

Microplastics Sample Collection Method Evaluation and Standardization Workplan (OPC)

30 September 2023

I. Project Objective & Background

Overall Objective: Produce standardized sample collection protocols for monitoring environmental microplastics in stormwater, sediment, and biota through the solicitation of scientific expert opinion and experimental evaluation.

A group of international experts in microplastic sample collection and analysis were invited to an in-person workshop at the Southern California Coastal Water Research Project headquarters in the early spring of 2023. Experts successfully identified collection methods for each matrix and drafted study designs to evaluate their performance for the purposes of method standardization and the development of performance criteria. Draft evaluation studies were prioritized via a group vote, and workgroups were formed for each matrix to continue to refine study designs. For some matrices, a literature search revealed that collection methods had already been evaluated in a similar manner to the designs proposed during the workshop. In these cases, the workgroup has proceeded with drafting standardized operating procedure (SOP) documents.

II. Sediment

Specific Objective: Produce a SOP for the collection of sediment for microplastics analysis.

A. Study Design Refinement and Literature Review

Expert evaluation during the workshop identified sampling depth and shallow sampling gear as the primary factors having the greatest effect on the overall results when sampling sediment for microplastics analysis. A literature review revealed that the majority of microplastics are found within the top ~10 cm of sediment, varying by the specific location and other factors (e.g., sediment deposition rates), and that the overwhelming majority of guidelines for microplastic sediment sampling prescribe a 5 cm sampling depth. For shallow sampling gear, the literature review revealed a previously published study which compared the microplastic recovery rates of a Van Veen, a sediment corer, a percussion corer, and a stainless-steel shovel. The expert group agreed that the results of the study suggest the use of a Van Veen or sediment coring device.

B. Standard Operating Procedure Development

Based upon the results of the literature review, there was expert consensus that an experimental evaluation of methods was not required, and the working group will proceed with drafting a SOP for sampling sediment in wadeable and unwadeable conditions (e.g., sampling from a boat). This initial draft will undergo several rounds of revision within the sediment workgroup before expert review.

C. Method Refinement and Reporting

Feedback and comments from expert review will be evaluated by the sediment workgroup, and the SOP will be revised accordingly. The final version of the SOP will be included within the final technical report.

Deliverable: A SOP for the collection of sediment for microplastics analysis.

III. Biota

Specific Objective: Produce a SOP for the collection of biota for microplastics analysis.

A. Study Design Refinement and Literature Review

During the workshop, experts described several study designs to aid in the interpretation of microplastic occurrence data in biota. This included an assessment of microplastic distribution within a food web as well as the assessment of variability amongst replicate samples and sites. However, there was agreement that an evaluation study was not required for the development of a standardized protocol to collect biota for microplastics analysis.

B. Standard Operating Procedure Development

The working group will proceed with drafting a SOP for sampling biota. The protocol will describe specific procedures for bivalves and fish and provide recommendations for sample size and the amount of tissue to be collected. The protocol will also provide recommendations for adapting methods for the collection of other taxa of interest. This initial draft will undergo several rounds of revision within the biota workgroup before expert review.

C. Method Refinement and Reporting

Feedback and comments from expert review will be evaluated by the biota workgroup, and the SOP will be revised accordingly. The final version of the SOP will be included within the final technical report.

Deliverable: A SOP for the collection of biota for microplastics analysis.

IV. Stormwater

Specific Objective: Produce a SOP for the collection of stormwater for microplastics analysis.

A. Study Refinement and Literature Review

Experts agreed during the workshop that the evaluation of collection methods for microplastics in stormwater flows was the highest priority amongst the selected matrices. Stormwater was prioritized due to the complexity that is inherent to stormwater sampling (e.g., timing around storm events, variability of flows, etc.) and the knowledge that stormwater is likely a major pathway for microplastic transport. During subsequent workgroup meetings, a literature search was conducted, and a study design was developed to evaluate three different types of sampling techniques in an experimental flume and in the field. All stormwater work will be subcontracted

to the Gray Lab at University of California Riverside as this research group has extensive expertise in stormwater and microplastic research.

