance is conducted to ensure that influent equipment is unobstructed during sampling events. These structural and operational modifications have altered the standard hydrologic function of the targeted facility inlets to an extent that inlet condition indicators are not considered representative of typical, non-monitored facilities.

One additional caveat for this analysis is that Countywide Stormwater Programs have limited ability to control landscape maintenance at the monitored facilities. Maintenance is typically performed by municipal staff or contractors according to contracts negotiated with the

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[6] Trash removal may have water quality benefits associated with preventing breakdown of the trash items or pollutants within or adhering to those items but would likely not be measurable within the scale of the current Project.

municipality and not under control of Program staff. Although modifications to maintenance practices may be desirable from a monitoring design perspective, such changes are generally not feasible to implement at a regional scale. Moreover, altering the maintenance practices only at monitored facilities would risk further degrading their representativeness of non-monitored facilities.

Each facility was reviewed for the above-described indicators (Table 4-13). Information on ponding depth is taken from site visits performed over the course of equipment installation and monitoring operations and, lacking any type of new structural maintenance, is not expected to change greatly over a given monitoring year. Information on vegetation density is taken from periodic maintenance assessments performed by monitoring staff and may change for a given facility over a shorter timeframe.

Table 4-13 also includes water quality monitoring results associated with each monitored facility. Total Suspended Solids (TSS) and dissolved copper (DCu) results are included as surrogates for soil-associated and dissolved phase analytes, respectively. The calculated load reductions shown in Table 4-13 exclude data collected at sites OAB-18E, OAB-18W, and SSA-LOTZ during the February 13, 2025 design storm event due to the confounding effect their inclusion would have on analysis. Negative percent reduction results indicate a net increase in analyte load.

Table 4.13. Maintenance and related attributes of BAMSC Regional LID Monitoring Facilities.

Program	Facility	Monitoring WY	Facility Type	Facility Sizing Ratio	Exfiltration	Ponding Depth	Ponding Depth Class	Overgrown	Landscape Maint Frequency	Influent Load, TSS (g)	Effluent Load, TSS (g)	TSS % reduction	Influent Load, DCu (ug)	Effluent Load, DCu (ug)	DCu % reduction
ACCWP	OAB-18E	2025	Bioretention	3.4%	No	< 6”	< Design	Yes	≤ 1/mo	4,745[b]	11[b]	100%[b]	0.12[b]	0.01	96%[b]
ACCWP	OAB-18W	2025	Bioretention	1.9%	No	7 - 8"	Design	No	≤ 1/mo[a]	5919[b]	76[b]	99%[b]	0.14[b]	0.02	87%[b]
CCCWP	Ohlone	2024	Bioretention	3.3%	Yes	6"	Design	No	4x / mo	44,970	2,047	95%	4.68	4.76	-2%
CCCWP	Ohlone	2025	Bioretention	3.3%	Yes	6"	Design	No	4x / mo	11,470	310	97%	2.36	0.81	66%
SMCWPPP	SMS	2024	Bioretention	2.4%	Yes	6"	Design	No	≤ 1/mo	7,927	262	97%	1.29	0.24	81%
SMCWPPP	SMS	2025	Bioretention	2.4%	Yes	6"	Design	No	2x / mo	15,229	710	95%	1.17	0.46	61%
SCVURPPP	TCM6	2024	Bioretention	2.2%	Yes	12"	Design	No	2x / mo	9,565	438	95%	0.25	0.20	17%
SCVURPPP	TCM6	2025	Bioretention	2.2%	Yes	12"	Design	No	2x / mo	7,718	1,067	86%	0.42	0.35	16%
SSA	SSA-LOTZ	2025	Bioretention	2.3%	No	< 6”	Design	No	4x / mo	8,493[b]	1,479[b]	83%[b]	0.27[b]	0.82[b]	-202%[b]

a Performed at a frequency to maintain water flow in the facility and remove emergent weeds.

b Excludes February 13, 2025 overflow events at OAB-18E, OAB-18W, and SSA-LOTZ..

Regional Data Analysis

Data analysis was conducted to examine the relationship between the three maintenance indicators identified above and pollutant load reductions for TSS and dissolved copper (Table 4-13). Although originally intended for inclusion in the compiled dataset, station SSA-LOTZ was excluded because it was the only facility of its type (i.e., water table above level of underdrain) represented within the region. Initial statistical analyses suggested that inclusion of SSA-LOTZ data would skew results. For example, inclusion of SSA-LOTZ WY 2025 data suggested that facilities with 4x/month maintenance exhibited a negative dissolved copper reduction (-45.9%), indicating net export associated with this practice. After excluding the SSA-LOTZ data, the same maintenance category exhibited a positive dissolved copper reduction (31.9%), although with high variability. Therefore, the analyses presented below includes only data compiled from ACCWP, CCCWP, SCVURPPP, and SMCWPPP datasets passing QA review.

Statistical Methods

Kruskal-Wallis tests were conducted to assess differences in pollutant load reduction across three maintenance characteristics: ponding depth class, vegetation density, and landscape maintenance frequency. This nonparametric test was selected due to the small sample size and the non-normal distribution of the data.

Results

The small sample size (n=8) limits statistical power and the ability to detect significant differences between groups. in addition, the unbalanced design, with only one facility in the overgrown and below-design ponding depth categories, precludes robust comparisons for these characteristics. Results of the statistical tests run for each maintenance factor are discussed below.

- **Maintenance Frequency.** Landscape maintenance frequency showed the strongest relationship (although not statistically significant) with pollutant reduction performance. Facilities maintained at low frequency (≤1/month, n=3) exhibited the highest performance, with mean TSS reduction of 98.4% (SD=1.6%) and dissolved copper reduction of 87.7% (SD=7.3%). Facilities receiving moderate frequency maintenance (2x/month, n=3) exhibited mean TSS reduction of 92.3% (SD=5.3%) and mean dissolved copper reduction of 31.3% (SD=25.8%). High frequency maintenance (4x/month, n=2) exhibited mean TSS reduction of 96.4% (SD=1.3%) and mean dissolved copper reduction of 31.9% (SD=47.5%). The Kruskal-Wallis test indicated no statistical significance for either TSS (p=0.062) or dissolved copper (p=0.082).
- **Ponding Depth**. Ponding depth class exhibited differences in performance, though with limited statistical power due to unbalanced sample sizes. The single facility with below-design ponding depth (<6 inches) exhibited 99.8% TSS reduction and 95.6% dissolved copper reduction. Facilities at design ponding depth (6-12 inches, n=7) exhibited mean TSS reduction of 95.0% (SD=4.1%) and dissolved copper reduction of 46.5% (SD=35.4%). The Kruskal-Wallis test indicated no statistical significance (p=0.127 for both pollutants).
- **Vegetation Density**. Vegetation density results were identical to ponding depth findings, as the groupings for the overgrown category (n=1, OAB-18E) and not overgrown (n=7) were the same as those described for ponding depth above. The overgrown facility achieved 99.8% TSS reduction and 95.6% dissolved copper reduction, while facilities that were not

overgrown showed mean TSS reduction of 95.0% (SD=4.1%) and dissolved copper reduction of 46.5% (SD=35.4%). Statistical significance was identical to that of ponding depth (p=0.127 for both pollutants).

Discussion

Several limitations constrain the quantitative analysis of relationships between maintenance characteristics and facility performance at BAMSC study sites. First, the above factors cannot be viewed independently of others that might affect hydrologic performance. Physical and design attributes, such as facility sizing and presence or absence of a lining, are likely to have a greater effect on facility hydrology than maintenance practices. Second, the very act of monitoring has altered facility hydrologic function to such an extent that it likely outweighs any detectable maintenance-related signal. Actions such as focusing influent flow into single entry points and ensuring that remaining curb cuts remain unobstructed from vegetation, trash, and debris limit our ability to draw firm conclusions from monitoring in this regard.

ACCWP Special Study

In addition to the regional data analysis provided above, there is an additional special study that was implemented by ACCWP that was specifically designed to address the maintenance-related Management Question. ACCWP compiled data to compare results for adjacent facilities of the same construction type managed under different maintenance practices:

1) Data collected at OAB-18E (representing unrestored, minimal maintenance condition)
2) Data collected at OAB-18W (representing the typical maintenance condition)

While only a limited number of datapoints are available to represent these two conditions, interim results are compiled in Table 4-14. As discussed previously, loads data for WY 2024 are not included due to the uncertainty related to hydrologic measurements for that monitoring year.

Table 4.14. Comparison of WY 2025 monitoring results in unmaintained and maintained ACCWP monitoring facilities. Overflow events excluded from analyses.

Site	WY	# Samples[1]	Condition	Analyte	% load reduction, excluding overflow event	% load reduction, including overflow event
OAB-18E	2025	2 / 3	Unmaintained	TSS	100%	60%
OAB-18W	2025	2 / 3	Maintained	TSS	99%	70%
OAB-18E	2025	2 / 3	Unmaintained	Cu, Diss.	96%	27%
OAB-18W	2025	2 / 3	Maintained	Cu, Diss.	87%	45%

[1] Only sample events for which load reductions are calculable are represented. Load reduction calculations excluding the Feb 13, 2025 overflow event reflect results of two sampling events.

As the facility restoration conducted at the OAB-18W site prior to WY 2025 monitoring has the potential to positively affect facility hydrologic performance, ACCWP was interested in comparing water balance for the two facilities (for more information on OAB-18W restoration see ACCWP 2026). For this comparison, ACCWP compiled water balance data for the February 13, 2025 overflow event, which was the only monitored storm to generate bypass within the facility during WY 2025. The calculated water balance for the two monitoring stations is presented in Table 4-15. For this one storm, both overflow and outflow via effluent are proportionally higher in the unmaintained side of the facility (OAB-18E); this is likely attributable to the 28% of inputs that are assigned to the unknown category for OAB-18W.

Table 4.15. Water balance at ACCWP sites OAB-18E and OAB-18W for February 13, 2025 monitoring event. Results are shown as percentage of total input to each facility.

Site	Water Balance Component (cf)								Total Inputs = Total Outputs
	Inputs		Outputs						
	Runoff	Direct Rainfall	Storage in Soil Media	Evapotranspiration	Overflow	Outflow	Exfiltration	Unknown losses & measurement/estimation errors	
OAB-18E	96%	4%	7%	0%	54%	36%	0%	3%	100%
OAB-18W	98%	2%	4%	0%	43%	25%	0%	28%	100%

Given the small number of datapoints, no conclusions are drawn at this time; however, data collection and analysis will continue through the MRP 3.0 permit term.

5.0 CONCLUSIONS

LID monitoring, including convening of TAG meetings, hydrologic monitoring and calculation of a water balance, collection and analysis of flow-weighted influent and effluent samples, assessment of LID maintenance activities, and regional analysis of monitoring data, was conducted during WY 2024 and WY 2025 in compliance with Provision C.8.d of the MRP and in accordance with the SCVURPPP LID Monitoring Plan (SCVURPPP 2023, 2024). SCVURPPP monitoring was primarily conducted at the Top Golf Public Green Streets TCM6 facility in the City of San José.

5.1 Assessment of LID Effectiveness

5.1.1 Hydrology

Influent and effluent flows along with other hydrologic parameters (rainfall depth and ponding depth) were successfully monitored at the San José TCM6 facility throughout the WY 2024 and WY 2025 wet seasons. Beginning in WY 2025, shallow groundwater depth was also successfully monitored. Influent and effluent flow data were used to calculate pollutant loadings into and out of the facility. The other parameters were used to calculate a water balance. Effluent was not observed or recorded at the TCM4 facility during WY 2024 or WY 2025. As a result, in WY 2025, monitoring equipment was removed from this site; however, field crews occasionally made visual observations with the same findings. Although this suggests that 100% treatment may have been achieved through infiltration, it prevented collection of paired influent/effluent samples as required under MRP Provision C.8.d. Monitoring at TCM4 was discontinued during WY 2025 and is not expected to resume. A new monitoring facility (in addition to ongoing monitoring at TCM6) will be prepared for WY 2027 if needed to meet MRP3.0 monitored storm event requirements.

The TCM6 site demonstrated a strong hydromodification benefit, with only 51% of total WY 2024 – WY 2025 inputs measured as outflow through the facility's underdrain and those outflows showed reduced peaks and delayed releases (detention) compared to the dual inputs of runoff and direct rainfall. These benefits were seen throughout the rainy seasons of both water years, including during storm events that were not sampled for water quality analysis. Hydromodification is an important benefit of LID designs, reducing water velocity and therefore erosion and turbidity in receiving waters; reducing flows through the MS4 and likely therefore also reducing inflow and infiltration into the sanitary sewer; and helping to moderate local flooding events, all benefits validated by TCM6's hydrologic performance.

Though it is important to note that 25% of the cumulative WY 2024 – WY 2025 output at TCM6 is classified as "unknown losses," this collective flow is still likely to receive the same hydromodification (and water quality) benefits of the directly observed outputs. This is due to the nature of the "unknown" losses, which as described in Section 4.1.1, most likely primarily constitute flows through preferential pathways out of the bioretention basin and into native soil. TCM6 did not experience any overflows (untreated bypasses) during WY 2024 – WY 2025 and, since native soil will provide comparable or superior hydromodification benefits as the bioretention soil media and drain rock of the LID facility, these "unknown" flows are still effectively treated by the device.

5.1.2 Water Quality

Sediment-Bound Pollutants

Bioretention features treat stormwater primarily through solids removal processes. Therefore, they should be most effective at removing sediment-associated pollutants (TSS; total copper, mercury, and zinc; and PCBs). Indications from the WY 2024 and WY 2025 sampling events at TCM6 suggest this to be the case, with high concentration reductions (46% - 94% at TCM6) and even higher load reductions (74% - 97% at TCM6) across all sediment-bound pollutants. As a whole, these analytes saw the best water quality performance of all project analytes, an unsurprising but nonetheless positive result that demonstrates the effective removal of several key contaminants.

Dissolved Metals

Although total copper, mercury, and zinc are considered sediment-bound, their dissolved fraction (or, more accurately, the smallest particle size portion of the metals content, as well as any truly dissolved or colloidal metals) are not considered sediment-bound and would therefore not be expected to be removed through sedimentation and filtration. However, dissolved metals can be removed from water by sorption and precipitation processes, with adsorption – the binding of aqueous species to surfaces – considered to be the most important mechanism in the removal of dissolved metals in stormwater BMPs (WRF 2020). Adsorption of dissolved metals is complex and influenced by many factors, including the presence of organic matter (high in biotreatment soil media, increasing metals adsorption); pH (generally close to neutral in LID devices, hindering adsorption); concentration of the analyte in question (generally low for dissolved metals in these LID samples, also hindering adsorption); time in contact with treatment media (high for retained runoff but low in detained runoff, likely reducing adsorption in the sampled effluent); and the presence and concentration of other factors in the soil media - including quartz, other metals, carbonate, and phosphorus – which are beyond the scope of this study to model and assess (WRF 2020; Diatta and Kocialkowski 1998; McLaren et al. 1983; Schuster 1991). The expected result would be some dissolved metals removal, though to a lesser degree than removal of the sediment-bound pollutants and with a higher degree of variability across regional sites and individual storms.

At TCM6, these expectations were largely met: concentrations of dissolved copper and dissolved mercury were inconsistent and often increased in individual storms, while loads most often decreased but by less than in the sediment-bound pollutants and possibly primarily due to the hydromodification benefits of LID treatment. Unlike dissolved mercury and dissolved copper, dissolved zinc performed very well, comparable to the sediment-bound pollutants and with one of the highest removal rates of all analytes. This is likely due to cation exchange and other processes within the soil media which are consistent with zinc's stronger tendency for sorption relative to copper and mercury.

Total Petroleum Hydrocarbons (TPH)

Total Petroleum Hydrocarbons are not considered sediment-bound but can be removed from effluent through several bioretention pathways, including settling and filtering, adsorption, and biodegradation, with some research suggesting that well-vegetated BMPs are particularly effective at TPH removal (LeFevre et al. 2012; Schueler and Youngk 2015; WRF 2020). Data collected in WY 2025 detected high reductions in TPH concentrations (60% - 83% at TCM6) and very high reductions in TPH loads (88% - 96% at TCM6), with better performance among the longer-chain C24-C36 motor oil TPH compounds than the shorter-chain C12-C24 diesel compounds. Based on these results, the high load removals observed in the TCM6 monitoring facility validates the overall efficacy of bioretention basins in attenuating a common pollutant.

Nonetheless, the challenges with TPH monitoring must be addressed: TPH analysis is ideally conducted on grab samples rather than the composite samples available at LID monitoring sites; available TPH laboratory analysis has turned out to be low resolution or low quality; and carbon-chain groupings (in this case C12-C24 and C24-C36) are not standardized between labs, adding to the challenges of changes in lab partners. As a result of these challenges, large quantities of sample data (all of the regionwide WY 2024 samples, as well as additional samples from individual storm events) for TPH had to be invalidated and excluded from analysis.

PFAS

Interpretation of PFAS results presents a more complex situation than the other analytes. The general understanding of environmental fate and transport of PFAS analytes is at a much earlier stage of development relative to the other analytes targeted by this Project. Additionally, the 40 PFAS analytes that are measured through EPA Method 1633 include a variety of compounds with very different makeup and properties, including long- and short-chain compounds; presence as precursor, intermediary, or terminal products; differences in water solubility; etc. Within Santa Clara County, PFAS results were inconsistent from storm to storm and between individual PFAS analytes, and regionwide total PFAS results varied widely from facility to facility. Santa Clara's TCM6 performed somewhat more poorly than the region as a whole – which saw a 4% total PFAS analyte load increase across both water years compared to a 68% increase at TCM6 – but total PFAS analyte loads increased in most of the other BAMSC facilities as well. Unlike the other water quality constituents analyzed in this Program, PFAS results and related LID performance could not be consistently predicted or accurately summarized.

One possible explanation for this unpredictability is that waters flowing through the facility are enriching in PFAS as they percolate through the soil and gravel layers, or as they come into contact with structural materials within the facility (e.g., underdrain, adhesives, landscape fabric). This PFAS could be leaching from components of the LID facility itself or from external sources, such as trash, or from the application of inadvertently contaminated biosolids (Faught et al. 2025), a notable finding considering the high percentage of biosolids-sourced compost used in bioretention soil media around the Bay Area.

Another possible explanation for higher concentrations on the effluent side lies with the limitations of the analytical method itself. EPA 1633 quantifies 40 of thousands of possible PFAS compounds, many of these terminal products of breakdown processes. There exists the possibility that overall mass of PFAS in influent and effluent samples may not be dissimilar, but that transformation processes within the facility are converting PFAS precursor compounds that are not analyzed via EPA 1633 into terminal products that are. A recent SFEI study investigated influent and effluent samples in wastewater with similarly higher concentrations in effluent relative to influent. Follow-on analyses included a Total Oxidizable Precursor (TOP) assay in combination with EPA 1633 on replicate sample material, which indicated the presence of precursors in wastewater influent samples that were not detectable by the EPA method (Lin et al. 2024). The same concept was demonstrated in Burlington, North Carolina, where total PFAS concentrations in wastewater treatment plant effluent were detected at multiple orders of magnitude higher than in the plant's influent; further analysis revealed extremely high concentrations of precursor PFAS compounds that were only detectable through oxidation (as part of the wastewater treatment process or through a TOP assay) or through other advanced PFAS processing and analysis techniques such as a Total Hydrolysable Precursor (THP) assay (Faught et al. 2025). And a 2024 study aiming to evaluate PFAS analytical methods found a 4-fold increase in detectable PFAS compounds when using a TOP assay compared to EPA 1633 (Dixit et al. 2024).

Overall PFAS results from this study are inconclusive, suggesting that additional academic research into the fate and transport of PFAS compounds and, perhaps, the development of additional PFAS analytical techniques, is needed before LID monitoring for PFAS can draw meaningful or useful conclusions.

5.1.3 Maintenance Assessments

Maintenance assessments conducted during WY 2024 – WY 2025 identified routine maintenance issues at TCM6 and potentially more severe structural defects at TCM4, with varying levels of impacts:

- Routine maintenance needs do not appear to impact LID functioning, validating the maintenance schedule carried out by the City of San José and/or City contractors as likely sufficient for most LID facilities. This conclusion is supported by the consistently high concentration and load reductions of most Program analytes of concern, including TPH, which research indicates is more effectively removed in well-vegetated BMPs (LeFebre et al. 2012).
- The modifications to LID facilities to enable sample collection render these facilities more susceptible to clogged inlets, particularly during leaf drop at the start of the wet season, requiring additional maintenance (conducted by SCVURPPP's monitoring contractor) prior to each monitored storm event to ensure that runoff was able to flow into the facility and through the monitoring equipment. Left unattended, the buildup of leaves and sediment in the device inlet may have resulted in ineffective flow measurements, hindered sample collection, or possibly resulted in untreated bypasses. This additional level of maintenance required by the monitoring program is unrepresentative of the maintenance received by non-monitored LID facilities, though it highlights the need for municipalities or other maintenance entities to be able to tailor their LID maintenance as needed to account for specific LID device designs, pollutant loads, and use cases.
- The lack of effluent at TCM4 prevented LID monitoring of that facility during WY 2024 and WY 2025. Importantly, the requirement to collect effluent samples is not shared by most LID facilities, and the lack of sampleable effluent does not necessarily mean that the facility is not treating influent – were it not for the monitoring program, TCM4 may be a fully functional C.3 device. Nonetheless, this facility does demonstrate the benefits that municipalities or other LID facility operators could gain from being able to conduct flow tests or wet-weather observations early in the construction of new LID devices in order to identify and remedy structural defects as needed.

