Watching Our Watersheds (WOW) Regional Trash Monitoring Project

Funded through USEPA WQIF Grant #98T61401

Integrated Monitoring Report: Trash Outfall Monitoring Progress Report

Water Year 2024 and 2025

Final March 31, 2026

Submitted in compliance with Provision C.8.h.iii.(2) of NPDES Permit No. CAS612008, Order No. R2-2022-0018

Prepared on behalf of:

- Alameda Countywide Clean Water Program
- Contra Costa Clean Water Program
- San Mateo Countywide Water Pollution Prevention Program
- Santa Clara Valley Urban Runoff Pollution Prevention Program
- Solano Stormwater Alliance

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ACCWP	Alameda Countywide Clean Water Program
BAMSC	Bay Area Municipal Stormwater Collaborative
Caltrans	California Department of Transportation
CBI	catch basin insert
CCCWP	Contra Costa Clean Water Program
CPAR	Corrective and Preventive Action Report
CPS	connector pipe screens
FTC	full trash capture
GAM	generalized additive modeling
HDS	hydrodynamic separator
IMR	integrated monitoring report
LID	low impact development
MBTS	multi-benefit treatment system
MQO	management quality objectives
MRP	municipal regional permit
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
OVTA	on-land visual trash assessment
POP	probability of precipitation
QAO	quality assurance officer
QAPP	quality assurance project plan
QPF	quantitative precipitation forecast
RCP	reinforced concrete pipe
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SMCWPPP	San Mateo Countywide Water Pollution Prevention Program
SSA	Solano Stormwater Alliance
SWRCB	State Water Resources Control Board
TAG	technical advisory group
UCMR	urban creeks monitoring report
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
WOW	Watching Our Watersheds
WY	water year

EXECUTIVE SUMMARY

Provision C.8.e of the Municipal Regional Stormwater National Pollutant Discharge Elimination System (NPDES) Permit (MRP 3.0) Order No. R2-2022-0018 issued by the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB or Regional Water Board) directs Permittees to conduct trash monitoring at municipal separate storm sewer system (MS4) outfalls and in receiving waters. It prescribes specific criteria, methods, and frequencies for monitoring locations that must be met to address the management and monitoring questions listed in MRP 3.0. This Trash Outfall Monitoring Integrated Monitoring Report (IMR) satisfies Provision C.8.h.v. of MRP 3.0 to summarize trash outfall monitoring accomplishments from the planning year of water year (WY) 2023 through the first two years of monitoring in WYs 2024 and 2025. The report was prepared collaboratively by member programs of the Bay Area Municipal Stormwater Collaborative (BAMSC) on behalf of MRP 3.0 Permittees.

Provision C.8.e trash monitoring was informed by the Trash Monitoring Technical Advisory Group (Trash TAG), which BAMSC formed in WY 2023. The Trash TAG is comprised of impartial science advisors and Regional Water Board staff. During WY 2023, Trash TAG meetings #1 and #2 were conducted in March and May 2023, respectively, with a focus on obtaining Trash TAG guidance and feedback on the development of the Trash Outfall Monitoring Plan and Quality Assurance Project Plan (QAPP). In WY 2024, Trash TAG meetings #3 and #4 were conducted in March and May 2024, respectively, with a focus on obtaining Trash TAG guidance and feedback on the development of the Trash Receiving Water Monitoring Plan and QAPP. TAG meeting #5, held on February 25, 2025, focused on presenting results and analyses from the first year of trash outfall monitoring (i.e., WY 2024) and discussions on potential adaptations to future monitoring approaches.

A minimum of 11 MS4 outfalls regionwide must be monitored during at least three wet weather events per year, beginning October 1, 2023. Monitoring must be conducted with netting devices (or equivalent devices) attached to the end of outfall pipes or at other equivalent locations that allow for the capture of trash discharging through the MS4. Targeted outfalls must drain areas that are controlled to a low trash generation level (i.e., less than 5 gallons per acre per year) and must be representative of the types of trash controls present across the region. Provision C.8.e.ii also requires direct measurement of flow at the monitoring station (to calculate loading) and collection of data on the type of material collected.

A total of 65 trash samples were collected over the two-year monitoring period (WYs 2024 and 2025). During WY 2024, 30 trash samples were collected during three storm events at 10 of the 11 monitoring locations. A minimum of three storm events were sampled at 9 of the 11 monitoring locations for a total of 35 samples collected during WY 2025; only two storms were sampled at two sites in Santa Clara County (SC-STE and SC-COY) due to equipment malfunctions or vandalism. Six trash samples were collected at site SSA-LOTZ during WY 2025 to make up for construction delays at the monitoring location that precluded monitoring in WY 2024.

Each trash sample was characterized by measuring the total volume of collected trash and the volume of trash categorized into 13 categories. In addition, a qualitative assessment of each catchment area draining to the monitored outfall was conducted prior to the first monitoring event, at a minimum, to evaluate the levels of trash observed on streets and sidewalks that may contribute to the trash measured at the outfall. The assessments included observations of trash sources and trash controls implemented in the catchment.

The total trash volumes measured during the 65 sample events and standardized by contributing area ranged between 0 and 0.41 gallons per acre for each event. Most samples (45 of 65, 63%) were below 0.05 gallons/acre during each event. Only six samples were higher than 0.1 gallons/acre. The highest trash volumes per unit area measured in each county occurred at site PCH in Contra Costa (0.41 gallons/acre), PUBSAF in Alameda (0.30 gallons/acre), site SFC in Santa Clara (0.21 gallons/acre), and site PIL in San Mateo (0.07 gallons/acre).

Field measurements were used to calculate flow for all non-sampled storms during each water year. Water flows measured during sampled storm events in the outfall pipes were impacted at most sites due to the material (trash and debris) captured in the nets impeding flow. Therefore, flows for sample events were calculated using HEC-HMS rainfall-runoff models for timeframes when nets were installed. Flow data (both measured and calculated) were used to develop annual hydrographs for each site. Rainfall data were obtained for one or more rain gauges in proximity to the monitored catchment, and rainfall totals for each storm event were calculated using an inverse distance squared weighted average.

BAMSC Programs used either linear regression or generalized additive modeling (GAM) statistical analyses to estimate annual trash loads for WYs 2024 and 2025. Trash volumes (gallons/acre) for unsampled storms were calculated by using a site-specific equation developed via the linear regression or GAM model. Four independent variables (peak flow, total flow, maximum rainfall intensity, and antecedent dry period) were compared with measured trash volumes to establish the equations. The estimated annual trash load for each site during each WY was then calculated as the sum of the trash loads measured or calculated for all defined storm events in that WY. Across the nine modeled sites, one of the four independent variables evaluated was preliminarily identified as the best indicator of trash loading. Estimated trash loading rates for each WY ranged from 0.21 gallons/acre to 3.6 gallons/acre for all sites. Two sites (AC-CTYCTR and CC-PCH) had the highest trash loading rates, 2.1 to 3.6 gallons/acre, respectively. The annual rates for the remaining sites were all below 1.0 gallon/acre during the two-year monitoring period.

BAMSC identified several refinements to the trash outfall monitoring approach to provide greater flexibility in selecting/sampling storms for the trash monitoring program, thereby improving estimates of annual trash loadings. Refinements include sampling a wider range of storm conditions with varying antecedent dry periods (when limited trash may have been mobilized) to provide data useful as inputs to a model being developed to estimate annual trash loads from monitored watersheds. In addition, place less emphasis on sampling storms predicted to be at or above the design standard storm (one-year, one-hour), especially at sites where nets frequently detach when rainfall intensity reaches the one-year, one-hour storm frequency. In addition, trash data collected for storms below the full trash capture design standard will provide more valuable data for estimating annual trash loading in catchments with full trash capture devices.

The collaborating BAMSC partners anticipate that the trash outfall monitoring program will continue into the next permit term and see value in continuing it to refine calculations of trash loading and to evaluate the effectiveness of trash management actions. Several refinements to the trash outfall monitoring program are recommended to increase the utility and efficiency of the program: 1) eliminating trash characterization requirements since these data have not proven useful for understanding whether existing trash controls are working and have limited utility to identify gaps in existing trash controls; 2) Allow for flexibility in selecting monitoring sites so that monitoring can either be continued at existing sites or started at new sites, based on a combination of data needs and practicality; 3) Include the option of developing flow data via rainfall-runoff models as opposed to monitoring flow at the monitoring site; 4) Set a practical number of required storm events to be monitored over the 5-year permit term (e.g., 12 to 15 during the permit term), but provide flexibility on the annual minimum; 5) If required to change the location of existing monitoring sites, a year to design, fabricate, and install the required netting devices and obtain necessary encroachment and environmental permits should be afforded, and the total required storm events to be monitoring over the permit term should be reduced accordingly (e.g., from 15 to 12 events, or 12 to 9 events) for those new sites; 6) Convene Trash TAG meetings as-needed rather than with a mandatory frequency; and 7) Streamline reporting requirements to require annual data submittal, but analysis and interpretation during the latter portion of the permit term.

1. INTRODUCTION

On behalf of all public agencies (i.e., Permittees) subject to the Municipal Regional Stormwater NPDES Permit (MRP 3.0) Order No. R2-2022-0018 issued by SFBRWQCB or Regional Water Board, this Trash Outfall Monitoring Integrated Monitoring Report (IMR) was prepared collaboratively by members of the BAMSC Trash Monitoring Workgroup. Members of the BAMSC Trash Monitoring Workgroup include the following countywide stormwater programs:

- Alameda Countywide Clean Water Program (ACCWP)
- Contra Costa Clean Water Program (CCCWP)
- San Mateo Countywide Water Pollution Prevention Program (SMCWPPP)
- Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)
- Solano Stormwater Alliance (SSA)

This report fulfills the requirements of Provision C.8.h.v. of MRP 3.0 for summarizing trash monitoring accomplishments, beginning with the planning phase in Water Year (WY)[1] 2023 and the subsequent two years of monitoring in WYs 2024 and 2025, conducted in compliance with Provision C.8.e (Trash Monitoring) into an IMR. Section 2.5 provides a summary of the required information to be included in the IMR. The trash outfall IMR is presented herein; the trash receiving water IMR was submitted to the Regional Water Board as a separate report.

This report was prepared as a task defined under the Watching Our Watersheds (WOW) regional trash monitoring project, which is funded by a grant from the United States Environmental Protection Agency (USEPA) Water Quality Improvement Fund. The WOW project addresses several MRP Provision C.8.e requirements for trash monitoring, including the development of regional trash monitoring progress reports and integrated monitoring reports.

[1] Most hydrologic monitoring occurs for a period defined as a water year (WY), which begins on October 1 and ends on September 30 of the named year. This report includes all monitoring activity for WYs 2024 and 2025, which started on October 1, 2023 and concluded September 30, 2025.

2. BACKGROUND

The level of trash in California's receiving waters has increased substantially over the past few decades, causing one of the state's most significant water quality issues (SWRCB 2015). Over the last decade, MRP Permittees have invested significant public resources to implement source controls and stormwater infrastructure improvements and upgrades to reduce the amount of trash discharged from their MS4s to receiving waters. Many of these actions are prescribed by Provision C.10 of the MRP, which mandates that Permittees achieve a 100% reduction[2] of trash in stormwater discharges from baseline (2009) levels by June 2025. To date, most Permittees have been able to achieve the goal of 100% reduction, and the majority of those municipalities that did not meet the goal have developed plans to achieve 100% by early 2026.

With the adoption of MRP 3.0 in 2022, the Regional Water Board also added significant trash monitoring requirements. Provision C.8.e of MRP 3.0 directs the Permittees to conduct trash monitoring at MS4 outfalls and in receiving waters, and prescribes specific monitoring location criteria, methods, and frequencies that must be achieved to address the management questions and monitoring questions listed below. Provision C.8.e.v required Permittees to submit a "collective" (i.e., regional) trash monitoring plan that demonstrates how the requirements in Provision C.8.e will be met. The Permittees submitted the Trash Outfall Monitoring Plan to the Regional Water Board Executive Officer for approval on July 31, 2023 (BAMSC 2023a), and the Plan was subsequently approved.[3]

The Trash Outfall Monitoring Plan was designed to address the following management and monitoring questions listed in MRP 3.0:

Management Questions

1. Have Permittees' trash management actions effectively prevented trash from their jurisdictions from discharging to receiving waters?
2. Are discharges of trash from areas within trash management areas controlled to a low trash generation level, causing and/or contributing to adverse trash impacts in receiving water?

Monitoring Questions

1. What is the trash condition and approximate level of trash (volume, type, and size) within and discharging into receiving waters in areas that receive MS4 runoff controlled to a low trash generation via the installation of full trash capture devices, or the implementation of other trash management actions equivalent to full trash capture systems?
2. Does the level of trash in the receiving water correlate strongly with the conditions of the tributary drainage area of the MS4?

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[2] The methods used to demonstrate 100% trash load reduction are prescribed in the MRP. Achievement of the MRP 100% trash load reduction benchmark does not mean that 100% of the trash discharged has been prevented or intercepted. As described in the MRP, the achievement of the benchmark means that land areas contributing trash to an MS4 are either treated by certified Full Trash Capture (FTC) systems or controlled to a level of low trash generation.

[3] A separate trash receiving water monitoring plan was submitted on July 31, 2024 (BAMSC 2024c). Results of trash receiving water monitoring are submitted in a separate report.

2.1 Monitoring Approach

Provision C.8.e.ii describes the specific monitoring methods, number of sites, types of sampling events, and monitoring frequency that must be implemented during the term of MRP 3.0 (i.e., 2022--2027). A summary of these requirements is described below.

Outfall Monitoring

Beginning October 1, 2023, a minimum of 11 outfalls regionwide must be monitored during a minimum of three wet weather events per year. The required allocation of sites among the stormwater programs is listed in Table 1. Monitoring must be conducted with netting devices (or equivalent devices) attached to the end of the outfall pipe or other equivalent location that allows for capture of trash discharging through the MS4. Targeted outfalls must drain areas that are controlled to the low trash generation level and must be representative with respect to the types of trash controls present across the region. Provision C.8.e.ii also requires direct measurement of flow at the monitoring station (to calculate loading) and collection of data on the type of material collected.

Receiving Water Monitoring

A pilot program to directly sample sections of receiving waters that receive runoff primarily from MS4 outfalls that drain tributary areas controlled to the low trash generation level must begin October 1, 2024. At least six receiving water sites regionwide must be monitored during at least three wet weather events per year. The required allocation among the counties is listed in Table 1. Targeted storm events should be likely to result in discharges of trash through the MS4 system, and targeted receiving water monitoring locations should not be downstream of direct discharge sites (e.g., homeless encampments, illegal dumping sites). Provision C.8.e.ii also requires direct measurement of flow at the monitoring station (to calculate loading) and collection of data on the type of material collected. Results from the first year of receiving water trash monitoring are provided in the Receiving Water Trash Integrated Monitoring Report, which is included as an attachment to the Urban Creeks Monitoring Report (WY 2025).

Table 1. Number of MRP 3.0-required trash monitoring sites for each monitoring program

County	# of Outfall Sites	# of Receiving Water Sites
Alameda	3	2
Contra Costa	2	1
Santa Clara	3	2
San Mateo	2	1
Solano	1	0
Totals	**11**	**6**

2.2 Technical Advisory Group (TAG)

To assist in the development and implementation of a scientifically-sound trash monitoring plan, Provision C.8.e.iv requires Permittees to form and convene a technical advisory group composed of impartial science advisors and Regional Water Board staff. The Trash TAG members include monitoring experts from throughout California:

- Tony Hale, Ph.D. – Director of the Environmental Informatics Program, San Francisco Estuary Institute (SFEI)
- Shelly Moore – Executive Director, Moore Institute for Plastic Pollution Research
- Tom Mumley, Ph.D.[4] – Assistant Executive Officer, San Francisco Bay Regional Water Board
- Dawn Petschauer[5] – Stormwater Program Administrator, City of Pasadena
- Ted Von Bitner, PhD – Assistant Vice President, WSP USA

To date, five Trash TAG meetings have been convened, with a total of eight meetings planned over the MRP 3.0 permit term. During WY 2023, TAG meetings #1 and #2 were conducted in March and May 2023, respectively, with a focus on obtaining Trash TAG guidance and feedback on the development of the Trash Outfall Monitoring Plan and QAPP. In WY 2024, TAG meetings #3 and #4 were conducted in March and May 2024, respectively, with a focus on obtaining Trash TAG guidance and feedback on the development of the Trash Receiving Water Monitoring Plan and QAPP.

TAG Meeting #5, held on February 25, 2025, focused on presenting results and analyses from the first year of trash outfall monitoring (i.e., WY 2024) and discussions on potential adaptations to future monitoring approaches. Subsequent meetings will be held at least annually to provide continued feedback regarding the implementation of both Trash Monitoring Plans. Trash TAG Meeting #6 is planned for early 2026.

Provision C.8.e.v also requires Permittees to provide opportunities for input on the development of the Trash Monitoring Plan(s) by interested parties and scientific experts other than those participating in the TAG. As described in the trash outfall and receiving water monitoring plans, this requirement was satisfied by seeking input from stakeholders that participate in the BAMSC Trash Subcommittee (which includes California Department of Transportation [Caltrans], local watershed groups, USEPA, university professors and academics, and Save the Bay) and other organizations, such as San Francisco Baykeeper.

2.3 Trash Monitoring Plan and QAPP

In WY 2023, the BAMSC Trash Monitoring Workgroup developed a Regional Trash Outfall Monitoring Plan (Version 1.0) (BAMSC 2023a) and QAPP (Version 1.0) (BAMSC 2023b) that met the requirements of Provision C.8.e of the MRP. The Regional Trash Outfall Monitoring Plan and QAPP were submitted to the Regional Water Board Executive Officer for approval on July 31, 2023, in compliance with the deadline required in Provision C.8.e.v of MRP 3.0. On August 31, 2023, the Regional Water Board Executive Officer conditionally approved both Plans, requiring that an updated version with changes be submitted on July 31, 2024. During the subsequent year, the BAMSC Workgroup revised the Regional Trash Outfall Monitoring Plan (Version 2.0) (BAMSC 2024a)

[4] Dr. Mumley retired from his position at the Regional Water Board in June 2024. His replacement on the Trash TAG is Rebecca Nordenholt, Senior Environmental Scientist, Regional Water Board.

[5] As of January 2026, Dawn Petschauer is no longer on the TAG; a replacement member to be determined.

and QAPP (Version 2.0) (BAMSC 2024b) in response to the requests included in the conditional approval and resubmitted those documents to the Water Board on July 31, 2024. Final approval for both the Monitoring Plan and QAPP was provided by the Water Board in a letter sent by email on January 30, 2025.

2.4 Reporting Requirements

Along with each Urban Creeks Monitoring Report (UCMR), Permittees are required to submit annual trash monitoring progress reports no later than March 31 reporting on all data collected during the previous water year. In lieu of the WY 2025 UCMR, Permittees are required to submit a comprehensive IMR no later than March 31, 2026. This IMR reports on all the data collected since the previous IMR. For trash outfall monitoring, this report covers planning actions conducted in WY 2023, data collected in WYs 2024 and 2025, and includes the information requested in Provision C.8.h.v of the MRP. The types of information and corresponding section of this report is summarized in Table 2.

Table 2. Information listed in Provision C.8.h.v provided in this report.

Information	Section in Report
Narrative description of monitoring conducted, including the number of sites monitored and the number of monitoring events completed	Section 3.4.1
Description of storm events that were sampled, including the date(s) and times when samples were collected, intensity and duration of the storm event, a description of where along the hydrograph the storm event was sampled, and justification used to determine the storm event was of appropriate size to displace and/or mobilize the transport of trash though the MS4 system	Section 3.4.1, Attachment B
Narrative description, including maps, of any MS4 outfalls, homeless encampments, and illegal dumping sites, located upstream of each outfall monitoring sample site	Attachment B
Description and the results of data analysis methods, including statistical analyses	Sections 3.4.2 and 3.4.4
Results and lessons learned	Section 4.3
Data quality assurance procedures that were implemented for samples collected	Section 3.5
Monitoring events (including locations and methods) planned for the subsequent fiscal year(s)	Section 5.2
Updates of required Initial Trash Monitoring Plan elements	Section 5.2, Attachment B
Summary of budget for each monitoring requirement[1]	NA
With cause and justification, recommendations for changes to any of the elements of Provision C.8.e	Section 5.3

[1] Budget summaries for Trash Monitoring and other C.8 monitoring programs are reported separately by each of the participating BAMSC programs.

3. TRASH OUTFALL MONITORING

During WYs 2024[6] and 2025, Member Programs from the BAMSC Trash Monitoring Workgroup conducted trash monitoring at 11 regionwide outfall monitoring locations.

Key components of the outfall monitoring program are summarized in the sections below. These components include:

- Monitoring site locations
- Sampling methods
- Data analysis methods
- Results
- Data quality assessment

3.1 Monitoring Site Locations

Eleven trash outfall locations were selected for trash outfall monitoring. Outfall monitoring sites are listed in Table 2 and illustrated in Figure 1. The site selection process is described in detail in the Trash Outfall Monitoring Plan (BAMSC 2024a). Regionwide, there were very few outfalls that met the site selection criteria listed in MRP 3.0 and, as discussed with the TAG, could safely and feasibly be monitored. However, the required number of sites was identified, and collectively, the sites provide a broad range of watershed conditions that are generally representative of trash-generating areas throughout the region. At the request of the Water Board, one monitoring site (AC-CIVIC) in Alameda County was discontinued after year one (WY 2024) monitoring. This site was replaced by site AC-CTYCTR, which was monitored starting in year two (WY 2025). The new site was selected to increase the spatial distribution of the sites in Alameda County.

Table 3. Trash outfall monitoring locations

County	Station ID	Waterbody	Location	Latitude	Longitude	Catchment Size (acres)	Outfall Diameter (in)
Alameda	AC-PUBSAF	Alamo Canal	Dublin	37.70317	-121.91971	11	36
Alameda	AC-OUTBK	Dublin Creek	Dublin	37.69947	-121.93204	19	36
Alameda	AC-CIVIC[1]	Alamo Canal	Dublin	37.70333	-121.91934	13	24
Alameda	AC-CTYCTR[2]	San Lorenzo Creek	Hayward	37.67764	-122.08227	3.7	18
Contra Costa	CC-PCH	Grayson Creek	Pacheco	37.98345	-122.0684	3.9	18
Contra Costa	CC-WC	Walnut Creek	Walnut Creek	37.90346	-122.05934	1.0	15
San Mateo	SM-PIL	Canal to Pilarcitos Creek	Half Moon Bay	37.46929	-122.43381	86	47
San Mateo	SM-SBS	Canal to Steinberger Slough	San Carlos	37.5123	-122.25785	57	30
Santa Clara	SC-SFC	San Francisquito Creek	Palo Alto	37.44610	-122.17248	60	42
Santa Clara	SC-STE	Stevens Creek	Mountain View	37.37815	-122.06934	137	54
Santa Clara	SC-COY	Coyote Creek	San Jose	37.32246	-121.86009	400	60
Solano	SSA-LOTZ	Suisun Slough	Suisun City	38.24331	-122.03866	4	36

1 Monitoring site for WY 2024 only
2 New monitoring sites beginning in WY 2025

[6] Due to contracting and construction delays, the Solano County site (SSA-LOTZ) was not monitored in WY 2024; facility construction was completed in time to conduct monitoring in WY 2025.

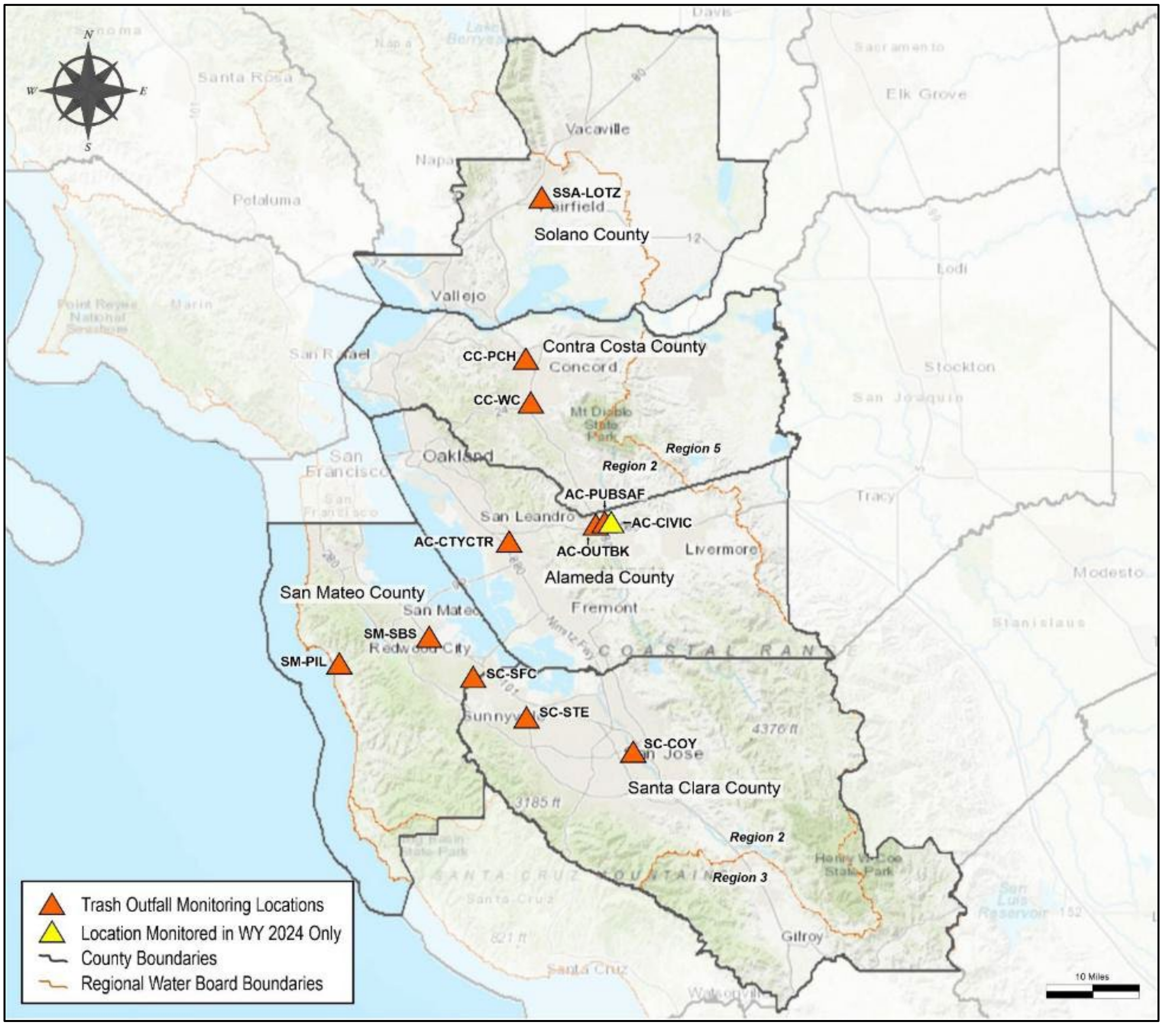

Figure 1. Trash outfall monitoring sites

3.2 Sampling Methods

The BAMSC Trash Monitoring Workgroup developed a regionally consistent approach to outfall trash monitoring and data evaluation, informed by recommendations from Trash TAG members. This section summarizes the sampling equipment and methods used to monitor trash at outfalls.

3.2.1 Sampling Equipment

Each stormwater program, except SSA, selected Oldcastle NetTech™ Gross Pollutant Trap devices with removable 5 mm mesh nets as the trash collection devices (Figure 2). SSA used an alternative basket-style netting system, designed by Fabco® Industries, which was installed at the overflow drain of a multi-benefit treatment system (MBTS). The trash net component for both systems is installed prior to each targeted storm event and removed after each event.

In-Situ Level TROLL® water level sensors were installed at most sites to monitor the flow rate within the storm drainpipe upstream of the trash net; for site SSA-LOTZ, ponding depth adjacent to the overflow pipe was measured to calculate flow into the overflow pipe. Water depth measurements are recorded for the entire wet season. During the first year of monitoring (WY 2024) at the two San

Mateo sites, water depth sensors did not accurately measure water depth due to low gradients and vegetation in the channel, which caused water to back up into the storm drainpipe. In WY 2025, the flow depth sensor at site SM-PIL was moved to a section with a steeper gradient, approximately 100 feet downstream of the outfall (Figure 2). There were no options to relocate the depth sensor at site SM-SBS (which was also impacted by tidal exchange); therefore, flow monitoring was discontinued in WY 2025 and replaced with flow modeling.

A) Trash net attached to outfall (site SC-COY
B) Basket install at overflow drain in MBTS Facility (site SSA-LOTZ)
C) Water level sensor installed in storm drainpipe (site SC-STE)
D) Water level sensor installed in trapezoidal channel, below outfall (site SM-PIL)

Figure 2. Monitoring equipment is installed at storm drain outfalls.

3.2.2 Qualitative Assessment of Trash in Catchments

In addition to quantitative trash monitoring and flow monitoring, a qualitative assessment of each monitoring catchment was conducted (at a minimum) during September 2023 and 2024, prior to the first monitoring event for each WY. The assessments included observations of trash levels and the trash controls implemented in the catchment area draining to the outfalls, as well as observations of trash at the outfalls and their vicinity (e.g., creek banks, drainage ditches). Assessment observations were documented in Catchment Characterization Log Sheets.

Depending on the size of the catchment, the assessments were conducted as windshield or walking surveys. They included the entire catchment or specific areas of interest (e.g., potentially high- or moderate-trash-generation areas) (see Section 4 and Attachment B for site-specific details).

3.2.3 Sampling Events

Each stormwater program is required to monitor trash at outfalls during three storm events each WY over the duration of MRP 3.0, beginning October 1, 2023 (WYs 2024-2027). The type of storm that is targeted for a particular sampling event may vary based on the characteristics of the catchment, the prior storms monitored at a given location, information gained through previous monitoring, or other factors; however, in general, stormwater programs use the following mobilization criteria guidelines:

- Quantitative precipitation forecast (QPF) of approximately 0.25 inch of rain or greater over 24 hours;
- Probability of precipitation (POP) of approximately 70% or greater; and
- Antecedent dry period of approximately 72 hours or greater (defined as no event exceeding 0.1 inch of cumulative rainfall over a 24-hour period).

Using these guidelines, each BAMSC Member Program also attempted to meet the MRP suggested criteria to monitor the following types of storms:

- Storms that trigger trash discharge and trash transport through the MS4 (0.25 inch of rain over a 24-hour period);
- The first significant storm event of each water year; and
- One storm per year forecasted to exceed the full capture design standard storm (i.e., the one-year, one-hour storm event).

The uncertainties in weather forecasting may have prevented the collection of these events. At any given location, the design storm may not occur in a given year, or if it does, it may not be well forecast (too high or too low). Thus, the design storm is more difficult to accurately sample than other storms, which don’t have as specific a rainfall target.

Similarly, the first significant storm event may have occurred before the start of a given water year. It may fall outside of the monitoring window or occur when field staff are unavailable to mobilize (e.g., holidays).

3.2.4 Sample/Data Collection

Trash nets were installed at each stormwater outfall one to two days prior to the targeted storm event. Following each monitoring event, trash nets were removed from the outfall and transported to a secure off-site dewatering and storage location, where the nets (and material in the nets) were stored for approximately one week to allow the water to drain from the nets and the material contained within to partially dry. Following the dewatering period, the material captured in the net was removed and placed on a large table. The material was then thoroughly sorted according to methods described in the Trash Outfall Monitoring Plan and QAPP, and all trash items/pieces >5mm were separated from organic debris (e.g., soil, sand, leaves, branches). All items/pieces identified as trash were placed into storage containers (i.e., plastic or mesh bags with < 5mm openings), and the organic debris was disposed of appropriately. Trash in each container associated with a specific site and storm event was considered a "trash sample."

3.2.5 Trash Characterization

Each trash sample was characterized by measuring the volume of trash items/pieces following protocols defined in the *Standard Operating Procedure for Trash Characterization* - Appendix E of the Trash Outfall Monitoring Plan (BAMSC 2024a). Trash items/pieces were sorted into 13 different categories, and the volume of trash in each category was measured using containers that ranged in size from 50 mL graduated cylinders to 5-gallon buckets, depending on the amount of trash present in a sample. The total volume of trash items/pieces that did not fit into a 5-gallon bucket was estimated and noted on trash characterization collection forms.

3.2.6 Flow Measurement/Calculations

At various intervals throughout the wet season, field crews downloaded data from water level sensors located in / adjacent to each outfall. Flow rates from outfalls were derived by converting water level data to flow data using Manning's Equation for a partially full pipe for sites with standard outfalls and equations for broad-crested and sharp-crested weirs for site SSA-LOTZ. Flow data were used to confirm that water was discharged through the MS4 during storm events and (as described further below) to support the development of trash loading rate estimates. Water level/flow data were collected from October 1 through April 30, for both WYs 2024 and 2025, to assess the entire wet weather season[7], the potential timeframe in which trash would potentially be discharged via an MS4.

Water flows measured during sampled storm events in the outfall pipes were affected at most sites, with material (trash and debris) captured in the nets impeding flow. Therefore, flows for sample events were calculated using HEC-HMS rainfall-runoff models for the time periods when nets were installed. Field measurements were used to calculate flow for all non-sampled storms during each water year. Flow data model accuracy was assured by calibrating the models to field-collected flow data.[8] and by comparing values measured in similarly sized catchments with aligned land-use characteristics.

Water level loggers were installed in September, prior to the monitoring period and were retrieved at the end of April . All loggers were factory calibrated each year.

3.2.7 Peak Flow Calculations for Full Trash Capture Design Storms

Full Trash Capture (FTC) systems that have been certified by the State Water Resources Control Board (State Water Board) to intercept trash in stormwater sufficiently were installed by Permittees in many of the outfall monitoring catchments. These FTC systems are designed to intercept trash in peak flows generated by storm events at or below a certain size (i.e., at or below the one-year, one-hour storm event). Storm events of this size are called "FTC Design Storms" and vary by location, based on watershed characteristics (e.g., slope, imperviousness, etc.) and the historical frequency and intensity of storm events that occur in the applicable geographical area. Identifying the peak

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[7] California weather is generally characterized by a wet season (i.e., October 1 through April 30) and an extended dry season (i.e., late spring through early fall) (Caltrans 2020).

[8] Flow measurements in the field were not used to validate modeled flow at site SM-PIL during WY 2024 or site SM-SBS (both years).

flow associated with the FTC design storms allows BAMSC member programs to understand better which storm events (or portions of events) exceed the FTC design storm size threshold and are not expected to intercept all trash transported through the MS4.

To estimate trash loading from monitored stormwater outfalls and assess whether the FTC systems installed in the associated upstream catchments are effectively intercepting trash during storms at or below the FTC design storm (i.e., the one-year, one-hour storm event), the peak flow associated with the FTC design storm for each outfall catchment was calculated using the Rational Method. A technical memorandum describing the methods and preliminary results of the design storm analysis was developed and is included in this report as Attachment A. The results presented in Attachment A should be considered preliminary due to discrepancies in some catchments between design storms predicted from rainfall intensities and those predicted from peak flows calculated using the Rational Method. Refined calculations may be conducted in the future for some or all of the catchment areas, and accordingly, the estimated design storm and associated peak flows included in Attachment A may be revised.

3.3 Data Analysis Methods

A combination of graphical and statistical methods was used to calculate and assess storm-event and annual trash-loading rates, and the degree to which different types of trash were observed across space (sites) and time (events or WYs) at outfall monitoring sites. Comparisons between trash volumes measured during storm events (i.e., dependent parameter) and independent parameters, antecedent dry weather periods, sample/storm durations, total rainfall, peak rainfall intensities, peak flows, and total flows were evaluated to assist with developing storm event and annual trash loading rates at all sites. Relationships between dependent and independent variables were evaluated using statistical analyses (linear regression or generalized additive modeling (GAM) statistical analysis). Linear regression is a statistical method that models the relationship between a dependent variable and one or more independent variables by fitting a straight line that best predicts the dependent variable. GAM analysis is a flexible modeling technique in which the relationship between predictor and response variables is captured by smooth functions that can be both linear and non-linear.

In developing trash loading rate estimates, measured trash volumes were used for sampled events, and estimated trash volumes (gallons/acre) from the linear regression or GAM model with the best fit were used for unsampled storm events. More detailed descriptions of each model and annual load calculation are provided in Attachment B. The preliminary loading rate estimates presented using these methods should be considered exploratory and subject to change based on additional analyses (e.g., multivariate statistics) that will be evaluated in subsequent years as more trash monitoring data become available.

3.4 Results

This section presents data results for monitoring data collected in WYs 2024 and 2025 at all outfall monitoring sites. More detailed results for each site are presented in the summaries included in Attachment B, developed by each applicable BAMSC Member Program.

3.4.1 Sample Events

A total of 65 trash samples were collected over the two-year monitoring period (Table 3). During WY 2024, 30 trash samples were collected during three storm events at 10 of the 11 monitoring locations. At least three storm events were sampled at 9 of the 11 monitoring locations for a total of 35 samples collected during WY 2025; only two storms were sampled at two sites in Santa Clara County (SC-STE and SC-COY) due to equipment malfunctions or vandalism. Six trash samples were collected at site SSA-LOTZ during WY 2025 to make up for construction delays at the monitoring location that precluded monitoring in WY 2024. An extra trash sample was collected at site SM-PIL, for a total of four samples during WY 2025.

The BAMSC Member Programs attempted to meet all the MRP 3.0 criteria suggested for storm monitoring (summarized in Section 3.2.3). Samples were collected during the first seasonal flush at all sites for both WYs, except for site SC-COY on November 18, 2024, when the net was vandalized, and the sample was lost. Sample events were also conducted during storms that were predicted to exceed the one-year, one-hour design storm for both WYs at most sites. Sample events for storms predicted to exceed design storm were not conducted at sites SC-STE and SC-COY due to lower rainfall intensities compared to other sites (WY 2024) or consistent net malfunction during larger storm events (WY 2025).

Seven of the 65 samples (11%) collected were partial samples;[9] two of these events occurred in Alameda County, one in San Mateo County, and four in Santa Clara County. Ten sample events at four sites were disqualified due to equipment failure or vandalism; eight of the disqualified samples occurred at two sites in Santa Clara County (SC-STE and SC-COY). Sites SC-, STE, and SC-COY have relatively large catchment areas compared to the other outfall sites (137 and 400 acres, respectively; as reported in Table 2). The high number of storm events with equipment failure may suggest that these catchments exceed the upper size limit for effective monitoring using the trash net method described in MRP 3.0.

The storm characteristics for each sample event, including storm start and end date, antecedent dry period (days), total precipitation (inches), maximum rainfall intensity (inches/hour), peak flow rate (cfs), and total flow volume (cfs), are summarized in Table 4. The sample duration (i.e., the period during which nets were deployed during each storm) is also provided. Characteristics and qualifiers for sampled storm events, such as first seasonal flush, partial samples (i.e., net detached during storm), and when storms exceeded the 1-year, 1-hour (design storm) using measured rainfall intensity and peak flow (see Section 3.2.7, Attachment A) are also indicated in Table 4.

[9] Partial samples include samples that were collected for at least 70% of the storm prior to net detaching from outfall. Sample events that include less than 70% of the storm duration were disqualified.

Table 4. Trash outfall sample events over the two-year monitoring period (WYs 2024 and 2025).

County	Site	WY 2024							WY 2025									Total Samples
		13-Nov	15-Dec	29-Dec	18-Jan	30-Jan	14-Feb	29-Feb	31-Oct	11-Nov	21-Nov	11-Dec	30-Jan	3-Feb	11-Feb	12-Mar	30-Mar	
Alameda	AC-CTYCTR									F		S		D				3
	AC-OUTBK	F			Y	D	S			F		S		D				6
	AC-PUBSAF	F			D	D				F		S		D				6
	AC-CIVIC	F			D	D												3
Contra Costa	CC-PCH	F			D	D				F			S		D			6
	CC-WC	F			D	D				F			S		D			6
Santa Clara	SC-SFC	F			D	S				F		S			D			6
	SC-STE	F		Y	S	X		S	F	Y		S	Y			Y		5
	SC-COY	X	S	S	S					F		X	X			S		5
San Mateo	SM-PIL	F			D	S			F	F		S			D			7
	SM-SBS	F			D	S				F		S			Z	S		6
Solano	SSA-LOTZ										S	S	S		D	S	S	6
																	Total Samples	**65**

D = Event forecast to exceed one-year, one-hour design standard
F = First Flush
S = Event forecast to exceed 0.25 inch over 12 hours
X = Vandalism
Y = Equipment Failure
Z =Other

Green	Complete Sample Event
Yellow	Partial Sample Event (Capture > 70% of storm event)
Red	Disqualified Sample Event
Gray	Water Year Not Sampled at this Site

Table 5. Sample duration, rainfall, and flow characteristics for each monitoring event during the two-year monitoring period (WYs 2024 and 2025).

County	Site	WY	Storm Began	Storm Finished	Sample Duration (hrs)	Antecedent Dry (days)	Rainfall Total (in)	Maximum Rainfall Intensity (in/hr)	Peak Flow (cfs)	Total Flow (cf)	First Seasonal Flush[1]	Partial Sample	Forecast Rainfall Exceeds Design Storm[2]	Measured Rainfall Exceeds Design Storm[3]	Peak Flow Exceeded Design Storm[4]	Trash Volume (gal/acre)
Alameda	AC-CIVIC	2024	11/15/23	11/18/23	72	9	0.4	0.1	0.6	4,069	X					0.01
			01/19/24	01/22/24	68	3	1.5	0.23	0.9	14,680			X			0.04
			01/31/24	02/02/24	42	6	1.2	0.21	0.9	11,899						0.04
	AC-CTYCTR	2025	11/11/24	11/11/24	10	9	0.3	0.09	0.1	73	X					0.12
			12/12/24	12/13/24	32	16	0.9	0.23	0.1	900						0.10
			02/03/25	02/04/25	20	2	1.5	0.41	0.2	2,204		X				0.04
	AC-OUTBK	2024	11/15/23	11/18/23	72	9	0.5	0.1	2.6	14,459	X					0
			01/31/24	02/02/24	42	6	1.2	0.21	4.4	54,277						0.04
			02/14/24	02/20/24	145	9	1.9	0.37	6.0	90,133						0.05
		2025	11/11/24	11/11/24	3	40	0.3	0.2	2.2	5,940	X					0.01
			12/12/24	12/12/24	4	16	0.6	0.18	3.5	33,240						0.00004
			02/04/25	02/04/25	17	37	1.1	0.36	5.4	76,920						0.07
	AC-PUBSAF	2024	11/15/23	11/18/23	72	9	0.4	0.1	1.6	6,189	X					0.02
			01/19/24	01/22/24	68	3	1.5	0.23	4.4	25,328			X		X	0.04
			01/31/24	02/02/24	42	6	1.2	0.21	3.6	20,311						0.03
		2025	11/11/24	11/11/24	3	40	0.3	0.2	2.9	8,420	X					0.30
			12/12/24	12/12/24	4	16	0.6	0.18	3.7	27,320						0.02
			02/04/25	02/04/25	17	37	1.1	0.36	4.9	57,560					X	0.07
Contra Costa	CC-PCH	2024	11/17/23	11/18/23	16	170	0.4	0.14	0.5	3,187	X					0.06
			01/21/24	01/22/24	7	1	0.5	0.18	0.5	3,025			X			0.08
			01/31/24	02/01/24	19	7	1.3	0.34	2.4	11,539			X	X	X	0.41
		2025	11/11/24	11/12/24	6	189	0.2	0.11	0.2	763	X					0.02
			02/03/25	02/03/25	73	28	1.3	0.12	0.1	4,072						0.0002
			02/14/25	02/14/25	32	7	3.1	0.52	11.8	106,382				X	X	0.037
	CC-WC	2024	11/17/23	11/18/23	25	12	0.4	0.12	0.1	634	X					0
			01/21/24	01/22/24	7	1	0.7	0.17	0.2	2,041			X			0
			01/31/24	02/02/24	46	7	1.2	0.13	0.1	2,936						0
		2025	11/11/24	11/12/24	28	189	0.3	0.14	0.1	110	X					0.0002

County	Site	WY	Storm Began	Storm Finished	Sample Duration (hrs)	Antecedent Dry (days)	Rainfall Total (in)	Maximum Rainfall Intensity (in/hr)	Peak Flow (cfs)	Total Flow (cf)	First Seasonal Flush[1]	Partial Sample	Forecast Rainfall Exceeds Design Storm[2]	Measured Rainfall Exceeds Design Storm[3]	Peak Flow Exceeded Design Storm[4]	Trash Volume (gal/acre)
			01/31/25	020/3/25	77	28	1.3	0.11	0.0	157						0
			02/12/25	02/15/25	54	7	2.8	0.33	0.2	1,860						0
San Mateo	SM-PIL	2024	11/16/23	11/18/23	39	11	1.1	0.2	2.2	11,872	X					0.07
			01/21/24	01/22/24	11	1	2.1	0.52	7.8	68,987			X	X		0.06
			01/31/24	02/02/24	44	7	1.2	0.17	1.7	22,232						0.02
		2025	11/01/24	11/02/24	19	> 30	0.2	0.08	1.3	7,414	X					0.01
			11/11/24	11/11/24	13	9	0.6	0.39	13.5	33,745	X					0.04
			12/11/24	12/13/24	29	15	0.9	0.26	4.3	52,414						0.01
			02/11/25	02/14/25	65	4	2.2	0.53	12.1	142,517			X	X		0.02
	SM-SBS	2024	11/17/23	11/17/23	6	> 47.6	0.2	0.09	0.5	1,864	X					0.05
			01/21/24	01/22/24	9	1	1.4	0.45	8.5	54,125		X	X	X		0.01
			01/31/24	02/02/24	40	7	1.6	0.18	2.3	59,390						0.02
		2025	11/11/24	11/11/24	10	> 41.4	0.4	0.26	7.5	18,173	X					0.05
			12/12/24	12/13/24	37	16	0.9	0.3	10.5	58,450						0.02
			03/12/25	03/16/25	88	10	1.6	0.36	27.7	121,525					X	0.04
Santa Clara	SC-COY	2024	12/17/23	12/19/23	43	29	0.9	0.18	5.4	43,750						0.03
			12/29/23	12/30/23	9	9	0.8	0.21	8.8	78,858						0.01
			01/21/24	01/22/24	14	1	1.0	0.27	17.9	269,541						0.03
		2025	11/11/24	11/11/24	4	> 41.4	0.4	0.26	13.7	69,554	X	X				0.02
			03/12/25	03/14/25	52	6	1.4	0.17	30.1	292,601						0.02
	SC-SFC	2024	11/17/23	11/18/23	6	> 47.9	0.3	0.2	3.9	10,864	X					0.21
			01/20/24	01/20/24	6	3	0.1	0.07	2.2	7,089		X				0.03
			01/31/24	02/05/24	113	7	3.3	0.19	4.5	147,378						0.01
		2025	11/11/24	11/12/24	30	> 41.2	0.4	0.22	2.3	7,149	X					0.09
			12/12/24	12/13/24	40	16	0.6	0.21	8.3	45,333						0.05
			02/12/25	02/14/25	52	5	2.8	0.54	29.0	230,966			X	X		0.07
	SC-STE	2024	11/17/23	11/18/23	15	12	0.3	0.12	1.6	6,235	X					0.09
			01/21/24	01/22/24	9	2	0.8	0.3	10.0	38,463		X				0.004
			02/29/24	03/02/24	59	9	1.1	0.19	3.2	87,594						0.04

County	Site	WY	Storm Began	Storm Finished	Sample Duration (hrs)	Antecedent Dry (days)	Rainfall Total (in)	Maximum Rainfall Intensity (in/hr)	Peak Flow (cfs)	Total Flow (cf)	First Seasonal Flush[1]	Partial Sample	Forecast Rainfall Exceeds Design Storm[2]	Measured Rainfall Exceeds Design Storm[3]	Peak Flow Exceeded Design Storm[4]	Trash Volume (gal/acre)
		2025	11/02/24	11/02/24	10	> 32	<0.1	0.07	0.1	1,229	X					0.02
			12/12/24	12/13/24	28	17	0.6	0.21	3.4	30,597						0.01
Solano	SSA-LOTZ	2025	11/22/24	11/25/24	80	1	2.2	0.33	0.0	0						0
			12/11/24	12/16/24	112	16	3.4	0.69	3.1	3,054				X		0.0001
			01/31/25	02/04/25	94	28	2.7	0.18	3.0	2,188						0.0004
			02/12/25	02/13/25	17	8	2.4	0.53	0.7	619			X	X		0.0003
			03/12/25	03/13/25	13	27	0.3	0.13	0.0	0						0
			03/30/25	03/30/25	5	16	0.1	0.07	0.0	0						0

1 Table also indicates storms that were first seasonal flush events, partial samples (net detach before end of storm), and exceeded the estimated peak flow for the design storm.

2 . Storm event forecast to exceed one-year, one-hour design standard.

3 Storm event exceeded the design storm, based on measured rainfall intensity.

4 Peak flow exceeded design storm, based on the Rational Method.

3.4.2 Trash Characterization

Total trash volumes normalized by the contributing land area (i.e., trash loading rates) are illustrated in Figure 3. The trash loading rates for most sampling events (45 of 65, 69%) were below 0.05 gallons/acre. Only five sample events had rates greater than 0.1 gallons/acre. The highest trash volumes per unit area measured in a single sample event for each county occurred at site PCH in Contra Costa (0.41 gallons/acre), PUBSAF in Alameda (0.3 gallons/acre), site SFC in Santa Clara (0.21 gallons/acre), and site PIL in San Mateo (0.07 gallons/acre). No trash was identified in 3 of the 6 samples at site SSA-LOTZ in Solano, and the three remaining samples had a very small amount of trash.

Table 5 includes the total volumes of trash observed in the 65 samples collected at the 11 outfalls during WYs 2024 and 2025, as well as the volumes of trash observed in each of the 13 trash categories. The combined volume of the 7 plastic trash categories accounted for 122 of the 143 gallons of trash (85%) collected and characterized during the 65 sample events (Figure 4). The "*Other Plastic Items/Pieces*" trash category accounted for 91 gallons, representing 75% of the total plastic trash volume (Figure 5). Items in this category primarily consisted of plastic and beverage packaging from convenience and grocery stores. "*Single-use Plastic Food/Drink Ware*", "*Expanded Polystyrene* (*EPS) Foam Food Ware*", and "*Single-use Plastic Bags*" collectively accounted for about 13% of the plastic trash volume. Most cities in the San Francisco Bay Area have adopted county ordinances banning the distribution of some materials in these categories, and the State of California recently implemented a statewide ban on EPS foam foodware effective January 1, 2025. The "*EPS Foam Other"* category accounted for 9% of the plastic trash volume.

A comparison of trash composition among the four counties is presented in Figure 6. The proportion of "*Other Plastic*" trash was highest in San Mateo County (79%), followed by Contra Costa County (71%), Santa Clara County (61%), and Alameda County (52%). The combined proportion of "*Single-use Plastic Food/Drink Ware*" and "*EPS Foam Food Ware*" (i.e., banned materials) was highest in Santa Clara and Contra Costa Counties (both 14%), followed by Alameda County (11%) and San Mateo County (5%). Tobacco-related trash was highest in Contra Costa County (7%) compared to all other counties.

Table 6. Volume of trash, sorted into 13 categories, measured in 65 trash samples collected from 11 storm drain outfalls during WYs 2024 and 2025

			Plastic Trash Items (ounces)							Non-Plastic Trash Items (ounces)						Total Volume		
County	**Site**	**Sample Date**	**Single-Use Carryout Plastic Bags**	**Expanded Polystyrene (EPS) Foam Food Ware**	**(EPS) Foam Other**	**Single Use Plastic Food /Drink Ware**	**Smoking Products, Traditional**	**Smoking Products, Other**	**Other plastic Items / Pieces**	**Organic / Paper**	**Fabric**	**Metal**	**Glass**	**Mixed**	**Biohazard**	**Total Ounces**	**Total Gallons**	**Gallons/ acre**
Alameda County	OUTBK	11/13/23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.00
	OUTBK	01/30/24	0.0	0.0	12.0	12.0	0.0	0.0	64.0	0.0	0.0	1.0	0.0	0.0	0.0	89	0.7	0.04
	OUTBK	02/14/24	0.0	0.2	0.0	84.0	0.1	1.7	20.0	411.4	6.8	0.2	0.0	0.9	0.0	525	4.1	0.22
	OUTBK	11/11/24	0.0	0.0	0.0	0.0	0.1	0.0	31.0	0.0	0.0	0.0	0.0	0.0	0.0	31	0.2	0.01
	OUTBK	12/11/24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	< 0.01
	OUTBK	02/03/25	0.0	0.0	0.0	21.7	0.0	0.0	110.1	30.0	0.0	0.0	0.0	0.0	0.0	162	1.3	0.07
	CIVIC	11/13/23	0.0	0.0	0.7	0.0	0.1	0.0	10.1	0.0	0.0	0.0	0.0	0.0	0.0	11	0.1	0.01
	CIVIC	01/18/24	0.0	0.0	1.0	30.0	0.4	0.0	16.9	11.8	0.0	0.0	0.0	0.0	0.0	60	0.5	0.04
	CIVIC	01/30/24	0.0	0.0	18.6	11.8	0.5	0.0	22.0	15.2	0.0	0.0	0.0	0.0	0.0	68	0.5	0.04
	CTYCTR	11/11/24	0.0	0.0	0.3	0.7	0.2	1.2	40.0	3.4	0.0	9.0	0.0	0.2	0.0	55	0.4	0.12
	CTYCTR	12/11/24	0.0	0.0	0.2	22.7	0.3	0.9	16.0	0.0	0.0	6.0	0.0	0.0	0.0	46	0.4	0.10
	CTYCTR	02/03/25	0.0	0.0	0.3	0.0	0.3	0.3	16.0	0.0	0.0	0.2	0.0	0.0	0.0	17	0.1	0.04
	PUBSAF	11/13/23	0.0	0.0	8.1	0.0	0.4	0.0	16.1	0.0	0.0	0.7	0.0	0.0	0.6	26	0.2	0.02
	PUBSAF	01/18/24	0.0	0.0	1.4	6.0	1.2	2.0	5.1	37.2	2.0	0.5	0.0	0.0	0.0	55	0.4	0.04
	PUBSAF	01/30/24	0.0	0.0	0.0	0.0	0.7	6.8	25.4	5.1	0.0	0.0	0.0	0.0	0.0	38	0.3	0.03
	PUBSAF	11/11/24	0.0	0.0	0.1	0.0	0.2	0.3	415.0	0.2	0.0	0.0	0.0	0.0	0.0	416	3.2	0.30
	PUBSAF	12/11/24	0.0	0.0	23.0	0.0	0.3	0.3	4.2	3.4	0.0	0.0	0.0	0.0	0.0	31	0.2	0.02
	PUBSAF	02/03/25	0.0	0.0	0.3	1.4	0.2	0.3	84.0	16.0	0.0	0.0	0.0	0.0	0.0	102	0.8	0.07

			Plastic Trash Items (ounces)							Non-Plastic Trash Items (ounces)						Total Volume		
County	**Site**	**Sample Date**	**Single-Use Carryout Plastic Bags**	**Expanded Polystyrene (EPS) Foam Food Ware**	**(EPS) Foam Other**	**Single Use Plastic Food /Drink Ware**	**Smoking Products, Traditional**	**Smoking Products, Other**	**Other plastic Items / Pieces**	**Organic / Paper**	**Fabric**	**Metal**	**Glass**	**Mixed**	**Biohazard**	**Total Ounces**	**Total Gallons**	**Gallons/ acre**
Contra Costa County	PCH	11/13/23	0.0	0.0	0.0	12.7	0.3	0.0	16.1	0.2	0.0	0.0	0.0	0.0	0.0	29	0.2	0.06
	PCH	01/18/24	0.0	0.5	7.6	0.0	0.1	0.0	32.5	0.0	0.9	0.0	0.0	0.0	0.0	42	0.3	0.08
	PCH	01/30/24	0.0	25.4	5.1	28.1	0.5	27.1	113.8	2.5	0.0	1.0	0.8	0.0	0.0	204	1.6	0.41
	PCH	11/11/24	0.0	0.0	0.1	0.0	0.1	0.3	5.1	0.0	1.6	0.0	0.0	0.0	0.0	7	0.1	0.01
	PCH	01/30/25	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	<0.01
	PCH	02/11/25	0.0	0.0	0.0	0.7	0.2	0.2	16.0	1.4	0.0	0.0	0.0	0.0	0.0	18	0.1	0.04
	WC	11/13/23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.00
	WC	01/18/24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.00
	WC	01/30/24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.00
	WC	11/11/24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	<0.01
	WC	01/30/25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.00
	WC	02/11/25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.00
Santa Clara	COY	12/15/23	0.0	16.0	78.0	78.0	2.5	8.5	920.0	18.0	40.0	363.0	0.0	20.0	1.0	1545	12.1	0.03
	COY	12/29/23	0.0	48.0	170.7	79.0	1.7	2.0	199.0	6.0	16.0	17.0	0.0	48.0	0.0	587	4.6	0.01
	COY	01/18/24	50.0	32.0	256.0	72.0	1.7	4.2	982.0	5.0	40.0	96.0	0.0	16.0	0.0	1555	12.1	0.03
	COY	11/11/24	0.0	16.0	142.0	141.0	2.5	6.0	818.0	7.6	5.1	48.8	0.0	0.0	0.0	1187	9.3	0.02
	COY	03/11/25	0.0	77.0	120.3	122.0	32.0	8.0	709.0	154.0	0.0	2.7	43.0	12.0	0.1	1280	10.0	0.02
	SFC	11/13/23	29.1	42.7	58.2	333.7	0.5	36.4	970.0	29.1	40.0	54.5	0.0	0.0	0.0	1594	12.5	0.21
	SFC	01/18/24	0.0	0.0	85.3	45.1	0.2	0.0	87.6	0.0	3.4	0.7	0.0	0.0	0.0	222	1.7	0.03
	SFC	01/30/24	0.0	0.0	0.3	1.7	1.0	1.7	65.0	1.7	0.0	0.3	0.0	0.0	0.0	72	0.6	0.01
	SFC	11/11/24	0.0	3.4	12.0	51.0	0.9	11.8	603.8	10.0	5.9	17.0	0.0	0.0	0.0	716	5.6	0.09

			Plastic Trash Items (ounces)							Non-Plastic Trash Items (ounces)						Total Volume		
County	**Site**	**Sample Date**	**Single-Use Carryout Plastic Bags**	**Expanded Polystyrene (EPS) Foam Food Ware**	**(EPS) Foam Other**	**Single Use Plastic Food /Drink Ware**	**Smoking Products, Traditional**	**Smoking Products, Other**	**Other plastic Items / Pieces**	**Organic / Paper**	**Fabric**	**Metal**	**Glass**	**Mixed**	**Biohazard**	**Total Ounces**	**Total Gallons**	**Gallons/ acre**
	SFC	12/11/24	0.0	0.0	4.0	18.0	0.7	5.1	281.6	5.0	13.5	23.0	0.0	0.0	0.0	351	2.7	0.05
	SFC	02/11/25	0.0	0.0	14.0	92.0	0.9	1.7	270.0	70.0	25.0	50.5	0.0	20.0	0.0	544	4.3	0.07
	STE	11/13/23	0.0	3.4	142.2	222.2	3.4	16.0	973.1	6.8	142.2	100.3	0.0	10.1	0.0	1620	12.7	0.09
	STE	01/18/24	0.0	0.0	1.7	32.1	0.7	0.0	27.1	1.7	0.0	1.0	0.0	0.0	0.0	64	0.5	<0.01
	STE	02/29/24	0.0	24.0	32.0	123.3	1.7	6.0	371.0	15.0	20.0	17.0	0.0	7.0	2.0	619	4.8	0.04
	STE	10/31/24	0.0	5.0	11.8	34.0	1.5	16.0	273.0	46.0	4.2	31.8	0.0	0.3	0.0	424	3.3	0.02
	STE	12/11/24	0.0	0.0	28.0	10.0	3.4	0.3	70.8	0.5	3.4	16.2	0.0	0.0	0.0	133	1.0	0.01
San Mateo County	PIL	11/13/23	0.0	0.0	14.0	12.0	6.0	12.0	600.0	60.0	12.0	14.0	0.0	0.0	0.0	730	5.7	0.07
	PIL	01/18/24	0.0	0.0	22.0	40.0	1.7	2.5	520.0	23.7	15.9	12.0	0.0	0.0	0.0	638	5.0	0.06
	PIL	01/30/24	0.0	0.0	28.0	0.0	2.4	0.0	102.3	27.1	5.1	12.0	0.0	0.0	0.0	177	1.4	0.02
	PIL	10/31/24	0.0	0.0	6.0	0.0	0.3	0.9	141.7	0.0	0.3	0.0	0.0	0.0	0.0	149	1.2	0.01
	PIL	11/11/24	0.0	0.0	22.0	30.0	5.1	6.0	273.0	10.8	31.0	24.3	0.0	0.0	0.0	402	3.1	0.04
	PIL	12/11/24	0.0	0.0	2.0	19.0	0.9	2.0	64.0	12.0	0.0	1.0	0.0	0.0	0.0	101	0.8	0.01
	PIL	02/11/25	0.0	0.0	17.0	0.5	0.9	3.4	180.0	8.0	0.0	0.9	0.0	0.0	0.0	211	1.6	0.02
	SBS	11/13/23	0.0	0.0	40.0	6.0	0.5	20.0	297.1	1.7	8.5	0.0	0.1	0.0	0.0	374	2.9	0.05
	SBS	01/18/24	0.0	0.0	3.4	0.9	0.3	5.1	36.4	0.1	2.5	0.0	0.0	0.0	0.0	49	0.4	0.01
	SBS	01/30/24	0.0	0.0	4.2	3.4	0.3	1.7	105.3	0.0	1.7	0.0	0.0	0.0	0.0	117	0.9	0.02
	SBS	11/11/24	0.0	0.0	8.0	0.0	0.5	10.0	342.0	1.0	0.0	16.0	0.0	0.0	0.0	378	2.9	0.05
	SBS	12/11/24	24.0	0.0	10.0	0.5	8.0	0.4	59.0	0.0	0.0	36.9	0.0	0.0	0.0	139	1.1	0.02
	SBS	03/11/25	0.0	0.0	4.0	51.0	0.7	2.0	226.0	38.0	0.7	0.2	0.0	0.0	0.0	323	2.5	0.04

			Plastic Trash Items (ounces)							Non-Plastic Trash Items (ounces)						Total Volume		
County	Site	Sample Date	Single-Use Carryout Plastic Bags	Expanded Polystyrene (EPS) Foam Food Ware	(EPS) Foam Other	Single Use Plastic Food /Drink Ware	Smoking Products, Traditional	Smoking Products, Other	Other plastic Items / Pieces	Organic / Paper	Fabric	Metal	Glass	Mixed	Biohazard	Total Ounces	Total Gallons	Gallons/ acre
Solano County	Lot2	11/21/24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.00
	Lot2	12/11/24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	<0.01
	Lot2	02/01/25	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0	0.0	<0.01
	Lot2	02/11/25	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	<0.01
	Lot2	03/11/25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.00
	Lot2	03/30/25	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.00
Total Volume (oz)			103	294	1,416	1,850	89	231	11,648	1,097	448	976	44	134	4	18,332		
Total Volume (gal)			1	2	11	14	1	2	91	9	3	8	0	1	0		143	
Percent of Total Volume			0.6	1.6	7.7	10.1	0.5	1.3	63.5	6.0	2.4	5.3	0.2	0.7	0.0			

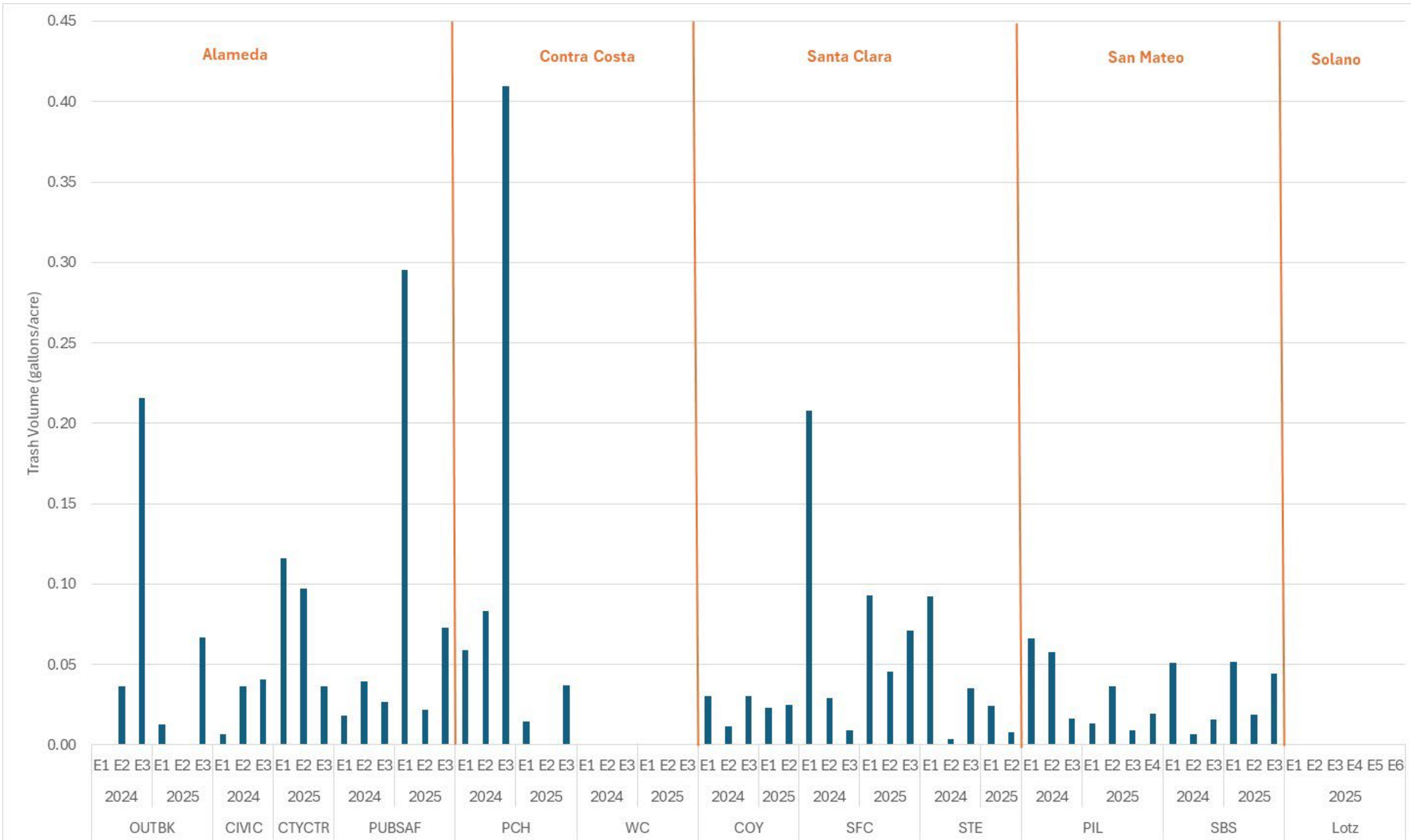

Figure 3. Total trash volume, normalized by contributing drainage area, for 65 trash samples collected from 11 storm drain outfalls during WYs 2024 and 2025.

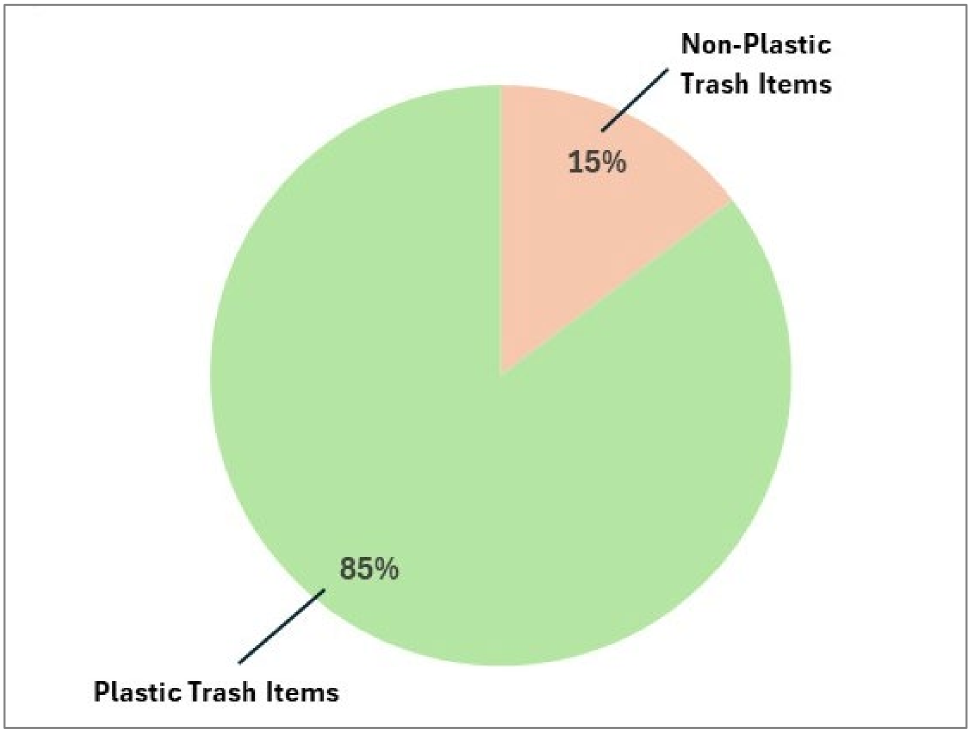

Figure 4. Comparison of plastic versus non--plastic trash items measured in 65 samples collected at stormwater outfalls during WYs 2024 and 2025.

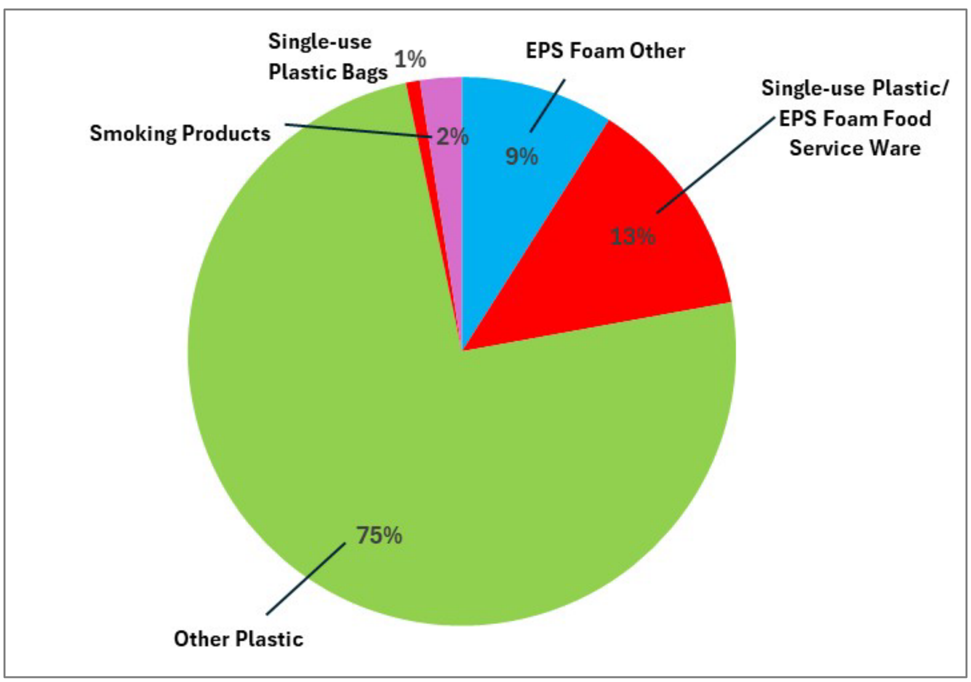

Figure 5. Comparison of plastic trash items measured in 65 samples collected at stormwater outfalls during WYs 2024 and 2025.

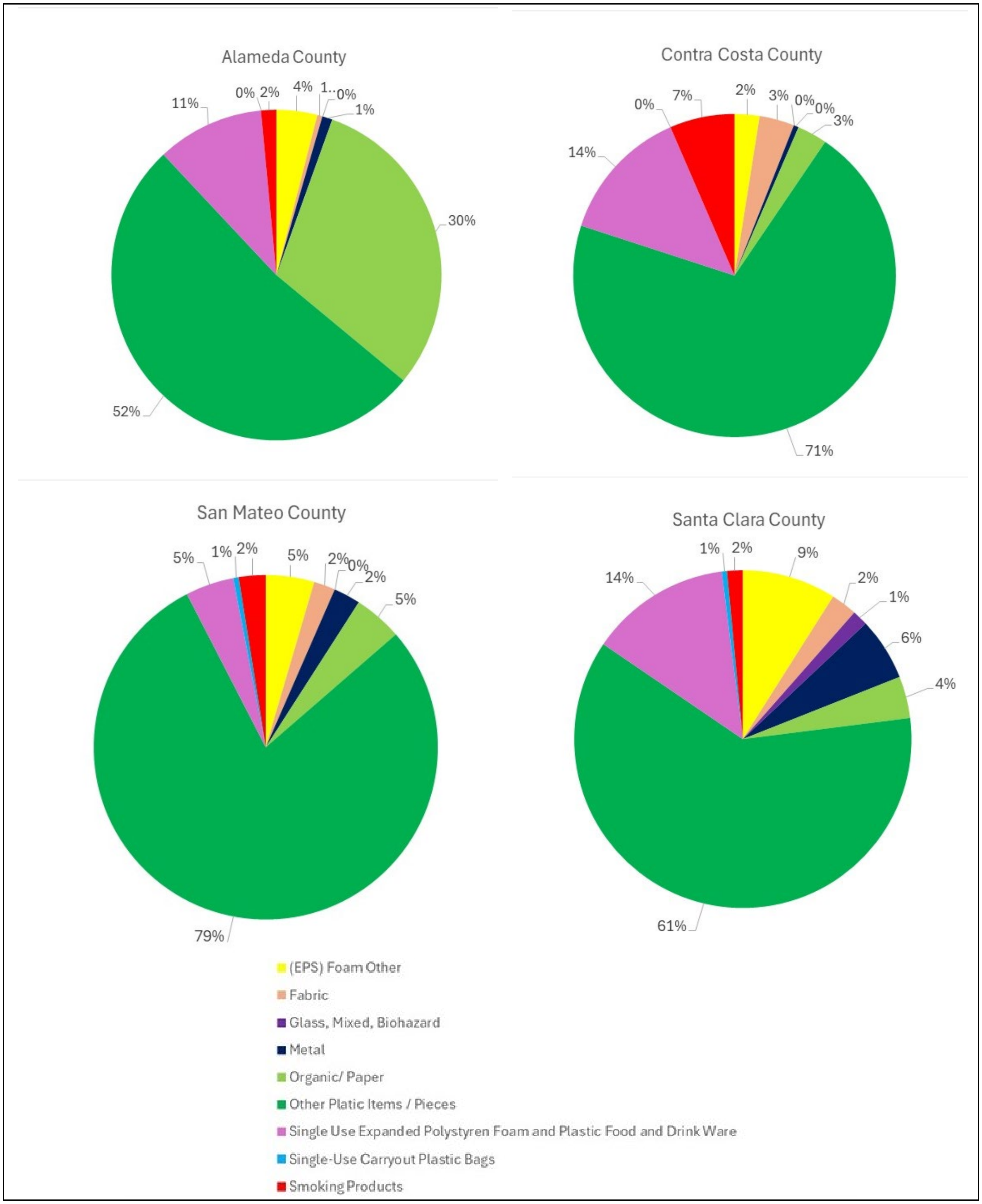

Figure 6. Trash composition in samples collected at stormwater outfalls grouped by county, WYs 2024-2025.

3.4.3 Rainfall and Flow

Rainfall data compiled from selected rain gages were evaluated to define the total number of storm events at each monitoring site that occurred during WYs 2024 and 2025. In Alameda County, precipitation data for the three monitoring sites located in the City of Dublin (AC-PUBSAF, AC-OUTBK, AC-CIVIC) were obtained from a single nearby rain gauge operated by Zone 7. Precipitation data for the AC-CTYCTR site was obtained from two rain gauges located in the City of Hayward and operated by the Alameda County Public Works Agency. Rainfall data for all remaining sites were compiled using regional Weather Underground stations in proximity to catchment areas. Weather stations were filtered for quality control using the method outlined in De Vos et al. (2019). Once weather stations were selected, rainfall totals were calculated using an inverse distance squared weighted average and storm events were defined using the following criteria:

- At least 0.1-inch precipitation in 6 hours (Caltrans 2020);
- 24 hours of antecedent dry conditions (i.e., no rainfall); and
- Event ends when < 0.1 inch of rain occurs over 6 hours

Note: these criteria were used as a more conservative definition of a storm that might transport trash and contribute to annual loads and thus, are different than the criteria described in Section 3.2.3 used to mobilize for sampling events.

The total number of storms that occurred at each monitoring site during WYs 2024 and 2025 using the above definition is shown in Table 6. These storms are presumed to be large enough to transport trash into the MS4 and mobilize trash to the outfall where trash nets are placed. Characteristics for each of the storms are provided in the Program specific data results in Attachment B.

Table 7. Total number of storms at each monitoring site during wet season for WYs 2024 and 2025

County	Site	Total Storms	
		WY 2024	WY 2025
Alameda	AC-CIVIC	24	NA
	AC-OUTBK	24	19
	AC-CTYCTR	NA	23
	AC-PUBSAF	24	19
Contra Costa	CC-PCH	25	19
	CC-WC	29	17
Santa Clara	SC-SFC	27	19
	SC-STE	24	17
	SC-COY	26	16
San Mateo	SM-PIL	30	21
	SM-SBS	27	18
Solano	SSA-LOTZ	NA	15

NA = Not applicable. Site was not monitored during this water year.

Flow data were generated using Manning's Equation for a partially full pipe for standard outfalls and equations for broad-crested and sharp-crested weirs for SSA-LOTZ. If field conditions restricted the application of Manning's Equation to accurately calculate flow, either linear regression or rainfall-runoff models were developed as described in Section 3.2.6. Annual hydrographs for each site are presented in Attachment B, with storms that were monitored during the WY indicated on each hydrograph.

3.4.4 Estimated Annual Trash Load

To estimate annual trash loads, measured trash volumes from sampled storm events were extrapolated to unsampled storms using rating curves that relate trash volume to independent variables (e.g., peak flow, rainfall intensity, antecedent dry period). Three different approaches were considered when estimating trash volumes for unsampled storms. The first approach combined all the monitoring data from all 11 contributing drainage areas. The second approach grouped sites by catchment characteristics, including catchment size (large vs small) and extent of full trash capture controls. The third approach evaluated data from each catchment independently.

A comparison of trash volume and peak flow for 60 storm events across the 11 catchments is shown in Figure 7. [10]

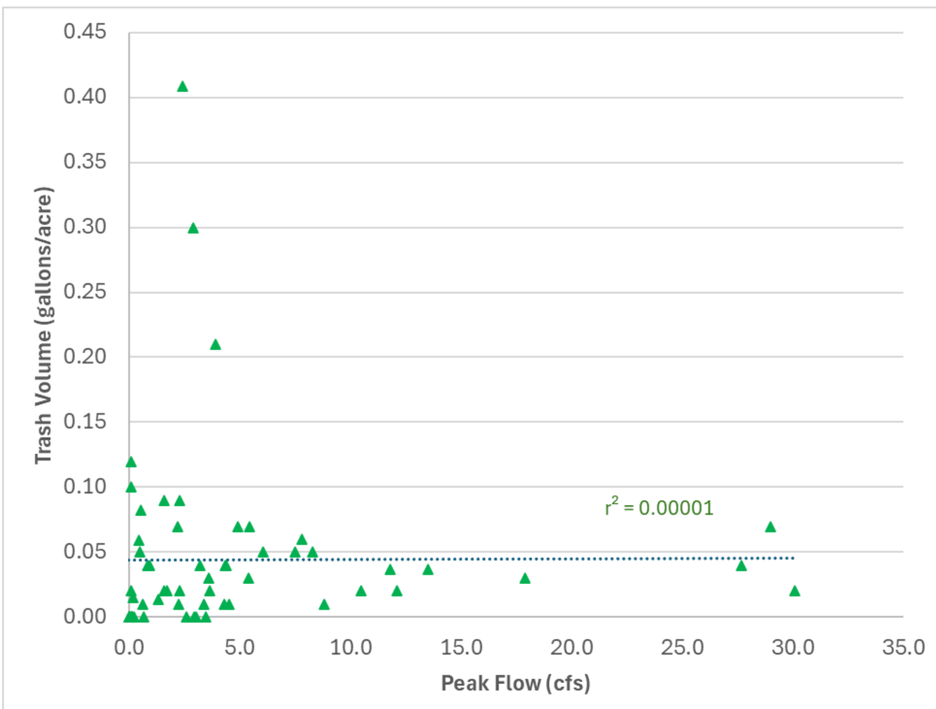

Figure 7. Comparison of trash volume and peak flow at 11 outfall monitoring sites (n=60)

A comparison of trash volume and maximum rainfall intensity, with catchments grouped by extent of full trash capture (i.e., greater or less than 90%), for 60 storm events across 11 catchments is shown in Figure 8.

[10] The five partial samples (net detached prior to end of storm) were excluded from the analysis.

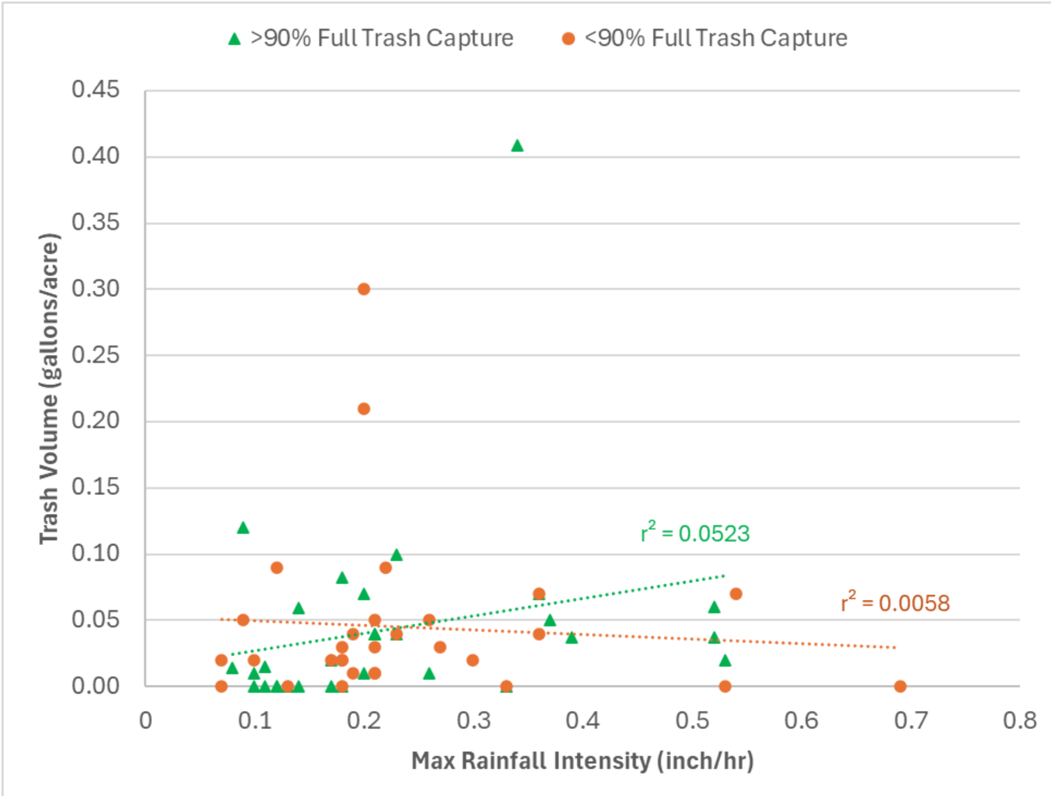

Figure 8. Comparison of trash volume and maximum rainfall intensity at 11 outfall monitoring sites

Both figures indicate poor overall correlations between trash volumes and rainfall or peak flow at the regional scale. In addition, grouping sites by the extent of full trash capture controls within the catchments did not improve correlations for either factor. These results suggest that variability in catchment characteristics (e.g., land use, drainage size) introduces confounding effects that obscure clear relationships between rainfall/flow metrics and trash volumes. As such, the BAMSC Programs focused data evaluation, for this report, at the catchment scale to better identify factors influencing trash loads within individual drainage areas. A primary limitation of this approach was the small sample size at each site (n= 2 to 7, including outliers) representing only one to two years of data collection and resulting in low statistical power.