B. Experimental Flume Study

The Gray Lab will perform a series of flume experiments to evaluate the accuracy and precision of microplastics sampling devices and sampling deployment approaches in a controlled setting. This study will utilize a 17-meter-long recirculating flume in the Experimental Sedimentology Laboratory at UC Santa Barbara, run by Dr. Vamsi Ganti. The flume will be used to create conditions of a given fluvial transport mode (e.g., surface transport, washload, etc.) and concentration. Sampling devices (e.g., bedload net samplers, isokinetic bottle samplers, pump sampling, and surface grab/dip sampling) will be applied to the flume flow using different deployment approaches (e.g., point-based sampling, depth integrated sampling). The concentration of microplastics collected through these methods will be rapidly evaluated on the basis of mass and/or count, which will be facilitated by the choice of experimental microplastics particles. Sampling device and deployment approaches will be evaluated for accuracy relative to independently estimated microplastics concentration (e.g., mass balance of flume), and precision both within and between sampling device/approach and class. These results will inform, in part, the design of the field trials portion of the project.

C. Field Trials

The Gray Lab will complete the final design of field trials to compare the performance of microplastics monitoring approaches in stormflow in rivers in Southern California using information obtained from the literature review and the experimental flume study. The field trials will be designed to compare the concentration and character of microplastics collected from sampling devices and sample deployment approaches applied to the same discharge events on rivers experiencing stormflow, and evaluate the accuracy and precision of these methods under actual field applications. Field trial design components will include sampler type, deployment type (e.g., cable, hand line, fixed), deployment approach and target volumes, identification of final sample sites, target discharge events and ranges, target sample and blank numbers. Field trial sites may be co-located with Los Angeles County Department of Public Works (LAC DPW) Mass Emission Stations (MES) to leverage LAC DPW hydrologic monitoring (including discharge) and autosampler infrastructure, as well as the PI's ongoing monitoring projects at MES: S01 (Ballona Creek), S10 (Lower Los Angeles River), S13 (Coyote Creek), S28 (Dominguez Channel) funded by the LA County Safe Clean Water Program (SCWP).

The Gray Lab shall conduct monitoring for field trials in accordance with the final design during the 2023/24 wet season. If the number of samples does not meet the needs of the study design, then the contractor may conduct additional sampling during the 2024/25 wet season. The subcontractor will coordinate with LAC DPW for MES access and will obtain all permits required for monitoring.

D. Laboratory Analysis

The Gray Lab will analyze microplastics samples collected during field trials to quantify count-base microplastics concentration and character (i.e., size, shape, and polymer type). The analytical

method to be used will agree with the methods recently adopted by the State Water Resources Control Board for the extraction and measurement of microplastic particles by either Raman Spectroscopy or Infrared Spectroscopy, with possible additional steps that may be required for extraction of microplastics from high loads of mineral and organic suspended sediments.

E. Standard Operating Procedure Development

The Gray Lab shall draft, in consultation with SCCWRP personnel and stormwater workgroup, a Stormflow Monitoring for Microplastics SOP informed by the results of the experimental flume study and field trials. The draft SOP will include a complete guide to microplastic monitoring in stormflow that addresses sampler choice and deployment approaches on the basis of system (river/channel) type, transport conditions, microplastics present, and study goals.

F. External Review

Once the SOP has been reviewed and revised by the stormwater workgroup, it will be circulated amongst external reviewers to solicit critical feedback. Examples of external reviewers include scientific experts in microplastics collection and analysis outside of the workgroup, experts in stormwater research and sampling as well as environmental managers, scientists, and technicians with general environmental monitoring expertise.

G. Method Refinement and Reporting

Feedback and comments from external review will be evaluated by the stormwater workgroup, and the SOP will be revised accordingly. The final version of the SOP will be included within the final technical report.

Deliverable: A SOP for the collection of stormwater for microplastics analysis.

V. Schedule

Matrix	Task	Anticipated Completion Date
Sediment	Initial SOP Draft	December 2023
	Final SOP Document	June 2024
Biota	Initial SOP Draft	December 2023
	Final SOP Document	June 2024
Stormwater	Literature Review	September 2023
	Experimental Flume Study	May 2024
	Field Trials	March 2025
	Laboratory Analysis	October 2025
	Initial SOP Draft	December 2025
	External Expert SOP Evaluation	January 2026
	Final SOP Document	March 2026
All Matrices	Final Technical Report	June 2026