A deeper analysis of maintenance schedules and impacts was made at the regional level, by pooling maintenance, hydrology, and water quality data and by utilizing Alameda County's test of differing maintenance schedules for otherwise comparable facilities. Results are preliminary due to small sample sizes but show that existing maintenance schedules are sufficient to maintain LID performance in most instances, as reflected by high total suspended solids and dissolved copper load reductions, which were used as surrogates for soil-associated and dissolved phase analytes, respectively. However, the act of monitoring itself requires structural and operational modifications at the monitored facilities, thereby limiting the ability to directly assess the effects of maintenance schedules using monitored facilities.

5.2 Lessons Learned

During the first two years of monitoring in WY 2024 and WY 2025, there were several lessons learned that may result in modifications to the monitoring program moving forward:

- **Limited Effluent Samples.** In some cases, samples may be collected that do not have sufficient volume to be analyzed for all constituents, particularly for monitored storm events that result in less precipitation than expected. Because unpredictable weather and high program costs still render these storm events valuable, programs should plan on making decisions on which constituents to analyze, selecting analytes based on dynamic priorities such as representation (e.g., TSS and dissolved copper as proxies for other analytes); regulation (prioritizing analytes with TMDLs or other applicable water quality objectives); and data collected to date (i.e., how many data points have already been collected per analyte).
- **Lack of Effluent – Device Failures.** Effluent flow was not detected at TCM4 during the first storm event monitored on January 2, 2024. Field crews discovered leaks in the overflow vault while conducting storm observations 4 days later. Initially the Project Team attempted to patch these leaks on January 9th, however the patches proved insufficient. The City of San José construction contractor was required to conduct a more extensive repair of the system to stop the leaks, which was done at the end of the rainy season (May and June 2024), but which did not result in effluent detections during WY 2025 storm events. Therefore, no effluent flow was measured at TCM4 during WY 2024 or WY 2025 and monitoring at TCM4 will be discontinued beginning in WY 2026. SCVURPPP staff will assess sample collection at TCM6 during WY 2026 and will prepare a new LID monitoring facility for WY 2027 (in addition to continued monitoring at TCM6) if needed to meet MRP3.0 monitored storm event requirements.
- **Lack of Effluent – Device Successes**. Several storm events around the region were rejected due to lack of effluent samples, rendering the requirement for paired influent-effluent samples impossible. In some cases, such storm events likely represent a failure of the monitoring equipment (e.g., blockage of intake tubing, missing flow data) and the storm event should be rejected. However, in some cases the lack of effluent sample may be simply the result of a fully functional LID device, which by design should retain and/or infiltrate as much inflow as possible. For unlined LID facilities, and/or in other circumstances where program staff believe the device to be functional and the influent measurements to be accurate, these storm events should be included in the monitoring data, with the assumption of 100% flow diversion and 100% analyte load reductions.
- **Equipment Blanking and Tubing Reuse.** An analysis of blanks testing (pre-season equipment blanks prior to WY 2024 and WY 2025; end-of-season field blanks collected in WY 2024; and end-of-season peristaltic tubing blanks in WY 2025) conducted for all BAMSC partners and reviewed by the Water Board and TAG has allowed streamlined blanks moving forward. Specifically, end-of-season field blanks and peristaltic tubing blanks are no longer necessary and will not be conducted moving forward, beginning with WY 2026.

- **Equipment Selection and Monitoring Implementation.** In early WY 2024, the bubblers used to determine influent and effluent flow were found to fail under field conditions. As a result, they were replaced with bubblers from a different manufacturer. Where possible, newly equipped LID monitoring facilities should undergo wet weather observations and/or flood testing prior to the start of monitoring in order to identify and remedy such equipment issues.
- **Sample Volumes**. Initial discussions with analytical laboratories indicated that a minimum volume of 6.0 L would be required to supply sufficient volume to support all analyses. It was later learned that additional sample volume should be supplied to the laboratories to allow for loss during transfer from carboys to individual sample containers and to support re-analyses of samples as required. For these reasons, the minimum volume for WY 2025 sampling events was increased to 10.0 L per event, with a target volume of 20.0 L per event.
- **TPH Analytical Method**. TPH was analyzed as both Diesel (C12-C24) and Motor Oil (C24-C36) at PACE Analytical, as a subcontractor to Caltest Analytical, in WY 2024. RLs at PACE for TPH-diesel were 200 µg/L with an MDL of 74 µg/L and TPH-motor oil had a RL of 500 µg/L with an MDL between 160 µg/L and 180 µg/L. These RLs met QAPP targets (BAMSC 2023). However, WY 2024 results saw very few instances of quantified values for TPH across all counties for the BAMSC coordinated LID sampling. This, combined with PACE no longer reporting the carbon ranges we requested, led to finding a new laboratory for TPH analysis. Beginning in WY 2025, TPH samples were sent to Moore Twining Associates in Fresno, which allowed the Project to have TPH reported in the same carbon ranges for consistency and with lower RLs, i.e., TPH-diesel: RL=50 µg/µg/L, MDL=42 µg/L and TPH-motor oil: RL=100 µg/L, MDL=25 µg/L. However, though Moore Twining returned results with a higher resolution, frequent QA flags have motivated the BAMSC partners to seek yet another lab for TPH analysis, though this may result in mismatched carbon ranges.
- **Definition of a Storm**. During WY 2024, storm observations and review of monitoring data confirmed that in multiple cases viable storms were not sampled (or served as false starts) due to storms not meeting the initial storm requirements. Specifically, storms often did not present as more uniform intensity storms over a given duration. Instead, storms often presented in a series of fronts with dry gaps greater than 6 hours. This was often due to a small front passing that did not produce sufficient rainfall followed by a larger front that occurred more than six hours but less than 24 hours after the end of initial precipitation. To address this situation, in WY 2025 BAMSC Programs (with concurrence by Water Board staff) adjusted the storm event end criterion so that it ends “with a period of ***between 6 and 24*** consecutive hours, each hour with precipitation less than or equal to 0.01 inches.”

6.0 RECOMMENDATIONS

6.1 LID Monitoring in WY 2026 – WY 2027

The recommendations in this section address LID monitoring during WY 2026 and through the remainder of the MRP 3.0 permit term. They are based on findings from two years (WY 2024 and WY 2025) of SCVURPPP LID monitoring, as well as insights gained from the regional data analysis.

- SCVURPPP will continue to conduct LID monitoring at TCM6 in accordance with the Monitoring Plan (SCVURPPP 2024) as modified by the Addendum (Appendix A) and will discontinue sampling at TCM4 moving forward. The goal is to collect a minimum of 25 paired samples by the end of the MRP 3.0 permit term (i.e., WY 2027) with an annual minimum of three paired samples. SCVURPPP will prepare a new LID monitoring site (in addition to TCM6) for monitoring during WY 2027 if needed to meet the minimum of 25 paired samples.
- SCVURPPP will continue to collaborate with the BAMSC partners through the RMC. One key effort that the RMC will investigate is whether an alternative laboratory can be identified for analysis of TPH.
- SCVURPPP will continue to participate in annual meetings of the LID TAG.

6.2 Recommendations to Inform MRP 4.0

The recommendations in this section are directed toward the next iteration of the MRP (MRP 4.0), which is currently under development and anticipated to become effective on July 1, 2027. These recommendations are provided in the context of overall Provision C.8 monitoring requirements, which expanded substantially from MRP 2.0 to MRP 3.0 and represent a significant portion of overall Program resources (see Part E of the IMR). Among the MRP 3.0 Provision C.8 monitoring elements, LID monitoring is the most resource-intensive, reflecting the complexity of equipment needs, field sampling, analytical requirements, and reporting obligations. Accordingly, the intent of these recommendations is to enhance the utility and efficiency of LID monitoring under MRP 4.0.

The Program looks forward to discussing potential modifications to LID monitoring requirements under MRP 4.0 through Provision C.8 workgroup process. Continued collaboration among Permittees, the Water Board, and other stakeholders will be important to evaluate monitoring objectives, data utility, and program costs, and to identify opportunities to refine monitoring requirements in ways that improve overall stormwater management and protection of beneficial uses.

6.2.1 Modification of Management Questions

Results from monitored storm events during MRP 3.0 have provided a regional understanding of LID effectiveness and demonstrated the value of a coordinated, multi-program monitoring approach. At the conclusion of MRP 3.0, however, the available dataset will consist of a large number of monitored storm events over a small number of years - primarily reflecting short-term facility performance. The collaborating BAMSC partners anticipate that LID monitoring will continue into the next permit term and see value in continuing this program with a shift to answering the primary unanswered question: How does LID effectiveness change over time?

To support this shift in emphasis, BAMSC recommends retaining the existing LID Management Questions (see Section 2.1) while refining how they are addressed in MRP 4.0. Management Question #1, assessing pollutant removal and hydrologic benefits, would be retained without modification, with the option to focus MRP 4.0 monitoring on the temporal (rather than spatial and temporal) component of LID performance. Each Program would be allowed to maintain sampling at their current LID monitoring facilities or individually select new site(s) in order to best assess any impacts of LID aging and long-term trends.

Management Question #2, assessing the impacts of O&M and maintenance frequency, would be modified to better align with the scale and intent of the regional LID monitoring program and with the new Asset Management requirements established under Provision C.21 of MRP 3.0.

One challenge with the current monitoring program is that the act of LID monitoring inherently changes facility hydrology and requires frequent site visits for equipment installation and maintenance, site inspection, and storm-event sampling. These activities support identification of obvious maintenance issues and timely communication with City staff but limit the ability to evaluate performance under varying or minimal routine O&M conditions. Crucially, these activities also mean that maintenance at monitored LID facilities is not representative of maintenance at non-monitored LID facilities. Further complicating this analysis, the term “deteriorated” in the Management Question is not explicitly defined and has proven difficult to assess in the context of the monitoring program. Additionally, MRP Provision C.21 requires development and implementation of Asset Management (AM) Plans that seek to prevent loss or failure of inventoried hard assets, including LID facilities. The AM Plans include a process for evaluating the current condition (i.e., performance level and effectiveness) and identifying the need for rehabilitation and replacement of inventoried assets. This tracking currently runs in parallel to the MQ #2 assessments conducted as part of C.8 LID Monitoring.

As discussed here and in Section 4.4.7, the effectiveness of O&M cannot be assessed through the LID monitoring program. To improve clarity and alignment among MRP provisions, and to reduce duplication of effort, BAMSC recommends eliminating or refining Management Question #2 to leverage data collected through the Provision C.21 Asset Management condition assessment process.

6.2.2 Modifications to Improve Efficiency

The following modifications are intended to improve LID monitoring efficiency while preserving continuity, data quality, and long-term value.

- **Streamline monitoring efforts.** LID monitoring includes substantial marginal costs of sampling and analysis for every sampled storm event, while California’s intermittent precipitation patterns complicate planning for and achieving high minimum sampling event requirements. Reducing the minimum number of sampling events would allow BAMSC programs to better allocate resources across all MRP provisions; simultaneously, extending LID monitoring into future permit terms would allow the ongoing collection of statistically significant samples and better reveal long-term trends in constituent detection and LID treatment efficacy. We suggest that a minimum of 15 sampling events are sampled by each program over the MRP 4.0 permit term, with a minimum of two events per year. This will enhance efficiency; reduce vulnerability to highly variable seasonal and annual weather patterns; and continue gathering statistically significant and representative data to assess long-term trends.

- **Remove TPH from the list of sample analytes.** TPH analysis is most often, and most effectively, conducted on grab samples, while the nature of flow-weighted LID monitoring necessitates the collection of composite samples which are of limited utility for assessing TPH. Additionally, BAMSC agencies have struggled to identify a commercial TPH laboratory that has both an acceptable QA process and sufficiently high-resolution reporting levels to avoid non-detects in LID samples. Despite repeated best efforts, large quantities of MRP 3.0 sampling data for TPH had to be excluded from analysis.
    - The acceptable data collected during MRP 3.0 detected considerable reductions in TPH concentrations (65-79% regionwide) and loads (83-88% regionwide) between LID influent and effluent. Due to this strong result and the limitations of ongoing sampling, BAMSC partners feel that additional analysis of TPH will not add value to LID designs or further inform the Management Questions.
- **Remove PFAS from the list of sample analytes.** PFAS testing and analysis is complex and burdensome. Despite the cost, commercially available analytical methods only report on 40 of the tens of thousands of PFAS analytes present in the environment, significantly limiting the utility of this analysis. The resources currently dedicated to PFAS are likely better applied to the monitoring, analysis, and management of the other constituents of concern and implementation of other MRP provisions and control measures.
    - PFAS monitoring is still in the realm of academic research and should not be required in municipal stormwater permits. Instead, PFAS monitoring should be conducted by research organizations and academia which are less tied to reporting requirements and timelines and better able to access university laboratories and novel sample processing and analytical methods. Research organizations such as the RMP ECWG, which has recently doubled in size, are already actively monitoring CECs in stormwater runoff[7] (Moran et al. DRAFT 2025).
    - There is little reason to expect that PFAS analytes would be removed from runoff by bioretention facilities. PFAS do not break down under natural conditions beyond the transformation of precursor or intermediary compounds into terminal compounds and their sorption rate in normal or sandy soil conditions is minimal (Fassman-Beck et al. 2025). LID monitoring during the MRP 3.0 permit term has confirmed the presence of PFAS in stormwater runoff and in the treated effluent of monitored LID devices and confirmed that conventional LID treatment does not meaningfully or consistently remediate or sequester PFAS. Additionally, PFAS are both poorly regulated at present and widely observed in stormwater runoff (Xiao et al. 2012). Therefore, further LID monitoring of PFAS will not serve to answer the Management Questions; enhance stormwater compliance or scientific understanding of PFAS; or provide additional protection of human health and the environment.

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[7] RMP studies are guided by academic science advisors and stakeholders, including BAMSC representatives. RMP study designs go through multiple levels of review and consideration, including initial conceptualization by the ECWG, recommendations by the Technical Review Committee, and approval by the RMP Steering Committee.

6.2.3 Modifications to Enhance Communication and Reporting

- **Convene TAG meetings as-needed rather than with a mandatory frequency**. While the TAG was highly beneficial in the planning and start-up phases of the MRP 3.0 LID monitoring program, reduced TAG input is needed for the continuation of the existing, successful program. The TAG may be effectively utilized during the MRP 4.0 IMR data analysis stage or at other times as needed.

Streamline reporting requirements. MRP 3.0 UCMRs and IMRs have provided in-depth interpretation of short-term local and regional LID Management Questions and will continue to do so for the duration of the MRP 3.0 permit term. While long-term trends are vital and not yet fully documented, such trends are not effectively elucidated by time-consuming annual or near-annual data analysis and interpretation. Therefore, a renewed LID monitoring program would be most efficient and effective with CEDEN data and monitoring progress reports submitted annually and comprehensive data interpretation, incorporating all QA-approved water quality, hydrology, and maintenance data collected during MRPs 3.0 and 4.0, conducted exclusively in the MRP 4.0 IMR.

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Appendix A

SCVURPPP Monitoring Plan Addendum: Summary of Changes Prior to WY 2026

APPENDIX A: SCVURPPP MONITORING PLAN ADDENDUM: SUMMARY OF CHANGES PRIOR TO WY 2026

Revised Approach to Regional BAMSC LID Monitoring QA/QC Procedures and SCVURPPP Site-Specific Updates, Oct. 2025

SCVURPPP LID Monitoring Plan Section **(October 31, 2024)**	**Regional (BAMSC) or Site-Specific (SCVURPPP)**	**Issue/Topic**	**Revised Approach**
Section 5.1, Section 5.2, and Section 9.1	BAMSC	Eliminate peristaltic pump tubing replacement between storms.	Styrene ethylene butylene styrene (SEBS) pump-roller tubing (i.e., peristaltic pump tubing), dedicated to a specific location, will be used continuously for up to one full season of service, provided that it is decontaminated by the project cleaning protocols prior to initial installation each September and provided that the structural integrity of the tubing has not been compromised through prior use. Additionally, the SEBS pump-roller tubing is rinsed (backflushed) in place with Type I deionized water before and after each monitored storm event. To test whether reuse of the SEBS pump-roller tubing contributes to sample contamination/carryover, each countywide program collected and analyzed one end-of-season equipment blank on one influent SEBS pump-roller tubing that was used during the final sampled storm of WY 2025. Except for one result at the method detection limit for TPH motor oil, all blank results from testing at all locations for all analytes were non-detect. Based on these results, all BAMSC programs will reuse SEBS pump-roller tubing in WY 2026, eliminating peristaltic pump tubing replacement between storms. Backflushing Type 1 deionized water before and after each storm event will continue.

Section 5.1, Section 5.2, and Section 9.1	BAMSC	Allow cleaning rather than replacement of HDPE intake tubing between seasons.	HDPE intake tubing, dedicated to a specific location, will be reused year after year, provided that it is decontaminated by the project cleaning protocols prior to reinstallation each September and provided that the structural integrity of the tubing has not been compromised through prior use. Additionally, the HDPE tubing is rinsed (backflushed) in place with Type I deionized water before and after each monitored storm event.
Section 9.1	BAMSC	Eliminate end of season equipment field blanks.	The frequency of end of season equipment field blanks will be reduced to an "as needed" basis, consistent with the QAPP, which will be evaluated on a case-by-case basis (e.g., if there is evidence of contamination or other issues that might impact sample quality). This decision was based on results from the end of season field blanks which were non-detect except for a few minor detections at the method detection limit.
Section 2.3.2	SCVURPPP	Eliminate Treatment Control Measure 4 (TCM4) from list of facilities to be monitored.	During WY 2024 and WY 2025, effluent was rarely observed at one of the two targeted LID facilities (i.e., TCM4). Although this indicates that nearly 100% treatment may have been achieved through infiltration, it limited opportunities to collect paired influent/effluent samples as required under MRP Provision C.8.d, except during very large storm events. Because it is difficult to accurately predict storm events in San José, monitoring efforts at TCM4 will be discontinued. If a sufficient number of sampling events cannot be achieved at TCM6 to achieve the MRP permit term requirement (n=25), an additional LID facility will be identified for monitoring.

Appendix B

WY 2024 Hydrographs for TCM6

APPENDIX B: WY 2024 HYDROGRAPHS FOR TCM6

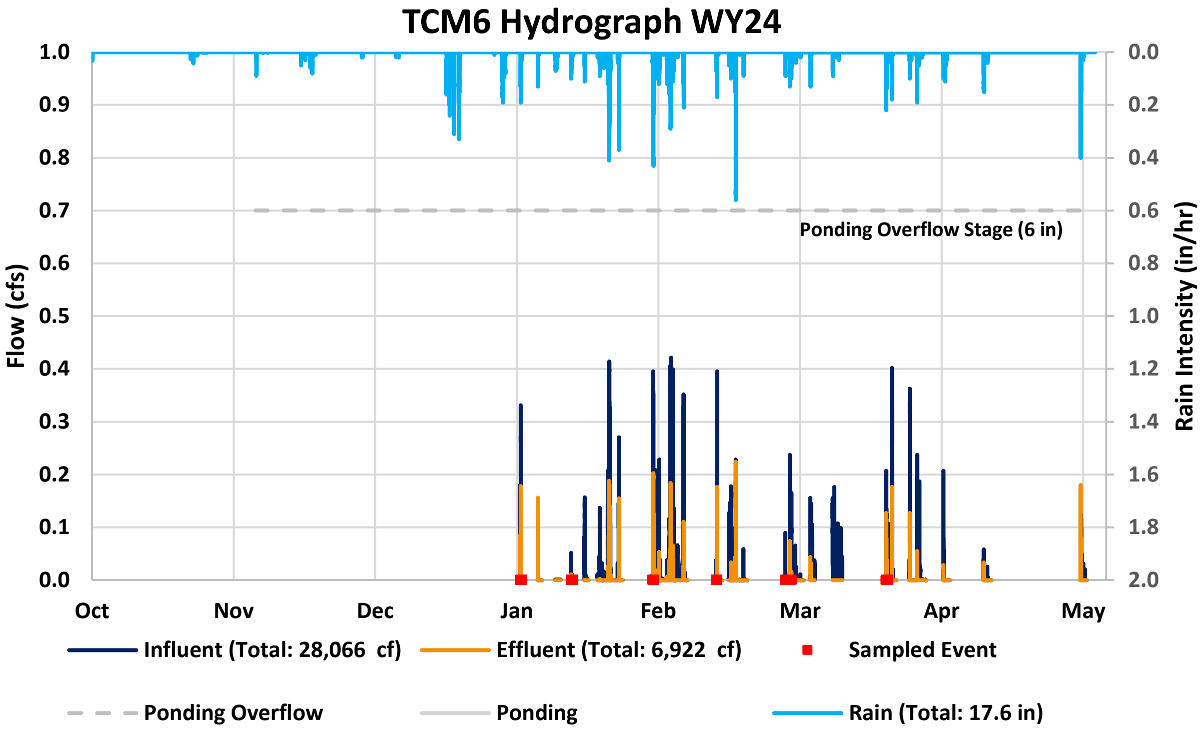

Figure B.1. WY 2024 hydrology data measured at TCM6, San José, CA.

