RMP
REGIONAL MONITORING
PROGRAM FOR WATER QUALITY
IN SAN FRANCISCO BAY

sfei.org/rmp

MULTI-YEAR PLAN

2024 ANNUAL UPDATE

FINAL: JANUARY 2024

Contribution Number: 1167

RMP ORIGIN AND PURPOSE

In 1992 the San Francisco Bay Regional Water Board passed Resolution No. 92-043 directing the Executive Officer to send a letter to regulated dischargers requiring them to implement a regional multi-media pollutant monitoring program for water quality (RMP) in San Francisco Bay. The Water Board's regulatory authority to require such a program comes from California Water Code Sections 13267, 13383, 13268 and 13385. The Water Board offered to suspend some effluent and local receiving water monitoring requirements for individual discharges to provide cost savings to implement baseline portions of the RMP, although they recognized additional resources would be necessary. The Resolution also included a provision that the requirement for a RMP be included in discharger permits. The RMP began in 1993, and over ensuing years has been a successful and effective partnership of regulatory agencies and the regulated community.

The goal of the RMP is to collect data and communicate information about water quality in San Francisco Bay in support of management decisions. This goal is achieved through a cooperative effort from a wide range of regulators, dischargers, scientists, and environmental advocates. This collaboration has fostered the development of a multifaceted, sophisticated, and efficient program that has demonstrated the capacity for considerable adaptation in response to changing management priorities and advances in scientific understanding.

RMP PLANNING

This collaboration and adaptation is achieved through the participation of stakeholders and scientists in frequent committee and workgroup meetings (Figure 1).

The annual planning cycle begins with a workshop in October in which the Steering Committee articulates general priorities among the information needs on water quality topics of concern. In the second quarter of the following year, the workgroups and strategy teams put forward recommendations for special studies to the Technical Review Committee (TRC). At their June meeting, the TRC combines all of this input into a study plan for the following year that is submitted to the Steering Committee who then considers this recommendation and makes the final decision on the annual workplan.

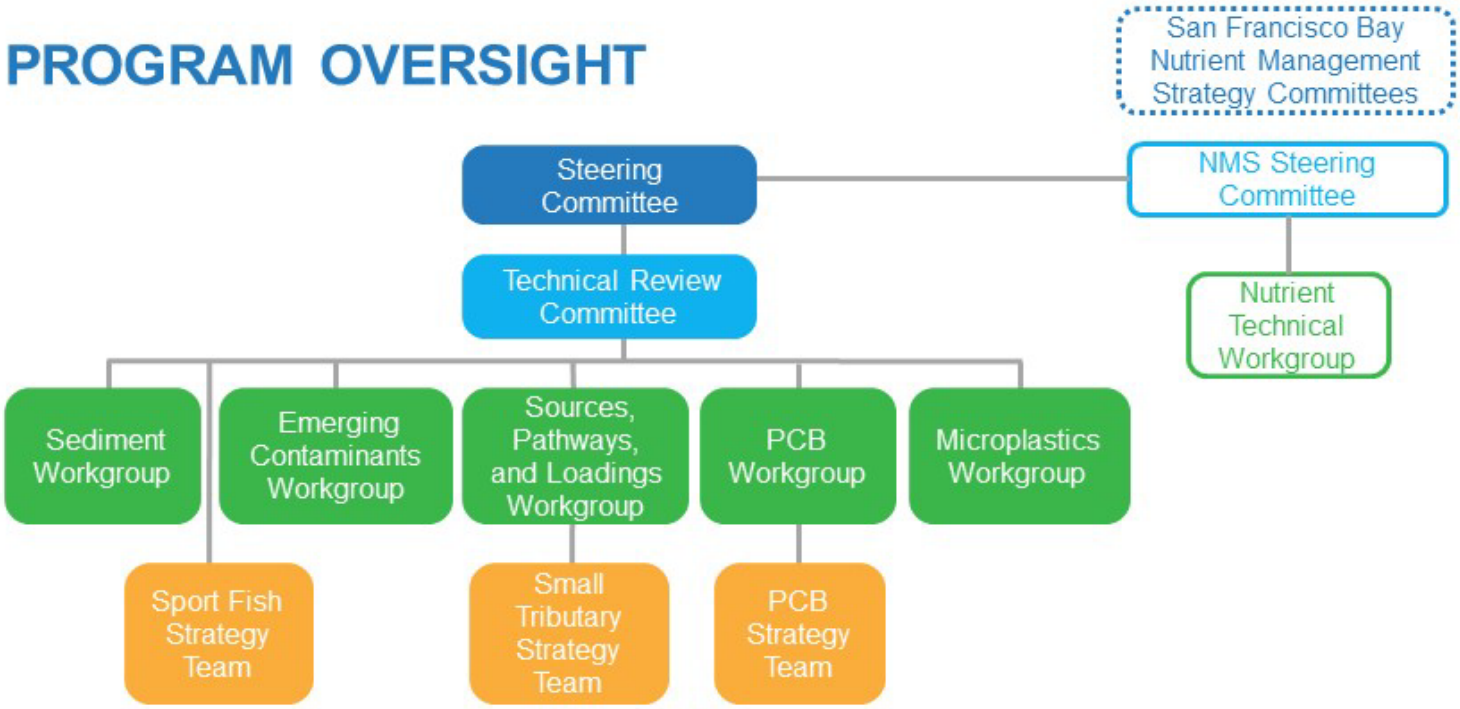
In order to fulfill the overarching goal of the RMP, the Program has to be forward-thinking and anticipate what decisions are on the horizon, so that when their time comes, the scientific knowledge needed to inform the decisions is at hand. Consequently, each of the workgroups and teams develops three to five-year plans for studies to address the highest priority management questions for their subject area. Collectively, the efforts of all these groups represent a substantial body of deliberation and planning.

PURPOSE AND ORGANIZATION OF THIS DOCUMENT

The purpose of this document is to guide efforts and summarize plans developed within the RMP. The intended audience includes representatives of the many organizations who directly participate in the Program. This document will also be useful for individuals who are not directly involved with the RMP but are interested in an overview of the Program and where it is heading.

The organization of this Multi-Year Plan parallels the RMP planning process (Figure 2). Section 1 presents the long-term management plans of the agencies responsible for managing water quality in the Bay and the overarching management questions that guide the Program. The agencies' long-term management plans provide the foundation for RMP planning (Figure 2). In order to turn the plans into effective actions, the RMP distills prioritized lists of management questions that need to be answered (Page 8). The prioritized management questions then serve as a roadmap for scientists on the Technical Review Committee, workgroups, and strategy teams to plan and implement scientific studies to address the most urgent information needs. This information sharpens the focus on management actions that will most effectively and efficiently improve water quality in the Bay.

Figure 1. Collaboration and adaptation in the RMP is achieved through the engagement of stakeholders and scientists in frequent committee and workgroup meetings.



The Steering Committee consists of representatives from discharger groups (wastewater, stormwater, dredging, industrial) and regulatory agencies (Regional Water Board and U.S. Army Corps of Engineers). The Steering Committee determines the overall budget and allocation of program funds, tracks progress, and provides direction to the Program from a manager's perspective.

Workgroups report to the TRC and address the main technical subject areas covered by the RMP. The Nutrient Technical Workgroup was established as part of the committee structure of a separate effort—the Nutrient Management Strategy—and makes recommendations to the RMP committees on the use of the RMP funds that support nutrient studies. The workgroups consist of regional scientists and regulators and invited scientists recognized as authorities in the field. The workgroups directly guide planning and implementation of special studies.

Oversight of the technical content and quality of the RMP is provided by the **Technical Review Committee** (TRC), which provides recommendations to the Steering Committee.

RMP strategy teams constitute one more layer of planning activity. These stakeholder groups meet as needed to develop long-term RMP study plans for addressing high priority topics.

Figure 2. Science in support of water quality management.

Section 2 provides an overview of the RMP budget, including where the funding comes from and how it is allocated among different elements of the Program. This section provides a summary of the priority topics to be addressed by the Program over the next three to five years.

Section 3 presents the three to five-year plans developed by the workgroups and strategy teams for the current focus areas: emerging contaminants, microplastics, nutrients, PCBs, sediment, and small tributary loads. Led by the stakeholder representatives that participate in these groups, each workgroup and strategy team develops a specific list of management questions for each topic that the RMP will strive to answer over the next three to five years. With guidance from the science advisors on the workgroups, plans are developed to address these questions. These plans include proposed projects and tasks and projected annual budgets. Information synthesis efforts are often conducted to yield recommendations for the next phase of studies. For now, study plans and budget allocations for these strategies are largely labelled as “to be determined”. Other pieces of information are also included to provide context for the multi-year plans. First, for each high priority topic, specific management policies or decisions that are anticipated to occur in the next few years are listed. Second, the latest advances in understanding achieved through the RMP and other programs on Bay water quality topics of greatest concern are summarized. Lastly, additional context is provided by listing studies performed within the last five years and studies that are currently underway.

Section 4 describes five-year plans for other elements that are essential to the mission of the RMP: Status and Trends Monitoring, Program Management, Communications, Data Management, and Quality Assurance.

Section 5 contains lists of RMP studies that are relevant to specific permit conditions for dredging, stormwater discharges, and municipal and industrial wastewater discharges.

A Living Document

The RMP Multi-Year Plan is updated annually to provide an up-to-date description of the priorities and directions of the Program. An annual Planning Workshop is held in conjunction with the October Steering Committee meeting. A draft Multi-Year Plan is prepared before the workshop, and approved by the Steering Committee at the January meeting.

More detailed descriptions of the elements of the RMP are provided in the annual Detailed Workplan (available at www.sfei.org/rmp).

Figure 3. Annual planning calendar for the Regional Monitoring Program.

Annual Steering Committee Calendar

- January
  - Approve Multi-Year Plan
  - Review incomplete projects from the previous year
  - Approve annual report outline
  - Pick date for Annual Meeting
- April
  - Plan for Annual Meeting
  - Provide additional planning guidance to workgroups
- July
  - Multi-year Plan: mid-year check-in, workshop planning
  - Approve special studies recommended by the TRC for the next year and update projects list for SEP funding
  - Plan for Annual Meeting
  - Report on SFEI financial audit
  - Briefly discuss fees for year after next
  - Select annual report theme for next year
- October
  - Multi-Year Planning Workshop
  - Confirm chair(s) and Charter
  - Decision on fees for the year after next
  - Approve workplan and budget for next year
  - Decision on workgroups to be held next year
  - Discuss outcome of the Annual Meeting

Each meeting (except October) includes a Science Program Update from a workgroup or strategy team focus area.

Annual Technical Review Committee Calendar

- March
  - Confirm chair(s)
  - Review special studies to ensure coordination
  - Provide planning guidance to workgroups
- June
  - Recommend special studies for funding
  - Review SEP project list
  - Review S&T target analyte list, CEC tiers
  - Review plans for Annual Meeting and annual report
- September
  - Prepare for Annual Meeting
  - Review Status and Trends Monitoring Design
  - Discuss lab intercomparison studies
- December
  - Review annual report outline for next year
  - Informatics update
  - Present workplan for next year and outcome of Multi-Year Planning Workshop
  - Review intercalibration studies and plans

Each meeting includes feedback on proposed and ongoing studies.

Annual Workgroup Calendar

Workgroups meet annually between April and June to discuss results from prior studies and select proposals to recommend to the TRC and SC for funding the next year.

Multi-Year Calendar: RMP fees are approved in 3-year increments. The most recent approval was for 2023-2025. The dredger fee schedule is reviewed every 3 years. The most recent approval was for 2022-2024. The MOU between SFEI and the Water Board for administering the RMP is amended every two years. The most recent amendment was for 2023-2024.

Current and anticipated management decisions, policies, and actions by the regulatory agencies that manage water quality in San Francisco Bay

Decisions, Policies, and Actions	Timing
BAY WATERSHED PERMITS (NEXT REISSUANCE)	
Municipal Regional Stormwater Permit	2027
Mercury and PCBs Watershed Permit for Municipal and Industrial Wastewater (Implement mercury and PCB TMDLs)	2027
Nutrient Watershed Permit for Municipal Wastewater (Implement Nutrient Management Strategy)	2024
CURRENT HIGH PRIORITY DRIVERS BY TOPIC	
303(d) List and 305(b) Report Current listings and next cycle	2024 2026*/2030
Beneficial Reuse of Dredged Sediment Review sediment guidelines+ and testing criteria Evaluate the effectiveness of strategic placement	Ongoing Ongoing
Contaminants of Emerging Concern Updates to CEC Tiered Risk-Based Framework Opportunities to inform regional actions and state and federal regulations	Annual Ongoing
Determination of Wastewater Permit Limits California Toxics Rule	Ongoing
PCBs Review existing TMDL and inform revisions	Complete by 2028
Mercury Review existing TMDL and inform revisions	Complete by 2026
Nutrients Inform the Nutrient Management Strategy	Ongoing
OTHER DRIVERS BY TOPIC	
Beneficial uses Fish exposure (PCBs, Hg, and PFAS) and tribal uses	Ongoing
Current Use Pesticides EPA Registration Review of fipronil and imidacloprid DPR fipronil mitigation measures	Ongoing

Decisions, Policies, and Actions	Timing
OTHER DRIVERS BY TOPIC	
Copper Site specific objectives triggers+	Ongoing
Cyanide Site specific objectives triggers+	Ongoing
Dioxins Review 303(d) listings and establish TMDL development plan or alternative	Ongoing
Dredging Permits Bioaccumulation testing triggers and in-Bay disposal thresholds+	Ongoing
Legacy Pesticides (DDT, Dieldrin, Chlordane) Monitoring recovery (biota)	Ongoing
Sediment Hot Spots Review 303(d) listings and establish TMDL development plan or alternative	Ongoing
POTENTIAL FUTURE DRIVERS	
Specific CECs, e.g., PFAS	TBD
Effects of reduced wastewater and stormwater inputs to the Bay	TBD
Effects of reverse osmosis concentrate discharge to the Bay	TBD
South Bay standards-related selenium assessment	TBD
Sea level rise adaptation and changes in salinity, pH, temperature, and dissolved oxygen due to climate change	TBD
Trash and Microplastics	TBD
Wetland restoration permits and regional monitoring	TBD
Tribal and subsistence use as beneficial uses	TBD

+ Comparisons to triggers updated every 5 years for sediment and every 2 years for water; *Data for 2030 Integrated Report needed by 2026

RMP Outcomes (as of February 2019)

Legislation
- CA Flame Retardants in Consumer Products (2018)
- CA Pharmaceutical Stewardship (2018)
- SF Flame Retardant Ordinance (2017)
- Palo Alto & San Francisco expanded polystyrene ordinances (2015, 2016)
- CA Microbead Ban (2015)
- US Microbead Ban (2015)
- CA Copper in Brake Pads (2010)
- CA PBDE Ban (2003)

