HERRERA
Science + Planning + Design

# TECHNICAL MEMORANDUM

**Date:** October 16, 2025

**To:** Jessica Atlakson, City of Redmond

**From:** John Lenth, Herrera Environmental Consultants, Inc.
Meghan Mullen, Herrera Environmental Consultants, Inc.

**Subject:** Tosh Creek Street Sweeping Study: Final Report

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# Acknowledgements

This project is funded in part by the King County Wastewater Treatment Division. The content herein does not constitute an endorsement by King County government, its employees, or its elected and appointed officials.

King County

Department of Natural Resources and Parks
**Wastewater Treatment Division**

# Introduction

The Redmond Paired Watershed Study (RPWS) is one of several effectiveness monitoring studies that was selected for implementation starting in 2014 for the Stormwater Action Monitoring (SAM) program for Puget Sound. The goal of effectiveness monitoring under the SAM program is to provide widely applicable information for improving stormwater management in the region. The specific study question to be addressed through the RPWS is as follows:

> **How effective are watershed rehabilitation efforts at improving receiving water conditions at the watershed scale?**

Monitoring for the RPWS initiated in 2016 and is anticipated to continue for a 10-year time frame. Trend analyses reports are being prepared at regular intervals to summarize analyses that were performed to detect potential improving trends in receiving water conditions. The first and second trend analysis reports were prepared after 4 and 8 years of study implementation, respectively (Herrera 2021, 2025). The first report documented a significant decrease in total suspended solids (TSS) and total copper concentrations in Monticello Creek that appeared related to a City of Redmond (City) project that progressively increased street sweeping frequency in the associated watershed. These results were consistent with another study that was implemented by the City of Seattle (SPU 2018).

To validate the effectiveness of street sweeping for improving water quality, the City obtained grant funding from King County Wastewater Treatment Division to progressively increase street sweeping in the Tosh Creek watershed. At the same time, the City obtained funding from the Washington State Department of Ecology (Ecology) to augment ongoing monitoring that is being performed for the RPWS to evaluate whether street sweeping can be effective at removing other pollutants of concern that are associated with roadway runoff and whether this removal can be detected in the nearby receiving water. Specifically, the City collected additional samples for evaluating concentrations of 6PPD-quinone (6PPDQ) and polycyclic aromatic hydrocarbons (PAHs) during the routine water quality monitoring that is conducted for the RPWS. A widely used antioxidant in rubber tires, 6PPDQ is an emerging contaminant in stormwater that is linked to acute mortality of coho salmon. PAHs are a common type of organic pollutant found in stormwater runoff that are known or probable human carcinogens and toxic to aquatic life. This augmented monitoring for the RPWS is hereafter referred to as the Tosh Creek Street Sweeping Study. The subsequent analyses that were performed for this study specifically looked at the benefits of street sweeping for decreasing concentrations of TSS and total copper to validate the results from the Monticello Creek study (Herrera 2021), while also assessing the potential benefits of street sweeping for decreasing concentrations of 6PPDQ and PAHs.

Data collection, processing, management, and analysis procedures for the RPWS are documented in a Quality Assurance Project Plan (QAPP) that was prepared for the study (Herrera 2015). The Tosh Creek Street Sweeping Study was implemented over a 2-year period covering water year (WY) 2023 and WY2024. Monitoring procedures specific to the Tosh Creek Street Sweeping Study are documented in an addendum (Herrera 2022) to the QAPP for the RPWS. An interim report (Herrera 2023) was prepared to present results from the Tosh Creek Street Sweeping Study after three quarters of implementation in WY 2023.

This technical memorandum summarizes the final results for the Tosh Creek Street Sweeping Study. It is organized to include separate sections with the following information:

- Experimental Design
- Results
- Discussion
- Conclusions

# Experimental Design

This section describes the experimental design for the Tosh Creek Street Sweeping Study. It begins with a description of the rationale for selecting the Tosh Creek watershed as the focus of the study. It then provides a summary of the street sweeping program that was implemented for the study. Finally, the sampling and data analysis procedures that were used to evaluate the effectiveness of street sweeping for 6PPDQ, PAHs, TSS, and total copper removal are described.

## Watershed Selection Rationale

As described in more detail below, the Tosh Creek, Monticello Creek, and Evans Creek watersheds are the only three "Application" watersheds in the RPWS that have been prioritized for rehabilitation efforts pursuant to the City's watershed management plan (Herrera 2013). The Evans Creek watershed was dropped from the study at the end of WY2022, and the Monticello Creek watershed was the focus of City's previous study on street sweeping effectiveness. Hence, the Tosh Creek watershed was selected for this follow-up study.

## Street Sweeping Program

City staff swept all public roads (3.54 miles) in the Tosh Creek watershed within Redmond city limits one time per month starting on October 29, 2022, and extending through the remainder of WY2023, and two times per month over all of WY2024. This is in addition to the regularly scheduled quarterly street sweeping. Sweeping was performed using a regenerative street sweeper. This street sweeper cleans curb to curb, including the crown of the road, with the intention of cleaning all surfaces possible during sweeping events. City staff used a counter to determine how many cars were parked on the road to estimate area of road missed.

To provide a control for assessing the effectiveness of the increased street sweeping in the Tosh Creek watershed, street sweeping in the Country Creek watershed was maintained at the regularly scheduled quarterly interval. Augmented monitoring for the Tosh Creek Street Sweeping Study was performed in both Tosh Creek and Country Creek, as described in the following subsection.

# Sampling and Data Analysis Procedures

The experimental design for the RPWS has two primary components:

- **Status and Trends Monitoring:** Routine and continuous measurements of various hydrologic, chemical, physical habitat, and biological indicators of stream health over an extended time frame to quantify improvements in receiving water conditions in response to watershed rehabilitation efforts.
- **Effectiveness Monitoring:** Measurements of hydrologic and chemical parameters over a relatively short time frame to document the effectiveness of specific structural stormwater controls that have been constructed to improve receiving water conditions.

The Status and Trends Monitoring utilizes a “paired watershed” experimental design that involves collecting these measurements in seven watersheds categorized as follows:

- Three “Application” watersheds with wadeable lowland streams that are moderately impacted by urbanization and prioritized for rehabilitation efforts. (*Note that one Application watershed was dropped from the study at the end of WY2022.*)
- Two “Reference” watersheds with relatively pristine wadeable lowland streams that do not require rehabilitation.
- Two “Control” watersheds with wadeable lowland streams that are significantly impacted by urbanization and not currently prioritized for rehabilitation.

Table 1 identifies the name, predominant land use/cover, size of each watershed, and the number of outfalls and upstream road crossings; the location of all the watersheds is shown in Figure 1. A detailed summary of conditions within each watershed is also provided in the QAPP that was prepared for the RPWS (Herrera 2015).

The Monticello Creek watershed, shaded purple in Table 1, was the watershed used for the Monticello Creek street sweeping study discussed above. Major arterials in this watershed are Avondale Road Northeast and Northeast 116th Street. Riparian buffers on the main stem downstream, along Avondale Road Northeast, are modest (Herrera 2013).

The Tosh Creek and Country Creek watersheds, shaded orange in Table 1, are the application and control watersheds used for the Tosh Creek Street Sweeping Study. Major arterials in the Tosh Creek watershed include Northeast 51st Street and West Lake Sammamish Parkway Northeast, though the downstream monitoring location in this watershed, Tosh-Mouth, is upstream of the crossing with West Lake Sammamish Parkway Northeast, and Northeast 51st Street runoff is routed to a wetland north of the Tosh Creek main stem. For the Tosh Creek Watershed, riparian buffers are generally broad and mostly in good condition with abundant trees (Herrera 2013).

**Table 1. Application, Reference, and Control Watersheds for the Redmond Paired Watershed Study.**

| Watershed Name | Watershed Type | Dominant Land Use/Cover | Watershed Total Area (acres) | Watershed Area Inside Redmond (acres) | Number of Outfalls and Ditches[c] | Number of Upstream Road Crossings[d] |
|---|---|---|---|---|---|---|
| Evans Creek Tributary 108[a,b] | Application | Residential | 397 | 0[b] | ND | 2 |
| Monticello Creek | Application | Residential/Commercial | 345 | 264 | 11 | 12 |
| Tosh Creek | Application | Residential/Commercial | 299 | 276 | 6 | 1 |
| Colin Creek[b] | Reference | Forest | 1,990 | 90 | 0 | 0 |
| Seidel Creek[b] | Reference | Forest | 1,188 | 615 | 6 | 0 |
| Country Creek | Control | Residential/Commercial | 212 | 212 | 12 | 6 |
| Tyler's Creek | Control | Residential/Commercial | 168 | 167 | 6 | 2 |

Source: Herrera (2013)

ND = no data (watershed is outside of city limits)

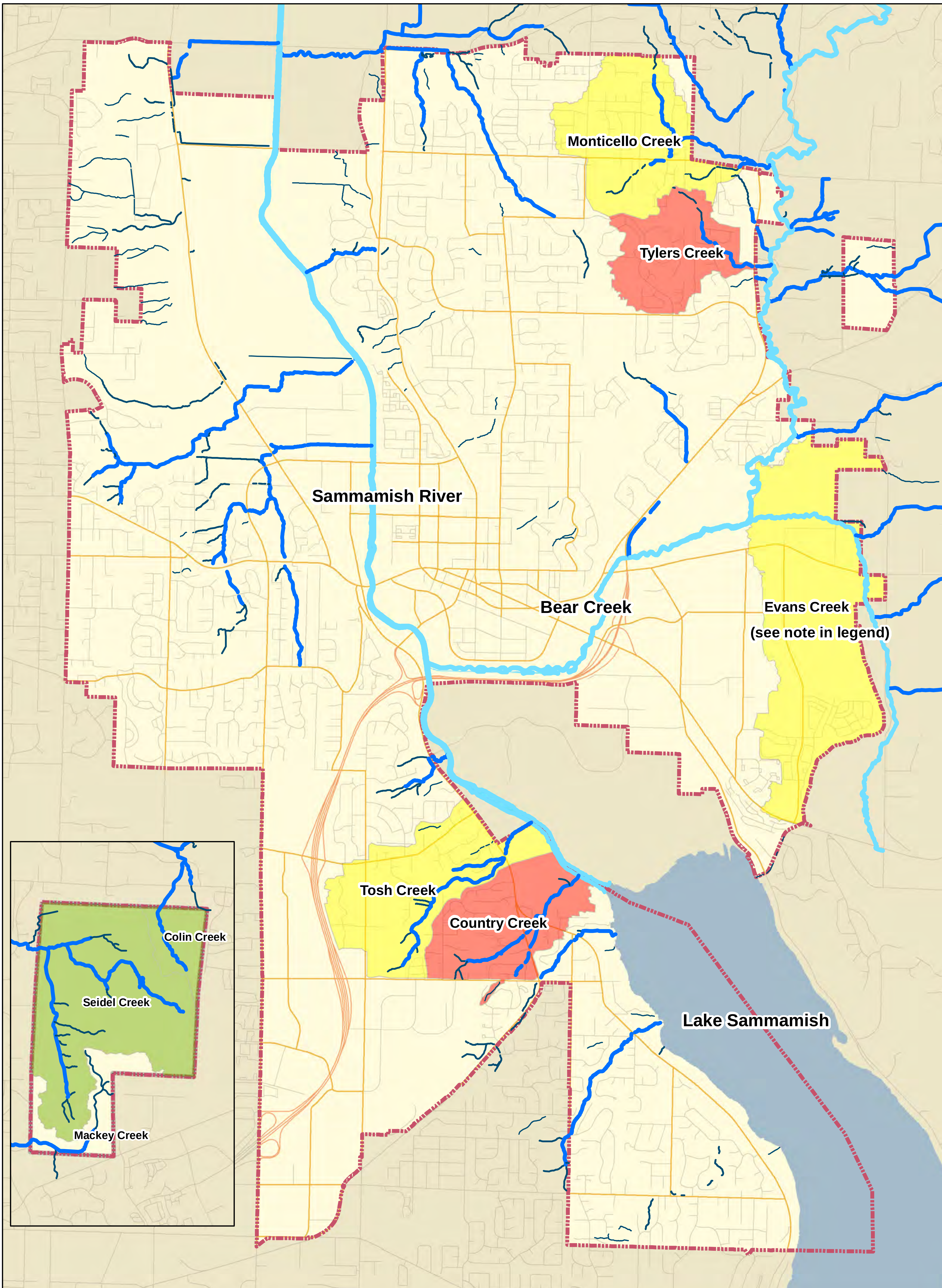
a This watershed was dropped from the study at the end of WY2022.

b Watershed is in unincorporated King County.

c Number of mapped stormwater outfalls or ditches draining pollution generating surfaces that discharge to a stream, for all stream classes within the city limits.

d Desktop analysis completed in 2025. Only includes crossings upstream of the most downstream monitoring location.

Major arterials in the Country Creek watershed include West Lake Sammamish Parkway Northeast, Bellevue Redmond (Bel-Red) Road, and Northeast 40th Street. Riparian buffers are broad in the upper reach but narrow in the middle reaches (Herrera 2013).




## Figure 1 - Application, Reference, and Control Watersheds

City of Redmond, Washington
06/18/2015

N

0 0.25 0.5 1 1.5 Miles

CityofRedmond
WASHINGTON

Disclaimer: This map is created and maintained by the Natural Resources Division of the City of Redmond, Washington, for reference purposes only. The City makes no guarantee as to the accuracy or completeness of the features shown on this map.

### Legend

- Class I Stream
- Class II Stream
- Class III Stream
- Class IV Stream
- City Limits
- Reference Watersheds
- Application Watersheds
- Control Watersheds

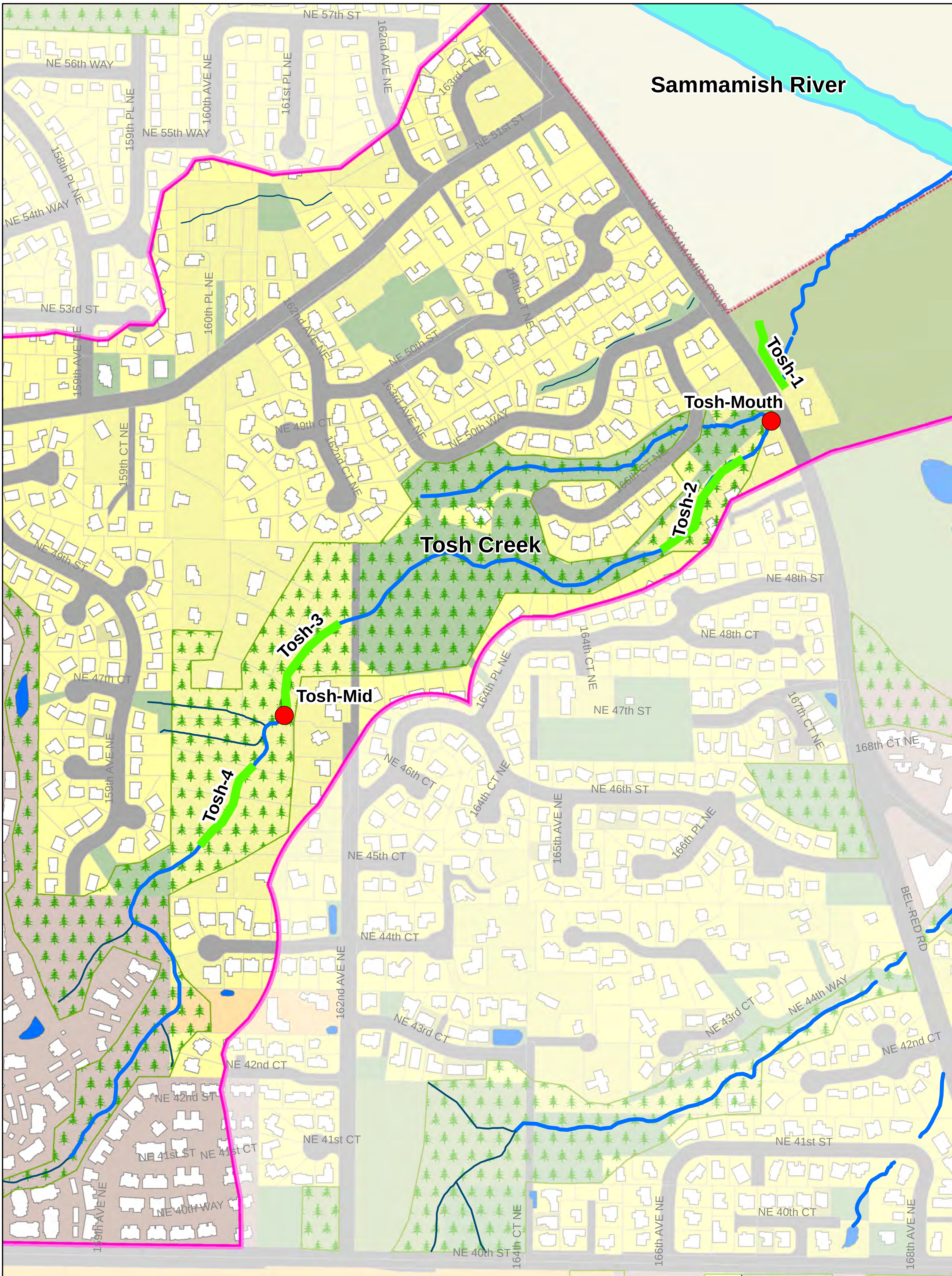
**This figure shows Evans Creek watershed within Redmond. Evans 108 is east of Redmond and illustrated in Figure 2.**

In connection with the Status and Trends Monitoring, routine water quality monitoring is conducted in each of these watersheds, which involves the collection of samples during three storm events and one base flow event in each quarter of the WY. For the Tosh Creek Street Sweeping Study, the water quality monitoring in each of the study watersheds continued as described in the QAPP for the RPWS; however, this monitoring was augmented by sample collection for 6PPDQ and PAHs in the Tosh Creek watershed and the Country Creek watershed. This sample collection spanned WY2023 and WY2024, respectively, to capture the increase in street sweeping frequency described in the previous section. In each watershed, the additional sampling for 6PPDQ and PAHs occurred at the station located at the creek mouth and at the upstream station located mid-watershed. The creek mouth and mid-watershed stations in the Tosh Creek watershed are designated Tosh-Mouth (TOSMO abbreviation) and Tosh-Mid (TOSMI abbreviation), respectively (Figure 2). The creek mouth and mid-watershed stations in the Country Creek watershed are designated Country-Mouth (COUMO abbreviation) and Country-Mid (COUMI abbreviation), respectively (Figure 3).

Collected samples from each station were submitted to OnSite Environmental, Inc. in Redmond, WA for analysis of the full suite of monitoring parameters identified in the QAPP for the RPWS and the following PAHs that are identified in the QAPP addendum for the Tosh Creek Street Sweeping Study:

- 1-Methylnaphthalene
- 2-Methylnaphthalene
- Acenaphthene
- Acenaphthylene
- Anthracene
- Benz[a]anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(ghi)perylene
- Benzo(j,k)fluoranthene
- Chrysene
- Dibenzo(a,h)anthracene
- Fluoranthene
- Fluorene
- Indeno(1,2,3-cd)pyrene
- Naphthalene
- Phenanthrene
- Pyrene

Collected samples were also submitted to SGS AXYS Analytical Services, Ltd., in Sidney, British Columbia, Canada, for analysis of 6PPDQ in accordance with the QAPP addendum for the Tosh Creek Street Sweeping Study. Because analytical procedures for 6PDDQ were still in development, the laboratory was not accredited by Ecology for the analysis of this parameter over the duration of the study.




# Figure 2. Tosh Creek Paired Watershed Study Monitoring Locations

City of Redmond, Washington

11/22/2013

N

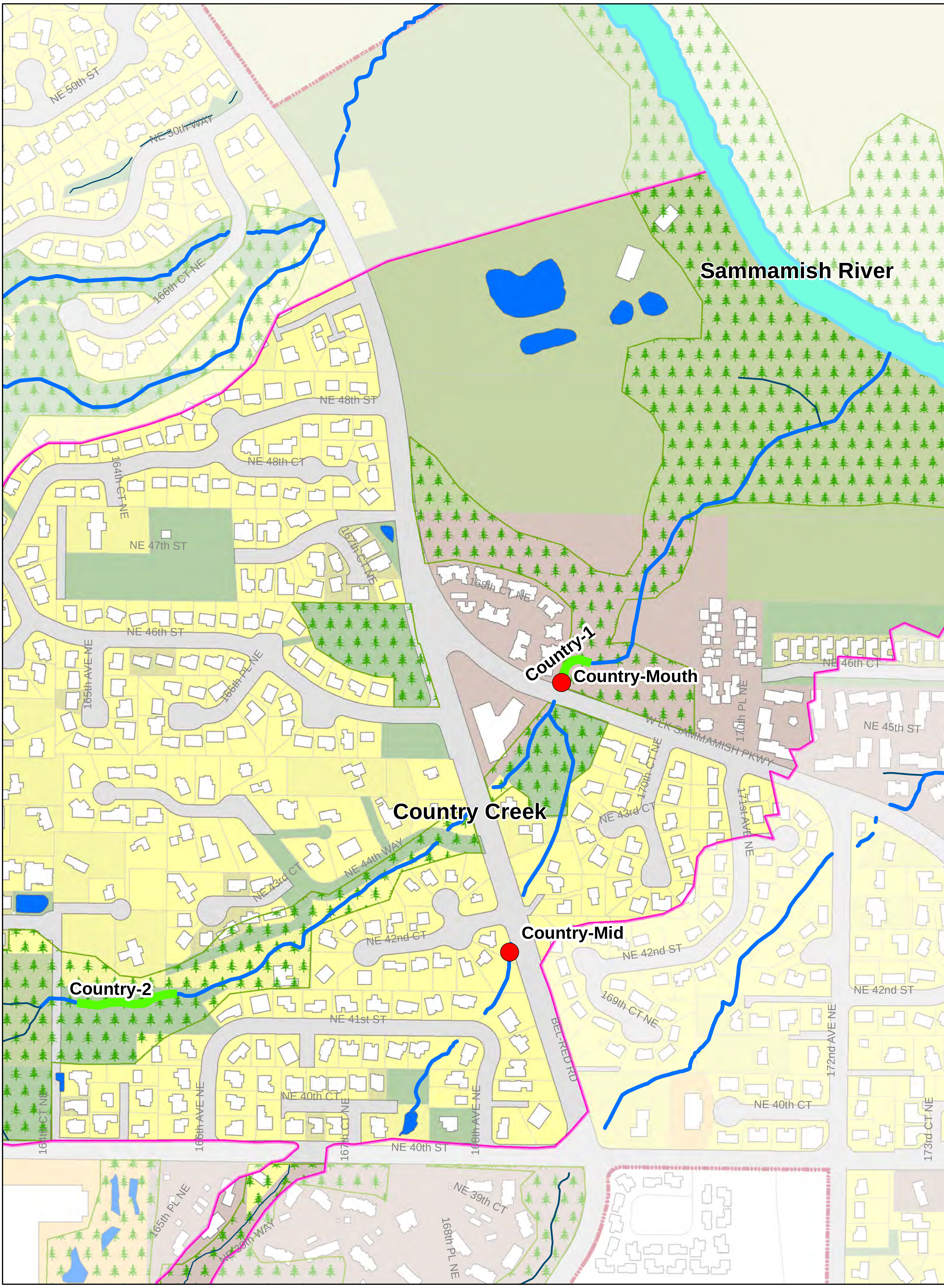
0 0.0375 0.075 0.15 Miles

**Legend**

- Class I Stream
- Class II Stream
- Class III Stream
- Class IV Stream
- Ponds
- City Limits
- Watershed Boundary
- Commercial
- Industrial
- Multifamily
- Park / Undeveloped
- Public ROW
- Single Family HighDensity
- Single Family Low Density
- Single Family Medium Density
- Single Family Rural Density
- Hydrology & WQ Monitoring
- Physical Habitat, sediment & B-IBI Monitoring

City of Redmond WASHINGTON

Disclaimer: This map is created and maintained by the Natural Resources Division of the City of Redmond, Washington, for reference purposes only. The City makes no guarantee as to the accuracy or completeness of the features shown on this map.




# Figure 3 - Country Creek Paired Watershed Study Monitoring Locations

City of Redmond, Washington

6/25/2015

N

0 0.0325 0.065 0.13 Miles

City of Redmond WASHINGTON

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**Legend**

- Class I Stream
- Class II Stream
- Class III Stream
- Class IV Stream
- Ponds
- City Limits
- Watershed Boundary
- Commercial
- Industrial
- Multifamily
- Park / Undeveloped
- Public ROW
- Single Family HighDensity
- Single Family Low Density
- Single Family Medium Density
- Single Family Rural Density
- Flow & WQ Monitoring
- Habitat, Sediment, & Biological Monitoring

The QAPP for the RPWS established measurement quality objectives (MQOs) for discrete water quality data that are expressed in terms of precision, bias, representativeness, completeness, and comparability. Specific MQOs for 6PPDQ and PAHs were also identified in the QAPP addendum for the Tosh Creek Street Sweeping Study. Prior to their analysis, the data obtained from the sampling described above were reviewed to determine whether these MQOs were met. As necessary, data were flagged as estimates or rejected based on this review. Results from this review were documented in a data validation memorandum that is included as Appendix A to this technical memorandum.

6PPDQ and PAHs data were only available for periods when “monthly sweeping” and “twice monthly sweeping” was occurring (i.e., two treatments). To evaluate the potential water quality benefits of street sweeping for these parameters, concentrations in samples from these two respective treatment periods were compared using a Mann-Whitney U test (Helsel and Hirch 2002) to determine if they were significantly different. The following null and alternative hypotheses were specifically tested based on an α-level of 0.05 for a one-tailed test:

- Ho: Concentrations of 6PPDQ and PAHs measured during the twice monthly sweeping were higher or equal than those measured during the monthly sweeping.
- Ha: Concentrations of 6PPDQ and PAHs measured during the twice monthly sweeping were lower than those measured during the monthly sweeping.

Four analyses were performed on data from the following samples:

- Samples collected in Tosh Creek during storm events
- Samples collected in Country Creek during storm events
- Samples collected in Tosh Creek during base flow events
- Samples collected in Country Creek during base flow events

Results from the analyses of data from samples collected during storm and base flow events, respectively, were compared qualitatively across each watershed. The pattern of interest in this comparison was a decrease in pollutant concentrations with increased street sweeping in the Tosh Creek watershed and no decrease in the Country Creek watershed, where street sweeping was maintained at the regularly scheduled quarterly interval.

Data for TSS and total copper were available for periods when “quarterly sweeping,” “monthly sweeping,” and “twice monthly sweeping” was occurring (i.e., three treatments). Specifically, data obtained from routine monitoring for the RPWS over WY2021 and WY2022 when street sweeping occurred on a quarterly basis were leveraged for this analysis to validate the results from the Monticello Creek Study. For this analysis, concentrations of these parameters in samples from these three respective periods were compared using a Kruskal-Wallis test (Helsel and Hirch 2002) to determine if there were significant differences based on an α-level of 0.05. If significant differences were detected, a post-hoc multiple comparison test was performed to determine if there were significant differences in concentrations between each possible combination of treatments (i.e., quarterly versus monthly, quarterly versus twice monthly, and monthly versus twice monthly). In addition to TSS and total copper, this analysis was also performed on "particulate" copper since the dissolved fraction of copper is not expected to be removed by street sweeping. Particulate copper was computed by subtracting the dissolved copper concentration from the total copper concentration for each collected sample.

Similar to 6PPDQ and PAHs, four separate analyses were performed on data for TSS, total copper, and particulate copper from the following samples:

- Samples collected in Tosh Creek during storm events
- Samples collected in Country Creek during storm events
- Samples collected in Tosh Creek during base flow events
- Samples collected in Country Creek during base flow events

Results from the analyses of data from samples collected during storm and base flow events, respectively, were compared qualitatively for each watershed. Again, the pattern of interest in this comparison was a decrease in pollutant concentrations with increased street sweeping in the Tosh Creek watershed and no decrease in the Country Creek watershed where street sweeping was maintained at the regularly scheduled quarterly interval.

The analyses described above were consistent with analyses that were performed for the Monticello Creek study (Herrera 2021) and analyses for the Tosh Creek Street Sweeping Study that are identified in the addendum (Herrera 2022) to the QAPP for the RPWS. Following review of a draft version of this memorandum, additional analyses were recommended for Tosh Creek Street Sweeping Study. Specifically, a mixed-effects model was recommended to better account for correlations within groups (e.g., monitoring stations, storm events). These analyses focused on 6PPDQ, particulate copper, and TSS. PAHs were not analyzed using this method due to the high proportion of non-detects.

For this analysis, several mixed-effects models were developed to evaluate temporal changes in pollutant concentrations while accounting for repeated measures and site-specific variability. The mixed-effects framework allows both fixed effects (e.g., watershed, year, event type) and random effects (e.g., sampling site, event date) to be incorporated, improving the ability to distinguish systematic trends or treatment effects—such as the influence of street sweeping—from random or site-level variability. This approach provides a more robust statistical basis for evaluating whether observed differences between watersheds or across years are likely attributable to management actions rather than natural or sampling variability.

# Results

Results from the Tosh Creek Street Sweeping Study are summarized in this section. It includes an overview of the number of events that were sampled to provide data for assessing the benefits of street sweeping. It then provides a description of concentrations measured for each parameter and their frequency of detection. Finally, the results from statistical analyses performed on the data are presented.

## Sampling Event Summary

As shown in Table 2, a total of 30 samples were collected for assessing 6PPDQ and PAH concentrations, respectively, across WY2023 and WY2024; 15 samples were collected in WY2023, and 15 samples were collected in WY2024, respectively. In both cases, four of these samples were collected during base flow; the remaining samples were collected during storm events. Similarly, a total of 35 samples were collected for assessing TSS and total copper concentrations, respectively, across WY2023 and WY2024; 16 samples were collected in WY2023, and 19 samples were collected in WY2024, respectively. Again, four of the samples from each WY were collected during base flow; the remaining samples were collected during storm events.

In addition to the samples identified in Table 2, data from a total of 26 samples were available for assessing TSS and total copper concentrations, respectively, across WY2021 and WY2023 when quarterly street sweeping was occurring; 8 of these samples were collected during base flow, and the remaining samples were collected during storm events.

As shown in Table 2, samples from three events in WY2023 were collected while quarterly street sweeping was still occurring because the monthly sweeping did not initiate until October 29, 2022. Because these samples represented a small fraction of the total number of samples, they were not deemed suitable for assessing concentrations of 6PPDQ and PAHs during the quarterly street sweeping. Hence, the associated data from these samples were lumped with the data from samples collected during the monthly street sweeping for all subsequent analyses involving these parameters. Conversely, these samples were lumped with the data from samples collected during the quarterly street sweeping for the analyses involving TSS and total copper.

**Table 2. Sampling Dates for Street Sweeping Study in Tosh Creek and Country Creek Watersheds.**

| Sampling Date | Street Sweeping Treatment in Tosh Creek | Event Type | Parameter Analyzed (yes/no) and N-value | | | |
|---|---|---|---|---|---|---|
| | | | 6PPDQ | PAHs | TSS | Total Copper |
| 9/27/2022[a] | Quarterly[b] | *Base* | *No* | *No* | **Yes** | **Yes** |
| 10/21/2022 | Quarterly[b] | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| 10/26/2022 | Quarterly[b] | *Base* | **Yes** | **Yes** | *No* | *No* |
| 11/22/2022 | Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| 11/29/2022 | Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| 1/8/2023 | Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| 1/12/2023 | Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| 1/20/2023 | Monthly | *Base* | **Yes** | **Yes** | **Yes** | **Yes** |
| 2/7/2023 | Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |

**Table 2 (continued). Sampling Dates for Street Sweeping Study in Tosh Creek and Country Creek Watersheds.**

| Sampling Date | Street Sweeping Treatment in Tosh Creek | Event Type | Parameter Analyzed (yes/no) and N-value | | | |
|---|---|---|---|---|---|---|
| | | | 6PPDQ | PAHs | TSS | Total Copper |
| 3/2/2023 | Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| 3/13/2023 | Monthly | **Storm** | **No** | **No** | **Yes** | **Yes** |
| 4/6/2023 | Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| 4/20/2023 | Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| 4/27/2023 | Monthly | *Base* | **Yes** | **Yes** | **Yes** | **Yes** |
| 5/5/2023 | Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| 7/11/2023 | Monthly | *Base* | **Yes** | **Yes** | **Yes** | **Yes** |
| 9/25/2023 | Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| 10/5/2023 | Twice Monthly | *Base* | **Yes** | **Yes** | **Yes** | **Yes** |
| 10/10/2023 | Twice Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| 10/16/2023 | Twice Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| 10/24/2023 | Twice Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| 11/6/2023 | Twice Monthly | **Storm** | *No* | *No* | **Yes** | **Yes** |
| 12/5/2023 | Twice Monthly | **Storm** | *No* | *No* | **Yes** | **Yes** |
| 12/22/2023 | Twice Monthly | **Storm** | *No* | *No* | **Yes** | **Yes** |
| 1/8/2024 | Twice Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| 1/24/2024 | Twice Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| 2/21/2024 | Twice Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| 2/28/2024 | Twice Monthly | **Storm** | **No** | **No** | **Yes** | **Yes** |
| 3/7/2024 | Twice Monthly | *Base* | **Yes** | **Yes** | **Yes** | **Yes** |
| 4/25/2024 | Twice Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| 5/21/2024 | Twice Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| 6/2/2024 | Twice Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| 6/13/2024 | Twice Monthly | *Base* | **Yes** | **Yes** | **Yes** | **Yes** |
| 7/29/2024 | Twice Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| 9/5/2024 | Twice Monthly | *Base* | **Yes** | **Yes** | **Yes** | **Yes** |
| 9/25/2024 | Twice Monthly | **Storm** | **Yes** | **Yes** | **Yes** | **Yes** |
| **N-value** | Quarterly/Monthly | **Storm** | 11 | 11 | 12 | 12 |
| **N-value** | Quarterly/Monthly | *Base* | 4 | 4 | 4 | 4 |
| **N-value** | Twice Monthly | **Storm** | 11 | 11 | 15 | 15 |
| **N-value** | Twice Monthly | *Base* | 4 | 4 | 4 | 4 |
| **N-value** | All Treatments | All Events | 30 | 30 | 35 | 35 |

[a] Sample collected in WY2022 but used to meet the base flow sampling requirement for WY2023.

[b] Sample collected during regularly scheduled quarterly street sweeping. The associated data from the sample were lumped with the data from samples collected during the monthly street sweeping for analyses performed for 6PPDQ and PAHs.

## Concentration and Detection Frequency Summary

This section summarizes concentrations and detection frequencies for measured parameters in both watersheds during base flow and storm events, highlighting the highest median and maximum values observed and noting detection frequency. More detailed summary statistics for concentrations of each parameter by event type (storm or base) and treatment type (quarterly, monthly, and twice monthly sweeping) are also provided in the following appendices to this memorandum:

- Appendix B Tabular Summary Statistics for 6PPDQ and PAHs
- Appendix C Box Plots for 6PPDQ and PAHs
- Appendix D Tabular Summary Statistics for TSS, Total Copper, and Particulate
- Appendix E Box Plots for TSS, Total Copper, and Particulate Copper

As shown in Table 3, 6PPDQ was present at concentrations exceeding the reporting limit in the majority of samples (percent detected range = 88 to 100 percent across all stations and event types). Concentrations measured in individual samples ranged from 0.1 to 81.4 nanograms per liter (ng/L) across all stations and event types. Across all stations and storm events, the highest median concentration (26.4 ng/L) was measured at the COUMO station. Across all stations and base flow events, the highest median concentration (2.3 ng/L) was measured at the TOSMI station.

**Table 3. Summary Statistics for 6PPD-quinone (ng/L) by Station and Sampling Event Type.**

| Station | N | Minimum | Median | Maximum | Interquartile Range | Percent Detected | Percent Exceeding Screening Level Value for Acute Exposure[a] |
|---|---|---|---|---|---|---|---|
| **Storm Events** | | | | | | | |
| TOSMI | 22 | 3.3 | 17.4 | 81.4 | 11.7 | 100% | 68% |
| TOSMO | 22 | 1.3 | 7.9 | 20.9 | 8.5 | 100% | 27% |
| COUMI | 22 | 0.2 | 7.5 | 22.8 | 7.3 | 100% | 23% |
| COUMO | 22 | 1.5 | 26.4 | 64.1 | 30.0 | 100% | 77% |
| **Base Flow** | | | | | | | |
| TOSMI | 8 | 0.6 | 2.3 | 8.4 | 2.2 | 100% | 0% |
| TOSMO | 8 | 0.2 | 1.3 | 4.3 | 1.8 | 100% | 0% |
| COUMI | 8 | 0.1 | 0.4 | 1.5 | 0.3 | 88% | 0% |
| COUMO | 8 | 0.4 | 1.4 | 7.7 | 1.5 | 100% | 0% |

[a] Acute criterion for protection of aquatic life is 12 ng/L (Ecology 2024).

For reference, a screening level value of 12 ng/L has been established to protect aquatic life from acute exposure to 6PPDQ (Ecology 2024). A screening level value is distinct from the national recommended Ambient Water Quality Criteria. The U.S. Environmental Protection Agency (EPA) issues screening level values when data are limited and they can't derive criteria according to their 1985 guidelines. Ecology has developed water quality criteria for 6PPDQ and is awaiting EPA approval on those before being implemented in Clean Water Act actions like permits and assessments. The screening level value was exceeded in 43 (49 percent) of the samples collected during storm events across all stations. The greatest number of exceedances were observed at the TOSMI station (68 percent of samples) and COUMO station (77 percent of samples). While the screening level value is generally more applicable to acute exposure during storm events, no samples collected during base flow events exceeded this value.

Out of the 18 PAHs identified in the Experimental Design section, only the following 11 were detected at concentrations that exceeded their associated reporting limit (percent detected range is provided also across all stations and event types):

- Benz[a]anthracene: range = 0 to 36 percent
- Benzo(a)pyrene: range = 0 to 27 percent
- Benzo(b)fluoranthene range = 0 to 55 percent
- Benzo(ghi)perylene range = 0 to 32 percent
- Benzo(j,k)fluoranthene range = 0 to 18 percent
- Chrysene range = 0 to 41 percent
- Dibenzo(a,h)anthracene range = 0 to 9 percent
- Fluoranthene range = 0 to 5 percent
- Indeno(1,2,3-cd)pyrene range = 0 to 36 percent
- Phenanthrene range = 0 to 5 percent
- Pyrene range = 0 to 5 percent

As shown in Appendix B (Tables B-2 through B-18), the highest maximum concentration (0.280 micrograms per liter [µg/L]) was measured for phenanthrene at the TOSMO station across all stations and storm events. Median concentrations across all stations and base flow events were generally at the reporting limit.

As shown in Table 4, TSS was present at concentrations exceeding the reporting limit in the majority of samples (percent detected range = 82 to 100 percent across all stations and event types). Concentrations measured in individual samples ranged from 0.8 to 790 milligrams per Liter (mg/L) across all stations and event types. Across all stations and storm events, the highest median concentration (69.5 mg/L) was measured at the TOSMO station while the highest maximum concentration (790 mg/L) was measured at the TOSMI station. Across all stations and base flow events, the highest median concentration (11.0 mg/L) was measured at the COUMI station, while the highest maximum concentration (170 mg/L) was measured at the TOSMO station.

| Table 4. Summary Statistics for Total Suspended Solids (mg/L) by Station and Sampling Event Type. | | | | | | |
|---|---|---|---|---|---|---|
| **Station** | **N** | **Minimum** | **Median** | **Maximum** | **Interquartile Range** | **Percent Detected** |
| **Storm Events** | | | | | | |
| TOSMI | 44 | 1.0 | 58.5 | 790 | 65.8 | 98% |
| TOSMO | 44 | 1.0 | 69.5 | 710 | 116 | 98% |
| COUMI | 44 | 1.0 | 26.5 | 320 | 60.0 | 98% |
| COUMO | 44 | 1.0 | 22.0 | 150 | 35.3 | 98% |
| **Base Flow** | | | | | | |
| TOSMI | 17 | 0.8 | 8.8 | 55.0 | 8.0 | 94% |
| TOSMO | 17 | 0.8 | 9.6 | 170 | 12.0 | 94% |
| COUMI | 17 | 4.4 | 11.0 | 51.0 | 9.8 | 100% |
| COUMO | 17 | 0.8 | 5.0 | 39.0 | 3.8 | 82% |

As shown in Table 5, total copper was present at concentrations exceeding the reporting limit in most samples (percent detected range = 47 to 100 percent across all stations and event types).

Concentrations measured in individual samples ranged from 1.0 to 47 µg/L across all stations and event types. Across all stations and storm events, the highest median concentration (6.9 µg/L) was measured at the TOSMI station while the highest maximum concentration (47 µg/L) was measured at this same station. Across all stations and base flow events, the highest median concentration (2.2 µg/L) was measured at the TOSMI station. Across all base flow events, the highest maximum concentration

(11.0 µg/L) was measured at all stations, reflecting an unusually high reporting limit that was obtained from the laboratory for the sampling event on January 22, 2021.

| Table 5. Summary Statistics for Total Copper (ug/L) by Station and Sampling Event Type. | | | | | | |
|---|---|---|---|---|---|---|
| **Station** | **N** | **Minimum** | **Median** | **Maximum** | **Interquartile Range** | **Percent Detected** |
| **Storm Events** | | | | | | |
| TOSMI | 44 | 1.9 | 6.9 | 47 | 4.5 | 100% |
| TOSMO | 44 | 1.6 | 5.8 | 41 | 5.3 | 100% |
| COUMI | 44 | 1.0 | 3.3 | 27 | 3.2 | 95.5% |
| COUMO | 44 | 1.1 | 4.3 | 40 | 2.8 | 100% |
| **Base Flow** | | | | | | |
| TOSMI | 17 | 1.0 | 2.2 | 11 | 2.2 | 94% |
| TOSMO | 17 | 1.0 | 1.0 | 11 | 0.3 | 47% |
| COUMI | 17 | 1.0 | 1.0 | 11 | 0.9 | 47% |
| COUMO | 17 | 1.0 | 1.0 | 11 | 0.2 | 53% |

Concentrations of particulate copper measured in individual samples ranged from 0 to 42 µg/L across all stations and event types (Table 6). Across all stations and storm events, the highest median concentration (3.4 µg/L) was measured at the TOSMI station, while the highest maximum concentration (42 µg/L) was measured at this same station. Across all stations and base flow events, the highest median concentration (1.1 µg/L) was measured at the TOSMI station. The highest maximum concentration (10.0 µg/L) across all base flow events was measured at all stations and again reflects an unusually high reporting limit that was obtained from the laboratory for the sampling event on January 22, 2021.

**Table 6. Summary Statistics for Particulate Copper (ug/L) by Station and Sampling Event Type.**

| Station | N | Minimum | Median | Maximum | Interquartile Range |
|---|---|---|---|---|---|
| **Storm Events** | | | | | |
| TOSMI | 44 | 0.20 | 3.4 | 42 | 3.8 |
| TOSMO | 44 | 0.20 | 3.1 | 37 | 4.4 |
| COUMI | 44 | 0.00 | 1.5 | 13 | 2.3 |
| COUMO | 44 | 0.10 | 1.6 | 19 | 1.8 |
| **Base Flow** | | | | | |
| TOSMI | 17 | 0.0 | 1.1 | 10 | 2.3 |
| TOSMO | 17 | 0.0 | 0.0 | 10 | 0.3 |
| COUMI | 17 | 0.0 | 0.0 | 10 | 0.9 |
| COUMO | 17 | 0.0 | 0.0 | 10 | 0.1 |

# Statistical Analysis Results

## Mann-Whitney and Kruskal-Wallis Test Results

Raw results from the Mann-Whitney U tests comparing concentrations of 6PPDQ and PAHs measured during the periods with “monthly sweeping” and “twice monthly sweeping” are presented in Appendix F. Results from the control watershed, where no sweeping was conducted, are examined qualitatively to provide contextual comparison. Table 7 identifies the specific instances where concentrations measured during the twice monthly sweeping period were significantly lower than those measured during the monthly sweeping period for each combination of station and parameter from sampling that occurred during storm and base flow events, respectively. These results indicate concentrations were lower in storm event samples during the twice monthly sweeping period for only one station and parameter combination (TOSMO and benz[a]anthracene) in the Tosh Creek watershed where street sweeping was increased. At the same time, concentrations were lower in storm event samples during the twice monthly sweeping period for 11 of the PAHs at the COUMI station in the Country Creek watershed where street sweeping was not increased. These patterns are generally evident in the box plots that are provided in Appendix C. No significant differences were detected for any station or parameter combination based on the base flow event samples.

| Table 7. Mann-Whitney U Test Results. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Tosh Creek Watershed Stations: Increased Sweeping Experimental | | | | Country Creek Watershed Stations: No Increased Sweeping Control | | | |
| | TOSMO | | TOSMI | | COUMO | | COUMI | |
| Parameter | Storm | Base | Storm | Base | Storm | Base | Storm | Base |
| 6PPDQ | | | | | | | | |
| 1-Methylnaphthalene | | | | | | | Decrease | |
| 2-Methylnaphthalene | | | | | | | Decrease | |
| Acenaphthene | | | | | | | Decrease | |
| Acenaphthylene | | | | | | | Decrease | |
| Anthracene | | | | | | | Decrease | |
| Benz[a]anthracene | Decrease | | | | | | | |
| Benzo(a)pyrene | | | | | | | | |
| Benzo(b)fluoranthene | | | | | | | | |
| Benzo(ghi)perylene | | | | | | | | |
| Benzo(j,k)fluoranthene | | | | | | | | |
| Chrysene | | | | | | | | |
| Dibenzo(a,h)anthracene | | | | | | | Decrease | |
| Fluoranthene | | | | | | | Decrease | |
| Fluorene | | | | | | | Decrease | |
| Indeno(1,2,3-cd)pyrene | | | | | | | | |
| Naphthalene | | | | | | | Decrease | |
| Phenanthrene | | | | | | | Decrease | |
| Pyrene | | | | | | | Decrease | |

**Decrease:** Concentrations for the indicated parameter were significantly lower during the twice monthly sweeping periods relative to those measured during the monthly sweeping period based on a one-tailed test at an α-level of 0.05.

Raw results from the Kruskal-Wallis tests comparing concentrations of TSS, total copper, and particulate copper measured during the periods with “quarterly sweeping,” “monthly sweeping,” and “twice monthly sweeping” are presented in Appendix G. Based on these results and the associated post-hoc multiple comparison tests, the following patterns were detected in the data for each combination of station and parameter from sampling that occurred during storm and base flow events, respectively.:

- Tosh Creek Watershed Stations – Increased Sweeping Experimental
    - TOSMO: TSS concentrations from storm event samples were significantly lower during the monthly sweeping relative to those from the quarterly sweeping period; no other differences detected (see graphical representation in Figure 4).

- Country Creek Watershed Stations – No Increased Sweeping Control
  - COUMI: TSS concentrations from storm event samples were significantly lower during the twice monthly sweeping period relative to those from the quarterly sweeping period; no other differences detected (see graphical representation in Figure 5).
  - COUMI: Total copper concentrations from storm event samples were significantly lower during the monthly sweeping period relative to those from the quarterly sweeping period; no other differences detected (see graphical representation in Figure 6).

No significant differences were detected for any station or parameter combination based on the base flow event samples.

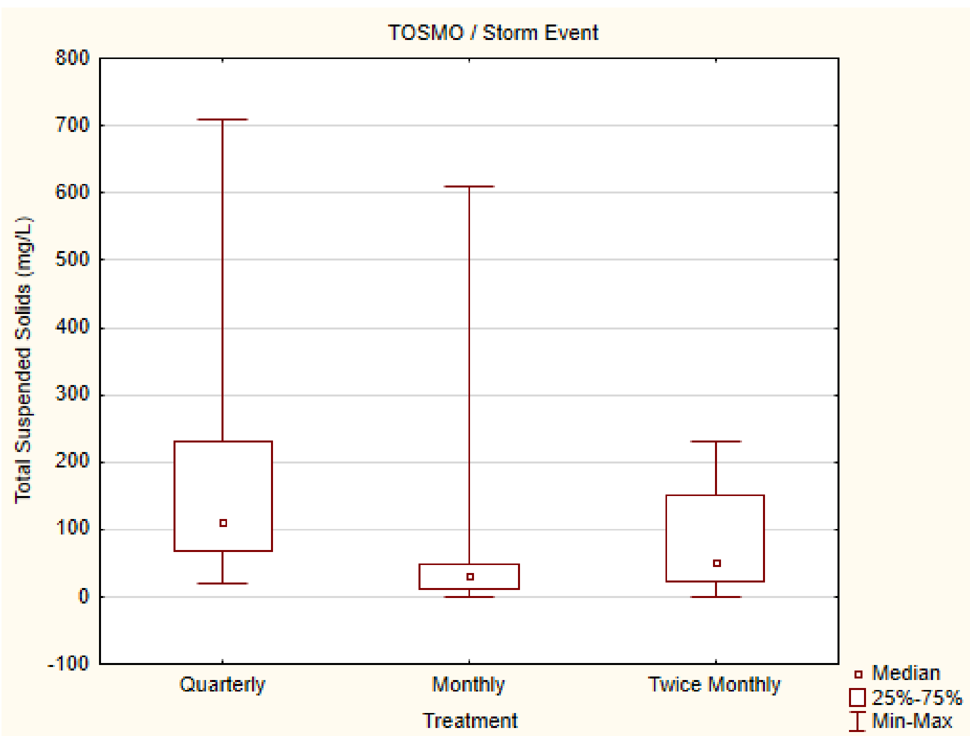


Figure 4. Suspended Solids Concentrations Measured at the TOSMO Station During Storm Events Across Street Sweeping Treatments.

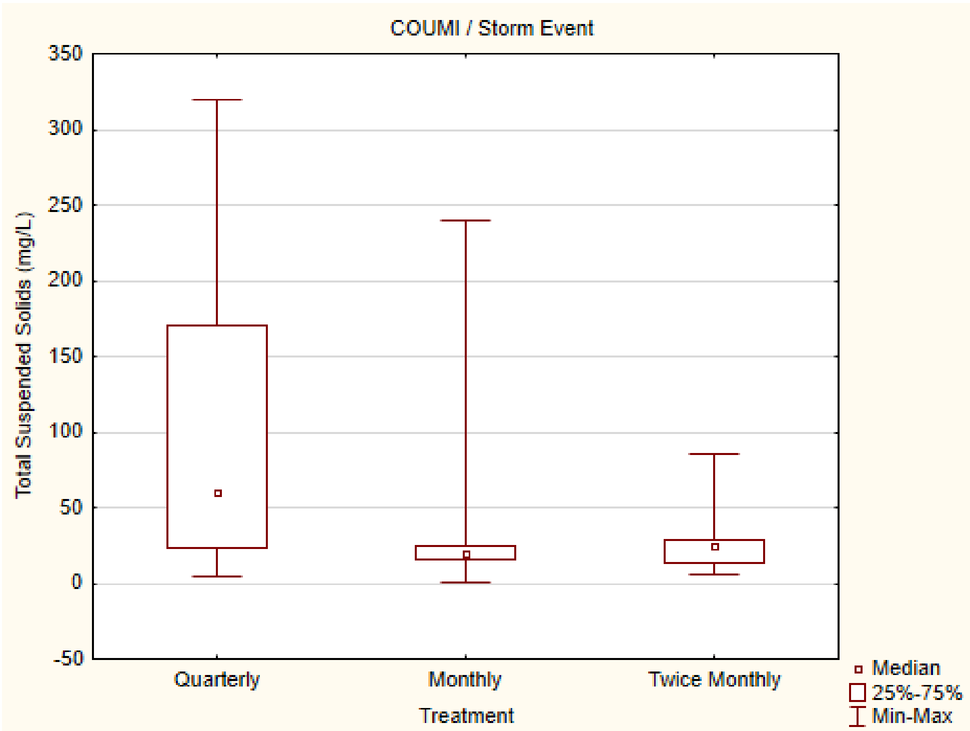


Figure 5. Suspended Solids Concentrations Measured at the COUMI Station During Storm Events Across Street Sweeping Treatments.

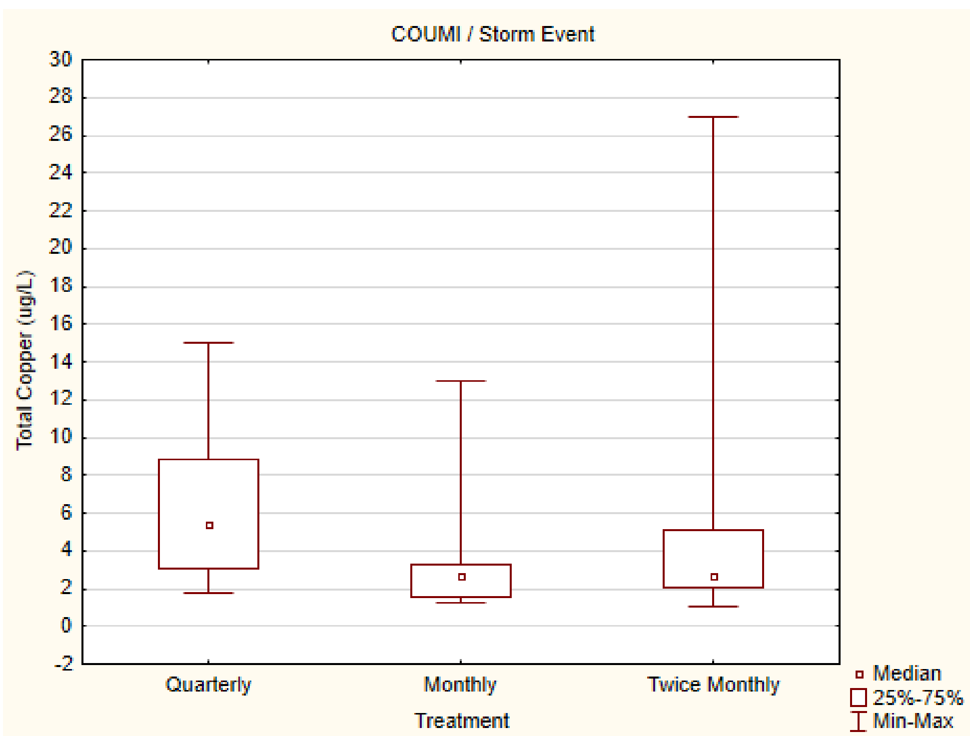


Figure 6. Total Copper Concentrations Measured at the COUMI Station During Storm Events Across Street Sweeping Treatments.

# Mixed Model Results

Mixed-effects models were used to evaluate whether differences in constituent concentrations between watersheds and water years were statistically meaningful while accounting for correlations among repeated samples from the same monitoring locations and sampling events. Four models (FM1–FM4) were compared for each analyte using Akaike's Information Criterion (AIC), Bayesian Information Criterion (BIC), and log-likelihood as indicators of relative model fit (Table 8). Lower AIC, BIC, and -2*log-likelihood values indicate better model fit after penalizing for model complexity.

For 6PPDQ, FM4 (which included only event type as fixed effects and excluded water year and watershed) produced the lowest AIC and BIC, indicating a slightly better fit relative to models that included water year, watershed, or interaction terms. This suggests that differences in 6PPDQ concentrations were better explained by event type rather than by interannual or spatial variation between 2023 and 2024.

For both TSS and particulate copper, FM1 (which included interactive watershed and water year effects and event-type effects) provided the best overall fit, implying modest evidence that interannual variation contributed to observed differences and that the interannual variation was different between the Tosh and Country Creek watersheds.

Overall, model comparisons suggest that while water year effects were detectable for TSS and particulate copper, the strongest and most consistent predictor of constituent concentrations was event type (reflecting that storm events typically had higher concentrations than base flow events).

To summarize:

- Event type (storm vs. base flow) was the strongest predictor of 6PPDQ, TSS, and particulate copper concentrations in both Tosh and Country Creeks.
- For 6PPDQ, neither watershed (Tosh vs. Country) nor water year provided meaningful information, suggesting that sweeping-related differences were not detectable.
- For TSS and particulate copper, the interaction between watershed and water year was statistically significant, indicating that the change in concentrations over time differed between Tosh and Country Creeks. Specifically, concentrations decreased in both watersheds from 2021 to 2024, but the decrease was smaller in Tosh Creek, consistent with weaker hydrologic connectivity between swept surfaces and monitoring locations (see more detailed interpretation of these results in the Discussion section).

**Table 8. Mixed Model Comparison.**

| Model | Formula | Fixed Effects | Random Effects | 6PPDQ (2023–2024) | | | TSS (2021–2024) | | | Particulate Copper (2021–2024) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | AIC | BIC | -2 * Log Likelihood | AIC | BIC | -2 * Log Likelihood | AIC | BIC | -2 * Log Likelihood |
| FM1 | log(Result) ~ Watershed * WaterYear + eventType + (1 \| Location) + (1 \| eventDate) | Interaction between Watershed and Water Year<br>Event Type | Monitoring Station<br>Sampling Date | 335.53 | 357.83 | **319.53** | **711.85** | 739.84 | **695.87** | **671.7** | 699.68 | **655.70** |
| FM2 | log(Result) ~ Watershed + WaterYear + eventType + (1 \| Location) + (1 \| eventDate) | Watershed<br>Water Year<br>Event Type | Monitoring Station<br>Sampling Date | 334.81 | 364.32 | 320.81 | 714.85 | 739.33 | 700.85 | 676.97 | 701.45 | 662.97 |
| FM3 | log(Result) ~ Watershed * EventType + (1 \| Location) + (1 \| eventDate) | Watershed<br>Event Type | Monitoring Station<br>Sampling Date | 332.82 | 349.55 | 320.82 | 716.62 | **737.61** | 704.62 | 677.95 | **698.94** | 665.95 |
| FM4 | log(Result) ~ eventType + (1 \| Location) + (1 \| eventDate) | Event Type | Monitoring Station<br>Sampling Date | **330.99** | **344.93** | 320.99 | 716.76 | 737.75 | 704.76 | 682.11 | 703.09 | 670.11 |
| **Model Interpretation Summary** | | | | All models performed approximately similarly, and the event type (base vs. storm) was the most important explanatory variable.<br>There was insufficient evidence to suggest that the rate of change for 6PPQ concentrations differed between the two watersheds. | | | The best performing model (FM1) indicates that the event type is important and that temporal trends in TSS were different between Tosh and Country Creeks. | | | The best performing model (FM1) indicates that the event type is important and that temporal trends in particulate copper were different between Tosh and Country Creeks. | | |

**Table 9. Selected Mixed Model Summary for 6PPD-quinone, Total Suspended Solids, and Particulate Copper.**

| Parameter | Selected Model | Effect | Estimate | Standard Error | p-value | Interpretation |
|---|---|---|---|---|---|---|
| **6PPDQ** | FM4 | (Intercept) | 0.069 | 0.400 | 0.867 | Baseline condition (base flow). |
| | | **Event Type (Storm)** | **2.248** | **0.309** | **<0.001** | Storm events had 9.5 times higher 6PPDQ concentrations than base flow. |
| **TSS** | FM1 | **(Intercept)** | **1.779** | **0.337** | **<0.001** | Baseline condition (Country Creek, water year 2021, base flow). |
| | | **Event Type (Storm)** | **1.723** | **0.310** | **<0.001** | Storm events had 5.6 times higher TSS concentrations than base flow. |
| | | Watershed (Tosh) | 0.514 | 0.303 | 0.229 | Tosh Creek TSS was 1.7 times greater than Country, but this trend was *not* statistically significant. |
| | | **WaterYear** | **-0.328** | **0.127** | **0.012** | In Country Creek, TSS decreased by ~33 percent per year between 2021 and 2024. |
| | | **WaterYear: Tosh** | **0.196** | **0.087** | **0.026** | In Tosh Creek, the TSS decrease was smaller (~13 percent per year). |
| **Particulate Copper** | FM1 | **(Intercept)** | **-0.803** | **0.228** | **0.002** | Baseline condition (Country Creek, water year 2021, base flow). |
| | | **Event Type (Storm)** | **1.330** | **0.229** | **<0.001** | Storm events had 3.8 times higher particulate copper concentrations than base flow. |
| | | *Watershed: Tosh* | *0.671* | *0.172* | *0.056* | Tosh Creek particulate copper was 2.0 times greater than Country. This trend was *borderline* statistically significant. |
| | | **WaterYear** | **-0.269** | **0.098** | **0.007** | In Country Creek, particulate copper decreased by ~27 percent per year between 2021 and 2024. |
| | | **WaterYear: Tosh** | **0.238** | **0.088** | **0.007** | In Tosh Creek, the decline was much smaller (~3 percent per year, potentially flat). |

# Discussion

As noted in the Introduction, the first trend analysis report that was prepared for the RPWS (Herrera 2021) documented a significant decrease in TSS and total copper concentrations in Monticello Creek that appeared related to a City project that progressively increased street sweeping frequency in the associated watershed. Specifically, this observed water quality improvement was coincident with an increase in street sweeping in the basin from quarterly, to monthly, to twice monthly. In addition to TSS and total copper, analyses were also performed on data for other pollutants that are most likely to be affected by street sweeping, which included total phosphorus, total nitrogen, and total zinc. The pattern of interest in this analysis was a consistent decrease in pollutant concentrations across all three periods of street sweeping. "Consistent" implies the data move in one direction through each of the time periods. It is possible to have a significant difference among the three time periods but not have it move in one consistent direction (e.g., elevated concentrations in the first time period, significantly lower in the second, but then elevated again in the third time period). This is a less-interesting pattern because sweeping was progressively increased through the time periods, so any improvement in water quality caused by increased sweeping should also follow this trend (i.e., consistent improvement through each time period). As documented in Herrera (2021), TSS and total copper both exhibited a consistent and significant decrease at the MONMS station in the Monticello Creek watershed during storms; a similar decrease was not observed at any of the other 13 monitoring stations located across the 7 study watersheds.

These results are also consistent with a street sweeping study that was implemented by Seattle Public Utilities (SPU) along Martin Luther King Avenue in Seattle, Washington (SPU 2018). This study also found a relationship between sweeping and decreased pollutant concentrations in stormwater for two pollutants: particulate copper and coarse sediment above 250 microns. Unlike the study performed in the Monticello Creek watershed and the study discussed herein that examine potential water quality improvements in the receiving water from street sweeping, the SPU study examined potential water quality improvements in the catch basin directly adjacent to the road being swept; hence, there were likely fewer confounding variables to contend with in the SPU study. Although the study in the Monticello Creek watershed and the SPU study had substantially different designs, they both came to a similar conclusion, which is that street sweeping appears to have an effect on copper and TSS in stormwater.

While the Tosh Creek Street Sweeping Study was implemented in part to validate the results from these previous studies, the results obtained do not provide any additional evidence that street sweeping is effective at reducing TSS and total copper because no consistent decreasing trend was observed in the data in response to the increased street sweeping based on the results from the Kruskal-Wallis test. Furthermore, a consistent decreasing trend was also not observed for 6PPDQ and PAHs in response to the increased street sweeping based on results from the Mann-Whitney U test. In fact, consistent decreases in pollutant concentrations were generally detected more frequently at the COUMI station in the Country Creek watershed where no increase in street sweeping occurred.

To better evaluate these patterns, additional analyses were performed using mixed-effects models that more explicitly accounted for temporal autocorrelation (e.g., repeated sampling within stations and storm events) and differences among sites. Results from the mixed-effects model generally confirmed the findings from the Mann-Whitney U and Kruskal-Wallis tests: both Tosh and Country Creeks showed decreasing concentrations of TSS and particulate copper between 2021 and 2024, but the decreases were weaker in Tosh Creek and not statistically distinguishable from natural variation or background trends. No measurable trend was observed for 6PPDQ.

The lack of a clear sweeping signal in Tosh Creek likely reflects hydrologic and land use factors rather than analytical limitations. Field review and drainage mapping indicate that while there are a number of busy public roadways within the delineated Tosh Creek watershed, most are routed through stormwater systems that discharge to wetlands north of the creek, reducing direct road-to-stream connectivity. In contrast, Country Creek has a higher proportion of directly connected road crossings and outfalls. Tosh

Creek has 0.8 outfall per 1,000 feet of creek, while Country Creek has 1.6 outfalls per 1,000 feet and Monticello has 3.5 outfalls per 1,000 feet. Tosh Creek also contains two large multifamily complexes with private roads that were not included in the City's sweeping program. Together, these factors suggest that sweeping in Tosh Creek may have less influence on the instream monitoring locations than in more directly connected systems such as Monticello Creek.

Additionally, external factors such as post-pandemic changes in traffic patterns appear unlikely to explain the results. Regional traffic volumes increased steadily between 2021 and 2024 (Table 10), yet particulate copper and TSS concentrations decreased modestly in both watersheds. This suggests that while overall pollutant loading may be influenced by vehicle activity, the degree of hydraulic connection between road surfaces and streams remains a key determinant of instream water quality response to sweeping.

**Table 10. Traffic Count Data Within and Near the Tosh and Country Creek Watersheds.**

| | WSDOT Traffic Data | | Redmond Traffic Data | | |
|---|---|---|---|---|---|
| Year | State Route 520 Traffic AADT (@ NE 40th Street) | Percent Annual Change | NE 51st Street and Lake Sammamish Parkway | Lake Sammamish Parkway and Bel-Red | 156th Avenue and Bel-Red |
| 2019 | 74,788 | -- | 3,700 | 20,500 | 19,000 |
| 2020 | 48,596 | -35% | -- | -- | -- |
| 2021 | 53,840 | 11% | -- | -- | -- |
| 2022 | 61,404 | 14% | 2,883 | 17,141 | 15,565 |
| 2023 | 64,706 | 5% | -- | -- | -- |
| 2024 | 67,359 | 4% | -- | -- | -- |

WSDOT = Washington State Department of Transportation; AADT = annual average daily traffic

Traffic data reported from <https://wsdot.public.ms2soft.com/tcds/tsearch.asp?loc=Wsdot&mod=TCDS> and <https://www.redmond.gov/863/Traffic-Counts>.

Finally, it is possible the benefits of street sweeping could not be demonstrated because the experimental design used for the Tosh Creek Street Sweeping Study was not sufficiently robust. In general, there are many confounding factors that come into play when interpreting variations in water quality over different time periods in urban watersheds (e.g., timing of sample collection, climatic variation, land use land cover changes, etc.) (Bertrand-Krajewski et al. 1998; Lee et al. 2002; Hatt et al. 2004). This is especially true when monitoring is being conducted in the receiving water where numerous instream processes can influence water quality (e.g., bank and channel scour, groundwater inputs, etc.). As noted above, the SPU study examined potential water quality improvements in the catch basin directly adjacent to the road being swept, which resulted in fewer confounding variables. It is possible the benefits of street sweeping could be more easily detected for parameters such as 6PPDQ through implementation of a more controlled study.

# Conclusions

The Tosh Creek Street Sweeping Study was implemented to achieve the following objectives:

- Validate results from previous studies that documented decreasing concentrations of TSS and total copper associated with increased street sweeping.
- Assess the potential benefits of street sweeping for decreasing concentrations of 6PPDQ and PAHs.

The experimental design involved sweeping all public roads in the Tosh Creek watershed within Redmond city limits one time per month starting on October 29, 2022, and extending through the remainder of WY2023, and two times per month over all of WY2024. This is in addition to the regularly scheduled quarterly street sweeping. To provide a control for assessing the effectiveness of the increased street sweeping in the Tosh Creek watershed, street sweeping in the Country Creek watershed was maintained at the regularly scheduled quarterly interval.

In connection with the Status and Trends Monitoring for the RPWS, routine water quality monitoring was conducted in the Tosh Creek and Country Creek watersheds that involved the collection of samples during three storm events and one base flow event in each quarter of the WY; however, this monitoring was augmented by sample collection for 6PPDQ and PAHs. This sample collection spanned WY2023 and WY2024, respectively, to capture the increase in street sweeping.

Results from this sampling showed 6PPDQ was present at concentrations exceeding the reporting limit in the majority of samples. Furthermore, the screening level value for 6PPDQ (Ecology 2024) was exceeded in 49 percent of the samples collected during storm events across all stations; this value was not exceeded in any of the samples collected during base flow. PAHs were frequently not present at concentrations that exceeded applicable reporting limits.

Results from both conventional statistical tests and mixed-effects model analyses indicate that TSS and particulate copper concentrations decreased slightly in both Tosh and Country Creeks between 2021 and 2024, but no measurable difference could be attributed to the increased sweeping frequency in Tosh Creek. No trends were observed for 6PPDQ or PAHs. These results suggest that while water quality in both watersheds may be improving modestly, the effect of street sweeping is not discernible in Tosh Creek, likely due to limited direct connectivity between swept streets and the receiving water and the influence of other non-swept surfaces (e.g., private roads and parking areas).

While these findings do not validate the results from the previous study in Monticello Creek, this is expected to be due to the low street-to-stream connectivity of Tosh Creek, rather than evidence that street sweeping is ineffective. Previous studies have shown that street sweeping can improve stormwater quality where swept surfaces are hydrologically well connected to monitored outfalls or streams. In settings such as Tosh Creek, where that connection is weaker, the benefits of sweeping may not be detectable at instream monitoring locations despite measurable decreases in roadway pollutant sources.

# References

Bertrand-Krajewski, J.L., G. Chebbo, and A. Saget. 1998. Distribution of Pollutant Mass Vs. Volume in Stormwater Discharges and the First Flush Phenomenon. Water Research 32(8):2341–2356.

Ecology. 2024. Concise Explanatory Statement Chapter 173-201A WAC Aquatic Life Toxics Critiera: Summary of Rulemaking and Response to Comments. State of Washington State Department of Ecology. Publication No. 24-10-032. August.

Hatt, B.E., T.D. Fletcher, C.J. Walsh, and S.L. Taylor. 2004. The Influence of Urban Density and Drainage Infrastructure on the Concentrations and Loads of Pollutants in Small Streams. Environmental Management 34(1):112–124.

Helsel, D.R., and R.M. Hirsch. 2002. Statistical Methods in Water Resources Techniques of Water Resources Investigations, Book 4, chapter A3. U.S. Geological Survey.

Herrera. 2013. 2013 City of Redmond, Washington: Citywide Watershed Management Plan. Prepared for the City of Redmond by Herrera Environmental Consultants, Inc., Seattle, Washington. December 31.

Herrera. 2015. Quality Assurance Project Plan: Redmond Paired Watershed Study. Prepared for the City of Redmond by Herrera Environmental Consultants, Inc., Seattle, Washington. December 31.

Herrera. 2021. Redmond Paired Watershed Study Trend Analysis Report: Water Years 2016–2019. Prepared for the City of Redmond by Herrera Environmental Consultants, Inc., Seattle, Washington. February 19.

Herrera. 2022. Addendum 1 to the Quality Assurance Project Plan for the Redmond Paired Watershed Study. Prepared for the City of Redmond by Herrera Environmental Consultants, Inc., Seattle, Washington. June 8.

Herrera. 2023. Tosh Creek Street Sweeping Study – Interim Summary Report. Prepared for the City of Redmond by Herrera Environmental Consultants, Inc., Seattle, Washington. July 5.

Herrera. 2025. Redmond Paired Watershed Study Trend Analysis Report: Water Years 2016–2023. Prepared for the City of Redmond by Herrera Environmental Consultants, Inc., Seattle, Washington. June 25.