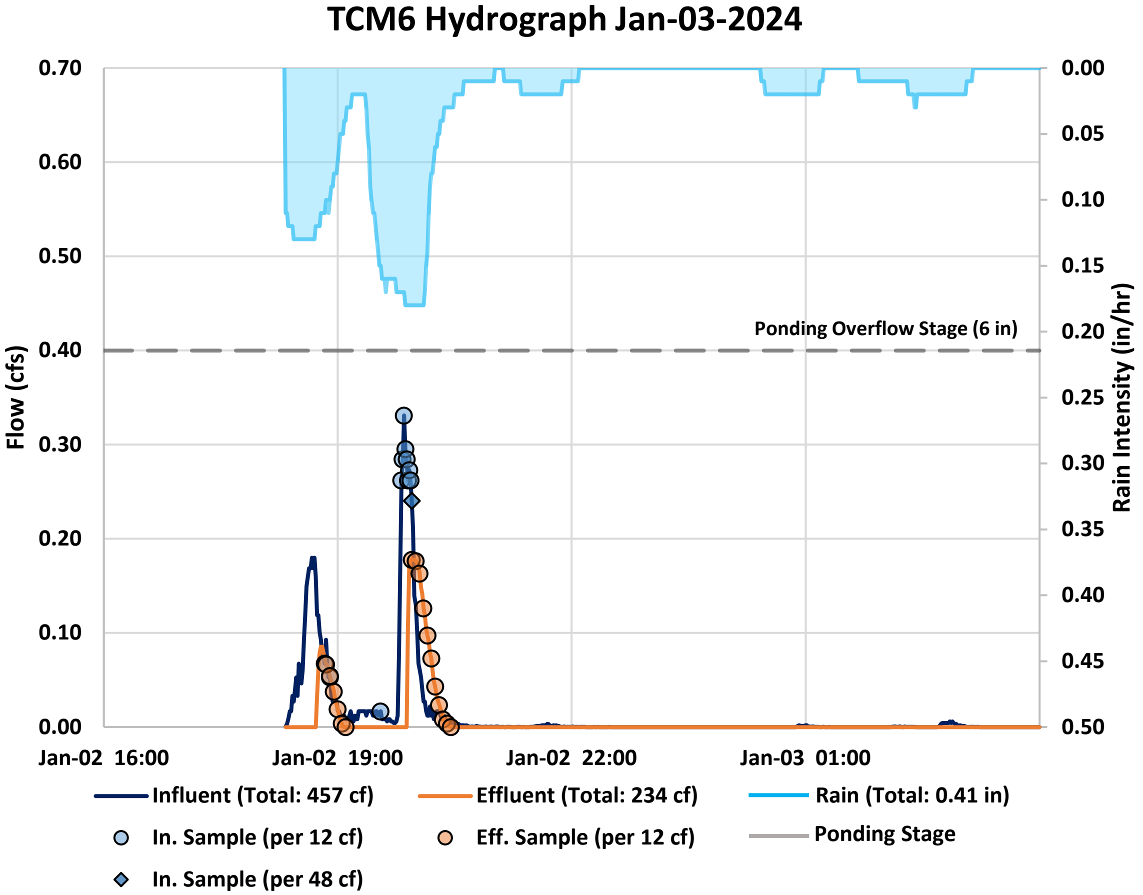

Figure B.2. Rainfall, flow and sample collection during storm event 1, January 3rd, 2024, at TCM6 in San José, CA.

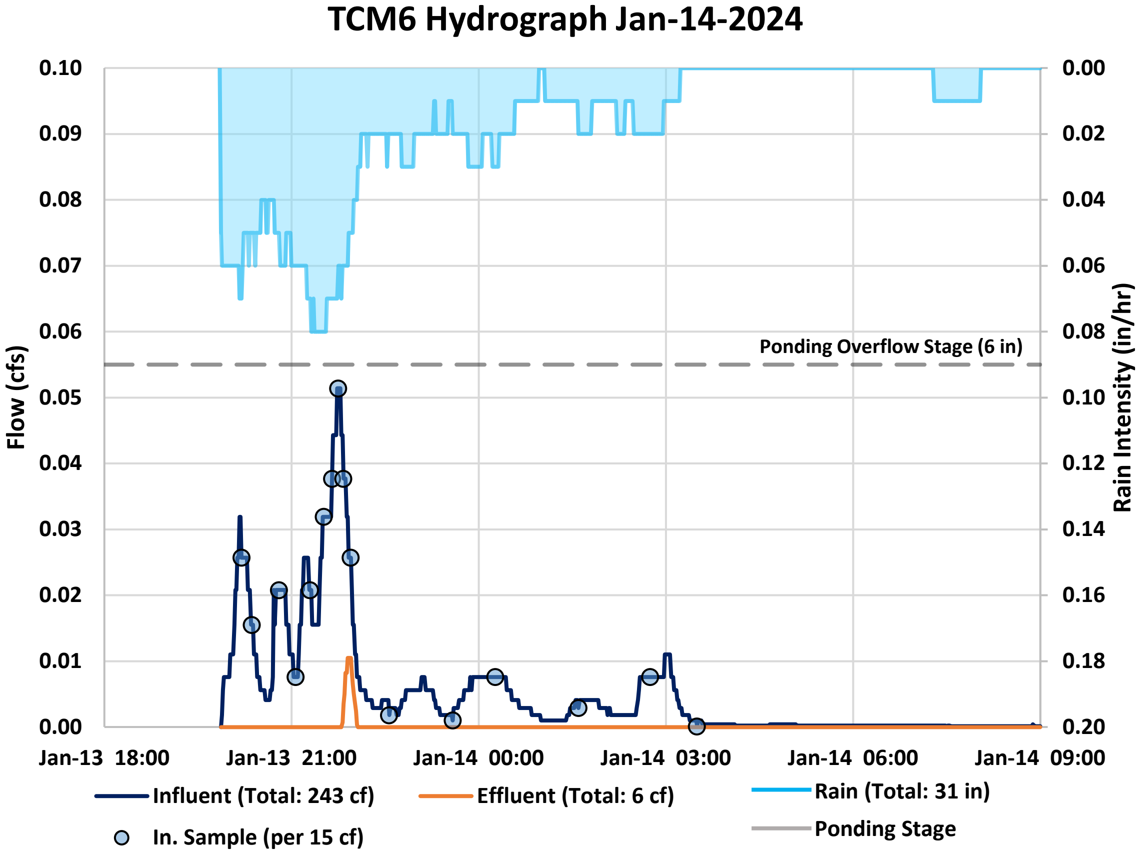

Figure B.3. Rainfall, flow and sample collection during storm event 2, January 14th, 2024, at TCM6 in San José, CA.

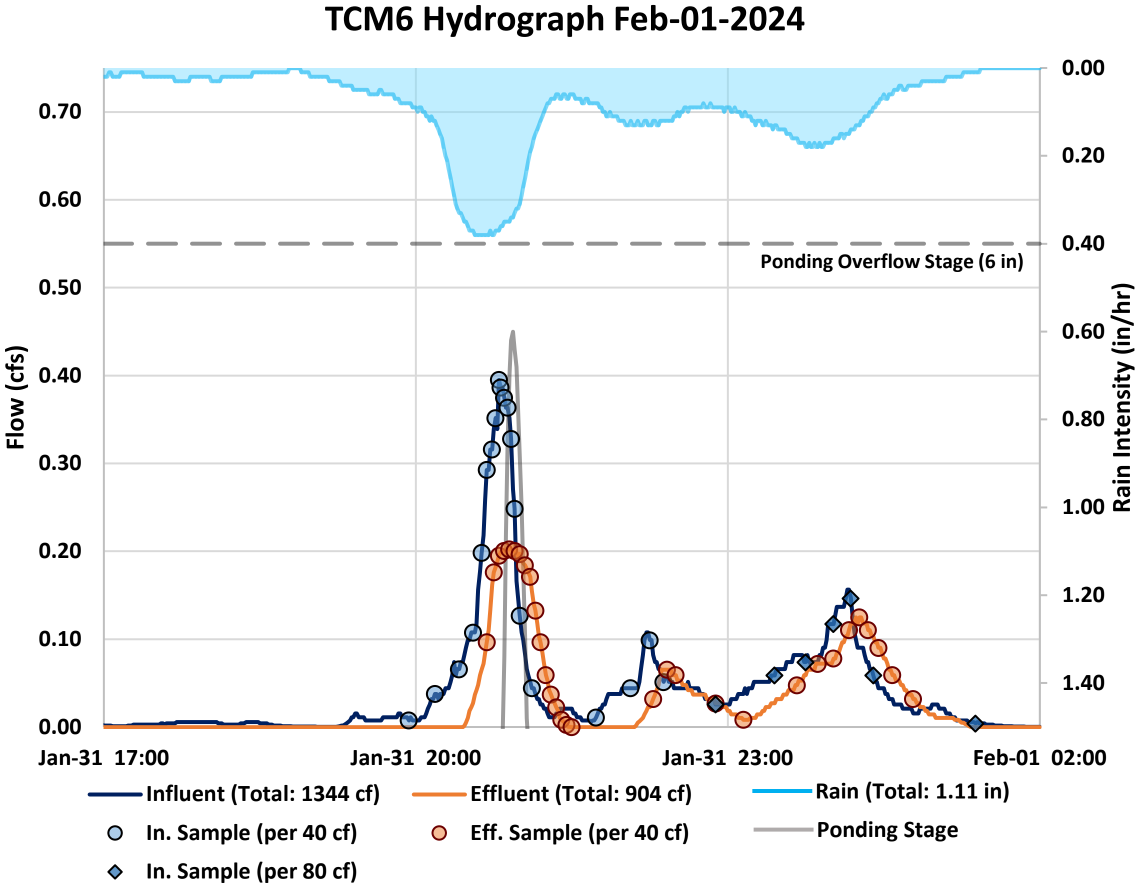

Figure B.4. Rainfall, flow and sample collection during storm event 3, February 1st, 2024, at TCM6 in San José, CA.

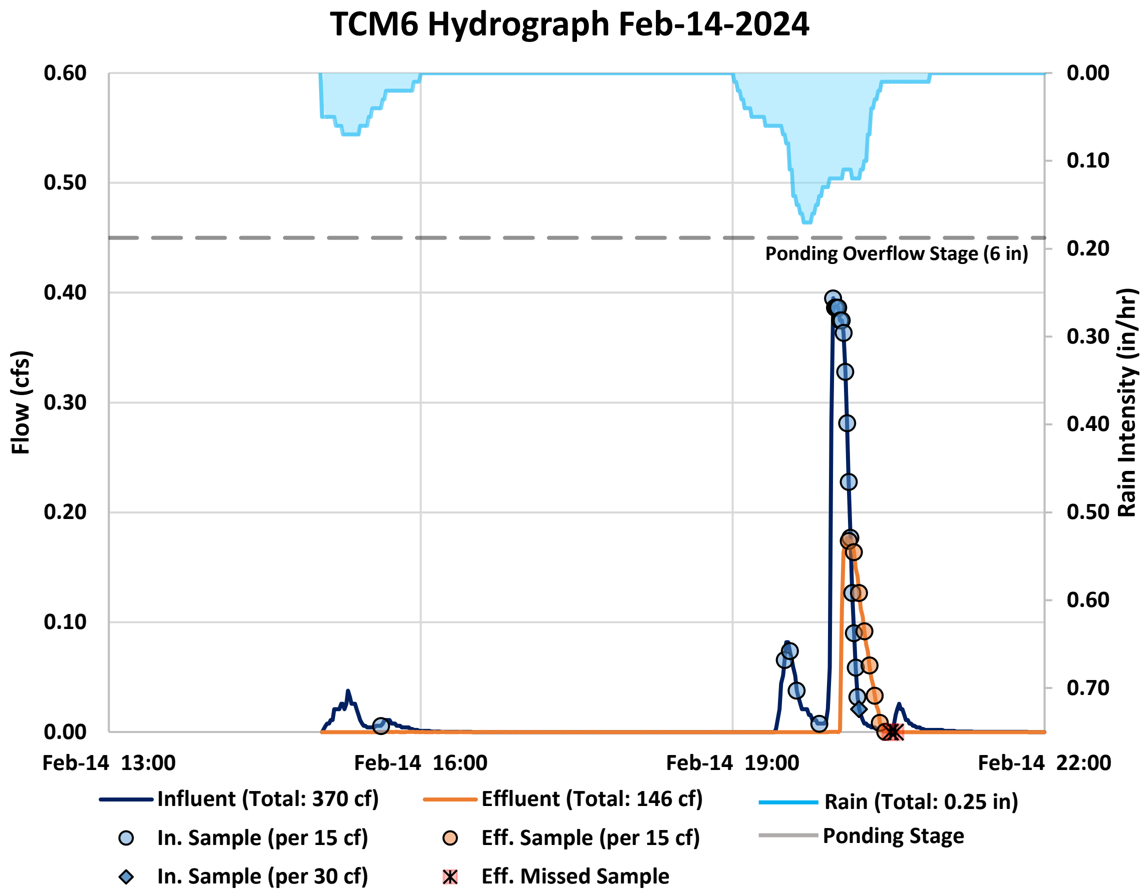

Figure B.5. Rainfall, flow and sample collection during storm event 4, February 14th, 2024, at TCM6 in San José, CA.

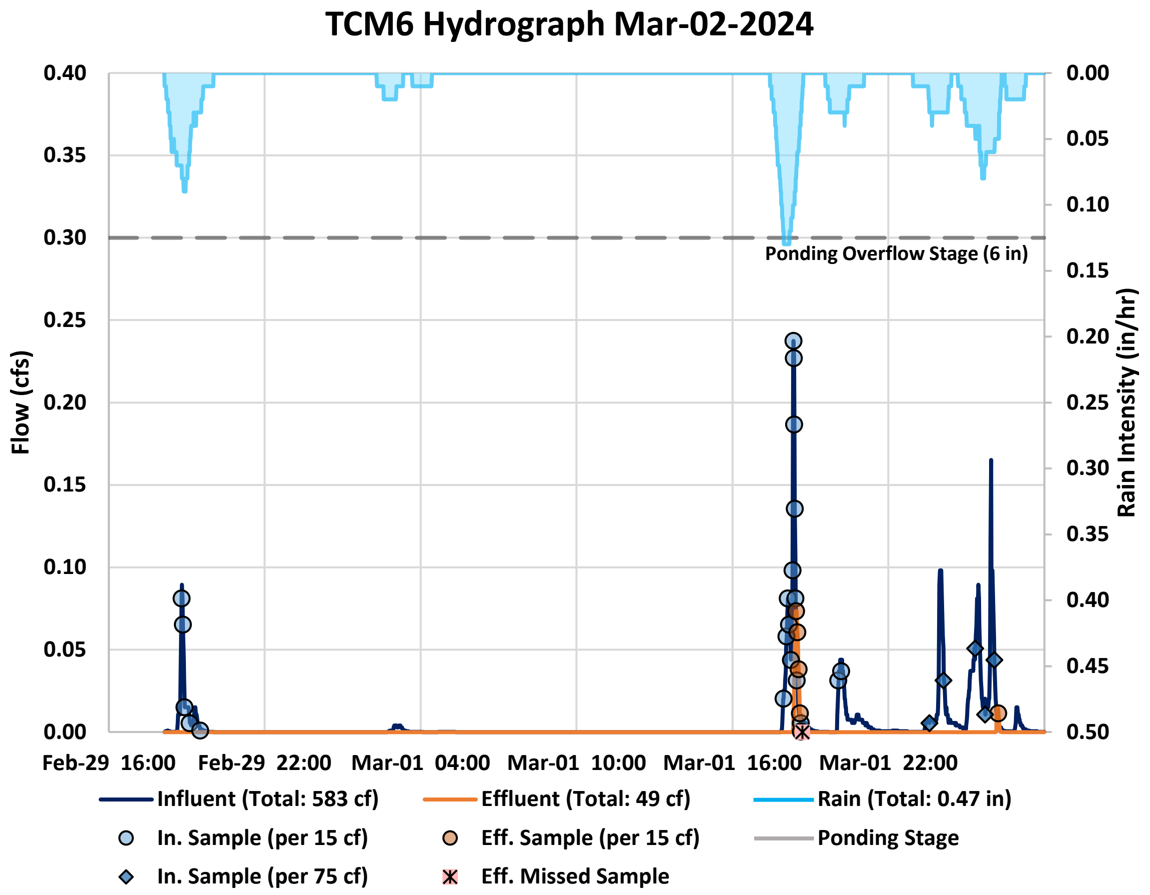

Figure B.6. Rainfall, flow and sample collection during storm event 5, March 2nd, 2024, at TCM6 in San José, CA.

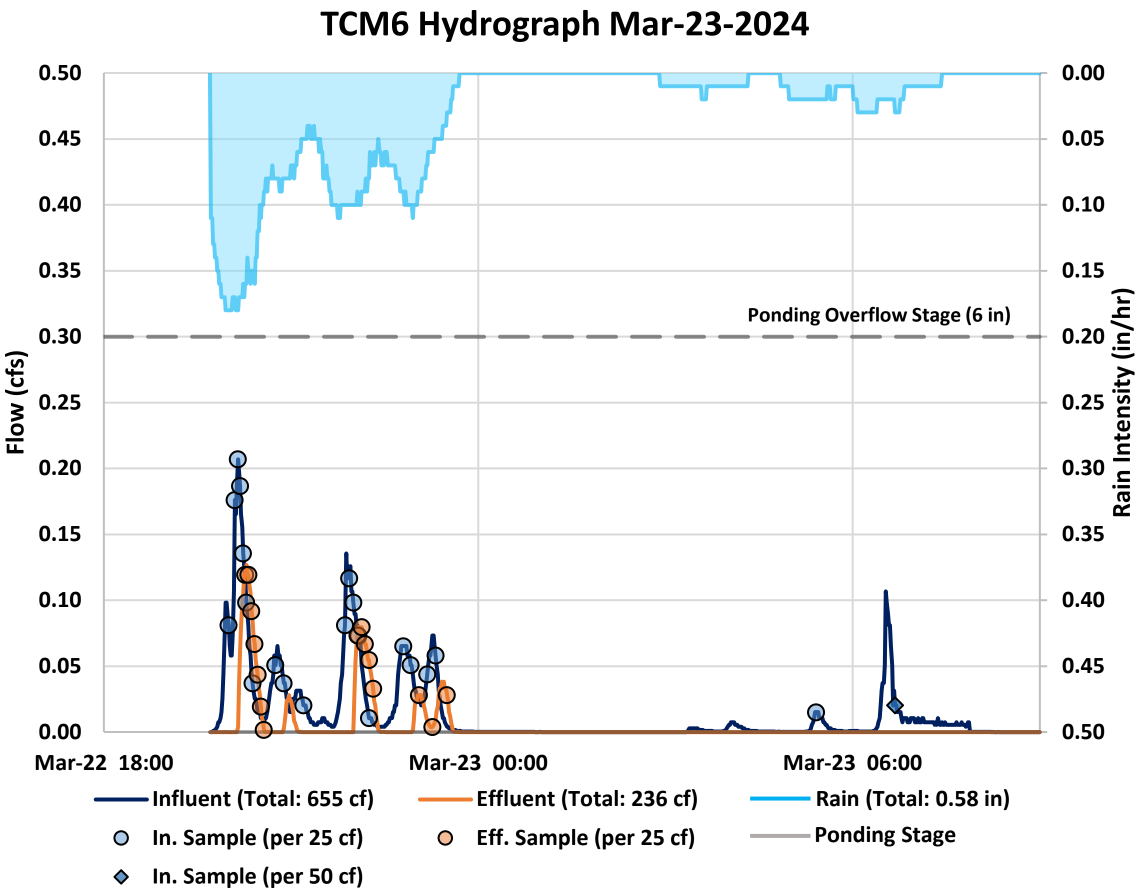

Figure B.7. Rainfall, flow and sample collection during storm event 6, March 23rd, 2024, at TCM6 in San José, CA.