Three counties (San Mateo, Santa Clara and Contra Costa) used linear regression to evaluate the association between trash volume and five independent variables (i.e., sample duration, peak flow, total flow, max rainfall intensity and antecedent dry period) to further explore correlations and better predict trash volumes from unsampled storms. Alameda County used a Generalized Additive Model (GAM) to evaluate the same set of independent variables as the other BAMSC Programs. Solano County only had three storms during WY 2025 that produced overflow conditions under which nets would capture trash; all three storm events were monitored. Therefore, the annual trash load was the sum of all three sample events and no modeling was needed to estimate the annual volume of trash observed from that site.

Based on preliminary results, factors that best correlated with trash volumes varied across the BAMSC Programs. Monitoring data for San Mateo and Santa Clara Counties indicated that samples collected during first seasonal flush events were associated with unusually large trash volumes at relatively low flows. This pattern likely reflects the "wash-off" effect of trash that accumulated during the preceding dry season, rather than conditions representative of storms later in the wet season, which had lower trash volumes. Because the effect of the "first seasonal flush" could bias relationships between explanatory variables and trash volumes from storms later in the WY, first seasonal flush data were excluded from subsequent linear regression analyses. The trash volumes measured during first seasonal flush events were then added back into the modeled trash loads for remaining sample events during the WY to calculate the annual trash load.

San Mateo and Santa Clara Counties also excluded partial sample events (n=5) from their linear regression models. These partial events typically occurred during larger storms when nets detached and had lower trash volumes than would be expected. Flow data indicate that when nets become full of trash and debris, water backs up into the pipe. Under these conditions, trash is likely present within the pipe but is not captured by the net before the detachment occurs. In addition, trash that is transported during the storm event after the detachment would not be captured. Therefore, trash volumes associated with these partial sample events could underestimate the volume of trash associated with a storm event.

Alameda and Contra Costa Counties did not observe the same pattern of higher-than-expected trash volumes for first seasonal flush sample events. As a result, these data were included in their models. Similarly, the two partial samples in Alameda County, which represented approximately 90% of the total storm flow at one site and 97% at the second, were incorporated into their GAM models.

Linear regression and GAM model results for 9[11] catchments are provided in Program-specific results in Attachment B. For each site, estimated trash loads were calculated using two to four candidate independent/explanatory variables. The best fit variable for each site, along with 90% confidence intervals, is summarized in Table 7. Sample sizes were small (n = 2 to 7. Including outliers), resulting in low statistical power. Across the 9 modeled sites, each of the 4 candidate variables was identified as the best explanatory variable at least one site. For the 9 modeled sites, best fit estimated trash loads ranged from 0.27 gallons/acre/year (SM-PIL in WY 2025) to 3.6 gallons/acre/year (CC-PCH in WY 2024). The two sites with the highest estimated annual trash loads were AC-CTYCTR (2.1 gallons/acre/year and CC-PCH (3.6 gallons/acre/year). The remaining sites had below 1.0 gallon/acre/year over the two-year monitoring period. The two sites that were not modeled included CC-WC, which had essentially no trash for all six sample events for both years, and SSA-LOTZ, which only had three storms during WY 2025, which resulted in overflow in the LID facility, all of which were sampled (i.e., trash was only collected in the net associated with overflow events).

Additional multivariate statistical analyses evaluating the influence of multiple factors on trash volumes during storm events will be considered in future years as more data become available. In particular, more observations from underrepresented storm types (e.g., smaller storms, storms with broader range of antecedent dry periods) are needed to better explore the relationships among independent/explanatory variables (e.g., peak flow and antecedent dry period) and trash volumes.

[11] Site CC-WC in Contra Costa County and site SSA-LOTZ had essentially no trash captured over the two-year monitoring period and thus, was not included in the analysis.

Table 8. Estimated annual trash loads at outfall monitoring sites during WYs 2024 and 2025.

Site	Monitoring Year	Estimated Annual Trash Load (gal/acre/yr)[1]			Best Explanatory Variable
		Best	Low	High	
AC-OUTBK	WY 2024	0.5	0.27	0.73	Peak Flow
	WY 2025	0.64	0.19	1.10	
AC-PUBSAF	WY 2024	0.74	0.50	0.97	Antecedent Dry Period
	WY 2025	0.9	0.68	1.12	
AC-CTYCTR	WY 2025	2.1	1.84	2.36	Total Flow
CC-PCH	WY 2024	3.6	1.25	5.93	Peak Flow
	WY 2025	3.2	0.77	5.65	
CC-WC	WY 2024	0.0	NA	NA	NA
	WY 2025	0.0002	NA	NA	
SM-PIL	WY 2024	0.52	0.38	0.67	Maximum Rainfall Intensity
	WY 2025	0.27	0.19	0.35	
SM-SBS	WY 2024	0.37	0.31	0.44	Peak Flow
	WY 2025	0.51	0.32	0.72	
SC-SFC	WY 2024	0.97	0.64	1.31	Peak Flow
	WY 2025	0.55	0.36	0.73	
SC-STE	WY 2024	0.53	0.46	0.58	Total Flow
	WY 2025	0.70	0.60	0.76	
SC-COY	WY 2024	0.51	0.10	0.85	Maximum Rainfall Intensity
	WY 2025	0.28	0.08	0.46	
SSA-LOTZ	WY 2025	0.0007	NA	NA	NA

1 Low and high estimates represent 90% confidence interval of the regression line or GAM smooth, as applicable. NA represents trash loads that were not modeled.

3.5 Statement of Data Quality

WY 2024 and 2025 monitoring activities included the collection of continuous flow data at each monitored outfall and the collection and characterization of trash discharged from outfalls during a minimum of three sampling events at each site. All monitoring data were validated following procedures described in the QAPP (Version 2.0) (AMS 2024). Review of monitoring data quality associated with each of these components is included below by data type, and where relevant, described more fully in individual Program-specific results in Attachment B.

3.5.1 Completeness

MRP 3.0 Provision C.8.e.iii specifies a minimum number of annual sampling events to be completed by each Program. Table 8 summarizes the target number of sampling events for each Program, which varies based on the required number of monitoring sites; the total number of successful events, including those with partial samples (i.e., at least 70% of storm water sampled); and, in parenthesis, the total number of attempted events, including those disqualified due to equipment failures, vandalism, or storms did not meet minimum size criteria because of incorrect forecasts. Through WY 2025, all but one Program met the minimum requirement. SCVURPPP did not meet the target of 18 successful events, although 24 events were attempted. In contrast, SMCWPPP exceeded the minimum target of 12 sampling events by one event.

Table 9. Number of sampling events completed and attempted[1] by Program during WYs 2024 and 2025

Program	WY 2024-2025 Target	WY 2024 Events	WY 2025 Events	Total Events
ACCWP	18	9 (10)	9 (9)	**18 (19)**
CCCWP	12	6 (6)	6 (6)	**12 (12)**
SCVURPPP	18	9 (12)	7 (12)	**16 (24)**
SMCWPPP	12	6 (6)	7 (8)	**13 (14)**
SSA	6	0 (0)	6 (6)	**6 (6)**

[1] Attempted events, including those disqualified, are shown in parentheses.

3.5.2 Hydrologic Data

BAMSC Programs deployed the same model of water-level logger at each outfall pipe monitoring site. However, two issues were identified during monitoring activities or data processing that required modeling to address interferences encountered during implementation.

First, at the two San Mateo sites (SM-PIL and SM-SBS), field observations during WY 2024 indicated that water was backing up into the monitored outfalls, with and without nets attached, thereby artificially increasing water depth and biasing water-level measurements. For these stations, flow for the entire monitoring window was estimated using precipitation records and rainfall-runoff models. During WY 2025, the water-level logger at site SM-PIL was moved downstream of the outfall, allowing for non-biased water-level measurements during most storm and non-storm conditions. Modeled flow data continue to be used for sampled storm events at site SM-PIL as the net appears to affect water levels in the downstream ditch. There were no options to re-locate the water-level logger at site SM-SBS (which was also impacted by tidal exchange); therefore, flow monitoring was discontinued in WY 2025 and replaced with flow modeling. Modeled flow results are discussed in more detail in Program-specific results in Attachment B.

Second, at the remaining monitoring stations, QA review of water-level data indicated a pronounced difference in the relationship between rainfall and measured water depth for the storms where nets were attached vs. those for which they were not. Although the trash capture nets are designed to allow water to pass through, accumulated vegetation and trash captured by the nets tended to impede flow, causing water to back up within the MS4 and elevate water levels while nets were attached. Relocating water-level loggers farther upgradient in the MS4 does not appear to be a viable solution given the generally shallow slopes of the pipes and limited distance between the outfalls and upstream trash controls or storm drain junctions.

Due to net interference with flow during sample events, precipitation and flow data from storm events without nets attached were used to estimate flow for sample events with nets attached. ACCWP used linear regression models to estimate flow for sample events. All other stormwater programs used HEC-HMS models. Model development is described in the Program-specific results in Attachment B.

Two new monitoring sites were added in WY 2025. At AC-CTYCTR, hydrologic monitoring was affected by deployment of trash capture nets; therefore, flow associated with monitoring events was estimated using linear regression, consistent with the approach described above. At site SSA-LOTZ, flow enters the trash monitoring outfall only during higher intensity or longer duration storms, when water level exceeds the facility's ponding depth. To estimate flows into the overflow pipe, SSA installed a depth sensor adjacent to the overflow and continuously monitored water level over the course of the monitoring year. Water-level measurements exceeding the ponding depth were assumed to discharge to the overflow pipe, and depth measurements were converted to flow rates using the average flow estimates derived from broad-crested weir and sharp-crested weir equations. Visual observations during storm events did not indicate any discrepancies between observed overtopping and estimated flow intervals.

3.5.3 Trash Characterization Data

As part of the data quality review process, BAMSC Programs review all aspects of the data collection, analysis, and reporting process to identify any deviations from the project QAPP (AMS 2024). Minor deficiencies (e.g., incomplete datasheets, data entry errors) may be addressed at the local level. More significant deficiencies or those that may affect future data collection and reporting efforts are detailed in a Corrective and Preventative Action Report (CPAR), which describes the discrepancies identified, proposed response actions, and dispensation of affected data.

In WY 2024, there were two issues identified during trash characterization data quality review that required development of a CPAR. Both issues were related to replicate analyses, which are required and specified in the QAPP (AMS 2024). The first issue was associated with the characterization team not performing the minimum number of replicate analyses specified in the QAPP. The second issue was associated with the results of the duplicate samples not achieving QAPP control limits for individual trash categories.

The Project Quality Assurance Officer (QAO) developed CPARs for each deficiency. Corrective actions included additional training and the requirement for the QAO to observe a minimum of one characterization event in WY 2025. The QAO performed an audit of WY 2025 characterization efforts on April 22, 2025, and found that efforts had been undertaken to address both CPARs sufficiently. The QAO observed no additional deficiencies during the audit.

A review of precision data associated with WY 2025 monitoring characterizations suggests that characterization results are largely in control. With the exception of the SSA sample, for which accumulated trash failed to meet minimum volume requirements to allow calculation of the Relative Percent Difference (RPD) for the duplicate sample, at least one field duplicate was performed for each Program. The majority of duplicate characterizations achieved the QAPP target of 25% RPD or less, with the exception of one sample collected by SCVURPPP which had an RPD of 34% for the fabric trash category. All characterization data collected in WY 2024 and WY 2025 are considered acceptable for analytical and interpretive purposes.

4. DISCUSSION

4.1 Investigation of Trash Generation Levels Based on Monitoring Results

Prior to conducting trash outfall monitoring during WYs 2024 and 2025, each BAMSC Member Program conducted trash characterization assessments within the catchments draining to the monitored outfalls. The assessments included visual observations, as well as written and photo-documentation of trash present along roadway curbs and gutters and, to the extent practicable, within catch basins and storm drains. Observed trash sources were documented with GPS coordinates and/or marked on paper maps. Results of the trash characterization assessments are included in the Program-specific results in Attachment B. Identified sources were reported to Permittees for -follow-up management actions, which are also reported in Attachment B.

Maintenance records for all full trash capture devices located within the monitored catchments are also provided in Attachment B. These records include dates when devices were cleaned and the estimated quantity of material removed, if known. Other trash controls (i.e., outside of full trash capture devices) implemented by Permittees in the Trash Management Areas that overlap with the monitored catchments are summarized in Attachment B.

As described in Section 3, preliminary annual trash loading results indicate that there is a relatively low level of trash being discharged during WYs 2024 and 2025. As a result, Programs did not conduct -follow-up investigations into specific trash sources or control measures implemented in the catchments, based on the trash observed in the netting devices deployed at the outfalls. Trash characterization assessments will continue to be conducted each year prior to the monitoring season to document potential trash sources within each catchment and, as needed, throughout the wet season.

4.2 Consideration of Alternative Monitoring Methods

In 2024, the Trash TAG provided comments on the Draft Trash Outfall Monitoring Plan, suggesting that the selected outfall monitoring sites are “not adequately representative of the region’s various drainage areas settings, such as land use and other factors that affect trash generation.” The comments also acknowledged the numerous constraints for selecting outfalls suitable for installing trash capture nets (e.g., no landing, below high-water mark, access).

As a result of these comments, BAMSC described, in the Final Outfall Monitoring Plan, an adaptive management process to evaluate (and potentially develop) alternative outfall monitoring methods (to end-of-pipe netting devices) that would allow for different catchment areas to be monitored in the future. The first step in the adaptive management process described in the Final Outfall Monitoring Plan was to review and document existing methods/approaches previously used to conduct trash monitoring of stormwater discharges or in receiving waters.

In July 2025, BAMSC developed a technical memorandum (BAMSC 2025) that described potential alternative trash monitoring methods and an assessment of whether one or more methods may be feasible and/or practical for addressing MRP trash monitoring and management questions. The three categories of existing methods found in the literature were assessed:

- Photo/video capture of trash and enumeration/characterization via machine learning techniques;

- Manually collecting subsamples of trash transported during storm events using nets deployed within the MS4 system or at the stormwater outfall; and
- Quantification or qualitative assessment of trash discharged from the MS4 and deposited on the banks of a receiving water directly below a stormwater outfall.

Based on existing technologies identified during the literature review, none of the alternative methods identified and assessed are viable replacements for the current trash outfall monitoring methods deployed by Permittees to meet the MRP requirements and answer the trash outfall monitoring and management questions established in provision C.8. Via email communications in December 2025, Regional Water Board staff participating on the TAG agreed with this conclusion presented in the BAMSC memorandum. As a result, netting devices will continue to be used during the term of MRP 3.0.

4.3 Lessons Learned

Lessons learned from the first two years of trash outfall monitoring are summarized below. Several of these issues are site specific and do not pertain to all sites. Program-specific related information is provided in Attachment B.

- The design storm (i.e., one-year, one-hour storm event) is difficult to predict from the information that is provided in the National Weather Service forecasts.
- Challenges sampling large catchments due to high volume of water/debris during storms that create stress on attached nets. Repeated net failures (i.e., nets break or detach from outfall) at two large outfall monitoring sites (SC-STE and SC_COY), which range in size from 137 to 400 acres.
- Challenges sampling larger intense storms that exceed the capacity of trash nets. Nets occasionally detach during larger storms, especially early in the wet season when stormwater runoff includes a high volume of leaves and organic debris that can clog the net and block the passage of water through the net.
- Constraints finding outfalls that are suitable for trash nets create challenges to replace problematic sites. As documented in the Regional Monitoring Plan, identifying sites that are suitable for outfall net monitoring are challenging due to many constraints.
- Challenges measuring flow at the outfalls during sampling events due to nets affecting flow conditions. In addition, low gradient channels, vegetation and tidal influence can affect flow conditions at some sites.
- A high proportion of the plastic trash (75%) identified in samples are grouped into a single category “plastic, other.” This category includes plastic bags (re-usable), plastic food ware accessories, food wrappers, plastic bottles, bottle caps, and a wide range of other types of plastic. Many of these trash types could be split into additional subclasses, which may provide more useful information related to the types/sources of plastic that is transported into the MS4.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Conclusions for the first two years (WYs 2024 and 2025) of trash outfall monitoring include:

- A total of 65 trash samples were collected over the two-year monitoring period. During WY 2024, 30 trash samples were collected during 3 storm events at 10 of the 11 monitoring locations; site SSA-LOTZ could not be sampled due to construction delays. During WY 2025, at least 3 storm events were sampled at 9 of the 11 monitoring locations for a total of 35 samples; only 2 storm events were successfully sampled at 2 sites in Santa Clara County (SC-STE and SC-COY) due to equipment failures or vandalism. Six trash samples were collected at site SSA-LOTZ during WY 2025, to make up for the 3 missed samples in WY 2024.

- In both years, trash samples were collected during the first seasonal flush at all sites, except for site SC-COY, where the net was vandalized and the sample was lost. Sample events were also conducted during storms that were forecast to exceed the one-year, one-hour design standard at most sites. Sample events for storms forecast to exceed the design standard were not conducted at sites SC-STE and SC-COY due to lower rainfall intensities compared to other sites (WY 2024) or net malfunction during bigger storm events (WY 2025).

- Due to inaccurate water depth measurements in the MS4 caused by net interference with flow, rainfall-runoff or linear regression models were used to calculate flow during all sample events at 9 of the 11 monitoring sites.[12] Field measurements were used to calculate flow during unsampled storm events at all sites, except site SM-SBS, where water depth measurements are impacted throughout the year (with and without the net) due to backed up flow in a low gradient channel and/or tidal/groundwater influence at the outfall.

- Based on 65 trash samples collected regionally, plastic material comprised 85% of the trash collected. "*Other Plastic*" represented 75% of the plastic material. Other important plastic trash items include "*Single Use Food/Drink Ware*", "*EPS Foam Food Ware*" and "*Single-use Plastic Bags*", which combined comprised 13% of the plastic trash volume. Many cities in the San Francisco Bay Area have adopted bans on the distribution of all three trash types. Nine percent of the plastic trash volume was associated with the "*EPS Foam Other*" category. "*Smoking Products*" accounted for approximately 2% of the plastic trash volume.

- Trash volumes (gallons/acre) for unsampled storms were estimated by linear regression or GAM model fit equations for a variety of independent variables (peak flow, total flow, max rainfall intensity and antecedent dry period). Estimated annual trash loads were then calculated as the sum of trash loads for all defined storm events for each WY. Across the 9 sites modeled, each of the 4 variables was identified as the best explanatory variable at least at one site.

[12] Flow at site SSA-LOTZ only occurs when the facility overflows, which was actually measured throughout the WY 2025 monitoring season at this site.

- Annual trash loads across the 11 sites ranged from 0.27 gallons/acre/year (SM-PIL in WY 2025) to 3.6 gallons/acre/year (CC-PCH in WY 2024). The two sites with the highest estimated trash loads had trash loads of 2.1 gallons/acre/year (AC-CTYCTR) and 3.6 gallons/acre/year (CC-PCH). The remaining sites were all below 1.0 gallon/acre/year over the two-year monitoring period. The 2 sites with the lowest trash levels include CC-WC and SSA-LOTZ, both of which had practically no trash captured during any of the 6 sample events.
- Based on existing technologies identified during the literature review, none of the alternative methods identified and assessed are viable replacements for the current trash outfall monitoring methods deployed by BAMSC Permittees to meet the MRP requirements and answer the trash outfall monitoring and management questions established in provision C.8. As a result, netting devices will continue to be used during the term of MRP 3.0.

5.2 Refinements for the Next Water Year

General refinements to the monitoring approach planned for WY 2026 are summarized below. Specific refinements for individual monitoring sites and/or Programs are provided in Attachment B.

5.2.1 Storm Selection

Refinements to the trash outfall monitoring approach were developed to provide greater flexibility in storm selection and sampling, with the goal of improving estimates of annual trash loads. These refinements include:

Antecedent Dry Period

Existing guidelines in the MRP suggest sampling storms with antecedent dry periods of at least 48 hours (defined in the Monitoring Plan as no separate event exceeding 0.1 inch of cumulative rainfall within a 24-hour period). Application of this criterion during the first two years of monitoring resulted in missed storm events that may have mobilized trash and could have provided data relevant to specific management and monitoring questions. Sampling a wider variety of storm conditions, including events with shorter antecedent dry periods would provide data useful for development of trash load models. Therefore, the 48-hour antecedent dry period guideline will be relaxed for WY 2026.

Storm Size

Reduced emphasis will be placed on sampling storms that are forecasted to be at or above the design standard storm (one-year, one-hour). At many sites, trash nets detached when rainfall intensities approached the one-year, one-hour storm, resulting in lost or incomplete data. In addition, trash data collected during storms that are below the full trash capture design standard are expected to provide more representative information for estimating annual trash loads in catchments with full trash capture devices.

First Seasonal Flush

At a subset of monitoring locations, samples collected during the first seasonal flush contained unusually large trash volumes associated with relatively low flows. This pattern likely reflects the wash-off of trash accumulated over the entire dry season, rather than conditions representative of storms later in the wet season. Because this carryover effect could bias relationships between explanatory variables and trash volume, sampling of first flush storms may be reduced at selected site to allow for collection of data from other storm types (e.g., storm following extended dry periods that occur after first seasonal flush).

5.2.2 Trash Characterization

Revise trash characterization procedures and data collection form to include new trash subcategories to identify and measure items that previously would be classified in the "*plastic, other*" category.

5.2.3 Peak Flow Calculations for Design Storm

Compile additional data and information sources for selected catchments to refine calculation of peak flows (Attachment A) that represent the 1-year, 1-hour storm event.

5.3 Recommendations to Inform MRP 4.0

Results from trash outfall monitoring conducted during MRP 3.0 have provided useful information to address the management and monitoring questions. The collaborating BAMSC partners see value in continuing trash outfall monitoring into MRP 4.0 and recommend the following refinements to the monitoring program to enhance its utility and efficiency:

- Maintain the existing Trash Outfall Monitoring Program during MRP 4.0 to continue collecting data that will inform further refinement of annual trash loading models and determine longer-term trends in monitored catchments.
- Eliminate the trash characterization (identifying trash types and volume) requirement since these data have not proven useful for understanding whether existing trash controls are working and they have limited utility to identifying gaps in existing trash controls. Overall trash volume of each sample would still be measured.
- Allow for flexibility in selecting monitoring sites for MRP 4.0 so that monitoring can either be continued at existing sites or started at new sites, based on a combination of data needs and practicality. This flexibility would provide the ability to discontinue monitoring at existing sites that are problematic, allow for the numerous constraints to identifying new sites to be considered, as well as the needs for longer-term data sets that will improve the accuracy and certainty of trash loading model(s).
- Set a practical number of required storm events to be monitored over the 5-year permit term (e.g., 12 to 15 during the permit term), but provide flexibility on the annual minimum (e.g., reduce annual minimum from 3 to 2). This refinement would provide flexibility to "work ahead" in wet years and "bank" samples for potential dry years.
- If required to change the location of existing monitoring sites, a year to design, fabricate, and install the required netting devices and obtain necessary encroachment and environmental permits should be afforded, and the total required storm events to be monitoring over the permit term should be reduced accordingly (e.g., from 15 to 12 events, or 12 to 9 events) for those new sites.

- Include the option of developing flow data via rainfall-runoff models as opposed to monitoring flow at the monitoring site. Collecting flow measurements at many monitoring sites are not feasible due to channel conditions and tidal influence that cause backflow into the storm drain pipe. In addition, depth sensors across all sites are impacted during sample events due to net interference that alters flow conditions within the MS4. As a result, modeled flow will continue to be necessary for developing flow data for the entire hydrograph at each site.
- Convene Trash TAG meetings as-needed rather than at a mandatory frequency. The Trash TAG was highly beneficial in the planning and start-up phases of the MRP 3.0 Trash Outfall monitoring program, but input from the Trash TAG will be needed less during the continuation of the existing, successful outfall monitoring program. The Trash TAG can be more effectively utilized in the MRP 4.0 during the IMR data analysis and interpretation stages than during typical monitoring years where interpretation is less of a priority.
- Streamline reporting requirements to require annual data submittal, but analysis and interpretation during the latter portion of the permit term. While analyses conducted to assess long-term trends are vital to answering management and monitoring questions, such trends are not effectively elucidated by time-consuming annual or near-annual data analysis and interpretation. Therefore, a refined trash outfall monitoring program would be most efficient and effective with data reported annually, and a comprehensive data interpretation conducted exclusively in the MRP 4.0 IMR.

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Attachment A

Peak Flow Calculations

Technical Memorandum

DATE:	January 8, 2026 (Draft)
TO:	BAMSC Monitoring and Pollutant of Concern (MRP) Subcommittee
CC:	Electronic Project File
FROM:	Renee Crawford, P.E., Chris Sommers, Bonnie de Berry, Paul Randall
SUBJECT:	WOW Outfall Monitoring, Hydrologic Calculation Methodology for 1-year (100% occurrence interval), 1-hour Storm Event

Stormwater programs that participate in the Bay Area Municipal Stormwater Collaborative (BAMSC) are collecting flow data from outfalls where trash monitoring is conducted to help in developing annual stormwater discharge and trash loading estimates from stormwater outfalls. Full trash capture (FTC) systems designed to intercept trash in stormwater have been installed in many of the municipal separate storm sewer system (MS4) in the monitored catchments. These FTC systems are designed to intercept trash in runoff generated by storm events of a certain size (i.e., at or below the 1-yr 1-hr storm event). Storm events of this size are called FTC design storms and vary by location, based on the historical frequency and intensity of storm events within those geographical areas around the Bay Area. Identifying the peak flow associated with the FTC design storms allows BAMSC stormwater programs to better understand which storm events (or portions of events) are above the FTC design storm size threshold that FTC systems are not designed to address.

To help estimate trash loading from monitored stormwater outfalls and determine whether the FTC systems installed in the associated upstream catchments are effectively intercepting trash during storms at or below the FTC design storm, the peak flow associated with the FTC design storm for each monitored catchment was calculated using standard hydrologic methods. This allows direct comparison of flow monitoring data against predicted design flows to segregate events that may have exceeded FTC system capacity. This methodology is informative for all monitoring sites, but works best for smaller catchments where FTC controls are located at or nearby to the monitored outfall.

For larger and more complex catchments (e.g., multiple types of dispersed FTC systems upstream of monitored outfall), this may or may not be indicative of flow conditions exceeding design standard of a given FTC system within that catchment. For that reason, we also compare measured precipitation data for each monitored event against the one-year, one-hour storm rainfall intensity predicted for the overall catchment. Comparison of monitoring data with these two metrics, while not a perfect indicator, will provide valuable information to inform loads modeling efforts.

FTC Design Storm Flow Rate Calculation Methodology

Consistent with the process outlined in the Statewide Trash Amendments[1] and the Municipal Regional NDPES Stormwater Permit (MRP) for the San Francisco Bay Area[2], the Rational Method was used to calculate the estimated peak flow rate for each monitored outfall drainage area that is associated with the FTC design storm. All but one of the outfall locations has a contributing drainage area of less than 200 acres (i.e., the industry standard upper-limit for use of this method) and so this method was deemed acceptable for calculating peak flow rates for these drainage areas. Additionally, for simplicity's sake the Rational Method was also applied to the one outfall location with a 400-acre contributing area. The Rational Method employs the following equation:

$$Q = (C\ I\ A) / K_u$$

Where:

Q	=	Flow, cubic feet per second, cfs, ft^3/s (m^3/s)
C	=	Dimensionless runoff coefficient
I	=	Rainfall Intensity, inches per hour, in/h (mm/h)
A	=	Drainage Area, acres, ac (ha)
K_u	=	Unit Conversion constant, 1.0 in CU (360 in SI)

Catchment Drainage Area (A)

The catchment drainage area (A) was obtained from Table 3.5 of the *Regional Stormwater Outfall Trash Monitoring Plan*[3].

Runoff Coefficients (C)

Runoff coefficients were calculated as a weighted value based upon percent coverage within the catchment areas of land use categories in Table 3.3 of the *Regional Stormwater Outfall Trash Monitoring Plan*. The C-value for each land use category was based on the following:

- Aerial imagery,
- USGS Web Soil Survey data[4],
- The Alameda County Flood Control and Water Conservation District (ACFCWCD) Hydrology and Hydraulics Manual (2016)[5], and
- the Santa Clara County (SCC) Drainage Manual (2007)[6], Table 3-1 appropriate soil types (A, B, C, D).

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[1] SWRCB (State Water Resources Control Board). 2015. Amendment to the Water Quality Control Plan for the Ocean Waters of California to Control Trash and Part 1 Trash Provisions of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California. Final Staff Report including the Substitute Environmental Documentation. Division of Water Quality, California Environmental Protection Agency. April 2015.

[2] SFBRWQCB (San Francisco Bay Regional Water Quality Control Board). 2022. San Francisco Region Water Quality Municipal Regional Stormwater NPDES Permit. Order No. R2-2022-0018, NPDES Permit No. CAS612008.

[3] BAMSC (Bay Area Municipal Stormwater Collaborative). 2024. Regional Trash Monitoring Plan, Municipal Stormwater Outfall Monitoring, Version 2.0, July 31, 2024.

[4] Web Soil Survey, United States Department of Agriculture (USDA), online tool accessed 10/20/2025.

[5] Hydrology and Hydraulics Manual, Alameda County Flood Control and Water Conservation District, 2016.

[6] Drainage Manual, Santa Clara County, 2007.

The C-values for each land use type reflect the soil types within the drainage areas for each County. Commercial and Industrial areas, which comprise a significant portion of the locations' contributing acreage, utilize runoff coefficients which tend to vary little between soil types, primarily due to typically significant impervious surface coverage of the soils.

The runoff coefficients (C) have the highest possibility for interpretation and error in these calculations. However, the land use-based derivation of the C-values used these calculations are typical for sizing drainage infrastructure and stormwater treatment systems. The imperviousness of each catchment drainage area, based upon the National Land Cover Data (NLCD)[7] "Impervious Surface Product" generated using an automated classification system based on multispectral satellite imagery was also available for use and was used as a comparison to imperviousness estimates derived from land use-based C-values. Within most catchment areas, the weighted C-value derived via land use is within 10% of the weighted C-value based on the NLCD Impervious Surface Product. Based on our understanding of the resolution and accuracy of the NLCD data layer, we concluded that the land use-based method provides a more reliable categorization for these calculations and was therefore used to estimate peak flows from the 1-year, 1-hour storm event for each outfall.

Note on potential errors in the NLCD Impervious Surface Product

The impervious surface percentage derived from the NLCD Impervious Surface Product interprets the percentage of 30-meter pixels that are covered by artificial substrate or structures to provide an impervious percentage of each pixel. These data were overlaid with the catchment areas in GIS to provide an imperviousness percentage. Based upon review of the product's available User Guide information, it is unclear why some drainage areas (e.g., catchment SC-SFC) reflect a low imperviousness as compared with the visual assessment presenting a higher percentage of buildings, pavement and other impervious surfaces. The User Guide indicates that the data set is updated at regular intervals, and the totality of the drainage area has changed little in the last 5-10 years, so even data which is older would be anticipated to reflect current development conditions. Without looking at an image of the overlay of the imperviousness data layer and comparing that information to the aerial imagery, it is unclear how this and other areas could reflect such low imperviousness. It could be errors within individual 30mx30m pixels; it could be analysis misinterpretation of the surfaces that was not corrected in the NLCD QC process. If deemed necessary, a potential next step would be to review the NLCD data layer in conjunction with aerial imagery at these discrete locations.

<u>Rainfall intensity (I)</u>

Rainfall intensity was based on the 1-year, 1-hour storm event for all outfalls, which is the design storm for full trash capture devices required by MRP Section C.10, and utilizes the NOAA 90% confidence interval at each outfall's geographic location. The rainfall intensity was obtained from Table 4.2 of the *Regional Stormwater Outfall Trash Monitoring Plan*. Because the storm event and length are dictated by the MRP, there is no need to derive a time of concentration (T_c) for each drainage area, regardless of size. The intensity was checked at various locations within each drainage area. The majority of the drainage areas are small and have little to no variation. The larger drainage areas had a variation of approximately 0.01 inches per hour. In cases where

[7] Annual National Land Cover Database (NLCD) Collection 1 Science Product User Guide, USGS, June 2025.

there was variability, the value representing the majority of the catchment area was used, rather than weighting the value. Weighting the value would result in a relatively minor impact to the resultant flow rate.

The intensity resulting from extrapolating the 1-year, 1-hour intensity from the 2-year through 10-year storm events provided in the ACFCWCD and the SCC Drainage Manuals is within the NOAA Low/High range for intensity values at each site. Therefore, NOAA 90% confidence interval intensity values are considered to be a reasonable representation for each catchment area.

With the exception of the two largest drainage areas (SC-COY and SC-STE), the estimated pipe-routed times of concentration, which would be the typical flow regime in a 1-year storm event, are less than 60 minutes. This condition means that runoff from the entire catchment area would be expected to have reached the outfall in less than one hour.

Results

For each of the outfall monitoring locations, Table 1 provides a summary of the catchment area size; the land use-based weighted runoff coefficient; the estimated 1-year, 1-hour storm intensity and FTC flow rate based upon the NOAA Atlas 14 90% confidence interval intensity; and the Water Year 2024 (WY 2024) through Water Year 2025 (WY 2025) monitored maximum rainfall intensity and flow rate measured in the field.

The far right two columns of the table compare the estimated 1-year, 1-hour FTC design storm event rainfall intensity (I) and FTC flow rate (Q) to the maximum flow rates monitored in the field (i.e., monitored maximum). The purpose of this comparison is to evaluate whether the maximum flow rate monitored during a storm event exceeded the calculated FTC flow rate (i.e., the 1-year, 1-hour storm event), and thus trash discharged during this event would not have (conceptually) been intercepted by the upstream FTC system(s). In summary, the monitored maximum flow rate was greater than the FTC flow rate (Q) during one or more storm events at five of the 12 outfall monitoring locations. At the remaining six active monitoring locations, measured maximum flow rates never exceeded the FTC flow rate during the period of record.

Table 1: Summary of hydrological calculation estimates for the Full Trash Capture (FTC) design storm (1-yr, 1-hr) and comparison to monitored flows at eleven stormwater outfall sites in the San Francisco Bay Area.

Outfall Monitoring Location Site ID	Area (A) (acres)	Land Use-based Weighted Runoff Coefficient (C)	Estimated Full Trash Capture (FTC) Design Storm (1-yr, 1-hr)		Rainfall and Flow Data Water Years 2024 and 2025		Rainfall and Flow Data Exceeds Estimated?	
			$I_{NOAA\ 90\%}$ (in/hr)	Q_{est} (cfs)	I_{max} (in/hr)	Q_{max} (cfs)	I_{max} (in/hr)	Q_{max} (cfs)
AC-CIVIC[1]	13.0	0.77	0.45	4.5	0.2	0.9	No	No
AC-CTYCTR	3.7	0.79	0.42	1.2	0.4	0.2	No	No
AC-OUTBK	19.0	0.79	0.46	6.9	0.4	6.0	No	No
AC-PUBSAF	11.0	0.79	0.45	3.9	0.4	4.9	No	**Yes**
CC-PCH	3.9	0.80	0.33	1.0	0.5	11.8	Yes	**Yes**
CC_WC	1.0	0.79	0.42	0.3	0.33	0.24	No	No
SC-COY	401.0	0.69	0.32	87.1	0.4	82.1	Yes	No
SC-SFC	60.0	0.76	0.36	16.4	0.9	44.4	Yes	**Yes**
SC-STE	137.0	0.65	0.36	32.4	0.4	10.0	Yes	No
SM-PIL	86.0	0.69	0.50	29.9	0.9	14.1	Yes	No
SM-SBS	57.0	0.66	0.42	15.9	0.8	27.7	Yes	**Yes**
SSA-LOTZ[2]	4.3	0.8	0.39	1.4	0.7	3.1	Yes	**Yes**

[1] Site AC-CIVIC was only monitored during WY 2024. It was replaced with site AC-CTYCTR.

[2] Area, Land Use, NOAA intensity, and Rainfall and Flow Data for WY2025 data obtained from *Appendix B – SSA Trash Outfall Monitoring Progress Report, Water Year 2025.*

Attachment B

Trash Outfall Monitoring – Results by County

Alameda Countywide Clean Water Program (ACCWP)

Contra Costa Clean Water Program (CCCWP)

San Mateo Countywide Water Pollution Prevention Program (SMCWPPP)

Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)

Solano Stormwater Alliance (SSA)

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B1 ALAMEDA COUNTY CLEAN WATER PROGRAM (ACCWP)

B1.1 Introduction

Consistent with MRP 3.0 Provision C.8.e, ACCWP selected three MS4 outfall locations in Alameda County for trash outfall monitoring beginning in WY 2024. Each of the three monitoring sites is located within the City of Dublin, CA (Figure AC-1). The first outfall location (AC-OUTBK) drains directly to Dublin Creek. Sites AC-CIVIC and AC-PUBSAF both drain to Alamo Canal.

In its 2023 Conditional Approval letter of the ACCWP Monitoring Plan, the Water Board required ACCWP to change at least one of the three outfall monitoring sites, or add an additional site elsewhere in the County, for greater geographic representation across the County. The Program identified a replacement outfall in the City of Hayward near De Anza Park (Figure AC-1). Site AC-CIVIC in Dublin was discontinued after conduct of WY 2024 monitoring and replaced with site AC-CTYCTR in Hayward in time for initiation of WY 2025 monitoring.

Characteristics of each monitoring location and corresponding drainage area are provided below.

Outback (AC-OUTBK)

Site AC-OUTBK is a 36-inch diameter reinforced concrete pipe (RCP) that drains an approximately 19-acre catchment area bounded by I-580 and San Ramon Road in the City of Dublin (Figure AC-2). Land use in the catchment area is predominantly commercial. Baseline trash generation rates are approximately 7% low, 56% moderate, and 36% high by area. The catchment area is controlled to a low trash designation by use of a high-capacity treatment system (hydrodynamic separator (HDS)) installed approximately 30 feet upstream of the outfall. Trash management actions in the catchment have resulted in reducing the estimated trash generation rate from 13.4 (baseline) to 2.5 (current) gallons/acre/year.[13]

The outfall at site AC-OUTBK drains to a concrete landing on the north bank of Dublin Creek, which is constrained in the immediate area by I-580 on the south side and development on the north. ACCWP installed an OldcastleTM NetTech™ insert device for monitoring at this location. The outfall is owned by the Zone 7 Water Agency (Zone 7). The surrounding banks are mostly earthen with interspersed grade control structures and exhibit a high density of trash that is likely blown in from the adjacent highway. There are also indications of use of the banks in the project vicinity by unhoused populations via observations of campsites and accumulations of discarded trash and belongings.

Dublin Public Safety Complex (AC-PUBSAF)

Site AC-PUBSAF is a 36-inch RCP that drains an approximately 11-acre catchment area, which includes the Dublin Public Safety Complex and a commercial block west of Clark Avenue in the City of Dublin (Figure AC-3). Land use in the catchment area is predominantly commercial. Baseline trash generation rates for the catchment area are approximately 4% high and 96%

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[13] Baseline trash generation rates were developed in 2012 by all Permittees, prior to the implementation of trash control measures. Current trash generation are based on the reductions in trash generation following the implementation of trash control measures (BAMSC 2024a). Both baseline and current trash generation rates were estimated as a spatially weighted average using midpoint values of trash generation rate categories and the proportion of each catchment that is controlled to low for each timeframe.

moderate by area. The catchment area is controlled to a low trash designation by a combination of a privately-owned HDS unit (approximately 44% of the overall catchment area), catch basin inserts (5%), and two multi-benefit stormwater treatment systems (MBTSs) (48%). Trash management actions in the catchment have resulted in reducing the estimated trash generation rate from 8.1 (baseline) to 2.6 (current) gallons/acre/year.

The outfall, owned by Zone 7, drains to a sloped concrete apron on the west bank of Alamo Canal approximately 150 m upstream of I-580. ACCWP installed an OldcastleTM NetTech™ insert device for monitoring at this location. The surrounding banks are earthen and typically exhibited relatively low densities of trash accumulation.

DeAnza Park, Hayward (AC-CTYCTR)

Site AC-CTYCTR, which replaced site AC-CIVIC at the end of WY 2024 monitoring, is a 24-inch RCP that drains an approximately 3.7-acre catchment area north of City Center Drive in the City of Hayward (Figure AC-4). Land use in the catchment area is predominantly commercial. Baseline trash generation rates for the catchment area were identified as 100% moderate by area. The catchment area is controlled to a low trash designation by use of connector pipe screen (CPS) units installed at three inlets upstream of the outfall. Trash management actions in the catchment have resulted in reducing the estimated trash generation rate from 7.5 (baseline) to 2.5 (current) gallons/acre/year.

The outfall, which is owned by the City of Hayward, drains to San Lorenzo Creek in De Anza Park just downstream of 2nd Street. The outfall is an 18-inch concrete pipe that empties onto a long concrete spillway on the north bank of the creek (Figure AC-4). Prior to WY 2025 monitoring, ACCWP installed a headwall in De Anza Park to use with an Oldcastle NetTech™ Gross Pollutant Trap system with 5 mm mesh size for use in monitoring.

Dublin Civic Center (AC-CIVIC)

Site AC-CIVIC is a 24-inch RCP that drains an approximately 13-acre catchment area west of the Dublin Civic Center and Public Library in the City of Dublin (Figure AC-5). Land use in the catchment area is predominantly commercial. Baseline trash generation rates for the catchment area are identified as approximately 2% low and 98% moderate by area. The catchment area is controlled to a low trash designation by use of an HDS installed just upstream of the outfall. Trash management actions in the catchment have resulted in reducing the estimated trash generation rate from 7.4 (baseline) to 2.5 (current) gallons/acre/year.

The outfall, owned by Zone 7, drains onto a concrete apron on the east bank of Alamo Canal approximately 600 feet upstream of I-580. ACCWP installed an Oldcastle™ NetTech™ insert device for monitoring at this location. The surrounding banks are earthen and typically exhibited relatively low densities of trash accumulation. A section of the bank just upstream of the outfall was covered with plastic sheeting throughout WY 2024 due to erosion occurring in this area.

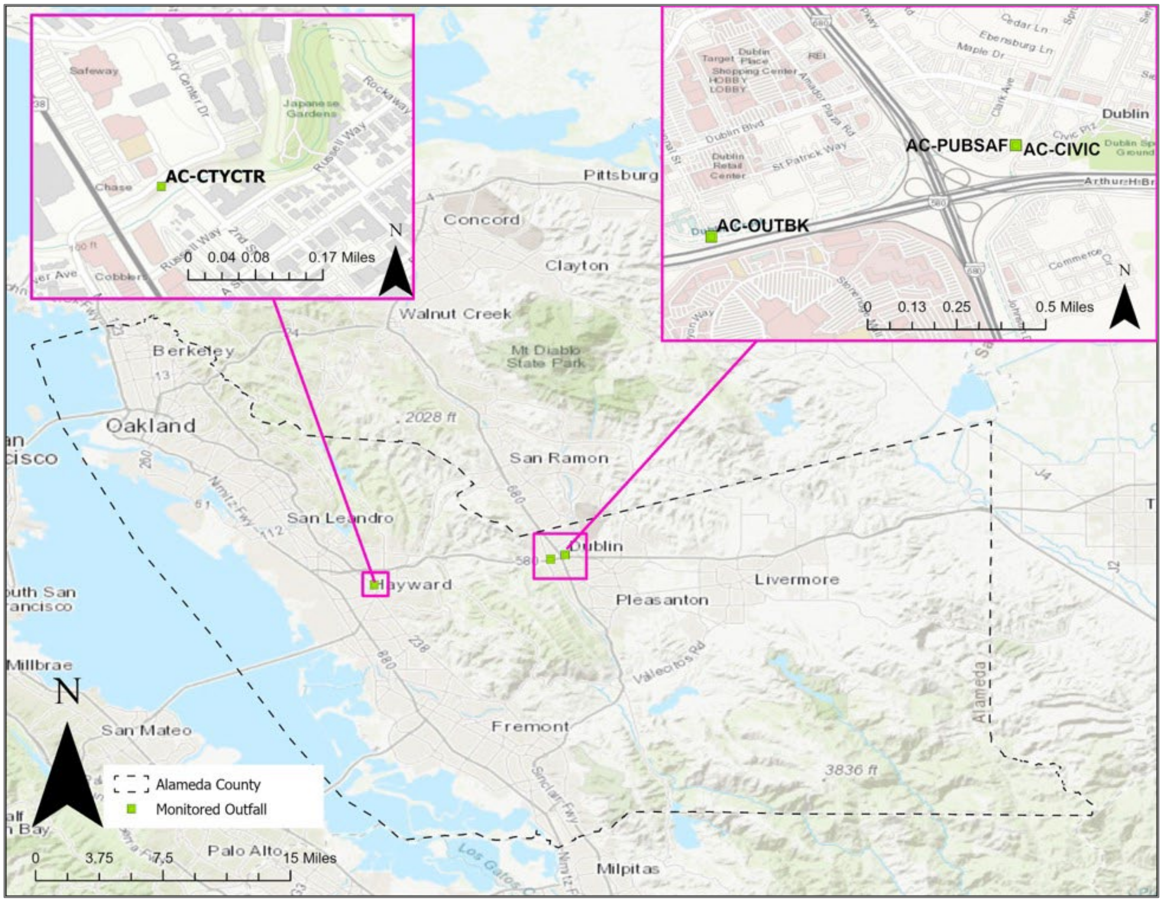


Figure AC-1. Trash Outfall Monitoring Locations in Alameda County

Figure AC-2. AC-OUTBK outfall, prior to the installation of the NetTech™ monitoring device, located on the north bank of Dublin Creek, City of Dublin

Figure AC-3. AC-PUBSAF outfall, prior to the installation of the NetTech™ monitoring device, located on the west bank of Alamo Canal, City of Dublin

Figure AC-4. AC-CTYCTR outfall, with the NetTech™ monitoring device, located on the north bank of San Lorenzo Creek, City of Hayward

Figure AC-5. AC-CIVIC outfall, with the NetTech™ monitoring device, located on the east bank of Alamo Canal, City of Dublin

B1.2 Results

B1.2.1 Sample Events

During WYs 2024 and 2025, eighteen successful sample events were conducted at the four monitoring locations discussed in Section B1 (three events at each of three target stations during each WY). During WY 2024, one additional sampling event was attempted at site AC-OUTBK but was discarded due to possible loss of material from the trash net.

The dates and times for net deployment and retrieval and the duration of sample collection for each successful sample event are presented in Table AC-1. Summary statistics for rainfall and flow for each sample event are also provided. Additional results showing rainfall totals and flow measurements for each sample event, as well as over the entire wet season, are presented in Section B2.3 below.

ACCWP received and installed NetTech™ inserts at three WY 2024 monitoring locations (AC-OUTBK, AC-PUBSAF, and AC-CIVIC) in mid-October 2024. Due to a manufacturing delay, the associated NetTech™ trash collection nets were not received until early November 2024, which caused a delay in opening of the WY 2024 monitoring season.[14] The installation of the trash capture device at AC-CTYCTR was completed in time to begin the WY 2025 sampling on schedule. A summary of the WY 2024 and 2025 sample events is presented below.

WY 2024 Event 1

During the first sample event of the season for the three WY 2024 ACCWP sites, nets were deployed over a seven-day period in mid-November (Table AC-1). The forecast achieved the Monitoring Plan storm event selection criteria with a quantitative precipitation forecast (QPF) of 0.55 inch and probability of precipitation (POP) > 70%. The predicted storm timing for the first sample event was delayed several days after net deployment, and the majority of rain arrived on the last two days of monitoring. Actual precipitation totaled 0.4 inches over the duration of deployment at all three sites, with a peak of 0.07 inch/hour as measured at the Zone 7 weather station near Alamo Canal. Event 1 was preceded by nine days of dry conditions. Samples were successfully collected at each of the three monitoring sites.

WY 2024 Event 2

ACCWP deployed nets over a five-day period at the three sites in mid-January 2024. For this event, the forecast included a QPF above 1 inch with a greater than 90% POP; the forecast also indicated a possible design storm event, with associated flash flood warnings for the City of Dublin. Actual precipitation over this deployment period totaled 1.5 inches with a peak intensity of 0.23 inch/hour. Event 2 was preceded by approximately 3 days of dry conditions (Table AC-1). During net retrievals for this event, the end of the net attached at site AC-OUTBK was found to be partially opened. Due to the potential loss of material, this sample was discarded and a replacement monitoring event was planned for this site. Samples were collected successfully from AC-PUBSAF and AC-CIVIC.

WY 2024 Event 3

ACCWP deployed nets over a three-day period at the three sites in late January and early February. At the time of net deployment, the forecast for this storm included a QPF of 2.1 inches with a 95%

[14] This did not affect ACCWP's ability to collect the first significant rainfall due to a delay in the onset of seasonal wet weather.

POP; the forecast also indicated a potential design storm event with flash flood warnings for the City of Dublin. Actual precipitation for the event measured at 1.2 inches with a peak intensity of 0.2 inch/hour. The antecedent dry condition for this storm was approximately 6 days. Samples were successfully collected from all three sites. This was the second successful monitoring event at AC-OUTBK and the third and final event sampled at AC-PUBSAF and AC-CIVIC.

WY 2024 Event 4 (AC-OUTBK only)

Due to potential loss of material at site AC-OUTBK during sampling Event 2, ACCWP deployed the net at this site for a fourth storm to collect a third sample at this location for the monitoring year. ACCWP deployed the net at AC-OUTBK for approximately seven days in mid-February 2024. At the time of net deployment, the forecast for this storm included a QPF of 2.2 inches with an 85% POP for the six-day period following deployment. Actual precipitation for the event was recorded as 1.9 inches, with a peak intensity of 0.37 inches/hour, which was slightly below both the measured maximum intensity over the course of WY 2024 (0.378 inches/hour on March 6, 2024) and the one-year one-hour design storm of 0.43 inches/hour for Dublin (https://hdsc.nws.noaa.gov/hdsc/pfds/). The antecedent dry condition for this storm was approximately 9 days. A sample was successfully collected from AC-OUTBK for the third and final event.

WY 2025 Event 5

Prior to initiation of WY 2025 monitoring, WY 2024 site AC-CIVIC was discontinued and replaced with site AC-CTYCTR. ACCWP deployed trash capture nets for the WY 2025 first significant storm event, which occurred in mid-November 2025. This was preceded by one false start monitoring event where nets were deployed but precipitation did not meet minimum storm definition requirements, and this is not considered a successful monitoring event.

ACCWP deployed nets at three WY 2025 monitoring locations (AC-OUTBK, AC-PUBSAF, and AC-CTYCTR) for a two-day period beginning November 10, 2024 (Table AC-1). The forecast achieved the Monitoring Plan storm event selection criteria with a QPF of 0.25 inch and POP > 80% for both Hayward and Dublin monitoring sites. Actual precipitation at the Dublin stations was measured as 0.28 inches over approximately three hours with a peak intensity of 0.2 inches/hour. Actual precipitation at the Hayward site totaled 0.34 inches over approximately nine hours with a peak intensity of 0.1 inches/hour. Event 5 was preceded by over 30 days of dry conditions. Samples were successfully collected at each of the three monitoring sites.

WY 2025 Event 6

ACCWP deployed nets over a two-day period at the three sites in mid-December 2024. For this event, the forecast included a QPF above 0.6 inches with a greater than 90% POP for all sites. Actual precipitation measured at the Dublin stations totaled 0.49 inches with a peak intensity of 0.18 inches/hour recorded over approximately four hours of consistent precipitation. At the Hayward station, precipitation measured 0.91 inches with a peak intensity of 0.23 inches/hour recorded over 32 hours. Event 6 was preceded by approximately 16 days of dry conditions (Table AC-1). Samples were successfully collected at each of the three monitoring sites.

WY 2025 Event 7

ACCWP deployed nets over a two-day period at the three sites in early February 2025. The forecast for all sites included a QPF of approximately 1.75 inches over 30 hours with a > 95% POP. The forecasts indicated a potential design storm event with flash flood warnings for all sites. Actual precipitation at the Dublin sites measured at 1.12 inches over 17 hours with a peak intensity of 0.36 inches/hour, below the design storm intensity of 0.45 inches/hour; actual precipitation at the Hayward site measured at 1.5 inches over 20 hours with a peak intensity of 0.41 inches/hour, just below the design storm intensity of 0.44 inches/hour.[15] The trash net at CTYCTR site released on February 4, 2025 at 17:00 hours after approximately 1.32 inches of measured precipitation, representing a period of approximately 97% of the total flow measured for this station over the entire storm. The antecedent dry condition for this storm was approximately 2 days. Samples were successfully collected from all three sites.

[15] NOAA Precipitation Frequency Estimates. https://hdsc.nws.noaa.gov/pfds/pfds_map_cont.html?bkmrk=ca

Table AC-1. Summary of net deployment and storm period, antecedent dry period, and rainfall total and intensity for trash outfall sampling events conducted in Alameda County during WY 2024 and WY 2025

Site	WY	Sample ID	Net Deploy[3] Start Date	Net Deploy End Date	Sample Duration (hours)	Storm Duration (hours)	Antecedent Dry (days)	Precipitation Total (in)	Maximum Intensity (in/hr)	First Significant Storm
AC-OUTBK	2024	Event 1	11/13/23 15:35	11/21/23 09:05	72	72	9	0.4	0.07	x
		Event 3	01/30/24 14:35	02/02/24 08:10	41	41	6	1.2	0.2	
		Event 4	02/14/24 11:20	02/21/24 12:25	150	150	9	1.9	0.37	
	2025	Event 5	11/10/24 12:25	11/12/24 10:15	3	3	>30	0.3	0.20	x
		Event 6	12/11/24 16:00	12/13/24 13:50	4	4	16	0.6	0.18	
		Event 7	02/03/25 12:00	02/05/25 08:53	17	17	37	1.1	0.36	
AC-PUBSAF	2024	Event 1	11/13/23 13:53	11/21/23 09:37	72	72	9	0.4	0.07	x
		Event 2	01/18/24 10:45	01/23/24 10:30	68	68	3	1.5	0.23	
		Event 3	01/30/24 12:58	02/02/24 09:40	41	41	6	1.2	0.21	
	2025	Event 5	11/10/24 11:46	11/12/24 10:50	3	3	>30	0.3	0.20	x
		Event 6	12/11/24 16:00	12/13/24 13:50	4	4	17	0.6	0.18	
		Event 7[1]	02/03/25 11:20	02/05/25 09:08	17	17	37	1.1	0.36	
AC-CTYCTR	2025	Event 5	11/10/24 13:06	11/12/24 09:30	10	10	9	0.3	0.09	x
		Event 6	12/11/24 16:30	12/13/24 13:30	32	32	16	0.9	0.23	
		Event 7[2]	02/03/25 21:45	02/05/25 07:30	19.5	20	2	1.5	0.41	
AC-CIVIC	2024	Event 1	11/13/23 13:40	11/21/23 09:21	72	72	9	0.4	0.07	x
		Event 2	01/18/24 11:50	01/23/24 10:07	68	68	3	1.5	0.23	
		Event 3	01/30/24 13:40	02/02/24 09:10	41	41	6	1.2	0.20	

Note: Disqualified events that resulted in no sample collected due to equipment failure or lack of a qualifying storm event are not included.

1Analysis of flow measurements indicated net detached at 17:24 on 02/04/25. Approximately 90% of flow associated with this storm event had passed through the outfall by the time of detachment.

2. Analysis of flow measurements indicated net detached at 17:00 on 02/04/25. Approximately 97% of flow associated with this storm event had passed through the outfall by the time of detachment.

3 Defined as time of precipitation start to end for a defined storm event.

4 Discontinued station following WY 2024 monitoring.

B1.3 Trash Characterization

Trash collected for all ACCWP sampling events were sorted into 13 trash categories defined for the Project and measured for volume. Results associated with WY 2024 and WY 2025 monitoring are discussed by sampling site in the sections that follow.

AC-OUTBK

Total trash volumes measured at site AC-OUTBK across the six successful sampling events in WY 2024 and WY 2025 ranged from 0 to 4.1 gallons (Table AC-2). The 4.1 gallon sample associated with Event 3 is greatly influenced by what is considered an outlier sample, where two large, flattened cardboard boxes were found accumulated in the net and are thought to have been placed inside the outfall as a sleeping pad prior to deployment of the net.[16] Sampling protocols have been modified to look for larger objects that may have been placed inside the outfall before each sampling event. Removing this outlier from the calculations would result in an average volume more closely in line with remaining five sampling events (0.05 gallons/acre). The outlier data is included in Table AC-2 but excluded from all remaining discussion and analysis.

Table AC-2. Trash volume measured for 13 trash types identified from trash samples collected at Alameda County outfall trash monitoring site AC-OUTBK in WY 2024 and WY 2025

	Trash Type	WY 2024			WY2025		
		Event 1	**Event 2**	**Event 4**	**Event 5**	**Event 6**	**Event 7**
Plastic Trash Items (oz)	Single-Use Carryout Plastic Bags	0	0	0	0	0	0
	Expanded Polystyrene (EPS) Foam	0	0	0.2	0	0	0
	(EPS) Foam Other	0	12	0	0	0	0
	Single Use Plastic Food / Drink Ware	0	12	84	0	0	21.7
	Smoking Products, Traditional	0	0	0.1	0.07	0	0
	Smoking Products, Other	0	0	1.7	0	0	0
	Other plastic Items / Pieces	0	64	20	31	0.03	110.1
Non-Plastic Trash (oz)	Organic / Paper	0	0	411[1]	0	0.03	30
	Fabric	0	0	6.8	0	0.03	0
	Metal	0	1	0.2	0	0	0
	Glass	0	0	0	0	0	0
	Mixed	0	0	0.9	0	0	0
	Biohazard	0	0	0	0	0	0
	Total Gallons	**0**	**0.7**	**4.11**	**0.2**	**0**	**1.3**
	Total Gallons/Acre	**0**	**0.04**	**0.221**	**0.01**	**0**	**0.07**

1 Outliers included in table but are removed for analytical purposes in remainder of report. See discussion above in Section B.2.2.1.

[16] The HDS unit associated with this monitoring site is located less than 20 m upstream of the outfall and the likelihood of the boxes making it through the HDS in wet but intact condition are considered low.

The total volume of trash collected in each sample collected at site AC-OUTBK, standardized for area, is shown in Figure AC-6. Event 1, the first significant storm event of WY 2024, generated the lowest volume of trash across the six successful sampling events completed during WY 2024 and WY 2025. It was preceded by two smaller storm events that did not achieve mobilization criteria– an approximately 0.1-inch storm on October 22, 2024 and an approximately 0.2-inch storm on November 5, 2024–but may have served to transport some volume of trash through the system.

The highest measured trash volume per unit area occurred during Event 4 in WY 2024, which is associated with the highest total storm precipitation (1.9 inches) and maximum storm intensity (0.37 inches/hour) of all storms monitored at the site to-date. Excluding the aforementioned outlier sample, all remaining sample events generated sampled trash volumes below 0.1 gallons/acre. Estimated annual trash loading rates for AC-OUTBK are presented in Section 3.4.4 of the main report.

AC-PUBSAF

Total trash volumes measured at site AC-PUBSAF across the six successful sampling events ranged from 0.1 to 3.2 gallons per event (Table AC-3). The one sample event that exceeded 1-gallon total volume (3.2 gallons) was associated with the WY 2025 first significant storm event. Trash collected during this sampling event was nearly entirely associated with the category of “Other Plastic Items,” and consisted mainly of plastic bottles, plastic bags, and plastic food wrappers (including Halloween candy). The total volume of trash collected in each sample collected at site AC-PUBSAF, standardized for area, is shown in Figure AC-7.

Table AC-3. Trash volume measured for 13 trash types identified from trash samples collected at Alameda County outfall trash monitoring site AC-PUBSAF in WY 2024 and WY 2025

	Trash Type	WY 2024			WY2025		
		Event 1	Event 2	Event 3	Event 5	Event 6	Event 7
Plastic Trash Items (oz)	Single-Use Carryout Plastic Bags	0	0	0	0	0	0
	Expanded Polystyrene (EPS) Foam	0	0	0	0	0	0
	(EPS) Foam Other	8.1	1.4	0	0.07	23.00	0.34
	Single Use Plastic Food / Drink Ware	0	6	0	0	0	1.35
	Smoking Products, Traditional	0.4	1.2	0.7	0.2	0.27	0.17
	Smoking Products, Other	0	2	6.8	0.34	0.27	0.34
	Other plastic Items / Pieces	16	5	25	415	4.2	84
Non-Plastic Trash (oz)	Organic / Paper	0	37.2	5.1	0.24	3.4	16
	Fabric	0	2	0	0	0	0
	Metal	0.7	0.5	0	0	0	0
	Glass	0	0	0	0	0	0
	Mixed	0	0	0	0	0	0
	Biohazard	0.6	0	0	0	0	0
	Total Gallons	**0.2**	**0.4**	**0.3**	**3.2**	**0.2**	**0.8**
	Total Gallons/Acre	**0.02**	**0.04**	**0.03**	**0.30**	**0.02**	**0.07**

AC-CTYCTR

Monitoring at site AC-CTYCTR was initiated in WY 2025, so there is only one year of data available for this reporting period (Table AC-4). Total trash volumes measured did not vary greatly over the three WY 2025 monitoring events (0.1 to 0.4 gallons per event). Monitoring Event 7 at this location experienced the most intense precipitation measured to-date for any ACCWP monitoring event (0.41 inches/hour) but generated the lowest trash volume (0.1 gallon) for this site; this may in part be due to a relatively short antecedent dry period associated with this storm (55 hours). The total volume of trash collected in each sample collected at site AC-CTYCTR, standardized for area, is shown in Figure AC-8.

Table AC-4. Trash volume measured for 13 trash types identified from trash samples collected at Alameda County outfall trash monitoring site AC-CTYCTR in WY 2025 (site initiated in WY 2025)

		WY 2024			WY2025		
	Trash Type	**Event 1**	**Event 2**	**Event 3**	**Event 5**	**Event 6**	**Event 7**
Plastic Trash Items (oz)	Single-Use Carryout Plastic Bags	NS	NS	NS	0	0	0
	Expanded Polystyrene (EPS) Foam	NS	NS	NS	0	0	0
	(EPS) Foam Other	NS	NS	NS	0.27	0.17	0.34
	Single Use Plastic Food / Drink Ware	NS	NS	NS	0.68	22.68	0.03
	Smoking Products, Traditional	NS	NS	NS	0.17	0.34	0.34
	Smoking Products, Other	NS	NS	NS	1.20	0.85	0.34
	Other plastic Items / Pieces	NS	NS	NS	40.00	16.00	16.00
Non-Plastic Trash (oz)	Organic / Paper	NS	NS	NS	3.40	0	0
	Fabric	NS	NS	NS	0	0	0
	Metal	NS	NS	NS	9.00	6.00	0.17
	Glass	NS	NS	NS	0	0	0
	Mixed	NS	NS	NS	0.17	0	0
	Biohazard	NS	NS	NS	0	0	0
	Total Gallons	**NS**	**NS**	**NS**	**0.4**	**0.4**	**0.1**
	Total Gallons/Acre	**NS**	**NS**	**NS**	**0.12**	**0.10**	**0.04**

AC-CIVIC

Monitoring at site AC-CIVIC was discontinued at the end of WY 2024, so there is only one year of data available for this reporting period (Table AC-5). As was the case with WY 2025 data captured at AC-CTYCTR, total trash volumes measured at AC-CIVIC did not vary greatly over the three WY 2024 monitoring events (0.01 to 0.04 gallons/acre per event). The total volume of trash collected in each sample collected at site AC-CIVIC, standardized for area, is shown in Figure AC-9.

Table AC-5. Trash volume measured for 13 trash types identified from trash samples collected at Alameda County outfall trash monitoring site AC-CIVIC in WY 2024 (site discontinued end of WY 2024)

Trash Type		WY 2024			WY2025		
		Event 1	Event 2	Event 3	Event 5	Event 6	Event 7
Plastic Trash Items (oz)	Single-Use Carryout Plastic Bags	0	0	0	NS	NS	NS
	Expanded Polystyrene (EPS) Foam	0	0	0	NS	NS	NS
	(EPS) Foam Other	0.7	1	18.6	NS	NS	NS
	Single Use Plastic Food / Drink Ware	0	30	11.8	NS	NS	NS
	Smoking Products, Traditional	0.1	0.4	0.5	NS	NS	NS
	Smoking Products, Other	0	0	0	NS	NS	NS
	Other plastic Items / Pieces	10	17	22	NS	NS	NS
Non-Plastic Trash (oz)	Organic / Paper	0	11.8	15.2	NS	NS	NS
	Fabric	0	0	0	NS	NS	NS
	Metal	0	0	0	NS	NS	NS
	Glass	0	0	0	NS	NS	NS
	Mixed	0	0	0	NS	NS	NS
	Biohazard	0	0	0	NS	NS	NS
	Total Gallons	**0.1**	**0.5**	**0.5**	**NS**	**NS**	**NS**
	Total Gallons/Acre	**0.01**	**0.04**	**0.04**	**NS**	**NS**	**NS**

The total volumes of trash collected in each ACCWP sample collected during the reporting period, standardized for area, are shown in Figures AC-6 (AC-OUTBK), AC-7 (AC-PUBSAF), AC-8 (AC-CTYCTR), and AC-9 (AC-CIVIC). The highest volume of trash collected associated with any one sampling event, excluding the previously-mentioned outlier, occurred at site AC-PUBSAF during Event 5, the first significant storm sampling event of WY 2025 (0.3 gallons/acre). Estimated annual trash loading rates for all sites are presented in Section 3.4.4 of the main report.

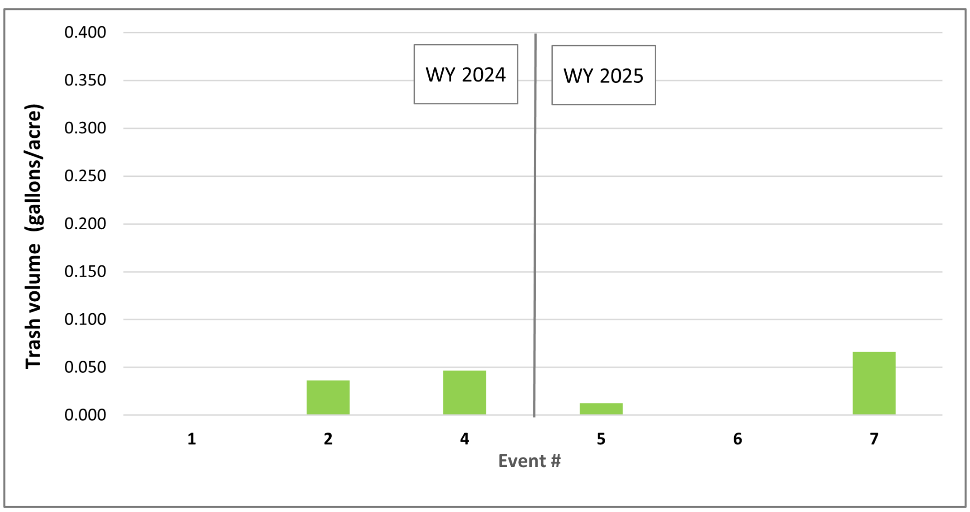


Figure AC-6. Trash volumes standardized by area for six sample events at site AC-OUTBK in Dublin, Alameda County

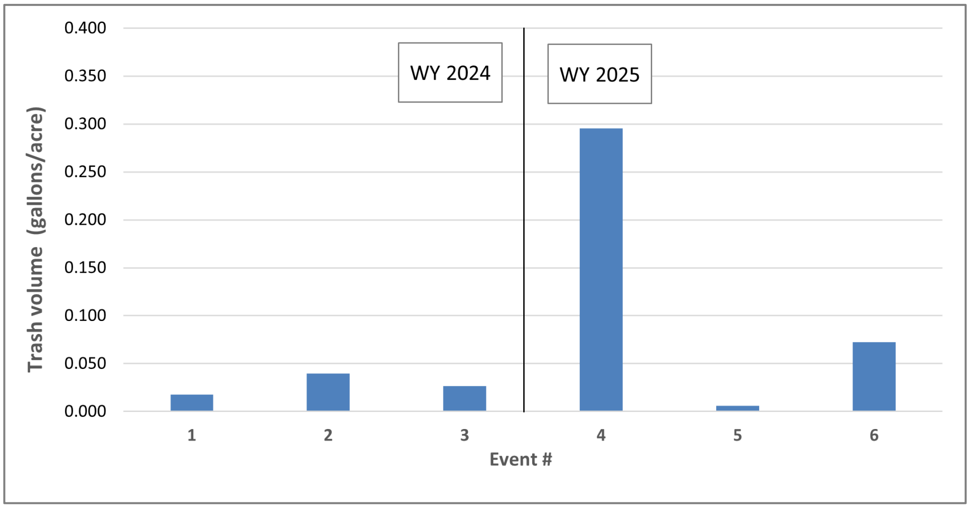


Figure AC-7. Trash volumes standardized by area for six sample events at site AC-PUBSAF in Dublin, Alameda County

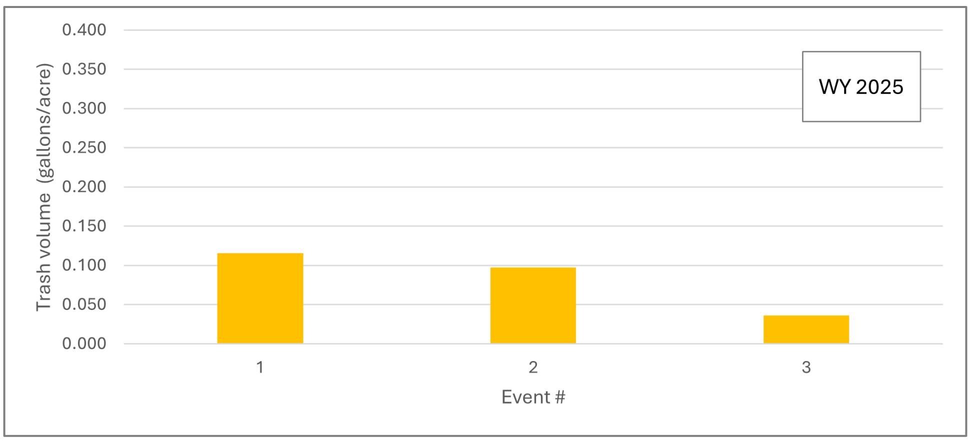


Figure AC-8. Trash volumes standardized by area for three sample events at site AC-CTYCTR in Hayward, Alameda County

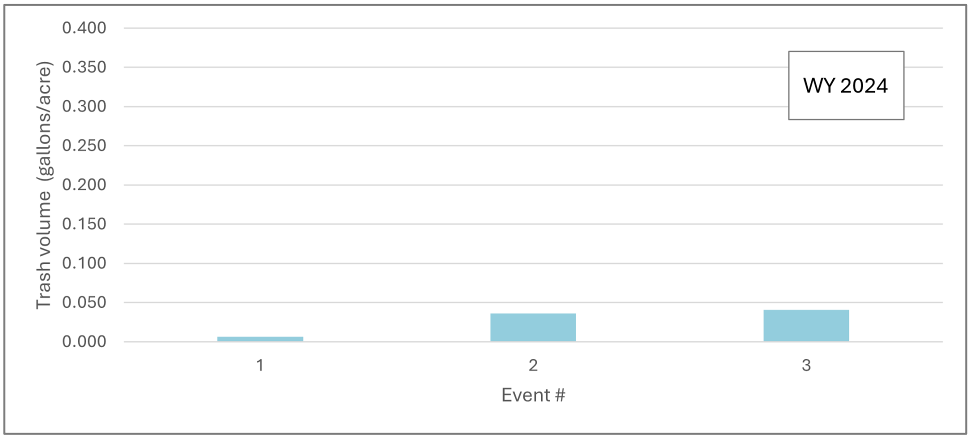


Figure AC-9. Trash volumes standardized by area for three sample events at site AC-CIVIC in Dublin, Alameda County

The most common trash type identified at ACCWP sites was plastic, of which there are six separate subcategories identified for this investigation.[17] The total volume for the combined six plastic trash categories presented in Tables AC-2 through AC-5 accounted for 81% to 90% of the trash collected at each of the four ACCWP monitoring sites during this reporting period (Figure AC-10).

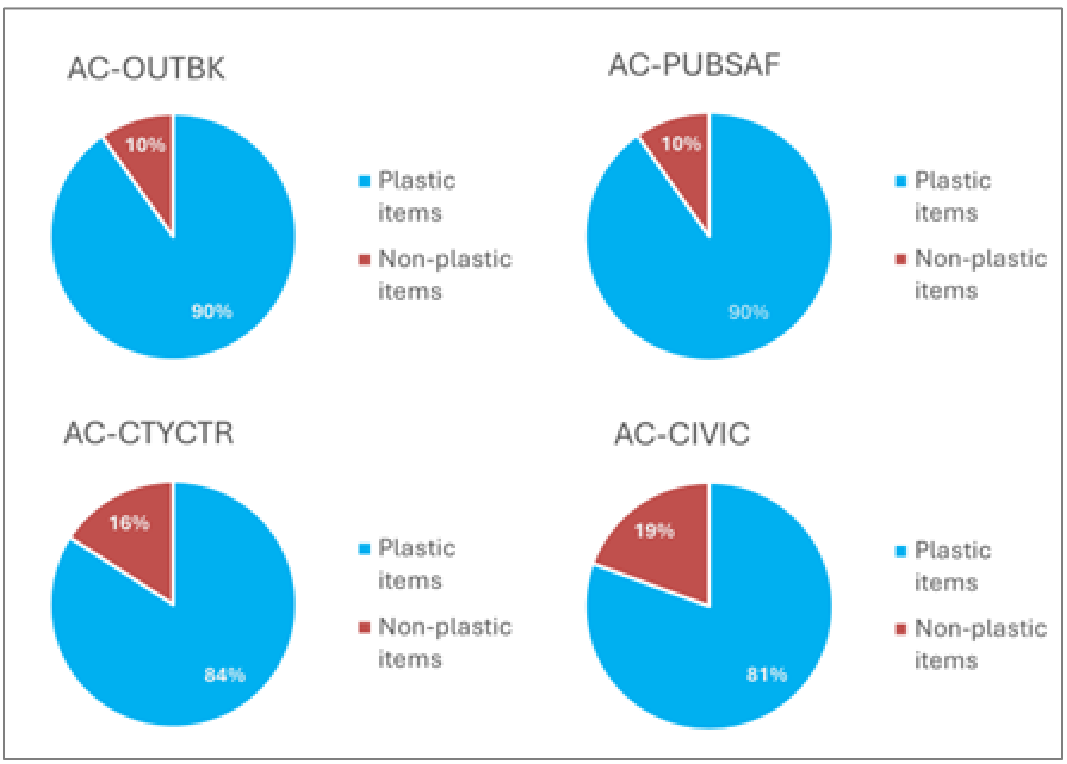


Figure AC-10. Comparison of plastic versus non-plastic trash items measured for all samples collected during the reporting period at four ACCWP sites

[17] The categories of "Smoking Products, Traditional" and "Smoking Products, Other" identified in Tables AC-2 through AC-5 are combined for these analyses.

The most common type of plastic trash was "*Other Plastic Items/Pieces*" which accounted for between approximately 40% and 90% of all plastic trash items observed at the four ACCWP monitoring sites (Figures AC-11 and AC-12), with an average across all sites for the reporting period of 77%. The "*Other Plastic Items/Pieces*" category includes plastic packaging for food and beverage goods purchased at convenience and grocery stores. The combined categories of "*Single Use Plastic Food/Drink Ware*" and "*Expanded Polystyrene* (*EPS) Foam Food/drink Ware*" made up the second largest trash volume encountered and accounted for between 1% to 37% of the plastic trash items observed at the four sites (average of 16%). It is perhaps not surprising that the highest levels of food ware-related plastic occurred in the catchments with multiple establishments selling food and beverages (AC-OUTBK and AC-CTYCTR).

No single-use plastic bags were observed at any of the sites during the study period. "*EPS Foam Other"* varied between the sites and events and accounted between 1% and 18% of total volume of plastic items between sites (average of 6%). The trash volume associated with smoking products generally made up a smaller proportion of total volume, approximately 1% to 3% at all sites (average of 2%).

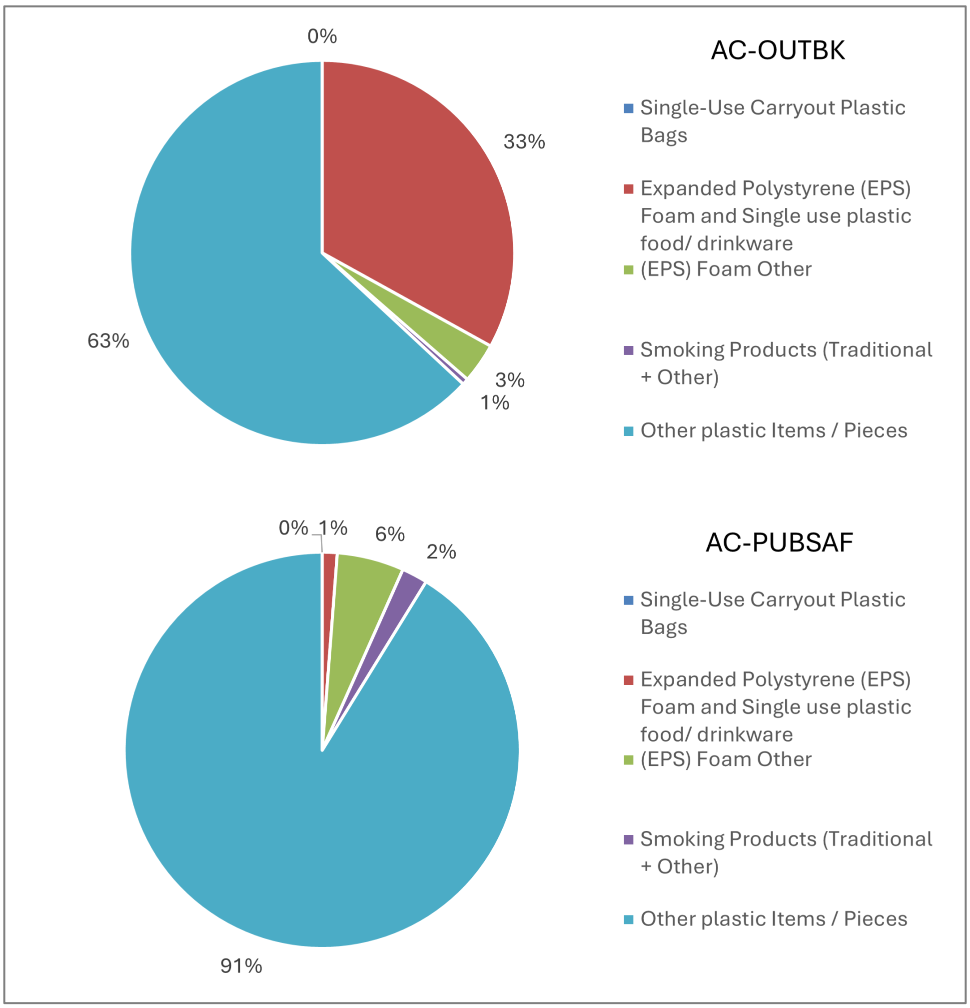


Figure AC-11. Comparison of plastic trash items measured for all samples collected during the reporting period at ACCWP sites AC-OUTBK and AC-PUBSAF (WY2024 and WY2025)

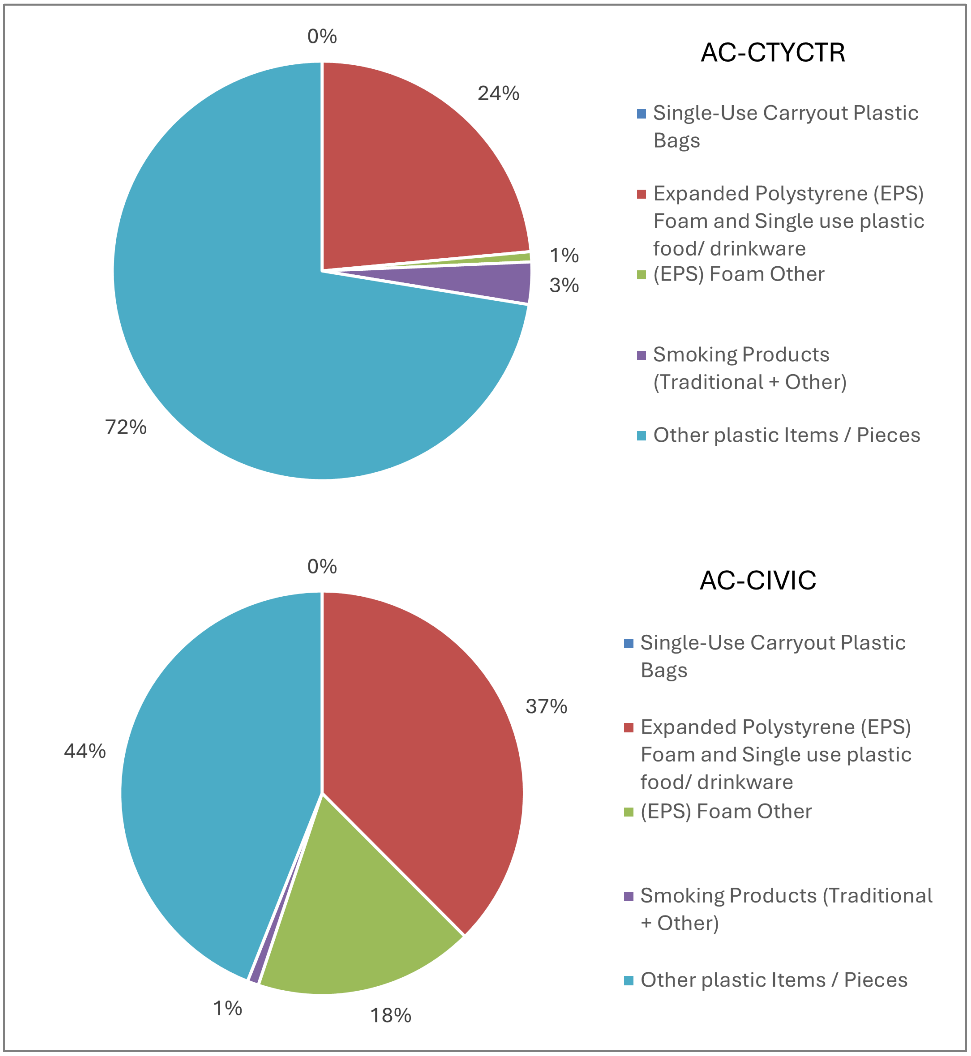


Figure AC-12. Comparison of plastic trash items measured for all samples collected during the reporting period at ACCWP sites AC-CTYCTR (WY 2025) and AC-CIVIC (WY 2024)

B1.4 Rainfall and Flow

Precipitation data for the three monitoring sites located in Dublin was obtained from a rain gauge operated by Zone 7 that is nearby to all three WY 2024 monitoring locations and identified as weather station "LJ1_BDB - Line J-1 below Dublin Blvd." The weather station is located approximately 0.8 (AC-OUTBK), 0.3 (AC-CIVIC), and 0.2(AC-PUBSAF) km from the three Dublin monitoring stations, respectively.