Lee, J.H., K.W. Bang, L.H. Ketchum, J.S. Choe, and M.J. Yu. 2002. First Flush Analysis of Urban Storm Runoff. Science of the Total Environment 293(1–3):163–175.

Schueler, T. 1987. Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs. Prepared for the Washington Metropolitan Water Resources Planning Board. July 7.

SPU. 2018. NPDES Phase I Municipal Stormwater Permit: Street Sweeping Water Quality Effectiveness Study Final Report. Seattle Public Utilities, Seattle, Washington.

Tian Z., M. Gonzalez, C.A. Rideout, H.N. Zhao, X. Hu, J. Wetzel, E. Mudrock, C.A. James, J.K. McIntyre, and

E.P. Kolodziej. 2022. 6PPD-Quinone: Revised Toxicity Assessment and Quantification with a Commercial Standard. Environmental Science & Technology Letters 2022, 9, 2, 140–146.

# Appendix A

## Data Validation Memorandum

# Herrera Environmental Consultants, Inc.

# Internal Memorandum

**Date:** January 30, 2025

**To:** Project File

**From:** Nikki VandePutte

**Subject:** Data Quality Assurance Review of the Redmond Paired Watershed Stormwater Retrofit Effectiveness Water Quality Monitoring Data – Tosh Creek Street Sweeping

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## Data Quality Assurance Review

This memorandum presents a review of data quality for 127 water samples (including 7 field duplicates) collected for the Redmond Paired Watershed Stormwater Retrofit Effectiveness Study between October 26, 2022, and September 25, 2024 (Table 1).

OnSite Environmental, Inc., of Redmond, Washington, analyzed the samples for polycyclic aromatic hydrocarbons (PAHs) by EPA Method 8270E-SIM.

SGS AXYS Analytical Services, Ltd., of Sidney, British Columbia, Canada, analyzed samples for 6PPDQuinone (6PPDQ) by Method MLA-118.

| Table 1. Effectiveness Monitoring Samples. | | | |
|---|---|---|---|
| **Date Collected** | **Lab SDG** | **Samples Collected** | **QC Samples Collected** |
| 10/21/2022 | 2210-222 | 4 stations | NA |
| 10/26/2022 | 2210-298 | 4 stations | NA |
| 11/22/2022 | 2211-296 | 4 stations | NA |
| 11/29/2022 | 2211-351 | 4 stations | NA |
| 1/8/2023 | 2301-049 | 4 stations | NA |
| 1/12/2023 | 2301-084 | 4 stations | NA |
| 1/20/2023 | 2301-173 | 4 stations | 1 field duplicate |
| 2/7/2023 | 2302-068 | 4 stations | NA |
| 3/2/2023 | 2303-020 | 4 stations | 1 field duplicate |
| 4/6/2023 | 2304-066 | 4 stations | NA |
| 4/20/2023 | 2304-245 | 4 stations | 1 field duplicate |
| 4/27/2023 | 2304-315 | 4 stations | NA |
| 5/5/2023 | 2305-051 | 4 stations | NA |
| 7/11/2023 | 2307-049 | 4 stations | NA |
| 9/25/2023 | 2309-253 | 4 stations | 1 field duplicate |
| 10/5/2023 | 2310-056 | 4 stations | 1 field duplicate |
| 10/10/2023 | 2310-116 | 4 stations | NA |
| 10/16/2023 | 2310-190 | 4 stations | NA |
| 10/24/2023 | 2310-287 | 4 stations | NA |
| 1/8/2024 | 2401-067 | 4 stations | 1 field duplicate |
| 1/24/2024 | 2401-243 | 4 stations | NA |
| 2/21/2024 | 2402-276 | 4 stations | NA |
| 3/7/2024 | 2403-095 | 4 stations | NA |
| 4/25/2024 | 2404-348 | 4 stations | NA |
| 5/21/2024 | 2405-300 | 4 stations | NA |
| 6/2/2024 | 2406-001 | 4 stations | 1 field duplicate |
| 6/13/2024 | 2406-159 | 4 stations | NA |
| 7/29/2024 | 2407-311 | 4 stations | NA |
| 9/5/2024 | 2409-040 | 4 stations | NA |
| 9/25/2024 | 2409-327 | 4 stations | NA |

The laboratory's performance was reviewed in accordance with quality control (QC) criteria established in the *Redmond Paired Watershed Study Quality Assurance Project Plan* (QAPP) (Herrera 2015) and *Addendum 1 to the Quality Assurance Project Plan for the Redmond Paired Watershed Study* (Herrera 2022), by the laboratory, and in the specified methods.

Quality control data summaries submitted by the laboratory were reviewed; raw data were not submitted by the laboratory. Data Quality Assurance Worksheets were completed for each laboratory report. Data


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qualifiers (flags) were added to the sample results in the laboratory reports. Data validation results are summarized below, followed by definitions of data qualifiers.

## Custody, Preservation, Holding Times, and Completeness – Acceptable with Qualification

Samples were collected at all stations for every event. The goal for sampling events was three storms and one base flow event per quarter for 2 years (32 events, 128 samples). However, in both water years, only two storms were sampled in Quarter 4 due to dry weather. Thus, the total number of events was 30, and the total number of samples was 120.

The samples were properly preserved, and sample custody was maintained from sample collection to receipt at the laboratory. The laboratory reports were complete and contained results for all samples and tests requested on the chain-of-custody (COC) forms. Samples were analyzed within the required method holding times, with the exceptions noted below and summarized in Table 2.

- Ninety-five 6PPDQ samples were extracted outside the 14-day extraction holding time specified in the QAPP but were within the laboratory's 35-day holding time. No data that met the laboratory's holding time were qualified.
- The 6PPDQ sample collected at COUMI on February 7, 2023, was extracted outside of QAPP and laboratory holding time (64 days vs. laboratory's 35-day holding time) and qualified as estimated.
- The 6PPDQ sample collected at COUMI on March 2, 2023, was extracted outside of QAPP and laboratory holding time (41 days vs. laboratory's 35-day holding time) and qualified as estimated.
- All four 6PPDQ samples collected on February 21, 2024, were analyzed outside of QAPP holding time (30 vs. 28 days after extraction) and qualified as estimated.
- All four 6PPDQ samples collected on March 7, 2024, were analyzed outside of QAPP holding time (30 vs. 28 days after extraction) and qualified as estimated.
- All four 6PPDQ samples collected on April 25, 2024, were analyzed outside of QAPP holding time (35–36 vs. 28 days after extraction) and qualified as estimated.
- All four 6PPDQ samples collected on May 21, 2024, were analyzed outside of QAPP holding time (35–36 vs. 28 days after extraction) and qualified as estimated.

| Table 2. Data Qualified due to Holding Time Exceedances. | | | | | |
|---|---|---|---|---|---|
| Date Collected | Lab SDG | Sample Location | Parameter | Reason for Qualification | Flag |
| 2/7/2023 | 2301-068 | COUMI | 6PPDQ | Extraction holding time exceedance | J |
| 3/2/2023 | 2303-020 | COUMI | 6PPDQ | Extraction holding time exceedance | J |
| 2/21/2024 | 2402-276 | All 4 locations | 6PPDQ | Holding time exceedance | J |
| 3/7/2024 | 2403-095 | All 4 locations | 6PPDQ | Holding time exceedance | J |
| 4/24/2024 | 2404-348 | All 4 locations | 6PPDQ | Holding time exceedance | J |
| 5/21/2024 | 2405-300 | All 4 locations | 6PPDQ | Holding time exceedance | J |

## Laboratory Reporting Limits – Acceptable with Discussion

The laboratory reporting limits met those established in the QAPP with some exceptions. 6PPDQ (47 samples) were slightly elevated (greater than or equal to 0.11 vs. 0.1 ng/L); however, data quality was not affected because the samples were detected above the reporting limit. Reporting limits for PAHs (38 samples) were slightly elevated (0.11–0.16 vs. 0.1 ng/L, or 0.011–0.022 vs. 0.01 ng/L), with some undetected values; however, the increased RLs were slight, and data quality was not affected. No data were qualified based on laboratory reporting limits.

## Method Blank Analysis – Acceptable with Qualification

Method blanks were analyzed at the required frequency. Method blanks did not contain levels of target analytes above the laboratory reporting limits, with the following exceptions:

- The method blank analyzed with 6PPDQ samples collected on July 11, 2023, had a detection above the reporting limit (0.12 ng/L vs. reporting limit of 0.1). One associated sample, COUMO, was qualified as estimated because the concentration was within five times the concentration detected in the method blank, as specified in the QAPP addendum (Herrera 2022).
- The method blank analyzed with 6PPDQ samples collected on October 5, 2023, had a detection above the reporting limit (0.178 ng/L vs. reporting limit of 0.1). One associated sample, COUMI, was qualified as estimated because the concentration was within five times the concentration detected in the method blank.
- The method blank analyzed with 6PPDQ samples collected on October 10, 2023, had a detection above the reporting limit (0.178 ng/L vs. reporting limit of 0.1). One associated sample, COUMI, was qualified as estimated because the concentration was within five times the concentration detected in the method blank.

- The method blank analyzed with 6PPDQ samples collected on October 24, 2023, had a detection above the reporting limit (0.231 ng/L vs. reporting limit of 0.1). One associated sample, COUMI, was qualified as estimated because the concentration was within five times the concentration detected in the method blank.
- While the method blank analyzed with 6PPDQ samples collected in January 2023 (January 8, 12, and 20) was undetected, the reporting limit was elevated (0.65 ng/L vs. goal of 0.1 ng/L). The laboratory qualified the method blank result as estimated due to low surrogate recovery for the method blank (3 percent vs. minimum 30 percent) but noted that the method of quantification produces data that are recovery corrected. To account for potential undetected blank contamination, the one associated sample result (COUMI on January 20, 2023 [0.57 ng/L]) below the blank reporting limit was qualified as estimated (flagged J).

Data qualified due to method blank results are listed in Table 3.

**Table 3. Data Qualified due to Method Blank Results.**

| Date Collected | Lab SDG | Sample Location | Parameter | Reason for Qualification | Flag |
|---|---|---|---|---|---|
| 7/11/2023 | 2307-049 | COUMO | 6PPDQ | Method blank contamination | J |
| 1/20/2023 | 2301-173 | COUMI | 6PPDQ | Elevated method blank reporting limit | J |
| 10/5/2023 | 2310-056 | COUMI | 6PPDQ | Method blank contamination | J |
| 10/10/2023 | 2310-116 | COUMI | 6PPDQ | Method blank contamination | J |
| 10/24/2023 | 2310-287 | COUMI | 6PPDQ | Method blank contamination | J |

## Laboratory Control Sample Analysis – Acceptable

Laboratory control samples (LCS) were analyzed with project samples for PAHs at the required frequency. The percent recovery values for all parameters met the criteria established in the QAPP.

## Surrogate Standard Recovery Analysis– Acceptable with Qualification

Surrogate standards were analyzed with project samples for PAHs and 6PPDQ. With the exceptions noted below and provided in Table 4, the percent recovery values met the control limits established in the QAPP.

- Surrogate standards were analyzed for samples COUMO, TOSMO, and TOSMI collected on February 7, 2023, for 6PPDQ. The percent recoveries were below the criteria (2, 11, and 22 percent vs. minimum 30 percent). The corresponding project sample results were qualified as estimated.

- A surrogate standard was analyzed for sample COUMO collected on March 2, 2023, for 6PPDQ. The percent recovery was below the criteria (6 percent vs. minimum 30 percent). The project sample result was qualified as estimated.
- Surrogate standards were analyzed for samples COUMO and TOSMO collected on April 27, 2023, for 6PPDQ. The percent recoveries were below the criteria (12 and 23 percent vs. minimum 30 percent). The corresponding project sample results were qualified as estimated.
- A surrogate standard was analyzed for sample TOSMO collected on January 8, 2024, for 6PPDQ. The percent recovery was below the criteria (25 percent vs. minimum 30 percent). The result for TOSMO was qualified as estimated.

**Table 4. Data Qualified due to Surrogate Standard Recovery.**

| Date Collected | Lab SDG | Sample Location | Parameter | Reason for Qualification | Flag |
|---|---|---|---|---|---|
| 2/7/2023 | 2301-068 | COUMO, TOSMO, TOSMI | 6PPDQ | Low surrogate recovery | J |
| 3/2/2023 | 2303-020 | COUMO | 6PPDQ | Low surrogate recovery | J |
| 4/27/2023 | 2304-315 | COUMO, TOSMO | 6PPDQ | Low surrogate recovery | J |
| 1/8/2024 | 2401-067 | TOSMO | 6PPDQ | Low surrogate recovery | J |

## Laboratory Duplicate Analysis – Acceptable

Due to the low rate of detection, LCS duplicate samples were analyzed for PAHs rather than duplicates of project samples. The relative percent difference (RPD) was calculated for each analyte where both duplicate values were greater than five times the reporting limit (RL). The difference between duplicate values was calculated if the detected compound concentration was less than five times the RL in either the sample or the duplicate. The RPD values or difference values met the control limits established by the laboratory or specified method.

## Field Duplicate Analysis – Acceptable with Discussion

Field duplicates were analyzed for 6PPDQ and PAHs at a frequency of once per quarter (goal of 8 duplicates). However, only 7 duplicates were collected during the project period. A duplicate was not collected in Quarter 4 of WY2024 because it was planned for the third storm, which was not sampled due to dry weather that quarter.

The RPD was calculated for each analyte where both the values were greater than five times the RL. The difference between the duplicate values was calculated if the detected compound concentration was less than five times the RL in either the sample or the field duplicate. The RPD or difference values met the control limits established in the QAPP.

# Definition of Data Qualifiers

The following are data qualifier definitions (Table 5) applied for this project.

**Table 5. Data Qualifier Definitions.**

| Data Qualifier | Definition |
|---|---|
| J | Value is an estimate based on analytical results |
| R | Value is rejected based on analytical results |
| U | Value is below the reporting limit |
| UJ | Value is below the reporting limit and is an estimate based on analytical results |

# References

Herrera. 2015. Redmond Paired Watershed Study Quality Assurance Project Plan. Prepared by Herrera Environmental Consultants, Inc., Seattle, Washington. December 31.

Herrera. 2022. Addendum 1 to the Quality Assurance Project Plan for the Redmond Paired Watershed Study. Prepared by Herrera Environmental Consultants, Inc., Seattle, Washington. June 8.

# Appendix B

## Tabular Summary Statistics for 6PPD-quinone and Polycyclic Aromatic Hydrocarbons

| Table B-1. Summary Statistics for 6PPD-quinone (ng/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **N** | **Minimum** | **25th Percentile** | **Median** | **75th Percentile** | **Maximum** | **Interquartile Range** | **% Detected** |
| Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 3.3 | 8.5 | 19.2 | 21.6 | 81.4 | 13.1 | 100% |
| TOSMO | 11 | 1.3 | 4.0 | 8.8 | 12.6 | 20.9 | 8.5 | 100% |
| COUMI | 11 | 1.1 | 3.0 | 7.4 | 10.9 | 16.8 | 7.8 | 100% |
| COUMO | 11 | 1.5 | 6.4 | 20 | 22.7 | 64.1 | 16.3 | 100% |
| Twice Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 5.2 | 11.5 | 16.4 | 21.9 | 41.1 | 10.4 | 100% |
| TOSMO | 11 | 1.3 | 4.4 | 7.3 | 13.3 | 17.2 | 8.9 | 100% |
| COUMI | 11 | 0.2 | 3.8 | 7.6 | 11.4 | 22.8 | 7.6 | 100% |
| COUMO | 11 | 6.1 | 30.4 | 38.5 | 47.9 | 55.8 | 17.5 | 100% |
| All Storm Events | | | | | | | | |
| TOSMI | 22 | 3.3 | 10.1 | 17.4 | 21.8 | 81.4 | 11.7 | 100% |
| TOSMO | 22 | 1.3 | 4.3 | 7.9 | 12.8 | 20.9 | 8.5 | 100% |
| COUMI | 22 | 0.2 | 3.7 | 7.5 | 10.9 | 22.8 | 7.3 | 100% |
| COUMO | 22 | 1.5 | 14.4 | 26.4 | 44.4 | 64.1 | 30.0 | 100% |
| Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.6 | 1.5 | 3.2 | 5.5 | 8.4 | 4.0 | 100% |
| TOSMO | 4 | 0.6 | 1.0 | 2.7 | 4.3 | 4.3 | 3.3 | 100% |
| COUMI | 4 | 0.1 | 0.4 | 0.5 | 0.8 | 1.5 | 0.4 | 75% |
| COUMO | 4 | 0.4 | 1.6 | 2.1 | 3.5 | 7.7 | 1.8 | 100% |
| Twice Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.7 | 1.6 | 2.3 | 3.0 | 3.5 | 1.4 | 100% |
| TOSMO | 4 | 0.2 | 0.5 | 1.0 | 1.5 | 1.8 | 1.1 | 100% |
| COUMI | 4 | 0.3 | 0.3 | 0.3 | 0.4 | 0.5 | 0.2 | 100% |
| COUMO | 4 | 0.4 | 0.6 | 0.9 | 1.3 | 1.6 | 0.8 | 100% |
| All Base Flow | | | | | | | | |
| TOSMI | 8 | 0.6 | 1.5 | 2.3 | 3.7 | 8.4 | 2.2 | 100% |
| TOSMO | 8 | 0.2 | 0.6 | 1.3 | 2.4 | 4.3 | 1.8 | 100% |
| COUMI | 8 | 0.1 | 0.3 | 0.4 | 0.5 | 1.5 | 0.3 | 88% |
| COUMO | 8 | 0.4 | 0.6 | 1.4 | 2.0 | 7.7 | 1.5 | 100% |

ng/L: nanograms per Liter

| Table B-2. Summary Statistics for 1-Methylnaphthalene (ug/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | N | Minimum | 25th Percentile | Median | 75th Percentile | Maximum | Interquartile Range | % Detected |
| Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.048 | 0.049 | 0.050 | 0.053 | 0.055 | 0.003 | 0% |
| TOSMO | 11 | 0.037 | 0.049 | 0.050 | 0.058 | 0.065 | 0.008 | 0% |
| COUMI | 11 | 0.04 | 0.050 | 0.050 | 0.055 | 0.065 | 0.005 | 0% |
| COUMO | 11 | 0.048 | 0.050 | 0.055 | 0.055 | 0.065 | 0.005 | 0% |
| Twice Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.048 | 0.049 | 0.050 | 0.050 | 0.050 | 0.001 | 0% |
| TOSMO | 11 | 0.048 | 0.049 | 0.049 | 0.050 | 0.060 | 0.001 | 0% |
| COUMI | 11 | 0.048 | 0.049 | 0.049 | 0.050 | 0.050 | 0.002 | 0% |
| COUMO | 11 | 0.048 | 0.050 | 0.050 | 0.055 | 0.080 | 0.005 | 0% |
| All Storm Events | | | | | | | | |
| TOSMI | 22 | 0.048 | 0.049 | 0.050 | 0.050 | 0.055 | 0.001 | 0% |
| TOSMO | 22 | 0.037 | 0.049 | 0.050 | 0.055 | 0.065 | 0.007 | 0% |
| COUMI | 22 | 0.04 | 0.049 | 0.050 | 0.050 | 0.065 | 0.002 | 0% |
| COUMO | 22 | 0.048 | 0.05 | 0.055 | 0.055 | 0.080 | 0.005 | 0% |
| Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.048 | 0.050 | 0.053 | 0.056 | 0.060 | 0.007 | 0% |
| TOSMO | 4 | 0.048 | 0.048 | 0.049 | 0.050 | 0.050 | 0.001 | 0% |
| COUMI | 4 | 0.049 | 0.049 | 0.052 | 0.055 | 0.055 | 0.006 | 0% |
| COUMO | 4 | 0.05 | 0.050 | 0.050 | 0.054 | 0.065 | 0.004 | 0% |
| Twice Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.049 | 0.049 | 0.050 | 0.050 | 0.050 | 0.001 | 0% |
| TOSMO | 4 | 0.048 | 0.049 | 0.049 | 0.052 | 0.060 | 0.003 | 0% |
| COUMI | 4 | 0.048 | 0.053 | 0.055 | 0.059 | 0.070 | 0.006 | 0% |
| COUMO | 4 | 0.042 | 0.046 | 0.049 | 0.053 | 0.060 | 0.006 | 0% |
| All Base Flow | | | | | | | | |
| TOSMI | 8 | 0.048 | 0.049 | 0.050 | 0.051 | 0.060 | 0.002 | 0% |
| TOSMO | 8 | 0.048 | 0.048 | 0.049 | 0.050 | 0.060 | 0.001 | 0% |
| COUMI | 8 | 0.048 | 0.049 | 0.055 | 0.055 | 0.070 | 0.006 | 0% |
| COUMO | 8 | 0.042 | 0.050 | 0.050 | 0.053 | 0.065 | 0.003 | 0% |

ug/L: micrograms per Liter

**Table B-3. Summary Statistics for 2-Methylnaphthalene (ug/L) by Station, Street Sweeping Treatment, and Sampling Event Type.**

| | N | Minimum | 25th Percentile | Median | 75th Percentile | Maximum | Interquartile Range | % Detected |
|---|---|---|---|---|---|---|---|---|
| Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.048 | 0.049 | 0.050 | 0.053 | 0.055 | 0.003 | 0% |
| TOSMO | 11 | 0.037 | 0.049 | 0.050 | 0.058 | 0.065 | 0.008 | 0% |
| COUMI | 11 | 0.04 | 0.050 | 0.050 | 0.055 | 0.065 | 0.005 | 0% |
| COUMO | 11 | 0.048 | 0.050 | 0.055 | 0.055 | 0.065 | 0.005 | 0% |
| Twice Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.048 | 0.049 | 0.050 | 0.050 | 0.050 | 0.001 | 0% |
| TOSMO | 11 | 0.048 | 0.049 | 0.049 | 0.050 | 0.060 | 0.001 | 0% |
| COUMI | 11 | 0.048 | 0.049 | 0.049 | 0.050 | 0.050 | 0.002 | 0% |
| COUMO | 11 | 0.048 | 0.050 | 0.050 | 0.055 | 0.080 | 0.005 | 0% |
| All Storm Events | | | | | | | | |
| TOSMI | 22 | 0.048 | 0.049 | 0.050 | 0.050 | 0.055 | 0.001 | 0% |
| TOSMO | 22 | 0.037 | 0.049 | 0.050 | 0.055 | 0.065 | 0.007 | 0% |
| COUMI | 22 | 0.04 | 0.049 | 0.050 | 0.050 | 0.065 | 0.002 | 0% |
| COUMO | 22 | 0.048 | 0.050 | 0.055 | 0.055 | 0.080 | 0.005 | 0% |
| Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.048 | 0.050 | 0.053 | 0.056 | 0.060 | 0.007 | 0% |
| TOSMO | 4 | 0.048 | 0.048 | 0.049 | 0.050 | 0.050 | 0.001 | 0% |
| COUMI | 4 | 0.049 | 0.049 | 0.052 | 0.055 | 0.055 | 0.006 | 0% |
| COUMO | 4 | 0.05 | 0.050 | 0.050 | 0.054 | 0.065 | 0.004 | 0% |
| Twice Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.049 | 0.049 | 0.050 | 0.050 | 0.050 | 0.001 | 0% |
| TOSMO | 4 | 0.048 | 0.049 | 0.049 | 0.052 | 0.060 | 0.003 | 0% |
| COUMI | 4 | 0.048 | 0.053 | 0.055 | 0.059 | 0.070 | 0.006 | 0% |
| COUMO | 4 | 0.042 | 0.046 | 0.049 | 0.053 | 0.060 | 0.006 | 0% |
| All Base Flow | | | | | | | | |
| TOSMI | 8 | 0.048 | 0.049 | 0.050 | 0.051 | 0.060 | 0.002 | 0% |
| TOSMO | 8 | 0.048 | 0.048 | 0.049 | 0.050 | 0.060 | 0.001 | 0% |
| COUMI | 8 | 0.048 | 0.049 | 0.055 | 0.055 | 0.070 | 0.006 | 0% |
| COUMO | 8 | 0.042 | 0.050 | 0.050 | 0.053 | 0.065 | 0.003 | 0% |

ug/L: micrograms per Liter

| Table B-4. Summary Statistics for Acenaphthene (ug/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | N | Minimum | 25th Percentile | Median | 75th Percentile | Maximum | Interquartile Range | % Detected |
| Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.048 | 0.049 | 0.050 | 0.053 | 0.055 | 0.003 | 0% |
| TOSMO | 11 | 0.037 | 0.049 | 0.050 | 0.058 | 0.065 | 0.008 | 0% |
| COUMI | 11 | 0.040 | 0.050 | 0.050 | 0.055 | 0.065 | 0.005 | 0% |
| COUMO | 11 | 0.048 | 0.050 | 0.055 | 0.055 | 0.065 | 0.005 | 0% |
| Twice Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.048 | 0.049 | 0.050 | 0.050 | 0.050 | 0.001 | 0% |
| TOSMO | 11 | 0.048 | 0.049 | 0.049 | 0.050 | 0.060 | 0.001 | 0% |
| COUMI | 11 | 0.048 | 0.049 | 0.049 | 0.050 | 0.050 | 0.002 | 0% |
| COUMO | 11 | 0.048 | 0.050 | 0.050 | 0.055 | 0.080 | 0.005 | 0% |
| All Storm Events | | | | | | | | |
| TOSMI | 22 | 0.048 | 0.049 | 0.050 | 0.050 | 0.055 | 0.001 | 0% |
| TOSMO | 22 | 0.037 | 0.049 | 0.050 | 0.055 | 0.065 | 0.007 | 0% |
| COUMI | 22 | 0.040 | 0.049 | 0.050 | 0.050 | 0.065 | 0.002 | 0% |
| COUMO | 22 | 0.048 | 0.050 | 0.055 | 0.055 | 0.080 | 0.005 | 0% |
| Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.048 | 0.050 | 0.053 | 0.056 | 0.060 | 0.007 | 0% |
| TOSMO | 4 | 0.048 | 0.048 | 0.049 | 0.050 | 0.050 | 0.001 | 0% |
| COUMI | 4 | 0.049 | 0.049 | 0.052 | 0.055 | 0.055 | 0.006 | 0% |
| COUMO | 4 | 0.050 | 0.050 | 0.050 | 0.054 | 0.065 | 0.004 | 0% |
| Twice Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.049 | 0.049 | 0.050 | 0.050 | 0.050 | 0.001 | 0% |
| TOSMO | 4 | 0.048 | 0.049 | 0.049 | 0.052 | 0.060 | 0.003 | 0% |
| COUMI | 4 | 0.048 | 0.053 | 0.055 | 0.059 | 0.070 | 0.006 | 0% |
| COUMO | 4 | 0.042 | 0.046 | 0.049 | 0.053 | 0.060 | 0.006 | 0% |
| All Base Flow | | | | | | | | |
| TOSMI | 8 | 0.048 | 0.049 | 0.050 | 0.051 | 0.060 | 0.002 | 0% |
| TOSMO | 8 | 0.048 | 0.048 | 0.049 | 0.050 | 0.060 | 0.001 | 0% |
| COUMI | 8 | 0.048 | 0.049 | 0.055 | 0.055 | 0.070 | 0.006 | 0% |
| COUMO | 8 | 0.042 | 0.050 | 0.050 | 0.053 | 0.065 | 0.003 | 0% |

ug/L: micrograms per Liter

| Table B-5. Summary Statistics for Acenaphthylene (ug/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | N | Minimum | 25th Percentile | Median | 75th Percentile | Maximum | Interquartile Range | % Detected |
| Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.048 | 0.049 | 0.050 | 0.053 | 0.055 | 0.003 | 0% |
| TOSMO | 11 | 0.037 | 0.049 | 0.050 | 0.058 | 0.065 | 0.008 | 0% |
| COUMI | 11 | 0.040 | 0.050 | 0.050 | 0.055 | 0.065 | 0.005 | 0% |
| COUMO | 11 | 0.048 | 0.050 | 0.055 | 0.055 | 0.065 | 0.005 | 0% |
| Twice Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.048 | 0.049 | 0.050 | 0.050 | 0.050 | 0.001 | 0% |
| TOSMO | 11 | 0.048 | 0.049 | 0.049 | 0.050 | 0.060 | 0.001 | 0% |
| COUMI | 11 | 0.048 | 0.049 | 0.049 | 0.050 | 0.050 | 0.002 | 0% |
| COUMO | 11 | 0.048 | 0.050 | 0.050 | 0.055 | 0.080 | 0.005 | 0% |
| All Storm Events | | | | | | | | |
| TOSMI | 22 | 0.048 | 0.049 | 0.050 | 0.050 | 0.055 | 0.001 | 0% |
| TOSMO | 22 | 0.037 | 0.049 | 0.050 | 0.055 | 0.065 | 0.007 | 0% |
| COUMI | 22 | 0.040 | 0.049 | 0.050 | 0.050 | 0.065 | 0.002 | 0% |
| COUMO | 22 | 0.048 | 0.050 | 0.055 | 0.055 | 0.080 | 0.005 | 0% |
| Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.048 | 0.050 | 0.053 | 0.056 | 0.060 | 0.007 | 0% |
| TOSMO | 4 | 0.048 | 0.048 | 0.049 | 0.050 | 0.050 | 0.001 | 0% |
| COUMI | 4 | 0.049 | 0.049 | 0.052 | 0.055 | 0.055 | 0.006 | 0% |
| COUMO | 4 | 0.050 | 0.050 | 0.050 | 0.054 | 0.065 | 0.004 | 0% |
| Twice Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.049 | 0.049 | 0.050 | 0.050 | 0.050 | 0.001 | 0% |
| TOSMO | 4 | 0.048 | 0.049 | 0.049 | 0.052 | 0.060 | 0.003 | 0% |
| COUMI | 4 | 0.048 | 0.053 | 0.055 | 0.059 | 0.070 | 0.006 | 0% |
| COUMO | 4 | 0.042 | 0.046 | 0.049 | 0.053 | 0.060 | 0.006 | 0% |
| All Base Flow | | | | | | | | |
| TOSMI | 8 | 0.048 | 0.049 | 0.050 | 0.051 | 0.060 | 0.002 | 0% |
| TOSMO | 8 | 0.048 | 0.048 | 0.049 | 0.050 | 0.060 | 0.001 | 0% |
| COUMI | 8 | 0.048 | 0.049 | 0.055 | 0.055 | 0.070 | 0.006 | 0% |
| COUMO | 8 | 0.042 | 0.050 | 0.050 | 0.053 | 0.065 | 0.003 | 0% |

ug/L: micrograms per Liter

| Table B-6. Summary Statistics for Benz[a]anthracene (ug/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **N** | **Minimum** | **25th Percentile** | **Median** | **75th Percentile** | **Maximum** | **Interquartile Range** | **% Detected** |
| Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.005 | 0.005 | 0.005 | 0.006 | 0.026 | 0.001 | 9% |
| TOSMO | 11 | 0.005 | 0.005 | 0.006 | 0.006 | 0.012 | 0.001 | 9% |
| COUMI | 11 | 0.004 | 0.005 | 0.006 | 0.011 | 0.046 | 0.006 | 27% |
| COUMO | 11 | 0.005 | 0.005 | 0.006 | 0.006 | 0.010 | 0.000 | 9% |
| Twice Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.005 | 0.005 | 0.005 | 0.005 | 0.011 | 0.000 | 18% |
| TOSMO | 11 | 0.005 | 0.005 | 0.005 | 0.005 | 0.014 | 0.000 | 9% |
| COUMI | 11 | 0.005 | 0.005 | 0.005 | 0.011 | 0.022 | 0.006 | 45% |
| COUMO | 11 | 0.005 | 0.005 | 0.005 | 0.006 | 0.015 | 0.001 | 9% |
| All Storm Events | | | | | | | | |
| TOSMI | 22 | 0.005 | 0.005 | 0.005 | 0.005 | 0.026 | 0.000 | 14% |
| TOSMO | 22 | 0.005 | 0.005 | 0.005 | 0.006 | 0.014 | 0.001 | 9% |
| COUMI | 22 | 0.004 | 0.005 | 0.006 | 0.012 | 0.046 | 0.007 | 36% |
| COUMO | 22 | 0.005 | 0.005 | 0.006 | 0.006 | 0.015 | 0.001 | 9% |
| Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.005 | 0.005 | 0.005 | 0.006 | 0.006 | 0.001 | 0% |
| TOSMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.000 | 0% |
| COUMI | 4 | 0.005 | 0.005 | 0.005 | 0.006 | 0.006 | 0.001 | 0% |
| COUMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.007 | 0.000 | 0% |
| Twice Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.000 | 0% |
| TOSMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| COUMI | 4 | 0.005 | 0.005 | 0.006 | 0.011 | 0.026 | 0.005 | 25% |
| COUMO | 4 | 0.004 | 0.005 | 0.005 | 0.005 | 0.006 | 0.001 | 0% |
| All Base Flow | | | | | | | | |
| TOSMI | 8 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| TOSMO | 8 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| COUMI | 8 | 0.005 | 0.005 | 0.006 | 0.006 | 0.026 | 0.001 | 13% |
| COUMO | 8 | 0.004 | 0.005 | 0.005 | 0.005 | 0.007 | 0.000 | 0% |

ug/L: micrograms per Liter

| Table B-7. Summary Statistics for Anthracene (ug/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | N | Minimum | 25th Percentile | Median | 75th Percentile | Maximum | Interquartile Range | % Detected |
| Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.048 | 0.049 | 0.050 | 0.053 | 0.055 | 0.003 | 0% |
| TOSMO | 11 | 0.037 | 0.049 | 0.050 | 0.058 | 0.065 | 0.008 | 0% |
| COUMI | 11 | 0.040 | 0.050 | 0.050 | 0.055 | 0.065 | 0.005 | 0% |
| COUMO | 11 | 0.048 | 0.050 | 0.055 | 0.055 | 0.065 | 0.005 | 0% |
| Twice Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.048 | 0.049 | 0.050 | 0.050 | 0.050 | 0.001 | 0% |
| TOSMO | 11 | 0.048 | 0.049 | 0.049 | 0.050 | 0.060 | 0.001 | 0% |
| COUMI | 11 | 0.048 | 0.049 | 0.049 | 0.050 | 0.050 | 0.002 | 0% |
| COUMO | 11 | 0.048 | 0.050 | 0.050 | 0.055 | 0.080 | 0.005 | 0% |
| All Storm Events | | | | | | | | |
| TOSMI | 22 | 0.048 | 0.049 | 0.050 | 0.050 | 0.055 | 0.001 | 0% |
| TOSMO | 22 | 0.037 | 0.049 | 0.050 | 0.055 | 0.065 | 0.007 | 0% |
| COUMI | 22 | 0.040 | 0.049 | 0.050 | 0.050 | 0.065 | 0.002 | 0% |
| COUMO | 22 | 0.048 | 0.050 | 0.055 | 0.055 | 0.080 | 0.005 | 0% |
| Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.048 | 0.050 | 0.053 | 0.056 | 0.060 | 0.007 | 0% |
| TOSMO | 4 | 0.048 | 0.048 | 0.049 | 0.050 | 0.050 | 0.001 | 0% |
| COUMI | 4 | 0.049 | 0.049 | 0.052 | 0.055 | 0.055 | 0.006 | 0% |
| COUMO | 4 | 0.050 | 0.050 | 0.050 | 0.054 | 0.065 | 0.004 | 0% |
| Twice Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.049 | 0.049 | 0.050 | 0.050 | 0.050 | 0.001 | 0% |
| TOSMO | 4 | 0.048 | 0.049 | 0.049 | 0.052 | 0.060 | 0.003 | 0% |
| COUMI | 4 | 0.048 | 0.053 | 0.055 | 0.059 | 0.070 | 0.006 | 0% |
| COUMO | 4 | 0.042 | 0.046 | 0.049 | 0.053 | 0.060 | 0.006 | 0% |
| All Base Flow | | | | | | | | |
| TOSMI | 8 | 0.048 | 0.049 | 0.050 | 0.051 | 0.060 | 0.002 | 0% |
| TOSMO | 8 | 0.048 | 0.048 | 0.049 | 0.050 | 0.060 | 0.001 | 0% |
| COUMI | 8 | 0.048 | 0.049 | 0.055 | 0.055 | 0.070 | 0.006 | 0% |
| COUMO | 8 | 0.042 | 0.050 | 0.050 | 0.053 | 0.065 | 0.003 | 0% |

ug/L: micrograms per Liter

| Table B-8. Summary Statistics for Benzo(a)pyrene (ug/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **N** | **Minimum** | **25th Percentile** | **Median** | **75th Percentile** | **Maximum** | **Interquartile Range** | **% Detected** |
| Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.005 | 0.005 | 0.005 | 0.006 | 0.045 | 0.001 | 18% |
| TOSMO | 11 | 0.005 | 0.005 | 0.006 | 0.007 | 0.035 | 0.002 | 18% |
| COUMI | 11 | 0.004 | 0.005 | 0.006 | 0.007 | 0.063 | 0.002 | 18% |
| COUMO | 11 | 0.005 | 0.005 | 0.006 | 0.006 | 0.012 | 0.001 | 9% |
| Twice Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.005 | 0.005 | 0.005 | 0.007 | 0.015 | 0.002 | 27% |
| TOSMO | 11 | 0.005 | 0.005 | 0.005 | 0.006 | 0.013 | 0.001 | 18% |
| COUMI | 11 | 0.005 | 0.005 | 0.005 | 0.013 | 0.021 | 0.008 | 36% |
| COUMO | 11 | 0.005 | 0.005 | 0.005 | 0.006 | 0.011 | 0.001 | 9% |
| All Storm Events | | | | | | | | |
| TOSMI | 22 | 0.005 | 0.005 | 0.005 | 0.006 | 0.045 | 0.001 | 23% |
| TOSMO | 22 | 0.005 | 0.005 | 0.005 | 0.006 | 0.035 | 0.001 | 18% |
| COUMI | 22 | 0.004 | 0.005 | 0.005 | 0.011 | 0.063 | 0.006 | 27% |
| COUMO | 22 | 0.005 | 0.005 | 0.006 | 0.006 | 0.012 | 0.001 | 9% |
| Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.005 | 0.005 | 0.005 | 0.006 | 0.006 | 0.001 | 0% |
| TOSMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.000 | 0% |
| COUMI | 4 | 0.005 | 0.005 | 0.005 | 0.006 | 0.006 | 0.001 | 0% |
| COUMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.007 | 0.000 | 0% |
| Twice Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.000 | 0% |
| TOSMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| COUMI | 4 | 0.005 | 0.005 | 0.009 | 0.014 | 0.020 | 0.009 | 50% |
| COUMO | 4 | 0.004 | 0.005 | 0.005 | 0.005 | 0.006 | 0.001 | 0% |
| All Base Flow | | | | | | | | |
| TOSMI | 8 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| TOSMO | 8 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| COUMI | 8 | 0.005 | 0.005 | 0.006 | 0.007 | 0.020 | 0.002 | 25% |
| COUMO | 8 | 0.004 | 0.005 | 0.005 | 0.005 | 0.007 | 0.000 | 0% |

ug/L: micrograms per Liter

| Table B-9. Summary Statistics for Benzo(b)fluoranthene (ug/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | N | Minimum | 25th Percentile | Median | 75th Percentile | Maximum | Interquartile Range | % Detected |
| Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.0050 | 0.005 | 0.008 | 0.014 | 0.087 | 0.009 | 45% |
| TOSMO | 11 | 0.0050 | 0.005 | 0.006 | 0.007 | 0.017 | 0.002 | 18% |
| COUMI | 11 | 0.0050 | 0.005 | 0.006 | 0.013 | 0.095 | 0.007 | 36% |
| COUMO | 11 | 0.0050 | 0.005 | 0.006 | 0.006 | 0.021 | 0.001 | 18% |
| Twice Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.0050 | 0.005 | 0.015 | 0.020 | 0.028 | 0.015 | 64% |
| TOSMO | 11 | 0.0050 | 0.005 | 0.006 | 0.014 | 0.033 | 0.009 | 45% |
| COUMI | 11 | 0.0050 | 0.005 | 0.015 | 0.023 | 0.043 | 0.018 | 64% |
| COUMO | 11 | 0.0050 | 0.005 | 0.006 | 0.016 | 0.034 | 0.011 | 36% |
| All Storm Events | | | | | | | | |
| TOSMI | 22 | 0.0050 | 0.005 | 0.011 | 0.018 | 0.087 | 0.013 | 55% |
| TOSMO | 22 | 0.0050 | 0.005 | 0.006 | 0.012 | 0.033 | 0.007 | 32% |
| COUMI | 22 | 0.0050 | 0.005 | 0.008 | 0.021 | 0.095 | 0.016 | 50% |
| COUMO | 22 | 0.0050 | 0.005 | 0.006 | 0.010 | 0.034 | 0.005 | 27% |
| Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.0050 | 0.005 | 0.005 | 0.006 | 0.006 | 0.001 | 0% |
| TOSMO | 4 | 0.0050 | 0.005 | 0.005 | 0.005 | 0.005 | 0.000 | 0% |
| COUMI | 4 | 0.0050 | 0.005 | 0.005 | 0.006 | 0.006 | 0.001 | 0% |
| COUMO | 4 | 0.0050 | 0.005 | 0.006 | 0.008 | 0.014 | 0.003 | 25% |
| Twice Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.0050 | 0.005 | 0.005 | 0.005 | 0.005 | 0.000 | 0% |
| TOSMO | 4 | 0.0050 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| COUMI | 4 | 0.0050 | 0.005 | 0.014 | 0.028 | 0.044 | 0.023 | 50% |
| COUMO | 4 | 0.0040 | 0.005 | 0.005 | 0.005 | 0.006 | 0.001 | 0% |
| All Base Flow | | | | | | | | |
| TOSMI | 8 | 0.0050 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| TOSMO | 8 | 0.0050 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| COUMI | 8 | 0.0050 | 0.005 | 0.006 | 0.010 | 0.044 | 0.005 | 25% |
| COUMO | 8 | 0.0040 | 0.005 | 0.005 | 0.006 | 0.014 | 0.001 | 13% |

ug/L: micrograms per Liter

| Table B-10. Summary Statistics for Benzo(ghi)perylene (ug/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | N | Minimum | 25th Percentile | Median | 75th Percentile | Maximum | Interquartile Range | % Detected |
| Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.005 | 0.005 | 0.005 | 0.006 | 0.043 | 0.001 | 18% |
| TOSMO | 11 | 0.005 | 0.005 | 0.006 | 0.007 | 0.055 | 0.002 | 18% |
| COUMI | 11 | 0.004 | 0.005 | 0.006 | 0.009 | 0.052 | 0.004 | 27% |
| COUMO | 11 | 0.005 | 0.005 | 0.006 | 0.006 | 0.017 | 0.001 | 9% |
| Twice Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.005 | 0.005 | 0.005 | 0.013 | 0.022 | 0.008 | 45% |
| TOSMO | 11 | 0.005 | 0.005 | 0.005 | 0.008 | 0.012 | 0.003 | 27% |
| COUMI | 11 | 0.005 | 0.005 | 0.005 | 0.013 | 0.023 | 0.008 | 36% |
| COUMO | 11 | 0.005 | 0.005 | 0.005 | 0.006 | 0.019 | 0.001 | 18% |
| All Storm Events | | | | | | | | |
| TOSMI | 22 | 0.005 | 0.005 | 0.005 | 0.012 | 0.043 | 0.007 | 32% |
| TOSMO | 22 | 0.005 | 0.005 | 0.005 | 0.007 | 0.055 | 0.002 | 23% |
| COUMI | 22 | 0.004 | 0.005 | 0.006 | 0.013 | 0.052 | 0.008 | 32% |
| COUMO | 22 | 0.005 | 0.005 | 0.006 | 0.006 | 0.019 | 0.001 | 14% |
| Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.005 | 0.005 | 0.005 | 0.006 | 0.006 | 0.001 | 0% |
| TOSMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.000 | 0% |
| COUMI | 4 | 0.005 | 0.005 | 0.005 | 0.006 | 0.006 | 0.001 | 0% |
| COUMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.007 | 0.000 | 0% |
| Twice Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.000 | 0% |
| TOSMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| COUMI | 4 | 0.005 | 0.005 | 0.009 | 0.014 | 0.018 | 0.009 | 50% |
| COUMO | 4 | 0.004 | 0.005 | 0.005 | 0.005 | 0.006 | 0.001 | 0% |
| All Base Flow | | | | | | | | |
| TOSMI | 8 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| TOSMO | 8 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| COUMI | 8 | 0.005 | 0.005 | 0.006 | 0.007 | 0.018 | 0.002 | 25% |
| COUMO | 8 | 0.004 | 0.005 | 0.005 | 0.005 | 0.007 | 0.000 | 0% |

ug/L: micrograms per Liter

| Table B-11. Summary Statistics for Benzo(j,k)fluoranthene (ug/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | N | Minimum | 25th Percentile | Median | 75th Percentile | Maximum | Interquartile Range | % Detected |
| Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.005 | 0.005 | 0.005 | 0.006 | 0.021 | 0.001 | 18% |
| TOSMO | 11 | 0.004 | 0.005 | 0.005 | 0.006 | 0.044 | 0.001 | 9% |
| COUMI | 11 | 0.004 | 0.005 | 0.006 | 0.007 | 0.032 | 0.002 | 18% |
| COUMO | 11 | 0.005 | 0.005 | 0.006 | 0.006 | 0.017 | 0.001 | 9% |
| Twice Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.005 | 0.005 | 0.005 | 0.005 | 0.017 | 0.000 | 18% |
| TOSMO | 11 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| COUMI | 11 | 0.005 | 0.005 | 0.005 | 0.005 | 0.012 | 0.000 | 9% |
| COUMO | 11 | 0.005 | 0.005 | 0.005 | 0.006 | 0.008 | 0.001 | 0% |
| All Storm Events | | | | | | | | |
| TOSMI | 22 | 0.005 | 0.005 | 0.005 | 0.005 | 0.021 | 0.000 | 18% |
| TOSMO | 22 | 0.004 | 0.005 | 0.005 | 0.006 | 0.044 | 0.001 | 5% |
| COUMI | 22 | 0.004 | 0.005 | 0.005 | 0.006 | 0.032 | 0.001 | 14% |
| COUMO | 22 | 0.005 | 0.005 | 0.006 | 0.006 | 0.017 | 0.001 | 5% |
| Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.005 | 0.005 | 0.005 | 0.006 | 0.006 | 0.001 | 0% |
| TOSMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.000 | 0% |
| COUMI | 4 | 0.005 | 0.005 | 0.005 | 0.006 | 0.006 | 0.001 | 0% |
| COUMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.007 | 0.000 | 0% |
| Twice Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.000 | 0% |
| TOSMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| COUMI | 4 | 0.005 | 0.005 | 0.006 | 0.008 | 0.014 | 0.002 | 25% |
| COUMO | 4 | 0.004 | 0.005 | 0.005 | 0.005 | 0.006 | 0.001 | 0% |
| All Base Flow | | | | | | | | |
| TOSMI | 8 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| TOSMO | 8 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| COUMI | 8 | 0.005 | 0.005 | 0.006 | 0.006 | 0.014 | 0.001 | 13% |
| COUMO | 8 | 0.004 | 0.005 | 0.005 | 0.005 | 0.007 | 0.000 | 0% |

ug/L: micrograms per Liter

| Table B-12. Summary Statistics for Chrysene (ug/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **N** | **Minimum** | **25th Percentile** | **Median** | **75th Percentile** | **Maximum** | **Interquartile Range** | **% Detected** |
| Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.005 | 0.005 | 0.006 | 0.013 | 0.058 | 0.008 | 36% |
| TOSMO | 11 | 0.005 | 0.005 | 0.006 | 0.007 | 0.040 | 0.002 | 18% |
| COUMI | 11 | 0.004 | 0.005 | 0.006 | 0.007 | 0.071 | 0.002 | 18% |
| COUMO | 11 | 0.005 | 0.005 | 0.006 | 0.006 | 0.017 | 0.001 | 9% |
| Twice Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.005 | 0.005 | 0.005 | 0.016 | 0.026 | 0.011 | 45% |
| TOSMO | 11 | 0.005 | 0.005 | 0.005 | 0.006 | 0.050 | 0.001 | 18% |
| COUMI | 11 | 0.005 | 0.005 | 0.011 | 0.020 | 0.029 | 0.015 | 55% |
| COUMO | 11 | 0.005 | 0.005 | 0.005 | 0.006 | 0.022 | 0.001 | 18% |
| All Storm Events | | | | | | | | |
| TOSMI | 22 | 0.005 | 0.005 | 0.005 | 0.015 | 0.058 | 0.010 | 41% |
| TOSMO | 22 | 0.005 | 0.005 | 0.005 | 0.006 | 0.050 | 0.001 | 18% |
| COUMI | 22 | 0.004 | 0.005 | 0.006 | 0.018 | 0.071 | 0.013 | 36% |
| COUMO | 22 | 0.005 | 0.005 | 0.006 | 0.006 | 0.022 | 0.001 | 14% |
| Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.005 | 0.005 | 0.005 | 0.006 | 0.006 | 0.001 | 0% |
| TOSMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.000 | 0% |
| COUMI | 4 | 0.005 | 0.005 | 0.005 | 0.006 | 0.006 | 0.001 | 0% |
| COUMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.007 | 0.000 | 0% |
| Twice Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.000 | 0% |
| TOSMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| COUMI | 4 | 0.005 | 0.005 | 0.012 | 0.020 | 0.026 | 0.015 | 50% |
| COUMO | 4 | 0.004 | 0.005 | 0.005 | 0.005 | 0.006 | 0.001 | 0% |
| All Base Flow | | | | | | | | |
| TOSMI | 8 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| TOSMO | 8 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| COUMI | 8 | 0.005 | 0.005 | 0.006 | 0.009 | 0.026 | 0.004 | 25% |
| COUMO | 8 | 0.004 | 0.005 | 0.005 | 0.005 | 0.007 | 0.000 | 0% |

ug/L: micrograms per Liter

| Table B-13. Summary Statistics for Dibenzo(a,h)anthracene (ug/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **N** | **Minimum** | **25th Percentile** | **Median** | **75th Percentile** | **Maximum** | **Interquartile Range** | **% Detected** |
| Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| TOSMO | 11 | 0.004 | 0.005 | 0.005 | 0.006 | 0.011 | 0.001 | 9% |
| COUMI | 11 | 0.004 | 0.005 | 0.006 | 0.007 | 0.016 | 0.002 | 18% |
| COUMO | 11 | 0.005 | 0.005 | 0.006 | 0.006 | 0.014 | 0.001 | 9% |
| Twice Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.000 | 0% |
| TOSMO | 11 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| COUMI | 11 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.000 | 0% |
| COUMO | 11 | 0.005 | 0.005 | 0.005 | 0.006 | 0.011 | 0.001 | 0% |
| All Storm Events | | | | | | | | |
| TOSMI | 22 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| TOSMO | 22 | 0.004 | 0.005 | 0.005 | 0.006 | 0.011 | 0.001 | 5% |
| COUMI | 22 | 0.004 | 0.005 | 0.005 | 0.006 | 0.016 | 0.001 | 9% |
| COUMO | 22 | 0.005 | 0.005 | 0.006 | 0.006 | 0.014 | 0.001 | 5% |
| Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.005 | 0.005 | 0.005 | 0.006 | 0.006 | 0.001 | 0% |
| TOSMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.000 | 0% |
| COUMI | 4 | 0.005 | 0.005 | 0.005 | 0.006 | 0.006 | 0.001 | 0% |
| COUMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.007 | 0.000 | 0% |
| Twice Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.000 | 0% |
| TOSMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| COUMI | 4 | 0.005 | 0.005 | 0.006 | 0.006 | 0.007 | 0.001 | 0% |
| COUMO | 4 | 0.004 | 0.005 | 0.005 | 0.005 | 0.006 | 0.001 | 0% |
| All Base Flow | | | | | | | | |
| TOSMI | 8 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| TOSMO | 8 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| COUMI | 8 | 0.005 | 0.005 | 0.006 | 0.006 | 0.007 | 0.001 | 0% |
| COUMO | 8 | 0.004 | 0.005 | 0.005 | 0.005 | 0.007 | 0.000 | 0% |

ug/L: micrograms per Liter

| Table B-14. Summary Statistics for Fluoranthene (ug/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **N** | **Minimum** | **25th Percentile** | **Median** | **75th Percentile** | **Maximum** | **Interquartile Range** | **% Detected** |
| Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.048 | 0.049 | 0.050 | 0.053 | 0.055 | 0.003 | 0% |
| TOSMO | 11 | 0.037 | 0.049 | 0.050 | 0.058 | 0.065 | 0.009 | 0% |
| COUMI | 11 | 0.040 | 0.050 | 0.055 | 0.060 | 0.120 | 0.010 | 9% |
| COUMO | 11 | 0.048 | 0.050 | 0.055 | 0.055 | 0.065 | 0.005 | 0% |
| Twice Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.048 | 0.049 | 0.050 | 0.050 | 0.050 | 0.001 | 0% |
| TOSMO | 11 | 0.048 | 0.049 | 0.049 | 0.050 | 0.180 | 0.001 | 9% |
| COUMI | 11 | 0.048 | 0.049 | 0.049 | 0.050 | 0.050 | 0.002 | 0% |
| COUMO | 11 | 0.048 | 0.050 | 0.050 | 0.055 | 0.080 | 0.005 | 0% |
| All Storm Events | | | | | | | | |
| TOSMI | 22 | 0.048 | 0.049 | 0.050 | 0.050 | 0.055 | 0.001 | 0% |
| TOSMO | 22 | 0.037 | 0.049 | 0.050 | 0.055 | 0.180 | 0.007 | 5% |
| COUMI | 22 | 0.040 | 0.049 | 0.050 | 0.054 | 0.120 | 0.005 | 5% |
| COUMO | 22 | 0.048 | 0.050 | 0.055 | 0.055 | 0.080 | 0.005 | 0% |
| Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.048 | 0.050 | 0.053 | 0.056 | 0.060 | 0.007 | 0% |
| TOSMO | 4 | 0.048 | 0.048 | 0.049 | 0.050 | 0.050 | 0.001 | 0% |
| COUMI | 4 | 0.049 | 0.049 | 0.052 | 0.055 | 0.055 | 0.006 | 0% |
| COUMO | 4 | 0.050 | 0.050 | 0.050 | 0.054 | 0.065 | 0.004 | 0% |
| Twice Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.049 | 0.049 | 0.050 | 0.050 | 0.050 | 0.001 | 0% |
| TOSMO | 4 | 0.048 | 0.049 | 0.049 | 0.052 | 0.060 | 0.003 | 0% |
| COUMI | 4 | 0.048 | 0.053 | 0.055 | 0.059 | 0.070 | 0.006 | 0% |
| COUMO | 4 | 0.042 | 0.046 | 0.049 | 0.053 | 0.060 | 0.006 | 0% |
| All Base Flow | | | | | | | | |
| TOSMI | 8 | 0.048 | 0.049 | 0.050 | 0.051 | 0.060 | 0.002 | 0% |
| TOSMO | 8 | 0.048 | 0.048 | 0.049 | 0.050 | 0.060 | 0.001 | 0% |
| COUMI | 8 | 0.048 | 0.049 | 0.055 | 0.055 | 0.070 | 0.006 | 0% |
| COUMO | 8 | 0.042 | 0.050 | 0.050 | 0.053 | 0.065 | 0.003 | 0% |

ug/L: micrograms per Liter

| Table B-15. Summary Statistics for Fluorene (ug/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | N | Minimum | 25th Percentile | Median | 75th Percentile | Maximum | Interquartile Range | % Detected |
| Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.048 | 0.049 | 0.050 | 0.053 | 0.055 | 0.003 | 0% |
| TOSMO | 11 | 0.037 | 0.049 | 0.050 | 0.058 | 0.065 | 0.008 | 0% |
| COUMI | 11 | 0.040 | 0.050 | 0.050 | 0.055 | 0.065 | 0.005 | 0% |
| COUMO | 11 | 0.048 | 0.050 | 0.055 | 0.055 | 0.065 | 0.005 | 0% |
| Twice Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.048 | 0.049 | 0.050 | 0.050 | 0.050 | 0.001 | 0% |
| TOSMO | 11 | 0.048 | 0.049 | 0.049 | 0.050 | 0.060 | 0.001 | 0% |
| COUMI | 11 | 0.048 | 0.049 | 0.049 | 0.050 | 0.050 | 0.002 | 0% |
| COUMO | 11 | 0.048 | 0.050 | 0.050 | 0.055 | 0.080 | 0.005 | 0% |
| All Storm Events | | | | | | | | |
| TOSMI | 22 | 0.048 | 0.049 | 0.050 | 0.050 | 0.055 | 0.001 | 0% |
| TOSMO | 22 | 0.037 | 0.049 | 0.050 | 0.055 | 0.065 | 0.007 | 0% |
| COUMI | 22 | 0.040 | 0.049 | 0.050 | 0.050 | 0.065 | 0.002 | 0% |
| COUMO | 22 | 0.048 | 0.050 | 0.055 | 0.055 | 0.080 | 0.005 | 0% |
| Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.048 | 0.050 | 0.053 | 0.056 | 0.060 | 0.007 | 0% |
| TOSMO | 4 | 0.048 | 0.048 | 0.049 | 0.050 | 0.050 | 0.001 | 0% |
| COUMI | 4 | 0.049 | 0.049 | 0.052 | 0.055 | 0.055 | 0.006 | 0% |
| COUMO | 4 | 0.050 | 0.050 | 0.050 | 0.054 | 0.065 | 0.004 | 0% |
| Twice Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.049 | 0.049 | 0.050 | 0.050 | 0.050 | 0.001 | 0% |
| TOSMO | 4 | 0.048 | 0.049 | 0.049 | 0.052 | 0.060 | 0.003 | 0% |
| COUMI | 4 | 0.048 | 0.053 | 0.055 | 0.059 | 0.070 | 0.006 | 0% |
| COUMO | 4 | 0.042 | 0.046 | 0.049 | 0.053 | 0.060 | 0.006 | 0% |
| All Base Flow | | | | | | | | |
| TOSMI | 8 | 0.048 | 0.049 | 0.050 | 0.051 | 0.060 | 0.002 | 0% |
| TOSMO | 8 | 0.048 | 0.048 | 0.049 | 0.050 | 0.060 | 0.001 | 0% |
| COUMI | 8 | 0.048 | 0.049 | 0.055 | 0.055 | 0.070 | 0.006 | 0% |
| COUMO | 8 | 0.042 | 0.050 | 0.050 | 0.053 | 0.065 | 0.003 | 0% |

ug/L: micrograms per Liter

| Table B-16. Summary Statistics for Indeno(1,2,3-cd)pyrene (ug/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **N** | **Minimum** | **25th Percentile** | **Median** | **75th Percentile** | **Maximum** | **Interquartile Range** | **% Detected** |
| Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.005 | 0.005 | 0.005 | 0.006 | 0.042 | 0.001 | 18% |
| TOSMO | 11 | 0.005 | 0.005 | 0.006 | 0.007 | 0.027 | 0.002 | 18% |
| COUMI | 11 | 0.004 | 0.005 | 0.006 | 0.007 | 0.054 | 0.002 | 18% |
| COUMO | 11 | 0.005 | 0.005 | 0.006 | 0.006 | 0.019 | 0.001 | 9% |
| Twice Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.005 | 0.005 | 0.005 | 0.012 | 0.018 | 0.007 | 45% |
| TOSMO | 11 | 0.005 | 0.005 | 0.005 | 0.006 | 0.015 | 0.001 | 18% |
| COUMI | 11 | 0.005 | 0.005 | 0.010 | 0.013 | 0.025 | 0.008 | 55% |
| COUMO | 11 | 0.005 | 0.005 | 0.005 | 0.007 | 0.020 | 0.002 | 18% |
| All Storm Events | | | | | | | | |
| TOSMI | 22 | 0.005 | 0.005 | 0.005 | 0.011 | 0.042 | 0.006 | 32% |
| TOSMO | 22 | 0.005 | 0.005 | 0.005 | 0.006 | 0.027 | 0.001 | 18% |
| COUMI | 22 | 0.004 | 0.005 | 0.006 | 0.012 | 0.054 | 0.007 | 36% |
| COUMO | 22 | 0.005 | 0.005 | 0.006 | 0.006 | 0.020 | 0.001 | 14% |
| Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.005 | 0.005 | 0.005 | 0.006 | 0.006 | 0.001 | 0% |
| TOSMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.000 | 0% |
| COUMI | 4 | 0.005 | 0.005 | 0.005 | 0.006 | 0.006 | 0.001 | 0% |
| COUMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.007 | 0.000 | 0% |
| Twice Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.000 | 0% |
| TOSMO | 4 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| COUMI | 4 | 0.005 | 0.005 | 0.010 | 0.017 | 0.025 | 0.011 | 50% |
| COUMO | 4 | 0.004 | 0.005 | 0.005 | 0.005 | 0.006 | 0.001 | 0% |
| All Base Flow | | | | | | | | |
| TOSMI | 8 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| TOSMO | 8 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.000 | 0% |
| COUMI | 8 | 0.005 | 0.005 | 0.006 | 0.008 | 0.025 | 0.003 | 25% |
| COUMO | 8 | 0.004 | 0.005 | 0.005 | 0.005 | 0.007 | 0.000 | 0% |

ug/L: micrograms per Liter

| Table B-17. Summary Statistics for Naphthalene (ug/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | N | Minimum | 25th Percentile | Median | 75th Percentile | Maximum | Interquartile Range | % Detected |
| Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.048 | 0.049 | 0.050 | 0.053 | 0.055 | 0.003 | 0% |
| TOSMO | 11 | 0.037 | 0.049 | 0.050 | 0.058 | 0.065 | 0.008 | 0% |
| COUMI | 11 | 0.040 | 0.050 | 0.050 | 0.055 | 0.065 | 0.005 | 0% |
| COUMO | 11 | 0.048 | 0.050 | 0.055 | 0.055 | 0.065 | 0.005 | 0% |
| Twice Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.048 | 0.049 | 0.050 | 0.050 | 0.050 | 0.001 | 0% |
| TOSMO | 11 | 0.048 | 0.049 | 0.049 | 0.050 | 0.060 | 0.001 | 0% |
| COUMI | 11 | 0.048 | 0.049 | 0.049 | 0.050 | 0.050 | 0.002 | 0% |
| COUMO | 11 | 0.048 | 0.050 | 0.050 | 0.055 | 0.080 | 0.005 | 0% |
| All Storm Events | | | | | | | | |
| TOSMI | 22 | 0.048 | 0.049 | 0.050 | 0.050 | 0.055 | 0.001 | 0% |
| TOSMO | 22 | 0.037 | 0.049 | 0.050 | 0.055 | 0.065 | 0.007 | 0% |
| COUMI | 22 | 0.040 | 0.049 | 0.050 | 0.050 | 0.065 | 0.002 | 0% |
| COUMO | 22 | 0.048 | 0.050 | 0.055 | 0.055 | 0.080 | 0.005 | 0% |
| Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.048 | 0.050 | 0.053 | 0.056 | 0.060 | 0.007 | 0% |
| TOSMO | 4 | 0.048 | 0.048 | 0.049 | 0.050 | 0.050 | 0.001 | 0% |
| COUMI | 4 | 0.049 | 0.049 | 0.052 | 0.055 | 0.055 | 0.006 | 0% |
| COUMO | 4 | 0.050 | 0.050 | 0.050 | 0.054 | 0.065 | 0.004 | 0% |
| Twice Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.049 | 0.049 | 0.050 | 0.050 | 0.050 | 0.001 | 0% |
| TOSMO | 4 | 0.048 | 0.049 | 0.049 | 0.052 | 0.060 | 0.003 | 0% |
| COUMI | 4 | 0.048 | 0.053 | 0.055 | 0.059 | 0.070 | 0.006 | 0% |
| COUMO | 4 | 0.042 | 0.046 | 0.049 | 0.053 | 0.060 | 0.006 | 0% |
| All Base Flow | | | | | | | | |
| TOSMI | 8 | 0.048 | 0.049 | 0.050 | 0.051 | 0.060 | 0.002 | 0% |
| TOSMO | 8 | 0.048 | 0.048 | 0.049 | 0.050 | 0.060 | 0.001 | 0% |
| COUMI | 8 | 0.048 | 0.049 | 0.055 | 0.055 | 0.070 | 0.006 | 0% |
| COUMO | 8 | 0.042 | 0.050 | 0.050 | 0.053 | 0.065 | 0.003 | 0% |

ug/L: micrograms per Liter

| Table B-18. Summary Statistics for Phenanthrene (ug/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | N | Minimum | 25th Percentile | Median | 75th Percentile | Maximum | Interquartile Range | % Detected |
| Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.048 | 0.049 | 0.050 | 0.053 | 0.055 | 0.003 | 0% |
| TOSMO | 11 | 0.037 | 0.049 | 0.050 | 0.058 | 0.065 | 0.008 | 0% |
| COUMI | 11 | 0.040 | 0.050 | 0.050 | 0.055 | 0.065 | 0.005 | 0% |
| COUMO | 11 | 0.048 | 0.050 | 0.055 | 0.055 | 0.065 | 0.005 | 0% |
| Twice Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.048 | 0.049 | 0.050 | 0.050 | 0.050 | 0.001 | 0% |
| TOSMO | 11 | 0.048 | 0.049 | 0.049 | 0.050 | 0.280 | 0.001 | 9% |
| COUMI | 11 | 0.048 | 0.049 | 0.049 | 0.050 | 0.050 | 0.002 | 0% |
| COUMO | 11 | 0.048 | 0.050 | 0.050 | 0.055 | 0.080 | 0.005 | 0% |
| All Storm Events | | | | | | | | |
| TOSMI | 22 | 0.048 | 0.049 | 0.050 | 0.050 | 0.055 | 0.001 | 0% |
| TOSMO | 22 | 0.037 | 0.049 | 0.050 | 0.055 | 0.280 | 0.007 | 5% |
| COUMI | 22 | 0.040 | 0.049 | 0.050 | 0.050 | 0.065 | 0.002 | 0% |
| COUMO | 22 | 0.048 | 0.050 | 0.055 | 0.055 | 0.080 | 0.005 | 0% |
| Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.048 | 0.050 | 0.053 | 0.056 | 0.060 | 0.007 | 0% |
| TOSMO | 4 | 0.048 | 0.048 | 0.049 | 0.050 | 0.050 | 0.001 | 0% |
| COUMI | 4 | 0.049 | 0.049 | 0.052 | 0.055 | 0.055 | 0.006 | 0% |
| COUMO | 4 | 0.050 | 0.050 | 0.050 | 0.054 | 0.065 | 0.004 | 0% |
| Twice Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.049 | 0.049 | 0.050 | 0.050 | 0.050 | 0.001 | 0% |
| TOSMO | 4 | 0.048 | 0.049 | 0.049 | 0.052 | 0.060 | 0.003 | 0% |
| COUMI | 4 | 0.048 | 0.053 | 0.055 | 0.059 | 0.070 | 0.006 | 0% |
| COUMO | 4 | 0.042 | 0.046 | 0.049 | 0.053 | 0.060 | 0.006 | 0% |
| All Base Flow | | | | | | | | |
| TOSMI | 8 | 0.048 | 0.049 | 0.050 | 0.051 | 0.060 | 0.002 | 0% |
| TOSMO | 8 | 0.048 | 0.048 | 0.049 | 0.050 | 0.060 | 0.001 | 0% |
| COUMI | 8 | 0.048 | 0.049 | 0.055 | 0.055 | 0.070 | 0.006 | 0% |
| COUMO | 8 | 0.042 | 0.050 | 0.050 | 0.053 | 0.065 | 0.003 | 0% |

ug/L: micrograms per Liter

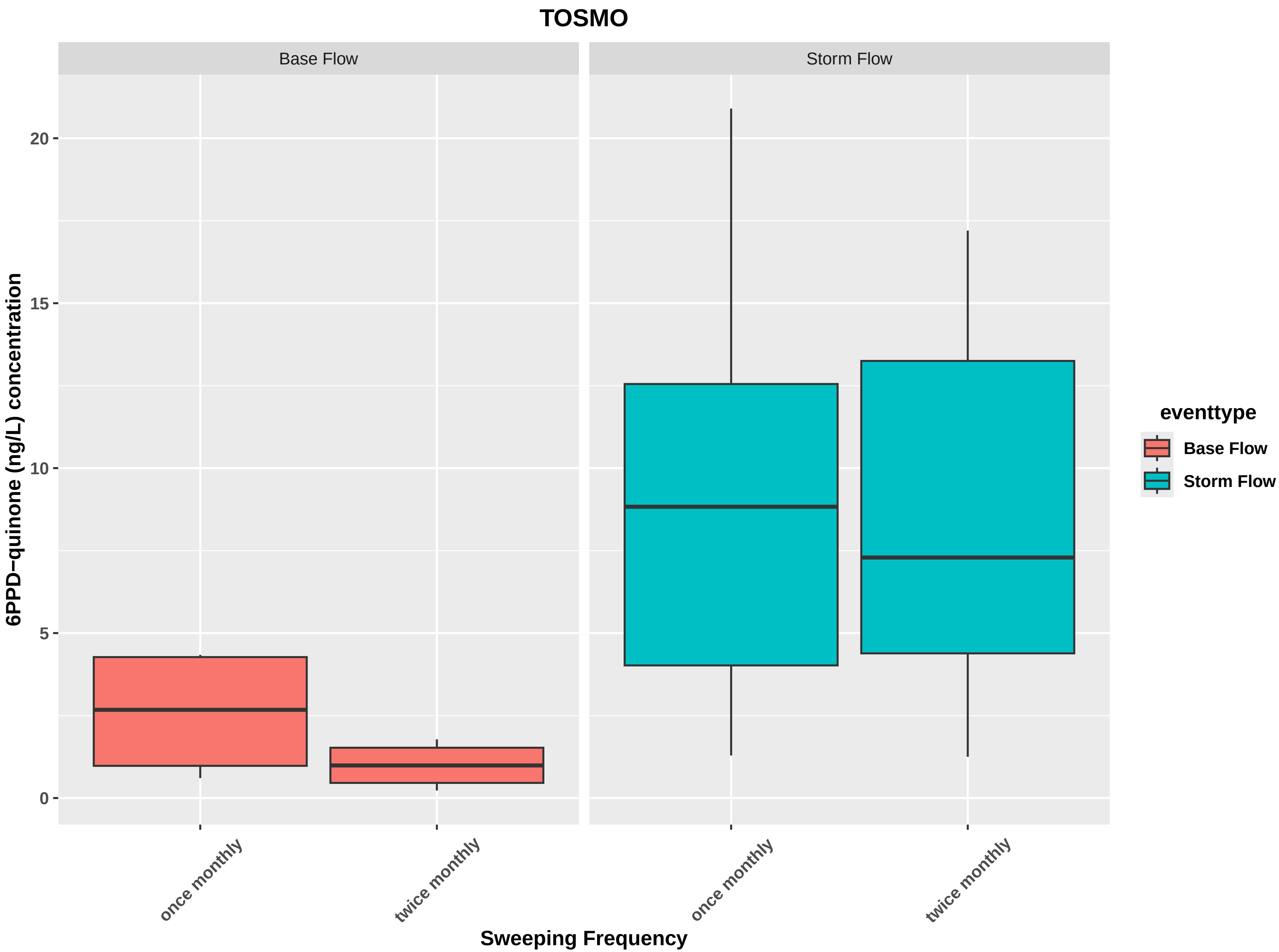
| Table B-19. Summary Statistics for Pyrene (ug/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **N** | **Minimum** | **25th Percentile** | **Median** | **75th Percentile** | **Maximum** | **Interquartile Range** | **% Detected** |
| Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.00 | 0% |
| TOSMO | 11 | 0.04 | 0.05 | 0.05 | 0.06 | 0.07 | 0.01 | 0% |
| COUMI | 11 | 0.04 | 0.05 | 0.06 | 0.06 | 0.11 | 0.01 | 9% |
| COUMO | 11 | 0.05 | 0.05 | 0.06 | 0.06 | 0.07 | 0.01 | 0% |
| Twice Monthly Sweeping - Storm Events | | | | | | | | |
| TOSMI | 11 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.00 | 0% |
| TOSMO | 11 | 0.05 | 0.05 | 0.05 | 0.05 | 0.14 | 0.00 | 9% |
| COUMI | 11 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.00 | 0% |
| COUMO | 11 | 0.05 | 0.05 | 0.05 | 0.06 | 0.08 | 0.01 | 0% |
| All Storm Events | | | | | | | | |
| TOSMI | 22 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.00 | 0% |
| TOSMO | 22 | 0.04 | 0.05 | 0.05 | 0.06 | 0.14 | 0.01 | 5% |
| COUMI | 22 | 0.04 | 0.05 | 0.05 | 0.05 | 0.11 | 0.01 | 5% |
| COUMO | 22 | 0.05 | 0.05 | 0.06 | 0.06 | 0.08 | 0.01 | 0% |
| Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.05 | 0.05 | 0.05 | 0.06 | 0.06 | 0.01 | 0% |
| TOSMO | 4 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.00 | 0% |
| COUMI | 4 | 0.05 | 0.05 | 0.05 | 0.06 | 0.06 | 0.01 | 0% |
| COUMO | 4 | 0.05 | 0.05 | 0.05 | 0.05 | 0.07 | 0.00 | 0% |
| Twice Monthly Sweeping - Base Flow | | | | | | | | |
| TOSMI | 4 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.00 | 0% |
| TOSMO | 4 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.00 | 0% |
| COUMI | 4 | 0.05 | 0.05 | 0.06 | 0.06 | 0.07 | 0.01 | 0% |
| COUMO | 4 | 0.04 | 0.05 | 0.05 | 0.05 | 0.06 | 0.01 | 0% |
| All Base Flow | | | | | | | | |
| TOSMI | 8 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.00 | 0% |
| TOSMO | 8 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.00 | 0% |
| COUMI | 8 | 0.05 | 0.05 | 0.06 | 0.06 | 0.07 | 0.01 | 0% |
| COUMO | 8 | 0.04 | 0.05 | 0.05 | 0.05 | 0.07 | 0.00 | 0% |