NPDES Regional Permits
- *Municipal and industrial wastewater*
  - Mercury and PCBs (2017)
- *Municipal stormwater*
  - MRP 2.0 (2015)
  - MRP 1.0 (2010)

Regulations
- CA Safer Consumer Products Regulations (ongoing)
- CA Fipronil Application (2017)
- CA Flame Retardants in Furniture (2013)
- CA Pyrethroid Application (2012)

TMDLs
- Selenium (2016)
- PCBs (2009)
- Mercury (2008)
- Urban Creeks Diazinon and Pesticide-Related Toxicity (2007)

Water Quality Objectives
- Copper (North of Dumbarton) (2010)
- Copper and Nickel (South of Dumbarton) (2002)

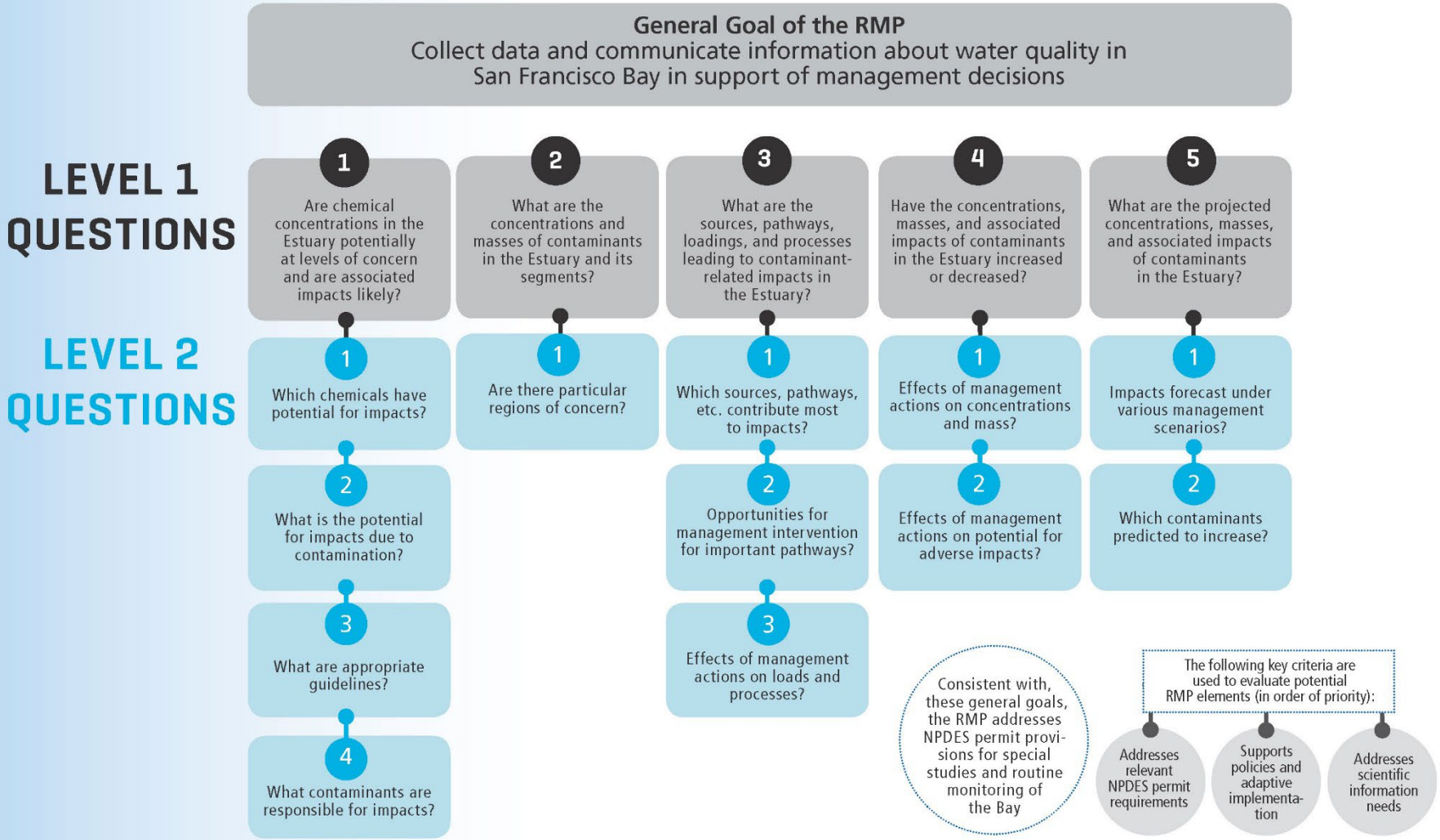
San Francisco Bay 303(d) List Updates
- 2018
- 2010
- 2006
- 2002
- 1998
- 1996

Phase-outs
- US PFOA (2015)
- US Deca-BDE (2013)
- US PFOS (2002)

Fish Advisory
- SF Bay (2011)

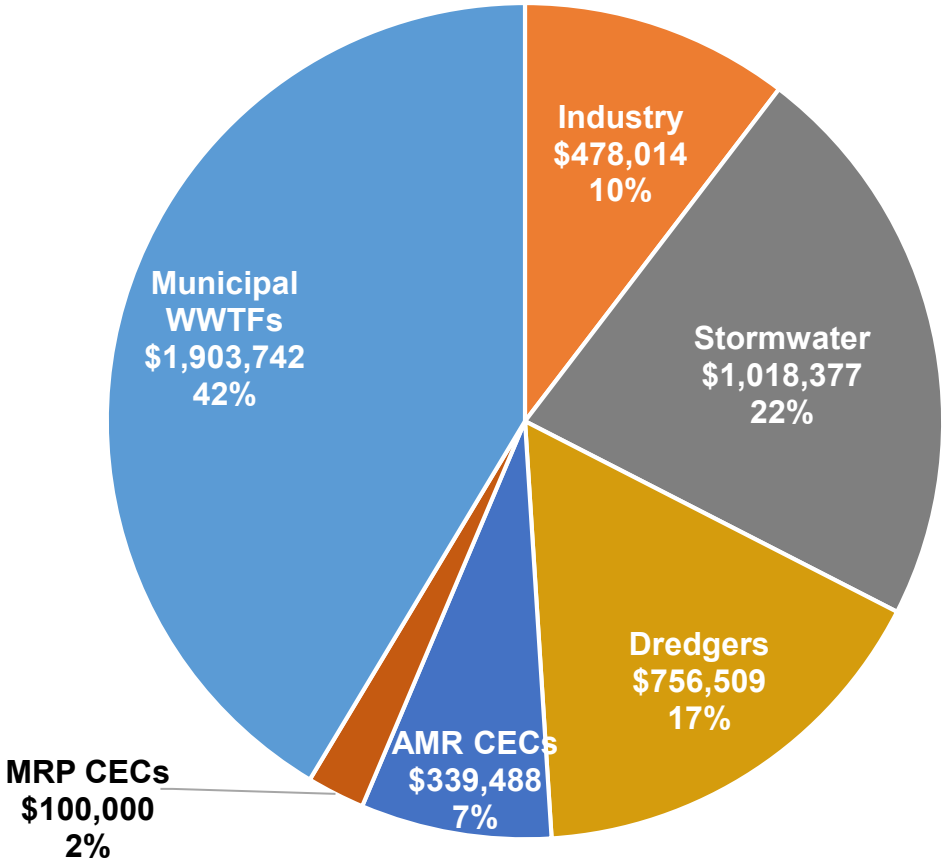
RMP GOAL AND MANAGEMENT QUESTIONS

RMP stakeholders have articulated an overarching goal and a tiered framework of management questions that organize and guide RMP studies. The management questions are closely linked to existing and planned regulations.



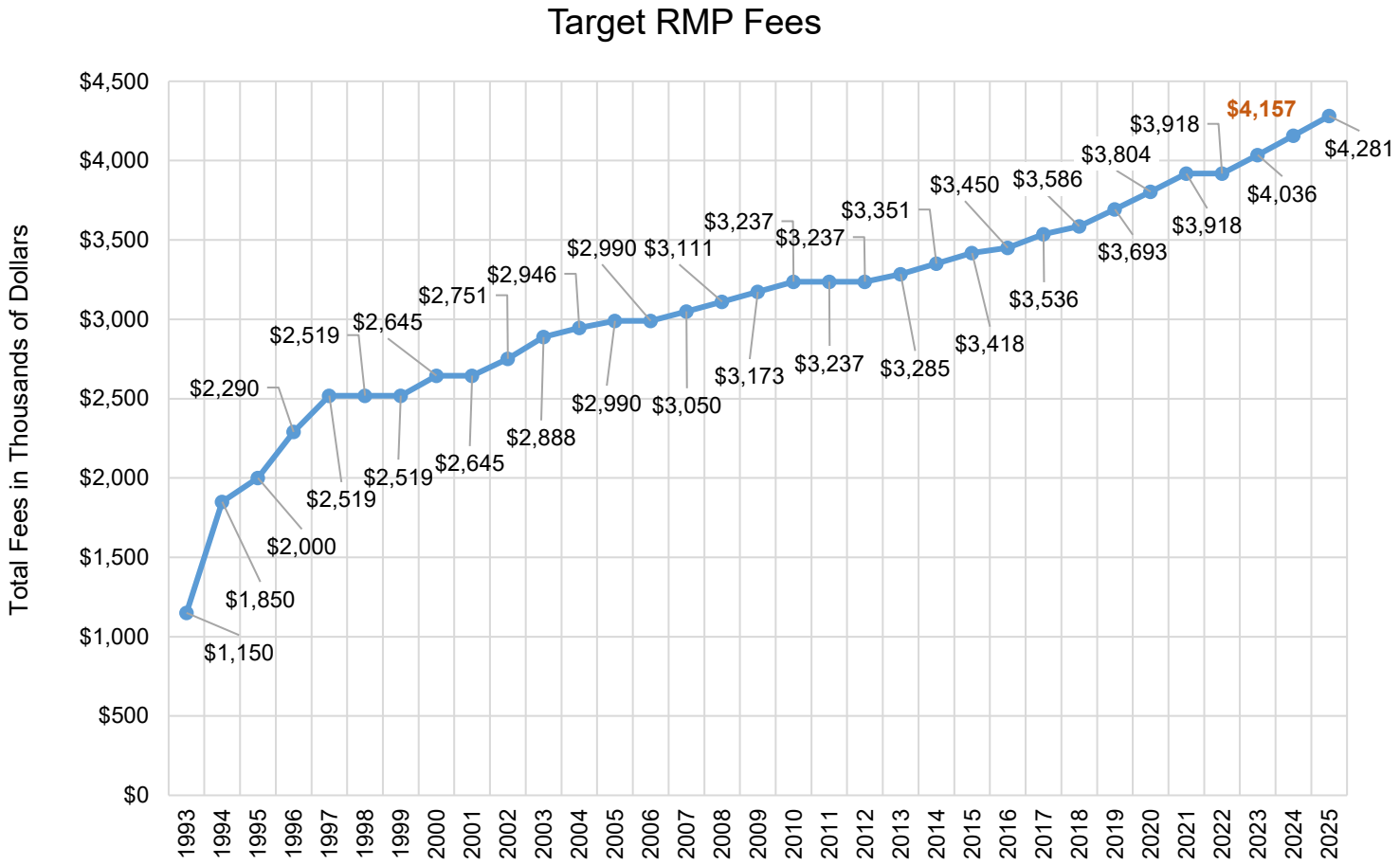
BUDGET: Revenue by Sector 2024

RMP fees are divided among four major discharger groups. Core RMP fees in 2024 are $4.157 million. Municipal wastewater treatment agencies are the largest contributor, followed by stormwater agencies. The contribution from dredgers includes $400,000 from the U.S. Army Corps of Engineers. Refineries constitute the majority of the industrial sector, and also contribute to the Program due to dredging activities at their facilities. In addition to fees, the RMP also receives funding for emerging contaminant-related studies from Alternate Monitoring and Reporting (AMR) Program funds from municipal wastewater agencies ($339.5k) and a supplement from the municipal stormwater dischargers ($100k) as outlined in the Municipal Regional Stormwater Permit.



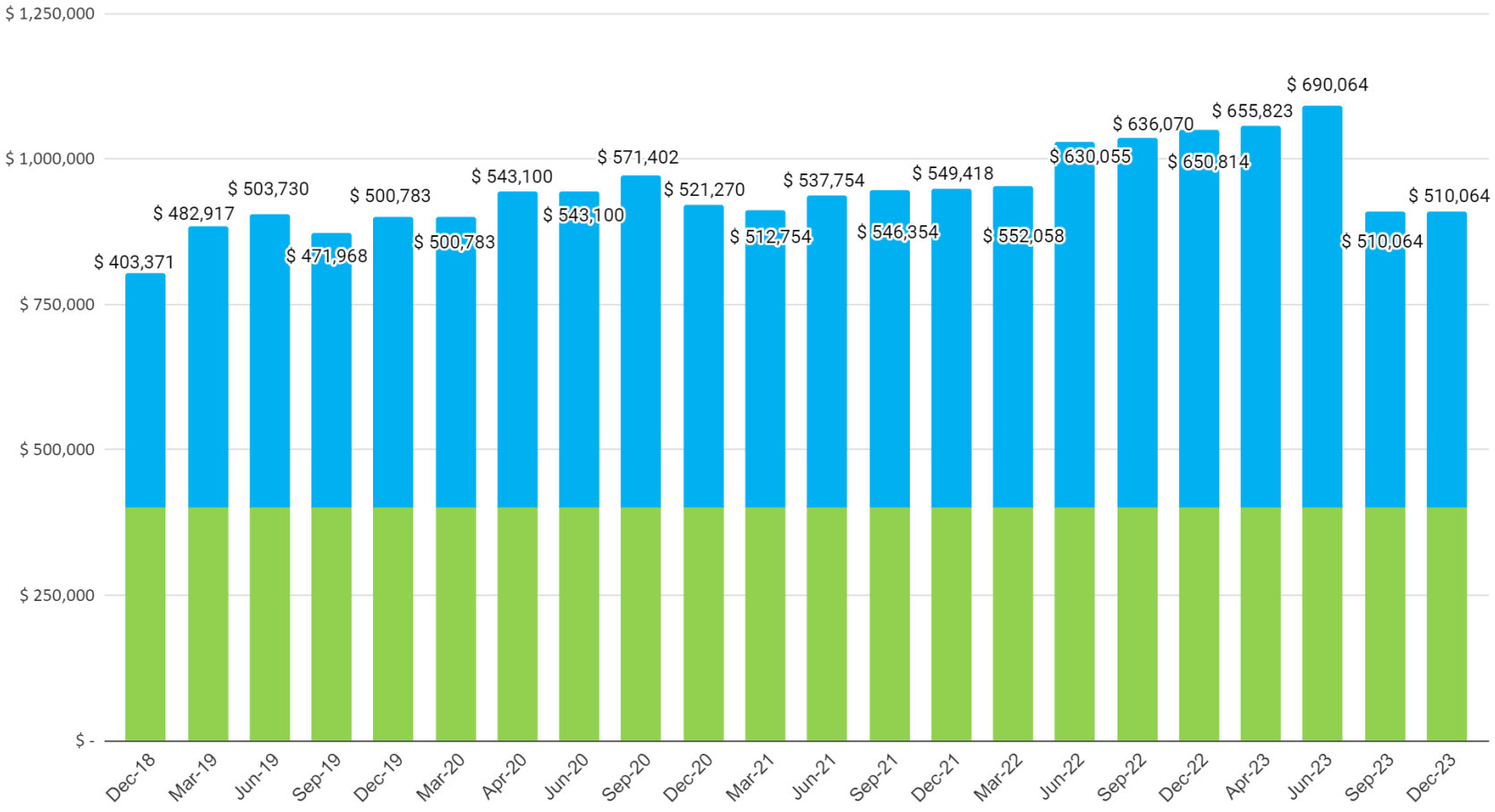
BUDGET: Revenue by Year

Target RMP fees in 2024 are $4.157 million, an increase in 3% from 2023. For 2023-2025, the Steering Committee has approved a 3% increase in fees for each year. Over the past 20 years, RMP fee growth has not kept up with inflation.