Precipitation data for the AC-CTYCTR site was obtained from two rain gauges operated by the Alameda County Public Works Agency in Hayward, CA. Weather station ACF#25 at San Miguel (02G0019) is located approximately 2 km north of the trash monitoring site and weather station Ward Creek near Sylvan Glen Court (M03B0002) is located approximately 1.5 km southwest of it. Total precipitation was calculated for the trash monitoring effort as an inverse weighted average.

To estimate end-of-pipe flows for each monitoring location, ACCWP installed depth sensors in each monitored outfall prior to the start of each monitoring season. Sensors functioned well and generated a continuous record throughout the wet season. Manning's Equation was used to calculate flow from depth measurements at 2-minute sampling intervals, and to calculate total and peak volume per storm. However, for the majority of storm events for which monitoring nets were attached, the nets along with their accumulated material (vegetation and trash) caused flow to back up into the pipes, artificially inflating depth measurements and biasing high the calculated flows.

To estimate flows for the storms where net deployments interfered with depth sensor measurements, total precipitation and total and peak flow data were collected for all storms at all locations when nets were not deployed. The data from those unsampled storms were used in a linear regression model analysis to estimate total and peak flow for the sampled storm events at each location for which this interference occurred.

The lm function was used in R Studio 2023 (Version 6.1.524). The resulting linear equation was then used to estimate total and peak flow at each site with the total rainfall precipitation for a given storm. Total precipitation was found to be a significant predictor of both total and peak flow at all sampling sites. However, total flow and precipitation had stronger linear relationships than peak flow and rainfall. The weaker linear relationships between peak flow and total precipitation could be due to other factors such as storm intensity and storm duration. The storms sampled in this analysis consisted of both short, intense storms and those with lower intensity spread over several days. These differences in intensity and duration impact peak flow volumes even if the overall total precipitation is similar.

WY 2024 monitoring data was used to estimate total and peak flow occurring at the three WY 2024 monitoring sites. Combined WY 2024 and WY 2025 monitoring data was used to estimate flows for the three WY 2025 monitoring events at each site. Going forward, ACCWP will not revise a prior year's modeling results but will incorporate all existing flow monitoring data for a given site in estimating flows for that site in a given monitoring year.[18]

B1.5 Event Hydrographs

Measured precipitation totals and flow data calculated for each site over the wet season of WY 2025 are presented in Figure AC-13. Flows for each storm event for which trash nets were deployed have been estimated as described previously. Plots of rainfall and flow data for each WY 2025 sample event are shown in Figures AC-14 (AC-OUTBK), AC-15 (AC-PUBSAF), and AC-16 (AC-CTYCTR),

Annual hydrographs for WY 2024 monitoring sites AC-OUTBK, AC-PUBSAF, and AC-CIVIC are presented in Figure AC-17. Plots of rainfall and flow data for each WY 2025 sample event at sites AC-OUTBK, AC-PUBSAF, and AC-CIVIC are presented in Figure AC-18, Figure AC-19, and Figure AC-20, respectively.

The net deployment interval is indicated in all figures showing sampling events. To match the estimated total flow volumes to the 2-minute interval flows calculated using Manning's Equation, the difference between the in situ calculated total volume and the model estimated total volume were used to create a scaling factor to correct for high biased flow data when nets were attached. The differences between in situ calculated and modeled flows were estimated using the equation: (In Situ Total Flow – Modeled Total Flow) / In Situ Total Flow. The scaling factor was created by adding 1 to the decimal difference. Manning's Equation calculated flows at each timestep during a sampling event

[18] Barring major changes to land use / land cover in the catchment.

were multiplied by this site- and event-specific scaling factor to correct for high-biased measurements. These scaled flows are reflected during storm events in all hydrograph figures.

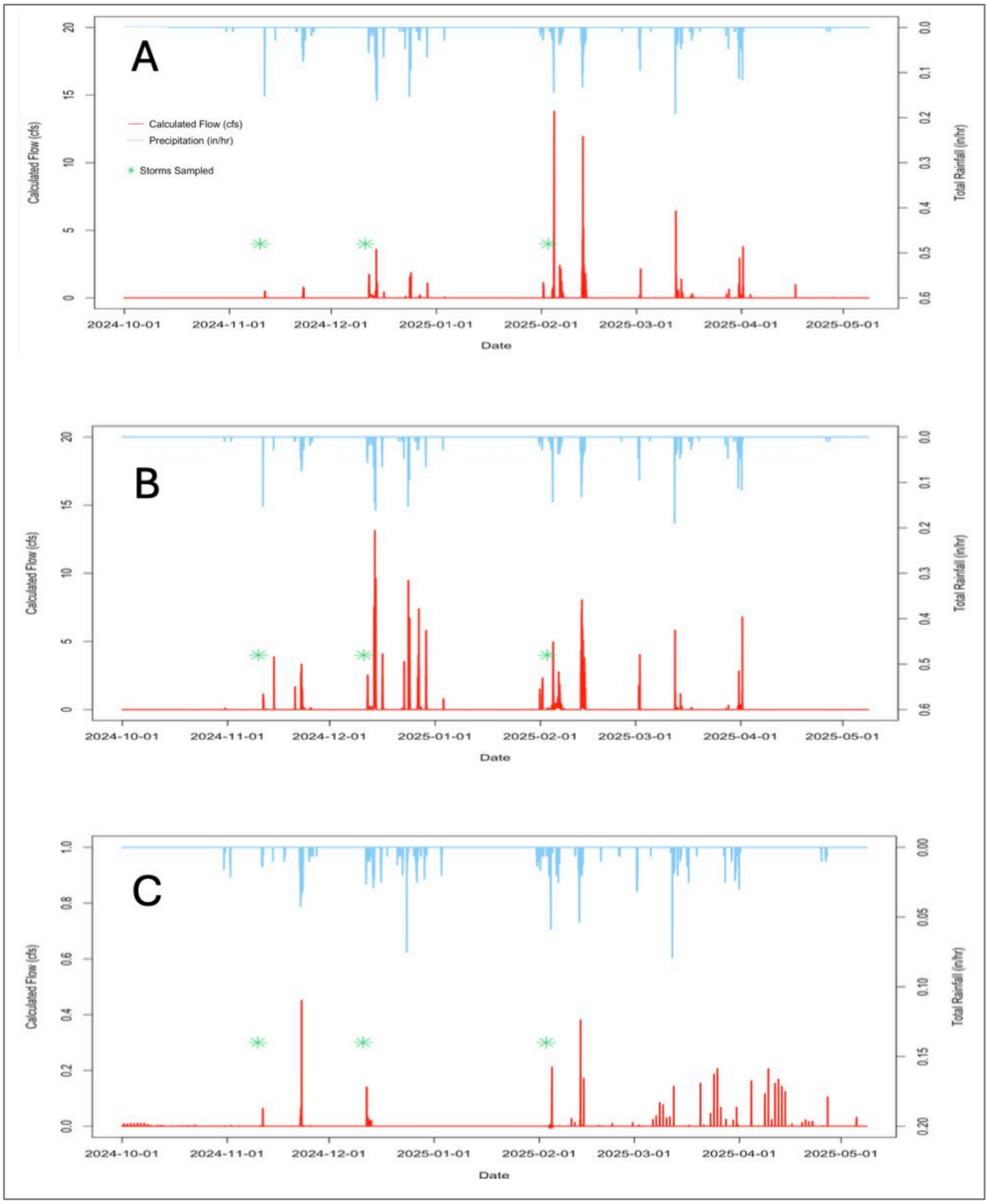


Figure AC-13. Annual hydrographs for three outfall trash monitoring sites in Alameda County monitored in WY 2025

A) AC-OUTBK B) AC-PUBSAF C) AC-CTYCTR

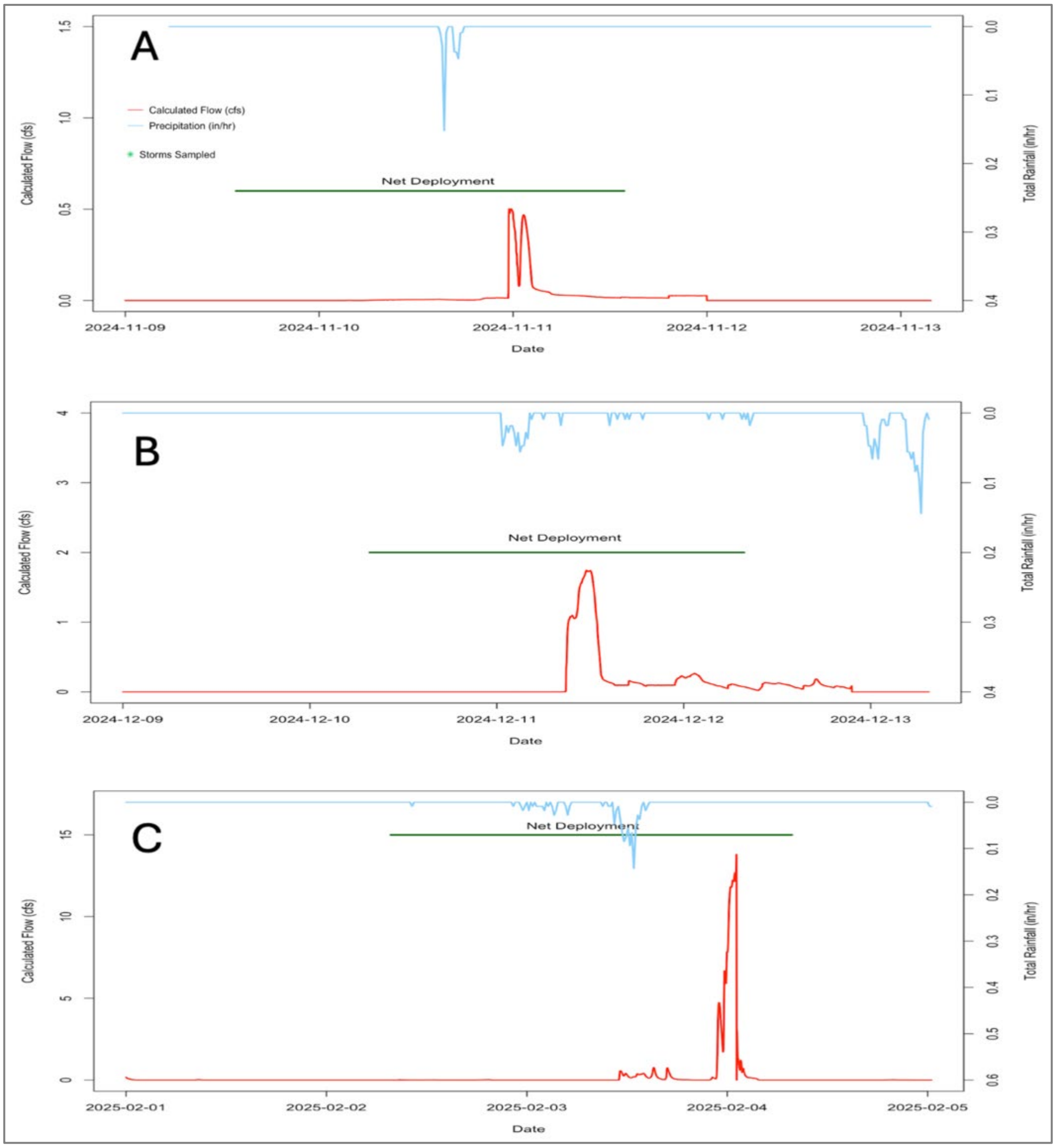


Figure AC-14. Hydrographs for three WY 2025 outfall trash monitoring events at ACCWP site AC-OUTBK

A) Event 5, November 2024 B) Event 6, December 2024 C) Event 7, February 2025.

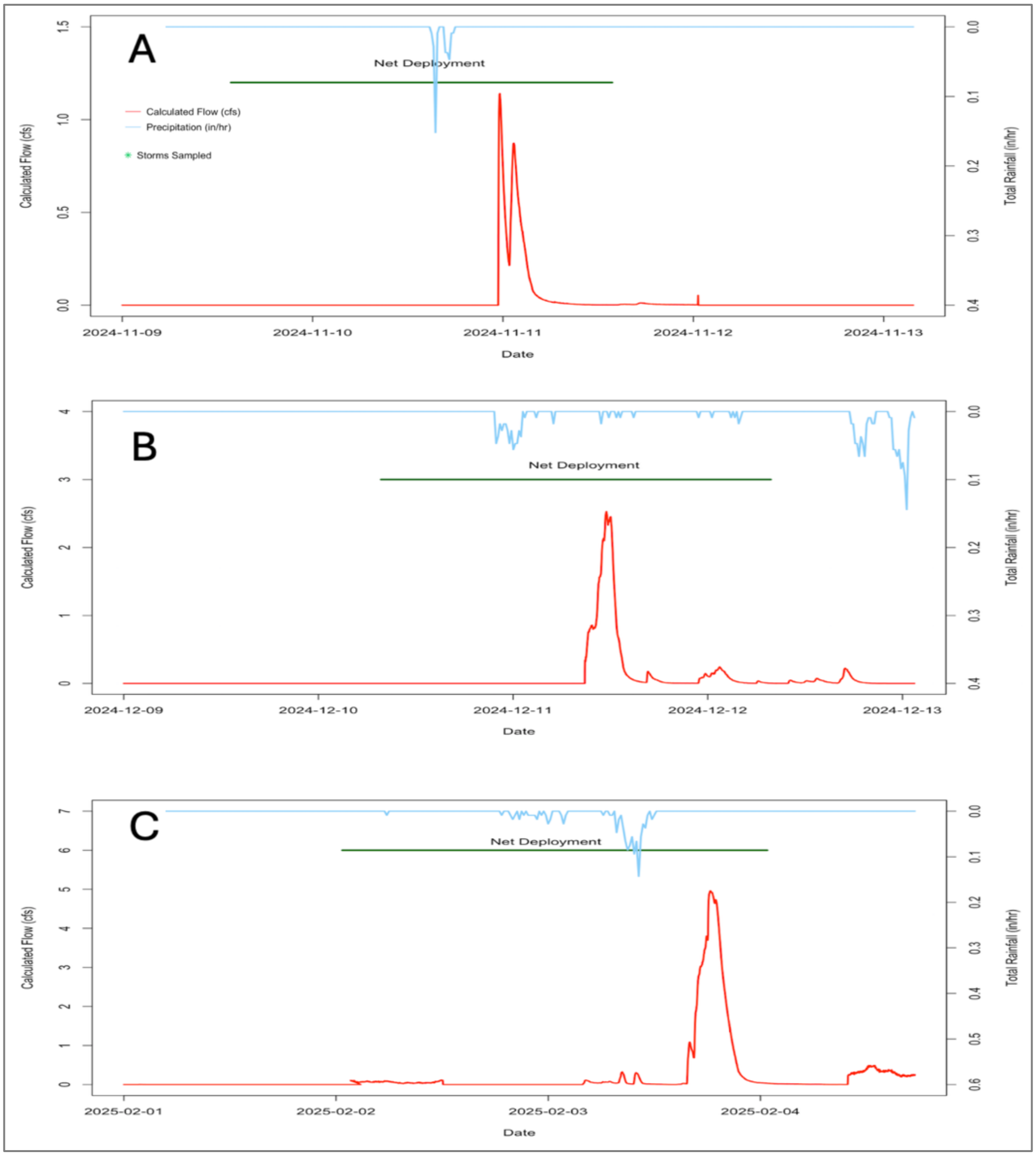


Figure AC-15. Hydrographs for three WY 2025 outfall trash monitoring events at ACCWP site AC-PUBSAF

A) Event 5, November 2024 B) Event 6, December 2024 C) Event 7, February 2025

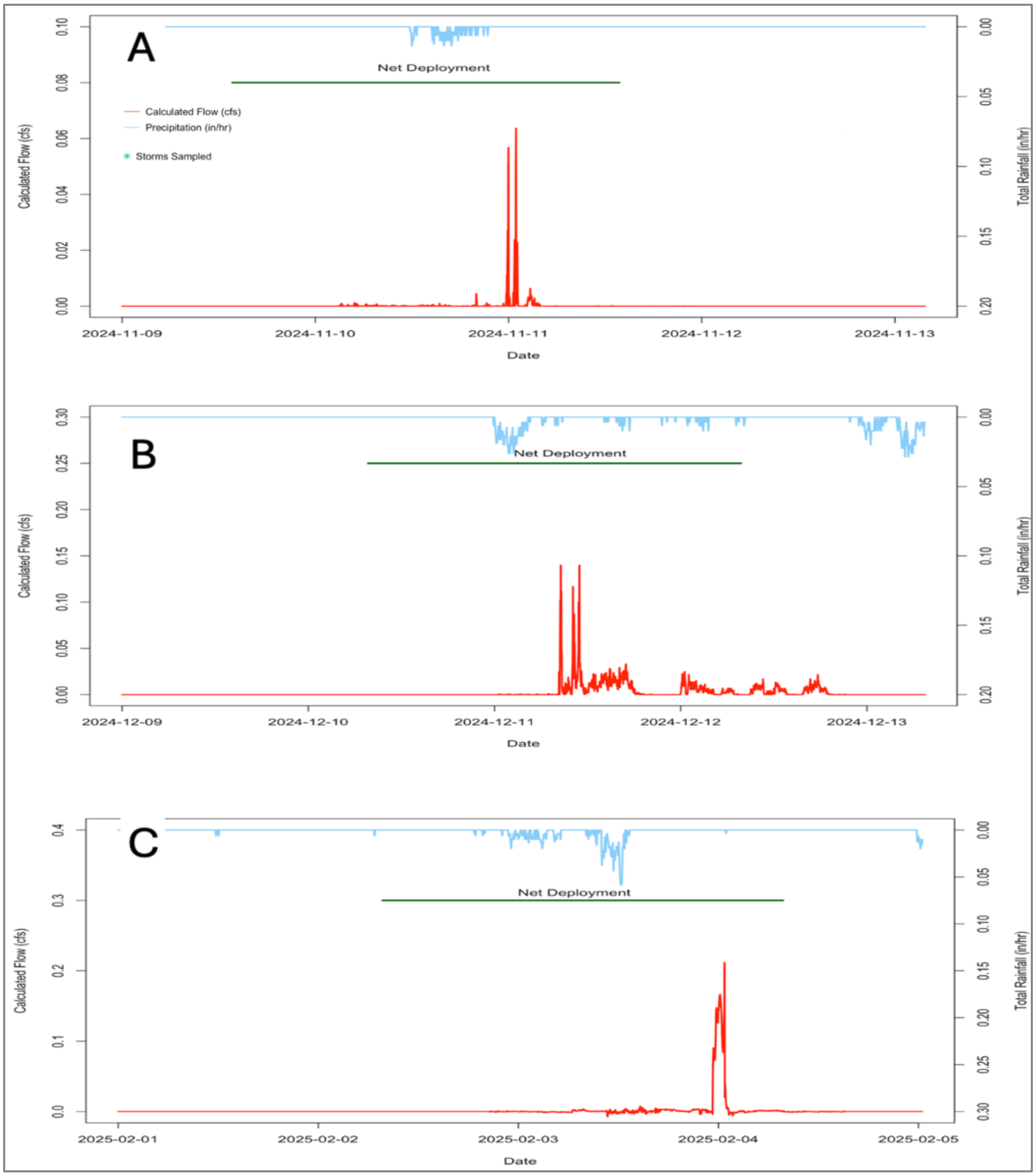


Figure AC-16. Hydrographs for three WY 2025 outfall trash monitoring events at ACCWP site AC-CTYCTR

A) Event 5, November 2024 B) Event 6, December 2024 C) Event 7, February 2025

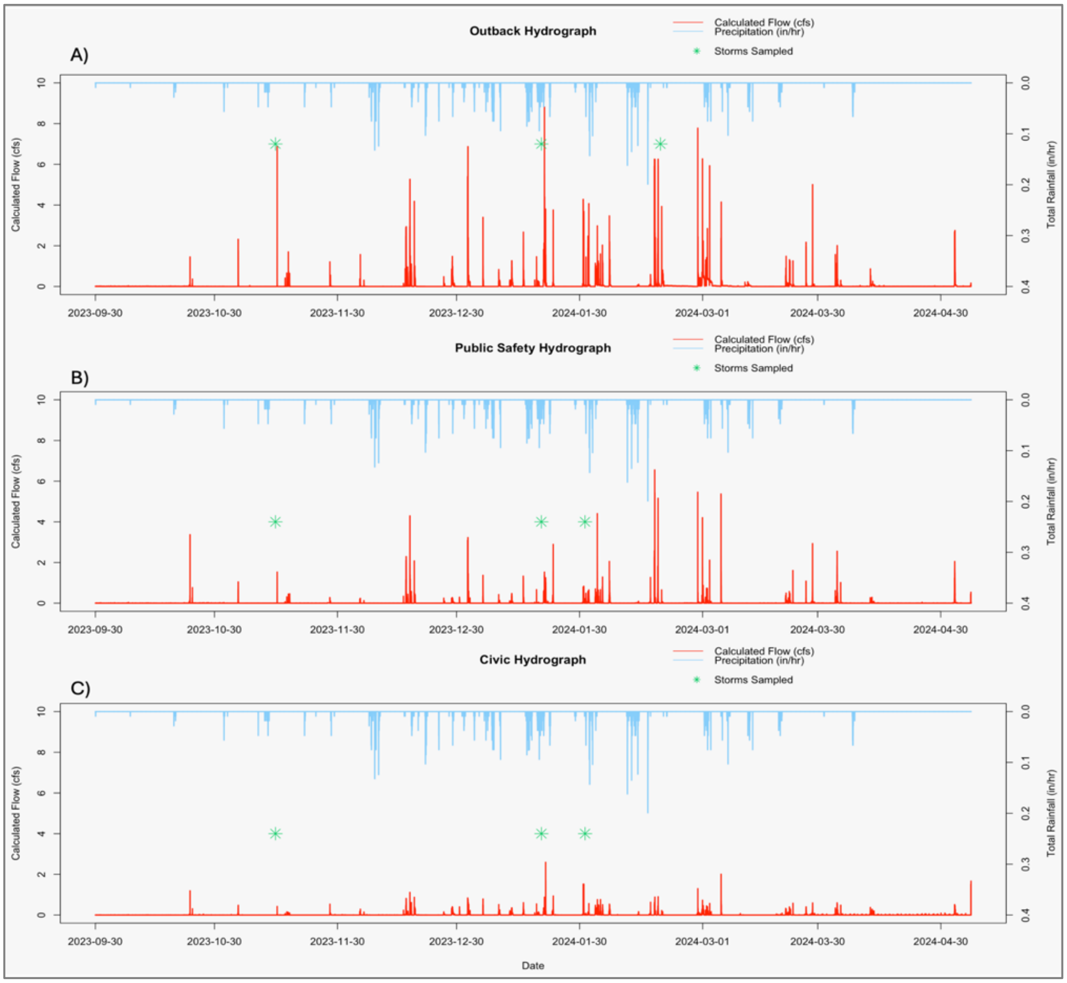


Figure AC-17. Annual hydrographs for three outfall trash monitoring sites in Alameda County monitored in WY 2024

A) AC-OUTBK B) AC-PUBSAF C) AC-CIVIC

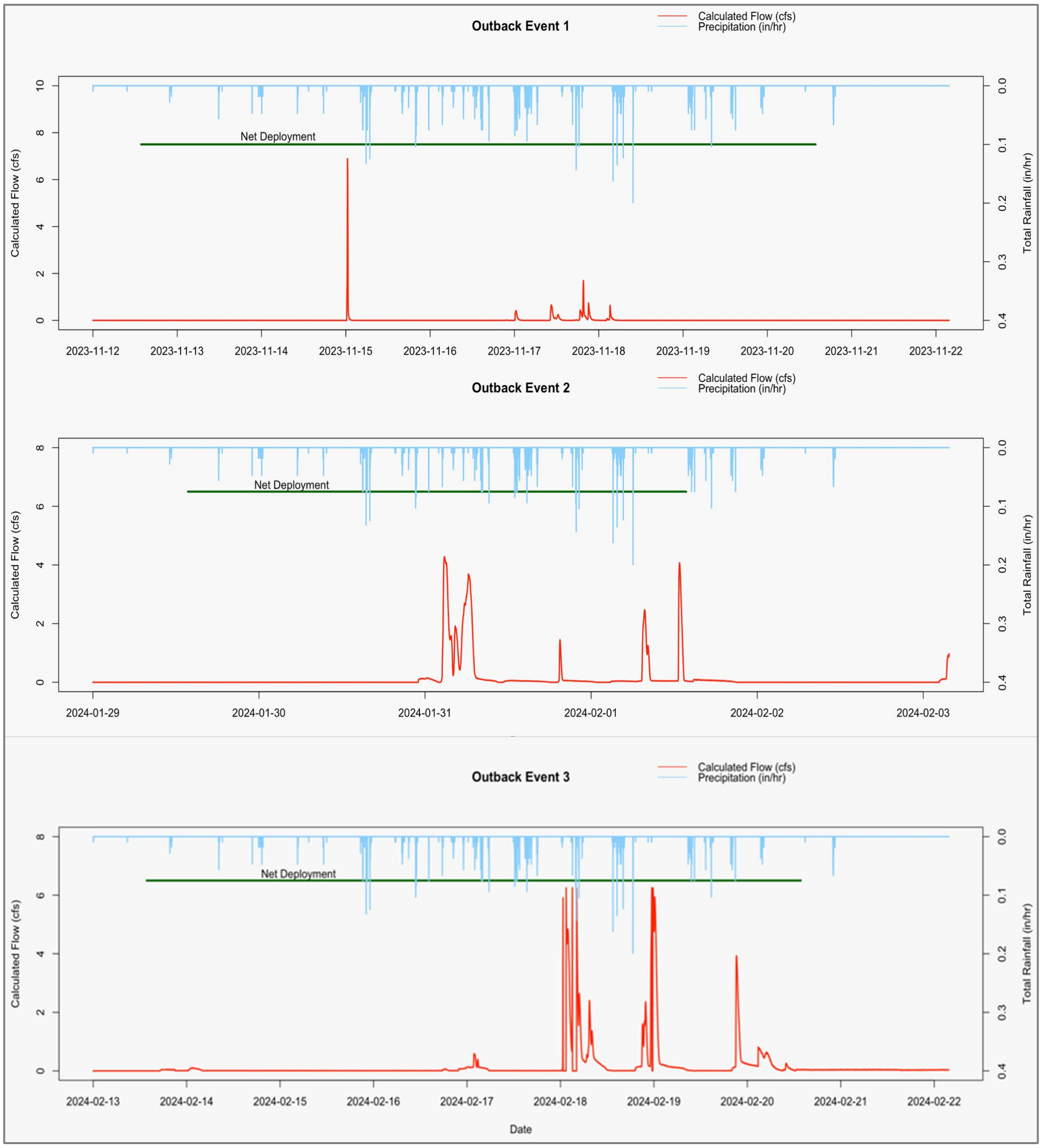


Figure AC-18. Hydrographs for three WY 2024 sample events at site AC-OUTBK

Top: Event 1, November 2023 Middle: Event 3, January-February 2024 Bottom: Event 4, February 2024

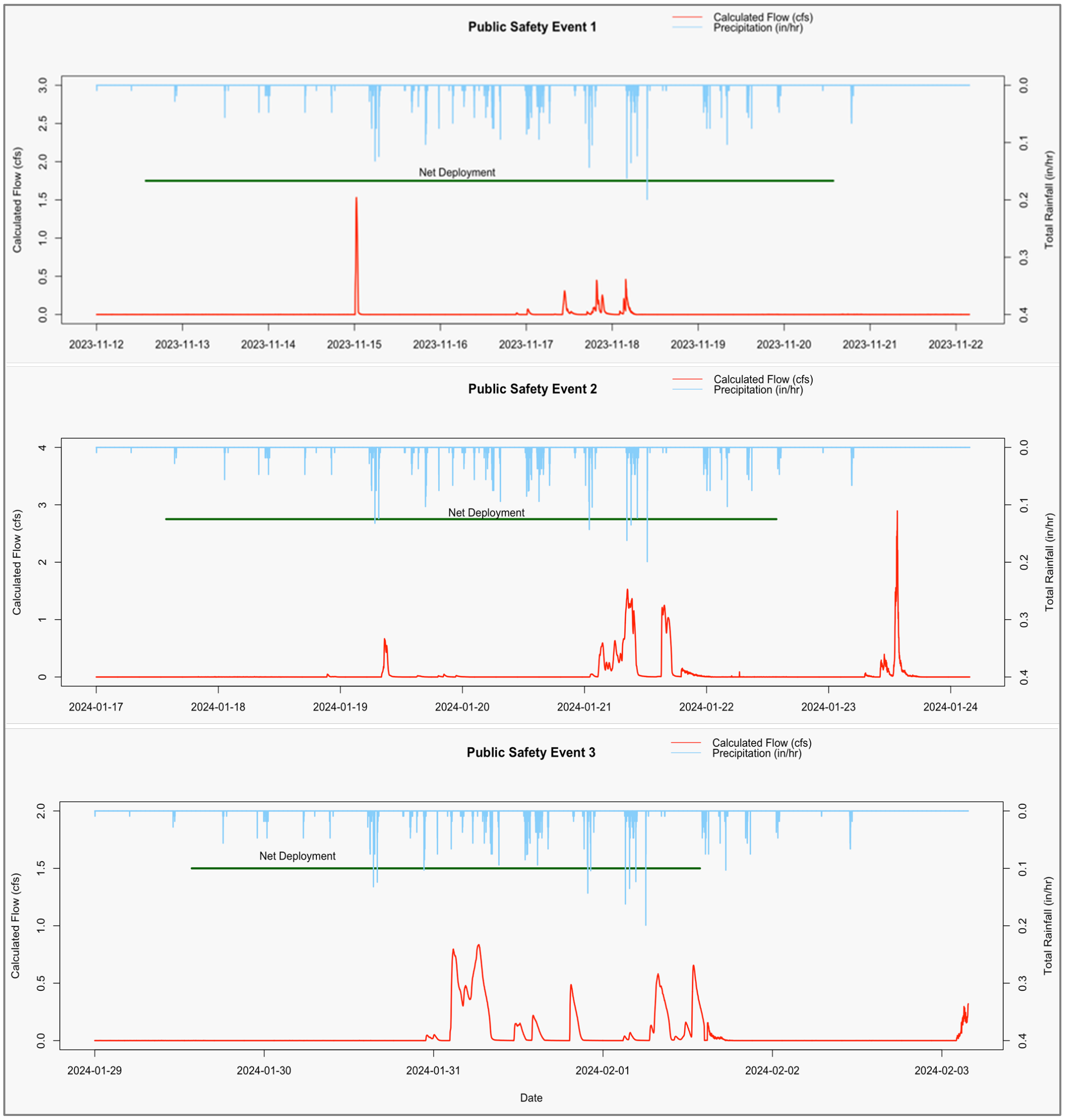


Figure AC-19. Hydrographs for three WY 2024 sample events at site AC-PUBSAF

Top: Event 1, November 2023 Middle: Event 2, January 2024 Bottom: Event 3, January-February 2024.

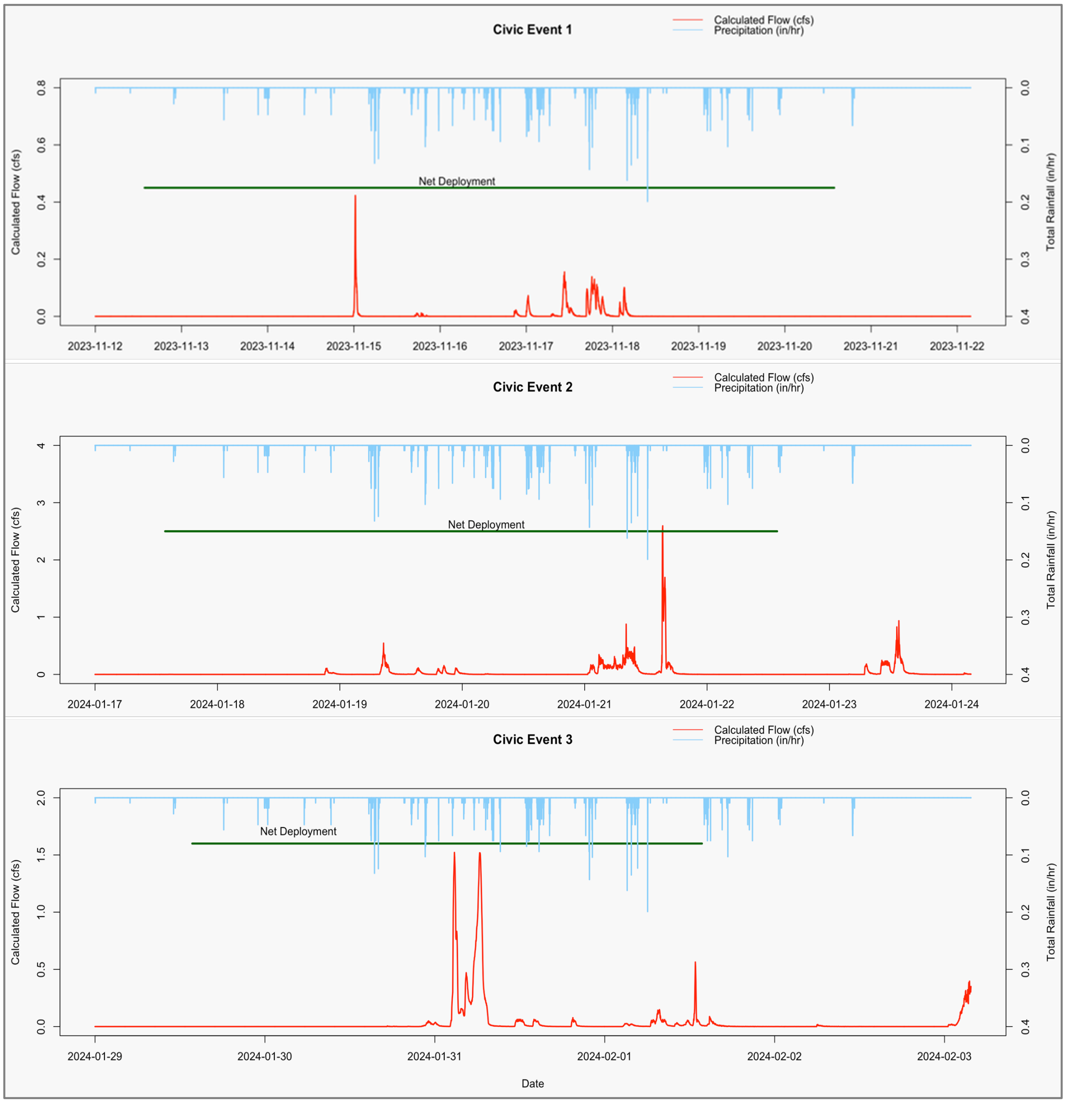


Figure AC-20. Hydrographs for three WY 2024 sample events at site AC-CIVIC

Top: Event 1, November 2023 Middle: Event 2, January 2024 Bottom: Event 3, January-February 2024.

B1.5.1 Storm Characteristics

In an effort to calculate the annual trash load discharged at each outfall during each WY, the total number of storms that occurred in each WY were identified using compiled precipitation data. Storm events were defined using the following criteria:

- Minimum 0.1-inch precipitation in 6 hours (Caltrans 2020)
- Minimum 24 hours of antecedent dry conditions (i.e., no rainfall)
- Event ends when < 0.1 inch of rain measured over 6 hours

A summary of storm characteristics for the three ACCWP sites monitored during WY 2024 and WY 2025 is provided in Appendix AC-A. Information includes storm duration, antecedent dry period, total rainfall (inches), maximum intensity rainfall (inches/hour), peak flow (cfs) and total flow (cf). Sampled storm events and total trash volume (gallons/acre) for successful sampling events are indicated in the appendix. Disqualified sample events (i.e., sampled events with potential loss of sampled material) are also indicated. First significant storms and storms that were forecast to exceed the FTC design storm (i.e., the peak flow generated from a one-year, one-hour frequency storm) are also identified in the appendix. The definition of design storm is provided in Appendix A.

At site AC-OUTBK, a total of 24 and 19 storms were identified for WY 2024 and WY 2025, respectively. ACCWP sampled the first significant storm during both years, a 0.45 inch storm that started November 15, 2023 and a 0.34 inch storm that started November 11, 2024; the first sampled storm in WY 2024 was preceded by a 0.2-inch storm that did not meet mobilization criteria and was not sampled. Trash volumes measured for these two sampling events were 0.00 and 0.01 gallons/acre for WY 2024 and WY 2025, respectively.

As was the case for site AC-OUTBK, a total of 24 and 19 storms were identified for site AC-PUBSAF for WY 2024 and WY 2025, respectively. ACCWP sampled the same first significant storm events as at AC-OUTBK. Trash volumes for first significant storm events here were 0.02 and 0.30 gallons/acre for WY 2024 and WY 2025, respectively.

Due to the replacement of WY 2024 site AC-CIVC with WY 2025 site AC-CTYCTR, we only have one year of monitoring data at each of these two locations. In the case of AC-CTYCTR, there were 23 distinct storm events identified for WY 2025 in Hayward, CA. The first significant storm event at this site (0.33 inch magnitude) was sampled on November 11, 2024 and was preceded by two additional rainfall events that did not meet mobilization criteria, a 0.1-inch storm occurring early morning October 31, 2024 and a 0.17-inch magnitude storm starting late evening on November 1, 2024. Trash volumes measured associated with the first significant storm monitoring event were measured at 0.12 gallons/acre, the highest volume measured at this site over the course of the WY 2025 monitoring.

For the single year of monitoring conducted at site AC-CIVIC, there were 24 storms identified over the course of WY 2024. ACCWP sampled the first significant storm, a 0.45-inch storm that started November 15, 2023. Trash volume associated with the first significant storm sampling event here was 0.01 gallons/acre.

-- Over the two years of monitoring at sites AC-OUTBK, AC-CTYCTR (2025 only), and AC-CIVIC (WY 2024 only), none of the storms had peak precipitation intensities or peak flows that exceeded the theoretical design storm calculated for their respective catchments (see Appendix A to the main report for details on calculations). At site AC-PUBSAF, a surprising 18 storms during WY 2024 and WY 2025 monitoring exceeded the theoretical design storm peak flow, which was calculated to be 3.9 cfs (see Appendix); none of these storms, however, exceeded the predicted peak precipitation intensity for the site.

A comparison of sampled and unsampled storms over the WY 2024 – WY 2025 reporting period at site AC-OUTBK is shown by peak flow in Figure AC-21. Over the two years of sampling, the lowest peak flow measurement recorded during a trash sampling event occurred during a storm on November 11, 2024 (2.2 cfs), the first significant storm event for WY 2025. Four sample events were conducted during the 12 highest peak flow events recorded over the two-year reporting period. Storm sizes that are underrepresented in the sample group include storms with peak flows below 3.4 cfs, for which there are 24 storm events during the reporting period, but represented by just two datapoints, both of which are associated with the first significant storm of the season.

In examining the magnitude of precipitation against sampling events, storms generating less than 0.6-inch total precipitation make up approximately 63% of storms experienced during the reporting period but are represented only by the two events sampling the first significant storm of each season (Figure AC-22). The remaining four trash sampling events conducted represent the 16 total events where total precipitation exceeded 0.6 inches in magnitude, including the second largest storm that presented during the reporting period

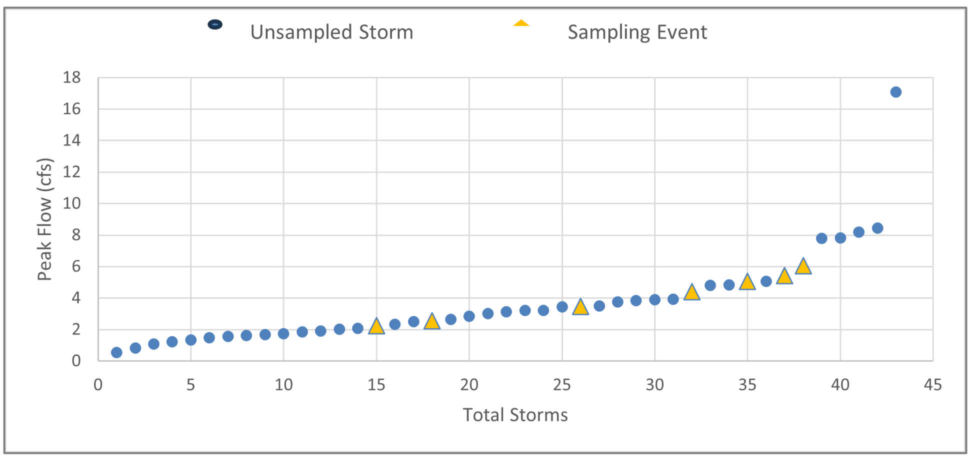


Figure AC-21. Distribution of sampling events against peak flows measured at AC-OUTBK during WY 2024 and WY 2025 monitoring

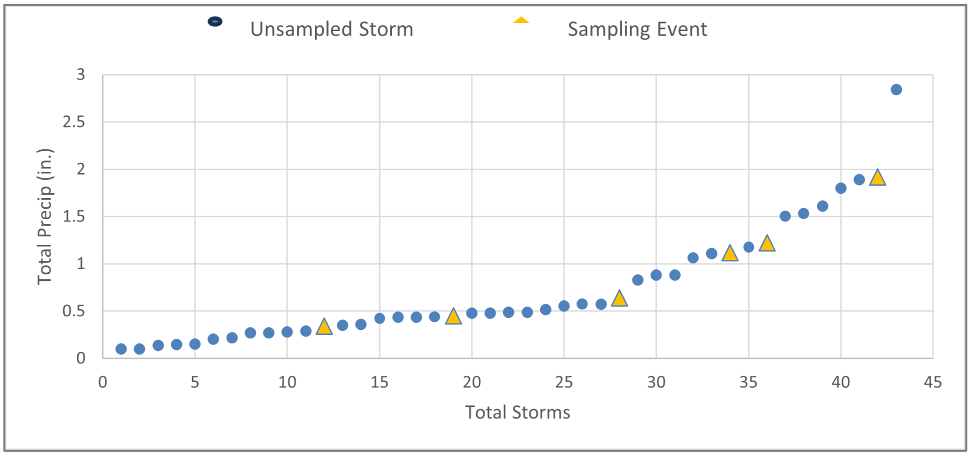


Figure AC-22. Distribution of sampling events against total precipitation measured at AC-OUTBK during WY 2024 and WY 2025 monitoring

A comparison of sampled and unsampled storms over the WY 2024 – WY 2025 reporting period at site AC-PUBSAF is shown by peak flow in Figure AC-23. Over the two years of sampling, the lowest peak flow measurement recorded during a trash sampling event occurred during a storm on November 15, 2023 (1.6 cfs), the first seasonal significant storm event for WY 2024. Four sampling events were conducted associated with the 11 storms that generated flows between 3.5 cfs and 5 cfs. There are no datapoints associated with storm events generating flows above 5 cfs. And the 22 storms with peak flows below 3.5 cfs (51% of all storms during the reporting period) are represented by two storm events, both associated with the first significant storm of the monitoring season.

For total precipitation, ACCWP conducted trash monitoring associated with four of the 16 storm events that exceeded 0.6 inches in total precipitation. As was the case with AC-OUTBK, 63% of storms experienced during the reporting period produced less than 0.6 inches total precipitation but are represented only by the two events sampling the first significant storm of each season (Figure AC-24).

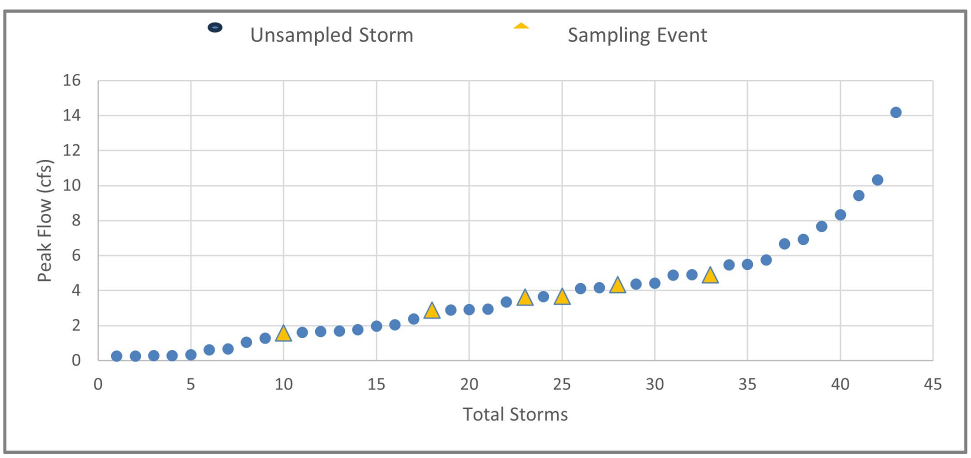


Figure AC-23. Distribution of sampling events against peak flows measured at AC-PUBSAF during WY 2024 and WY 2025 monitoring

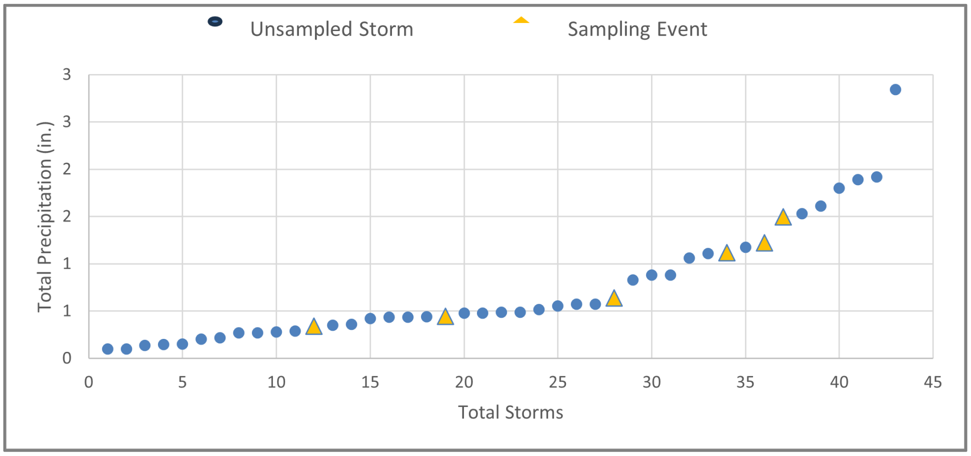


Figure AC-24. Distribution of sampling events against total precipitation measured at AC-PUBSAF during WY 2024 and WY 2025 monitoring

A comparison of sampled and unsampled storms over the WY 2025 monitoring season at site AC-CTYCTR is shown by peak flow in Figure AC-25. The lowest peak flow measurement recorded at this site during a trash sampling event occurred during a storm on November 11, 2024 (0.8 cfs), the first significant storm event for WY 2025. Compared with ACCWP sites AC-OUTBK and AC-PUBSAF, the trash sampling events at AC-CTYCTR much better represent the variety of storm and flow events experienced at the site. For this site, there is one sampling event associated with flow events with peak flows at or below 0.1 cfs, which made up approximately 59% of all WY 2025 storm events. An additional two trash sampling events were conducted associated with storm events that generated flows above 0.1 cfs, which made up approximately 41% of all events over this period.

In regard to storm magnitude, the first significant storm sampled in WY 2025 was associated with a 0.33-inch magnitude precipitation event. The two follow-on sampling events during the WY, a 0.91-inch storm over 32 hours in mid-December 2024 and a 1.53-inch storm over 20 hours in early February 2025, represent two of the six total storms that exceeded 0.75 inches in magnitude (Figure AC-26).

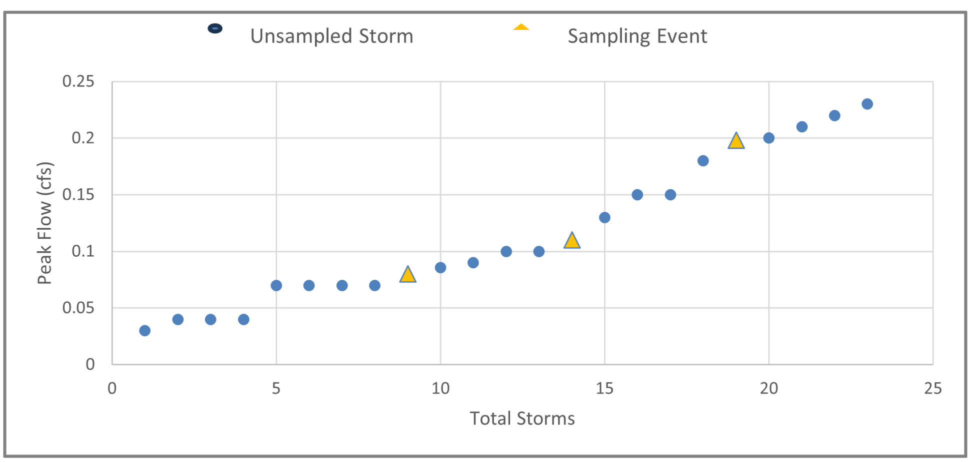


Figure AC-25. Distribution of sampling events against peak flows measured at AC-CTYCTR during WY 2025 monitoring

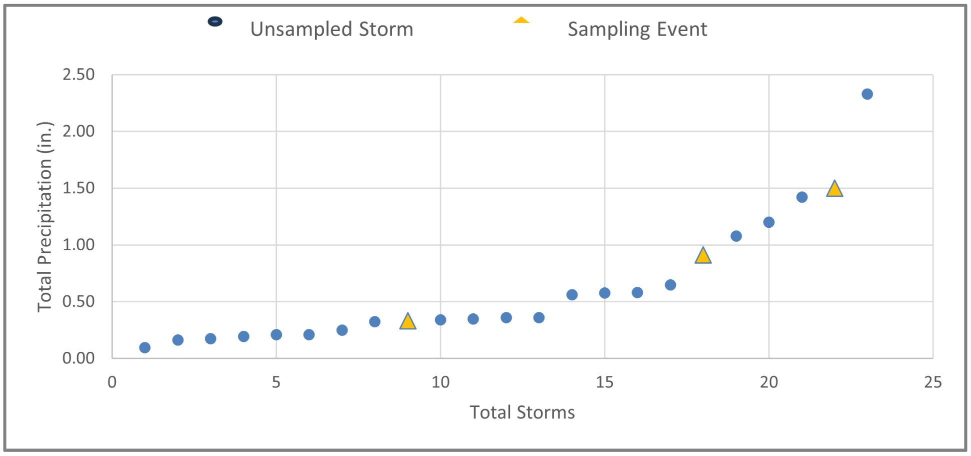


Figure AC-26. Distribution of sampling events against total precipitation measured at AC-CTYCTR during WY 2025 monitoring

A comparison of sampled and unsampled storms over the WY 2024 monitoring season at site AC-CIVIC is shown by peak flow in Figure AC-27. During this single monitoring year, the lowest peak flow measurement recorded during a trash sampling event occurred during a storm on November 15, 2023 (0.6 cfs), which is considered the first significant rainfall event for WY 2024 here. Trash sampling events coincided with two of the seven highest reported peak flow events (greater than or equal to 0.9 cfs). The remaining sample event, the first significant storm event, is the only datapoint representative of approximately 71% of storms that generated flows below 0.9 cfs.

For total precipitation, ACCWP conducted trash monitoring at site AC-CIVIC associated with the same three WY 2024 storms that were sampled at AC-PUBSAF. This included monitoring of four of the 16 storm events that exceeded 0.6 inches in total precipitation in WY 2024 and two of the largest six storms by magnitude (Figure AC-28).

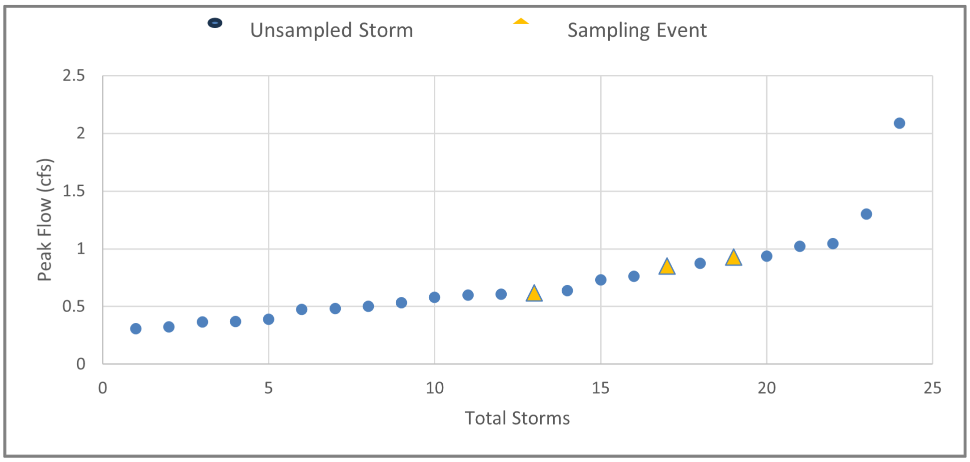


Figure AC-27. Distribution of sampling events against peak flows measured at AC-CIVIC during WY 2024 monitoring

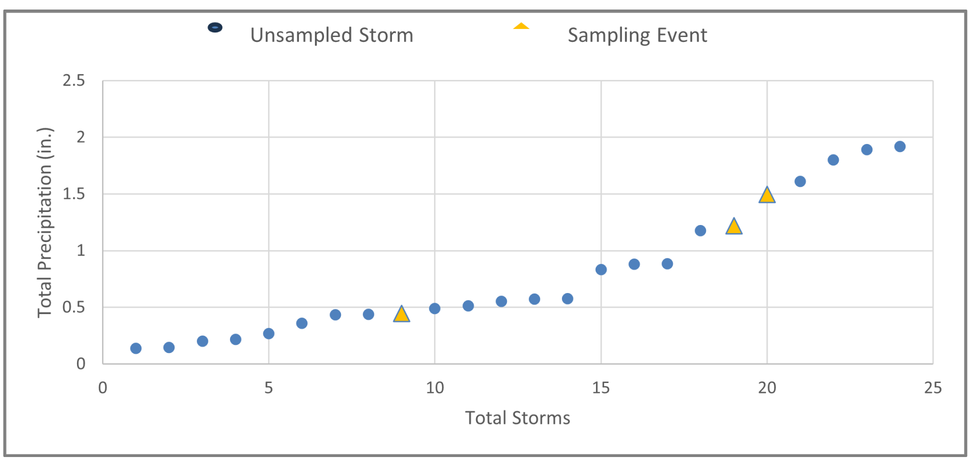


Figure AC-28. Distribution of sampling events against total precipitation measured at AC-CIVIC during WY 2024 monitoring

MRP 3 C.8.e.3(iii) permit provisions require Programs to sample trash for a minimum of three storms per year, including the first significant storm event and one event forecast to achieve the one-year, one-hour design storm for each outfall. Given that forecasts can rapidly change, ACCWP has targeted larger, more intense storm forecasts for monitoring net deployment to achieve permit requirements. As the above figures show, monitoring results for the reporting period are more reflective of trash movement in larger storm systems and those that may transport more trash due to longer antecedent dry periods, and our understanding of trash movement in smaller events that are not potential first significant storm events is somewhat lacking in relation.

B1.6 Draft Annual Trash Load Estimate

Several factors may influence trash accumulation and transport through the MS4. These include factors that are difficult to measure accurately (e.g., a representative trash generation rate, physical factors within the catchment that may tend to trap trash items before entering the MS4, and timing, intensity, and effectiveness of management actions like cleanups and street sweeping), and those that are more easily quantified (e.g., antecedent dry period, total rainfall, maximum rainfall intensity, peak flow, and total flow). The latter factors were evaluated for their association with the measured trash volumes (standardized to catchment area) generated through WY 2024 and WY 2025 monitoring conducted by ACCWP.

As part of the BAMSC regional collaboration, ACCWP investigated alternate techniques to linear regression analysis for estimating trash loadings from study watersheds. Using the monitoring data recorded at the ACCWP monitoring sites over the two-year reporting period, measurements of above-listed factors were independently compared to trash volume data using generalized additive modeling (GAM) statistical analyses. GAM analysis is a flexible modeling technique where the relationship between predictor and response variables is captured through smooth functions that can be both linear and non-linear (Hastie & Tibshirani 1986). The GAM approach expands the scope of a traditional linear regression to identify non-linear interactions between variables. Models were compared using the Akaike Information Criterion (AIC), where the model relationship with the lowest AIC was chosen to predict trash volume estimates for the unsampled storms at a given site (Table AC-6). GAM analysis and predicted trash volumes were conducted using the mgcv package (v1.9.3; Wood, 2017) in R Studio (v2025.5.0.496). GAM model relationships for each best predictor variable per site are shown in Figure AC-29.

Trash volumes were predicted using the best GAM model fit to generate a preliminary estimate of trash loading for each storm event that was not sampled (Figure AC-30). Estimated annual trash loads (Table AC-6) were calculated as the sum of trash loads per storm event for a given site and WY in addition to the sum of the observed trash volumes for each sampled storm (Table AC-7). Over the course of WY 2024 and WY 2025 monitoring conducted by ACCWP, measured trash loads ranged from 0 - 0.07 gallons/acre at site AC-OUTBK and 0.02 – 0.3 gallons/acre at site AC-PUBSAF. At AC-CTYCTR, measured trash loads ranged from 0.04 – 0.12 gallons/acre in WY 2025, the only year for which monitoring data is available for this site. Predicted trash loads for unsampled storms were estimated from the best GAM model fit and had similar ranges across sites. Estimated loadings per storm event for AC-OUTBK ranged from 0 – 0.1 and 0 – 0.24 gallons/acre in WY24 and 25, respectively, and from 0.02 – 0.15 gallons/acre in both WY24 and 25 for AC-PUBSAF (Figure AC-30). In WY25 for AC-CTYCTR predicted trash volumes per storm event ranged from 0 – 0.12 gallons/acre (Figure AC-30).

Additional trash volume data is needed from under-represented storms (e.g. smaller storms, storms with a range of antecedent dry periods) to better investigate the relationship between predictor variables and their influence on trash volumes. This analysis is preliminary and could be expanded to include multi-variables once additional monitoring events are completed.

The statistical analysis is currently limited by our sample size. Sample size may also be a reason for non-significant predictor variables at AC-CTYCTR where n = 3. The GAM model explains most of the deviance (Table AC-6), but the variables are not statistically significant, as the GAM model cannot be certain the relationship would be the same if there were more data points. The gray bands shown in the model figures (Figure AC-29) get wider as there is more uncertainty in the relationship. While the AC-CTYCTR models are limited by the number of data points, the AC-PUBSAF models have the highest amount of uncertainty (the widest gray bands) and explain the least amount of deviance. Additionally, the peak flow model for AC-CTYCTR is likely overfit with only three data points set at the lowest number of smoothing knots. As such, the second-best model (total flow) was used for trash volume predictions here.

Table AC-6. Summary statistics of GAM models for each sampling location where predictor variables were tested against the standardized trash volumes (gal/acre)

Predictor Variable	edf[1]	F-value	p-value	Adj. R^2	Dev. Expl. %	AIC
CTYCTR (n=3)						
Total Flow	**1.47**	**50.4**	**0.1**	**0.976**	**99.4**	**-19.51**
Peak Flow	1	8.1797E+29	**<0.0001**	1	100	-219.6
Total Rainfall	1.52	17	0.18	0.929	98.3	-16.45
Maximum Rainfall Intensity	1.51	28.7	0.14	0.958	99	-17.99
Antecedent Dry	1.69	2.28	0.39	0.702	95.4	-13.27
OUTBK (n=6)						
Total Flow	1	12.9	**0.023**	0.704	76.4	-29.1
Peak Flow	**1**	**13.2**	**0.022**	**0.71**	**76.7**	**-29.18**
Total Rainfall	1.33	4.96	0.11	0.533	65.7	-25.75
Maximum Rainfall Intensity	1	12	**0.026**	0.687	74.9	-28.75
Antecedent Dry	1	0.09	0.78	-0.221	2.28	-20.58
PUBSAF (n=6)						
Total Flow	1	0.32	0.6	-0.157	7.45	-5.088
Peak Flow	1	0.07	0.8	-0.228	1.73	-4.729
Total Rainfall	1	1.06	0.36	0.0127	21	-6.039
Maximum Rainfall Intensity	1	0.06	0.82	-0.232	1.48	-4.713
Antecedent Dry	**1.4**	**4.51**	**0.13**	**0.516**	**65.1**	**-9.664**

Bolded cells in the p-value column indicate models with significant p-values.
Bolded cells across all rows indicate the model chosen by AIC value to be used to estimate trash volumes for unsampled storms.
1 edf is the estimated degrees of freedom accounting for the smoothing function.

Table AC-7. Annual trash load estimates by site for both years of monitoring

Site	Water Year	Total Load Measured from Sampled Events (gal/acre)	Total Predicted Load from Remaining Storms (gal/acre)	Estimated Annual Load (gal/acre)	Best Explanatory Variable
AC-OUTBK	WY 2024	0.09	0.409	0.499	Peak Flow
	WY 2025	0.08	0.563	0.643	
AC-PUBSAF	WY 2024	0.09	0.648	0.738	Antecedent Dry Period
	WY 2025	0.39	0.511	0.901	
AC-CTYCTR	WY 2025	0.26	1.842	2.102	Total Flow

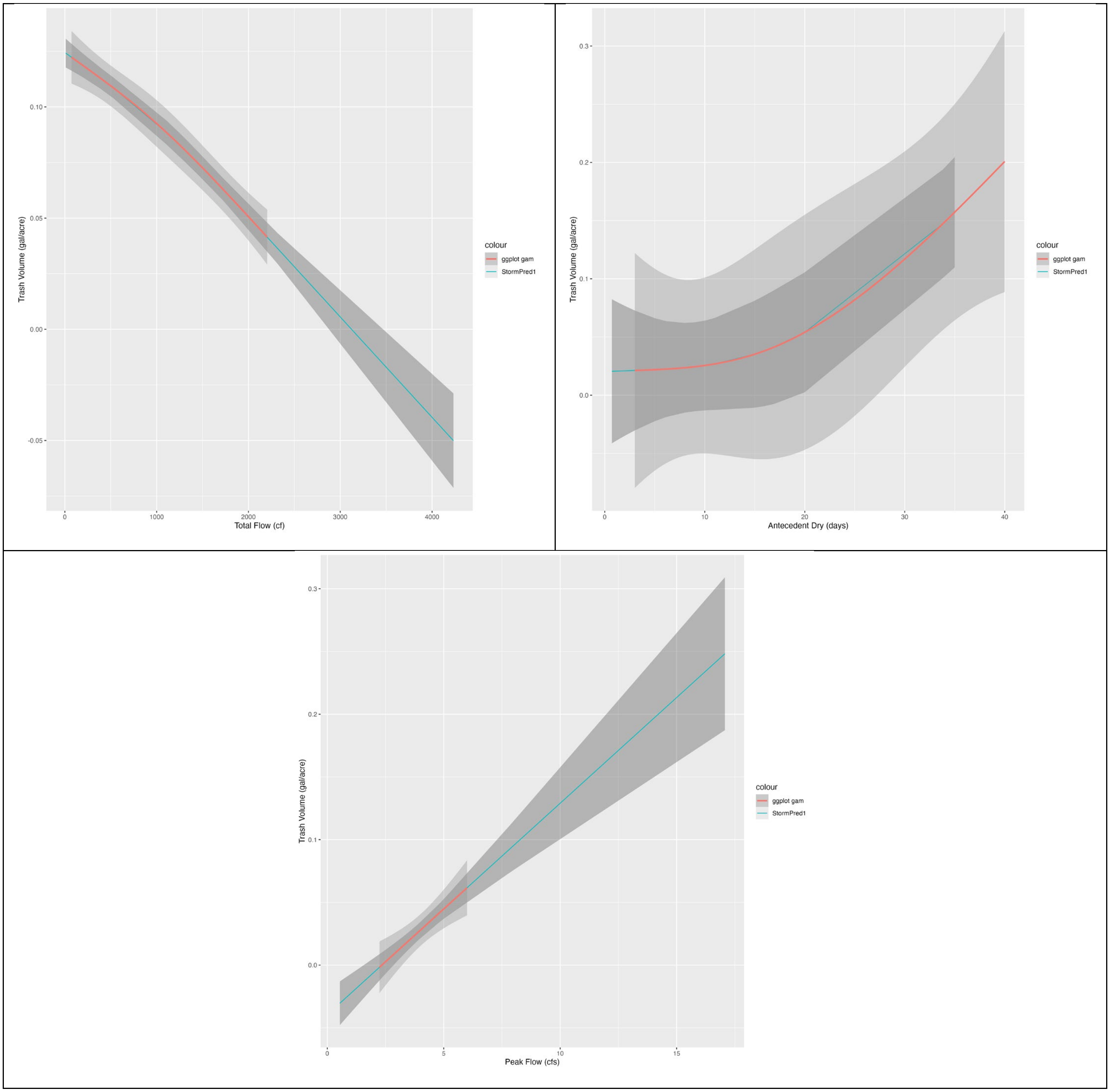


Figure AC-29. GAM model relationships showing the best model fit (red) from all sampled storms chosen by AIC and predicted trash volumes from all unsampled storms from both WY 2024 and WY 2025

The gray bands surrounding both red and blue lines show uncertainty in both the model and predicted estimates. The wider the gray band, the more uncertainty in the model/estimate.

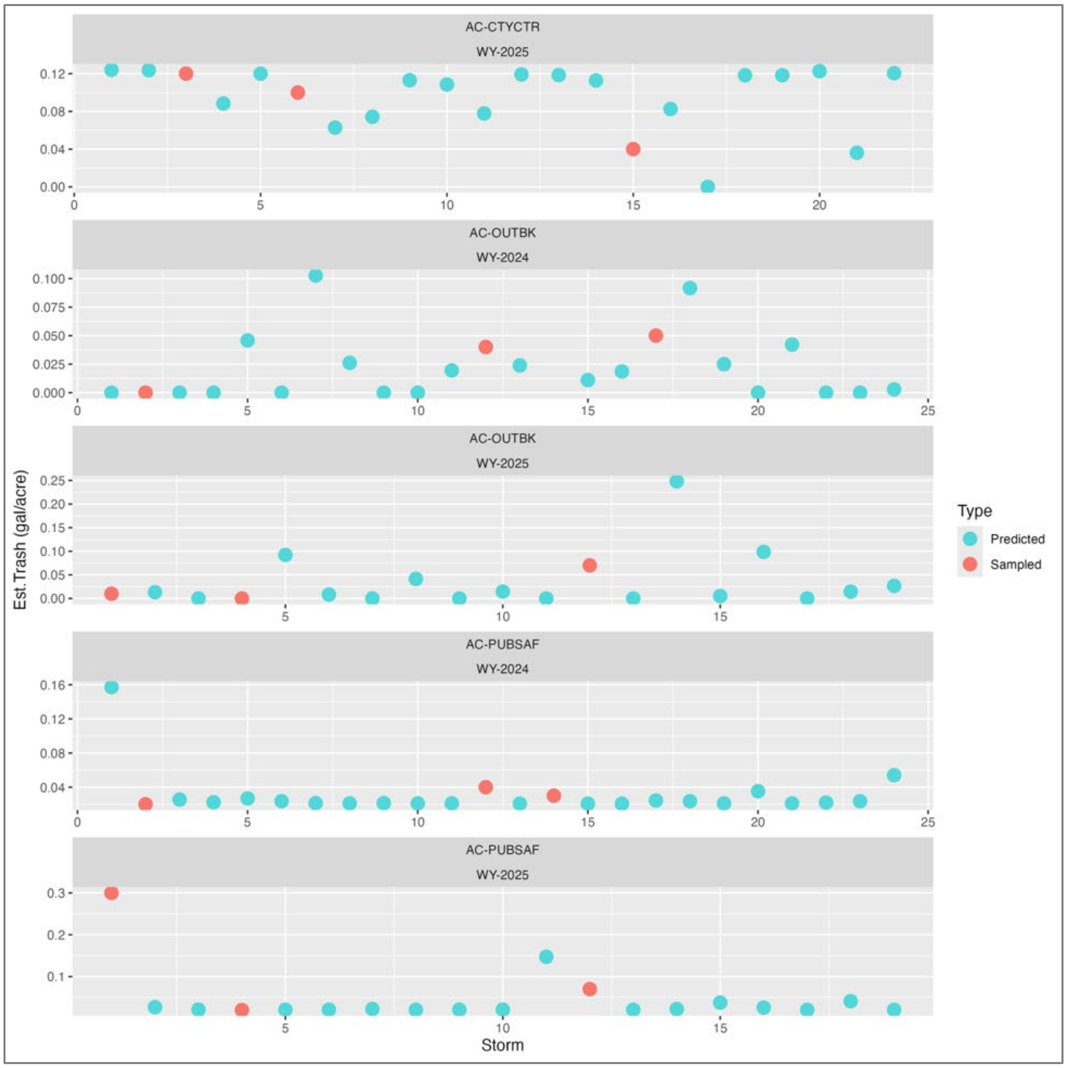


Figure AC-30. Sampled (red) and predicted (teal) trash volumes (gal/acre) for ACCWP monitoring sites AC-OUTBK, AC-PUBSAF, and AC-CTYCTR during WY 2024 and WY 2025

Predicted trash volumes used GAM model fit determined by AIC and the best predictor variable per site.

It should be noted that ACCWP monitoring results (flow and trash volume) from all storms experienced in WY 2024 and WY 2025 were used in developing loading estimates. ACCWP did not exclude storm events that may have exceeded the design storm capacity at individual FTC facilities, which are not intended to perform as FTC at flows exceeding the design standard.

While peak precipitation intensity measured during monitoring events at all sites approached the published 1-year, 1-hour storms for Dublin locations (AC-OUTBK, AC-PUBSAF, and AC-CIVIC), no monitored storm here exceeded the design standard precipitation intensity for their respective catchments. In fact, only one storm at any ACCWP site produced a measured precipitation intensity above the predicted design storm (a February 12, 2025 event measured a 0.5 in/hr peak intensity at site AC-CTYCTR), and this later season storm was not monitored for trash. And while use of peak flow calculated for site AC-PUBSAF to identify design storms here resulted in a predicted 18 storms exceeding the design standard over the two-year monitoring period, this number is not believed to be realistic and is disregarded for this analysis. No other ACCWP monitoring location generated flow measurements exceeding the theoretical design storm flow intensity in the two-year monitoring period.

ACCWP, along with its regional partners, will continue to investigate potential use of flow measurements as indicators of monitoring events that exceeded FTC design capacity and the potential effect of these storms upon modeling results. Given the differences in trash controls, catchment sizes, and proximity of controls to flow measurement points, we do not anticipate flow measurements improving upon precipitation measurements for all locations, but could potentially for a subset of regional locations.

B1.7 Investigation of Trash Generation

This section describes visual observations to document trash generation within the monitored outfall catchment prior to each monitoring season. It is important to note that trash observed during the assessment represents a snapshot in time and may have considerable variation over time. However, observed trash levels can provide additional context for determining if existing trash controls are effective at reducing trash discharge through the MS4. Existing trash management actions within each catchment are summarized in the following section.

B1.8 Catchment Assessments

Given the relatively small size of the study catchments, ACCWP was able to conduct multiple visual assessments of trash sources in each of the three catchment areas monitored for each sampling event. AMS staff walked the public rights-of-way and noted the presence of trash during the dry season prior to start of annual monitoring and again during each net deployment. As time allowed, a second assessment was conducted following individual sampling events to gauge any observable differences in the pre- and post-storm environment. A description for each of the catchment areas is provided above in Section 1. A summary of the observations and known operation and maintenance records is provided for each site below.

Site AC-OUTBK

Very dense littering and/or wind-blown trash were observed accumulating along the banks on either side of the monitored outfall in both WY 2024 and WY 2025. This is likely an effect of both proximity to I-580 and unhoused populations that were observed near to the outfall and within the upstream catchment periodically. There also appears to be regular illegal dumping occurring in the catchment. There are several commercial dumpsters associated with local businesses in the commercial parking areas, and on multiple occasions staff observed materials left beside the dumpsters (e.g., cardboard and bags full of garbage).

Food and drinkware associated with multiple restaurants and coffee shops in the catchment were regularly observed in the parking areas around these establishments. In some cases, this litter appeared to be caught in vegetated strips adjacent to the parking areas. In other cases, waste was observed in the paved parking areas and more likely to reach the MS4.

The curb and gutter areas around Regional Street were regularly littered with trash, including paper, glass, metal, and miscellaneous plastic items. Street sweeping did appear to be ongoing, given the presence and absence of leaf litter, but new loadings of trash appeared to be occurring on a regular basis.

The main source of trash within the catchment appeared to be associated with construction activities that were ongoing over the course of the monitoring seasons (Table AC-8 and Figure AC-31). Several different construction projects were identified over the WY 2024 and WY 2025 study period, both within and just outside of the catchment boundaries. There were both construction-related materials (plastic bands, tools, soil dumping) that were observed regularly, as well as food and drink ware that was deposited in three different areas that appeared to be used as break spots during both monitoring seasons.

Table AC-8. Trash assessments in catchment for site AC-OUTBK during WY 2024 and WY 2025

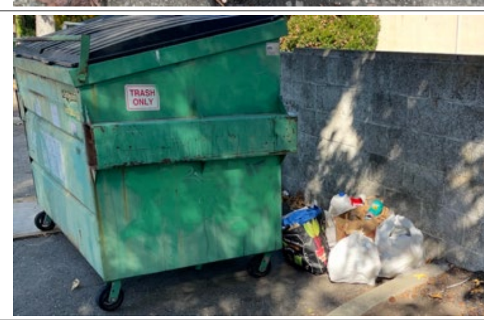
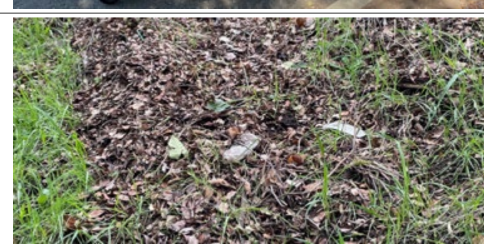
Observations During Survey	Latitude, Longitude	Photos
Trash likely related to construction activities. There were multiple areas that appeared to be used for work breaks and other sites where pieces of construction materials accumulated. (photo taken 2/14/2024)	37.70056, -121.93251	
Food and beverage waste accumulated in parking areas near restaurants and coffee shops. (photo taken 2/3/2025)	37.69998, -121.93224	
Litter associated with use of parking areas by possible unhoused persons. (photo taken 2/3/2025)	37.70062, -121.93261	
Likely dumping was observed at commercial dumpster areas on multiple occasions (full garbage bags, cardboard, etc.). (photo taken 11/10/2024)	37.70188, -121.93398	
Litter accumulating on banks adjacent to the outfall; high trash density not evident from photo. (photo taken 1/18/2024)	37.69957, -121.93203	

Figure AC-31. Trash sources identified in highest densities during trash assessments for catchment AC-OUTBK, WY 2024 and WY 2025

Site AC-PUBSAF

There was fairly minimal trash observed adjacent to the outfall for any of the WY 2024 or WY 2025 sampling events. Although access to the adjacent levee road is restricted, like that at the AC-OUTBK site, the area around the monitored outfall does not appear to be visited by members of the public,[19] unlike AC-OUTBK.

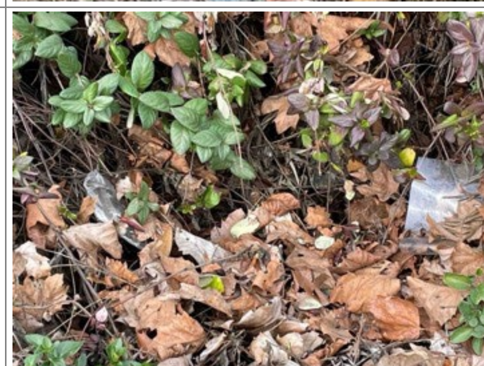
The majority of litter observed in the AC-PUBSAF catchment during sampling events appeared to be accumulating in vegetated areas adjacent to roadways, including bioretention features (Table AC-9 and Figure AC-32). This is in comparison to AC-OUTBK, AC-CTYCTR, and AC-CIVIC catchments, in which litter was regularly observed in light to moderate densities on roadways and in parking areas.

Although there was no obvious construction occurring in the catchment during WY 2024 monitoring activities, AMS field staff noted multiple locations within the catchment that appeared to be used as break areas. These areas had regular and relatively dense accumulations of food and beverage waste, smoking products, and other miscellaneous trash. In WY 2025, an active construction project extended the duration of the monitoring season, and one of the two storm drain inlets with catch basin inserts (CBIs) was partially or fully blocked with straw waddles (all of the monitoring season) and a weighted mat (part of the season).

The two CBIs contained within the catchment were cleaned prior to the wet season in WY 2024. Upon inspection prior to the first WY 2024 sampling event here, AMS field staff observed one of these catch basins was mostly full of leaves. AMS communicated this to the City of Dublin, and the leaves were cleared prior to the next sampling event. In WY 2025, the CBI adjacent to the construction area was partially obstructed by vegetation and difficult to determine the capacity of; the unblocked CBI was observed at 50% to 75% full of vegetation for the three monitoring events. Both CBIs were inspected and cleaned as appropriate for a total of three times during WY 2025 (Figure AC-33).

[19] The chain link fence adjacent to the levee road was observed to have been cut open several times in WY 2025, but no evidence of study area usage by the public was observed through the monitoring year.

Table AC-9. Trash assessments in catchment for site AC-PUBSAF during WY 2024 and WY 2025

Observations During Survey	Latitude, Longitude	Photos
Food waste, smoking products, and miscellaneous waste in areas that appear to be used for work breaks. (photo taken 11/10/2024)	37.70409, -121.92188	
Multiple types of waste trapped by vegetation in bioretention features. (photo taken 1/18/2024	37.70347, -121.91992	
Vegetation in non-bioretention areas temporarily trapping blown-in waste. (photo taken 1/18/2024	37.70393, -121.92084	
Food waste at suspected break areas. (photo taken 2/3/2025)	37.70384, -121.93132	
Storm drain inlet adjacent to WY 2025 construction site. (photo taken 11/10/2024)	37.70421, -121.92195	

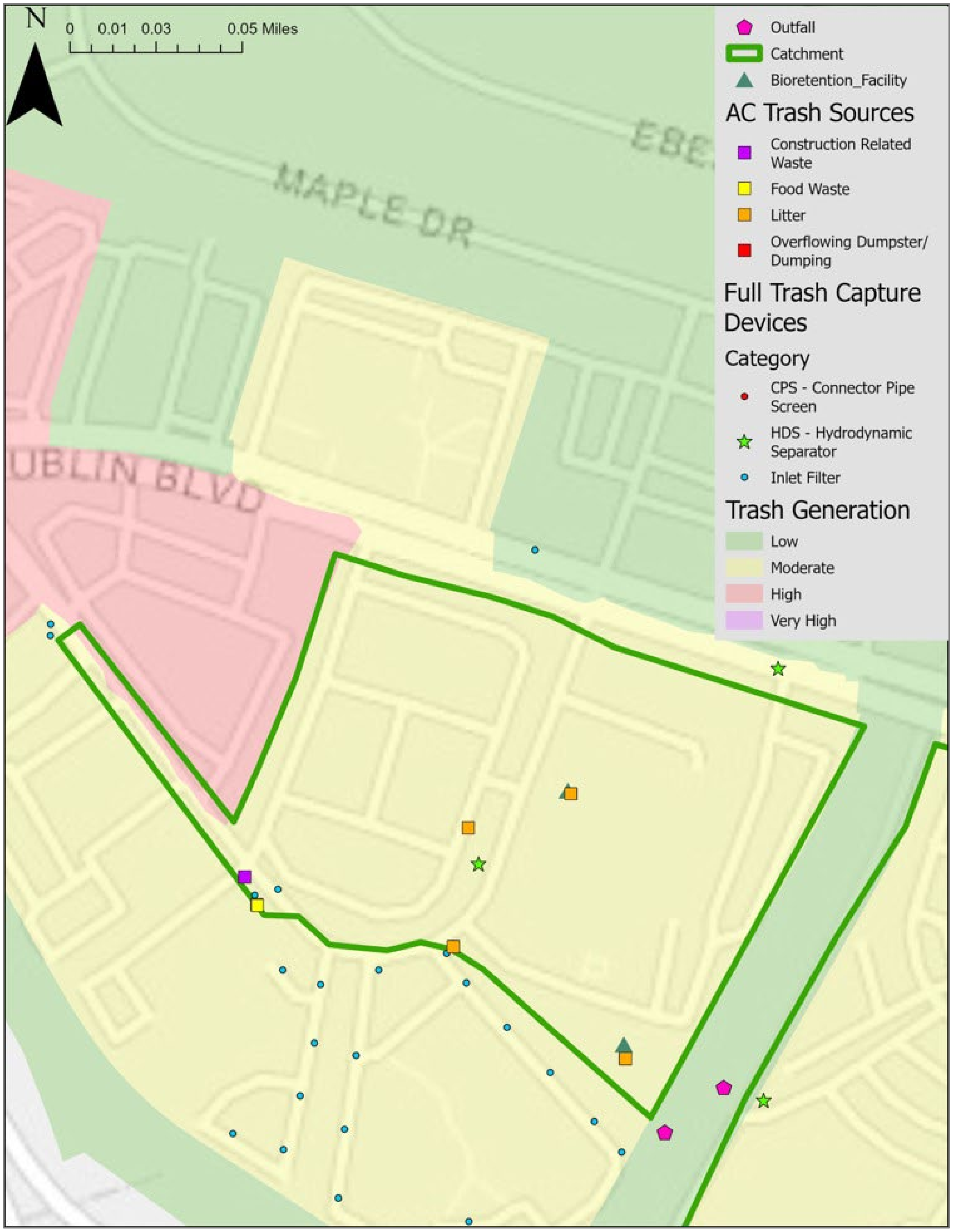


Figure AC-32. Trash sources identified in highest densities during trash assessments for catchment AC-PUBSAF, WY 2024 and WY 2025

Figure AC-33. Photos of City of Dublin catch basin insert DUB-FCD-059 before (l) and after (r) cleaning event on November 4, 2024

Site AC-CTYCTR

The AC-CTYCTR monitoring site is located on the northern edge of De Anza Park in Hayward, which experiences extensive usage by unhoused populations, both in the park and in the adjacent commercial areas within the catchment (Table AC-10 and Figure AC-34). Commercial parking areas were generally kept clean of trash, but green spaces within commercial developments exhibited very dense trash accumulation (most commonly food-related waste and pet waste).