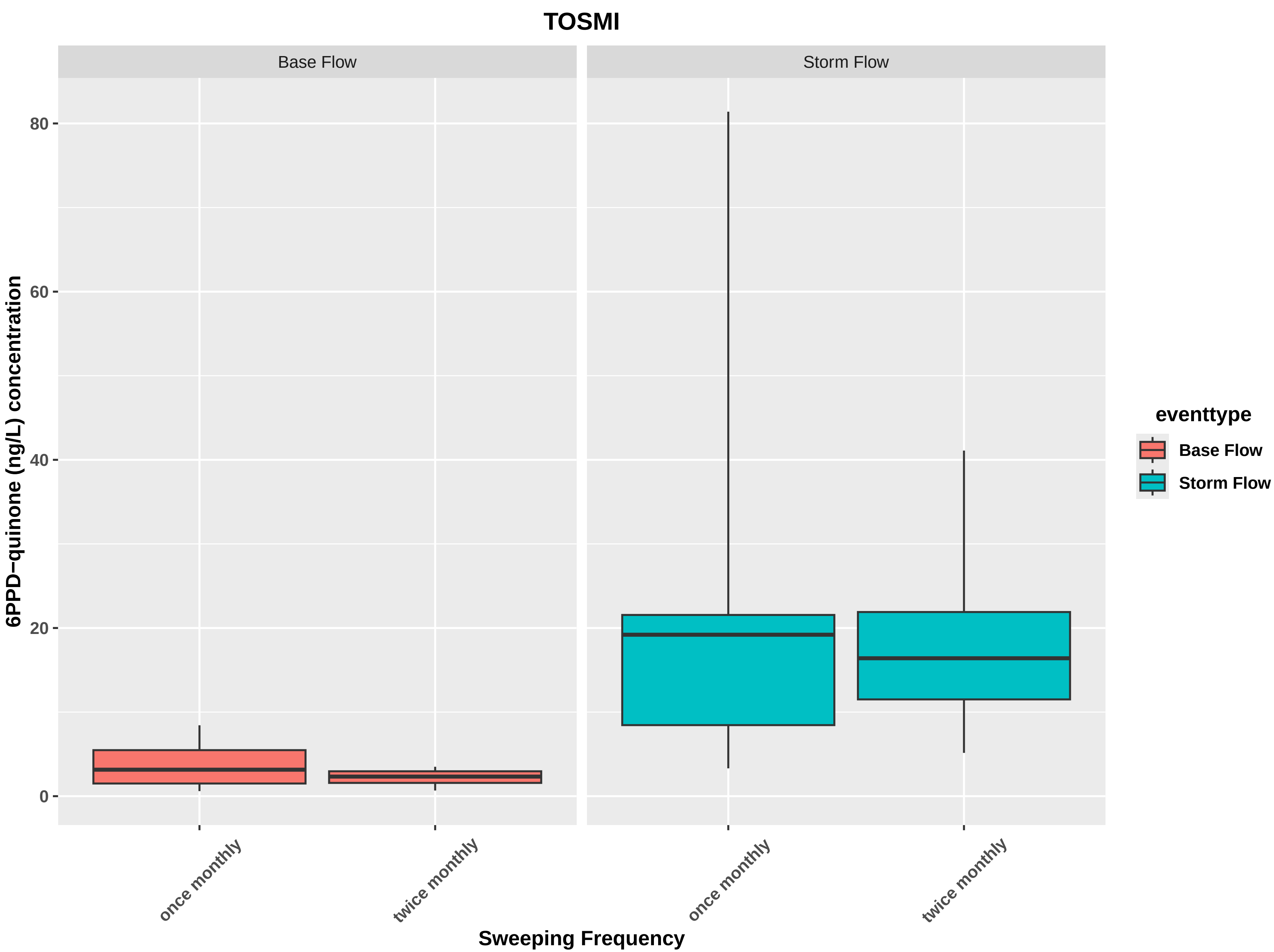
ug/L: micrograms per Liter

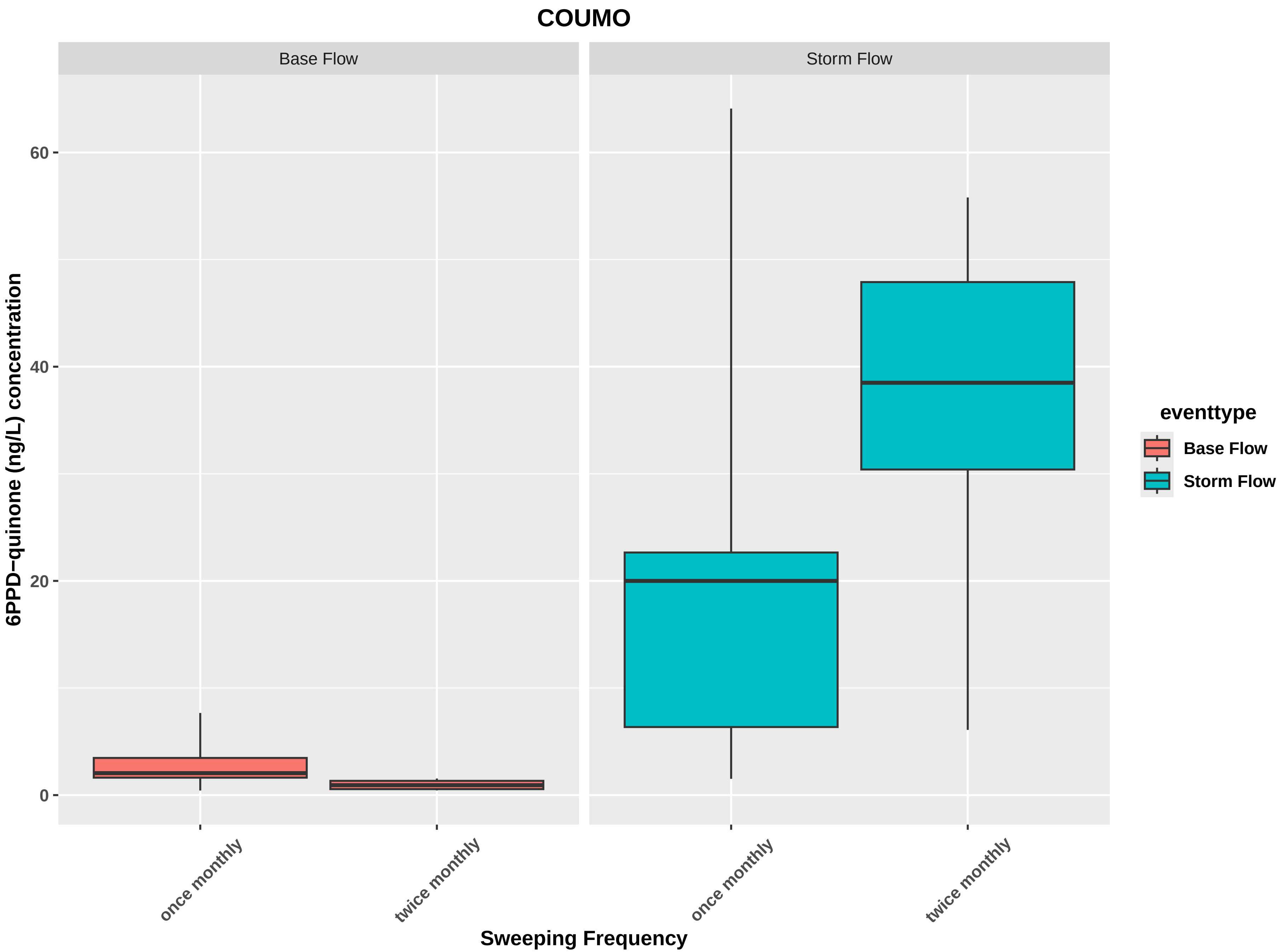
# Appendix C

## Box Plots for 6PPD-quinone and Polycyclic Aromatic Hydrocarbons

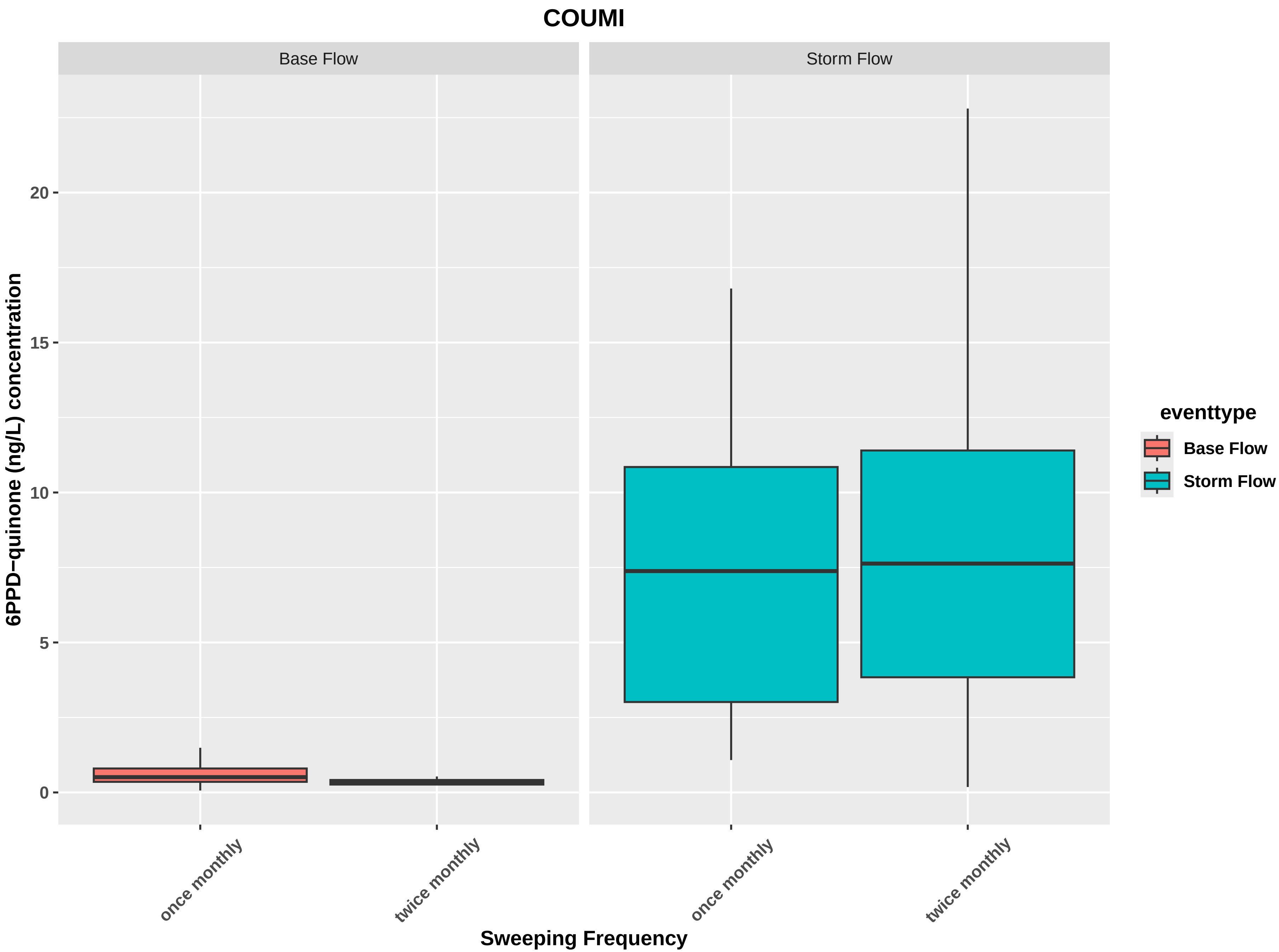
HERRERA
Science + Planning + Design

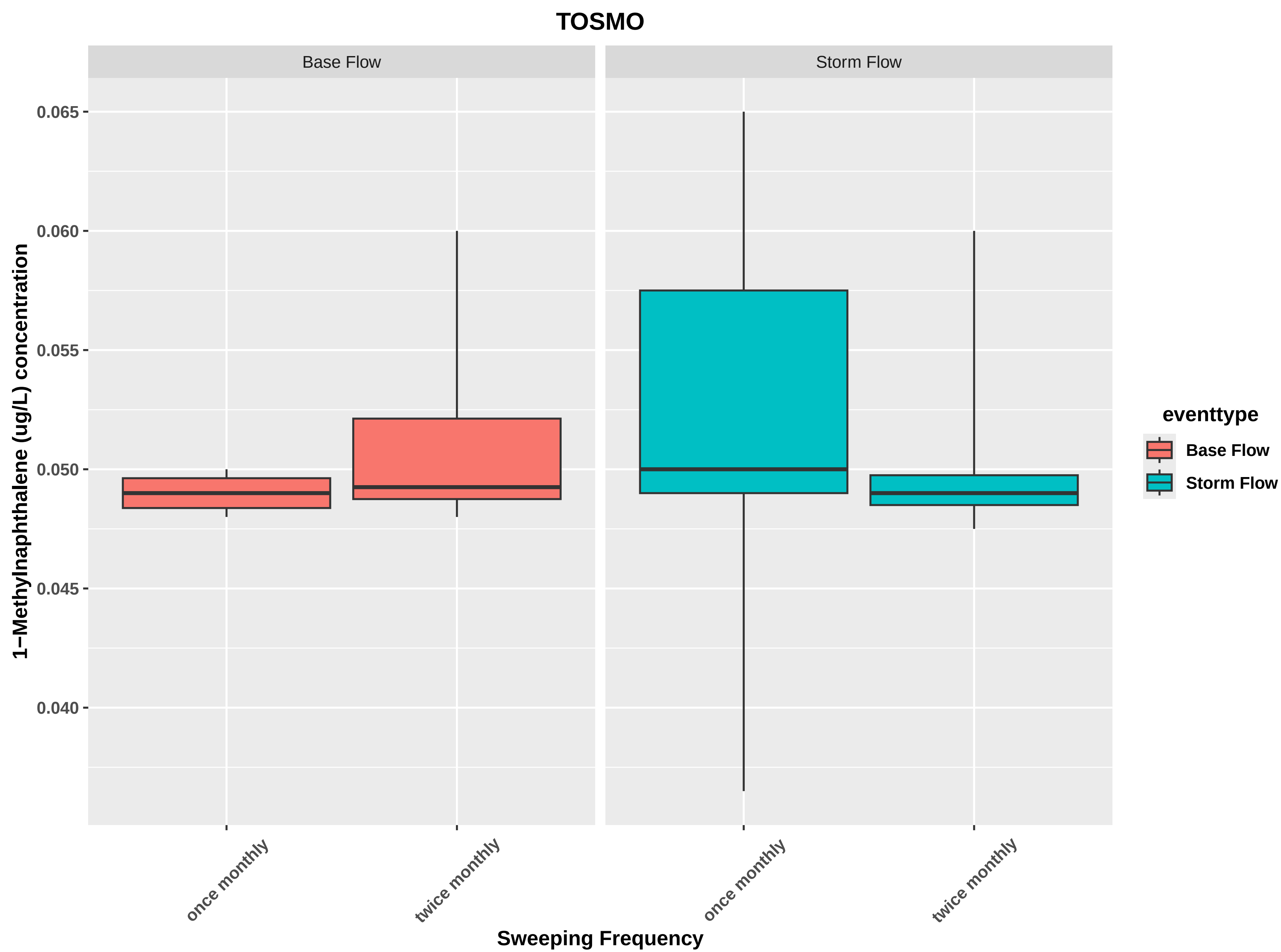

TOSMO
Base Flow
Storm Flow
6PPD−quinone (ng/L) concentration
0
5
10
15
20
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

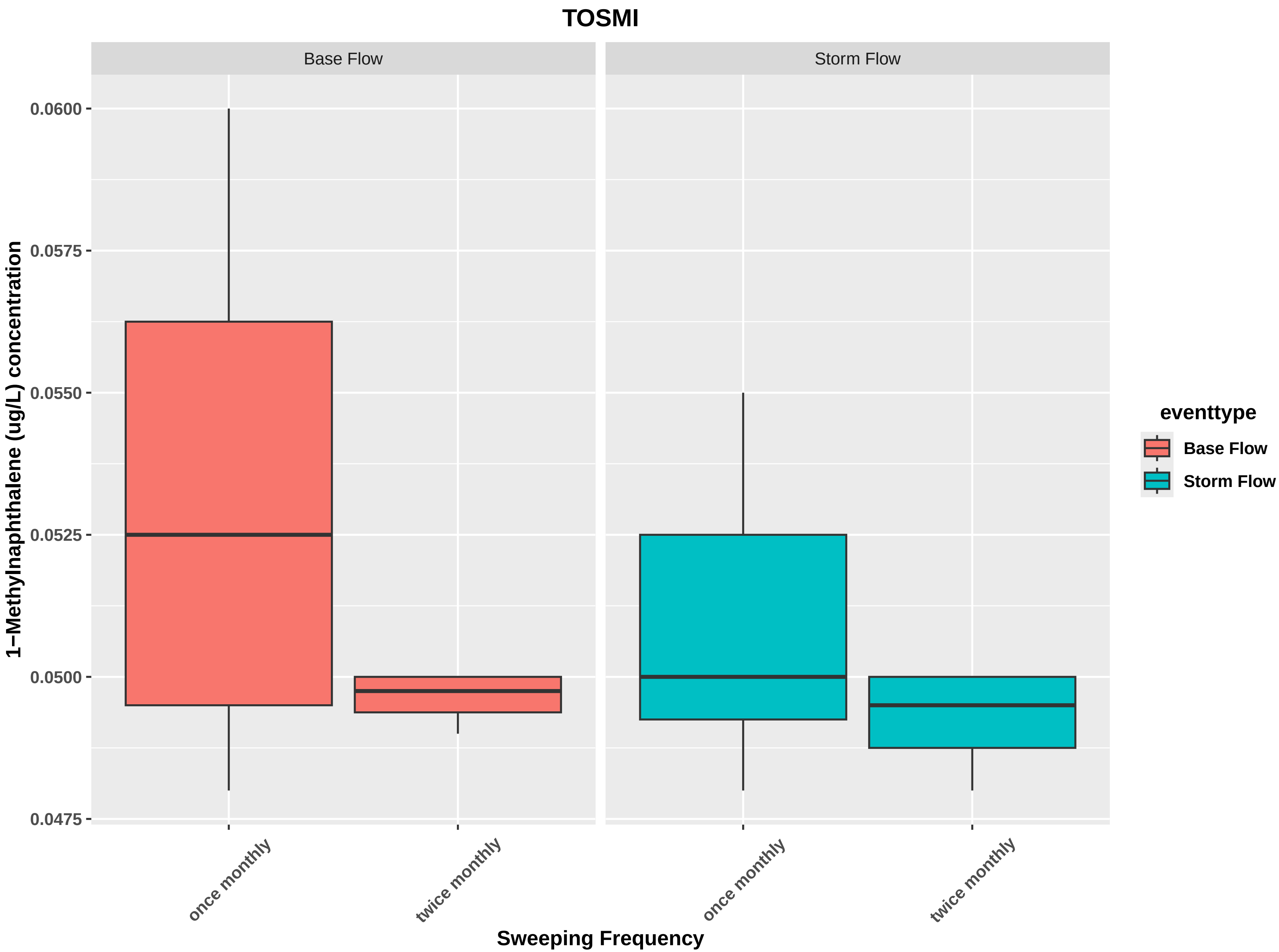

TOSMI
Base Flow
Storm Flow
80
60
40
20
0
6PPD−quinone (ng/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow



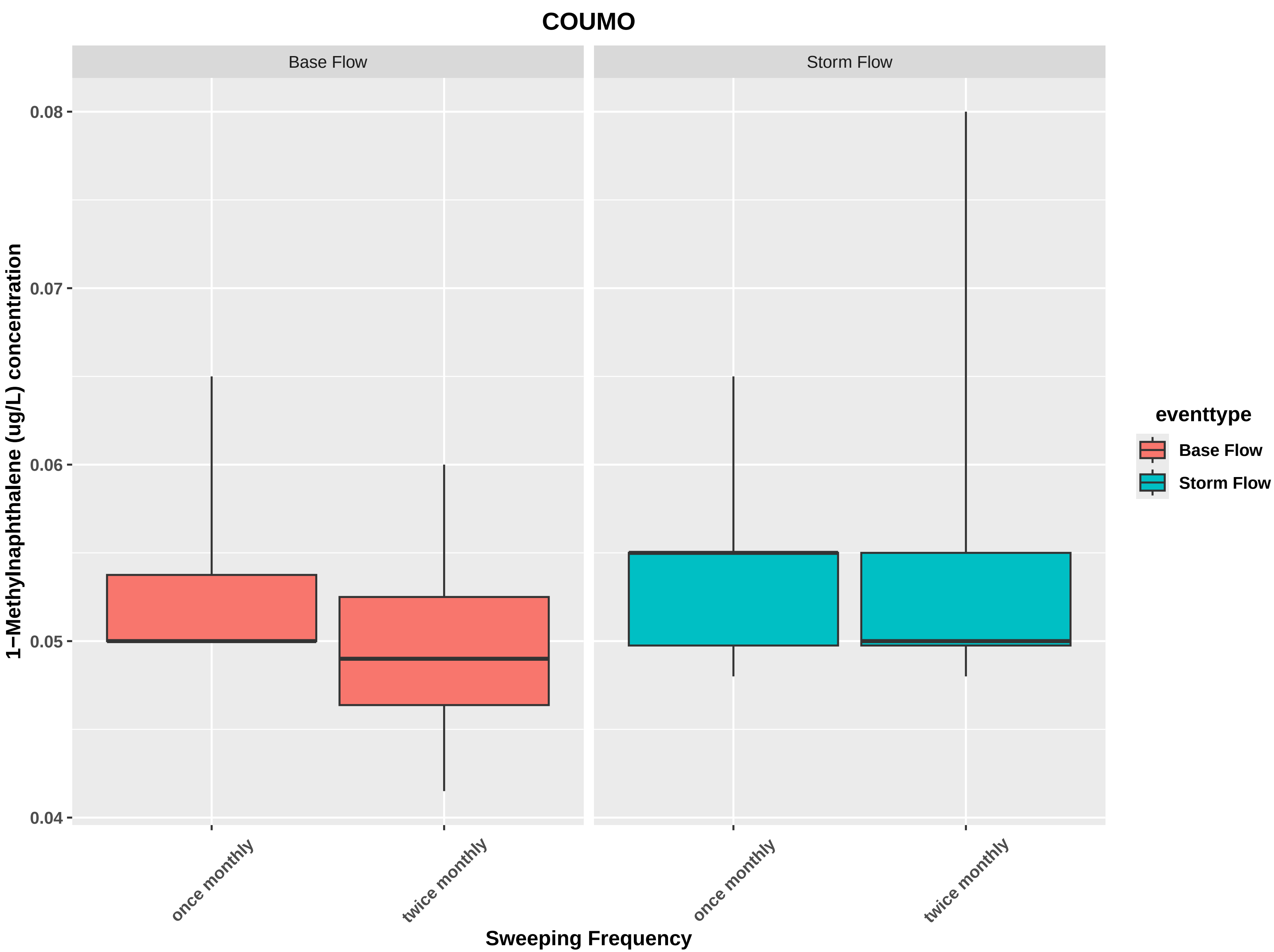
COUMO
Base Flow
Storm Flow
6PPD−quinone (ng/L) concentration
60
40
20
0
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

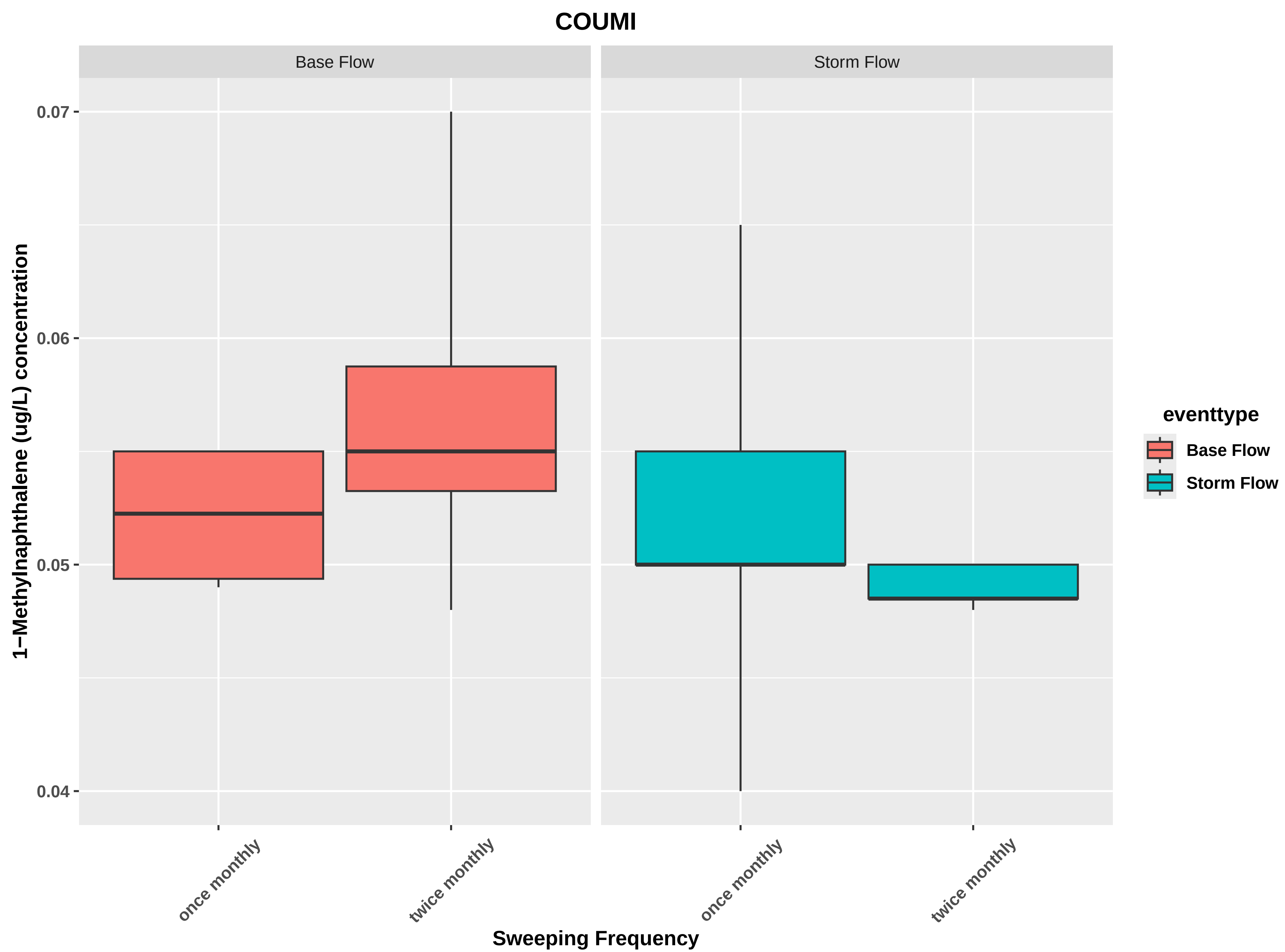

COUMI
Base Flow
Storm Flow
6PPD−quinone (ng/L) concentration
0
5
10
15
20
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

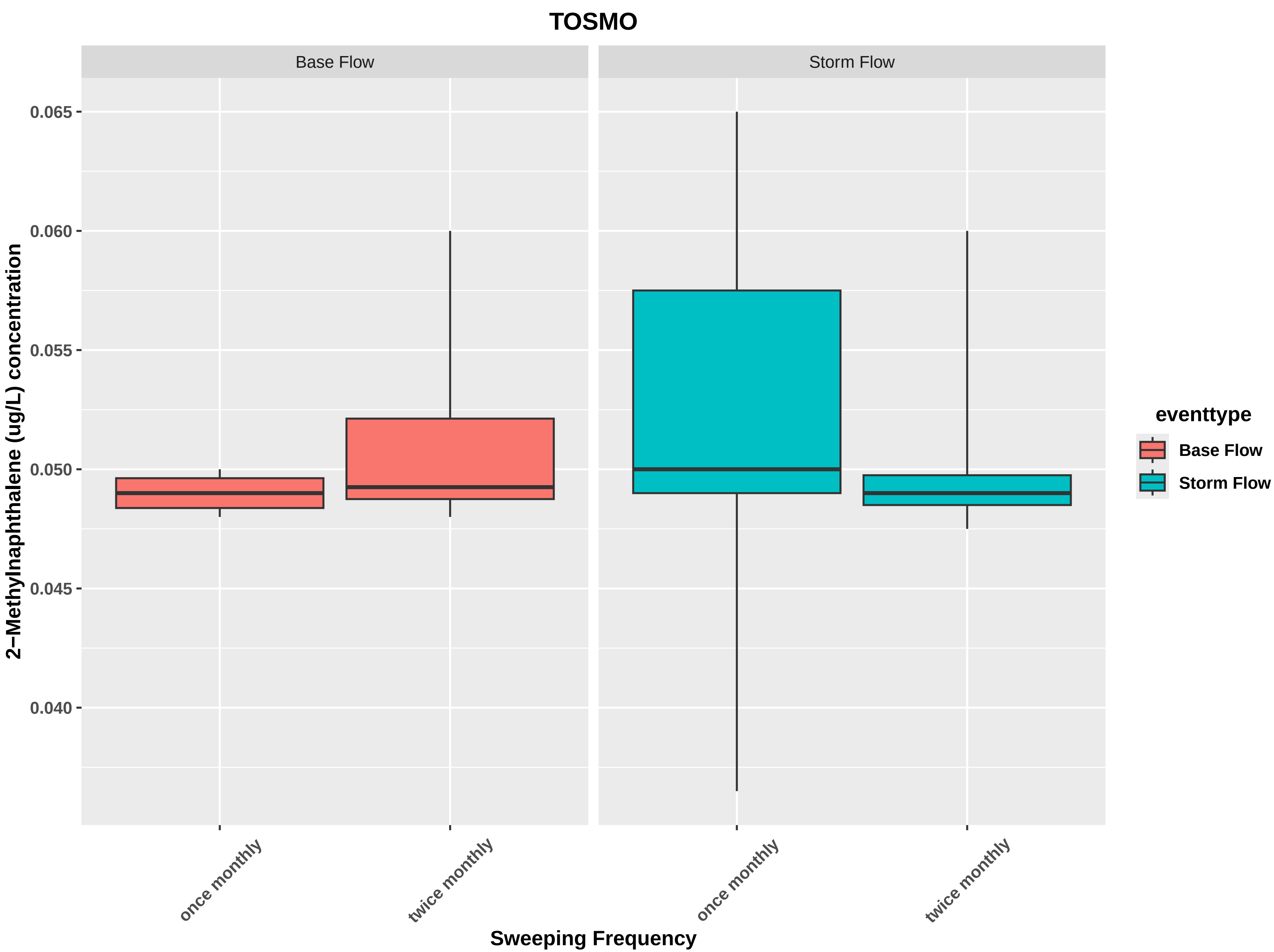

TOSMO
Base Flow
Storm Flow
1−Methylnaphthalene (ug/L) concentration
0.065
0.060
0.055
0.050
0.045
0.040
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

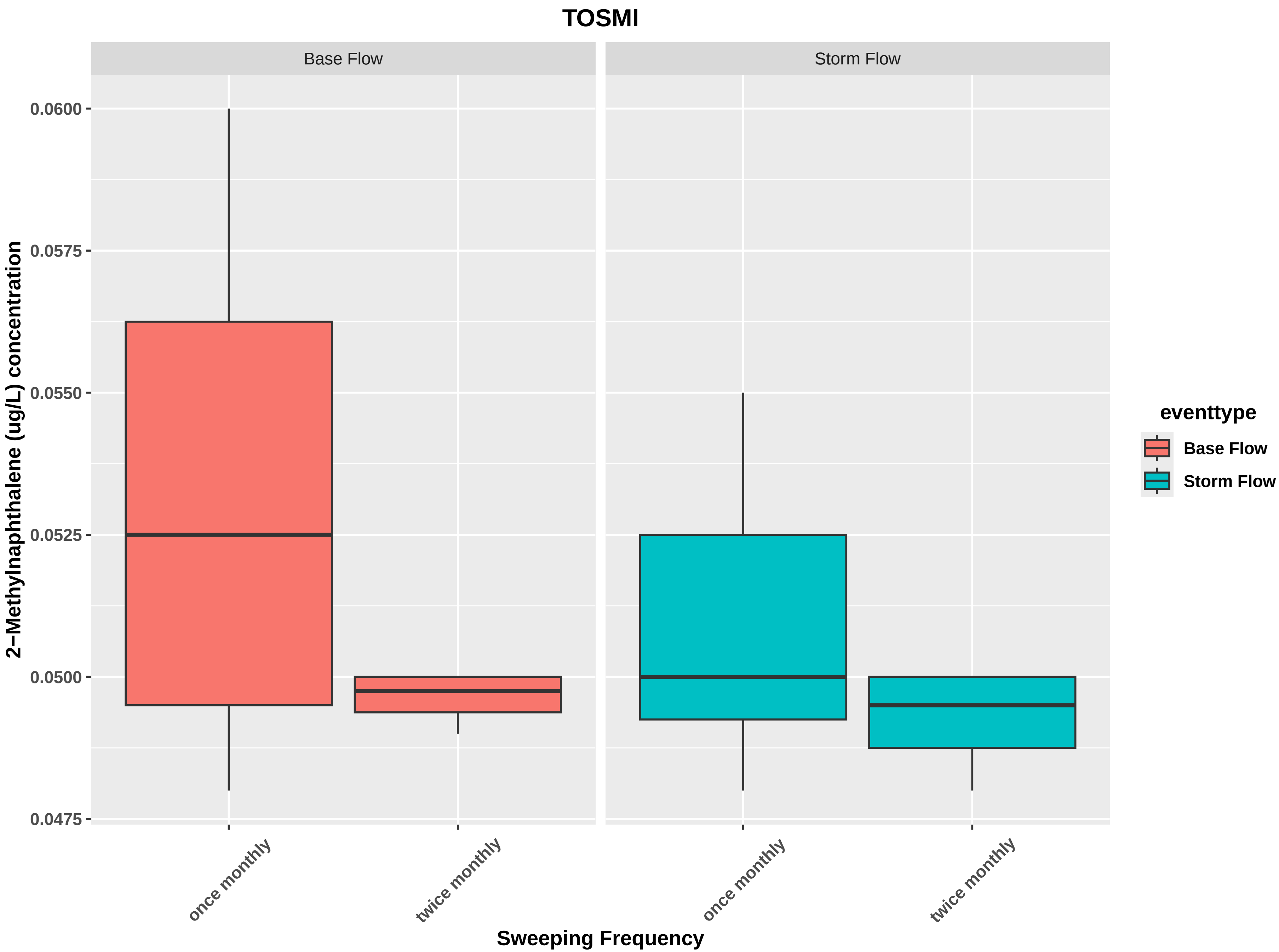


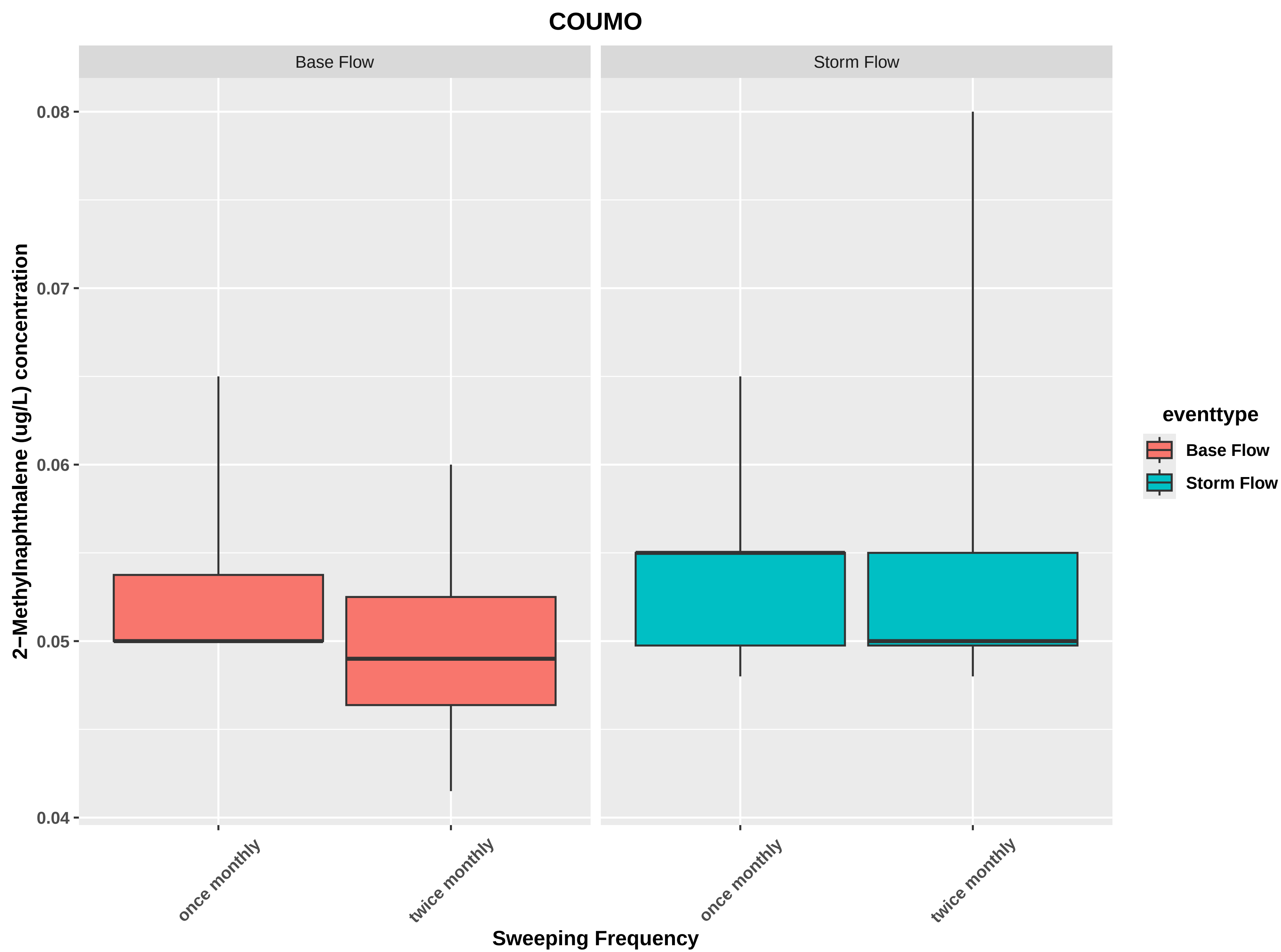
TOSMI
Base Flow
Storm Flow
0.0600
0.0575
0.0550
0.0525
0.0500
0.0475
1−Methylnaphthalene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

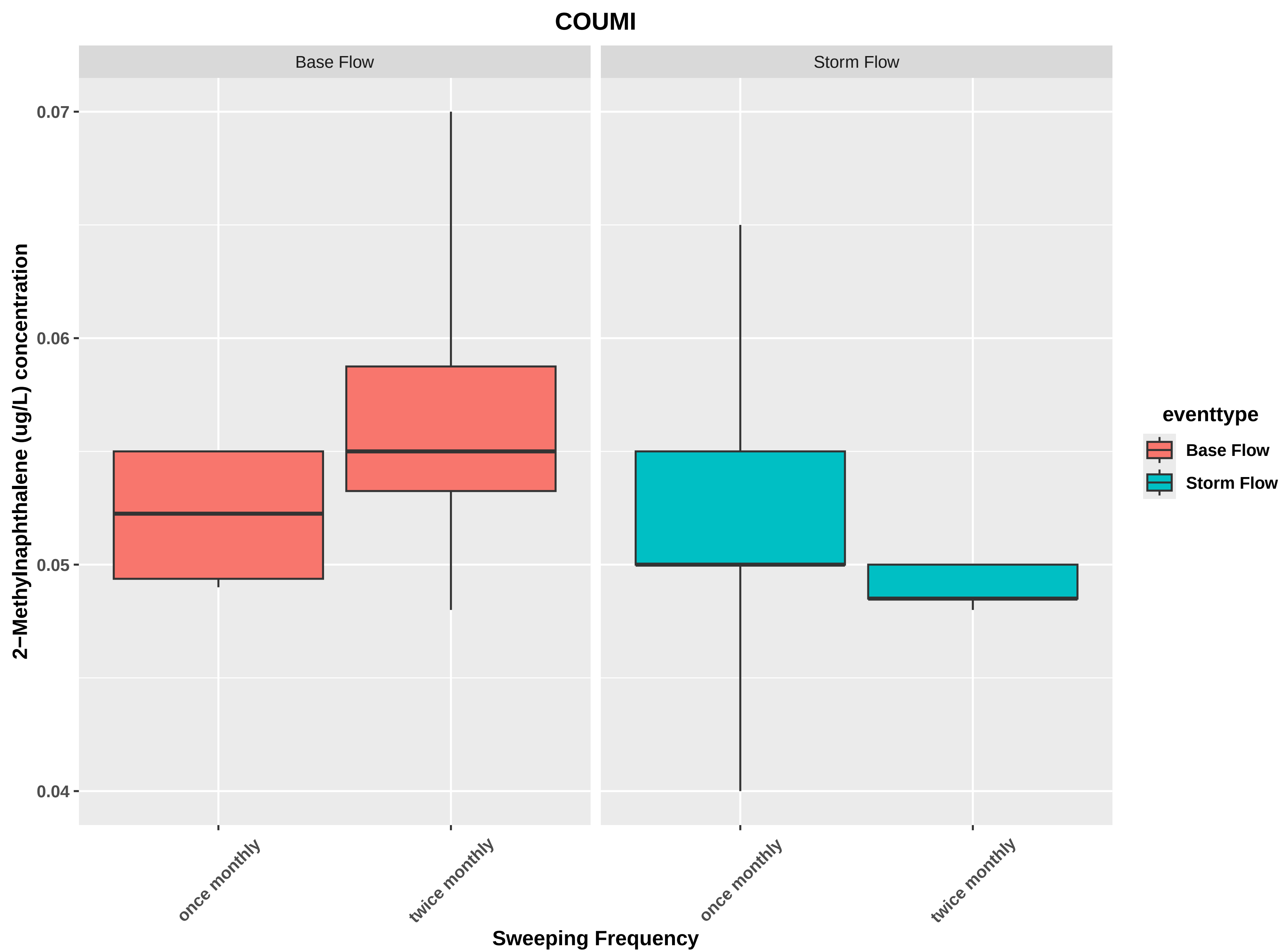

COUMO
Base Flow
Storm Flow
1−Methylnaphthalene (ug/L) concentration
0.08
0.07
0.06
0.05
0.04
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

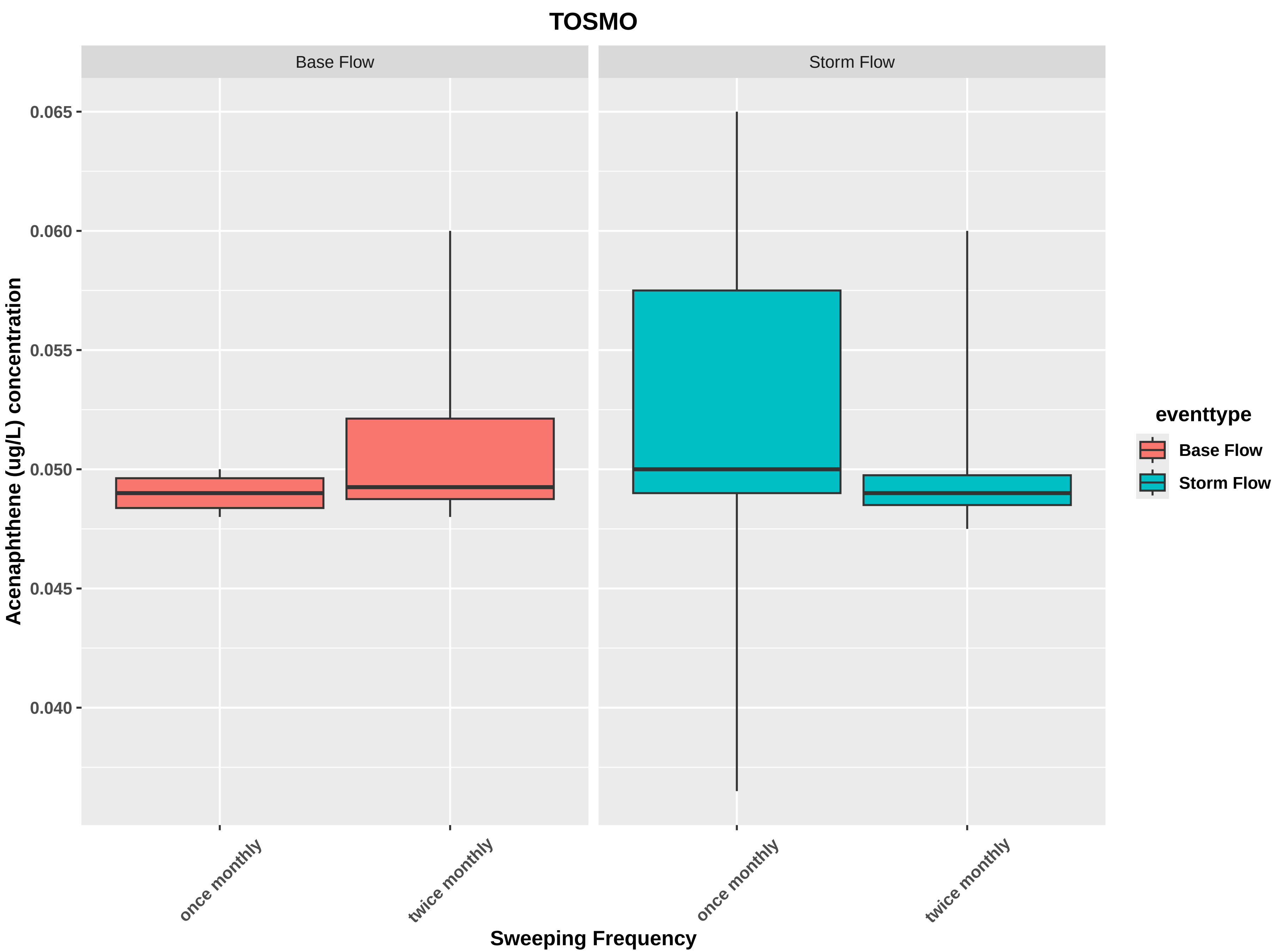

COUMI
Base Flow
Storm Flow
0.07
0.06
0.05
0.04
1−Methylnaphthalene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

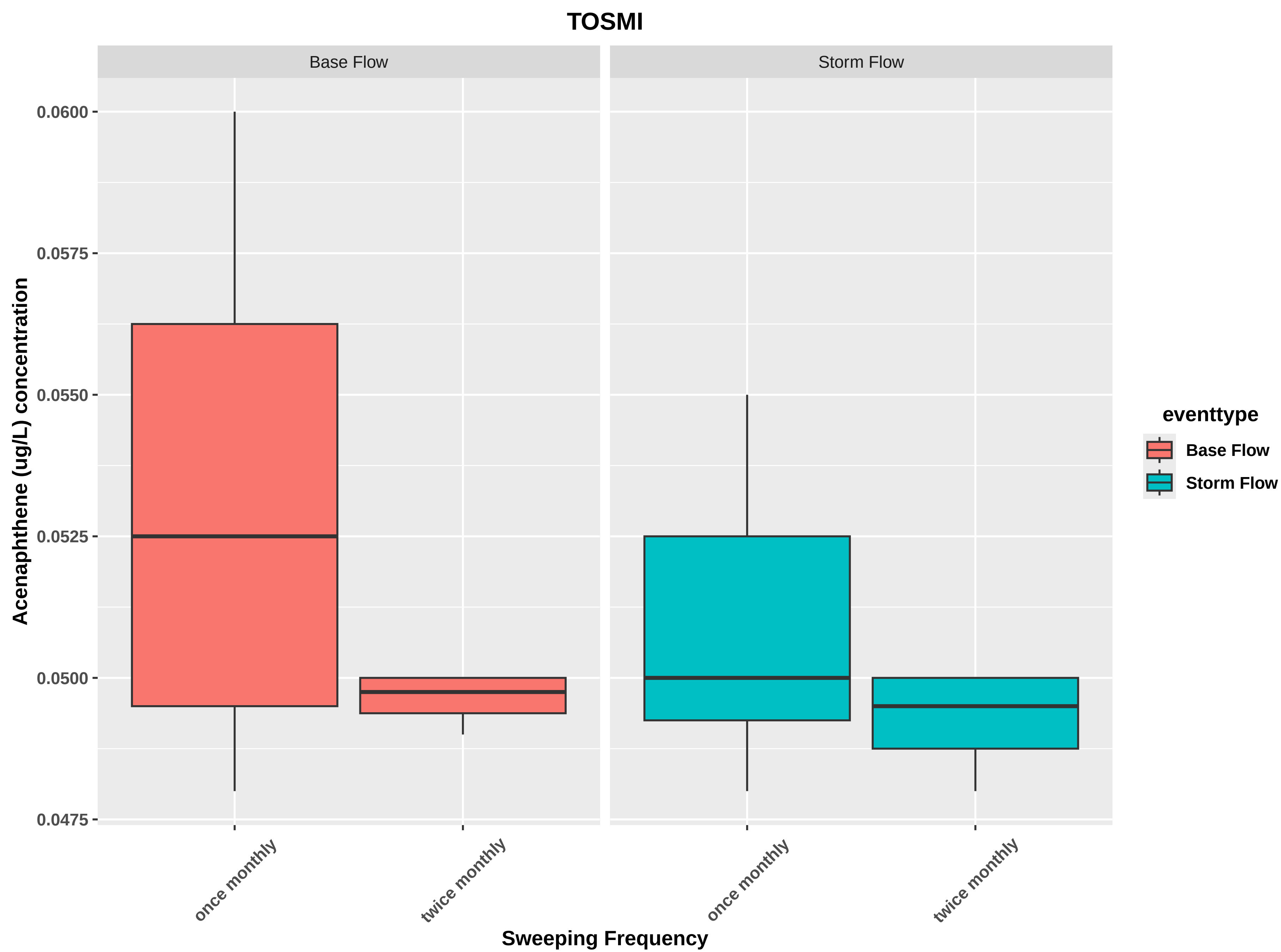

TOSMO
Base Flow
Storm Flow
2−Methylnaphthalene (ug/L) concentration
0.065
0.060
0.055
0.050
0.045
0.040
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

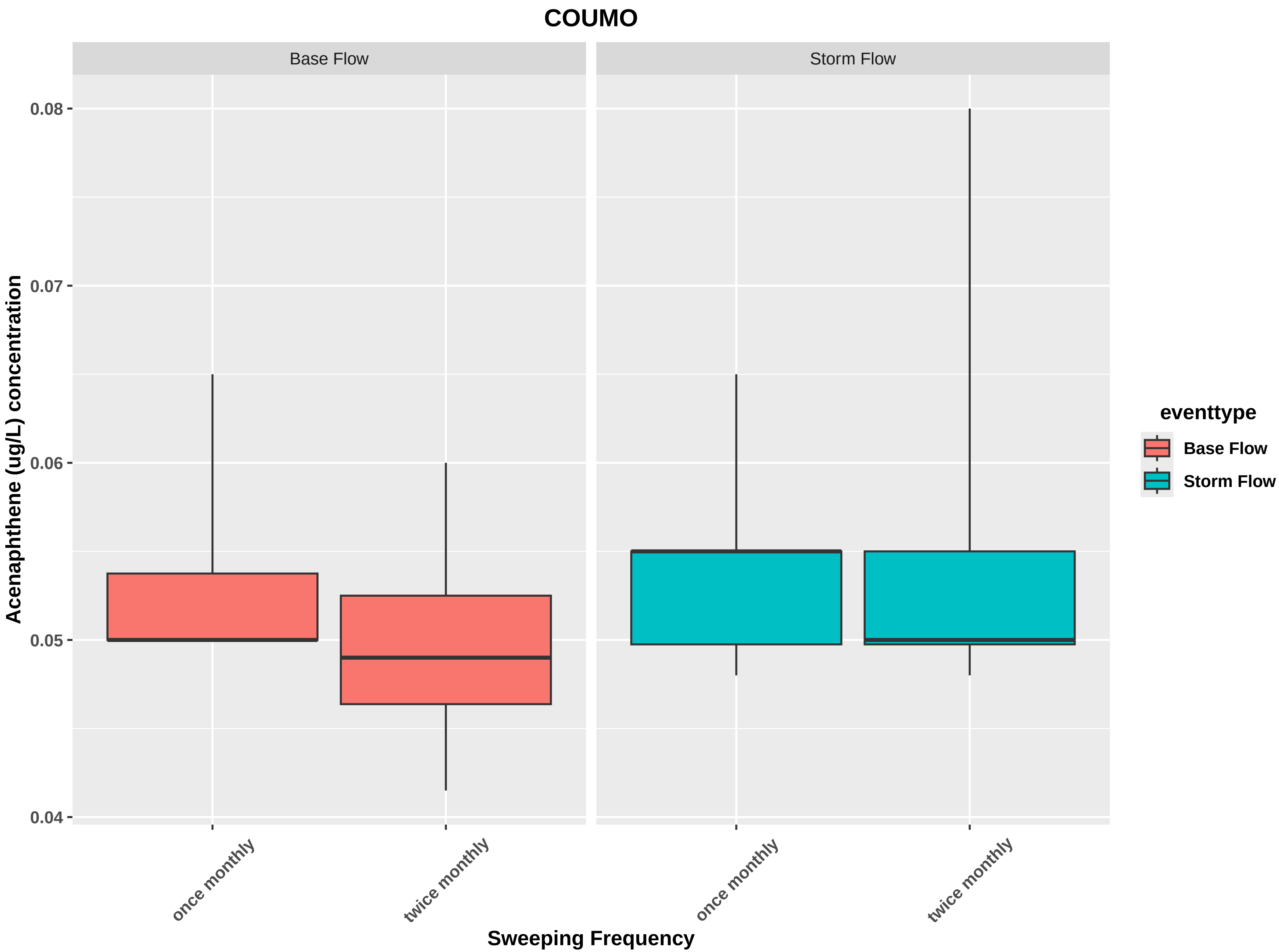

TOSMI
Base Flow
Storm Flow
2−Methylnaphthalene (ug/L) concentration
0.0600
0.0575
0.0550
0.0525
0.0500
0.0475
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

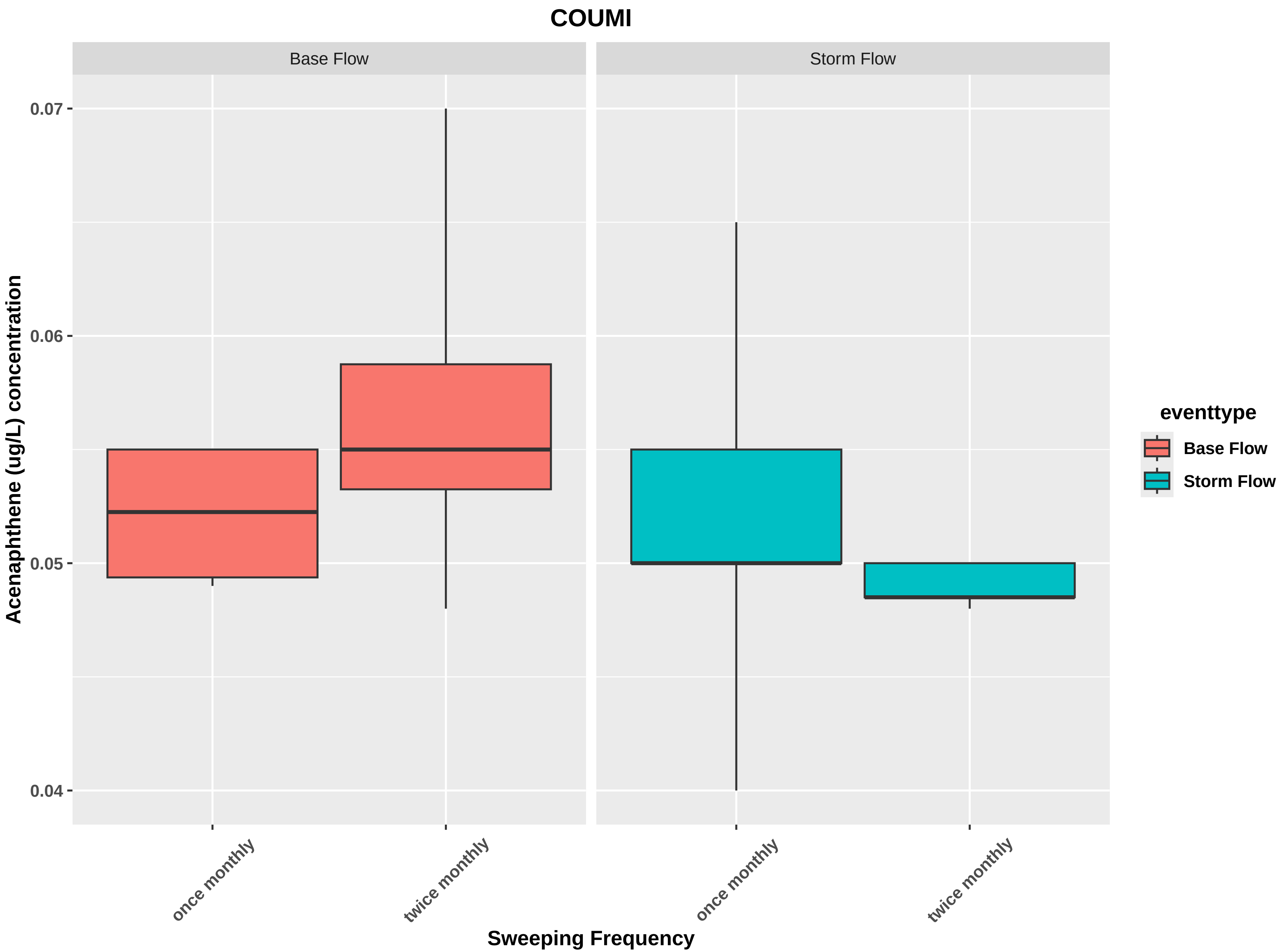

COUMO
Base Flow
Storm Flow
0.08
0.07
0.06
0.05
0.04
2−Methylnaphthalene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow


COUMI
Base Flow
Storm Flow
0.07
0.06
0.05
0.04
2−Methylnaphthalene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

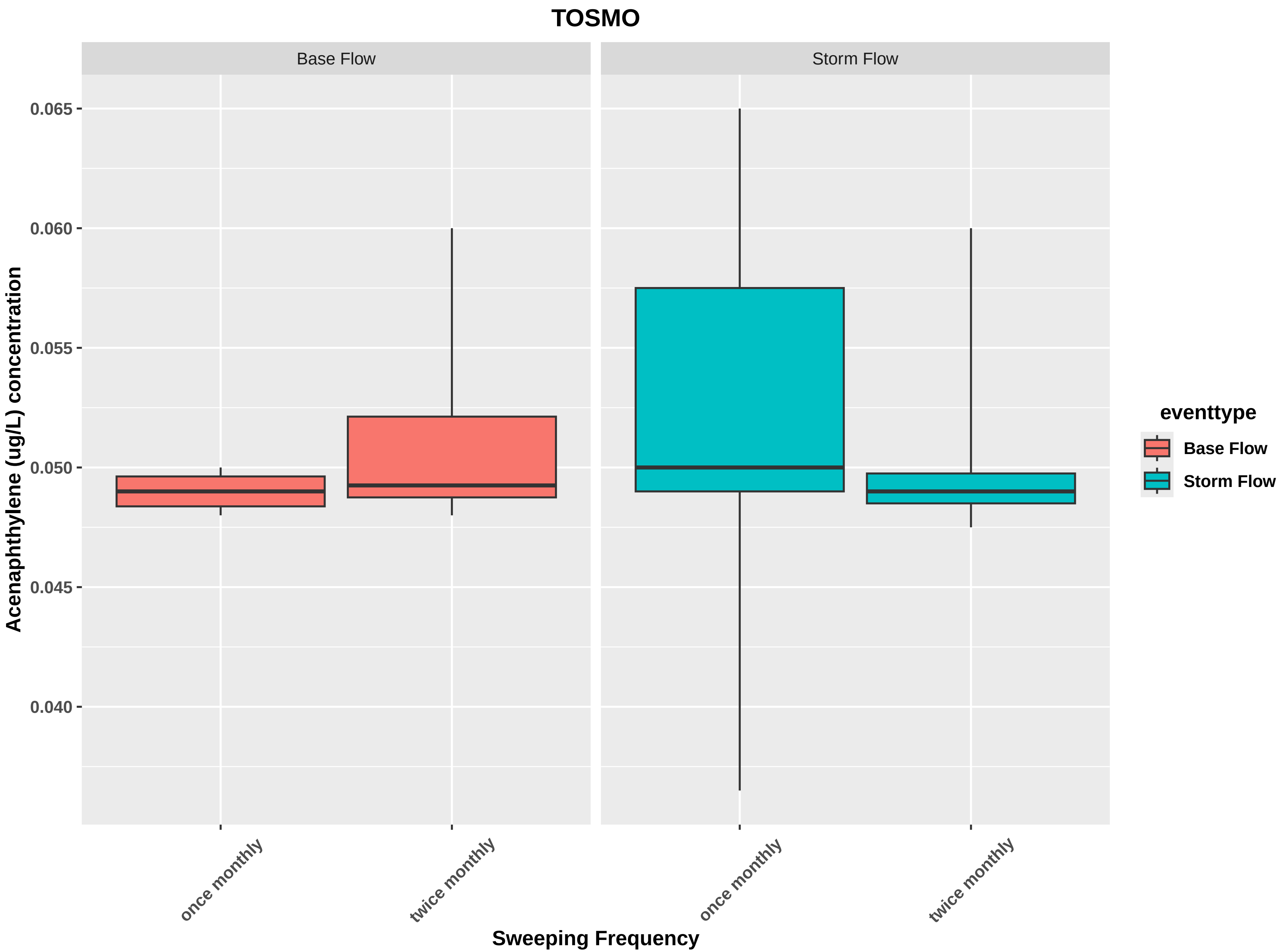

TOSMO
Base Flow
Storm Flow
Acenaphthene (ug/L) concentration
0.065
0.060
0.055
0.050
0.045
0.040
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

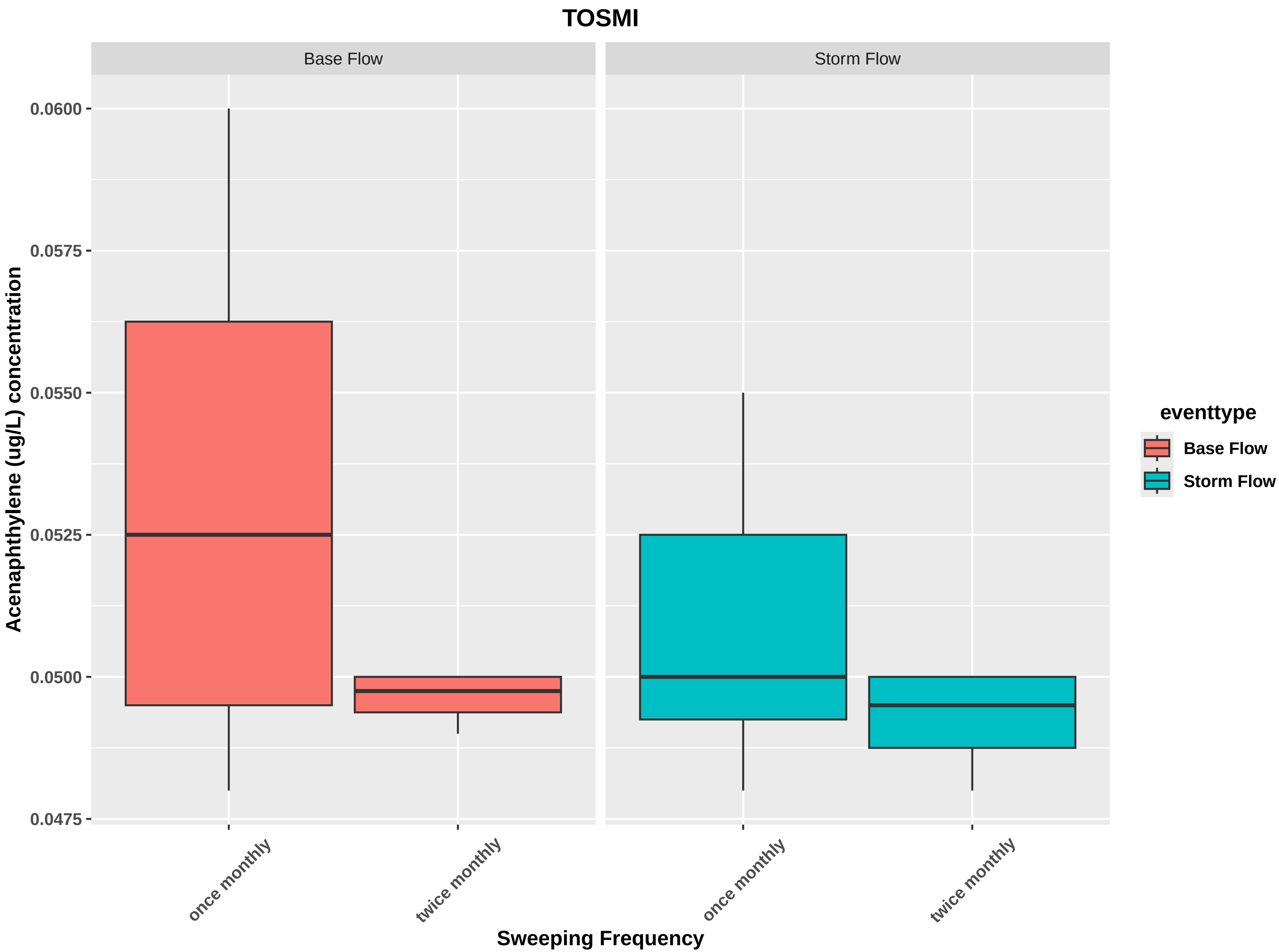

TOSMI
Base Flow
Storm Flow
0.0600
0.0575
0.0550
0.0525
0.0500
0.0475
Acenaphthene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow


COUMO
Base Flow
Storm Flow
0.08
0.07
0.06
0.05
0.04
Acenaphthene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

