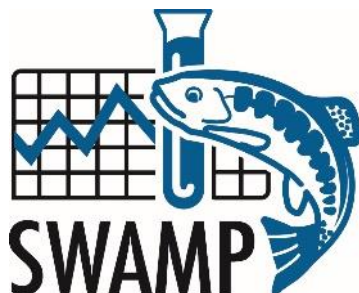


Surface Water Ambient Monitoring Program

STREAM POLLUTION TRENDS MONITORING PROGRAM QUALITY ASSURANCE PROJECT PLAN



State Water Resources Control Board
2023-2025

GROUP A: Project Management**A.1: Title**

Project Title: Surface Water Ambient Monitoring Program (SWAMP) Stream Pollution Trends (SPoT) Monitoring Program Quality Assurance Project Plan (QAPP)

Lead Organization: University of California, Davis Marine Pollution Studies Laboratory at Granite Canyon (UCD-GC), 34500 Highway One, Monterey, CA 93953; Environmental Laboratory Accreditation Program Certificate No. 2821

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Effective Date: This QAPP is effective from 2023 to 2025.

Version: 1

Preface: This QAPP document defines procedures and criteria for the SPoT Monitoring Program that will be used by the staff of SWAMP and all involved parties. The SPoT Monitoring Program started in 2008 as a means to monitor long-term pollution trends and their effects on stream biota in California. Doing so enables the State and Regional Water Boards to relate this water quality data to land-use and agency management efforts so that appropriate steps can be taken.

Cite as: State Water Resources Control Board. 2023. Statewide Stream Pollution Trends Monitoring Program: Quality Assurance Project Plan. Sacramento, CA: Surface Water Ambient Monitoring Program.

The approvals below were submitted separately, and originals are kept on file by the State Water Resources Control Board (SWRCB).

A.2 Approvals

The approvals below were submitted via Adobe Sign and can be viewed online on the [SWAMP IQ Wiki website](#)

Bushra Khan

Lead Scientist and UC Davis Laboratory Quality Assurance Officer


Bushra Khan (Sep 15, 2023 15:48 PDT) **Date** Sep 15, 2023

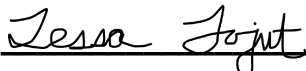
Andrew Hamilton

SWRCB Quality Assurance Officer

 **Date** Sep 19, 2023

Tessa Fojut

SWAMP Program Quality Assurance Officer

 **Date** 9/15/23

Autumn Bonnema

MPSL Quality Assurance Officer

 **Date** Oct 23, 2023

Julia Sudds

Babcock Laboratories Quality Division Leader


Julia Sudds (Sep 21, 2023 08:50 PDT) **Date** Sep 21, 2023

Sean Campbell

SGS AXYS Project Manager


Sean Campbell (Dec 8, 2023 11:11 PST) **Date** Dec 8, 2023

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A.4: Distribution List

A copy of this Quality Assurance Project Plan (QAPP), in hardcopy or electronic format, is to be received and retained by at least one person from each participating entity. At least one person from each participating entity shall be responsible for receiving, retaining and distributing the QAPP to their respective staff within their own organization. Contact information for the primary contact person (listed first) for each participating organization is provided in Table 1.

Table 1. Distribution List

Contact Name	Agency	Contact Information
Bushra Khan Katie Siegler	UC Davis Marine Pollution Studies Laboratory at Granite Canyon (UCD-GC)	34500 Highway One Monterey, CA 93940 (831) 624-0947 bhkhan@ucdavis.edu csiegler@ucdavis.edu
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A.5: Project Organization

The lines of communication between the participating entities, project organization and responsibilities are outlined in Table 2 and Figure 1.

Table 2. Positions and Duties

Position	Name	Responsibilities
Region 9 EPA Surface Water Standards Coordinator	Eric Dubinsky	Oversees SWAMP federal funding and Program outputs.
State Water Resources Control Board Management	Greg Gearheart	Program planning and oversight; project budget allocation and reconciliation with program objectives.
SWAMP Program Coordinator	Ali Dunn	Program planning and oversight and reconciliation with program objectives.
State Water Resources Control Board SPoT Project Coordinator	Tony Gill	Coordination with the Project Manager; reviewing monitoring plans, QAPP, and reports; participating in project workgroups; and maintaining information available on the SWAMP webpages.
Office of Information Management and Analysis (OIMA) Contract Manager	Chad Fearing	Manages and approves contract deliverables and invoices.
SPoT Lead Scientist	Bushra Khan	Monitoring design, data analysis and reporting; oversee development and submission of contract deliverable in coordination with the Project Manager (e.g., monitoring plans, reports); coordination with the Scientific Review Committee.
Project Manager (PM)	Katie Siegler	Generates and maintains project QAPP; ensures all activities are completed within proper timeframes; oversees project deliverables, and entry of field and laboratory-generated data into SWAMP formats.
UC Davis Marine Pollution Studies Laboratory at Granite Canyon (UCD-GC) Laboratory Director	Bryn Phillips	Ensures that all sediment toxicity analyses are completed within the proper timelines.

Position	Name	Responsibilities
UCD-GC Laboratory Quality Assurance Officer	Bushra Khan	Ensures that the laboratory quality assurance plan and QAPP criteria are met through routine monitoring and auditing of the systems; reviews and approves data prior to submission to the SWAMP Information Management and Quality Assurance Center; investigates and conduct laboratory corrective actions.
UCD-GC Sample Manager	Randi Barton	Manages sample receiving, sub-sampling, maintenance, test set up, and disposal of samples.
UCD-GC Field Crew Manager	Randi Barton	Confirms sampling schedules, ensures proper field training; assists in planning logistics for each sampling event.
UCD-GC Data Manager	Katie Siegler (field data) and Randi Barton (toxicity data)	Enters and submits data into SWAMP database; responds to data requests from SWRCB.
State Water Resources Control Board Quality Assurance Officer	Andrew Hamilton	Approves QAPP; reports to U.S. EPA and SWRCB management.
SWAMP Quality Assurance Officer and Database Manager	Tessa Fojut	Reviews and approves QAPP; oversees Data Managers; establishes program-level quality objectives and requirements for project; reports to U.S. EPA and SWRCB management and coordinates with SWRCB QAO.
SWAMP IQ Data Managers	Kimberly Pham (organics data); Delany Broome (metals data); Tony Gill (toxicity data)	Reviews, verifies, and loads chemistry and composite data to SWAMP database; reports to SWAMP QAO.
Babcock Laboratories, Inc. Project Manager	Allie Guerra	Main point of contact for Babcock Laboratories and liaison to any subcontracted chemistry laboratories, responsible for bottle requests, coordinating logistics, and ensuring data are delivered.
Babcock Laboratories, Inc. Quality Assurance Manager	Julia Sudds	Ensures that the laboratory quality assurance plan and SPoT QAPP criteria are met through routine monitoring and auditing of the systems, investigate and conduct laboratory corrective actions.

Position	Name	Responsibilities
SGS AXYS Project Manager	Sean Campbell	Ensures that the laboratory quality assurance plan and SPoT QAPP criteria are met for organics analyses through routine monitoring and auditing of the systems, investigate and conduct laboratory corrective actions.
McC Campbell Analytical Quality Assurance Director	Theresa Johnson	Ensures that the laboratory quality assurance plan and SPoT QAPP criteria are met for total organic carbon analyses through routine monitoring and auditing of the systems, investigate and conduct laboratory corrective actions.
Moss Landing Marine Laboratory Marine Pollution Studies Laboratory (MPSL-DFW) Data Quality Assurance Officer	Autumn Bonnema	Ensures that the laboratory quality assurance plan and SPoT QAPP criteria are met for metals and mercury analyses through routine monitoring and auditing of the systems, investigate and conduct laboratory corrective actions.

Involved Parties and Roles

Project Management

Bushra Khan is the Lead Scientist, whose role is to generate the annual monitoring plan, approve the QAPP, lead data analysis and reporting requested for the project, and coordinate with the Scientific Review Committee.

Katie Siegler of UCD-GC is the Project Manager and oversees all aspects related to the planning and timely completion of the project. This includes organizing field crews, instructing UCD-GC staff, scheduling sampling days, and interacting with the contract laboratories. The Project Manager oversees UCD-GC staff that organize sample collection, conduct field and laboratory toxicity analyses, and manage sample submission to laboratories for analyses of organic chemistry, trace metals, and total organic carbon (TOC).

The SPoT Project Coordinator for the Water Boards (Tony Gill) is the main point of contact at the Water Boards for the Project Manager and Lead Scientist, reviews monitoring plans, QAPPs, and reports, participates in and assists with planning project meetings and workgroups, and maintains information available on the SWAMP webpages related to SPoT.

The SWAMP Program Coordinator, Ali Dunn (OIMA), oversees programmatic planning and oversight and works to adapt the program to continue to meet its objectives.

The Program Manager, Greg Gearheart (OIMA, Director), oversees programmatic strategic and operational planning, and proposes and approves OIMA budgets and budget changes.

Chad Fearing of the Office of Information Management and Analysis (OIMA) is the Contract Manager responsible for approving invoices and ensuring the Contractors meet the contract terms for the Water Boards contracts with UCD, Babcock Laboratories, and MPSL-DFW.

U.S. EPA Region 9 Standards Liaison Eric Dubinsky ensures SWAMP complies with federal regulations and approves federal funding for its programs.

Laboratory

Bryn Phillips, the UCD-GC Laboratory Director, ensures that all sediment toxicity analyses are completed within the proper timelines. Bushra Khan, the UCD-GC QAO, will ensure that quality control for all toxicity sample processing and data analysis procedures, as described in this QAPP, are maintained throughout the life of the project. The UCD-GC QAO will report all findings to the SWAMP QAO and SPoT Project Coordinator.

Babcock Laboratories, Inc. is the contract laboratory that subcontracts analyses for all organics, and TOC analyses, and Julia Sudds is the Babcock QAO. Allie Guerra is the Babcock Laboratories Project Manager for the Water Boards and is the main point of contact for issues relating to sampling and shipping logistics, analysis requests, and delivering data. Babcock, and the laboratories it subcontracts with, will analyze samples in accordance with each laboratory's standard operating procedures and all applicable quality assurance and quality control (QA/QC) requirements established in this QAPP.

SGS AXYS is the contract laboratory for all organics analyses and is subcontracted by Babcock Laboratories via a master service agreement. Sean Campbell is the SGS AXYS project manager for SPoT who ensures that all samples are tracked and analyzed in accordance with all the applicable QA/QC requirements, and all data are submitted for this project for organics analyses.

McC Campbell Analytical is the contract laboratory for total organic carbon (TOC) analyses and is subcontracted by Babcock Laboratories via a master service agreement. Theresa Johnson is the quality assurance director who ensures that all samples are tracked and analyzed in accordance with all the applicable QA/QC requirements.

MPSL-DFW is the contract laboratory for all trace metal analyses, and Autumn Bonnema ensures that all samples are tracked and all data are submitted for this project for metals analyses. Autumn Bonnema is also the MPSL-DFW QAO and will ensure samples are analyzed in accordance with all the applicable QA/QC requirements established in this QAPP.

Project Quality Assurance and Data Management

The SWAMP QAO (Tessa Fojut, SWAMP IQ) assesses the data for compliance with the project QAPP and the [SWAMP Quality Assurance Program Plan \(SWAMP QAPrP\)](#) and ensures that the project meets U.S. EPA requirements for projects receiving federal EPA funds. The SWAMP QAO also works with the State Board QAO to ensure that the project and data meet the requirements of the State Water Board's Quality Management Plan. The SWAMP QAO has the authority to halt actions if there are significant deviations from required procedures or evidence of a systematic failure.

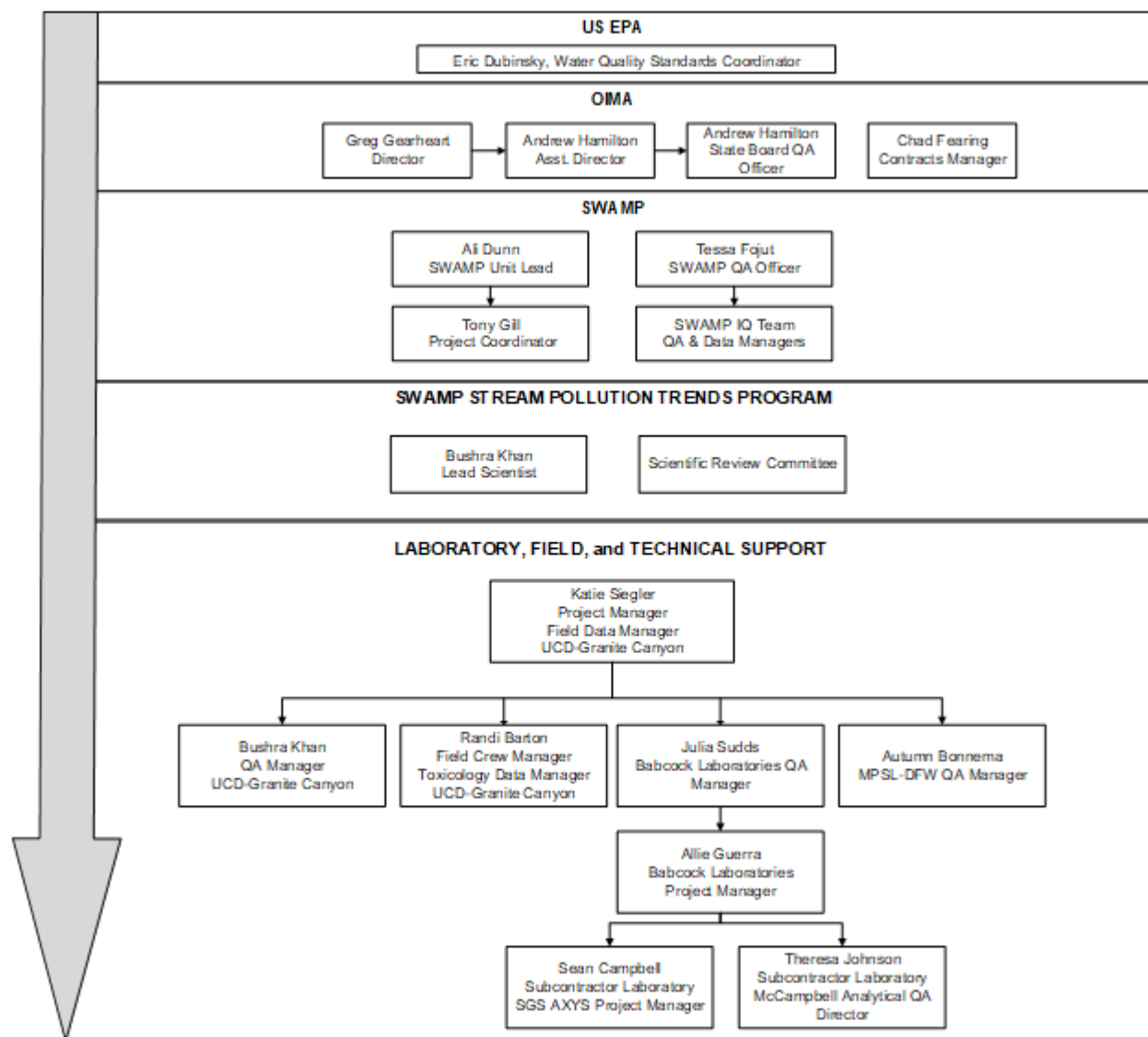
SWAMP IQ Data Managers (Tony Gill: Toxicity, Kim Pham: Chemistry, Delany Broome: Chemistry) review data received from UCD-GC and the contract laboratories to verify whether they meet all applicable QA/QC requirements established in this QAPP. The SWAMP IQ Data Managers load verified data into the SWAMP database as it is received and reviewed.