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Appendix C

WY 2024 – WY 2025 Results for BAMSC LID Monitoring Facilities: Concentrations, Load Reductions, and Facility Summary Statistics

APPENDIX C: WY 2024 – WY 2025 RESULTS FOR BAMSC LID MONITORING FACILITIES: CONCENTRATIONS, LOAD REDUCTIONS, AND FACILITY SUMMARY STATISTICS

The following tables show water quality results for each BAMSC LID monitoring facility. Table names and numbers in this appendix have been standardized for ease of comparison and do not necessarily reflect table names and numbers in the corresponding IMR reports.

Tables include all QA-approved monitoring data collected in WY 2024 and WY 2025. For each analyte or analyte class, Table 4.A displays WY 2024 and WY 2025 influent and effluent concentrations per storm event and the arithmetic means and average concentration percent reductions across the two-year study period. Table 4.B displays influent-to-effluent concentration percent reductions and load percent reductions for each analyte and storm event, and for the total two-year study period. Table 4.C displays summary statistics for each analyte or analyte class across the two-year study period. In all cases, negative concentration or load changes indicate net analyte increases in concentration or load, respectively. All PCB data displayed or discussed here refer to a sum of the RMP 40 PCB Congeners. Similarly, “Total PFAS Analytes” used here refers to a sum of all 40 detected PFAS analytes analyzed with the EPA 1633 methodology, with non-detects treated as 0 and J-flagged results included.

Source data, including results for individual PCB congeners and PFAS analytes, is available through CEDEN and upon request. Further discussion of these results and the data included in them can be found in the *IMR Part A: LID Monitoring (WY 2023-2025)* report for each BAMSC program partner.

Santa Clara County

Table 4.A. Summary of WY 2024 and WY 2025 water quality data collected at the SCVURPPP San José TCM6 bioretention facility, San José, CA.

Analytes	Units	WY 2024 Storm End Date												WY 2025 Storm End Date										WY 2024 - WY 2025 Influent Mean	WY 2024 - 2025 Effluent Mean
		1/2/2024		1/14/2024		2/1/2024		2/14/2024		3/2/2024		3/23/2024		11/11/2024		12/12/2024		12/14/2024		2/14/2025 [d]		3/13/2025 [e]			
		Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent		
Conventional, Physical, and Synthetic Organics																									
pH	none	7.0	7.0	7.5	NA	7.1	7	7.3	7.2	7.3	7.3	7.2	7.1	6.9	7.1	7.3	7.1	7.4	7.2	7.1	7.0	7.1	6.8	7.2	7.1
Hardness as CaCO3	mg/L	40	30	24	NA	18	16	20	42	30	40	18	30	108	48	20	26	16	14	20	14	20	26	30.4	28.6
Total Suspended Solids	mg/L	310	15	48	NA	53	8.6	87	11	68	8.4	81	9.2	113	20	38.4	7.4	58.2	17.3	22	4.5	128	20	91.5	12.1
TPH as Diesel C12-C24	µg/L	< 74	< 74	310	NA	< 74	< 74	< 74	< 74	< 74	< 74	< 74	< 74	1200	530	370	160	69	< 42	180	< 42	350	NA	433.8 [a]	172.5 [a]
TPH as Motor Oil C24-C36	µg/L	< 160	< 160	420 J	NA	< 160	< 160	< 160	< 160	< 160	< 160	< 160	< 160	660	250	340	< 25	68 J	< 25	310	< 25	470	NA	369.6 [a]	62.5 [a]
Total Metals																									
Copper	µg/L	33	8.3	8.6	NA	8.4	4.7	10	5.5	9.8	6.7	12	7.8	26	16	8	5.9	7	5.3	4.7	3.2	19	8.2	13.3	7.2
Mercury	µg/L	0.053	0.012	0.012	NA	0.016	0.008	0.019	0.009	0.013	0.009	0.010	0.009	0.016	0.010	0.007	0.004	0.008	0.006	0.008	0.004	0.018	0.005	0.016	0.008
Zinc	µg/L	338	8.8	103	NA	100	6.2	117	7.4	129	10	159	8.8	286	17	104	6.2	82	8.6	52	4.5	247	20	156.1	9.8
Dissolved Metals																									
Copper	µg/L	3.4	6.6	2.9	NA	1.5	3.7	1.8	4.2	3.4	5.4	3.8	6.2	12	12	3.7	5.6	1	3.3	1.9	2.5	3.4	6.1	3.5	5.6
Mercury	µg/L	0.002	0.001	0.002	NA	0.003	0.005	0.001	0.004	0.002	0.005	0.002	0.005	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.003	0.002	0.003
Zinc	µg/L	32	2.9	37	NA	15	1.5	12	2.6	51	4	35	4.3	149	6.4	40	1.7	25	2.2	24	2.6	25	5	40.5	3.3
PCB Congeners																									
Total RMP 40 PCB Congeners	ng/L	0.23	0.42	1.7	NA	1.8	0.27	3.6	0.23	2.2	0.28	1.70	0.14	9.69	0.41	1.66	0.20	2.49	0.38	1.58	0.17	4.03	NA	2.8	0.3
PFAS																									
Total PFAS Analytes [b]	µg/L	0.01262	0.02859	0.00724	NA	0.00092	0.01012	0 [c]	0.02221	0.00646	0.02790	0.00230	0.02875	0.04213	0.14852	0.01438	0.02584	0.00032	0.01690	0.00441	0.00408	0.00729	0.02945	0.00891	0.03424

NC Not calculated.
NA Not analyzed due to low sample volume.
J Analyte was detected; value is considered an estimate since it falls between the MDL and the reporting limit.
< Analyte not detected at or above the associated method detection limit (MDL).
a Influent and Effluent Mean and Total Concentration % Reduction for TPH is calculated using only WY 2025 data due to the high degree of TPH non-detects from the analytical method used in WY 2024.
b Total PFAS Analytes is the sum of all 40 detected PFAS analytes analyzed with the EPA 1633 methodology. Non-detects are treated as 0 for the purposes of this calculation and individual J-flagged results are included.
c MDLs vary by PFAS analyte. For the February 14th, 2024 influent sample, all PFAS analytes were non-detect, with MDLs ranging from 0.279 – 8.46 µg/L.
d For the storm event ending on February 14th, 2025, influent sample was collected on February 14th and effluent sample collected on February 13th.
e For the storm event ending on March 13th, 2025, influent sample was collected on March 13th and effluent sample collected on March 12th.

Table 4.A. Summary of WY 2024 and WY 2025 water quality data collected at the SCVURPPP San José TCM4 bioretention facility, San José, CA.

Analytes	Units	WY 2024 Storm End Date		WY 2025 Storm End Date		WY 2024 - WY 2025 Influent Mean
		1/14/2024		11/11/2024		
		Influent	Effluent	Influent	Effluent	
Conventional, Physical, and Synthetic Organics						
pH	none	7.5	NA	7	NA	7.3
Hardness as CaCO3	mg/L	32	NA	96	NA	64
Total Suspended Solids	mg/L	56	NA	101	NA	79
TPH as Diesel C12-C24	µg/L	< 74	NA	1100	NA	550
TPH as Motor Oil C24-C36	µg/L	< 160	NA	630	NA	315
Total Metals						
Copper	µg/L	8.4	NA	22	NA	15
Mercury	µg/L	0.033	NA	0.024	NA	0.029
Zinc	µg/L	80	NA	192	NA	136
Dissolved Metals						
Copper	µg/L	1.8	NA	10	NA	5.8
Mercury	µg/L	0.002	NA	0.001	NA	0.002
Zinc	µg/L	12	NA	75	NA	44
PCB Congeners						
Total RMP 40 PCB Congeners	ng/L	6.4	NA	4	NA	5.1
PFAS						
Total PFAS Analytes [a]	µg/L	0.00670	NA	0.03828	NA	0.02249

NA Not analyzed due to low sample volume.
< Analyte not detected at or above the associated method detection limit (MDL).
a Total PFAS Analytes is the sum of all 40 detected PFAS analytes analyzed with the EPA 1633 methodology. Non-detects are treated as 0 for the purposes of this calculation and individual J-flagged results are included.

Table 4.B. Concentration and load percent reductions per analyte and storm event, WY 2024 and WY 2025, for water quality data collected at the SCVURPPP San José TCM6 bioretention facility, San José, CA.

Analyte (units)	WY 2024 Storm End Date												WY 2025 Storm End Date										Total (WY 2024 - WY 2025)	
	1/2/2024		1/14/2024		2/1/2024		2/14/2024		3/2/2024		3/23/2024		11/11/2024		12/12/2024		12/14/2024		2/14/2025		3/13/2025			
	Conc. % Reduction	**Load % Reduction**	**Conc. % Reduction**	**Load % Reduction**	**Conc. % Reduction**	**Load % Reduction**	**Conc. % Reduction**	**Load % Reduction**	**Conc. % Reduction**	**Load % Reduction**	**Conc. % Reduction**	**Load % Reduction**	**Conc. % Reduction**	**Load % Reduction**	**Conc. % Reduction**	**Load % Reduction**	**Conc. % Reduction**	**Load % Reduction**	**Conc. % Reduction**	**Load % Reduction**	**Conc. % Reduction**	**Load % Reduction [a]**	**Total Concentration % Reduction**	**Total Load % Reduction**
Conventional, Physical, and Synthetic Organics																								
pH	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	**NC**	**NC**
Hardness as CaCO3	25%	62%	NC	NC	11%	40%	-110%	17%	-33%	89%	-67%	40%	56%	72%	-30%	63%	13%	36%	30%	58%	-30%	67%	**6%**	**56%**
Total Suspended Solids	95%	98%	NC	NC	84%	89%	87%	95%	88%	99%	89%	96%	82%	89%	81%	95%	70%	78%	80%	88%	84%	96%	**87%**	**91%**
TPH as Diesel C12-C24	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	56%	72%	57%	88%	100%	100%	100%	100%	NC	NC	**60%**	**88%**
TPH as Motor Oil C24-C36	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	62%	76%	100%	100%	100%	100%	100%	100%	NC	NC	**83%**	**96%**
Total Metals																								
Copper	75%	87%	NC	NC	44%	62%	45%	78%	32%	94%	35%	77%	38%	61%	26%	79%	24%	45%	32%	60%	57%	89%	**46%**	**71%**
Mercury	80%	88%	NC	NC	50%	66%	50%	81%	0%	94%	0%	68%	38%	60%	40%	84%	25%	45%	56%	70%	72%	93%	**52%**	**74%**
Zinc	97%	99%	NC	NC	94%	96%	94%	98%	92%	99%	94%	98%	94%	96%	94%	98%	90%	92%	91%	95%	92%	98%	**94%**	**97%**
Dissolved Metals																								
Copper	-94%	1%	NC	NC	-147%	-66%	-133%	8%	-59%	87%	-63%	41%	0%	36%	-51%	57%	-230%	-141%	-32%	22%	-79%	54%	**-58%**	**16%**
Mercury	50%	74%	NC	NC	-67%	-12%	-300%	-58%	-150%	79%	-150%	10%	0%	36%	-25%	72%	0%	27%	-90%	-19%	-45%	62%	**-78%**	**21%**
Zinc	91%	95%	NC	NC	90%	93%	78%	91%	92%	99%	88%	96%	96%	97%	96%	99%	91%	94%	89%	94%	80%	95%	**92%**	**96%**
PCB Congeners																								
Total RMP 40 PCB Congeners	NC	NC	NC	NC	85%	90%	94%	97%	87%	99%	92%	97%	96%	97%	88%	97%	85%	89%	89%	94%	NC	NC	**90%**	**94%**
PFAS Analytes																								
Total PFAS Analytes [b]	-127%	-8%	NC	NC	-995%	-585%	↑	↑	-332%	66%	-1150%	-319%	-253%	-110%	-80%	53%	-5247%	-3536%	7%	49%	-304%	4%	**-284%**	**-68%**

Concentration % Reduction is calculated as ($\text{Concentration}_{\text{inf}}$ – $\text{Concentration}_{\text{eff}}$)/$\text{Concentration}_{\text{inf}}$ for each storm event. Total Concentration % Reduction is calculated from the means with the same formula.

Load % Reduction is calculated as (Sum_{inf} – Sum_{eff})/Sum_{inf} for each storm event. Total Load % Reduction is calculated from the sums across both WY 2024 and WY 2025 with the same formula. Total Load % Reduction only includes storm events where both influent and effluent were analyzed for a given constituent.

NC = Not calculated due to the high number of non-detects in the storm-specific influent and effluent data or other sample considerations. TPH calculations are frequently NC for WY 2024 data due to high degree of non-detects from the analytical method used in WY 2024.

↑ Influent was non-detect but Effluent was detected, indicating a concentration and load increase.

[a] Total Influent Storm Volume for the February 13th/14th, 2025 event is potentially biased slightly high due to sediment clogging of the bubbler sensor during the second half of the storm, which may impact load reduction calculations.

[b] Total PFAS Analytes is the sum of all 40 detected PFAS analytes analyzed with the EPA 1633 methodology. Non-detects are treated as 0 for the purposes of this calculation and individual J-flagged results are included.

Table 4.C. Descriptive statistics of WY 2024 and WY 2025 water quality data collected at the SCVURPPP San José TCM6 bioretention facility, San José, CA.

Analyte (units)	Sample Count		Interquartile Range (25th-75th percentiles)		Median		Mean		Total Load % Reduction
	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	
Conventional, Physical, and Synthetic Organics									
pH	11	10	7.1 - 7.3	7.0 - 7.2	7.2	7.1	7.2	7.1	NC
Hardness as CaCO3 (mg/L)	11	10	19 - 27	19 - 38	20	28	30	29	56%
Total Suspended Solids (mg/L)	11	10	50.5 - 100	8.5 - 16.7	68	10.1	91.5	12.1	91%
TPH as Diesel C12-C24 (µg/L)	5	4	180 - 370	0 - 252.5	350	80	434	173	88%
TPH as Motor Oil C24-C36 (µg/L)	5	4	310 - 470	0 - 62.5	340	0	370	63	96%
Total Metals									
Copper (µg/L)	11	10	8.2 - 15.5	5.35 - 8.1	9.8	6.3	13.3	7.2	71%
Mercury (µg/L)	11	10	0.009 - 0.017	0.005 - 0.009	0.013	0.009	0.016	0.008	74%
Zinc (µg/L)	11	10	101.5 - 203	6.5 - 9.7	117	8.7	156.1	9.8	97%
Dissolved Metals									
Copper (µg/L)	11	10	1.85 - 3.55	3.83 - 6.18	3.40	5.50	3.53	5.56	16%
Mercury (µg/L)	11	10	0.002 - 0.002	0.002 - 0.005	0.002	0.003	0.002	0.003	21%
Zinc (µg/L)	11	10	24.5 - 38.5	2.3 - 4.2	32.0	2.8	40.5	3.3	96%
PCB Congeners									
Total RMP 40 PCB Congeners (ng/L)	11	9	1.68 - 3.05	0.2 - 0.38	1.80	0.27	2.79	0.28	94%
PFAS									
Total PFAS Analytes (µg/L) [b]	11	10	0.00161 - 0.00995	0.01823 - 0.02871	0.00646	0.02687	0.00891	0.03424	-68%

Sample Count is the total number of viable samples for WY 2024 and WY 2025.

Total Load % Reduction is calculated from the sums across both WY 2024 and WY 2025 as (Sum_{inf} – Sum_{eff})/$Sum_{inf.}$ Total Load % Reduction only includes storm events where both influent and effluent were analyzed for a given constituent.

a TPH calculations exclude WY 2024 data due to high degree of non-detects and/or uncertainty from the analytical method used in WY 2024.

b Total PFAS Analytes is the sum of all 40 detected PFAS analytes analyzed with the EPA 1633 methodology. Non-detects are treated as 0 for the purposes of this calculation and individual J-flagged results are included.

San Mateo County

Table 4.A. Summary of WY 2024 and WY 2025 water quality data collected at the SMCWPPP Santa Clara Street (School Site) bioretention facility, Brisbane, CA.

Analytes	Units	WY 2024 Storm End Date										WY 2025 Storm End Date												WY 2024 - WY 2025 Influent Mean	WY 2024 - 2025 Effluent Mean
		3/2/2024		3/23/2024		3/27/2024		4/14/2024		5/4/2024		11/21/2024		12/12/2024		12/14/2024		2/1/2025		2/13/2025		3/13/2025			
		Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent		
Conventional, Physical, and Synthetic Organics																									
pH	none	7.1	7.6	7.2	7.5	7.1	7.3	7.3	7.9	7.0	7.5	7.1	7.4	6.9	7.3	7.1	7.5	NA	NA	7.2	7.6	6.8	7.4	7.1	7.5
Hardness as CaCO3	mg/L	66	42	36	48	38	66	26	80	20	26	20	52	14	30	24	30	16	32	28	28	22	32	28.2	42.4
Total Suspended Solids	mg/L	120	7.8	62	11	65	10	54	7.1	36	6.0	16.4	5.0	58	7.9	104	10.5	59.3	6.6	43.1	5.3	82.3	7.1	63.7	7.7
TPH as Diesel C12-C24	µg/L	< 74	< 74	320	< 74	< 74	< 74	450	< 74	< 74	< 74	330	230	220	94	75	71	NA	NA	89	48 J	600	110	263 [a]	111 [a]
TPH as Motor Oil C24-C36	µg/L	< 160	< 160	< 160	< 160	< 160	< 160	< 160	< 160	< 160	< 160	620	240	340	< 25	110	53 J	NA	NA	110	60 J	1300	150	496 [a]	101 [a]
Total Metals																									
Copper	µg/L	26	6.7	18	9.2	15	7.0	17	7.2	11	8.3	16	15	14	7.1	14	5.5	15	7.5	12	5.5	19	8.3	16.1	7.9
Mercury	µg/L	0.019	0.006	0.013	0.007	0.11	0.008	0.006	0.004	0.014	0.005	0.006	0.002	0.008	0.003	0.009	0.004	0.0067	0.0047	0.012	0.005	0.009	0.004	0.019	0.005
Zinc	µg/L	134	6.4	79	7.8	67	5.8	50	6.4	42	7.2	42	5.6	63	4.8	58	4.6	68	9.4	43	5.6	100	6.0	68	6.3
Dissolved Metals																									
Copper	µg/L	9.2	5.1	9.3	7.1	7.4	5.7	8.0	6.0	6.4	6.9	9.2	12	5.9	4.8	4.7	4.1	6.5	6.7	6.0	4.1	6.5	7.1	7.2	6.3
Mercury	µg/L	0.003	0.003	0.002	0.003	0.006	0.004	0.002	0.003	0.005	0.003	0.002	0.001	0.0022	0.0025	0.003	0.002	0.0020	0.0024	0.004	0.004	0.002	0.003	0.0030	0.0029
Zinc	µg/L	31	2.3	30	2.9	19	2.0	18	2.3	16	3.2	23	3.8	15	2.4	16	1.2	19	6.4	18	1.6	23	2.3	20.7	2.8
PCB Congeners																									
Total RMP 40 PCB Congeners	ng/L	14	0.41	5.5	0.70	3.9	0.65	3.9	NA	1.6	0.45	3.19	0.38	1.39	0.35	1.15	0.37	2.72	0.20	0.74	0.34	5.34	0.48	4.0	0.4
PFAS																									
Total PFAS Analytes [b]	µg/L	0.103	0.108	0.050	0.129	0.040	0.078	0 [c]	0.087	0.030	0.064	0.038	0.072	0.022	0.051	0.033	0.029	0.015	0.069	0.073	0.062	0.030	0.113	0.039	0.078

NC Not calculated.
NA Not analyzed due to low sample volume.
< Analyte not detected at or above the associated method detection limit (MDL).
a Influent and Effluent Mean and Total Concentration % Reduction for TPH is calculated using only WY 2025 data due to the high degree of TPH non-detects from the analytical method used in WY 2024.
b Total PFAS Analytes is the sum of all 40 detected PFAS analytes analyzed with the EPA 1633 methodology. Non-detects are treated as 0 for the purposes of this calculation and J-flagged results are included.
c MDLs vary by PFAS analyte. For the April 14, 2024 influent sample, all PFAS analytes were non-detect, with MDLs ranging from 0.00223 - 0.0677 µg/L.
J Analyte was detected; value is considered an estimate since it falls between the MDL and the reporting limit.

Table 4.B. Concentration and load percent reductions per analyte and storm event, WY 2024 and WY 2025, for water quality data collected at the SMCWPPP Santa Clara Street (School Site) bioretention facility, Brisbane, CA.