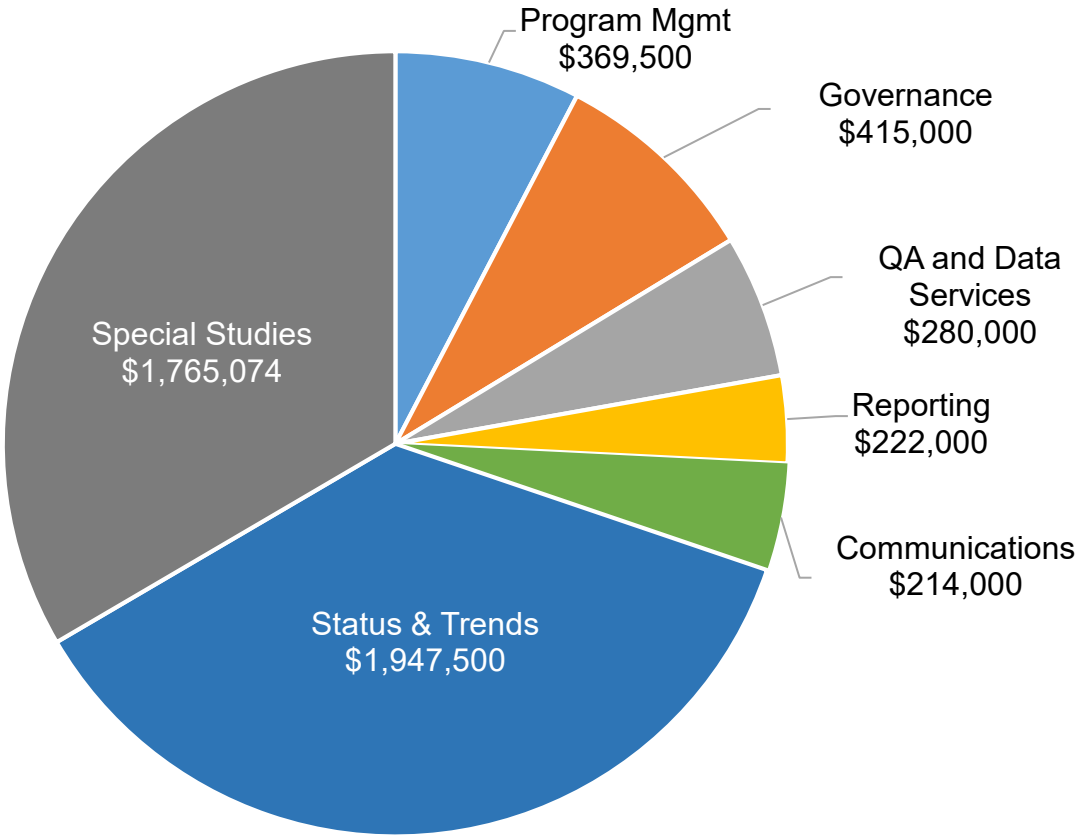
BUDGET: Reserve Funds

The RMP maintains a balance of Undesignated Funds for contingencies. Higher than anticipated revenues and elimination or reduction of lower priority elements sometimes leads to accumulation of funds that can be used for high priority topics at the discretion of the Steering Committee. The Bay RMP Undesignated Funds balance over the past four budget years is shown below. The height of the bar shows the total balance of the Undesignated Funds. The bars are color coded to indicate the RMP policy that $400,000 of the Undesignated Funds should be held as a Reserve. The Steering Committee increased the Reserve amount from $200,000 to $400,000 in 2018 so that the reserve is now approximately 10% of the annual Program budget.



BUDGET: Expenses 2024

In 2024, 71% of the budget is allocated on Status & Trends and Special Studies. Quality assurance and data systems, reporting, and communications are each approximately 5% of the budget. Governance meetings (8%) are critical to ensure that the RMP is addressing stakeholder needs and conducting studies that include peer-review from project planning through report preparation. Finally, 7% of the budget is needed for program management, including fiduciary oversight of contracts and expenditures.



ACTUAL AND FORECAST BUDGETS: Special Studies 2021-2026

RMP actual and planned expenditures on special study topics. Costs for 2021-2024 are based on approved budgets. Costs for 2025 and beyond are estimates for planning based on the most recent input from the Workgroups and Strategy Teams. The funds available for 2025-2026 were estimated based on a 3% RMP revenue increase each year, and subtracting estimated Status and Trends monitoring costs (page 39) and programmatic expenses.

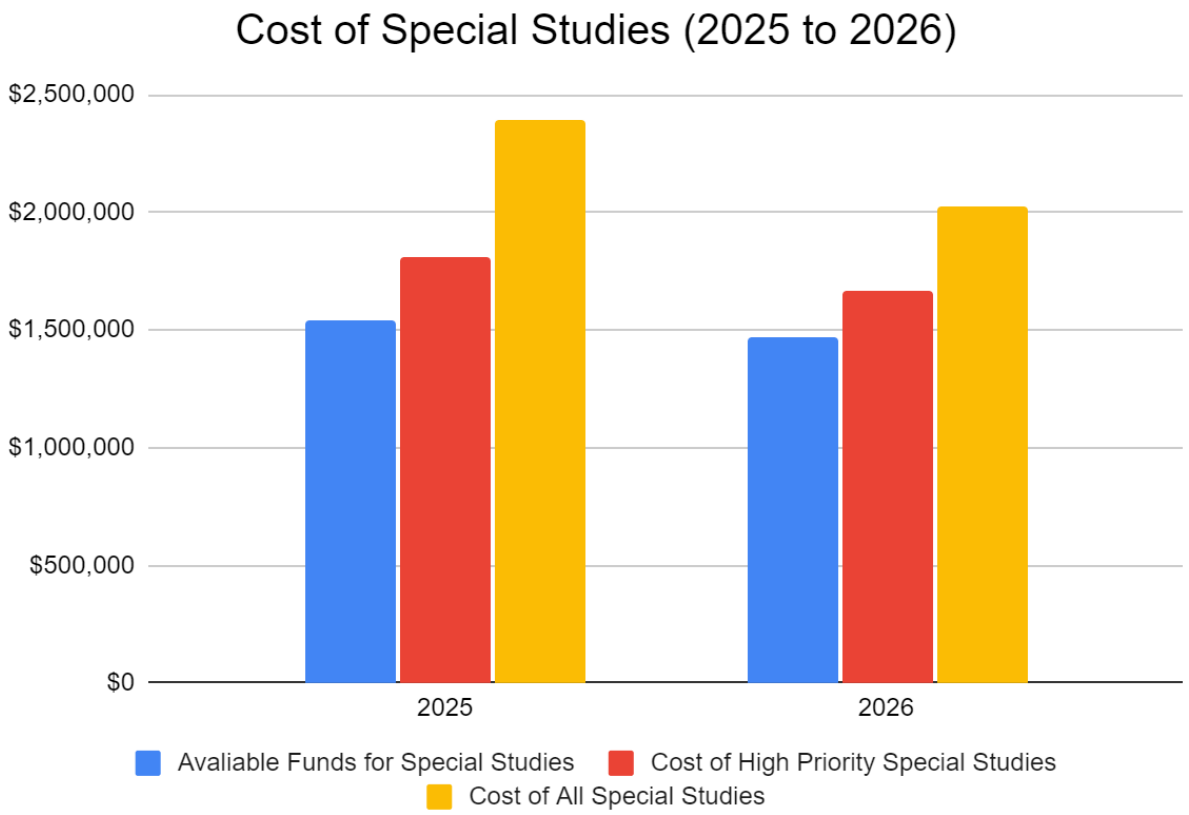
FOCUS AREA	2021	2022	2023	2024	2025	2026
	Budget	*Budget*	*Budget*	*Budget*	*Forecast*	*Forecast*
Emerging Contaminants	$338,000	$320,000	$638,000	$714,600	$734,000	$756,000
Microplastic	$61,500	$35,500	$13,000	$94,100	$133,000	$57,000
Nutrients*	$250,000	$250,000	$250,000	$250,000	$400,000	$400,000
PCBs	$131,880	$108,000	$75,000	$95,846	$0	$0
Sediment	$214,050	$185,000	$267,000	$297,528	$842,000	$590,000
Sources, Pathways, Loading	$265,000	$193,000	$290,000	$316,000	$282,000	$220,000
SPECIAL STUDIES TOTAL	**$1,260,430**	**$1,091,500**	**$1,533,000**	**$1,768,074**	**$2,391,000**	**$2,023,000**
Predicted RMP Core Budget for Special Studies		$820,699	$1,083,586	$1,188,586	$1,090,498	$1,010,533
Predicted AMR Funds		$320,000	$329,600	$339,488	$349,673	$360,163
Predicted Stormwater CEC Funds			$100,000	$100,000	$100,000	$100,000
PREDICTED SPECIAL STUDIES BUDGET TOTAL		**$1,140,699**	**$1,513,186**	**$1,628,074**	**$1,540,171**	**$1,470,716**

*The estimated RMP budgets on this table do not cover all of the funding needs for the Nutrients Management Strategy. Funding for these strategies is partially provided from other sources.

In 2016, the RMP became eligible to receive penalty funds for Supplemental Environmental Projects. Wastewater agencies also began to provide the RMP with Alternative Monitoring Requirement (AMR) funds for additional emerging contaminants studies. These new funding streams will augment the core RMP budget for special studies. The AMR expired in 2021 but was replaced with a similar permit amendment for CEC monitoring starting in 2022. The MRP issued in 2022 included an opportunity for Municipal Stormwater entities to contribute $100k to the RMP in lieu of individual monitoring for CECs. The SEP funds are not predictable. The AMR and MRP funds have been included in the predicted special studies budget total in the table above because these funds are predictable. AMR funds will increase at the same rate as the core RMP fees.

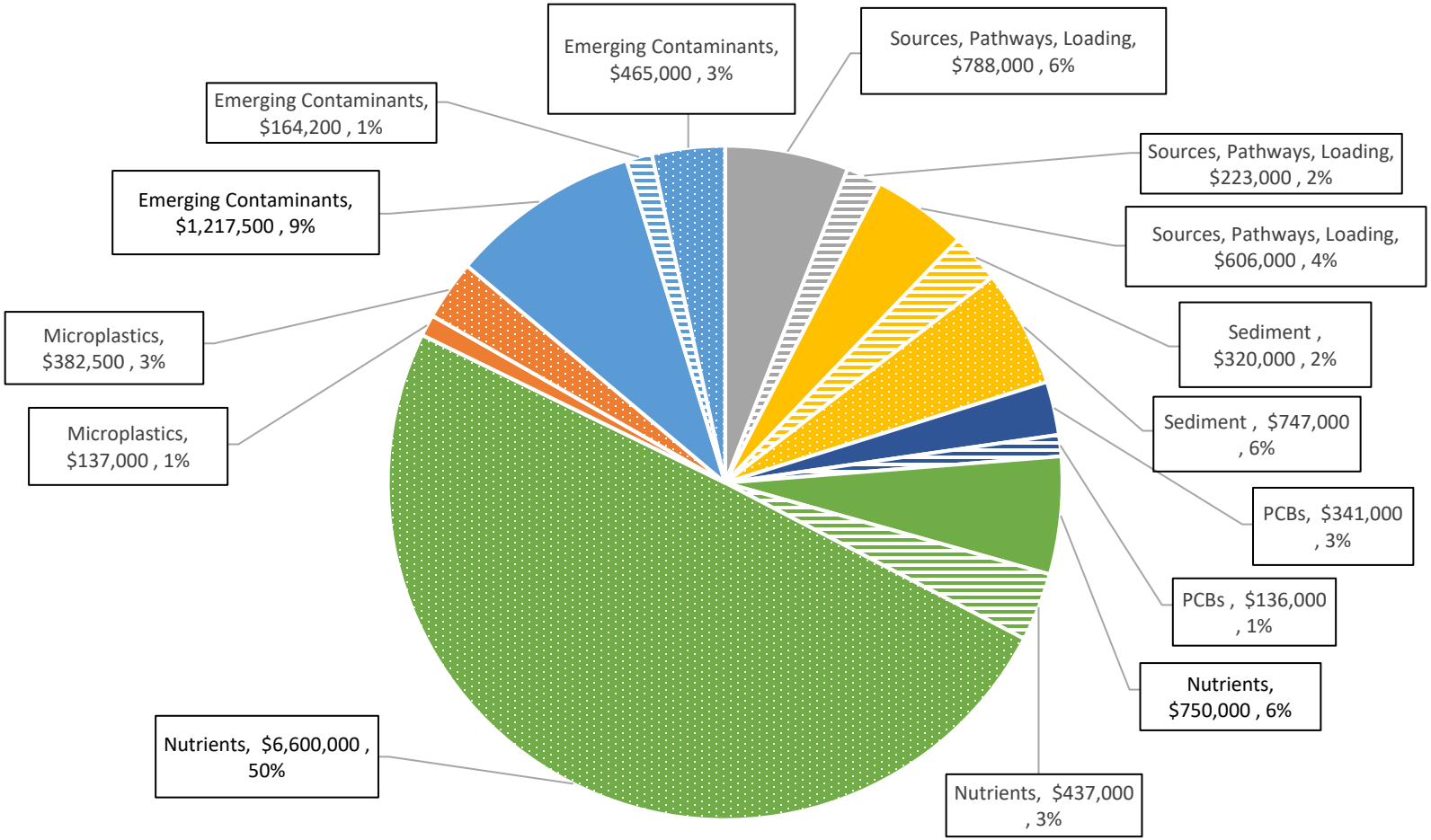
PROJECTED BUDGET: SPECIAL STUDIES 2025 to 2026

Projected funds available for special studies in 2024-2025 (blue), the cost of high priority studies (red), and the cost of all special studies based on the multi-year plans for all workgroups (orange). High priority studies for 2025 are estimates because not all workgroups have selected and prioritized studies for those years.