Scientific Review Committee

The SPoT Scientific Review Committee is comprised of staff from San Francisco Estuary Institute (Kelly Moran), California Department of Pesticide Regulation (CDPR; Robert Budd), United States Geological Survey (USGS; Jim Orlando), Central Coast Regional Water Quality Control Board (Mary Hamilton) and Exponent (Ashley Parks). Committee members review the assessment questions, objectives, design, indicators, and methods used in the SPoT Program and provide recommendations to improve the monitoring design.

Project Organizational Chart

Figure 1 depicts the structure of the SPoT Program. Management responsibilities extend downward, while the flow of data moves upwards from the bottom of the chart.

Figure 1. Organizational Chart

A.6: Project Background, Overview and Intended Use of Data

Project Background

The SPoT Monitoring Program was developed with the purpose of improving our understanding of watersheds and water quality through the monitoring of in-stream contaminants and sediment toxicity. SPoT conducts statewide monitoring to provide data on the annual condition of California waterways and analyzes trends over time for sediment toxicity and contaminant concentrations. The goal is to provide data to the Water Boards that can be used to assess whether beneficial uses are being attained, as well as information on the sources or land uses associated with contaminants or toxicity that could be used to inform regulatory programs on effective management actions. The

SPoT Monitoring Program is focused on measuring toxicity and contaminant levels in sediment at integrator sites at the base of a watershed because (1) many contaminants accumulate in sediments, (2) sediment contaminant concentrations are more stable than in the water column, which allows for annual sampling rather than more frequent sampling under varying conditions to adequately describe stream conditions, and (3) data from integrator sites can inform conditions throughout the watershed.

The first annual SPoT survey, carried out in 2008, was documented in the report *Statewide Perspective on Chemicals of Concern and Connections between Stream Water Quality and Land Use* (Hunt et al. 2012). These findings have served as the baseline from which long-term trends in the categories and quantities of pollutants have since been determined.

Focusing on the impacts of land use and development, the SPoT Monitoring Program compares monitoring results across watersheds throughout the state in order to evaluate changes over time and assess potential risk to aquatic life. SPoT was initiated in 2008 with three primary goals:

1. Determine long-term, statewide trends in stream contaminant concentrations and effects.
2. Relate key water quality indicators to land-use characteristics and management efforts.
3. Establish a network of sites throughout the state to serve as a backbone for collaboration with local, regional, and federal monitoring programs and management agencies.

In addition, the SPoT Program is designed to establish a statewide network of sites that link to monitoring efforts by other programs including storm water agencies, Total Maximum Daily Load (TMDL) programs, irrigated agriculture regulatory programs, and regional monitoring programs to provide a statewide context for local monitoring. The SPoT Program collaborates with some of these programs informally to provide additional information or leverage existing data, while other collaborations are formally done through contracting and are part of the SWAMP Toxicology and Contaminants Program (TCP). SPoT is part of the broader SWAMP Toxicity and Contaminants Program (TCP), which assesses impacts of anthropogenic contaminants on aquatic ecosystems. SPoT is currently the only monitoring project of the TCP that is continuous and ongoing each year, other projects of the TCP are short-term projects to accomplish more limited objectives.

Project Overview

SPoT conducts statewide monitoring to provide information on the condition of California waterways with respect to trends in sediment toxicity and contamination from many analyte groups such as metals, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, legacy pesticides, current use pesticides, and polybrominated diphenyl ethers in watershed sediments. SPoT data are currently used by the Water Boards to

assess the levels to which aquatic life beneficial uses are supported in California streams and rivers.

The SPoT Program indicators are measured in stream sediment because this matrix best accommodates program goals. Most trace metal and many organic pollutants that enter streams adhere to suspended sediment particles and organic matter, and this sediment-associated phase is the major pathway for contaminant loading in streams and downstream waterways (DiToro et al. 1991; Foster and Charlesworth 1996; Karickhoff 1984). In addition, sediment measurements are appropriate for long-term trend monitoring because pollutants that accumulate in depositional sediment on the stream bed are much more stable over time (~months to years) than dissolved or suspended pollutants that move downstream in pulses that are highly variable over short time scales (~hours). SPoT sampling is timed to collect sediment from recent stream bed deposits during base flow periods after the high-water season when most sediment and pollutant transport takes place. There are ninety SPoT sites (Table 2), and samples are collected annually at each site.

Assessment Framework and Management Questions

SPoT has developed an assessment framework related to aquatic life beneficial uses, specifically “warm freshwater habitat” (WARM) and “cold freshwater habitat” (COLD). The assessment framework is consistent with frameworks developed for other components of SWAMP (Bernstein 2010) and is intended to guide SPoT over the long-term.

The four objectives of the assessment framework can be summarized as (1) status; (2) trends; (3) sources and pathways; and (4) effectiveness of management actions.

Over the long-term, the primary emphasis of the statewide Program will be on evaluating status and trends. Monitoring status and trends in toxicity and contaminants will provide some information on sources and pathways and effectiveness of statewide management actions at a broader geographic scale. However, other types of monitoring (e.g., water monitoring) and other programs (e.g., regional Total Maximum Daily Load [TMDL] programs) are also needed for addressing sources and pathways and effectiveness of management actions.

SPoT Assessment Framework

1. STATUS: Are beneficial uses impacted by toxicity or contaminants?
2. TRENDS: Are toxicity and contaminants increasing or decreasing in California surface waters?
 - 2.1. Are there unique trends at individual sites?
 - 2.2. Are any trends associated with land use types?
3. SOURCES: What are the causes of toxicity?
 - 3.1. What are the sources of contaminants with threshold exceedances?
4. EFFECTIVENESS OF MANAGEMENT ACTIONS: Are mitigation actions effective?

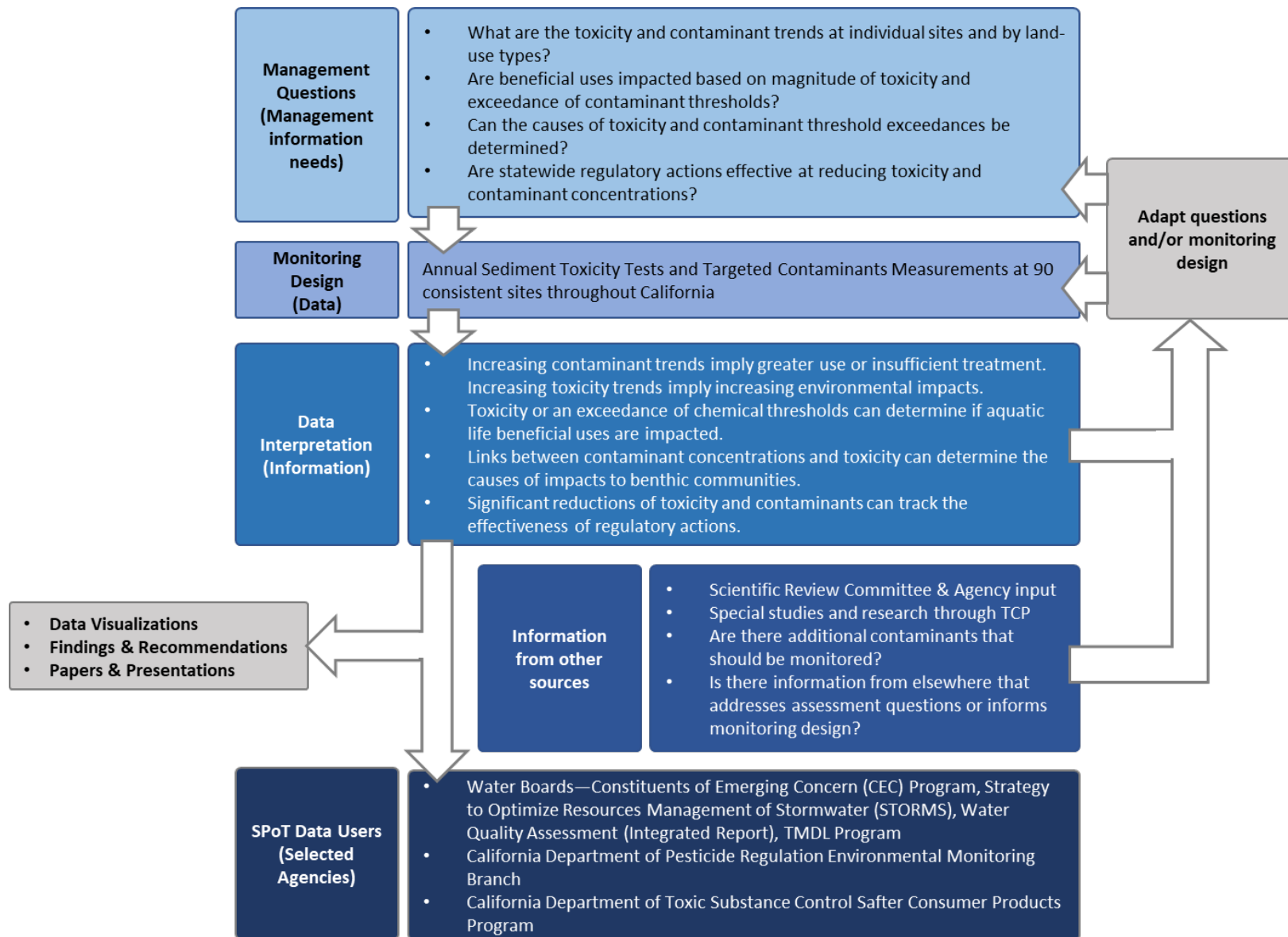
The SPoT assessment framework provides high-level questions that guide the monitoring design and relate directly to the broader SWAMP assessment framework (Bernstein 2010). Management questions were also defined to provide more specific answerable questions to guide the data interpretation of SPoT.

SPoT Management Questions

- STATUS: Are beneficial uses impacted based on magnitude of toxicity and exceedance of contaminant thresholds?
- TRENDS: What are the toxicity and contaminant trends at individual sites and by land-use types?
- SOURCES: Can the causes of toxicity and contaminant threshold exceedances be determined?
- EFFECTIVENESS OF MANAGEMENT ACTIONS: Are statewide regulatory actions effective at reducing toxicity and contaminant concentrations?

Figure 2 illustrates the adaptive relationships between the management questions, monitoring design, data interpretation and the data users.

Figure 2. SPoT Management Questions



Constituents Monitored

Toxicity Testing and Data Interpretation

SPoT performs toxicity tests on all sediment samples with the amphipod *Hyalella azteca* and on a subset of samples with the midge *Chironomus dilutus*. Both organisms are sensitive to a variety of contaminants occurring in ambient waters and sediments and are tested using standard U.S. EPA protocols. If water samples are collected, *Ceriodaphnia dubia* may be used for testing because this species is used for water column exposures in U.S. EPA protocols and is also sensitive to a variety of contaminants occurring in ambient waters.

Toxicity data are analyzed using SWAMP hypothesis testing methods that involve separate-variance t-tests and comparisons to a threshold value based on the control. These results are submitted to the SWAMP Database. Additional analysis using the Test for Significant Toxicity (U.S. EPA 2010) is conducted for trend reporting. Single samples are categorized based on the magnitude of toxicity (“non-toxic,” “toxic,” and “highly toxic”). Toxicity responses are also summarized for each site and categorized as “no toxicity,” “some toxicity,” “moderate toxicity,” and “high toxicity.” Sites with no toxic samples are non-toxic; sites with at least one toxic sample have some toxicity; sites with at least one sample below the high toxicity threshold (38.6%) have moderate toxicity, and sites with an average survival less than the high toxicity threshold have high toxicity. Toxicity responses are also compared to chemical concentrations within land uses using Spearman’s rank correlation, and further compared to individual chemical thresholds based on median lethal concentrations. Significant trends of toxicity and chemical concentrations at individual sites, within land uses, and statewide are determined using the Mann-Kendall analysis.

Contaminants Analysis

Sediment from all SPoT sites is analyzed for a suite of organic chemicals, metals, and total organic carbon. A subset of forty sites that generally represent the most urban watersheds, referred to as Tier II sites (see Table 2), are analyzed for organic chemicals most likely to be present in urban areas, for example, PBDEs, fipronil, and per- and polyfluoroalkyl substances (PFAS). The individual pollutants that may be measured in sediment for SPoT are listed in [Appendix A](#). Beginning in 2023, analytes will be selected for each site based on current trend analysis for more targeted analytical information, which will be documented in an annual Monitoring Plan.

Intended Use of Data

Of the four intended data use categories described in the SWAMP QAPrP, SPoT data belongs in the Ambient classification, as it is intended to be used for support of Water Quality Control Plans, Integrated Report development, policy development, and other beneficial use assessments.

The Water Boards' primary use of SPoT data is for surface water quality assessment as documented in the [Integrated Report](#), which is made up of the 303(d) List of Impaired Waters and 305(b) Condition Report. The Integrated Report uses SPoT data to write lines of evidence and determine whether waterbodies are attaining their beneficial uses with relation to specific pollutants, and subsequently whether they are impaired for particular pollutants. The water quality objectives and associated numeric evaluation guidelines used to assess monitoring data for the Integrated Report are the primary action levels of interest for SPoT. Some of these may change with each Integrated Report cycle as the science continues to develop, but are available in each Integrated Report, for example the [2020-2022 Integrated Report](#).

Other programs that have used or are currently using SPoT data to aid in program development include:

- The Storm Water Strategy (STORMS) is using SPoT data to inform development of a statewide framework for urban pesticide reductions, which is expected to result in [Urban Pesticides Provisions](#) of the Inland Surface Waters, Enclosed Bays, and Estuaries Plan. SPoT data may also be used to evaluate performance of the Urban Pesticides Provisions over time.
- The Water Board's Contaminants of Emerging Concern (CEC) program is using SPoT data to develop monitoring recommendations for [CECs in California's Aquatic Ecosystems](#).
- Regional board TMDL projects have used SPoT data in TMDL development and tracking TMDL effectiveness over time, such as the [Salinas River Watershed Sediment Toxicity and Pyrethroid Pesticides in Sediment TMDL](#).
- The Water Boards' agriculture and regional storm water programs, as well as the U.S. EPA Watershed Improvement Measure, evaluate temporal trends using SPoT data to support their program development.
- SPoT data may also be used by the California Department of Pesticide Regulation (CDPR) to survey current pesticide use, reevaluate registrations, and reassess pesticide surface water regulations.

Geographic Locations

When sampling sites were selected for the SPoT Program, the following geographic characteristics were considered optimal:

- location in a large watershed with heterogeneous land cover;
- location at or near the base of a watershed, defined as the confluence with either an ocean, lake, or another stream of equal or greater stream order; and
- location where site-specific conditions are appropriate for the indicators selected (e.g., depositional areas, sufficient flow, appropriate channel morphology, and substrate).

The availability of existing data on sediment contaminant concentrations, biological impacts, or other relevant water quality parameters was also an important consideration when selecting a site, particularly if SPoT sites are co-located with key sites from cooperative programs. A list of sampling sites is provided in Table 2. The majority of these sites have been sampled for SPoT since 2008.