The banks adjacent to the monitored outfall were very consistently littered with trash, which appeared to be associated with a nearby encampment. To prevent blown-in trash from being captured in monitoring nets, ACCWP placed a temporary screening device between the headwall and bank here for the duration of all deployments.

The three CBIs that provide trash control to the monitored outfall are serviced by the City of Hayward twice per year. AMS field staff observed these facilities prior to each monitoring event, and limited capacity was never observed to be a potential issue at any of the three inlets.

Table AC-10. Trash assessments in catchment for site AC-CTYCTR during WY 2025

Location and Type of Trash	Latitude, Longitude	Photos
Food and beverage related waste littering the grounds upstream of one of the three CBIs. (photo taken 2/3/2025)	37.67841, -122.08226	
Dense trash along bank at outfall. (photo taken 11/10/2024)	37.67763, -122.08217	
Screening structure to prevent introduction of wind-blown / dumped litter into trash monitoring net. (photo taken 12/11/2024)	37.67769, -122.08220	

Figure AC-34. Trash sources identified in highest densities during trash assessments for catchment AC-CTYCTR, WY 2025

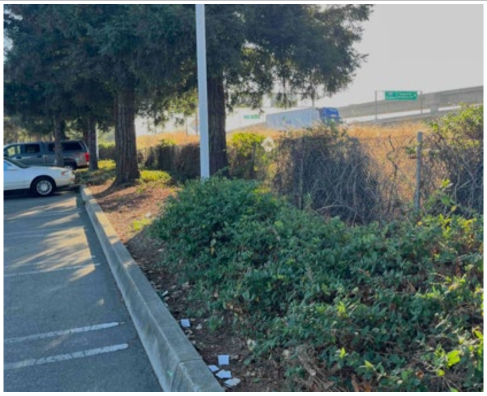
Site AC-CIVIC

The AC-CIVIC monitoring site is located along a heavily used public trail, the Alamo Canal Trail. Trash associated with trail usage appeared to be fairly low during the WY 2024 monitoring season, with the trail and banks around the monitored outfall appearing mostly devoid of obvious litter.

There were several activities occurring in the catchment that did appear to be associated with trash accumulation, however (Table AC-11 and Figure AC-35). Similar to AC-OUTBK, the catchment is located adjacent to I-580 and windblown trash was regularly observed accumulating in the nearby parking area and associated landscaping. There was also construction occurring at the Dublin Civic Center during the monitoring period. There were some construction-related materials that were observed in the adjacent parking area (mostly plastic items or pieces), but not in great densities. And possible usage by unhoused persons was observed, with several personal care products showing up in the parking areas (e.g., toothbrushes, floss picks).

The main source of trash in the catchment appears related to the public playing fields located on the east side of the catchment. Food and drink waste and smoking products were regularly observed in the landscaped areas and adjacent parking lots.

Table AC-11. Trash assessments in catchment for site AC-CIVIC during WY 2024

Location and Type of Trash	Latitude, Longitude	Photos
Food and beverage related waste in the grounds surrounding the public ballfields. (photo taken 01/18/24).	37.70298, -121.91806	
Smoking products in the parking areas surrounding the public ballfields. (photo taken 01/30/24).	37.70266, -121.91809	
Wind-blown litter in the vegetation and parking area adjacent to I-580. (photo taken 10/06/23).	37.70217, -121.91904	

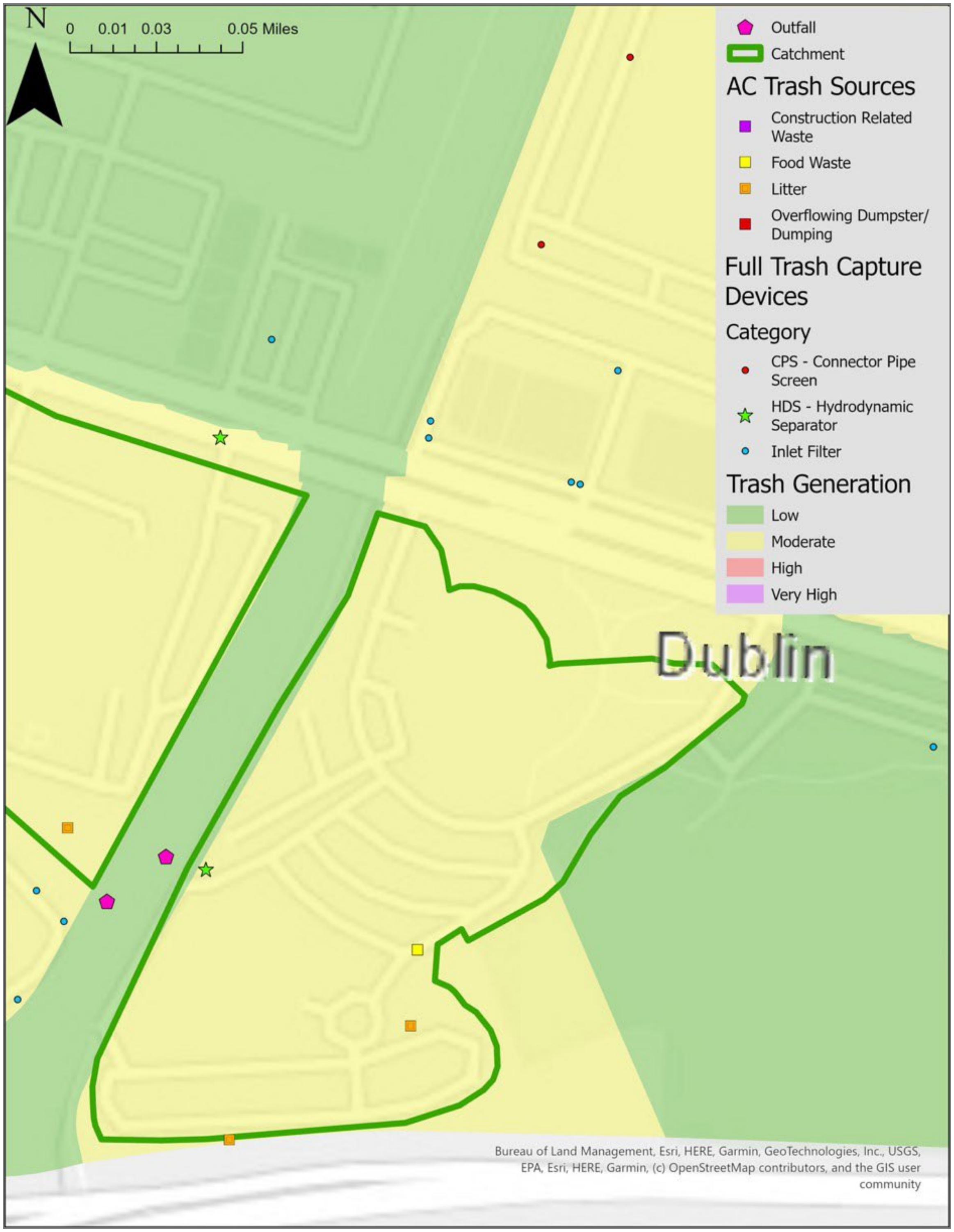


Figure AC-35. Trash sources identified in the City of Dublin, during trash assessment for catchment AC-CIVIC

B1.9 Trash Management Actions

Operations and maintenance records (where available) for full trash capture devices and other trash controls implemented in the monitored catchments are summarized in Table AC-12.

Table AC-12. Summary of operations and maintenance activities associated with full trash capture and other controls implemented in catchments for ACCWP outfall monitoring sites

Monitored Catchment	Full Trash Capture	Other controls
AC-OUTBK	The City of Dublin contracts for cleaning of publicly owned HDS units two times per year. Inspected minimum twice per year, cleaned as required.	Street sweeping (2x / month)
AC-PUBSAF	The City of Dublin requires privately-owned HDS devices to be maintained three times per year.	Street sweeping (2x / month)
	The City of Dublin contracts for cleaning of CBIs three times per year; inspected minimum twice per year, cleaned as required.	
	Two bioretention features on Public Safety Complex property; these are inspected as part of overall grounds upkeep on an approximately biweekly basis and maintained as conditions indicate (vegetation management, trash removal, rodent control, etc.).	
AC-CTYCTR	The City of Hayward conducts inspection and cleaning of inlets twice per year.	Street sweeping (2x / month)
AC-CIVIC	The City of Dublin contracts for cleaning of publicly owned HDS units two times per year. Inspected minimum twice per year, cleaned as required.	Street sweeping (2x / month)

B1.10 Refinements

There are no major refinements anticipated for ACCWP WY 2026 outfall trash monitoring. Specific steps that will be reviewed for possible implementation:

- ACCWP will continue to review modeling techniques available for interpretation of monitoring data as additional datapoints are generated. This may include review of additional modeling techniques or refinement of existing models. With additional data points, ACCWP may also be able to investigate additional variables as to their effect upon monitored trash loads.
- To support future modeling efforts, ACCWP will target monitoring of smaller storms (i.e., QPF < 0.5 inch) to improve the representativeness of sampled storms relative to the types of storms known to occur over a given year. To-date, monitored storms are heavily weighted toward storms that are anticipated to transport higher loads of trash (e.g., higher magnitude of precipitation, higher rainfall intensity, first significant storm). This step will increase the probability of false starts but is deemed a critical data need.

B1.11 References

Hastie, T.J. & Tibshirani, R.J. 1986. Generalized additive models. *Statistical Science*, *1*(3), 297–318.

Wood, S.N. 2017. Generalized Additive Models: An Introduction with R, 2nd edition. Chapman and Hall/CRC.

APPENDIX AC: WY 2024 AND WY 2025 STORM EVENT SUMMARIES

Table AC-13. Summary of storm characteristics and sample information for site AC-OUTBK during WY 2024

Storm Began	Storm End	Storm Duration (hrs)	Antecedent Dry (days)	Precipitation Total (in)	Maximum Intensity (in/hr)	Peak Flow[1] (cfs)	Total Flow[1] (cf)	Sample Event	First Significant Storm	Trash Volume (gal)	Comment
WY 2024 (24 storms total)											
11/05/23	11/06/23	27	35	0.20	0.12	2.3	4,193				
11/15/23	11/18/23	72	9	0.45	0.07	2.6	14,459	x	x	0	
11/29/23	11/29/23	6	10	0.15	0.11	1.2	3,376				
12/06/23	12/07/23	25	6	0.14	0.06	1.5	2,978				
12/17/23	12/20/23	77	11	1.80	0.27	5.1	64,837				
12/29/23	12/29/23	7	8	0.52	0.12	1.3	14,634				
12/30/23	01/03/24	104	3	1.18	0.3	8.4	99,331				
01/06/24	01/06/24	2	2	0.27	0.18	3.9	5,886				
010/9/24	01/10/24	32	3	0.22	0.08	1.1	10,683				
01/13/24	01/14/24	23	2	0.44	0.11	1.6	27,393				
01/16/24	01/16/24	8	2	0.36	0.19	3.5	19,973				
01/19/24	01/22/24	68	3	1.50	0.23	5.1	68,424	x			No sample[2]
01/24/24	01/24/24	7	1	0.44	0.25	3.8	9,821				
01/31/24	02/02/24	41	6	1.22	0.21	4.4	54,277	x		0.7	Forecast > design storm
02/03/24	02/05/24	50	1	1.61	0.22	3.0	44,685				
02/07/24	02/07/24	7	1	0.49	0.15	3.5	14,047				
02/14/24	02/20/24	150	9	1.92	0.37	6.0	90,133	x		0.9[3]	Forecast > design storm
02/29/24	03/04/24	86	8	1.89	0.26	7.8	126,081				
03/06/24	03/07/24	19	2	0.57	0.38	3.8	15,975				
03/22/24	03/25/24	69	15	0.88	0.12	1.5	24,849				
03/27/24	03/30/24	62	2	0.55	0.22	4.8	13,902				
04/04/24	04/05/24	33	5	0.83	0.2	1.9	15,994				
04/13/24	04/14/24	23	8	0.58	0.13	0.8	8,146				
05/04/24	05/04/24	17	20	0.88	0.22	2.5	23,013				

1 Peak and total flows for monitored storms were based on linear regressions performed on WY 2024 data.
2 Potential loss of sample material during or after storm.
3 Volume excludes outliers.

Table AC-14. Summary of storm characteristics and sample information for site AC-PUBSAF during WY 2024

Storm Began	Storm End	Storm Duration (hrs)	Antecedent Dry (days)	Precipitation Total (in)	Maximum Intensity (in/hr)	Peak Flow[1] (cfs)	Total Flow[1] (cf)	Sample Event	First Significant Storm	Trash Volume (gal)	Comment
WY 2024 (24 storms total)											
11/05/23	110/6/23	27	35	0.2	0.12	1.0	3,387				
11/15/23	11/18/23	72	9	0.45	0.07	1.6	6,189	x	x	0.2	
11/29/23	11/29/23	6	10	0.15	0.11	0.3	776				
12/06/23	12/07/23	25	6	0.14	0.06	0.3	846				
12/17/23	12/20/23	77	11	1.80	0.27	4.4	38,383				
12/29/23	12/29/23	7	8	0.52	0.12	0.3	3,919				
12/30/23	01/03/24	104	3	1.18	0.3	3.3	20,582				
01/06/24	01/06/24	2	2	0.27	0.18	1.7	2,689				
01/09/24	01/10/24	32	3	0.22	0.08	0.7	4,625				
01/13/24	01/14/24	23	2	0.44	0.11	0.6	7,444				
01/16/24	01/16/24	8	2	0.36	0.19	1.8	7,671				
01/19/24	01/22/24	68	3	1.50	0.23	4.4	25,328	x		0.4	Forecast > design storm
01/24/24	01/24/24	7	1	0.44	0.25	2.9	6,619				
01/31/24	02/02/24	41	6	1.22	0.21	3.6	20,311	x		0.3	Forecast > design storm
02/03/24	02/05/24	50	1	1.61	0.22	4.4	23,785				
02/07/24	02/07/24	7	1	0.49	0.15	2.0	7,492				
02/14/24	02/20/24	150	9	1.92	0.37	6.7	40,311				
02/29/24	03/04/24	86	8	1.89	0.26	5.5	23,952				
03/06/24	03/07/24	19	2	0.57	0.38	5.5	11,816				
03/22/24	03/25/24	69	15	0.88	0.12	1.6	9,361				
03/27/24	03/30/24	62	2	0.55	0.22	2.9	8,056				
04/4/24	04/05/24	33	5	0.83	0.2	2.4	12,666				
04/13/24	04/14/24	23	8	0.58	0.13	0.3	2,455				
05/04/24	05/04/24	17	20	0.88	0.22	2.0	12,414				

1 Peak and total flows for monitored storms were based on linear regressions performed on WY 2024 data.

Table AC-15. Summary of storm characteristics and sample information for site AC-CIVIC during WY 2024

Storm Began	Storm End	Storm Duration (hrs)	Antecedent Dry (days)	Precipitation Total (in)	Maximum Intensity (in/hr)	Peak Flow[1] (cfs)	Total Flow[1] (cf)	Sample Event	First Significant Storm	Trash Volume (gal)	Comment
WY 2024 (24 storms total)											
11/05/23	11/06/23	27	35	0.20	0.12	0.5	2,038				
11/15/23	11/18/23	72	9	0.45	0.07	0.6	4,069	x	x	0.1	
11/29/23	11/29/23	6	10	0.15	0.11	0.5	1,353				
12/06/23	12/07/23	25	6	0.14	0.06	0.3	1,697				
12/17/23	12/20/23	77	11	1.80	0.27	1	16,336				
12/29/23	12/29/23	7	8	0.52	0.12	0.4	4,886				
12/30/23	01/03/24	104	3	1.18	0.30	0.9	13,853				
01/06/24	01/06/24	2	2	0.27	0.18	0.8	1,761				
01/09/24	01/10/24	32	3	0.22	0.08	0.5	2,682				
01/13/24	01/14/24	23	2	0.44	0.11	0.3	5,420				
01/16/24	01/16/24	8	2	0.36	0.19	0.6	3,920				
01/19/24	01/22/24	68	3	1.50	0.23	0.9	14,680	x		0.5	Forecast > design storm
01/24/24	01/24/24	7	1	0.44	0.25	0.9	3,915				
01/31/24	02/02/24	41	6	1.22	0.21	0.9	11,899	x		0.5	Forecast > design storm
02/03/24	02/05/24	50	1	1.61	0.22	0.7	17,243				
02/07/24	02/07/24	7	1	0.49	0.15	0.4	2,623				
02/14/24	02/20/24	150	9	1.92	0.37	1	21,428				
02/29/24	03/04/24	86	8	1.89	0.26	1.3	17,297				
03/06/24	03/07/24	19	2	0.57	0.38	2.1	4,963				
03/22/24	03/25/24	69	15	0.88	0.12	0.6	7,897				
03/27/24	03/30/24	62	2	0.55	0.22	0.6	5,370				
04/04/24	04/05/24	33	5	0.83	0.20	0.6	6,656				
04/13/24	04/14/24	23	8	0.58	0.13	0.4	5,444				
05/04/24	05/04/24	17	20	0.88	0.22	0.5	4,781				

1 Peak and total flows for monitored storms were based on linear regressions performed on WY 2024 data.

Table AC-16. Summary of storm characteristics and sample information for site AC-OUTBK during WY 2025

Storm Began	Storm End	Storm Duration (hrs)	Antecedent Dry (days)	Precipitation Total (in)	Maximum Intensity (in/hr)	Peak Flow[1] (cfs)	Total Flow[1] (cf)	Sample Event	First Significant Storm	Trash Volume (gal)	Comment
WY 2025 (19 storms total)											
11/11/24	11/11/24	2.75	>30	0.34	0.20	2.244	5,940	x	x	0.2	
11/22/24	11/23/24	14.25	11.0	1.06	0.23	3.13	44,153				
11/25/24	11/25/24	6.25	2.2	0.1	0.09	0.54	8,258				
12/12/24	12/12/24	3.75	15.6	0.64	0.18	3.474	33,240	x		0.0	
12/13/24	12/14/24	14	1.8	1.53	0.40	7.82	63,578				
12/16/24	12/16/24	7.25	1.8	0.28	0.12	2.84	19,630				
12/22/24	12/23/24	3.5	6.2	0.1	0.09	1.72	5,503				
12/24/24	12/24/24	11	1.1	0.49	0.22	4.8	27,110				
12/26/24	12/27/24	12.75	2.1	0.48	0.10	1.89	33,910				
12/29/24	12/29/24	4	2.0	0.35	0.19	3.21	21,256				
02/01/25	02/01/25	10	33.8	0.29	0.07	2.07	24,157				
02/04/25	02/04/25	17.25	36.6	1.12	0.36	5.442	76,920	x		1.3	Forecast > design storm
02/06/25	02/06/25	14.75	1.5	0.44	0.12	2.03	19,998				
02/12/25	02/14/25	32.75	5.9	2.84	0.43	17.07	390,652				
03/02/25	03/02/25	2.25	15.9	0.15	0.14	2.65	4,336				
03/12/25	03/13/25	19.75	10.3	1.11	0.38	8.19	51,334				
03/14/25	03/14/25	4.5	0.7	0.27	0.14	1.67	8,822				
03/31/25	03/31/25	7.25	16.9	0.48	0.25	3.2	12,701				
04/01/25	04/01/25	8	0.7	0.42	0.25	3.93	11,283				

1 Peak and total flows for monitored storms were based on linear regressions performed on WY 2024 and WY 2025 data.

Table AC-17. Summary of storm characteristics and sample information for site AC-PUBSAF during WY 2025.

Storm Began	Storm End	Storm Duration (hrs)	Antecedent Dry (days)	Precipitation Total (in)	Maximum Intensity (in/hr)	Peak Flow[1] (cfs)	Total Flow[1] (cf)	Sample Event	First Significant Storm	Trash Volume (gal)	Comment
WY 2025 (19 storms total)											
11/11/24	11/12/24	2.75	>30	0.34	0.2	2.9	8,420	x	x	3.2	
11/22/24	11/23/24	14.25	11	1.06	0.23	4.2	48,107				
11/25/24	11/25/24	6.25	2.2	0.10	0.09	0.3	4,110				
12/12/24	12/12/24	3.75	15.6	0.64	0.18	3.7	27,320	x		0.2	
12/13/24	12/14/24	14	1.8	1.53	0.4	14.2	183,953				
12/16/24	12/16/24	7.25	1.8	0.28	0.12	4.9	36,892				
12/22/24	12/23/24	3.5	6.2	0.10	0.09	4.1	11,613				
12/24/24	12/24/24	11	1.1	0.49	0.22	10.3	69,361				
12/26/24	12/27/24	12.75	2.1	0.48	0.1	8.3	80,575				
12/29/24	12/29/24	4	2.0	0.35	0.19	5.8	40,597				
02/01/25	02/01/25	10	33.8	0.29	0.07	2.9	40,589				
02/04/25	02/04/25	17.25	36.6	1.12	0.36	4.9	57,560	x		0.8	Forecast > design storm
02/06/25	02/06/25	14.75	1.5	0.44	0.12	1.3	6,913				
02/12/25	02/14/25	32.75	5.9	2.84	0.43	9.4	329,508				
03/02/25	03/02/25	2.25	15.9	0.15	0.14	4.9	12,398				
03/12/25	03/13/25	19.75	10.3	1.11	0.38	6.9	28,164				
03/14/25	03/14/25	4.5	0.7	0.27	0.14	1.7	4,139				
03/31/25	03/31/25	7.25	16.9	0.48	0.25	3.6	10,485				
04/01/25	04/01/25	8	0.7	0.42	0.25	7.9	11,414				

1 Peak and total flows for monitored storms were based on linear regressions performed on WY 2024 and WY 2025 data.

Table AC-18. Summary of storm characteristics and sample information for site AC-CTYCTR during WY 2025

Storm Began	Storm End	Storm Duration (hrs)	Antecedent Dry (days)	Precipitation Total (in)	Maximum Intensity (in/hr)	Peak Flow[1] (cfs)	Total Flow[1] (cf)	Sample Event	First Significant Storm	Trash Volume (gal)	Comment
WY 2025 (23 storms total)											
10/31/24	10/31/24	1.8	>30	0.10	0.08	0.03	10				
11/01/24	11/02/24	4.2	1.7	0.17	0.07	0.04	27				
11/11/24	11/11/24	9.5	9.2	0.33	0.09	0.08	73	x	x	0.4	
11/22/24	11/23/24	14.5	10.8	1.42	0.27	0.22	1,111				
11/25/24	11/25/24	15.4	1.7	0.16	0.04	0.04	150				
12/12/24	12/13/24	32.3	16.2	0.91	0.23	0.11	900	x		0.4	
12/13/24	12/14/24	14.5	0.6	1.08	0.26	0.21	1,726				
12/16/24	12/16/24	7.7	3.0	0.32	0.13	0.18	1,459				
12/22/24	12/23/24	6.3	6.1	0.21	0.11	0.13	383				
12/24/24	12/24/24	11.8	1.0	0.65	0.29	0.20	530				
12/26/24	12/27/24	30.3	1.6	1.20	0.21	0.15	1,373				
12/29/24	12/29/24	6.6	1.8	0.36	0.13	0.10	178				
01/03/25	01/03/25	5.6	4.7	0.21	0.13	0.07	202				
01/31/25	02/01/25	25.8	28.1	0.58	0.13	0.07	392				
02/03/25	02/04/25	19.7	2.3	1.50	0.41	0.20	2,204	x		0.1	Forecast > design storm
02/06/25	02/07/25	23.2	1.5	0.58	0.17	0.07	1,260				
02/12/25	02/14/25	33.0	5.6	2.33	0.50	0.23	4,233				
03/02/25	03/02/25	5.8	15.9	0.20	0.09	0.07	209				
03/12/25	03/13/25	18.1	10.3	0.56	0.26	0.15	207				
03/14/25	03/14/25	4.3	0.8	0.35	0.16	0.04	61				
03/16/25	03/17/25	14.7	2.6	0.34	0.09	0.09	2,321				
03/31/25	04/01/25	29.4	13.7	0.36	0.12	0.10	134				
05/12/25	05/12/25	1.9	40.9	0.25	0.22	0.09	329				

1 Peak and total flows for monitored storms were based on linear regressions performed on WY 2024 and WY 2025 data.

B2 CONTRA COSTA CLEAN WATER PROGRAM (CCCWP)

B2.1 Introduction

Two MS4 outfall locations in Contra Costa County are being monitored for trash discharges. The first outfall location (CC-PCH) is in the census designated place of Pacheco near the intersection of Center Avenue and Pacheco Boulevard. The outfall is located approximately 50 meters west of the Pacheco Boulevard intersection on the north side of the Grayson Creek overpass on Center Avenue (Figure CC-1). The second outfall location (CC-WC) is in the City of Walnut Creek, on the western side of Civic Park where Walnut Creek passes under a wooden pedestrian footbridge. The outfall is located approximately 10 meters south of the pedestrian footbridge next to the park's public parking lot off Civic Drive (Figure CC-2). Characteristics of each monitoring location and corresponding drainage area are provided below.

Grayson Creek (CC-PCH)

Site CC-PCH is an 18--inch -diameter outfall that drains a 3.9--acre catchment in the census designated place of Pacheco. This catchment consists of the following urban land uses[20]: retail centers (75%), commercial businesses (24%), and urban parks (1%). Baseline trash generation rates (i.e. pre-trash control established in 2009) for the catchment were identified as approximately 25% moderate and 75% high by area. One hundred percent of the catchment area is treated with full trash capture catch basin inserts. Trash management actions in the catchment have resulted in reducing the trash generation rates from 24.4 (baseline) to 2.5 (current) gallons/acre/year.

The outfall at site CC-PCH (Figure CC-3) is located one meter north of the Grayson Creek overpass on Center Avenue near the intersection of Pacheco Boulevard. The outfall discharges runoff from the catchment area onto a concrete skirt on the eastern bank of a bioengineered flood control levee before draining into Grayson Creek. The surrounding creek banks are approximately 8 feet above the channel during baseflow conditions.

Walnut Creek (CC-WC)

Site CC-WC is a 15--inch -diameter outfall that drains a 1-acre catchment area in the City of Walnut Creek. The catchment area consists of a public parking lot and facilities within Civic Park east of Civic Drive. Baseline trash generation rates for the catchment were identified as approximately 100% moderate. The catchment area is controlled to a low trash designation by 100% treatment with a full trash capture catch basin insert. Trash management actions in the catchment have resulted in reducing the trash generation rate from 7.5 (baseline) to 2.5 (current) gallons/acre/year.

The outfall at site CC-WC (Figure CC-4) drains to Walnut Creek approximately 10 meters south of a pedestrian footbridge in Civic Park as it crosses over Walnut Creek near the public parking lot off Civic Drive. The outfall pipe discharges onto a concrete skirt located on a predominantly natural stream bank on the west side of the channel. The surrounding banks are approximately 19 feet above the channel.

[20] Land use data derived from ABAG (2006).

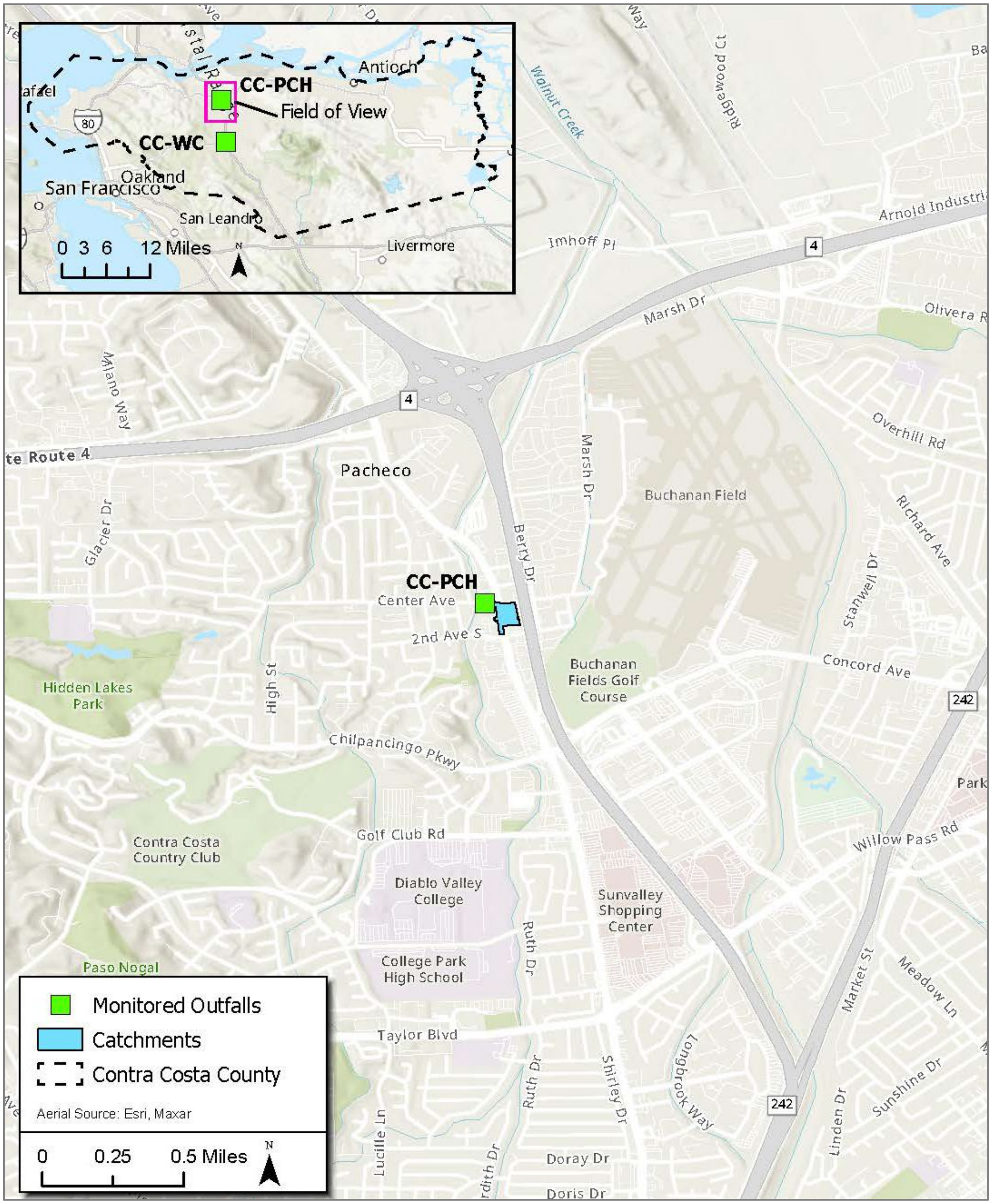


Figure CC-1. Trash outfall monitoring site, Pacheco, Contra Costa County

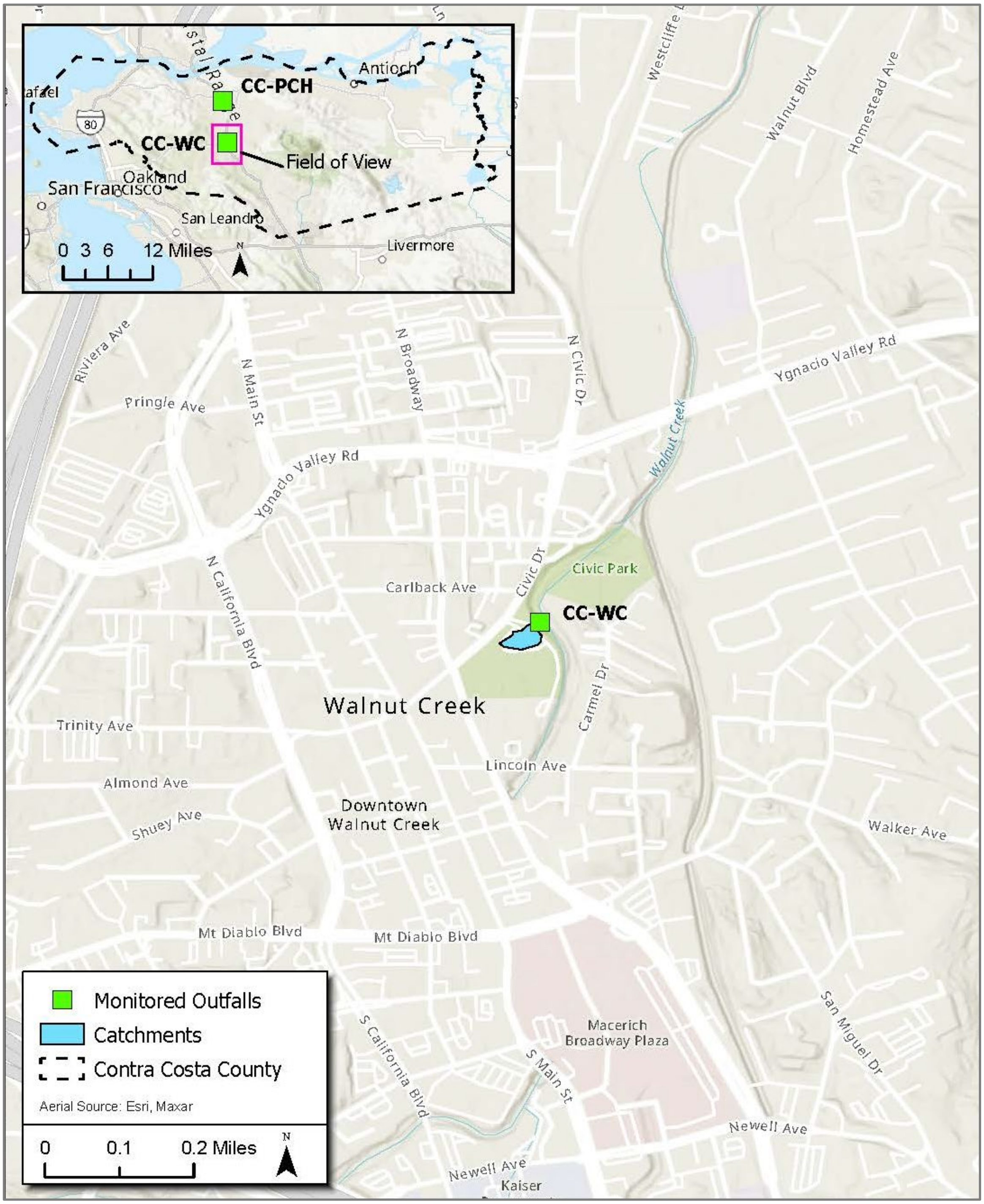


Figure CC-2. Trash outfall monitoring site, City of Walnut Creek, Contra Costa County

Figure CC-3. Trash monitoring outfall located in census designated place of Pacheco, Contra Costa County

Figure CC-4. Trash monitoring outfall located in Civic Park, City of Walnut Creek, Contra Costa County

B2.2 Monitoring Results

B2.2.1 Sample Events

During WYs 2024 and 2025, six storm events were targeted for sample collection at each of the two trash outfall monitoring locations in Contra Costa County. For all six events, one hundred percent of sample collection was completed at both sites over the two-year monitoring period.

The dates and times for net deployment and retrieval and the duration of sample collection for all six sample events are presented in Table CC-1. Summary statistics for rainfall and flow for each sample event are also provided. Additional results showing rainfall total and flow measurements for each sample event, as well as over the entire wet season, are presented in Appendix CC-A.

A summary of the six sample events conducted at the two Contra Costa County sites to date is presented below.

Sample Event 1 (November 13-20, 2023)

During the first sampling event of WY 2024, the nets were deployed at both Contra Costa sites over a seven-day period in midNovember- (Table CC-1). The predicted storm for this first sample event was delayed several days, and the majority of rain arrived on the last two days of net deployment. Precipitation totals at sites CC-PCH and CC-WC were 0.56 and 0.59 inches, respectively. Maximum rainfall intensities at CC-PCH and CC-WC were 0.14 and 0.12 inches/hour, respectively.

Sample Event 1 at both sites was collected during the first significant rainfall event (first flush) of the season, following a 170-day and 11.5-day antecedent dry period at sites CC-PCH and CC-WC, respectively. The sample event at both sites occurred approximately seven days after a small storm that occurred on November 5, 2023. Field crews were not mobilized for the November 5 storm because the predicted forecast was below the criteria for mobilization. Rainfall totals during the November 5 event were 0.12 inches and 0.15 inches at sites CC-PCH and CC-WC, respectively. At site CC-PCH, 0.12 inches fell over an 8-hour period, with no 6-hour period containing 0.10 inches, thereby not meeting the definition of a storm event and explaining the different antecedent dry periods between the two locations.

Sample Event 2 (January 18-23, 2024)

Sampling Event 2 occurred over a five-day sampling period in January 2024. The storm event over this period produced 0.94 and 1.11 inches of rainfall over a 13.25- and 16.25-hour period at sites CC-PCH and CC-WC, respectively. Maximum rainfall intensities at CC-PCH and CC-WC were 0.18 and 0.17 inches/hour, respectively. Rainfall intensities did not exceed the storm intensity design standards at either site. Antecedent dry conditions for sites CC-PCH and CC-WC were 3.5 and 3.3 days, respectively.

Sample Event 3 (January 30-February 2, 2024)

The last sample event of WY 2024 included the highest rainfall totals at both sites (1.50 and 1.23 inches at CC-PCH and CC-WC, respectively) and highest rainfall intensity at site CC-PCH (0.34 inches/hour). The rainfall intensity at CC-WC was 0.13 inches/hour. The rainfall intensity at CC-PCH was above the full trash capture device design standard storm (i.e. the one-year, one-hour storm event), which for sites CC-PCH and CC-WC is 0.33 and 0.42 inches, respectively (https://hdsc.nws.noaa.gov/hdsc/pfds/) (BAMSC 2024). Rainfall intensity at Walnut Creek was predicted to exceed design standards; however, intense rainfall was not recorded in the City of Walnut Creek. Antecedent dry conditions at both sites were approximately seven days for this storm event.

Sample Event 4 (November 11-November 12, 2024)

The fourth sample event characterizes the first seasonal flush for WY 2025 (Table CC-1). During the fourth sample event, nets were deployed at both sites over a two-day period. Rainfall totals at the sites were recorded as 0.23 and 0.29 inches at sites CC-PCH and CC-WC, respectively. Rainfall for this storm occurred over a relatively short period of time, with rainfall duration at site CC-PCH and CC-WC occurring for five and 4.25 hours, respectively. Maximum rainfall intensity for site CC-PCH was 0.11 inch/eshour, and maximum rainfall intensity for site CC-WC was 0.14 inches/hour. The antecedent dry period at both sites was 189 days.

Sample Event 5 (January 30-February 3, 2025)

Sample Event 5 (second sample event for WY 2025) occurred over a five--day period in late January-early February. Precipitation totals ranged from 1.27 to 1.30 inches at sites CC-PCH and CC-WC, respectively. Rainfall duration lasted for a total of 61.25 and 59.25 hours in Pacheco and Walnut Creek, respectively. Maximum rainfall intensity at site CC-PCH was recorded as 0.12 inches/hour, and maximum rainfall intensity recorded at site CC-WC was 0.11 inches/hour. The antecedent dry period prior to the storm was approximately 28 days at both locations.

Sample Event 6 (February 11-February 14, 2025)

The last sample event of WY 2025 occurred in mid-February during one of the largest storms of the season. Precipitation totals ranged between 3.06 and 2.79 inches for sites CC-PCH and CC-WC, respectively (Table CC-1). Maximum rainfall intensity ranged from 0.52 to 0.33 inches/hour for sites CC-PCH and CC-WC, respectively; exceeding the design storm standard at CC-PCH. The antecedent dry period prior to the storm was approximately six days.

Table CC-1. Summary of net deployment and storm period, antecedent dry period, and rainfall total and intensity for trash outfall sampling events conducted in Contra Costa County during WY 2024 and WY 2025

Site	Water Year	Sample Event	Net Deploy Start Date & Time	Net Deploy End Date & Time	Sample Duration (hours)	Storm Duration (hours)	Antecedent Dry (days)	Rainfall Total (inches)	Maximum Intensity (in/hr)[1]	First Seasonal Flush
CC-PCH	2024	Event 1	11/13/23 12:30	11/20/23 13:00	169	16	170	0.56	0.14	x
		Event 2	01/18/24 12:45	01/23/24 13:15	121	13.5	3.5	0.94	0.18	
		Event 3	01/30/24 13:00	02/02/24 10:00	69	18	7.2	1.50	0.34	
	2025	Event 4	11/11/24 08:00	11/12/24 11:30	28	5.1	189	0.23	0.11	x
		Event 5	01/30/25 12:15	02/03/25 12:15	96	61.3	27.8	1.27	0.12	
		Event 6	02/11/25 13:00	02/14/25 13:00	72	27.3	5.5	3.06	0.52	
CC-WC	2024	Event 1	11/13/23 11:30	11/20/23 11:30	168	25	11.5	0.59	0.12	x
		Event 2	01/18/24 11:30	01/23/24 12:00	121	16.5	3.3	1.11	0.17	
		Event 3	01/30/24 12:00	02/02/24 11:30	72	46	7.1	1.23	0.13	
	2025	Event 4	11/11/24 07:15	11/12/24 10:15	27	4.8	189	0.29	0.14	x
		Event 5	01/30/25 10:45	02/03/25 13:15	99	59.3	27.9	1.30	0.11	
		Event 6	02/11/25 12:00	02/14/25 14:00	74	30.4	5.9	2.79	0.33	

1 Rainfall intensity is integrated over 60-minute periods.

B2.2.2 Trash Characterization

Trash collected for each of the six sample events at site CC-PCH was sorted into 13 trash categories and measured for volume (Table CC-2), consistent with the project's QAPP. Total trash volumes across the six samples ranged from <0.01 to 1.60 gallons. The highest volume of trash at site CC-PCH was collected during Event 3 (1.60 gallons), during a storm that produced a rainfall intensity that exceeded full-trash capture design standards. In contrast, Events 1-2 and 4-5 represent storm events where rainfall intensity did not exceed the design standard and had a combined total volume of 0.62 gallons of trash for the four sample events. The largest storm that was sampled over the two WYs occurred during Event 6, with 0.14 gallons of trash collected. Event 6 produced over 3 inches of precipitation and had a similar antecedent dry period as Event 3 in WY 2024 (5 to 7 days); however, Event 6 was preceded by a large storm (1.96 inches with a maximum rainfall intensity of 0.45 inches/hour) two weeks earlier. In contrast, Event 3 in WY 2024 was one of the first large and intense events of the water year, preceded by only one event similar in size and magnitude that year (1.83 inches of total rainfall and 0.33 inches/hour) occurring approximately 40 days prior to sample Event 3.

Table CC-2. Trash volume measured for 13 trash types from trash samples collected at outfall monitoring site CC-PCH, Pacheco, Contra Costa County

		WY 2024			WY 2025		
	Trash Type	Event 1	Event 2	Event 3	Event 4	Event 5	Event 6
Plastic Trash Items (oz)	Single-Use Carryout Plastic Bags	0	0	0	0	0	0
	Expanded Polystyrene (EPS) Foam	0	0.51	25.4	0	0	0
	(EPS) Foam Other	0	7.61	5.10	0.10	0	0
	Single Use Plastic Food / Drink Ware	12.7	29.1	28.1	0	0	0.68
	Smoking Products, Traditional	0.34	0.10	0.51	0.10	0.03	0.17
	Smoking Products, Other	0	0	27.1	0.34	0	0.20
	Other plastic Items / Pieces	16.1	3.40	113.8	5.10	0.07	16.0
Non-Plastic Trash (oz)	Organic / Paper	0.17	0	2.50	0.03	0	1.35
	Fabric	0	0.85	0	1.62	0	0
	Metal	0	0	1.0	0.03	0	0
	Glass	0	0	0.84	0	0	0.03
	Mixed	0	0	0	0	0	0
	Biohazard	0	0	0	0	0	0
	Total Gallons	**0.23**	**0.32**	**1.60**	**0.06**	**<0.001**	**0.14**
	Total Gallons/Acre[1]	**0.059**	**0.082**	**0.409**	**0.015**	**<0.001**	**0.037**

1 CC-PCH catchment area = 3.9 acres

Material collected for each of the six successful sample events at site CC-WC was sorted and measured for volume. No trash was collected during the three storm events in WY 2024, and no trash was collected during Events 5 and 6 in WY 2025. Trash collected from the outfall during Event 4 (first flush event of WY 2025), consisted of 0.03 ounces of fabric (Table CC-3). Organic material was collected from the trash net during all events, consisting mostly of detritus and leaf matter.

Table CC-3. Trash volume measured for 13 trash types from trash samples collected at outfall monitoring site CC-WC, Walnut Creek, Contra Costa County

		WY 2024			WY 2025		
	Trash Type	**Event 1**	**Event 2**	**Event 3**	**Event 4**	**Event 5**	**Event 6**
Plastic Trash Items (oz)	Single-Use Carryout Plastic Bags	0	0	0	0	0	0
	Expanded Polystyrene (EPS) Foam	0	0	0	0	0	0
	(EPS) Foam Other	0	0	0	0	0	0
	Single Use Plastic Food / Drink Ware	0	0	0	0	0	0
	Smoking Products, Traditional	0	0	0	0	0	0
	Smoking Products, Other	0	0	0	0	0	0
	Other plastic Items / Pieces	0	0	0	0	0	0
Non-Plastic Trash (oz)	Organic / Paper	0	0	0	0	0	0
	Fabric	0	0	0	0.03	0	0
	Metal	0	0	0	0	0	0
	Glass	0	0	0	0	0	0
	Mixed	0	0	0	0	0	0
	Biohazard	0	0	0	0	0	0
	Total Gallons	**0**	**0**	**0**	**<0.001**	**0**	**0**
	Total Gallons/Acre[1]	**0**	**0**	**0**	**<0.001**	**0**	**0**

1 CC-WC catchment area = 1.0 acre

The total volume of trash collected in each sample at site CC-PCH, standardized for area, is shown in Figure CC-5. The highest trash volume per unit area occurred at site CC-PCH for Event 3 with 0.41 gallons per acre. The total volume of trash collected in each sample collected at site CC-WC, standardized for area, is shown in Figure CC-6. The highest trash volume for site CC-WC occurred during Event 4 (<0.001 gallons per acre). No trash was collected at site CC-WC during sample Events 1-3 and 5-6. Estimated annual trash loading rates for both sites are presented in Section 3.4.4 of the main report.

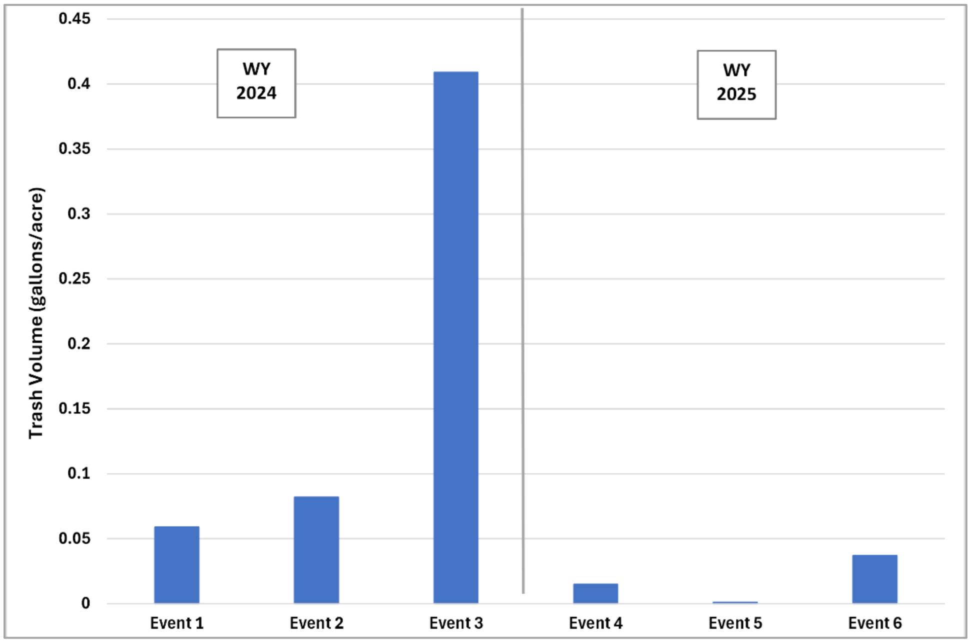


Figure CC-5. Trash volumes standardized by area for six sample events at site CC-PCH, Pacheco, Contra Costa County

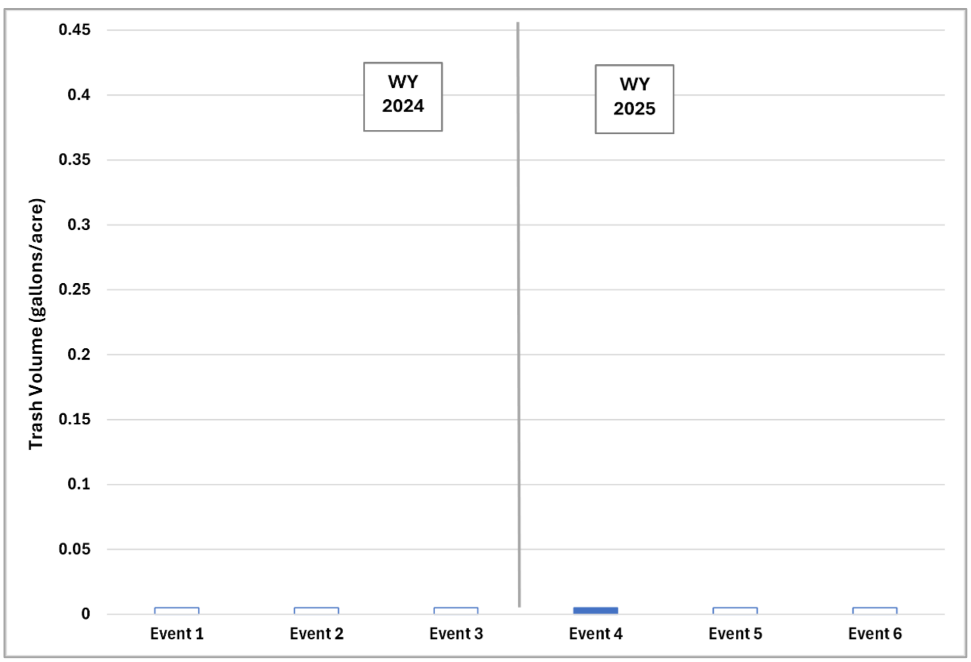


Figure CC-6. Trash volumes standardized by area for six sample events at site CC-WC, City of Walnut Creek, Contra Costa County

No trash was collected at this site for Events 1-3 and 5-6.

The most common trash type identified in the Pacheco (CC-PCH) samples was plastic, of which there are six separate subcategories. The total volume for the combined six plastic trash categories presented in Table CC-2 accounted for 98% of the trash collected during the two WYs (Figure CC-7).

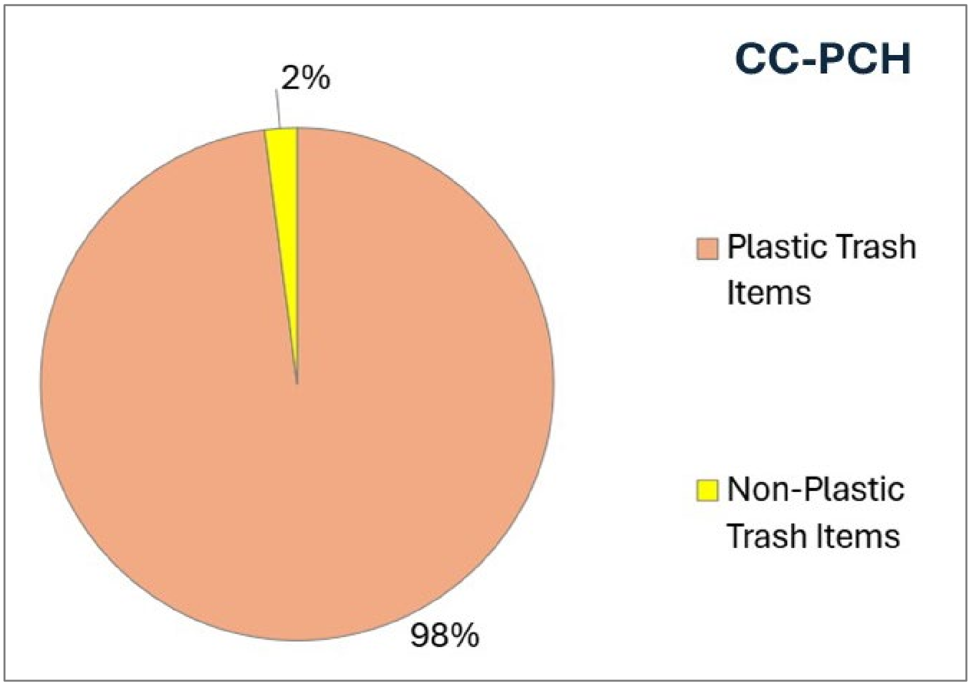


Figure CC-7. Comparison of plastic versus non-plastic trash items measured for all samples collected during the two years of monitoring

The most common type of plastic trash was "*Single-Use Plastic Food/Drinkware*" and "*Expanded Polystyrene (EPS) Foam Food/Drinkware*" which accounted for 61% of all plastic trash items observed at CC-PCH (Figure CC-8). The "*Other Plastic Items/Pieces*" category includes plastic package for food and beverage goods purchased at convenience and grocery stores and accounted for the second most plastic trash items observed (30%) at CC-PCH. The combined plastic items "*EPS Foam (Other)*" and "*Smoking Products*" accounted for 8% and 1% of plastic items, respectively. "*Single-Use Plastic Bags*" accounted for 0% of plastic trash items. Existing State ordinances ban the distribution of single-use plastic bags at grocery stores in the San Francisco Bay Area.

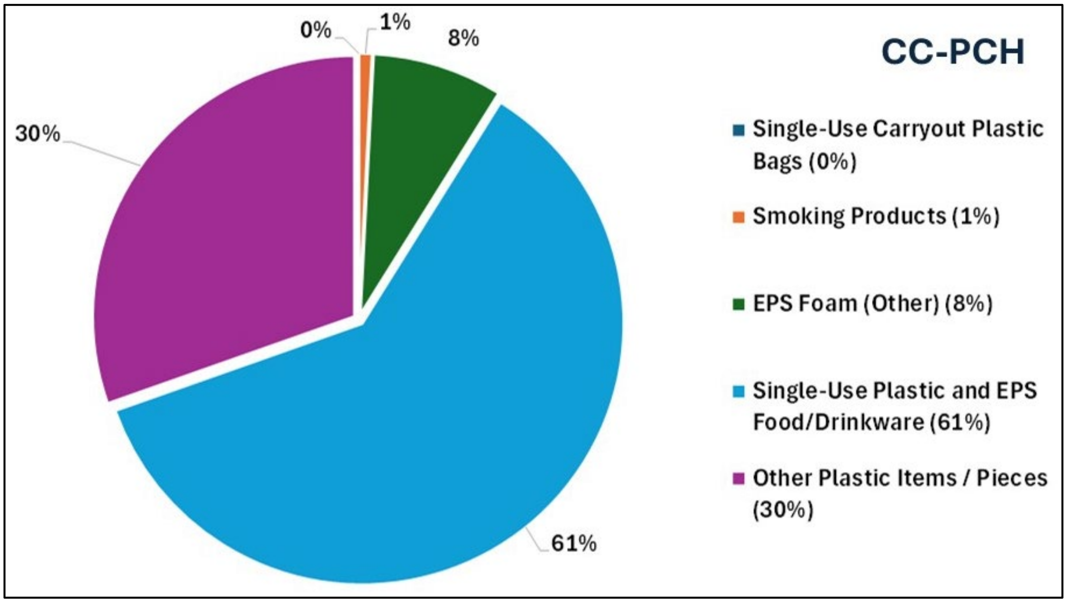


Figure CC-8. Comparison of plastic trash items measured for all CC-PCH samples collected during the two years of monitoring

B2.2.3 Rainfall and Flow

Rainfall data were compiled from Weather Underground stations in proximity to catchment areas for sites CC-PCH and CC-WC. Rainfall totals were calculated using an inverse distance squared weighted average from rainfall data collected from 13 Weather Underground stations near site CC-PCH and 12 Weather Underground stations near site CC-WC.

Water depth sensors were deployed in the MS4 pipe upstream of each trash outfall monitoring site in Contra Costa County. Water level data were converted to flow data using the Manning Equation for a partially full pipe. One hundred percent of data were collected at both sites during the WY 2024 and 2025 monitoring periods. Data collected was field verified for accuracy during the storm season with no issues (water depth manually recorded in outfalls during storms was accurate in relation to water depth recorded by water depth instruments). At both sites, Manning Equation variables (i.e. pipe size, pipe slope, and roughness coefficient) were field verified in relation to provided as-built plans.

At site CC-WC, a steep pipe gradient and small catchment area caused flow to bypass the depth sensor at times, causing periods of flow to not be measured during storm events. To address this, additional in-pipe deployment locations were attempted before field crews determined the most effective way to measure 100% of runoff was to install a Thel-Mar® volumetric weir in the pipe to prevent bypass around the sensor. A 15-inch Thel-Mar® weir was installed on March 28, 2024. Flow data prior to the installation of the Thel-Mar weir were modeled using USACE hydrologic modeling software. The hydrologic model and modeled data were calibrated using field collected data following installation of the Thel-Mar® weir in the MS4 pipe.

Annual hydrographs for both sites are presented in Figures CC-9 and Figure CC-10. The figures also show trash volume (normalized by area) for each of the sampled storm events. Plots of rainfall, flow data and sampling period for each sample event for both sites during WY 2025 are shown in Figures CC-11 to CC-12. Hydrographs for individual sample events that occurred during WY 2024 were provided in the Trash Outfall Monitoring Progress Report for WY 2024 (BAMSC 2025).

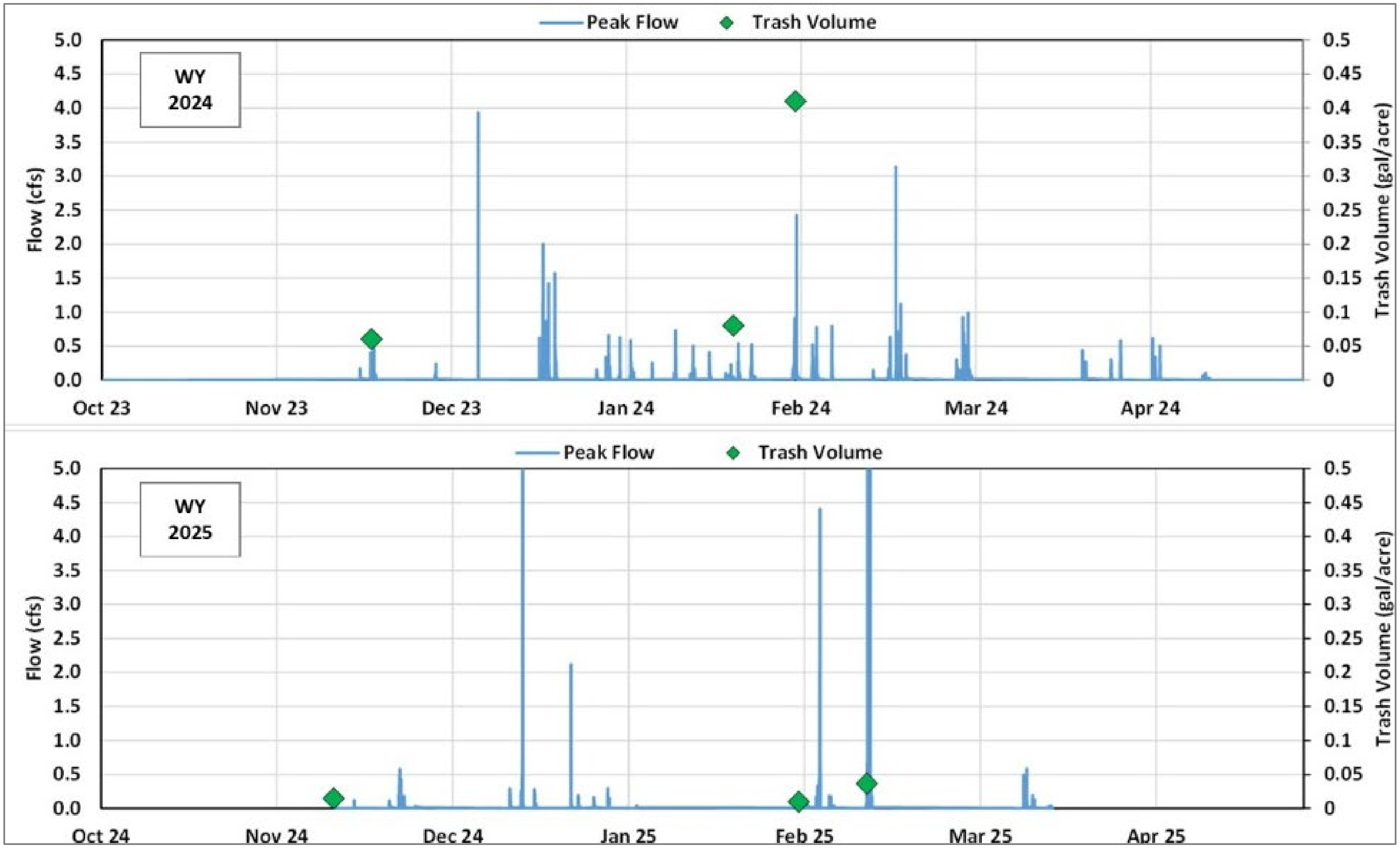


Figure CC-9. Annual hydrograph and trash volume (normalized by area) for each sample event conducted at site CC-PCH, Contra Costa County

Two events in WY 2025 exceeded the upper limit of the primary x-axis (peak flow). Peak flow and storm statistics for all events are available in Table CC-10

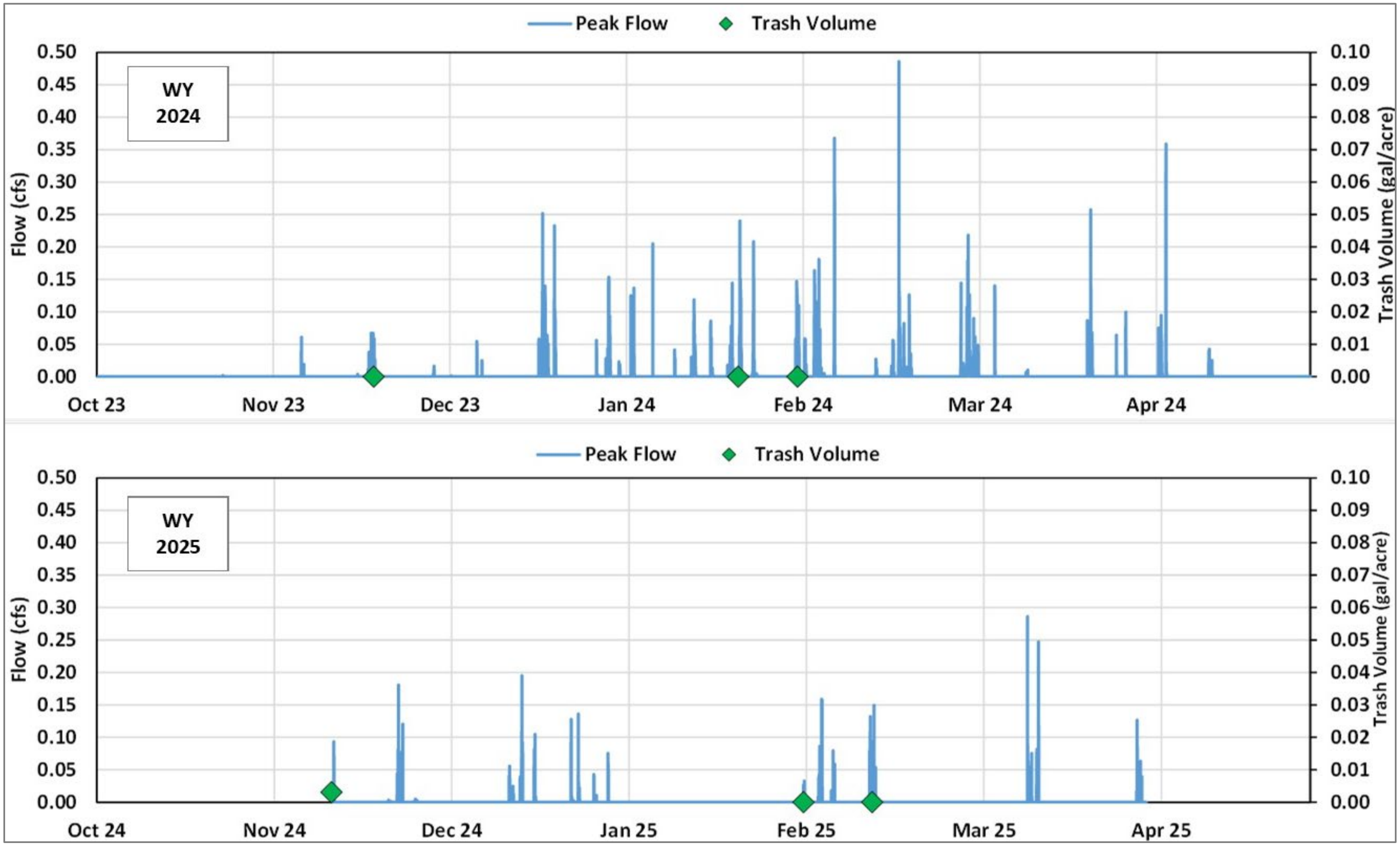


Figure CC-10. Annual hydrograph and trash volume (normalized by area) for each sample event conducted at site CC-WC in Contra Costa County

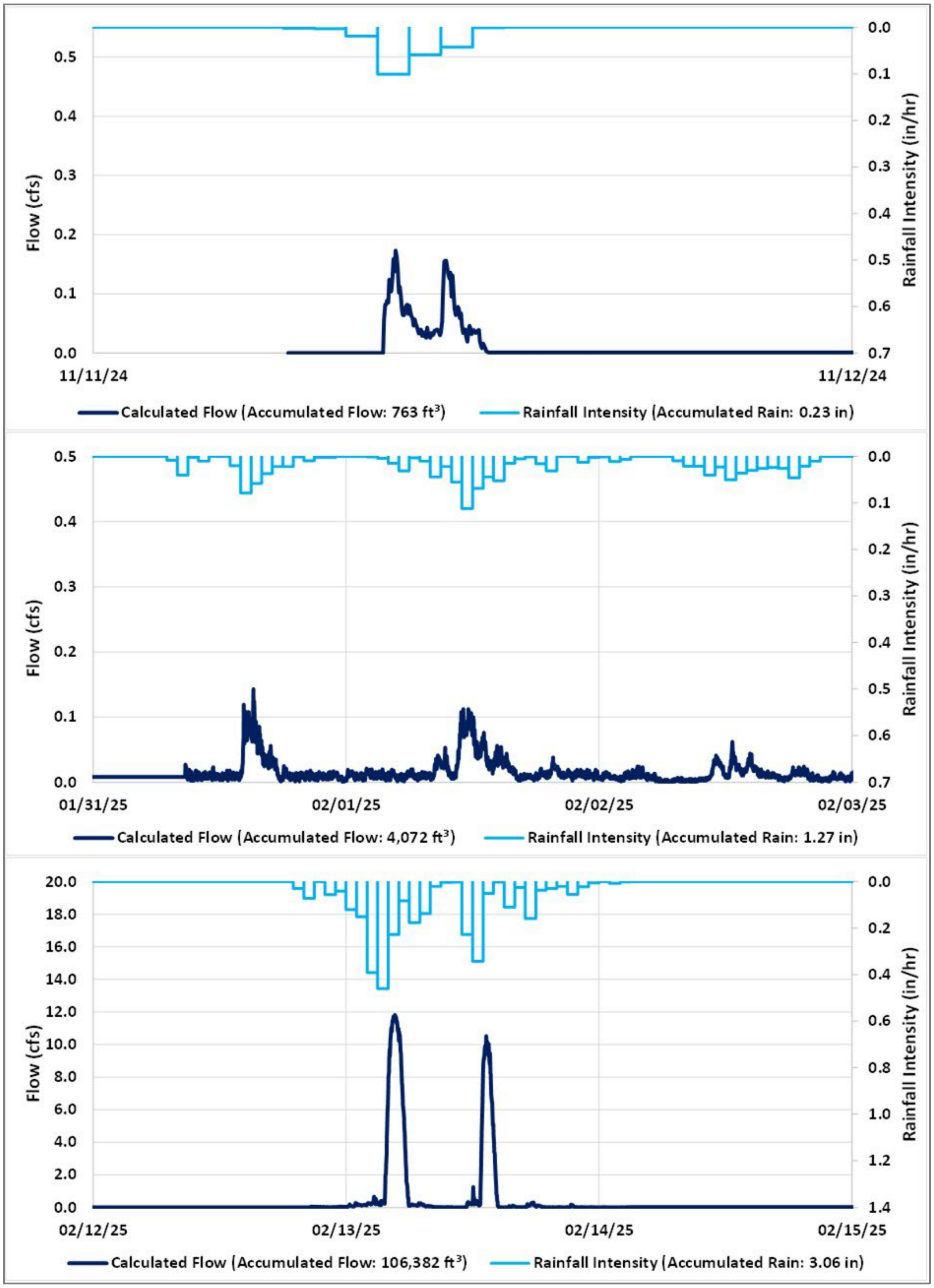


Figure CC-11. Hydrographs for three successful sample events at site CC-PCH during WY 2025

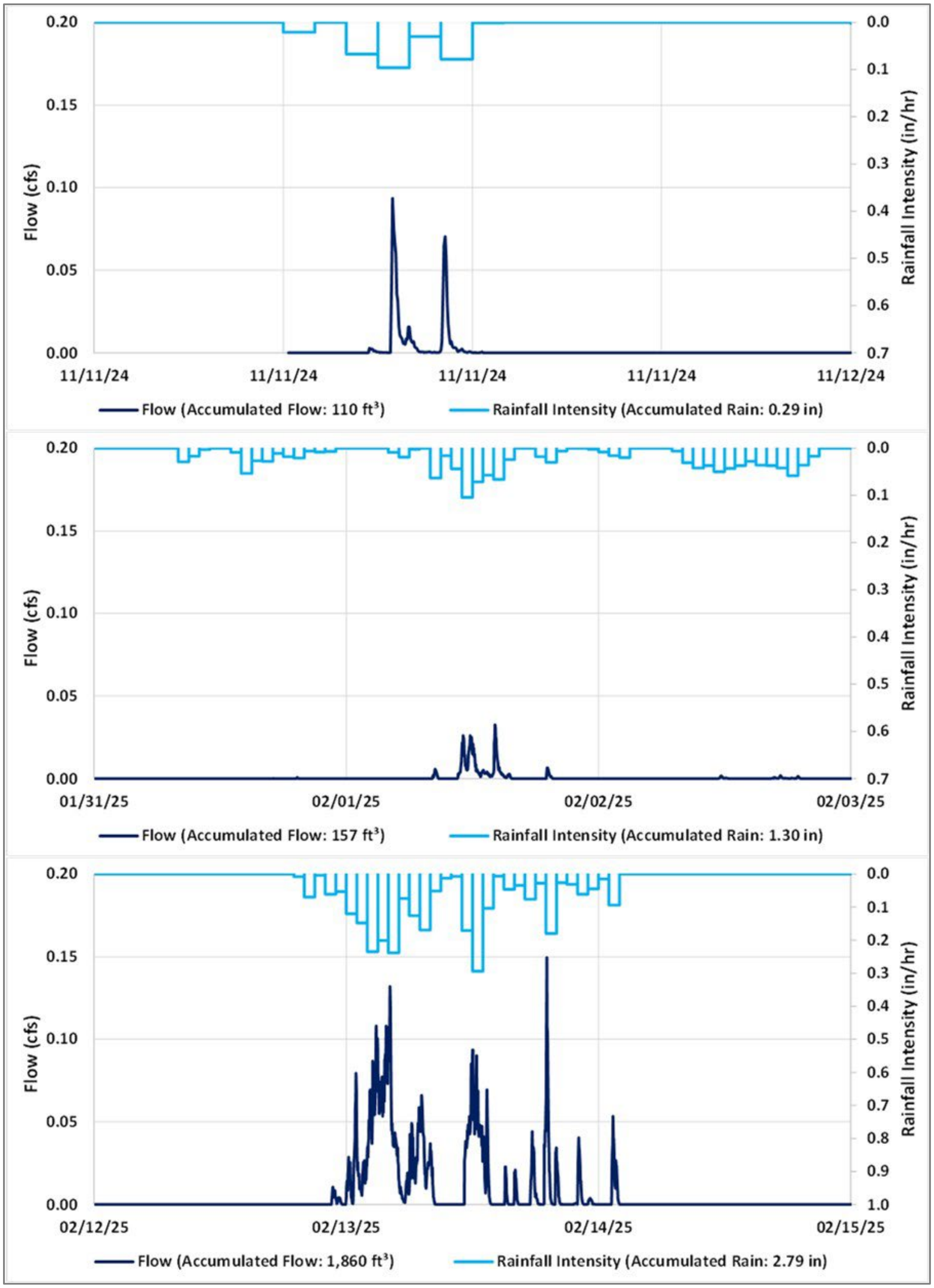


Figure CC-12. Hydrographs for three successful sample events at site CC-WC during WY 2025

B2.2.4 Storm Characteristics

In effort to calculate the annual trash load discharged at each outfall during each WY, the total number of storms that occurred in each WY were identified using compiled rainfall data. Storm events were defined using the following criteria:

- At least 0.1-inch precipitation in 6 hours (Caltrans 2020)
- 24 hours of antecedent dry conditions (i.e., no rainfall)
- Event ends when < 0.1 inch of rain occurs over 6 hours

A summary of storm characteristics for both sites monitored during WY 2024 and WY 2025 is provided in Appendix CC-A. Information includes sample duration (defined as the length of the storm during net deployment), antecedent dry period, total rainfall (inches), maximum intensity rainfall (inches/hour), peak flow (cfs) and total flow (cf). Sampled storm events and total trash volume (gallons/acre) for each event are indicated in the appendix. First seasonal flush storms and storms that met or exceeded the FTC design storm (i.e., the peak flow generated from a one-year, one-hour frequency storm) are also identified in the appendix. The definition of design storm is provided in Attachment A.

At site CC-PCH, a total of 25 and 19 storms were identified for WY 2024 and WY 2025, respectively. There was one first seasonal flush event for both years; total rainfall during first flush events was 0.56 and 0.23 inch in WY 2024 and WY 2025, respectively. Trash volumes for the first flush storm events were 0.06 and 0.02 gallons/acre for WY 2024 and WY 2025, respectively.

At site CC-WC, a total of 29 and 18 storms were identified in WY 2024 and WY 2025, respectively. There was one first seasonal flush event for both years; total rainfall for first flush events was 0.60 inches and 0.29 inches in WY 2024 and WY 2025, respectively. Trash volumes for first flush storm events were 0.00 and <0.001 gallons/acre for both years. The first flush event of WY 2025 was the only sample event with trash in the net at the Walnut Creek outfall.

Over the two years of monitoring at site CC-PCH, nine storms exceeded the design storm peak flow rate (one-year, one-hour flow rate), which was calculated to be 1.0 cfs (see Section 3.2.7 for methods used to calculate design storm). At site CC-WC, three storms had peak flow that exceeded the design storm (one-year, one-hour), which was calculated to be 0.3 cfs (see Attachment A).

A comparison of sampled and unsampled storms over a two-year monitoring period at site CC-PCH is shown in Figure CC-13. Over the two years of sampling, the lowest peak flows sampled occurred during sample events 4 and 5 (the first two sample events of WY 2025), on November 11, 2024 and January 31, 2025. These events produced peak flows of 0.17 and 0.14 cfs, respectively. Trash volumes for these events were 0.02 and <0.001 gallons/acre, representing the lowest total volume of trash collected during the monitoring period. Two sample events were conducted during high peak flow events over the past two years, both during storm events that generated peak flow exceeding the design storm. Peak flows during these events were recorded as 2.43 and 11.8 cfs during sample Events 3 and 6, respectively. Total trash volumes for these events were 0.41 and 0.04 gallons/acre, respectively. Variation in trash volume collected during peak flow events at CC-PCH suggests increasing sample count will improve single (e.g. peak flow) and multivariate (e.g. peak flow and antecedent dry period) analyses. Storm sizes underrepresented in the sample group include peak flows between 0.25 and 2 cfs (13 storms). The variation in trash volume collected during peak flow events suggests that increasing sample count across all storm sizes and types will benefit all types of variable analyses.

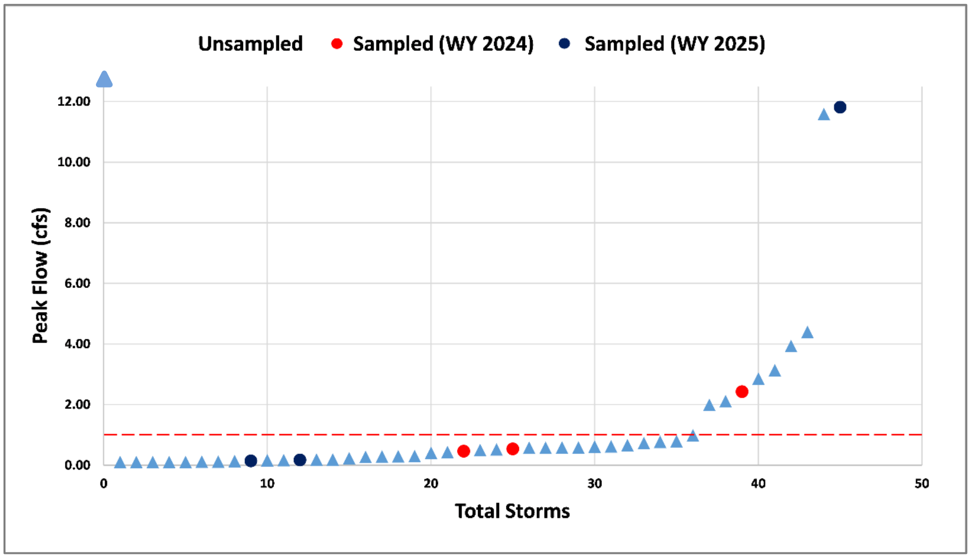


Figure CC-13. Distribution of peak flows for storms, sampled and unsampled, during WY 2024 and WY 2025 at site CC-PCH

Predicted peak flow design storm standard (1.0 cfs) is shown as a red dashed horizontal line.

A similar comparison of sampled and unsampled storms over the two-year monitoring period at site CC-WC is shown in Figure CC-14. Over the two years of sampling, the lowest peak flow sampled occurred during a storm on November 17, 2024 (0.03 cfs). The highest peak flow sampled was 0.15 cfs. There were zero storms sampled over the two-year monitoring period that exceeded the calculated design standard. For five out of six sample events, no trash was collected. The total volume collected during the seasonal first flush event in WY 2025 was <0.01 gallon/acre during a storm that produced a peak flow of 0.09 cfs. Storm sizes underrepresented in the sample group include peak flows above 0.15 cfs (16 storms).

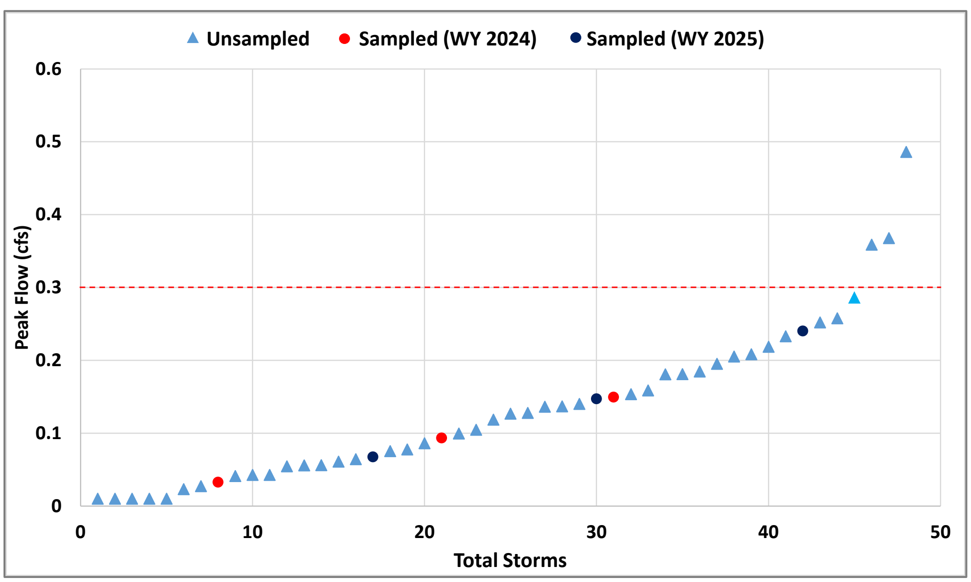


Figure CC-14. Distribution of peak flows for storms, sampled and unsampled, during WY 2024 and WY 2025 at site CC-WC

Predicted peak flow design storm standard (0.3 cfs) is shown as a red horizontal dashed line.

B2.2.5 Draft Annual Trash Load Estimate

Several factors that may influence trash accumulation and transport into the MS4 were evaluated for their association with the observed trash volume (normalized by area). These include antecedent dry period, sample duration, total rainfall, peak rainfall intensity, peak flow, and total flow. All these factors were independently compared to trash volume data using linear regression statistical analyses (Table CC-4). Despite a small sample size (n=5), two variables (maximum rainfall intensity and peak flow) showed moderate correlation with trash volume. Each of these variables was independently used to estimate annual trash loads for site CC-PCH.

Initial analyses at site CC-PCH included the Event 6 sample collected during peak flows exceeding the one-year, one-hour design storm; however, this sample was determined to be an outlier due to a low volume of trash collected during the highest recorded peak flow event. This data point may prove useful in future multivariate analyses, as the Event 6 sample was collected 14 days after a previous storm that exceeded design storm peak flows reflecting catchment area conditions following the wash-off of trash and subsequent accumulation over a two-week period. Until more data is available, this outlier was excluded from current linear regression analyses.

Annual trash load estimates for site CC-WC were calculated to be <0.01 gallons/acre/year. The annual trash load estimate for CC-WC is based on five out of six samples containing no trash, and one sample containing less than 0.03 ounces. All six sample events monitored at site CC-WC were below the calculated one-year, one-hour design storm standard.

Table CC-4. Summary statistics for comparison between trash volume and explanatory variables using linear regression

Sample Location	CC-PCH (n=5)		
Explanatory Variable	**r^2**	**Linear Coefficient**	**Intercept**
Sample duration (hours)	0.43	0.000	0.009
Antecedent dry (days)	0.55	-0.002	0.079
Total rain (inch)	0.02	-0.010	0.045
Total flow (cfs)	0.50	0.000	-0.002
Maximum rain intensity (in/hr)	0.74	0.52	-0.048
Peak flow (cfs)	0.88	0.159	-0.014

Variables in gray shading were used to predict average annual trash loads.

The equations for the linear regression lines were used to provide a very preliminary estimate of trash loading for each storm event. The sum of the predicted and observed trash volumes for each storm was used to estimate the total annual load of trash discharged from each outfall (Table CC-5). For comparison, annual trash loads were also calculated by applying the average trash volume for sampled events equally to each storm event identified for each WY. This was the simple method used to calculate annual load in the Annual Progress Report for WY 2024 (BAMSC 2025).