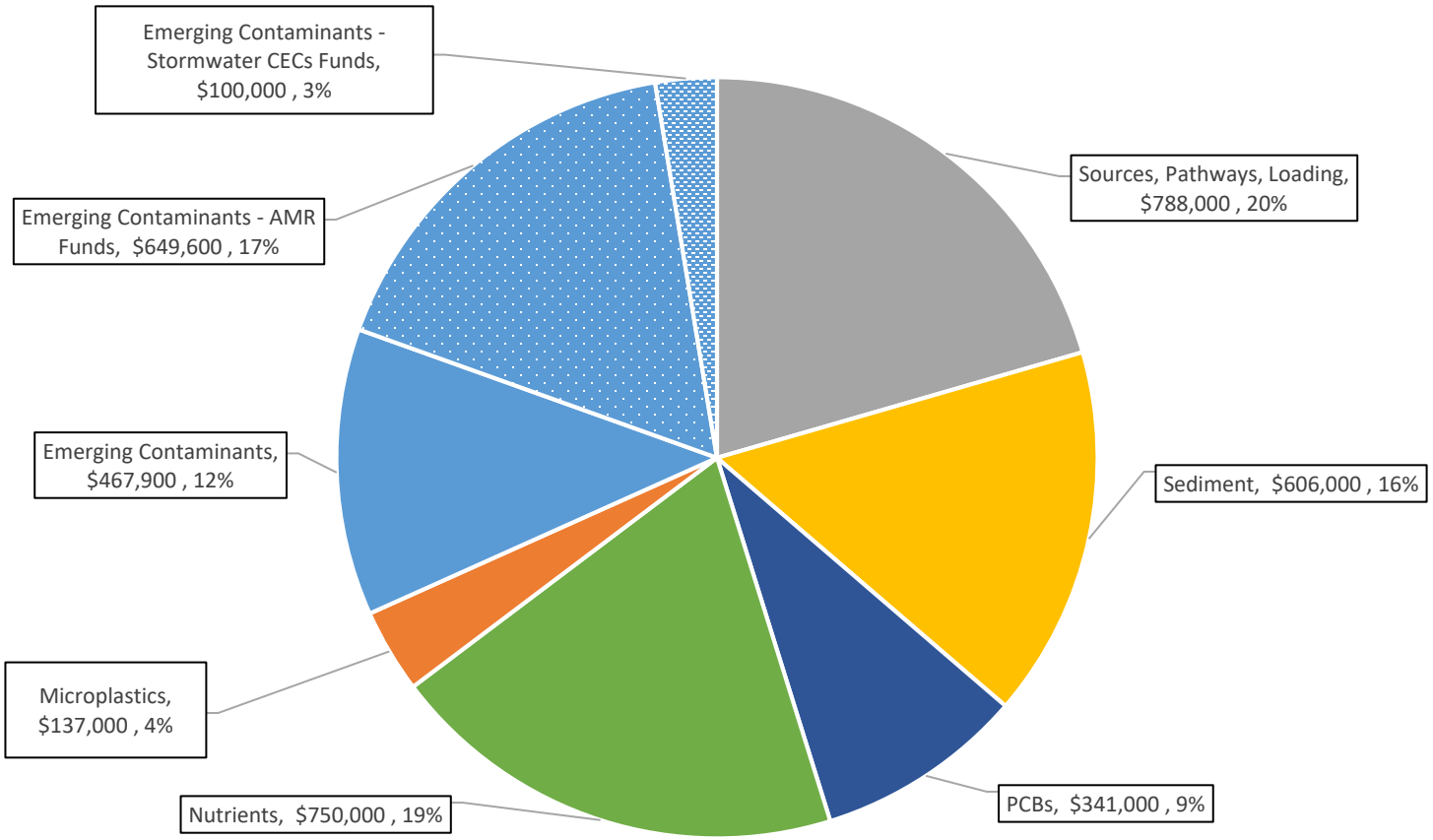
BUDGET: All Special Studies funding 2021-2023

Total funding for Special Studies for each workgroup over the past three years. RMP Special Studies funding (solid slices), MMP & Supplemental Environmental Projects funding (striped slices), Pro-Bono & External funding (dotted slices) for the past three years. Total funds: $13,314,200



BUDGET: RMP Funding for Special Studies 2021-2023

RMP-funding for Special Studies for each workgroup over the past three years. Emerging Contaminants Special Studies funding includes AMR funds (dotted slice) and Stormwater CECs funds (hashed slice). Total funding is $3,839,500.



Fishing on the Bay. Photograph by Shira Bezalel.

EMERGING CONTAMINANTS

Relevant Management Policies and Decisions

Regional Action Plans for emerging contaminants

Early management intervention, including green chemistry and pollution prevention

State and federal pesticide regulatory programs

State Water Board CEC Program

DTSC Safer Consumer Products Program

Recent Noteworthy Findings

The RMP is revising the CEC strategy that guides our monitoring and science. Discussions with stakeholders and science advisors have led to revisions to management questions and the tiered risk-based framework for CECs in the Bay. Draft chapters describe a four-element strategy consisting of 1) CEC monitoring and risk evaluation; 2) monitoring and modeling in contaminant pathways; 3) use of novel approaches to identify additional CECs, including nontarget analysis and new approach methodologies; and 4) review of the scientific literature and interactions with scientists around the world to learn from others and share expertise. We will complete the revision in 2024.

RMP monitoring revealed widespread occurrence of PFAS, also known as "forever chemicals," at parts per trillion concentrations in the waters of the Bay. The RMP analyzed Bay water in 2021 for 40 PFAS. Eleven were detected in water collected from 22 sites. Concentrations were generally consistent with similar studies globally. While levels in Bay water may not pose risks to wildlife, they do suggest concern for people who eat fish from the Bay. California has passed bans on PFAS in some products to reduce harmful exposures. Sustained, multi-matrix monitoring of this important class of CECs is a high priority for the RMP.

The RMP conducts exploratory studies of CECs in municipal wastewater effluent and urban stormwater runoff. Recently completed wastewater studies focused on sunscreen ingredients and bisphenols. Two of three sunscreens analyzed, oxybenzone and avobenzone, were detected in effluent from six Bay Area facilities. Five of 17 bisphenols were detected in effluent from the same facilities. A previous study at a single facility found higher levels of BPA, suggesting a decrease over the last 15 years. Meanwhile, findings from the RMP's multi-year stormwater CECs screening study are described in the 2023 RMP Update.

Priority Questions for the Next Five Years

1. Which CECs have the potential to adversely impact beneficial uses in San Francisco?
2. What are the sources, pathways and loadings leading to the presence of individual CECs or groups of CECs in the Bay?
3. What are the physical, chemical, and biological processes that may affect the transport and fate of individual CECs or groups of CECs in the Bay?
4. Have levels of individual CECs or groups of CECs changed over time in the Bay or pathways? What are potential drivers contributing to change?
5. Are the concentrations of individual CECs or groups of CECs predicted to increase or decrease in the future?
6. What are the effects of management actions?

MULTI-YEAR PLAN FOR EMERGING CONTAMINANTS

Special studies and monitoring in the RMP from 2020 to 2026. Numbers indicate budget allocations in $1000s. Budgets in parentheses represent funding or in-kind services from external sources (e.g., SEP funds). Budgets that are starred represent funding that has been allocated for the given study within other workgroups. Bold boxes indicate multi-year studies. Items shaded in yellow are considered high priority for 2025 funding and beyond. Dollar signs indicate projected future priorities for RMP special studies funding.

Element	Study	Funder	Questions addressed	2020	2021	2022	2023	2024	2025	2026
Strategy	CEC Strategy[1]	RMP	1-6	75	60	125	60	62	64	66
	Tires Strategy	RMP	1-6				10	10	10	10
	Stormwater Monitoring Strategy	RMP	1,2			50	55			
STORMWATER MONITORING AND MODELING										
Stormwater	Strategy-driven Stormwater CECs Monitoring and Modeling (multiple contaminant classes)	RMP WQIF	1,2				250	300 (100)	300 (100)	300 (87.2)
HIGH CONCERN CECs										
PFAS	PFAS: Synthesis and Strategy	RMP	1-6					107		
	Stormwater PFAS[2]	RMP	1,2	40	29.6	20				
	PFAS in Ambient Bay Water	RMP	1,4,6		50					
	PFAS in Influent, Effluent, Biosolids; Study TBD, est. value	BACWA	1,2,4,6		(135)	(290)				
	PFAS in Archived Sport Fish	RMP Water Brd	1,4			12.5 (20)	42			
	North Bay Margin Sediment PFAS[3]	SEP	1,2,4,6				(53)			
	Bay Water TOP Assay	RMP	1					67.2		
	PFAS Sources to Solutions	WQIF (proposal submitted)	1-6					(547)	(751)	(799)
	RMP Status and Trends[4]	RMP S&T	1,4			Water (wet) Eggs	Water (dry/wet) Sediment Prey fish Seals	Water (wet) Eggs Sport fish Seals	Water (dry)	Water (wet)

Element	Study	Funder	Questions addressed	2020	2021	2022	2023	2024	2025	2026
Organo-phosphate Esters	Stormwater Organophosphate Ester Flame Retardants[2]	RMP	1,2	40	29.6	20				
	OPE & Plastic Additive Wastewater Monitoring	RMP	1,2,4,6					95.4		
	OPEs: Synthesis and Strategy	RMP	1-6							75
	RMP Status and Trends[4]	RMP S&T	1,4		Water (dry)	Water (wet)	Water (dry/wet)	Water (wet)	Water (dry)	Water (wet)
MODERATE CONCERN CECs										
Alkylphenols & Alkylphenol Ethoxylates	Stormwater Ethoxylated Surfactants[2]	RMP	1,2	40	29.6	20				
	Followup of Multi-matrix Study	RMP	1,2,4			30	30			
Bisphenols	Bisphenols in Stormwater[2]	RMP	1,2	21	29.6	20				
	Bisphenols in Wastewater, Sediment	RMP	1,2	72						
	RMP Status and Trends[4]	RMP S&T	1,4		Water (dry)	Water (wet)	Water (dry/wet) Sediment	Water (wet)	Water (dry)	Water (wet)
LOW or POSSIBLE CONCERN CECs										
PBDEs	RMP Status and Trends[5]	RMP S&T	1,3,4			Eggs	Sediment	Sport fish		
Plastic Additives	Phthalates and Replacements in Water, Archived Sediment	RMP	1,4						100	
Personal Care & Cleaning	Sunscreens in Wastewater	MMP	1,2	(36.5)						
	QACs in Wastewater, Other Matrices	MMP NSF	1,2,4		(58.2) (20)					
	QACs & New Concerns in Bay Water, Wastewater	RMP	1,2							70
Construction Materials	Newly Identified Concerns such as Isothiazolinones	RMP	1							50
Chlorinated Paraffins	Chlorinated Paraffins (medium-long) in Sediment[3]	SEP	1				(53)			
Vehicles, Roadways	Tire, Roadway Contaminants Follow-up from NTA, Stormwater[2]	RMP	1,2	40	29.6	20				
	Tire Contaminants Wet Season Water Screen	RMP	1,2			50	40	50		50

Element	Study	Funder	Questions addressed	2020	2021	2022	2023	2024	2025	2026
(studies also listed in Tires MYP)	Newly Identified Tire Contaminants (Bay or Stormwater)	RMP	1,2							50
	Total Tire Rubber/Tire Chemical Indicators (Stormwater, Bay Wet Season Water, Sediment)	RMP	1,2							25
NONTARGET & OTHER STUDIES										
NTA (including followup targeted studies based on NTA findings)	NTA Data Mining of Water & Sediment Findings	RMP	1,2				45			
	Non-targeted Analysis of Bay Fish	RMP	1					23	50	
	Follow-up Targeted Study (data mining results)	RMP	1						50	
	Microplastic Additives NTA Study	RMP	1						120	
	RMP Status and Trends[4]	RMP S&T	1,4,6				Seals	Seals	Water	Water
Other	Toxicology	RMP	1		60				60	60
RELEVANT STUDIES IN OTHER WORKGROUPS										
Modeling (SPLWG)	Integrated Monitoring and Modeling Strategy - CEC Conceptual Model	RMP	1,2,4		50					
Modeling (SPLWG)	CEC Stormwater Load Modeling Exploration	RMP	2			25				
Strategy (MPWG)	Tires Strategy, Multi-Year Plan	RMP	1,2,3,6			25.5				
Modeling (PCBWG)	In-Bay Fate Model	RMP SEP WQIF	1,3,4,5,6		45	75	(408) (350)	(340)	(235)	
RMP-funded Special Studies Subtotal - ECWG				**328**	**318**	**367.5**	**532**	**714.6**	**754**	**756**
High Priority Special Studies for Future RMP Funding									**604**	**596**
RMP-funded Special Studies Subtotal – Other Workgroups				**0**	**95**	**125.5**	**0**	**0**		
MMP & Supplemental Environmental Projects Subtotal				**36.5**	**58.2**	**0**	**106**			
Pro-Bono & Externally Funded Studies Subtotal				**0**	**155**	**310**	**0**	**647**	**851**	**886.2**
OVERALL TOTAL				**364.5**	**531.2**	**677.5**	**638**	**1361.6**	**1605**	**1642.2**

1 – The CEC Strategy funds preparation of RMP CEC Strategy Revisions, Updates, and Memos; it also funds literature review, scientific conference attendance, and responses to information requests from RMP stakeholders. Preparation of a major revision to the CEC Strategy began in 2022, resulting in a higher funding request.
2 – The multi-year (2019-2022) stormwater study includes five groups of analytes: PFAS, ethoxylated surfactants, organophosphate esters, bisphenols (added year 2), and targeted stormwater analytes identified via non-targeted analysis. The total projected cost ($586k) is spread across five groups and four years.
3 – A SEP received in 2022 is funding sediment analysis of PFAS and chlorinated paraffins; the $106k budget is split between these classes.
4 – When a CEC class is included in the RMP Status and Trends monitoring activities for a particular year, we denote the relevant matrix. Water monitoring may occur in the wet and/or dry season (indicated by wet and dry, respectively). Pilot studies in prey fish and marine mammals (“seals”) are underway.