Table 2. SPoT Stations

Tier II Sites shaded in gray and identified by asterisk * on Station Name

Station Code	Station Name	Target Latitude	Target Longitude
105KLAMKK	Klamath River at Kamp Klamath	41.5171	-124.03896
109MAD101	Mad River upstream Hwy 101	40.91763	-124.08946
111EELFRN	Eel River at Fernbridge	40.61129	-124.20407
113NA3269	Navarro at Dimmick St Park	39.15911	-123.63861
114LAGWOH	Laguna de Santa Rosa at Wohler	38.49254	-122.88327
114RRDSDM	Russian River downstream Duncan Mills	38.44750	-123.05583
201WLK160	Walker Creek Ranch	38.17545	-122.82044
204ALA020	Alameda Creek E. of Alvarado Blvd*	37.58200	-122.05200
204SLE030	San Leandro Creek at Empire Road*	37.72556	-122.18361
204SMA020	San Mateo Creek at Gateway Park*	37.57028	-122.31861
205COY060	Coyote Creek at Montague*	37.39540	-121.91485
205GUA020	Guadalupe Creek at USGS Gaging Station 11169025*	37.37389	-121.93194
206SON010	Sonoma Creek at Hwy 121 bridge	38.24050	-122.45127
207KIR020	Kirker Creek at Floodway*	38.01650	-121.83881
207LAU020	Laurel Creek at Pintail Drive*	38.24830	-122.00668
207WAL020	Walnut Creek at Concord Ave O.C.*	37.98063	-122.05160
304SLRWAT	San Lorenzo River below Water Street*	36.97685	122.02390
304SOK	Soquel Creek at Knob Hill Parking Lot*	36.98014	-121.95624
305THU	Pajaro River at Thurwachter Bridge*	36.87977	-121.79195
307CML	Carmel River at Hwy 1	36.53638	-121.91268
309DAV	Salinas River at Davis Road	36.64681	-121.70139
309TDW	Tembladero Slough at Monterey Dunes Way	36.77218	-121.78660
310ARG	Arroyo Grande Creek at 22nd Street*	35.09521	-120.60625
310SLB	San Luis Obispo Creek at San Luis Bay Drive	35.18832	-120.71792
312SMA	Santa Maria River at Estuary	34.96046	-120.64256
313SAI	San Antonio Creek at San Antonio Rd West	34.78233	-120.52997
314SYN	Santa Ynez River at 13th St	34.67677	-120.55442
315ATA	Atascadero Creek at Ward Drive*	34.42345	-119.81929
315MIS	Mission Creek at Montecito St*	34.41304	-119.69401

Station Code	Station Name	Target Latitude	Target Longitude
402VRB0xx	Ventura River*	34.28173	-119.30669
403STCBQT	Bouquet Canyon Creek*	34.42782	-118.54022
403STCEST	Santa Clara River Estuary	34.23557	-119.21674
403STCSSP	Sespe Creek	34.39414	-118.94096
404BLNAxx	Ballona Creek Downstream of Sawtelle (Centinela)*	33.98600	-118.41700
405SGRA2x	San Gabriel River RA-2*	33.78708	-118.09367
408CGCS06	Calleguas Creek Below Camrosa WWTP*	34.17978	-119.04053
412LARWxx	LA River near Willow*	33.80490	-118.20500
504BCHROS	Big Chico Creek at Rose Ave*	39.72716	-121.86308
504SACHMN	Sac R at Hamilton City	39.75110	-121.99798
508SACBLF	Sacramento River at Balls Ferry	40.41762	-122.19334
510LSAC08	Clarksburg Marina	38.38312	-121.52057
511CAC113	Cache Creek at Hwy 113	38.72066	-121.76430
515SACKNK	Sacramento Slough at Karnak	38.78456	-121.65439
515YBAMVL	Yuba River at Maryville*	39.13421	-121.59290
519AMNDVY	American River at Discovery Park*	38.60094	-121.50550
519BERBRY	Bear River at Berry Rd.	38.96175	-121.54677
519FTRNCS	Feather River at Nicolaus	38.89746	-121.59050
520BUTPAS	Butte Slough Upstream of Pass Road bridge	39.18786	-121.90919
520CBDKLU	Colusa Basin Drain at Knights Landing Upstream	38.79923	-121.72504
520SACLSA	Sacramento River at Colusa near Bridge Street*	39.21415	-122.00031
531SAC001	Cosumnes River at Twin Cities Road	38.29083	-121.37583
532AMA002	Sutter Creek at Hwy 49	38.39250	-120.80139
535MER007	Bear Creek near Bert Crane Road	37.25556	-120.65194
535MER546	Merced River at River Road	37.35041	-120.96223
535STC206	Dry Creek at La Loma Rd.*	37.64568	-120.98081
535STC504	San Joaquin River at Crows Landing	37.43323	-121.01597
541MER522	San Joaquin River at Lander Avenue	37.29528	-120.85028
541MER542	Mud Slough downstream of San Luis Drain	37.26389	-120.90611
541MERECY	Marsh Creek at E Cypress Rd*	37.99107	-121.69626
541SJC501	San Joaquin River at Airport Way	37.67556	-121.26417
541STC019	Orestimba Creek at River Road	37.41389	-121.01417
541STC516	Del Puerto Creek at Vineyard Avenue	37.52139	-121.14861
544SAC002	Mokelumne River at New Hope Road	38.23611	-121.41889
551LKI040	Kings River - S. Fork	36.25580	-119.85510
558CCR010	Cross Creek - Rd. 60 and Hwy 99	36.40437	-119.45697
558PKC005	Packwood Creek in pond upstream of Rd 94	36.27894	-119.35971

Station Code	Station Name	Target Latitude	Target Longitude
558TUR090	Tule River - Rd. 64 bridge	36.08837	-119.42891
603BSP002	Bishop Creek at East Line St*	37.36156	-118.38606
631WWKLAR	West Walker River at Larson Lane	38.54679	-119.49494
633WCRSED	West Fork Carson River at Paynesville	38.80885	-119.77725
634UTRSED	Upper Truckee River near inlet to Lake Tahoe*	38.93439	-120.00035
635MARSED	Martis Creek near mouth	39.30211	-120.12135
635TRKSED	Lower Truckee River near CA/NV state line	39.46477	-120.00320
635TROSED	Trout Creek (Truckee) near mouth*	39.33240	-120.16558
637SUS001	Susan River near Litchfield	40.37771	-120.39514
719CVSCOT	Coachella Valley Stormwater Channel Outlet	33.52444	-116.07778
723ARGRB1	Alamo River Outlet	33.19920	-115.59710
723NROTWM	New River Outlet	33.10472	-115.66361
801CCPT12	Chino (San Antonio) Creek at Euclid/Hwy 83 bridge*	33.94016	-117.65427
801SARVRx	Santa Ana River at Prado Basin Park Rd	33.92403	-117.59765
801SDCxxx	San Diego Creek at Campus*	33.65556	-117.84472
901SJSJC9	San Juan Creek 9*	33.48443	-117.67577
902SSMR07	Santa Margarita at Basilone Rd*	33.31117	-117.34538
903SLRRBB	San Luis Rey River at Benet Road Bridge*	33.22036	-117.35821
904ESCOxx	Escondido Creek at Camino del Norte*	33.04829	-117.22602
905SDSDQ9	San Dieguito River 9*	32.97877	-117.23506
906LPLPC6	Los Penasquitos Creek 6*	33.90720	-117.23055
907SDRWAR	San Diego River at Ward Rd*	32.78032	-117.11046
909SWRWSx	Sweetwater River at Willow St bridge*	32.65898	-117.04231
911TJHRxx	Tijuana River at Hollister Rd*	32.55142	-117.08394

Project Schedule

SPoT monitoring occurs during each calendar year. Planning for the upcoming monitoring season begins in January and then the QAPP is reviewed each year to determine if revisions are needed. The annual Kickoff Meeting is held in April in preparation for sampling that typically begins in May and ends in October. Each calendar year's field work and toxicity testing will be completed by November 15th. Chemical analyses and data submissions to SWAMP IQ are estimated to be completed by no later than March 15th of the following year. Scientific Review Committee meetings to review the annual data collected and trends over time and receive recommendations from committee members usually occur in February/March and October/November of each year.

Monitoring Schedule

All SPoT sites are sampled as part of a continuous monitoring effort that began in 2008 (in 2018, 10 of the original 100 sites were removed, as they did not meet Data Quality Objectives). To collect samples at all ninety sites, SPoT sampling starts in May and ends in October of each calendar year. Specific sampling dates and logistics are planned each year and documented in an annual Monitoring Plan. Samples are collected during base flow or near-base flow conditions following annual peak flows. Ideally, sampling occurs before significant contaminant breakdown via hydrolysis or photolysis. Sampling follows index periods, and are scheduled based primarily on regional hydrologic cycles, with Southern California coastal streams, some of which are ephemeral, sampled in spring, and other regions sampled later in the year as stream flows recede.

Project Constraints

Weather Constraints

Extreme wet weather can affect sampling by significantly diluting or mobilizing the constituents to be measured. At project sites that have experienced flooding during the sampling year, sample locations may be moved slightly (within 500 meters) in order to ensure collection of representative depositional sediments rather than eroded banks. Extreme dry weather can result in no flow at a sampling location, in which case dry sediments are collected. Freezing weather can cause conditions that adversely affect the constituents to be measured or prevent access to some of the areas where sampling is needed. Freezing conditions that prevent sampling has not yet occurred at a SPoT site, as sample collections occur before winter weather.

Access Constraints

Access to sampling sites may be limited for this project because of unexpected topographical features or legal restrictions. If a site is not accessible, then an alternate site location will be chosen. These alternate locations will be determined on an as-needed basis at the time of sample collection. The alternate location is often selected based on hydrologic changes from the previous year. A change in sampling location may affect conclusions drawn from the data.

Financial Constraints

Funding constraints have reduced the number of sites sampled or analytes measured for SPoT during a sampling year. There are currently 90 sites sampled. However, this number may be revised for future sampling years depending on funding.

Samples of Opportunity

Regional Water Board personnel may find it necessary to collect a sample from a water body or area that is not a part of the SPoT Monitoring Program or covered in this QAPP to investigate a potential water quality problem. For example, a sample may be taken

when a complaint from a concerned citizen is received; when spills are reported; or based on field observations (e.g., odors, color changes, etc.). If an opportunity to conduct unplanned sampling is presented, samples will be collected, labeled, documented, and processed following standard operating procedures in this QAPP, including relevant QA/QC, so that results are comparable to other data collected under this QAPP.

A.7: Quality Objectives and Criteria

Project Quality Objectives

SPoT is a statewide monitoring program under SWAMP. Therefore data collected under SPoT must meet the quality objectives documented in the SWAMP QAPrP.

The data collected from SPoT and other SWAMP programs is used by the Water Boards to develop the biannual California Integrated Report, as directed by the Listing Policy. This policy establishes data quality requirements for the evaluation of water quality standards attainment:

- *Water Body Specific Information:* Data used to assess water quality standards attainment should be actual data that can be quantified and qualified.
- *Spatial Representation:* Samples should be representative of the water body segment. To the extent possible, samples should be represented statistically or in a consistent, targeted manner in a segment of a water body.
- *Quantitation of Chemical Concentrations:* When available data are less than or equal to the quantitation limit and the quantitation limit is less than or equal to the water quality standard, the value will be considered as meeting the water quality standard, objective, criterion, or evaluation guideline. When the sample value is less than the quantitation limit and the quantitation limit is greater than the water quality standard, objective, criterion, or evaluation guideline, the result shall not be used in the analysis. The quantitation limit includes the minimum level, practical quantitation level, or reporting limit.
- *Evaluation of Data Consistent with the Expression of Numeric Water Quality Objectives, Water Quality Criteria, or Evaluation Guidelines:* If the water quality objectives, criteria, or guidelines state a specific averaging period and/or mathematical transformation, the data should be evaluated in a consistent manner prior to conducting any statistical analysis for placement of the water on the section 303(d) list. If sufficient data are not available for the stated averaging period, the available data shall be used to represent the averaging period.

Data Quality Indicators

Data quality indicators are the quantitative measures and qualitative descriptors used to set limits of acceptable levels of data error. The principal data quality indicators used for this program are precision, bias, accuracy, representativeness, completeness, comparability, and sensitivity. The quantitative measures include precision, bias, and sensitivity, while accuracy (in general), representativeness, and comparability are

qualitative descriptors. Completeness is unique and can be described by both quantitative measures and qualitative descriptors. For definitions of all quality control terms, please see the SWAMP QAPrP.

Precision

The precision of a measurement system describes how close the agreement is between multiple measurements. The precision of the processes associated with the chemical analyses will be determined by analyzing field and laboratory duplicates. Field duplicates evaluate precision in the sampling and laboratory processes while laboratory duplicates are used to evaluate precision of the laboratory processes, including evaluation of variability associated with sub-sampling. Field duplicates must account for at least 5% of the project's total sample count for inorganic and synthetic organic analyses in sediment.

At least one laboratory duplicate per analytical batch (defined as 20 samples or less) is required for metals and synthetic organic chemicals analyzed by isotope dilution methods. For synthetic organic chemicals analyzed by traditional methods, a laboratory duplicate is not required because precision will be evaluated based on the analysis of a matrix spike and matrix spike duplicate (MS/MSD). The RPD between two replicate samples or the relative standard deviation (RSD) between more than two replicate samples will be less than the SWAMP MQOs listed for each analyte of interest. The calculations are as follows:

Laboratory duplicate

$$RPD = ((C_{\text{sample}} - C_{\text{duplicate}}) / \text{mean}) * 100$$

Where:

C_{sample} : the concentration of the original sample

$C_{\text{duplicate}}$: the concentration of the duplicate sample

Mean: the mean concentration of both samples.

Matrix spike duplicate

$$RPD = ((R_{\text{MS}} - R_{\text{MSD}}) / \text{mean}) * 100$$

Where:

R_{MS} : the recovery associated with the matrix spike

R_{MSD} : the recovery associated with matrix spike duplicate

Mean: the mean of the two recoveries (R_{MS} and R_{MSD}).

$RSD = \text{Standard Deviation (of all replicate samples)} \times 100 / \text{Average (all replicate samples)}$

For toxicity testing, laboratory precision is assessed using reference toxicant tests and field duplicates. A reference toxicant test is a toxicity test on a dilution series of a known contaminant, such as potassium chloride. The test should produce an expected result that evaluates both organism sensitivity and quality, as well as technical expertise. One reference toxicant test per analytical batch is required when using organisms that are either commercially supplied or wild-caught. Monthly reference toxicant testing is required for laboratories utilizing in-house cultures. The last plotted data point of reference toxicant tests should be within two standard deviations of the cumulative mean, with tests that fall outside of U.S. EPA's recommended control chart limits being evaluated to determine the validity of the associated tests, which must be conducted on a per-batch/monthly basis.

Bias

Bias is the quantitative measure of the difference between a measured or determined value and the true value. Bias can be unintentionally introduced in sample collection through improper timing, reach selection, sample contamination, and depositional area selection for the surveys. These biases are controlled by training field crews to sample in the lowest gradient (i.e., calmest) reaches, and during the base flows that follow the high flow season (i.e., late spring through fall). Field blanks will also be used to measure any contamination introduced during sample collection and handling of water samples. Field blanks must meet the minimum number required for this project and must not produce a statistically different result from that of the controls.

For chemical analyses, bias is evaluated in several ways. Laboratory Control Samples (LCS) and MS or isotope dilution analogues (IDA) are used to determine the analyte-specific bias associated with each analytical laboratory. LCS are used to determine analytical bias, and MS or IDA are used to determine the bias associated with the sediment matrix. Surrogates can also help determine whether sample preparation and analytical procedures have biased an analysis. Laboratory blanks (or "method blanks") are used to determine if target analytes or interferences in the laboratory environment, reagents, or instruments have introduced bias.

Bias is controlled in toxicity testing by following SOPs and ensuring the tests meet the SWAMP MQOs to avoid introducing systematic bias in the tests. Ensuring that reference toxicant tests results are within two standard deviations of the mean and are within U.S. EPA's recommended limits demonstrates that organism health or sensitivity will not bias the test results. In addition, test organisms are obtained from outside vendors and will meet the age requirements established in the applicable MQO because the age of the organism at test initiation can bias toxicity test results.

Accuracy

Accuracy refers to the closeness of agreement between a measured or determined value and the true value. Evaluation of the accuracy of laboratory procedures is achieved through the preparation and analysis of reference materials (CRM or LCS) and spiked samples with each analytical batch. For inorganic analyses, accuracy is

measured by reference materials and matrix spikes (MS). For organics analyses, accuracy is measured by reference materials and either surrogates and MS or IDAs (used in isotope dilution methods). For toxicity tests, accuracy is controlled by assuring the precision and bias of the analysis is within acceptable limits, since accuracy is the combined effect of precision and bias.