Plots comparing two variables (maximum rainfall intensity and peak flow) and trash volume data for site CC-PCH are shown in Figure CC-15. The 90% confidence intervals for the regression line are shown in each plot. As models were trained on a small dataset, predictions for values that are outside the original data range carry high uncertainty. This is displayed by extended confidence interval shading on plots when the model predicts values that are beyond the training data, illustrating that predictions outside of the original data carry higher uncertainty.

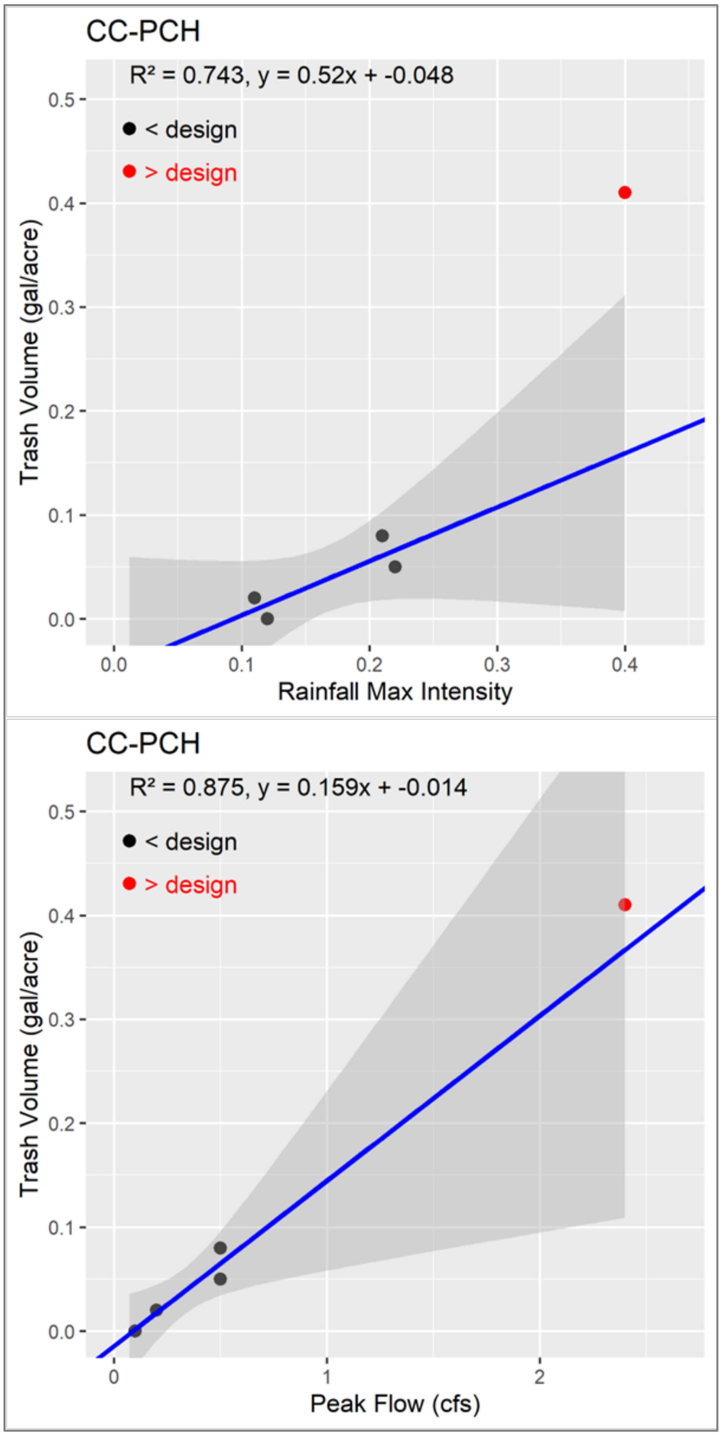


Figure CC-15. Comparison of two independent storm variables

Rainfall maximum intensity (top) and peak flow (bottom) and trash volume data collected at site CC-PCH for two years of monitoring. The dark gray shading represents the 90% confidence interval

The equations explaining the regression line for the two variables shown in Figure CC-15 were used to calculate trash volumes for all storms that occurred during WYs 2024 and 2025. Preliminary estimated annual trash loads calculated for each variable, combined with measured volumes from sampled storms, are shown in Table CC-5.

Estimated annual trash loads by variable at site CC-PCH were similar in range across each year: 1.72 to 1.32 gallons/acre/year for maximum rainfall intensity and 3.59 to 3.20 gallons/acre/year for peak flow. Estimated annual trash loads by variable were relatively similar in variation across both years: 1.72 and 3.59 gallons/acre/year for maximum rainfall intensity and peak flow, respectively, in WY 2024, and 1.32 and 3.20 gallons/acre/year for maximum rainfall intensity and peak flow, respectively, in WY 2025. Predicted trash loads from remaining storms were higher in WY 2025 across both maximum rainfall and peak flow variables (1.26 and 3.14 gallons/acre) despite there being fewer storms, as there was a greater number of higher magnitude storms (Appendix CC-A). The low and high estimates of the annual trash load, based on 90% confidence intervals for the linear regression line, combined with trash load volume (gallons) from sampled events, are presented for both water years at site CC-PCH in Table CC-6.

The method by which the estimated annual load is based on average sample volumes applied uniformly to all storms during each wet season (i.e., the method previously used in the Annual Progress Report for WY 2024 [BAMSC 2025]) is shown in Table CC-5 for comparison. For site CC-PCH, an average trash volume of 0.101 gallons/acre were applied to 25 storms in WY 2024 and 19 storms in WY 2025.

Table CC-5. Annual trash load for site CC-PCH for both years of monitoring

Site	Monitoring Year	Total Load from Sampled Events (gal/acre)	Explanatory Variable				Annual Load Average Trash Volume (gal/acre/yr)
			Maximum Rainfall Intensity (in/hr)		Peak Flow (cfs)		
			Total Predicted Load from Remaining Storms	Annual Load (gal/acre/yr)	Total Predicted Load from Remaining Storms	Annual Load (gal/acre/yr)	
CC-PCH	WY 2024	0.55	1.17	**1.72**	3.04	**3.59**	2.51
	WY 2025	0.06	1.26	**1.32**	3.14	**3.20**	1.92

Additional multivariate statistical analyses that evaluate the influence of multiple factors on trash volume will be considered in subsequent years as more data becomes available. Additional trash volume data is needed from under-represented storms (e.g., smaller storms, storms with range of antecedent dry periods) to better explore the relationship between factors (e.g., peak flow and antecedent dry) and their influence on trash volumes.

Table CC-6. Annual trash load for sites CC-PCH for both years of monitoring

Site	Monitoring Year	Maximum Rainfall Intensity (in/hr) Estimated Annual Trash Load (gal/acre/year)			Peak Flow (cfs) Estimated Annual Trash Load (gal/acre/year)		
		Best	Low*	High*	Best	Low*	High*
CC-PCH	WY 2024	**1.72**	0.55	3.10	**3.59**	1.25	5.93
	WY 2025	**1.32**	0.05	2.80	**3.20**	0.77	5.65

*Low and high estimates represent 90% confidence interval of the regression line.

B2.3 Investigation of Trash Generation

This section describes visual observations to document trash generation within the monitored outfall catchment prior to each monitoring season. It is important to note that trash observed during the assessment represents a snapshot in time and may have considerable variation over time. However, observed trash levels can provide additional context for determining if existing trash controls are effective at reducing trash discharge through the MS4. Existing trash management actions within each catchment are summarized in the following section.

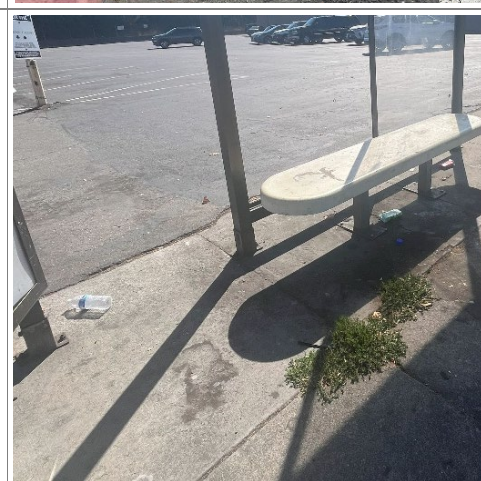
B2.3.1 Catchment Assessments

Visual observations of trash in the catchment areas for sites CC-PCH and CC-WC were conducted in September, prior to the beginning of each water year. Descriptions of the catchment areas are provided above in Section B1.1. Summaries of trash observations made during foot and windshield surveys conducted in September 2024 and 2025 are provided below. The summaries include type and location of trash observed during each survey. Areas with minimal or no trash in the catchment were also noted. The locations of observed trash were mapped to determine if existing trash controls would likely prevent the observed trash from discharging into the storm drain (Figures CC-16 and CC-17). A summary of the levels of trash observed in relation to existing trash management controls for each catchment are described below.

Site CC-PCH

The catchment area for CC-PCH was observed to have litter and windblown trash along the curb and gutter and sidewalks of Pacheco Boulevard (Table CC-7). Trash observed in the catchment area was consistent with items that could be purchased from nearby convenience stores (e.g. single-use plastic food and drinkware and other plastic items). Convenience stores located in or adjacent to the catchment area include a gas station convenience store and 7-Eleven®. Both businesses have trash cans outside their facilities and appear to be well or routinely maintained. Traditional smoking products (i.e., cigarette butts and packaging) were common along the sidewalk outside the casino and card room located in and on the perimeter of the catchment area, despite the availability of nearby wall-mounted and free-standing cigarette butt receptacles. While litter along the curb and gutter of both Pacheco Boulevard and Center Avenue was documented, the highest concentration of trash was typically associated with loitering or encampments. Trash was documented next to bus stops along Pacheco Boulevard and planter boxes outside businesses along the public sidewalk. Field crews noted that no trash receptacles were available in proximity to the bus stop and, while there were no encampments in the catchment area, encampments were visible in the general area, and the catchment area was a foot traffic corridor between encampments and the convenience store in the catchment.

Table CC-7. Trash assessment in catchment for site CC-PCH, Pacheco, Contra Costa County

Location and Type of Trash	Latitude, Longitude	Photos
Litter on Pacheco Boulevard Aluminum cans, cigarette butts, and single-use drinkware were commonly observed items in the curb and gutter of the catchment area. (photo taken: 9/24/2024)	37.98313, -122.06763	
Litter on Pacheco Boulevard	37.98322, -122.06736	
Public bus stop on Pacheco Boulevard Litter was often located on and next to bus stop benches. No trash cans were located next to the benches, and trash was discarded in a manner that suggested loitering or requirements to leave food/drink behind before boarding public transport.	37.98292, -122.06761	

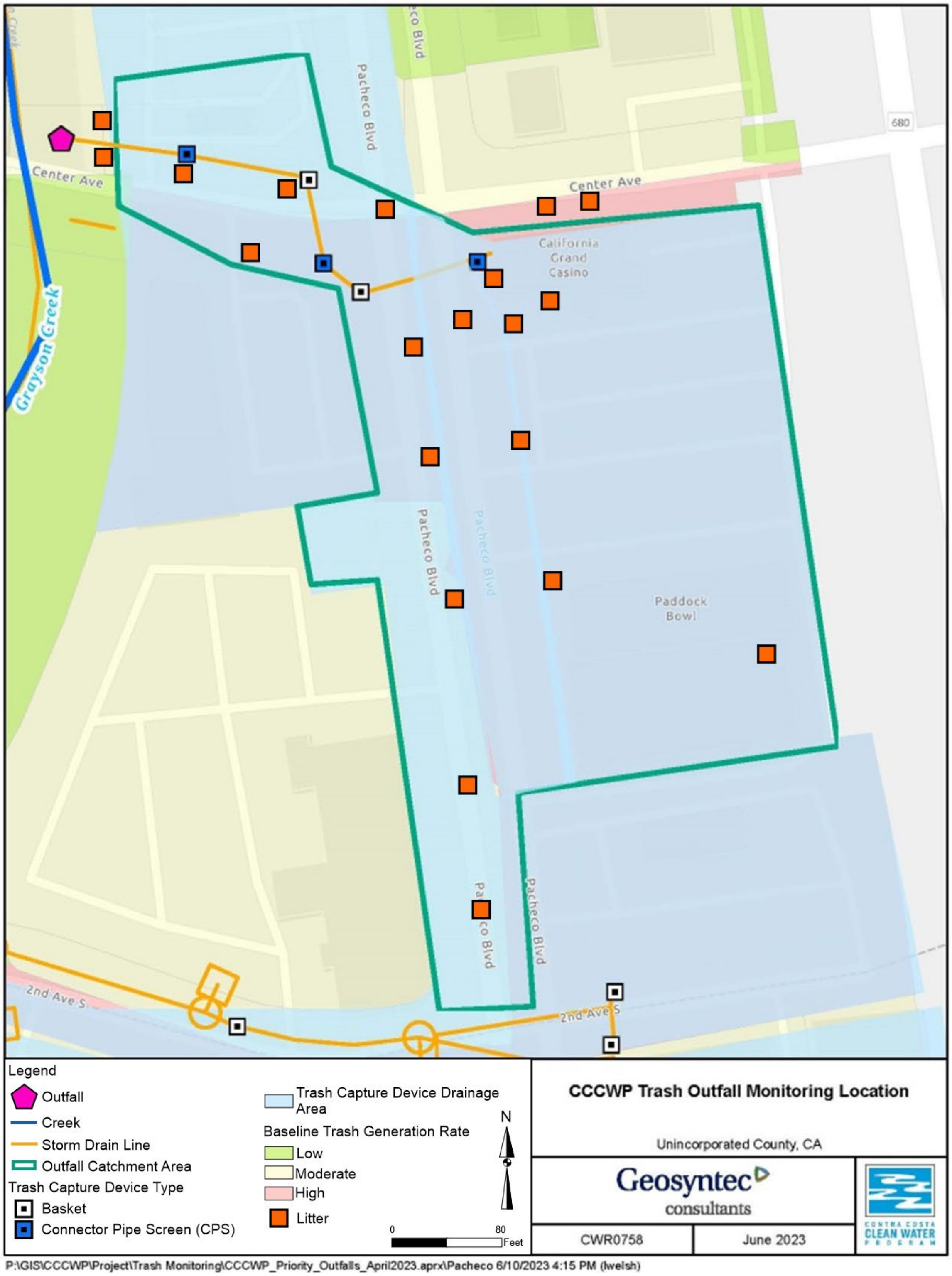
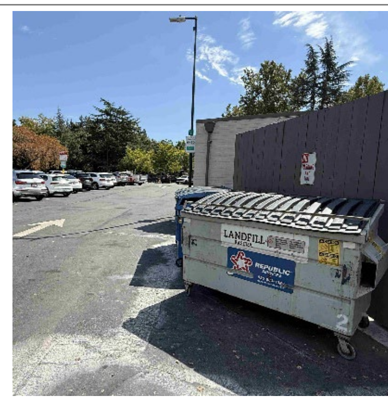


Figure CC-16. Trash sources identified in the census designated place of Pacheco during trash assessment for catchment CC-PCH, September 2024

Site CC-WC

In general, minimal trash was observed in the parking lot, sidewalk, dumpster area, and facilities in the CC-WC catchment area. Litter associated with single-use food and drinkware was observed in the curb and gutter and general parking lot area, and cigarette butts were observed against the City's ceramics studio facility (Table CC-8). Visual observations indicate trash receptacles and potential trash sources adjacent to the catchment area were well maintained and clean. Windblown trash was observed on the creek bank outside the catchment area near the outfall.

Table CC-8. Trash assessment in catchment for site CC-WC, in the City of Walnut Creek

Location and Type of Trash	Latitude, Longitude	Photos
Litter and organics along curb and gutter of Civic Park parking lot Trash was generally light in the catchment area. Trash was often single-use food and drinkware (photo taken on 9/24/2024).	37.90338, -122.05938	
CC-WC catchment area Dumpsters in the catchment were secure and well maintained.	37.90323, -122.05959	
During pre-season inspections, community volunteers were observed conducting on-land cleanups in the catchment area and area adjacent to the catchment.	37.90329, -122.05928	

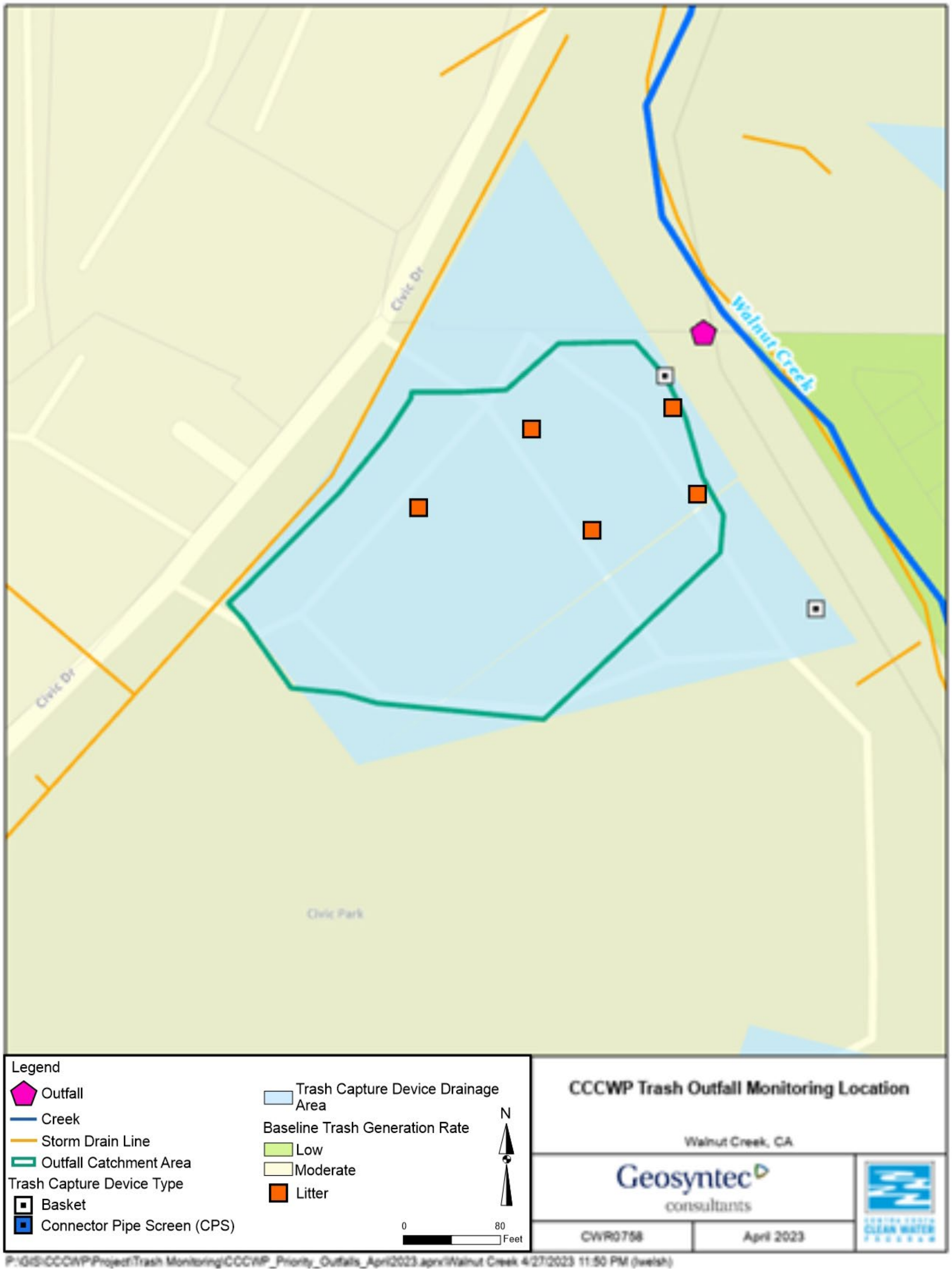


Figure CC-17. Trash sources identified in the City of Walnut Creek during trash assessment for catchment CC-WC, September 2024

B2.3.2 Trash Management Actions

Operations and maintenance records for full trash capture devices and other trash control measures implemented in the monitored catchments are summarized in Table CC-9.

Table CC-9. Summary of operations and maintenance activities associated with full trash capture and other controls implemented in catchments for outfall monitoring sites

Monitored Catchment	Full Trash Capture	Other Controls
CC-PCH	CPS and baskets are cleaned at least once annually (cleaned on 10/17/23 and 03/05/24 during WY 2024 and 10/24/24, 02/19/25 and 03/24/25 in WY 2025)	– Enhanced street sweeping – On-land clean ups – Storm drain cleaning
CC-WC	Basket is cleaned annually (cleaned on 11/13/23 during WY 2024 and 09/23/24 just prior to the start of WY 2025)	– Improved bin container management – On-land clean ups

CC-PCH

Email from Contra Costa County:

"Contra Costa County's trash management actions in the drainage area of the outfall monitoring site include street sweeping twice a month, stormwater business inspections, and servicing the full trash capture devices and auto-retractable screens that are present. As part of the stormwater business inspections, trash assessments are conducted, and notices of violations are issued for trash discharges."

CC-WC

Email from City of Walnut Creek:

"The two dumpsters in the parking lot DMA are for the City Ceramics Studio building and activities. They are emptied once a week. The park is swept twice a week due to high volume of programmed Arts and Rec activities, including a senior center at the far end of the park (which has two dumpsters, serviced two times a week). The TCDs are cleaned as permit requires and as needed before storms due to the abundant tree canopy and leaf drop this time of year. The surrounding park area just outside the catchment also has separate trash and recycle bins, as well as a couple big belly solar trash/recycle compactors that hold more and keep the trash contained due to the nature of the device. Parks staff maintain the park area daily."

B2.4 Refinements

CCCWP has no suggested refinements to trash outfall monitoring in Contra Costa County for WY 2026.

Table CC-10. Summary of storm characteristics and sample information at site CC-PCH during WY 2024 and WY 2025

Start Date	End Date	Storm Duration (hrs)	Antecedent Dry (days)	Precipitation Total (in)	Maximum Intensity (in/hr)	Peak Flow (cfs)[1]	Total Flow (cf)[1]	Sample Event	First Flush	Trash Volume (gal/acre)	Comment
WY 2024 (25 storms total)											
11/17/23	11/18/23	16.00	170	0.37	0.14	0.46	3,187	1	X	0.059	
11/29/23	11/29/23	4.42	10.8	0.15	0.09	0.14	422				
12/06/23	12/6/23	4.00	7.4	0.32	0.27	**3.93**	1,824				
12/17/23	12/20/23	71.92	10.8	1.83	**0.33**	**2.00**	21,034				
12/29/23	12/30/23	18.42	8.8	0.83	0.15	0.66	6,815				
12/31/23	12/31/23	4.50	1.6	0.20	0.18	0.63	990				
01/02/24	01/02/24	6.17	1.8	0.38	0.18	0.59	2,455				
01/10/24	01/10/24	7.58	3.9	0.26	0.13	0.73	1,969				
01/13/24	01/13/24	8.00	2.9	0.50	0.22	0.51	2,707				
01/16/24	01/16/24	2.75	2.7	0.23	0.14	0.41	1,290				
01/20/24	01/20/24	5.75	3.5	0.18	0.10	0.23	808				
01/21/24	01/22/24	7.33	1.2	0.52	0.18	0.54	3,025	2		0.082	
01/24/24	01/24/24	5.58	1.9	0.26	0.13	0.53	1,686				
01/31/24	02/01/24	19.00	7.2	1.34	**0.34**	**2.43**	11,539	3		0.409	
02/03/24	02/04/24	22.42	2.6	1.13	0.17	0.78	8,726				
02/07/24	02/07/24	4.75	2.5	0.51	0.26	0.80	3,166				
02/14/24	02/14/24	5.17	7.0	0.12	0.09	0.12	324				
02/17/24	02/20/24	78.08	2.7	1.94	**0.43**	**3.13**	15,605				
02/29/24	03/02/24	59.25	8.8	1.53	0.25	0.99	12,879				
03/22/24	03/23/24	18.00	19.8	0.50	0.09	0.44	6,515				
03/27/24	03/27/24	5.33	4.3	0.18	0.12	0.30	1,349				
03/29/24	03/29/24	6.75	1.4	0.30	0.21	0.58	1,607				
04/04/24	04/05/24	33.33	5.7	0.76	0.22	0.62	4,829				
04/13/24	04/13/24	9.33	7.5	0.23	0.08	0.07	840				
05/04/24	05/04/24	6.33	20.7	1.05	**0.43**	**2.86**	7,211				

Start Date	End Date	Storm Duration (hrs)	Antecedent Dry (days)	Precipitation Total (in)	Maximum Intensity (in/hr)	Peak Flow (cfs)[1]	Total Flow (cf)[1]	Sample Event	First Flush	Trash Volume (gal/acre)	Comment
WY 2025 (19 storms total)											
11/11/24	11/12/24	6.33	189	0.23	0.11	0.17	763	4	X	0.015	
11/14/24	11/15/24	6.67	3.2	0.11	0.08	0.12	314				
11/21/24	11/21/24	18.17	6.3	0.25	0.07	0.11	817				
11/23/24	11/24/24	30.00	1.7	1.92	**0.34**	0.58	7,340				
11/26/24	11/26/24	28.00	2.8	0.30	0.06	0.03	971				
12/12/24	12/13/24	20.25	16.8	0.64	0.19	0.29	1,988				
12/14/24	12/15/24	20.50	1.9	1.93	**0.70**	**11.59**	37,377				
12/16/24	12/17/24	11.25	2.4	0.58	0.20	0.28	1,577				
12/23/24	12/23/24	18.83	6.3	0.67	**0.55**	**2.12**	2,000				
12/24/24	12/25/24	11.58	1.5	0.35	0.16	0.19	781				
12/27/24	12/28/24	17.83	2.6	0.48	0.14	0.16	986				
12/29/24	12/30/24	9.83	2.6	0.55	0.28	0.30	1,495				
01/03/25	01/04/25	7.92	5.0	0.17	0.07	0.04	287				
02/03/25	02/03/25	73.33	28.1	1.27	0.12	0.14	4,072	5		<0.001	
02/04/25	02/05/25	22.33	3.5	1.96	**0.45**	**4.40**	17,965				
02/07/25	02/07/25	24.08	2.4	0.72	0.16	0.19	1,538				
02/14/25	02/14/25	31.50	6.5	3.06	**0.52**	**11.82**	106,382	6		0.037	
03/14/25	03/15/25	49.42	27.8	1.41	0.26	0.59	3,795				
03/17/25	03/18/25	21.25	4.3	0.31	0.10	0.04	803				

1 Peak flows that exceeded the one-year, one-hour storm event are indicated in **bold**.

Table CC-11. Summary of storm characteristics and sample information at site CC-WC during WY 2024 and WY 2025

Start Date	End Date	Storm Duration (Hours)	Antecedent Dry (days)	Precipitation Total (in)	Maximum Intensity (in/hr)	Peak Flow (cfs)	Total Flow (cf)	Sample Event	First Flush	Trash Volume (gal/acre)	Comment
WY 2024 (29 storms total)											
11/05/23	11/06/23	6.00	159	0.15	0.11	0.06	189				
11/17/23	11/18/23	24.92	11.5	0.44	0.12	0.07	634	1	X	0.0	
12/06/23	12/06/23	6.00	17.9	0.11	0.08	0.05	76				
12/17/23	12/19/23	39.17	10.7	0.91	0.21	0.25	2,288				
12/20/23	12/20/23	6.00	1.1	0.41	0.18	0.23	1,215				
12/27/23	12/27/23	6.00	7.2	0.14	0.07	0.06	152				
12/29/23	12/30/23	9.58	1.8	0.63	0.16	0.15	1,635				
12/31/23	12/31/23	6.00	1.6	0.12	0.08	0.02	122				
01/02/24	01/03/24	15.67	1.7	0.57	0.19	0.14	1,192				
01/06/24	01/06/24	6.00	3.3	0.19	0.17	0.21	226				
01/10/24	01/10/24	6.00	3.6	0.16	0.07	0.04	106				
01/13/24	01/14/24	10.83	3.0	0.57	0.17	0.12	1,506				
01/16/24	01/16/24	6.00	2.6	0.31	0.16	0.09	479				
01/20/24	01/20/24	9.08	3.3	0.19	0.09	0.08	372				
01/21/24	01/22/24	7.25	1.2	0.70	0.17	0.24	2,041	2		0.0	
01/24/24	01/24/24	7.00	2.0	0.35	0.15	0.21	760				
01/31/24	02/02/24	46.25	7.1	1.20	0.13	0.14	2,936	3		0.0	
02/03/24	02/04/24	22.92	1.5	1.09	0.16	0.18	3,051				
02/07/24	02/07/24	6.00	2.5	0.53	0.24	**0.37**	1,284				
02/14/24	02/14/24	6.00	7.0	0.13	0.04	0.03	83				
02/17/24	02/20/24	75.50	2.7	1.56	0.34	**0.49**	3,509				
02/29/24	03/03/24	78.58	8.8	1.46	0.20	0.22	3,624				
03/06/24	03/06/24	6.00	2.9	0.19	0.18	0.14	235				
03/22/24	03/23/24	17.58	15.9	0.79	0.15	0.26	860				
03/27/24	03/28/24	6.17	4.2	0.15	0.09	0.06	68				
03/29/24	03/29/24	7.33	1.4	0.39	0.26	0.10	379				
04/04/24	04/05/24	33.58	5.6	0.78	0.19	**0.36**	1,188				
04/13/24	04/13/24	6.00	7.5	0.28	0.11	0.04	265				

Start Date	End Date	Storm Duration (Hours)	Antecedent Dry (days)	Precipitation Total (in)	Maximum Intensity (in/hr)	Peak Flow (cfs)	Total Flow (cf)	Sample Event	First Flush	Trash Volume (gal/acre)	Comment
05/04/24	05/04/24	9.00	20.8	0.79	0.23	0.18	1,127				
WY 2025 (18 total storms)											
11/11/24	11/12/24	28.40	189	0.30	0.14	0.09	110	4	X	<0.01	
11/20/24	11/21/24	24.90	9.5	0.16	0.04	0.01	5				
11/22/24	11/24/24	48.40	1.7	1.80	0.34	0.18	886				
11/25/24	11/26/24	24.60	2.8	0.22	0.05	0.01	23				
12/11/24	12/13/24	31.30	16.7	0.64	0.18	0.06	468				
12/13/24	12/15/24	35.20	2.0	1.27	0.41	0.20	920				
12/16/24	12/17/24	29.50	2.4	0.47	0.16	0.10	461				
12/22/24	12/23/24	25.10	6.5	0.24	0.17	0.13	157				
12/24/24	12/25/24	27.40	1.3	0.33	0.14	0.14	229				
12/26/24	12/27/24	30.10	2.6	0.34	0.09	0.04	139				
12/29/24	12/30/24	27.50	2.5	0.42	0.21	0.08	390				
01/31/25	02/03/25	76.80	28.3	1.28	0.11	0.03	157	5		0.0	
02/03/25	02/05/25	44.60	3.3	1.46	0.27	0.16	1,071				
02/06/25	02/07/25	38.10	0.6	0.16	0.02	0.01	15				
02/12/25	02/15/25	53.50	6.5	2.79	0.33	0.15	1,860	6		0.0	
03/02/25	03/03/25	24.20	17.2	0.12	0.08	0.01	54				
03/12/25	03/15/25	73.70	10.5	1.37	0.28	0.29	1,220				
03/31/25	04/02/25	41.50	19.1	0.32	0.08	0.13	218				

1 Peak flows that exceeded the one-year, one-hour storm event are indicated in bold.

B3 SAN MATEO COUNTYWIDE WATER POLLUTION PREVENTION PROGRAM (SMCWPPP)

B3.1 Introduction

Two MS4 outfall locations in San Mateo County are being monitored for trash discharges. The first outfall location (SM-PIL) is at the upstream end of a drainage ditch adjacent to California State Route (SR) 1 that flows approximately 300 meters south to its confluence with Pilarcitos Creek in Half Moon Bay (Figure SM-1). The second outfall location (SM-SBS) is in the City of San Carlos at the upstream end of a drainage ditch that flows approximately 600 meters east, under US 101, to its confluence at Steinberger Slough (Figure SM-2). Characteristics of each monitoring location and corresponding drainage area are provided below.

Pilarcitos Creek (SM-PIL)

Site SM-PIL is a 47-inch-diameter outfall that drains an 86-acre catchment in the City of Half Moon Bay. This catchment area consists of following urban land uses:[21] commercial (23%), K-12 schools (32%), industrial (16%), residential (12%), urban area that is not under Permittee jurisdiction (e.g., PG&E substation, airports) (14%), and Caltrans Right of Way (ROW) (2%). Baseline trash generation rates (i.e., pre-trash control established in 2009) for the catchment were identified as approximately 50% low, 32% moderate and 19% high/very high by area.

Ninety-two percent of the catchment (79 acres) is treated with a high-Flow capacity FTC treatment system (i.e., hydrodynamic separator). A portion of SR 1 and a small area of the commercial shopping center, both untreated, drain into the MS4 between the FTC system and the monitoring location at the outfall. In addition, trash control measures equivalent to FTC systems have been implemented in areas not addressed by the FTC system. These control measures include trash inspections conducted on private properties (i.e., private land development area or PLDAs) that address 4.7 acres of land area in the catchment. Collectively, these trash control measures implemented in the catchment have resulted in the reduction of the trash generation rate for areas in the catchment that are under City of Half Moon Bay's jurisdiction from 9.1 (baseline) to 2.4 (current) gallons/acre/year.

The outfall at site SM-PIL is located at the north end of a narrow, manmade concrete-lined ditch that flows south along SR 1 for approximately 1,150 feet before discharging to Pilarcitos Creek (Figure SM-3). The outfall and the manmade ditch are owned by Caltrans. The outfall includes an existing concrete headwall and concrete landing area. The surrounding banks are approximately 4 feet above the channel. Sediment accumulation has allowed the channel bottom to establish dense non-native herbaceous vegetation.

Steinberger Slough (SM-SBS)

Site SM-SBS is at a 30-inch-diameter outfall that drains a 57-acre catchment area in the City of San Carlos. This catchment area consists of the following urban land uses: residential (53%), commercial/retail (18%), industrial (24%), and urban park (5%). While the outfall is owned by Caltrans, less than 1% of the catchment area is in Caltrans ROW. Baseline trash generation rates for the catchment were identified as approximately 53% low, 43% moderate and 4% high by area. A

[21] Land use data derived from ABAG (2006).

total of 38 acres (67%) are treated with catch basin insert FTC systems (i.e., eight connector pipe screen devices). Trash reductions from control measures equivalent to FTC systems include trash inspections conducted on PLDAs (16 acres). Collectively these trash control measures implemented in the catchment have resulted in the reduction of the trash generation rate for areas in the catchment that are under City of San Carlos' jurisdiction from 5.1 (baseline) to 2.1 (current) gallons/acre/year.

The outfall at site SM-SBS, which does not include a headwall, is located at the west end of an earthen ditch that flows approximately 1,640 feet northeast toward US 101 (Figure SM-4). The ditch flows under the highway and continues for approximately 2,460 feet to the confluence of Steinberger Slough. The banks along the ditch are approximately 4 feet above the bottom.

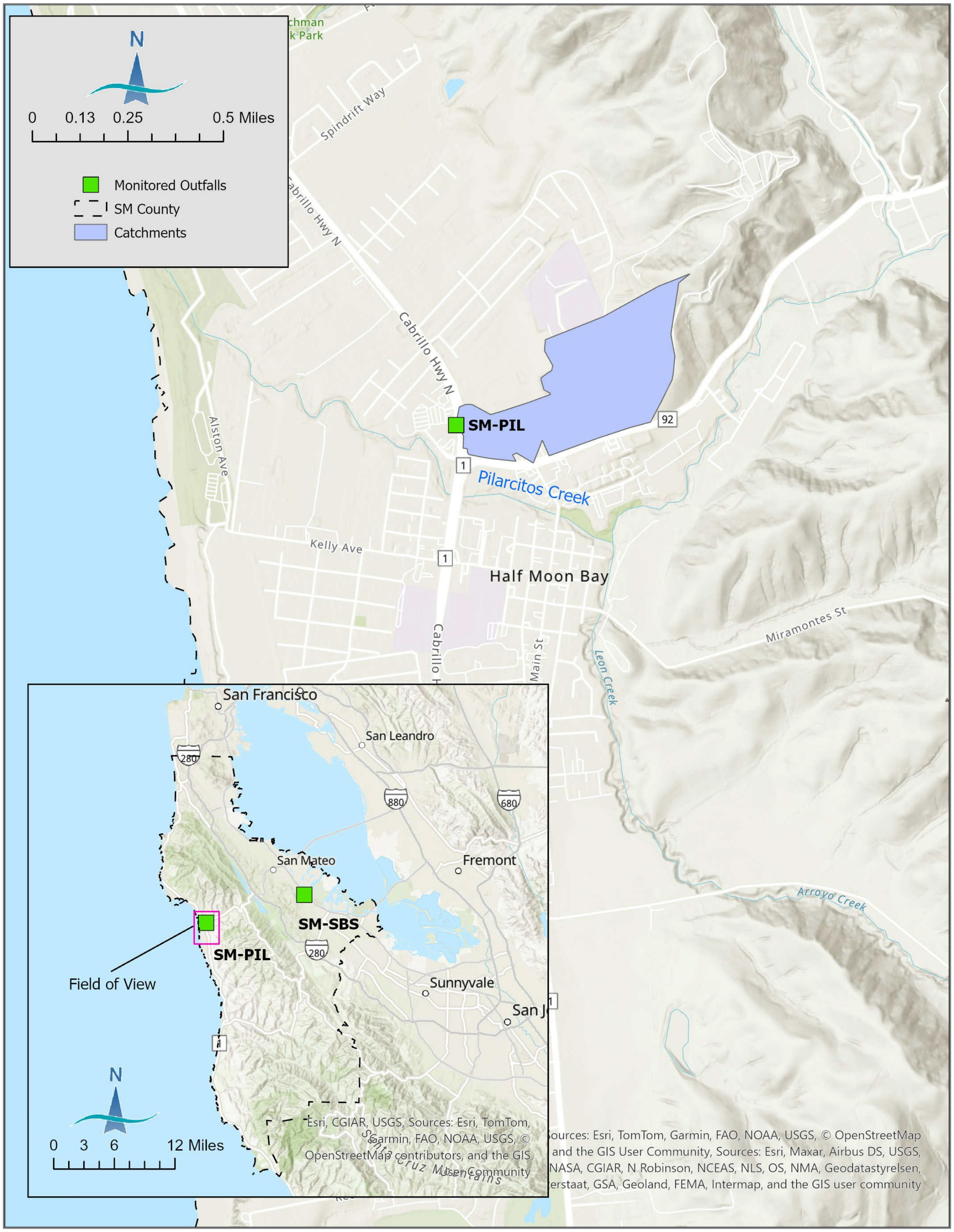


Figure SM-1. Trash outfall monitoring site in Half Moon Bay, San Mateo County

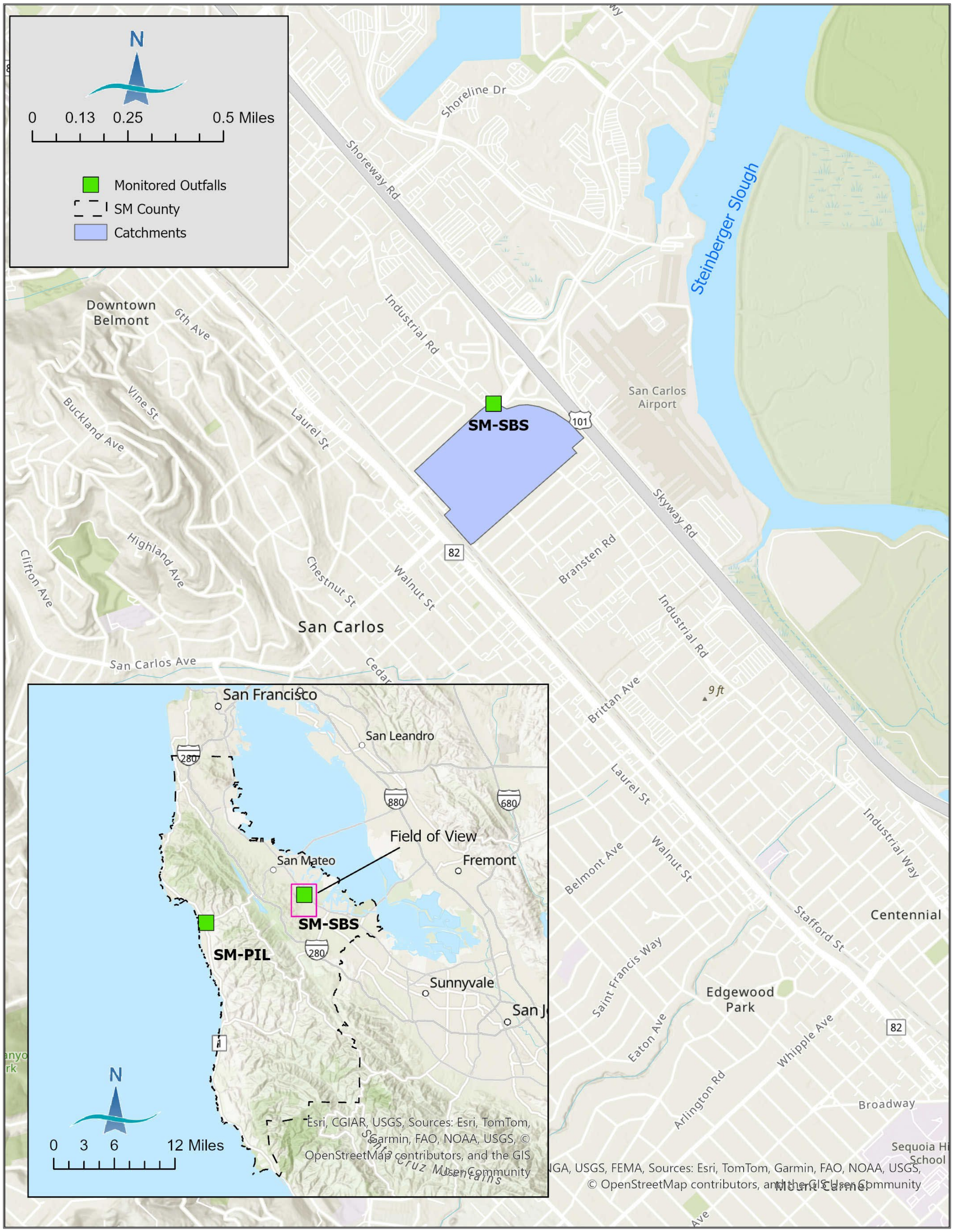


Figure SM-2. Trash outfall monitoring site in City of San Carlos, San Mateo County

Figure SM-3. Outfall located upstream end of drainage ditch to Pilarcitos Creek, City of Half Moon Bay

Figure SM-4. Outfall located upstream of drainage ditch to Steinberger Slough, City of San Carlos

B3.2 Monitoring Results

B3.2.1 Sample Events

During WYs 2024 and 2025, eight sampling events were conducted over eight different storm events at the two trash outfall monitoring locations in San Mateo County. One of the sample events at site SM-SBS was disqualified when a tree fell on the outfall resulting in loss of the sample. In total, seven samples were collected at both sites over the two-year monitoring period.

The dates and times for net deployment and retrieval and the duration of sample collection for all seven sample events are presented in Table SM-1. Summary statistics for rainfall and flow for each sample event are also provided. Additional results showing rainfall totals and flow measurements for each sample event, as well as over the entire wet season, are presented in Section B3.4 below.

A summary of the eight sample events conducted at the two San Mateo sites to date is presented below. Trash samples were not collected at every sample event. A total of seven and six trash samples were collected at sites SM-PIL and SM-SBS, respectively, across the eight sample events.

Sample Event 1 (November 13-20, 2023)

During the first sampling event of WY 2024, the nets were deployed at both San Mateo sites over a seven-day period in mid-November (Table SM-1). The predicted storm for this first sample event was delayed several days and the majority of rain arrived on the last two days of net deployment. Precipitation totals were higher at the coastal site (SM-PIL) compared to the Bay site (SM-SBS), with approximately 1.3 inches and 0.7 inch recorded, respectively.

The sample event occurred approximately seven days after a smaller storm that occurred on November 5, 2023. Field crews were not mobilized for the November 5 storm because the predicted forecast was below the criteria for mobilization. The smaller unsampled storm resulted in approximately 0.23 inch of rain over a 6-hour span at site SM-PIL. Total rainfall was substantially smaller at the Bay site SM-SBS, with only 0.06 inch falling over that period.

It is assumed the November 5 storm may have resulted in some trash getting transported into the MS4 upstream of the SM-PIL outfall. However, since this storm was relatively small, it is likely that flows were insufficient to flush out all the trash and debris that accumulated in the catchment over the dry season. Thus, both early season storms on November 5 (unsampled) and November 13 (sampled) were considered to represent the first seasonal flush following the dry season.

Sample Event 2 (January 18-23, 2024)

Sampling Event 2 included the highest rainfall total (ranging from 2 to 3 inches) and intensity (ranging from 0.8 to 0.9 inch/hour) compared to other sample events in WY 2024 (Table SM-1). The rainfall intensities were well above the full capture design standard storm (i.e., the one-year, one-hour storm event), which for sites SM-SBS and SM-PIL is 0.44 and 0.49 inch/hour, respectively (https://hdsc.nws.noaa.gov/hdsc/pfds/) (BAMSC 2024). Antecedent dry conditions for both sites were approximately three days. At site SM-SBS, the net was found detached from the outfall during the net retrieval visit on January 23, 2024. It is assumed that the net detached at 3:20 a.m. on January 22, based on changes in water depth measured in the pipe. As a result, the net was not attached to the outfall for the last 5.5 hours of the storm (approximately 27% of the tail end of the storm).

Storm Event 3 (January 31-February 2, 2024)

Nets were deployed at both sites for a three-day period in late-January and early-February. The third and final sample event of the WY 2024 season was the longest storm duration (approximately 40 hours) compared to the other WY 2024 sampling events (Table SM-1). The total rainfall ranged from 1.3 to 1.7 inches at sites SM-PIL and SM-SBS, respectively. Antecedent dry conditions for both sites were approximately six days.

Sample Event 4 (October 31-November 4, 2024)

During the fourth sample event (first event of WY 2025), nets were deployed at both sites over a six-day period at the beginning of November 2024 (Table SM-1). The amount of rainfall was much less than the predicted forecast, resulting in minimal to no flow at the outfall monitoring locations. Precipitation totals were highest at the coastal site (SM-PIL); approximately 0.24 inch of rain were recorded during the entire six-day net deployment. A majority of the precipitation occurred over a four-hour period on November 1, during which the peak rainfall intensity of 0.08 inch/hour occurred. Field observations during net retrieval at site SM-PIL indicate the net was submerged in standing water and contained a small amount of organic material and trash.

The rain totals were much lower at the Bay site (SM-SBS); only 0.04 inch of rain were recorded during the six-day net deployment, which did not meet the definition for a storm event (see Section 3.4.3 in main report). Field observations during net retrieval indicated the outfall and downstream channel were both dry and the net was empty.

Sample Event 5 (November 11- 12, 2024)

Sampling Event 5 was the second storm event of WY 2025 and occurred approximately one week following the previous storm that was sampled at both sites (i.e., Sample Event 4). Precipitation totals ranged between 0.37 and 0.57 inch for sites SM-SBS and SM-PIL, respectively (Table SM-1). Rainfall for this storm occurred over a relatively short period of time, with intensities ranging from 0.26 and 0.39 inch/hour for sites SM-SBS and SM-PIL, respectively.

This storm was considered the first seasonal flush at site SM-SBS and the second seasonal flush at site SM-PIL. Because the first storm event at site SM-PIL was relatively small, it was assumed that flows were insufficient to flush out all the trash and debris that accumulated in the catchment over the dry season. Thus, sample data for site SM-PIL during the first two storms of the WY 2026 season were collectively considered to be the trash volume associated with the first seasonal flush.

Sample Event 6 (December 11-December 13, 2024)

Sample Event 6 (third sample event for WY 2025) occurred over a two-day period in mid-December. Precipitation totals ranged between 0.87 and 0.91 inch for sites SM-SBS and SM-PIL, respectively (Table SM-1). Maximum rainfall intensity ranged from 0.26 to 0.3 inch/hour for sites SM-SBS and SM-PIL, respectively. The antecedent dry period prior to the storm was approximately two weeks.

Sample Event 7 (February 11-February 14, 2025)

The fourth sample event of WY 2025 occurred during mid-February during one of the largest storms of the season. Precipitation totals ranged between 2.2 and 3.0 inch for sites SM-PIL and SM-SBS, respectively (Table SM-1). Maximum rainfall intensity ranged from 0.53 to 0.61 inch/hour for sites SM-SBS and SM-PIL, respectively; both exceeding the design storm standards. The antecedent dry period prior to the storm was approximately four days.

The sample collected at site SM-SBS was disqualified for this sample event. A large tree fell on top of the outfall during the storm and resulted in net detaching from the outfall. During retrieval, the net was submerged in the water and not cinched closed. There was very little material observed within the net. The net at site SM-PIL was still attached to the outfall and contained organic debris and trash. This was the fourth and final sample event at site SM-PIL for WY 2025.

Sample Event 8 (March 12-March 13, 2025)

The fifth sample event for WY 2025 was conducted in mid-March only at site SM-SBS. The total precipitation for the storm was one inch, with maximum rainfall intensity of 0.36 inch/hour (Table SM-1). The antecedent dry period prior to the storm was approximately 10 days.

Table SM-1. Summary of net deployment and storm period, antecedent dry period, and rainfall total and intensity for trash outfall sampling events conducted in San Mateo County during WY 2024 and WY 2025

Site	Water Year	Sample Event	Net Deploy Start Date	Net Deploy End Date	Sample Duration (Hours)	Storm Duration (Hours)	Antecedent Dry[2] (days)	Precipitation Total (in)	Maximum Intensity (in/hr)	First Seasonal Flush
SM-PIL	2024	Event 1	11/13/23 08:15	11/20/23 07:30	171	39	11	1.3	0.2	x
		Event 2	01/18/24 11:00	01/23/24 07:30	116	34	3	2.9	0.52	
		Event 3	01/30/24 17:00	02/02/24 08:00	63	44	7	1.2	0.17	
	2025	Event 4	10/30/24 15:25	11/04/24 06:50	63	19	>30	0.2	0.08	x
		Event 5	11/10/24 15:30	11/12/24 06:50	14	13	9	0.6	0.39	x
		Event 6	12/11/24 15:00	12/13/24 07:00	32	29	16	0.9	0.26	
		Event 7	02/11/25 13:10	02/14/25 07:20	61	65	5	2.2	0.53	
SM-SBS	2024	Event 1	11/13/23 09:30	11/20/23 08:30	167	6	>30	0.7	0.25	x
		Event 2[1]	01/18/24 10:00	01/22/24 03:20	89	15	3	2.1	0.45	
		Event 3	01/30/24 16:00	02/02/24 09:00	65	40	6	1.7	0.18	
	2025	Event 5	11/10/24 14:40	11/12/24 08:10	10	10	41	0.4	0.26	x
		Event 6	12/11/24 14:20	12/13/24 08:00	32	37	16	0.9	0.30	
		Event 8	03/11/25 15:20	03/13/25 07:10	18	88	10	1.0	0.36	

Note: Partial sample events due to early net detachment are included in the table. Disqualified events that resulted in no sample collected due to equipment failure are not included.

1 Net was found detached on retrieval date/time (01/23/24 at 9:00); assume net detached on 01/22/24 at 03:20, based on changes in water depth measured in the pipe. If these assumptions are correct, the net was attached approximately 73% of the duration for the combined two storm peaks.

2 Antecedent Dry Period for the first seasonal flush represents the dry period between wet seasons and is depicted as > 30 days.

B3.2.2 Trash Characterization

Trash collected for each of the seven sample events at site SM-PIL was sorted into 13 trash categories and measured for volume (Table SM-2), consistent with the project's QAPP. Total trash volumes across the seven samples ranged from 0.8 to 5.7 gallons. The highest volume of trash at site SM-PIL was collected during Event 1 (5.7 gallons), which was the first seasonal flush during WY 2024. In contrast, Event 5 and Event 6, representing two consecutive storms that represented the first seasonal flush during WY 2025, had a combined total of 4.3 gallons of trash. The largest storms that were sampled over the two WYs occurred during Events 2 and 8, with 5.0 and 1.6 gallons of trash, respectively. Both storms produced over 2 inches of precipitation and similar maximum rainfall intensities, ranging from 0.52 to 0.53 inch/hour.

Table SM-2. Trash volume measured for thirteen trash types from trash samples collected at outfall monitoring site SM-PIL, located in Half Moon Bay, San Mateo County

		WY 2024			WY 2025			
	Trash Type	**Event 1**	**Event 2**	**Event 3**	**Event 4**	**Event 5**	**Event 6**	**Event 7**
Plastic Trash Items (oz)	Single-Use Carryout Plastic Bags	0	0	0	0	0	0	0
	Expanded Polystyrene (EPS) Foam	0	0	0	0	0	0	0
	(EPS) Foam Other	14	22	28	6	22	2	17
	Single Use Plastic Food / Drink Ware	12	40	0	0	30	19	0.5
	Smoking Products, Traditional	6	2	2	0.3	5	0.9	0.9
	Smoking Products, Other	12	3	0	0.9	6	2	3
	Other plastic Items / Pieces	600	520	102	142	273	64	180
Non-Plastic Trash (oz)	Organic / Paper	60	24	27	0	11	12	8
	Fabric	12	16	5	0.3	31	0	0
	Metal	14	12	12	0	24	1	0.9
	Glass	0	0	0	0	0	0	0
	Mixed	0	0	0	0	0	0	0
	Biohazard	0	0	0	0	0	0	0
	Total Gallons	**5.7**	**5.0**	**1.4**	**1.2**	**3.1**	**0.8**	**1.6**
	Total Gallons/Acre[a]	**0.07**	**0.06**	**0.02**	**0.01**	**0.04**	**0.01**	**0.02**

a SM-PIL catchment area = 86 acres

Trash collected for each of the six successful sample events[22] at site SM-SBS was sorted into 13 trash categories and measured for volume (Table SM-3). Trash volumes across the six samples ranged from 0.04 to 2.9 gallons. The highest volume of trash at site SM-SBS was collected during Event 1 and Event 5 (2.9 gallons). Both storm events were the first seasonal flush for each year.

The lowest volume of trash was observed at site SM-SBS (0.4 gallons) during Event 2. The net detached during the peak of the storm during this event, which may have contributed to the lower trash volume. Event 8 had the second largest volume of trash of all six events during the two WYs. This event was the largest storm sampled during WY 2025 with 1.0 inch of total precipitation.

Table SM-3. Trash volume measured for thirteen trash types from trash samples collected at outfall monitoring site SM-SBS, located in San Carlos, San Mateo County

Trash Type		WY 2024			WY 2025		
		Event 1	Event 2	Event 3	Event 5	Event 6	Event 8
Plastic Trash Items (oz)	Single-Use Carryout Plastic Bags	0	0	0	0	24	0
	Expanded Polystyrene (EPS) Foam	0	0	0	0	0	0
	(EPS) Foam Other	40	3	4	8	10	4
	Single Use Plastic Food / Drink Ware	6	0.9	3	0	0.5	51
	Smoking Products, Traditional	0.5	0.3	0.3	0.51	8	0.7
	Smoking Products, Other	20	5	2	10	0.41	2
	Other plastic Items / Pieces	297	36	105	342	59	226
Non-Plastic Trash (oz)	Organic / Paper	1.7	0	0	1	0	38
	Fabric	9	3	2	0	0	0.7
	Metal	0	0	0	16	37	0.2
	Glass	0.1	0	0	0	0	0
	Mixed	0	0	0	0	0	0
	Biohazard	0	0	0	0	0	0
	Total Gallons	**2.9**	**0.4**	**0.9**	**2.9**	**1.1**	**2.5**
	Total Gallons/Acre[a]	**0.05**	**0.01**	**0.02**	**0.05**	**0.02**	**0.04**

a SM-SBS catchment area = 57 acres.

The total volume of trash collected in each sample collected at site SM-PIL, standardized for area, is shown in Figure SM-5. The highest trash volume per unit area occurred at site SM-PIL for Events 1 and 2, 0.07 and 0.06 gallons per acre, respectively. The total volume of trash collected in each sample collected at site SM-SBS, standardized for area, is shown in Figure SM-6. The highest trash volume for site SM-SBS occurred during Events 1 and 5 (both 0.05 gallons per acre). Estimated annual trash loading rates for both sites are presented in Section 3.4.4 of the main report.

[22] No trash was collected during Event 4 due to minimal rainfall which resulted in no discharge at outfall or trash collected within the net. Event 7 was disqualified due to net detachment and lost sample.

Figure SM-5. Trash volumes standardized by area for seven sample events at site SM-PIL, in Half Moon Bay, San Mateo County

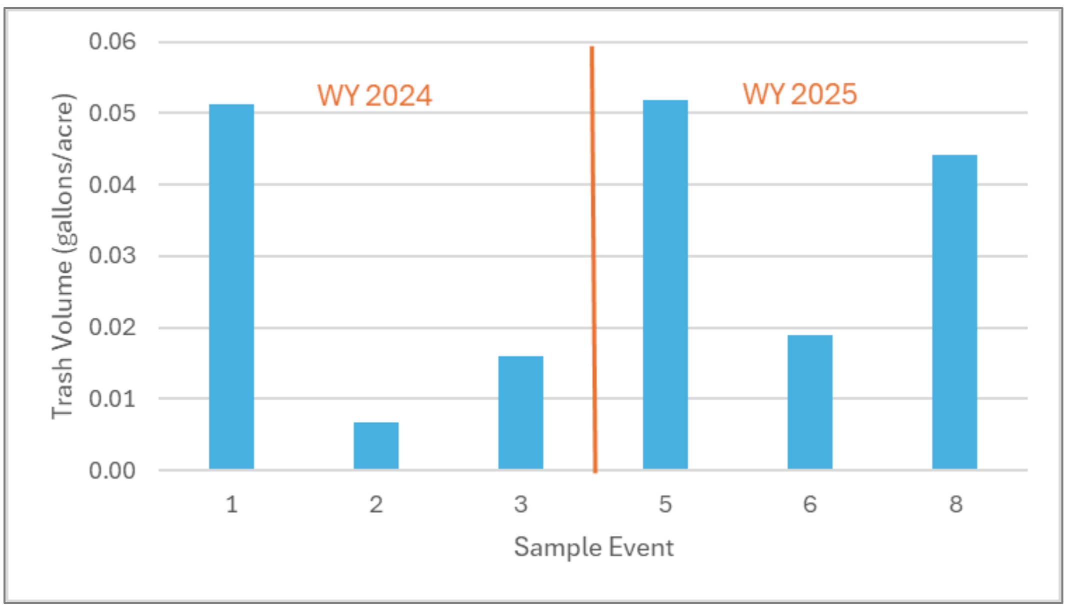


Figure SM-6. Trash volumes standardized by area for six sample events at site SM-SBS, in City of San Carlos, San Mateo County

The most common trash type identified in from the two San Mateo sites was plastic, of which there are six separate subcategories. The total volume for the combined six plastic trash categories presented in Tables SM-2 and SM-3 accounted for 89% and 92% of the trash collected from sites SM-PIL and SM-SBS, respectively during the two WYs (Figure SM-7).

The most common type of plastic trash was "*Other Plastic Items/Pieces*" which accounted for 88% and 84% of all plastic trash items observed at the SM-PIL and SM-SBS sites, respectively (Figure SM-8). The "*Other Plastic Items/Pieces*" category includes plastic packaging for food and beverage goods purchased at convenience and grocery stores. Combined, "*Single Use Plastic Food/Drink Ware*" and "*Expanded Polystyrene* (*EPS) Foam Food/drink Ware*" accounted for about 5% of the plastic trash items observed at both sites, while "*Single Use Plastic Bags*" accounted for only about 2% of the plastic trash at site SM-SBS. No single use plastic bags were observed from samples at the SM-PIL site. Existing City, County and State ordinances ban the distribution of these three categories of trash in the San Francisco Bay Area. "*EPS Foam Other"* accounted for approximately 5% of the plastic items at both sites. Smoking products accounted for approximately 2% to 4% of plastic items observed at sites SM-PIL and SM-SBS, respectively.

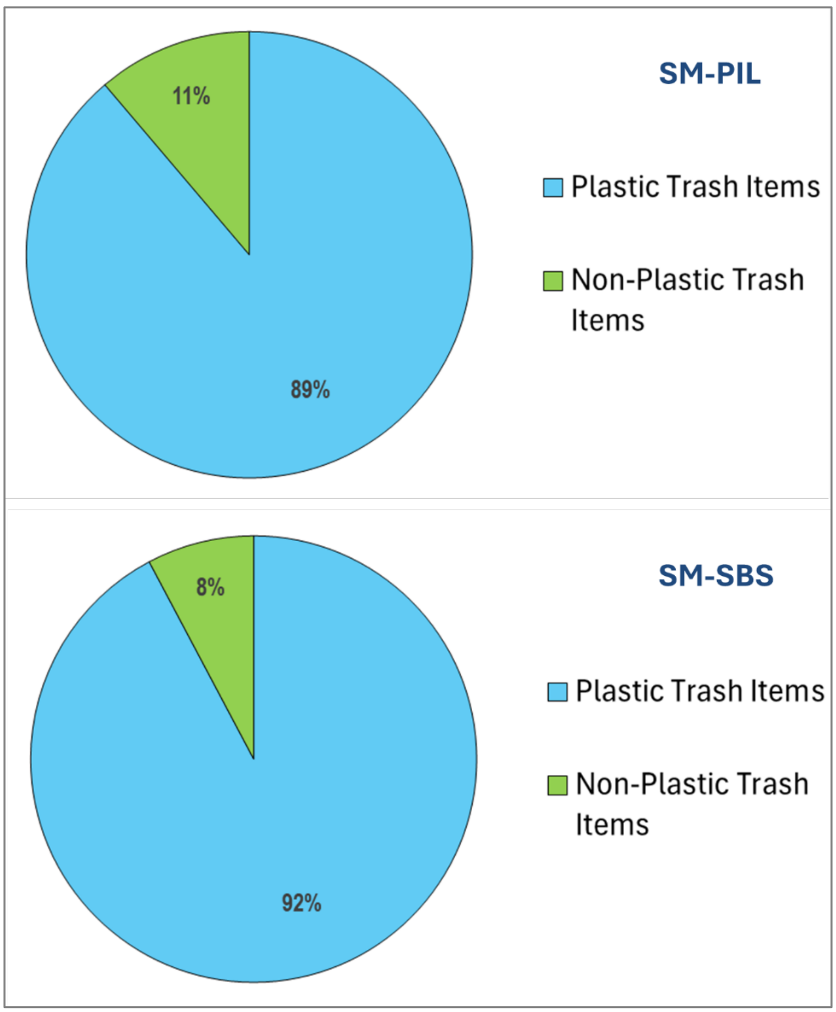


Figure SM-7. Comparison of plastic versus non-plastic trash items measured for all samples collected during the two years of monitoring

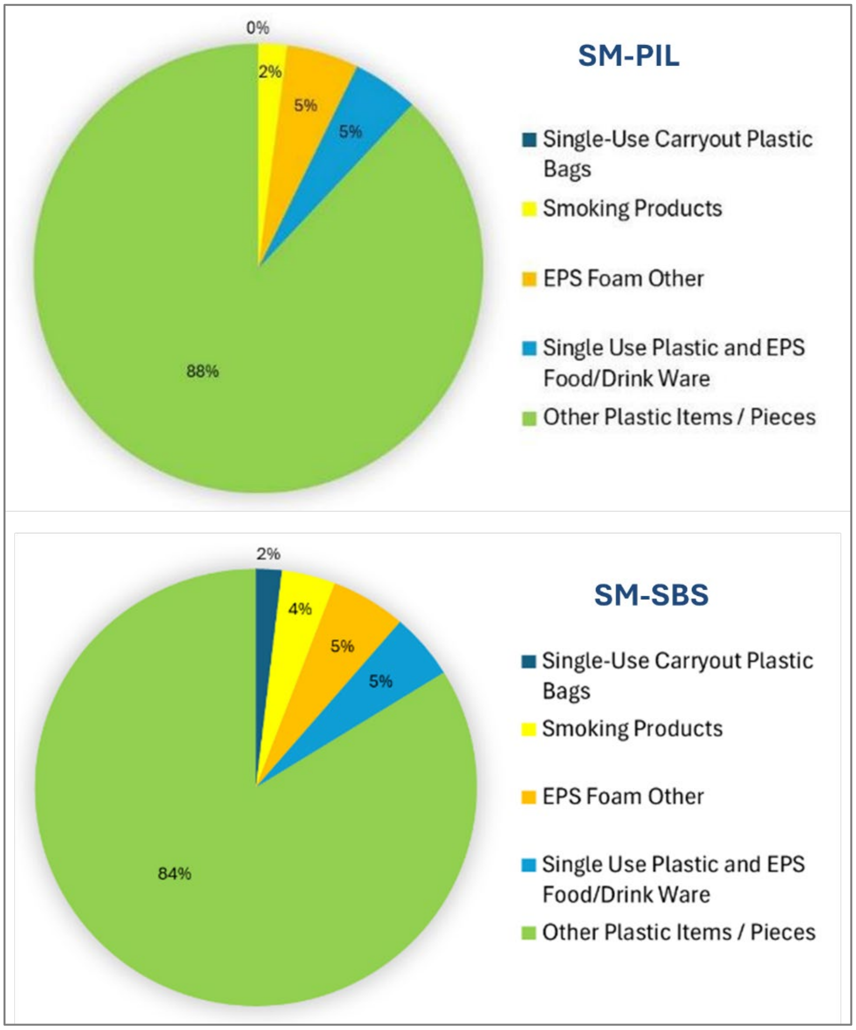


Figure SM-8. Comparison of plastic trash items measured for all samples collected during the two years of monitoring

B3.2.3 Rainfall and Flow

In WY 2024, water depth sensors were deployed in the MS4 pipe upstream of each trash outfall monitoring site in San Mateo County. The data from these sensors, however, did not accurately represent flow accurately due to water in the discharge channel backing up into and submerging the outfalls during storm events. Water also backed up into the MS4 pipe upstream of the depth sensors when the trash sampling nets were installed at the outfall. Further, tidal influences significantly affected water depth at the SM-SBS site.

As a result, measured flow data and Manning's Equation could not be used to accurately calculate flows at either station. As an alternative, flow rates were calculated using the rainfall-runoff model described in Section 3.2.6. Rainfall data was compiled from Weather Underground stations in proximity to catchment areas for site SM-PIL (20 stations) and site SM-SBS (12 stations). Rainfall totals for the sampled catchments were calculated using an inverse distance squared weighted average. Modeled flows were used to develop annual hydrographs for both sites during WY 2024.

Prior to the monitoring season of WY 2025, the flow sensor at site SM-PIL was re-located to a steeper gradient section of the concrete channel, about 100 feet downstream of the outfall. As a result, accurate water depths were collected during all non-sampled storm events and used to develop an annual hydrograph for WY 2025 (note: modeled flows were still used for all sample events when the net interferes with the flow). Modeled flows were still used in WY 2025 at site SM-SBS to develop the annual hydrograph.

Annual hydrographs for both sites are presented in Figures SM-9 and Figure SM-10. The figures also show trash volume (standardized by area) for each of the sampled storm events. Plots of rainfall, flow data and sampling period for each sample event, including disqualified events, for both sites during WY 2025 are shown in Figures SM-11 to SM-13. Hydrographs for individual sample events that occurred during WY 2024 were provided in the Trash Outfall Monitoring Progress Report for WY 2024 (BAMSC 2025).

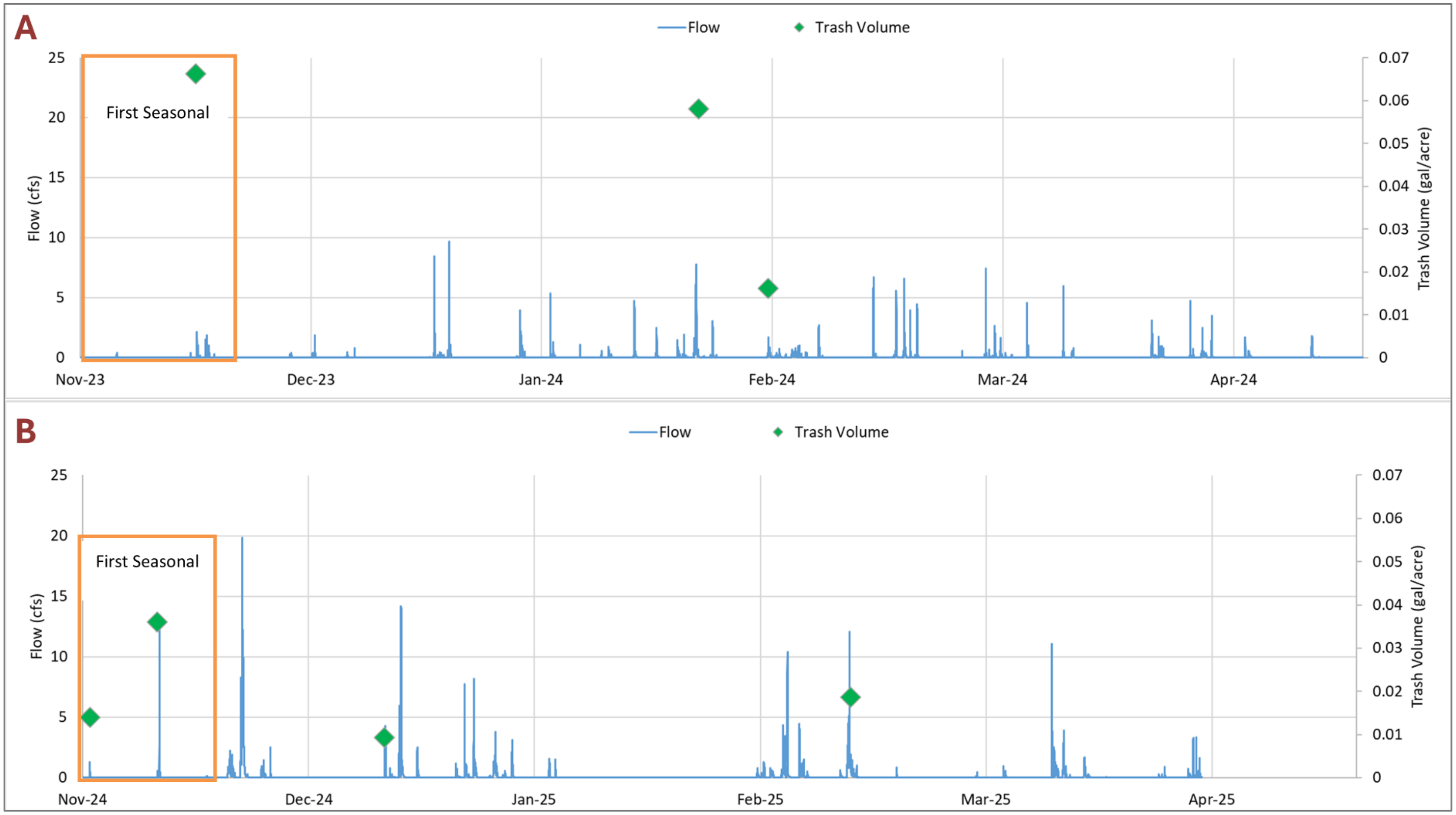


Figure SM-9. Annual hydrograph and trash volume (standardized for area) for each sample event conducted at site SM-PIL in San Mateo County

A) WY 2024 B) WY2025

First seasonal flush storm events are indicated in the figure. Modeled flow data was used for hydrograph in WY 2024; observed flow was used for hydrograph in WY 2025, with the exception of storms when nets were attached to the outfall, which are represented using modeled flow data.

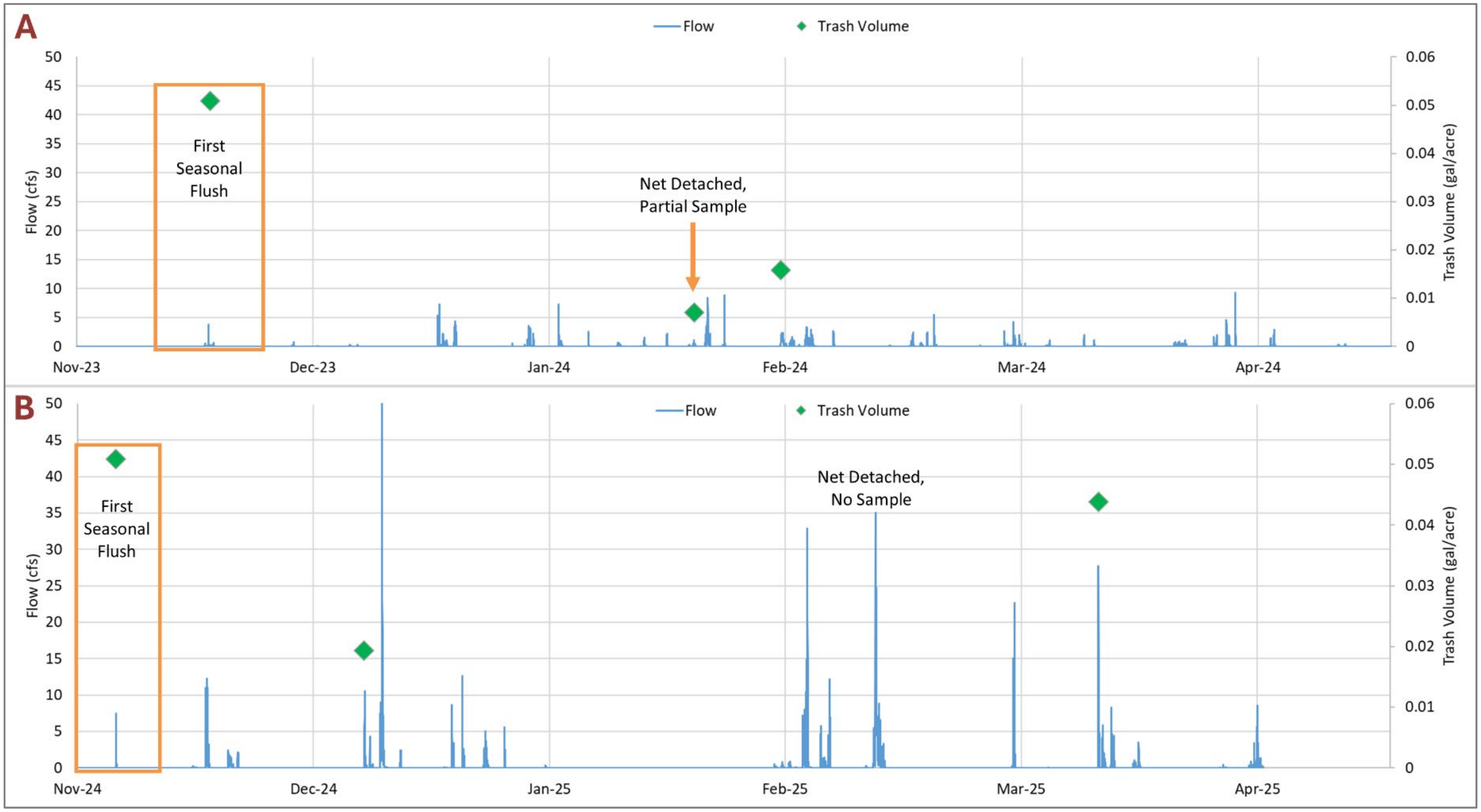


Figure SM-10. Annual hydrograph and trash volume (standardized for area) for each sample event conducted at site SM-SBS in San Mateo County

A) WY 2024 B) WY2025
First seasonal flush storm events are indicated in the figure. Modeled flow data was used for hydrograph in WY 2024 and WY 2025.

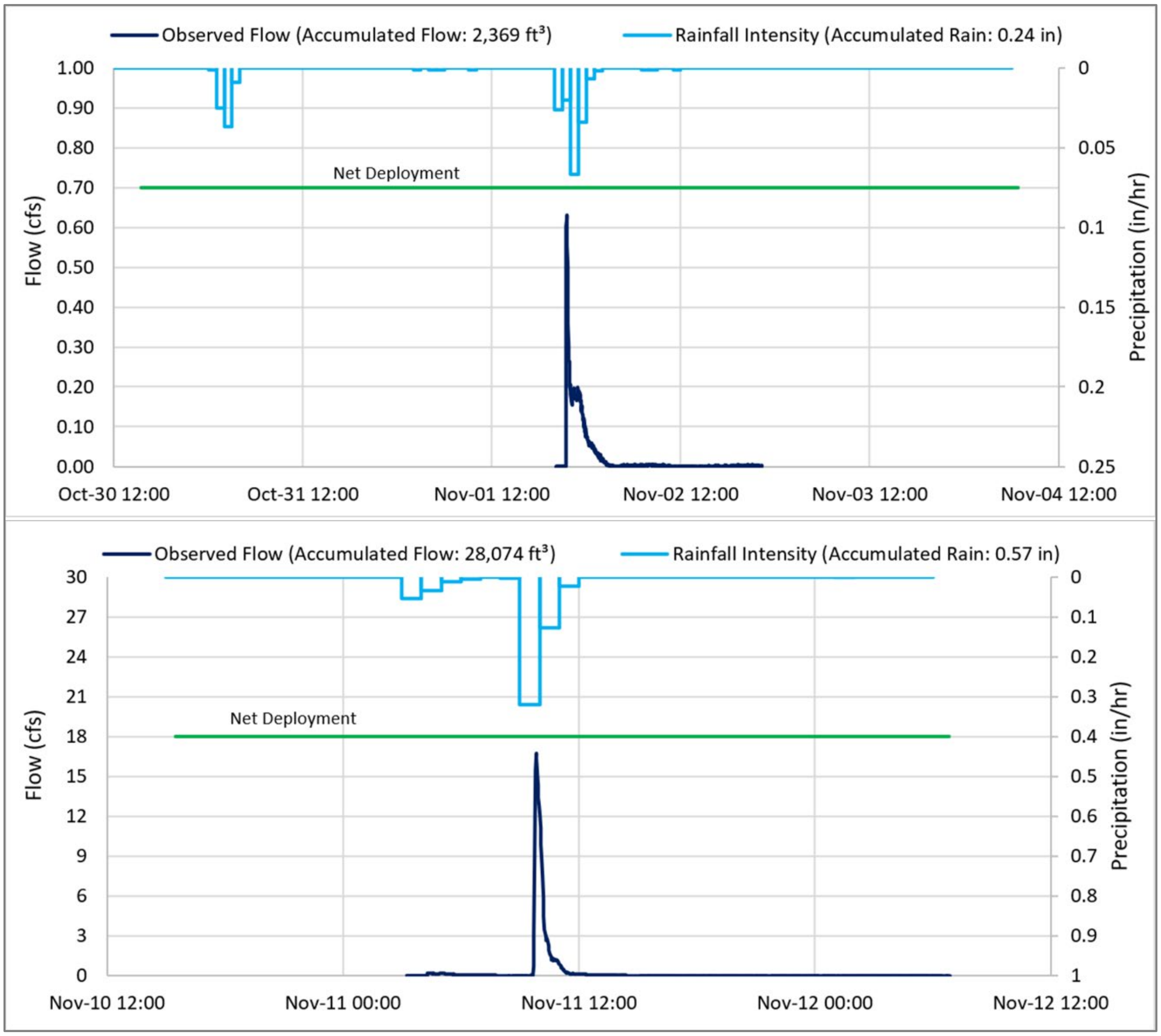


Figure SM-11. Hydrographs for two storms that represent the first seasonal flush at site SM-PIL during WY 2025

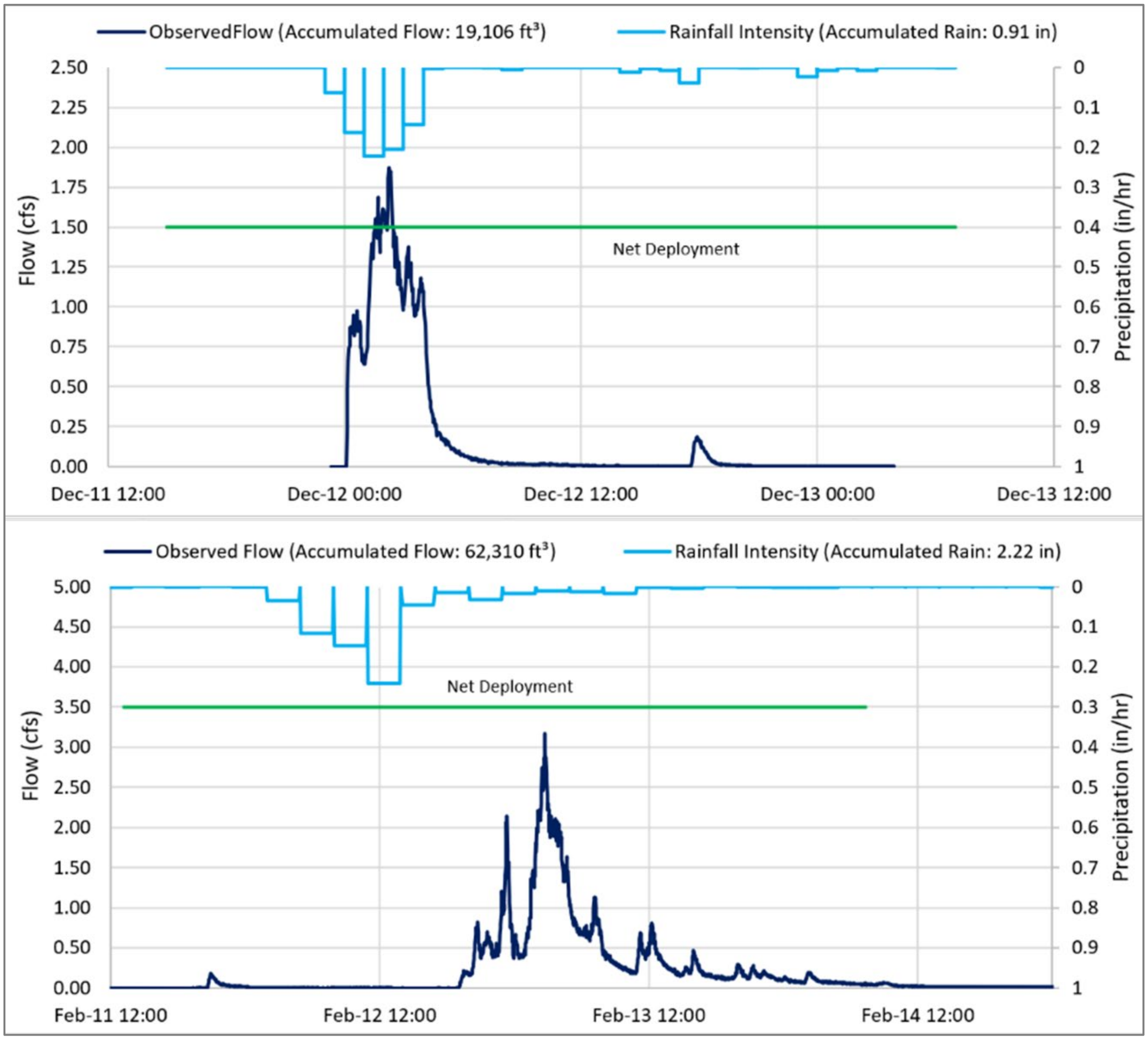


Figure SM-12. Hydrographs for two remaining sample events (non-first flush) at site SM-PIL during WY 2025

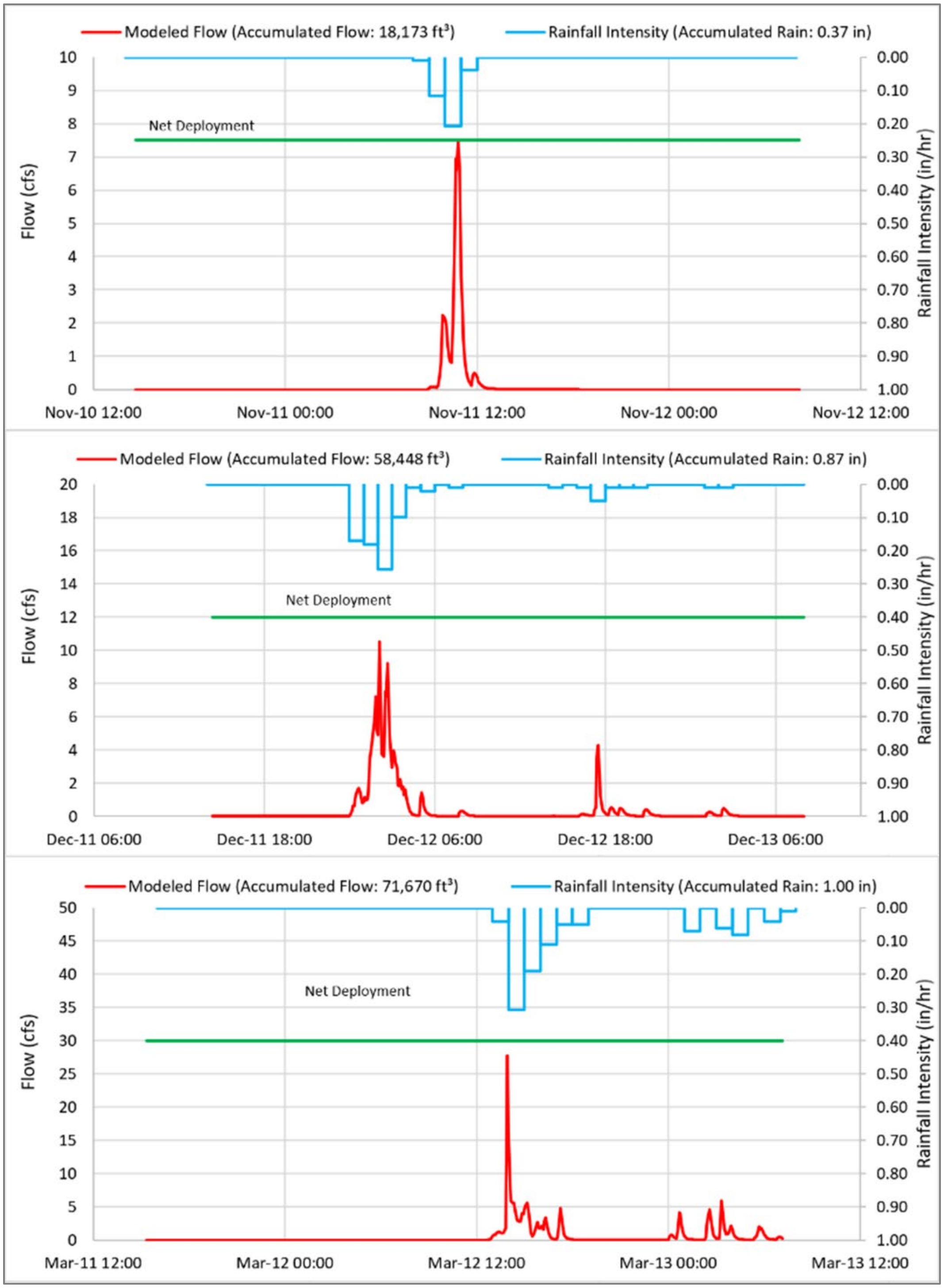


Figure SM-13. Hydrographs for three successful sample events at site SM-SBS during WY 2025

B3.2.4 Storm Characteristics

In effort to calculate the annual trash load discharged at each outfall during each WY, the total number of storms that occurred in each WY were identified using compiled rainfall data. Storm events were defined using the following criteria:

- At least 0.1 inch precipitation in 6 hours (Caltrans 2020)
- 24 hours of antecedent dry conditions (i.e., no rainfall)
- Event ends when < 0.1 inch of rain occurs over 6 hours

A summary of storm characteristics for both sites monitored during WY 2024 and WY 2025 is provided in Appendix SM-A. Information includes sample duration (defined as the length of the storm during net deployment), antecedent dry period, total rainfall (inches), maximum intensity rainfall (inches/hour), peak flow (cfs) and total flow (cfs). Sampled storm events, partially sampled events (i.e., sample represented approximately 70% or greater of storm duration prior to net detachment) and total trash volume (gallons/acre) for each event are indicated in the appendix. Disqualified sample events (i.e., net was detached early in the storm event due to equipment failure/vandalism) are also indicated. First seasonal flush storms and storms that met or exceeded the FTC design storm (i.e., the peak flow generated from a one-year, one-hour frequency storm) are also identified in the appendix. The definition of design storm is provided in Section X.X of the main report.