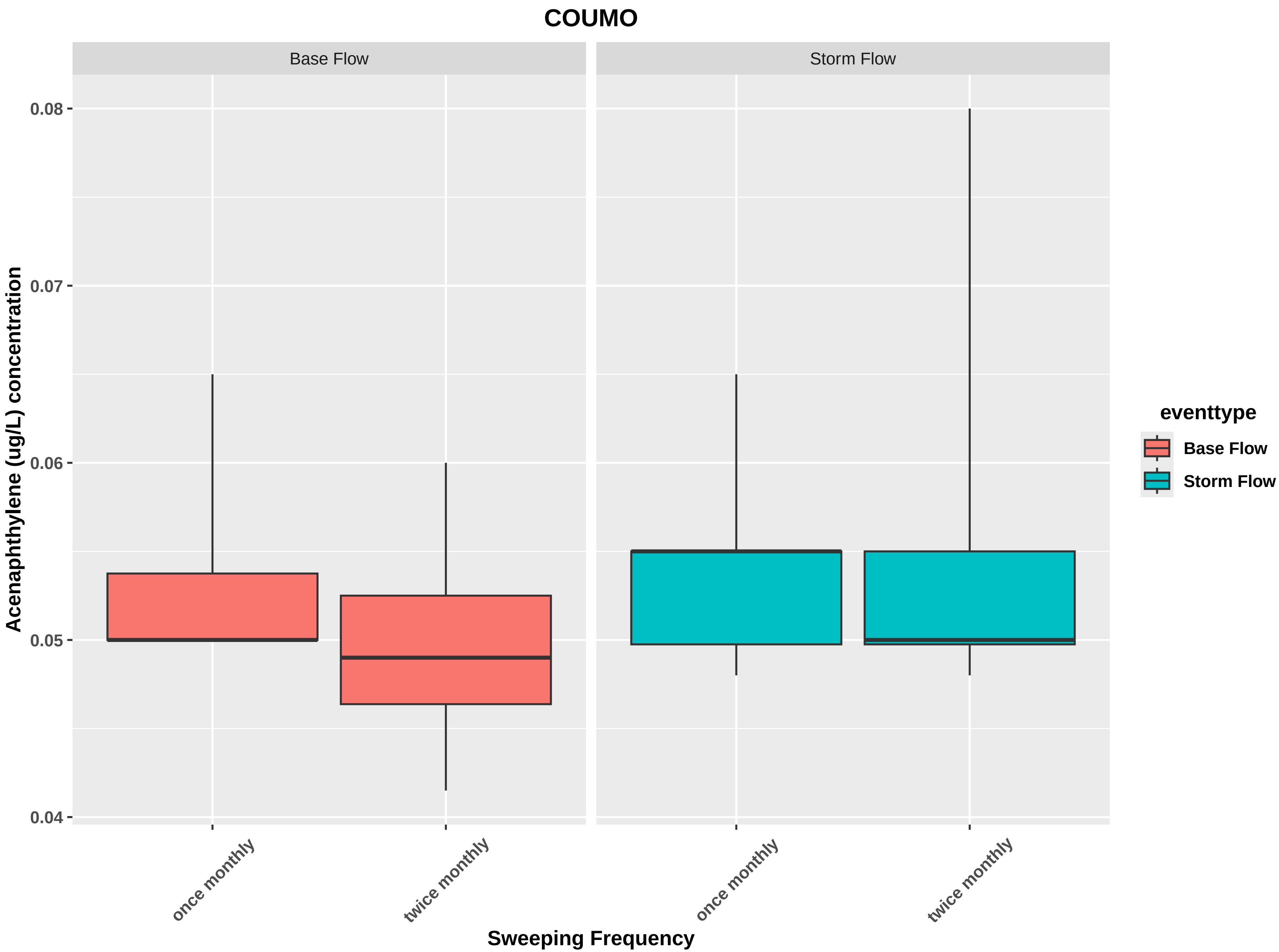


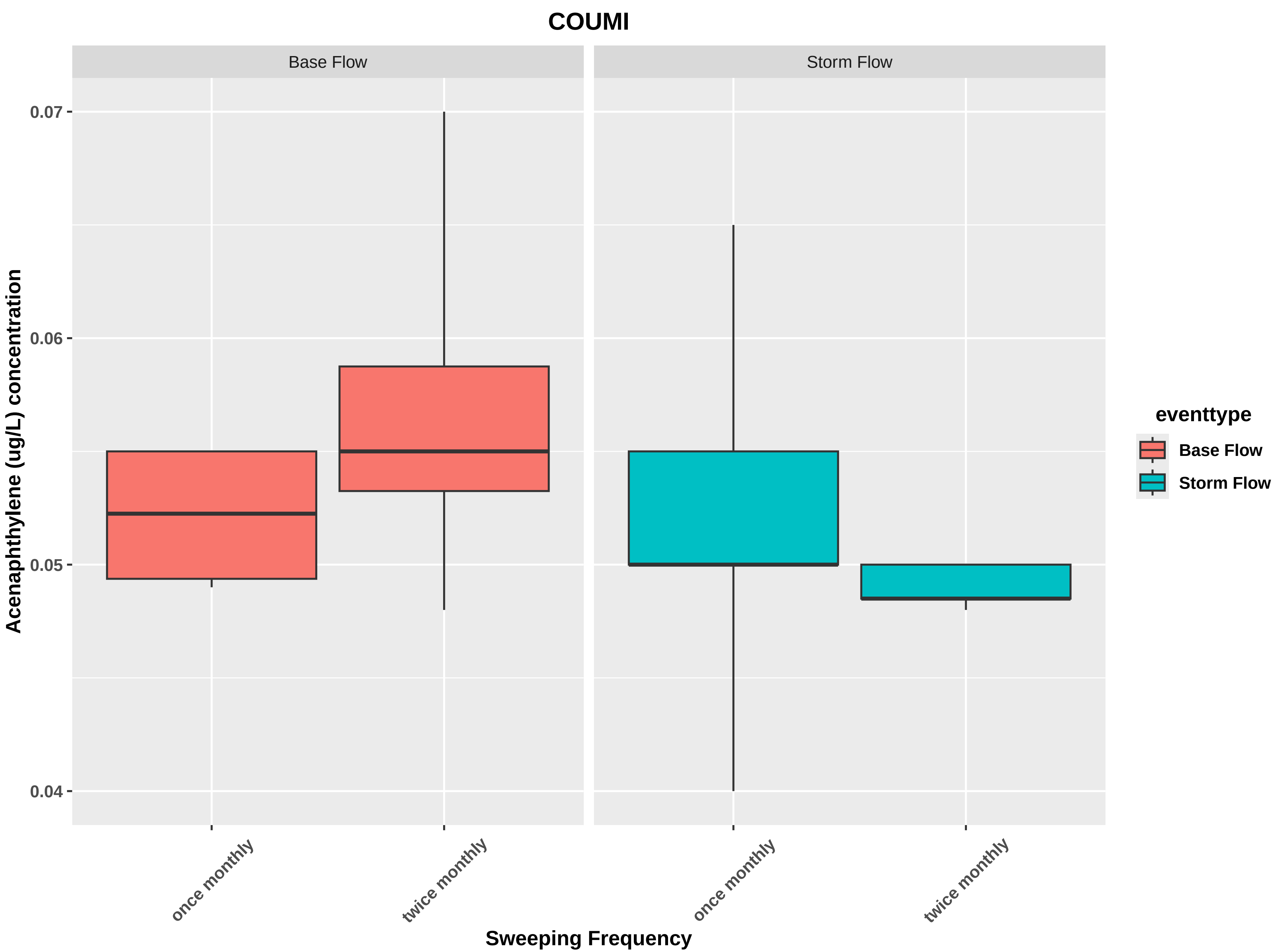
COUMI
Base Flow
Storm Flow
0.07
0.06
0.05
0.04
Acenaphthene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

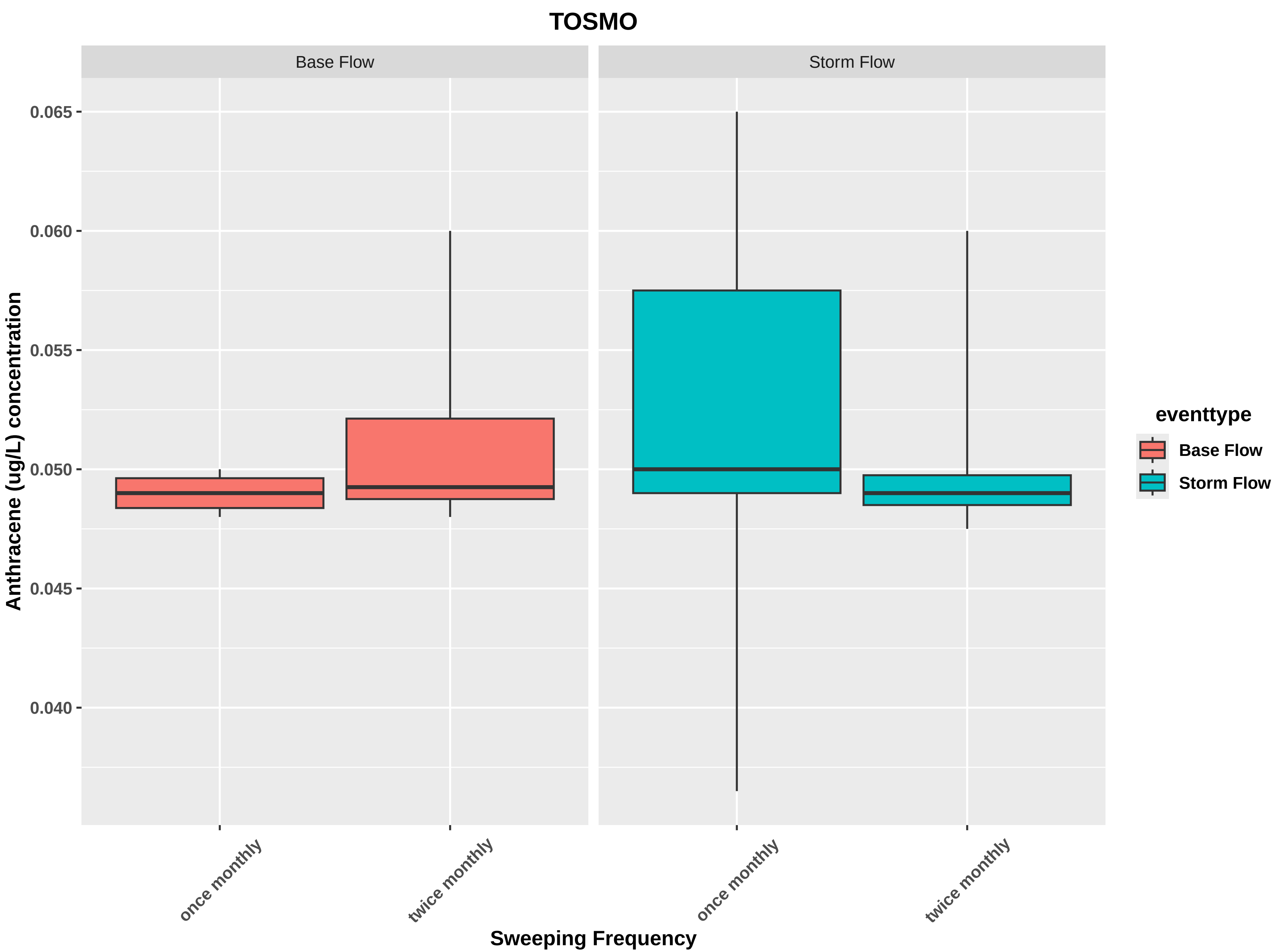

TOSMO
Base Flow
Storm Flow
0.065
0.060
0.055
0.050
0.045
0.040
Acenaphthylene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow



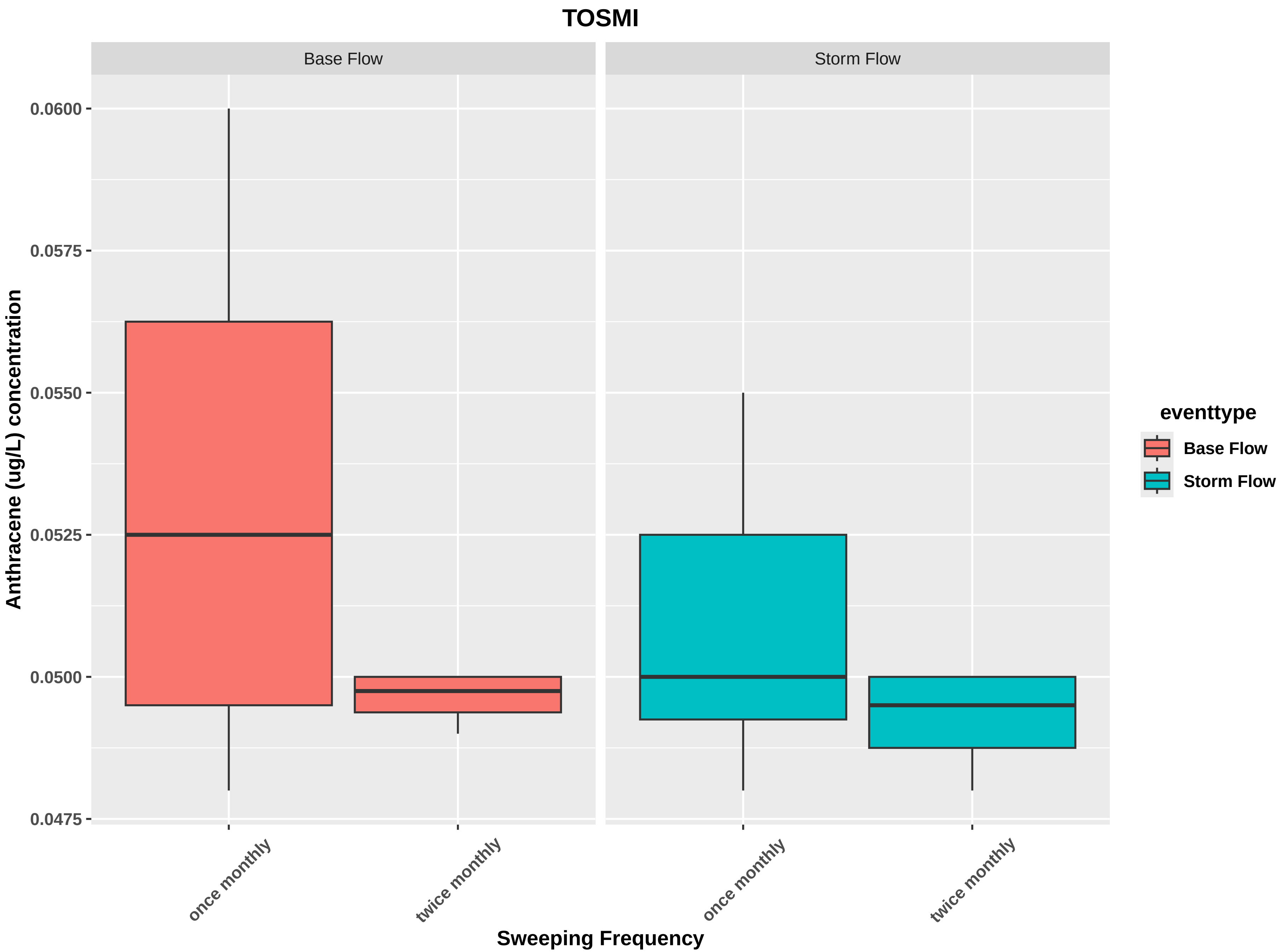
TOSMI
Base Flow
Storm Flow
Acenaphthylene (ug/L) concentration
0.0600
0.0575
0.0550
0.0525
0.0500
0.0475
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

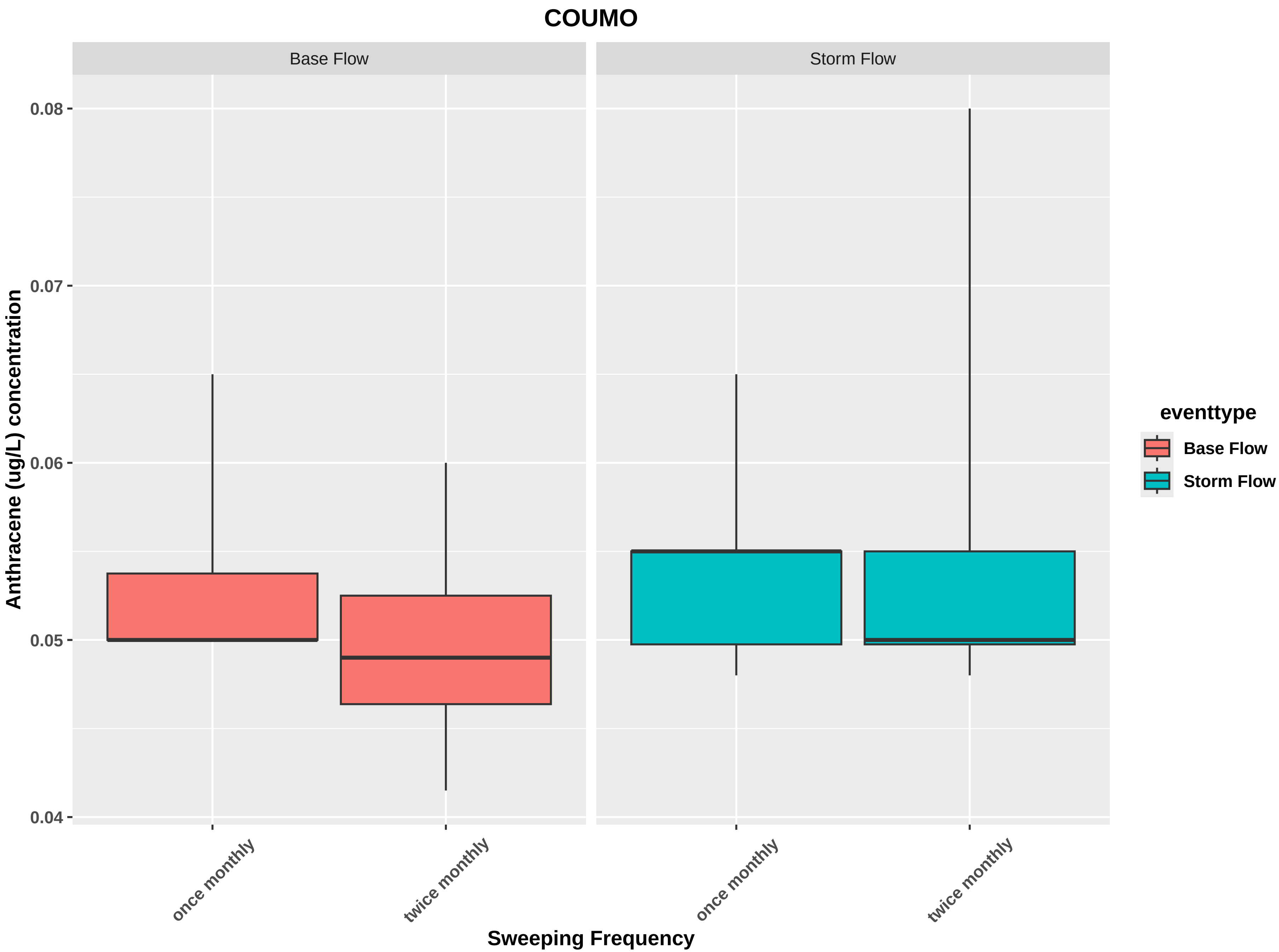

COUMO
Base Flow
Storm Flow
0.08
0.07
0.06
0.05
0.04
Acenaphthylene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

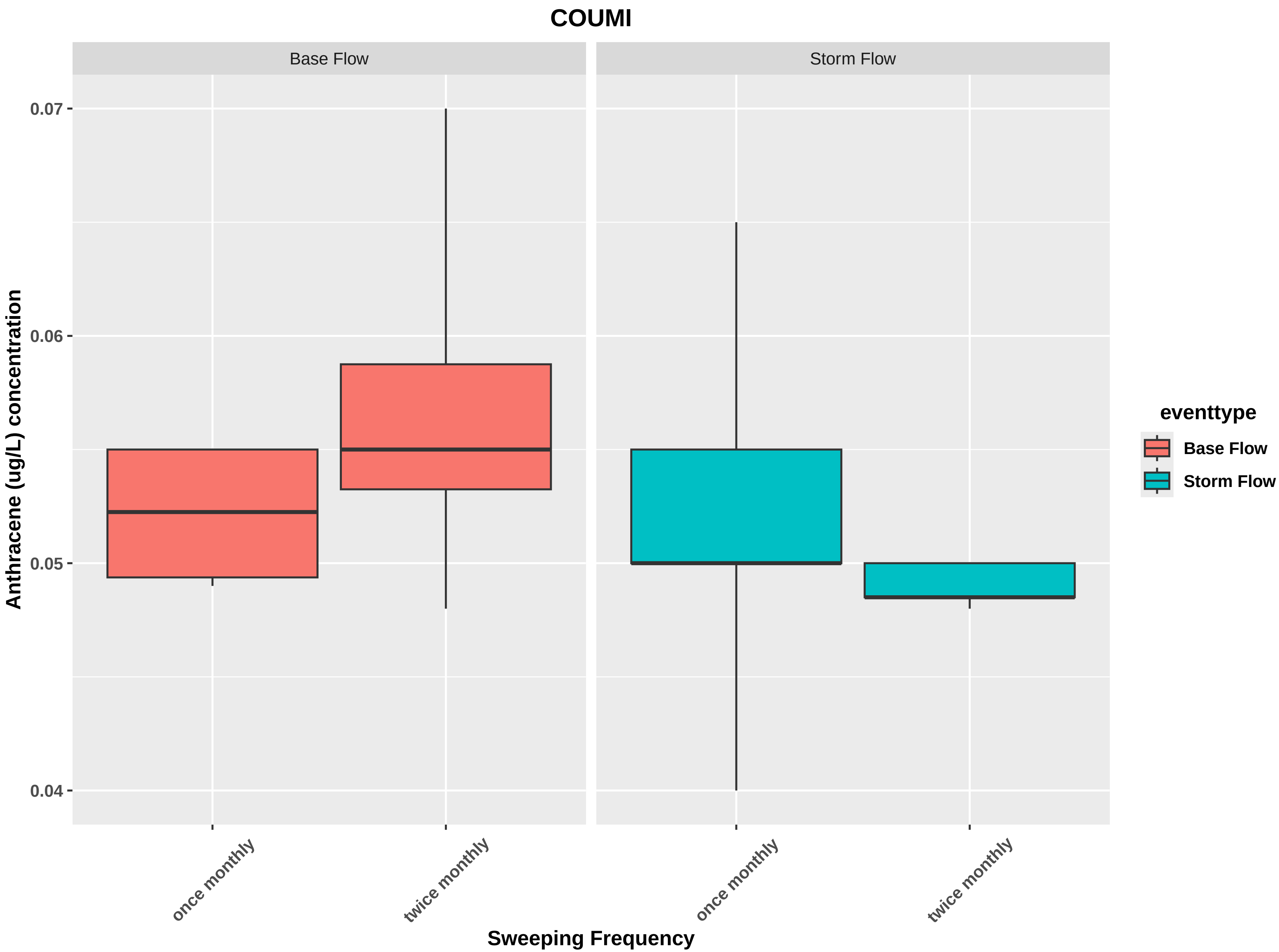

COUMI
Base Flow
Storm Flow
0.07
0.06
0.05
0.04
Acenaphthylene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow



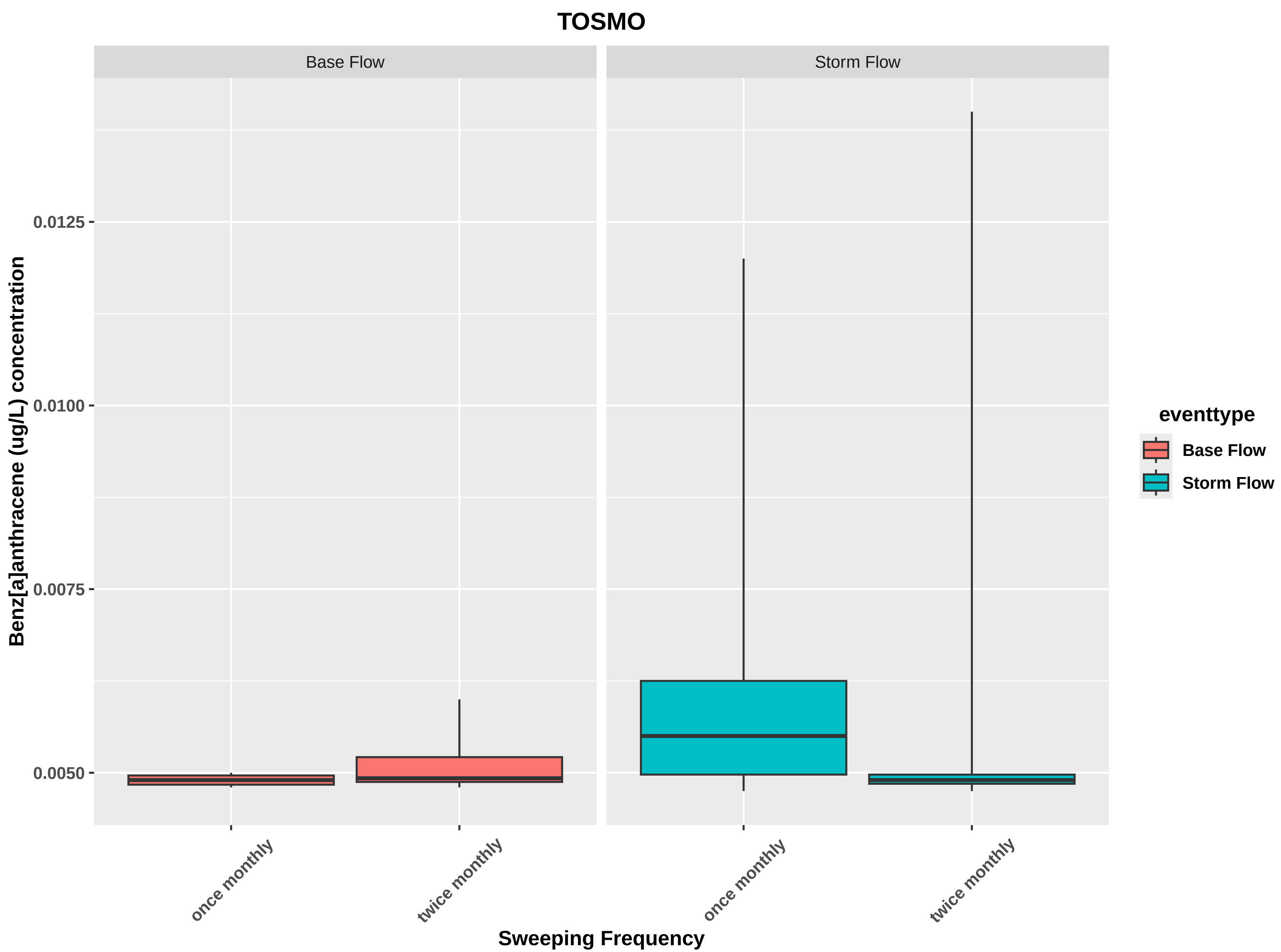
TOSMO
Base Flow
Storm Flow
0.065
0.060
0.055
0.050
0.045
0.040
Anthracene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

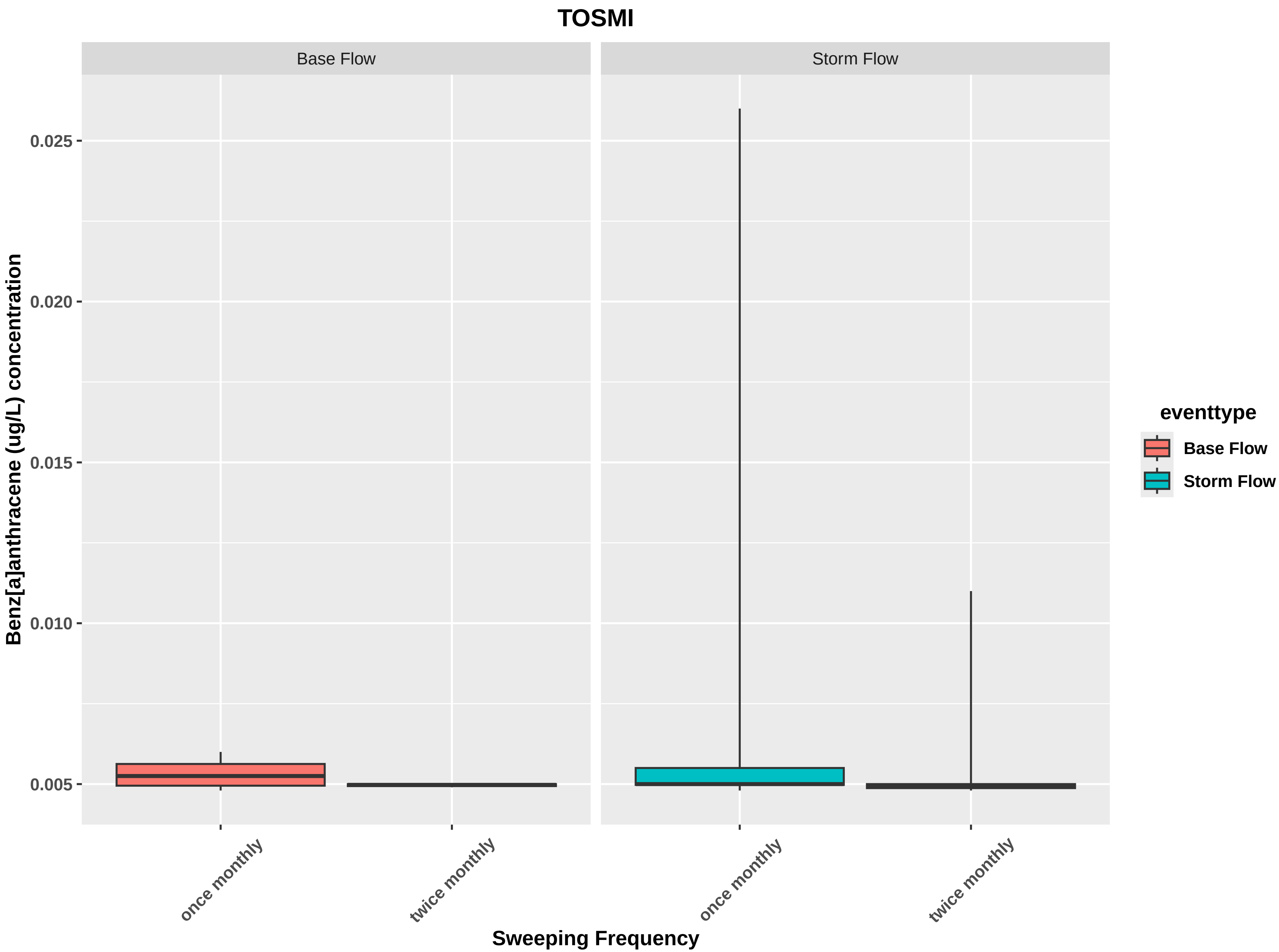

TOSMI
Base Flow
Storm Flow
0.0600
0.0575
0.0550
0.0525
0.0500
0.0475
Anthracene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow


COUMO
Base Flow
Storm Flow
0.08
0.07
0.06
0.05
0.04
Anthracene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

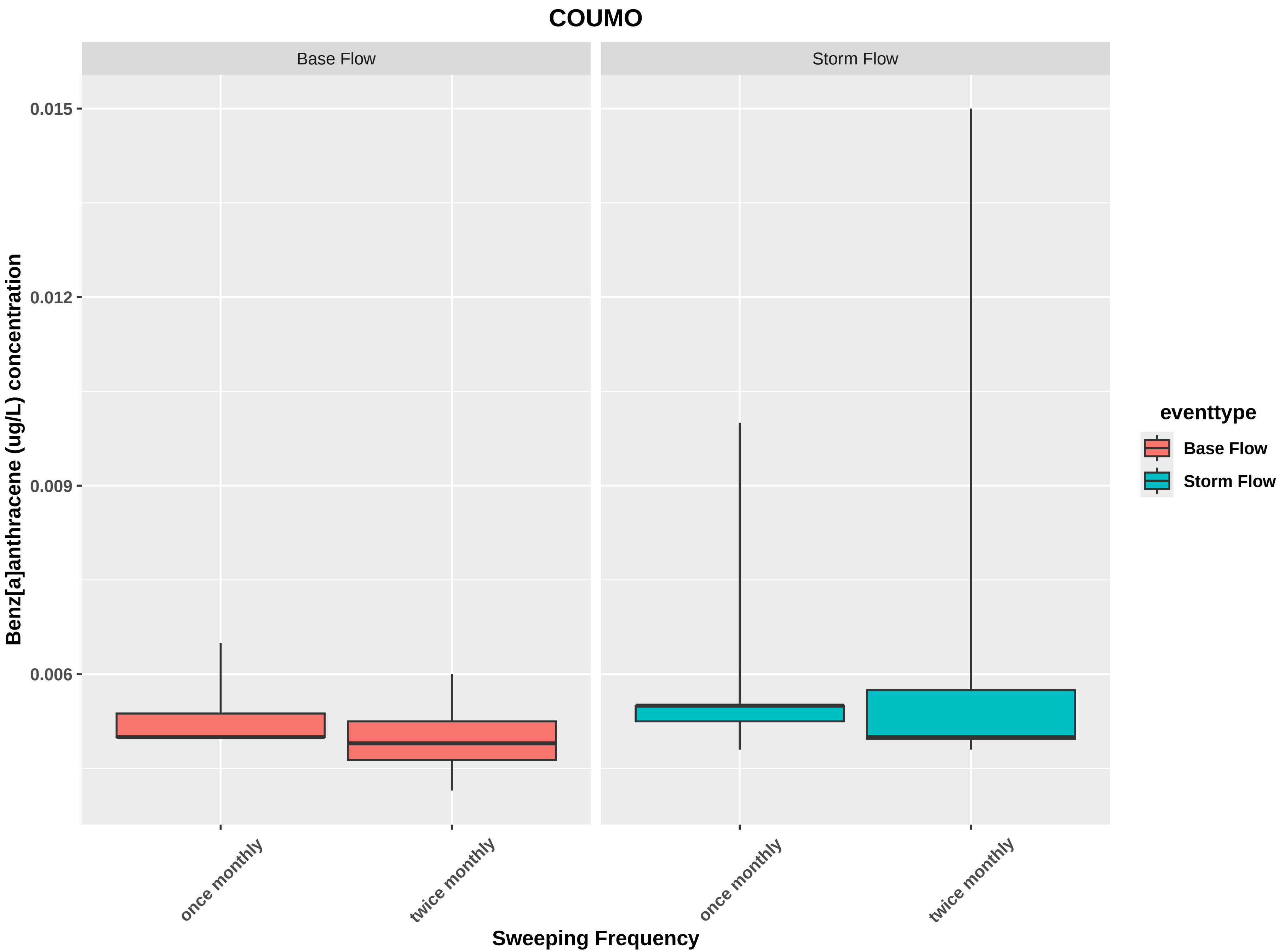


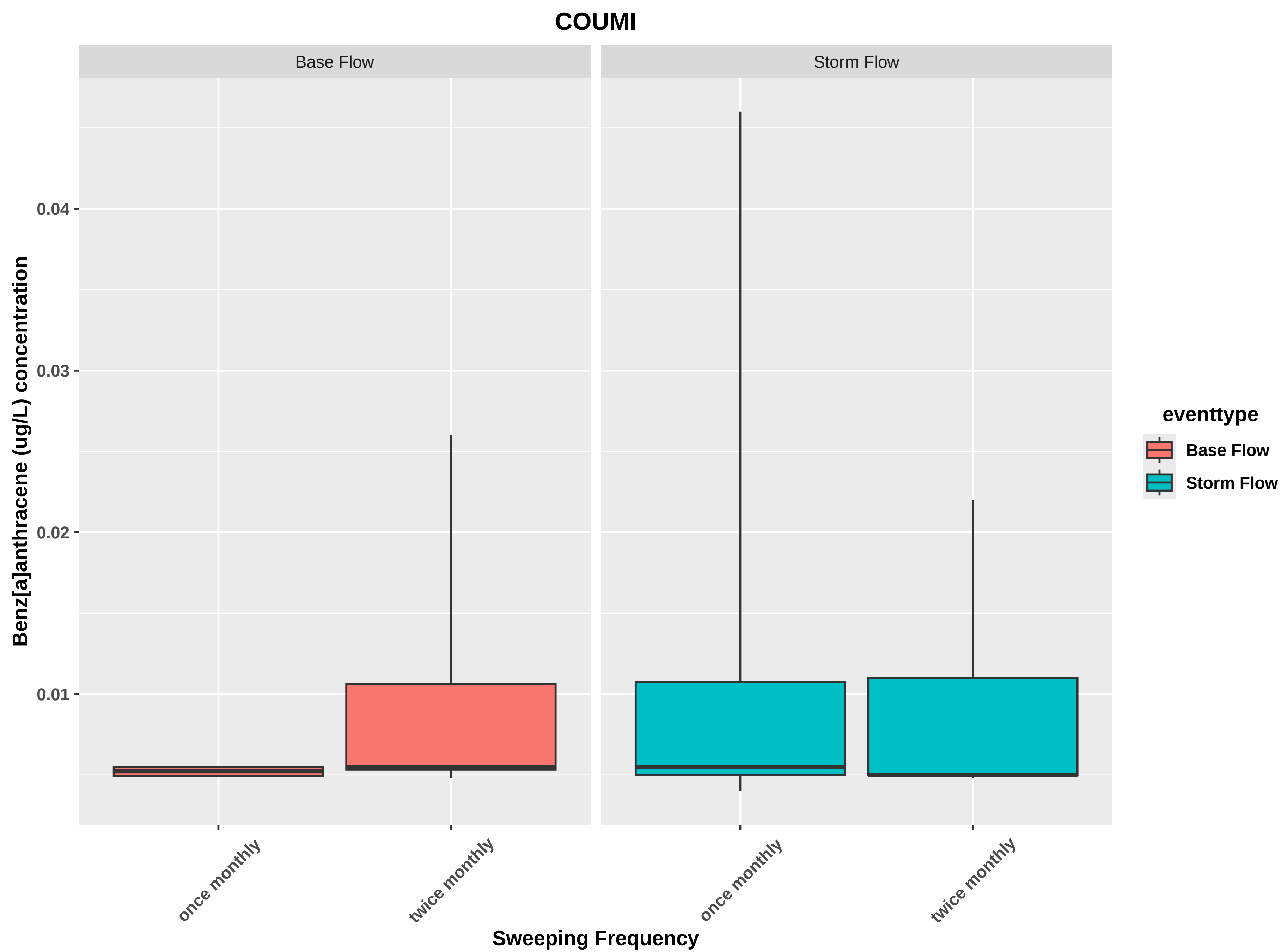
COUMI
Base Flow
Storm Flow
0.07
0.06
0.05
0.04
Anthracene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

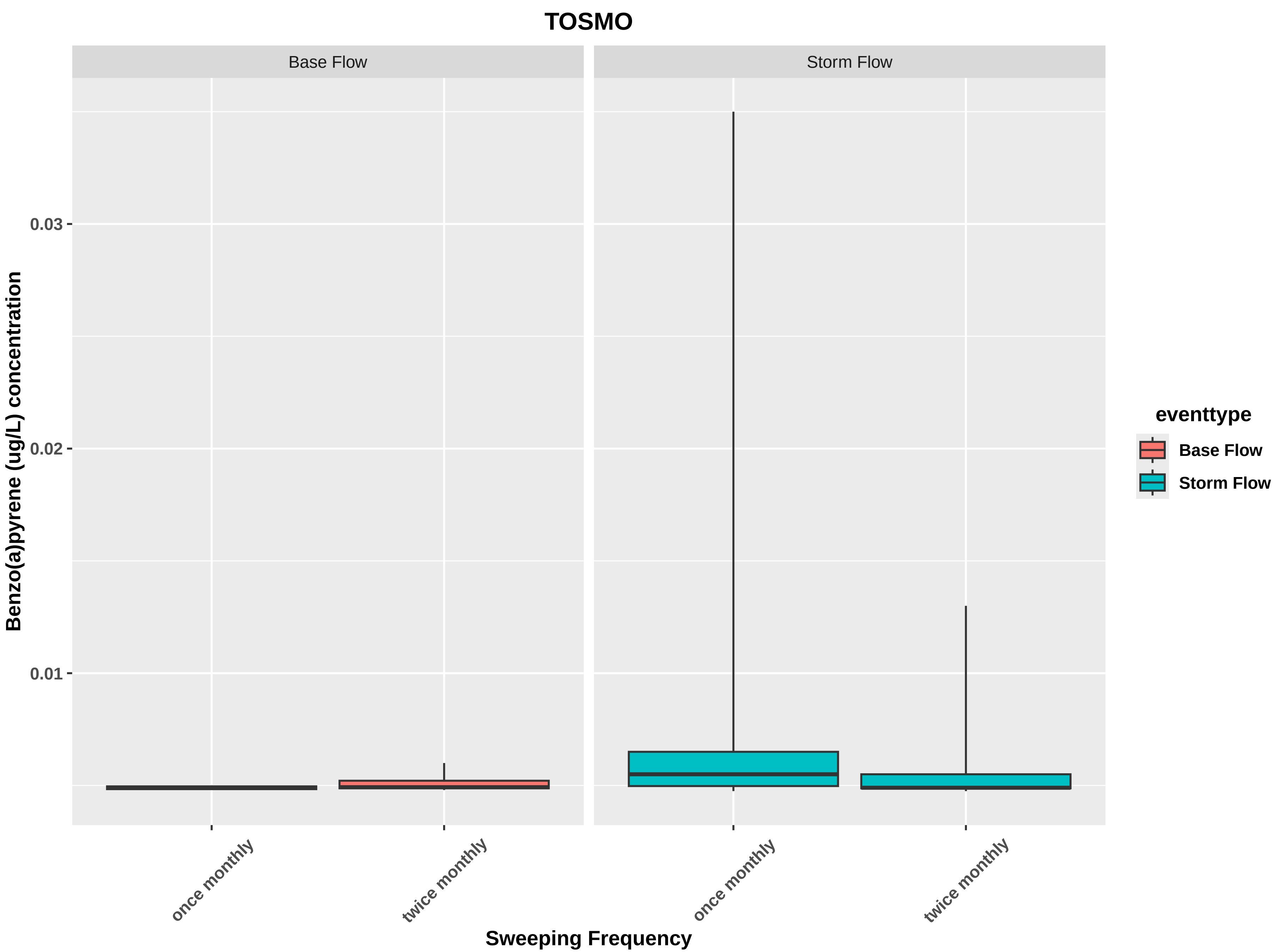

TOSMO
Base Flow
Storm Flow
0.0125
0.0100
0.0075
0.0050
Benz[a]anthracene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow



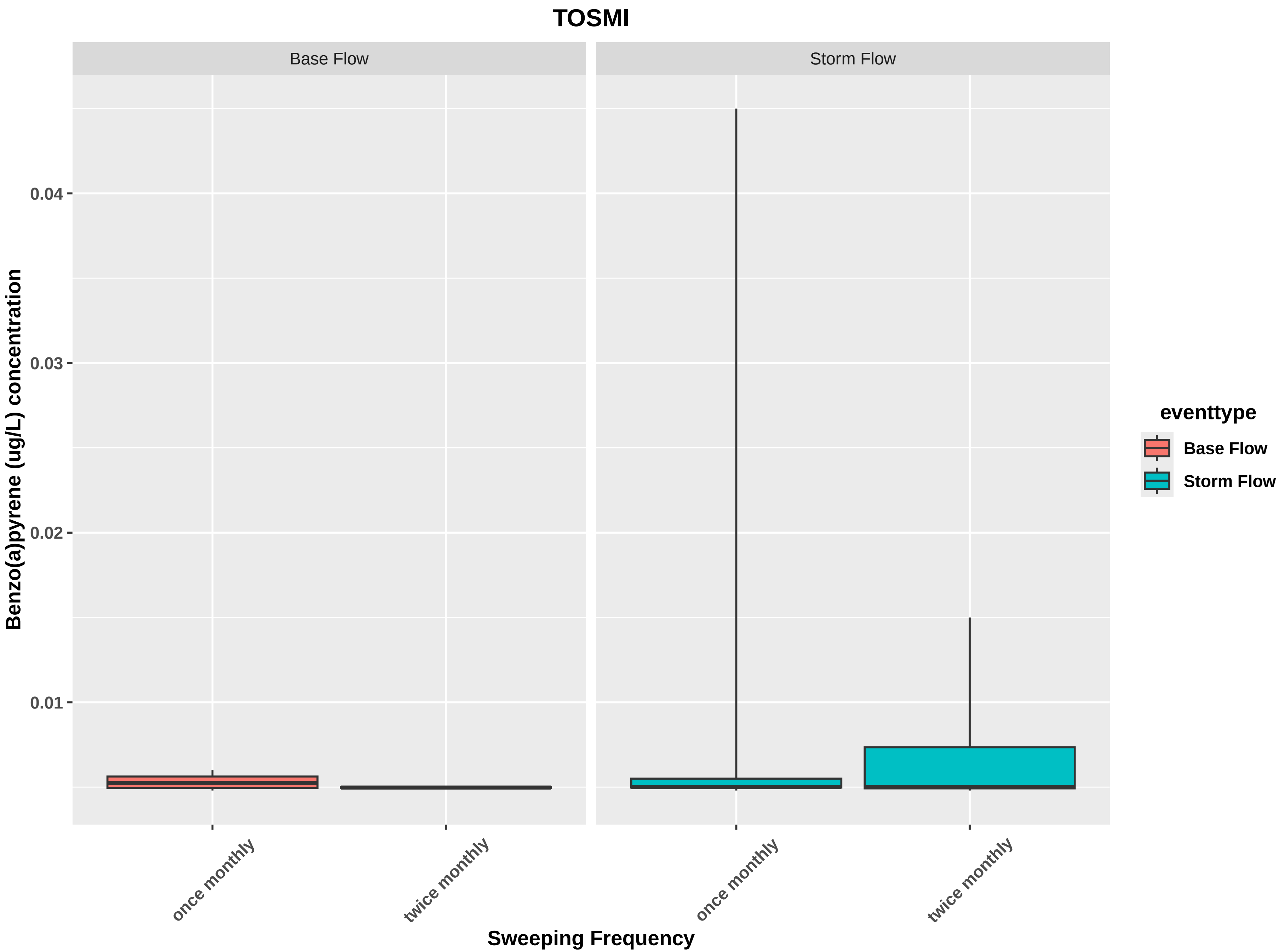
TOSMI
Base Flow
Storm Flow
Benz[a]anthracene (ug/L) concentration
0.025
0.020
0.015
0.010
0.005
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

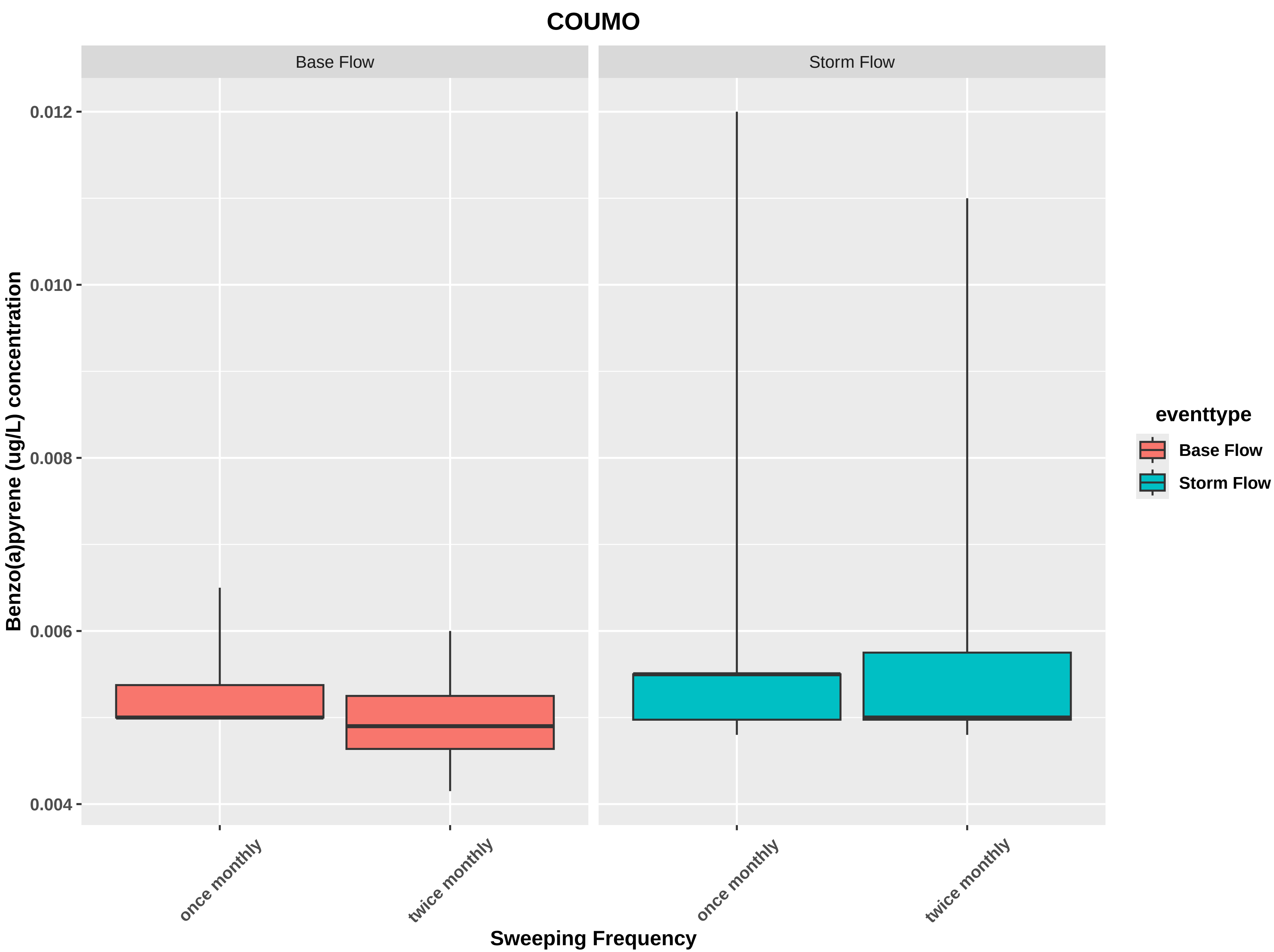

COUMO
Base Flow
Storm Flow
Benz[a]anthracene (ug/L) concentration
0.015
0.012
0.009
0.006
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow


COUMI
Base Flow
Storm Flow
0.04
0.03
0.02
0.01
Benz[a]anthracene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

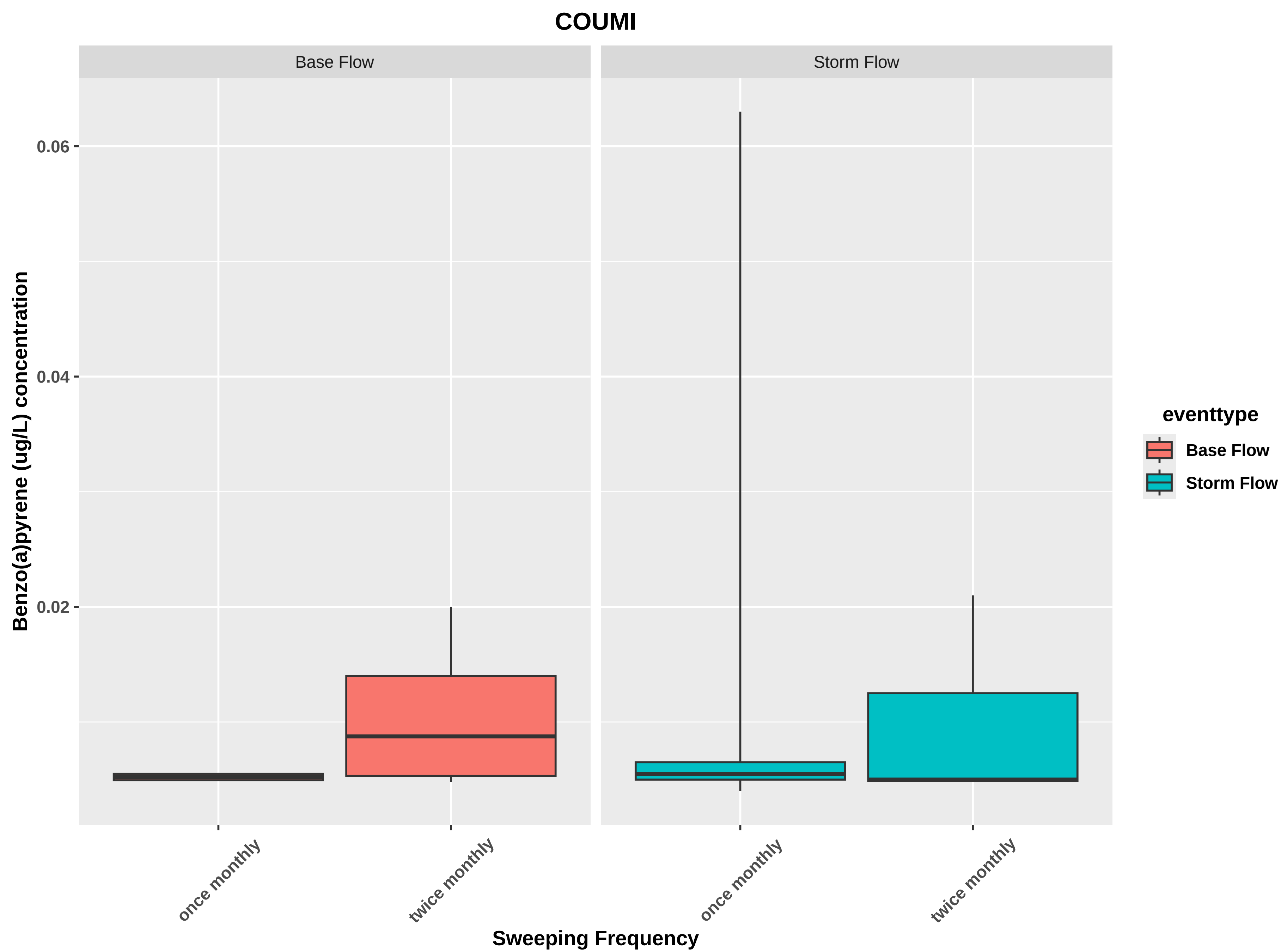


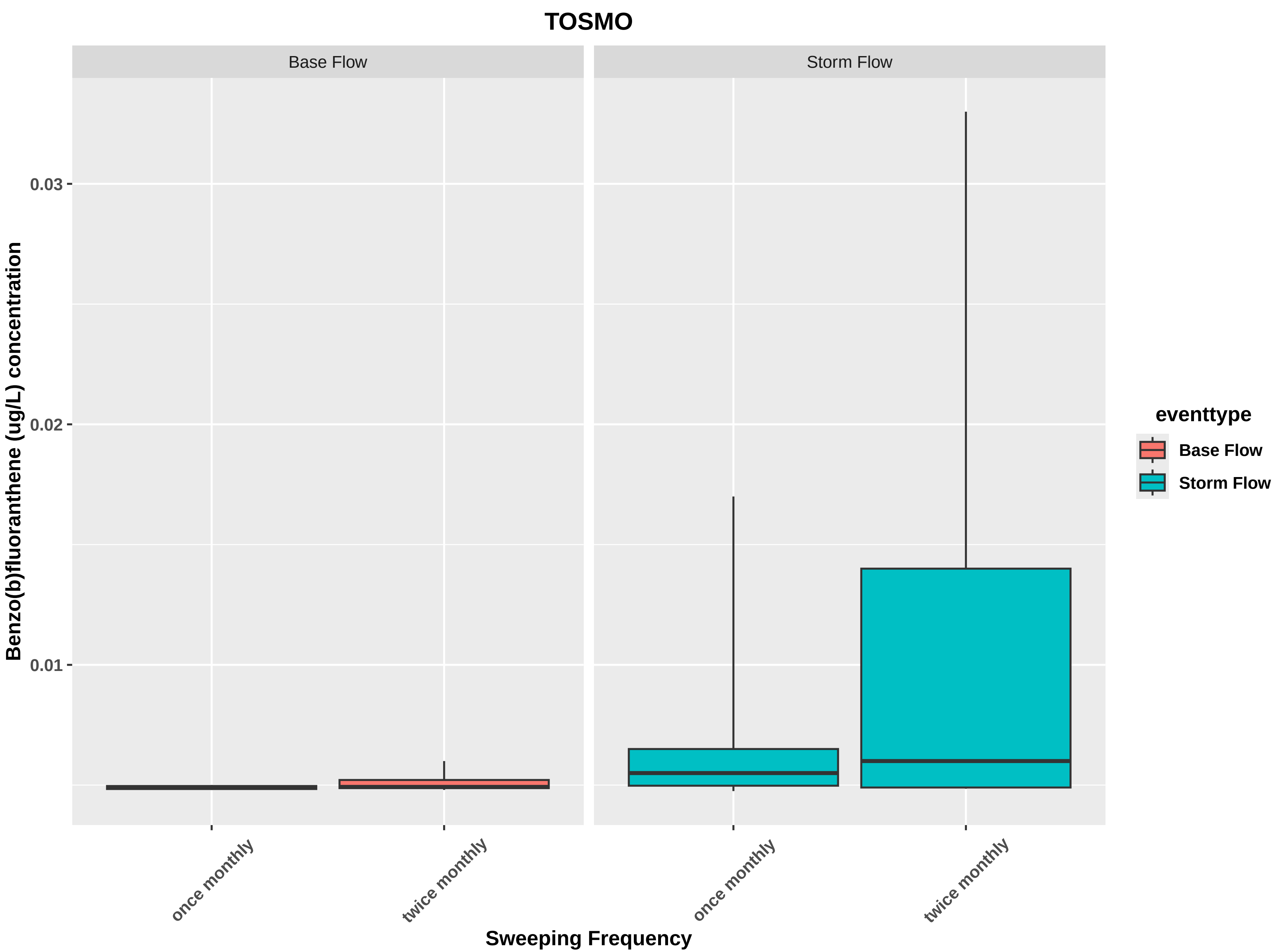
TOSMO
Base Flow
Storm Flow
0.03
0.02
0.01
Benzo(a)pyrene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow


TOSMI
Base Flow
Storm Flow
Benzo(a)pyrene (ug/L) concentration
0.04
0.03
0.02
0.01
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

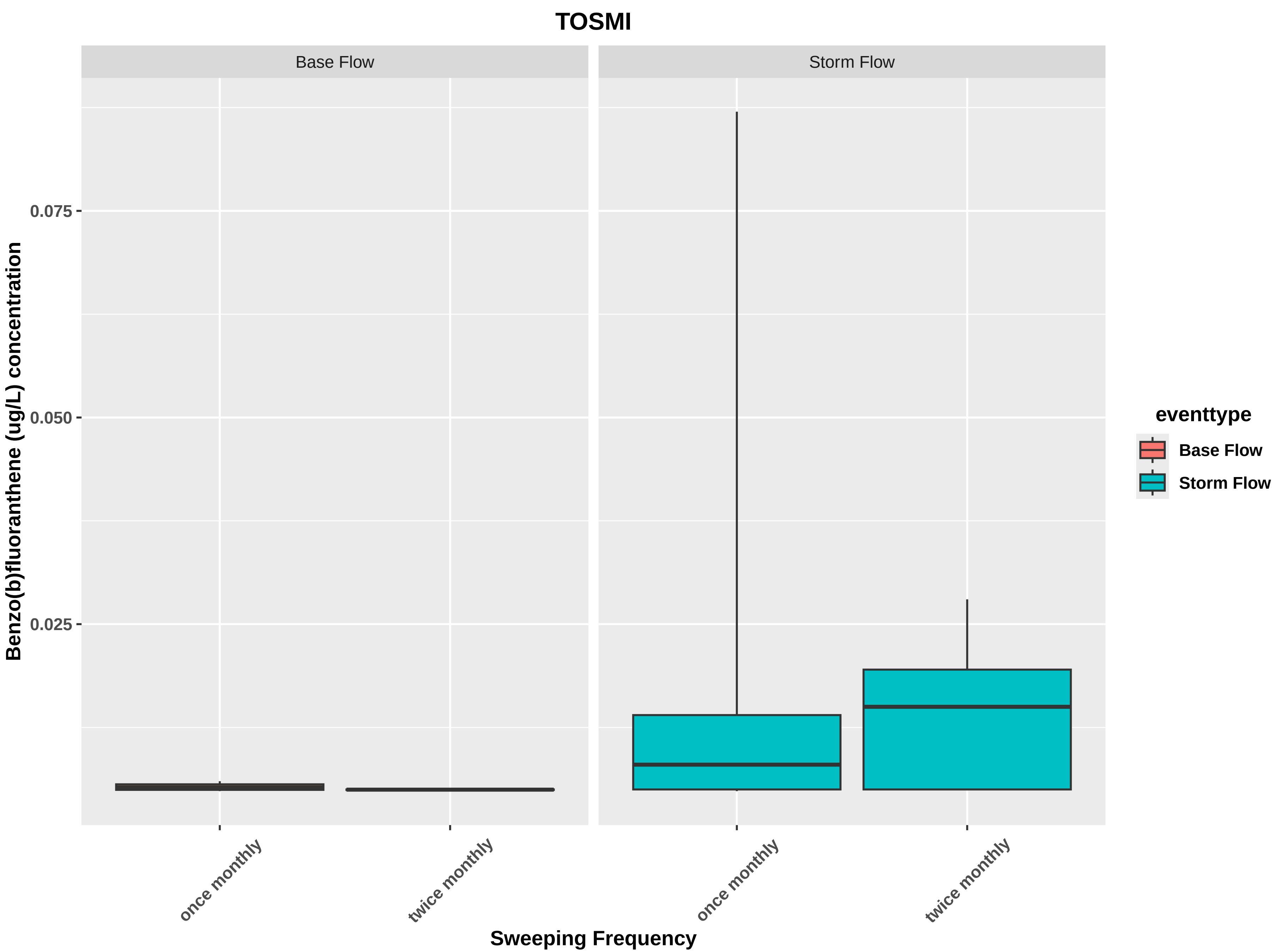


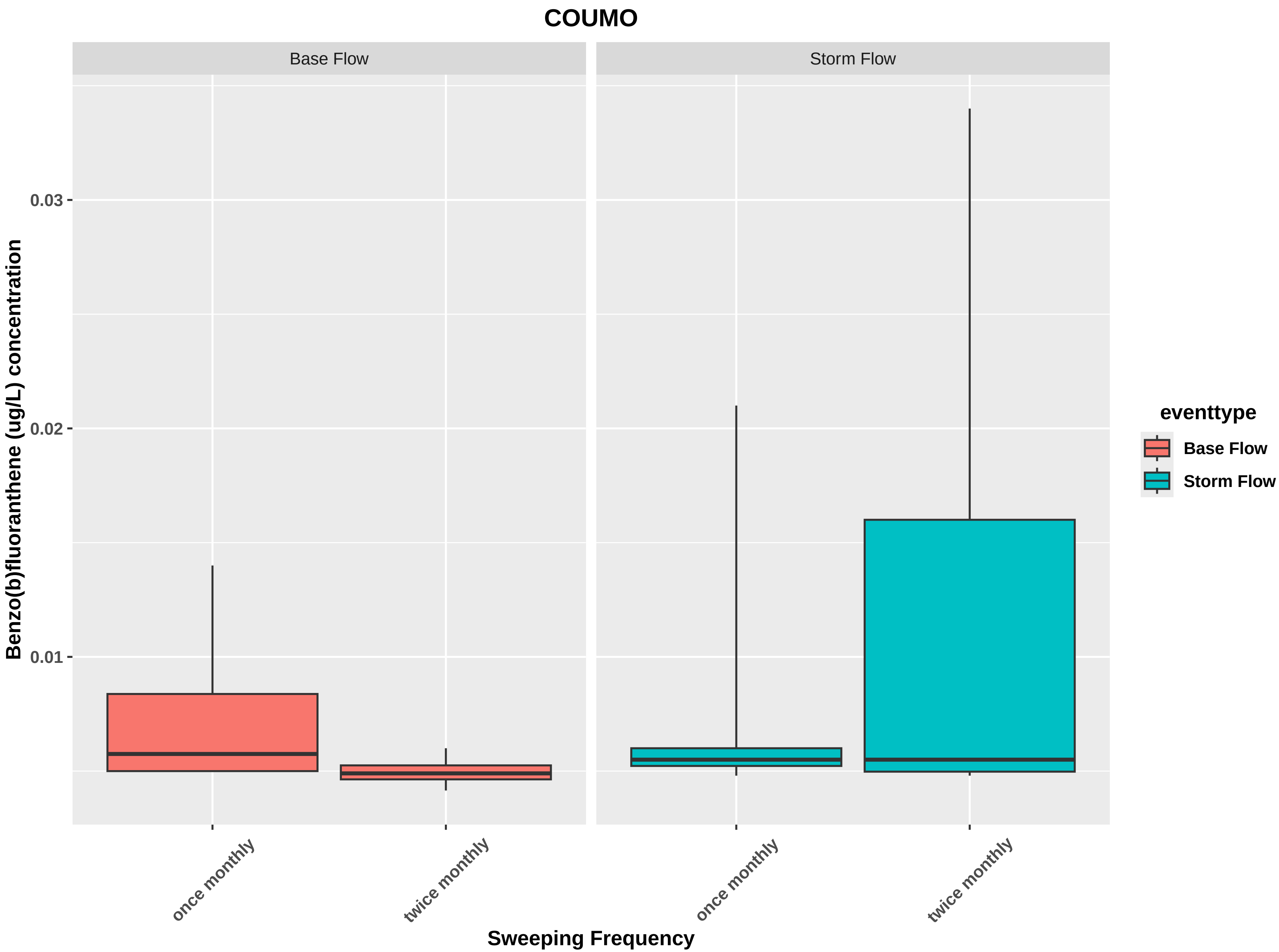
COUMO
Base Flow
Storm Flow
0.012
0.010
0.008
0.006
0.004
Benzo(a)pyrene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

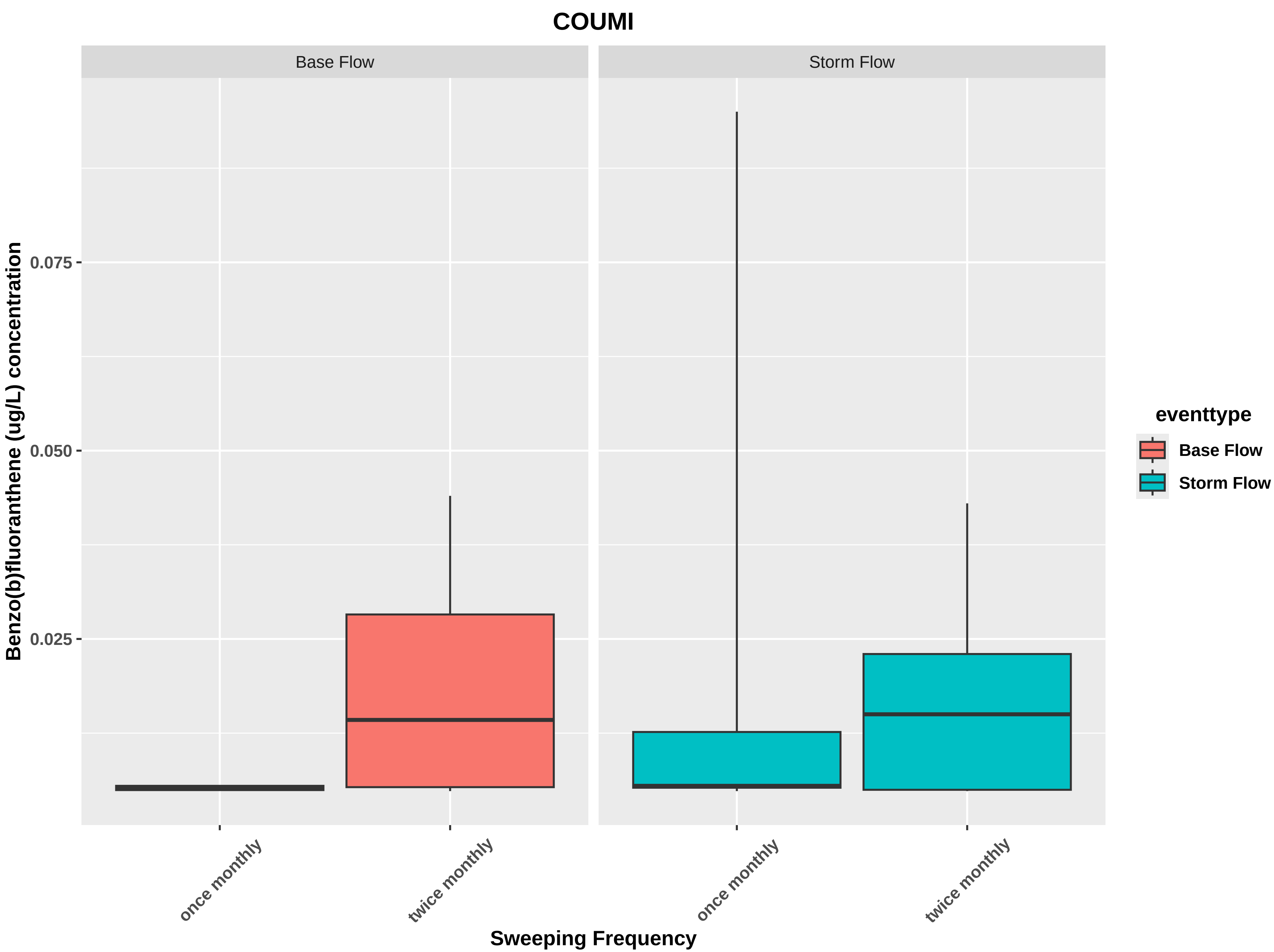

COUMI
Base Flow
Storm Flow
Benzo(a)pyrene (ug/L) concentration
0.06
0.04
0.02
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