This short-term multi-year plan (MYP) responds to recent data revealing the magnitude of tire chemical/particle emissions and their toxicity to aquatic organisms. The plan synthesizes the tire-related studies in the ECWG and MPWG multi-year plans; we do not anticipate the need to highlight these studies in a tire-specific plan after 2027. Studies are synthesized here and also included in the MYPs of relevant workgroups.

TIRES

Relevant Management Policies and Decisions

DTSC Safer Consumer Products Program (tire chemicals, microplastics)

California's Statewide Microplastics Strategy adopted by the Ocean Protection Council (OPC) calls for a tires-specific pollution prevention strategy by 2023

CalRecycle Waste Tire Recycling Management Program implementation

State and Regional Water Board decisions on addressing tire-related chemicals or microplastics under the Clean Water Act

Recent Noteworthy Findings

Tires may be the biggest source of microplastic pollution globally. In the Bay Area, a recent RMP study estimated that vehicles release 15-18 million kg of tire wear particles annually. When it rains, stormwater runoff carries micro and nano-sized tire particles—and the toxic chemicals associated with them—from outdoor surfaces to creeks and the Bay.

Tire particles contain hundreds of chemicals, some of which are known or suspected to be toxic to aquatic organisms or to have toxic transformation products. Examples include N-(1,3-dimethylbutyl)-N'-phenyl-p-phenylenediamine (6PPD), zinc, benzothiazoles, bisphenols, 1,3-diphenylguanidine, polyaromatic hydrocarbons (PAHs), and hexa(methoxymethyl)melamine.

RMP monitoring has detected tire particles and tire-related chemicals in Bay Area stormwater and in the Bay during the wet season. Additional Bay wet season monitoring of tire-related chemicals is in progress.

The RMP collaborated in a study that found a highly toxic-derived contaminant (6PPD-quinone) in Bay Area stormwater at levels lethal to coho salmon. In response to these data, DTSC has required manufacturers to seek safer ways to formulate tires. A growing body of data indicate that steelhead salmon, still migrating through the Bay to surrounding watersheds, are also sensitive to this contaminant.

At present, risks from other tire-related chemicals are largely unknown because tire formulations are proprietary. Furthermore, transformation products and their toxicity are not fully understood.

Studies exposing estuarine and freshwater test organisms to tire microparticles, nanoparticles, and leachate revealed lethal and sublethal effects (e.g., on reproduction, growth, and behavior) at concentrations believed to be environmentally relevant. Concentrations of tire particles in the Bay are currently unknown.

The OPC and RMP funded development of a stormwater conceptual model report that identified scientific information needs and enumerated a broad spectrum of potential measures to address tire pollution. A second RMP report included Bay Area-specific estimates of tire emissions and tire market information gleaned from a pro-bono UC Berkeley project, which is being used to focus study designs by non-RMP scientists whose work can inform the RMP.

Priority Question for the Next Five Years

Do tire particles or chemicals have the potential to adversely impact beneficial uses in San Francisco Bay?

MULTI-YEAR PLAN FOR SHORT-TERM EFFORT ON TIRE-RELATED CHEMICALS AND PARTICLES

Tire-related studies in the RMP from 2017 to 2027. Numbers indicate budget allocations in $1000s. Budgets in parentheses represent funding or in-kind services from external partners. Budgets that are starred include items beyond tires. Items shaded in yellow are considered high priority for 2024 funding and beyond. Bold boxes indicate multi-year studies. *Studies are synthesized in this short-term MYP and are also included in the MYPs of relevant workgroups (ECWG, MPWG).*

Element	Study	Funder	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Strategy	Tires strategy	RMP ECWG							10	10	10	10	10
Monitoring	Tire contaminants in Bay wet season	RMP ECWG						50	40	50		50	
	Total tire rubber/tire chemical indicators (stormwater, Bay wet season, sediment)	RMP ECWG										25	75
	Tire and road contaminants (stormwater)	RMP ECWG			33	40	29.6	20					
	Newly identified tire contaminants (Bay or stormwater)	RMP ECWG										50	50
	RMP tires strategy	RMP MPWG						25.5					
	Stormwater conceptual model - all elements	RMP MPWG OPC				30* (30*)	40* (90*)						
	Microplastics regional study - all elements	RMP MPWG Moore/External	75* (518*)	(210*)	(340*)								
	Tire market synthesis to inform science (pro bono)	BEACN (UCB)					(20)						
	Green stormwater infrastructure: Evaluating the efficacy of rain gardens	EPA/External	(10*)					(62*)	(62*)	(62*)			
RMP-funded Special Studies Subtotal – Tires					**33**	**70**	**69.6**	**95.5**	**50**	**60**	**10**	**135**	**135**
High Priority Special Studies for RMP Funding											**10**	**85**	**135**
Pro-Bono & Externally Funded Studies Subtotal			**528**	**210**	**340**	**30**	**110**	**62**	**62**	**62**			
OVERALL TOTAL			**603**	**210**	**373**	**100**	**179.6**	**157.5**	**112**	**122**	**10**	**135**	**135**

*Includes items beyond tires

MICROPLASTIC

Relevant Management Policies and Decisions

State-wide microplastics strategy and state-wide drinking water monitoring

Plastic Pollution Prevention and Packaging Producer Responsibility Act (SB 54, Allen, 2022)

Local and state bans and other management actions on single-use plastics, including plastic bags, foam packaging materials, plastic straws

DTSC Safer Consumers Products Program decisions on regulation of chemicals in tires, food packaging, building materials

Federal policy on microplastics and microfiber pollution

State and Federal bans on microbeads

State-wide trash requirements

Municipal pollution prevention strategies including green stormwater infrastructure

Recent Noteworthy Findings

Plastics are among the most ubiquitous materials used in modern society. Microplastics, pieces of plastic under 5 mm in size, have been identified in virtually every environment on Earth. Microplastics are often derived from larger plastic items, such as tiny tire wear particles shed while driving, fibers shed from textiles during washing and drying, and fragments from litter. Tire particles may be the biggest global source of microplastics. Due to our car culture, scientists estimate that the US has the highest tire particle emissions in the world—7 to 12 pounds per person every year.

The San Francisco Bay Microplastics Project was completed in 2019, and found microplastics to be ubiquitous in Bay water, sediment, bivalves, and prey fish. This study quantified for the first time microplastics in urban stormwater runoff, and made the breakthrough discovery that concentrations in urban runoff were significantly higher than wastewater effluent. The vast majority of particles observed in urban stormwater runoff were suspected to be tire wear particles and fibers.

Additionally in 2020, a collaboration with University of Washington identified various tire ingredients present in Bay stormwater runoff, including 6PPD-quinone at concentrations that are lethal to a salmon species that was historically present in the Bay (coho). More recent data indicate that steelhead, a salmon species still migrating through the Bay to surrounding watersheds, are also sensitive to this chemical.

While fibers were the second most common class of microplastics observed in stormwater, there is minimal understanding of the major sources of fibers observed in urban stormwater.

Air transport of microplastics is a key data gap in our understanding of microplastic sources and pathways. Air transport is particularly important for tire wear particles and fibers because both types of particles have characteristics that make them easily suspended in the air and have the potential to be transported long distances. Other important remaining data gaps include exposure of Bay aquatic organisms and risk for adverse impacts, and the effects of current and future solutions implemented to reduce microplastic pollution.

Priority Questions for the Next Five Years

1. What are the levels of microplastics in the Bay? What are the risks of adverse impacts?
2. What are the sources, pathways, processes, and relative loadings leading to levels of microplastics in the Bay?
3. Are microplastic levels changing over time? What are the potential drivers contributing to changes?
4. What are the anticipated effects of management actions?

MULTI-YEAR PLAN FOR MICROPLASTICS

Microplastic studies and monitoring in the RMP from 2020 to 2026. Numbers indicate budget allocations in $1000s. Budgets in parentheses represent funding or in-kind services from external sources (e.g., SEP funds). Budgets that are starred represent funding that has been allocated within other workgroups. Bold boxes indicate multi-year studies. Items shaded in yellow are considered high priority for 2025 funding and beyond.

Element	Study	Funder	Questions Addressed	2020	2021	2022	2023	2024	2025	2026
Strategy	Microplastic Strategy	RMP Patagonia/OPC	1,2,3,4	20 (30)	10	37	13 (50)	16 (100)	17 (50)	17
	Tires Strategy (ECWG)	RMP	1,2			25.5	10*	10*	10*	10*
Bay Monitoring	Bivalves	RMP	1,3							
	Fish	RMP	1,3							
	Sediment	RMP/OPC U. Rovira I Virgili	1,3		3.5		(15)			40
	Water	RMP/OPC	1,3						65	
Characteri-zing sources, pathways, loadings, processes	Wastewater	SCCWRP/OPC	1,2,3		(26)					
	Stormwater	RMP OPC	1,2,3					68	51	(40)
	Stormwater Conceptual Model	RMP OPC	1,2,4	30 (30)	30 (90)					
	Evaluating efficacy of rain gardens	SFEP/EPA	2,4			(62)	(62)	(62)		
	Investigating clothing dryers as a source	Sea Grant/OPC	2,4					(170)	(230)	
	Air monitoring	RMP OPC/Sea Grant/NOAA	1,2							(40)
	Assessing Information on Ecological Impacts	RMP NSF/CCCSD	1	(50)	18 (7.5+50)					
	Characterize microplastic additives	RMP ECWG	1,4						120*	
	Tire market synthesis to inform science (pro bono)	UC Berkeley	1,2,4			(20)				
RMP-funded Special Studies Subtotal – MPWG				**50**	**61.5**	**62.5**	**13**	**84**	**133**	**57**
High Priority Special Studies for Future RMP Funding									**116**	**40**
RMP-funded Special Studies Subtotal – Other Workgroups							**10**	**10**	**130**	**10**
MMP & Supplemental Environmental Projects Subtotal										
Pro-Bono & Externally-funded Special Studies Subtotal				**110**	**173.5**	**82**	**127**	**332**	**280**	**80**
OVERALL TOTAL				**160**	**235**	**144.5**	**140**	**416**	**413**	**137**

NUTRIENTS

Relevant Management Policies and Decisions

Developing nutrient numeric endpoints and an assessment framework

Evaluating need for revised objectives for dissolved oxygen and other parameters

Identifying protective nutrient loads and potential management options for achieving those loads.

Recent Noteworthy Findings

High frequency sensors are providing continuous data at nine sites in South Bay and Lower South Bay. These data show that elevated phytoplankton biomass and low dissolved oxygen are frequently observed in Lower South Bay slough habitats and suggest that exchange with restored ponds introduces high phytoplankton biomass into sloughs, leading to increased respiration and the potential for low dissolved oxygen events.

A major harmful algal bloom (HAB) event in August 2022 resulted in severe water quality impacts and major fish kills. Increased HAB monitoring has been a major NMS priority and has resulted in substantial increases in HAB-related data since ~2015. Multiple HAB-forming organisms are commonly detected in the Bay (generally at low abundance); several HAB-toxins are also commonly detected in water samples and bivalves. On-going work is focused on understanding factors contributing to HAB occurrences.

Progress continues on numerical modeling to predict nutrient transport, cycling, and source apportionment; phytoplankton blooms; oxygen cycling; other biogeochemical processes; and characterize uncertainty in model predictions.

Priority Questions for the Next Five Years

1. What conditions in different Bay habitats would indicate that beneficial uses are being protected versus experiencing nutrient-related impairment?

2. In which subembayments or habitats are beneficial uses being supported? Which subembayments or habitats are experiencing nutrient-related impairment?

3. To what extent is nutrient over-enrichment, versus other factors, responsible for current impairments?

4. What management actions would be required to mitigate such impairments and protect beneficial uses?

5. Under what future scenarios could nutrient-related impairments occur and which of these scenarios warrant pre-emptive management actions?

6. What management actions would be required to protect beneficial uses under those scenarios?

7. What nutrient sources contribute to elevated nutrient concentrations in subembayments or habitats that are currently impaired, or would be impaired in the future by nutrients?

8. When nutrients exit the Bay through the Golden Gate, where are they transported and how do they influence water quality in coastal areas?

9. What specific management actions, including load reductions, are needed to mitigate or prevent current or future impairment?

The Nutrient Management Strategy (NMS) is a major collaborative regional science program. The RMP funds monitoring and special studies are complementary to the studies funded by the NMS.

MULTI-YEAR PLAN FOR NUTRIENTS

Special studies and monitoring in the RMP from 2020 to 2026. Numbers indicate budget allocations in $1000s. Budgets in parentheses represent funding or in-kind services from external sources (e.g., SEP funds). Budgets that are starred represent funding that has been allocated within other workgroups. Bold boxes indicate multi-year studies. Items shaded in yellow are considered high priority for 2024 funding and beyond.

Element	Study	Funder	Collaborations with other WGs	Questions Addressed	2020	2021	2022	2023	2024	2025	2026
Strategy	Program coordination	RMP		1-5							
Monitoring	Moored sensors	RMP		1	250	250	250	250	250	400	400
	HF mapping on the shoal	SEP		1,3			(185)				
	Water quality in the Bay	RMP S&T		1	250	250	258	265	274	283	292
Modeling	Nutrient Modeling	SEP	PCBWG	4,5				(408)*			
	HAB Model Development	SEP						252			
RMP-funded Special Studies Subtotal					**250**	**250**	**250**	**250**	**250**	**400**	**400**
High Priority Special Studies for RMP Funding										**400**	**400**
RMP Status and Trends for Nutrients					**250**	**250**	**258**	**265**	**274**	**283**	**292**
RMP-funded Special Studies Subtotal – Other Workgroups								**408**			
MMP & Supplemental Environmental Projects Subtotal							**185**	**252**			
Pro-Bono & Externally-funded Special Studies Subtotal[1]					**2200**	**2200**	**2200**	**2200**	**2200**	**2200**	**2200**
OVERALL TOTAL					**2450**	**2450**	**2635**	**2702**	**2450**	**2600**	**2600**

[1] Funding provided by BACWA, CCCSD, DSP, Regional San, City of Palo Alto, City of Sunnyvale, State Water Resources Control Board, and DWR-EMP for a range of studies that support the Nutrient Management Strategy. The descriptions of these projects are not included here for simplicity. More details about the projects being funded by the Nutrient Management Strategy can be found here: http://sfbaynutrients.sfei.org/books/nutrient-strategy-goals-and-work-elements

PCBs

Relevant Management Policies and Decisions

PCBs TMDL – support for appropriate changes to the TMDL by 2028

NPDES Municipal Regional Stormwater Permit and wastewater permit requirements

Focusing management actions and/or locations for reducing PCB impairment (upland)

Determining cleanup priorities (in-Bay)

Recent Noteworthy Findings

In 2019, shiner surfperch had a Bay-wide average PCB concentration 18 times higher than the TMDL target. These concentrations have resulted in an advisory from the Office of Environmental Health Hazard Assessment (OEHHA) recommending no consumption for all surfperch in the Bay. PCB concentrations in shiner surfperch and white croaker show limited signs of decline.