Representativeness

Representativeness is the degree to which measurements correctly represent the environmental condition, target organism population, and/or watershed to be studied. SPoT sampling locations were selected at the drainage points of large watersheds across the state to provide representative data in support of collaborative and statewide watershed-based monitoring programs. Sediment samples collected from these integrator sites are a logistically feasible way to collect samples representative of large watersheds because the sediment accumulates contaminants from the entire drainage.

SPoT staff, in coordination with Regional Water Board monitoring coordinators and storm water agencies, developed a monitoring design to incorporate sample sites that are representative of the major watersheds of the state. The Southern California Stormwater Monitoring Coalition participated in site selection for the southern California SPoT sites. A representative from the Bay Area Stormwater Management Agencies Association served on the SWAMP committee that designed the program, and all SPoT sites in the San Francisco Bay Region are aligned with monitoring sites for the Municipal Regional Stormwater National Pollutant Discharge Elimination Permit (SFBRWQCB 2011). SPoT sites in the Central Coast and Central Valley Regions are shared by the Cooperative Monitoring Program for Agriculture and Irrigated Lands Regulatory Program, respectively. Therefore, in most cases, the SPoT assessments of sediment toxicity and chemistry complement water column measurements made by cooperating programs.

Completeness

Completeness refers to the comparison between the amount of valid data originally planned to be collected, and the actual quantity collected. A minimum of 90 percent completeness of the planned sampling and analyses is the goal for SPoT.

Comparability

Comparability expresses the measure of confidence that one dataset can be compared to and combined with another for a decision(s) to be made. The SPoT sample site selection methodology and sampling design were developed to ensure data comparability across years. In addition, all sample collection, analyses, and reporting will be carried out with procedures and methodologies consistent with past SPoT data collection efforts and applicable [SWAMP MQOs](#) and Ambient Data Quality Objectives.

Sensitivity

Analytical sensitivity for chemistry analyses is defined as the lowest value an instrument or method can measure with reasonable statistical certainty. MPSL-DFW and Babcock Laboratories and their subcontractors must utilize analytical methods with laboratory-determined method detection limits (MDL) and reporting limits (RL) that meet the level of sensitivity required to meet the Measurement Quality Objectives (MQOs) for this project. For applications requiring a greater degree of statistical confidence, the RL, which is based upon project requirements and proven laboratory capabilities, is used. The RLs for the SPoT Program analytes can be found in [Appendix A](#). One of the primary goals of SPoT is to analyze trends in pollutants over time, thus consistent RLs are required so that the sensitivity of the chemical analyses are comparable over long time periods so the data can be statistically analyzed without censoring significant portions of the data. MPSL and Babcock Laboratories and their subcontractors must utilize analytical methods with laboratory-determined method detection limits (MDL) and reporting limits (RL) that meet the level of sensitivity required to meet the thresholds of the Project Data Quality Objectives.

The sensitivity of toxicity tests is primarily dependent on the organism used for testing. SPoT uses two organisms to cover a wide range of sensitivities to metals, industrial chemicals and pesticides. Sensitivity can further be affected by toxicity test methodology, including the number of replicates, the evaluation threshold, and the statistical approach utilized. All toxicity tests will be conducted by UCD-GC and follow U.S. EPA methodology and statistical approaches.

Measurement Quality Objectives

Measurement quality objectives (MQOs) are the acceptance criteria for the quality control samples that are used to assess the data quality indicators. SWAMP has programmatic MQOs that are used to assess SPoT data. The SPoT MQOs for each quality control sample used to inform each of the data quality indicators are given in Table 6, Table 7, Table 8 and Table 9. For definitions of all quality control terms, please see the SWAMP QAPrP.

A.8: Special Training/Certification

Specialized Training and Safety Requirements

No specialized training or certifications are required for this project. All laboratory staff are required to maintain training per field and laboratory specific requirements and follow the safety protocols established in each of their respective laboratories and applicable SOPs.

Training Provided

The PM trains all field staff in sample collection procedures in a field training day, while the UCD-GC QAO trains new staff in all laboratory procedures related to SPoT toxicity

tests. All new staff members are evaluated and supervised in the field and laboratory setting before they are allowed to work independently. All trainings are recorded in a safety training log and available upon request. Babcock staff sign off on applicable SOPs before performing analyses independently. MPSL-DFW staff must be familiar with analytical methods, modifications, and have authorization from the QAO to perform analyses prior to running any samples.

Laboratory Accreditation

ELAP accreditation of analyses performed as part of the SPoT Program is not required but is recommended for all analyses that are offered for accreditation by ELAP. For analyses performed by subcontractor laboratories, the SPoT Project Manager and SPoT Project Coordinator seek out laboratories that are accredited for the methods they will be performing.

UCD-GC is accredited by the State Water Board's Environmental Laboratory Accreditation Program (ELAP) for toxicity testing methods used for this project.

Babcock Laboratories and all the subcontract laboratories that will be performing SPoT analyses are accredited by ELAP. However, ELAP accreditation is not offered for analysis of pyrethroids, fipronils, individual PCBs, or PBDEs in the sediment matrix. SGS AXYS will be performing these organics analyses and they are ISO 17025 or TNI accredited for these analyses.

MPSL-DFW is ELAP accredited for some analyses and is in the process of gaining ELAP accreditation for metals in sediment.

All SOPs and documentation pertaining to laboratory safety procedures will be retained by all laboratories involved in the SPoT Program.

A.9: Documentation and Records Requirements

The following section describes the documents, records, and data deliverables required for the SPoT Program.

Planning Documents

Revisions and updates to this QAPP will be carried out by Katie Siegler and Bryn Phillips, with technical input from the Laboratory and SWAMP QAOs. All changes will be considered draft until reviewed and approved by the SPoT Project Coordinator, the SWAMP QAO, and the SWRCB QAO. The QAPP must be reviewed at least annually and revised where necessary. It must meet U.S. EPA, SWRCB, and SWAMP quality system requirements to be approved.

The SPoT Project Coordinator will send an electronic copy of this QAPP to the PM, who will then distribute it to all parties directly involved in this project. Any future amendments to this QAPP will be distributed in the same fashion. Each version of this

QAPP will be retained at the SWRCB. The SPoT QAPP will be updated every three years. Within the three-year term of the SPoT QAPP, it is reviewed on an annual basis and amended, if necessary.

Sample Collection and Handling Records

- Hardcopy field data sheets ([Appendix B](#)) will be completed by the staff at UCD-GC during each field visit. The hardcopy field data sheets are retained at UCD-GC for 10 years and will be made available to the State and Regional Water Boards upon request.
- An electronic copy of the field data sheet is forwarded to the analyzing laboratory in advance of sample receipt.
- Chain of custody (COC) forms are submitted with all sub-samples sent to analytical laboratories.

Analytical Records

Contract laboratories must maintain all raw data, instrument or equipment maintenance logs, calibrations, and relevant measurements and records for this project. All records must be retained at their respective laboratories for a minimum of 10 years from the contract's cessation (if applicable) and provided to State or Regional Water Board staff upon request.

Laboratory Reports

Laboratory reports for chemical analyses are issued by the laboratories performing the analyses and are submitted to UCD-GC and SWAMP IQ. SWAMP IQ will retain the laboratory reports for a minimum of 10 years from the receipt of the reports and will make them available upon request.

Electronic Data Deliverables

Toxicity test data, chemistry data, and field data collected for SPoT will be submitted electronically to SWAMP IQ, using the [appropriate SWAMP data templates and following the applicable business rules](#).

Corrective and Preventative Action Reports

Corrective and Preventative Action Reports (CPAR) are developed in response to an incident of non-conformance at any stage of data collection, from site visitation to sample analysis. CPARs are to be filled out by field crew members and laboratory personnel when a deviation from standard or required protocol has occurred, and must include the following information:

- Identification of the non-conformance including, but not limited to, the date, location, analysis/sample(s)/procedure/instrument affected, and the resulting effect.

- Identification of the root cause of the discrepancy or deviation.
- Suggested or summarized corrective actions taken to address the immediate issue and prevent future occurrences.

A CPAR will be provided to the SPoT Project Coordinator and PM via email ([CPAR template](#)). CPARs are submitted to the SWAMP QAO for review and approval.

Trend Reporting

SPoT monitoring began in 2008 and the first trend report was written in 2011. Other trend reports followed every two years until year seven. A 10-year trend report was written interpreting the results of data analyses from 2008-2017. Upon request, SPoT fact sheets are produced to provide easily understandable summaries of key SPoT findings. Future reporting will include summaries of and interpretations of outputs from the SWAMP data dashboard that are currently being developed.

GROUP B: Data Generation and Acquisition

B.1: Sampling Process Design

The monitoring design of SPoT is based on USGS's National Water Quality Assessment program (USGS, NAWQA: <http://water.usgs.gov/nawqa/>). NAWQA utilizes "integrator sites" for its sampling, which are areas established near the base of larger, relatively heterogeneous drainage basins with complex combinations of environmental settings, slow water flow, and appropriate micro-morphology to allow deposition and accumulation. These basins are indexed using eight-digit USGS hydrologic unit codes (HUC) and include watersheds for the Russian, South Fork American, Salinas, and Santa Clara Rivers. Sediment samples collected from integrator sites are considered to be a relatively good, and logistically feasible means of assessing large watersheds for long-term trends.

Initially, SPoT sampled 100 sites throughout California on an annual basis. This decreased to 90 sites in 2018. All sites were chosen for geographical representation and decided upon with input from the nine Regional Water Quality Control Boards, as well as local and regional monitoring programs, such as those directed by storm water agencies and coalitions, irrigated lands regulatory programs, and regional monitoring programs.

Surveys are scheduled based on regional hydrologic cycles, with Southern California coastal streams sampled in spring, and other regions sampled progressively later in the year as stream flows recede. A pilot study was conducted in the 2009-2010 SPoT survey in which three additional reaches per watershed were sampled during spring, summer, and fall survey to characterize spatial and temporal variability of the sampling design. The results from the additional samples were then compared to the results from other years using an F-ratio test to determine if seasonal variability was significantly greater than annual variability. It was determined that a single station at the base of the watershed was representative of other stations in the lower part of the watershed and was also seasonally representative.

B.2: Sampling Methods

Sediment samples will be collected in accordance with the SPoT field survey document, [Standard Operating Procedures \(SOPs\) for Conducting Field Collections of Bed Sediment Samples at Watershed Integrator Sites in the Surface Water Ambient Monitoring Program \(SWAMP\) Stream Pollution Trend \(SPoT\) Program](#) (SPoT Field SOP). Samples are collected along a 100 m reach, with subsamples collected from up to 10 depositional areas, depending on the location of fine sediment deposits. Subsamples are homogenized to address variability and create a sample representative of depositional sediment mobilized within the watershed. Care is taken to sample recent sediment deposits in active areas of the streambed by avoiding banks, beaches, and other areas where sediment may have been deposited more than one year previously.

Sediment is sampled to a depth of up to five centimeters when the entire five-centimeter core is homogeneous and appears to have been deposited within the same hydrologic cycle of seasonal high water receding to annual base flow. However, sediment may need to be collected as shallow as one centimeter if there is clear layering indicating deposition over multiple annual cycles.

Field crews measure dissolved oxygen, pH, conductivity, and temperature on-site. Crews also make observations of dominant substrate, presence of plant material, and water clarity and color.

Equipment

The following items will be used in the field:

- YSI EXO3 multi-parameter sonde
- Sediment core tubes
- Sediment scoops

The YSI EXO3 multi-parameter sonde is used to conduct field measurements of dissolved oxygen, temperature, conductivity, and pH. The sediment core tubes and scoops are to collect sediment samples in accordance with the procedures outlined in the SPoT Field SOP.

The sediment core tubes and scoops are to collect sediment samples in accordance with the procedures outlined in the SPoT Field SOP.

Cleaning/Decontamination

It is critical that sample contamination be avoided during collection. All sampling equipment is composed of a non-contaminating material and is thoroughly cleaned before each use, as described in the SPoT Field SOP. Sampling personnel wear nitrile gloves whenever taking or processing samples to avoid contact contamination. In addition, airborne contamination is avoided by keeping sample containers appropriately covered when not in use.

B.3: Sample Handling and Custody

Sample Documentation

Field data will be collected and documented on standardized field data sheets ([Appendix B](#)).

Sample Handling Requirements

Sample handling requirements for SPoT analytes were excerpted from SWAMP's MQOs for Conventional Parameters in Freshwater Sediment and Marine Sediment; Inorganic Analytes in Freshwater Sediment and Marine Sediment; Synthetic Organic

Compounds in Freshwater Sediment and Marine Sediment; and Freshwater Sediment Toxicity Testing ([Table 3](#)).

All samples will be handled, prepared, transported, and stored in a manner so as to minimize bulk loss, analyte loss, contamination, or biological degradation, according to the applicable MQOs ([Tables 5 through Table 8](#)), and the SPoT Field SOP. Sample container caps and lids will be checked for tightness and clearly labeled with an indelible marker. Samples are then placed in an insulated cooler with enough dry or wet ice to completely fill the space and then sealed with tape before shipping. Chain of Custody forms are either placed in an envelope and taped to the top of the cooler or placed in a Ziploc plastic bag and taped to the inside of the lid. It is assumed that samples in tape-sealed coolers are secure, whether being transported by staff vehicle, by common carrier, or by commercial package delivery.

Table 3. Sample Handling Requirements for SPoT Analytes in Sediment

Analyte	Recommended Container ¹	Recommended Preservation	Required Holding Time ²
Grain Size	Glass	Wet ice to $\leq 6^{\circ}\text{C}$ in the field, then refrigerate at $\leq 6^{\circ}\text{C}$	1 year
Organic Carbon (Total)	Glass	Cool to $\leq 6^{\circ}\text{C}$ or freeze to $\leq -20^{\circ}\text{C}$	28 days at $\leq 6^{\circ}\text{C}$; 1 year at $\leq -20^{\circ}\text{C}$
• Organochlorine Pesticides • Polynuclear Aromatic Hydrocarbons	Glass	Cool to $\leq 6^{\circ}\text{C}$ within 24 hours, then freeze to $\leq -20^{\circ}\text{C}$	1 year; samples must be extracted within 14 days of collection or thawing and analyzed within 40 days of extraction
• Polybrominated Diphenyl Ethers • Polychlorinated Biphenyls	Glass	Cool to $\leq 6^{\circ}\text{C}$ within 24 hours, then freeze to $\leq -20^{\circ}\text{C}$	None
PFAS	HDPE	Cool to $\leq 6^{\circ}\text{C}$ within 24 hours, then freeze to $\leq -20^{\circ}\text{C}$	90 days
Pyrethroids	Glass	Short-term storage: $\leq 6^{\circ}\text{C}$ in the dark; long-term storage, or storage of remaining sample: $\leq -20^{\circ}\text{C}$ in the dark	1 year at $\leq -20^{\circ}\text{C}$ in the dark; samples must be extracted within 14 days of collection or thawing and analyzed within 40 days of extraction
Trace Metals	Glass	Cool to $\leq 6^{\circ}\text{C}$ within 24 hours,	1 year; samples must be digested

Analyte	Recommended Container ¹	Recommended Preservation	Required Holding Time ²
		then freeze to $\leq -20^{\circ}\text{C}$	within 14 days of collection or thawing
Freshwater Sediment Toxicity	Amber glass recommended, but clear glass or plastic (polyethylene or polycarbonate) are acceptable	Wet or blue ice in field, $0 - 6^{\circ}\text{C}$ refrigeration in laboratory, dark at all times	<14 days (recommended) or <8 weeks (required) at $\leq 6^{\circ}\text{C}$ in the dark; do not freeze
Freshwater Water Toxicity	Amber glass recommended	Wet or blue ice in field, $0 - 6^{\circ}\text{C}$ refrigeration in laboratory, dark at all times	48 hours at 4°C in dark

1. Samples for TOC and grain size analysis can be combined in one 250-mL clear glass jar, and sub-sampled at the laboratory in order to utilize holding time differences for the two analyses. If this is done, the 250 mL combined sediment sample must be refrigerated (not frozen) at $\leq 6^{\circ}\text{C}$ for up to 28 days, during which time the sub-samples must be aliquoted in order to comply with separate storage requirements.