At site SM-PIL, a total of 30 and 21 storms were identified for WY 2024 and WY 2025, respectively. There were two first seasonal flush events for both years; a small storm (~0.2 inch total rainfall) was followed by slightly larger storm (0.6 total inch in WY 2024 and 1 total inch in WY 2025). The combination of these two events was assumed to represent the trash that accumulated in the catchment area over the previous dry season. Three of the four first seasonal flush events were sampled; the small storm in WY 2024 was estimated using the same volume from the small storm of similar size that was sampled in WY 2025. Trash volumes for the combined first seasonal flush events were 0.09 and 0.05 gallons/acre for WY 2024 and WY 2025, respectively.

At site SM-SBS, a total of 27 and 19 storms were identified in WY 2024 and WY 2025, respectively. There was one first seasonal flush event for both years; total rainfall was 0.2 inch and 0.4 inch in WY 2024 and WY 2025, respectively (note: an additional 0.5 inch rain fell over several days prior to the first flush event on November 17, 2023). Trash volumes for first flush storm events were 0.05 gallons/acre for both years.

Over the two years of monitoring at site SM-PIL, none of the storms had peak flows that exceeded the design storm (one-year, one-hour), which was calculated at be 32 cfs (See Section X.X for methods used to calculate design storm). At site SM-SBS, five storms during WY 2025 exceeded the design storm, which was calculated to be 16 cfs (see Appendix).

A comparison of sampled and unsampled storms over two-year monitoring period at site SM-PIL is shown in Figure SM-14. Over the two years of sampling, the lowest peak flow sampled occurred during a storm on November 1, 2024 (1.3 cfs), which was a first seasonal flush. Three sample events were conducted during the five highest peak flow events over the past two years. Storm sizes that are underrepresented in the sample group include peak flows under 1 cfs (14 storms) and peak flows between 4.5 and 7.5 cfs (12 storms).

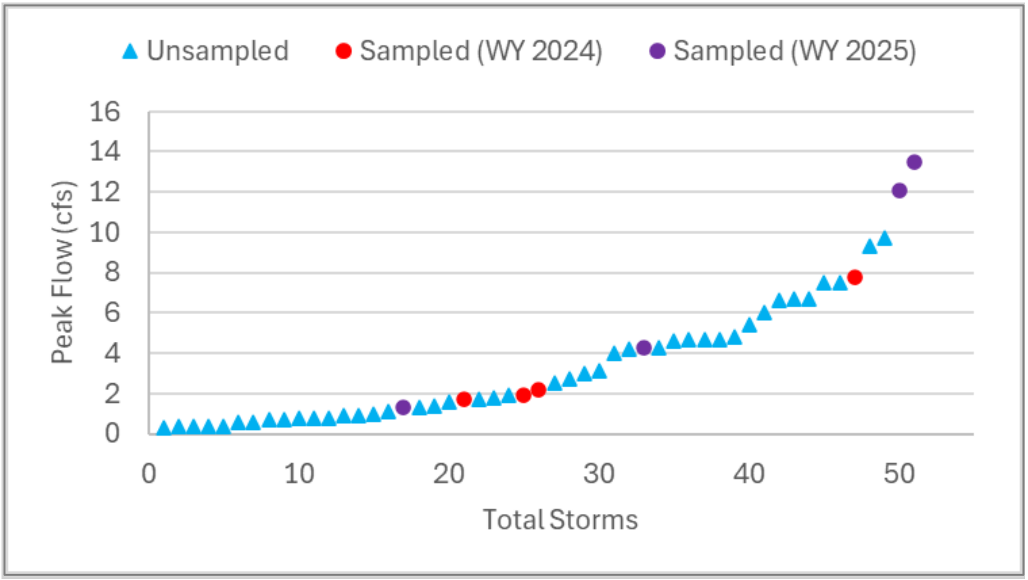


Figure SM-14. Distribution of peak flows for storms, sampled and unsampled, during WY 2024 and WY 2025 at site SM-PIL

A similar comparison of sampled and unsampled storms over the two-year monitoring period at site SM-SBS is shown in Figure SM-15. Over the two years of sampling, the lowest peak flow sampled occurred during a storm on November 17, 2024 (0.5 cfs), which was one of the first seasonal flush events. There were five storms with peak flows that exceeded 20 cfs; one of these storms was sampled (27.7 cfs) in March 2025 (another sample event was attempted for a storm with peak flow of 35 cfs, but the sample was lost after the net detached). Storm sizes that are underrepresented in the sample group include peak flows between 2.4 and 7.5 cfs (14 storms).

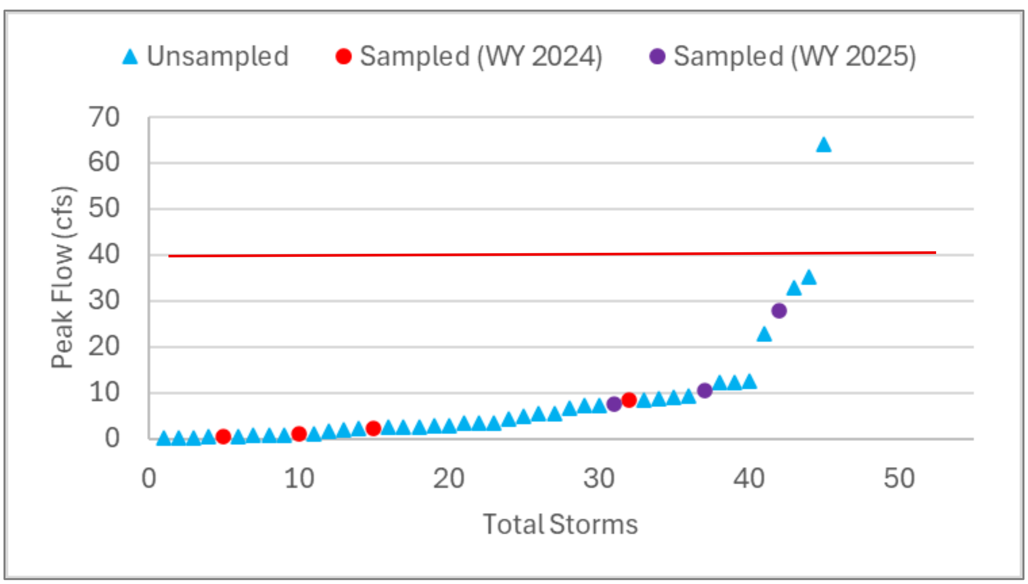


Figure SM-15. Distribution of peak flows for storms, sampled and unsampled, during WY 2024 and WY 2025 at site SM-SBS

Predicted peak flow design storm standard (29.9 cfs) is shown as red line.

B3.2.5 Draft Annual Trash Load Estimate

Several factors that may influence trash accumulation and transport into the MS4 were evaluated for their association with the observed trash volume (standardized by area). These include antecedent dry period, sample duration, total rainfall, peak intensity rainfall, peak flow, and total flow. All of these factors were independently compared to trash volume data using linear regression statistical analyses (Table SM-4). Despite very small sample sizes (n=3,4), three variables (maximum rainfall intensity, peak flow and total flow) showed moderate correlation with trash volume for both sites. Each of these variables was independently used to estimate annual trash loads.

Initial analyses included samples collected during first seasonal flush; however, these samples typically showed unusually large volumes of trash associated with lower flows. This pattern likely reflects the wash-off of trash that accumulated over the entire dry season, rather than conditions representative of storms later in the wet season. Because this carryover effect could bias the relationship between the explanatory variables and trash volume, first-flush data were excluded from subsequent linear regression analyses.

Partial sampling events, which typically occurred during larger storms when nets detached, had lower volumes of trash than would be expected. Flow data indicates that water is backed up into the pipe when nets are full of trash and debris. Trash is likely present in the pipe when water backs up and probably is not captured in the net before the detachment occurs. For this reason, a partial sample for one event at site SM-SBS was excluded in the linear regression data analysis.

Table SM-4. Summary statistics for comparison between trash volume and explanatory variables using linear regression

Sample Location	SM-PIL (n=4)				SM-SBS (n=3)			
Explanatory Variable	**r2**	**p value**	**Linear Coefficient**	**Intercept**	**r2**	**p value**	**Linear Coefficient**	**Intercept**
Sample Duration (hours)	0.93	0.01	0.001	-0.006	0.07	0.73	0.0002	0.02
Antecedent Dry (days)	0.04	0.8	-0.001	0.027	0.38	0.39	0.002	0.01
Total Rain (inch)	0.8	0.04	0.018	-0.004	0.34	0.41	0.01	0.01
Max Rain Intensity (in/hr)	0.93	0.01	0.064	-0.004	0.82	0.10	0.09	-0.002
Peak Flow (cfs)	0.69	0.08	0.003	0.0005	0.81	0.10	0.001	0.01
Total Flow (cfs)	0.88	0.02	2.42E-07	-0.001	0.80	0.11	4.46E-07	-0.002

The equations for the linear regression lines[23] were used to provide a very preliminary estimate of trash loading for each storm event, excluding first flush storms. Linear regression plots for three variables (max rainfall intensity, peak flow and total flow) and trash volume data for sites SM-PIL and SM-SBS are shown in Figures SM-16 and SM-17, respectively. The 90% confidence intervals for the regression line are shown in each plot.

[23] Each regression line was set to have zero y-intercept based on the assumption that base flow during dry conditions (i.e., non-storm flows) would produce zero trash volume.

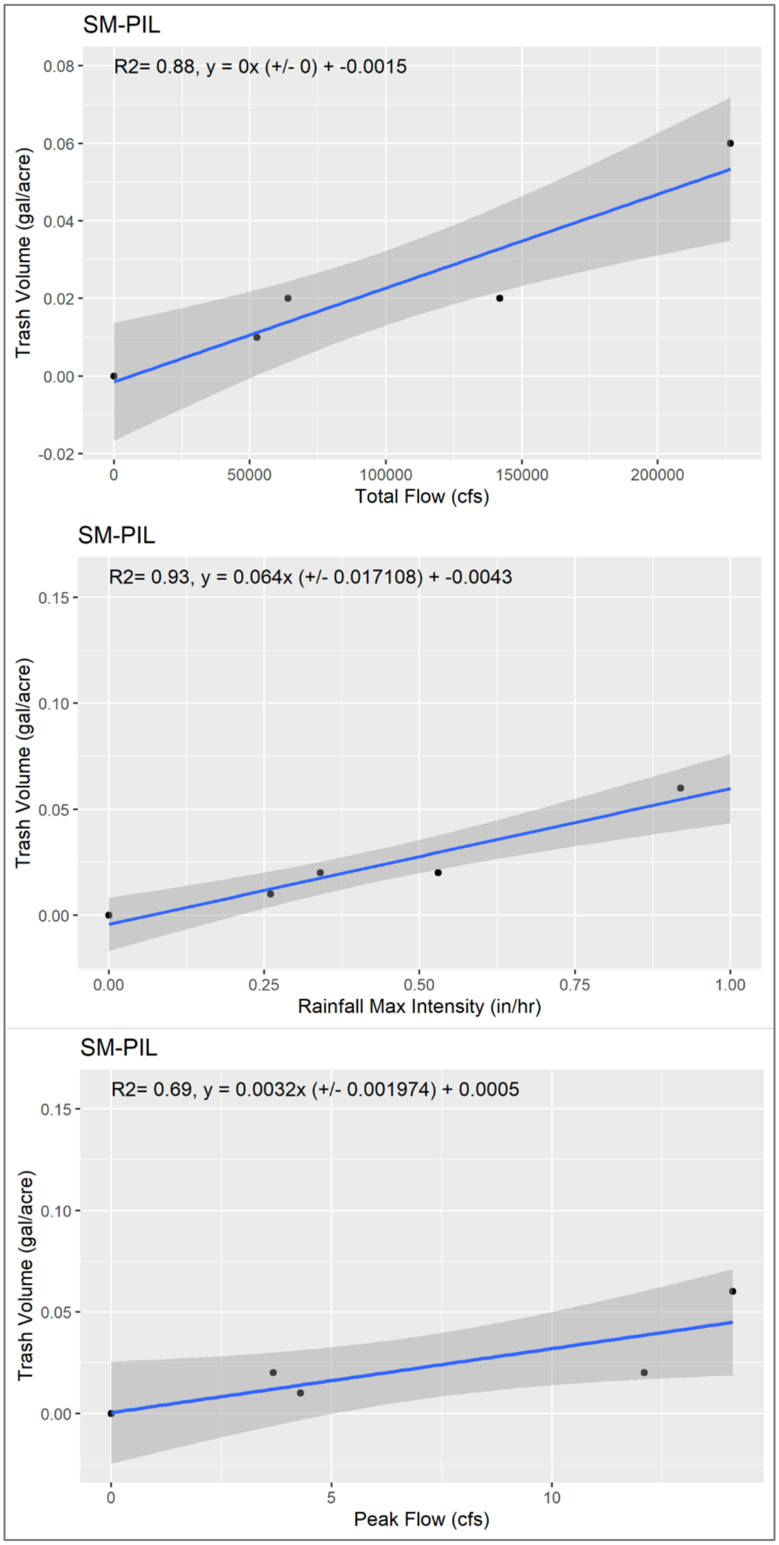


Figure SM-16. Comparison of peak flow and trash volume data collected at site SM-PIL for two years of monitoring

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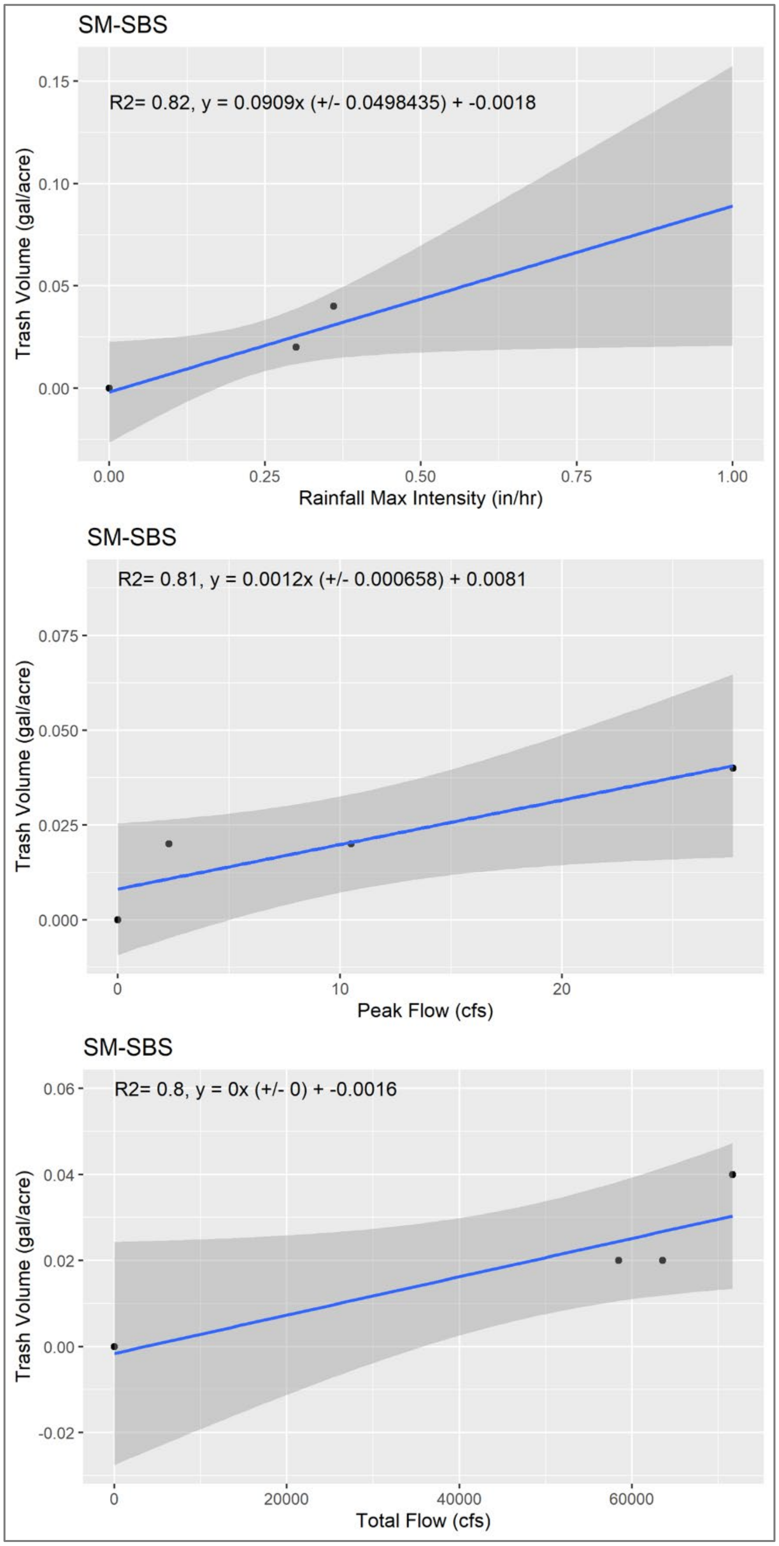


Figure SM-17. Comparison of peak flow and trash volume data collected at sites SM-SBS for two years of monitoring

The sum of the predicted and observed trash volumes for each non first seasonal flush storm was then combined with the observed volume of trash collected during the first seasonal flush event in each WY to estimate the total annual load of trash discharged from each outfall (Table SM-5).

Estimated trash loads (excluding first seasonal flush) were similar across the three variables used to predict trash volumes; 0.27 to 0.52 gallons/acre for maximum rainfall intensity; 0.26 to 0.51 gallons/acre for peak flow; and 0.18 to 0.76 gallons/acre for total flow. For site SM-PIL, the estimated trash loads were generally higher for all variables during WY 24 compared to WY 25. This pattern was reversed for peak and total flow variables for site SM-SBS. There were approximately 30% more storms in WY 24 compared to WY 25 (Appendix SM-A). The low and high estimates of the annual trash load, based on 90% confidence intervals for the linear regression line, combined with load from first seasonal flush, are presented for both sites and WYs in Table SM-6.

Annual trash loads were also calculated by applying the average trash volume for sampled events equally to each storm event identified for each WY (Table SM-5). This was the simple method used to calculate annual load in Annual Progress Report for WY 2024 (BAMSC 2025). For site SM-PIL, an average trash volume of 0.033 gallons/acre were applied to 30 storms in WY 2024 and 21 storms in WY 2025. For site SM-SBS, an average trash volume of 0.036 gallons/acre were applied to 27 storms in WY 2024 and 19 storms in WY 2025. In general, the estimated trash load using the average volume of trash was higher compared to regression lines using rainfall and flow variables.

Table SM-5. Estimated annual trash load for the two outfall monitoring sites in San Mateo County during WYs 24 and 25

Site	Monitoring Year	Total Load from First Flush (gal/acre)	Explanatory Variable						Annual Load Average Trash Volume
			Max Rainfall Intensity (inch/hr)		Peak Flow (cfs)		Total Flow (cf)		
			Total Load from Remaining Storms	Annual Load	Total Load from Remaining Storms	Annual Load	Total Load from Remaining Storms	Annual Load	
SM-PIL	WY 2024	0.09	0.43	**0.52**	0.33	**0.42**	0.10	**0.19**	0.99
	WY 2025	0.05	0.22	**0.27**	0.21	**0.26**	0.13	**0.18**	0.69
SM-SBS	WY 2024	0.05	0.44	**0.49**	0.32	**0.37**	0.26	**0.31**	0.97
	WY 2025	0.05	0.37	**0.42**	0.46	**0.51**	0.71	**0.76**	0.68

Table SM-6. Annual trash load for sites SM-PIL and SM-SBS for both years of monitoring.

Site	Monitoring Year	Max Intensity (in/hr) - Estimated Annual Trash Load (gal/acre)[1]			Peak Flow (cfs) - Estimated Annual Trash Load (gal/acre)[1]			Total Flow (cfs) - Estimated Annual Trash Load (gal/acre)[1]		
		Best	Low	High	Best	Low	High	Best	Low	High
SM-PIL	WY 2024	**0.52**	0.38	0.67	**0.42**	0.21	0.62	**0.19**	0.14	0.24
	WY 2025	**0.27**	0.19	0.35	**0.26**	0.13	0.38	**0.18**	0.13	0.23
SM-SBS	WY2024	**0.49**	0.21	0.75	**0.37**	0.31	0.44	**0.31**	0.14	0.49
	WY 2025	**0.42**	0.19	0.63	**0.51**	0.32	0.72	**0.76**	0.33	1.19

1 Low and high estimates represent 90% confidence interval of the regression line.

Additional multivariate statistical analyses that evaluate the influence of multiple factors on trash volume will be considered in subsequent years as more data becomes available. Additional trash volume data is needed from under-represented storms (e.g., smaller storms, storms with range of antecedent dry periods) to better explore the relationship between factors (e.g., peak flow and antecedent dry) and their influence on trash volumes.

B3.3 Investigation of Trash Generation

This section describes visual observations to document trash generation within the monitored outfall catchment prior to each monitoring season. It is important to note that trash observed during the assessment represents a snapshot in time and may have considerable variation over time. However, observed trash levels can provide additional context for determining if existing trash controls are effective at reducing trash discharge through the MS4. Existing trash management actions within each catchment are summarized in the following section.

B3.3.1 Catchment Assessments

Visual observations of trash in the catchment areas for sites SM-PIL and SM-SBS were conducted in September, prior to the beginning of each WY. Descriptions of the catchment areas are provided above in Section B3.1. Summaries of trash observations made during windshield surveys conducted in September 2024 and 2025 are provided below. The summaries include type and location of trash observed during each survey. Areas with minimal or no trash in the catchment were also noted. The locations of observed trash were mapped to determine if existing trash controls would likely prevent the observed trash from discharging into the storm drain. A summary of the levels of trash observed in relation to existing trash management controls for each catchment are described below.

Site SM-PIL

The trash survey focused on three main areas of the catchment area: 1) the commercial area west of Main Street, including the parking lot areas of New Leaf Market and Rite Aid; the commercial/ industrial area east of Main Street, including Ace Hardware and several auto shops; and 3) Lewis Foster Drive, which is the only route to Half Moon Bay High School. Trash observations were also made in the vicinity of the outfall (downstream of the catchment area).

In general, minimal trash was observed in the parking lots and dumpster areas within the commercial area associated with New Leaf Market. The exception was trash near dumpsters in the parking lot behind the Rite Aid and next to 7-Eleven (Table SM-7). Trash at this location was only observed during the September 2024 survey. A majority of the commercial area is treated with FTC controls (HDS and CPS, with the exception of the parking lot area south of New Leaf Market, which has other types of controls that are associated with the PLDA program (Figure SM-18).

Very low levels of trash were observed in the commercial area east of Main Street. There was a small amount of windblown trash and dumping along the road to Ace Hardware observed during both surveys conducted in 2023 and 2024. The commercial areas and public right-of-way along Main Street are all treated with FTC. Litter associated with single use food and beverage ware was observed along the pathway adjacent to Lewis Foster Drive between Main Street and the high school. There were no garbage cans between the high school and Main Street. Litter was observed during both years of the survey.

Trash levels were assessed along the banks and channel adjacent to the monitored outfall. Both littered and windblown trash were observed along the tops of the banks of the ditch adjacent to a pedestrian/bicycle pathway just downstream of the outfall monitoring site (Table SM-7 and

Figure SM-18). There were also some larger trash items (wooden pallet, electronics) associated with dumping just below the outfall. These trash items would not influence the trash load coming from the catchment.

Table SM-7. Trash assessment in catchment for site SM-PIL, in the City of Half Moon Bay, September 2024

Observations During Survey	Latitude, Longitude	Photos
Over-flowing dumpster in shopping center behind former Rite Aid. Trash scattered in parking lot.	37.468344, -122.43083	
Litter along Lewis Foster Drive, between Main Street and HMB high school (plastic bottles, food wrappers).	37.470279, -122.430384	
Dumping of trash in ditch below outfall (wooden pallet, electronics). Litter and wind-blown trash along the creek bank and bike path adjacent to Hwy 1. Note: trash was removed from below the outfall to prevent entanglement of the net.	37.469267, -122.433784	

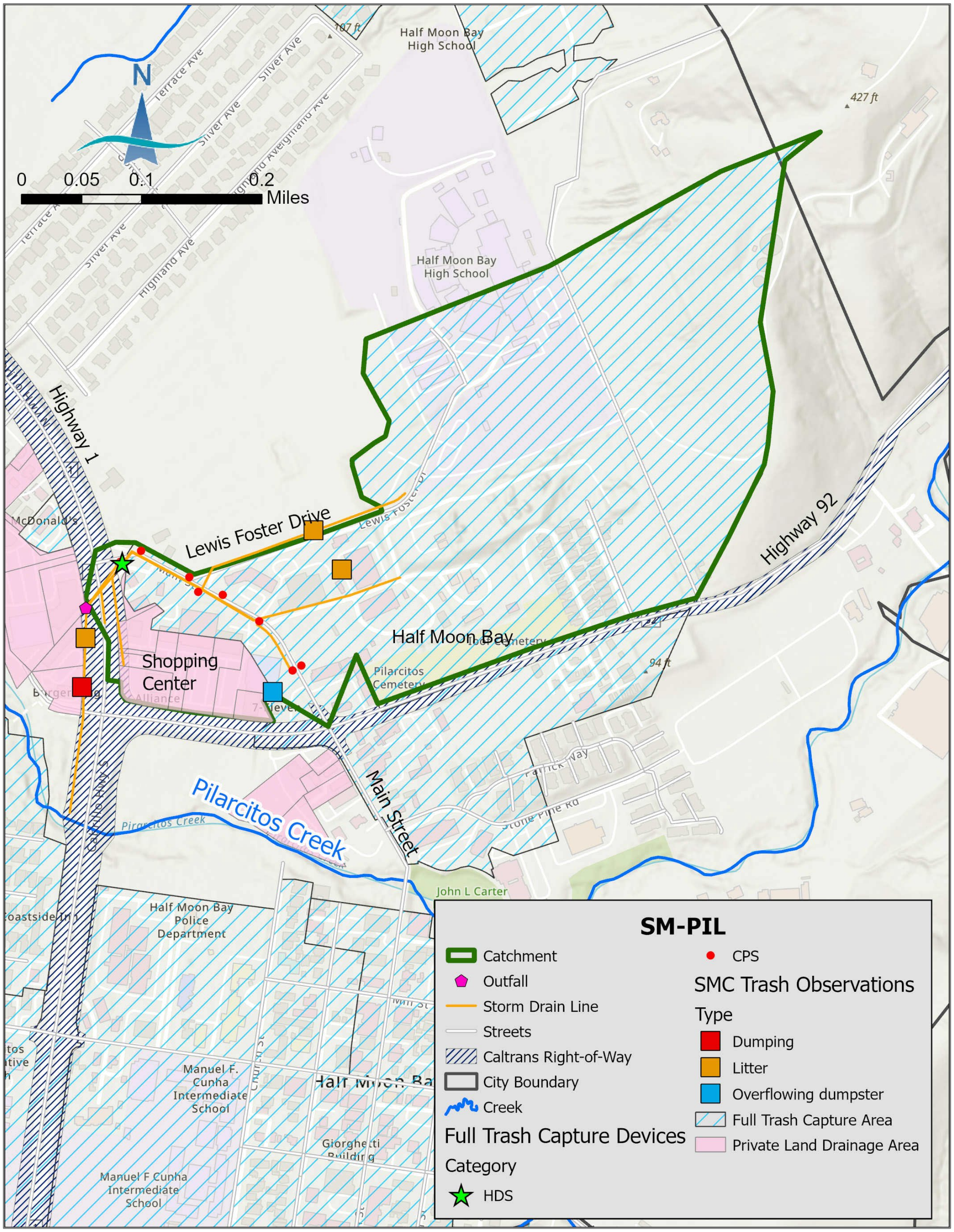


Figure SM-18. Trash sources identified in the City of Half Moon Bay during trash assessment for catchment SM-PIL, September 2024

Site SM-SBS

The trash survey in the SM-SBS catchment focused on five main areas: 1) Intersection of Holly and Industrial, which includes two gas stations and In-n-Out fast food restaurant; 2) commercial/industrial area along E San Carlos Av; 3) residential area between Holly Street and Montgomery St; 4) Laureola Park and adjacent commercial park; and 5) commercial area east of Industrial, including Residence Inn by Marriot and adjacent business park.

A majority of the area (70%) is treated with FTC (i.e., eight CPS). The remaining area that does not have FTC includes the commercial area east of Industrial, which has trash controls that are implemented as part of the PLDA program (Figure SM-19). This area also includes the Residence Inn, which contains a LID structure, which provides additional benefits for the treatment of trash.

In general, there was minimal trash observed in the entire catchment area during the visual assessments conducted both years. In September 2023, litter was observed at the parking lot of Laureola Park. The park is not treated with FTC. During both years, fast food waste was observed in the catch basin adjacent to the In-n-Out restaurant (note: this catch basin contains FTC device) (Table SM 8).

Very little litter was observed in parking lots and dumpster areas of the industrial and commercial businesses along E San Carlos Avenue. There was also no trash observed in the residential areas between Holly Street and Montgomery Street.

There was litter observed along both sides of the Caltrans ditch to which the outfall discharges (i.e., downgradient of the monitoring location). This litter appeared to have been transported by wind from the adjacent roadway and the parking lot of the nearby In-N-Out restaurant (Table SM-8 and Figure SM-19), rather than through the MS4.

Table SM-8. Trash assessment in catchment for site SM-SBS, in the City of San Carlos, September 2024

Location and Type of Trash	Latitude, Longitude	Photos
Litter in parking lot of Laureola Park.	37.50917, -122.25988	
Trash from roadway along ditch downgradient outfall.	37.512314, -122.257832	
Trash in catch basin near In-N-Out Note: inlets were cleaned out one week prior to the first monitoring event).	37.512218, -122.258016	
	37.512218, -122.258016	

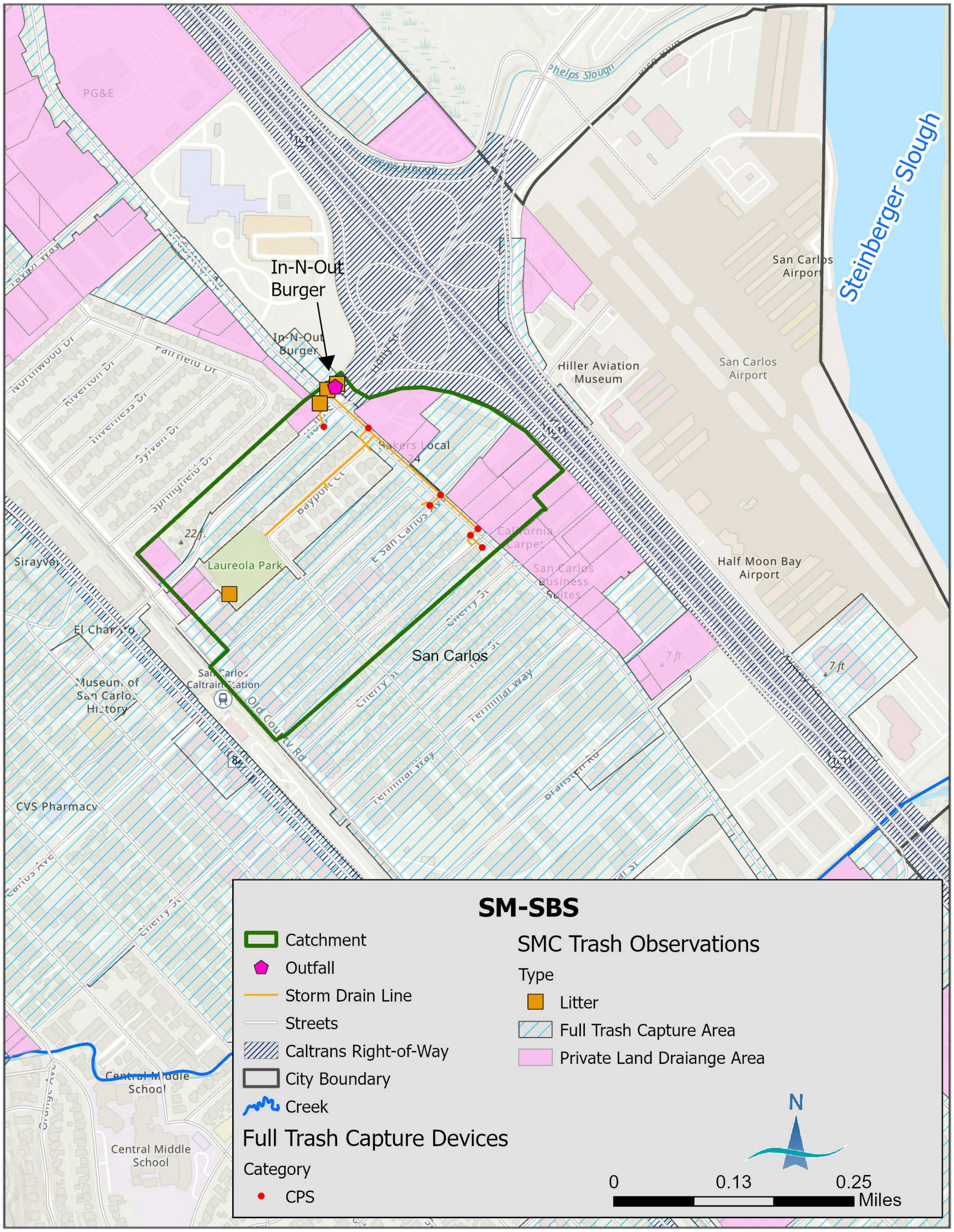


Figure SM-19. Trash sources identified in the City of San Carlos, during trash assessment for catchment SM-SBS, September 2024

B3.3.2 Trash Management Actions

Operations and maintenance records (where available) for FTC devices and other trash control measures implemented in the monitored catchments are summarized in Table SM-9.

Table SM-9. Summary of operations and maintenance activities associated with full trash capture and other controls implemented in catchments for outfall monitoring sites

Monitored Catchment	Full Trash Capture	# of PLDA Trash Inspections Conducted in WY 2025	Other Controls
SM-SBS	CPS are cleaned at least once annually; cleaned on 11/07/23 during WY2024 and 09/17/24 and 01/27/25 during WY2025.	16	– Enhanced street sweeping (2x/month) – On-land clean ups – Storm drain cleaning
SM-PIL	CDS hydrodynamic separator (HDS) is cleaned annually; cleaned on 10/20/23 during WY 2024 and 07/08/24 during WY 2025. Connector Pipe Screens are cleaned annually; cleaned on 10/16/23 through 10/19/23 during WY 2024 and 07/08/24 through 07/16/24 during WY 2025.	4.7	– Improved bin container management – Enhanced street sweeping (2x/month) – On-land clean ups

PLDA = Private Land Development Area

B3.4 Refinements

The following refinements to trash outfall monitoring were implemented prior to WY 2025 monitoring season in San Mateo County.

Flow Measurements

An evaluation of the water level sensor records from the wet season of WY 2024 at site SM-SBS indicated that flows could not be accurately measured due to standing water conditions at the outfall. The source of the water is presumed to be combination of tidal influence and ground water seepage due to close proximity to SF Bay. There are no manholes that can be feasibly and safely accessed along the storm drain system upstream of the outfall due to busy road conditions. As a result, with Regional Water Board staff concurrence (Aidan C, personal communication, September 19, 2024), water depth was not measured at this outfall location during WY 2025. Flows were calculated using the rainfall-runoff model.

Similar standing water conditions were observed at site SM-PIL. Low gradient and a depression in the ditch below the outfall created a pool of standing water at the outfall where the water depth sensor was installed in WY 2024. The depth sensor was relocated approximately 100 meters downstream of the outfall in the ditch to measure flow during the wet season of WY 2025.

APPENDIX SM: WY 2024 AND WY 2025 STORM EVENT SUMMARIES

Table SM-10. Summary of storm characteristics and sample information at site SM-PIL during WY 2024 and WY 2025

Storm Began	Storm Finished	Sample Duration (hrs)[1]	Antecedent Dry (days)	Precipitation Total (in)	Maximum Intensity (in/hr)	Peak Flow (cfs)[2]	Total Flow (cf)[2]	Sample Event[3]	First Flush	Partial Sample	Exceed Maximum Rainfall for Design Storm[4]	Exceed Peak Flow for Design Storm[5]	Trash Volume	Comment
WY 2024 (30 storms total)														
11/05/23	11/06/23	6	> 30	0.23	0.12	0.4	1,744		X				0.015	Estimated
11/16/23	11/18/23	39	10.5	1.08	0.20	2.2	11,872	1	X				0.07	
11/28/23	11/29/23	6	10.8	0.27	0.10	0.4	1,903							
12/01/23	12/02/23	10	2.7	0.49	0.18	1.9	4,568							
12/06/23	12/07/23	31	4	0.33	0.12	0.8	2,284							
12/18/23	12/20/23	54	10.5	2.34	0.62	9.7	34,247				X			
12/29/23	12/30/23	29	8.7	2.06	0.48	4.0	30,705							
01/02/24	01/03/24	11	3.3	0.66	0.46	5.4	9,990							
01/06/24	010/6/24	6	3.5	0.11	0.11	1.1	564							
01/09/24	01/10/24	29	2.5	0.55	0.16	0.9	4,585							
01/13/24	01/14/24	9	3.2	1.07	0.48	4.7	28,885							
01/16/24	01/16/24	6	2.6	0.58	0.25	2.5	12,888							
01/19/24	01/20/24	23	2.7	0.69	0.22	1.9	13,791							
01/21/24	01/22/24	11	1.2	2.06	0.52	7.8	68,987	2			X		0.06	
01/24/24	01/24/24	8	1.8	0.47	0.35	3.0	11,446							
01/31/24	02/02/24	44	7.1	1.15	0.17	1.7	22,232	3					0.02	
02/03/24	02/05/24	48	1.5	1.16	0.13	1.0	23,988							
02/07/24	02/07/24	6	1.6	0.54	0.26	2.7	11,486							
02/14/24	02/14/24	6	6.9	0.62	0.46	6.7	13,844							
02/17/24	02/20/24	78	2.6	2.88	0.55	6.6	80,350				X			
02/26/24	02/26/24	6	5.9	0.11	0.08	0.6	565							
02/29/24	03/02/24	54	2.7	1.46	0.47	7.5	35,783							
03/06/24	03/06/24	6	3.5	0.5	0.28	4.6	11,717							
03/10/24	03/11/24	6	4.5	0.7	0.55	6.0	19,190				X			
03/12/24	03/12/24	7	0.9	0.44	0.11	0.8	6,792							
03/22/24	03/24/24	38	10.3	1.48	0.42	3.1	31,856							

Storm Began	Storm Finished	Sample Duration (hrs)[1]	Antecedent Dry (days)	Precipitation Total (in)	Maximum Intensity (in/hr)	Peak Flow (cfs)[2]	Total Flow (cf)[2]	Sample Event[3]	First Flush	Partial Sample	Exceed Maximum Rainfall for Design Storm[4]	Exceed Peak Flow for Design Storm[5]	Trash Volume	Comment
03/27/24	03/30/24	75	3.4	1.67	0.28	4.7	39,477							
04/04/24	04/04/24	14	4.4	0.59	0.22	1.7	8,724							
04/12/24	04/13/24	10	8	0.78	0.31	1.8	12,806							
05/04/24	05/04/24	13	29.2	1.07	0.34	4.7	16,149							
WY 2025 (21 storms total)														
11/01/24	11/02/24	19	> 30	0.2	0.08	1.3	7,414	4	X				0.014	
11/11/24	11/11/24	13	8.5	0.6	0.39	13.5	33,745	5	X				0.037	
11/20/24	11/23/24	81	8.9	4.1	0.70	9.3	128,665				X			
11/25/24	11/27/24	49	1.2	0.5	0.13	0.8	6,749							
12/11/24	12/13/24	29	14.7	0.9	0.26	4.3	52,414	6					0.01	
12/13/24	12/15/24	34	0.7	1.7	0.64	7.5	54,733				X			
12/16/24	12/17/24	26	1.1	0.3	0.11	0.7	3,724							
12/21/24	12/22/24	31	4	0.3	0.09	0.3	3,792							
12/22/24	12/25/24	61	0.1	1.2	0.27	6.7	32,525							
12/26/24	12/28/24	33	1.3	0.9	0.20	1.4	18,544							
12/28/24	12/30/24	54	0.1	0.5	0.17	1.3	10,966							
01/03/25	01/05/25	48	3.8	0.4	0.11	0.6	5,120							
01/31/25	02/03/25	76	26.2	0.7	0.08	0.7	15,076							
02/03/25	02/05/25	47	0.2	1.9	0.40	4.8	56,615							
02/06/25	02/07/25	42	0.3	0.9	0.24	1.6	26,149							
02/11/25	02/14/25	65	3.9	2.2	0.53	12.1	142,517	7			X		0.02	
2/19/25	02/20/25	25	4.9	0.1	0.09	0.4	1,137							
03/05/25	03/07/25	29	13.3	0.2	0.10	0.4	1,773							
03/12/25	03/15/25	71	5.4	1.8	0.32	4.3	49,907							
03/16/25	03/18/25	32	1.4	0.5	0.12	0.9	10,991							
03/31/25	04/2/25	48	13.5	0.6	0.15	4.2	13,195							

Storm Began	Storm Finished	Sample Duration (hrs)[1]	Antecedent Dry (days)	Precipitation Total (in)	Maximum Intensity (in/hr)	Peak Flow (cfs)[2]	Total Flow (cf)[2]	Sample Event[3]	First Flush	Partial Sample	Exceed Maximum Rainfall for Design Storm[4]	Exceed Peak Flow for Design Storm[5]	Trash Volume	Comment

1 Sample Duration is defined as period net is attached to outfall during storm event.
2 Peak and total flows were based on rainfall-runoff model in WY 2024 and field measurements in WY 2025 (note: modeled peak/total flows were used for sampled storm events).
3 Sample Event described in Section B1.2.1 and Table SM-1.
4 sed on NOAA Precipitation Frequency Data Server (https://hdsc.nws.noaa.gov/hdsc/pfds/).
5 Based on Peak flow calculations using the Rational Method (Attachment A of IMR report)

Table SM-11. Summary of storm characteristics and sample information at site SM-SBS during WY 2024 and WY 2025

Storm Began	Storm Finished	Sample Duration (hrs)[1]	Antecedent Dry (days)	Precipitation Total (in)	Maximum Intensity (in/hr)	Peak Flow (cfs)[2]	Total Flow (cfs)[2]	Sample Event[3]	First Flush	Partial Sample	Exceed Maximum Rainfall for Design Storm[4]	Exceed Peak Flow for Design Storm[5]	Trash Volume	Comment
WY 2024 (27 storms total)														
11/17/23	11/17/23	6.0	> 47.6	0.2	0.09	0.5	1,864	1	X				0.05	
11/28/23	11/29/23	6.0	11.1	0.1	0.09	0.2	947							
12/17/23	12/20/23	59.4	18.7	2.6	0.31	7.2	103,646							
12/27/23	12/27/23	6.0	7.2	0.2	0.08	0.5	2,458							
12/29/23	12/30/23	19.8	1.8	1.1	0.24	3.5	43,402							
01/02/24	01/03/24	8.8	3.2	0.6	0.26	7.3	23,622							
01/06/24	01/06/24	6.0	3.6	0.2	0.17	2.5	6,991							
01/10/24	01/10/24	6.0	3.5	0.2	0.05	0.7	3,687							
01/13/24	01/13/24	6.0	3.1	0.3	0.12	1.6	10,083							
01/16/24	01/16/24	6.0	2.8	0.3	0.13	2.3	12,509							
01/20/24	01/20/24	6.0	3.2	0.2	0.06	1.1	6,161							
01/21/24	01/22/24	9.0	1.3	1.4	0.45	8.5	54,125	2		X	X		0.01	
01/24/24	01/24/24	7.6	1.9	0.6	0.51	8.9	24,317				X			
01/31/24	02/02/24	40.3	7.1	1.6	0.18	2.3	59,390	3					0.02	
02/03/24	02/04/24	24.4	1.6	1.7	0.26	3.4	68,606							
02/07/24	02/07/24	6.0	2.6	0.4	0.19	2.7	14,607							
02/14/24	02/14/24	6.0	6.9	0.1	0.04	0.1	385							
02/17/24	02/20/24	77.7	2.6	1.5	0.38	5.5	53,459							
02/26/24	02/26/24	6.0	5.9	0.1	0.09	0.2	857							
02/29/24	03/02/24	53.2	2.7	1.1	0.21	4.3	35,829							
03/06/24	03/06/24	6.0	3.8	0.1	0.11	1.1	3,571							
03/11/24	03/11/24	6.0	4.3	0.3	0.21	2.0	6,510							
03/22/24	03/24/24	34.3	11.5	0.8	0.12	0.8	17,295							
03/27/24	03/30/24	71.3	3.6	1.6	0.43	9.3	58,791				X			
04/04/24	04/04/24	14.1	4.5	0.7	0.18	2.9	23,472							
04/13/24	04/14/24	21.4	8.2	0.3	0.13	0.4	2,876							

Storm Began	Storm Finished	Sample Duration (hrs)[1]	Antecedent Dry (days)	Precipitation Total (in)	Maximum Intensity (in/hr)	Peak Flow (cfs)[2]	Total Flow (cfs)[2]	Sample Event[3]	First Flush	Partial Sample	Exceed Maximum Rainfall for Design Storm[4]	Exceed Peak Flow for Design Storm[5]	Trash Volume	Comment
05/04/24	05/04/24	7.1	20.3	0.9	0.32	6.6	29,630							
WY 2025 (18 total storms)														
11/11/24	11/11/24	9.8	> 41.4	0.4	0.26	7.5	18,173	5	X				0.05	
11/22/24	11/23/24	34.2	10.7	1.8	0.39	12.3	142,708							
11/25/24	11/26/24	23.0	1.3	0.4	0.07	2.4	31,362							
12/12/24	12/13/24	37.3	15.9	0.9	0.30	10.5	58,450	6					0.02	
12/13/24	12/15/24	35.1	0.4	1.8	0.68	64.1	274,679				X	X		
12/16/24	12/17/24	27.0	1	0.2	0.06	2.4	10,137							
12/22/24	12/23/24	24.7	5.3	0.3	0.20	8.7	15,360							
12/24/24	12/25/24	28.3	0.2	0.4	0.15	12.6	26,849							
12/26/24	12/28/24	34.1	1.4	0.7	0.13	5.0	51,936							
12/29/24	12/30/24	25.5	1.1	0.3	0.13	5.6	16,404							
01/31/25	02/02/25	45.8	32.2	0.3	0.05	0.8	10,774							
02/03/25	02/05/25	42.0	1.5	2.1	0.58	32.8	261,756				X	X		
02/06/25	02/08/25	53.7	0.6	1.0	0.21	12.1	72,876							
02/12/25	02/14/25	51.2	4.2	3.0	0.61	35.1	454,441	7			X	X		Disqualified Event
03/01/25	03/02/25	18.3	14.9	0.6	0.26	22.7	34,810					X		
03/12/25	03/16/25	87.6	10	1.6	0.36	27.7	121,525	8				X	0.04	
03/16/25	03/18/25	28.3	0.6	0.3	0.07	3.5	18,105							
03/31/25	04/02/25	49.3	13.2	0.7	0.16	8.5	40,438							

1 Sample Duration is defined as period net is attached to outfall during storm event.
2 Peak and total flows were based on rainfall-runoff model in WY 2024 and field measurements in WY 2025 (note: modeled peak/total flows were used for sampled storm events).
3 Sample Event described in Section B1.2.1 and Table SM-1.
4 Based on NOAA Precipitation Frequency Data Server (https://hdsc.nws.noaa.gov/hdsc/pfds/).
5 Based on Peak flow calculations using the Rational Method (Attachment A of IMR report)

B4 SANTA CLARA VALLEY URBAN RUNOFF POLLUTION PREVENTION PROGRAM (SCVURPPP)

B4.1 Introduction

Three MS4 outfall trash monitoring locations in Santa Clara County are being monitored for trash discharges. The first outfall location (SC-SFC) is in the City of Palo Alto approximately 70 meters west of El Camino Real. The outfall discharges directly into San Francisquito Creek (Figure SC-1). The second outfall location (SC-STE) is in the City of Mountain View approximately 50 meters west of El Camino Real. The outfall discharges directly into Stevens Creek (Figure SC-2). The third outfall location (SC-COY) is in the City of San Jose approximately 1 kilometer southeast of Interstate (I) 280. The outfall discharges directly into Coyote Creek (Figure SC-3). Characteristics of each monitoring location and corresponding drainage area are provided below.

San Francisquito Creek (SC-SFC)

Site SC-SFC is a 42-inch diameter outfall that drains a 60-acre catchment in the City of Palo Alto. The catchment area contains the following urban land uses[24]: commercial (91%), parks (6%) and urban areas that are not under Permittee jurisdiction (3%). The commercial area includes the Stanford Shopping Center and the Hoover Medical Campus. Baseline (i.e., pre-trash control) trash generation rates for jurisdictional acres in the catchment were identified as approximately 23% low and 77% moderate.

A total of 1.8 acres (3%) of the catchment is treated with catch basin inserts that provide full trash capture treatment. In addition, trash control measures equivalent to FTC systems have been implemented in areas not addressed by the FTC system. These control measures include trash inspections conducted on private properties (i.e., Private Land Development Area or PLDAs) that address 55 acres of land area in the catchment. In addition, trash reductions have been achieved using on-land visual trash assessment (OVTA) methods applied to four street locations surrounding the catchment (14 acres). Collectively, these trash control measures in the catchment have resulted in the reduction of the trash generation rate for areas in the catchment from 6.3 (baseline) to 4.6 (current) gallons/acre/year.

The outfall at site SC-SFC is located on the eastern bank of San Francisquito Creek on land owned by Stanford University. The outfall has a concrete headwall and landing that is approximately 5 feet above the high-water mark and 15 feet below the top of the bank and discharges directly into the creek (Figure SC-4). The outfall is located within a steep embankment that is wooded and has an understory characterized by dense vegetation and non-native herbaceous plants.

Stevens Creek (SC-STE)

Site SC-STE is at a 54-inch-diameter outfall that drains a 137-acre catchment area in the City of Mountain View. This catchment area consists of the following urban land uses: residential (73%), commercial/retail (24%) and Caltrans (SR 87) (3%). Baseline trash generation rates for jurisdictional acres in the catchment were identified as approximately 79% low, 11% moderate and 9% high by area.

[24] Land use data derived from ABAG (2006).

A total of 11.5 acres is treated with full trash capture: one privately owned High-Capacity Flow System (i.e., hydrodynamic separator) that treats 10.1 acres and 12 catch basin inserts, installed by City of Mountain View in 2025, that treats 1.4 acres. Trash control measures equivalent to FTC systems have been implemented in areas not addressed by the FTC system. These measures include trash inspections conducted on private properties (i.e., Private Land Development Area or PLDAs) that address 11 acres and On-land Visual Trash Assessment (OVTA) methodology that address 104 acres in the catchment area. In addition, the City of Mountain view implemented trash management actions in the catchment that were associated with the relocation of a large homeless community living in recreational vehicles. Large vehicle parking restrictions were added and the MS4 system was flushed. Collectively, these trash control measures in the catchment have resulted in the reduction of the trash generation rate for areas in the catchment from 6.1 (baseline) to 2.3 (current) gallons/acre/year.

The outfall at site SC-STE is located 200 meters south of El Camino Real, on land owned by the City of Mountain View. The outfall landing area and surrounding banks is armored with sacrete. The outfall is approximately 2.5 meters above the channel high water mark and 3 meters below the top of the bank and discharges directly into Stevens Creek (Figure SC-5). The bottom of the creek in the surrounding area is a combination of natural and manmade structures. A mix of woody vegetation and non-native herbaceous plants (e.g., Himalayan blackberry) are present at the top of the bank, adjacent to the armoring.

Coyote Creek (SC-COY)

Site SC-COY is at a 60-inch diameter outfall that drains a 400-acre catchment area in the City of San Jose. This catchment area consists of the following land uses: industrial (57%), commercial/retail (22%), and park land (6%) and non-urban (15%). Baseline trash generation rates for jurisdictional acres in the catchment were identified as approximately 24% low, 72% moderate and 4% high by area.

A total of 184 acres is treated with full trash capture, including one High-Capacity Flow System (i.e., hydrodynamic separator) that treats 178 acres and two catch basin inserts, installed by City of San Jose in 2025, that treats 6.2 acres. Trash control measures equivalent to FTC systems have been implemented in areas not addressed by the FTC system. These measures include trash inspections conducted on private properties (i.e., Private Land Development Area or PLDAs) that address 107 acres and On-land Visual Trash Assessment (OVTA) method that address 105 acres. Trash management actions in the catchment have resulted in reducing the trash generation rate from 7.3 (baseline) to 3.1 (current) gallons/acre/year.

The outfall at site SC-COY is located on the western bank of Coyote Creek, near the Japanese Gardens in Kelley Park, owned by City of San Jose. This outfall does not contain a headwall but does have a wide landing area protected with riprap. The outfall is approximately 5 feet above the channel high water mark and 5 feet below the top of the bank and discharges directly into the creek (Figure SC-6). The outfall is situated in a lower portion of the levee along Coyote Creek. Vegetation in the armoring and below the outfall is sparse, consisting of nonnative plants and trees at the ordinary high-water mark.

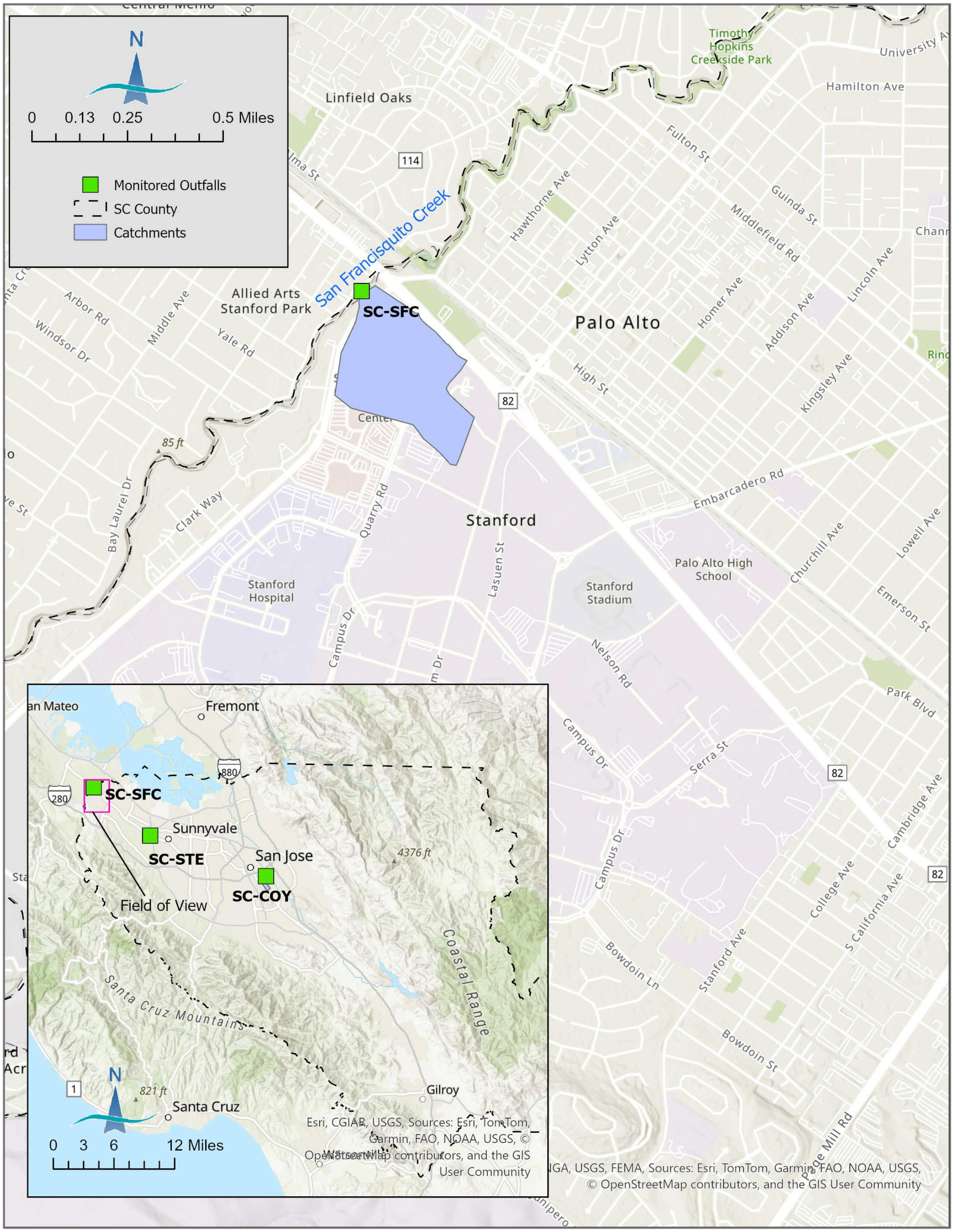


Figure SC-1. Trash outfall monitoring site in City of Palo Alto, Santa Clara County

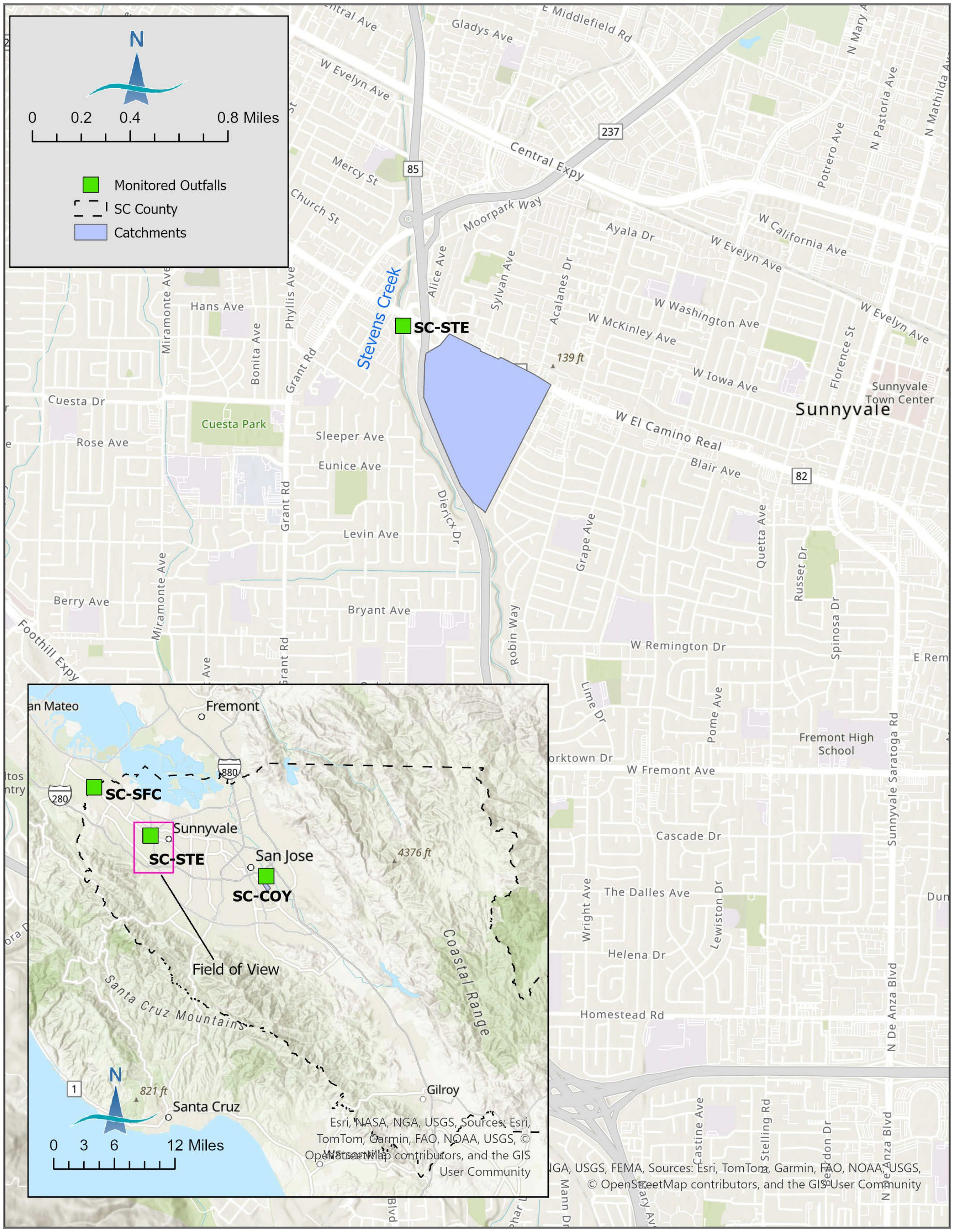


Figure SC-2. Trash outfall monitoring site in City of Mountain View, Santa Clara County

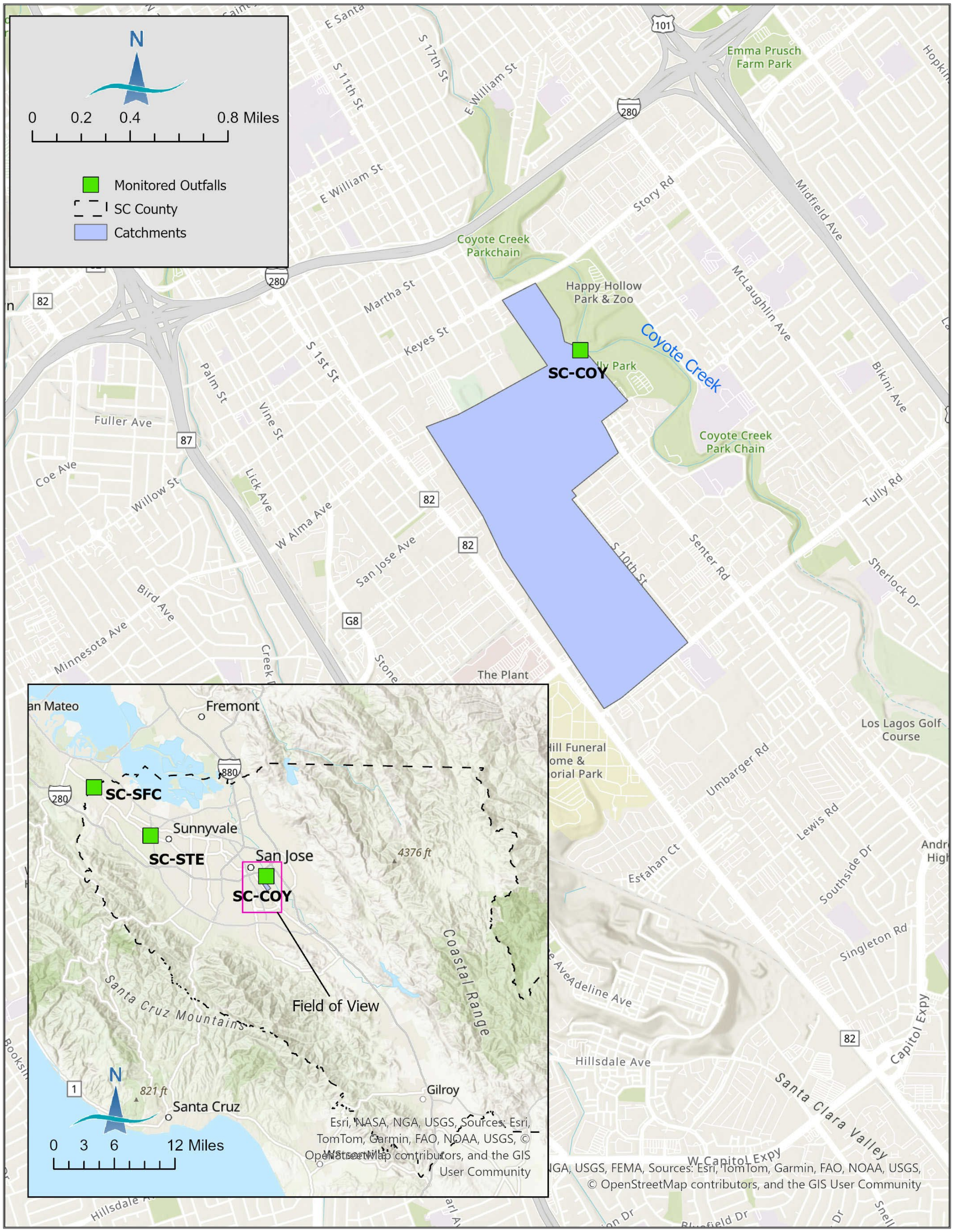


Figure SC-3. Trash outfall monitoring site in City of San Jose, Santa Clara County

Figure SC-4. Outfall located above San Francisquito Creek, City of Palo Alto

Figure SC-5. Outfall above Stevens Creek, City of Mountain View

Figure SC-6. Outfall above Coyote Creek, City of San Jose

B4.2 Monitoring Results

B4.2.1 Sample Events

During WYs 2024 and 2025, 12 sample events were conducted over 12 different storm events at three trash outfall sample locations in Santa Clara County. Six sample events were conducted over six different storms each year. During the entire sampling period, three attempts to collect samples at site SC-COY and five attempts to collect samples at site SC-STE were unsuccessful due to vandalism or equipment failure. There were also three events that partial samples were collected due to net detachment during the storm event.

The dates and times for net deployment and retrieval and the duration of sample collection for all sample events are presented in Table SC-1. The listed sample events describe all disqualified samples due to equipment failure/vandalism and all partial samples that occurred due to net detachments. Summary statistics for rainfall and flow for each sample event are also provided. Additional results showing rainfall totals and flow measurements for each sample event, as well as over the entire wet season, are presented in Section B4.2.3 of this attachment.

A summary of the 12 sample events conducted at the three Santa Clara sites is presented below.

Sample Event 1 (November 13-20, 2023)

During the first sampling event of WY 2024, the nets were deployed at all three sites over a seven-day period in mid-November (Table SC-1). The predicted storm was delayed over several days and the majority of rain arrived on the last two days of the net deployment. The first trash samples of the season were collected at sites SC-STE and SC-SFC, however the net was vandalized at site SC-COY, and the sample was lost. Total precipitation was about 0.55 inch at both sites SC-SFC and SC-STE. The samples collected at these two sites were the first seasonal flush.

Sample Event 2 (December 15-18, 2023)

The first successful sample event of the season conducted at site SC-COY was during a 26-hour storm in mid-December (Table SC-1). The storm occurred after nearly one month of antecedent dry conditions. The total precipitation for the storm was approximately 0.46 inch. The second storm of the season at site SC-COY produced a large amount of trash and organic debris. Although there was one month of dry conditions since the previous storm, the high volume of material suggests trash that had accumulated over the dry season may not have been entirely removed during the first seasonal flush in mid-November.

Sample Event 3 (December 29, 2023-January 2, 2024)

The second sample event for site SC-COY occurred during a short nine-hour storm at the end of December (Table SC-1). The storm was approximately nine days after the previous storm. The total precipitation for the storm was approximately 0.98 inch. A trash net was also deployed at site SC-STE during this storm; however, the net detached from the outfall early in the storm due to equipment malfunction. There was very little material captured within the net and the trash was not used as a sample.

Sample Event 4 (January 18-23, 2024)

Nets were deployed at all three sites in Santa Clara County over a six-day period in mid-January (Table SC-1). This sampling event was the second of the season for sites SC-STE and SC-SFC, and the third and final of the season for site SC-COY. The forecast predicted a storm that would exceed the design storm at all Santa Clara three sites. The sample event included two storms; one small storm followed by a much larger storm, with a combined 20 hours in duration across the sample event.

The total precipitation across the three sites ranged from 1.0 to 1.5 inches. The peak rainfall intensity was highest at site SC-SFC (0.71 inch), which exceeded the design standard storm (i.e., 0.37 inch). At sites SC-COY and SC-STE, peak rainfall intensity ranged between 0.27 to 0.3 inch/hour, both below the design standard storm. Antecedent dry conditions for all three sites were approximately three days.

The nets at sites SC-STE and SC-SFC detached during the peak intensity of the second storm peak, approximately 6 hours prior to the end of the overall storm event. As a result, nets at these two sites captured approximately 70-75% of the combined two storm peaks.

Sample Event 5 (January 31-February 2, 2024)

Nets were deployed at sites SC-SFC and SC-STE for a three-day period in late-January and early-February (Table SC-1). The storm was approximately 48 hours with a rainfall total of approximately 1.5 inches. Antecedent dry conditions for site SF-SFC were approximately seven days. The net at site SC-STE was vandalized, and as a result, no sample was collected at SC-STE during the storm event.

Sample Event 6 (February 29-March 4, 2024)

The last sample event of WY 2024 occurred at site SC-STE in late February and early March. The storm was approximately 59 hours, which was the longest compared to all other sampling events (Table SC-1). The total rainfall was 1.26 inches at the site. Antecedent dry conditions for the site were approximately nine days.

Sample Event 7 (October 31-November 4, 2024)

During the seventh sample event (first event of WY 2025), nets were deployed at all three sites over a six-day period at the beginning of November 2024 (Table SC-1). The amount of rainfall was much less than the predicted forecast, resulting in minimal to no flow at the outfall monitoring locations. Precipitation totals were highest within the catchment of site SM-STE; approximately 0.08 inch of rain were recorded during the entire six-day net deployment. A majority of the precipitation occurred over a one-hour period on November 2, during which the peak rainfall intensity of 0.07 inch/hour occurred. Field observations during net retrieval at site SC-STE indicate flow was present at the outfall and the net contained a small amount of organic material and trash. This event was considered an early seasonal flush. There was no apparent flow at the remaining two outfall monitoring sites and no trash was collected in the nets.

Sample Event 8 (November 11- 12, 2024)

Sampling Event 8 was the second storm event of WY 2025 and occurred approximately one week following the previous storm that was sampled, when trash was only successfully collected from site SC-STE. Precipitation totals ranged between 0.3 and 0.4 inch over three-hour time period on November 11, with relatively high intensity of approximately 0.25 inch/hour. (Table SC-1).

AT site SC-COY, only a partial sample was collected as the net detached approximately 0.26 inch of rainfall, which was approximately 72% of the entire storm. At site SC-STE, the net was cut open by newly installed cable and the sample was lost. A complete sample was collected at site SC-SFC. Samples collected at sites SC-COY and SC-SFC were considered first flush events.

Sample Event 9 (December 11-December 13, 2024)

Sample Event 9 (third sample event for WY 2025) occurred over a two-day period in mid-December. Precipitation totals was 0.6 inch across all sites, with maximum rainfall intensity of approximately 0.21 inch/hour (Table SC-1). There was approximately 16 days of antecedent dry period. Samples were collected at both SC-STE and SC-SFC. At site SC-COY, the net detached very early in the storm (only 0.14 inch of rainfall; 30% of the storm). Presumedly, the net detachment was more likely caused by vandalism. The small amount of material captured in the net was disqualified due to minimal amount of total storm captured.

Sample Event 10 (February 2-February 5, 2025)

Sample Event 10 (fourth sample event for WY 2025) was conducted at two sites: SC-COY and SC-STE. The storm has total rainfall ranging from 0.91 to 1.34 and maximum rainfall intensity ranging from 0.29 to 0.39 at sites SC-COY and SC_STE, respectively. Notably, the storm was preceded by 30 days of antecedent dry period (i.e., no precipitation occurred over the entire month of January 2025). Samples at both sites were lost due to equipment failure; cable used to secure the bottom of the net broke.

Sample Event11 (February 11-February 14, 2025)

The fifth sample event of WY 2025 was conducted only at site SC-SFC. The storm was one of the largest storms of the season; rainfall total in the catchment area was 2.9 inches, with maximum intensity of 0.54 inch/hour. The storm had about five days of antecedent dry period.

Sample Event 12 (March 12-March 13, 2025)

The sixth and last sample event for WY 2025 was conducted at two sites: SC-COY and SC-STE. The storm was approximately 1.3 total inch, with rainfall intensity ranging between 0.17 and 0.23 inch/hour for sites SC-COY and SC-STE, respectively. Due to logistical constraints, the net at the Coyote site was manually detached before the end of the storm; sample was collected for approximately 0.9 of 1.3 inches (67%) of the storm. The sample at site SC-STE was lost due to equipment failure; rope that secures the bottom of the net broke.

Table SC-1. Summary of net deployment and storm period, antecedent dry period, and rainfall total and intensity for trash outfall sampling events conducted in Santa Clara County during WY 2024 and WY 2025.

Water Year	Site	Sample ID	Net Deploy Start Date	Net Deploy End Date	Sample Duration (hours)	Storm Duration (hours)	Antecedent Dry (days)[5]	Precipitation Total (in)	Maximum Intensity (in/hr)	First Seasonal Flush
2024	SC-SFC	Event 1	11/13/23 10:00	11/20/23 09:15	167	6	>30	0.54	0.20	x
		Event 4[1]	01/18/24 08:45	01/22/24 04:30	92	16	3	1.54	0.71	
		Event 5	01/30/24 15:00	02/02/24 10:20	67	48	7	1.55	0.19	
2025		Event 8	11/11/24 07:15	11/12/24 09:15	26	26	> 30	0.37	0.22	x
		Event 9	12/11/24 13:45	12/13/24 08:45	43	40	15.5	0.56	0.21	
		Event 11	02/11/25 10:45	02/14/25 09:30	71	52	3.9	2.88	0.54	
2024	SC-STE	Event 1	11/13/23 10:40	11/20/23 11:00	168	15	>30	.55	0.12	x
		Event 4[2]	01/18/24 10:00	01/23/24 04:00	121	14	3	1.04	0.30	
		Event 6	02/29/24 07:45	03/04/24 07:00	95	59	9	1.26	0.19	
2025		Event 7	10/30/24 13:00	11/02/24 16:30	76	10	> 30	0.08	0.07	x
		Event 9	12/11/24 13:00	12/13/24 10:00	45	21	15.5	0.56	0.21	
2024	SC-COY	Event 2	12/15/23 09:30	12/18/23 12:30	75	26	29	.46	0.18	
		Event 3	12/29/23 08:00	01/02/24 07:15	95	9	9	.98	0.21	
		Event 4	01/18/24 06:45	01/23/24 11:45	125	20	4	1.52	0.27	
2025		Event 7[3]	11/11/24 08:00	11/11/24 12:30	5	3	> 30	0.28	0.26	
		Event 12[4]	03/11/25 13:00	03/13/25 10:00	45	22	6.1	0.90	0.17	

Note: Partial sample events due to early net detachment are indicated in the table. Disqualified events that resulted in no sample collected due to equipment failure are not included.

1 Net was found detached on retrieval date/time (01/23/24 at 9:45); assume net detached on 01/22/24 at 4:30, based on changes in water depth measured in the pipe; and storm ended at 10:00 am. If these assumptions are correct, the net was attached approximately 75% of the duration for the combined two storm peaks.

2 Net was found detached on retrieval date/time (01/23/24 at 10:45); assume net detached on 01/22/24 at 4:00, based on changes in water depth measured in the pipe; and storm ended at 10:45 am. If these assumptions are correct, the net was attached approximately 70% of the duration for the combined two storm peak.

3 Net was found detached on retrieval date/time (11/12/24 at 11:00); assume net detached on 11/11/24 at 12:30pm, based on changes in water depth measured in the pipe; and storm ended at 14:10 pm. If these assumptions are correct, the net was attached approximately 72% of the duration for the combined two storm peak.

4 Net was manually detached on retrieval date/time (03/13/25 at 10:00); storm ended at 13:20 pm. If these assumptions are correct, the net was attached approximately 66% of the duration of the storm.

5 Antecedent dry period for the first seasonal flush represents the dry period between wet seasons and is depicted as > 30 days

B4.2.2 Trash Characterization

Trash was collected for each of the six sample events at site SC-SFC and each of the five sample events at both site SC-STE and SC-COY, for total of 16 trash samples over the two-year monitoring period. All trash from these samples were sorted into 13 trash categories and measured for volume (Table SC-2), consistent with the project's QAPP.

During WY 2024, the highest volumes of trash for sites SC-SFC and SC-STE were collected during the first sample event, 12.7 gallons and 12.5 gallons, respectively. The two highest volumes of trash for SC-COY occurred during Sample Events 2 and 4, with approximately 12 gallons of trash for each event. The two highest volumes of trash collected in WY 2025, ranging from nine to 10 gallons, occurred at site SC-COY. The highest volumes of trash at sites SC-SFC and SC-STE, were 5.6 and 3.3 gallons, respectively, were both collected during first seasonal storm event.

Table SC-2. Trash volume measured for 13 trash types identified from trash samples collected during WY 2024 and WY 2025 at three outfall monitoring sites in Santa Clara County

		SC-SFC						SC-STE					SC-COY				
		WY 2024			WY 2025			WY 2024			WY 2025		WY 2024			WY 2025	
		11/13/23	1/18/24	1/30/24	11/11/24	12/11/24	2/11/25	11/13/23	1/18/24	2/29/24	10/31/24	12/11/24	12/15/23	12/29/23	1/18/24	11/11/24	3/11/25
	Trash Type	**Event 1**	**Event 4**	**Event 5**	**Event 8**	**Event 9**	**Event 11**	**Event 1**	**Event 4**	**Event 6**	**Event 7**	**Event 9**	**Event 2**	**Event 3**	**Event 4**	**Event 8**	**Event 12**
Plastic Trash Items (oz)	Single-Use Carryout Plastic Bags	29	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0
	Expanded Polystyrene (EPS) Foam Food Ware	43	0	0	3.4	0	0	3.4	0	24	5	0	16	48	32	16	77
	(EPS) Foam Other	58	85	0	12	4	14	142	2	32	12	28	78	171	256	142	120
	Single Use Plastic Food / Drink Ware	334	45	2	51	18	92	222	32	123	34	10	78	79	72	141	122
	Smoking Products, Traditional	0.5	0.2	1.0	0.9	0.7	0.9	3.4	0.7	1.7	1.5	3.4	2.5	1.7	1.7	2.5	32
	Smoking Products, Other	36	0.03	1.7	11.8	5	1.7	16	0	6	16	0.3	9	2	4	6	8
	Other plastic Items / Pieces	970	88	65	604	282	270	973	27	371	273	71	920	199	982	818	709
Non-Plastic Trash Items (oz)	Organic / Paper	29	0.03	1.7	10	5	70	6.8	1.7	15	46	0.5	18	6	5	7.6	154
	Fabric	40	3.4	0	5.9	13.5	25	142	0	20	4.2	3.4	40	16	40	5	0
	Metal	55	1	0	17	23	50	100	1	17	32	16	363	17	96	49	3
	Glass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43
	Mixed	0	0	0	0	0	20	10	0	7	0.3	0	20	48	16	0	12
	Biohazard	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0.1
	Total Gallons	**12.5**	**1.7**	**0.6**	**5.6**	**2.7**	**4.3**	**12.7**	**0.5**	**4.8**	**3.3**	**1.0**	**12.1**	**4.6**	**12.1**	**9.3**	**10.0**
	Gallons/ Acre	**0.21**	**0.03**	**0.01**	**0.09**	**0.05**	**0.07**	**0.09**	**0.00**	**0.04**	**0.02**	**0.01**	**0.03**	**0.01**	**0.03**	**0.02**	**0.02**

The total volume of trash collected for all sample events at site SC-SFC, standardized for area, is shown in Figure SC-7. The highest trash volume per unit area occurred at site SC-SFC for Event 1 (0.21 gallons per acre). In WY 2025, the three samples with the highest trash volumes, ranging from 0.5 to 0.9 gallons/acre, were all collected at site SC-SFC. Average trash volume at site SC-SFC was 0.76 gallons/acre.