Urban stormwater is the pathway carrying the largest PCB loads to the Bay and has the highest load reduction goals. Concentrations of PCBs and mercury on suspended sediment particles from a wide range of watersheds have been measured as an index of the degree of watershed contamination and potential for effective management action. The three sites with the highest estimated particle PCB concentrations as of 2019 were Pulgas Pump Station South (8,220 ng/g), Industrial Rd Ditch in San Carlos (6,139 ng/g), and Line 12H at Coliseum Way in Oakland (2,601 ng/g).

Assessments of three “priority margin units” (Emeryville Crescent, San Leandro Bay [SLB], and the Steinberger Slough/Redwood Creek area [SS/RC]) established conceptual models as a foundation for monitoring response to load reductions and for planning management actions. A key finding was that PCB concentrations in sediment and the food webs in the Crescent and SLB could potentially decline fairly quickly (within 10 years) in response to load reductions from the watershed. In contrast, recovery in SS/RC appears likely to be ultimately limited by the relatively high PCB concentrations that prevail in the South Bay compared to other subembayments.

In spite of the expected responsiveness of SLB, extensive field studies have documented persistent sediment contamination that is likely due to continuing inputs from the watershed.

Priority Questions for the Next Five Years

1. What are the rates of recovery of the Bay, its segments, and in-Bay contaminated sites from PCB contamination?
    a. What would be the impact of focused management of PMU watersheds?
    b. What would be the impact of management of in-Bay contaminated sites (e.g., removing and/or capping hot spots), both within the sites and at a regional scale?

MULTI-YEAR PLAN FOR PCBs

Special studies and monitoring in the RMP from 2020 to 2026. Numbers indicate budget allocations in $1000s. Budgets in parentheses represent funding or in-kind services from external sources (e.g., SEP funds). Budgets that are starred represent funding that has been allocated within other workgroups. Bold boxes indicate multi-year studies. Items shaded in yellow are considered high priority for 2024 funding and beyond. ss – Steinberger Slough; sl – San Leandro Bay

Category	Study	Funder	Questions addressed	2020	2021	2022	2023	2024	2025	2026
General	Develop and update multi-year workplan and continued support of PCB Workgroup meetings	RMP	1a,b	10						
	In-Bay Fate Model	RMP SEP WQIF	1a,b		45	75	(136)	(136) (350)‡	(136) (340)‡	(235)‡
	Integrated Watershed-Bay Model (SPLWG)	SEP	1a,b		(200)*					
	Margins Ambient	RMP								
PMU	PMU Stormwater	SEP	1a							
	PMU Sport Fish Monitoring (3 PMUs)	S&T	1a					(~20[a])		
	Passive Samplers	RMP	1a	91ss	87sl					
	PMU Prey Fish Monitoring (4 PMUs)	RMP	1a			26ss[b]	37ss[c] 7sl[e]			
	PMU Sediment	RMP	1a,b			26ss[b]	38ss[c]	96		
PMU/General	Food Web Model	WQIF	1a,b					(71)‡	(71)‡	
RMP-funded Special Studies Subtotal – PCBWG				**101**	**132**	**127**	**82**	**96**		
High Priority Special Studies for Future RMP Funding									**0**	**0**
RMP-funded Special Studies Subtotal – Other Workgroups				**0**	**200**	**0**	**0**			
MMP & Supplemental Environmental Projects Subtotal				**0**	**0**	**0**	**136**	**136**	**136**	
Pro-Bono & Externally-funded Special Studies Subtotal				**0**	**0**	**0**	**0**	**421**‡	**411**‡	**235**‡
OVERALL TOTAL				**101**	**132**	**127**	**218**	**653**	**547**	**235**

[a] Shiner surfperch; [b] Sample collection; [c] Sample analysis and reporting; [d] WQIF; [e] piggybacking on S&T near-field prey fish sampling

‡ Funds from the San Francisco Bay Water Quality Improvement Fund (WQIF) will support in-Bay modeling at the levels indicated for three years (2023-2025).

SEDIMENT

Relevant Management Policies and Decisions

Long-Term Management Strategy for Dredged Material in SF Bay (LTMS) to comply with the Basin Plan

NOAA 2011 Programmatic Essential Fish Habitat Agreement & 2015 LTMS Amended Programmatic Biological Opinion

PCB TMDL

Mercury TMDL

Regional Restoration Plans[1]

Recent Noteworthy Findings

From 2019 to 2020, the RMP funded the USGS to compile Bay bathymetric data and calculate Bay-wide bathymetric change from the 1980s to the 2010s. This work showed that the Bay floor has been net erosional over the past several decades, losing approximately 34M m^3 of sediment. Suisun Bay showed the greatest amount of sediment loss (approximately 18M m^3) while Central Bay showed net accretion (approximately 5M m^3). These findings can be used by ecosystem managers to inform a variety of sediment-related issues, including restoration of tidal marshes, exposure of legacy contaminated sediment, and strategies for the beneficial use of dredged sediment.

In July 2020, the USGS conducted research in South San Francisco Bay to assess the dominant controls on suspended sediment flocculation and associated particle settling velocity, which impacts the degree to which the Bay bed is eroding or accreting sediment. Data collection included gathering information on suspended sediment flocculation, wave energy, and flow dynamics. The results show that the relationship between suspended sediment settling velocity and local flow turbulence can vary considerably based on the method used to determine settling velocity. The results from this project will be useful for calibrating numerical models that simulate Bay sediment transport processes.

The Workgroup recently completed the development of a Bay sediment conceptual model that highlights what is known and not known about sediment delivery and deposition dynamics at multiple spatial and temporal scales. The report identifies the data gaps that are considered most pressing to address in the near future, with an emphasis on fine-sediment supply for baylands habitat support. The results from this effort will be used to inform policy decisions and build frameworks for sediment management, monitoring, and numerical modeling.

Priority Management Questions for the Next Five Years

1. What are acceptable levels of chemicals in sediment for placement in the Bay, baylands, or restoration projects?

2. Are there effects on fish, benthic species, and submerged habitats from dredging or placement of sediment?

3. What are the sources, sinks, pathways and loadings of sediment and sediment-bound contaminants to and within the Bay and subembayments?

4. How much sediment is passively reaching tidal marshes and restoration projects and how could the amounts be increased by management actions?

5. What are the concentrations of suspended sediment in the Estuary and its segments?

In 2023, the Workgroup developed subquestions for questions 3 through 5 as part of the development of the Sediment Monitoring and Modeling Workplan (McKee et al. 2023). In 2024, questions 1 and 2 will be reviewed by the Workgroup to determine if they should continue to be management priorities.

[1] San Francisco Bay Restoration Authority Goals, Baylands Goals Update for Climate Change, Subtidal Habitat Goals Project, and Action 13 “Manage sediment on a regional scale and advance beneficial reuse” from the Estuary Blueprint.

MULTI-YEAR PLAN FOR SEDIMENT

Sediment Workgroup special studies for 2020 to 2027. Numbers indicate budget allocations in $1000s. Budgets in parentheses represent funding or in-kind services from external sources (e.g., SEP funds). Budgets that are starred represent funding that has been allocated within other workgroups. Bold boxes indicate multi-year studies. Highlighted boxes indicate an initial indication of High Priority Projects, which may be updated in subsequent years. The numbers in brackets correspond to the management subquestion the study addresses. See the Sediment Monitoring and Modeling Workplan [McKee et al. 2023] for details about the subquestions.

Element	Study	Funder	Questions addressed	2020	2021	2022	2023	2024	2025	2026	2027
Strategy	Sediment Monitoring Strategy	WQIF/SEP	1,3,4			(200)					
	Workgroup Strategy	RMP	1,2,3,4	10		10	10				
	Sediment Modeling Strategy	RMP	1,2,3,4	26							
	Sediment Conceptual Model	RMP BCDC/USACE	3,4,5	(142)	(747)				50 [3.3]		
Screening Values	Sediment Bioaccumulation Guidance	RMP	1	23							
Data Mining	DMMO Database Enhancement	RMP	1,2		40	20					
Beneficial Reuse	Beneficial Reuse	RMP	1,2		34						
Loading to the Bay	Monitor Local Tributary Suspended Load and Bedload	RMP	3						140 [3.1]		
	Monitor Tributary Suspended Load and Bedload Flux	RMP	3	(385)*							
	Model Tributary Suspended Load and Bedload Flux	RMP	3						82 [3.1]	100 [3.1]	50 [3.1]
	Monitor Sediment Flux at Key Locations in the Bay (e.g., major creek mouths downstream of head of tide, mudflats/shallows, major bridges, Golden Gate)	RMP SEP	3,4,5				52, 70	79 [5.4]	100 [3.2] 50 [3.3] 75 [5.4]	75 [5.4]	50 [3.2] 75 [3.6]

Element	Study	Funder	Questions addressed	2020	2021	2022	2023	2024	2025	2026	2027
	Model Current and Future Sediment Flux at Key Locations throughout the Bay	RMP SEP	3,4	45		(408)*					
Sinks & reservoirs	Monitor Sediment Deposition at Key Locations in the Bay (e.g., creek reaches downstream of head of time, mudflats/shallows)	RMP SEP	3,4		140	215	15, (120)	204 [4.2]	120 [4.4]	140 [4.4]	150 [4.2] 150 [4.4]
	Model Current and Future Sediment Deposition Dynamics throughout the Bay	RMP WQIF	3,4				(350)*‡	(340)*‡	(235)*‡		150 [4.3]
	Bathymetric Change Studies	RMP USGS	3,4	77, (5)							
	Bathymetric Data Collection	RMP	3						50 [3.5]		50 [3.5]
	Shoreline Change Studies	RMP	3						75 [3.4]	75 [3.4]	
Sediment characteristics	Mapping Bed Sediment Characteristics for Model Calibration	RMP	5						50 [5.2]	100 [5.2]	100 [5.2]
	Characterizing Impacts of Flocculation on Settling Velocity	RMP SEP	3,4,5	(264)					50 [5.3]	100 [5.3]	100 [5.3]
	Using Satellite Imagery to Analyze Turbidity and Suspended Sediment Concentration	RMP	5						120 [5.1]	120 [5.1]	
RMP-funded Special Studies Subtotal – Sediment				**181**	**214**	**245**	**147**	**283**	**962**	**710**	**875**
High Priority Special Studies for RMP Funding									**460**	**535**	**425**
RMP-funded Special Studies Subtotal – Other Workgroups				**385**	**0**	**408**	**350**	**340**	**235**		
RMP Supplemental Environmental Projects Subtotal				**406**	**0**	**200**	**120**	**0**			
Pro-Bono & Externally Funded Studies Subtotal				**5**	**747**	**0**	**0**				
OVERALL TOTAL				**592**	**961**	**445**	**267**	**283**	**962**	**710**	**875**

‡ San Francisco Bay Water Quality Improvement Fund (WQIF) project that supports contaminant, sediment, and nutrient modeling.

SOURCES, PATHWAYS AND LOADING

Relevant Management Policies and Decisions

Developing and refining pollutant loading estimates, including for CECs, for future policy or management plan updates (collaboration with Emerging Contaminants Workgroup)

Informing provisions of the current and future versions of the Municipal Regional Stormwater Permit (MRP)

Identifying sources, pathways, and high leverage areas to prioritize for management actions

Tracking effectiveness of load reduction and changes in CECs presence and concentration in small tributaries

Estimating present and future sediment loads to the Bay (collaboration with Sediment Workgroup)

Supporting boundary concentration and loading conditions for Priority Margin Unit (PMU) and in Bay modeling (collaboration with PCB Workgroup)

Recent Noteworthy Findings and Future Directions

Shifting Focus: The Sources, Pathways, and Loadings Strategy is being updated to address evolving information needs and an integrated monitoring and modeling approach. Field based studies conducted over the past several decades have focused primarily on locating, quantifying, and managing PCBs and mercury in the urban environment to support management actions. Going forward, an increasing emphasis will be placed on contaminants of emerging concern (CECs), along with tracking trends in PCB and mercury loading through a combination of methods development, monitoring, and conceptual and numerical modeling. Rather than considering monitoring and modeling separately, we are in the process of finalizing a new integrated watershed monitoring and modeling (IWMM) approach for data interpretation where stormwater sampling methods will be designed to support modeling tools and where modeling results will feedback into the modification of the field program. Other pathways such as large river loading, wastewater, and atmospheric deposition may also be considered. The draft management questions provided here reflect these broadened needs.

Modeling: Two models have been developed to date. The Regional Watershed Spreadsheet Model (RWSM), a calibrated average annual time step volume concentration model, has so far provided support for planning efforts for PCBs and mercury, trash assessments, copper, and microplastics. To maintain usefulness, the RWSM is being updated in 2023 and 2024 to reflect a more recent climatic period (1991-2020) and the land use development and redevelopment that has occurred in the past 20 years. The Watershed Dynamic Model (WDM) is a lumped parameter model for simulating large, complex regions with mixed land-use types, a wide range of contaminants, upland erosion and sediment transport, and in-stream processes at an hourly scale. The water and sediment modules of the WDM were completed in 2021 and 2022 for water years (WYs) 1995-2020. The WDM is now being recalibrated to include 2020 land use and expanded to include contaminants load simulation (PCBs and Hg as pilot cases). The ongoing CECs load modeling review project is focusing on investigating and recommending appropriate ways of combining limited monitoring data and modeling to estimate regional scale CEC loads. We have also begun developing a watershed-bay modeling strategy and designing a pilot application of a coupled watershed-bay model to simulate the fate of sediment and contaminants.

Monitoring: Stormwater sampling goals continue to shift towards characterizing CECs in stormwater as well as continuing to support legacy pollutant modeling. Due to a very wet winter in WY 2023, all RMP stormwater monitoring projects made significant progress. At three locations, samples were collected to help support calibration of the WDM for mercury and PCBs; a study will continue in WY 2024. A special stormwater study for PCBs both upstream and downstream of Oakland GE in the San Leandro Bay Priority Margin Unit (PMU) was also implemented; a study will also continue in WY 2024. Although no sampling occurred in WY 2023, planning is underway for sampling selected CECs in stormwater in the wet season of WY 2024 to support modeling regional loads

with suitable precision for comparison to other pathways.

Remote Sampler: RMP scientists and engineers have begun piloting innovative remote samplers that will reduce the need for intensive manual sampling during storms, and thus both increase capacity and reduce cost for stormwater monitoring. Two projects funded for 2023 included remote sampler development for CECs and for deployment in tidal areas. Trial deployments for both of these uses were conducted to test logistical feasibility. Trial deployments with actual sample collection for chemical measurements are expected to begin with the coming winter rains (WY 2024). Though key technological challenges remain, the initial designs show great promise.