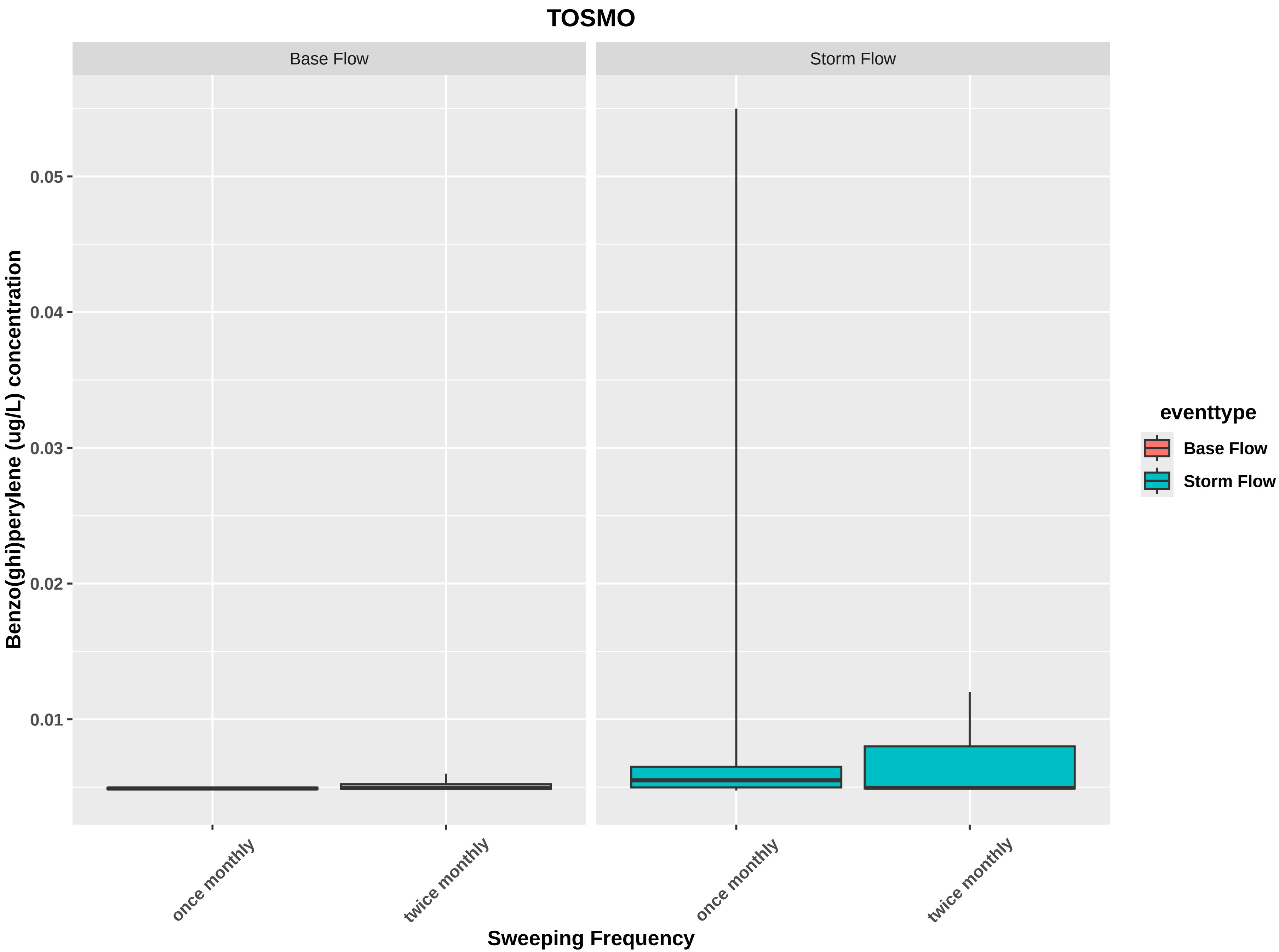


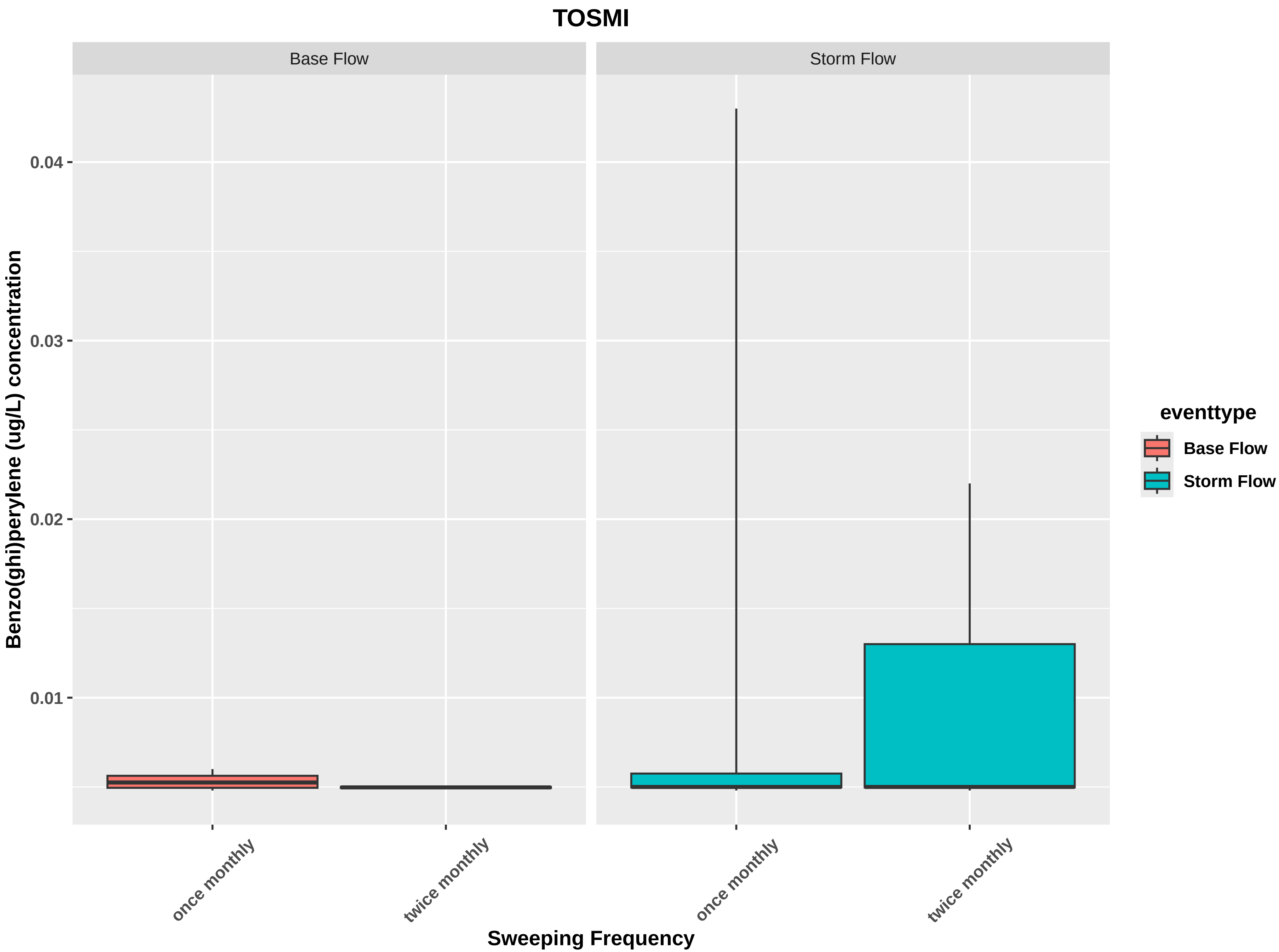
TOSMO
Base Flow
Storm Flow
0.03
0.02
0.01
Benzo(b)fluoranthene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

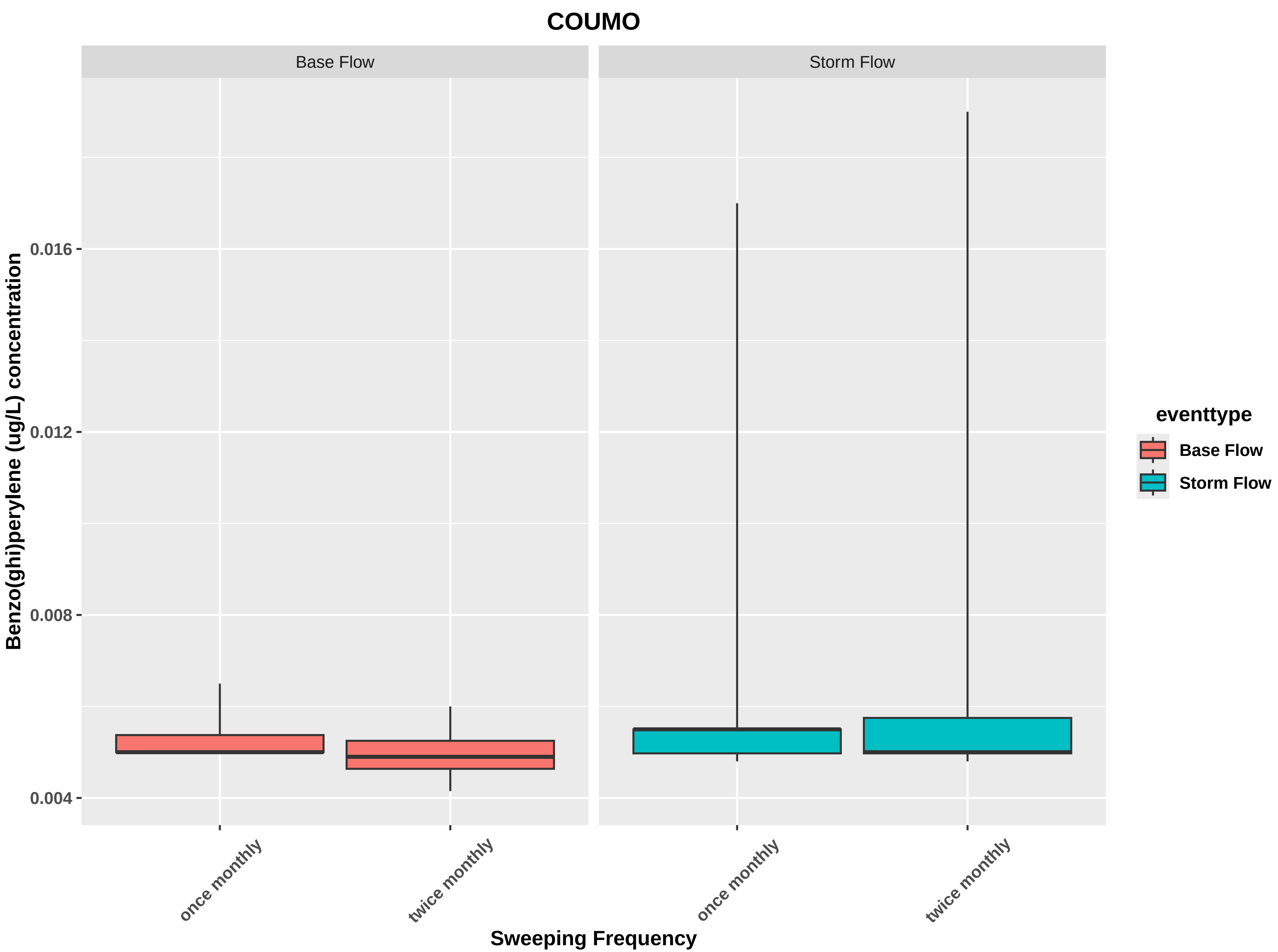

TOSMI
Base Flow
Storm Flow
Benzo(b)fluoranthene (ug/L) concentration
0.075
0.050
0.025
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

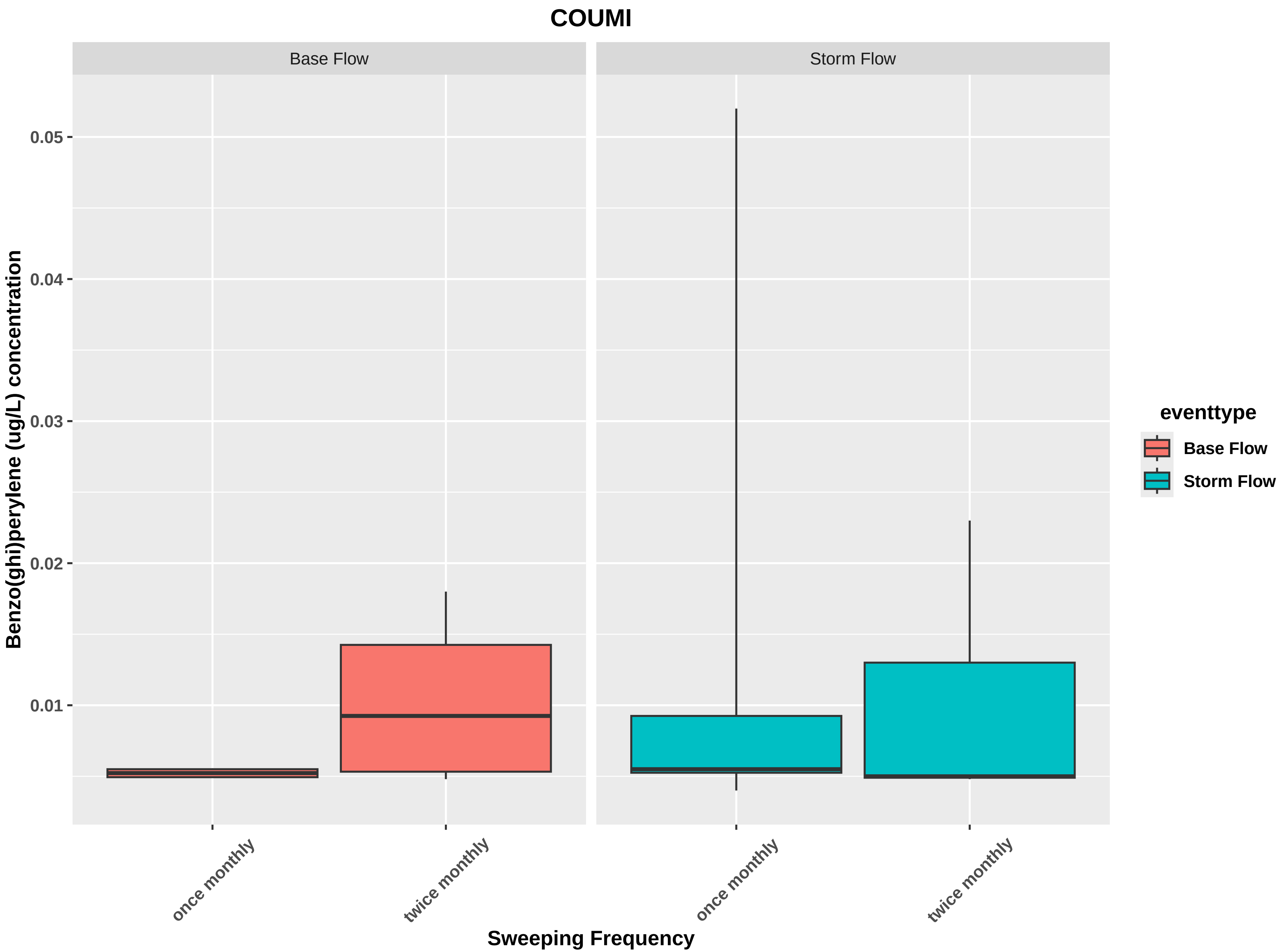

COUMO
Base Flow
Storm Flow
Benzo(b)fluoranthene (ug/L) concentration
0.03
0.02
0.01
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

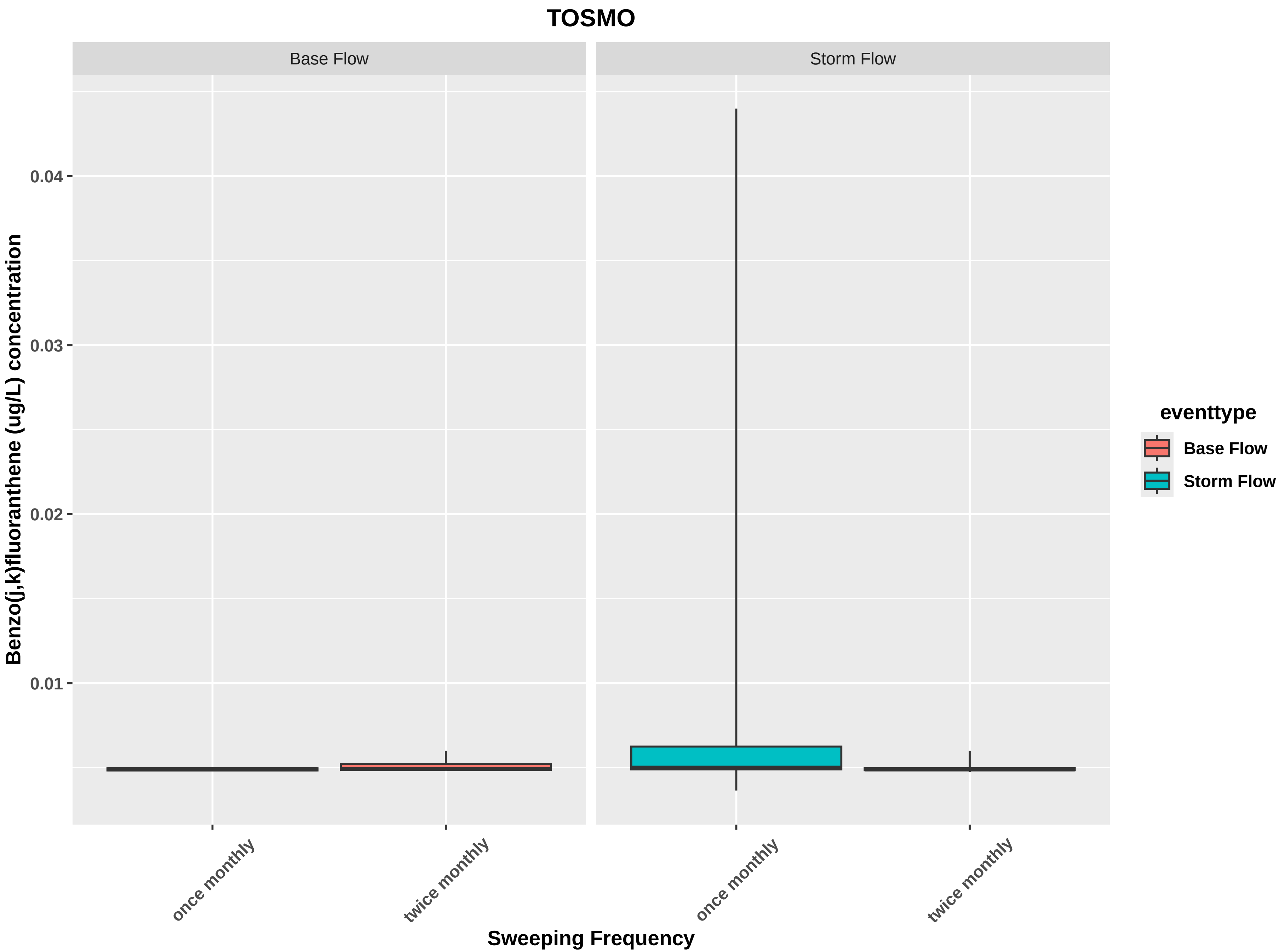

COUMI
Base Flow
Storm Flow
Benzo(b)fluoranthene (ug/L) concentration
0.075
0.050
0.025
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow


TOSMO
Base Flow
Storm Flow
Benzo(ghi)perylene (ug/L) concentration
0.05
0.04
0.03
0.02
0.01
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

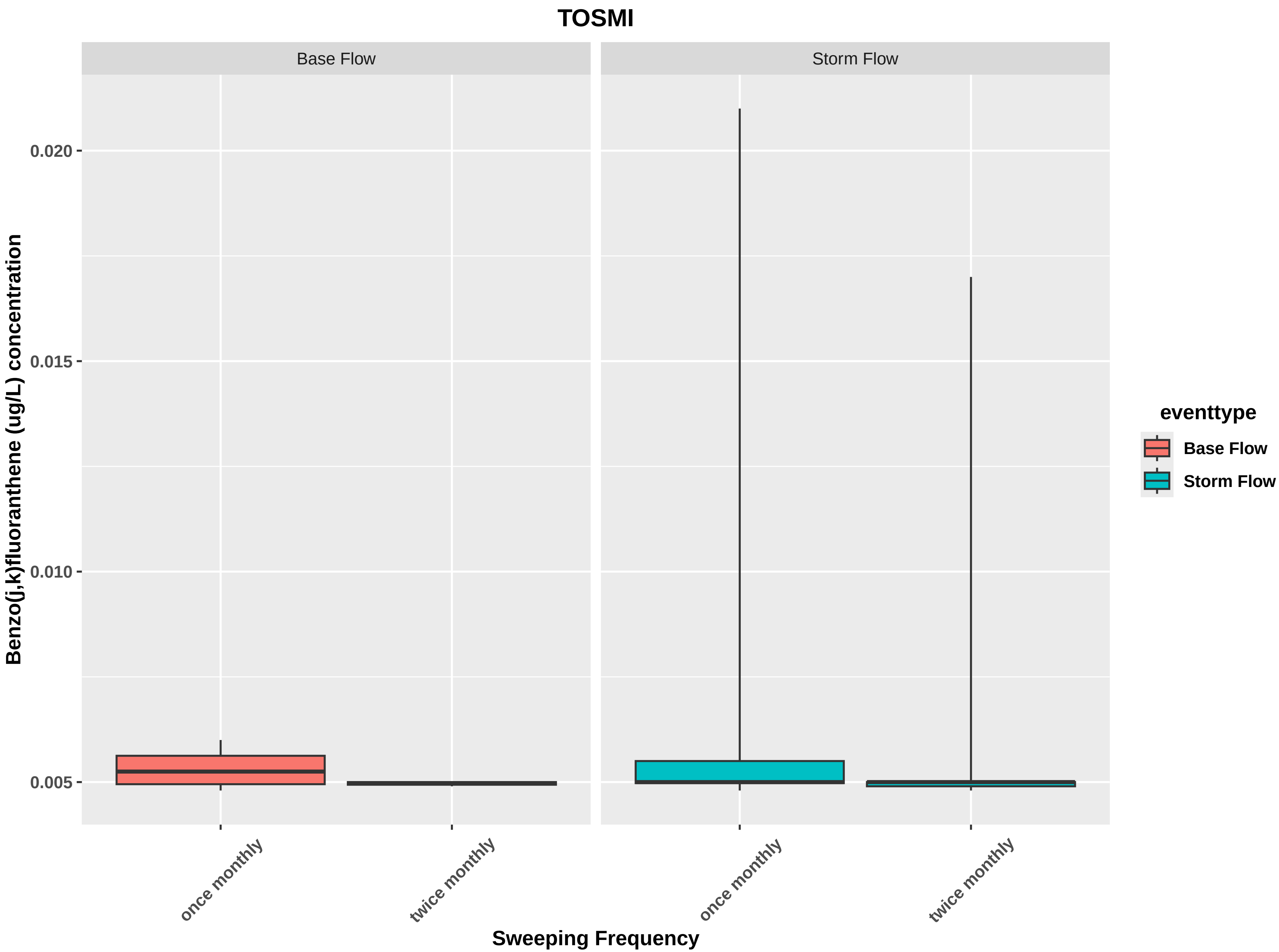

TOSMI
Base Flow
Storm Flow
0.04
0.03
0.02
0.01
Benzo(ghi)perylene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow


COUMO
Base Flow
Storm Flow
Benzo(ghi)perylene (ug/L) concentration
0.016
0.012
0.008
0.004
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

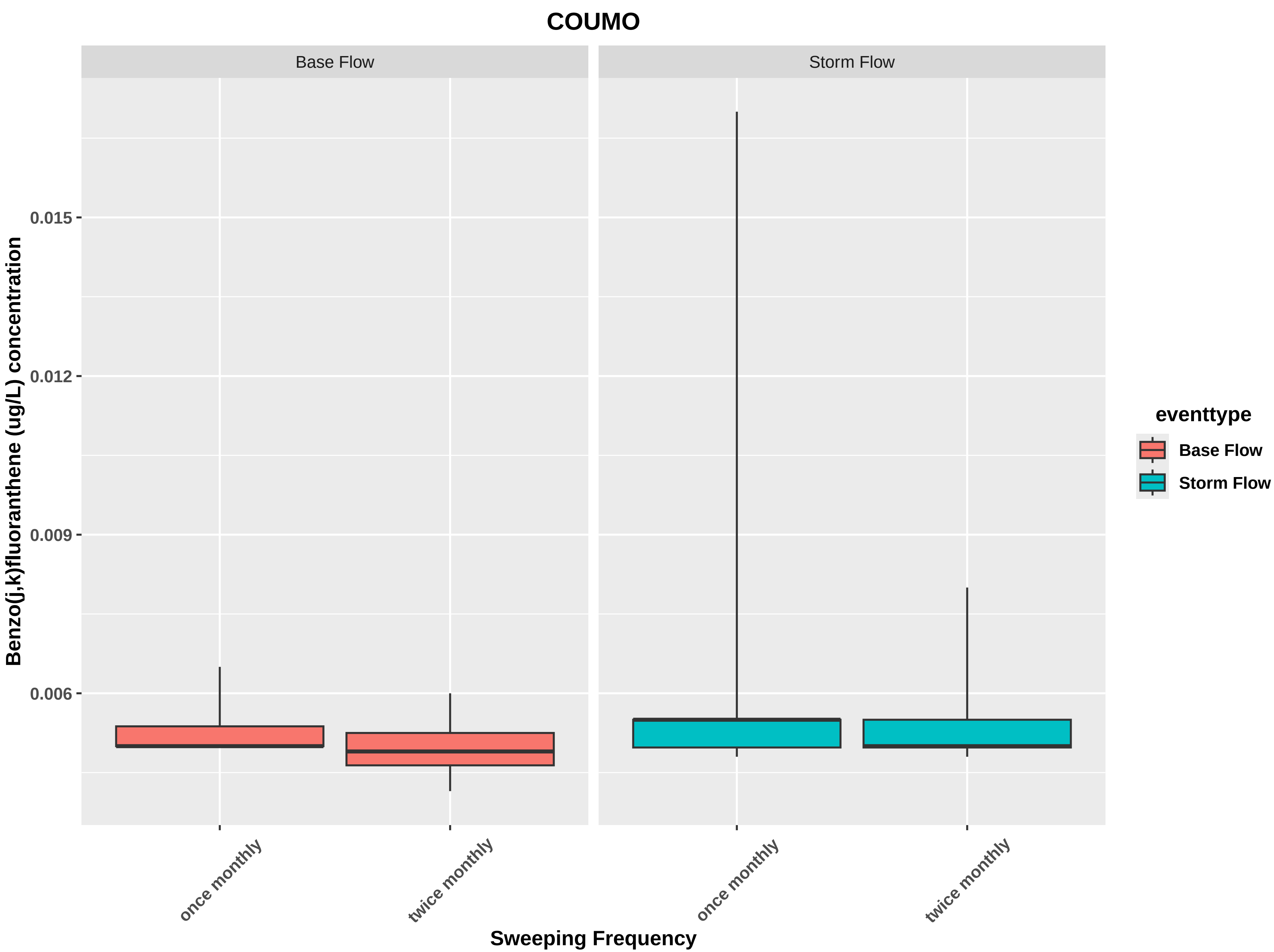

COUMI
Base Flow
Storm Flow
Benzo(ghi)perylene (ug/L) concentration
0.05
0.04
0.03
0.02
0.01
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

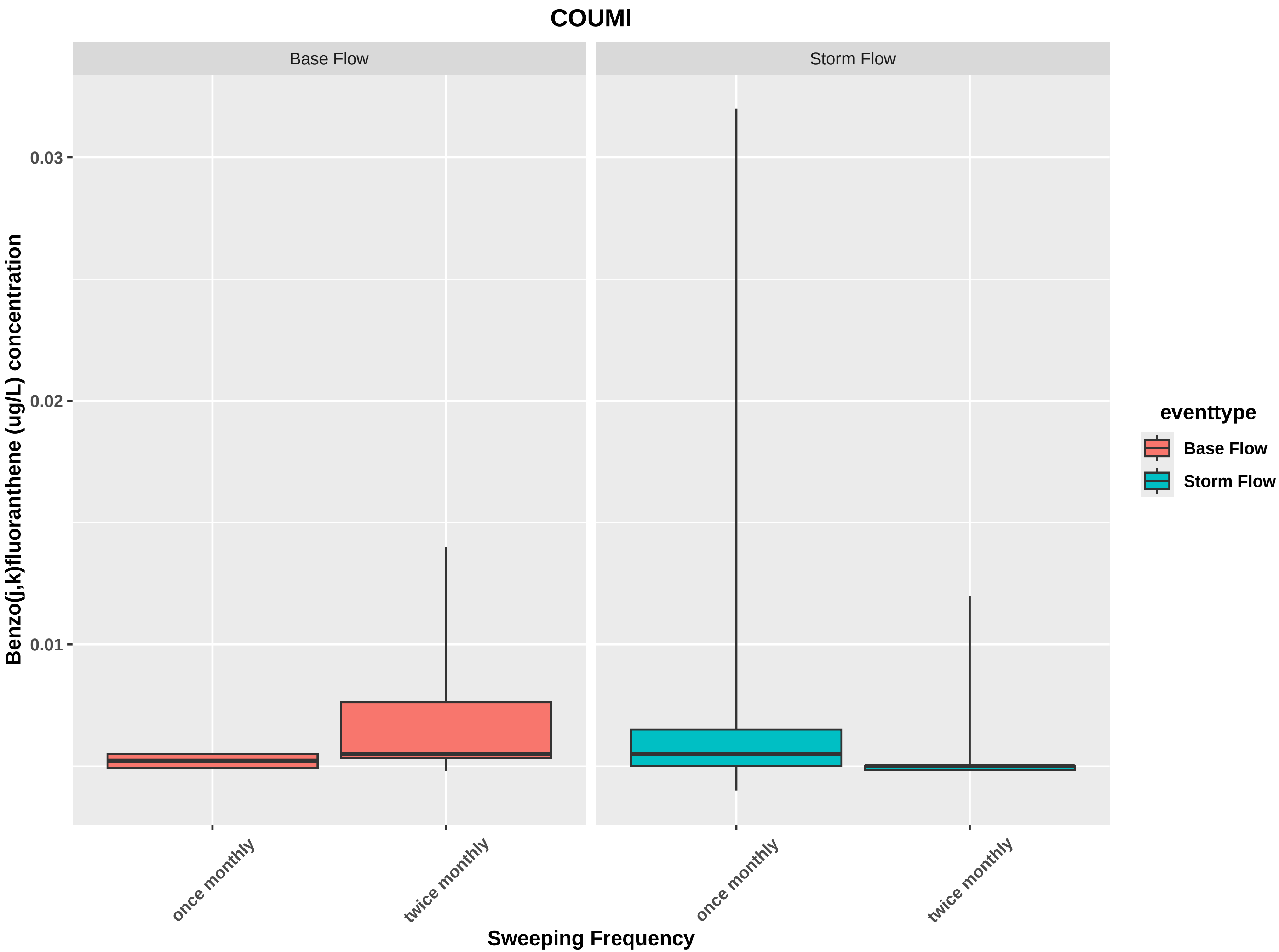


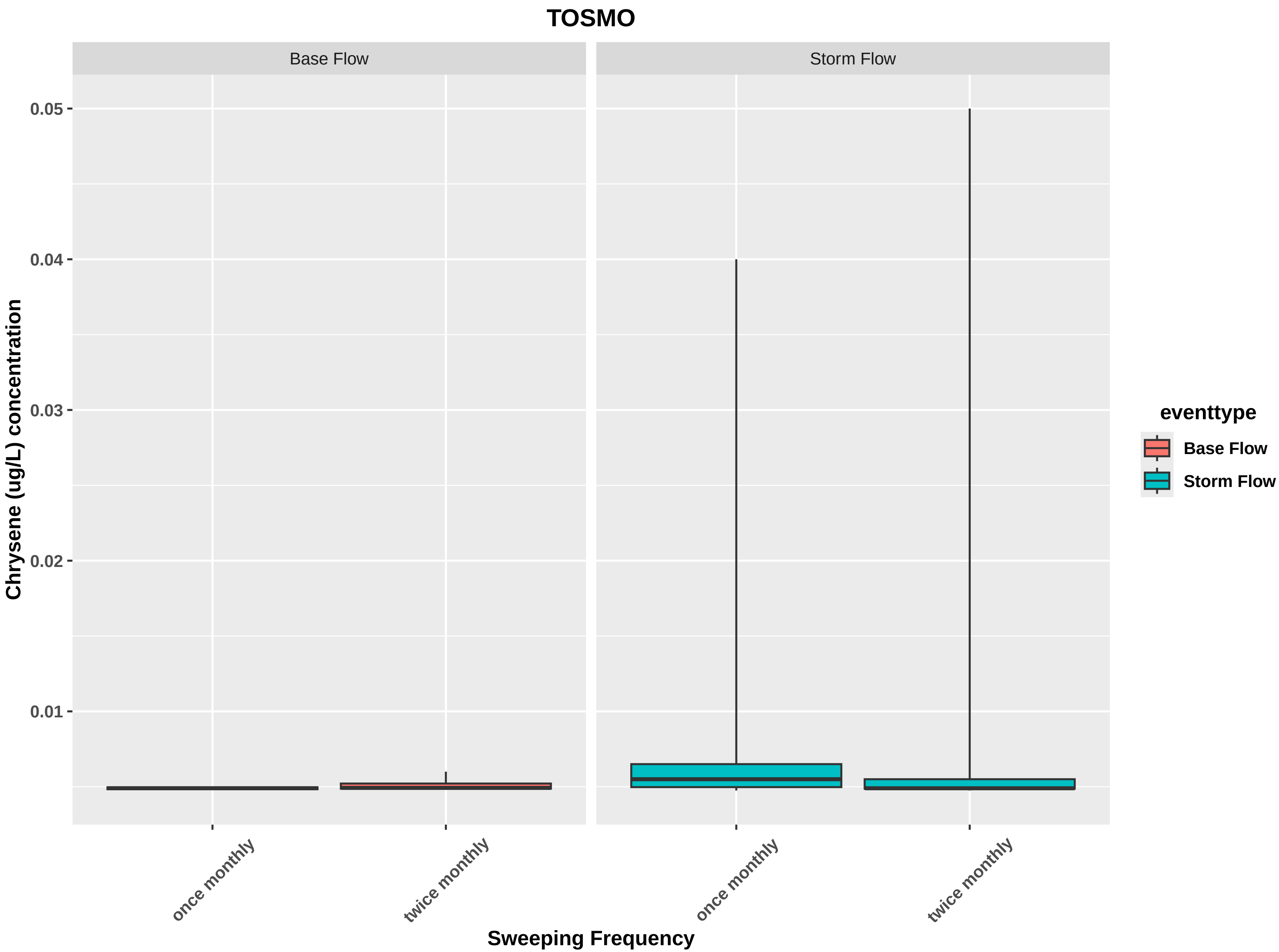
TOSMO
Base Flow
Storm Flow
Benzo(j,k)fluoranthene (ug/L) concentration
0.04
0.03
0.02
0.01
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

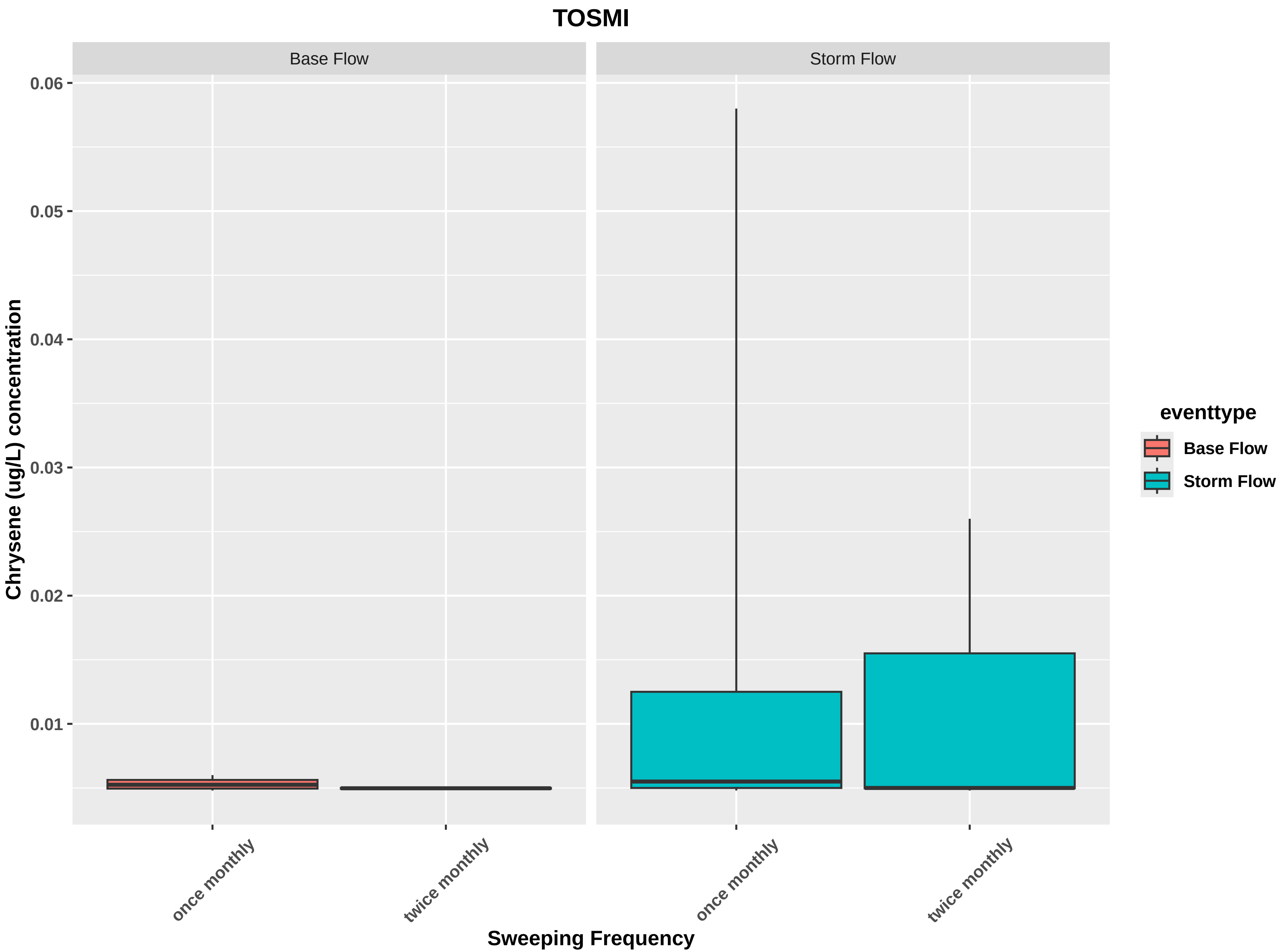


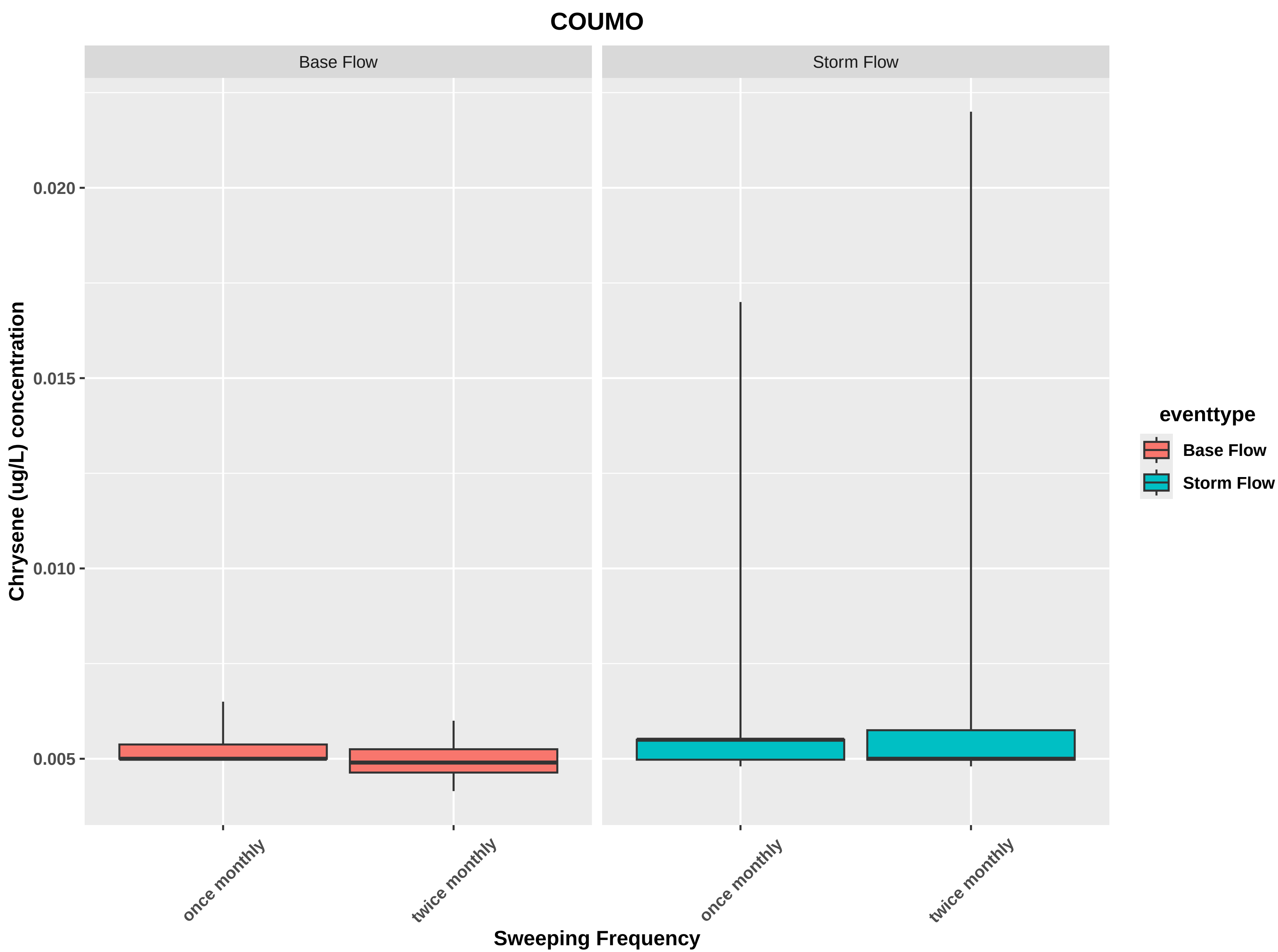
TOSMI
Base Flow
Storm Flow
0.020
0.015
0.010
0.005
Benzo(j,k)fluoranthene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

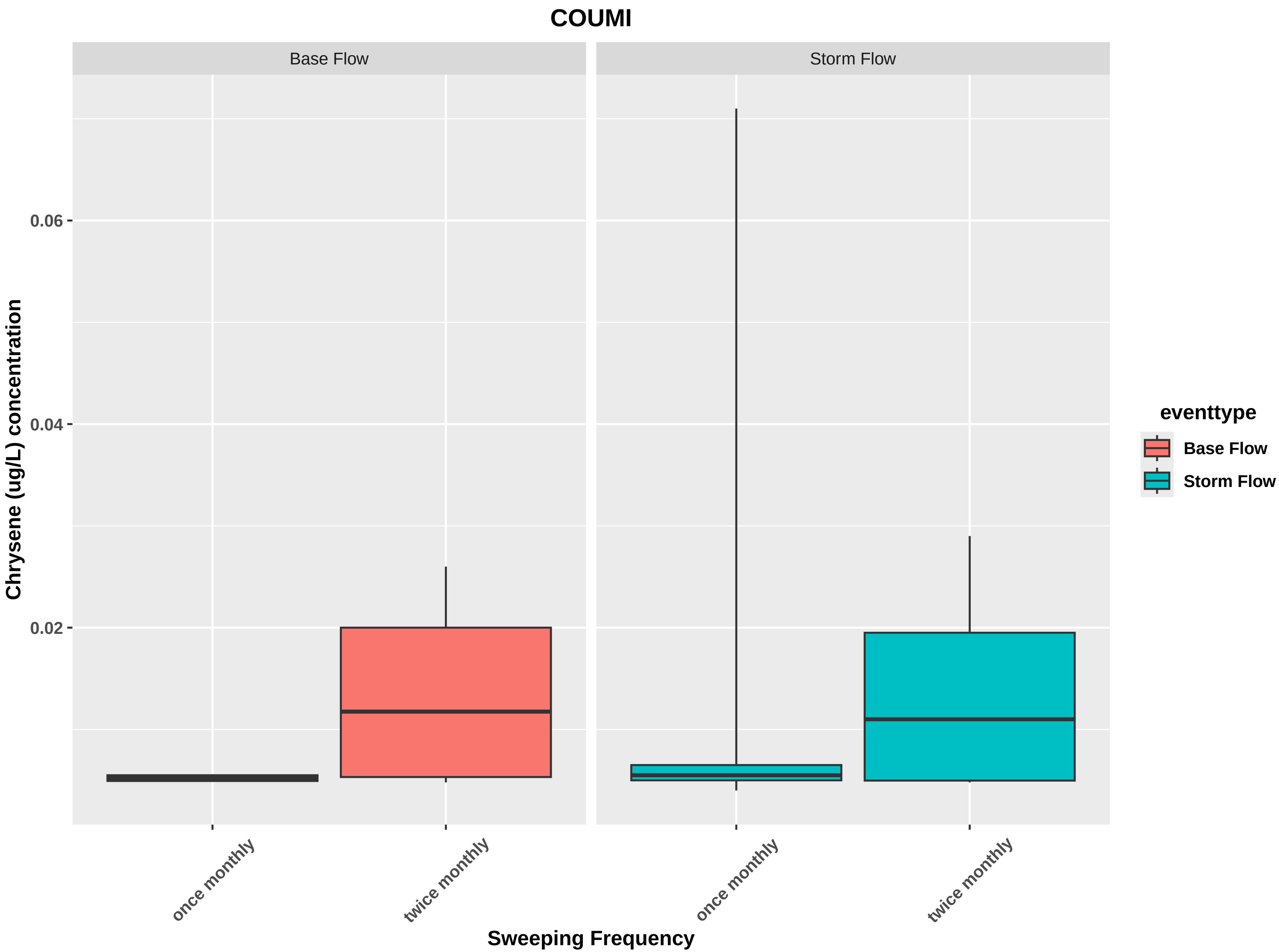

COUMO
Base Flow
Storm Flow
Benzo(j,k)fluoranthene (ug/L) concentration
0.015
0.012
0.009
0.006
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

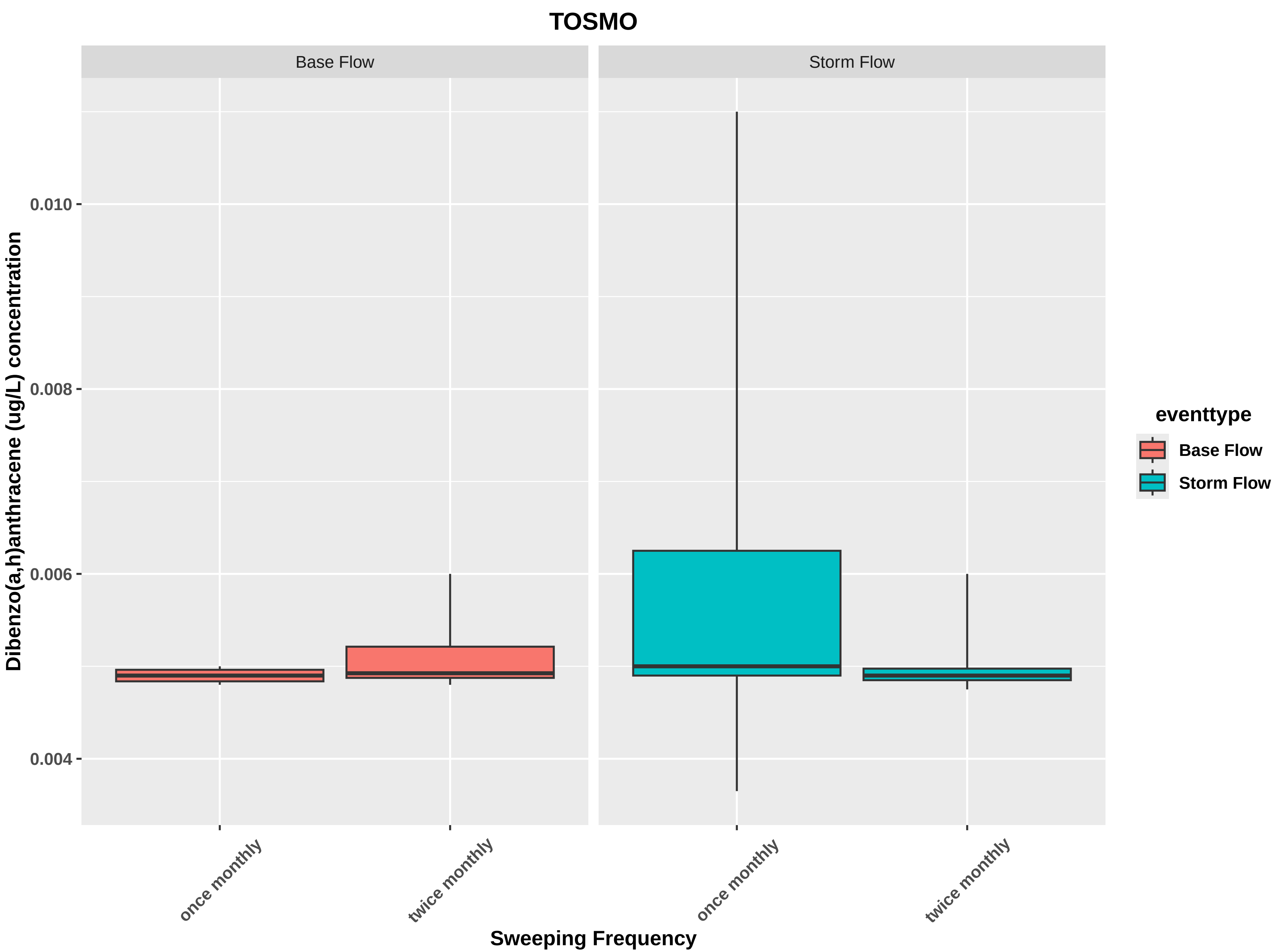

COUMI
Base Flow
Storm Flow
Benzo(j,k)fluoranthene (ug/L) concentration
0.03
0.02
0.01
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

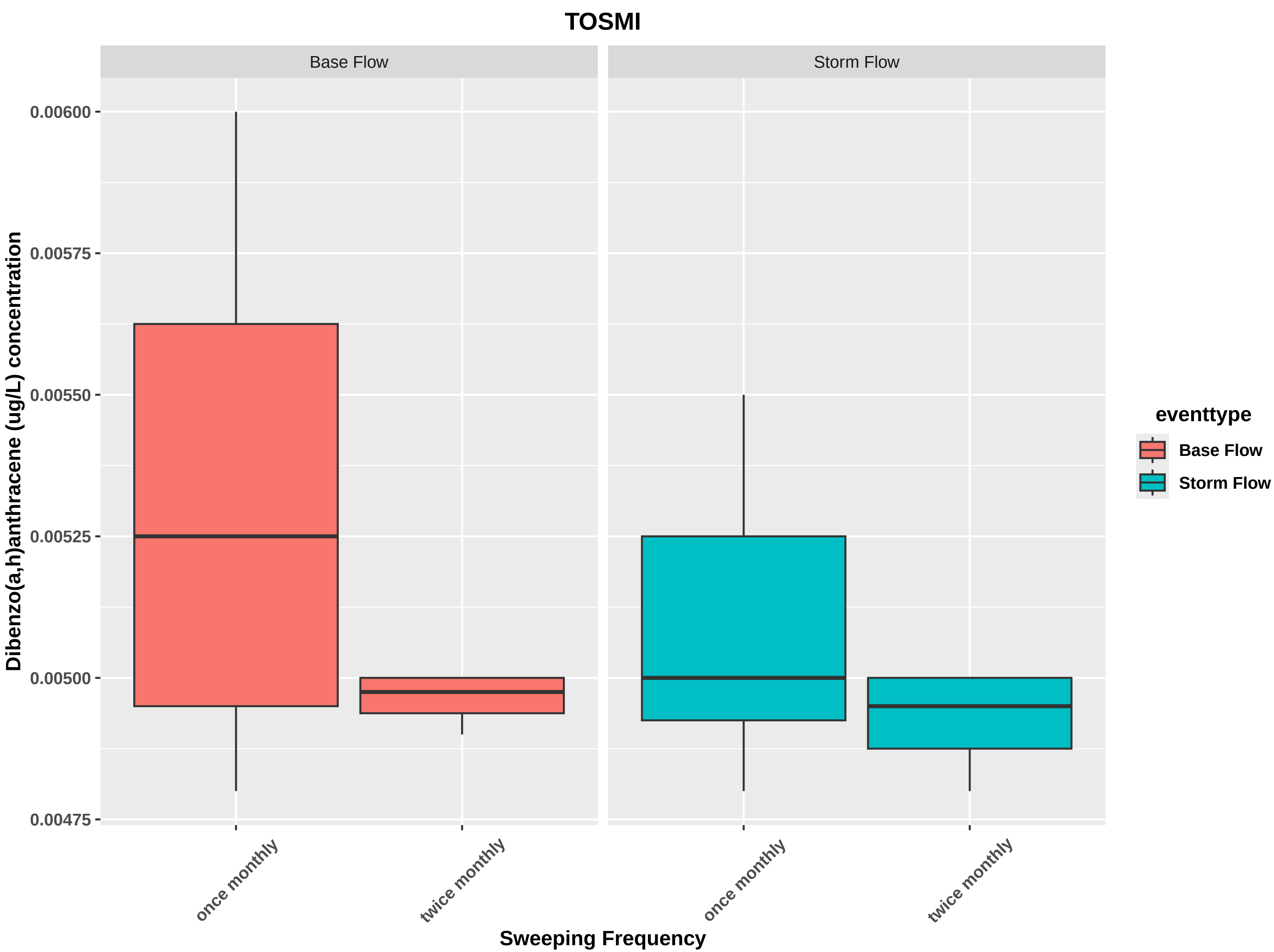

TOSMO
Base Flow
Storm Flow
0.05
0.04
0.03
0.02
0.01
Chrysene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow


TOSMI
Base Flow
Storm Flow
Chrysene (ug/L) concentration
0.06
0.05
0.04
0.03
0.02
0.01
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

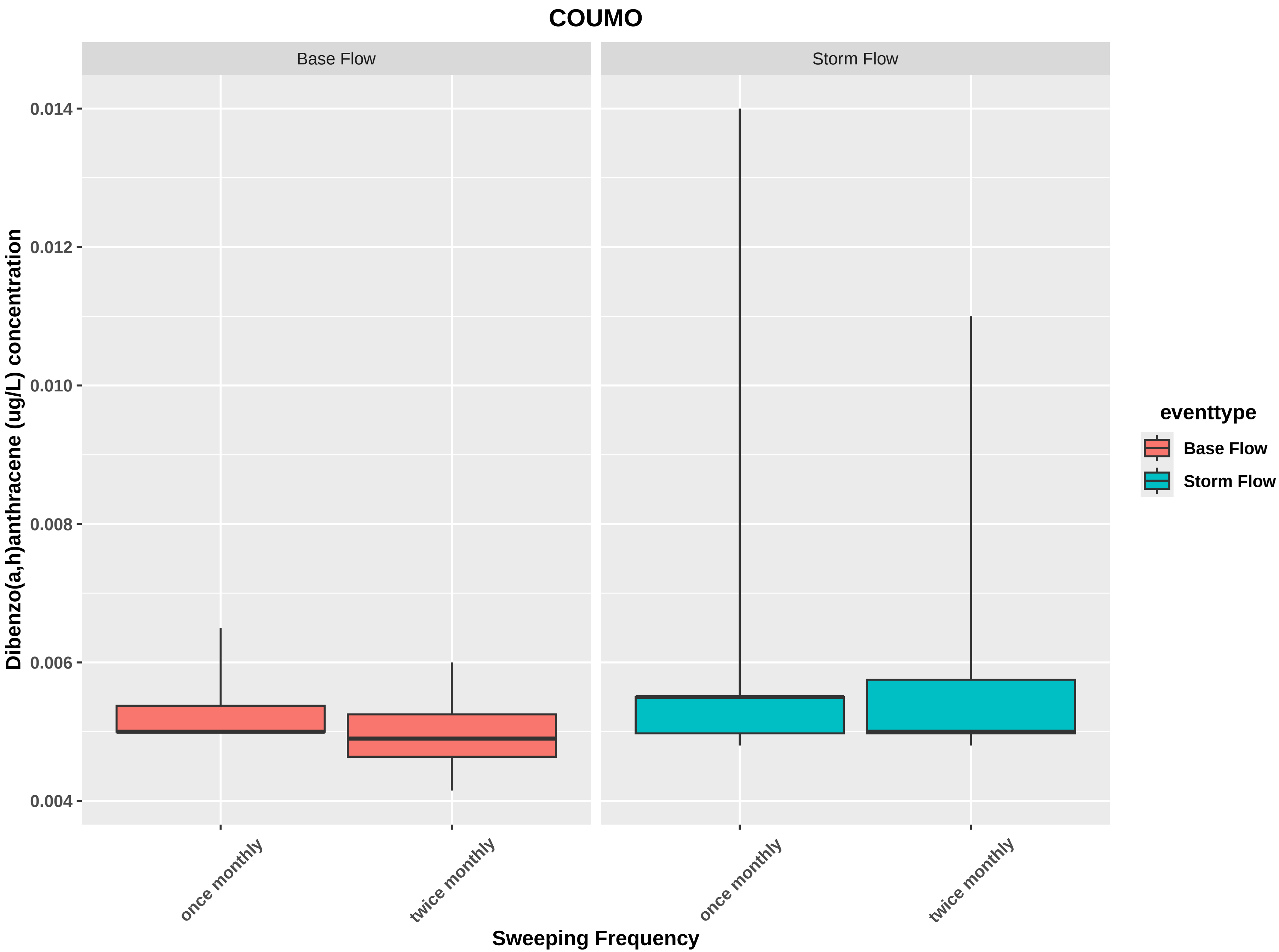

COUMO
Base Flow
Storm Flow
Chrysene (ug/L) concentration
0.020
0.015
0.010
0.005
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow


COUMI
Base Flow
Storm Flow
0.06
0.04
0.02
Chrysene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

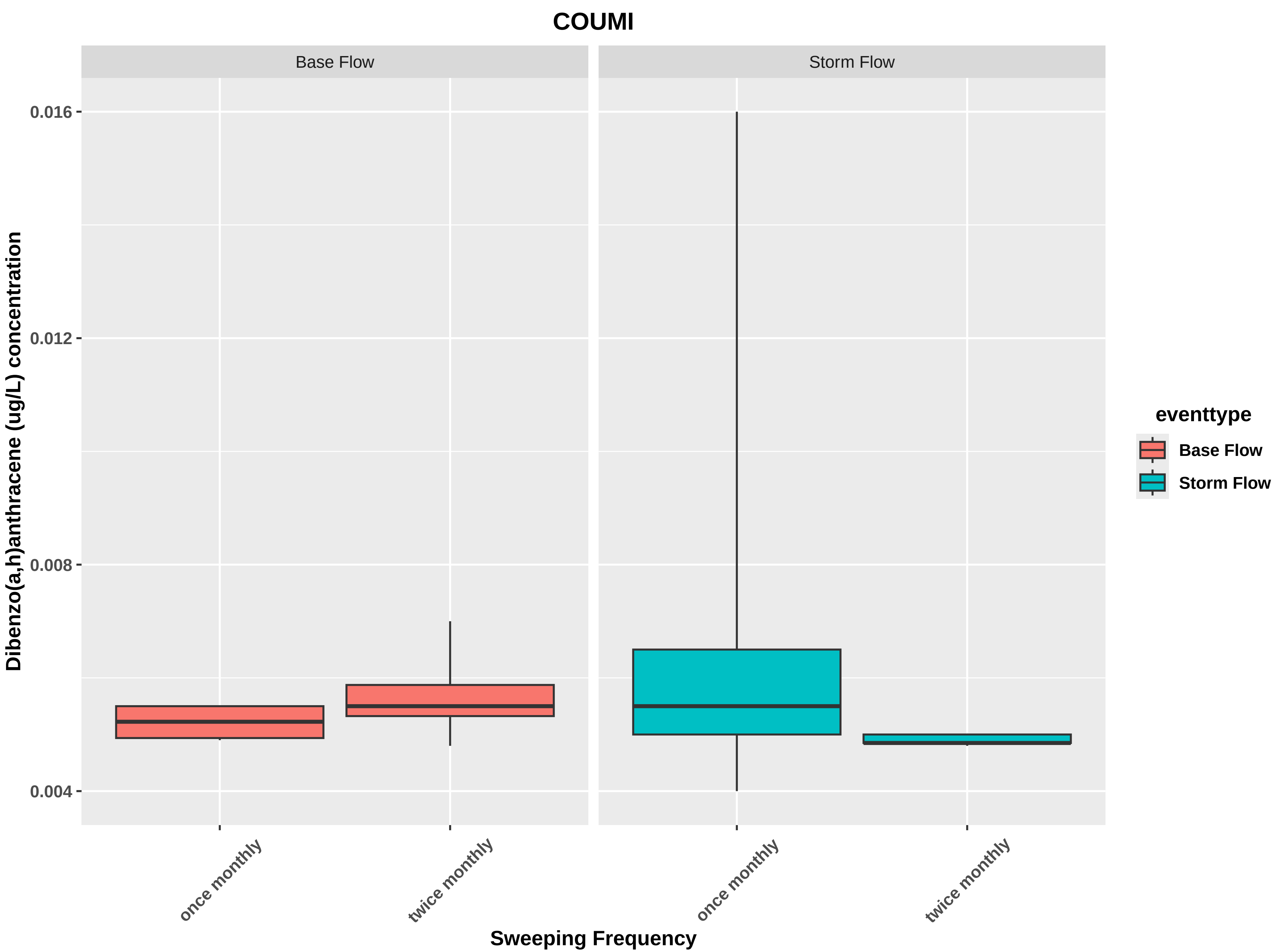

TOSMO
Base Flow
Storm Flow
Dibenzo(a,h)anthracene (ug/L) concentration
0.010
0.008
0.006
0.004
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

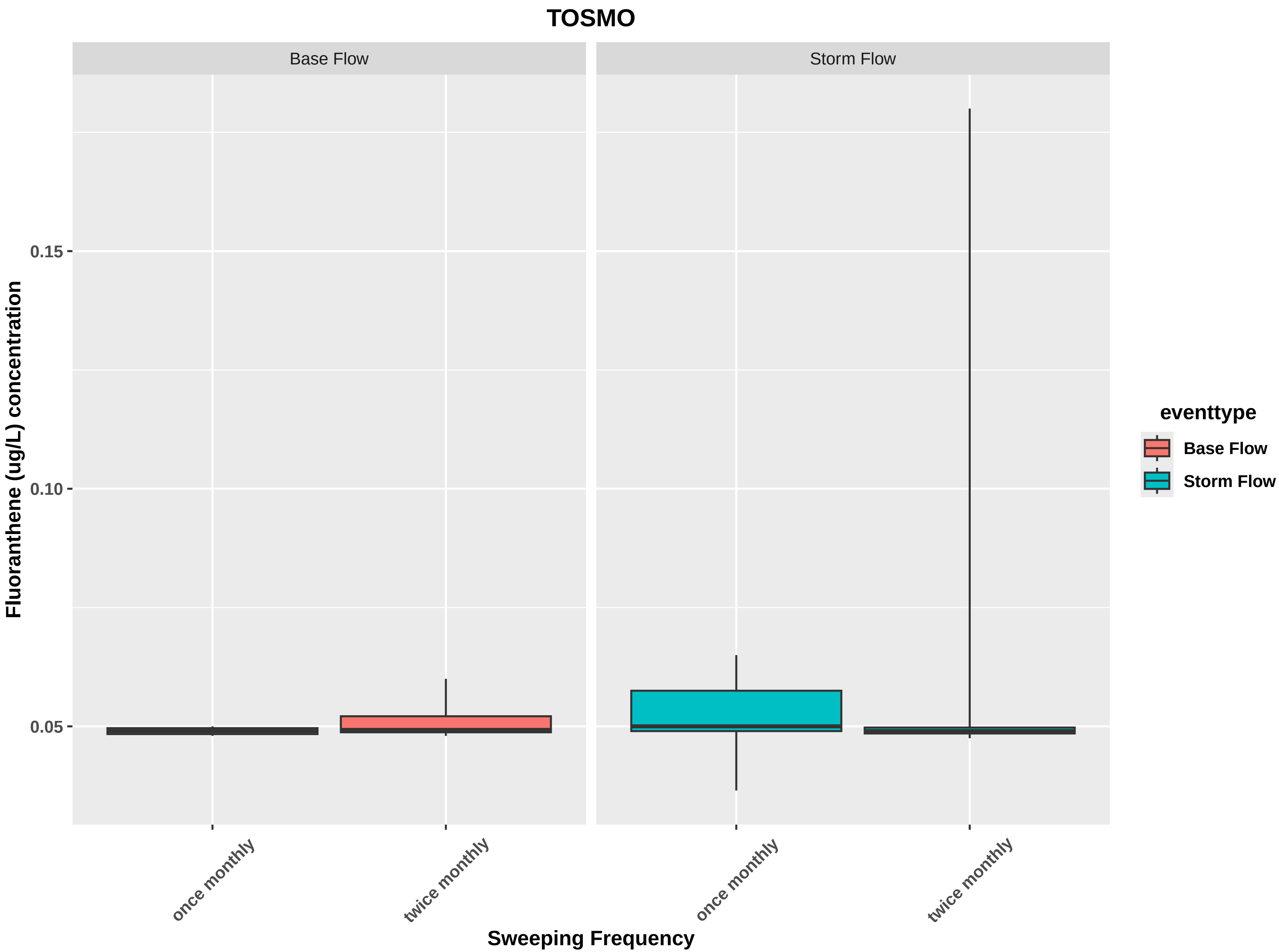


TOSMI
Base Flow
Storm Flow
0.00600
0.00575
0.00550
0.00525
0.00500
0.00475
Dibenzo(a,h)anthracene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

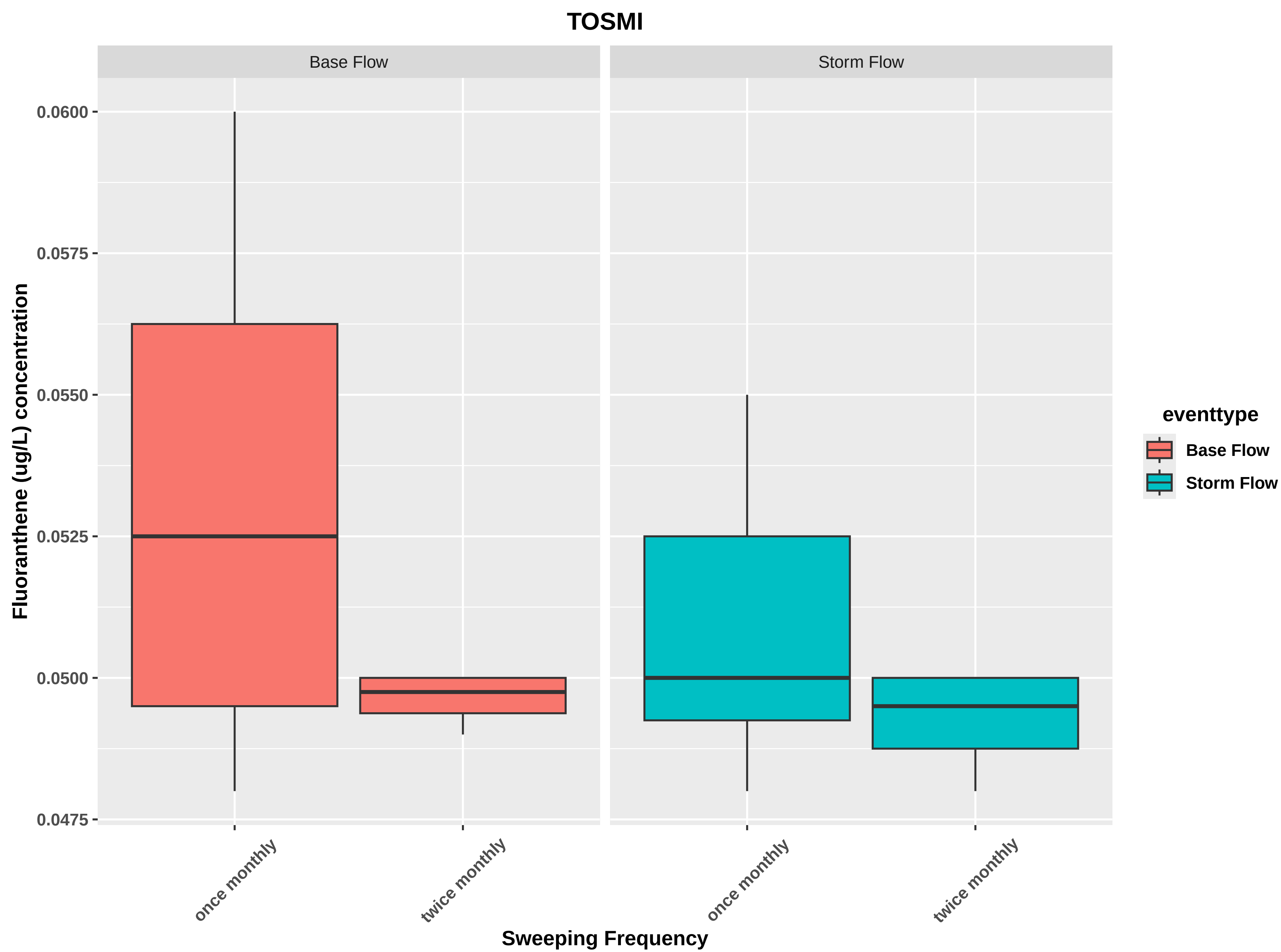


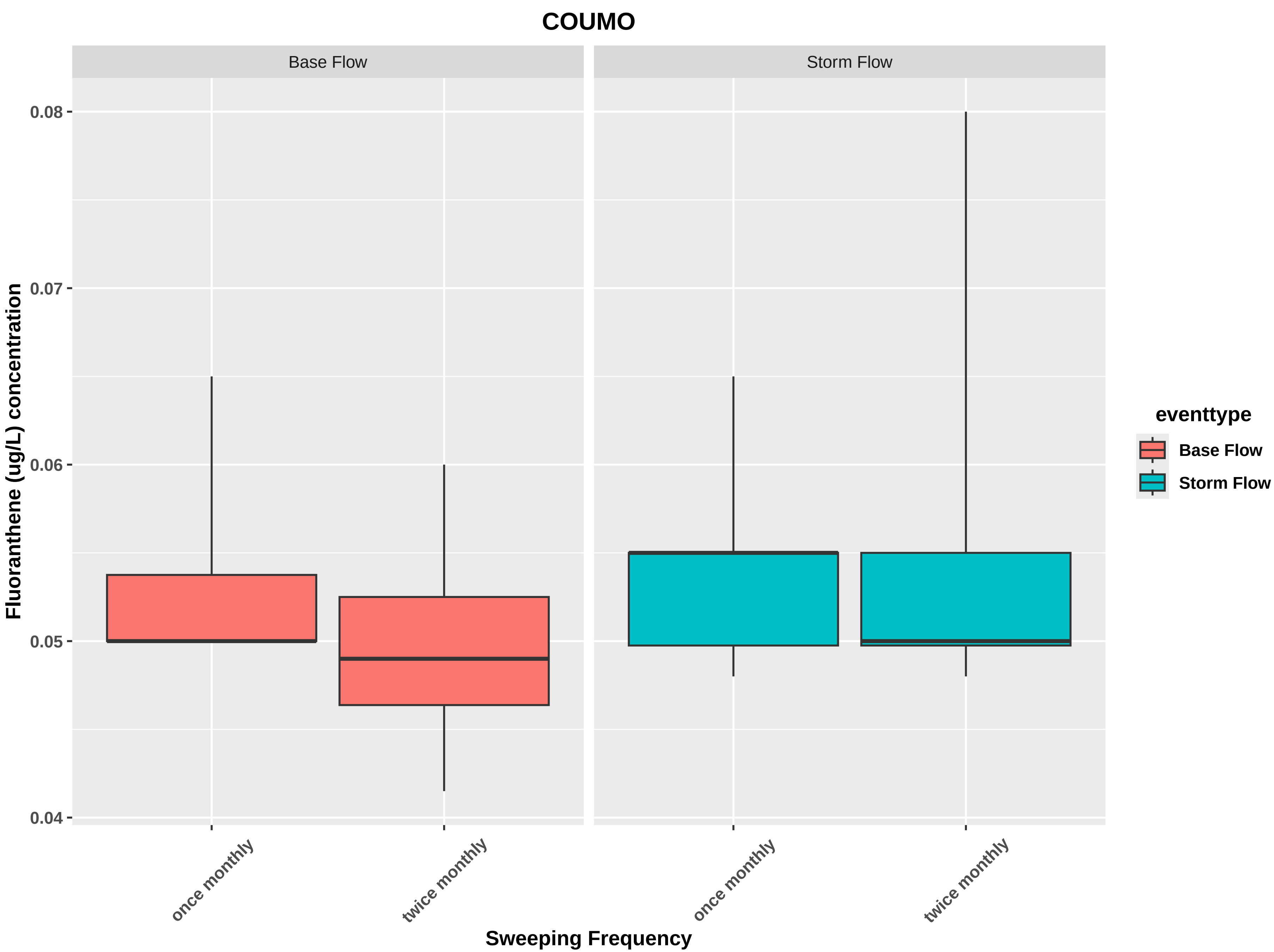
COUMO
Base Flow
Storm Flow
0.014
0.012
0.010
0.008
0.006
0.004
Dibenzo(a,h)anthracene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