2. Each "Required Holding Time" is based on the assumption that the "Recommended Preservation" (or a method-mandated alternative) has been employed. If a "Required Holding Time" for filtration, preservation, preparation, or analysis is not met, the PM and SWAMP QAO must be notified. Regardless of preservation technique, data not meeting the "Required Holding Time" will be appropriately flagged in the SWAMP database.

Sample Chain of Custody

Project chain of custody (COC) procedures require that the possession of samples is traceable from the time they are collected until completion and submittal of analytical results. Therefore, a complete COC form will accompany the transfer of samples to each analyzing laboratory and will be forwarded to the PM with the data reporting package (see SWAMP IQ Wiki for the [UCD-GC COC form](#) and the [Babcock Laboratories, Inc. COC](#)).

The receiving laboratory must have a sample custodian who examines the samples for proper documentation, preservation, and holding times. For SPoT, samples will be collected by UCD-GC personnel so samples will not change custody between field collection and laboratory storage. When samples are transported from UCD-GC to other laboratories, the temperature will be checked at the receiving laboratory using an infrared thermometer in order to determine compliance with the sample preservation methods established in the applicable toxicity test MQOs (e.g., $0 - 6^{\circ}\text{C}$). Contract laboratories will follow the COC procedures outlined in their respective QA plans (available upon request).

Copies of the COCs will be kept by each receiving laboratory. An electronic copy of the COC will be provided to the Contract Manager and SWAMP IQ Data Managers within 10 business days of submission of samples to the laboratory.

Sample Retention and Disposal

All samples must be retained for the entire duration of their required holding times and analyses. Any samples remaining after completion of analyses must be retained until the laboratory has received written confirmation from the UCD-GC PM that the data have been received, reviewed, and verified and disposal of samples is permitted.

It is the responsibility of the personnel of each analytical laboratory to ensure that all applicable regulations are followed in the disposal of samples or chemicals.

B.4: Analytical Methods and Field Measurements

Field Measurements

The YSI EXO3 multi-parameter sonde is used to conduct field measurements of dissolved oxygen, temperature, conductivity, and pH in the surface water (Table 4).

Table 4. Field Measurement Parameters

Analyte	Range	Accuracy	Resolution
Dissolved oxygen	0 to 50 mg/L	0 to 20 mg/L: ± 0.1 mg/L or 1% of reading, w.i.g.; 20 to 50 mg/L: $\pm 5\%$ of reading	0.01 mg/L
Temperature	-5 to 35°C 35 to 50°C	$\pm 0.01^\circ\text{C}$ $\pm 0.05^\circ\text{C}$	0.001 °C
Conductivity	0 to 200 mS/cm	0 to 100: $\pm 0.5\%$ of reading or 0.001 mS/cm, w.i.g.; 100 to 200: $\pm 1\%$ of reading	0.0001 to 0.01 mS/cm (range dependent)
pH	0 to 14 units	± 0.1 pH units within $\pm 10^\circ\text{C}$ of calibration temp	0.01 units

Laboratory Analytical Methods

The standardized test methods used to measure the analytes of interest to the SPoT Program are listed in [Table 5](#), along with the responsible laboratories. All toxicity testing and related toxicity water quality analyses are conducted by the University of California Davis Granite Canyon Lab. All metals analyses are conducted by the MPSL-DFW. All organics will be analyzed by SGS AXYS and TOC will be analyzed by McCampbell Analytical, who are both subcontracted by Babcock Laboratories via master service agreements. Subcontracted laboratories are subject to change if an instrument goes down or other issues arise at a laboratory that prevent them from meeting the requirements laid out in this QAPP. For organics methods, subcontracted labs may use modified methods that are considered equivalent provided they have demonstrated similar performance and meet the quality assurance requirements of the SPoT program. Turnaround times for laboratory data are specified in each contract.

Table 5. SPoT Analytes and Methodology

Laboratory/ Organization	Analyte	Method	Unit
UCD-GC	Sediment Toxicity	EPA 600/R-99/064 (U.S. EPA 2000); <i>Hyalella azteca</i> ; SOP 2.7	Percent Survival, mg/individual
UCD-GC	Sediment Toxicity	EPA 600/R-99/064 (U.S. EPA 2000); <i>Chironomus dilutus</i> ; SOP 2.8	Percent Survival, mg/individual
UCD-GC	Water Column Toxicity	EPA 821/R-02/012M (U.S. EPA 2002); <i>Hyalella azteca</i> ; SOP 2.20	Percent Survival
UCD-GC	Water Column Toxicity	ASTM E1706-20 (ASTM 2020); <i>Chironomus dilutus</i> ; SOP 2.26	Percent Survival, mg/individual
UCD-GC	Water Column Toxicity	EPA-821-R-02-013 (U.S. EPA 2002) <i>Ceriodaphnia dubia</i> ; SOP 2.3	Percent Survival, Reproduction
SGS AXYS	Fipronil and Degradates	MLA-114 (LC-MS/MS)	ng/g dw
SGS AXYS	Organochlorine Pesticides	EPA 1699 (MLA-228)	ng/g dw
SGS AXYS	PAHs	MLA-021 (LRGC-MS)	ng/g dw

Laboratory/ Organization	Analyte	Method	Unit
SGS AXYS	PBDEs	EPA 1614 (MLA-033)	pg/g dw
SGS AXYS	PCBs	EPA 1668C (MLA-010)	pg/g dw
SGS AXYS	PFAS	EPA 1633 (MLA-110 Rev 2)	ng/g dw
SGS AXYS	Pyrethroids	MLA-046 (HRGC-MS)	ng/g dw
McC Campbell Analytical	Total Organic Carbon	EPA 9060A	mg/kg
MPSL-DFW	Trace Metals	EPA 6020bM; EPA 3052M (Modified for digestion)	mg/kg dw
MPSL-DFW	Mercury	EPA 7473M	mg/kg dw

B.5: Quality Control

The laboratories participating in the SPoT Monitoring Program employ multiple approaches to quality control in order to identify possible contamination problem(s), matrix interference, and to evaluate the precision and accuracy of laboratory activities. The results of quality control sample analyses are compared to the SPoT Program MQOs to ensure compliance. The quality control requirements and MQOs are listed in Tables 6 through 9 below. If the method being used specifies more stringent requirements, the method requirements must be followed. For synthetic organic compounds, all detected analytes must be confirmed with a second column, second technique, or mass spectrometry. For definitions of all quality control terms, please see the SWAMP QAPrP.

A laboratory must request prior approval from the SWAMP QA Officer before proceeding with an analysis that would deviate from the quality control requirements in this QAPP. When control limits are exceeded, the Laboratory QAO will determine the cause(s) by reviewing SOPs and identifying, documenting, and correcting any deficiencies.

Table 6. Quality Control for Inorganic Analytes in Sediment

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Calibration Standard	Per analytical method or manufacturer's specifications	Per analytical method or manufacturer's specifications
Calibration Verification	Per 10 analytical samples	80-120% recovery
Laboratory Blank	Per 20 samples or per analytical batch, whichever is more frequent	<RL for target analyte
Laboratory Control Sample or Certified Reference Material	Per 20 samples or per analytical batch, whichever is more frequent	75-125% recovery
Matrix Spike	Per 20 samples or per analytical batch, whichever is more frequent	75-125% recovery
Matrix Spike Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	75-125% recovery; RPD<25%
Laboratory Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	RPD<25% (n/a if native concentration of either sample<RL)
Internal Standard	Accompanying every analytical run when method appropriate	60-125% recovery

Field Quality Control	Frequency of Analysis	Measurement Quality Objective
Field Duplicate	5% of total project sample count (Sampling stations for field duplicates are randomly selected.)	RPD <25% (n/a if native concentration of either sample<RL), unless otherwise specified by method
Equipment Blank	Per method	Blanks<RL for target analyte

Table 7. Quality Control for Synthetic Organic Compounds in Sediment

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Tuning	Per analytical method	Per analytical method
Calibration	Initial method setup or when the calibration verification fails	- Correlation coefficient ($r^2 > 0.990$) for linear and non-linear curves - If $RSD < 15\%$, average response factor (RF) may be used to quantitate; otherwise use equation of the curve - First- or second-order curves only (not forced through the origin) - Refer to SW-846 methods for SPCC and CCC criteria¹ - Minimum of 5 points per curve (one of them at or below the RL)
Calibration Verification	Per 12 hours	- Expected response or expected concentration $\pm 20\%$ - RF for SPCCs = initial calibration¹
Laboratory Blank	Per 20 samples or per analytical batch, whichever is more frequent	<RL for target analytes
Laboratory Control Sample or Certified Reference Material	Per 20 samples or per analytical batch, whichever is more frequent	LCS: 50-150% recovery CRM: 70-130% recovery
Matrix Spike ²	Per 20 samples or per analytical batch, whichever is more frequent. Not required for isotope dilution methods.	50-150% or based on historical laboratory control limits (average ± 3 SD)
Matrix Spike Duplicate ²	Per 20 samples or per analytical batch, whichever is more frequent. Not required for isotope dilution methods.	50-150% or based on historical laboratory control limits (average ± 3 SD); RPD < 25%
Laboratory Duplicate	Only required for isotope dilution methods: Per 20 samples or per analytical batch, whichever is more frequent.	RPD < 25% (n/a if native concentration of either sample < RL)
Surrogate	Included in all samples and all quality control (QC) samples. Not required for isotope dilution methods.	Based on historical laboratory control limits (50-150% or better)
Isotope Dilution Analogues	Only required for isotope dilution methods: Included in all samples and all quality control (QC) samples.	Based on historical laboratory control limits (50-150% or better)
Internal Standard	Included in all samples and all QC samples if required by the method	Per laboratory procedure

1. Mass spectrometry only

2. MS/MSD are generally not required for isotope dilution methods because any matrix effects should be evident in the IDA recoveries. However, if the method quantifies specific compounds using a nonanalogous isotopically labeled compounds, the analysis of matrix spike samples may help diagnose matrix interferences for these specific compounds.

Field Quality Control	Frequency of Analysis	Measurement Quality Objective
Field Duplicate	5% of total project sample count (Sampling stations for field duplicates are randomly selected.)	Per method
Equipment Blank	Per method	<RL for target analytes

Table 8. Quality Control for Pyrethroids in Sediment

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Tuning ¹	Per analytical method	Per analytical method
Calibration	Daily, or just prior to analysis; five or more level standards spanning the sample result range ² , with the lowest standard at or below the RL	$r \geq 0.995$ (or $r^2 \geq 0.995$, all curve types not forced through origin); or relative response factor (RRF) < 20%
Calibration Verification	Per 10 analytical samples ³	80-120% ⁴
Laboratory Blank	Per 20 samples or per analytical batch, whichever is more frequent	<RL for target analytes
Laboratory Control Sample ⁵	Per 20 samples or per analytical batch (preferably blind)	50-150%
Matrix Spike	Per 20 samples or per analytical batch, whichever is more frequent	50-150%
Matrix Spike Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	50-150%; RPD $\leq$ 35%
Surrogate ⁶	Included in all samples and all QC samples	Based on historical laboratory control limits (50-150% or better)
Internal Standard	Included in all samples and all QC samples (as available)	Per laboratory procedure

1. Mass spectrometry only

2. Sample results above the highest standard are to be diluted and re-analyzed.

3. Analytical samples include samples only and do not include clean-out or injection blanks.

4. Limit applies to a mid-level standard; low-level calibration checks near the reporting limit may have a wider range that is project-specific.

5. Laboratory control samples must be matrix-specific. A clean sediment, roasted sand, or roasted sodium sulfate may be used for sediments.

6. Laboratory historical limits for surrogate recovery must be submitted to the SWAMP database in the lab result comment section.

Field Quality Control	Frequency of Analysis	Measurement Quality Objective
Field Duplicate	5% of total project sample count (Sampling stations for duplicates are randomly selected.)	Per method

Table 9. Quality Control for Sediment Toxicity

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Laboratory Control Water	Laboratory control water consistent with Section 7 of the appropriate EPA method/manual must be tested with each analytical batch.	Laboratory control water must meet all test acceptability criteria (please refer to Section 7 of the appropriate EPA method/manual) for the species of interest.
Conductivity/Salinity Control Water	A conductivity or salinity control must be tested when these parameters are above or below the species tolerance.	Follow EPA guidance on interpreting data and refer to tables below for tolerance ranges.
Additional Control Water	Additional method blanks are required whenever manipulations are performed on one or more of the ambient samples within each analytical batch (e.g., pH adjustments, continuous aeration).	There must be no statistical difference between the laboratory control water and each additional control water within an analytical batch.
Sediment Control	Sediment control consistent with Section 7 of the appropriate EPA method/manual must be tested with each analytical batch of sediment toxicity tests.	Sediment control must meet all data acceptability criteria (please refer to Section 7 of the appropriate EPA method/manual) for the species of interest.

B.6: Instrument/Equipment Testing, Calibration, and Maintenance

Laboratory instruments are inspected and maintained in accordance with laboratory SOPs, which include those specified by the manufacturer and those specified by the method. These SOPs have been reviewed by each respective Laboratory QAO and

found to be in compliance with SWAMP criteria. Analysts are responsible for equipment testing, inspection, and maintenance.

The manufacturer's instructions for the laboratory equipment used in the SPoT Program will be followed as a minimum requirement. The results of equipment tests, inspections, maintenance, and repairs will be documented in the appropriate logbook. If an instrument fails to meet the accuracy and/or precision criteria after maintenance has been performed, the manufacturer will be contacted.

All laboratory equipment will be cleaned/decontaminated in accordance with the applicable laboratory's SOP(s). Copies of these SOPs are retained by the SWRCB and will be made available to the Regional Water Boards upon request.

Laboratory and field instruments are calibrated, standardized, and maintained according to the analytical method, the manufacturer's specifications, and the applicable MQOs ([Table 10](#)). Analytical instruments that fail to meet performance requirements will be checked and recalibrated according to their respective SOP. If the instrument still does not meet specifications, it will be repaired and retested until performance criteria are achieved. In addition, all maintenance activities will be recorded into the instrument's log. If sample analytical information is in question due to instrument performance, the PM will be contacted regarding the proper course of action.

At a minimum, all calibration procedures will meet the requirements specified in the U.S. EPA-approved methods of analysis. The means and frequency of calibration recommended by the manufacturer of the equipment or devices, as well as any instruction given specifically for an analytical method, will be followed. When such information is not specified by the method, instrument calibration will be performed at least once daily, and continuing calibration will be performed on a ten percent basis thereafter (with the exception of analysis by GC-MS). It is also required that records of calibration be kept by the person performing the calibration and be accessible for verification during a laboratory or field audit.

Table 10. Project Inspection/Acceptance and Calibration Requirements for Field and Laboratory Probes

Instrument Name/Model	Date Purchased	Inspection/Calibration Specifications	Acceptance Criteria	Frequency
YSI EXO3 multi-parameter sonde (field water quality)	2018	Per manual	Standards must read within 10% of target	Calibrated before each field run; dissolved oxygen calibrated before each measurement
Thermo Scientific Orion Versastar Pro – Advanced Electrochemistry Meter	2020	Per manual	Standards must read within 10% of target	Calibrated with standards daily
Hach DR/2010 spectrophotometer (lab ammonia)	2005	Per manual	Standards must read within 10% of target	Calibrated with standards for each use

B.7: Inspection/Acceptance of Supplies and Consumables

All supplies will be examined for damage as they are received. Laboratory personnel will review all supplies as they arrive to ensure the shipment is complete and intact. All chemicals are logged into the appropriate logbook and dated upon receipt. All supplies are stored appropriately and are discarded upon expiration date. If items are not found to be in compliance with accuracy, precision, and contamination criteria, they will be returned to the manufacturer.