Contaminants of Emerging Concern: Prior RMP studies have identified the presence of emerging contaminants in urban runoff and provided evidence that stormwater is an important pathway for CECs to reach the Bay. A four-year preliminary investigation of CECs in stormwater is culminating in 2023. Along with the results of this landmark study, the new remote sampler and the modeling projects mentioned above, all are feeding into the ongoing development of a stormwater CECs monitoring approach that integrates conceptual and computational modeling to cost-effectively answer management questions. These projects will feed into a 2023/2024 SPLWG strategy update to reflect the pivot toward CECs and to re-examine activities addressing legacy pollutants.

Priority Questions for the Next Five Years*

1) What are the sources, pathways, and loadings of pollutants and sediment to the Bay?

2) Which are the priority sources and pathways of pollutants that adversely impact or potentially adversely impact the Bay's environmental quality?

3) Are levels of individual pollutants or pollutant classes changing over time in the sources, pathways and loadings? What factors or management interventions have contributed to the change?

4) What are the effective management actions that can be implemented in the region to address pollutant pathways and sources, and where should they be implemented to have the greatest benefit?

MULTI-YEAR PLAN FOR SOURCES, PATHWAYS, AND LOADING

Sources, Pathways and Loadings Workgroup studies in the RMP from 2020 to 2026. Numbers indicate budget allocations in $1000s. Budgets in parentheses represent funding or in-kind services from external sources (e.g., SEP funds). Budgets that are starred represent funding that has been allocated for the given study within other workgroups. Items shaded in yellow are considered high priority for 2025 funding and beyond.

Element	Study	Funder	Collaboration with other Workgroups	Questions addressed	2020	2021	2022	2023	2024	2025	2026
Strategy	SPLWG strategy (formerly STLS coordination)	RMP			40	25	35	35	37	45	50
	SPLWG strategy report & management questions update	RMP	ECWG	1,2,3,4,5				45			
Monitoring	Monitoring to support regional loads and trends	RMP		1,3				10			
	POC reconnaissance monitoring	RMP		1,2,3,4	110	65	43				
	Tidal area remote sampler development	RMP		1,2,4				85	62	20	20
	Remote sampler purchase	RMP							180		
	Priority margin units (PMU) PCB monitoring	RMP		1,2,4	10						
	Priority margin units (PMU) PCB monitoring	SEP	PCBWG	1,2,4	37*						
Modeling	Modeling to support regional loads and trends (PCB/Hg)	RMP		3,5	100	150	90	130			
	WDM model maintenance	RMP		1					50	50	50
	CECs stormwater modeling	RMP		1			25				
	Advanced Data Analysis	RMP		1,2,3,4	50						
	Update San Francisco Bay region land-use map	SEP		2,4,5	(50)						
	Regional Watershed Spreadsheet Model update	SEP				(23)					
	Integrated watershed-bay modeling strategy and pilot implementation	SEP				(200)					
Integrated Studies	Integrated watershed monitoring and modeling strategy	RMP				50					

Element	Study	Funder	Collaboration with other Workgroups	Questions addressed	2020	2021	2022	2023	2024	2025	2026
	PCB/Hg monitoring and modeling to support load and trend assessment	RMP		1,3,5					217	167	100
RELEVANT STUDIES IN OTHER WORKGROUPS											
Monitoring	CECs stormwater monitoring and modeling	RMP WQIF‡	ECWG	1,2,4	181*	148*	100*	250*	300* (100)‡	300* (100)‡	300* (87.2)‡
Monitoring	Stormwater CECs monitoring strategy (approach)	RMP	ECWG				50*	55*			
Monitoring	Stormwater (method evaluation and monitoring)	RMP OPC	MPWG						68*	51*	40*
RMP-funded Special Studies Subtotal – SPLWG					**310**	**290**	**193**	**305**	**546**	**282**	**220**
High Priority Special Studies for RMP Funding										**282**	**220**
RMP-funded Special Studies Subtotal – Other Workgroups					**218**	**148**	**150**	**305**	**368**	**351**	**340**
MMP & Supplemental Environmental Projects					**50**	**223**					
Pro-Bono & Externally Funded Studies Subtotal											
OVERALL TOTAL					**360**	**513**	**193**	**305**	**546**	**282**	**220**

Photo by Shira Bezalel

STATUS AND TRENDS MONITORING

Relevant Management Policies and Decisions

Define ambient conditions in the Bay

Water Quality Assessment – 303(d) impairment listings or de-listings

Determination if there is a reasonable potential that a NPDES-permitted discharge may cause violation of a water quality standard

Evaluation of water and sediment quality objectives

Dredged material management

Development and implementation of TMDLs for mercury, PCBs, and selenium

Site-specific objectives and anti-degradation policies for copper and cyanide

Inform CEC tiered risk-based framework and CEC management actions

Recent Noteworthy Findings

In 2021, the RMP started to implement the revised S&T design by adding contaminants of emerging concern (bisphenols and organophosphate esters) to the Bay water sampling. Samples for PFAS were also collected as part of a special study and were added to the S&T design in 2023. Monitoring of CECs in the Moderate Concern tier has been added to every sampling matrix (water, sediment, biota) as part of the Status & Trends Program redesign.

A three-year pilot study to monitor CECs in Bay water during the wet season began in 2022. Samples were collected following three separate storm events from four targeted near-field stations (near where stormwater enters the Bay) and four stations along the spine of the Bay during the monthly USGS nutrients cruise. Samples are also to be collected in the dry season to allow comparison between CEC concentrations in wet and dry seasons to understand how long CECs are present in the Bay, and if they are found at levels of concern.

Bird eggs were collected in 2022 after a one-year delay due to Covid. Sampling was limited to double-crested cormorants at three locations. Forster terns were dropped from the bird egg monitoring design as recommended in the S&T Review. In the spring of 2023, muscle tissue plugs were collected from sturgeon in Suisun Bay for selenium analysis. This effort, scheduled for 2022, was also delayed. Monitoring of Toxic contaminants in harbor seals is being considered for addition to the Status and Trends program and a pilot two-year special study began in 2023.

Priority Questions for the Next Five Years

1. What are concentrations and masses of priority contaminants in the Bay, its compartments, and its segments?

2. Are contaminants at levels of concern?

3. Are there particular regions of concern?

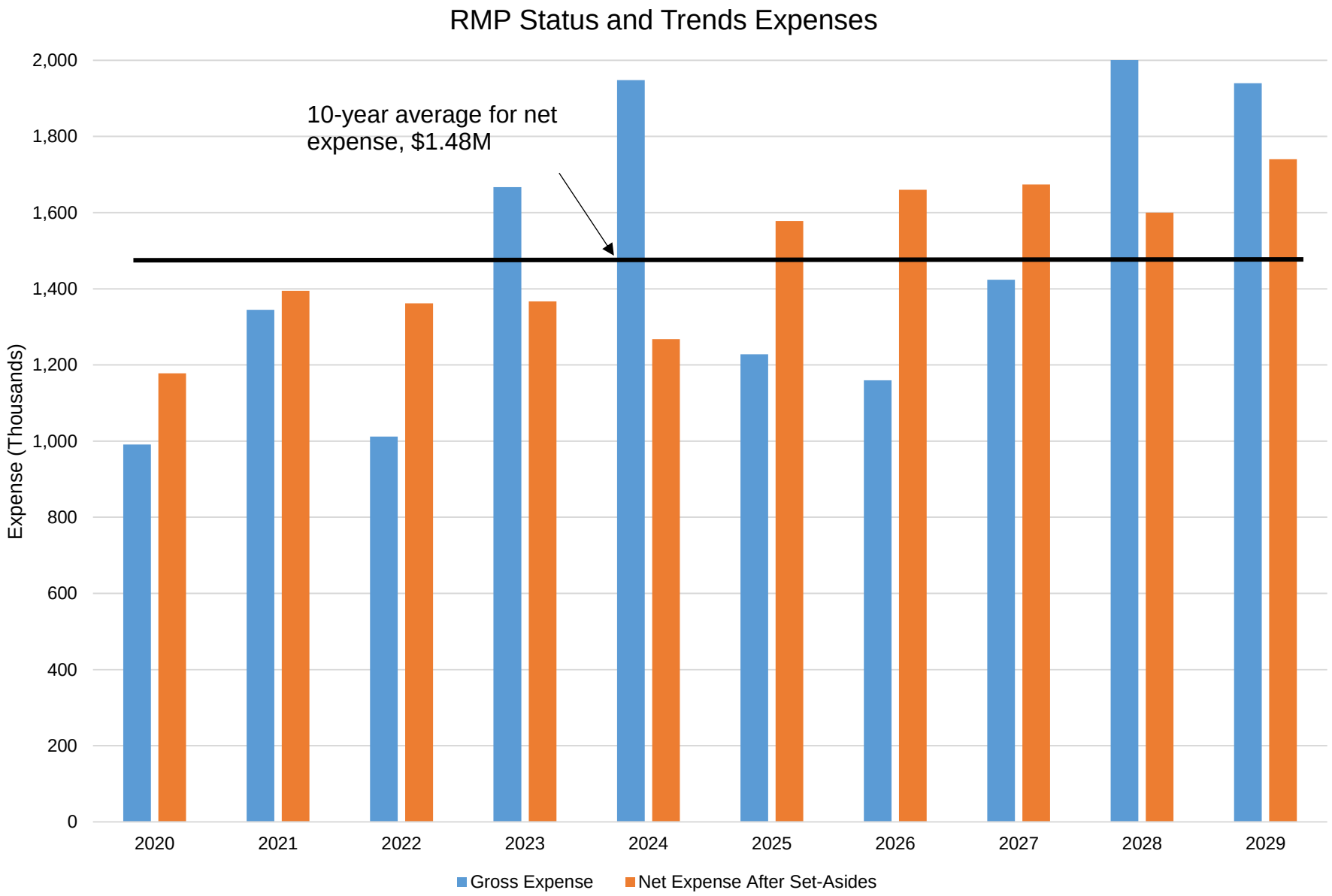
4. Have concentrations and masses increased or decreased?

When recommending addition of any analyte to S&T, the following details need to be specified: relevance of the analyte to a management question, matrix to be monitored, and the frequency, minimum duration, and the spatial extent (e.g., all sites or a subset) of monitoring.

MULTI-YEAR PLAN FOR STATUS AND TRENDS MONITORING

Status and Trends Monitoring costs in the RMP from 2019 to 2029. Values for 2025-2029 are forecasts. Numbers indicate budget allocations in $1000s.

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Monitoring Type	*Actl*	*Actl*	*Actl*	*Actl*	*Actl*	*Actl*	*Fcst*	*Fcst*	*Fcst*	*Fcst*	*Fcst*
USGS Moored Sensor Network for Suspended Sediment	250	300	400	400	400	400	400	460	460	460	460
USGS Monthly Cruises for Nutrients and Phytoplankton	242	250	250	258	265	273	283	292	299	307	317
S&T North Bay Selenium			72	127		18		136		140	
S&T Water	216		243	25	257	27	265		309		328
Wet season CECs- target & ambient				127	60	135		143		152	
CTR and Organics							88				
Non-target analysis							12	30			
Passives							51				
S&T Bird Eggs			256			195			200		
S&T Margins Sediment		319			110					235	
S&T Deep Bay Sediment					200					320	
S&T Sediment - target sites					95					190	
S&T Prey Fish					120					126	
S&T Sport Fish	405					560					650
S&T Harbor Seals						127					
Archives	84	62	84	43	80	56	85	60	90	63	95
Reporting & Support	22	23	12	10	20	25	14	14	14	25	27
Lab Intercomp Studies	55	37	28	22	60	82	30	25	52	82	63
Model Maintenance						50					
Grand Total	**1,274**	**991**	**1,345**	**1,012**	**1,667**	**1,948**	**1,228**	**1,160**	**1,424**	**2,100**	**1,940**
Set-Aside Funds Used	**0**	**88**	**0**	**0**	**300**	**680**	**0**	**0**	**0**	**500**	**200**
Set-Aside Funds Saved	**60**	**275**	**50**	**350**	**0**	**0**	**350**	**500**	**250**	**0**	**0**
Set-Aside Funds Balance	**653**	**840**	**890**	**1,240**	**940**	**260**	**610**	**1,110**	**1,360**	**860**	**660**
Net S&T Funding Needed	**1,334**	**1,178**	**1,395**	**1,362**	**1,367**	**1,268**	**1,578**	**1,660**	**1,674**	**1,600**	**1,740**


RMP Status and Trends Expenses
10-year average for net expense, $1.48M
Expense (Thousands)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
Gross Expense
Net Expense After Set-Asides

Regional Monitoring Program for Water Quality in San Francisco Bay

Monitoring Design for the Status and Trends Monitoring Program (2018-2029); sampling frequency from 2022-2029 is reflective of changes made to the Program through the Status and Trends Review process.

Program	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
USGS Moored Sensor Network for Suspended Sediment (5 targeted sites)[1]												
Parameters: SSC, Water temperature, Salinity	X	X	X	X	X	X	X	X	X	X	X	X
USGS Monthly Cruises for Nutrients and Phytoplankton in Deep Channel (38 targeted stations)												
Parameters: CTD profiles, light attenuation, SSC, DO, Chl-a, Phytoplankton speciation, Nutrients (NO_2, NO_3, NH_4, PO_4, Si)[2]	X	X	X	X	X	X	X	X	X	X	X	X
Every 2 Years: Toxic Contaminants in Water – dry season (5 targeted stations and 17 random stations)												
MeHg, Se, Cu (dissolved & particulate fractions in 2017 and onwards); Cu only after 2019		X		X		X		X		X		X
CN, Hardness, SSC, DOC, POC		X		X		X		X		X		X
Chl-a		X		X		X		X		X		X
CECs – PFAS, bisphenols, organophosphate esters				X	X	X	X	X		X		X
Non-target analysis (5 stations)								?				
Aquatic Toxicity (9 stations)[3]		X						X				
CTR parameters (10 samples at 3 targeted stations)[4], including PCBs and PAHs								X				

Program	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Every 2 years: Toxic Contaminants in Water – wet season (5 targeted stations, 4 ambient stations)												
CECs – PFAS, bisphenols, organophosphate esters					X	X	X		?		?	
Non-target analysis									?			
Every 2 years: Selenium in Water, Clams, and Sturgeon (2 targeted North Bay stations)												
Water – dissolved and particulate Se, chl-a, SSC, DOC		X	X	X	X			X		X		X
Clam tissue – selenium, stable isotopes (δ13C, δ15N, δ34S)		X	X	X	X			X		X		X
Sturgeon tissue - selenium					X			X		X		X
Every 3 Years: Toxic Contaminants in Bird Egg Tissue												
Cormorant Eggs: Hg, Se, PCBs, PBDEs, PFAS, legacy pesticides[5] (3 targeted stations)[7]	X			X[10]			X			X		
Tern Eggs: Hg, Se, PBDEs (variable fixed stations)[8]	X											
Every 5 Years: Toxic Contaminants in Near-field Bay Sediment (12 targeted near-field stations every 5 years)												
PFAS, bisphenols, TOC, N, % solids, grain size						X					X	
Every 5 Years: Toxic Contaminants in Bay Margin Sediments (12 random stations every 5 years/24 random station every 10 years)												
PFAS, bisphenols, TOC, N, % solids, grain size						X					X	
Ag, Al, As, Cd, Cu, Fe, Hg, MeHg, Mn, Ni, Pb, Se, Zn, PCBs			X								X	

Program	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Every 5 Years: Toxic Contaminants in Sediment (7 targeted stations and 10 random stations)[9]												
PFAS, bisphenols, TOC, N, % solids, grain size						X					X	
Ag, Al, As, Cd, Cu, Fe, Hg, MeHg, Mn, Ni, Pb, Se, Zn, PAHs, PCBs	X										X	
PBDEs (discontinued after 2023)	X					X						
Fipronil (discontinued after 2018)	X											
Every 5 Years: Toxic Contaminants in Sport Fish Tissue (7 targeted stations)												
Hg, Se, PCBs, PBDEs, dioxins		X					X					X
PFAS		X					X					X
Legacy pesticides[5]							X					X
Fipronil		X					?					
Every 5 Years: Toxic Contaminants in Prey Fish Tissue (4 targeted stations, 3 species)												
PFAS						X					X	
PCBs (PMUs only)						X					X	
Every 10 Years: Toxic Contaminants in Harbor Seals												
PFAS						SS	SS		?			