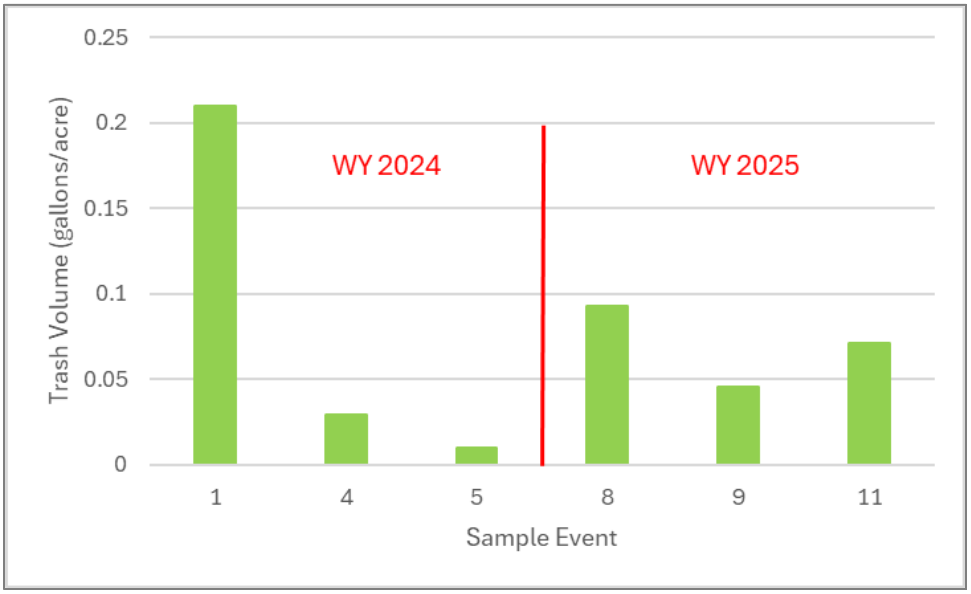


Figure SC-7. Trash volumes standardized by area for six sample events at site SC-SFC, City of Palo Alto, Santa Clara County

The total volume of trash collected for all sample events at site SC-STE, standardized for area, is shown in Figure SC-8. At site SC-STE, the highest trash volume occurred during Event 1 (0.09 gallons per acre).

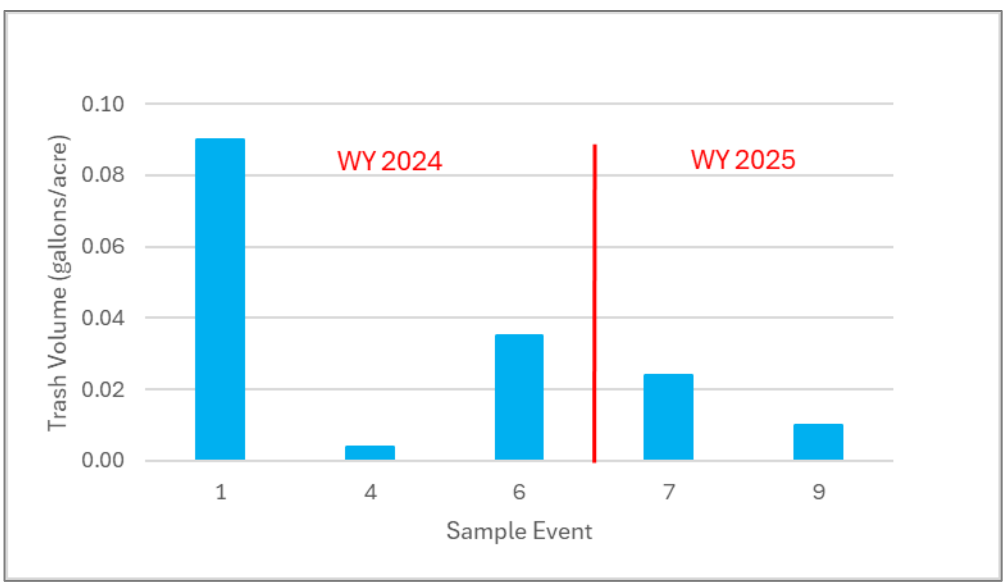


Figure SC-8. Trash volumes standardized by area for five sample events at site SC-STE, City of Mountain View, Santa Clara County.

The total volume of trash collected for all sample events at site SC-COY, standardized for area, is shown in Figure SC-9. In general, the lowest average trash volumes across all sample events occurred at site SC-COY and SC-STE, with 0.24 and 0.33 gallons/acre, respectively.

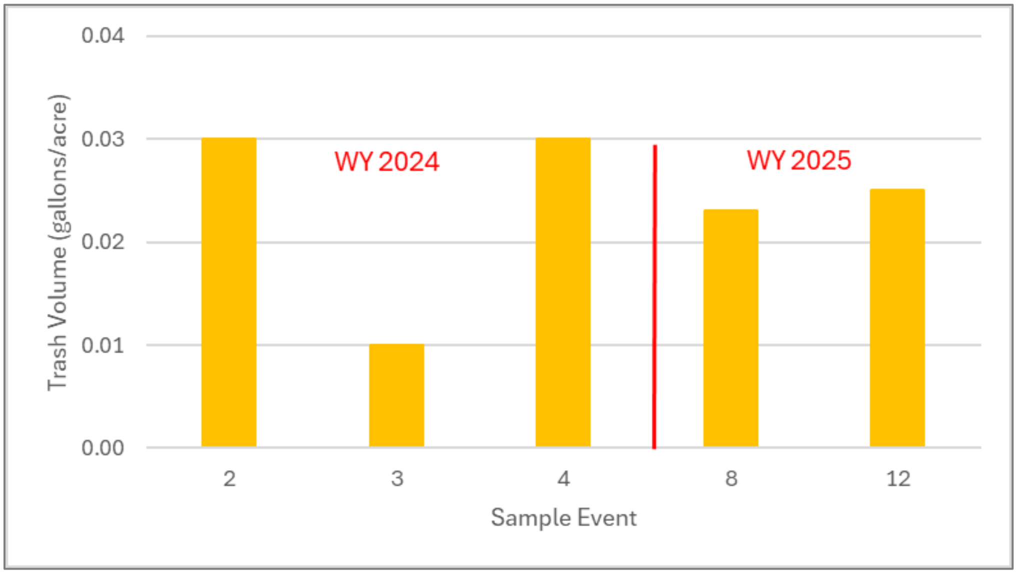


Figure SC-9. Trash volumes standardized by area for five sample events at site SC-COY, City of San Jose, Santa Clara County

Estimated annual trash loading rates for all three sites are presented in Section 3.4.4 of the main *Annual Trash Outfall Monitoring Progress Report for WY 2024* (i.e., main report).

The most common trash type identified from the three Santa Clara sites was plastic, of which there are six separate subcategories. The total volume for the combined six plastic trash categories presented in Table SC-2 accounted for 89%, 85%, and 83% of the trash collected during the two WYs for combined six sample events at sites SC-SFC, SC-STE, and SC-COY, respectively (Figure SC-10). The most common type of plastic trash was "*Other Plastic Items/Pieces*" which accounted for 73%, 70%, and 80% of all plastic trash items observed at sites SC-SFC, SC-STE, and SC-COY, respectively (Figure SC-11).

The "*Other Plastic Items/Pieces*" category includes plastic packaging for food and beverage goods purchased at convenience and grocery stores. The combined plastic items "*Single Use Plastic Food/Drink Ware*" and "*Expanded Polystyrene* (*EPS) Foam Food Ware*" accounted for approximately 19% of the plastic items at sites SC-SFC and SC-STE and 15% of the plastic items at site SC-COY. Single use plastic bags were absent (Site SC-STE) or minimal, with only 1% of the plastic items observed at sites SC-SFC and SC-COY. Existing City, County and State ordinances ban the distribution of these two categories of trash in the San Francisco Bay Area. "*EPS Foam Other"* accounted for approximately 9% of the plastic items observed at site SC-STE. Smoking products accounted for approximately 2% of plastic items observed at all three sites.

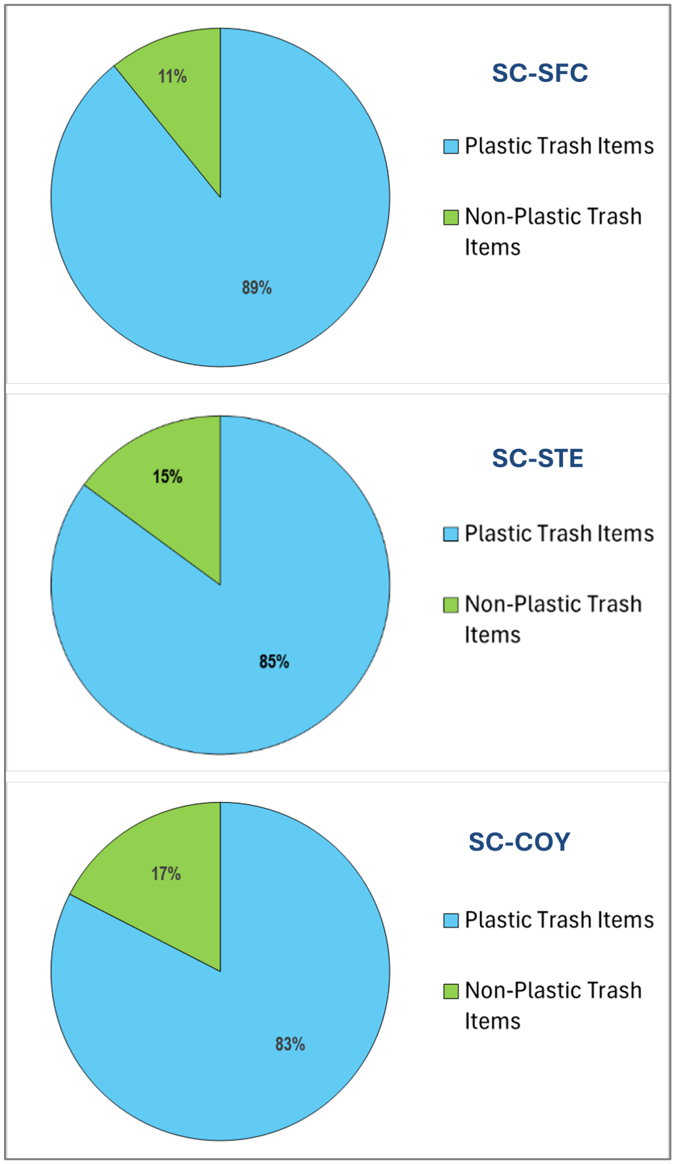


Figure SC-10. Comparison of plastic versus non-plastic trash items measured for all sample events conducted during WY 2024 and WY 2025 at outfall monitoring sites in Santa Clara County

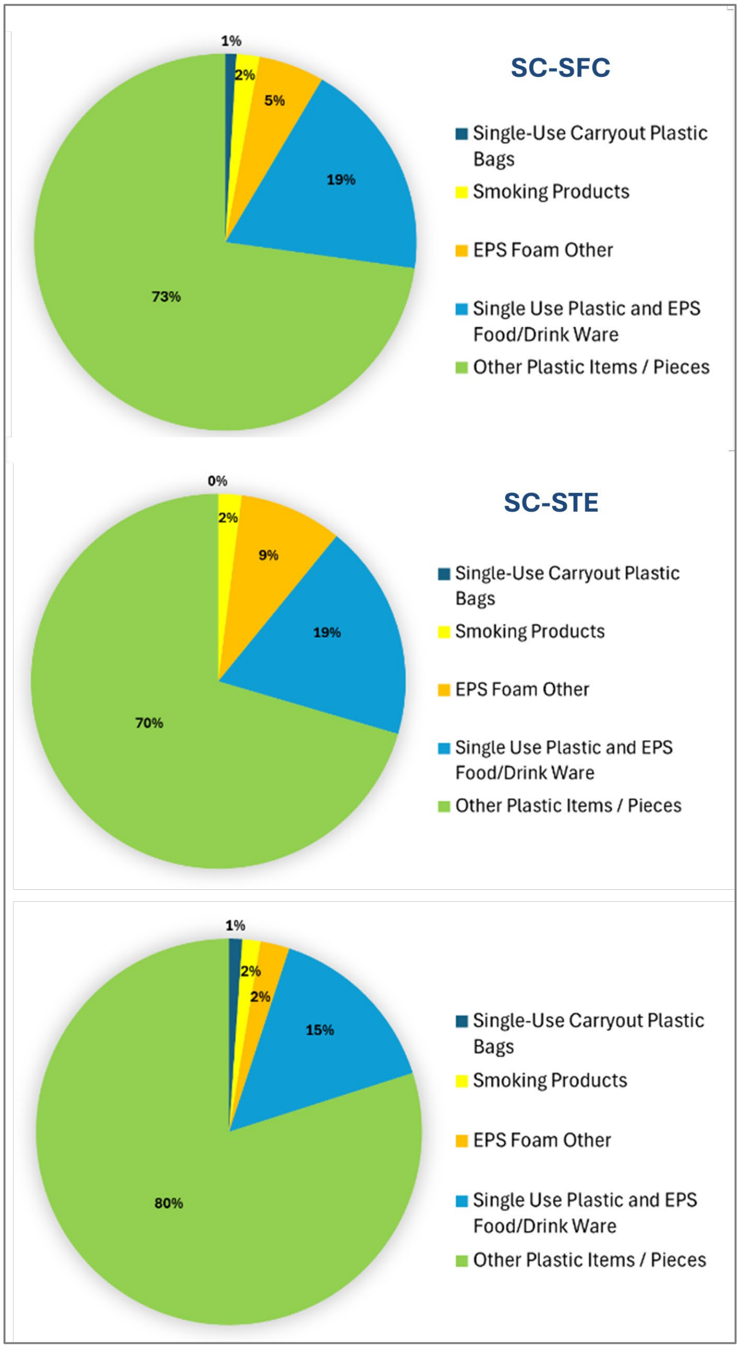


Figure SC-11. Comparison of plastic trash items measured for all sample events conducted during WY 2024 and WY 2025 at outfall monitoring sites in Santa Clara County

B4.2.3 Rainfall and Flow

In WY 2024, water depth sensors were deployed in the MS4 pipe upstream of each trash outfall monitoring site in Santa Clara County. The data collected from these sensors, however, did not accurately measure flow accurately due to the back up of water into the MS4 pipe upstream of the depth sensors when trash sampling nets were installed at the outfall.

As a result, measured flow data and Manning's Equation could not be used to accurately calculate flows at either station. As an alternative, flow rates were calculated using the rainfall-runoff model described in Section 3.2.6. Rainfall data was compiled from Weather Underground stations in proximity to catchment areas for site SC-SFC (11 stations), SC-STE (13 stations) and SC-COY (20 stations). Rainfall totals were calculated using an inverse distance squared weighted average.

The measured flow data was used to calibrate the modeled flow. A combination of measured flow (non-sampled storms) and modeled flow (sampled storms) were used to develop annual hydrographs for all three sites, SC-SFC, SC-STE and SC-COY, shown in Figures SC-12, SC-13 and SC-14, respectively. Plots of rainfall, flow data and sampling period for each sample event, including disqualified events, for all three sites during WY 2025 are shown in Figures SC-15 to SC-19. Hydrographs for individual sample events that occurred during WY 2024 were provided in the Trash Outfall Monitoring Progress Report for WY 2024 (BAMSC 2025).

B4.2.4 Storm Characteristics

In effort to calculate the annual trash load discharged at each outfall during each WY, the total number of storms that occurred in each WY were identified using the compiled rainfall data. Storm events were defined using the following criteria:

- At least 0.1 inch precipitation in 6 hours (Caltrans 2020)
- 24 hours of antecedent dry conditions (i.e., no rainfall)
- Event ends when < 0.1 inch of rain occurs over 6 hours

A summary of storm characteristics for both sites monitored during WY 2024 and WY 2025 is provided in Appendix SC. Information includes sample duration (defined as the length of the storm during net deployment), antecedent dry period, total rainfall (inches), maximum intensity rainfall (inches/hour), peak flow (cfs) and total flow (cfs). Sampled storm events, partially sampled events (i.e., sample represented approximately 70% or greater of storm duration prior to net detachment) and total trash volume (gallons/acre) for each event are indicated in the appendix. Disqualified sample events (i.e., net was detached early in the storm event due to equipment failure/vandalism) are also indicated. First seasonal flush storms and storms that met or exceeded the FTC design storm (i.e., the peak flow generated from a one-year, one-hour frequency storm) are also identified in the appendix. The definition of design storm is provided in Section X.X of the main report.

For this study, the first seasonal flush is defined as the early season storm(s) that transports trash that has accumulated over the previous dry season. More than one storm may be needed to completely flush out the accumulated trash, depending on the amount and intensity of rain during the first storm event of the season. At site SC-SFC, there was one first seasonal flush event in mid-November for both years; total rainfall was 0.3 inch and 0.4 inch in WY 2024 and WY 2025, respectively. Trash volume for both events ranged from 0.09 to 0.21 gallons/acres over the two years.

At site SC-STE, there were two storms that were defined as first seasonal flush during both WYs; a small storm (<0.1 inch total rainfall) occurred in early November, followed by a larger storm (ranging from 0.3 to 0.4 total inch) approximately 10 days later. The combination of both storm events was assumed to transport and discharge trash into the MS4 that accumulated in the catchment area over the previous dry season. Only one of the early season events were sampled each year. The trash volume for the unsampled early season storms were estimated: volume from the first season storm in WY 2025 was used to estimate trash volume for first season storm in WY 2024. Conversely, the volume from the second season storm in WY 2024 was used to estimate trash volume for second season storm in WY 2025. The combined trash volume for first flush events each year was 0.11 gallons/acres.

At site SC-COY, the first season storm was sampled in WY 2024, but the sample was disqualified due to vandalism. In WY 2025, a partial sample was collected during the first season storm (net detached during latter part of the storm). Sample volume from partial sample collected on November 11, 2024 (0.02 gallons/acre) was used as an estimate for disqualified first flush sample event during WY 2024.

There were less rainfall and fewer storms during WY 2025 compared to WY 2024. Across the three outfall monitoring sites in Santa Clara County, the total rainfall ranged from 10.6 to 13.9 inches in WY 2025, compared to 15.6 to 18.2 inches in WY 2024. Similarly, across all sites, there were 16 to 19 storm events during WY 2025 compared to 23 to 27 storm events in WY 2024. Higher rainfall totals and number of storms were consistently higher for both years at site SC-SFC, which is located on the wetter, west side of the Santa Clara Valley. In contrast, site SC-COY, on the drier, eastern side of the valley, consistently had less rainfall and fewer storms compared to all other sites.

Figure SC-2. Annual hydrograph and trash volume (standardized for area) for each sample event conducted at site SC-SFC during WY 2024 and WY 2025

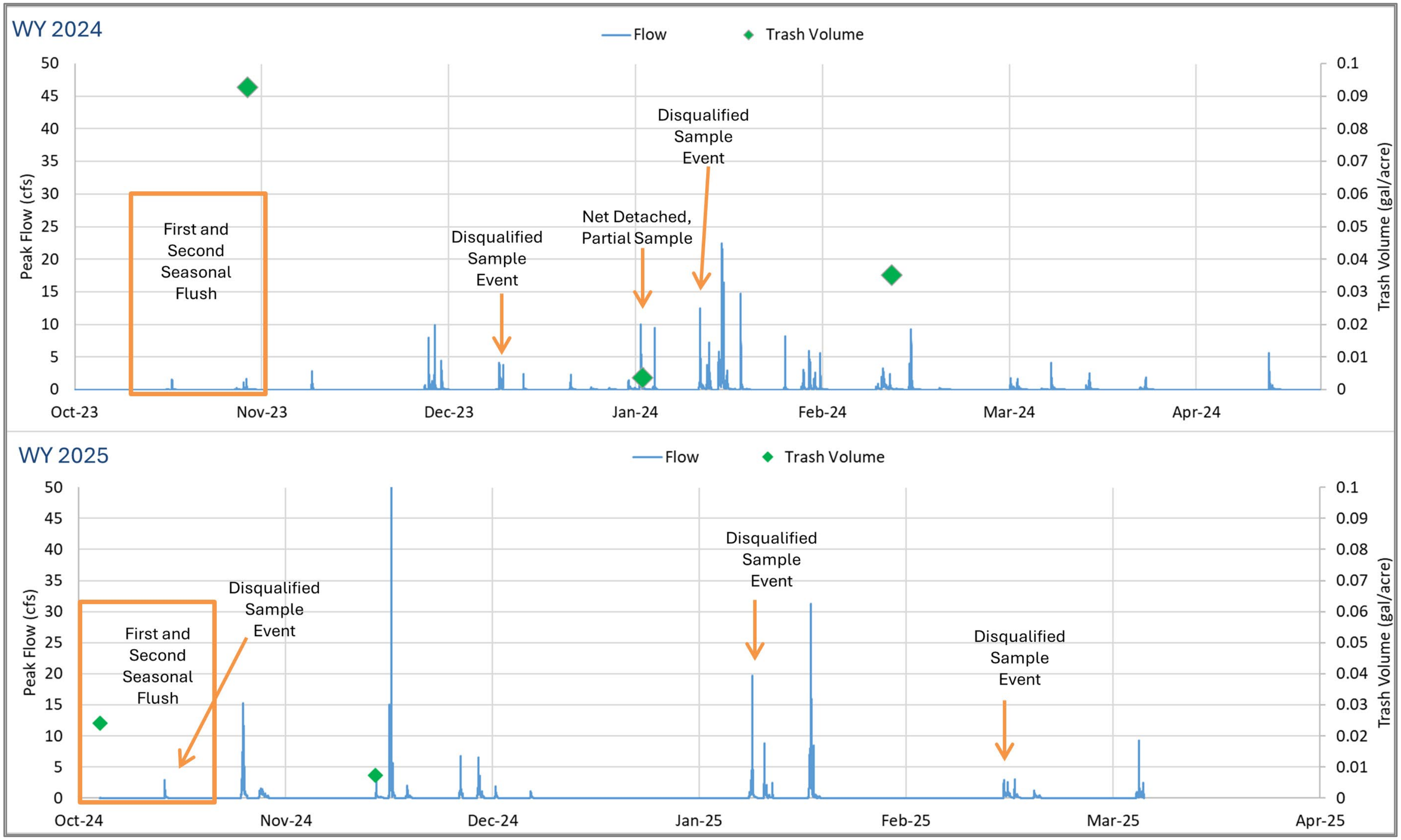


Figure SC-13. Annual hydrograph and trash volume (standardized for area) for each sample event conducted at site SC-STE during WY 2024 and WY2025

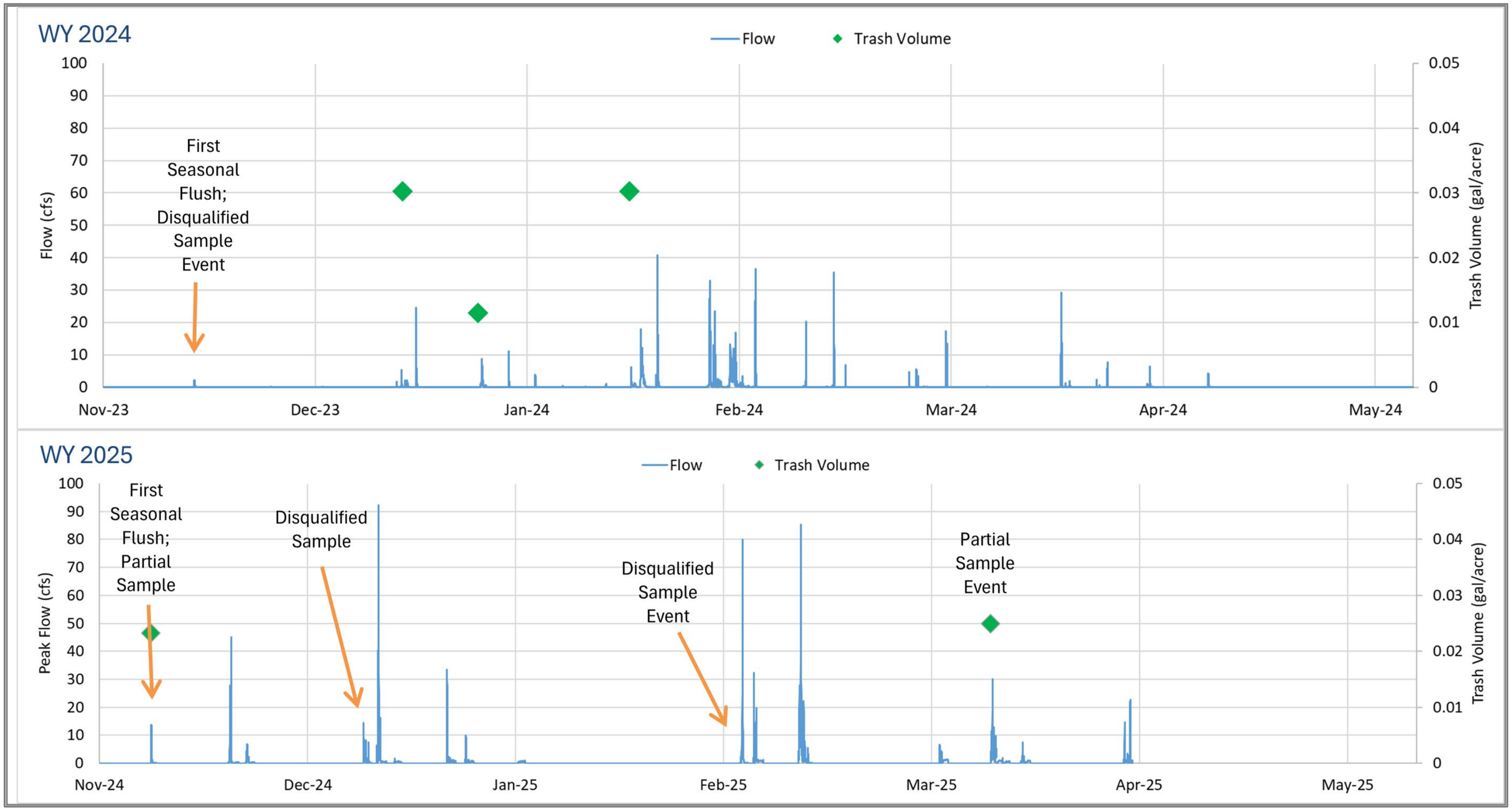


Figure SC-14. Annual hydrograph and trash volume (standardized for area) for each sample event conducted at site SC-COY during WY 2024 and WY2025

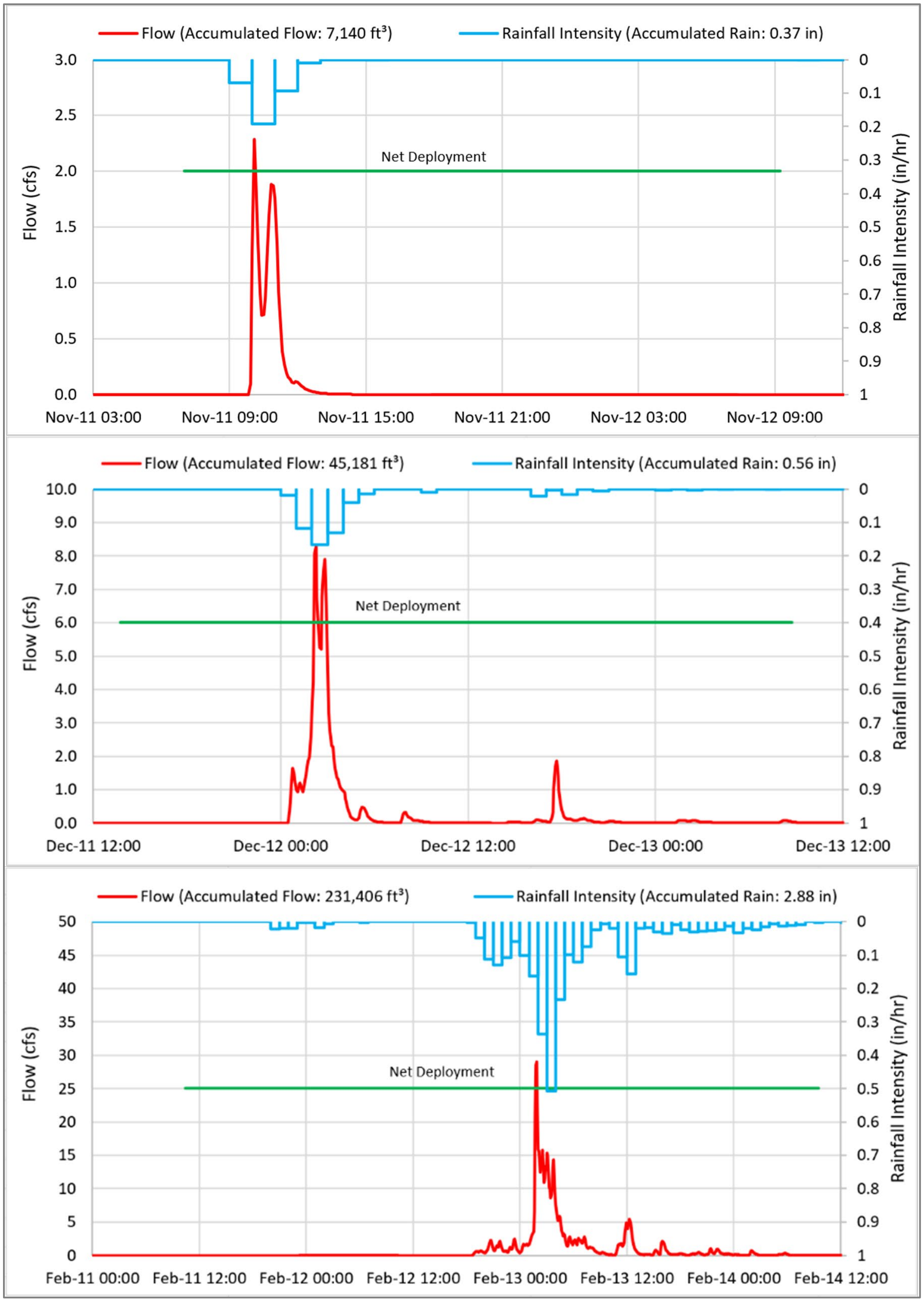


Figure SC-15. Hydrographs for three successful sample events at site SC-SFC during WY 2025

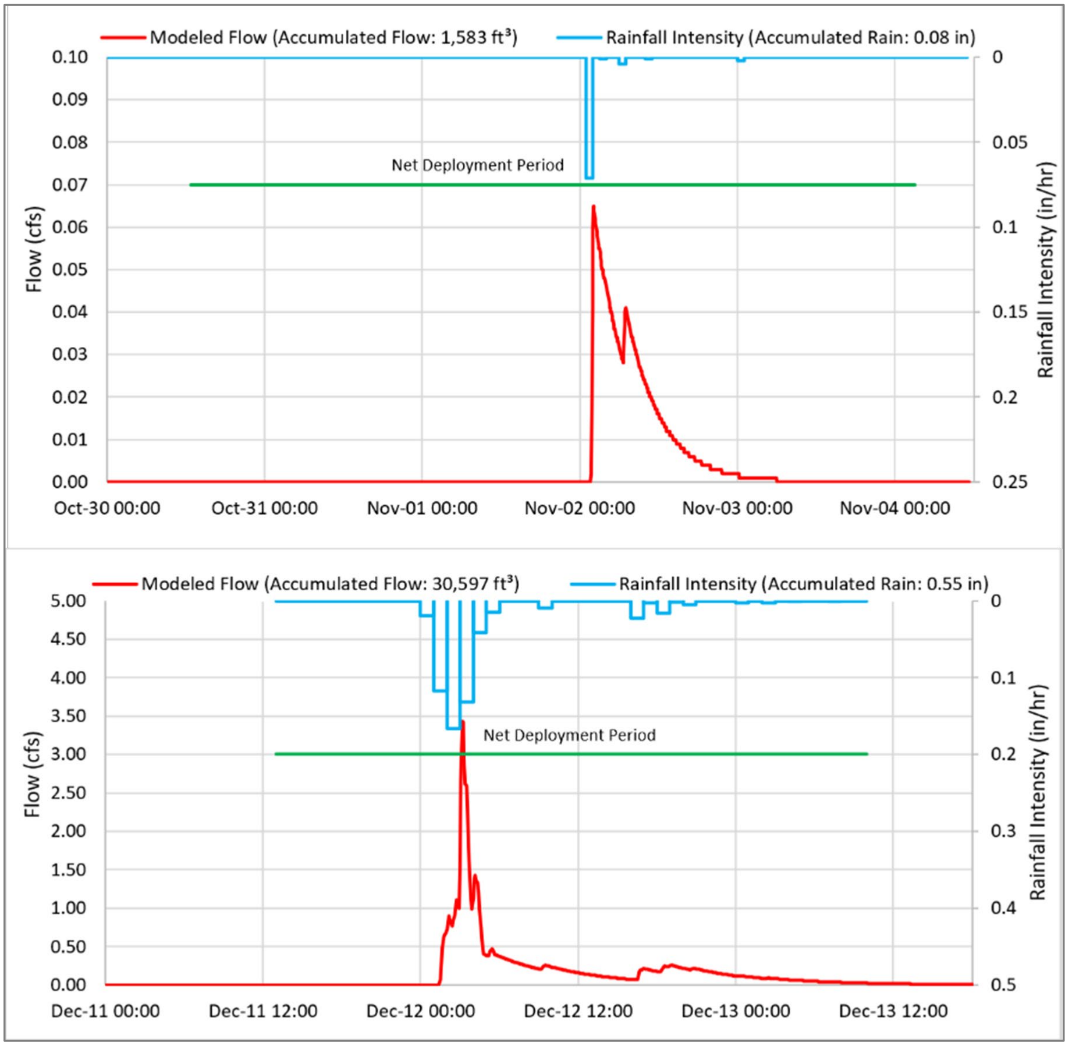


Figure SC-16. Hydrographs for two successful sample events at site SC-STE during WY 2025

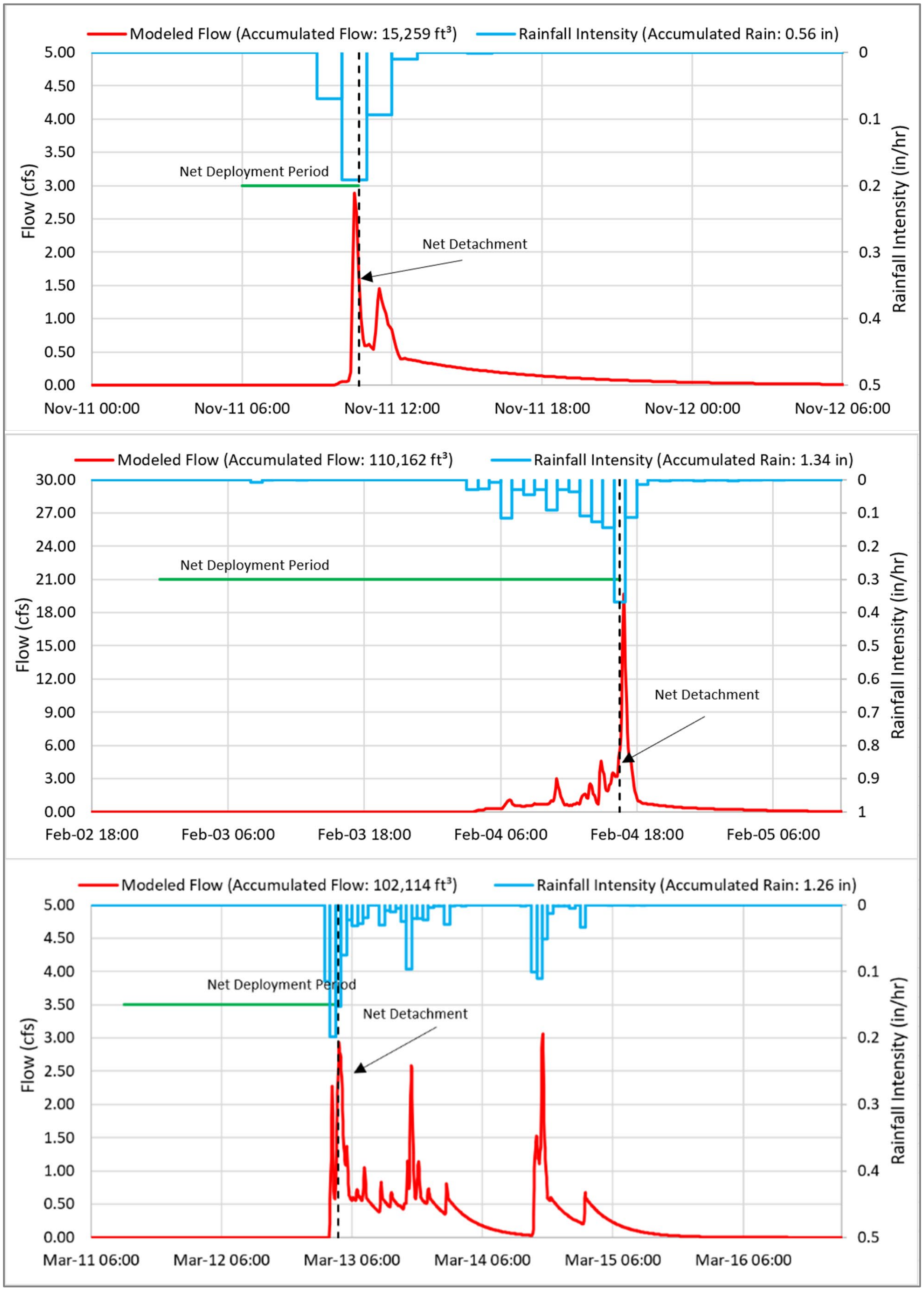


Figure SC-17. Hydrographs for three sample events that were disqualified due to equipment failure at site SC-STE during WY 2025

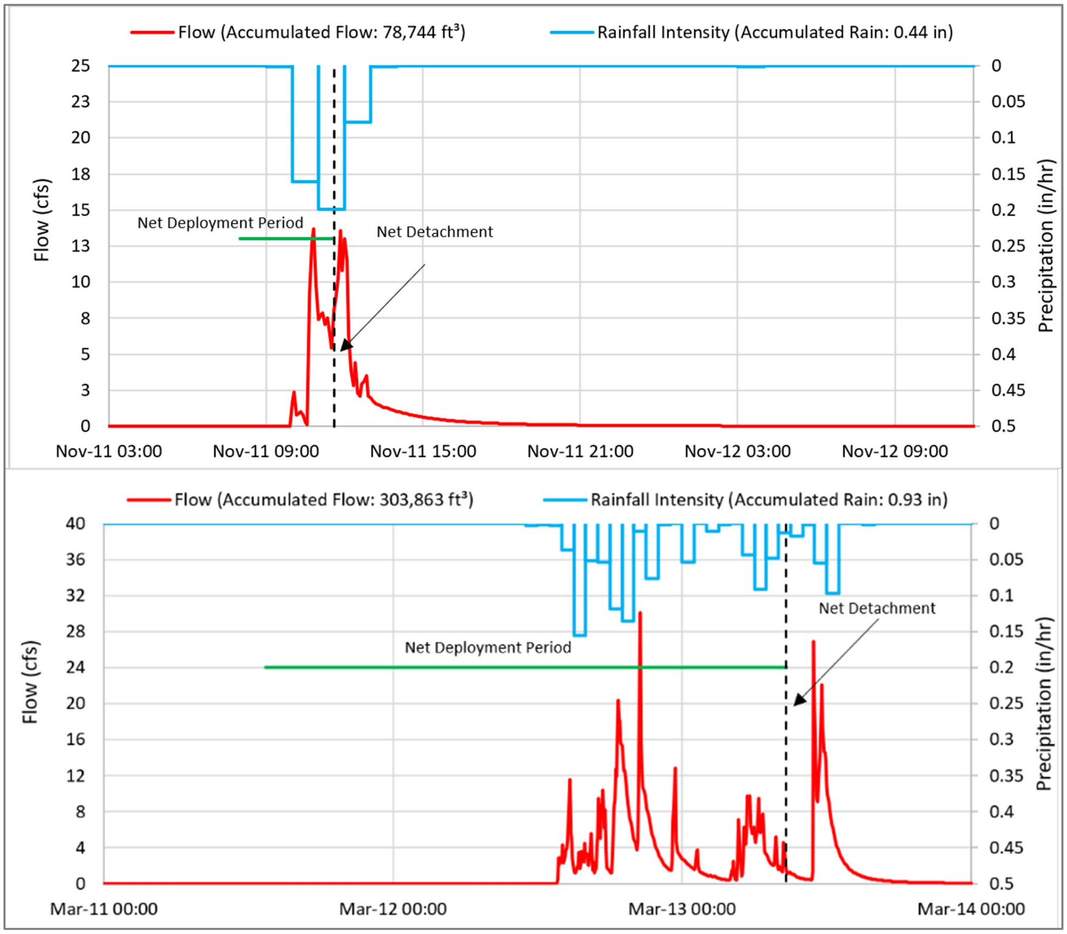


Figure SC-18. Hydrographs for two partial sample events at site SC-COY during WY 2025

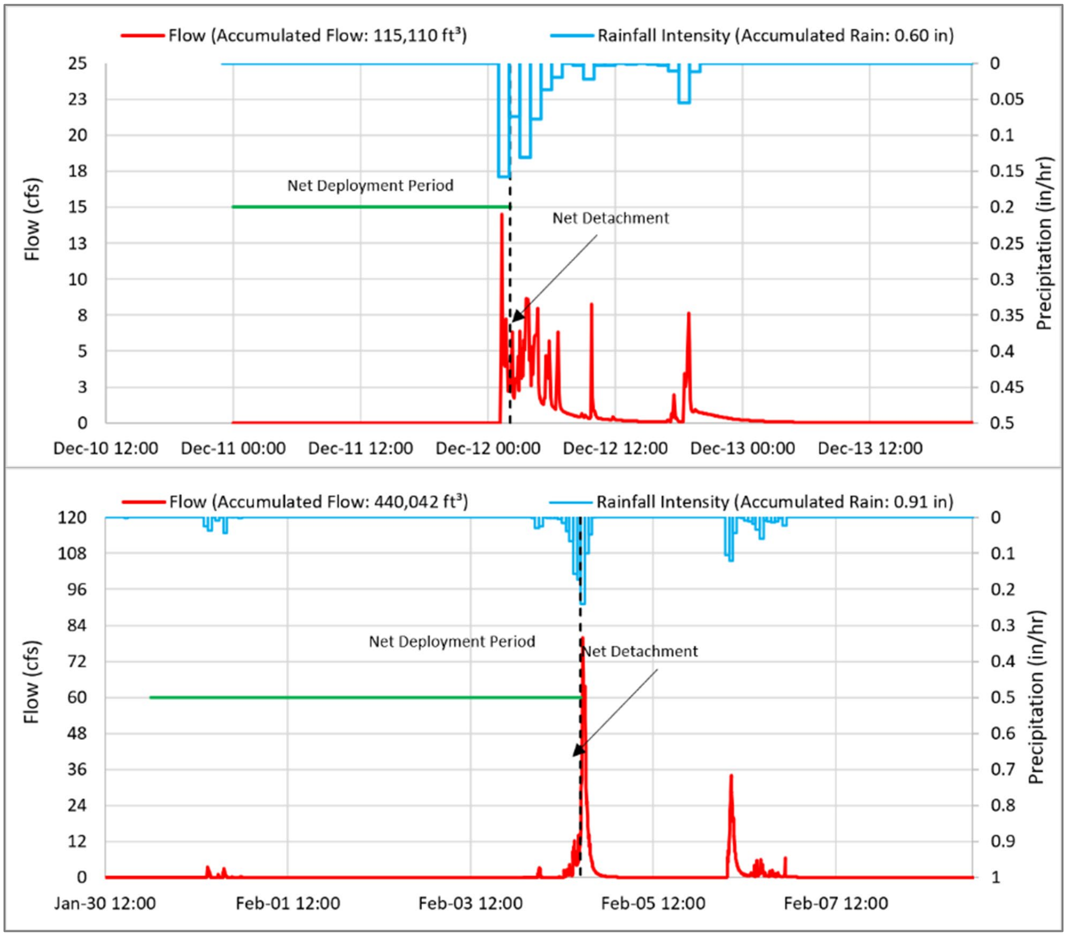


Figure SC-19. Hydrographs for two sample events that were disqualified due to equipment failure at site SC-COY during WY 2025

A comparison of sampled and unsampled storms using peak flows over the two-year monitoring period for site SC-SFC is provided in Figure SC-20. Over the two years of sampling, the lowest peak flow sampled occurred during the first seasonal flush on November 11, 2024 (2.3 cfs). Two of the seven storms that exceeded the predicted peak flow for the design storm (16.4 cfs) were sampled over the two years of monitoring. Storm sizes that are underrepresented in the sample population include peak flows under 2 cfs (11 storms); in particular, small storms that are not associated with the first seasonal flush event. Additional storms sizes that were unsampled include storms with peak flows between 10 and 30 cfs (11 storms).

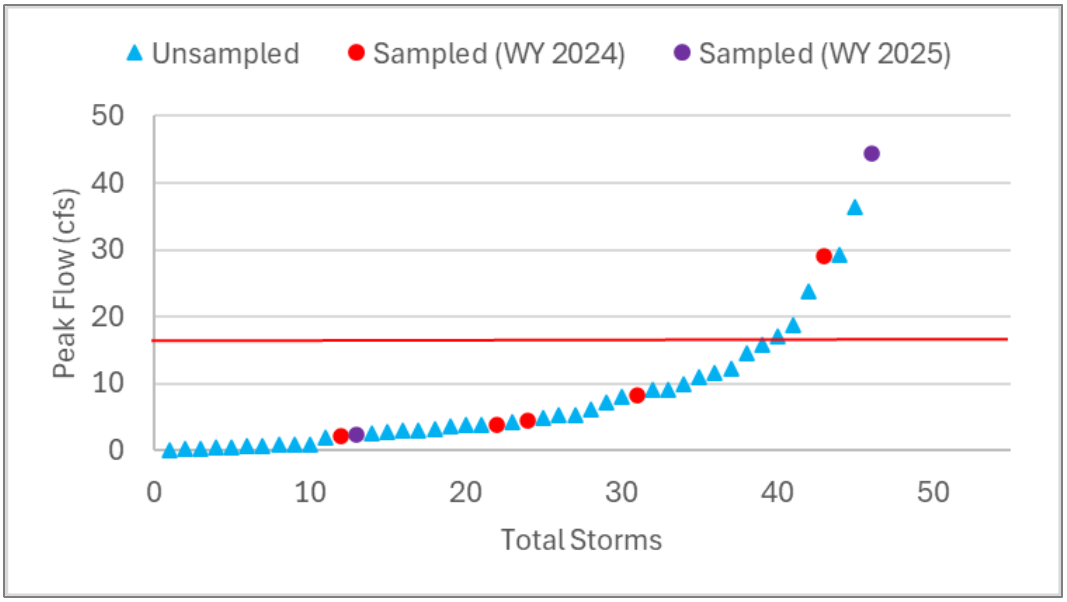


Figure SC-20. Distribution of peak flows for storms, sampled and unsampled, during WY 2024 and WY 2025 at site SC-SFC.

Predicted peak flow design storm standard (16.4 cfs) is shown as red line.

A comparison of sampled and unsampled storms over the two-year monitoring period for site SC-STE is provided in Figure SC-21. Over the two years of sampling, the lowest peak flow sampled occurred during the first seasonal flush on November 2, 2024 (<0.1 cfs). One of the two storms that exceeded the predicted peak flow for the design storm (32.4 cfs) was sampled during WY 2025. No sample events have been successfully collected for storms with peak flows greater than 10 cfs; two sample events in this range were disqualified due to equipment failure.

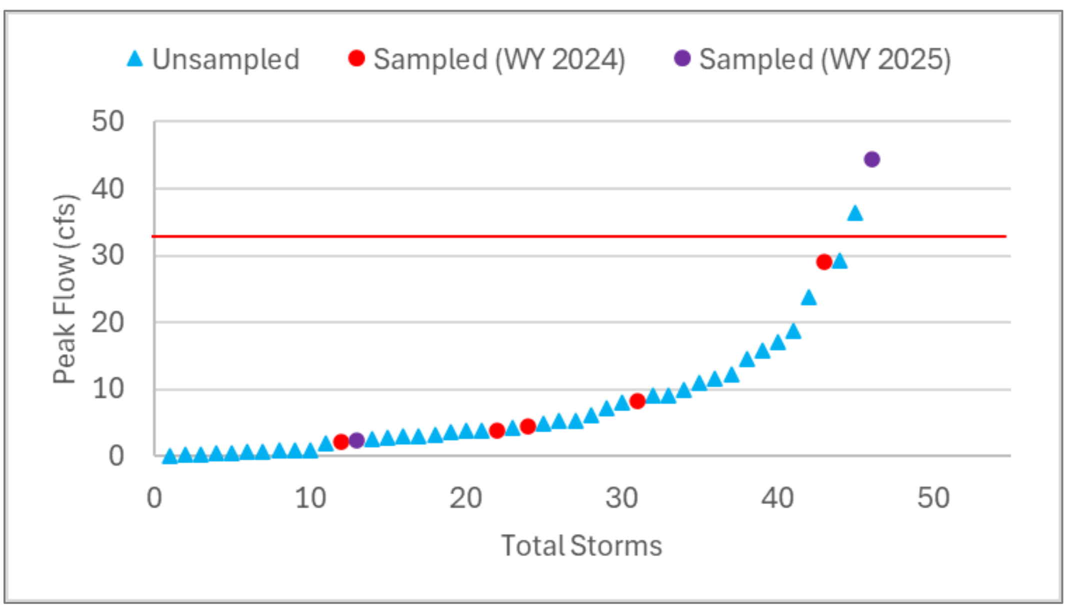


Figure SC-21. Distribution of peak flows for storms, sampled and unsampled, during WY 2024 and WY 2025 at site SC-STE

Predicted peak flow design storm standard (32.4 cfs) is shown as red line.

A comparison of sampled and unsampled storms over the two-year monitoring period for site SC-COY is provided in Figure SC-22. Similar to other sites, the lowest peak flow sampled occurred during second of two seasonal flush events on December 17, 2024 (5.4 cfs). No sample events have been collected for storms with peak flows greater than 30 cfs; one storm in this range was disqualified due to equipment failure.

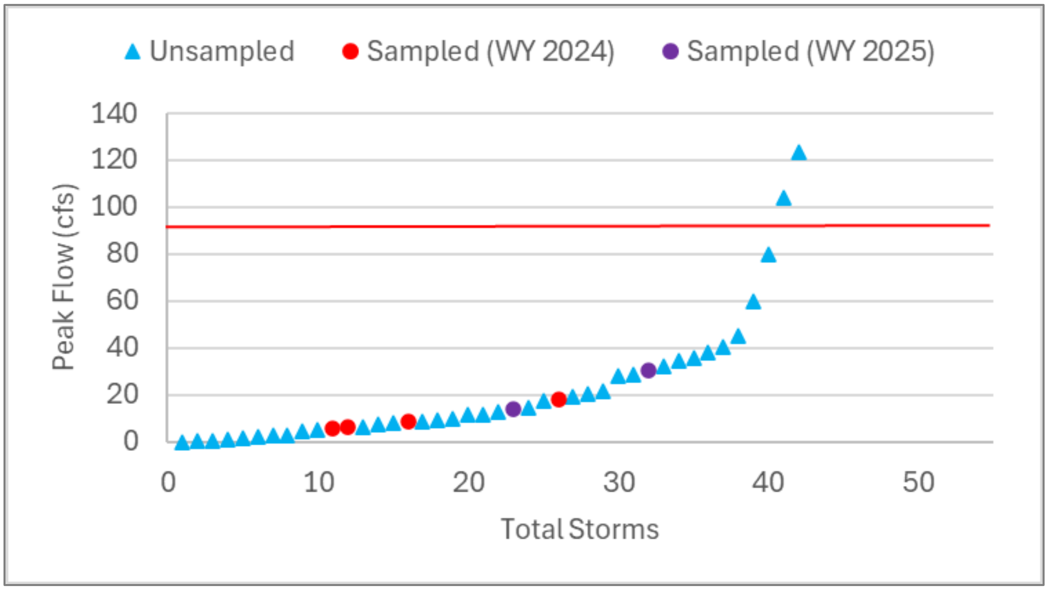


Figure SC-22. Distribution of peak flows for storms, sampled and unsampled, during WY 2024 and WY 2025 at site SC-COY

Predicted peak flow design storm standard (87.1 cfs) is shown as red line.

B4.2.5 Draft Annual Trash Load Estimate

Several factors that may influence trash accumulation and transport into the MS4 were evaluated for their association with the observed trash volume (standardized by area). These include antecedent dry period, sample duration, total rainfall, peak intensity rainfall, peak flow, and total flow. All of these factors were independently compared to trash volume data using linear regression statistical analyses (Table SC-3). Despite very small sample sizes (n=2,3), at least one of the three variables (maximum rainfall intensity, peak flow and total flow) showed moderate correlation with trash volume for at least one of the sites. Each of these variables was independently used to estimate annual trash loads.

Initial analyses included samples collected during first seasonal flush; however, these samples typically showed unusually large volumes of trash associated with lower flows. This pattern likely reflects the wash-off of trash that accumulated over the entire dry season, rather than conditions representative of storms later in the wet season. Because this carryover effect could bias the relationship between the explanatory variables and trash volume, first-flush data were excluded from subsequent linear regression analyses.

Partial sampling events, which typically occurred during larger storms when nets detached, had lower volumes of trash than would be expected. Flow data indicates that water is backed up into the pipe when nets are full of trash and debris. Trash is likely present in the pipe when water backs up and probably is not captured in the net before the detachment occurs. For this reason, one partial sample was excluded in the data analysis for both site SC-SFC and site SC-STE. An exception was made for the two partial samples collected at site SC-COY in WY 2025, since these represented 50% of the data to estimate trash load over the two years of monitoring.

The equations for the linear regression lines[25] were used to provide a very preliminary estimate of trash loading for each storm event, excluding first flush storms. Linear regression plots for three variables (max rainfall intensity, peak flow and total flow) and trash volume data for each site are shown in Figures SC-23 through SC-25. The 90% confidence intervals for the regression line are shown in each plot.

[25] Each regression line was set to have zero y-intercept based on the assumption that base flow during dry conditions (i.e., non-storm flows) would produce zero trash volume.

Table SC-3. Summary statistics for comparison between trash volume and explanatory variables using linear regression

Sample Location	SC-SFC (n=3)				SC-STE (n=2)				SC-COY (n=4)			
Explanatory Variable	r^2	*p* value	Linear Coefficient	Intercept	r^2	*p* value	Linear Coefficient	Intercept	r^2	*p* value	Linear Coefficient	Intercept
Sample Duration (hours)	0.19	0.56	0.0005	0.014	0.99	0.05	0.0004	-0.001	0.38	0.27	0.0002	0.008
Antecedent Dry (days)	0.20	0.55	0.002	0.018	0.09	0.80	0.001	0.01	0.25	0.40	0.0006	0.013
Total Rain (inch)	0.42	0.35	0.02	0.011	0.96	0.1	0.03	-0.003	0.37	0.28	0.01	0.007
Maximum Rain Intensity (in/hr)	0.49	0.30	0.10	0.005	0.48	0.5	0.1	0.000	0.42	0.23	0.06	0.005
Peak Flow (cfs)	0.79	0.11	0.002	0.009	0.43	0.5	0.01	0.001	0.25	0.40	0.0002	0.011
Total Flow (cfs)	0.60	0.22	2.6E-07	0.010	1.00	0.02	3.6E-07	-0.0005	0.19	0.46	1.73E-08	0.012

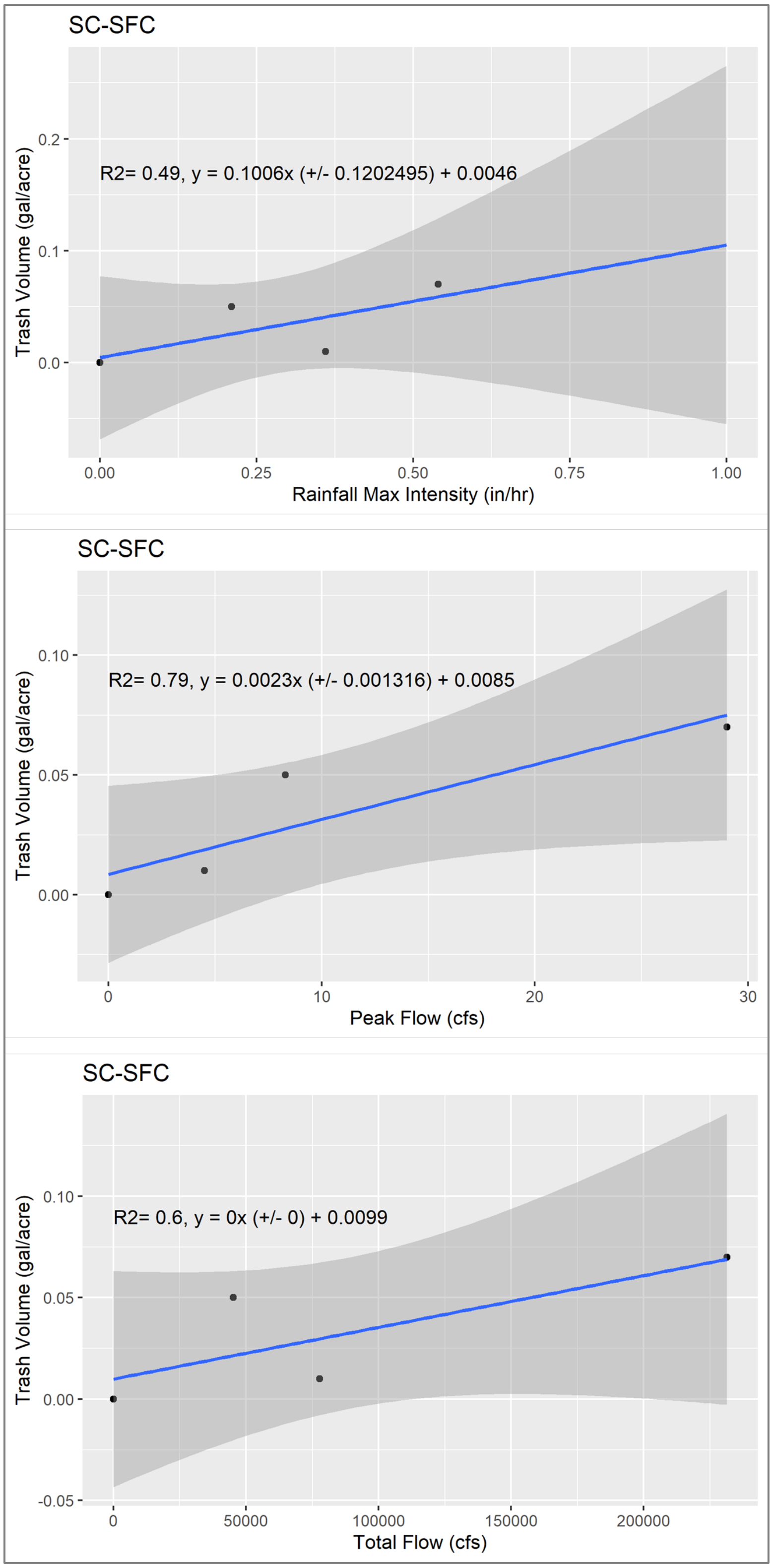


Figure SC-23. Comparison of peak flow and trash volume data collected at site SC-SFC for two years of monitoring

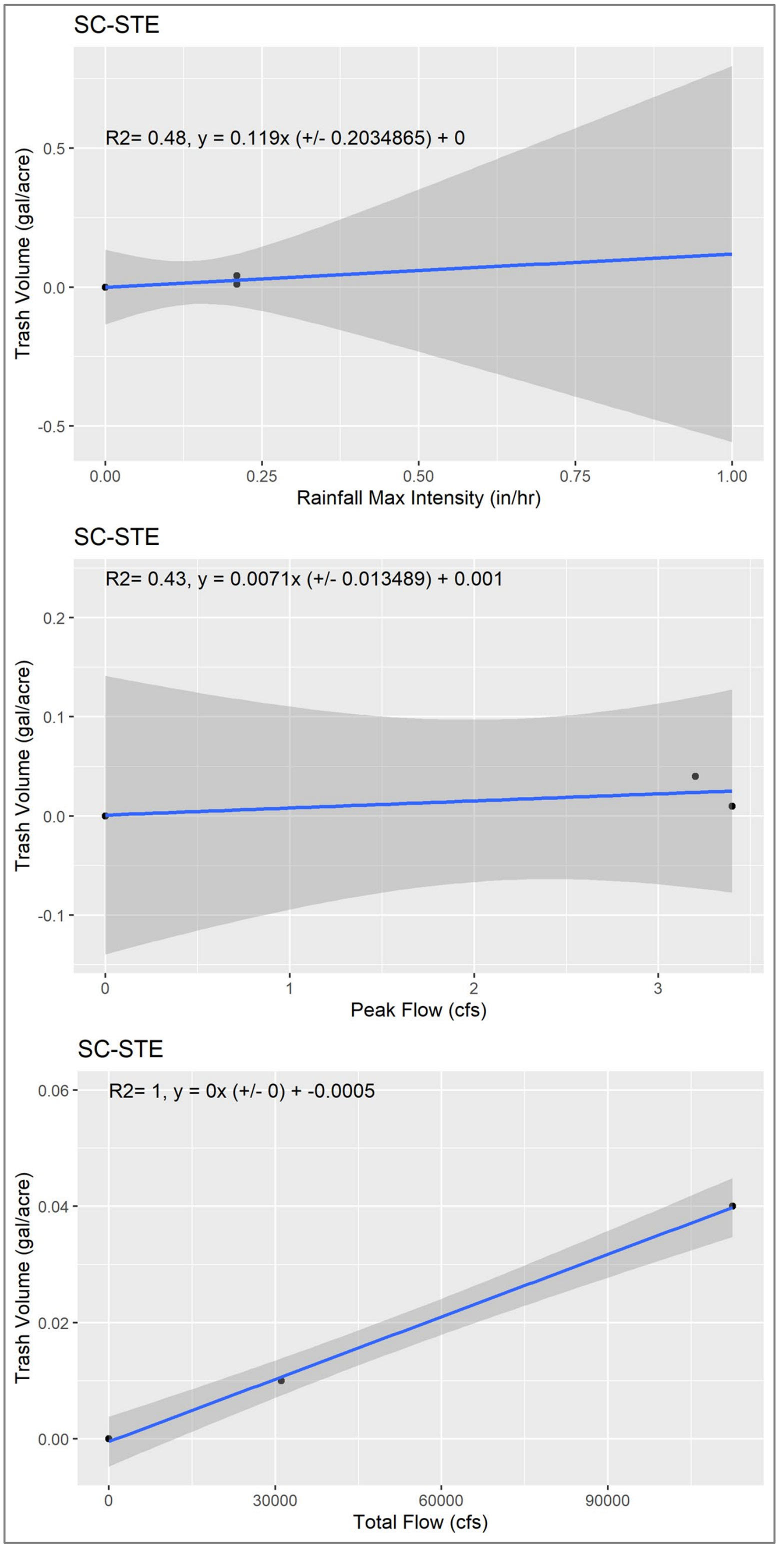


Figure SC-24. Comparison of peak flow and trash volume data collected at site SC-STE for two years of monitoring

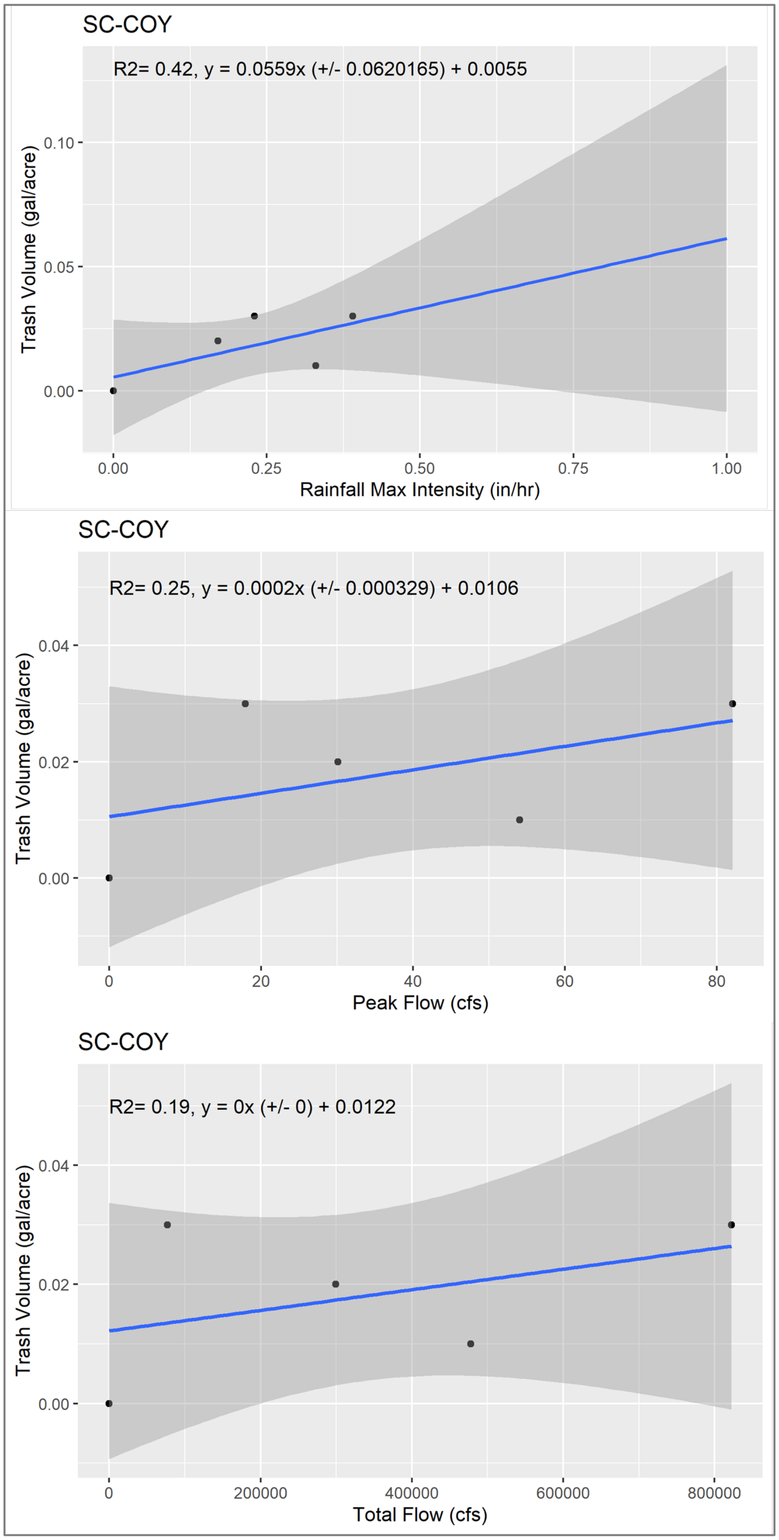


Figure SC-25. Comparison of peak flow and trash volume data collected at site SC-COY for two years of monitoring

The sum of the predicted and observed trash volumes for each non first seasonal flush storm was then combined with the observed volume of trash collected during the first seasonal flush event in each WY to estimate the total annual load of trash discharged from each outfall (Table SC-4).

Estimated trash loads (excluding first seasonal flush) for the three variables used to predict trash volumes ranged from 0.12 to 0.51 gallons/acre for maximum rainfall intensity; 0.29 to 1.5 gallons/acre for peak flow; and 0.27 to 0.58 gallons/acre for total flow. The estimated trash loads were generally higher for all variables during WY 24 compared to WY 25, with the exception for peak and total flow variables for site SC-STE. There were approximately 30% more storms in WY 24 compared to WY 25 (Appendix SC-A). The low and high estimates of the annual trash load, based on 90% confidence intervals for the linear regression line, combined with load from first seasonal flush, are presented for all sites and WYs in Table SC-5.

Annual trash loads were also calculated by applying the average trash volume for sampled events equally to each storm event identified for each WY (Table SC-4). This was the simple method used to calculate annual load in Annual Progress Report for WY 2024 (BAMSC 2025). For site SC-SFC, an average trash volume of 0.09 gallons/acre were applied to 27 storms in WY 2024 and 19 storms in WY 2025. For site SC-STE, an average trash volume of 0.04 gallons/acre were applied to 24 storms in WY 2024 and 17 storms in WY 2025. For site SC-COY, an average trash volume of 0.02 gallons/acre were applied to 26 storms in WY 2024 and 16 storms in WY 2025.

Table SC-4. Estimated annual trash load for the three outfall monitoring sites in Santa Clara County during WYs 24 and 25

Site	Monitoring Year	Total Load from First Flush (gal/acre)	Explanatory Variable						Annual Load – Average Trash Volume
			Maximum Rainfall Intensity (inch/hr)		Peak Flow (cfs)		Total Flow (cf)		
			Total Load from Remaining Storms	Annual Load	Total Load from Remaining Storms	Annual Load	Total Load from Remaining Storms	Annual Load	
SC-SFC	WY 2024	0.21	0.17	0.38	0.76	0.97	0.51	0.72	2.43
	WY 2025	0.09	0.12	0.21	0.46	0.55	0.41	0.50	1.71
SC-STE	WY2024	0.12	0.51	0.63	1.01	1.13	0.41	0.53	0.96
	WY 2025	0.12	0.33	0.45	1.50	1.62	0.58	0.70	0.68
SC-COY	WY 2024	0.03	0.48	0.51	0.34	0.37	0.34	0.37	0.52
	WY 2025	0.03	0.25	0.28	0.29	0.32	0.27	0.30	0.32

Table SC-5. Annual trash load, including load for first seasonal flush events, for all three sites for both years of monitoring

Site	Monitoring Year	Maximum Intensity (in/hr) - Estimated Annual Trash Load (gal/acre)			Peak Flow (cfs) - Estimated Annual Trash Load (gal/acre)			Total Flow (cf) - Estimated Annual Trash Load (gal/acre)		
		Best	Low[1]	High[1]	Best	Low[1]	High[1]	Best	Low[1]	High[1]
SC-SFC	WY 2024	**0.38**	0.22	1.46	**0.97**	0.64	1.31	**0.72**	0.60	0.96
	WY 2025	**0.21**	0.12	0.93	**0.55**	0.36	0.73	**0.50**	0.40	0.72
SC-STE	WY2024	**0.63**	0.12	1.64	**1.13**	0.12	3.07	**0.53**	0.46	0.58
	WY 2025	**0.45**	0.12	1.11	**1.62**	0.12	4.54	**0.70**	0.60	0.76
SC-COY	WY 2024	**0.51**	0.10	0.85	**0.37**	0.27	0.48	**0.37**	0.29	0.46
	WY 2025	**0.28**	0.08	0.46	**0.32**	0.15	0.50	**0.30**	0.15	0.49

1 Low and high estimates represent 90% confidence interval of the regression line.

Additional multivariate statistical analyses that evaluate the influence of multiple factors on trash volume will be considered in subsequent years as more data becomes available. Additional trash volume data is needed from under-represented storms (e.g., smaller storms, storms with range of antecedent dry periods) to better explore the relationship between factors (e.g., peak flow and antecedent dry) and their influence on trash volumes.

B4.3 Investigation of Trash Generation

This section describes visual observations to document trash generation within the monitored outfall catchment prior to each monitoring season. It is important to note that trash observed during the assessment represents a snapshot in time and may have considerable variation over time. However, observed trash levels can provide additional context for determining if existing trash controls are effective at reducing trash discharge through the MS4. Existing trash management actions within each catchment are summarized in the following section.

B4.3.1 Catchment Assessments

Visual observations of trash in the catchment areas for the three trash outfall monitoring sites were conducted in September, prior to the beginning of each WY. Descriptions of the catchment areas are provided above in Section B3.1. Summaries of trash observations made during windshield surveys conducted in September 2024 and 2025 are provided below. The summaries include type and location of trash observed during each survey. Areas with minimal or no trash in the catchment were also noted. The locations of observed trash were mapped to determine if existing trash controls would likely prevent the observed trash from discharging into the storm drain. A summary of the levels of trash observed in relation to existing trash management controls for each catchment are described below.

Site SC-SFC

The trash survey focused on two main areas of the catchment area: 1) the Stanford shopping center, including parking lots, catch basins, dumpsters and adjacent landscaping; and 2) sidewalks/curbs and adjacent landscaped areas along Sand Hill Road and El Camino Real. Trash observations were also made in the vicinity of the outfall (downstream of the catchment area).

In general, minimal trash was observed in the shopping center. Some trash items (e.g., single use food and beverage ware waste) were observed scattered throughout the parking lot area

(Table SC-6 and Figure SC-26). Paper and small plastic items were observed in catch basins and in the landscaped areas. Some trash items were observed adjacent to dumpsters. Although there are no FTC controls in the catchment drainage area, trash controls are implemented by the property owner. Trash is picked up throughout the property seven days per week and catch basins are cleaned out twice a year (Pam Boyle, City of Palo Alto, personal communication). The City of Palo Alto conducts regular inspections of the shopping center as part of the PLDA program.

Trash surveys were also conducted along the sidewalk, curbs and landscaped areas along Sand Hill Road and El Camino Real. In general, there was minimal trash observed along the public right of way. Trash was observed along fence line of a construction site at the northeast corner of the Stanford Shopping Center (Table SC-6). Some trash was observed in the median strip of Sand Hill Road. This area is treated with FTC controls.

There was no trash observed directly below the outfall. Pile of clothing was observed in the creek below the concrete landing of the outfall (Table SC-6).

Table SC-6. Trash assessment in catchment for site SC-SFC, in the City of Palo Alto, during WY 2025

Location and Type of Trash	Latitude, Longitude	Photos
Single use food and beverage ware in parking lot of Stanford Shopping Center	37.44443, -122.17279	
Trash accumulation in catch basin located in parking lot adjacent to RH in the Stanford Shopping Center.	37.44469, -122.17244	
Single use food and beverage ware in landscaped areas of Stanford Shopping Center	37.44416, -122.16855	

Location and Type of Trash	Latitude, Longitude	Photos
Trash observed near dumpsters at Stanford Shopping Center	37.44466, -122.17061	
Littered trash (fast food waste, wrappers, paper) along fence line to construction site at Stanford Shopping Center	37.44561, -122.17170	
No trash observed on concrete landing below outfall; clothes pile dumped below the landing on bottom of creek.	37.44610, -122.17248	

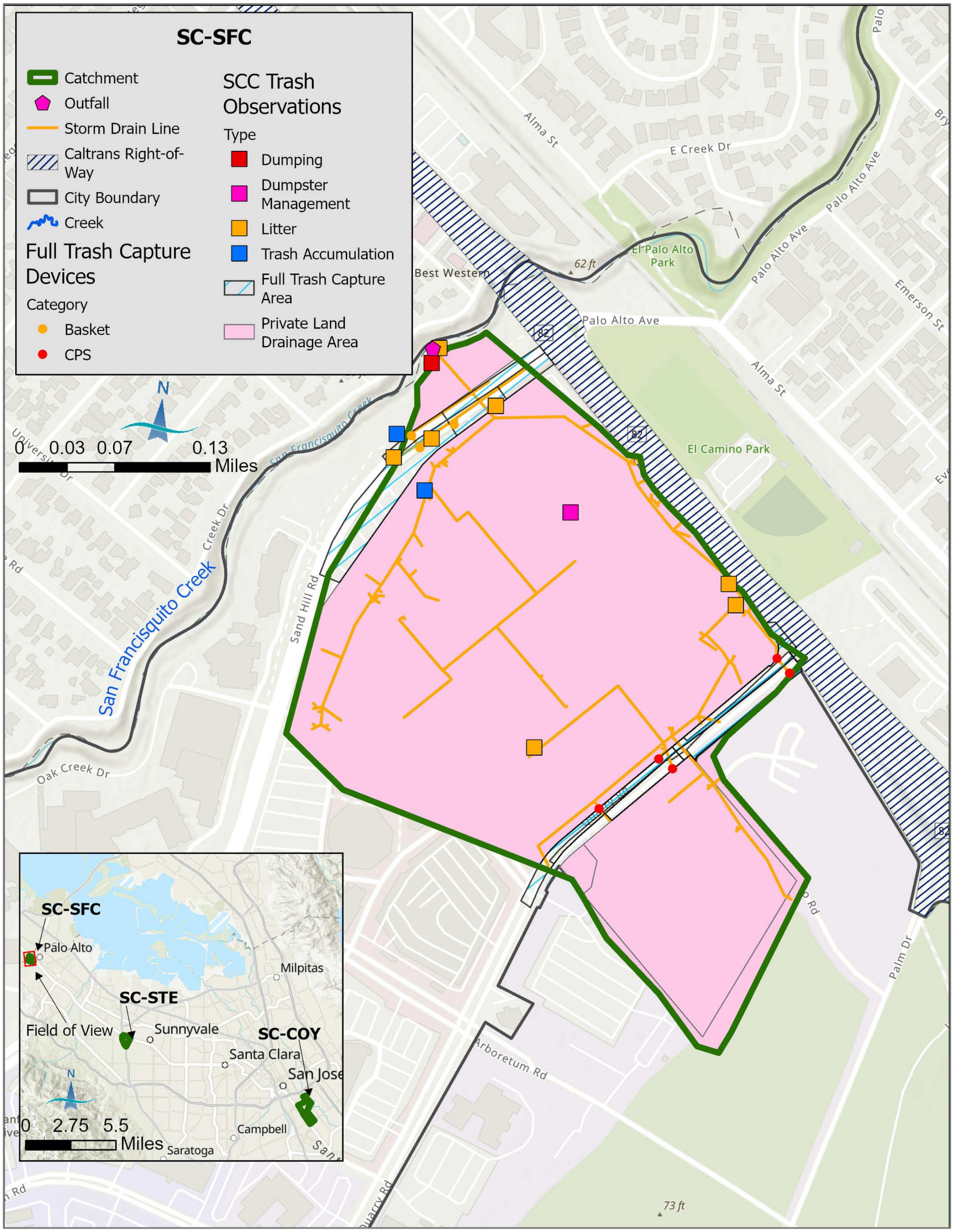


Figure SC-26. Trash sources identified in the City of Palo Alto, during trash assessment on September 2025 in the catchment drainage area of site SC-SFC

Site SC-STE

The trash survey focused on three main catchment areas: 1) commercial area along the south portion of El Camino Real (between Highway 85 and Knickerbocker Dr), which includes parking lots and dumpsters associated with Best Buy, Goodwill and a few restaurant businesses; 2) section of Continental Circle, along sound wall for Highway 85, which historically was used for RV parking; and 3) multi-family residential area, which makes up most of the catchment area, east and west of Dale Drive. Trash observations were also made in the vicinity of the outfall (downstream of the catchment area).

Overall, there was minimal trash observed in the catchment. Styrofoam packing material was observed near the dumpster behind Best Buy (Table SC-7). Some trash was observed along the sidewalk and curb in front of Goodwill. A small amount of trash was observed in the catch basin at the corner of Dale and El Camino. The areas along El Camino Real that are adjacent to Palo Alto Medical Center and apartments at Crestview are treated with FTC controls (Figure SC-27). The remaining areas along El Camino are cleaned by private property owners and inspected by the City of Mountain View as part of the PLDA program.

There was minimal trash observed in the remaining areas of the catchment, which are primarily residential. There was evidence of some litter and dumping along the sound wall of Continental Circle. No RVs were observed on the street. The remaining area is primarily multi-family residential properties that appeared to be well maintained; no trash was observed at dumpster areas or along sidewalks.

Some trash was observed at the outfall location of site SC-STE (Table SC-7 and Figure SC-27). The majority of the trash (plastic food wrappers, straw plastic bags) appeared to be unworn and clean, indicating that the source was from littering from people using the bike path at the top of bank (i.e., not transported via storm drain). Although there is a trash receptacle on the bike path close to the outfall, there were several plastic and paper cups observed along the top of bank. Larger trash items (e.g., clothing) in the dry creek bed near the outfall were documented; these trash items may have originated from people living in nearby homeless encampments under El Camino Real bridge, located about 100 meters downstream of the outfall.