Analyte	WY 2024 Storm End Date										WY 2025 Storm End Date												Total (WY 2024 - WY 2025)	
	3/2/2024		3/23/2024		3/27/2024		4/14/2024		5/4/2024		11/21/2024		12/12/2024		12/14/2024		2/1/2025		2/13/2025		3/13/2025			
	Conc. % Reduction	Load % Reduction [a]	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction [c]	Conc. % Reduction	Load % Reduction	Total Concentration % Reduction	Total Load % Reduction
Conventional, Physical, and Synthetic Organics																								
pH	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	**NC**	**NC**
Hardness as CaCO3	36%	NC	-33%	71%	-74%	29%	-208%	76%	-30%	75%	-160%	11%	-114%	33%	-25%	45%	-100%	-41%	0%	35%	-45%	22%	**-50%**	**45%**
Total Suspended Solids	94%	NC	82%	96%	85%	94%	87%	99%	83%	97%	70%	90%	86%	96%	90%	96%	89%	92%	88%	92%	91%	95%	**88%**	**95%**
TPH as Diesel C12-C24	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	30%	76%	57%	87%	5%	59%	NC	NC	46%	65%	82%	90%	**58% [b]**	**75% [b]**
TPH as Motor Oil C24-C36	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	61%	87%	NC	100%	52%	79%	NC	NC	45%	64%	88%	94%	**80% [b]**	**86% [b]**
Total Metals																								
Copper	74%	NC	49%	89%	53%	81%	58%	97%	25%	85%	6%	68%	49%	84%	61%	83%	50%	65%	54%	70%	56%	77%	**51%**	**79%**
Mercury	71%	NC	45%	88%	93%	97%	20%	94%	64%	93%	67%	89%	64%	89%	56%	81%	30%	51%	58%	73%	56%	76%	**75%**	**85%**
Zinc	95%	NC	90%	98%	91%	96%	87%	99%	83%	100%	87%	95%	92%	98%	92%	97%	86%	90%	87%	91%	94%	97%	**91%**	**96%**
Dissolved Metals																								
Copper	45%	NC	24%	84%	23%	68%	25%	94%	-8%	79%	-30%	56%	19%	75%	13%	62%	-3%	28%	32%	55%	-9%	41%	**12%**	**66%**
Mercury	-20%	NC	-67%	64%	29%	71%	-25%	90%	34%	87%	50%	83%	-14%	65%	33%	71%	-20%	16%	0%	35%	-50%	19%	**4%**	**61%**
Zinc	93%	NC	90%	98%	89%	96%	87%	99%	80%	96%	83%	94%	84%	95%	93%	97%	66%	76%	91%	94%	90%	95%	**87%**	**95%**
PCB Congeners																								
Total RMP 40 PCB Congeners	97%	NC	87%	97%	84%	93%	NC	NC	72%	95%	88%	96%	75%	92%	68%	86%	93%	95%	54%	70%	91%	95%	**89%**	**92%**
PFAS Analytes																								
Total PFAS Analytes [d]	-5%	NC	-161%	44%	-96%	19%	NC	NC	-114%	58%	-92%	99%	-128%	29%	11%	61%	-351%	-217%	14%	94%	-274%	-102%	**-99%**	**90%**

Concentration % Reduction is calculated as $(\text{Concentration}_{inf} - \text{Concentration}_{eff})/\text{Concentration}_{inf}$ for each storm event. Total Concentration % Reduction is calculated from the means with the same formula.
Load % Reduction is calculated as $(\text{Sum}_{inf} - \text{Sum}_{eff})/\text{Sum}_{inf}$ for each storm event. Total Load % Reduction is calculated from the sums across both WY 2024 and WY 2025 with the same formula.
NC = Not calculated due to the high number of non-detects in the storm-specific influent and effluent data or other sample considerations. TPH calculations are frequently NC for WY 2024 data due to high degree of non-detects from the analytical method used in WY 2024.
a Load reduction calculations were not performed for the March 2nd, 2024 event due to low influent calculations caused by sensor placement. Concentration calculations for this event are still considered accurate.
b Total Concentration % Reduction and Total Load % Reduction for TPH is calculated using only WY 2025 data due to the high degree of TPH non-detects from the analytical method used in WY 2024.
c Total Influent Storm Volume for the February 13th, 2025 event is biased slightly high due to flume blockage during the start of the storm, which impacts load reduction calculations.
d Total PFAS Analytes is the sum of all 40 detected PFAS analytes analyzed with the EPA 1633 methodology. Non-detects are treated as 0 for the purposes of this calculation and J-flagged results are included.

Table 4.C. Descriptive statistics of WY 2024 and WY 2025 water quality data collected at the SMCWPPP Santa Clara Street (School Site) bioretention facility, Brisbane, CA.

Analyte (units)	Sample Count		Interquartile Range (25th-75th percentiles)		Median		Mean		Total Load % Reduction
	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	
Conventional, Physical, and Synthetic Organics									
pH	10	10	7.0 - 7.2	7.4 - 7.6	7.1	7.5	7.1	7.5	NC
Hardness as CaCO3 (mg/L)	11	11	20 - 32	30 - 50	24	32	28.2	42.4	45%
Total Suspended Solids (mg/L)	11	11	49 - 74	6.3 - 9	59.3	7.1	63.7	7.7	95%
TPH as Diesel C12-C24 (µg/L)	5 [a]	5 [a]	89 - 330	71 - 110	220	94	263	111	75%
TPH as Motor Oil C24-C36 (µg/L)	5 [a]	5 [a]	110 - 620	53 - 150	340	60	496	101	86%
Total Metals									
Copper (µg/L)	11	11	14 - 17.5	6.9 - 8.3	15	7.2	16.1	7.9	79%
Mercury (µg/L)	11	11	0.008 - 0.014	0.004 - 0.005	0.009	0.005	0.019	0.005	85%
Zinc (µg/L)	11	11	47 - 74	5.6 - 6.8	63	6	68	6.3	96%
Dissolved Metals									
Copper (µg/L)	11	11	6.2 - 8.6	5.0 – 7.0	6.5	6	7.2	6.3	66%
Mercury (µg/L)	11	11	0.002 - 0.004	0.002 - 0.003	0.002	0.003	0.003	0.003	61%
Zinc (µg/L)	11	11	17 - 23	2.2 - 3.1	19	2.3	20.7	2.8	95%
PCB Congeners									
Total RMP 40 PCB Congeners (ng/L)	11	10	1.5 - 4.6	0.4 - 0.5	3.2	0.39	4	0.4	92%
PFAS									
Total PFAS Analytes (µg/L) [b]	11	11	0.026 - 0.045	0.063 - 0.097	0.033	0.072	0.039	0.078	90% [c]

Sample Count is the total number of viable samples for WY 2024 and WY 2025.

Total Concentration % Reduction is calculated from the influent and effluent means as ($\text{Concentration}_{\text{inf}}$ – $\text{Concentration}_{\text{eff}}$)/$\text{Concentration}_{\text{inf}}$

Total Load % Reduction is calculated from the sums across both WY 2024 and WY 2025 as (Sum_{inf} – Sum_{eff})/Sum_{inf}

a TPH calculations exclude WY 2024 data due to high degree of non-detects and/or uncertainty from the analytical method used in WY 2024.

b Total PFAS Analytes is the sum of all 40 detected PFAS analytes analyzed with the EPA 1633 methodology. Non-detects are treated as 0 for the purposes of this calculation and J-flagged results are included.

c PFAS Total Load % Reductions exclude the March 2nd, 2024 event due to low influent observations caused by sensor placement. Concentration results from this event are still considered accurate and included here.

Alameda County

Table 4.A. Summary of WY 2024 and WY 2025 water quality data collected at the ACCWP OAB-18E bioretention facility, Oakland CA.

Analytes	Unit	03/02/2024		03/23/2024		04/14/2024		11/21/2024		2/13/2025		3/13/2025		Influent Arithmetic Mean	Effluent Arithmetic Mean
		Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent		
Conventional, Physical, and Synthetic Organics															
pH		7.3	6.8	7.8	7.0	7.4	6.9	7.6	NA	7.2	6.9	8.0	6.5	7.6	6.8
Hardness as CaCO3	mg/L	40	28	42	28	48	30	68	NA	30	20	56	40	47	29
TSS	mg/L	130	10.4	123	14.5	141	16.2	177.0	NA	201.0	12.5	250	15.6	170.3	13.8
TPH as Diesel C12-C24	ug/L	<74	<82	<74	<74	480	<74	480	NA	180	59	530	140	397 [a]	100 [a]
TPH as Motor Oil C24-C36	ug/L	<160	<180	<160	<160	<160	<160	560	NA	350	73	610	190	507 [a]	132 [a]
Total Metals															
Copper	ug/L	10	9.0	13	11	17	9.9	22	NA	17	7.3	35	12	19.0	9.8
Mercury	ug/L	0.049	0.020	0.063	0.023	0.081	0.026	0.087	NA	0.0580	0.0120	0.120	0.028	0.76	0.02
Zinc	ug/L	139	22	145	27	155	26	289	NA	267	16	554	38	258	26
Dissolved Metals															
Copper	ug/L	1.2	5.9	2.5	7.1	4.7	6.4	5.7	NA	1.9	5.1	4.2	7.5	3.4	6.4
Mercury	ug/L	0.0014	0.0045	0.0046	0.0085	0.005	0.0069	0.004	NA	0.0012	0.0035	0.003	0.005	0.003	0.006
Zinc	ug/L	21	6.7	8.8	5	47	6.6	21	NA	56	7.8	21	8.1	29.1	6.8
PCB Congeners															
Total RMP 40 PCB Congeners	ng/L	12.97	1.94J	14.11	2.20J	11.18	2.03J	14.06	NA	22.11	2.43J	86.03	5.88J	26.7	2.9
PFAS[b]															
Total PFAS Compounds	ng/L	0.747J	11.694J	9.096 J	42.202J	0	5.45J	14.39J	NA	0	1.7	0	22.07	4.0	16.6

< Analyte not detected at or above the associated method detection limit.

NA Not analyzed due to low sample volume

J Estimated value below the reporting limit but at or above the method detection limit (includes individual congeners / compounds reported in totals)

[a] Influent and Effluent Means for TPH are calculated using only WY 2025 data due to the high degree of TPH non-detects from the analytical method used in WY 2024.

[b] Total PFAS Analytes is the sum of all 40 detected PFAS analytes analyzed with the EPA 1633 methodology. Non-detects are treated as 0 for the purposes of this calculation and J-flagged results are included in sums.

Table 4.B. Concentration and load percent reductions per analyte and storm event, WY 2024 and WY 2025, for water quality data collected at the ACCWP OAB-18E bioretention facility, Oakland, CA.

Analytes	Unit	WY 2024						WY 2025						Total (WY 2024 – WY 2025)	
		03/02/2024		03/23/2024		04/14/2024		11/21/2024		2/13/2025		3/13/2025			
		Conc. % Reduction	Load % Reduction[a]	Conc. % Reduction	Load % Reduction[a]	Conc. % Reduction	Load % Reduction[a]	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction[c]	Conc. % Reduction	Load % Reduction	Total Concentration % Reduction	Total Load % Reduction[a,c]
Convention, Physical, and Semi-volatiles															
pH	pH	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	**NC**	**NC**
Hardness as CaCO3	mg/L	30%	NC	33%	NC	38%	NC	NC	100%	33%	19%	29%	94%	**38%**	**58%**
TSS	mg/L	92%	NC	88%	NC	89%	NC	NC	100%	94%	41%	94%	99%	**92%**	**60%**
TPH as Diesel C12-C24[b]	ug/L	NC	NC	NC	NC	NC	NC	NC	100%	67%	32%	74%	98%	**75%**	**69%**
TPH as Motor Oil C24-C36[b]	ug/L	NC	NC	NC	NC	NC	NC	NC	100%	79%	36%	69%	97%	**74%**	**63%**
Total Metals															
Copper	ug/L	10%	NC	15%	NC	42%	NC	NC	100%	57%	28%	66%	97%	**48%**	**57%**
Mercury	ug/L	59%	NC	63%	NC	68%	NC	NC	100%	79%	36%	77%	98%	**71%**	**64%**
Zinc	ug/L	84%	NC	81%	NC	83%	NC	NC	100%	94%	41%	93%	99%	**90%**	**65%**
Dissolved Metals															
Copper	ug/L	-392%	NC	-184%	NC	-36%	NC	NC	100%	-168%	-56%	-79%	85%	**-90%**	**27%**
Mercury	ug/L	-221%	NC	-85%	NC	-38%	NC	NC	100%	-192%	-65%	-42%	88%	**-74%**	**29%**
Zinc	ug/L	68%	NC	43%	NC	86%	NC	NC	100%	86%	39%	61%	97%	**77%**	**47%**
PCB Congeners															
Total RMP 40 PCB Congeners	ng/L	85%	NC	84%	NC	82%	NC	NC	100%	89%	40%	93%	99%	**89%**	**67%**
PFAS															
Total PFAS Analytes[d]	ng/L	-1465%	NC	-364%	NC	NC	NC	NC	100%	NC	NC	NC	NC	**-312%**	**77%**

Concentration % Reduction is calculated as ($\text{Concentration}_{inf}$ – $\text{Concentratione}_{ff}$)/$\text{Concentration}_{inf}$ for each storm event. Total Concentration % Reduction is calculated from the means with the same formula.

Effluent load for 2/13/25 overflow event calculated as ($\text{Concentration}_{eff}$ x Volume_{eff}) + ($\text{Concentration}_{inf}$ x $\text{Volume}_{overflow}$). Load % Reduction for all other events is calculated as (Sum_{inf} – Sum_{eff})/Sum_{inf}. Total Load % Reduction is calculated from the sums across all acceptable data with the same formula.

NC = Not calculated due to the high number of non-detects in the influent and effluent data, low sample volumes, or other considerations. TPH and PFAS calculations are frequently NC for WY 2024 data due to high degree of non-detects from the analytical method used in WY 2024.

a Due to uncertainty re: WY 2024 hydrologic data, no load reductions are calculated for WY 2024 events and cumulative total load reduction is based only upon WY 2025 data

b Total Concentration % Reduction for TPH is calculated using only WY 2025 data due to the high degree of non-detects from the analytical method used in WY 2024.

c Expected load reductions are decreased by in-basin overflow occurring during 2/13/2025 sampling event.

d Total PFAS Analytes is the sum of all 40 detected PFAS compounds analyzed with the EPA 1633 methodology. Non-detects are treated as 0 for the purposes of this calculation.

Table 4.C. Descriptive statistics of WY 2024 and WY 2025 water quality data collected at the ACCWP OAB-18E bioretention facility, Oakland, CA.

Analyte (units)	Sample Count[a]		Interquartile Range (25th-75th percentiles)		Median		Mean		Concentration % Reduction[c]	Load % Reduction[d,e]
	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent		
Conventional, Physical, and Synthetic Organics										
pH	6	5	7.3-7.8	6.8-6.9	7.5	6.9	7.6	6.8	10	NC
Hardness as CaCO3 (mg/L)	6	5	40.5-54	28-30	45	28	47.3	29.2	38	58
Total Suspended Solids (mg/L)	6	5	132.8-195	12.5-15.6	159	14.5	170.3	13.8	92	60
TPH as Diesel C12-C24 (ug/L)	3	2	330-492	79-120	480	100	397	99.5	75[b]	69[b]
TPH as Motor Oil C24-C36 (ug/L)	3	2	455-585	102-161	560	132	507	131.5	74[b]	63[b]
Total Metals										
Copper (ug/L)	6	5	14-20.8	9-11	17	9.9	19	9.8	48	57
Mercury (ug/L)	6	5	0.059-0.086	0.020-0.026	0.072	0.023	0.076	0.022	71	64
Zinc (ug/L)	6	5	147.5-283.5	22-27	211	26	258	26	90	65
Dissolved Metals										
Copper (ug/L)	6	5	2.1-4.6	5.9-7.1	3.4	6.4	3.4	6.4	-90	27
Mercury (ug/L)	6	5	0.0019-0.0044	0.0045-.0069	0.0036	0.0047	0.0032	0.0056	-74	29
Zinc (ug/L)	6	5	21-40.5	6.6-7.8	21	6.7	29.1	6.8	77	47
PCB Congeners										
Total RMP 40 PCB Congeners (ng/L)	6	5	13.24-20.1	2.0-2.4	14.1	2.2	26.7	2.9	89	67
PFAS Compounds										
PFAS compounds	6	5	0-7.01	5.45-22.07	0.4	11.7	4.0	16.6	-312%	77

a Sample Count is the total number of viable samples for WY 2024 and WY 2025. Statistics include effluent water quality data analyzed for overflow events and have not been adjusted for un- or partially-treated overflow.

b TPH calculations exclude WY 2024 data due to high degree of non-detects from the analytical method used in WY 2024.

c Concentration % Percent Reduction is calculated from the influent and effluent means as $(\text{Concentration}_{\text{inf}} – \text{Concentration}_{\text{eff}})/\text{Concentration}_{\text{inf}}$

d Load % Reductions exclude WY 2024 data due to uncertainties in load measurements; calculated as $(\text{Sum}_{\text{inf}} – \text{Sum}_{\text{eff}})/\text{Sum}_{\text{inf}}$

e Effluent load for 2/13/25 overflow event calculated as $(\text{Concentration}_{\text{eff}} \text{ x Volume}_{\text{eff}}) + (\text{Concentration}_{\text{inf}} \text{ x Volume}_{\text{overflow}})$

Table 4.A. Summary of WY 2024 and WY 2025 water quality data collected at the ACCWP OAB-18W bioretention facility, Oakland CA.

Analytes	Unit	03/23/2024		04/14/2024		11/21/2024		2/13/2025		3/13/2025		Influent Arithmetic Mean	Effluent Arithmetic Mean
		Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent		
Conventional, Physical, and Synthetic Organics													
pH		7.6	7.2	7.5	7.4	7.5	7.1	7.1	7.0	7.3	NA	7.4	7.2
Hardness as CaCO3	mg/L	52	36	66	36	72	68	28	24	60	NA	56	41
TSS	mg/L	324	12.7	147	9.7	208.0	37.3	136.0	8.8	270	NA	217.0	17.1
TPH as Diesel C12-C24	ug/L	<74	<74	490	NA	480	290	130	53	520	NA	377[a]	172[a]
TPH as Motor Oil C24-C36	ug/L	<160	<160	<160	NA	670	280	220	76	690	NA	527[a]	178[a]
Total Metals													
Copper	ug/L	34	9.3	19	6.5	45	14.0	16	5.4	34	NA	29.6	8.8
Mercury	ug/L	0.20	0.029	0.084	0.022	0.093	0.038	0.0550	0.0140	0.1	NA	0.11	0.03
Zinc	ug/L	332	29	140	17	360	53.0	184	15	425	NA	288	29
Dissolved Metals													
Copper	ug/L	3.5	5	4	4.3	5.4	9.4	1	3.4	5.2	NA	3.8	5.5
Mercury	ug/L	0.0057	0.0085	0.0065	0.0083	0.005	0.002	0.0016	0.0044	0.0034	NA	0.0045	0.0059
Zinc	ug/L	21	3.6	8.6	2.5	37	12.0	10	6.5	29	NA	21.1	6.2
PCB Congeners													
Total RMP 40 PCB Congeners	ng/L	26.80	2.68J	12.51	NA	19.30	4.2J	23.40	1.80J	68.8	NA	30.2	2.9
PFAS[1]													
Total PFAS Analytes[b]	ng/L	0	30.864J	0.987J	0	2.07	74.09	0	0	0	NA	0.6	26.2

< Analyte not detected at or above the associated method detection limit.
NA Not analyzed due to low sample volume
J Estimated value below the reporting limit but at or above the method detection limit (includes individual congeners / compounds reported in totals)
a Influent and Effluent Means for TPH are calculated using only WY 2025 data due to the high degree of TPH non-detects from the analytical method used in WY 2024.
b Total PFAS Analytes is the sum of all 40 detected PFAS analytes analyzed with the EPA 1633 methodology. Non-detects are treated as 0 for the purposes of this calculation and J-flagged results are included in sums.

Table 4.B. Concentration and load percent reductions per analyte and storm event, WY 2024 and WY 2025, for water quality data collected at the ACCWP OAB-18W bioretention facility, Oakland, CA.

Analytes	Unit	WY 2024				WY 2025						Total (WY 2024 – WY 2025)	
		03/23/2024		04/14/2024		11/21/2024		2/13/2025		3/13/2025			
		Conc. % Reduction	Load % Reduction[a]	Conc. % Reduction	Load % Reduction[a]	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction[c]	Conc. % Reduction	Load % Reduction	Total Concentration % Reduction	Total Load % Reduction[a,c]
Convention, Physical, and Semi-volatiles													
pH	pH	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	**NC**	**NC**
Hardness as CaCO3	mg/L	31%	NC	45%	NC	6%	90%	14%	34%	NC	100%	**26%**	**61%**
TSS	mg/L	96%	NC	93%	NC	82%	98%	94%	54%	NC	100%	**92%**	**70%**
TPH as Diesel C12-C24[b]	ug/L	NC	NC	NC	NC	40%	94%	59%	46%	NC	100%	**54%**	**74%**
TPH as Motor Oil C24-C36[b]	ug/L	NC	NC	NC	NC	58%	96%	65%	47%	NC	100%	**66%**	**73%**
Total Metals													
Copper	ug/L	73%	NC	66%	NC	69%	97%	66%	47%	NC	100%	**70%**	**71%**
Mercury	ug/L	84%	NC	74%	NC	59%	96%	75%	49%	NC	100%	**76%**	**67%**
Zinc	ug/L	91%	NC	88%	NC	85%	99%	92%	54%	NC	100%	**90%**	**72%**
Dissolved Metals													
Copper	ug/L	-43%	NC	-8%	NC	-74%	82%	-240%	-32%	NC	100%	**-45%**	**45%**
Mercury	ug/L	-49%	NC	-28%	NC	57%	96%	-175%	-15%	NC	100%	**-31%**	**41%**
Zinc	ug/L	83%	NC	71%	NC	68%	97%	35%	39%	NC	100%	**71%**	**71%**
PCB Congeners													
Total RMP 40 PCB Congeners	ng/L	90%	NC	100%	NC	78%	98%	92%	54%	NC	100%	**90%**	**68%**
PFAS Compounds													
Total PFAS Compounds[d]	ng/L	NC	NC	100%	NC	-3479%	-263%	NC	NC	NC	NC	**-4192%**	**-263%**

Concentration % Reduction is calculated as (Concentration$_{inf}$ – Concentratione$_{ff}$)/Concentration$_{inf}$ for each storm event. Total Concentration % Reduction is calculated from the means with the same formula.