B.8: Data Management

Field Observations and Measurements

Field data will be collected and documented on field data sheets ([Appendix B](#)) and entered into a data entry shell database by Katie Siegler upon return to the laboratory. Field crews will check the entered data for typos and errors before the Laboratory QAO and PM verify the data to ensure proper flagging for equipment failures and impossible values. When field data have been entered into the shell database, then the PM uploads it to the [SWAMP FTP site](#) where the data contained therein are automatically transferred to the SWAMP Database. Original field sheets will be retained in a logbook at UCD-GC, which is managed by the Field Data Manager and is available upon request.

Laboratory Data

Raw toxicity data are transcribed from lab data sheets upon test completion by Randi Barton to the SWAMP templates for eventual input to the SWAMP Database. All toxicity data are reviewed for accuracy by the Laboratory QAO and/or the PM. MPSL-DFW and Babcock staff populate SWAMP templates for submission of chemical analysis data to the SWAMP Database. Toxicity and chemical analysis laboratory data are checked using the SWAMP Online Data Checker using a SWAMP template EDD format to ensure compliance with SWAMP business rules. If the data do not receive an error message from the SWAMP Online Data Checker, then the EDD will be submitted to the OIMA Helpdesk inbox for the SWAMP IQ Data Managers to verify the data.

All raw and statistically analyzed data are subject to a 100% check for accuracy by the PM, Laboratory QAOs (or Laboratory Managers or Leads), and SWAMP IQ. SWAMP IQ Data Managers review the data for accuracy and check them against the QAPP and applicable MQOs before uploading the data into the SWAMP Database. Data from the SWAMP Database transfers to the California Environmental Data Exchange Network (CEDEN) each week, where it can be accessed publicly. SWAMP IQ Data Managers contact the submitting laboratory if there are any questions or issues with submitted EDDs to resolve during the data verification process. Completeness of the data will be tracked through the SWAMP Database. See section D.1 for more information.

Original hard copies of all laboratory and field data are filed in a secure cabinet until requested by the SPoT Project Coordinator or SWAMP QAO. Original copies of the field sheets, laboratory logs, and data generated at UCD-GC are stored there for 20 years. SWAMP IQ stores EDDs as they were originally received and a separate copy if any modifications were made prior to loading to the database. EDDs are stored on the Water Boards shared network drive.

GROUP C: Assessments

C.1: Assessments and Response Actions

Project Kickoff (Readiness Review)

Prior to the start of each sampling season, the PM will arrange a teleconference or web conference with the Laboratory QAOs from each of the participating laboratories, applicable SWAMP IQ Data Managers, SWAMP QAO, Project Coordinator, and the OIMA Contract Manager. These meetings will facilitate coordination of project planning and logistics and should address the following topics: the project work order, field sheets, COC forms, sample collection timing, sample handling (shipping), laboratory turnaround times, and data submission.

Real-Time Data Audits

Data will be reviewed by each Laboratory QAO prior to submission of each batch to the PM or SWAMP Database. Field crew audits will be conducted once per sampling season, and a review of sampling procedures will be made by the Sample Manager and the PM, should problems arise. As SOPs are updated and refined, additional reviews will be made. Each laboratory data technician is responsible for flagging data that does not meet established QA/QC criteria.

If a reviewer discovers any discrepancy, the Laboratory QAO will discuss it with the personnel responsible for the activity. The discussion will include the accuracy of the information, potential factors leading to the deviation, how the deviation might impact data quality, and the corrective actions that might be considered. If the discrepancy is not resolved, the Laboratory QAO will issue a stop work order until the problem is fixed.

Internal quality checks are conducted by the Laboratory QAO, and minor errors are addressed by discussing issues with lab staff and reviewing training. If major discrepancies are observed, analytical equipment fails, or quality check samples fall outside of acceptability limits, personnel are to record the problem, according to their documentation protocols, and take the necessary actions to correct and resolve the issue. Corrective actions will be documented and provided in a Corrective and Preventative Action Report at the request of the SPoT Project Coordinator, SWAMP QAO, or the Contract Manager. The SWAMP QAO will review the report and may request additional information or actions to be taken. The laboratory shall respond with an amended Corrective and Preventative Action Report within the timeframes agreed upon in the current contract. The laboratory will notify the SPoT Project Coordinator, SWAMP QAO, and Contract Manager before proceeding with an analysis. Associated data resulting from a corrective action shall be flagged accordingly.

Technical System Audit

The Field Crew Manager shall conduct random field procedure audits to ensure adherence to the standard operating procedures, field health and safety requirements, and sample handling and custody procedures. The Laboratory Director or QAO shall conduct laboratory systems audits per the Laboratory Quality Management Plan.

Deviations and Corrective Actions

Analyses are conducted according to procedures and conditions recommended by the U.S. EPA, and described in laboratory SOPs, with the exception of those reported herein. Beyond those identified, deviations from these recommended conditions are reported to the Laboratory QAO. The Project Coordinator and the SWAMP QAO will also be notified within 48 hours of a deviation. The recommended corrective actions for the SPoT analytes are given below in tables 11-13.

In the event of an SOP/QAPP deviation or corrective action, a Corrective and Preventative Action Report will be prepared, completed, and signed, and the Project Coordinator and the SWAMP QAO will both be notified. Best professional judgment will be used in interpretation of results obtained when deviations in the test conditions have occurred. All deviations and associated interpretations will be reported in interim and final reports. Protocol amendments will be submitted to the Laboratory QAO, SWAMP QAO, and Project Coordinator. Upon approval, protocol amendments will be employed.

Table 11. Recommended Corrective Actions for SPoT Analytes in Sediment

Analyte	Laboratory Quality Control	Recommended Corrective Action
- Inorganic Analytes in Sediment - Synthetic Organic Compounds in Sediment	Calibration Standard	Recalibrate the instrument. Affected samples and associated QC must be reanalyzed following successful instrument recalibration.
- Inorganic Analytes in Sediment - Synthetic Organic Compounds in Sediment	Calibration Verification	Reanalyze the calibration verification to confirm the result. If the problem continues, halt analysis and investigate the source of the instrument drift. The analyst should determine if the instrument must be recalibrated before the analysis can continue. All of the samples not bracketed by acceptable calibration verification must be reanalyzed.
- Inorganic Analytes in Sediment - Synthetic Organic Compounds in Sediment	Method Calibration Range	If a target analyte(s) exceeds the method calibration range, dilute the sample and reanalyze. If dilution is unsuccessful, then reanalyze the sample using a smaller sample size.
- Inorganic Analytes in Sediment - Synthetic Organic Compounds in Sediment	Laboratory Blank	Reanalyze the blank to confirm the result. Investigate the source of contamination. If the source of the contamination is isolated to the sample preparation, the entire batch of samples, along with the new laboratory blanks and associated QC samples should be prepared and/or re-extracted and analyzed. If the source of contamination is isolated to the analysis procedures, reanalyze the entire batch of samples. If reanalysis is not possible, the associated sample results must be flagged to indicate the potential presence of the contamination.
- Inorganic Analytes in Sediment - Synthetic Organic Compounds in Sediment	Reference Material	Reanalyze the reference material to confirm the result. Compare this to the matrix spike/matrix spike duplicate recovery data. If adverse trends are noted, reprocess all of the samples associated with the batch.
- Inorganic Analytes in Sediment - Synthetic Organic Compounds in Sediment	Matrix Spike	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike to confirm the result. Review the recovery obtained for the matrix spike duplicate. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.

Analyte	Laboratory Quality Control	Recommended Corrective Action
- Inorganic Analytes in Sediment - Synthetic Organic Compounds in Sediment	Matrix Spike Duplicate	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike duplicate to confirm the result. Review the recovery obtained for the matrix spike. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
- Inorganic Analytes in Sediment - Synthetic Organic Compounds in Sediment	Laboratory Duplicate	Reanalyze the duplicate samples to confirm the results. Visually inspect the samples to determine if a high RPD between the results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity.
- Inorganic Analytes in Sediment - Synthetic Organic Compounds in Sediment	Internal Standard	Check the response of the internal standards. If the instrument continues to generate poor results, terminate the analytical run and investigate the cause of the instrument drift.
Synthetic Organic Compounds in Sediment	Surrogate	Analyze as appropriate for the utilized method. Troubleshoot as needed. If no instrument problem is found, samples should be re-extracted and reanalyzed if possible.
Synthetic Organic Compounds in Sediment	Isotope Dilution Analogues	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery. If there is excess matrix, then dilute the sample and reanalyze. If dilution is unsuccessful, then reanalyze the sample using a smaller sample size.

Analyte	Field Quality Control	Recommended Corrective Action
- Inorganic Analytes in Sediment - Synthetic Organic Compounds in Sediment	Field Duplicate	Visually inspect the samples to determine if a high RPD between results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity. All failures should be communicated to the project coordinator, who in turn will follow the process detailed in the method.

Table 12. Recommended Corrective Actions for Pyrethroids

Laboratory Quality Control	Recommended Corrective Action
Calibration Standard	Affected samples and associated quality control must be reanalyzed following successful instrument recalibration.
Calibration Verification	Initial calibration is analyzed immediately after calibration and should be from a source different than the calibration curve. Bracketing continuing calibration standards are used every ten sample runs for quantitation per method protocol. The analysis must be halted, the problem investigated, and the instrument recalibrated. All samples after the last acceptable continuing calibration verification must be reanalyzed.
Method Calibration Range	If a target analyte(s) exceeds the method calibration range, dilute the sample and reanalyze. If dilution is unsuccessful, then reanalyze the sample using a smaller sample size.
Laboratory Blank	The sample analysis must be halted, the source of the contamination investigated, the samples along with a new laboratory blank prepared and/or re-extracted, and the sample batch and fresh laboratory blank reanalyzed. If reanalysis is not possible due to sample volume, flag associated samples.
Laboratory Control Sample	The LCS is analyzed in the same manner as an environmental sample and the spike recovery demonstrates the accuracy of the method. Affected samples and associated quality control must be reanalyzed following LCS troubleshooting and resolution. After troubleshooting, compare to matrix spike/matrix spike duplicate recovery data. If adverse trends are noted, reprocess all samples associated with the batch.

Laboratory Quality Control	Recommended Corrective Action
Matrix Spike	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Appropriately spiked results should be compared to the matrix spike duplicate to investigate matrix interference. If matrix interference is suspected, the matrix spike result must be flagged. Appropriately spiked results should be compared to the matrix spike duplicate to investigate matrix interference. If matrix interference is suspected and LCS recoveries are acceptable, the matrix spike and matrix spike duplicate results must be flagged.
Matrix Spike Duplicate	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Appropriately spiked results should be compared to the matrix spike to investigate matrix interference. If matrix interference is suspected and LCS recoveries are acceptable, the matrix spike duplicate result must be flagged.
Surrogate	Analyze as appropriate per method. Trouble shoot as appropriate, if no instrument problem is found samples should be re-extracted and re-analyzed if possible.
Internal Standard	Analyze as appropriate per method. Troubleshoot as appropriate. If, after trouble-shooting, the responses of the internal standards remain unacceptable, the analysis must be terminated and the cause of drift investigated.

Field Quality Control	Recommended Corrective Action
Field Duplicate	For duplicates with a heterogeneous matrix or ambient levels below the reporting limit, failed results may be flagged. All failures should be communicated to the project coordinator, who in turn will follow the process detailed in the method.

Table 13. Recommended Corrective Actions for Freshwater Sediment Toxicity Tests

Laboratory Quality Control	Recommended Corrective Action
Laboratory Control Water	If tested with in-house cultures, affected samples and associated quality control must be retested within 24 hours of test failure. If commercial cultures are used, they must be ordered within 16 hours of test failure for the earliest possible receipt. Retests must be initiated within 30 hours of receipt, depending on the need for organism acclimation. The laboratory should try to determine the source of the control failure, document the investigation, and document the steps taken to prevent a recurrence.
Conductivity Control Water	Affected samples and associated quality control must be flagged.
Additional Control Water	Based on the objectives of the study, a water sample that has similar qualities to the test sample may be used as an additional control. Results that show statistical differences from the laboratory control should be flagged. The laboratory should try to determine the source of variation, document the investigation, and document the steps taken to prevent a recurrence. This is not applicable for TIE method blanks.
Sediment Control	Based on the objectives of the study, a sediment sample that has similar qualities to the test sample may be used as an additional control. Results that show statistical differences from the laboratory control should be flagged. The laboratory should try to determine the source of variation, document the investigation, and document the steps taken to prevent a recurrence.
Positive Controls: Reference Toxicant Tests	If the LC50 exceeds +/- two standard deviations of the running mean of the last 20 reference toxicant tests, the test should be flagged.

Field Quality Control	Recommended Corrective Action
Field Duplicate	For duplicates with a heterogeneous matrix, results that do not meet SWAMP criteria should be flagged. The project coordinator should be notified so that the sampling team can identify the source of variation and perform corrective action prior to the next sampling event.
Field Blanks	If contamination of the field blanks and associated samples is known or suspected, the laboratory should flag the affected data. The project coordinator should be notified so that the sampling team can identify the contamination source(s) and perform corrective action prior to the next sampling event.
Equipment Blanks	If contamination of the field blanks and associated samples is known or suspected, the laboratory should flag the affected data. The project coordinator should be notified so that the sampling team can identify the contamination source(s) and perform corrective action prior to the next sampling event.

Data Quality Assessment

A data quality assessment is conducted at the end of each sampling season and includes the following:

- Initial review of analytical and field data for complete and accurate documentation, COC procedures, compliance with analytical holding times, and required frequency of laboratory QA samples;
- Review of data verification of results;
- Reconciliation with corrective actions; and
- Discussion of any remaining issues and potential improvements for the following sampling season.

The results of the data quality assessment are discussed with the SWAMP QAO and at the Scientific Review Committee meeting to allow for additional feedback to continue to improve the SPoT Program.

C.2: Reports to Management

Corrective and Preventative Action Reports

Corrective actions are documented in the laboratory record. If a failure is not resolved, it is conveyed to the Laboratory QAO who determines if the failure compromised associated results. The nature and disposition of the problem will be documented in the report sent to the Project Coordinator.

GROUP D: Data Validation and Usability

D.1: Data Review, Verification and Validation Requirements

Primary Verification

All data reported for SPoT will be checked for errors in transcription, calculation, and computer input by the Laboratory Director, Sample Manager, and/or Laboratory QAO. Additionally, the Laboratory QAO will review sample logs and data forms to ensure that requirements for sample preservation, sample integrity, equipment calibration, and data quality have been met. Data that do not meet these requirements will either not be reported or will be reported with qualifiers, which serve as an explanation of any necessary considerations.

Secondary Verification

Because SPoT is a statewide SWAMP monitoring program, all SPoT data are required to go through the secondary verification process performed by SWAMP IQ Data Managers, as described in the SWAMP QAPrP. For secondary data verification, SWAMP IQ Data Managers verify that submitted data are in the correct format, use standardized vocabulary, follow the SWAMP business rules, and adhere to the MQOs prior to loading the data to the SWAMP database.

D.2: Verification and Validation Methods

Field data will be submitted electronically to the SWAMP FTP site through the use of a shell database. Field crews will check the entered data for typos and errors before the Laboratory QAO and PM verify the data to ensure proper flagging for equipment failures and impossible values.