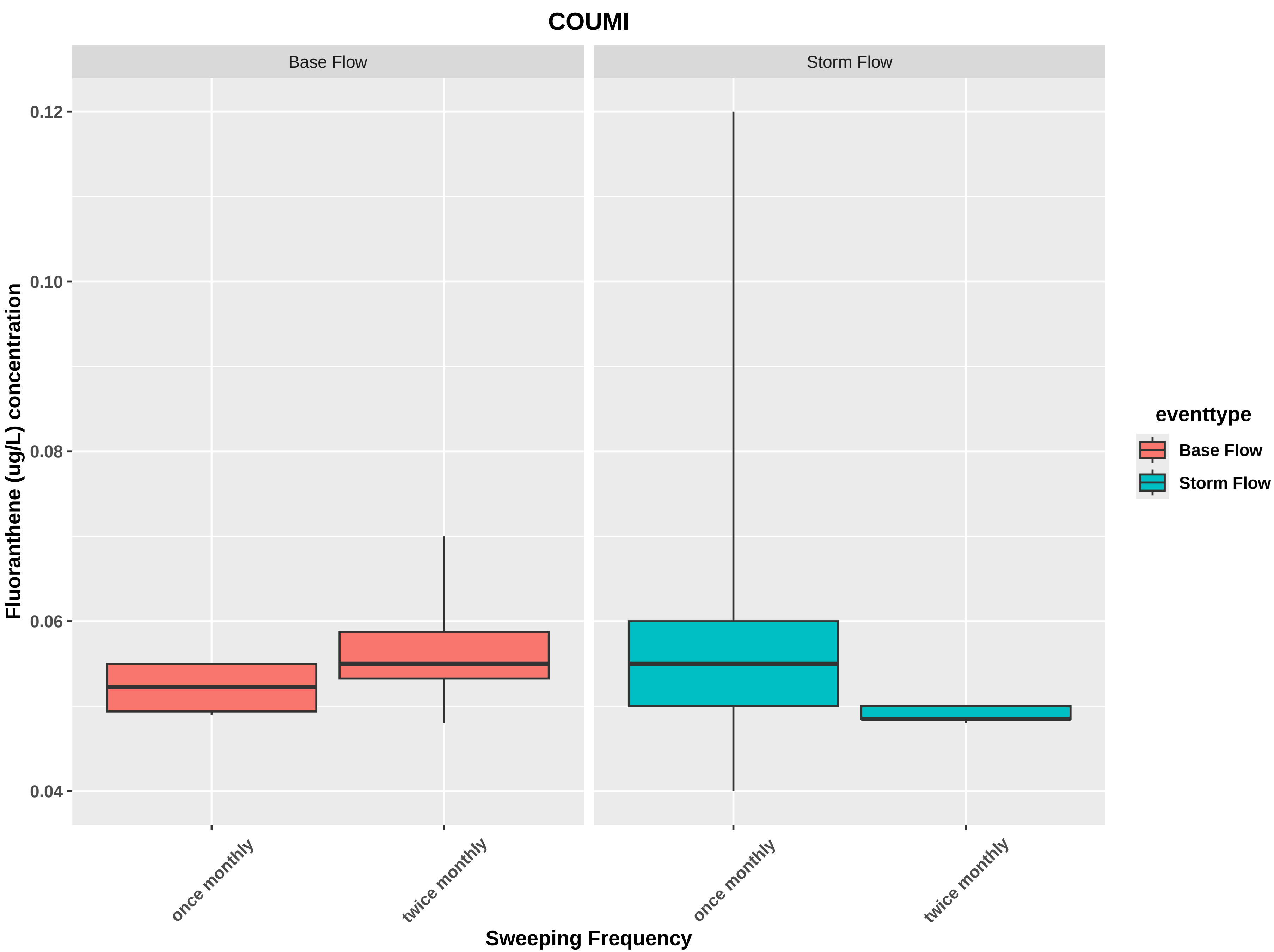

COUMI
Base Flow
Storm Flow
0.016
0.012
0.008
0.004
Dibenzo(a,h)anthracene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

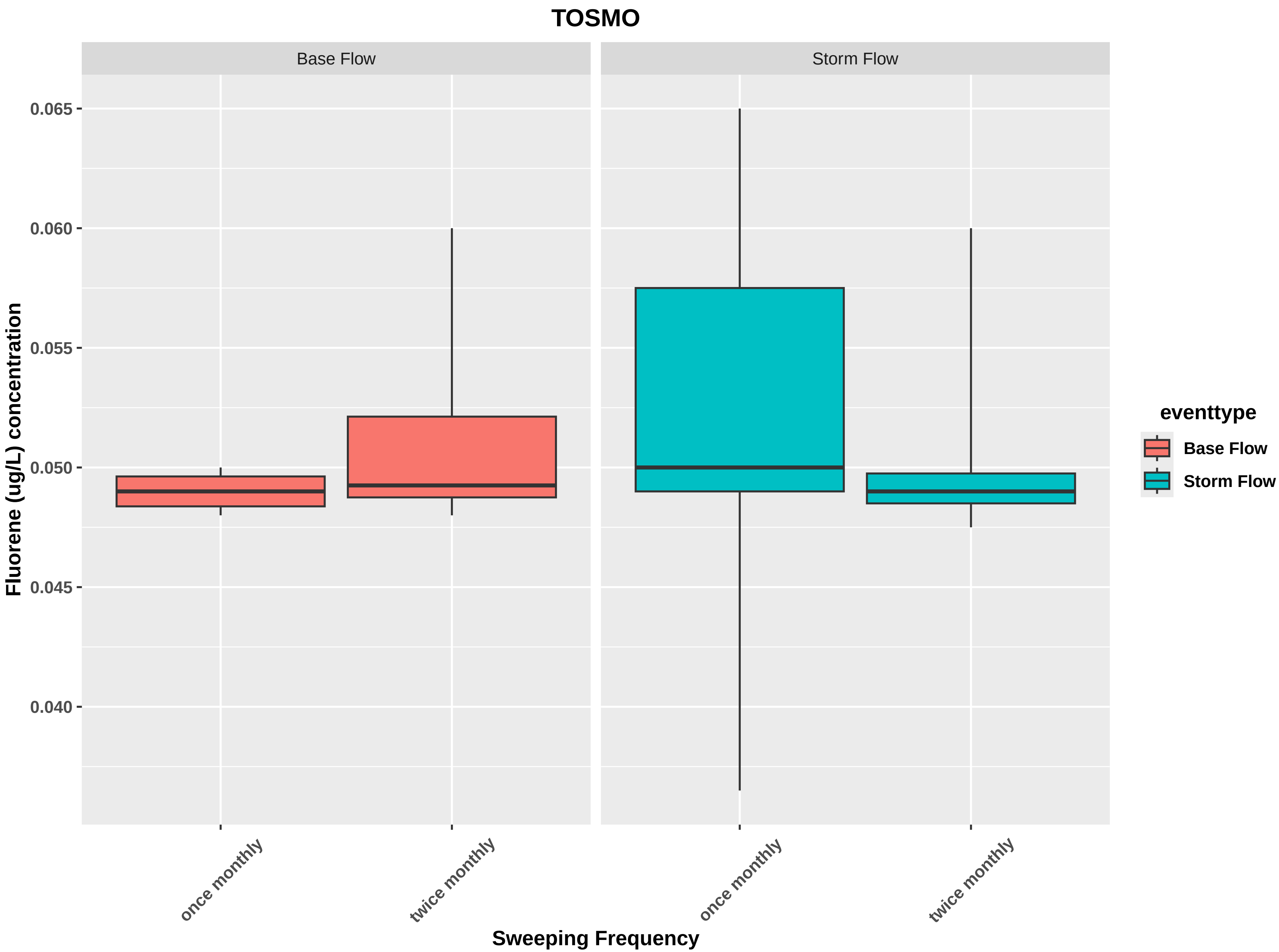


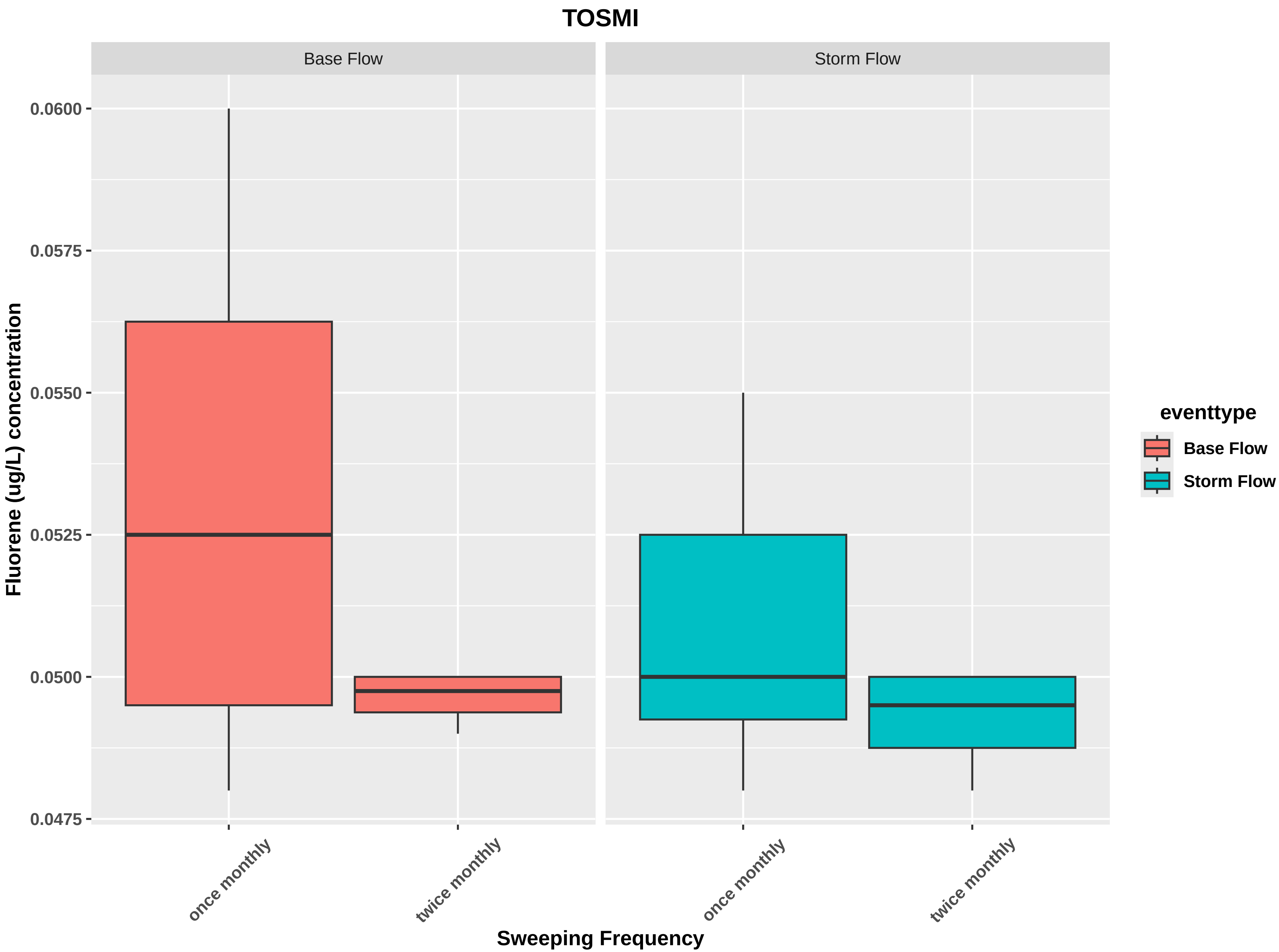
TOSMO
Base Flow
Storm Flow
0.15
0.10
0.05
Fluoranthene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow


TOSMI
Base Flow
Storm Flow
0.0600
0.0575
0.0550
0.0525
0.0500
0.0475
Fluoranthene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

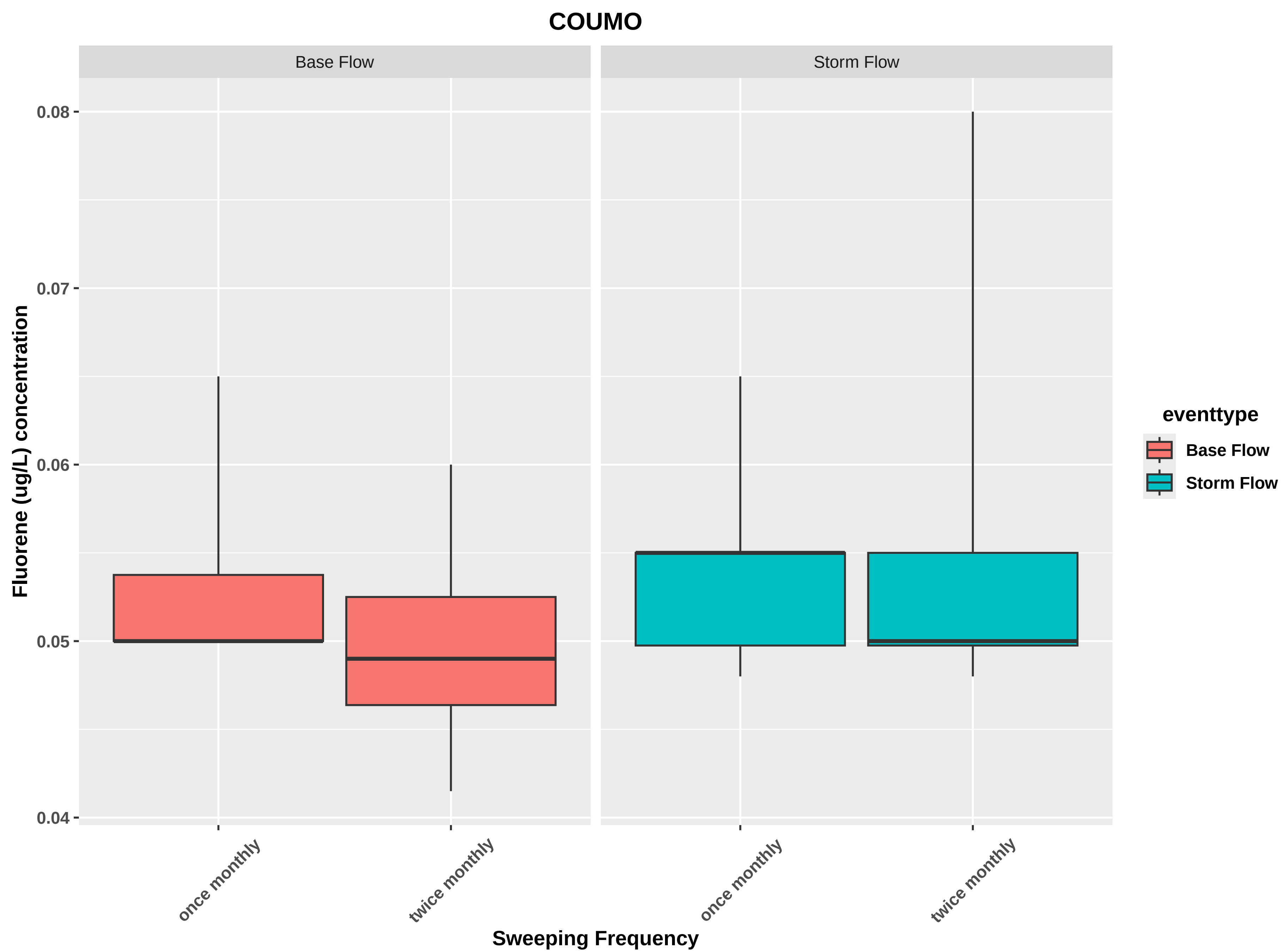

COUMO
Base Flow
Storm Flow
0.08
0.07
0.06
0.05
0.04
Fluoranthene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow


COUMI
Base Flow
Storm Flow
Fluoranthene (ug/L) concentration
0.12
0.10
0.08
0.06
0.04
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

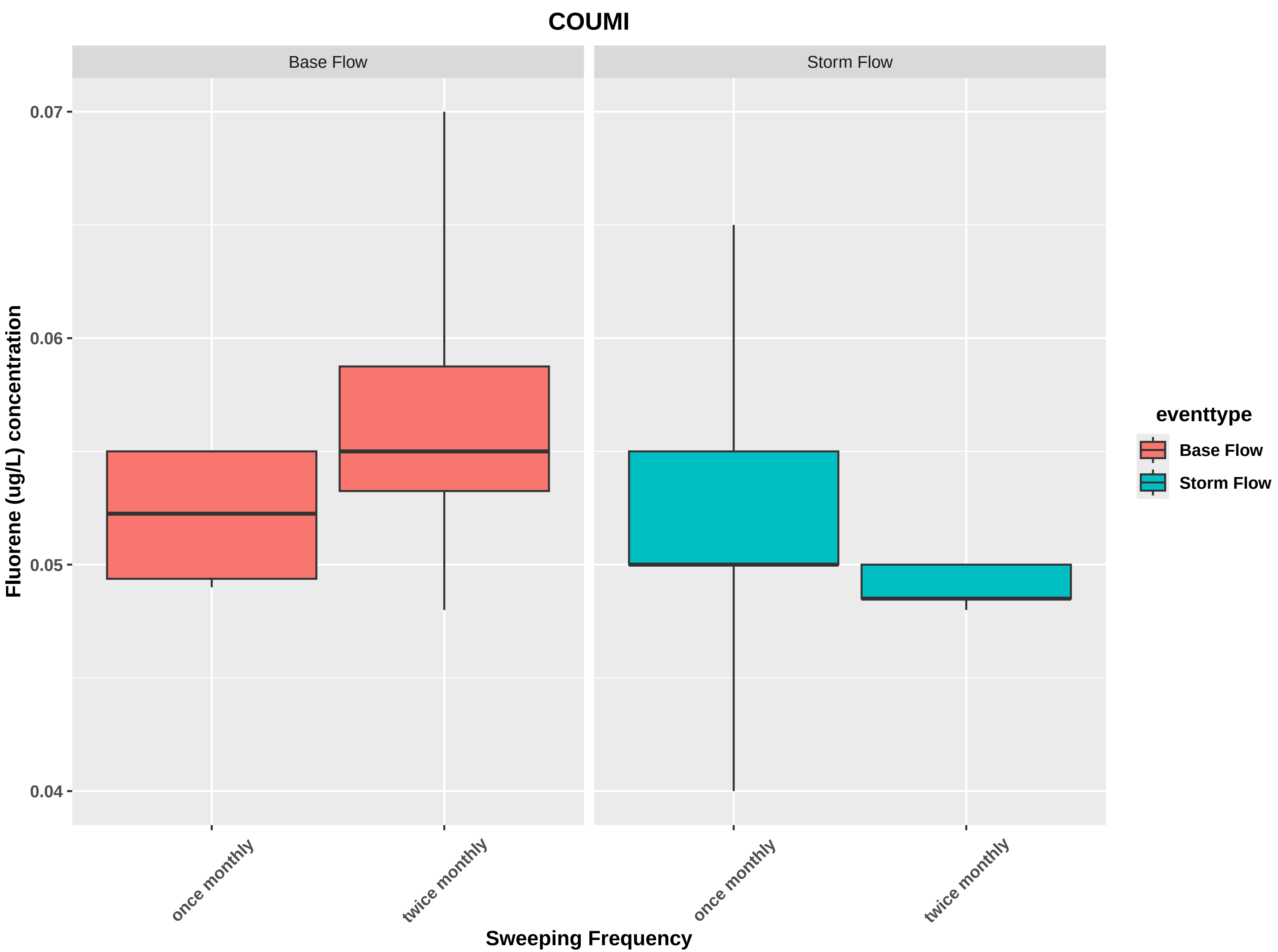

TOSMO
Base Flow
Storm Flow
Fluorene (ug/L) concentration
0.065
0.060
0.055
0.050
0.045
0.040
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow



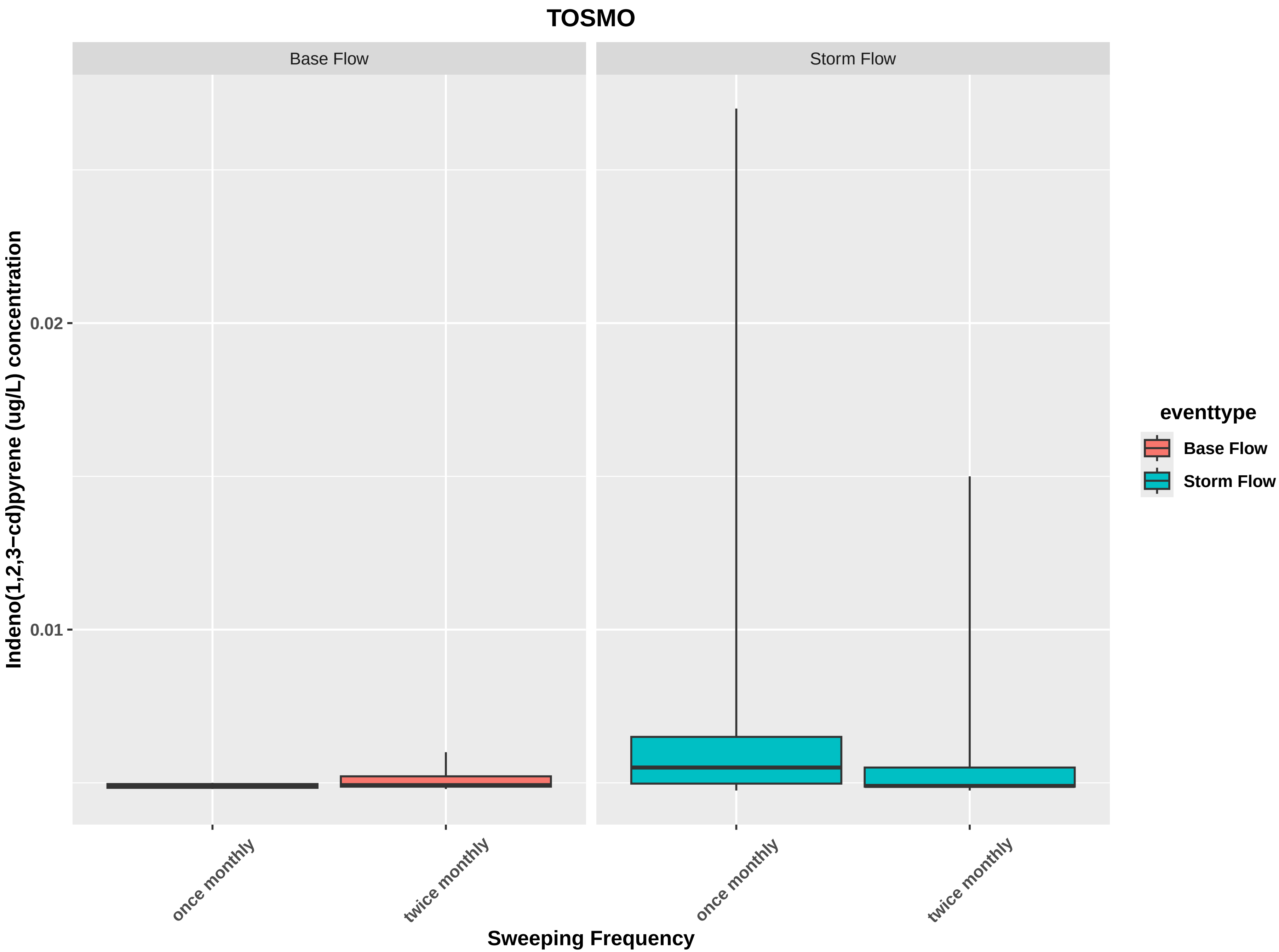
TOSMI
Base Flow
Storm Flow
0.0600
0.0575
0.0550
0.0525
0.0500
0.0475
Fluorene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow



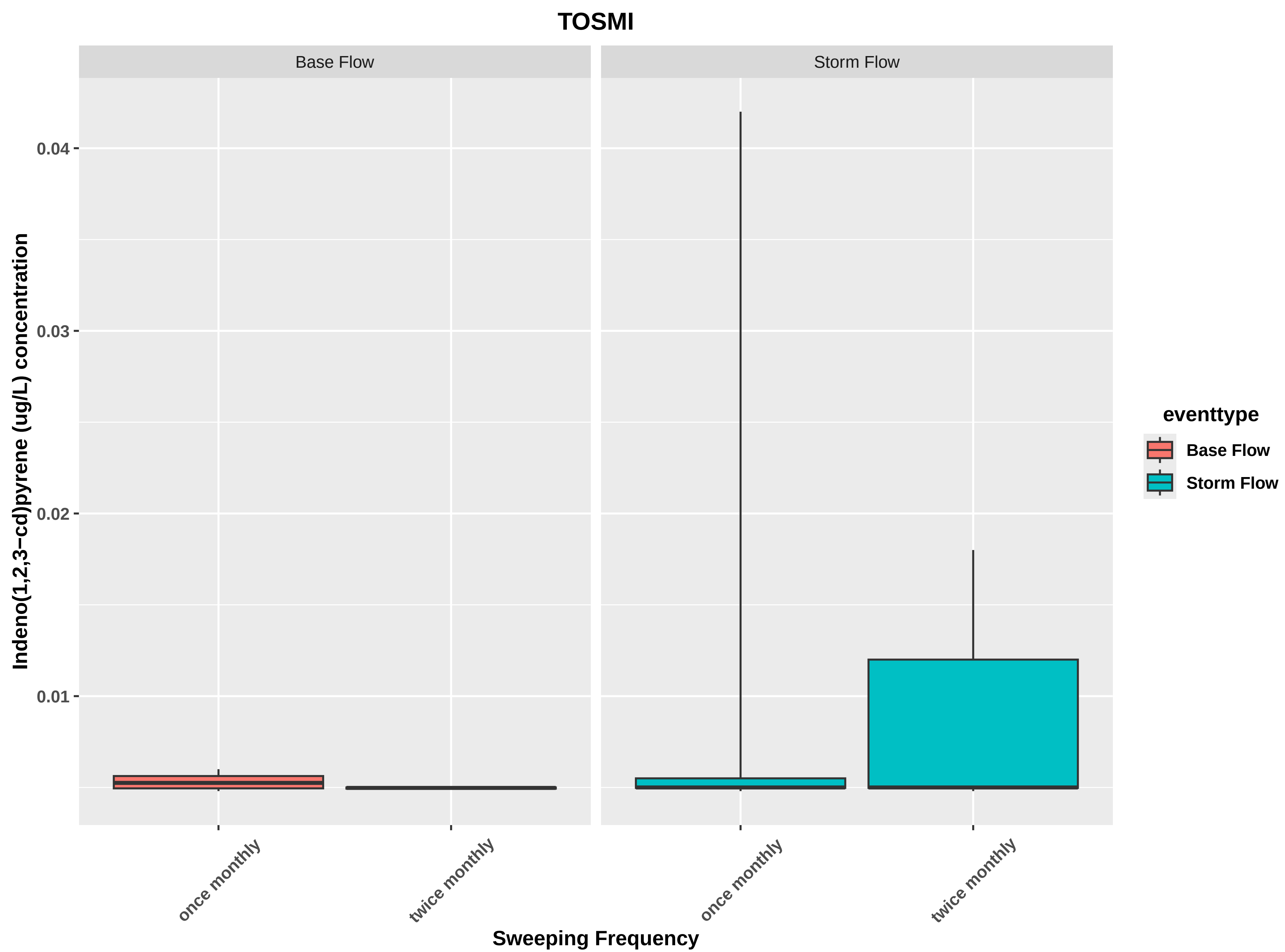
COUMO
Base Flow
Storm Flow
0.08
0.07
0.06
0.05
0.04
Fluorene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

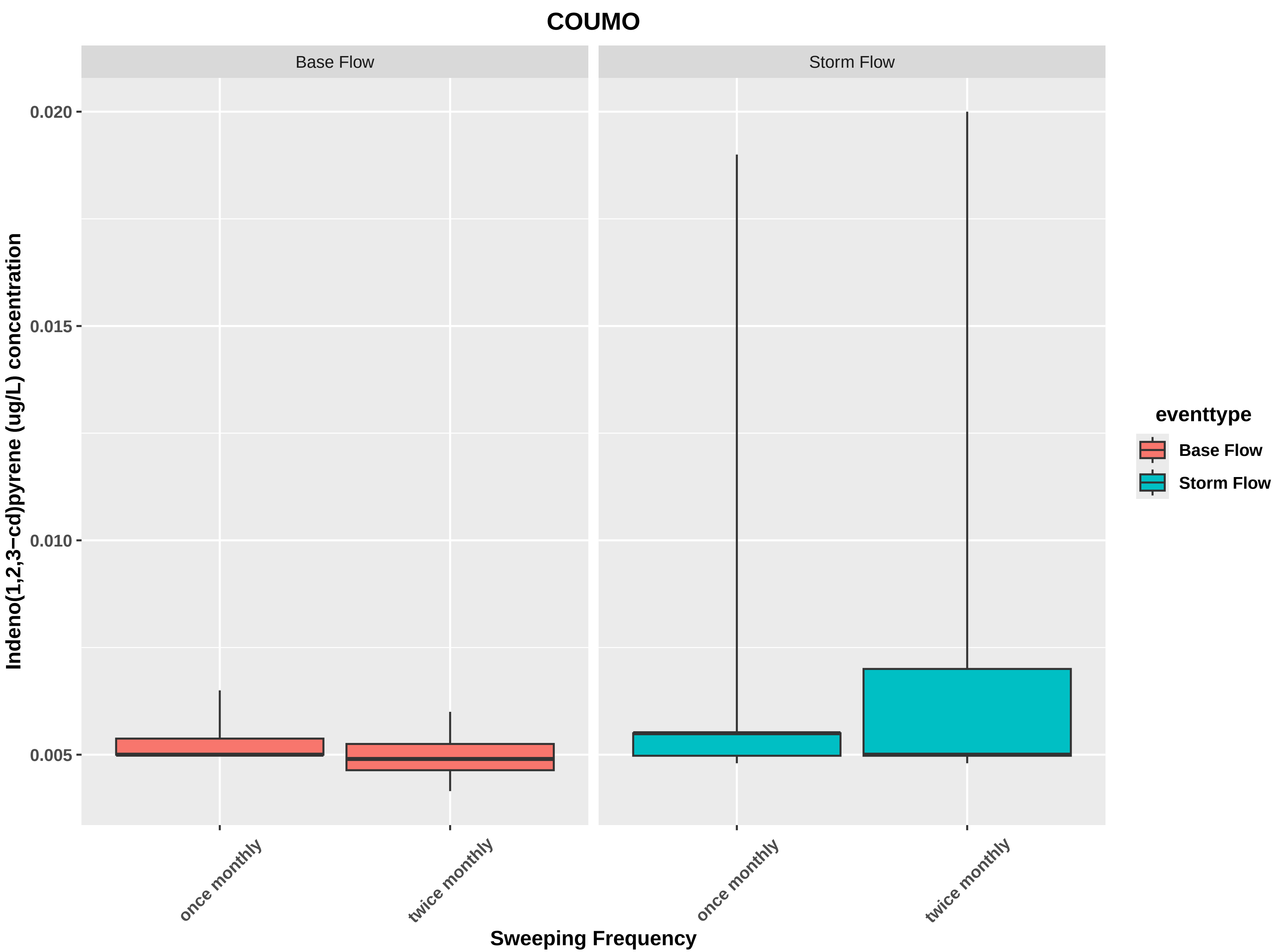


COUMI
Base Flow
Storm Flow
0.07
0.06
0.05
0.04
Fluorene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

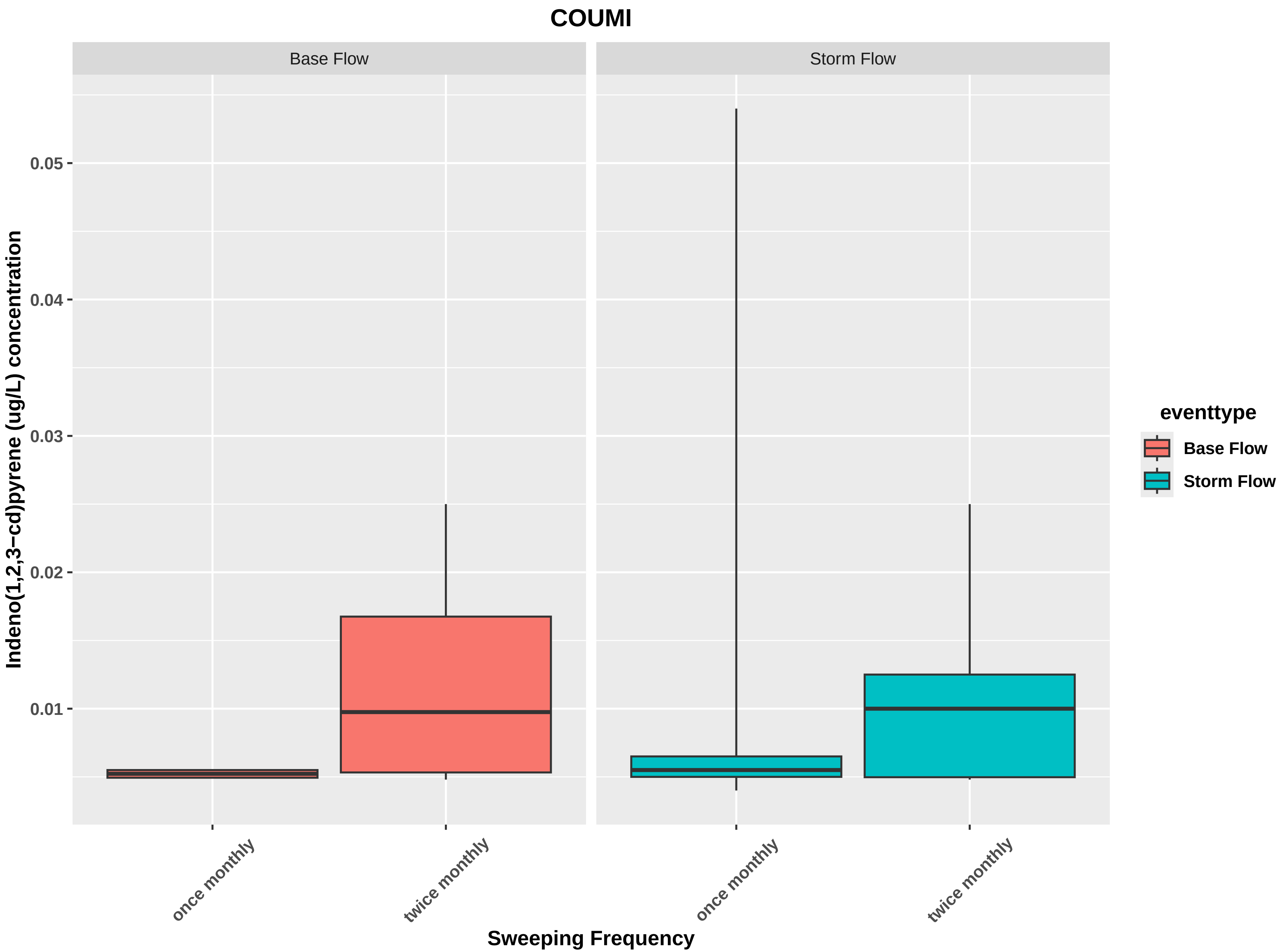


TOSMO
Base Flow
Storm Flow
Indeno(1,2,3−cd)pyrene (ug/L) concentration
0.02
0.01
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

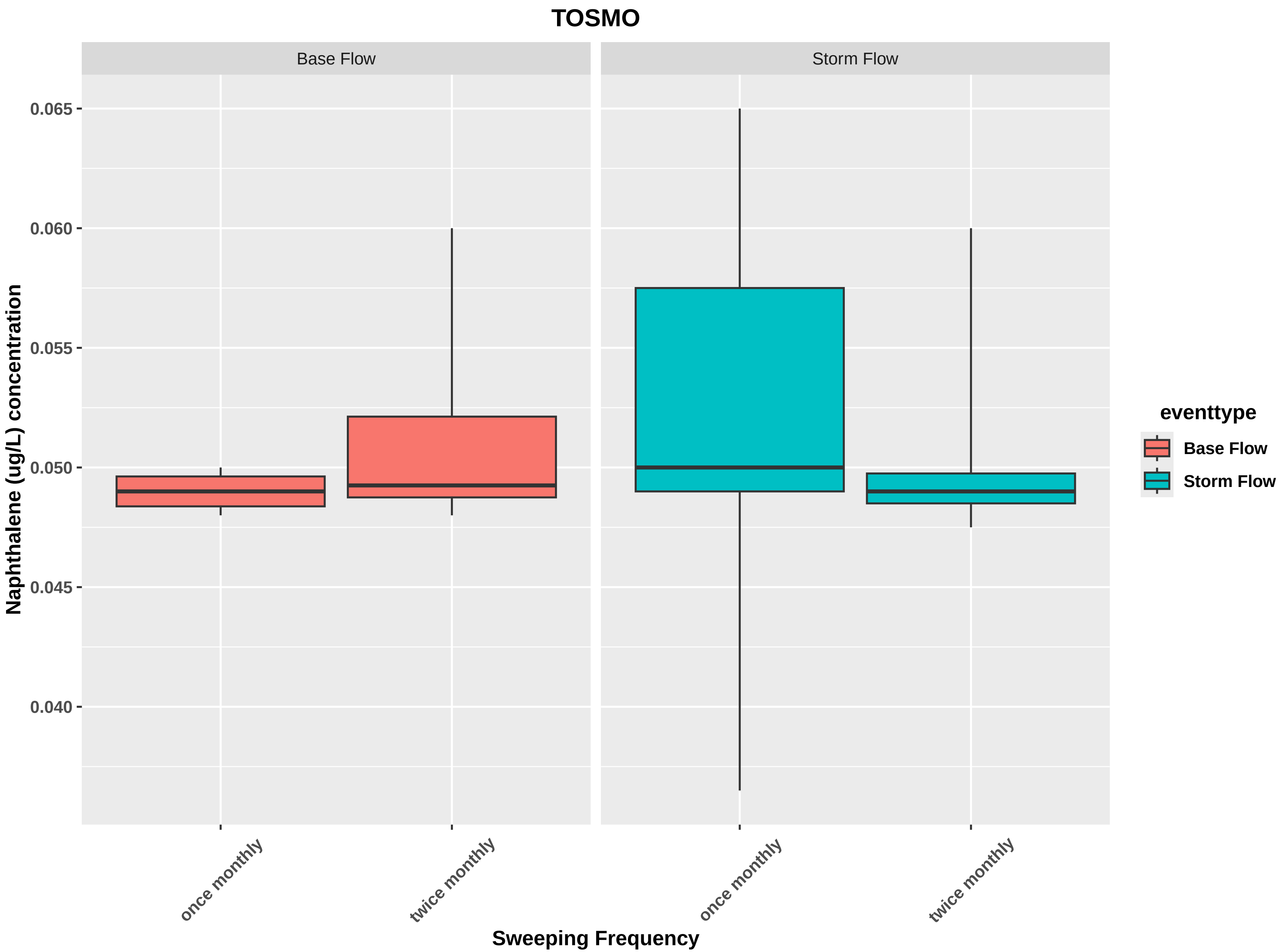

TOSMI
Base Flow
Storm Flow
0.04
0.03
0.02
0.01
Indeno(1,2,3−cd)pyrene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

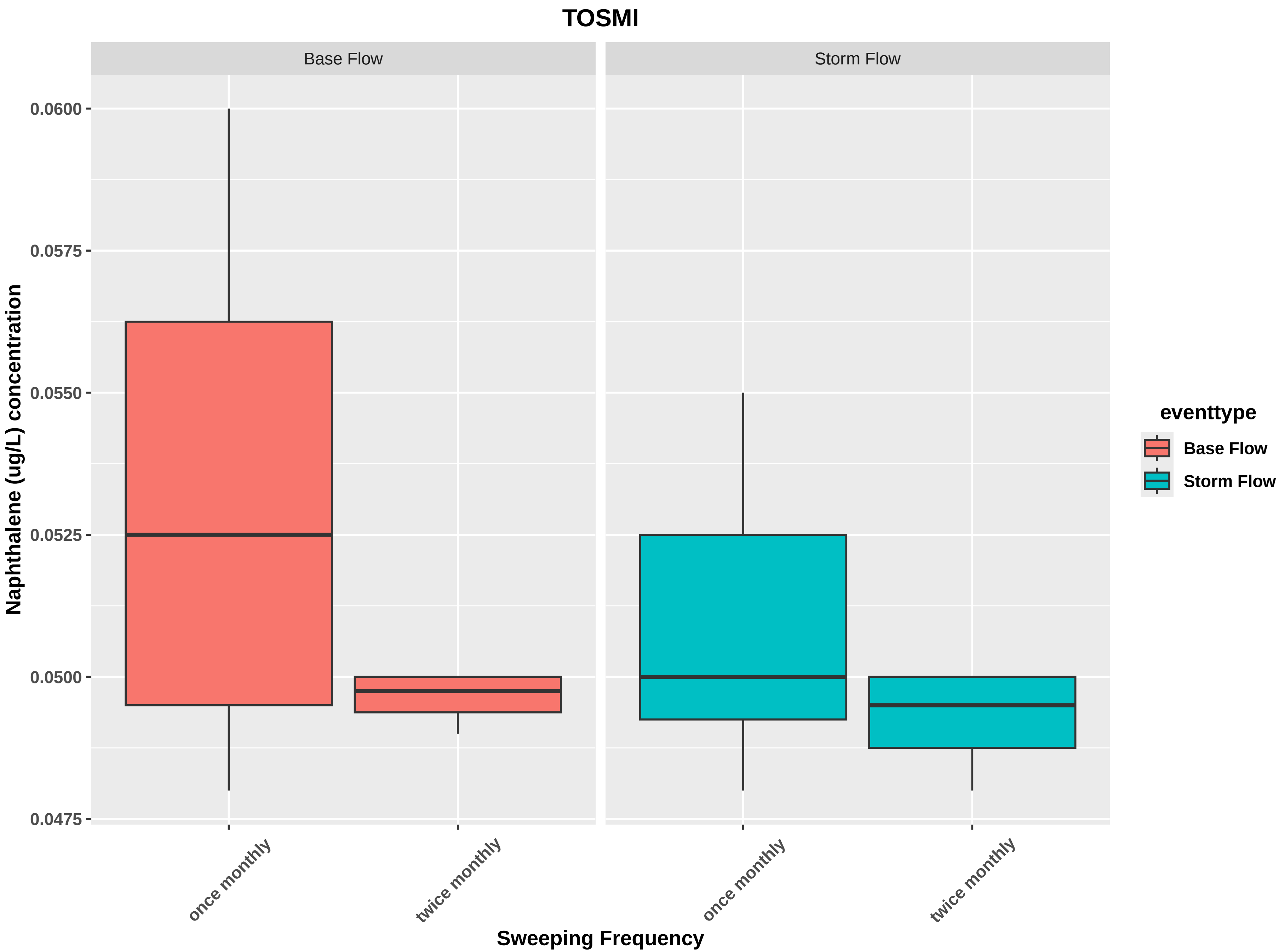


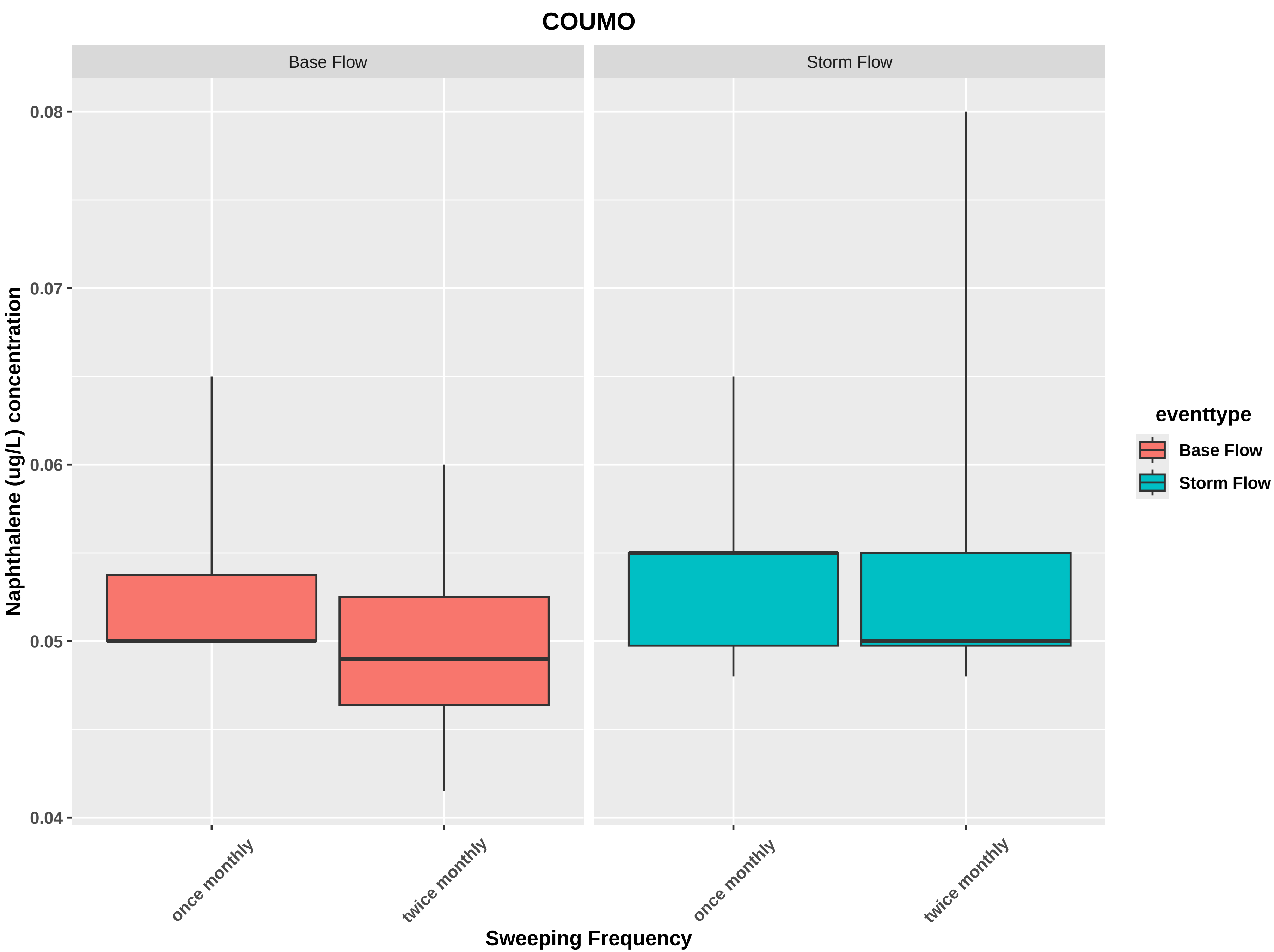
COUMO
Base Flow
Storm Flow
Indeno(1,2,3−cd)pyrene (ug/L) concentration
0.020
0.015
0.010
0.005
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

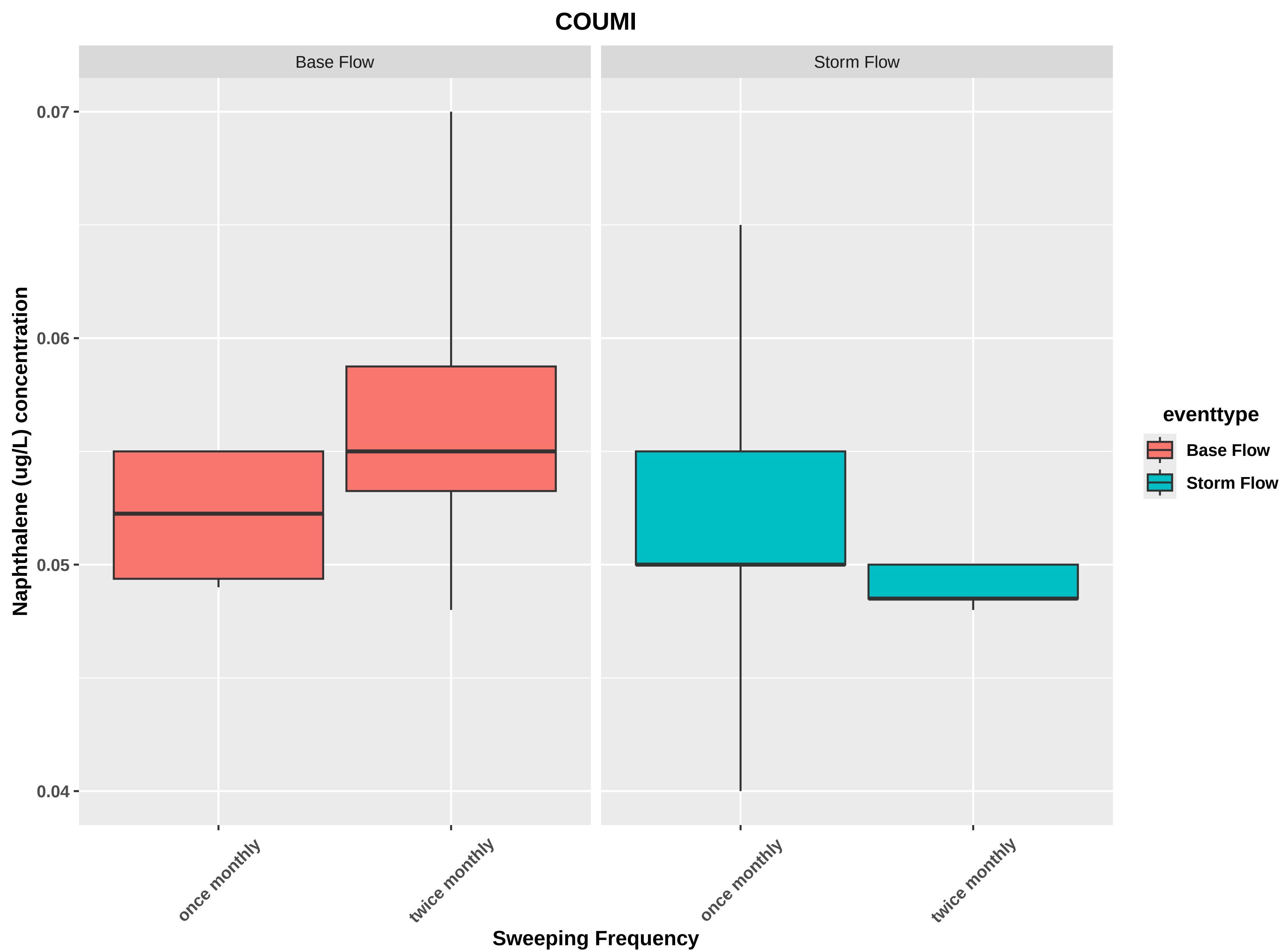


COUMI
Base Flow
Storm Flow
0.05
0.04
0.03
0.02
0.01
Indeno(1,2,3−cd)pyrene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

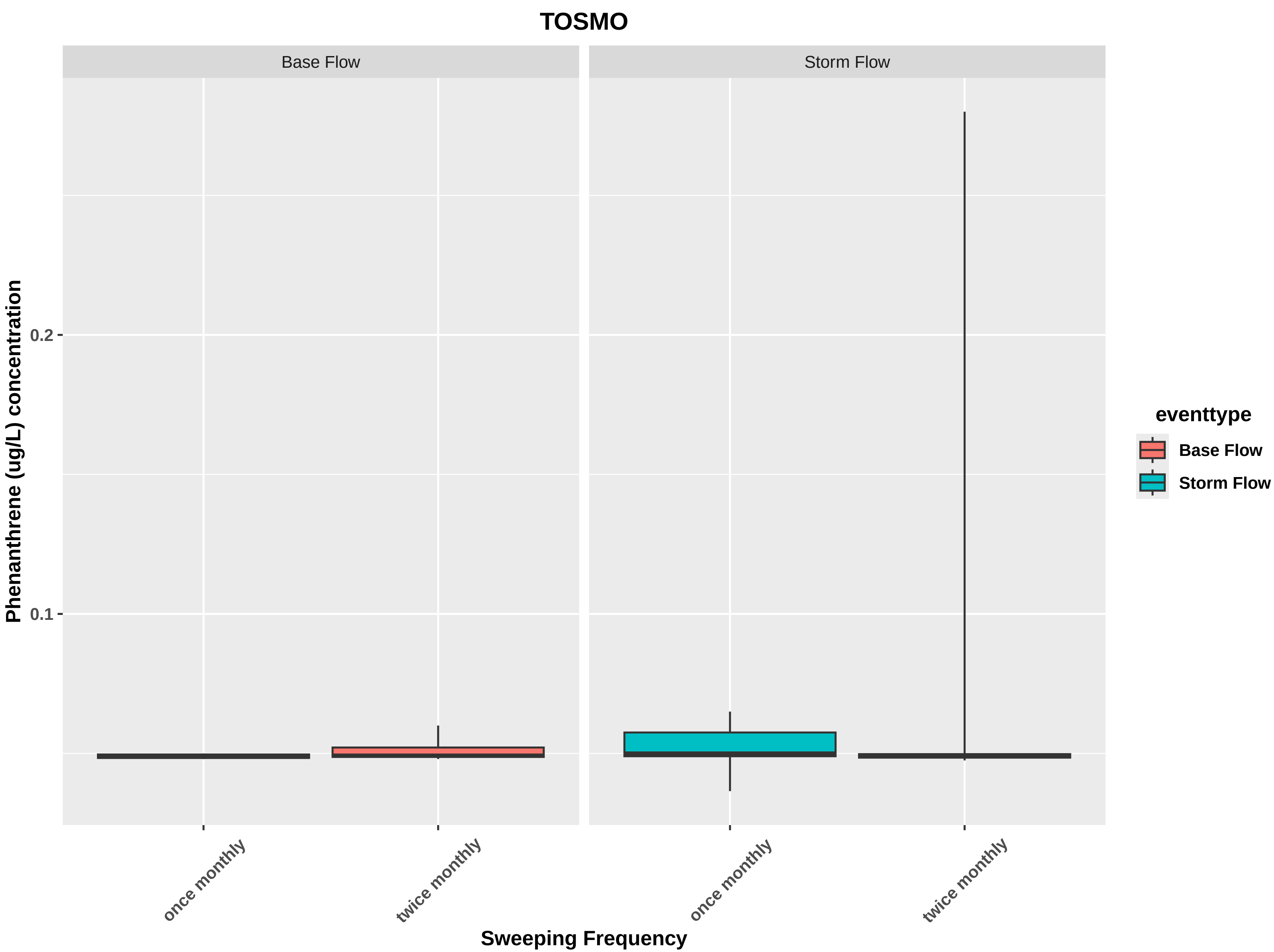

TOSMO
Base Flow
Storm Flow
0.065
0.060
0.055
0.050
0.045
0.040
Naphthalene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

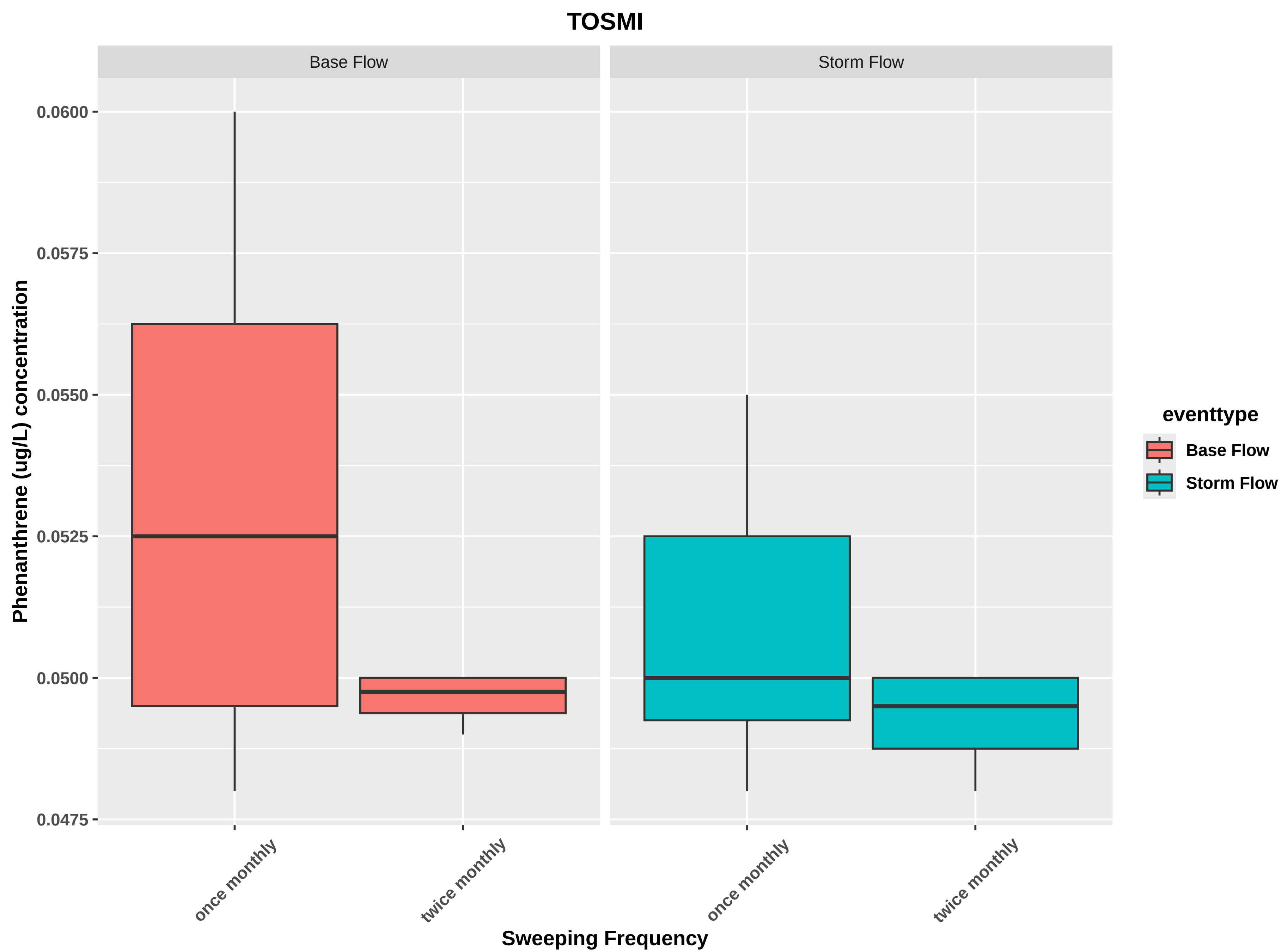

TOSMI
Base Flow
Storm Flow
Naphthalene (ug/L) concentration
0.0600
0.0575
0.0550
0.0525
0.0500
0.0475
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow


COUMO
Base Flow
Storm Flow
Naphthalene (ug/L) concentration
0.08
0.07
0.06
0.05
0.04
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

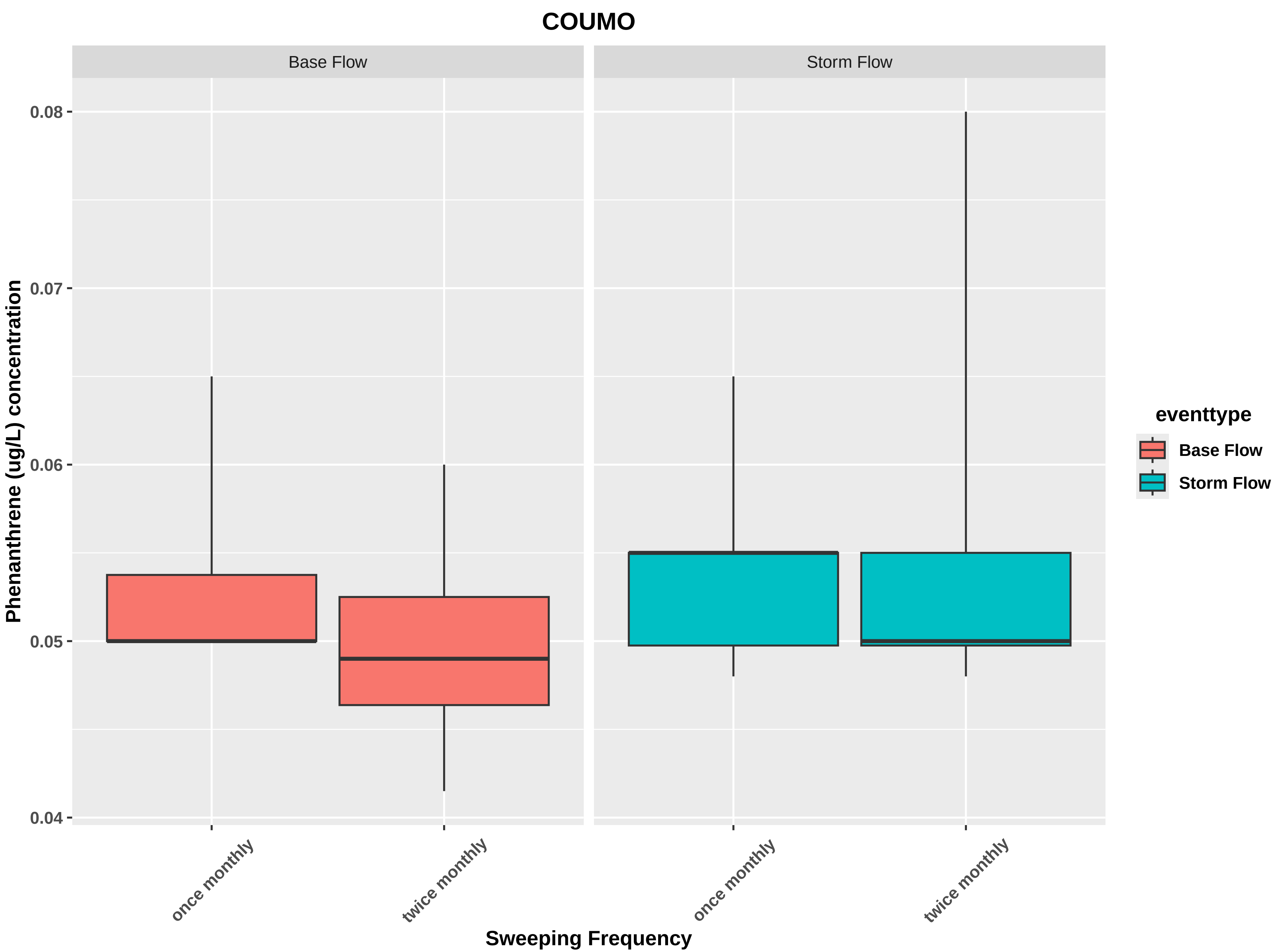


COUMI
Base Flow
Storm Flow
0.07
0.06
0.05
0.04
Naphthalene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

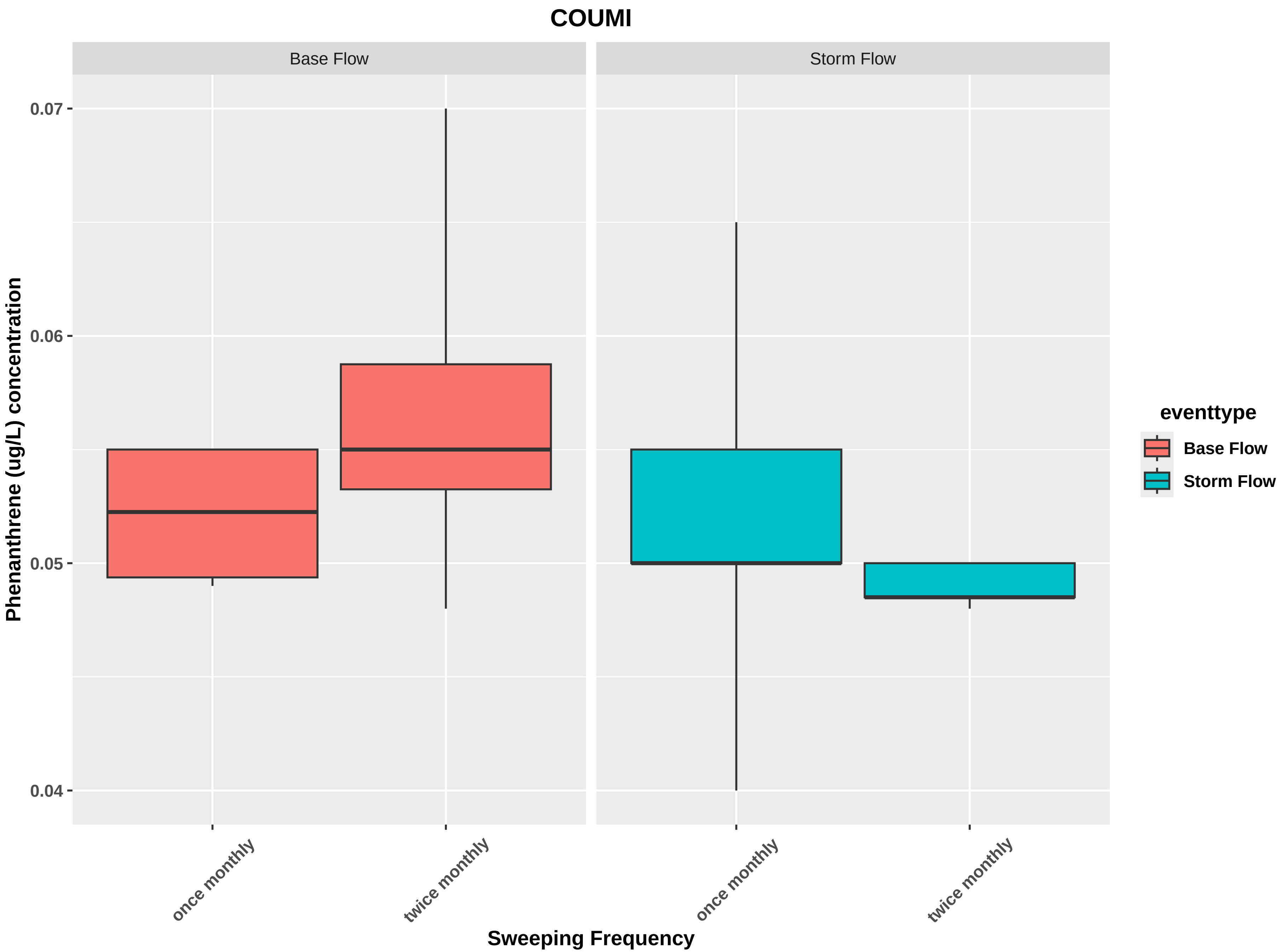

TOSMO
Base Flow
Storm Flow
Phenanthrene (ug/L) concentration
0.2
0.1
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

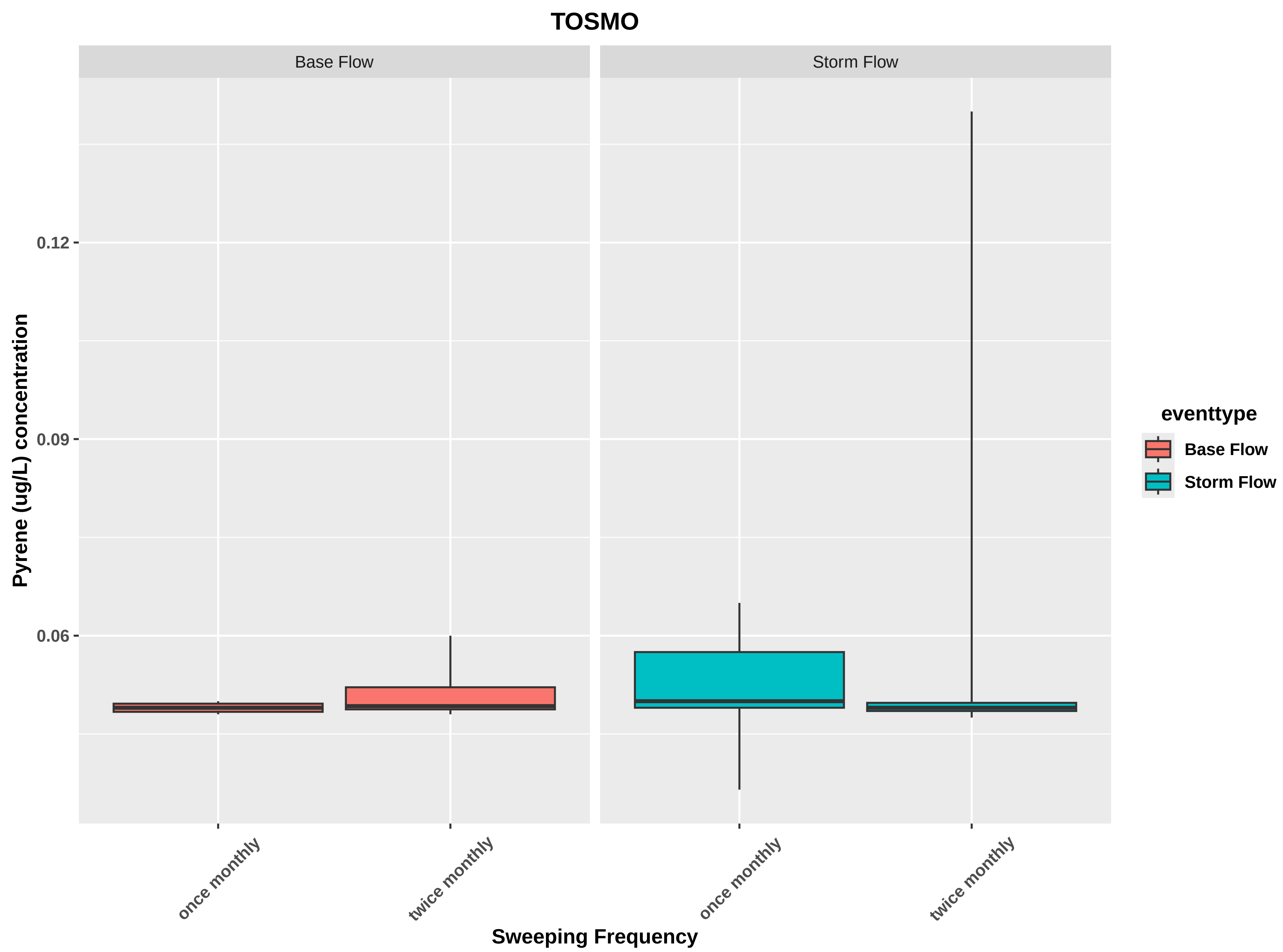


TOSMI
Base Flow
Storm Flow
0.0600
0.0575
0.0550
0.0525
0.0500
0.0475
Phenanthrene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