Effluent load for 2/13/25 overflow event calculated as (Concentration$_{eff}$ x Volume$_{eff}$) + (Concentration$_{inf}$ x Volume$_{overflow}$). Load % Reduction for all other events is calculated as (Sum$_{inf}$ – Sum$_{eff}$)/Sum$_{inf}$. Total Load % Reduction is calculated from the sums across all acceptable data with the same formula.

NC = Not calculated due to the high number of non-detects in the influent and effluent data, low sample volumes, or other considerations. TPH and PFAS calculations are frequently NC for WY 2024 data due to high degree of non-detects from the analytical method used in WY 2024.

a Due to uncertainty re: WY 2024 hydrologic data, no load reductions are calculated for WY 2024 events and cumulative total load reduction is based only upon WY 2025 data

b Total Concentration % Reduction for TPH is calculated using only WY 2025 data due to the high degree of non-detects from the analytical method used in WY 2024.

c Expected load reductions are decreased by in-basin overflow occurring during 2/13/2025 sampling event.

d Total PFAS Analytes is the sum of all 40 detected PFAS compounds analyzed with the EPA 1633 methodology. Non-detects are treated as 0 for the purposes of this calculation.

Table 4.C. Descriptive statistics of WY 2024 and WY 2025 water quality data collected at the ACCWP OAB-18W bioretention facility, Oakland, CA.

Analyte (units)	Sample Count[a]		Interquartile Range (25th-75th percentiles)		Median		Mean		Concentration % Reduction[c]	Load % Reduction[d,e]
	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent		
Conventional, Physical, and Synthetic Organics										
pH	5	4	7.3-7.5	7.1-7.3	7.5	7.2	7.4	7.2	3	NC
Hardness as CaCO3 (mg/L)	5	4	52-66	33-44	60	36	55.6	41.0	26	61
Total Suspended Solids (mg/L)	5	4	147-270	9.5-18.9	208	11.2	217.0	17.1	92	70
TPH as Diesel C12-C24 (ug/L)	3	2	392.5-497.5	112.3-230.8	485	171.5	376.7	171.5	54[b]	74[b]
TPH as Motor Oil C24-C36 (ug/L)	3	2	445-680	127-229	670	178	527	178	66[b]	73[b]
Total Metals										
Copper (ug/L)	5	4	19-34	4.8-8.4	34	6	29.6	8.8	70	71
Mercury (ug/L)	5	4	0.084-0.1	0.01-0.03	0.09	0.02	0.1	0.03	76	67
Zinc (ug/L)	5	4	184-360	17-35	332	23	288	29	90	72
Dissolved Metals										
Copper (ug/L)	5	4	3.5-5.2	4.1-6.1	4	4.7	3.8	5.5	-45	45
Mercury (ug/L)	5	4	0.0034-0.0057	0.0039-0.0083	0.0051	0.0064	0.0045	0.0059	-31	41
Zinc (ug/L)	5	4	10-29	3.3-7.9	21	5.1	21.1	6.2	71	71
PCB Congeners										
Total RMP 40 PCB Congeners (ng/L)	5	4	19.3-26.8	2.3-3.5	23.4	2.7	30.2	2.9	90	68
PFAS Compounds										
PFAS compounds	5	4	0-0.987	0-41.68	0	15.4	0.6	26.2	-4192%	-263%

[a] Sample Count is the total number of viable samples for WY 2024 and WY 2025. Statistics include effluent water quality data analyzed for overflow events and have not been adjusted for un- or partially-treated overflow.

[b] TPH calculations exclude WY 2024 data due to high degree of non-detects from the analytical method used in WY 2024.

[c] Concentration % Percent Reduction is calculated from the influent and effluent means as (Concentration$_{inf}$ – Concentration$_{eff}$)/Concentration$_{inf}$

[d] Load % Reductions exclude WY 2024 data due to uncertainties in load measurements; calculated as as (Sum$_{inf}$ – Sum$_{eff}$)/Sum$_{inf}$

[e] Effluent load for 2/13/25 overflow event calculated as (Concentration$_{eff}$ x Volume$_{eff}$) + (Concentration$_{inf}$ x Volume$_{overflow}$)

Solano County

Table 4.A. Summary of WY 2025 water quality data collected at the Solano County SSA-LOTZ bioretention facility, Suisun City, CA.

Analytes	Unit	2/2/2025		2/14/2025		3/13/2025		Influent Arithmetic Mean	Effluent Arithmetic Mean
		Influent	Effluent	Influent	Effluent	Influent	Effluent		
Conventional, Physical, and Synthetic Organics									
pH		7.1	8.0	7.8	7.9	7.3	7.6	7.4	7.8
Hardness as CaCO3	mg/L	26	94	138	186	108	496	90.7	258.7
TSS	mg/L	25.0	14.8	38.4	5.8	374.0	7.0	145.8	9.2
TPH as Diesel C12-C24	ug/L	130	51	140	48	480	110	250 [a]	70 [a]
TPH as Motor Oil C24-C36	ug/L	520	110	320	58	630	120	490 [a]	96 [a]
Total Metals									
Copper	ug/L	3.9	11.0	6.8	6.4	30.0	10.0	13.6	9.1
Mercury	ug/L	0.07	0.41	0.55	0.32	0.51	0.48	0.38	0.40
Zinc	ug/L	14.0	8.8	24.0	4.0	188.0	5.9	75.3	6.2
Dissolved Metals									
Copper	ug/L	1.7	7.5	2.5	4.8	5.0	8.8	3.1	7.0
Mercury	ug/L	0.007	0.056	0.016	0.077	0.004	0.088	0.009	0.074
Zinc	ug/L	2.4	1.9	2.8	1.2	9.2	2.1	4.8	1.7
PCB Congeners									
Total RMP 40 PCB Congeners	ng/L	0.22J	0.16J	0.32J	0.04J	4.89J	0.07J	1.8	0.1
PFAS[1]									
Total PFAS Analytes	ng/L	0	18.44	8.14	12.71	21.77	56.47	10.0	29.2

< Analyte not detected at or above the associated method detection limit.

NA Not analyzed due to low sample volume

J Estimated value below the reporting limit but at or above the method detection limit (includes individual congeners / compounds reported in totals)

a Influent and Effluent Means for TPH are calculated using only WY 2025 data due to the high degree of TPH non-detects from the analytical method used in WY 2024.

b Total PFAS Analytes is the sum of all 40 detected PFAS analytes analyzed with the EPA 1633 methodology. Non-detects are treated as 0 for the purposes of this calculation and J-flagged results are included in sums.

Table 4.B. Concentration and load percent reductions per analyte and storm event, WY 2025, for water quality data collected at the Solano County SSA-LOTZ bioretention facility, Suisun City, CA.

Analytes	Unit	WY 2025						Total (WY 2024 – WY 2025)	
		11/21/2024		2/13/2025		3/13/2025			
		Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction[a]	Conc. % Reduction	Load % Reduction	Total Concentration % Reduction	Total Load % Reduction[a]
Conventional, Physical, and Synthetic Organics									
pH	pH	NC	NC	NC	NC	NC	NC	NC	NC
Hardness as CaCO3	mg/L	-262%	-192%	-35%	-11%	-359%	-313%	**-185%**	**-44%**
TSS	mg/L	41%	52%	85%	70%	98%	98%	**94%**	**77%**
TPH as Diesel C12-C24[b]	ug/L	61%	68%	66%	57%	77%	79%	**72%**	**99%**
TPH as Motor Oil C24-C36[b]	ug/L	79%	83%	82%	68%	81%	83%	**80%**	**99%**
Total Metals									
Copper	ug/L	-182%	-127%	6%	16%	67%	70%	**33%**	**-2%**
Mercury	ug/L	-477%	-366%	42%	41%	6%	15%	**-7%**	**12%**
Zinc	ug/L	37%	49%	83%	69%	97%	97%	**92%**	**74%**
Dissolved Metals									
Copper	ug/L	-341%	-256%	-92%	-50%	-76%	-58%	**-129%**	**-105%**
Mercury	ug/L	-689%	-536%	-381%	-247%	-1995%	-1785%	**-710%**	**-331%**
Zinc	ug/L	21%	36%	57%	51%	77%	79%	**64%**	**51%**
PCB Congeners									
Total RMP 40 PCB Congeners	ng/L	28%	42%	87%	71%	99%	99%	**95%**	**79%**
PFAS Analytes									
Total PFAS Analytes[b]	ng/L	NC	NC	-56%	-26%	-159%	-133%	**-193%**	**-135%**

Concentration % Reduction is calculated as ($\text{Concentration}_{inf}$ – $\text{Concentratione}_{ff}$)/$\text{Concentration}_{inf}$ for each storm event. Total Concentration % Reduction is calculated from the means with the same formula.

Effluent load for 2/13/25 overflow event calculated as ($\text{Concentration}_{ieff}$ x Volume_{eff}) + ($\text{Concentration}_{inf}$ x $\text{Volume}_{overflow}$). Load % Reduction for all other events is calculated as (Sum_{inf} – Sum_{eff})/Sum_{inf}. Total Load % Reduction is calculated from the sums across all acceptable data with the same formula.

NC = Not calculated due to the high number of non-detects in the storm-specific influent and effluent data, low sample volumes, or other sample considerations. TPH and PFAS calculations are frequently NC due to high degree of non-detects

a Expected load reductions are decreased by in-basin overflow occurring during 2/13/2025 sampling event.

b Total PFAS Analytes is the sum of all 40 detected PFAS compounds analyzed with the EPA 1633 methodology. Non-detects are treated as 0 for the purposes of this calculation.

Table 4.C. Descriptive statistics of WY 2025 water quality data collected at the Solano County SSA-LOTZ bioretention facility, Suisun City, CA.

Analyte (units)	Sample Count[a]		Interquartile Range (25th-75th percentiles)		Median		Mean		Concentration % Reduction[b]	Load % Reduction[c,d]
	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent		
Conventional, Physical, and Synthetic Organics										
pH	3	3	7.2-7.6	7.8-8.0	7.3	7.9	7.4	7.8	-6%	NC
Hardness as CaCO3 (mg/L)	3	3	67-123	140-341	108	186	91	259	-185%	-44%
Total Suspended Solids (mg/L)	3	3	31.7-206.2	6.4-10.9	38.4	7.0	145.8	9.2	94%	77%
TPH as Diesel C12-C24 (ug/L)	3	3	135-310	49.5-80.5	140	51	250	70	72%	99%
TPH as Motor Oil C24-C36 (ug/L)	3	3	420-575	84-115	520	110	490	96	80%	99%
Total Metals										
Copper (ug/L)	3	3	5.4-18.4	8.2-10.5	6.8	10.0	13.6	9.1	33%	-2%
Mercury (ug/L)	3	3	0.29-0.53	0.37-0.45	0.51	0.41	0.38	0.40	-7%	12%
Zinc (ug/L)	3	3	19-106	5.0-7.4	24	5.9	75.3	6.2	92%	74%
Dissolved Metals										
Copper (ug/L)	3	3	2.1-3.8	6.2-8.2	2.5	7.5	3.1	7.0	-129%	-105%
Mercury (ug/L)	3	3	0.0057-0.0116	0.067-0.083	0.0071	0.077	0.009	0.074	-710%	-331%
Zinc (ug/L)	3	3	2.6-6	1.6-2	2.8	1.9	4.8	1.7	64%	51%
PCB Congeners										
Total RMP 40 PCB Congeners (ng/L)	3	3	0.27-2.6	0.05-0.11	0.32	0.07	1.81	0.09	95%	79%
PFAS										
Total PFAS Analytes (ng/L)	3	3	4.07-14.96	15.75-37.46	8.10	18.40	9.97	29.21	-193%	-135%

a Sample Count is the total number of viable samples for WY 2024 and WY 2025. Statistics include effluent water quality data analyzed for overflow events and have not been adjusted for un- or partially-treated overflow.
b Concentration % Percent Reduction is calculated from the influent and effluent means as ($\text{Concentration}_{inf}$ – $\text{Concentration}_{eff}$)/$\text{Concentration}_{inf}$
c Load % Reduction is calculated from the sums across both WY 2024 and WY 2025 as (Sum_{inf} – Sum_{eff})/Sum_{inf}
d Effluent load for 2/13/25 overflow event calculated as ($\text{Concentration}_{eff}$ x Volume_{eff}) + ($\text{Concentration}_{inf}$ x $\text{Volume}_{overflow}$)

Contra Costa County

Table 4.A. Summary of WY 2024 and WY 2025 water quality data collected at the Contra Costa County Ohlone Greenway bioretention facility, El Cerrito, CA.

		01/03/2024		01/14/2024		02/01/2024		03/02/2024		03/23/2024		03/28/2024		04/13/2024		11/11/2024		11/21/2024		12/12/2024		02/01/2025		03/12/2025		Influent Arithmetic Mean	Effluent Arithmetic Mean
Analyte or Analyte Category	Unit	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent		
Conventional, Physical, and Synthetic Organics																											
pH	none	7.0	6.6	6.9	6.6	7.0	6.8	7.2	6.8	7.2	7.0	7.0	6.8	7.5	6.9	7.0	6.7	7.1	7.0	6.7	6.7	7.2	6.9	6.8	6.7	7.1	6.8
Hardness as $CaCO_3$	mg/L	22	44	30	24	34	50	30	44	20	40	18	40	34	26	92	128	24	40	18	26	22	122	28	42	30	58
Total Suspended Solids	mg/L	83.8	2.0J	39.8	2.6J	80.0	5.8	43.6	1.1J	40.8	1.0J	45.2	3.4	25.6	<1.0	61.3	12.8	22.4	8.4	20.5	2.5J	27.3	1.6J	178	2.6J	53.5	3.5
TPH as Diesel C12-C24	ug/L	<74	<74	<74	<74	<74	<74	<74	<74	<74	<74	<74	<74	<74	<74	500	100	290	92	180	100	190	44J	370	95	306[1]	86[1]
TPH as Motor Oil C24-C36	ug/L	<160	<160	<160	<160	<160	<160	<160	<160	<160	<160	<160	<160	<160	<160	630	130	440	110	76	<25	430	46J	700	83J	455[1]	74[1]
Total Metals																											
Copper	ug/L	19	11	11	6.6	19	13	14	7.7	21	8.0	17	9.0	16	7.5	49	18	15	15	13	8.5	12	6.4	58	9.3	21	9.7
Mercury	ug/L	0.043	0.016	0.026	0.013	0.075	0.021	0.048	0.013	0.026	0.011	0.033	0.013	0.030	0.0095	0.024	0.014	0.010	0.0074	0.0074	0.0061	0.018	0.0044	0.40	0.0092	0.058	0.011
Zinc	ug/L	97	10	59	10	83	15	68	11	94	12	102	15	62	10	169	29	57	18	63	9.6	67	15	325	11	101	14
Dissolved Metals																											
Copper	ug/L	3.9	9.9	4.1	5.5	6.6	11	5.9	7.0	10	6.4	4.5	7.6	11	7.0	26	15	9.9	13	7.3	7.7	5.9	5.7	7.1	8.2	8.3	8.4
Mercury	ug/L	0.0020	0.0022	0.0036	0.0028	0.011	0.016	0.0056	0.0095	0.0045	0.0088	0.0046	0.011	0.0039	0.0086	0.0004	0.0010	0.0028	0.0019	0.0014	0.0037	0.0031	0.0040	0.0028	0.0099	0.0038	0.0064
Zinc	ug/L	15	7.7	17	6.6	17	9.9	25	8.1	29	9.0	17	10	31	8.1	71	19	34	14	33	6.9	29	14	20	8	28	10
PCB Congeners																											
Total RMP 40 PCB Congeners	ng/L	20.3	0.65	5.97	0.787	9.15	1.56	6.74	0.37	9.17	0.237	2.16	0.24	5.32	0.142	15.3	1.61	4.64	1.35	3.68	0.242	5.07	0.259	42.8	0.189	10.4	0.607
PFAS																											
Total PFAS	ng/L	33.2	42.1	23.1	37.9	38.2	42.3	17.5	35.4	19.9	65.0	13.9	55.8	ND	59.3	39.8	131	19.1	94.3	10.8	76.9	7.91	33.9	13.0	67.2	21.5	61.3

1 Influent and effluent means and percent reduction for TPH are calculated using only WY 2025 data due to the high degree of TPH non-detects from the analytical method used in WY 2024.
2 0% reduction is represented due to values being ND for both influent and effluent. MDL and RL differed between congeners.
3 Due to high particulate loading during the 04/13/24 event, the influent sample was run with a significantly smaller sample size, increasing the RL for that sample. Effluent results were adjusted to compensate for the higher limits seen in the influent sample for comparability purposes.
4 PFAS congeners are presented by groups – a breakdown of how the PFAS are divided into groups can be found in Attachment A to this appendix.
J Estimated value below the RL but at or above the MDL.
< Analyte not detected at or above the associated MDL.
ND Analyte not detected at or above the MDL.

Table 4.B. Concentration and load percent reductions per analyte and storm event, WY 2024 and WY 2025, for water quality data collected at the Contra Costa County Ohlone Greenway bioretention facility, El Cerrito, CA.

Analyte or Analyte Category	WY24 Storm End Date														WY25 End Storm Date										Total (WY24 – WY25)	
	01/03/2024		01/14/2024		02/01/2024		03/02/2024		03/23/2024		03/28/2024		04/13/2024		11/11/2024		11/21/2024		12/12/2024		02/01/2025		03/12/2025		Total Concentration % Reduction[1]	Total Load % Reduction
	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction	Conc. % Reduction	Load % Reduction		
Conventional, Physical, and Synthetic Organics																										
pH	6%%	48%	4%	27%	3%	19%	6%	46%	3%	77%	3%	63%	8%	35%	4%	52%	1%	87%	0%	58%	4%	97%	1%	69%	NC	NC
Hardness as $CaCO_3$	-100%	-11%	20%	39%	-47%	-22%	-47%	16%	-100%	53%	-122%	14%	24%	46%	-39%	30%	-67%	78%	-44%	39%	-455%	-92%	-50%	52%	-77%	-4%
Total Suspended Solids	98%	99%	93%	95%	93%	94%	97%	99%	98%	99%	92%	97%	100%	100%	79%	90%	63%	95%	88%	95%	94%	98%	99%	100%	93%	96%
TPH as Diesel C12-C24	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	80%	90%	68%	96%	44%	77%	77%	92%	74%	92%	66%[2]	88%[2]
TPH as Motor Oil C24-C36	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	79%	90%	75%	97%	100%	100%	89%	96%	88%	96%	89%[2]	96%[2]
Total Metals																										
Copper	42%	68%	40%	54%	32%	43%	45%	68%	62%	91%	47%	80%	53%	67%	63%	82%	0%	87%	35%	73%	47%	82%	84%	95%	38%	64%
Mercury	63%	79%	50%	62%	72%	77%	73%	84%	58%	90%	61%	85%	68%	78%	42%	71%	26%	90%	18%	65%	76%	92%	98%	99%	70%	82%
Zinc	90%	94%	83%	87%	82%	85%	84%	91%	87%	97%	85%	94%	84%	89%	83%	91%	68%	96%	85%	94%	78%	92%	97%	99%	83%	90%
Dissolved Metals																										
Copper	-154%	-40%	-34%	-3%	-67%	-39%	-19%	32%	36%	85%	-69%	35%	36%	55%	42%	71%	-31%	83%	-5%	56%	3%	67%	-15%	63%	-35%	21%
Mercury	-10%	39%	22%	40%	-45%	-21%	-70%	3%	-96%	54%	-139%	8%	-121%	-55%	-144%	-23%	32%	91%	-164%	-11%	-29%	55%	-254%	-13%	-82%	-7%
Zinc	49%	72%	61%	70%	42%	52%	68%	81%	69%	93%	41%	77%	74%	82%	73%	87%	59%	95%	79%	91%	52%	83%	60%	87%	60%	76%
PCB Congeners																										
Total RMP 40 PCB Congeners	97%	98%	87%	90%	83%	86%	95%	97%	97%	99%	89%	96%	97%	98%	89%	95%	71%	96%	93%	97%	95%	98%	100%	100%	88%	93%
PFAS																										
Total PFAS[3]	-27%	30%	-64%	-26%	-11%	8%	-102%	-16%	-227%	23%	-302%	-55%	NC	NC	-229%	-65%	-394%	35%	-611%	-198%	-328%	-48%	-419%	-65%	-99%	-19%

Concentration % Reduction is calculated as $(\text{Concentration}_{inf} – \text{Concentration}_{eff})/\text{Concentration}_{inf}$ for each storm event. Total Concentration % Reduction is calculated from the means with the same formula.