Table SC-7. Trash assessment in catchment for site SC-STE in the City of Mountain View during WY 2025

Location and Type of Trash	Latitude, Longitude	Photos
Styrofoam pieces near dumpster behind Best Buy.	37.37489, -122.06334	
Litter/dumping adjacent to Goodwill on sidewalk/gutter of El Camino Real.	37.375565, -122.061114	
Trash in catch basin on corner of Dale and El Camino Real.	37.37590, -122.06216	
Littered trash below outfall (food wrappers, straw, plastic bags, clothing) that appears to be from pedestrian pathway at top of bank. Litter observed at top of bank (fast food waste) and dumping (homeless) adjacent to path.	37.37815, -122.06934	

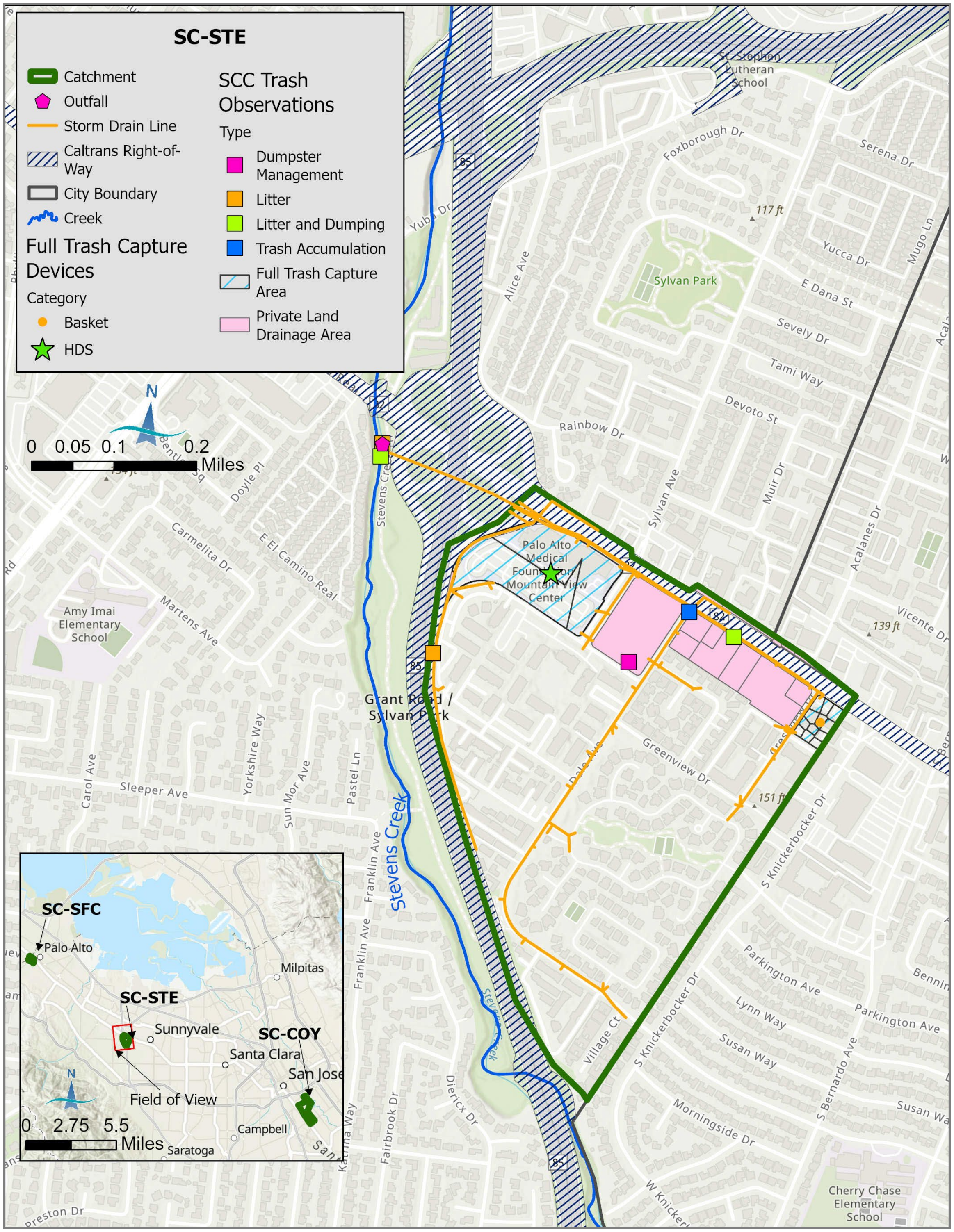


Figure SC-27. Trash sources identified in the City of Mountain View, during trash assessment on September 2025 in the catchment drainage area of site SC-STE

Site SC-COY

Trash observations during the windshield survey focused on three main catchment areas: 1) the industrial/commercial area bordered by S 7th Street and S 10th Street (west to east) and E Alma Avenue and Phelan Avenue (north to south); 2) S 7th Street south of Phelan Avenue to the edge of the catchment boundary at Tully Dr; 3) mixed land use area bordered by S 10th Street and Senter Road (west to east) and E Alma Avenue and Phelan Avenue.

Moderate to high levels of trash, primarily from dumping, were observed along the west side of S 7th Street along a section of the street with cement barricades (north of Valley Recycling) and between parked cars and bushes (north of Phelan Av) (Table SC-8 and Figure SC-28). There are no FTC controls in this portion of the catchment. The City of San Jose conducts inspections at businesses in this area to ensure trash management controls are implemented as part of the PLDA program. In addition, it is possible that much of the trash along S 7th Street may not get transported to the MS4 due to absence of curbs and gutters, with few catch basins.

There were also moderate to high levels of trash observed along section of S 7th Street between Phelan and Tully Road. Trash was observed along the curb and sidewalks adjacent to parked RVs, and various dumping locations (e.g., corner of Leo Av) (Table SC-8 and Figure SC-28). This portion of the catchment is treated by FTC controls.

There was minimal trash observed along S 10th Street or Senter Road. This area contains includes Excite Ballpark, Sharks Ice and San Jose Corporation Yard. The City of San Jose conducts inspections at businesses in this area to ensure trash management controls are implemented as part of the PLDA program. The City Parks and Recreation Department routinely picks up trash in Kelly Park.

A high level of trash was observed at the outfall and downstream areas of Coyote Creek. An accumulation of plastic trash items (e.g., food wrappers, bags and bottles) was observed within the flow path downstream of the outfall (Table SC-8 and Figure SC-28). Additional littered and dumped trash was seen scattered on the bank around the outfall. A large amount of trash (e.g., tarps, fabric) was observed at a homeless encampment located on the opposite bank from the outfall. Despite the presence of a chain link fence at the top of the bank, the outfall appears to provide access for people travelling between the encampment and nearby park facilities (e.g., picnic tables, bathrooms).

Table SC-8. Trash assessment in catchment for site SC-COY, in the City of San Jose, during WY 2025

Observations During Survey	Latitude, Longitude	Photos
Litter and dumping of trash at 1555 South 7th Street (facing north); trash mostly between fence and barricades	37.316568, -121.867499	
Litter and dumping at 1695 South 7th Street (north of Phelan Avenue); fast food waste, plastic bags between parked cars and bushes.	37.313962, -121.865639	
Dumping on corner of 7th Street and Leo Av	37.31161, -121.86303	

Observations During Survey	Latitude, Longitude	Photos
Trash dumped near RV campers on 7th St	37.30880, -121.85993	
Accumulation of plastic trash items (food wrappers, bags and bottles) and Styrofoam below outfall. Some trash items looked worn, suggesting they came from outfall. Other trash appears to be from litter.	37. 32246, -121.86009	
Litter and dumped trash items (fabric, tarps, bags) on opposite bank at illegal encampment. Littered and dumped trash items (food wrappers, paper, fabric) on bank around outfall.	37. 32246, -121.86009	

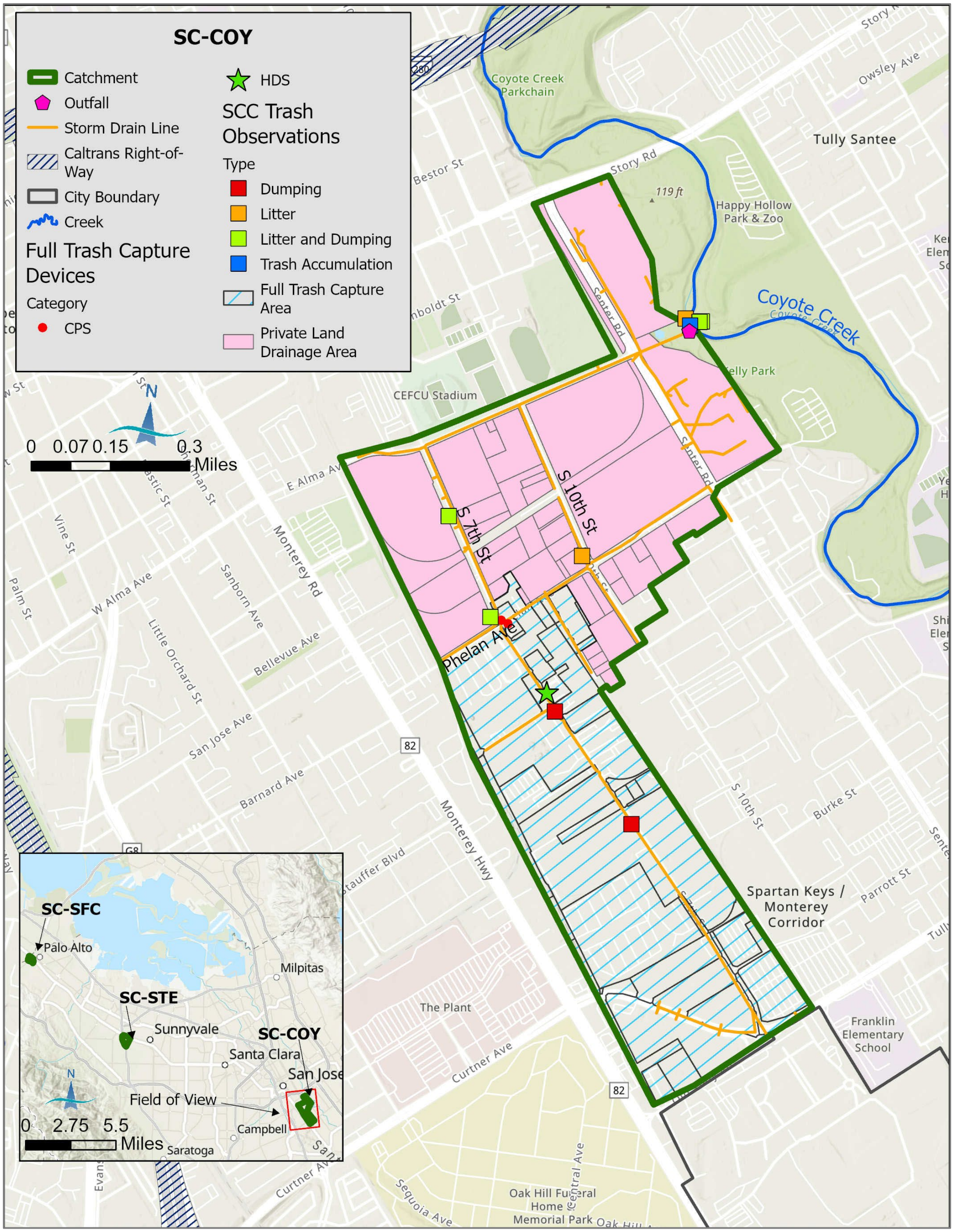


Figure SC-28. Trash sources identified in the City of San Jose during trash assessment on September 2025 in the catchment drainage area of site SC-COY

B4.3.2 Trash Management Actions

Operations and maintenance records (where available) for full trash capture devices and other trash controls implemented in the monitored catchments are summarized in Table SC-9.

Table SC-9. Summary of operations and maintenance activities associated with full trash capture and other controls implemented in catchments for outfall monitoring sites

Monitored Catchment	Full Trash Capture	Private Land Development Area Program (Acres)	Other Controls
SC-COY	CDS cleaned three times during WY 2025; inspected monthly. Cleaned on 08/29/24, 03/07/25 and 05/14/25; estimated volume of debris removed was 10.6, 13.4 and 9.7 cu yd; 10% of debris was trash. CPS on 7th and Phelan inspected on 11/6/25 and 05/08/25; cleaned on 10/11/24. Two new devices installed on 03/24/25.	107	– Improved bin container management – Enhanced street sweeping (2x/month) – On-land clean ups – Public Education – Trash Inspection Program – Smoking Ordinance – Encampment Management – Park Ranger Patrol – Free Junk Pickup
SC-STE	Private CDS and DVS systems (Palo Alto Medical Foundation) inspected and cleaned on 08/22/23, 08/14/24 and 08/06/25.	11.5	– Improved bin container management – Enhanced street sweeping (2x/month) – On-land clean ups – Partial Capture
SC-SFC	NA	55.4	– Daily trash pickup – Catch basin cleaned out 2x/year – Improved bin container management – Trash Inspection Program – On-land clean ups

LID = low impact development

B4.4 Refinements

The following refinements to trash outfall monitoring were implemented in Santa Clara County prior to WY 2025.

Flow Measurements

- Field measurements will be collected at each of the three trash outfall sites to verify pipe dimensions and slope data obtained from construction drawings. Field measurements will include measuring water depths at depth sensor location in the pipe during a storm event. Field data will be used to calibrate water depths measured using the sensor. Water velocities will also be measured synoptically with depth measurements.
- Larger trash nets will be procured and installed at sites SC-STE and SC-COY to increase surface area for flow to pass through net during each sampling event. Increased flow through the net should help to reduce the amount of water that is backed up into the pipe when the net is attached to the outfall.

APPENDIX SC:
WY 2024 AND WY 2025 STORM EVENT SUMMARIES

Table SC-10. Summary of storm characteristics and sample information at site SC-SFC during WY 2024 and WY 2025

Storm Began	Storm Finished	Sample Duration (hrs)[1]	Antecedent Dry (days)	Precipitation Total (in)	Maximum Intensity (in/hr)	Peak Flow (cfs)[2]	Total Flow (cf)[2]	Sample Event[2]	First Seasonal Flush	Partial Sample	Exceed Maximum Rainfall for Design Storm[4]	Exceed Peak Flow for Design Storm[5]	Trash Volume (gal/acre)	Comment
WY 2024 (27 storms total)														
11/17/23	11/18/23	6	> 47.9	0.3	0.20	3.9	10,864	1	X				0.21	
11/28/23	11/29/23	6	10.8	0.1	0.10	0.9	1,087							
12/17/23	12/20/23	59	18.8	1.8	0.25	29.2	121,849					X		
12/27/23	12/27/23	6	7.2	0.1	0.07	0.0	0							
12/29/23	12/30/23	22	1.6	1.2	0.27	18.7	165,002					X		
01/02/24	01/03/24	11	3.2	0.6	0.19	14.5	60,526							
01/06/24	01/06/24	6	3.4	0.1	0.11	3.8	7,709							
01/10/24	01/10/24	7	3.6	0.1	0.04	0.6	3,352							
01/13/24	01/14/24	6	3.2	0.2	0.10	1.9	10,446							
01/16/24	01/16/24	6	2.7	0.3	0.11	2.8	18,926							
01/20/24	01/20/24	6	3.2	0.1	0.07	2.2	7,089							
01/21/24	01/22/24	15	1.4	1.9	0.71	44.4	173,952	4			X	X	0.03	
01/24/24	01/24/24	8	1.6	0.6	0.42	12.2	27,240				X			
01/31/24	02/05/24	113	7.1	3.3	0.19	4.5	147,378	5					0.01	
02/07/24	02/07/24	6	2.2	0.4	0.21	5.4	11,079							
02/14/24	02/14/24	6	7.0	0.2	0.14	0.9	2,673							
02/17/24	02/20/24	72	2.8	1.6	0.37	15.8	54,779				X			
02/29/24	03/02/24	53	9.1	1.4	0.21	6.1	49,510							
03/06/24	03/06/24	8	3.4	0.3	0.21	9.1	21,853							
03/11/24	03/11/24	6	4.4	0.4	0.23	9.2	23,143							
03/22/24	03/24/24	32	11.5	0.7	0.18	4.8	29,927							
03/27/24	03/28/24	6	3.7	0.2	0.12	3.6	7,199							
03/29/24	03/29/24	7	1.2	0.3	0.23	7.2	17,717							
03/30/24	03/31/24	6	1.1	0.3	0.31	36.4	36,283					X		
04/04/24	04/04/24	16	4.3	0.7	0.20	4.2	26,180							
04/13/24	04/14/24	22	8.2	0.3	0.13	0.2	434							

Storm Began	Storm Finished	Sample Duration (hrs)[1]	Antecedent Dry (days)	Precipitation Total (in)	Maximum Intensity (in/hr)	Peak Flow (cfs)[2]	Total Flow (cf)[2]	Sample Event[2]	First Seasonal Flush	Partial Sample	Exceed Maximum Rainfall for Design Storm[4]	Exceed Peak Flow for Design Storm[5]	Trash Volume (gal/acre)	Comment
05/04/24	05/04/24	6	20.3	0.8	0.26	10.0	49,678							
WY 2025 (19 storms total)														
11/11/24	11/12/24	30	> 41.2	0.4	0.22	2.3	7,149	8	X				0.09	
11/22/24	11/23/24	35	10	1.2	0.24	11.0	100,055							
11/25/24	11/26/24	22	1.3	0.5	0.09	3.0	29,140							
12/12/24	12/13/24	40	15.9	0.6	0.21	8.3	45,333	9					0.05	
12/13/24	12/15/24	36	0.2	2.2	0.71	23.9	158,238				X	X		
12/16/24	12/17/24	29	0.9	0.2	0.09	2.6	12,437							
12/22/24	12/23/24	25	5.4	0.1	0.06	0.3	224							
12/23/24	12/25/24	34	0	0.4	0.13	11.7	42,046							
12/26/24	12/28/24	35	1.4	0.5	0.11	3.3	35,455							
12/29/24	12/30/24	27	1.1	0.2	0.10	3.0	14,453							
01/03/25	01/04/25	26	3.8	0.1	0.06	0.4	2,592							
01/31/25	02/03/25	68	27.2	0.1	0.03	0.7	8,591							
02/03/25	02/05/25	44	0.5	1.3	0.39	17.0	129,472				X	X		
02/06/25	02/07/25	31	0.5	0.5	0.17	3.8	18,736							
02/12/25	02/14/25	52	5.2	2.8	0.54	29.0	230,966	11			X	X	0.07	
03/01/25	03/03/25	34	14.9	0.1	0.03	0.4	1,255							
03/12/25	03/15/25	71	9.1	1.3	0.23	8.1	64,610							
03/16/25	03/18/25	28	1.5	0.2	0.07	5.3	24,485							
03/31/25	04/02/25	57	13.1	0.7	0.16	0.8	6,682							

1 Sample Duration is defined as period net is attached to outfall during storm event.
2 Peak and total flows were based on field measurements (note modeled peak/total flows were used for sampled storm events).
3 Sample Event described in Section B1.2.1 and Table SC-1.
4 Based on NOAA Precipitation Frequency Data Server (https://hdsc.nws.noaa.gov/hdsc/pfds/).
5 Based on Peak flow calculations using the Rational Method (Attachment A of IMR report)

Table SC-11. Summary of storm characteristics and sample information at site SC-STE during WY 2024 and WY 2025

Storm Began	Storm Finished	Sample Duration (hrs)[1]	Antecedent Dry (days)	Rainfall Total (in)	Maximum Rainfall Intensity (in/hr)	Peak Flow (cfs)[2]	Total Flow (cfs)[2]	Sample Event[3]	First Flush	Exceed Maximum Rainfall for Design Storm[4]	Exceed Peak Flow for Design Storm[5]	Trash Volume (gal/acre)	Comment
WY 2024 (24 storms total)													
11/05/23	11/05/23	NS	> 30	0.07	0.06	NR	NR		X			0.02	Estimated volume
11/17/23	11/18/23	14.9	12	0.3	0.12	1.6	6,235	1	X			0.09	
12/18/23	12/20/23	54.5	30	2.4	0.48	12.9	108,151			X			
12/29/23	12/30/23	19.5	9.3	1.3	0.24	4.1	67,355	3					Disqualified sample event
01/02/24	01/03/24	6.0	3.2	0.3	0.17	2.7	5,424						
01/10/24	01/10/24	6.0	7.4	0.3	0.16	2.6	9,698						
01/13/24	01/14/24	6.0	3.2	0.2	0.08	0.5	1,922						
01/16/24	01/17/24	6.0	2.7	0.1	0.05	0.3	2,678						
01/19/24	01/20/24	6.0	2.9	0.1	0.11	1.5	4,161						
01/21/24	01/22/24	8.7	1.6	0.8	0.30	10.0	38,463	4				0.004	Partial sample
01/24/24	01/24/24	7.5	1.9	0.6	0.43	4.5	9,128			X			
01/31/24	02/02/24	42.8	7.2	2.1	0.45	12.5	123,115	5		X			Disqualified sample event
02/03/24	02/05/24	37.8	1.4	2.4	0.38	27.3	335,828			X			
02/07/24	02/07/24	6.0	2	0.5	0.26	16.4	64,944						
02/14/24	02/14/24	6.0	7	0.2	0.17	8.0	8,695						
02/17/24	02/20/24	74.8	2.6	1.5	0.20	7.3	114,396						
02/29/24	03/02/24	58.6	8.9	1.1	0.19	3.2	87,594	6				0.04	
03/06/24	03/06/24	10.7	3.2	0.5	0.25	9.3	44,305						
03/11/24	03/11/24	6.0	4.6	0.1	0.11	0.3	3,896						
03/22/24	03/24/24	30.2	11.4	0.8	0.20	1.8	36,067						
03/29/24	03/29/24	8.6	5.2	0.5	0.23	4.1	24,064						
04/04/24	04/04/24	16.0	5.6	0.5	0.13	2.5	26,667						
04/13/24	04/14/24	24.8	8.2	0.4	0.11	1.9	19,657						
05/04/24	05/04/24	6.2	20.2	0.8	0.36	5.6	32,441			X			

Storm Began	Storm Finished	Sample Duration (hrs)[1]	Antecedent Dry (days)	Rainfall Total (in)	Maximum Rainfall Intensity (in/hr)	Peak Flow (cfs)[2]	Total Flow (cfs)[2]	Sample Event[3]	First Flush	Exceed Maximum Rainfall for Design Storm[4]	Exceed Peak Flow for Design Storm[5]	Trash Volume (gal/acre)	Comment
WY 2025 (17 storms total)													
11/02/24	11/02/24	10	> 32	<0.1	0.07	0.1	1,229	7	X			0.02	
11/11/24	11/12/24	27	9	0.4	0.22	2.9	15,259	8	X			0.09	Disqualified sample event; estimated sample volume
11/22/24	11/23/24	23	11	1.2	0.24	21.0	181,666						
11/25/24	11/26/24	35	3	0.5	0.09	2.1	73,170						
12/12/24	12/13/24	28	17	0.6	0.21	3.4	30,597	9				0.01	
12/13/24	12/14/24	21	2	2.2	0.71	73.0	379,542				X		
12/16/24	12/17/24	22	3	0.2	0.09	2.5	27,075						
12/24/24	12/24/24	15	8	0.4	0.13	8.3	50,557						
12/26/24	12/27/24	25	3	0.5	0.11	9.2	79,083						
12/29/24	12/29/24	12	3	0.2	0.10	2.7	19,881						
01/03/25	01/03/25	12	5	0.1	0.06	1.4	13,752						
02/04/25	02/05/25	39	32	1.3	0.39	19.7	110,162	10		X			Disqualified sample event
02/06/25	02/07/25	33	2	0.5	0.17	10.8	87,525						
02/12/25	02/14/25	41	7	2.8	0.54	38.9	374,602			X	X		
03/12/25	03/15/25	65	28	1.3	0.23	3.1	102,114	11					Disqualified sample event
03/16/25	03/18/25	28	4	0.2	0.07	1.7	27,759						
03/31/25	04/02/25	39	15	0.6	0.16	11.9	66,618						

1 Sample Duration is defined as period net is attached to outfall during storm event.
2 Peak and total flows were based on field measurements (note modeled peak/total flows were used for sampled storm events).
3 Sample Event described in Section B1.2.1 and Table SC-1.
4 Based on NOAA Precipitation Frequency Data Server (https://hdsc.nws.noaa.gov/hdsc/pfds/).
5 Based on Peak flow calculations using the Rational Method (Attachment A of IMR report)

Table SC-12. Summary of storm characteristics and sample information at site SC-COY during WY 2024 and WY 2025

Storm Began	Storm Finished	Sample Duration (hrs)[1]	Antecedent Dry (days)	Precipitation Total (in)	Max Intensity (in/hr)	Peak Flow (cfs)[2]	Total Flow (cfs)[2]	Sample Event[3]	First Flush	Exceed Max Rainfall for Design Storm[4]	Exceed Peak Flow for Design Storm[5]	Trash Volume	Comment
WY 2024 (26 storms total)													
11/18/23	11/18/23	6	> 48.2	0.3	0.21	2.2	14,744	1					Disqualified event
12/17/23	12/19/23	43	29	0.9	0.18	5.4	43,750	2				.03	
12/20/23	12/20/23	6	1	0.7	0.37	27.7	76,279			X			
12/29/23	12/30/23	9	9	0.8	0.21	8.8	78,858	3				.01	
01/02/24	01/03/24	6	4	0.4	0.24	11.3	25,138						
01/06/24	01/06/24	6	4	0.2	0.17	4.6	6,816						
01/10/24	01/10/24	6	4	0.1	0.06	0.4	747						
01/13/24	01/14/24	6	3	0.2	0.08	0.5	1,548						
01/16/24	01/17/24	6	3	0.2	0.10	1.2	4,896						
01/20/24	01/20/24	6	4	0.2	0.16	6.3	24,949						
01/21/24	01/22/24	14	1	1.0	0.27	17.9	269,541	4				.03	
01/24/24	01/24/24	8	2	0.6	0.39	18.9	20,107			X			
01/31/24	02/02/24	41	7	1.6	0.29	34.2	510,001						
02/03/24	02/05/24	35	1	1.8	0.22	20.3	404,946						
02/07/24	02/07/24	6	2	0.7	0.33	44.9	197,823			X			
02/14/24	02/14/24	8	7	0.2	0.19	21.7	51,258						
02/17/24	02/19/24	32	3	0.6	0.33	35.8	60,767			X			
02/20/24	02/20/24	6	2	0.2	0.16	7.8	14,854						
02/29/24	03/02/24	32	9	0.6	0.18	6.3	26,764						
03/06/24	03/06/24	6	4	0.7	0.25	17.5	84,790						
03/22/24	03/24/24	32	17	1.0	0.31	32.1	218,846						
03/27/24	03/28/24	6	4	0.1	0.09	2.6	0						
03/29/24	03/29/24	6	1	0.4	0.21	9.1	37,132						
04/04/24	04/04/24	15	5	0.5	0.17	7.4	28,212						
04/13/24	04/13/24	6	8	0.4	0.16	4.8	23,213						
05/04/24	05/04/24	7	21	1.2	0.45	0.0				X			

Storm Began	Storm Finished	Sample Duration (hrs)[1]	Antecedent Dry (days)	Precipitation Total (in)	Max Intensity (in/hr)	Peak Flow (cfs)[2]	Total Flow (cfs)[2]	Sample Event[3]	First Flush	Exceed Max Rainfall for Design Storm[4]	Exceed Peak Flow for Design Storm[5]	Trash Volume	Comment
WY 2025 (16 storms total)													
11/11/24	11/11/24	4	> 41.4	0.4	0.26	13.7	69,554	7	X			0.02	
11/22/24	11/24/24	36	11	0.8	0.23	59.6	269,458						
11/25/24	11/26/24	31	1	0.5	0.11	8.8	85,634						
12/12/24	12/13/24	29	16	0.6	0.18	14.5	117,187	10					Disqualified event
12/13/24	12/15/24	36	1	1.4	0.48	103.9	677,212			X	X		
12/16/24	12/17/24	26	1	0.1	0.07	2.6	42,524						
12/24/24	12/25/24	31	7	0.5	0.18	38.2	163,864						
12/26/24	12/27/24	29	1	0.4	0.10	12.7	85,526						
01/03/25	01/04/25	24	7	0.1	0.05	1.0	46,441						
02/04/25	02/05/25	34	31	0.9	0.29	80.0	440,042	11					Disqualified event
02/06/25	02/07/25	34	1	0.5	0.20	40.3	286,906						
02/12/25	02/14/25	47	5	1.7	0.26	123.5	1,559,010				X		
03/05/25	03/06/25	32	18	0.5	0.13	9.6	130,524						
03/12/25	03/14/25	52	6	1.4	0.17	30.1	292,601	12				0.02	
03/16/25	03/18/25	31	2	0.3	0.07	11.7	92,395						
03/31/25	04/02/25	47	14	0.5	0.10	28.4	210,071						

1 Sample Duration is defined as period net is attached to outfall during storm event.
2 Peak and total flows were based on field measurements (note modeled peak/total flows were used for sampled storm events).
3 Sample Event described in Section B1.2.1 and Table SC-1.
4 Based on NOAA Precipitation Frequency Data Server (https://hdsc.nws.noaa.gov/hdsc/pfds/).
5 Based on Peak flow calculations using the Rational Method (Attachment A of IMR report)

B5 SOLANO STORMWATER ALLIANCE (SSA)

B5.1 Introduction

Consistent with MRP 3.0 Provision C.8.e, SSA selected one MS4 monitoring location for trash outfall monitoring in WY 2024. The monitoring site (identified as SSA-LOTZ) is located at an Amtrak Park & Ride lot in Suisun City (Figure SSA-1).

This facility was envisioned to manage trash at what was identified as a high trash generating location but was also designed to incorporate green stormwater infrastructure components for the hydrological and water quality benefits. The proposed treatment retrofit is associated with an existing parking lot located between Lotz Way and Highway 12 in Suisun City. The Amtrak Park & Ride lot is located within Caltrans' right-of-way, and the project is being implemented in partnership with Caltrans District 4 through a cooperative implementation agreement.

The overall retrofit project design incorporates approximately 4,856 square feet at the eastern edge of the parking lot into a multi-benefit treatment system (MBTS). The upstream catchment to the monitoring location is approximately 4.3 acres and includes an asphalt parking lot, landscaping, and highway roadway, as shown in Figure SSA-2. The parking lot includes narrow landscaped islands between the parking bays and conventional drainage infrastructure, including curbs, gutters, and curb inlets, which will allow the runoff to flow into the MBTS. The parking lot slopes towards a drainage ditch on the eastern perimeter of the parking lot, with pre-project coverage of non-native grasses, bare earth, and rock, which will be retrofitted with a bioretention swale to slow and treat runoff from the parking lot and the offramp. The bioretention feature design is sized to meet both the full trash capture (one-year, one-hour storm event) and water quality (85% annual flow volume).

The trash monitoring device is located within the bioretention overflow, a 36-inch pipe situated at a low point near the eastern end of the MBTS. The monitoring device will be used to evaluate the effectiveness of the bioretention feature to prevent trash from entering downstream waterways up to and including the one-year, one-hour storm event (0.395 inch/hour[26]). A Fabco StormSack® filter bag is placed within the bioretention overflow pipe to capture any trash that bypasses the bioretention feature during monitored storm events.

Land use in the catchment area is identified as 75% commercial and 25% highway, though in practice the area comprises entirely transportation-related uses. Baseline trash generation rates are approximately 25% low and 75% high by area. There are no long-term homeless encampments identified within the catchment, although unhoused persons have been observed in the parking area and behind fencing (both areas that drain to the MBTS) on a consistent basis.

[26] NOAA Atlas. https://hdsc.nws.noaa.gov/pfds/pfds_map_cont.html?bkmrk=ca. Accessed Dec 13, 2024.

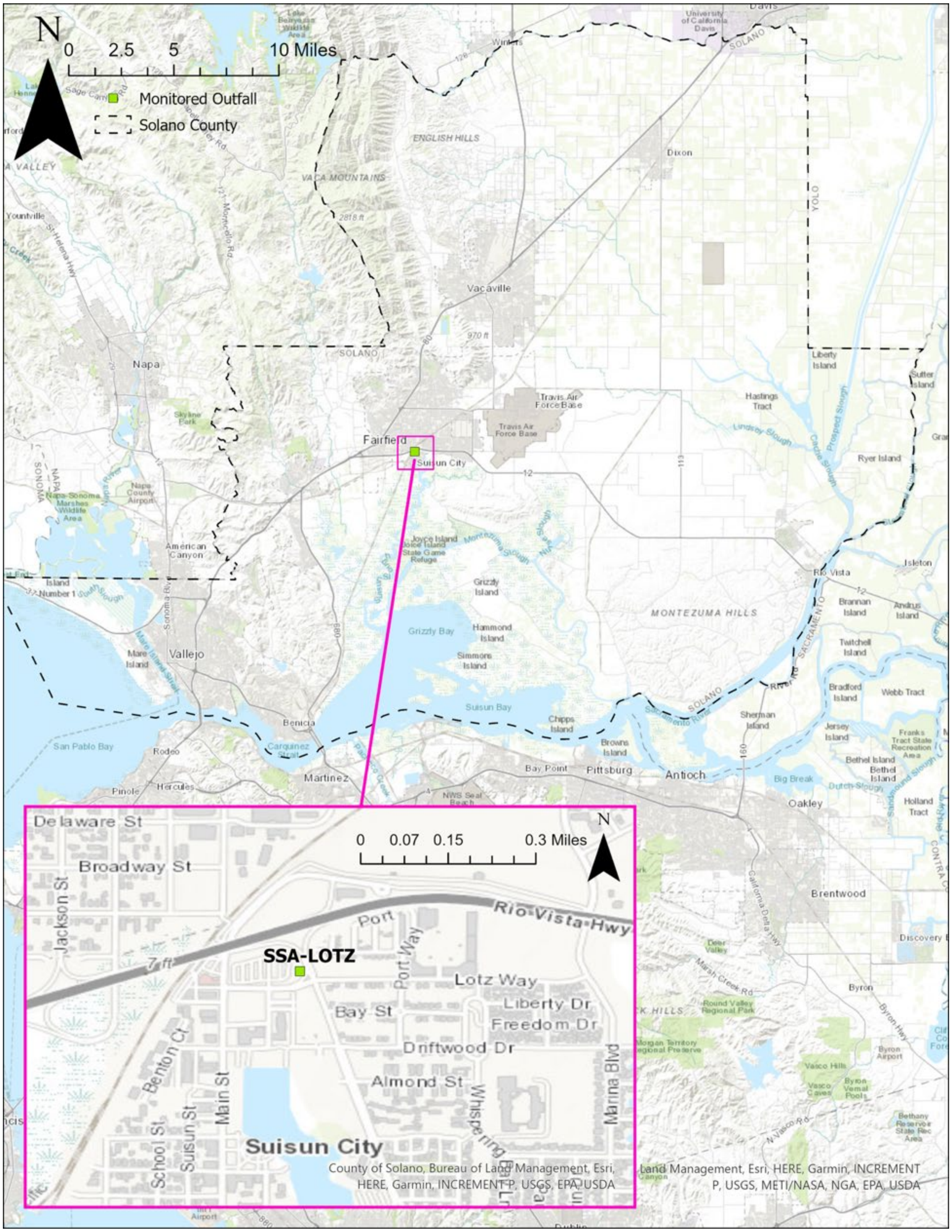


Figure SSA-2. Trash Outfall Monitoring Location SSA-LOTZ in Suisun County

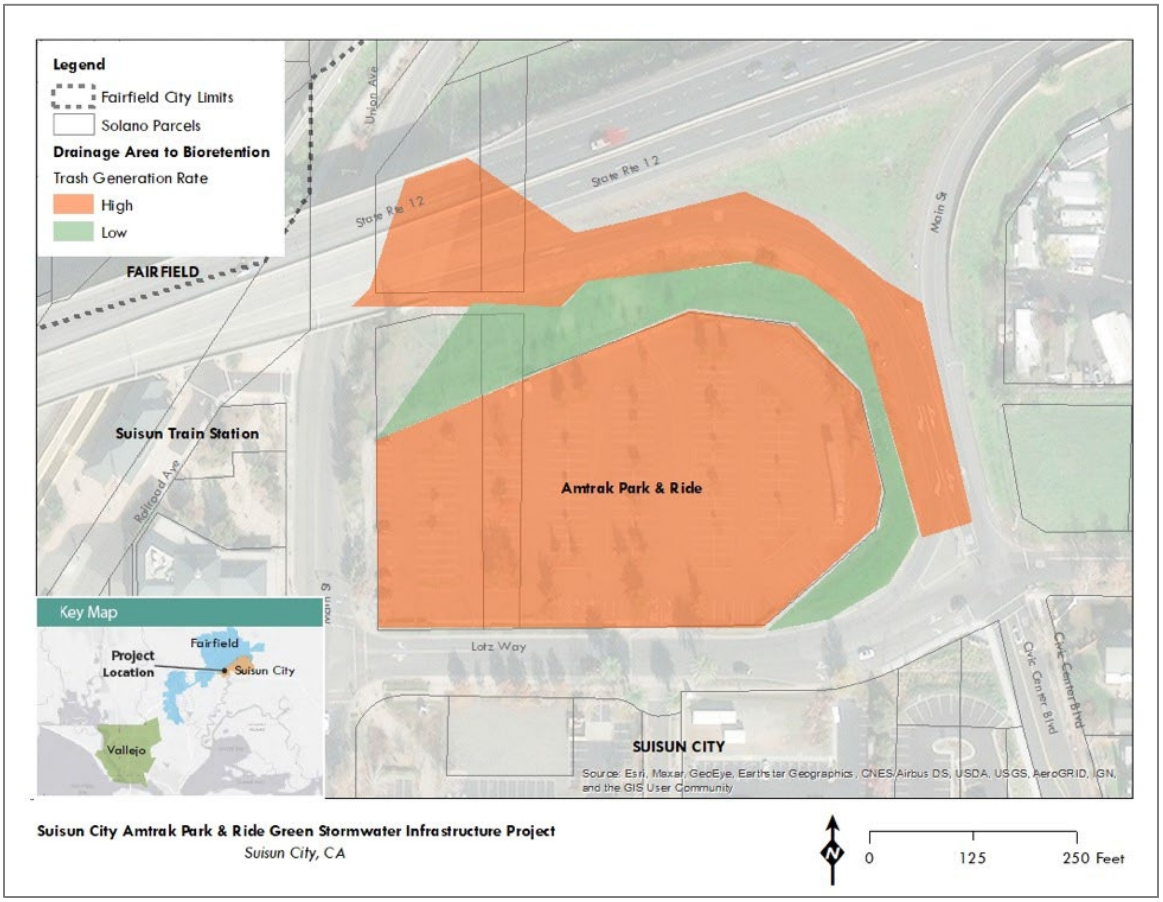


Figure SSA-2. Amtrak Park & Ride development located upstream of Suisun Slough, City of Suisun City with associated trash generation rates

Due to contracting and permitting delays, the construction of the MBTS was unable to be completed prior to the WY 2024 monitoring window. Construction was completed in October 2024 (Figure SSA-3), and WY 2025 monitoring proceeded beginning shortly thereafter.

Figure SSA-3. Amtrak Park & Ride MBTS overflow with trash capture net installed

B5.2 Results

B5.2.1 Sample Events

To make up for the delayed start to monitoring, in WY 2025, SSA targeted completion of up to six sampling events to put the Program on track to meet MRP 3 permit requirements.

The dates and times for net deployment and retrieval and the duration of sample collection for each successful sample event are presented in Table SSA-1. Summary statistics for rainfall and flow for each sample event are also provided. Additional results showing rainfall totals and flow measurements for each sample event, as well as over the entire wet season, are presented in Section B2.3 and Appendix SSA-A below.

WY 2025 Event 1

During the first sample event of the monitoring year, nets were deployed for a five-day period in late November (Table SSA-1), which represented the first significant storm event of the monitoring year. The forecast achieved the Monitoring Plan storm event selection criteria with a greater than 90% probability of >1 inch precipitation. The actual storm presented in two waves, separated by approximately 24 hours. Given that the prediction for the second front was much greater than the first, SSA made the decision to continue the monitoring event through the second front. Actual precipitation totaled 3.1 inches over the duration of deployment (November 21 through November 26), with a peak of 0.33 inch/hour as measured at an on-site weather station. Event 1 was preceded by more than 30 days of dry conditions. Samples were successfully collected following the conclusion of the storm system.

WY 2025 Event 2

For SSA monitoring event number two, a predicted storm for mid-December 2024 indicated a QPF of approximately 2.5 inches over six days with a probability greater than 90%. SSA deployed the trash capture net for the period December 10 through December 19, 2024 (Table SSA-1). The total precipitation for the extent of the storm was measured at 3.43 inches with a peak intensity of 0.69 inch/hour, above the predicted design storm intensity of 0.395 inch/hour. Rainfall extended from December 11 through December 16, 2024. Event 2 was preceded by approximately 16 days of antecedent dry conditions.

WY 2025 Event 3

Following another lengthy dry spell (approximately 27 days), SSA deployed its trash net for a late January forecast storm event. Predictions for this storm included a QPF over 4 inches over the course of six days. SSA deployed its trash net from January 31 through February 5, 2025 (Table SSA-1), which encompassed the rainfall event that fell from January 31 through February 4, 2025. The total precipitation for the storm was measured at 2.75 inches with a peak intensity of 0.18 inch/hour.

WY 2025 Event 4

For SSA monitoring event number four, a predicted storm for early February 2025 indicated an 80% chance of over 1.5 inches over an 18-hour period. SSA deployed the trash capture net for the period February 11 through February 18, 2025 (Table SSA-1). The total precipitation for sampling event four was measured at 2.44 inches with a peak intensity of 0.53 inch/hour, again above the predicted design storm intensity of 0.395 inch/hour. Rainfall extended from February 12 through February 13, 2025. The sampling event was preceded by approximately 8 days of dry weather.

WY 2025 Event 5

For SSA monitoring event number five, a predicted storm for mid-March indicated a QPF above 1.5 inches over two days with a probability above 85%. SSA deployed the trash capture net for the period March 7 through March 13, 2025 (Table SSA-1). The total precipitation for sampling event five, which extended from March 12 through the early morning of March 13, 2025, underperformed predictions and was measured at 0.34 inch with a peak intensity of 0.13 inch/hour. The sampling event was preceded by approximately 27 days of dry weather.

WY 2025 Event 6

For SSA monitoring event number six, a late March storm event presented with a 90% chance of 0.25 inch precipitation. SSA deployed the trash capture net for the period March 27 through March 31, 2025 (Table SSA-1). The total precipitation for this storm underperformed predictions, generating only 0.11 inch of rainfall with a peak intensity of 0.07 inch/hour. The sampling event was preceded by approximately 16 days of dry weather.

Table SSA-1. Summary of net deployment and storm period, antecedent dry period, and rainfall total and intensity for trash outfall sampling events conducted in Solano County during WY 2025

Site	WY	Event	Net Deploy Start Date	Net Deploy End Date	Sample Duration (Hours)	Storm Duration (Hours)	Antecedent Dry (days)	Precipitation Total (in)	Maximum Intensity (in/hr)	First Significant Storm	Predicted Design Storm
SSA-LOTZ	2025	1	11/21/24 15:07	11/26/24 10:20	80.5	80.5	1.4	2.16	0.33	x	
		2	12/10/24 14:45	12/19/24 09:00	111.7	111.7	16.2	3.43	0.69		x
		3	01/31/25 11:45	02/05/25 14:14	94.5	94.5	28.0	2.75	0.18		
		4	02/11/25 11:45	02/18/25 08:49	17.2	17.2	8.3	2.44	0.53		x
		5	03/07/25 11:23	03/13/25 12:30	13.2	13.2	27.0	0.34	0.13		
		6	03/27/25 11:23	03/31/25 10:30	5.0	5.0	15.8	0.11	0.07		

B5.3 Trash Characterization

Trash collected for all SSA sampling events were sorted into 13 trash categories defined for the Project and measured for volume. A very minimal amount of trash was collected associated with each of the six sampling events monitored at site SSA-LOTZ in WY 2025.[27] Total trash volumes measured across the six successful sampling events in WY 2025 ranged from 0 to 0.002 gallons per event (Table SSA-2).

Table SSA-2. Trash volume measured for 13 trash types identified from trash samples collected at Solano County outfall trash monitoring site SSA-LOTZ in WY 2025

Trash Type		WY 2025					
		Event 1	Event 2	Event 3	Event 4	Event 5	Event 6
Plastic Trash Items (oz)	Single-Use Carryout Plastic Bags	0.000	0.000	0.000	0.000	0.000	0.000
	Expanded Polystyrene (EPS) Foam	0.000	0.000	0.000	0.000	0.000	0.000
	(EPS) Foam Other	0.000	0.000	0.000	0.000	0.000	0.000
	Single Use Plastic Food / Drink Ware	0.000	0.000	0.000	0.000	0.000	0.000
	Smoking Products, Traditional	0.000	0.000	0.000	0.070	0.000	0.000
	Smoking Products, Other	0.000	0.000	0.000	0.000	0.000	0.000
	Other plastic Items / Pieces	0.000	0.000	0.140	0.100	0.000	0.000
Non-Plastic Trash (oz)	Organic / Paper	0.000	0.000	0.070	0.000	0.000	0.000
	Fabric	0.000	0.030	0.000	0.000	0.000	0.000
	Metal	0.000	0.000	0.000	0.000	0.000	0.000
	Glass	0.000	0.000	0.000	0.000	0.000	0.000
	Mixed	0.000	0.000	0.000	0.000	0.000	0.000
	Biohazard	0.000	0.000	0.000	0.000	0.000	0.000
	Total Gallons	0	0.0002	0.0016	0.0013	0	0
	Total Gallons/acre	0	0.0001	0.0004	0.0003	0	0

The total volume of trash collected in each sample collected at site SSA-LOTZ, standardized for area, is shown in Figure SSA-4. Only three storm events generated a measurable volume of trash in any category; sampling events 2, 3, and 4, which correspond to the only three storm events that generated overflow, each generated a small volume of trash measured at or less than 0.0004 gallons per acre for each event. None of sampling events 1, 5, and 6 resulted in any trash volume accumulating in the collection device, and our working assumption is that trash only escapes to the MS4 during periods when there is overflow. Estimated annual trash loading rates for SSA-LOTZ are presented in Section B.2.3.3 below.

[27] For some events, trash was collected associated with a particular category, but did not meet the minimum volume requirements to be reported (e.g., paper bits)

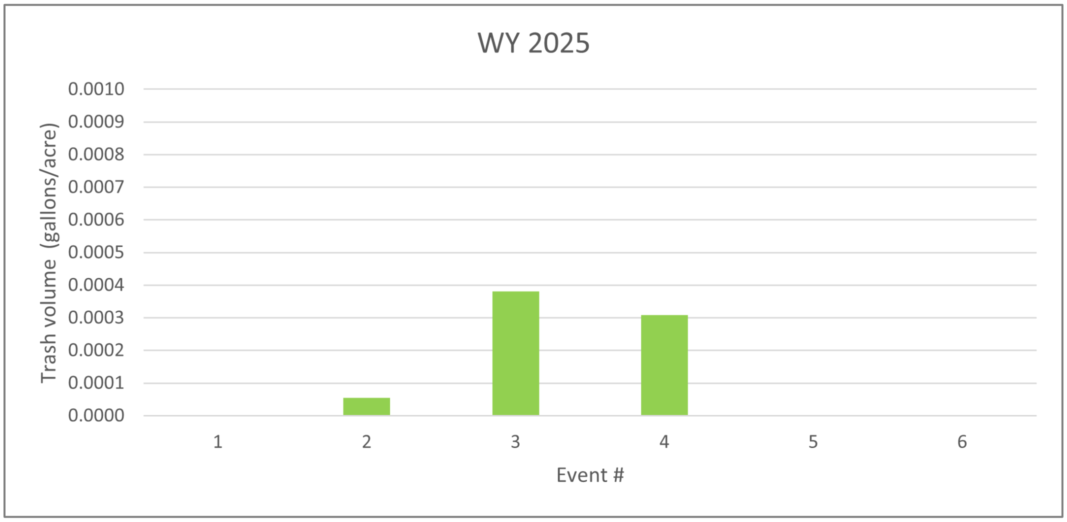


Figure SSA-4. Trash volumes standardized by area for six sample events at site SSA-LOTZ in Suisun City, Solano County

B5.4 Rainfall and Flow

Precipitation data for the SSA-LOTZ trash monitoring site was obtained from a rain gauge installed by SSA for use by the co-located Low Impact Development (LID) monitoring study conducted under MRP 3 Provision C.8.d. Precipitation data is measured using an on-site tipping bucket.

To estimate flows into the overflow pipe, SSA installed a depth sensor adjacent to the overflow pipe and continuously measured water level over the course of the monitoring year. Measurements exceeding the facility ponding depth were assumed to initiate flow into the overflow pipe, and depth measurements were converted into flow rates using the average of flow estimates produced by employing equations for broad-crested weir and sharp-crested weir calculations.

B5.4.1 Event Hydrographs

Measured precipitation totals and flow data calculated for SSA-LOTZ over the wet season of WY 2025 are presented in Figure SSA-5. Flow rates represent the volume of water exiting the MBTS through the overflow pipe where the trash net is deployed. Individual hydrographs for sampling events that experienced overflow are shown in Figure SSA-6 (Event 2), Figure SSA-7 (Event 3), and SSA-8 (Event 4). None of the remaining storm events generated any flow into the MS4.

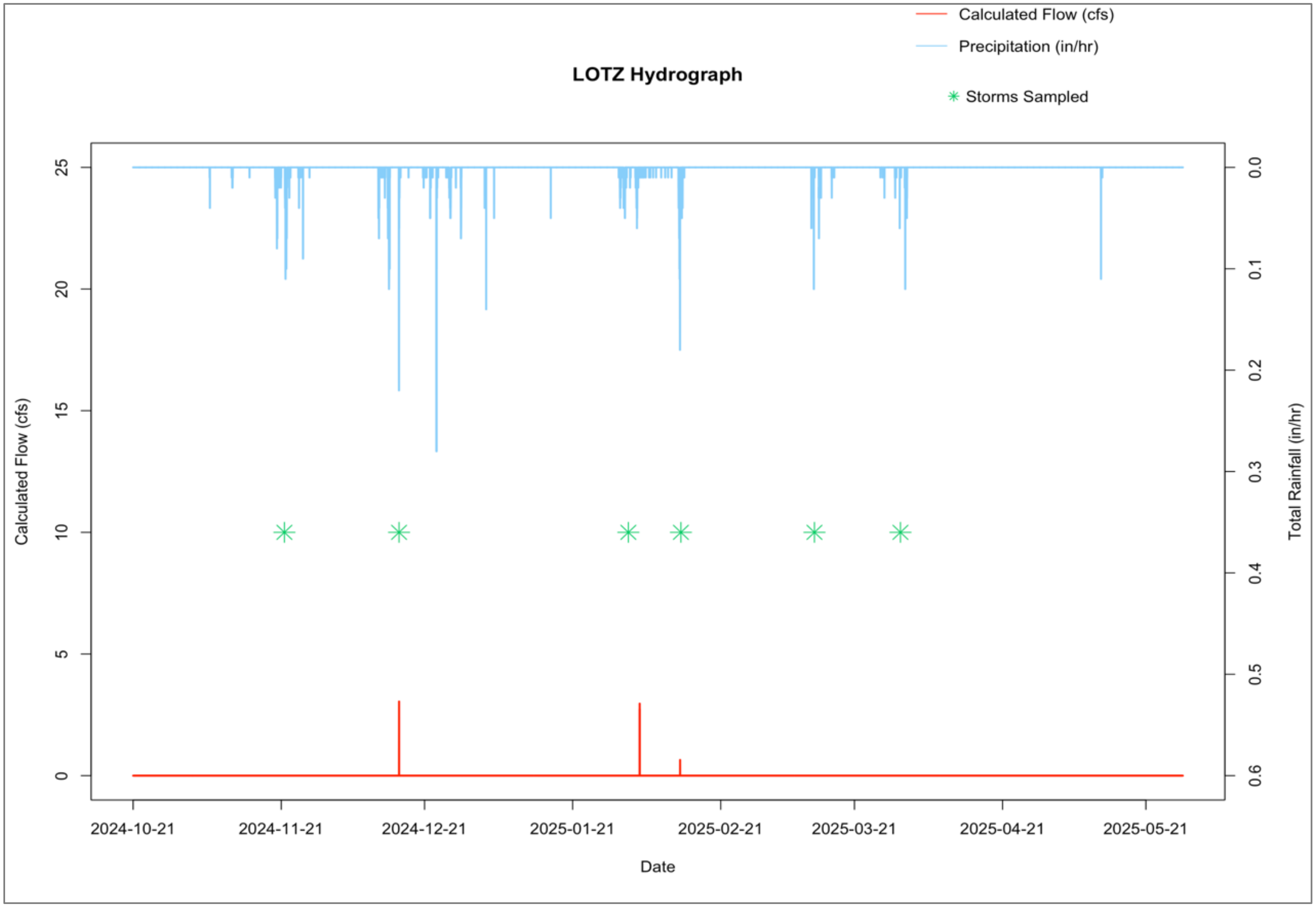


Figure SSA-5. Annual hydrograph for SSA monitoring site SSA-LOTZ

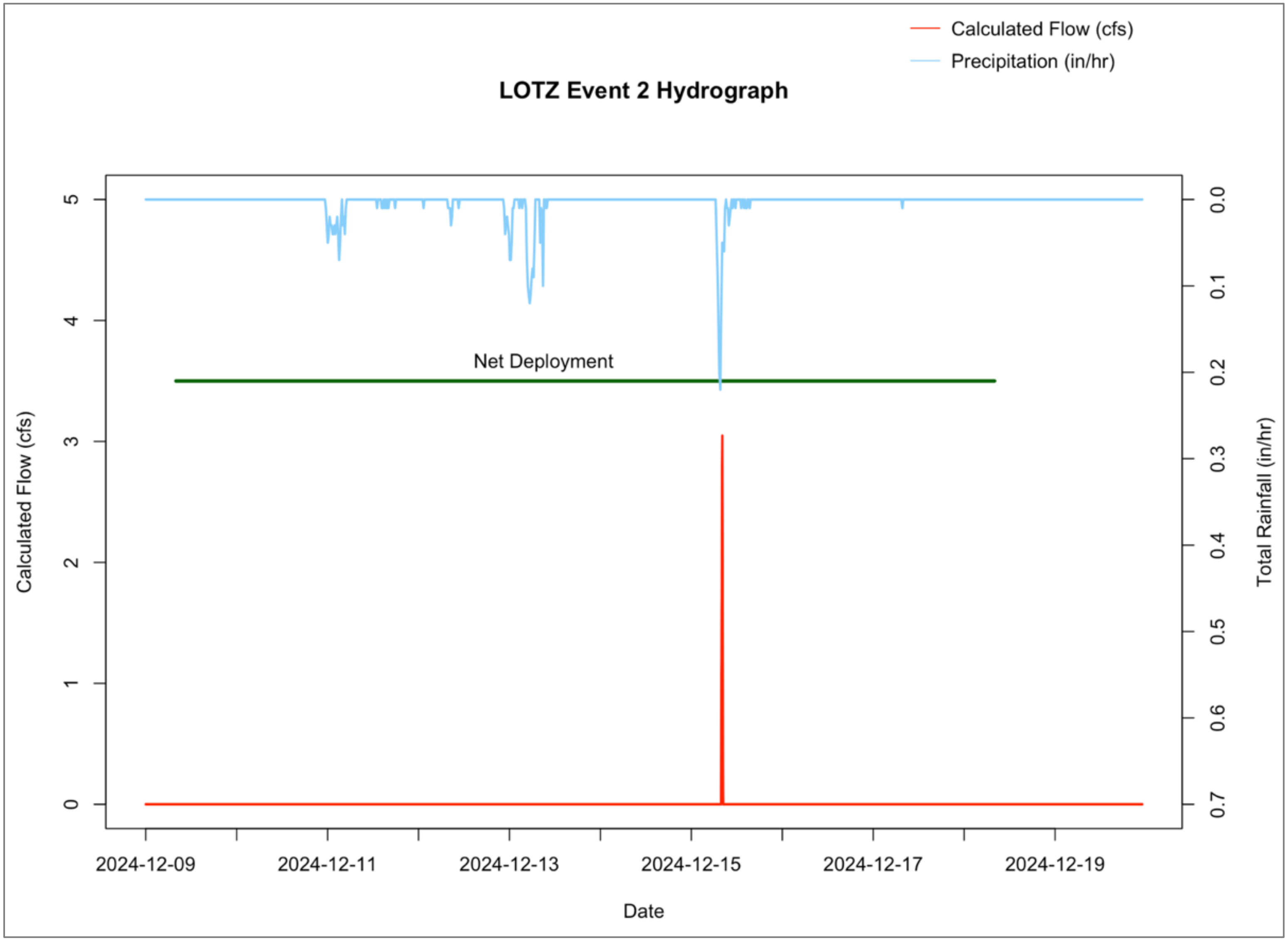


Figure SSA-6. Hydrograph for SSA-LOTZ monitoring Event 2

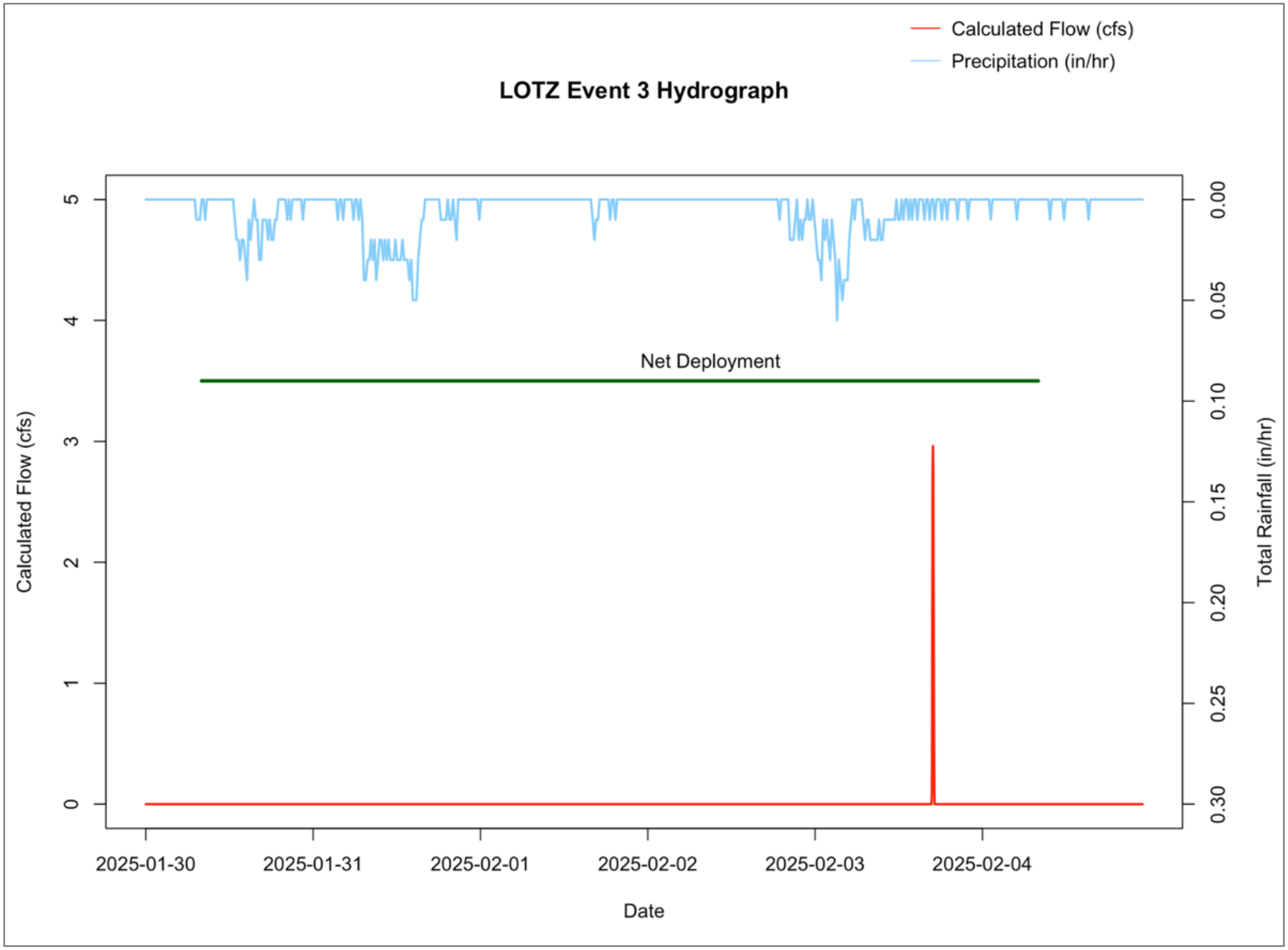


Figure SSA-7. Hydrograph for SSA-LOTZ monitoring Event 3

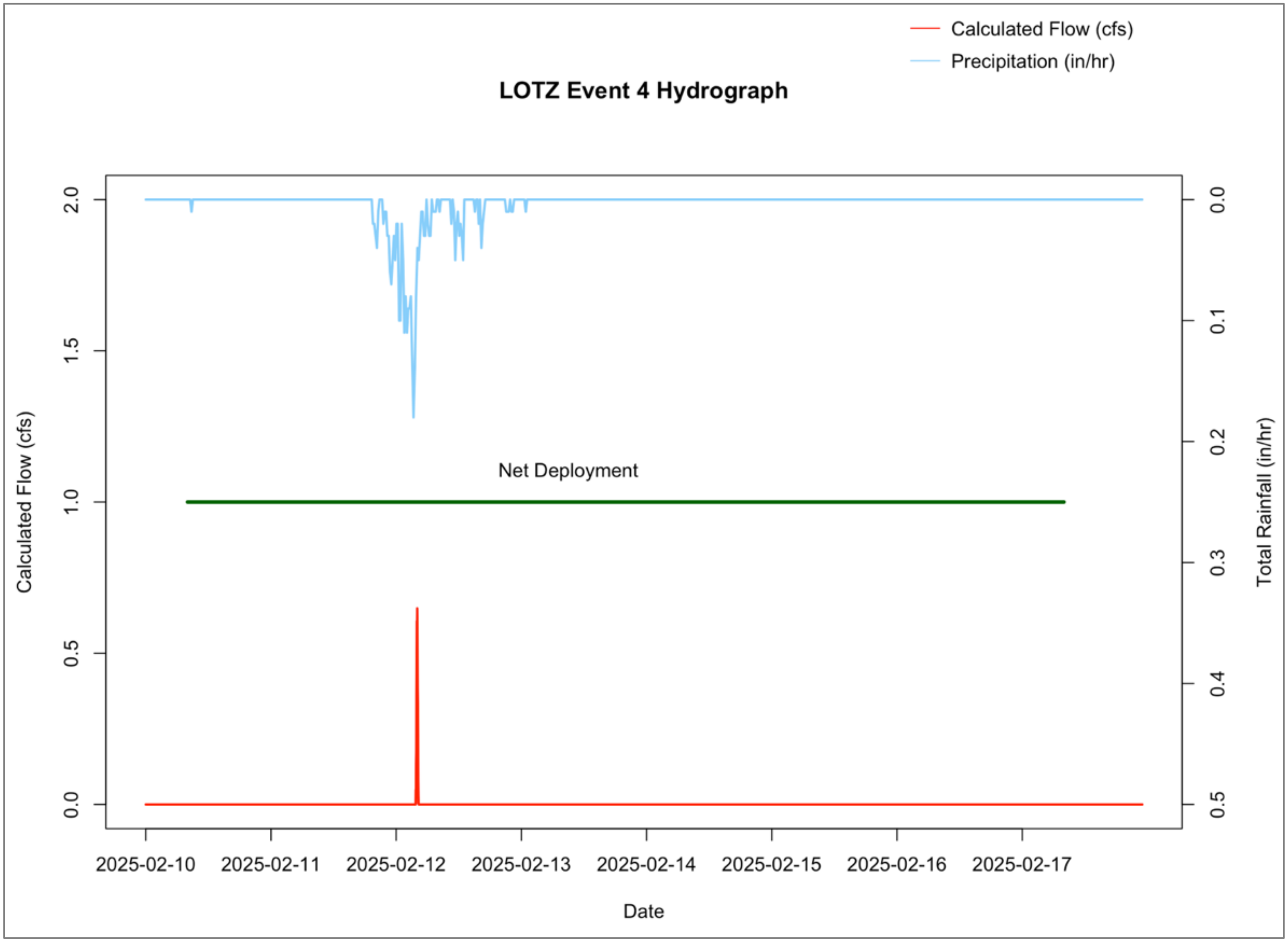


Figure SSA-8. Hydrograph for SSA-LOTZ monitoring Event 4

B5.4.2 Storm Characteristics

In an effort to calculate the annual trash load discharged at each outfall during each WY, the total number of storms that occurred in each WY were identified using compiled precipitation data. Storm events were defined using the following criteria:

- Minimum 0.1-inch precipitation in 6 hours (Caltrans 2020)
- Minimum 24 hours of antecedent dry conditions (i.e., no rainfall)
- Event ends when < 0.1 inch of rain measured over 6 hours

A summary of storm characteristics for the storms identified at site SSA-LOTZ in WY 2025 is provided in Appendix SSA-A. Information includes storm duration, antecedent dry period, total rainfall (inches), maximum intensity rainfall (inches/hour), peak flow (cfs) and total flow (cfs). Sampled storm events and total trash volume (gallons/acre) for successful sampling events are indicated in the appendix. First seasonal flush storms and storms that were forecast to exceed the FTC design storm (i.e., the peak flow generated from a one-year, one-hour frequency storm) are also identified in the appendix.

At site SSA-LOTZ, a total of 15 storms were identified in WY 2025 using the above criteria. SSA sampled the first significant storm event of the monitoring year, a 0.89 inch storm that started November 20, 2024. Given that a second, much stronger magnitude, storm front followed closely upon the passing of the first front, SSA staff removed the trash net between fronts, observed no trash captured, and made the decision to leave the trash net in place through the end of the second front. While individual statistics associated with the first two defined storms of the season are presented in Appendix SSA-A, the total precipitation (3.15 inches) and duration between the start of the first front and end of the second front (approximately 100 hours) are used for analyses and loading estimates throughout the rest of this report. There was no measurable trash captured associated with this first sampling event.

Based upon total precipitation measured as compared with the one-year, one-hour storm identified for Suisun City, three of the fifteen storms that presented in WY 2025 exceeded the design storm criteria for precipitation intensity of 0.395 inch/hour. SSA sampled two of these three storms: (1) a 3.43 inches storm with a peak rainfall intensity of 0.69 inch/hour in mid-December, and (2) a 2.44 inches storm with a peak intensity of 0.53 inch/hour in mid-February. A 0.65-inch storm with a peak intensity of 0.48 inch/hour was not sampled as it fell in the blackout period in the last week of December 2024; this storm also did not generate overflow from the MBTS facility into the MS4 so did not exceed the facility's storage capacity. One additional storm, a longer-duration storm starting on 2/1/25, generated overflow at the facility even though the maximum recorded intensity was only 0.18 in/hr. This shows that the rainfall intensity is a relatively good, but not perfect predictor of overflow at the facility. Comparison with the predicted peak flow identified in Appendix A is irrelevant, as any flow into the overflow pipe by definition exceeds the capacity of the MBTS.

A comparison of sampled and unsampled storms over the WY 2025 reporting period at site SSA-LOTZ is shown by peak flow in Figure SSA-9. Of the 14 total storms[28] that presented in WY 2025, only three were of sufficient magnitude/intensity to exceed the facility ponding depth that triggered flow into the overflow pipe; SSA sampled each of these three storm events.

[28] Statistics for WY 2025 storms 1 and 2 combined into a single event for analytical purposes.

In examining the magnitude of precipitation against sampling events (Figure SSA-10), SSA deployed the trash net for the four largest storms encountered at SSA-LOTZ during the reporting period and four of the five total storms that exceeded 1.0 inch in magnitude. There were an additional nine storms identified during the monitoring period measured at less than 1.0 inch in magnitude, which are represented by two WY 2025 trash sampling events (Figure SSA-10).

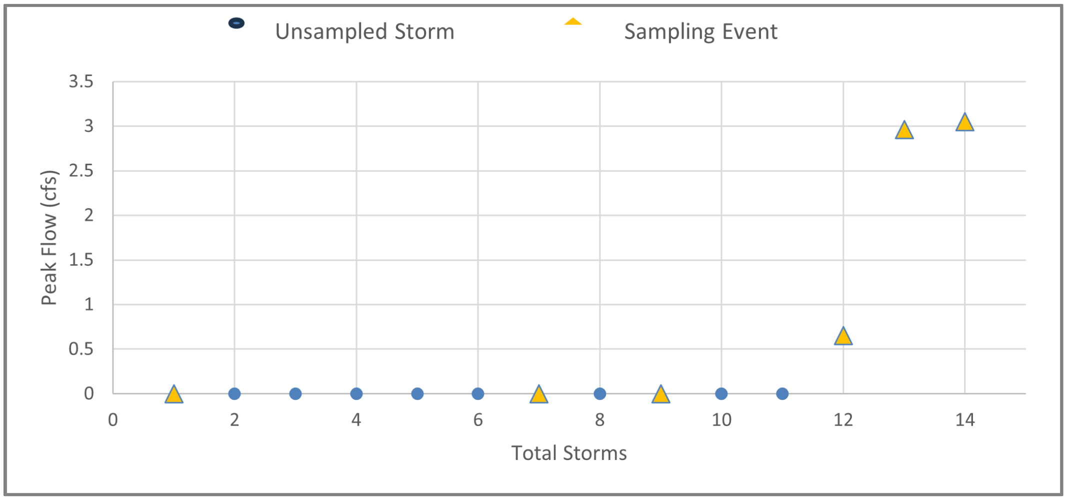


Figure SSA-9. Distribution of sampling events against peak flows measured at SSA-LOTZ during WY 2025 monitoring

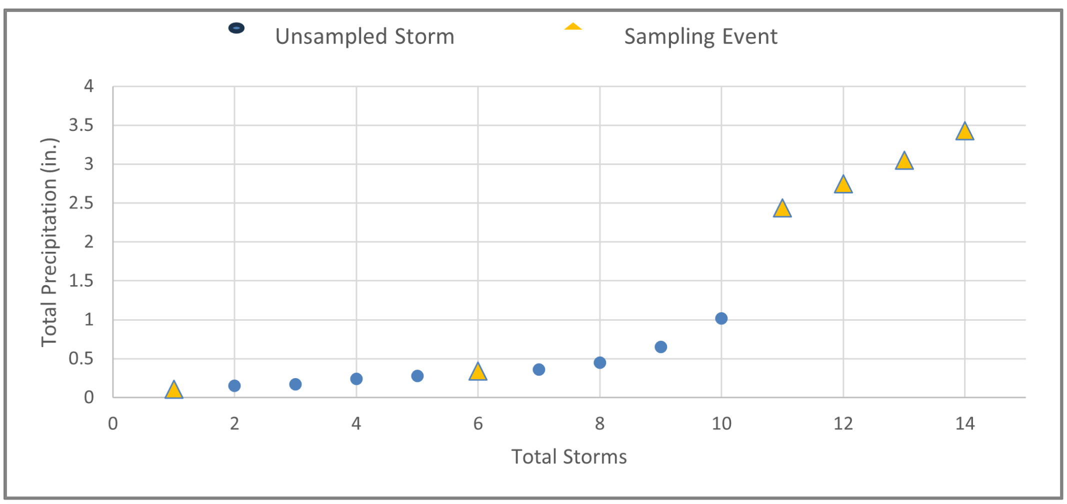


Figure SSA-10. Distribution of sampling events against total precipitation measured at site SSA-LOTZ during WY 2025 monitoring

MRP 3 C.8.e.3(iii) permit provisions require Programs to sample trash for a minimum of three storms per year, including the first significant storm event and one event forecast to achieve the one-year, one-hour design storm for each outfall. Given that forecasts can rapidly change, SSA has targeted larger, more intense storm forecasts for monitoring net deployment to achieve permit requirements. As the above figures show, monitoring results for the reporting period are more reflective of trash movement in larger storm systems and those that may be expected to transport more trash due to longer antecedent dry periods. Our monitoring of trash movement in smaller events that are not potential first flush events is somewhat lacking in relation, but given the relatively small volume of trash collected associated with larger events that generate overflow, this data gap is likely insignificant to our overall understanding of trash leaving the MBTS and entering the MS4.

B5.4.3 Draft Annual Trash Load Estimate

Varying levels of trash types and densities were observed in the catchment and in the MBTS itself over the course of WY 2025 monitoring (Figure SSA-11). Over the course of the year, trash was observed moving from the adjacent roadways down the vegetated slopes towards and into the MBTS facility. While some of the trash observed during pre-sampling event visits was collected in the net and is represented in the trash volumes reported (Table SSA-3), the great majority of trash did not collect in the net. This may be reflective of some escape from the system via wind transport, but is more likely related to the small number of overflow events exceeding facility ponding depth, the possible exclusion of some larger items by the trash rack surrounding the overflow (e.g., observed plastic sheeting and cardboard), and the manual removal of trash from the facility by Caltrans personnel at a typical rate of twice per week.

Figure SSA-11. Example trash accumulations in SSA-LOTZ MBTS facility prior to monitored storm events

Table SSA-3. Trash volume measured for thirteen trash types that were identified from trash samples collected at Solano County outfall trash monitoring site SSA-LOTZ in WY 2025

WY2025						
Event #	**Net Deploy Date**	**Net Retrieval Date**	**Precipitation Total (in)**	**Maximum Intensity (in/hr)**	**Overflow Event**	**Trash Volume (gallons/ac)**
Event 1	11/21/24	11/26/24	2.16	0.33		0
Event 2	12/10/24	12/19/24	3.43	0.69	x	0.00006
Event 3	01/31/25	02/05/25	2.75	0.18	x	0.00044
Event 4	02/11/25	02/18/25	2.44	0.53	x	0.00036
Event 5	03/07/25	03/13/25	0.34	0.13		0
Event 6	03/27/25	03/31/25	0.11	0.07		0

SSA conducted trash monitoring for each of the three overflow events experienced in WY 2025; these were the only three monitoring events to generate measurable volumes of trash over the course of the monitoring. Operating under the assumption that most or all trash will only be transported to the MS4 during overflow events, we can calculate rather than model the total volume of trash that exited the MBTS over the course of WY 2025. The total volume of trash that was captured during these three events was measured at 0.0031 gallons, which equates to approximately 0.0007 gallons/acre.

B5.5 Investigation of Trash Generation

This section describes visual observations to document trash generation within the monitored outfall catchment prior to each monitoring season. It is important to note that trash observed during the assessment represents a snapshot in time and may have considerable variation over time. However, observed trash levels can provide additional context for determining if existing trash controls are effective at reducing trash discharge through the MS4. Existing trash management actions within each catchment are summarized in the following section.

B5.6 Catchment Assessments

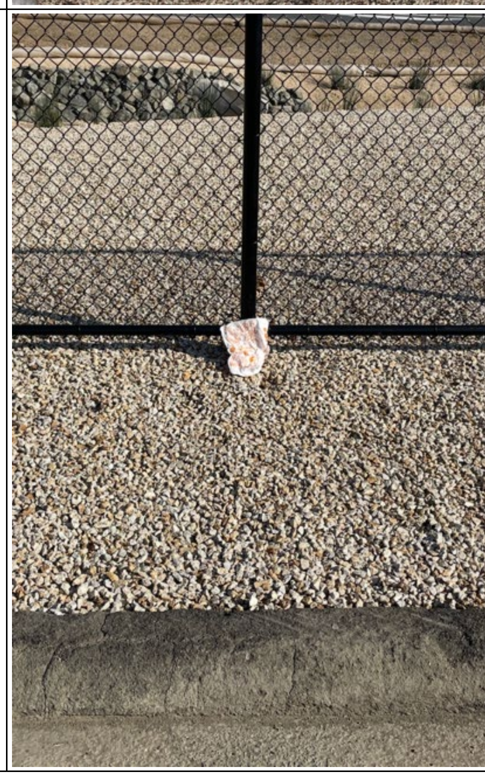
Given the relatively small size of the study catchment, SSA was able to conduct multiple visual assessments of trash sources in the SSA-LOTZ catchment area during WY 2025 monitoring. Applied Marine Sciences, Inc. (AMS) or Solano Resource Conservation District (RCD) staff walked the MBTS and surrounding areas and noted presence of trash during the dry season prior to start of annual monitoring and again associated with each net deployment. As time allowed, a second assessment was conducted following individual sampling events to gauge any observable differences in the pre- and post-storm environment.

Light to moderate densities of littering and wind-blown trash were observed accumulating along the hillside adjacent to roadways in WY 2025. Larger trash items were observed sliding down the hillside over time until their eventual landing in the MBTS or removal via cleanup.

Food and drink ware, along with accumulations of litter, were regularly observed in the parking areas adjacent to the MBTS. This litter may be associated with commuter usage of the facility or usage by potentially unhoused persons who were observed using the parking area on multiple occasions.

A variety of items were found accumulating in the MBTS itself over the course of monitoring. These included food waste items, paper, bottles, personal care products, drink cans, smoking products, and pet waste, with relevant examples documented in Table SSA-4 and Figure SSA-12.

Table SSA-4. Trash assessments in catchment for site SSA-LOTZ during WY 2025

Observations During Survey	Latitude, Longitude	Photos
Litter blowing in from Highway 12 . (photo taken 1/13/2025)	38.24386, -122.03975	
Plastic, paper, and unidentified items accumulating in MBTS. (photo taken 1/13/2025)	38.24338, -122.03869	
Food waste migrating from parking area. (photo taken 1/30/2025)	38.24328, -122.03884	

Observations During Survey	Latitude, Longitude	Photos
Cardboard box migrating down hillside from Civic Center Boulevard offramp. (photo taken 1/13/2025)	38.24368, -122.03880	

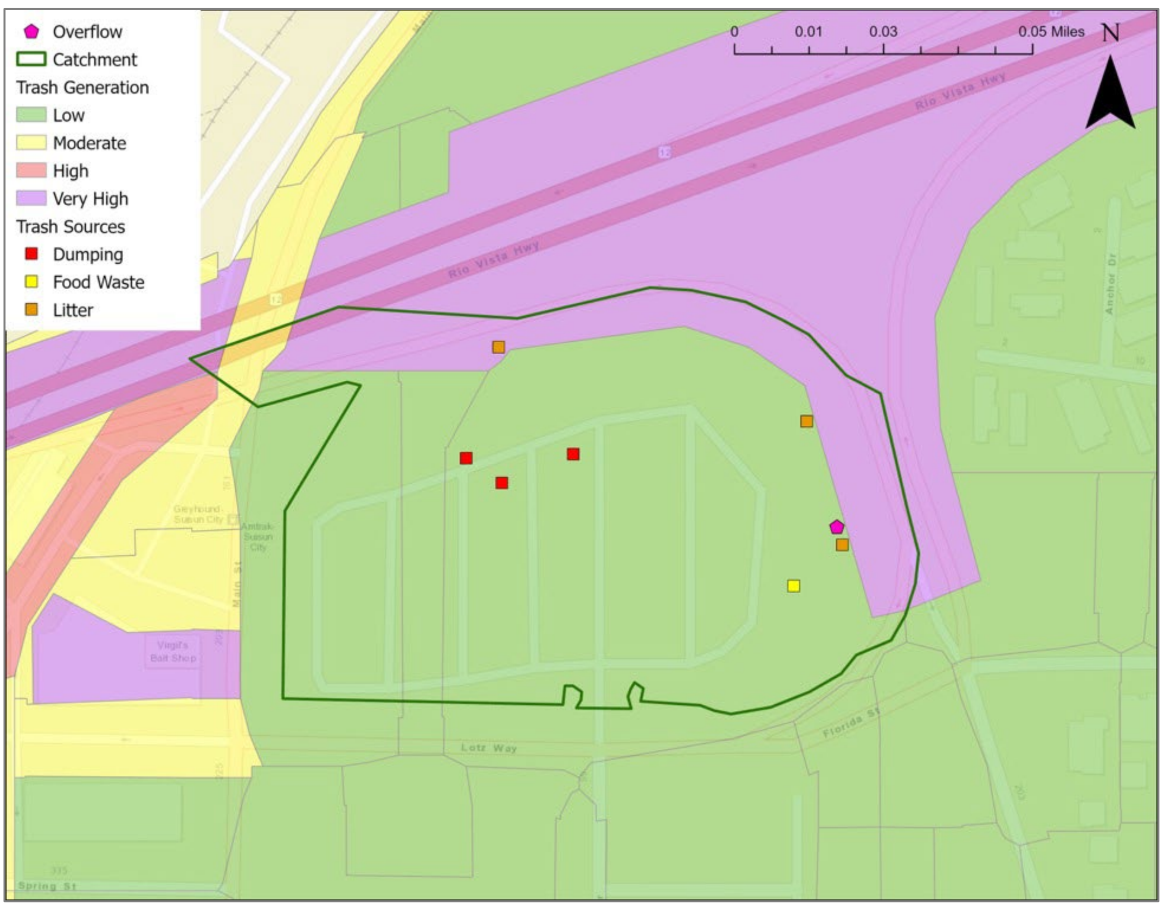


Figure SSA-12. Trash sources identified in highest densities during trash assessments for catchment SSA-LOTZ, WY 2025

B5.7 Refinements

The following refinements to trash outfall monitoring will be implemented in Solano County.

Monitoring effort

- SSA will attempt collection of a minimum of three sample events in WY 2026. Given the results of WY 2025 monitoring exhibited a very small volume of trash exiting the MBTS facility, in addition to the first significant storm of the season, SSA will target larger storm events (precipitation magnitude and intensity) to the extent possible.
- SSA will deploy trash nets during an extended dry weather period to provide additional information on potential wind-blown trash loading during non-storm events.

APPENDIX SSA
WY 2025 STORM EVENT SUMMARY

Table SSA-5. Summary of storm characteristics and sample information for site SSA-LOTZ during WY 2025

Storm Began	Storm End	Storm Duration (hrs)	Antecedent Dry (days)	Precipitation Total (in)	Max Intensity (in/hr)	Peak Flow (cfs)	Total Flow (cf)	Sample Event	First Sig. Storm	Trash Vol (gal)	Comment
WY 2025 (15 storms total)											
11/20/24	11/21/24	16.5	>30	0.89	0.22	0	0	x[1]	x[1]	0[1]	Combined sampling event
11/22/24	11/26/24	80.5	1.4	2.16	0.33	0	0				
12/12/24	12/17/24	111.7	16.2	3.43	0.69	3.05	3054	x		0.0001	Overflow event
12/23/24	12/23/24	4.2	6.1	0.17	0.10	0	0				
12/24/24	12/24/24	4.0	1.2	0.65	0.48	0	0				
12/27/24	12/27/24	11.2	2.4	1.02	0.18	0	0				
12/29/24	12/29/24	3.5	2.0	0.45	0.24	0	0				
01/03/25	01/04/25	7.7	4.9	0.24	0.14	0	0				
02/01/25	02/04/25	94.5	28.0	2.75	0.18	2.96	2,188	x		0.0003	Overflow event
02/13/25	02/14/25	17.2	8.3	2.44	0.53	0.65	619	x		0.0004	Overflow event
03/13/25	03/13/25	13.2	27.1	0.34	0.13	0	0	x		0	
03/14/25	03/14/25	4.5	1.0	0.36	0.17	0	0				
03/30/25	03/30/25	5.0	15.8	0.11	0.07	0	0	x		0	
04/01/25	04/02/25	12.5	1.8	0.28	0.17	0	0				
05/12/25	05/12/25	0.7	40.5	0.15	0.15	0	0				

1 Due to predicted magnitude of the second front and short dry period between fronts, the net was left in place for both storms.

Attachment C

Corrective and Preventative Action Report

APPLIED marine SCIENCES

January 4, 2026

Paul Randall
EOA, Inc.

Dear Paul,

As an outcome of the WY 2024 outfall trash monitoring reporting process, BAMSC Programs reviewed all aspects of the Year 1 monitoring efforts, identified two data quality concerns, and developed Corrective and Preventative Action Reports (CPARs) for each. Each issue concerned assessment of precision in WY 2024 trash characterization samples. One issue identified characterization staff not completing the required number of field replicate analyses, and the second concerned precision metrics falling outside of QAPP MQOs for ma subset of categories. As part of the CPAR process, the project QAO was required to perform a field audit of WY 2025 characterization activities. This memorandum summarizes results of that audit.

The audit was intended to assess the two issues detailed in the WY 2024 UCMR CPARs as well as review general trash characterization efforts. The audit was conducted on April 22, 2025, at the EOA offices in Oakland and generated the following findings:

- As identified as a corrective action, characterization staff had received additional training between Year 1 and Year 2 characterization efforts.
- Characterization staff were in agreement on classifications for individual trash items reviewed during the audit.
- Characterization staff appeared knowledgeable of sorting and assessment protocols.
- Characterization staff met the QAPP minimum requirement for replicate analyses of 1 per Program for WY 2025; it was not possible to calculate RPDs for the SSA Program samples given the minimal volumes generated in all WY 2025 samples.

With this audit, the two WY 2024 CPARs are considered closed and no additional audits of characterization events are planned. WY 2025 and future characterization effort data will be assessed as part of the annual QA review process and any future corrective actions will be identified and employed as needed.

Paul Salop
Quality Assurance Officer