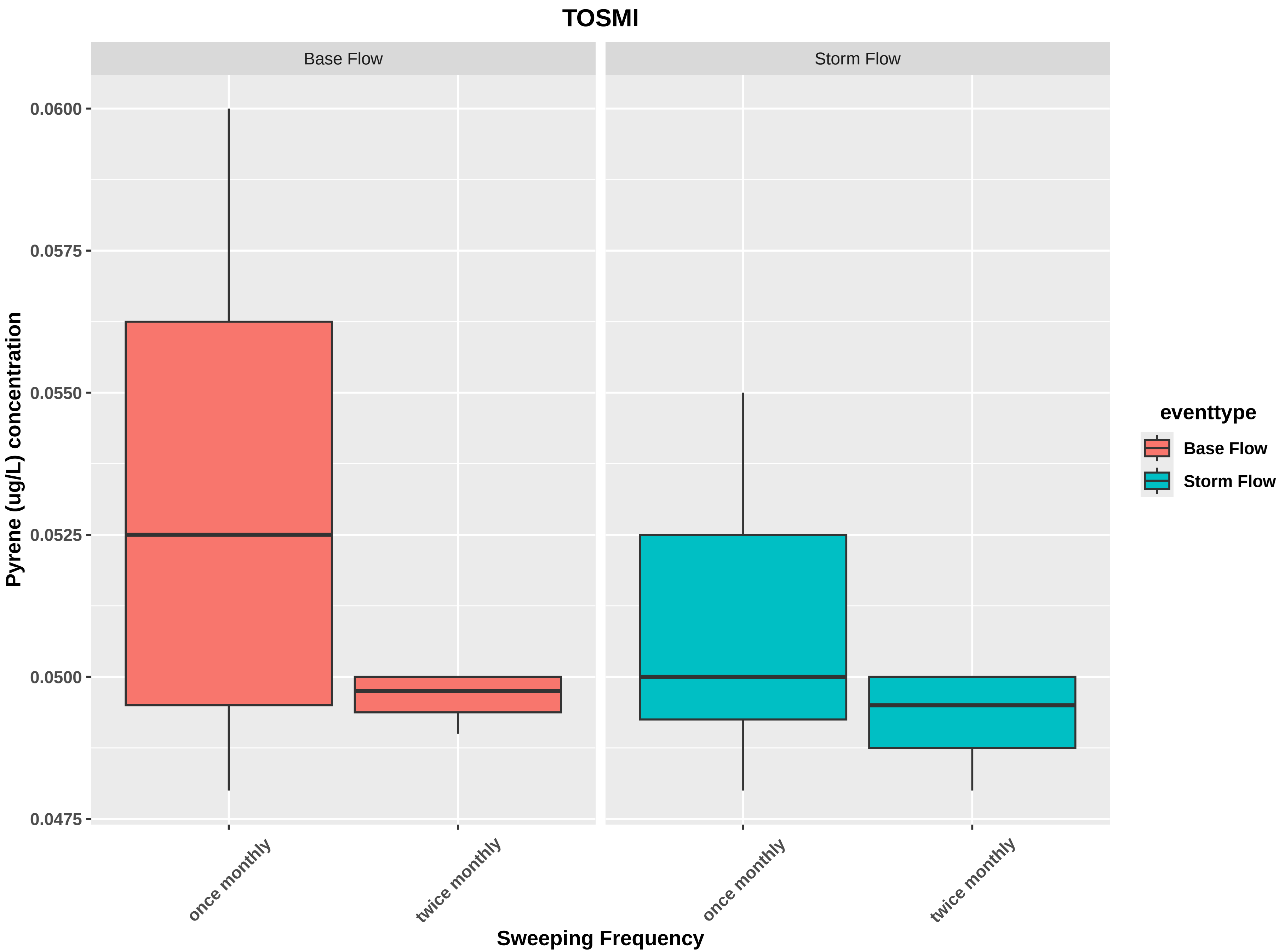


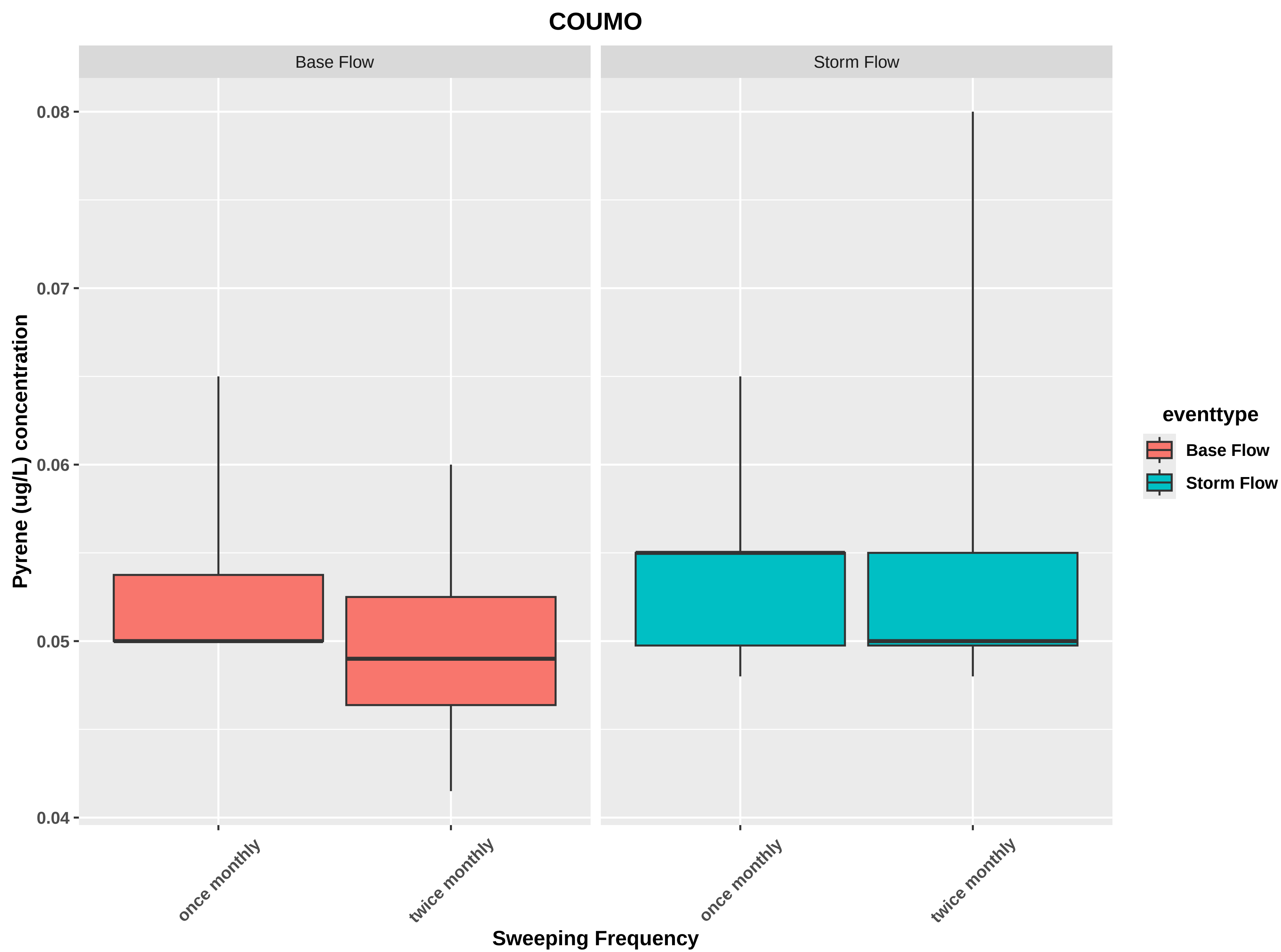
COUMO
Base Flow
Storm Flow
0.08
0.07
0.06
0.05
0.04
Phenanthrene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow


COUMI
Base Flow
Storm Flow
0.07
0.06
0.05
0.04
Phenanthrene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

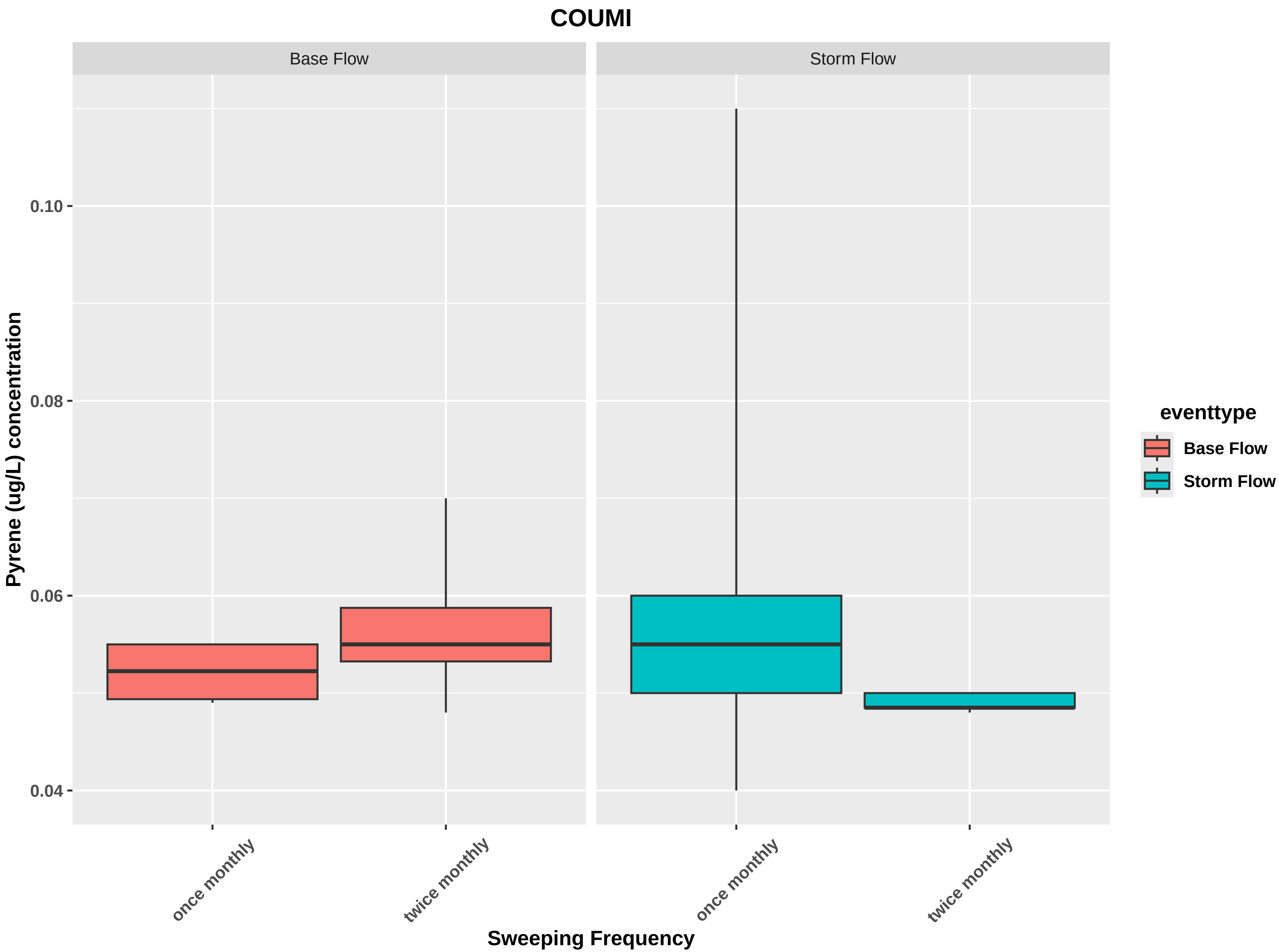


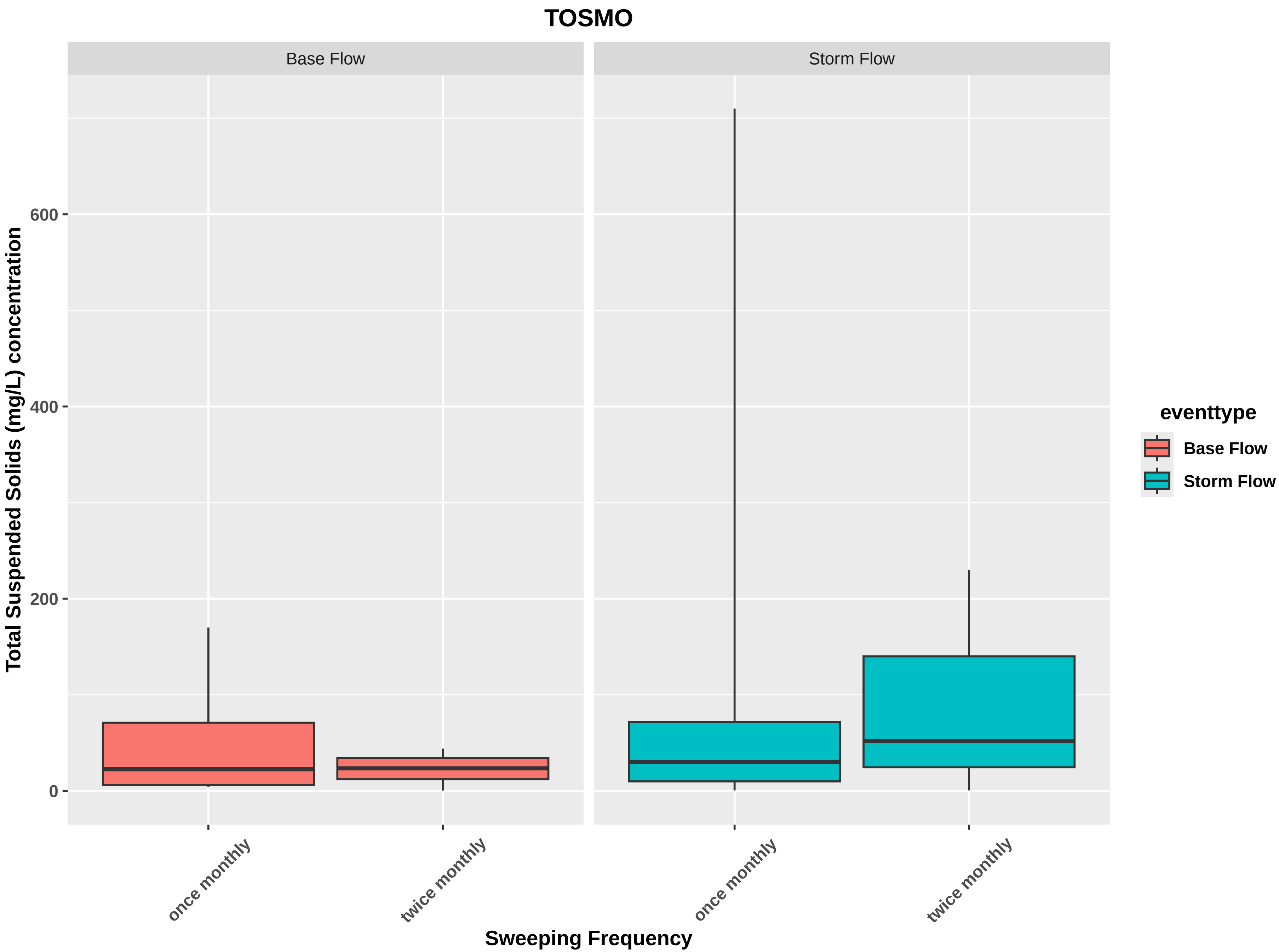
TOSMO
Base Flow
Storm Flow
0.12
0.09
0.06
Pyrene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow


TOSMI
Base Flow
Storm Flow
0.0600
0.0575
0.0550
0.0525
0.0500
0.0475
Pyrene (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

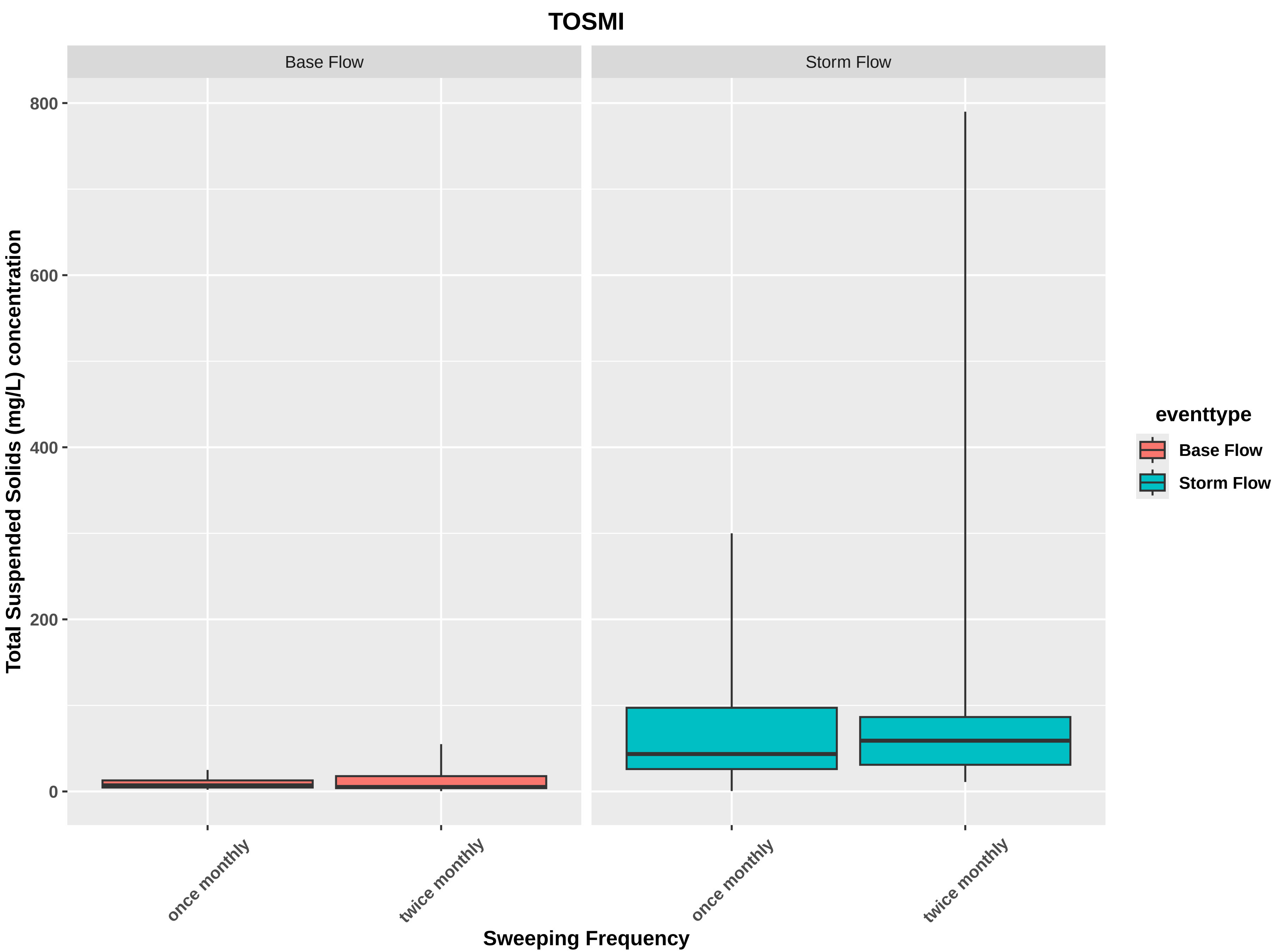


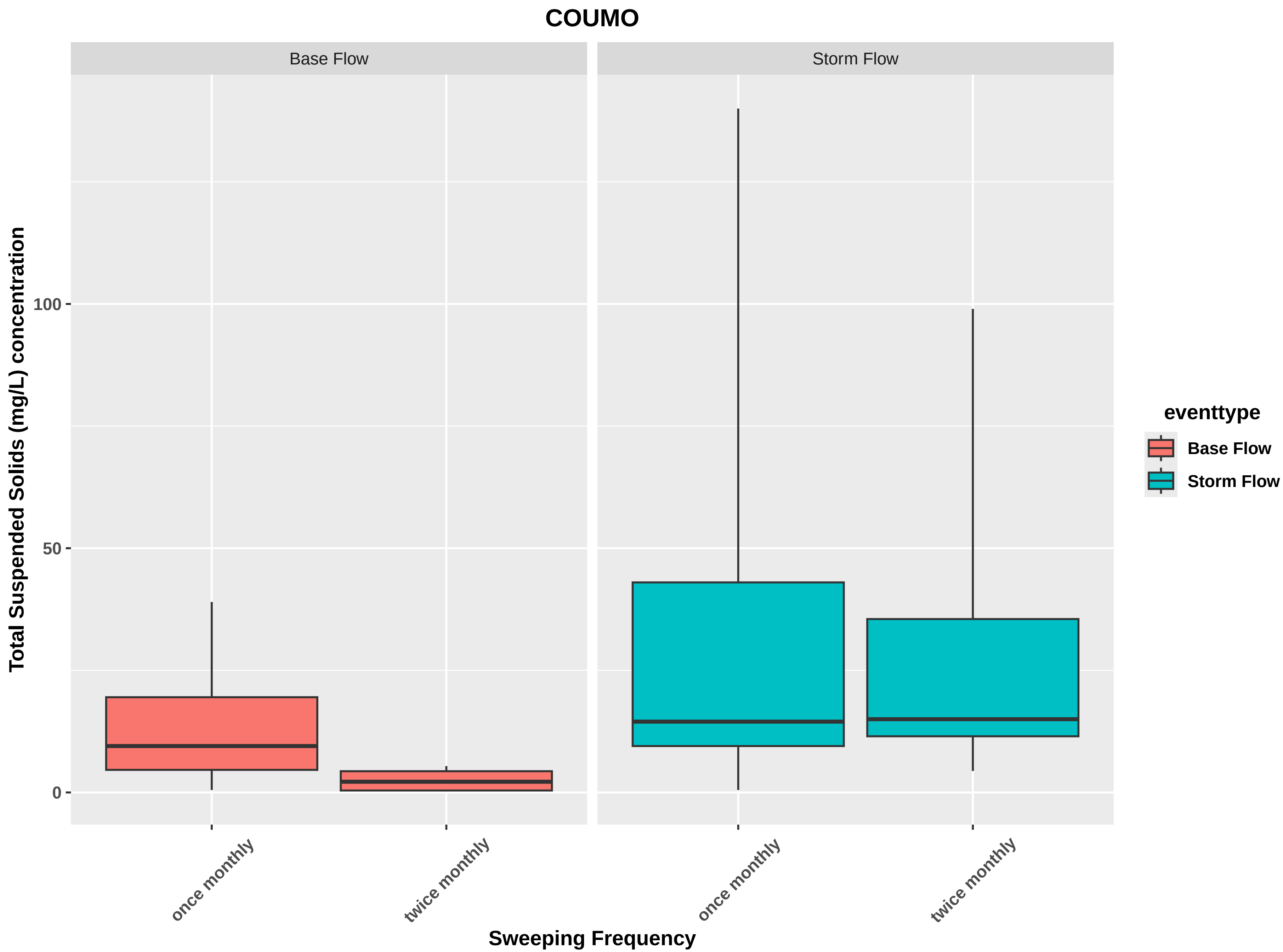
COUMO
Base Flow
Storm Flow
Pyrene (ug/L) concentration
0.08
0.07
0.06
0.05
0.04
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

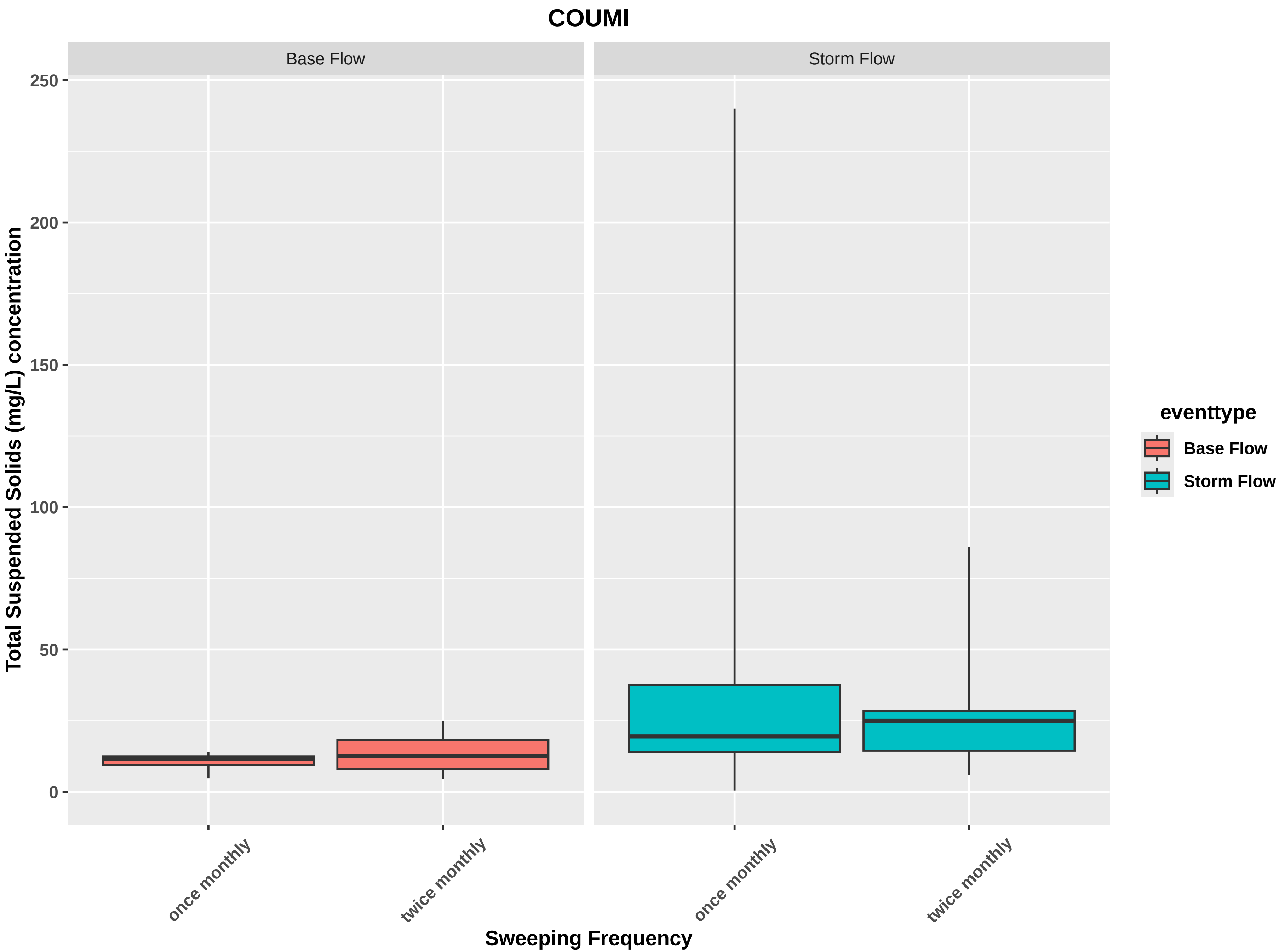

COUMI
Base Flow
Storm Flow
Pyrene (ug/L) concentration
0.10
0.08
0.06
0.04
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

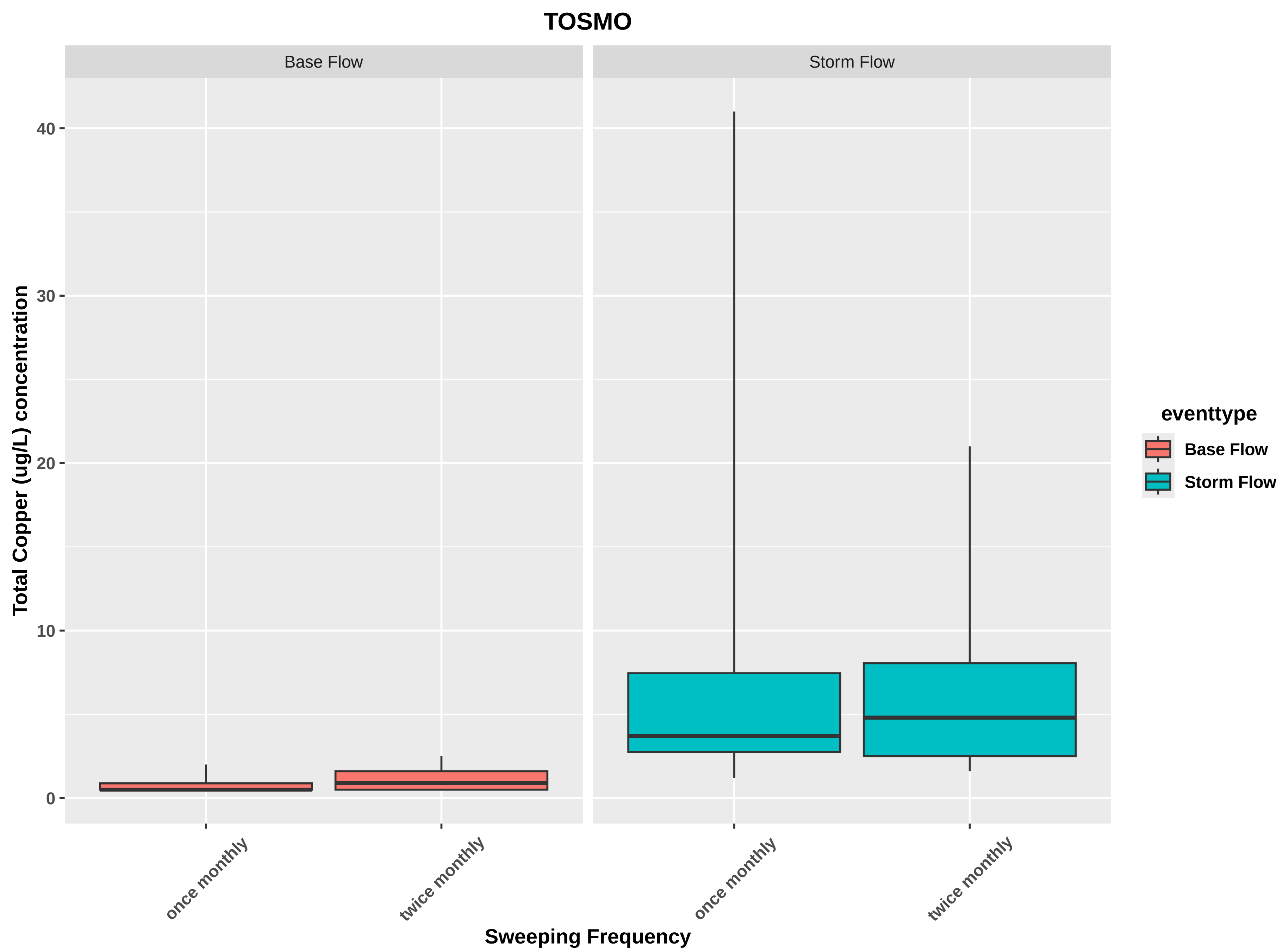


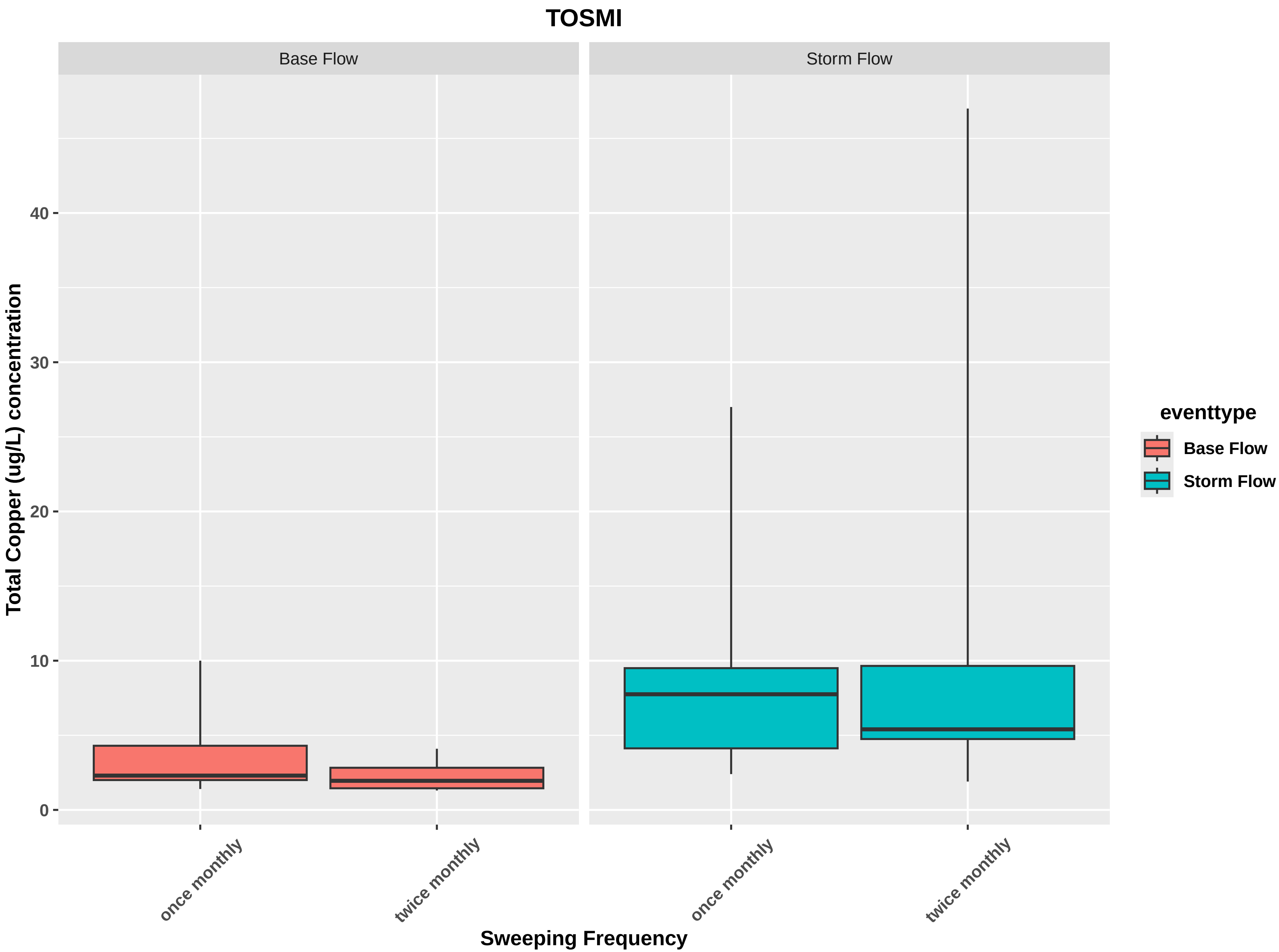
TOSMO
Base Flow
Storm Flow
Total Suspended Solids (mg/L) concentration
600
400
200
0
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

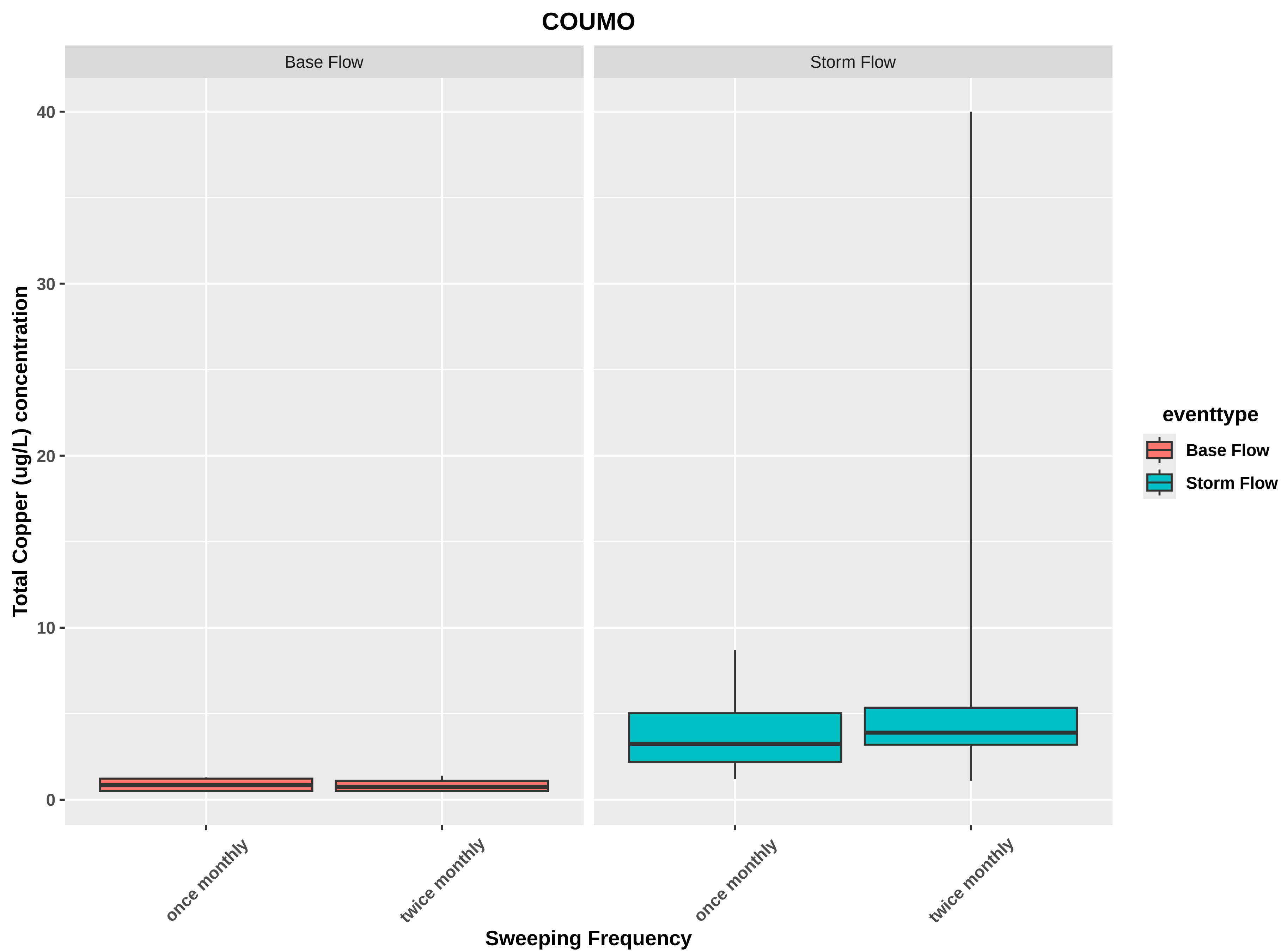

TOSMI
Base Flow
Storm Flow
800
600
400
200
0
Total Suspended Solids (mg/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

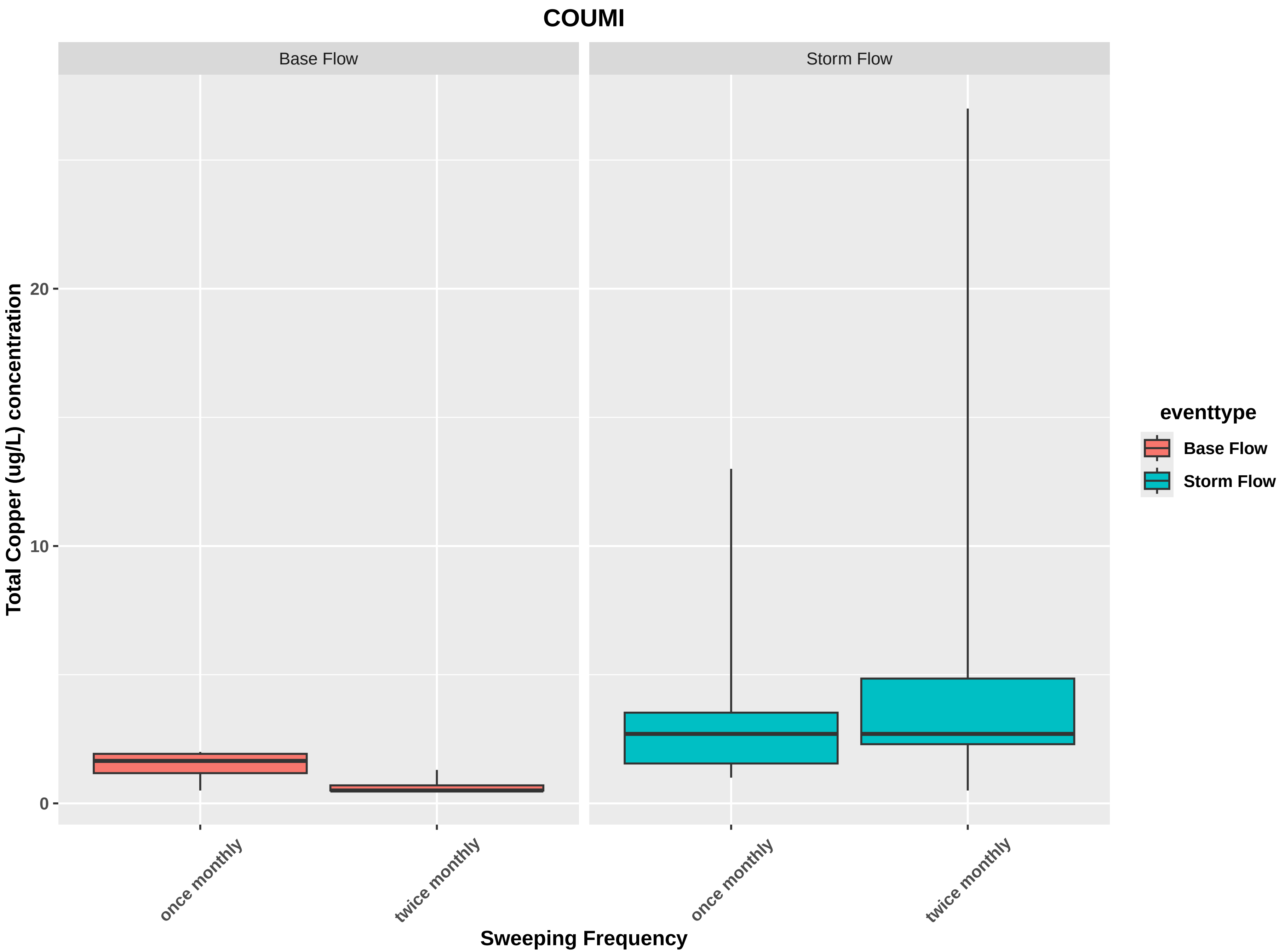

COUMO
Base Flow
Storm Flow
Total Suspended Solids (mg/L) concentration
100
50
0
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow


COUMI
Base Flow
Storm Flow
Total Suspended Solids (mg/L) concentration
250
200
150
100
50
0
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow


TOSMO
Base Flow
Storm Flow
40
30
20
10
0
Total Copper (ug/L) concentration
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow


TOSMI
Base Flow
Storm Flow
Total Copper (ug/L) concentration
0
10
20
30
40
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow


COUMO
Base Flow
Storm Flow
Total Copper (ug/L) concentration
40
30
20
10
0
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow


COUMI
Base Flow
Storm Flow
Total Copper (ug/L) concentration
20
10
0
once monthly
twice monthly
once monthly
twice monthly
Sweeping Frequency
eventtype
Base Flow
Storm Flow

# Appendix D

## Tabular Summary Statistics for Total Suspended Solids, Total Copper, and Particulate Copper

HERRERA
Science + Planning + Design

| Table D-1. Summary Statistics for Total Suspended Solids (mg/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | N | Minimum | 25th Percentile | Median | 75th Percentile | Maximum | Interquartile Range | % Detected |
| Quarterly Sweeping – Storm Events | | | | | | | | |
| TOSMI | 19 | 12.0 | 44.0 | 65.0 | 130 | 300 | 86.0 | 100 |
| TOSMO | 19 | 20.0 | 72.0 | 110 | 195 | 710 | 123 | 100 |
| COUMI | 19 | 4.4 | 32.5 | 60.0 | 135 | 320 | 102 | 100 |
| COUMO | 19 | 7.4 | 23.5 | 32.0 | 64.5 | 150 | 41.0 | 100 |
| Monthly Sweeping – Storm Events | | | | | | | | |
| TOSMI | 10 | 1.0 | 31.0 | 43.5 | 83.3 | 300 | 52.3 | 90 |
| TOSMO | 10 | 1.0 | 10.3 | 30.0 | 45.5 | 610 | 35.3 | 90 |
| COUMI | 10 | 1.0 | 16.3 | 19.5 | 24.3 | 240 | 8.0 | 90 |
| COUMO | 10 | 1.0 | 11.0 | 14.5 | 36.3 | 140 | 25.3 | 90 |
| Twice Monthly Sweeping – Storm Events | | | | | | | | |
| TOSMI | 15 | 11.0 | 31.0 | 59.0 | 86.5 | 790 | 55.5 | 100 |
| TOSMO | 15 | 1.0 | 24.5 | 52.0 | 140 | 230 | 116 | 100 |
| COUMI | 15 | 6.0 | 14.5 | 25.0 | 28.5 | 86.0 | 14.0 | 100 |
| COUMO | 15 | 4.4 | 11.5 | 15.0 | 35.5 | 99.0 | 24.0 | 100 |
| All Storm Events | | | | | | | | |
| TOSMI | 44 | 1.0 | 31.5 | 58.5 | 97.3 | 790 | 65.8 | 98 |
| TOSMO | 44 | 1.0 | 26.5 | 69.5 | 143 | 710 | 116 | 98 |
| COUMI | 44 | 1.0 | 16.8 | 26.5 | 76.8 | 320 | 60.0 | 98 |
| COUMO | 44 | 1.0 | 11.8 | 22.0 | 47.0 | 150 | 35.3 | 98 |
| Quarterly Sweeping – Base Flow | | | | | | | | |
| TOSMI | 9 | 2.4 | 5.0 | 11.0 | 13.0 | 26.0 | 8.0 | 100 |
| TOSMO | 9 | 2.2 | 3.8 | 4.2 | 11.0 | 16.0 | 7.2 | 100 |
| COUMI | 9 | 4.4 | 6.4 | 14.0 | 18.0 | 51.0 | 11.6 | 100 |
| COUMO | 9 | 1.8 | 2.8 | 5.8 | 7.2 | 39.0 | 4.4 | 100 |
| Monthly Sweeping – Base Flow | | | | | | | | |
| TOSMI | 4 | 5.4 | 8.0 | 11.4 | 16.8 | 25.0 | 8.8 | 100 |
| TOSMO | 4 | 7.0 | 9.0 | 23.8 | 71.0 | 170 | 62.1 | 100 |
| COUMI | 4 | 4.8 | 5.9 | 8.6 | 11.3 | 12.0 | 5.4 | 100 |
| COUMO | 4 | 1.0 | 4.0 | 5.5 | 7.8 | 13.0 | 3.8 | 75 |
| Twice Monthly Sweeping – Base Flow | | | | | | | | |
| TOSMI | 4 | 0.8 | 4.0 | 5.2 | 17.8 | 55.0 | 13.9 | 75 |
| TOSMO | 4 | 0.8 | 12.2 | 23.5 | 34.3 | 44.0 | 22.1 | 75 |
| COUMI | 4 | 4.6 | 8.1 | 12.6 | 18.3 | 25.0 | 10.2 | 100 |
| COUMO | 4 | 0.8 | 0.8 | 2.4 | 4.4 | 5.4 | 3.6 | 50 |
| All Base Flow | | | | | | | | |
| TOSMI | 17 | 0.8 | 5.0 | 8.8 | 13.0 | 55.0 | 8.0 | 94 |
| TOSMO | 17 | 0.8 | 4.0 | 9.6 | 16.0 | 170 | 12.0 | 94 |
| COUMI | 17 | 4.4 | 6.2 | 11.0 | 16.0 | 51.0 | 9.8 | 100 |
| COUMO | 17 | 0.8 | 2.4 | 5.0 | 6.2 | 39.0 | 3.8 | 82 |

mg/L: milligrams per Liter

| Table D-2. Summary Statistics for Total Copper (ug/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | N | Minimum | 25th Percentile | Median | 75th Percentile | Maximum | Interquartile Range | % Detected |
| Quarterly Sweeping – Storm Events | | | | | | | | |
| TOSMI | 19 | 3.2 | 5.6 | 7.5 | 10.6 | 27 | 5.0 | 100 |
| TOSMO | 19 | 4.0 | 5.2 | 7.5 | 9.7 | 41 | 4.6 | 100 |
| COUMI | 19 | 1.8 | 3.2 | 5.4 | 7.9 | 15 | 4.7 | 100 |
| COUMO | 19 | 2.0 | 4.2 | 5.1 | 6.2 | 11 | 2.1 | 100 |
| Monthly Sweeping – Storm Events | | | | | | | | |
| TOSMI | 10 | 2.4 | 4.2 | 7.8 | 9.4 | 18 | 5.3 | 100 |
| TOSMO | 10 | 1.7 | 3.1 | 3.7 | 5.4 | 27 | 2.3 | 100 |
| COUMI | 10 | 1.3 | 1.9 | 2.7 | 3.2 | 13 | 1.3 | 100 |
| COUMO | 10 | 1.2 | 2.2 | 3.3 | 4.6 | 8.7 | 2.4 | 100 |
| Twice Monthly Sweeping – Storm Events | | | | | | | | |
| TOSMI | 15 | 1.9 | 4.75 | 5.4 | 9.65 | 47 | 4.9 | 100 |
| TOSMO | 15 | 1.6 | 2.5 | 4.8 | 8.05 | 21 | 5.55 | 100 |
| COUMI | 15 | 1.0 | 2.3 | 2.7 | 4.85 | 27 | 2.55 | 87 |
| COUMO | 15 | 1.1 | 3.2 | 3.9 | 5.35 | 40 | 2.15 | 100 |
| All Storm Events | | | | | | | | |
| TOSMI | 44 | 1.9 | 5.0 | 6.9 | 9.5 | 47 | 4.5 | 100 |
| TOSMO | 44 | 1.6 | 3.8 | 5.8 | 9.0 | 41 | 5.3 | 100 |
| COUMI | 44 | 1.0 | 2.5 | 3.3 | 5.7 | 27 | 3.2 | 95.5 |
| COUMO | 44 | 1.1 | 3.3 | 4.3 | 6.1 | 40 | 2.8 | 100 |
| Quarterly Sweeping – Base Flow | | | | | | | | |
| TOSMI | 9 | 1.0 | 1.2 | 1.7 | 3.3 | 11 | 2.1 | 88.9 |
| TOSMO | 9 | 1.0 | 1.0 | 1.0 | 1.3 | 11 | 0.3 | 44.4 |
| COUMI | 9 | 1.0 | 1.0 | 1.0 | 6.0 | 11 | 5.0 | 33.3 |
| COUMO | 9 | 1.0 | 1.0 | 1.0 | 1.1 | 11 | 0.1 | 44.4 |
| Monthly Sweeping – Base Flow | | | | | | | | |
| TOSMI | 4 | 2.2 | 2.4 | 3.3 | 5.7 | 10 | 3.3 | 100 |
| TOSMO | 4 | 1.0 | 1.0 | 1.1 | 1.4 | 2.0 | 0.4 | 50 |
| COUMI | 4 | 1.0 | 1.3 | 1.7 | 1.9 | 2.0 | 0.6 | 100 |
| COUMO | 4 | 1.0 | 1.2 | 1.2 | 1.2 | 1.3 | 0.1 | 75 |
| Twice Monthly Sweeping – Base Flow | | | | | | | | |
| TOSMI | 4 | 1.3 | 1.5 | 2.0 | 2.8 | 4.1 | 1.4 | 100 |
| TOSMO | 4 | 1.0 | 1.0 | 1.2 | 1.6 | 2.5 | 0.6 | 50 |
| COUMI | 4 | 1.0 | 1.0 | 1.0 | 1.1 | 1.3 | 0.1 | 25 |
| COUMO | 4 | 1.0 | 1.0 | 1.0 | 1.1 | 1.4 | 0.1 | 50 |
| All Base Flow | | | | | | | | |
| TOSMI | 17 | 1.0 | 1.4 | 2.2 | 3.6 | 11 | 2.2 | 94 |
| TOSMO | 17 | 1.0 | 1.0 | 1.0 | 1.3 | 11 | 0.3 | 47 |
| COUMI | 17 | 1.0 | 1.0 | 1.0 | 1.9 | 11 | 0.9 | 47 |
| COUMO | 17 | 1.0 | 1.0 | 1.0 | 1.2 | 11 | 0.2 | 53 |

ug/L: micrograms per Liter

| Table D-3. Summary Statistics for Particulate Copper (ug/L) by Station, Street Sweeping Treatment, and Sampling Event Type. | | | | | | | |
|---|---|---|---|---|---|---|---|
| | N | Minimum | 25th Percentile | Median | 75th Percentile | Maximum | Interquartile Range |
| Quarterly Sweeping – Storm Events | | | | | | | |
| TOSMI | 19 | 0.2 | 2.8 | 3.9 | 6.2 | 15 | 3.4 |
| TOSMO | 19 | 1.1 | 3.0 | 5.1 | 7.0 | 37 | 4.0 |
| COUMI | 19 | 0.3 | 1.5 | 3.0 | 4.2 | 13 | 2.7 |
| COUMO | 19 | 0.3 | 1.6 | 2.2 | 3.4 | 8.9 | 1.8 |
| Monthly Sweeping – Storm Events | | | | | | | |
| TOSMI | 10 | 0.7 | 2.2 | 3.3 | 6.3 | 17 | 4.2 |
| TOSMO | 10 | 0.7 | 1.8 | 2.1 | 2.7 | 26 | 0.9 |
| COUMI | 10 | 0.3 | 0.7 | 1.3 | 1.6 | 12 | 0.8 |
| COUMO | 10 | 0.2 | 1.0 | 1.3 | 1.8 | 7.2 | 0.7 |
| Twice Monthly Sweeping – Storm Events | | | | | | | |
| TOSMI | 15 | 0.7 | 1.9 | 3.4 | 4.3 | 42 | 2.4 |
| TOSMO | 15 | 0.2 | 0.7 | 2.6 | 5.6 | 16 | 5.0 |
| COUMI | 15 | 0.0 | 0.8 | 1.5 | 2.1 | 5.0 | 1.4 |
| COUMO | 15 | 0.1 | 0.9 | 1.3 | 2.3 | 19 | 1.4 |
| All Storm Events | | | | | | | |
| TOSMI | 44 | 0.20 | 2.0 | 3.4 | 5.8 | 42 | 3.8 |
| TOSMO | 44 | 0.20 | 1.8 | 3.1 | 6.1 | 37 | 4.4 |
| COUMI | 44 | 0.00 | 1.1 | 1.5 | 3.3 | 13 | 2.3 |
| COUMO | 44 | 0.10 | 1.1 | 1.6 | 2.8 | 19 | 1.8 |
| Quarterly Sweeping – Base Flow | | | | | | | |
| TOSMI | 9 | 0.0 | 0.2 | 0.4 | 1.9 | 10 | 1.7 |
| TOSMO | 9 | 0.0 | 0.0 | 0.0 | 0.3 | 10 | 0.3 |
| COUMI | 9 | 0.0 | 0.0 | 0.0 | 5.0 | 10 | 5.0 |
| COUMO | 9 | 0.0 | 0.0 | 0.0 | 0.1 | 10 | 0.1 |
| Monthly Sweeping – Base Flow | | | | | | | |
| TOSMI | 4 | 1.1 | 1.2 | 2.2 | 4.6 | 8.9 | 3.4 |
| TOSMO | 4 | 0.0 | 0.0 | 0.1 | 0.4 | 0.9 | 0.4 |
| COUMI | 4 | 0.0 | 0.3 | 0.7 | 0.9 | 1.0 | 0.6 |
| COUMO | 4 | 0.0 | 0.1 | 0.2 | 0.2 | 0.2 | 0.1 |
| Twice Monthly Sweeping – Base Flow | | | | | | | |
| TOSMI | 4 | 0.3 | 0.3 | 0.9 | 1.8 | 3.1 | 1.5 |
| TOSMO | 4 | 0.0 | 0.0 | 0.2 | 0.6 | 1.5 | 0.6 |
| COUMI | 4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| COUMO | 4 | 0.0 | 0.0 | 0.0 | 0.1 | 0.4 | 0.1 |
| All Base Flow | | | | | | | |
| TOSMI | 17 | 0.0 | 0.3 | 1.1 | 2.6 | 10 | 2.3 |
| TOSMO | 17 | 0.0 | 0.0 | 0.0 | 0.3 | 10 | 0.3 |
| COUMI | 17 | 0.0 | 0.0 | 0.0 | 0.9 | 10 | 0.9 |
| COUMO | 17 | 0.0 | 0.0 | 0.0 | 0.1 | 10 | 0.1 |

ug/L: micrograms per Liter

# Appendix E

## Box Plots for Total Suspended Solids, Total Copper, and Particulate Copper

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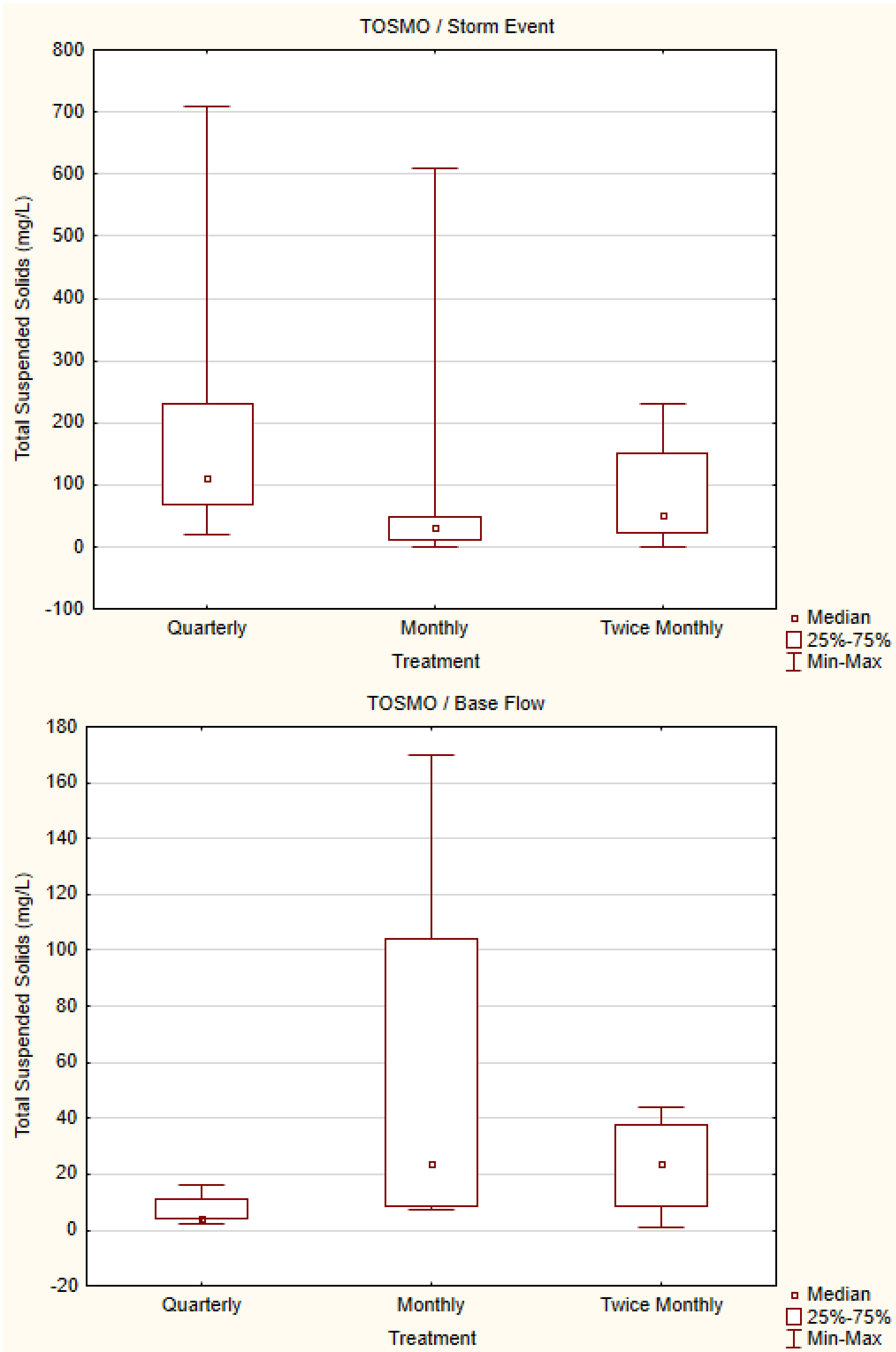
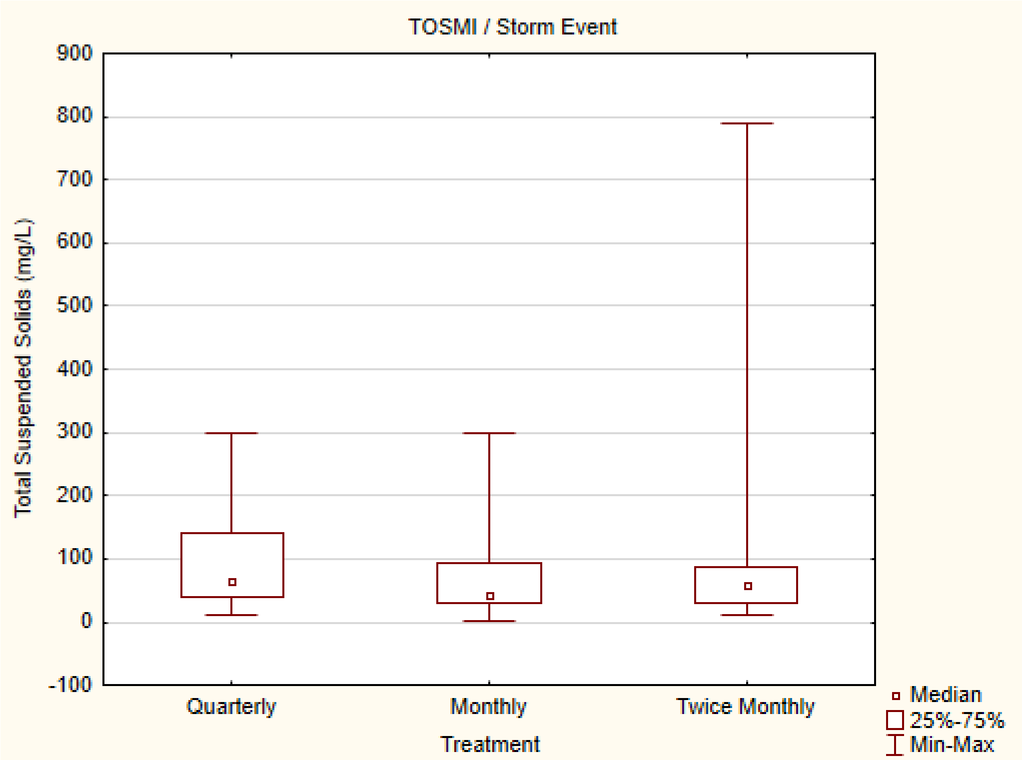
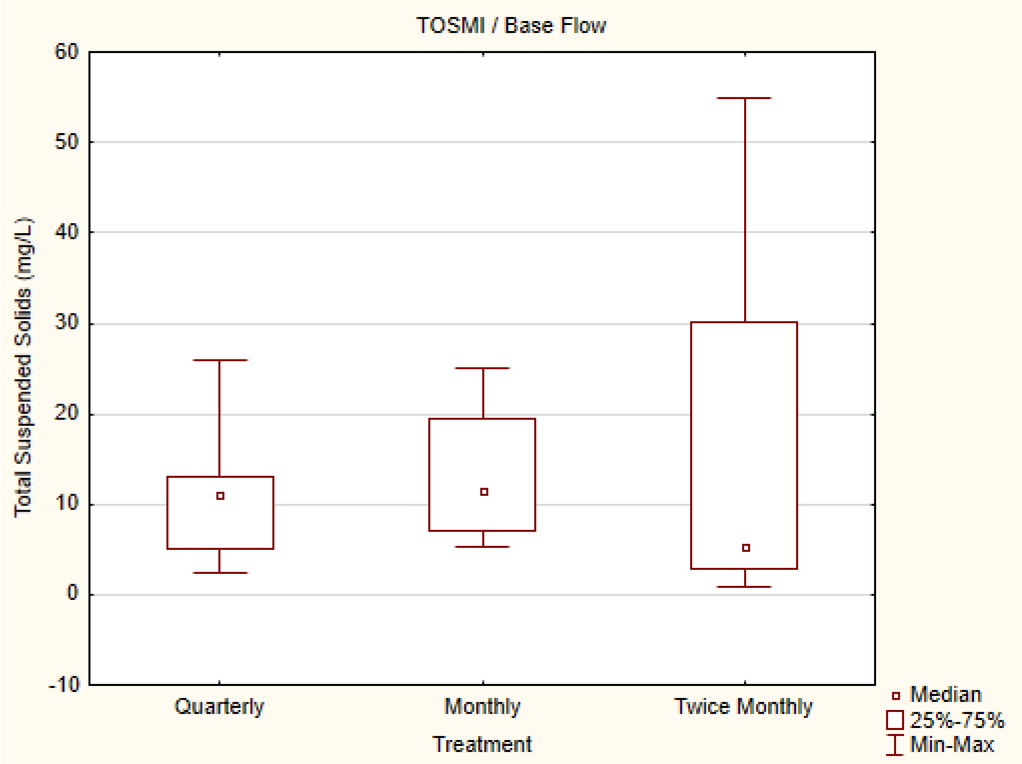
# Box Plots for TSS, Total Copper and Particulate

Total Suspended Solids

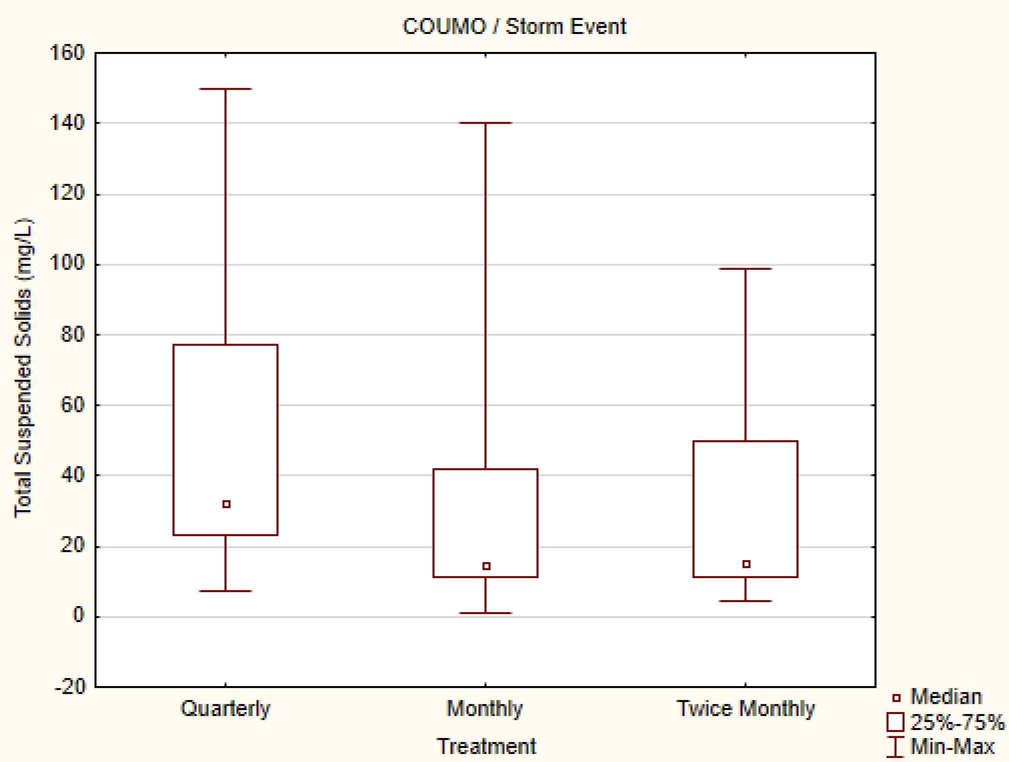




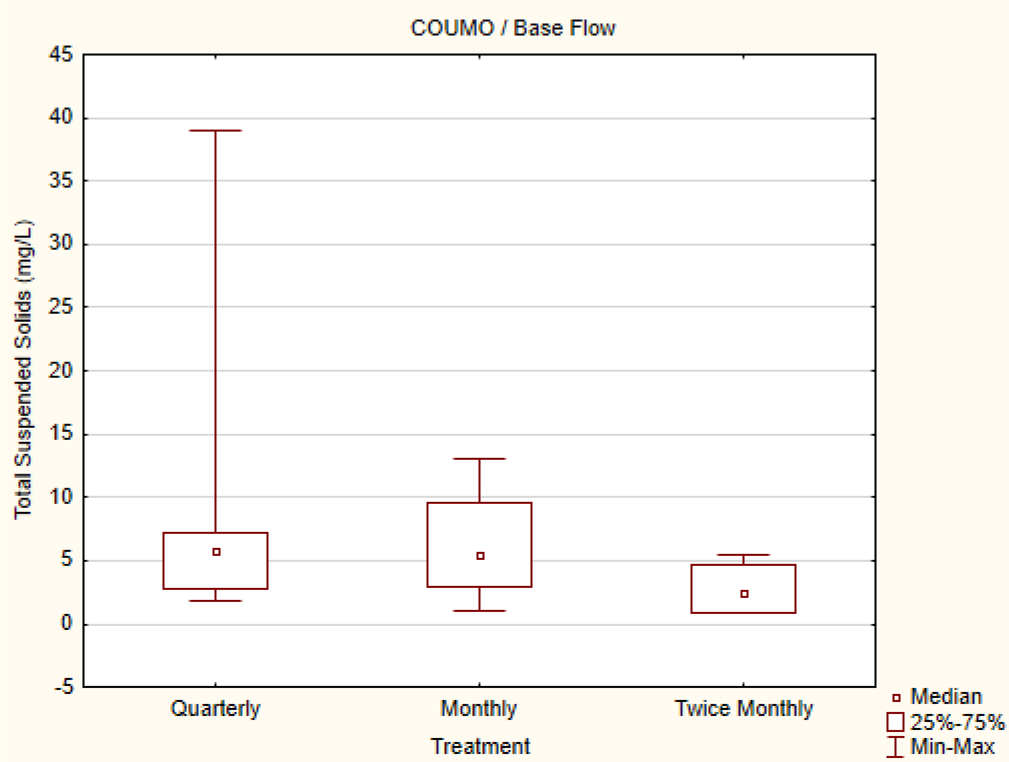
TOSMI / Storm Event
Total Suspended Solids (mg/L)
900
800
700
600
500
400
300
200
100
0
-100
Quarterly
Monthly
Twice Monthly
Treatment
Median
25%-75%
Min-Max

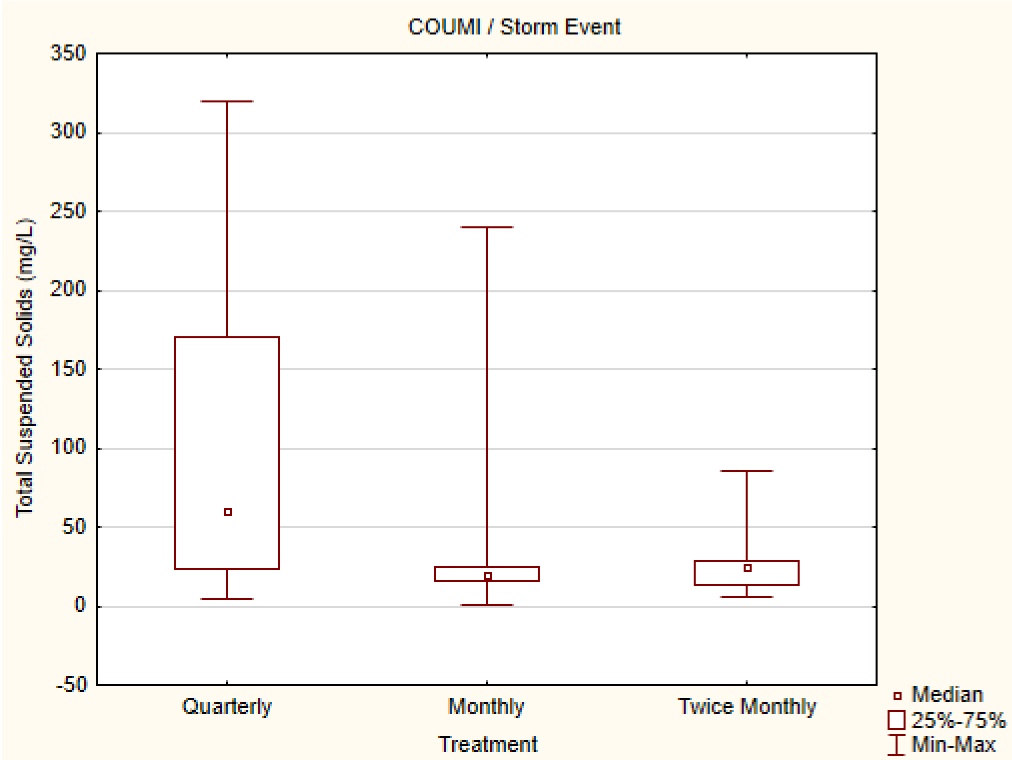
TOSMI / Base Flow
Total Suspended Solids (mg/L)
60
50
40
30
20
10
0
-10
Quarterly
Monthly
Twice Monthly
Treatment
Median
25%-75%
Min-Max