Load % Reduction is calculated as $(\text{Sum}_{inf} – \text{Sum}_{eff})/\text{Sum}_{inf}$ for each storm event. Total Load % Reduction is calculated from the sums across both WY 2024 and WY 2025 with the same formula.

NC = Not calculated due to the high number of non-detects in the storm-specific influent and effluent data or other sample considerations. TPH calculations are frequently NC for WY 2024 data due to high degree of non-detects from the analytical method used in WY 2024.

[1] Total concentration is the mean of the volume weighted concentrations of each event, as opposed to the arithmetic mean concentration (Table 4.-A) which is not weighted by event volume.

[2] Total concentration and load reductions for TPH are calculated using only WY 2025 data due to the high degree of TPH non-detects from the analytical method used in WY 2024.

[3] Total PFAS Analytes is the sum of all 40 detected PFAS analytes analyzed with the EPA 1633 methodology. Non-detects are treated as 0 for the purposes of this calculation and J-flagged results are included.

Table 4.C. Descriptive statistics of WY 2024 and WY 2025 water quality data collected at the Contra Costa County Ohlone Greenway bioretention facility, El Cerrito, CA.

Analyte (units)	Sample Count		Interquartile Range (25th-75th percentiles)		Median		Mean		Total Load % Reduction
	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	
Conventional, Physical, and Synthetic Organics									
pH	12	12	7.0 - 7.2	6.7 - 6.9	7.0	6.8	7.1	6.8	43%
Hardness as CaCO3 (mg/L)	12	12	22 - 31	36.5 - 45.5	28	41	30	58	-4%
Total Suspended Solids (mg/L)	12	12	26.9 - 66.0	1.48 - 4	43.6	2.55	53.5	3.5	96%
TPH as Diesel C12-C24 (µg/L)	5[a]	5[a]	190 - 370	92 - 100	330	95	306[1]	86[1]	882%
TPH as Motor Oil C24-C36 (µg/L)	5[a]	5[a]	430 - 630	46 - 110	535	83	455[1]	74[1]	962%
Total Metals									
Copper (µg/L)	12	12	14 - 20	7.7 - 12	17	8.75	21	9.7	64%
Mercury (µg/L)	12	12	0.0225 - 0.0443	0.0088 - 0.0133	0.03	0.012	0.058	0.011	82%
Zinc (µg/L)	12	12	63 - 98	10 - 15	83	11.5	101	14	90%
Dissolved Metals									
Copper (µg/L)	12	12	5.6 - 9.9	6.9 - 10	7.1	7.65	8.3	8.4	21%
Mercury (µg/L)	12	12	0.0026 - 0.0045	0.0027 - 0.0096	0.0036	0.0063	0.0038	0.0064	-7%
Zinc (µg/L)	12	12	17 - 32	7.93 - 11	28	8.55	28	10	76%
PCB Congeners									
Total RMP 40 PCB Congeners (ng/L)	12	12	4.96 - 10.7	0.239 - 0.928	6.74	0.3145	10.4	0.607	93%
PFAS									
Total PFAS Analytes (ng/L) [b]	12	12	13.5 - 28.2	41.1 - 69.6	19.4	57.55	21.5	61.3	-19%

Sample Count is the total number of viable samples for WY 2024 and WY 2025.

Total Load % Reduction is calculated from the sums across both WY 2024 and WY 2025 as $(\text{Sum}_{inf} – \text{Sum}_{eff})/\text{Sum}_{inf}$

[a] TPH calculations exclude WY 2024 data due to high degree of non-detects and/or uncertainty from the analytical method used in WY 2024.

[b] Total PFAS Analytes is the sum of all 40 detected PFAS analytes analyzed with the EPA 1633 methodology. Non-detects are treated as 0 for the purposes of this calculation and J-flagged results are included.

Appendix D

WY 2024 – WY 2025 Results for BAMSC LID Monitoring Facilities: Analyte-Specific Box and Whisker Plots

APPENDIX D: WY 2024 – WY 2025 RESULTS FOR BAMSC LID MONITORING FACILITIES: ANALYTE-SPECIFIC BOX AND WHISKER PLOTS

The following figures use box-and-whisker plots to show analyte-specific load reductions for each BAMSC LID monitoring facility. These plots allow for convenient visual comparison of the distribution and variability of storm-based load percent reductions across sites for different analytes. In each box-and-whisker figure, the lower and upper edges of each box represent the 25th and 75th percentiles of the storm-based load percent reduction data, respectively, and the line within each box represents the median (50th percentile). Whiskers and outliers, when present, indicate the range and extreme values of the data. Negative results indicate net increases in analyte load.

Figures include all QA-approved monitoring data collected in WY 2024 and WY 2025. Source data is included in *Appendix C: WY 2024 – WY 2025 Results for BAMSC LID Monitoring Facilities: Concentrations, Load Reductions, and Facility Summary Statistics*; through CEDEN; and by request. Further discussion of these results and the data included in them can be found in the *IMR Part A: LID Monitoring (WY 2023-2025)* report for each BAMSC program partner.

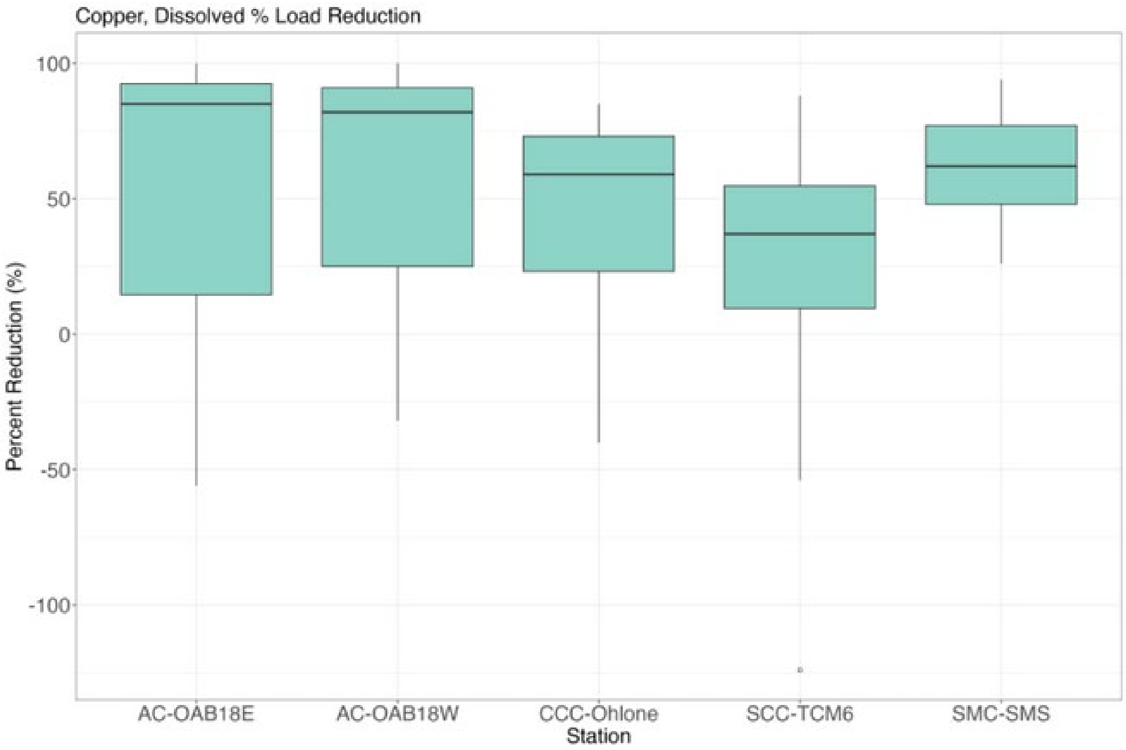

Figure D.1. Box and whisker plots showing distribution of Dissolved Copper Load % Reductions at five BAMSC LID monitoring sites, WY 2024 – WY 2025.

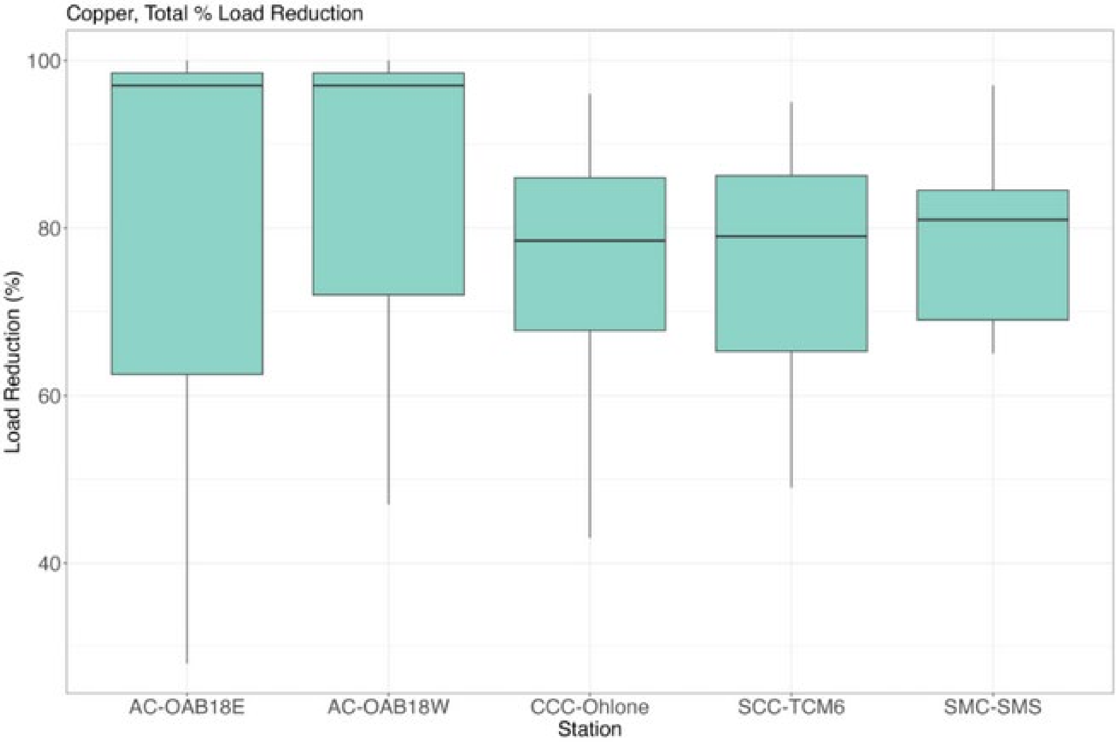

Figure D.2. Box and whisker plots showing distribution of Total Copper Load % Reductions at five BAMSC LID monitoring sites, WY 2024 – WY 2025.

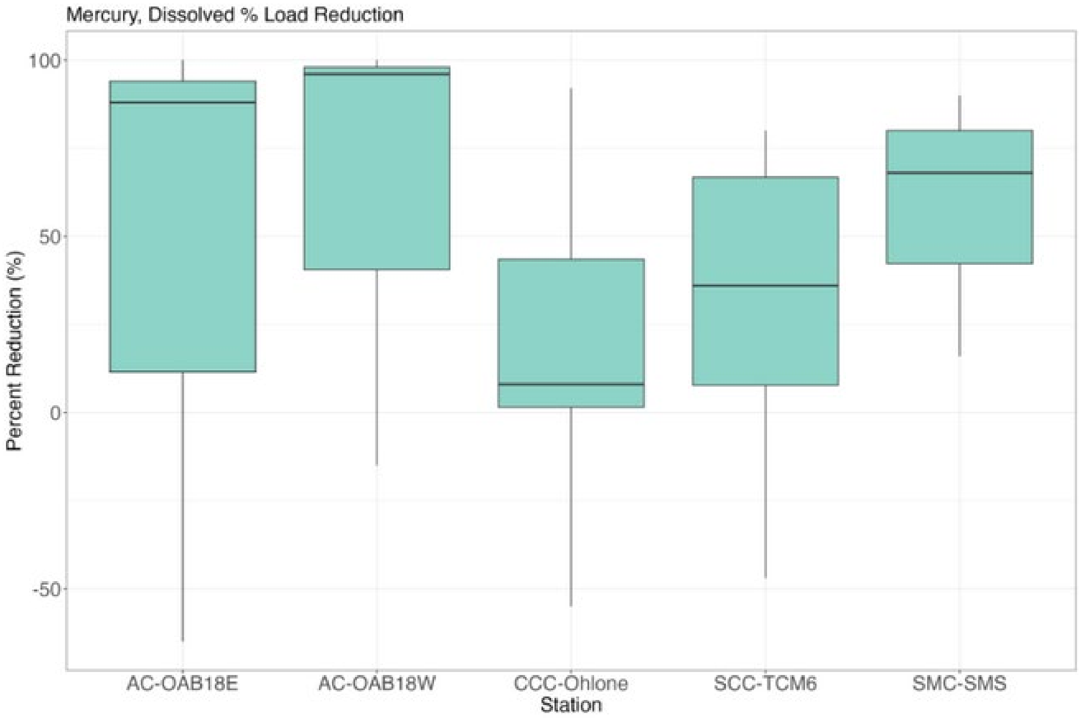

Figure D.3. Box and whisker plots showing distribution of Dissolved Mercury Load % Reductions at five BAMSC LID monitoring sites, WY 2024 – WY 2025.

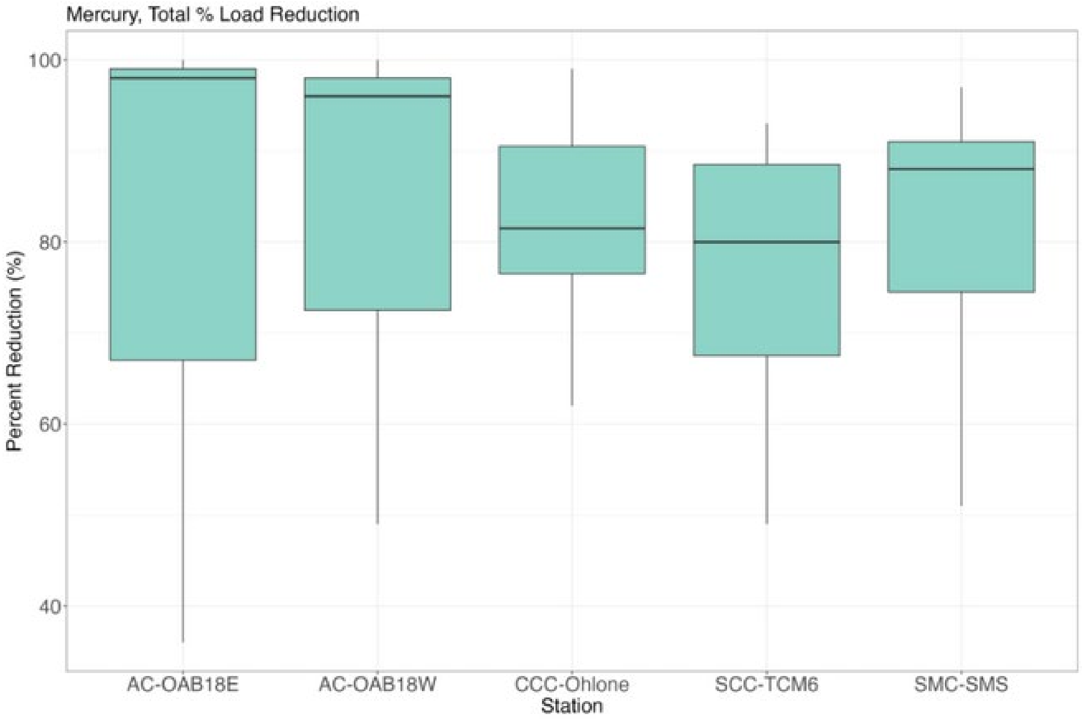

Figure D.4. Box and whisker plots showing distribution of Total Mercury Load % Reductions at five BAMSC LID monitoring sites, WY 2024 – WY 2025.

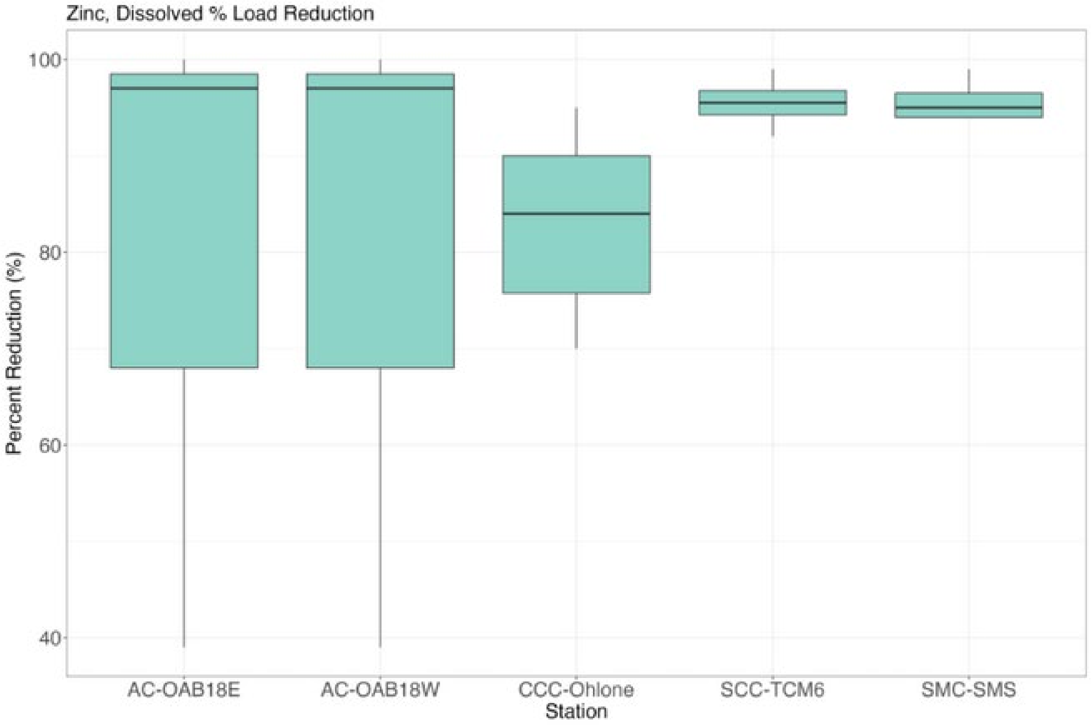

Figure D.5. Box and whisker plots showing distribution of Dissolved Zinc Load % Reductions at five BAMSC LID monitoring sites, WY 2024 – WY 2025.

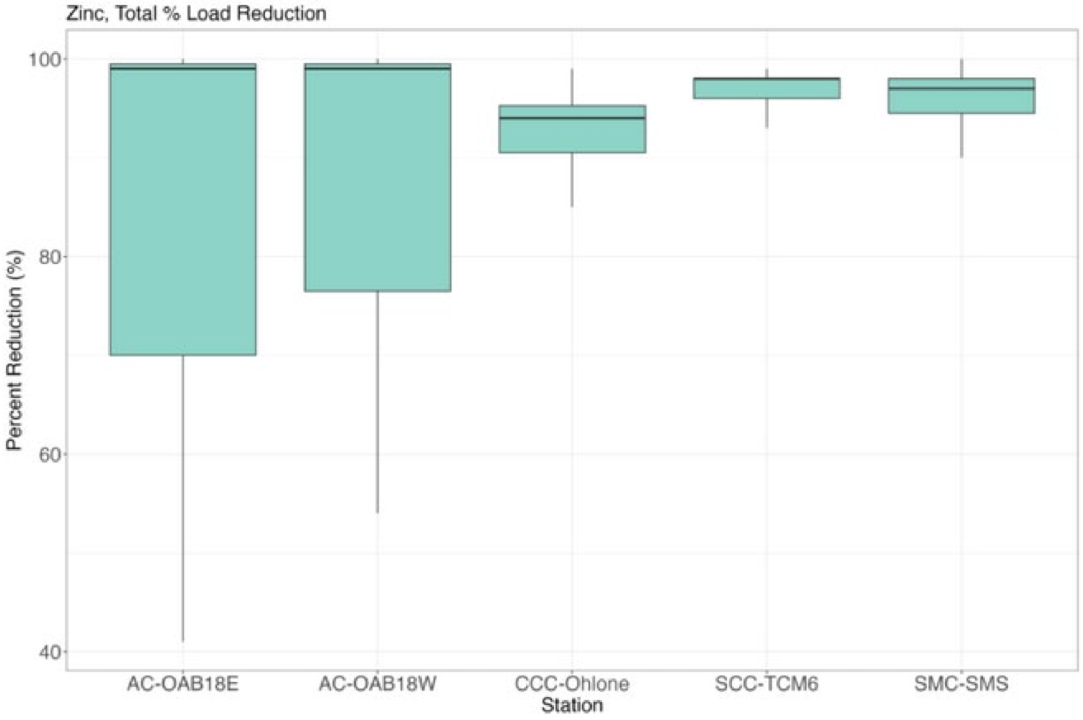

Figure D.6. Box and whisker plots showing distribution of Total Zinc Load % Reductions at five BAMSC LID monitoring sites, WY 2024 – WY 2025.