Laboratory data will be sent electronically to SWAMP IQ for verification and inclusion in the SWAMP Database. SWAMP IQ will follow the [SWAMP SOPs](#) when reviewing submitted toxicity and chemistry data and determining compliance with the applicable SWAMP MQOs. Discrepancies in flagged data, noted during the data verification process, will be communicated to the SWAMP QAO, Laboratory QAO, and PM prior to loading. Excessive amounts of data discrepancies may warrant corrective action, as described in section C.1.

D.3: Reconciliation with User Requirements

Potential anomalies that might occur during analysis include loss of data due to contract labs not meeting quality assurance requirements, or constantly evolving analyte lists based on inconsistent use of the same contract lab. Examples of this include the loss of the 2019 PCB data set because the contract laboratory violated business rules set forth by SWAMP and within this document. These data were omitted from trend analysis. Another example includes differing abilities among contract labs to measure a single set of PCB congeners. This has led to recalculations of sum PCB values for data analysis. These anomalies are reported to the SWAMP QAO.

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APPENDIX A: Target Analytes and Reporting Limits

Target analytes and reporting limits (RLs) are listed as programmatic goals. Current analytes and reporting limits are listed based on what the current analysis labs are capable of achieving. See section B.4 for the associated methods and laboratories.

Table A. Laboratory Reporting Limits for SPoT Analytes in Sediment.

Analyte Group	Target Analyte	Target RL	Lab RL	Unit
Metals	Arsenic (total)	0.3	0.27	mg/kg dw
Metals	Cadmium (total)	0.1	0.03	mg/kg dw
Metals	Chromium (total)	1	0.75	mg/kg dw
Metals	Copper (total)	2	1.92	mg/kg dw
Metals	Lead (total)	1	0.93	mg/kg dw
Metals	Manganese (total)	3	0.90	mg/kg dw
Metals	Mercury (total)	0.006	0.006	mg/kg dw
Metals	Nickel (total)	1.2	1.17	mg/kg dw
Metals	Silver (total)	0.2	0.06	mg/kg dw
Metals	Zinc (total)	10	3.96	mg/kg dw
Organochlorine	Aldrin (total)	1	0.4	ng/g dw
Organochlorine	Chlordane (cis-(alpha-); total)	1	0.4	ng/g dw
Organochlorine	Chlordane (trans-(gamma-); total)	1	0.4	ng/g dw
Organochlorine	Chlordane (oxy-; total)	1	0.4	ng/g dw
Organochlorine	Dacthal (total)	1	not available	ng/g dw
Organochlorine	DDD (o,p'; total)	1	0.2	ng/g dw
Organochlorine	DDD (p,p'; total)	1	0.2	ng/g dw
Organochlorine	DDE (o,p'; total)	2	0.2	ng/g dw
Organochlorine	DDE (p,p'; total)	2	0.2	ng/g dw
Organochlorine	DDMU (p,p'; total)	3	not available	ng/g dw
Organochlorine	DDT (o,p'; total)	3	0.2	ng/g dw
Organochlorine	DDT (p,p'; total)	5	0.2	ng/g dw
Organochlorine	Dieldrin (total)	0.5	0.2	ng/g dw
Organochlorine	Endosulfan I (total)	2	0.3	ng/g dw
Organochlorine	Endosulfan II (total)	5	0.6	ng/g dw
Organochlorine	Endosulfan Sulfate (total)	5	0.3	ng/g dw
Organochlorine	Endrin Aldehyde (total)	2	0.3	ng/g dw
Organochlorine	Endrin Ketone (total)	2	0.3	ng/g dw
Organochlorine	Endrin (total)	2	0.3	ng/g dw
Organochlorine	HCH (alpha-; total)	0.5	0.4	ng/g dw

Analyte Group	Target Analyte	Target RL	Lab RL	Unit
Organochlorine	HCH (beta-; total)	1	0.4	ng/g dw
Organochlorine	HCH (delta-; total)	1	0.1	ng/g dw
Organochlorine	HCH (gamma-; total)	0.5	0.4	ng/g dw
Organochlorine	Heptachlor Epoxide (total)	1	0.3	ng/g dw
Organochlorine	Heptachlor (total)	1	0.2	ng/g dw
Organochlorine	Hexachlorobenzene (total)	0.2	0.2	ng/g dw
Organochlorine	Methoxychlor (total)	3	0.2	ng/g dw
Organochlorine	Mirex Total (total)	1.5	0.2	ng/g dw
Organochlorine	Nonachlor (cis-; total)	1	0.4	ng/g dw
Organochlorine	Nonachlor (trans-; total)	1	0.4	ng/g dw
Organochlorine	Oxadiazon (total)	1	not available	ng/g dw
Organochlorine	Oxychlorthane (total)	1	not available	ng/g dw
PAH	Acenaphthene (total)	2	2.5	ng/g dw
PAH	Acenaphthylene (total)	2	2.5	ng/g dw
PAH	Anthracene (total)	2	2.5	ng/g dw
PAH	Benz(a)anthracene (total)	2	2.5	ng/g dw
PAH	Benzo(a)pyrene (total)	5	2.5	ng/g dw
PAH	Benzo(b)fluoranthene (total)	2	2.5	ng/g dw
PAH	Benzo(e)pyrene	5	2.5	ng/g dw
PAH	Benzo(g,h,i)perylene (total)	5	2.5	ng/g dw
PAH	Benzo(j,k)fluoranthenes (total)	5	2.5	ng/g dw
PAH	Chrysene (total)	2	2.5	ng/g dw
PAH	Dibenz(a,h)anthracene (total)	5	2.5	ng/g dw
PAH	Dibenzothiophene	5	2.5	ng/g dw
PAH	Fluoranthene (total)	2	2.5	ng/g dw
PAH	Fluorene (total)	2	2.5	ng/g dw
PAH	Indeno(1,2,3-c,d) pyrene; (total)	5	2.5	ng/g dw
PAH	1-Methylphenanthrene	5	2.5	ng/g dw
PAH	Naphthalene (total)	5	2.5	ng/g dw
PAH	Perylene	5	2.5	ng/g dw
PAH	Phenanthrene; Total (total)	5	2.5	ng/g dw
PAH	Pyrene; Total (total)	2	2.5	ng/g dw
PBDE	PBDE 007 (total)	0.2	0.1	ng/g dw
PBDE	PBDE 008/11 (total)	0.2	0.1	ng/g dw
PBDE	PBDE 010 (total)	0.2	0.1	ng/g dw
PBDE	PBDE 012/13 (total)	0.2	0.1	ng/g dw
PBDE	PBDE 015 (total)	0.2	0.1	ng/g dw
PBDE	PBDE 017/25 (total)	0.2	0.1	ng/g dw

Analyte Group	Target Analyte	Target RL	Lab RL	Unit
PBDE	PBDE 017 (total)	0.2	not available	ng/g dw
PBDE	PBDE 028/33 (total)	0.2	0.1	ng/g dw
PBDE	PBDE 030 (total)	0.2	0.1	ng/g dw
PBDE	PBDE 032 (total)	0.2	0.1	ng/g dw
PBDE	PBDE 035 (total)	0.2	0.1	ng/g dw
PBDE	PBDE 037 (total)	0.2	0.1	ng/g dw
PBDE	PBDE 047 (total)	0.2	0.1	ng/g dw
PBDE	PBDE 049 (total)	0.2	0.1	ng/g dw
PBDE	PBDE 051 (total)	0.2	0.1	ng/g dw
PBDE	PBDE 066 (total)	0.2	0.1	ng/g dw
PBDE	PBDE 071 (total)	0.2	0.1	ng/g dw
PBDE	PBDE 075 (total)	0.2	0.1	ng/g dw
PBDE	PBDE 077 (total)	0.2	0.1	ng/g dw
PBDE	PBDE 079 (total)	0.2	0.1	ng/g dw
PBDE	PBDE 085 (total)	0.4	0.1	ng/g dw
PBDE	PBDE 099 (total)	0.4	0.1	ng/g dw
PBDE	PBDE 100 (total)	0.4	0.1	ng/g dw
PBDE	PBDE 105 (total)	0.4	0.1	ng/g dw
PBDE	PBDE 116 (total)	0.4	0.1	ng/g dw
PBDE	PBDE 119/120 (total)	0.4	0.1	ng/g dw
PBDE	PBDE 126 (total)	0.4	0.1	ng/g dw
PBDE	PBDE 128 (total)	0.4	0.1	ng/g dw
PBDE	PBDE 138/166 (total)	0.4	0.1	ng/g dw
PBDE	PBDE 140 (total)	0.4	0.1	ng/g dw
PBDE	PBDE 153 (total)	0.4	0.1	ng/g dw
PBDE	PBDE 154 (total)	0.4	0.1	ng/g dw
PBDE	PBDE 155 (total)	0.4	0.1	ng/g dw
PBDE	PBDE 179 (total)	1	not available	ng/g dw
PBDE	PBDE 181 (total)	1	0.1	ng/g dw
PBDE	PBDE 183 (total)	1	0.1	ng/g dw
PBDE	PBDE 184 (total)	1	not available	ng/g dw
PBDE	PBDE 188 (total)	1	not available	ng/g dw
PBDE	PBDE 190 (total)	1	0.1	ng/g dw
PBDE	PBDE 200 (total)	0.8	not available	ng/g dw
PBDE	PBDE 201 (total)	0.8	not available	ng/g dw

Analyte Group	Target Analyte	Target RL	Lab RL	Unit
PBDE	PBDE 202 (total)	0.8	not available	ng/g dw
PBDE	PBDE 203 (total)	0.8	0.1	ng/g dw
PBDE	PBDE 206 (total)	2	0.1	ng/g dw
PBDE	PBDE 207 (total)	2	0.1	ng/g dw
PBDE	PBDE 208 (total)	2	0.1	ng/g dw
PBDE	PBDE 209 (total)	10	0.1	ng/g dw
PCB	PCB 001 (total)	200	2	pg/g dw
PCB	PCB 002 (total)	200	2	pg/g dw
PCB	PCB 003 (total)	200	2	pg/g dw
PCB	PCB 004 (total)	200	2	pg/g dw
PCB	PCB 005 (total)	200	2	pg/g dw
PCB	PCB 006 (total)	200	2	pg/g dw
PCB	PCB 007 (total)	200	2	pg/g dw
PCB	PCB 008 (total)	200	2	pg/g dw
PCB	PCB 009 (total)	200	2	pg/g dw
PCB	PCB 010 (total)	200	2	pg/g dw
PCB	PCB 011 (total)	200	2	pg/g dw
PCB	PCB 012/13 (total)	200	2	pg/g dw
PCB	PCB 014 (total)	200	2	pg/g dw
PCB	PCB 015 (total)	200	2	pg/g dw
PCB	PCB 016 (total)	200	2	pg/g dw
PCB	PCB 017 (total)	200	2	pg/g dw
PCB	PCB 018 (total)	200	not available	pg/g dw
PCB	PCB 019 (total)	200	2	pg/g dw
PCB	PCB 021/33 (total)	200	2	pg/g dw
PCB	PCB 022 (total)	200	2	pg/g dw
PCB	PCB 023 (total)	200	2	pg/g dw
PCB	PCB 024 (total)	200	2	pg/g dw
PCB	PCB 025 (total)	200	2	pg/g dw
PCB	PCB 026/29 (total)	200	2	pg/g dw
PCB	PCB 027 (total)	200	2	pg/g dw
PCB	PCB 028/20 (total)	200	2	pg/g dw
PCB	PCB 029 (total)	200	not available	pg/g dw
PCB	PCB 030/18 (total)	200	2	pg/g dw
PCB	PCB 031 (total)	200	2	pg/g dw
PCB	PCB 032 (total)	200	2	pg/g dw
PCB	PCB 033 (total)	200	not available	pg/g dw

Analyte Group	Target Analyte	Target RL	Lab RL	Unit
PCB	PCB 034 (total)	200	2	pg/g dw
PCB	PCB 035 (total)	200	2	pg/g dw
PCB	PCB 036 (total)	200	2	pg/g dw
PCB	PCB 037 (total)	200	2	pg/g dw
PCB	PCB 038 (total)	200	2	pg/g dw
PCB	PCB 039 (total)	200	2	pg/g dw
PCB	PCB 041/40/71 (total)	200	2	pg/g dw
PCB	PCB 042 (total)	200	2	pg/g dw
PCB	PCB 043 (total)	200	2	pg/g dw
PCB	PCB 044/47/65 (total)	200	2	pg/g dw
PCB	PCB 045/51 (total)	200	2	pg/g dw
PCB	PCB 046 (total)	200	2	pg/g dw
PCB	PCB 048 (total)	200	2	pg/g dw
PCB	PCB 049 (total)	200	not available	pg/g dw
PCB	PCB 050/53 (total)	200	2	pg/g dw
PCB	PCB 052 (total)	200	2	pg/g dw
PCB	PCB 054 (total)	200	2	pg/g dw
PCB	PCB 055 (total)	200	2	pg/g dw
PCB	PCB 056 (total)	200	2	pg/g dw
PCB	PCB 057 (total)	200	2	pg/g dw
PCB	PCB 058 (total)	200	2	pg/g dw
PCB	PCB 059/62/75 (total)	200	2	pg/g dw
PCB	PCB 060 (total)	200	2	pg/g dw
PCB	PCB 061/70/74/76 (total)	200	2	pg/g dw
PCB	PCB 063 (total)	200	2	pg/g dw
PCB	PCB 064 (total)	200	2	pg/g dw
PCB	PCB 066 (total)	200	2	pg/g dw
PCB	PCB 067 (total)	200	2	pg/g dw
PCB	PCB 068 (total)	200	2	pg/g dw
PCB	PCB 069/49 (total)	200	2	pg/g dw
PCB	PCB 070 (total)	200	not available	pg/g dw
PCB	PCB 072 (total)	200	2	pg/g dw
PCB	PCB 073 (total)	200	2	pg/g dw
PCB	PCB 074 (total)	200	not available	pg/g dw
PCB	PCB 077 (total)	200	2	pg/g dw
PCB	PCB 078 (total)	200	2	pg/g dw
PCB	PCB 079 (total)	200	2	pg/g dw
PCB	PCB 080 (total)	200	2	pg/g dw

Analyte Group	Target Analyte	Target RL	Lab RL	Unit
PCB	PCB 081 (total)	200	2	pg/g dw
PCB	PCB 082 (total)	200	2	pg/g dw
PCB	PCB 083/99 (total)	200	2	pg/g dw
PCB	PCB 084 (total)	200	2	pg/g dw
PCB	PCB 087 (total)	200	not available	pg/g dw
PCB	PCB 088/91 (total)	200	2	pg/g dw
PCB	PCB 089 (total)	200	2	pg/g dw
PCB	PCB 092 (total)	200	2	pg/g dw
PCB	PCB 094 (total)	200	2	pg/g dw
PCB	PCB 095/100/93/102/98 (total)	200	2	pg/g dw
PCB	PCB 096 (total)	200	2	pg/g dw
PCB	PCB 097 (total)	200	not available	pg/g dw
PCB	PCB 099 (total)	200	not available	pg/g dw
PCB	PCB 101 (total)	200	not available	pg/g dw
PCB	PCB 103 (total)	200	2	pg/g dw
PCB	PCB 104 (total)	200	2	pg/g dw
PCB	PCB 105 (total)	200	2	pg/g dw
PCB	PCB 106 (total)	200	2	pg/g dw
PCB	PCB 107 (total)	200	2	pg/g dw
PCB	PCB 108/124 (total)	200	2	pg/g dw
PCB	PCB 109/119/86/97/125/87 (total)	200	2	pg/g dw
PCB	PCB 110/115 (total)	200	2	pg/g dw
PCB	PCB 114 (total)	200	2	pg/g dw
PCB	PCB 117/116/85 (total)	200	2	pg/g dw
PCB	PCB 118 (total)	200	2	pg/g dw
PCB	PCB 120 (total)	200	2	pg/g dw
PCB	PCB 121 (total)	200	2	pg/g dw
PCB	PCB 122 (total)	200	2	pg/g dw
PCB	PCB 123 (total)	200	2	pg/g dw
PCB	PCB 126 (total)	200	2	pg/g dw
PCB	PCB 127 (total)	200	2	pg/g dw
PCB	PCB 128/166 (total)	200	2	pg/g dw
PCB	PCB 130 (total)	200	2	pg/g dw
PCB	PCB 131 (total)	200	2	pg/g dw
PCB	PCB 132 (total)	200	2	pg/g dw
PCB	PCB 133 (total)	200	2	pg/g dw