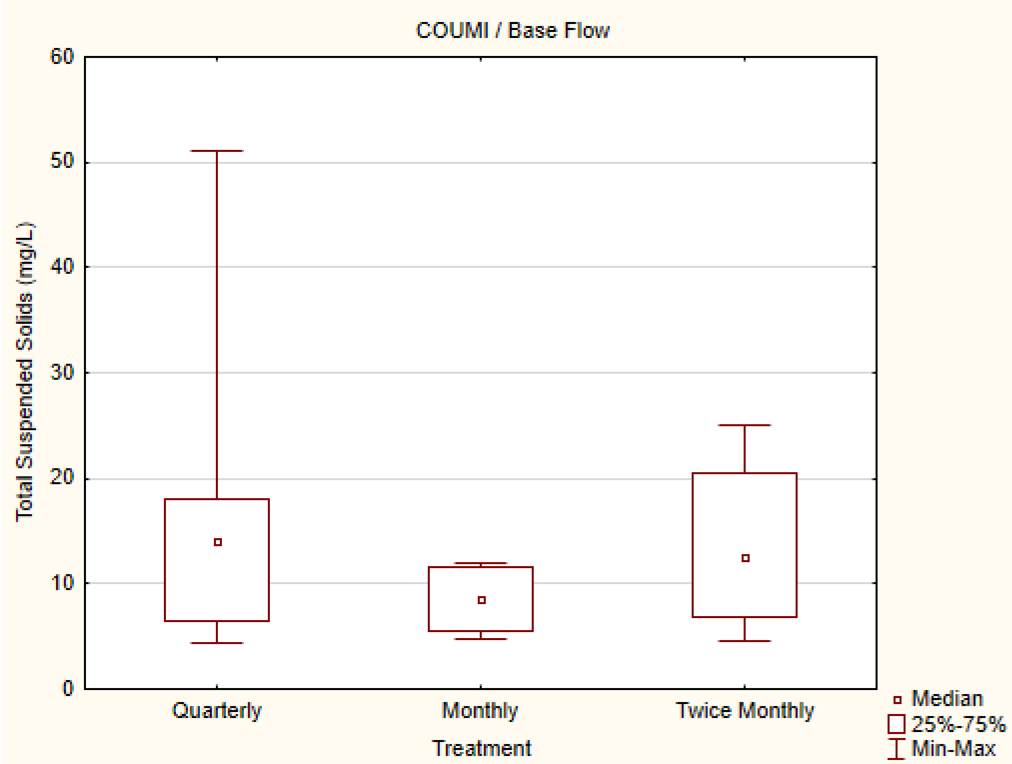


COUMO / Storm Event
160
140
120
100
80
60
40
20
0
-20
Total Suspended Solids (mg/L)
Quarterly
Monthly
Twice Monthly
Treatment
Median
25%-75%
Min-Max

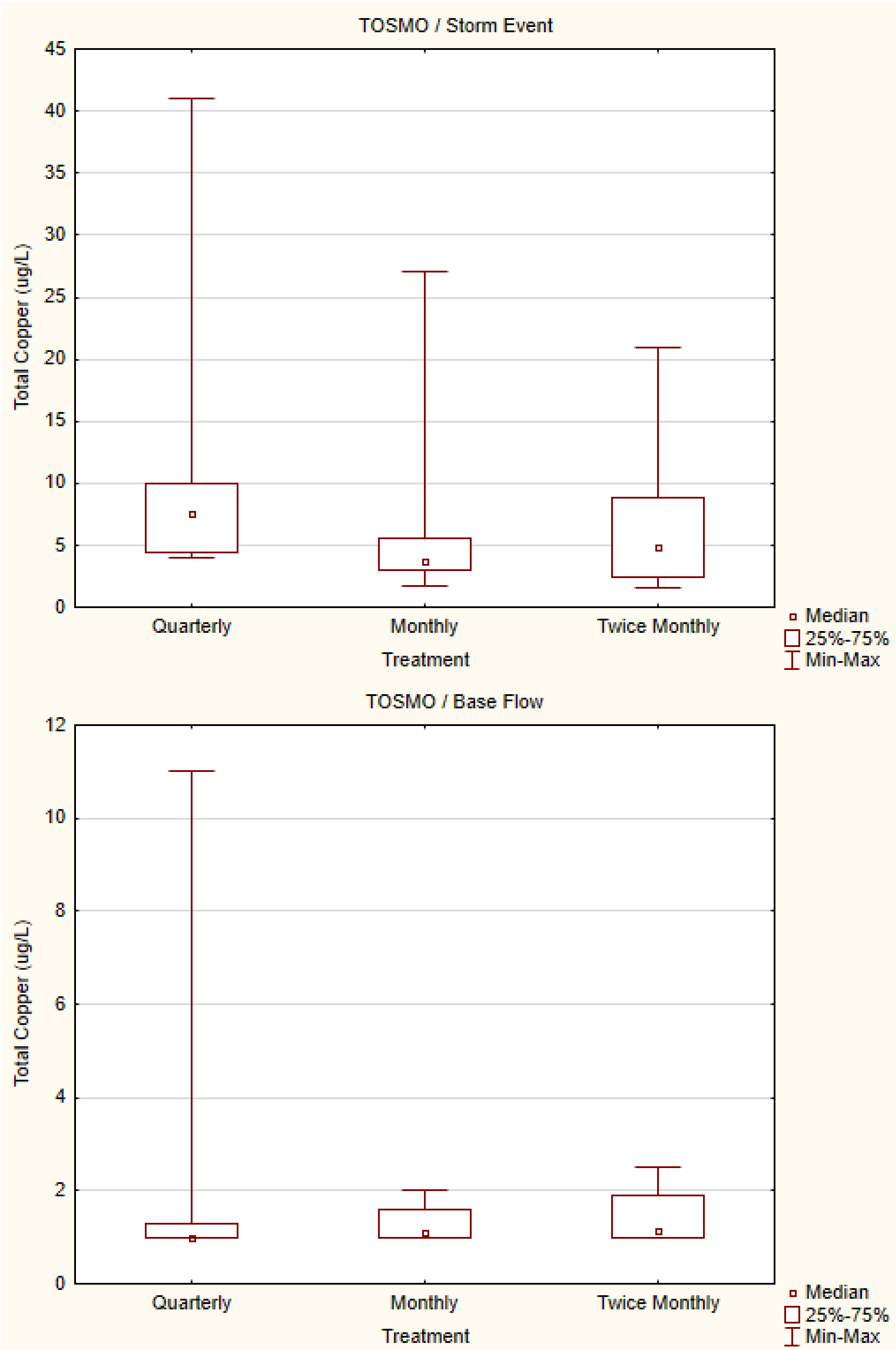



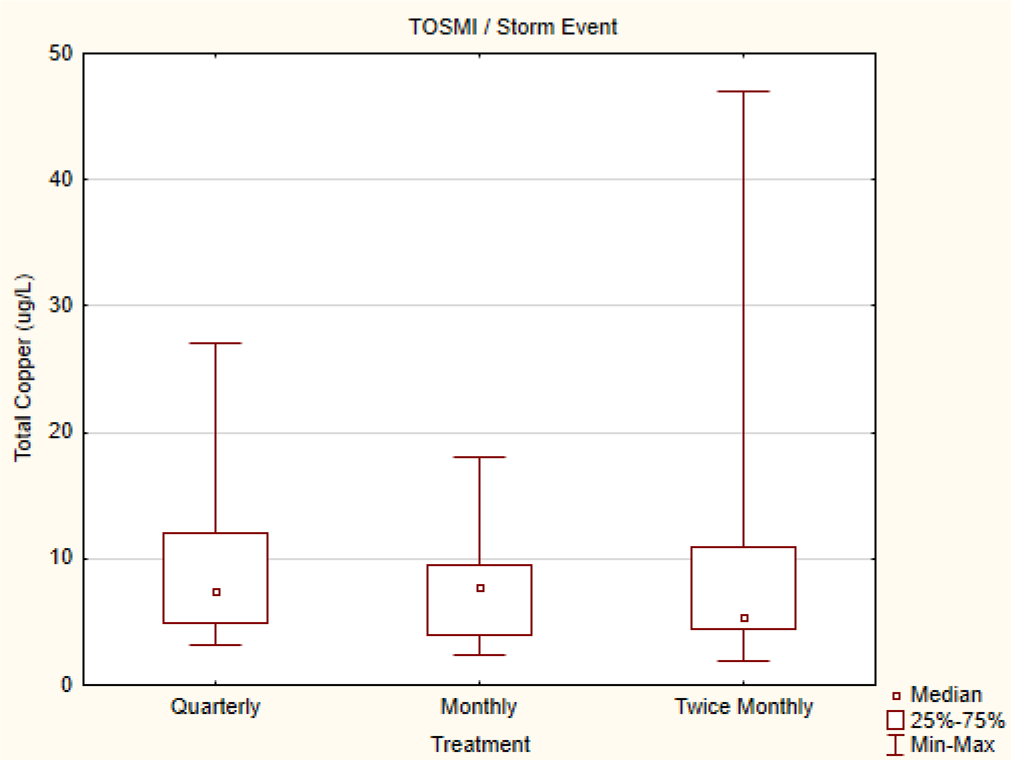
COUMO / Base Flow
45
40
35
30
25
20
15
10
5
0
-5
Total Suspended Solids (mg/L)
Quarterly
Monthly
Twice Monthly
Treatment
Median
25%-75%
Min-Max

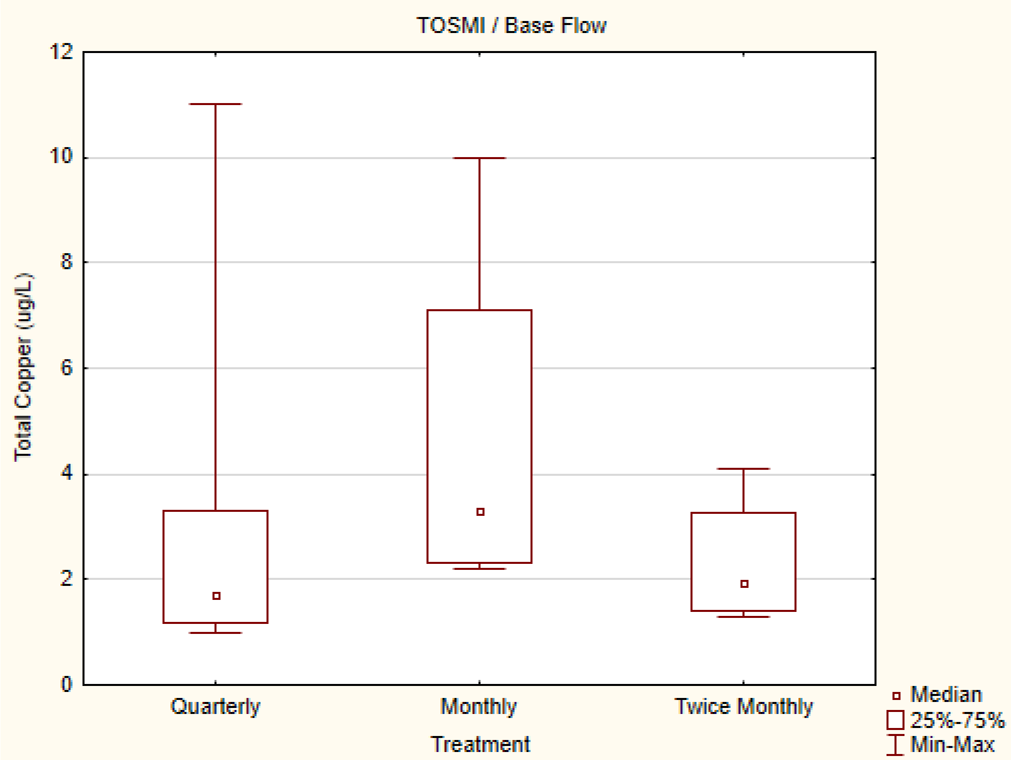

COUMI / Storm Event
Total Suspended Solids (mg/L)
350
300
250
200
150
100
50
0
-50
Quarterly
Monthly
Twice Monthly
Treatment
Median
25%-75%
Min-Max

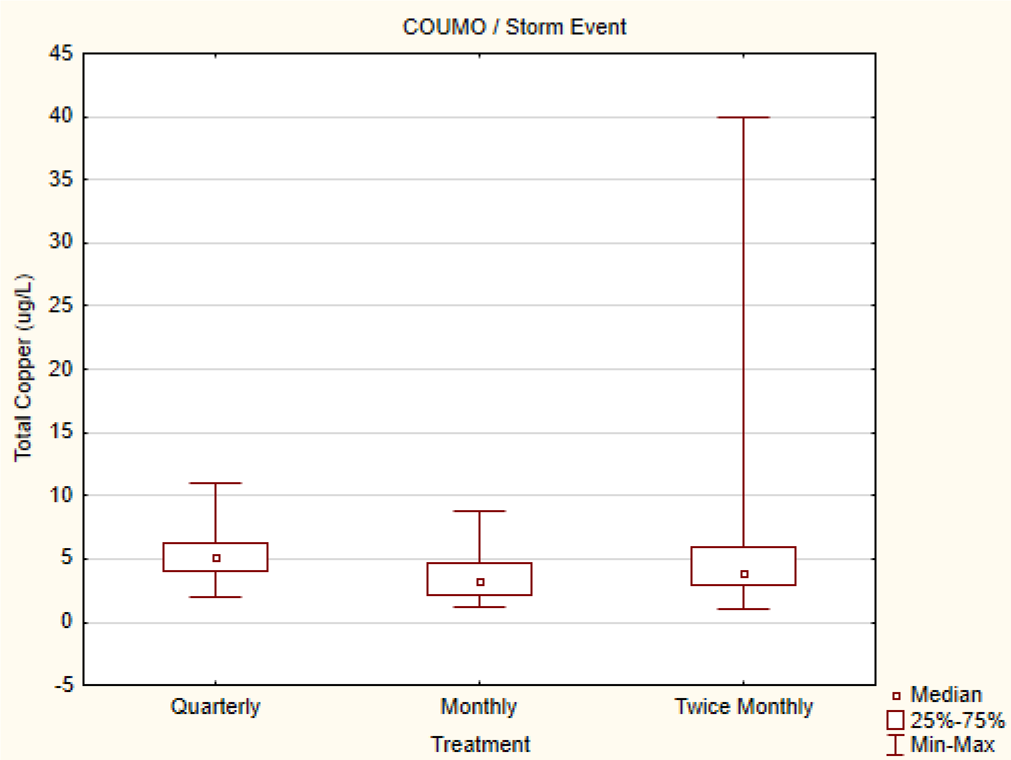

COUMI / Base Flow
Total Suspended Solids (mg/L)
60
50
40
30
20
10
0
Quarterly
Monthly
Twice Monthly
Treatment
Median
25%-75%
Min-Max

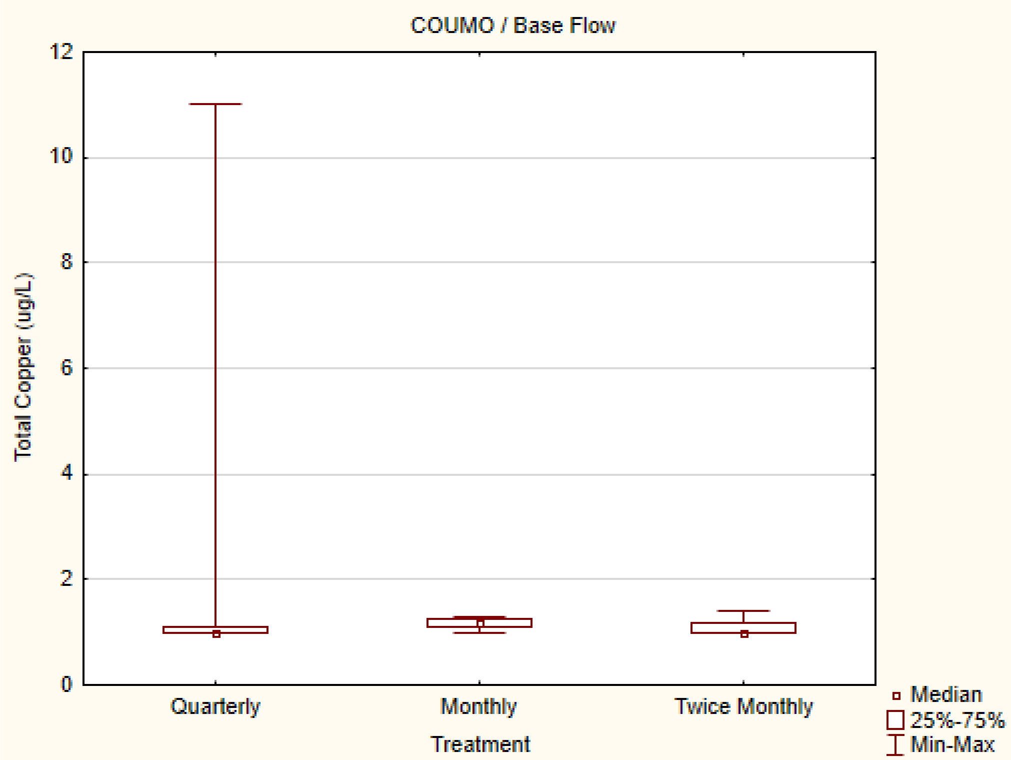
Total Copper (µg/L)

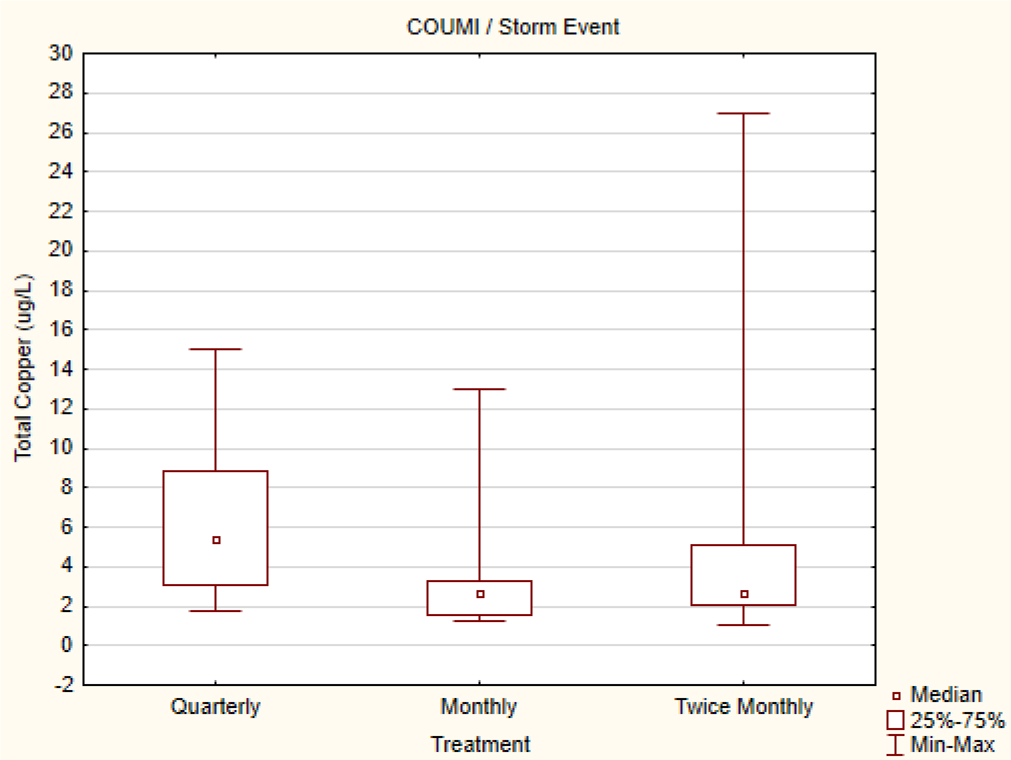


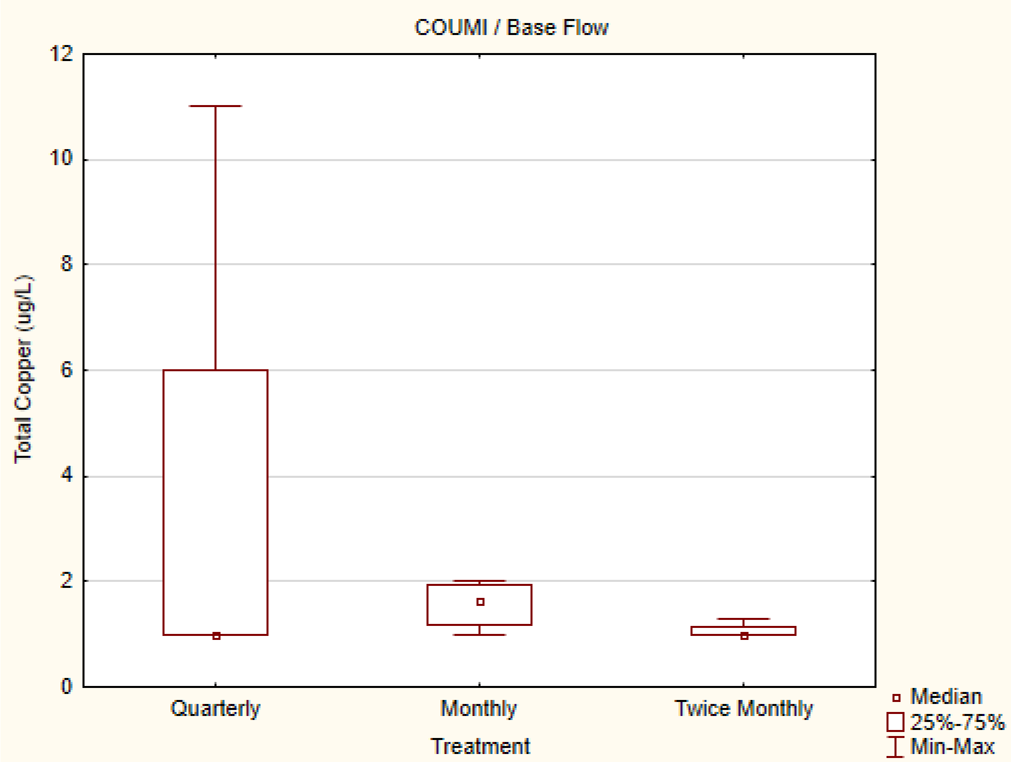

TOSMI / Storm Event
Total Copper (ug/L)
50
40
30
20
10
0
Quarterly
Monthly
Twice Monthly
Treatment
Median
25%-75%
Min-Max


TOSMI / Base Flow
Total Copper (ug/L)
12
10
8
6
4
2
0
Quarterly
Monthly
Twice Monthly
Treatment
Median
25%-75%
Min-Max

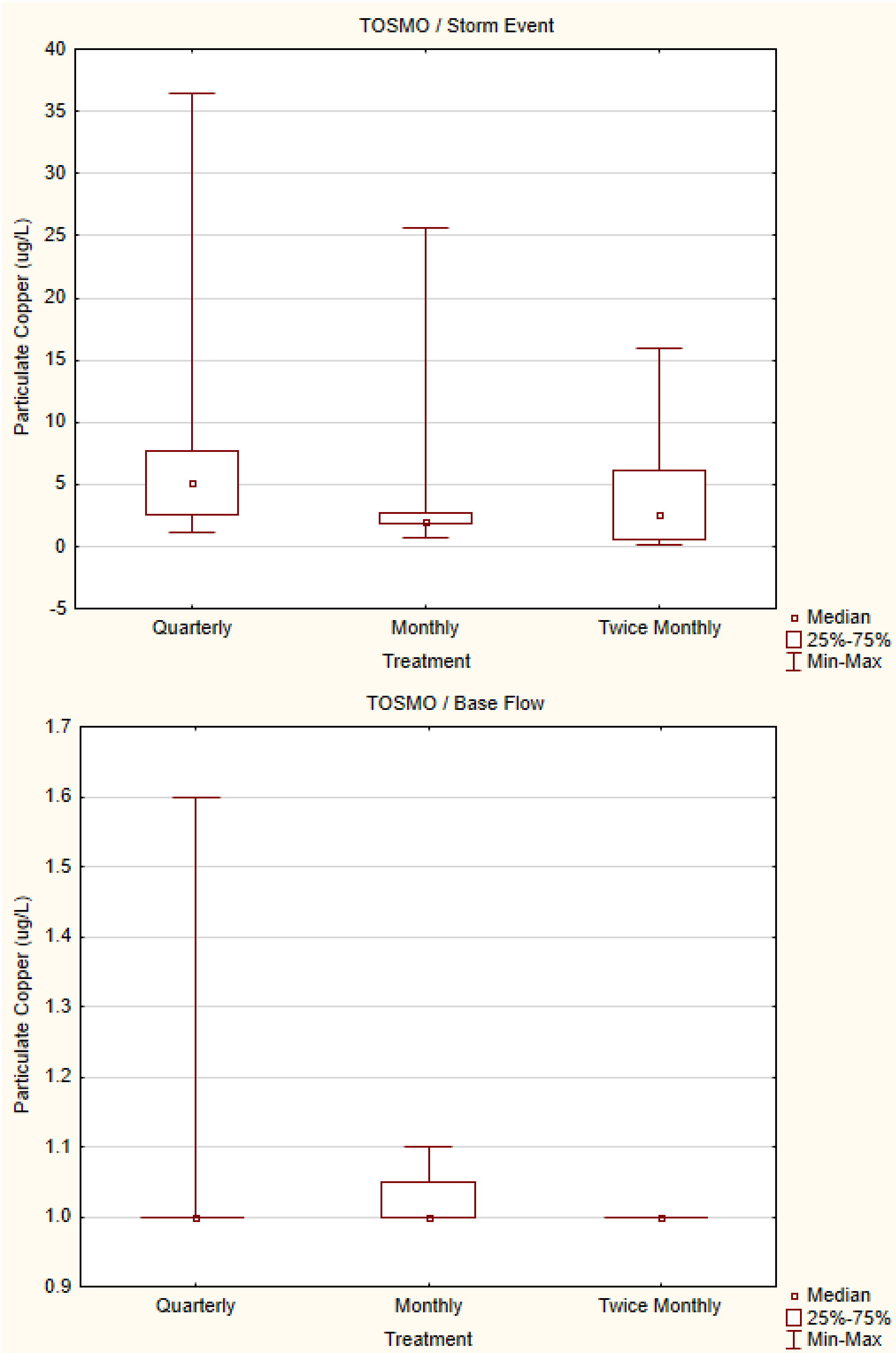

COUMO / Storm Event
Total Copper (ug/L)
45
40
35
30
25
20
15
10
5
0
-5
Quarterly
Monthly
Twice Monthly
Treatment
Median
25%-75%
Min-Max

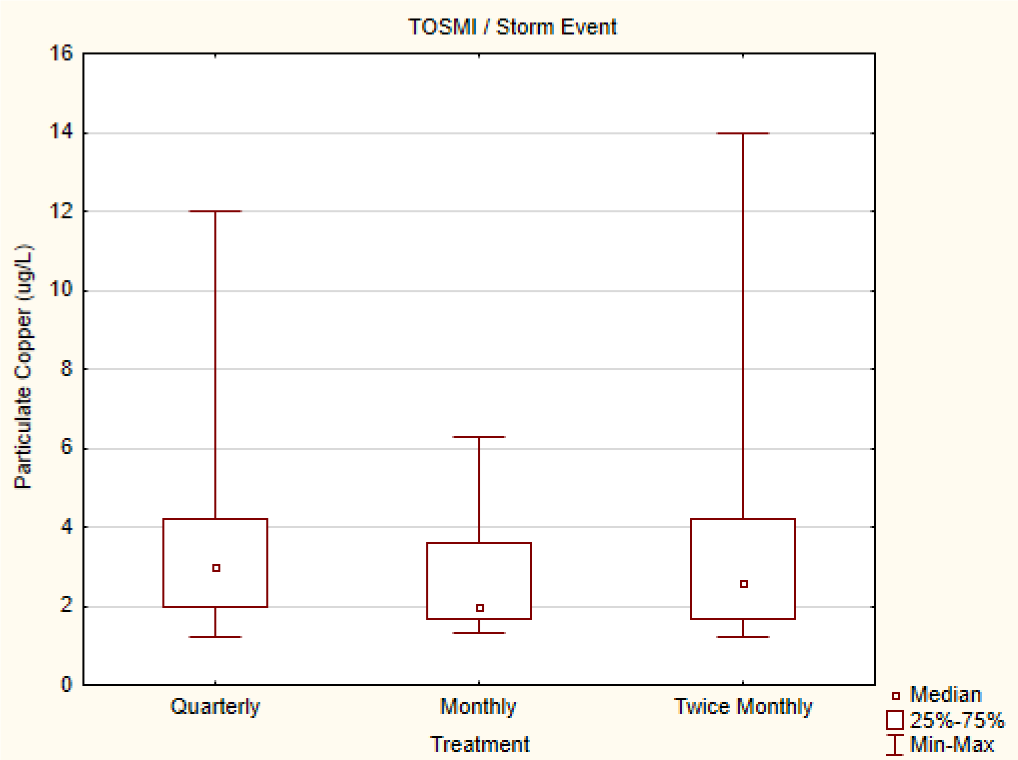

COUMO / Base Flow
Total Copper (ug/L)
12
10
8
6
4
2
0
Quarterly
Monthly
Twice Monthly
Treatment
Median
25%-75%
Min-Max

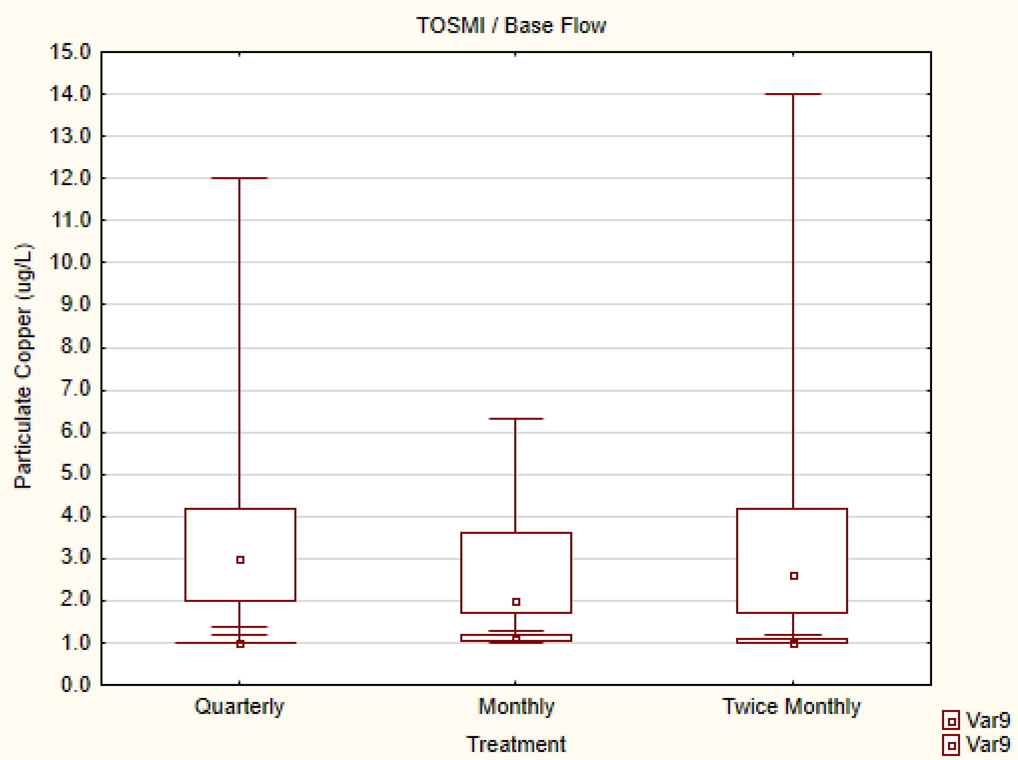

COUMI / Storm Event
Total Copper (ug/L)
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
-2
Quarterly
Monthly
Twice Monthly
Treatment
Median
25%-75%
Min-Max

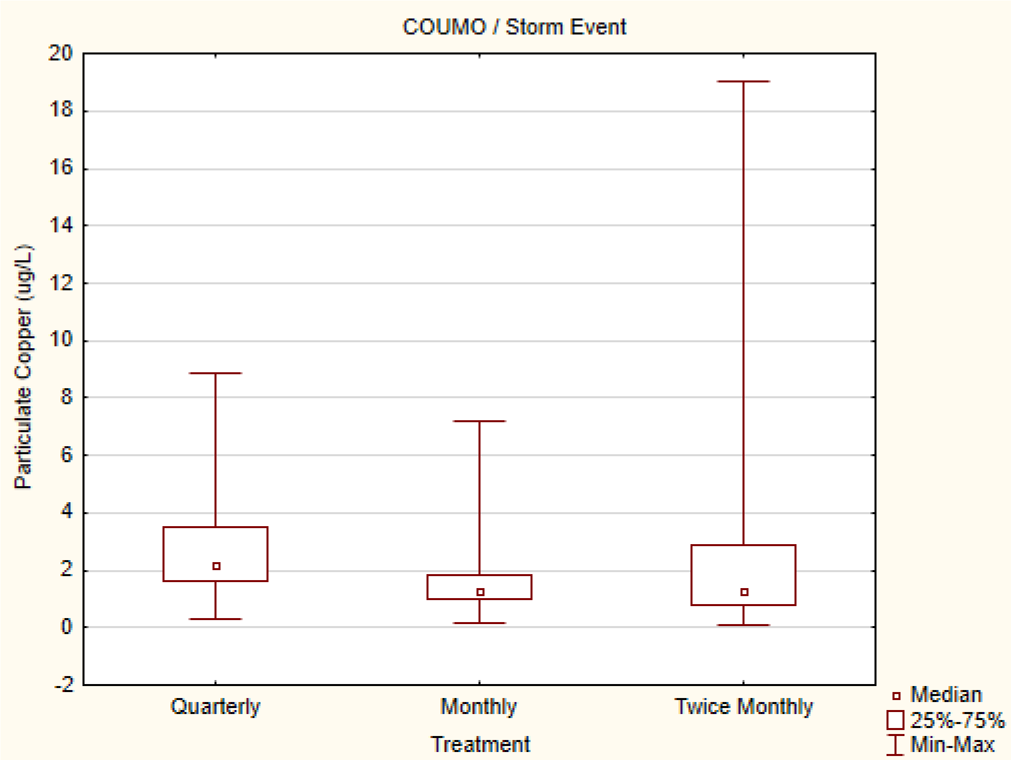

COUMI / Base Flow
Total Copper (ug/L)
12
10
8
6
4
2
0
Quarterly
Monthly
Twice Monthly
Treatment
Median
25%-75%
Min-Max

Particulate Copper (µg/L)

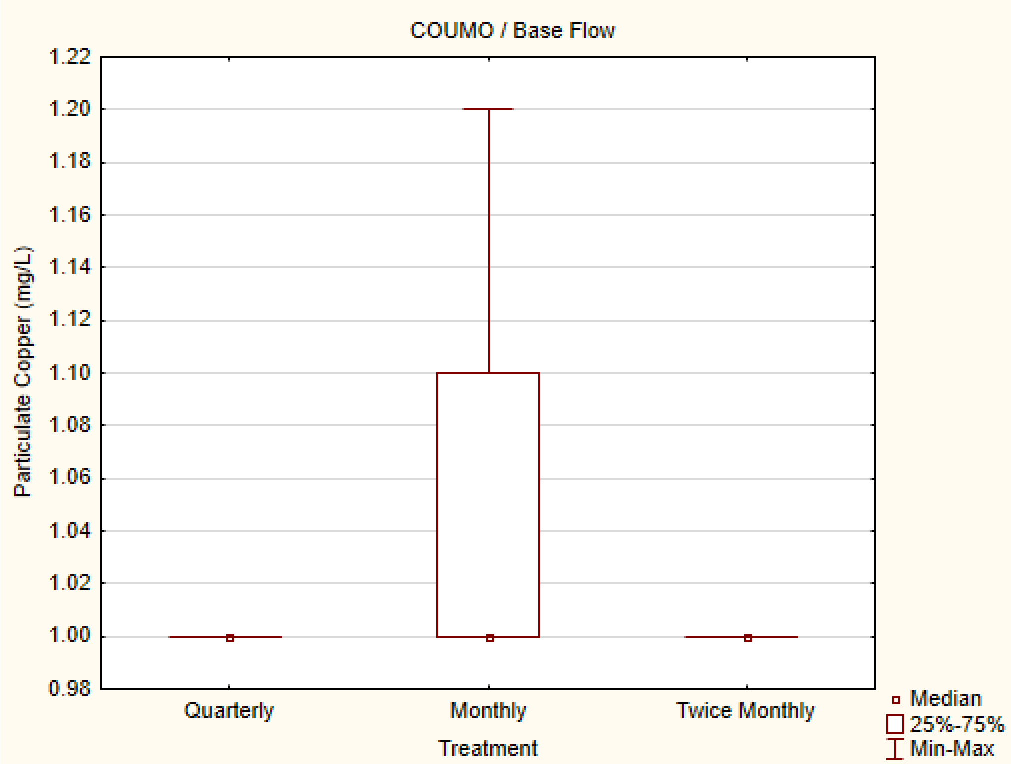



TOSMI / Storm Event
Particulate Copper (ug/L)
16
14
12
10
8
6
4
2
0
Quarterly
Monthly
Twice Monthly
Treatment
Median
25%-75%
Min-Max

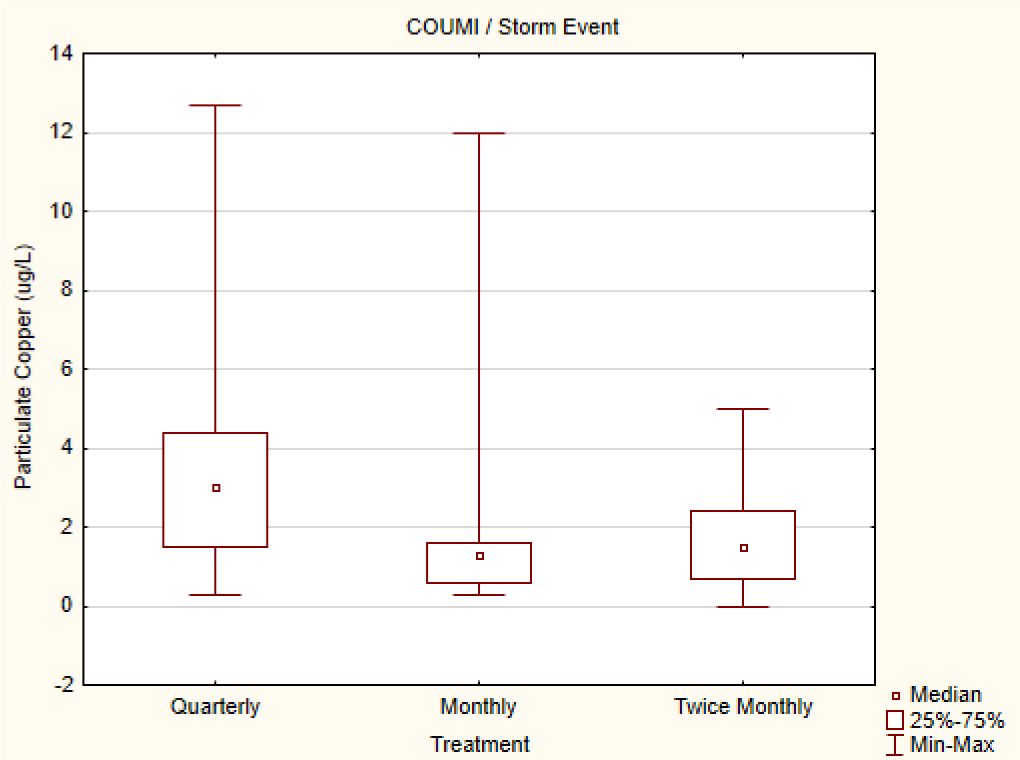

TOSMI / Base Flow
Particulate Copper (ug/L)
15.0
14.0
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Quarterly
Monthly
Twice Monthly
Treatment
Var9
Var9

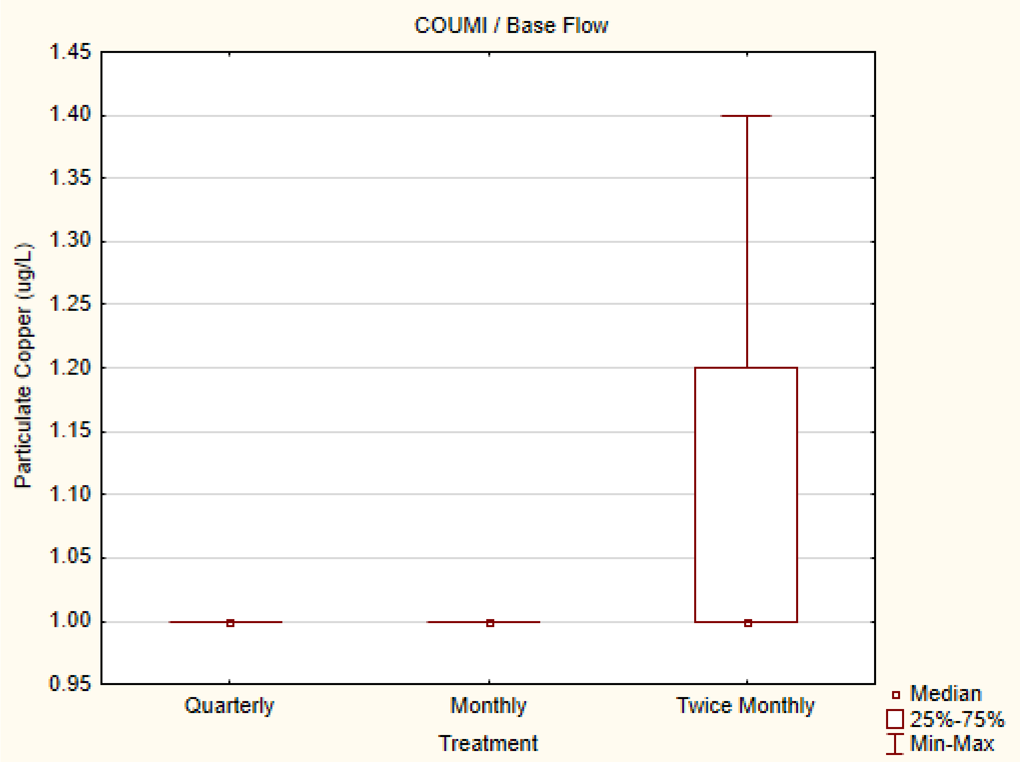


COUMO / Storm Event
Particulate Copper (ug/L)
20
18
16
14
12
10
8
6
4
2
0
-2
Quarterly
Monthly
Twice Monthly
Treatment
Median
25%-75%
Min-Max

COUMO / Base Flow
Particulate Copper (mg/L)
1.22
1.20
1.18
1.16
1.14
1.12
1.10
1.08
1.06
1.04
1.02
1.00
0.98
Quarterly
Monthly
Twice Monthly
Treatment
Median
25%-75%
Min-Max


COUMI / Storm Event
Particulate Copper (ug/L)
14
12
10
8
6
4
2
0
-2
Quarterly
Monthly
Twice Monthly
Treatment
Median
25%-75%
Min-Max


COUMI / Base Flow
Particulate Copper (ug/L)
1.45
1.40
1.35
1.30
1.25
1.20
1.15
1.10
1.05
1.00
0.95
Quarterly
Monthly
Twice Monthly
Treatment
Median
25%-75%
Min-Max

# Appendix F

## Mann-Whitney U Test Results

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| Table F-1. Mann-Whitney U Test Results. | | | | | |
|---|---|---|---|---|---|
| **Station Type** | **Station** | **Parameter** | **Event Type** | **n** | **p-value** |
| Tosh Creek Watershed Stations: Increased Sweeping Experimental | TOSMO | Total Suspended Solids | Base | 8 | 0.442857143 |
| | TOSMO | Total Suspended Solids | Storm | 27 | 0.823137492 |
| | TOSMO | Total Copper | Base | 8 | 0.795824015 |
| | TOSMO | Total Copper | Storm | 27 | 0.567833375 |
| | TOSMO | 1-Methylnaphthalene | Base | 8 | 0.669401646 |
| | TOSMO | 1-Methylnaphthalene | Storm | 22 | 0.104591253 |
| | TOSMO | 2-Methylnaphthalene | Base | 8 | 0.669401646 |
| | TOSMO | 2-Methylnaphthalene | Storm | 22 | 0.104591253 |
| | TOSMO | Acenaphthene | Base | 8 | 0.669401646 |
| | TOSMO | Acenaphthene | Storm | 22 | 0.104591253 |
| | TOSMO | Acenaphthylene | Base | 8 | 0.669401646 |
| | TOSMO | Acenaphthylene | Storm | 22 | 0.104591253 |
| | TOSMO | Anthracene | Base | 8 | 0.669401646 |
| | TOSMO | Anthracene | Storm | 22 | 0.104591253 |
| | TOSMO | Benz[a]anthracene | Base | 8 | 0.669401646 |
| | TOSMO | Benz[a]anthracene | Storm | 22 | 0.049371941 |
| | TOSMO | Benzo(a)pyrene | Base | 8 | 0.669401646 |
| | TOSMO | Benzo(a)pyrene | Storm | 22 | 0.117478908 |
| | TOSMO | Benzo(b)fluoranthene | Base | 8 | 0.669401646 |
| | TOSMO | Benzo(b)fluoranthene | Storm | 22 | 0.677726767 |
| | TOSMO | Benzo(ghi)perylene | Base | 8 | 0.669401646 |
| | TOSMO | Benzo(ghi)perylene | Storm | 22 | 0.244274523 |
| | TOSMO | Benzo(j,k)fluoranthene | Base | 8 | 0.669401646 |
| | TOSMO | Benzo(j,k)fluoranthene | Storm | 22 | 0.087900306 |
| | TOSMO | Chrysene | Base | 8 | 0.669401646 |
| | TOSMO | Chrysene | Storm | 22 | 0.124175476 |
| | TOSMO | Dibenzo(a,h)anthracene | Base | 8 | 0.669401646 |
| | TOSMO | Dibenzo(a,h)anthracene | Storm | 22 | 0.087900306 |
| | TOSMO | Fluoranthene | Base | 8 | 0.669401646 |
| | TOSMO | Fluoranthene | Storm | 22 | 0.160944278 |
| | TOSMO | Fluorene | Base | 8 | 0.669401646 |
| | TOSMO | Fluorene | Storm | 22 | 0.104591253 |
| | TOSMO | Indeno(1,2,3-cd)pyrene | Base | 8 | 0.669401646 |
| | TOSMO | Indeno(1,2,3-cd)pyrene | Storm | 22 | 0.111170337 |
| | TOSMO | Naphthalene | Base | 8 | 0.669401646 |
| | TOSMO | Naphthalene | Storm | 22 | 0.104591253 |
| | TOSMO | Phenanthrene | Base | 8 | 0.669401646 |
| | TOSMO | Phenanthrene | Storm | 22 | 0.160944278 |
| | TOSMO | Pyrene | Base | 8 | 0.669401646 |
| | TOSMO | Pyrene | Storm | 22 | 0.160944278 |
| | TOSMO | 6PPD-quinone | Base | 8 | 0.171428571 |
| | TOSMO | 6PPD-quinone | Storm | 22 | 0.43478335 |

| Table F-1. Mann-Whitney U Test Results. | | | | | |
|---|---|---|---|---|---|
| **Station Type** | **Station** | **Parameter** | **Event Type** | **n** | **p-value** |
| Tosh Creek Watershed Stations: Increased Sweeping Experimental | TOSMI | Total Suspended Solids | Base | 8 | 0.385751705 |
| | TOSMI | Total Suspended Solids | Storm | 27 | 0.704334748 |
| | TOSMI | Total Copper | Base | 8 | 0.385751705 |
| | TOSMI | Total Copper | Storm | 27 | 0.480532423 |
| | TOSMI | 1-Methylnaphthalene | Base | 8 | 0.229798693 |
| | TOSMI | 1-Methylnaphthalene | Storm | 22 | 0.080414695 |
| | TOSMI | 2-Methylnaphthalene | Base | 8 | 0.229798693 |
| | TOSMI | 2-Methylnaphthalene | Storm | 22 | 0.080414695 |
| | TOSMI | Acenaphthene | Base | 8 | 0.229798693 |
| | TOSMI | Acenaphthene | Storm | 22 | 0.080414695 |
| | TOSMI | Acenaphthylene | Base | 8 | 0.229798693 |
| | TOSMI | Acenaphthylene | Storm | 22 | 0.080414695 |
| | TOSMI | Anthracene | Base | 8 | 0.229798693 |
| | TOSMI | Anthracene | Storm | 22 | 0.080414695 |
| | TOSMI | Benz[a]anthracene | Base | 8 | 0.229798693 |
| | TOSMI | Benz[a]anthracene | Storm | 22 | 0.120558463 |
| | TOSMI | Benzo(a)pyrene | Base | 8 | 0.229798693 |
| | TOSMI | Benzo(a)pyrene | Storm | 22 | 0.368020785 |
| | TOSMI | Benzo(b)fluoranthene | Base | 8 | 0.229798693 |
| | TOSMI | Benzo(b)fluoranthene | Storm | 22 | 0.838710775 |
| | TOSMI | Benzo(ghi)perylene | Base | 8 | 0.229798693 |
| | TOSMI | Benzo(ghi)perylene | Storm | 22 | 0.63009194 |
| | TOSMI | Benzo(j,k)fluoranthene | Base | 8 | 0.229798693 |
| | TOSMI | Benzo(j,k)fluoranthene | Storm | 22 | 0.163922489 |
| | TOSMI | Chrysene | Base | 8 | 0.229798693 |
| | TOSMI | Chrysene | Storm | 22 | 0.578924598 |
| | TOSMI | Dibenzo(a,h)anthracene | Base | 8 | 0.229798693 |
| | TOSMI | Dibenzo(a,h)anthracene | Storm | 22 | 0.080414695 |
| | TOSMI | Fluoranthene | Base | 8 | 0.229798693 |
| | TOSMI | Fluoranthene | Storm | 22 | 0.080414695 |
| | TOSMI | Fluorene | Base | 8 | 0.229798693 |
| | TOSMI | Fluorene | Storm | 22 | 0.080414695 |
| | TOSMI | Indeno(1,2,3-cd)pyrene | Base | 8 | 0.229798693 |
| | TOSMI | Indeno(1,2,3-cd)pyrene | Storm | 22 | 0.667989667 |
| | TOSMI | Naphthalene | Base | 8 | 0.229798693 |
| | TOSMI | Naphthalene | Storm | 22 | 0.080414695 |
| | TOSMI | Phenanthrene | Base | 8 | 0.229798693 |
| | TOSMI | Phenanthrene | Storm | 22 | 0.080414695 |
| | TOSMI | Pyrene | Base | 8 | 0.229798693 |
| | TOSMI | Pyrene | Storm | 22 | 0.080414695 |
| | TOSMI | 6PPD-quinone | Base | 8 | 0.442857143 |
| | TOSMI | 6PPD-quinone | Storm | 22 | 0.551168646 |

| Table F-1. Mann-Whitney U Test Results. | | | | | |
|---|---|---|---|---|---|
| **Station Type** | **Station** | **Parameter** | **Event Type** | **n** | **p-value** |
| Country Creek Watershed Stations: No Increased Sweeping Control | COUMO | Total Suspended Solids | Base | 8 | 0.055105091 |
| | COUMO | Total Suspended Solids | Storm | 27 | 0.643012335 |
| | COUMO | Total Copper | Base | 8 | 0.56110886 |
| | COUMO | Total Copper | Storm | 27 | 0.80367635 |
| | COUMO | 1-Methylnaphthalene | Base | 8 | 0.178085164 |
| | COUMO | 1-Methylnaphthalene | Storm | 22 | 0.445657207 |
| | COUMO | 2-Methylnaphthalene | Base | 8 | 0.178085164 |
| | COUMO | 2-Methylnaphthalene | Storm | 22 | 0.445657207 |
| | COUMO | Acenaphthene | Base | 8 | 0.178085164 |
| | COUMO | Acenaphthene | Storm | 22 | 0.445657207 |
| | COUMO | Acenaphthylene | Base | 8 | 0.178085164 |
| | COUMO | Acenaphthylene | Storm | 22 | 0.445657207 |
| | COUMO | Anthracene | Base | 8 | 0.178085164 |
| | COUMO | Anthracene | Storm | 22 | 0.445657207 |
| | COUMO | Benz[a]anthracene | Base | 8 | 0.178085164 |
| | COUMO | Benz[a]anthracene | Storm | 22 | 0.306286521 |
| | COUMO | Benzo(a)pyrene | Base | 8 | 0.178085164 |
| | COUMO | Benzo(a)pyrene | Storm | 22 | 0.446683713 |
| | COUMO | Benzo(b)fluoranthene | Base | 8 | 0.091575102 |
| | COUMO | Benzo(b)fluoranthene | Storm | 22 | 0.679155652 |
| | COUMO | Benzo(ghi)perylene | Base | 8 | 0.178085164 |
| | COUMO | Benzo(ghi)perylene | Storm | 22 | 0.473282005 |
| | COUMO | Benzo(j,k)fluoranthene | Base | 8 | 0.178085164 |
| | COUMO | Benzo(j,k)fluoranthene | Storm | 22 | 0.355059613 |
| | COUMO | Chrysene | Base | 8 | 0.178085164 |
| | COUMO | Chrysene | Storm | 22 | 0.473282005 |
| | COUMO | Dibenzo(a,h)anthracene | Base | 8 | 0.178085164 |
| | COUMO | Dibenzo(a,h)anthracene | Storm | 22 | 0.446683713 |
| | COUMO | Fluoranthene | Base | 8 | 0.178085164 |
| | COUMO | Fluoranthene | Storm | 22 | 0.445657207 |
| | COUMO | Fluorene | Base | 8 | 0.178085164 |
| | COUMO | Fluorene | Storm | 22 | 0.445657207 |
| | COUMO | Indeno(1,2,3-cd)pyrene | Base | 8 | 0.178085164 |
| | COUMO | Indeno(1,2,3-cd)pyrene | Storm | 22 | 0.566130121 |
| | COUMO | Naphthalene | Base | 8 | 0.178085164 |
| | COUMO | Naphthalene | Storm | 22 | 0.445657207 |
| | COUMO | Phenanthrene | Base | 8 | 0.178085164 |
| | COUMO | Phenanthrene | Storm | 22 | 0.445657207 |
| | COUMO | Pyrene | Base | 8 | 0.178085164 |
| | COUMO | Pyrene | Storm | 22 | 0.445657207 |
| | COUMO | 6PPD-quinone | Base | 8 | 0.171428571 |
| | COUMO | 6PPD-quinone | Storm | 22 | 0.985967464 |

| Table F-1. Mann-Whitney U Test Results. | | | | | |
|---|---|---|---|---|---|
| **Station Type** | **Station** | **Parameter** | **Event Type** | **n** | **p-value** |
| Country Creek Watershed Stations: No Increased Sweeping Control | COUMI | Total Suspended Solids | Base | 8 | 0.657142857 |
| | COUMI | Total Suspended Solids | Storm | 27 | 0.678566537 |
| | COUMI | Total Copper | Base | 8 | 0.062047329 |
| | COUMI | Total Copper | Storm | 27 | 0.605920034 |
| | COUMI | 1-Methylnaphthalene | Base | 8 | 0.7790254 |
| | COUMI | 1-Methylnaphthalene | Storm | 22 | 0.017973601 |
| | COUMI | 2-Methylnaphthalene | Base | 8 | 0.7790254 |
| | COUMI | 2-Methylnaphthalene | Storm | 22 | 0.017973601 |
| | COUMI | Acenaphthene | Base | 8 | 0.7790254 |
| | COUMI | Acenaphthene | Storm | 22 | 0.017973601 |
| | COUMI | Acenaphthylene | Base | 8 | 0.7790254 |
| | COUMI | Acenaphthylene | Storm | 22 | 0.017973601 |
| | COUMI | Anthracene | Base | 8 | 0.7790254 |
| | COUMI | Anthracene | Storm | 22 | 0.017973601 |
| | COUMI | Benz[a]anthracene | Base | 8 | 0.7790254 |
| | COUMI | Benz[a]anthracene | Storm | 22 | 0.370340486 |
| | COUMI | Benzo(a)pyrene | Base | 8 | 0.849738844 |
| | COUMI | Benzo(a)pyrene | Storm | 22 | 0.298168753 |
| | COUMI | Benzo(b)fluoranthene | Base | 8 | 0.849738844 |
| | COUMI | Benzo(b)fluoranthene | Storm | 22 | 0.616607587 |
| | COUMI | Benzo(ghi)perylene | Base | 8 | 0.849738844 |
| | COUMI | Benzo(ghi)perylene | Storm | 22 | 0.177119322 |
| | COUMI | Benzo(j,k)fluoranthene | Base | 8 | 0.7790254 |
| | COUMI | Benzo(j,k)fluoranthene | Storm | 22 | 0.081050354 |
| | COUMI | Chrysene | Base | 8 | 0.849738844 |
| | COUMI | Chrysene | Storm | 22 | 0.629338008 |
| | COUMI | Dibenzo(a,h)anthracene | Base | 8 | 0.7790254 |
| | COUMI | Dibenzo(a,h)anthracene | Storm | 22 | 0.009794295 |
| | COUMI | Fluoranthene | Base | 8 | 0.7790254 |
| | COUMI | Fluoranthene | Storm | 22 | 0.013402698 |
| | COUMI | Fluorene | Base | 8 | 0.7790254 |
| | COUMI | Fluorene | Storm | 22 | 0.017973601 |
| | COUMI | Indeno(1,2,3-cd)pyrene | Base | 8 | 0.849738844 |
| | COUMI | Indeno(1,2,3-cd)pyrene | Storm | 22 | 0.629373613 |
| | COUMI | Naphthalene | Base | 8 | 0.7790254 |
| | COUMI | Naphthalene | Storm | 22 | 0.017973601 |
| | COUMI | Phenanthrene | Base | 8 | 0.7790254 |
| | COUMI | Phenanthrene | Storm | 22 | 0.017973601 |
| | COUMI | Pyrene | Base | 8 | 0.7790254 |
| | COUMI | Pyrene | Storm | 22 | 0.013402698 |
| | COUMI | 6PPD-quinone | Base | 8 | 0.242857143 |
| | COUMI | 6PPD-quinone | Storm | 22 | 0.551168646 |

[a] Values in red indicate a significant difference was detected for the indicated parameter between the street sweeping treatments based on results from a one-tailed Mann-Whitney U test at an a-level of 0.05.

# Appendix G

## Kruskal-Wallis Test Results

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| Table G-1. Kruskal-Wallis and Post-Hoc Multiple Comparison Test Results. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Mean Rank by Street Sweeping Treatment | | | | |
| Station Type | Station | Parameter | Event Type | Quarterly | Monthly | Twice Monthly | H-Statistic | p-value [a] |
| Tosh Creek Watershed Stations: Increased Sweeping Experimental | TOSMI | Total Copper | Storm | 23.3 | 21.7 | 20.7 | 0.3 | 0.8440 |
| | TOSMI | Total Supended Solids | Storm | 24.4 | 18.5 | 21.3 | 1.5 | 0.4726 |
| | TOSMI | Particulate Copper | Storm | 24.4 | 20.8 | 21.2 | 0.8 | 0.6790 |
| | TOSMI | Total Copper | Base | 7.6 | 12.6 | 8.6 | 2.8 | 0.2433 |
| | TOSMI | Total Supended Solids | Base | 8.7 | 10.1 | 6.5 | 1.2 | 0.5517 |
| | TOSMI | Particulate Copper | Base | 7.7 | 12.5 | 8.5 | 2.6 | 0.2733 |
| | TOSMO | Total Copper | Storm | 27.1 | 16.9 | 19.3 | 5.3 | 0.0708 |
| | TOSMO | Total Supended Solids | Storm | 26.5 | 14.2 | 19.5 | 6.7 | 0.0345 |
| | TOSMO | Particulate Copper | Storm | 27.1 | 18.9 | 19.0 | 4.3 | 0.1136 |
| | TOSMO | Total Copper | Base | 8.7 | 9.0 | 9.6 | 0.1 | 0.9494 |
| | TOSMO | Total Supended Solids | Base | 8.7 | 10.1 | 6.5 | 3.4 | 0.1873 |
| | TOSMO | Particulate Copper | Base | 8.6 | 9.0 | 9.9 | 0.2 | 0.9032 |
| Country Creek Watershed Stations: No Increased Sweeping Control | COUMI | Total Copper | Storm | 28.0 | 16.3 | 18.6 | 7.3 | 0.0263 |
| | COUMI | Total Supended Solids | Storm | 28.2 | 16.7 | 17.4 | 8.2 | 0.0165 |
| | COUMI | Particulate Copper | Storm | 28.5 | 16.8 | 18.8 | 7.4 | 0.0249 |
| | COUMI | Total Copper | Base | 9.2 | 11.0 | 6.5 | 1.9 | 0.3857 |
| | COUMI | Total Supended Solids | Base | 9.8 | 6.8 | 9.5 | 1.0 | 0.5921 |
| | COUMI | Particulate Copper | Base | 9.9 | 11.3 | 4.8 | 4.6 | 0.1013 |
| | COUMO | Total Copper | Storm | 26.5 | 16.5 | 20.3 | 4.5 | 0.1031 |
| | COUMO | Total Supended Solids | Storm | 27.6 | 18.1 | 19.1 | 5.2 | 0.0736 |
| | COUMO | Particulate Copper | Storm | 27.9 | 17.8 | 18.8 | 6.1 | 0.0484 |
| | COUMO | Total Copper | Base | 8.1 | 11.9 | 8.1 | 2.1 | 0.3444 |
| | COUMO | Total Supended Solids | Base | 8.7 | 10.1 | 6.5 | 2.6 | 0.2731 |
| | COUMO | Particulate Copper | Base | 8.2 | 11.6 | 8.1 | 1.8 | 0.4093 |

[a] Values in red indicate a significant difference was detected for the indicated parameter between the street sweeping treatments based on results from the Kruskal-Wallis test at an a-level of 0.05.

## Table G-2. Post-Hoc Multiple Range Test Results.[a]

| Treatment | Station | Parameter | Event Type | Quarterly | Monthly | Twice Monthly |
|---|---|---|---|---|---|---|
| Quarterly | COUMO | Total Suspended Solids | Base Flow | | 1.000000 | 0.236471 |
| Monthly | COUMO | Total Suspended Solids | Base Flow | 1.000000 | | 0.484288 |
| Twice Monthly | COUMO | Total Suspended Solids | Base Flow | 0.236471 | 0.484288 | |
| Quarterly | COUMO | Copper | Base Flow | | 0.644531 | 1.000000 |
| Monthly | COUMO | Copper | Base Flow | 0.644531 | | 0.880865 |
| Twice Monthly | COUMO | Copper | Base Flow | 1.000000 | 0.880865 | |
| Quarterly | TOSMI | Total Suspended Solids | Base Flow | | 1.000000 | 1.000000 |
| Monthly | TOSMI | Total Suspended Solids | Base Flow | 1.000000 | | 0.833477 |
| Twice Monthly | TOSMI | Total Suspended Solids | Base Flow | 1.000000 | 0.833477 | |
| Quarterly | TOSMI | Copper | Base Flow | | 0.284408 | 1.000000 |
| Monthly | TOSMI | Copper | Base Flow | 0.284408 | | 0.787855 |
| Twice Monthly | TOSMI | Copper | Base Flow | 1.000000 | 0.787855 | |
| Quarterly | COUMI | Total Suspended Solids | Base Flow | | 0.955163 | 1.000000 |
| Monthly | COUMI | Total Suspended Solids | Base Flow | 0.955163 | | 1.000000 |
| Twice Monthly | COUMI | Total Suspended Solids | Base Flow | 1.000000 | 1.000000 | |
| Quarterly | COUMI | Copper | Base Flow | | 1.000000 | 1.000000 |
| Monthly | COUMI | Copper | Base Flow | 1.000000 | | 0.622735 |
| Twice Monthly | COUMI | Copper | Base Flow | 1.000000 | 0.622735 | |
| Quarterly | TOSMO | Total Suspended Solids | Base Flow | | 0.265913 | 0.548684 |
| Monthly | TOSMO | Total Suspended Solids | Base Flow | 0.265913 | | 1.000000 |
| Twice Monthly | TOSMO | Total Suspended Solids | Base Flow | 0.548684 | 1.000000 | |
| Quarterly | TOSMO | Copper | Base Flow | | 1.000000 | 1.000000 |
| Monthly | TOSMO | Copper | Base Flow | 1.000000 | | 1.000000 |
| Twice Monthly | TOSMO | Copper | Base Flow | 1.000000 | 1.000000 | |

## Table G-2. Post-Hoc Multiple Range Test Results.[a]

| Treatment | Station | Parameter | Event Type | Quarterly | Monthly | Twice Monthly |
|---|---|---|---|---|---|---|
| Quarterly | COUMO | Copper | Storm Event | | 0.118858 | 0.448809 |
| Monthly | COUMO | Copper | Storm Event | 0.118858 | | 1.000000 |
| Twice Monthly | COUMO | Copper | Storm Event | 0.448809 | 1.000000 | |
| Quarterly | COUMO | Total Suspended Solids | Storm Event | | 0.174849 | 0.167367 |
| Monthly | COUMO | Total Suspended Solids | Storm Event | 0.174849 | | 1.000000 |
| Twice Monthly | COUMO | Total Suspended Solids | Storm Event | 0.167367 | 1.000000 | |
| Quarterly | TOSMI | Copper | Storm Event | | 1.000000 | 1.000000 |
| Monthly | TOSMI | Copper | Storm Event | 1.000000 | | 1.000000 |
| Twice Monthly | TOSMI | Copper | Storm Event | 1.000000 | 1.000000 | |
| Quarterly | TOSMI | Total Suspended Solids | Storm Event | | 0.710406 | 1.000000 |
| Monthly | TOSMI | Total Suspended Solids | Storm Event | 0.710406 | | 1.000000 |
| Twice Monthly | TOSMI | Total Suspended Solids | Storm Event | 1.000000 | 1.000000 | |
| Quarterly | COUMI | Copper | Storm Event | | 0.041876 | 0.069668 |
| Monthly | COUMI | Copper | Storm Event | 0.041876 | | 1.000000 |
| Twice Monthly | COUMI | Copper | Storm Event | 0.069668 | 1.000000 | |
| Quarterly | COUMI | Total Suspended Solids | Storm Event | | 0.050523 | 0.045856 |
| Monthly | COUMI | Total Suspended Solids | Storm Event | 0.050523 | | 1.000000 |
| Twice Monthly | COUMI | Total Suspended Solids | Storm Event | 0.045856 | 1.000000 | |
| Quarterly | TOSMO | Copper | Storm Event | | 0.103461 | 0.192682 |
| Monthly | TOSMO | Copper | Storm Event | 0.103461 | | 1.000000 |
| Twice Monthly | TOSMO | Copper | Storm Event | 0.192682 | 1.000000 | |
| Quarterly | TOSMO | Total Suspended Solids | Storm Event | | 0.019307 | 0.174323 |
| Monthly | TOSMO | Total Suspended Solids | Storm Event | 0.019307 | | 0.945682 |
| Twice Monthly | TOSMO | Total Suspended Solids | Storm Event | 0.174323 | 0.945682 | |

**Table G-2. Post-Hoc Multiple Range Test Results.[a]**

| Treatment | Station | Parameter | Event Type | Quarterly | Monthly | Twice Monthly |
|---|---|---|---|---|---|---|
| Quarterly | COUMO | Particulate Copper | Base Flow | | 0.786411 | 1.000000 |
| Monthly | COUMO | Particulate Copper | Base Flow | 0.786411 | | 0.980968 |
| Twice Monthly | COUMO | Particulate Copper | Base Flow | 1.000000 | 0.980968 | |
| Quarterly | TOSMI | Particulate Copper | Base Flow | | 0.333628 | 1.000000 |
| Monthly | TOSMI | Particulate Copper | Base Flow | 0.333628 | | 0.787855 |
| Twice Monthly | TOSMI | Particulate Copper | Base Flow | 1.000000 | 0.787855 | |
| Quarterly | COUMI | Particulate Copper | Base Flow | | 1.000000 | 0.271095 |
| Monthly | COUMI | Particulate Copper | Base Flow | 1.000000 | | 0.206111 |
| Twice Monthly | COUMI | Particulate Copper | Base Flow | 0.271095 | 0.206111 | |
| Quarterly | TOSMO | Particulate Copper | Base Flow | | 1.000000 | 1.000000 |
| Monthly | TOSMO | Particulate Copper | Base Flow | 1.000000 | | 1.000000 |
| Twice Monthly | TOSMO | Particulate Copper | Base Flow | 1.000000 | 1.000000 | |
| Quarterly | COUMO | Particulate Copper | Storm Event | | 0.126461 | 0.115563 |
| Monthly | COUMO | Particulate Copper | Storm Event | 0.126461 | | 1.000000 |
| Twice Monthly | COUMO | Particulate Copper | Storm Event | 0.115563 | 1.000000 | |
| Quarterly | TOSMI | Particulate Copper | Storm Event | | 1.000000 | 1.000000 |
| Monthly | TOSMI | Particulate Copper | Storm Event | 1.000000 | | 1.000000 |
| Twice Monthly | TOSMI | Particulate Copper | Storm Event | 1.000000 | 1.000000 | |
| Quarterly | COUMI | Particulate Copper | Storm Event | | 0.058451 | 0.086031 |
| Monthly | COUMI | Particulate Copper | Storm Event | 0.058451 | | 1.000000 |
| Twice Monthly | COUMI | Particulate Copper | Storm Event | 0.086031 | 1.000000 | |
| Quarterly | TOSMO | Particulate Copper | Storm Event | | 0.302839 | 0.203872 |
| Monthly | TOSMO | Particulate Copper | Storm Event | 0.302839 | | 1.000000 |
| Twice Monthly | TOSMO | Particulate Copper | Storm Event | 0.203872 | 1.000000 | |

[a] Values in red indicate a significant difference was detected for the indicated parameter between the street sweeping treatments at an a-level of 0.05.