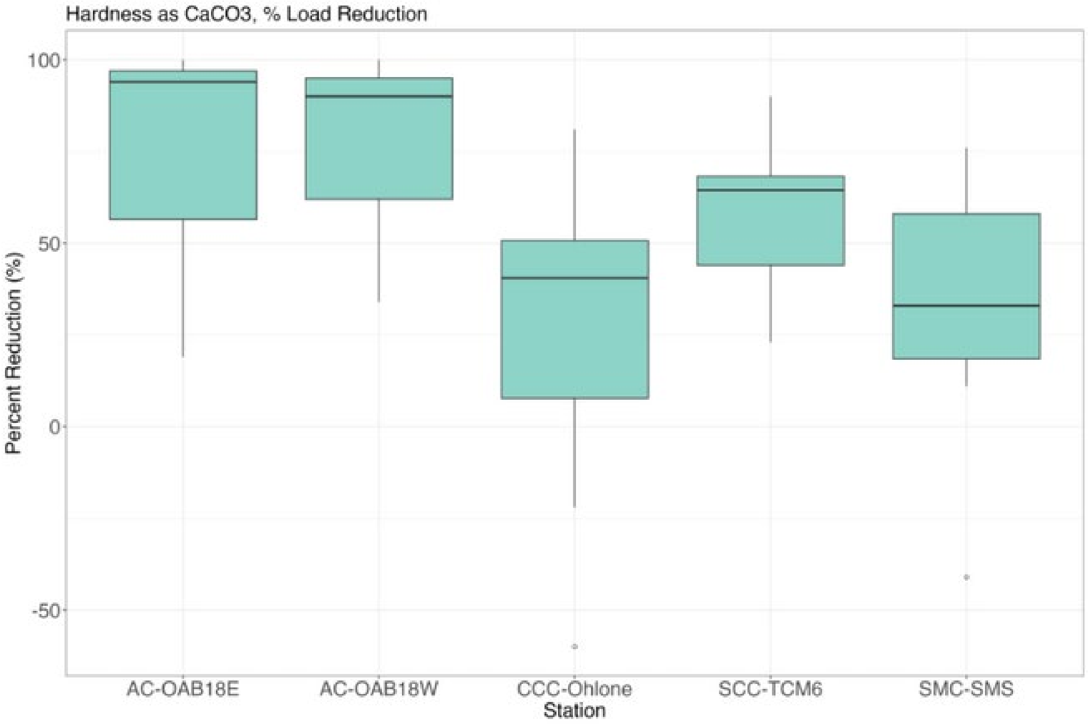

Figure D.7. Box and whisker plots showing distribution of Hardness as $CaCO_3$ Load % Reductions at five BAMSC LID monitoring sites, WY 2024 – WY 2025.

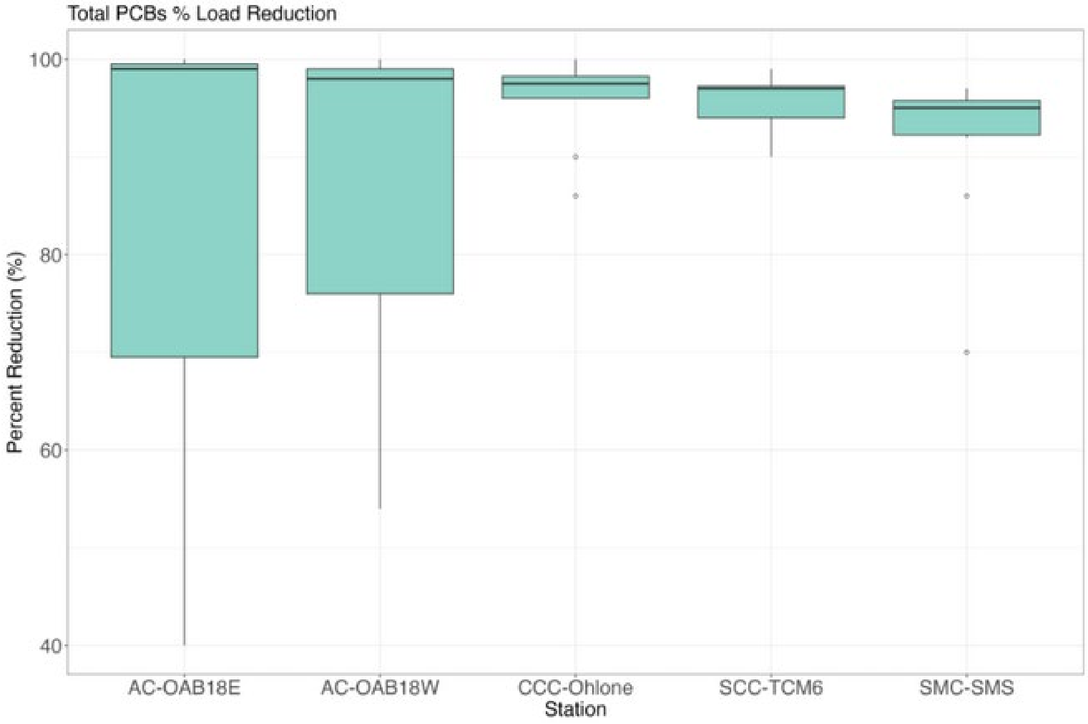

Figure D.8. Box and whisker plots showing distribution of Total PCBs Load % Reductions at five BAMSC LID monitoring sites, WY 2024 – WY 2025.

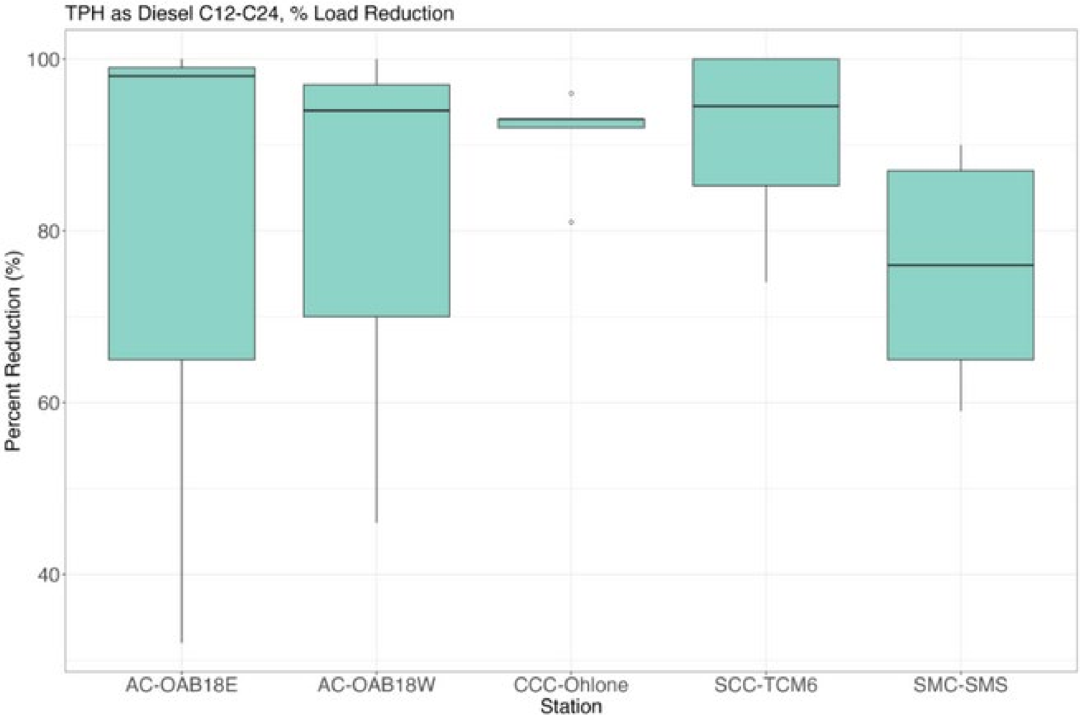

Figure D.9. Box and whisker plots showing distribution of TPH as Diesel (C12-C24) Load % Reductions at five BAMSC LID monitoring sites, WY 2024 – WY 2025.

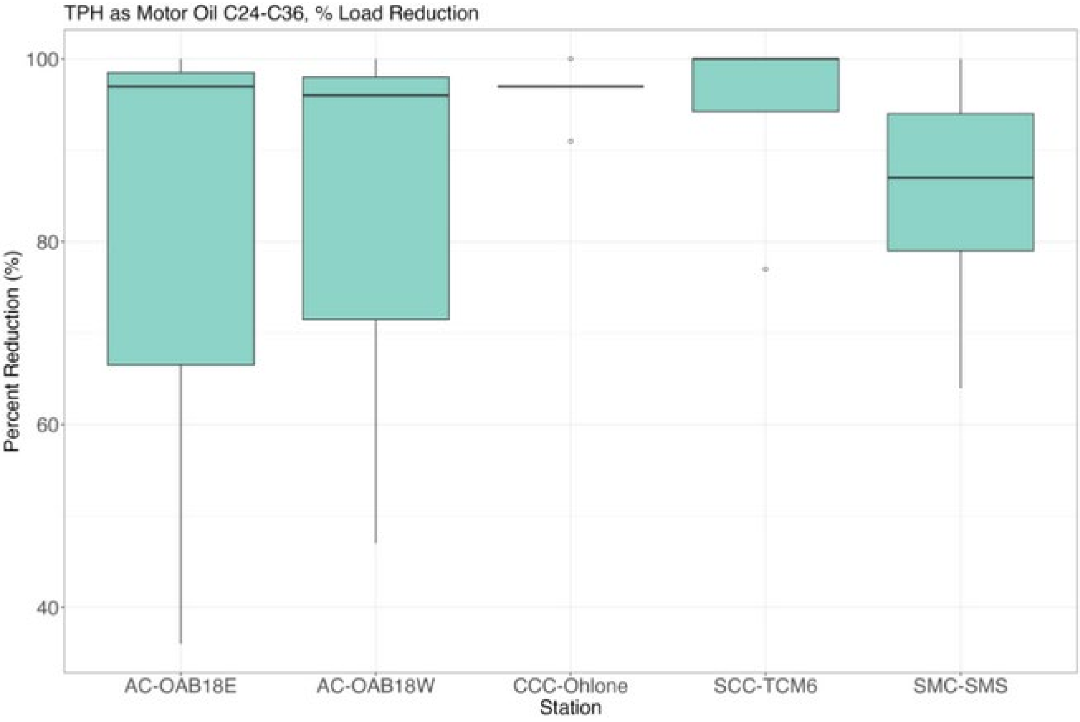

Figure D.10. Box and whisker plots showing distribution of TPH as Motor Oil (C24-C36) Load % Reductions at five BAMSC LID monitoring sites, WY 2024 – WY 2025.

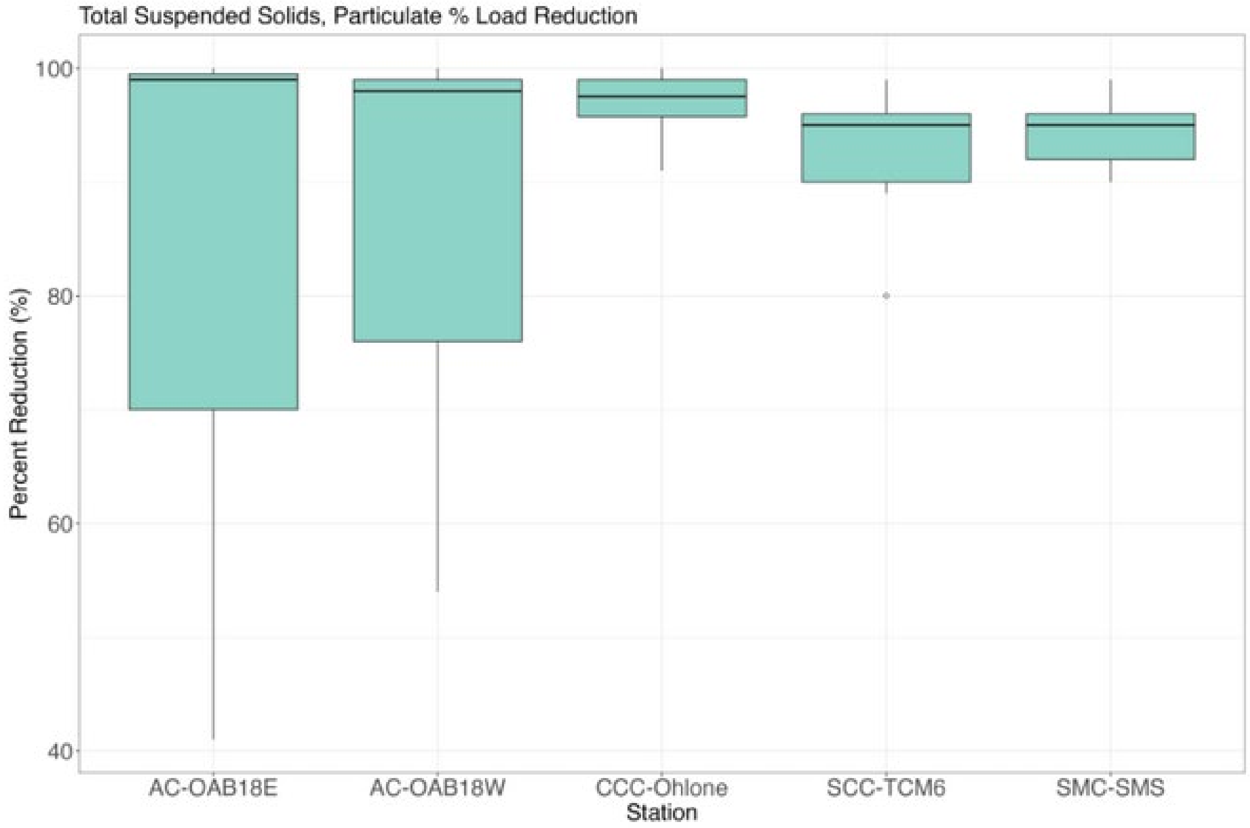

Figure D.11. Box and whisker plots showing distribution of TSS Load % Reductions at five BAMSC LID monitoring sites, WY 2024 – WY 2025

Appendix E

PFAS Analytes Acronyms and Chemical Names

APPENDIX E: PFAS ANALYTES ACRONYMS AND CHEMICAL NAMES

This table lists PFAS acronyms and chemical names, as well as precursor or terminal status for each listed PFAS analyte. Note that naming conventions for some PFAS analytes changed between WY 2024 and WY 2025 so both conventions are listed here for reference; all PFAS analytes referred to in the *IMR Part A: LID Monitoring (WY 2023-2025)* report use the WY 2025 acronyms and analyte names.

PFAS Acronym WY 2024	PFAS Analyte Name WY 2024	PFAS Acronym WY 2025	PFAS Analyte Name WY 2025	Precursor or Terminal
11Cl-PF3OUdS	Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid, 11-	11Cl-PF3OUdS	Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid, 11-	Terminal
9Cl-PF3ONS	Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid, 9-	9Cl-PF3ONS	Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid, 9-	Terminal
ADONA	Dioxa-3H-Perfluorononanoate Acid, 4,8-	ADONA	Dioxa-3H-Perfluorononanoic Acid, 4,8-	Terminal
EtFOSAA	Ethyl Perfluorooctane Sulfonamido Acetic Acid, N-	EtFOSAA	Ethyl Perfluorooctanesulfonamidoacetic Acid, N-	Precursor
EtFOSA	Ethyl-perfluorooctanesulfonamide, N-	EtFOSA	Ethyl Perfluorooctanesulfonamide, N-	Precursor
EtFOSE	Ethyl-perfluorooctanesulfonamidoethanol, N-	EtFOSE	Ethyl Perfluorooctanesulfonamidoethanol, N-	Precursor
3:3 FTCA	Fluorotelomer Carboxylic Acid, 3:3-	3:3FTCA	Perfluoropropyl Propanoic Acid, 3-	Precursor
5:3 FTCA	Fluorotelomer Carboxylic Acid, 5:3-	5:3FTCA	Perfluorooctanoic Acid, 2H,2H,3H,3H-	Precursor
7:3 FTCA	Fluorotelomer Carboxylic Acid, 7:3-	7:3FTCA	Perfluoroheptyl Propanoic Acid, 3-	Precursor
4:2 FTSA	Fluorotelomer Sulfonate, 4:2-	4:2FTS	Perfluorohexane Sulfonic Acid, 1H,1H,2H,2H-	Precursor
6:2 FTSA	Fluorotelomer Sulfonate, 6:2-	6:2FTS	Perfluorooctane Sulfonic Acid, 1H,1H,2H,2H-	Precursor
8:2 FTSA	Fluorotelomer Sulfonate, 8:2-	8:2FTS	Perfluorodecane Sulfonic acid, 1H,1H,2H,2H-	Precursor
meFOSAA	Methyl Perfluorooctane Sulfonamido Acetic Acid, N-	meFOSAA	Methyl Perfluorooctanesulfonamidoacetic Acid, N-	Precursor
meFOSA	Methyl-perfluorooctanesulfonamide, N-	meFOSA	Methyl Perfluorooctanesulfonamide, N-	Precursor
meFOSE	Methyl-perfluorooctanesulfonamidoethanol, N-	meFOSE	Methyl Perfluorooctanesulfonamidoethanol, N-	Precursor
PFEES	Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	Perfluoro(2-ethoxyethane)sulfonic Acid	Terminal
HFPO-DA	Perfluoro-2-Propoxypropanoic Acid	HFPO-DA	Hexafluoropropylene Oxide Dimer Acid	Terminal
NFDHA	Perfluoro-3,6-dioxaheptanoate	NFDHA	Nonafluoro-3,6-dioxaheptanoic acid	Terminal
PFMPA	Perfluoro-3-methoxypropanoate	PFMPA	Perfluoro-3-methoxypropanoic Acid	Terminal
PFMBA	Perfluoro-4-methoxybutanoate	PFMBA	Perfluoro-4-methoxybutanoic Acid	Terminal
PFBS	Perfluorobutanesulfonate	PFBS	Perfluorobutanesulfonic Acid	Terminal
PFBA	Perfluorobutanoate	PFBA	Perfluorobutanoic Acid	Terminal
PFDS	Perfluorodecanesulfonate	PFDS	Perfluorodecanesulfonic Acid	Terminal
PFDA	Perfluorodecanoate	PFDA	Perfluorodecanoic Acid	Terminal
PFDoDS	Perfluorododecanesulfonate	PFDoS	Perfluorododecanesulfonic Acid	Terminal
PFDoDA	Perfluorododecanoate	PFDoA	Perfluorododecanoic Acid	Terminal
PFHpS	Perfluoroheptanesulfonate	PFHpS	Perfluoroheptanesulfonic Acid	Terminal
PFHpA	Perfluoroheptanoate	PFHpA	Perfluoroheptanoic Acid	Terminal
PFHxS	Perfluorohexanesulfonate	PFHxS	Perfluorohexanesulfonic Acid	Terminal
PFHxA	Perfluorohexanoate	PFHxA	Perfluorohexanoic Acid	Terminal
PFNS	Perfluorononanesulfonate	PFNS	Perfluorononanesulfonic Acid	Terminal
PFNA	Perfluorononanoate	PFNA	Perfluorononanoic Acid	Terminal
FOSA	Perfluorooctanesulfonamide	PFOSA	Perfluorooctanesulfonamide	Precursor
PFOS	Perfluorooctanesulfonate	PFOS	Perfluorooctanesulfonic Acid	Terminal
PFOA	Perfluorooctanoate	PFOA	Perfluorooctanoic Acid	Terminal
PFPeS	Perfluoropentanesulfonate	PFPeS	Perfluoropentanesulfonic Acid	Terminal
PFPeA	Perfluoropentanoate	PFPeA	Perfluoropentanoic Acid	Terminal
PFTeDA	Perfluorotetradecanoate	PFTeDA	Perfluorotetradecanoic Acid	Terminal
PFtrDA	Perfluorotridecanoate	PFtrDA	Perfluorotridecanoic Acid	Terminal
PFUnA	Perfluoroundecanoate	PFUnA (PFUdA)	Perfluoroundecanoic Acid	Terminal