Analyte Group	Target Analyte	Target RL	Lab RL	Unit
PCB	PCB 134/143 (total)	200	2	pg/g dw
PCB	PCB 136 (total)	200	2	pg/g dw
PCB	PCB 137 (total)	200	2	pg/g dw
PCB	PCB 138/163/129/160 (total)	200	2	pg/g dw
PCB	PCB 139/140 (total)	200	2	pg/g dw
PCB	PCB 141 (total)	200	2	pg/g dw
PCB	PCB 142 (total)	200	2	pg/g dw
PCB	PCB 144 (total)	200	2	pg/g dw
PCB	PCB 145 (total)	200	2	pg/g dw
PCB	PCB 146 (total)	200	2	pg/g dw
PCB	PCB 147/149 (total)	200	2	pg/g dw
PCB	PCB 148 (total)	200	2	pg/g dw
PCB	PCB 149 (total)	200	not available	pg/g dw
PCB	PCB 150 (total)	200	2	pg/g dw
PCB	PCB 151/135/154 (total)	200	2	pg/g dw
PCB	PCB 152 (total)	200	2	pg/g dw
PCB	PCB 153/168 (total)	200	2	pg/g dw
PCB	PCB 155 (total)	200	2	pg/g dw
PCB	PCB 156/157 (total)	200	4	pg/g dw
PCB	PCB 157 (total)	200	not available	pg/g dw
PCB	PCB 158 (total)	200	2	pg/g dw
PCB	PCB 159 (total)	200	2	pg/g dw
PCB	PCB 161 (total)	200	2	pg/g dw
PCB	PCB 162 (total)	200	2	pg/g dw
PCB	PCB 164 (total)	200	2	pg/g dw
PCB	PCB 165 (total)	200	2	pg/g dw
PCB	PCB 167 (total)	200	2	pg/g dw
PCB	PCB 169 (total)	200	2	pg/g dw
PCB	PCB 170 (total)	200	2	pg/g dw
PCB	PCB 171/173 (total)	200	2	pg/g dw
PCB	PCB 172 (total)	200	2	pg/g dw
PCB	PCB 174 (total)	200	2	pg/g dw
PCB	PCB 175 (total)	200	2	pg/g dw
PCB	PCB 176 (total)	200	2	pg/g dw
PCB	PCB 177 (total)	200	2	pg/g dw
PCB	PCB 178 (total)	200	2	pg/g dw
PCB	PCB 179 (total)	200	2	pg/g dw
PCB	PCB 180/193 (total)	200	2	pg/g dw
PCB	PCB 181 (total)	200	2	pg/g dw

Analyte Group	Target Analyte	Target RL	Lab RL	Unit
PCB	PCB 182 (total)	200	2	pg/g dw
PCB	PCB 183/185 (total)	200	2	pg/g dw
PCB	PCB 184 (total)	200	2	pg/g dw
PCB	PCB 186 (total)	200	2	pg/g dw
PCB	PCB 187 (total)	200	2	pg/g dw
PCB	PCB 188 (total)	200	2	pg/g dw
PCB	PCB 189 (total)	200	2	pg/g dw
PCB	PCB 190 (total)	200	2	pg/g dw
PCB	PCB 191 (total)	200	2	pg/g dw
PCB	PCB 192 (total)	200	2	pg/g dw
PCB	PCB 194 (total)	200	2	pg/g dw
PCB	PCB 195 (total)	200	2	pg/g dw
PCB	PCB 196 (total)	200	2	pg/g dw
PCB	PCB 197/200 (total)	200	2	pg/g dw
PCB	PCB 198/199 (total)	200	2	pg/g dw
PCB	PCB 200 (total)	200	not available	pg/g dw
PCB	PCB 201 (total)	200	2	pg/g dw
PCB	PCB 202 (total)	200	2	pg/g dw
PCB	PCB 203 (total)	200	2	pg/g dw
PCB	PCB 204 (total)	200	2	pg/g dw
PCB	PCB 205 (total)	200	2	pg/g dw
PCB	PCB 206 (total)	200	2	pg/g dw
PCB	PCB 207 (total)	200	2	pg/g dw
PCB	PCB 208 (total)	200	2	pg/g dw
PCB	PCB 209 (total)	200	2	pg/g dw
PFAS	10:2 Fluorotelomer sulfonate	6.6	not available	ng/g dw
PFAS	11-chloroeicosafluoro 3-oxaundecane-1-sulfonate (11Cl-PF3OUdS)	2.6	0.64	ng/g dw
PFAS	Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA)	10.0	0.16	ng/g dw
PFAS	Perfluoro-4-methoxybutanoate (PFMBA)	10.0	0.16	ng/g dw
PFAS	Perfluoro-3-methoxypropanoate (PFMPA)	10.0	0.32	ng/g dw
PFAS	Perfluoro-3,6-dioxaheptanoate (NFDHA)	10.0	0.32	ng/g dw
PFAS	2H,2H,3H,3H-Perfluorodecanoic acid (7:3)	8.2	4.00	ng/g dw

Analyte Group	Target Analyte	Target RL	Lab RL	Unit
	perfluorodecanoic acid; 7:3 FTCA)			
PFAS	2H,2H,3H,3H-Perfluorooctanoic acid (5:3 perfluorooctanoic acid; 5:3 FTCA)	4.1	4.00	ng/g dw
PFAS	4,4,5,5,6,6,6-Heptafluorohexanoic Acid (3:3 perfluorohexanoic acid; 3:3 FTCA)	11.0	0.64	ng/g dw
PFAS	4,8-dioxa-3H-perfluorononanoate (ADONA)	1.7	0.64	ng/g dw
PFAS	4:2 Fluorotelomer Sulfonate (4:2 FTS)	3.0	0.64	ng/g dw
PFAS	6:2 Fluorotelomer Sulfonate (6:2 FTS)	7.6	2.21	ng/g dw
PFAS	8:2 Fluorotelomer Sulfonate (8:2 FTS)	4.0	0.64	ng/g dw
PFAS	9-chlorohexadecafluoro-3-oxanonane-1-sulfonate (9Cl-PF3ONS)	4.3	0.64	ng/g dw
PFAS	Perfluoro-2-propoxypropanoate (Hexafluoropropylene oxide dimer acid; HFPO-DA)	6.8	0.64	ng/g dw
PFAS	N-ethyl perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	7.9	0.16	ng/g dw
PFAS	N-Ethylperfluorooctanesulfonamide (N-EtFOSA)	3.3	0.16	ng/g dw
PFAS	N-Ethylperfluorooctanesulfonamide ethanol (N-EtFOSE)	9.1	1.60	ng/g dw
PFAS	N-methyl perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	5.4	0.16	ng/g dw
PFAS	N-Methylperfluorooctanesulfonamide (N-MeFOSA)	2.3	0.16	ng/g dw
PFAS	N-Methylperfluorooctanesulfonamide ethanol (N-MeFOSE)	2.6	1.60	ng/g dw

Analyte Group	Target Analyte	Target RL	Lab RL	Unit
PFAS	Perfluorobutanesulfonate (PFBS)	4.8	0.16	ng/g dw
PFAS	Perfluorobutanoate (PFBA)	1.2	0.64	ng/g dw
PFAS	Perfluorodecanesulfonate (PFDS)	10.0	0.16	ng/g dw
PFAS	Perfluorododecanesulfonate (PFDoS)	10.0	0.16	ng/g dw
PFAS	Perfluorodecanoate (PFDA)	1.0	0.16	ng/g dw
PFAS	Perfluorododecanoate (PFDoDA)	2.8	0.16	ng/g dw
PFAS	Perfluoroheptanesulfonate (PFHpS)	3.3	0.16	ng/g dw
PFAS	Perfluoroheptanoate (PFHpA)	4.8	0.16	ng/g dw
PFAS	Perfluorohexadecanoic acid (PFHxDA)	4.2	not available	ng/g dw
PFAS	Perfluorohexanesulfonate (PFHxS)	4.7	0.16	ng/g dw
PFAS	Perfluorohexanoate (PFHxA)	3.0	0.16	ng/g dw
PFAS	Perfluorononanesulfonate (PFNS)	6.9	0.16	ng/g dw
PFAS	Perfluorononanoate (PFNA)	1.6	0.16	ng/g dw
PFAS	Perfluorooctadecanoic acid (PFOcDA)	3.9	not available	ng/g dw
PFAS	Perfluorooctane Sulfonamide (PFOSA or FOSA)	8.8	0.16	ng/g dw
PFAS	Perfluorooctanesulfonate (PFOS)	7.3	0.16	ng/g dw
PFAS	Perfluorooctanoate (PFOA)	2.7	0.16	ng/g dw
PFAS	Perfluoropentanesulfonate (PFPeS)	5.2	0.16	ng/g dw
PFAS	Perfluoropentanoate (PFPeA)	2.7	0.32	ng/g dw
PFAS	Perfluorotetradecanoate (PFTeDA)	8.5	0.16	ng/g dw
PFAS	Perfluorotridecanoate (PFTrDA)	3.0	0.16	ng/g dw
PFAS	Perfluoroundecanoate (PFUnA)	2.7	0.16	ng/g dw
Phenylpyrazole	Fipronil	2	0.3	ng/g dw
Phenylpyrazole	Fipronil desulfinyl	2	0.3	ng/g dw
Phenylpyrazole	Fipronil sulfide	2	0.3	ng/g dw
Phenylpyrazole	Fipronil sulfone	2	0.3	ng/g dw

Analyte Group	Target Analyte	Target RL	Lab RL	Unit
Phenylpyrazole	Fipronil detrifluoromethylsulfinyl	2	1	ng/g dw
Pyrethroid	Allethrin (total)	0.25	2	ng/g dw
Pyrethroid	Bifenthrin (total)	0.25	2	ng/g dw
Pyrethroid	Cyfluthrin (total)	1.25	2	ng/g dw
Pyrethroid	Cyhalothrin, Lambda (total)	0.5	2	ng/g dw
Pyrethroid	Cypermethrin (total)	1	2	ng/g dw
Pyrethroid	Deltamethrin/Tralomethrin (total)	1	2	ng/g dw
Pyrethroid	Esfenvalerate/Fenvalerate (total)	0.5	2	ng/g dw
Pyrethroid	Fenpropathrin (total)	0.25	2	ng/g dw
Pyrethroid	Flucythrinate (total)	2	2	ng/g dw
Pyrethroid	Permethrin (cis-; total)	1.25	not available	ng/g dw
Pyrethroid	Permethrin (trans-; total)	2.5	not available	ng/g dw
Pyrethroid	Permethrin (total)	4	1	ng/g dw
Pyrethroid	Phenothrin (total)	1	1	ng/g dw
Pyrethroid	Prallethrin (total)	2	2	ng/g dw
Pyrethroid	Resmethrin (total)	2	2	ng/g dw

APPENDIX B: Field Data Sheet

SWAMP Field Data Sheet (Sediment Chemistry) - Integrator Study (EventType=WQ)					Entered in d-base (initial/date)		Pg	of	Pgs
*StationID:		*Date (mm/dd/yyyy):		/ /		*Group:		*Agency: UCD-GC	
*Funding:		*SampleTime (1st sample):		*Project: SWB_SPoT_2020		*Protocol: SWAMP_SPoT			
*Personnel:		*Purpose (circle all that apply): SedChem SedTox FieldObs				*PurposeFailure:			
*Location: Reach		*GPS/DGPS		Lat (dd.ddddd)		Long (ddd.ddddd)		Corrections/Changes	
GPS Device: Garmin 61st		Target:		-					
Datum: NAD83		Accuracy (ft/m):		*Pt1 (Upstream):		-			
Sonde: YSI Exo8 Calibr. Date:		*Pt2 (Downstream):		-					
Field Observations (SampleType = FieldObs)			WADEABILITY: Y / N / Unknown			Field Dup: YES / NO		SampleType=Integrated; LABEL_ID = FieldQA; create collection record upon data entry	
DOMINANTSUBSTRATE:		Bedrock, Concrete, Cobble, Gravel, Sand, Mud, Unk, Other			OCCUPATION METHOD: Walk-in R/V _____				
WATER CLARITY: Clear (see bottom), Cloudy (>4" vis), Murky (<4" vis)			WATER COLOR: Colorless, Green, Yellow, Brown						
PLANT PRESENCE:		Vascular, Nonvascular, Benthic Algae, Filamentous, Periphyton Layer, None		D.O. (mg/L)		pH		Cond. (uS/cm)	
								Temp. (°C)	
Depositional Area Sample Information									
Area	Overlying Water	Sample Debris	Depth Collec (cm)	Equipment Used			Notes		
1	Under / Damp / Dry	P A		Scoop (PE)	Core (PC)	Gloved Hand			
2	Under / Damp / Dry	P A		Scoop (PE)	Core (PC)	Gloved Hand			
3	Under / Damp / Dry	P A		Scoop (PE)	Core (PC)	Gloved Hand			
4	Under / Damp / Dry	P A		Scoop (PE)	Core (PC)	Gloved Hand			
5	Under / Damp / Dry	P A		Scoop (PE)	Core (PC)	Gloved Hand			
6	Under / Damp / Dry	P A		Scoop (PE)	Core (PC)	Gloved Hand			
7	Under / Damp / Dry	P A		Scoop (PE)	Core (PC)	Gloved Hand			
8	Under / Damp / Dry	P A		Scoop (PE)	Core (PC)	Gloved Hand			
9	Under / Damp / Dry	P A		Scoop (PE)	Core (PC)	Gloved Hand			
10	Under / Damp / Dry	P A		Scoop (PE)	Core (PC)	Gloved Hand			
COMMENTS: SAMPLE 5-10 DEPOSITIONAL AREAS WITHIN A 100 METER AREA, DRAW A BOX (USING 'X' FOR SAMPLE AREAS) WITH AN IDEA OF THE SPACING; SEDIMENT SHOULD BE FINE GRAIN AND NOT FEEL GRITTY; ADD COMMENTS ABOUT OUTFALLS, PIPES, DRAINS, AND TRIBUTARIES									
DO Probe Calibration QA									
% Sat Pre Sample									
% Sat Post Sample									
Bar. Pressure									

APPENDIX C: List of Acronyms and Initialisms

COC:	Chain of Custody
ELAP:	Environmental Laboratory Accreditation Program
GC-MS:	Gas Chromatography/Mass Spectrometry
HUC:	Hydrologic Unit Codes
MDL:	Method Detection Limit
MQO:	Measurement Quality Objectives
NAWQA:	National Water Quality Assessment
OIMA:	Office of Information Management and Analysis
PM:	Project Manager
QA:	Quality Assurance
QAO:	Quality Assurance Officer
QAPP:	Quality Assurance Project Plan
QC:	Quality Control
RPD:	Relative Percent Difference
RL:	Reporting Limit
RSD:	Relative Standard Deviation
SOP:	Standard Operating Procedures
SPoT:	Stream Pollution Trends Monitoring Program
SWAMP:	Surface Water Ambient Monitoring Program
SWAMP IQ:	Surface Water Ambient Monitoring Program Information Management and Quality Assurance Center
SWRCB:	State Water Resources Control Board
TMDL:	Total Maximum Daily Load
TOC:	Total Organic Carbon

UCD-GC: University of California, Davis, Marine Pollution Studies Laboratory
at Granite Canyon

U.S. EPA: U.S. Environmental Protection Agency

USGS: U.S. Geological Survey