Notes:
"X" = Planned sampling event. "?" = Event that is planned but must be approved by the RMP Steering Committee before implementation. SS = Special Study being conducted to trial sampling methods. Additional parameters can be added to sampling events to support RMP Special Studies.

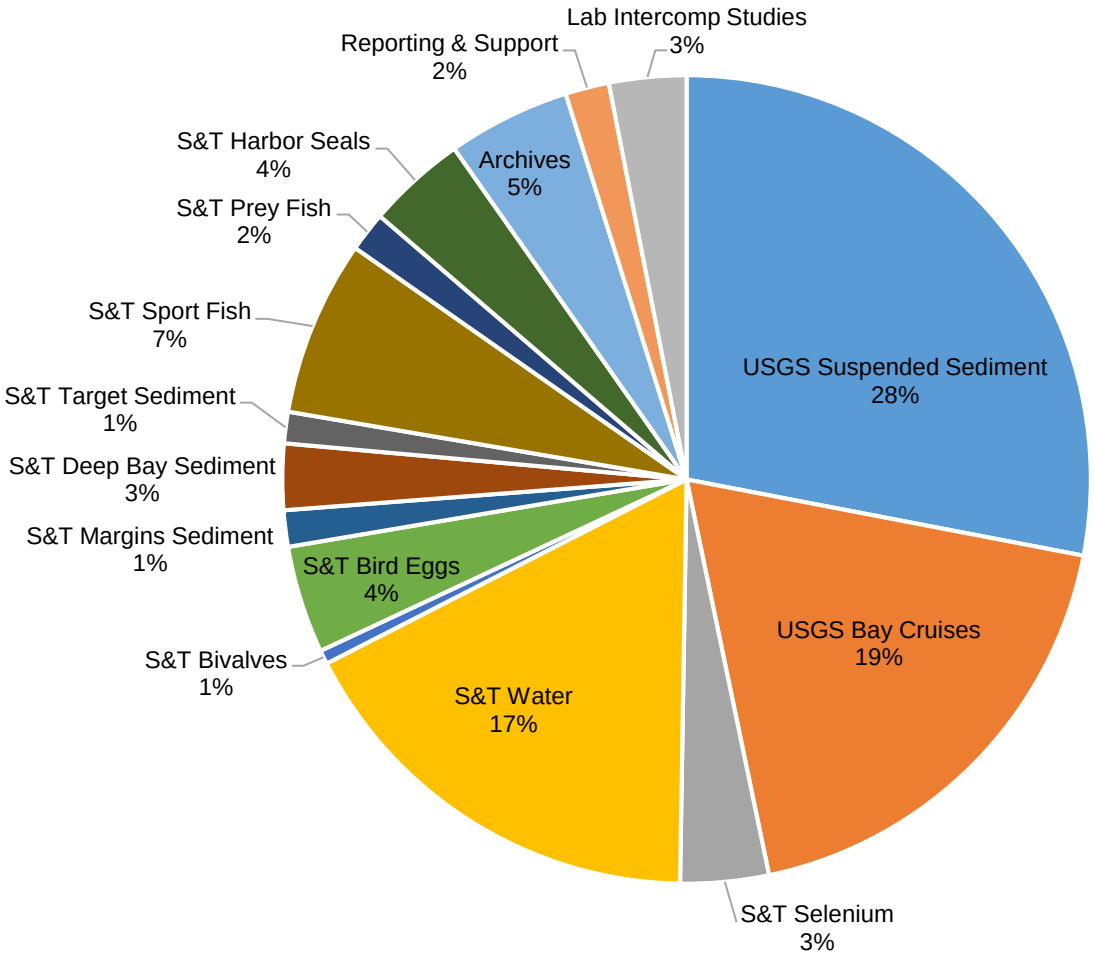
1. The RMP Status and Trend Program provides direct support to the U.S. Geological Survey (PI: Paul Work) for four SSC stations (Richmond Bridge, Pier 17, Alcatraz Island, Dumbarton Bridge). However, this contribution leverages SSC data at two more stations and salinity at eight stations funded by other partners. In addition, since 2012, the RMP has used Special Studies funds to add DO sensors at eight stations and nutrient-related sensors to three stations.
2. Monthly cruises are completed by the U.S. Geological Survey (PI: Brian Bergamaschi). Phytoplankton speciation and nutrient samples are collected at 14 stations.

3. Aquatic Toxicity is measured following EPA Method 1007.0 (*Americamysis bahia*).
4. CTR sampling occurs at the Sacramento River, Yerba Buena Island, and Dumbarton Bridge sites. Three samples collected at each site and one field blank.
5. "Pesticides" includes the suite of legacy pesticides that has been routinely measured by the RMP: Chlordanes (Chlordane, cis-; Chlordane, trans-; Heptachlor; Heptachlor Epoxide; Nonachlor, cis-; Nonachlor, trans-; Oxychlordane); Cyclopentadienes (Aldrin; Dieldrin; Endrin); DDTs (DDD(o,p'); DDD(p,p'); DDE(o,p'); DDE(p,p'); DDT(o,p'); DDT(p,p')); HCHs (HCH, alpha-; HCH, beta-; HCH, delta-; HCH, gamma-); Organochlorines (Hexachlorobenzene; Mirex).
7. Double-crested Cormorant (*Phalacrocorax auritus*) eggs are collected at three sites: Don Edwards National Wildlife Refuge, the Richmond-San Rafael Bridge, and Wheeler Island.
8. Forster's Tern (*Sterna forsteri*) eggs are typically collected from multiple sites in the Don Edwards National Wildlife Refuge and the Hayward Shoreline Regional Park.
9. Sediment samples are collected in the dry season (summer).
10. Collection was delayed until 2022 due to the Covid-19 pandemic.

Abbreviations:

Ag: Silver
Al: Aluminun
As: Arsenic
Cd: Cadmium
CECs – Contaminants of emerging concern
Chl-a: Chlorophyll-a
CTD: Conductivity, Temperature, and Depth
CTR: California Toxics Rule, see pollutant list here
https://www.waterboards.ca.gov/northcoast/board_decisions/adopted_orders/pdf/2012/120813_Hatcheries_Att_A.pdf
Cu: Copper
DO: Dissolved Oxygen
DOC: Dissolved Organic Carbon
Fe: Iron
Hg: Mercury
MeHg: Methylmercury
Mn: Manganese
NH_4: Ammonia (dissolved)
Ni: Nickel
NO_2: Nitrite (dissolved)
NO_3: Nitrate (dissolved)
PAHs: Polynuclear Aromatic Hydrocarbons
Pb: Lead
PBDEs: Polybrominated Diphenyl Ethers
PCBs: Polychlorinated Biphenyls
PFAS – Perfluorinated alkyl substances
PFCs: Perfluorinated Compounds
PMU – Priority Margin Unit (Emeryville Crescent, San Leandro Bay, Redwood Creek/Steinberger Slough)
PO_4: Phosphate (dissolved)
POC: Particulate Organic Carbon
Se: Selenium
Si: Silica (dissolved)
SSC: Suspended Sediment Concentration
TN: Total Nitrogen
TOC: Total Organic Carbon
TP: Total Phosphorus
Zn: Zinc

S&T Monitoring - Cost by Monitoring Type



5-Year Window
(2023-2027)

Total cost: $7.6M

PROGRAM MANAGEMENT

Approximately 10% of the total budget

Program management includes the following activities:

Program planning
- Preparing the Detailed Workplan and Multi-Year Plan

Contract and financial management
- Tracking expenditures versus budgets
- Developing and overseeing contracts and invoicing
- Providing financial updates to the RMP Steering Committee

Technical oversight
- Internal review by senior staff of reports, presentations, posters, workplans, memos, and other communications

Internal coordination
- Workflow planning
- Tracking deliverables and preparing RMP Deliverables Stoplight and Action items reports
- Staff meetings

External coordination
- Twenty meetings with external partners (SCCWRP, Wetlands RMP, SWAMP, and others) to coordinate programs and leverage RMP funds

Administration
- Office management assistance

Program Review
Periodically, the RMP conducts an overall peer review of the Program as a whole. Two external Program Reviews have been conducted to date, in 1997 and in 2003. The RMP has evolved considerably since the 2003 Review, with greatly enhanced planning processes that have made the Program much more forward-looking and thoroughly peer-reviewed.

A review of RMP governance was conducted in 2014 and a charter for the Program was adopted in 2015. An internal program review was conducted in 2016, focused on identifying new high priority technical areas and issues for the program to address. New science advisors, program partners, and technical focus areas were identified and will be further developed with the Technical Review Committee and Steering Committee.

The timing and scope of Program Reviews are determined by the Steering Committee. The Steering Committee does not consider a further External Program Review necessary at this time, as ongoing review of critical elements is well established.

Peer Review
Extensive peer review is a key to the cost-effective production of reliable information in the RMP. This peer review is accomplished through the following mechanisms.
- **Workgroups** include leading external scientists that work with stakeholders to develop workplans and provide feedback on project planning, implementation, and reporting
- The **Technical Review Committee** provides general technical oversight of the Program
- **Peer-reviewed publications** provide another layer of peer review for most significant RMP studies

GOVERNANCE

Approximately 10% of the total budget

RMP meetings provide a collaborative forum for communication among regulators, regulated entities, and scientists. This forum is provided by regular meetings of organizational and technical committees to track progress and guide future work. Additional information about the function and activities of each governance group can be found in Figures 1 and 3 in this booklet.

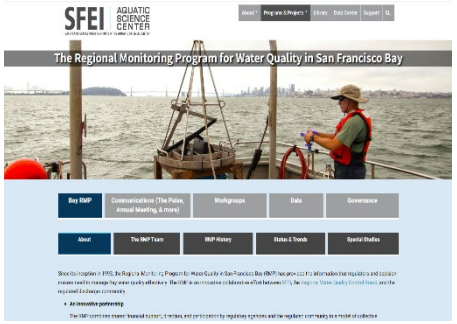
- **Steering Committee** – quarterly meetings to track progress, provide management direction, and track financials.
- **Technical Review Committee** – quarterly meetings to provide technical oversight.
- **Workgroups** – annual meetings to develop multi-year work plans, guide planning and implementation of special studies and Status and Trends monitoring, and provide peer-review of study plans and reports.
- **Strategy Teams** - stakeholder groups that meet as needed to provide frequent feedback on areas of emerging importance, and develop long-term RMP study plans for addressing these high priority topics. The RMP currently has active strategy teams for sport fish monitoring, small tributary loadings, and PCBs.

Photo by Jay Davis

ANNUAL REPORTING & COMMUNICATIONS

Approximately 10% of the total budget (+$85,000 in years when a full Pulse report is produced)

Includes the Pulse of the Bay, Annual Meeting, RMP Update, Multi-Year Plan, RMP website, Annual Monitoring Report, technical reports, journal publications, oral presentations, posters, & media outreach.



www.sfei.org/rmp

These platforms are used to make information from the RMP available to the following target audiences:

- Primary Audience
  - **RMP Participants**. Need information to encourage support for the RMP and water quality programs in the Bay. The Pulse, Annual Meeting, Multi-Year Plan, State of the Estuary report card, RMP website, newsletter, fact sheets, oral presentations, media outreach.
- Secondary Audiences
  - **Other regional managers**. Need information to inform their decisions and evaluate effectiveness of their actions. A target audience for all communication products.
  - **Regional law and policy makers**. Need information to encourage support for water quality programs in the Bay. The Pulse, media outreach.
  - **Regional Scientists**. Need to share information to increase understanding of water quality and maintain technical quality of the science. A target audience for all communication products.
  - **Media, public outreach specialists, educators**. Need information to encourage support for the RMP and water quality programs in the Bay, and to protect their health. A target audience for the Pulse, Multi-Year Plan, RMP web site, newsletter, fact sheets, media outreach.
  - **Managers and scientists from other regions**.

Highlights for the Next Five Years

- Pulse of the Bay (2024)
- RMP Update (2025)
- Continued website improvement

QUALITY ASSURANCE AND DATA SERVICES

Approximately 6% of the total budget for general support, plus funding in Status and Trends for handling S&T datasets

Data Services
Data management includes formatting, uploading, and reporting each year's Status and Trends data; managing, maintaining, and improving the RMP dataset to enable easy access to RMP data through CD3 (cd3.sfei.org); coordinating with statewide data management initiatives (e.g., SWAMP and CEDEN); and supporting quality assurance evaluation, data analysis, and RMP report production.

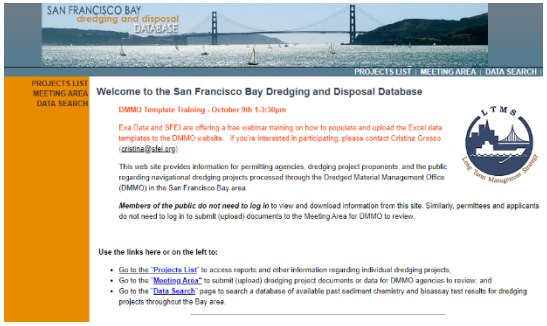
Quality Assurance
Quality assurance includes the review of data submitted by analytical laboratories; development and application of the QAPP; comparison of data to data quality objectives and prior results; review of congener ratios; and troubleshooting problems with the chemical analyses. Occasional special studies to assess sampling methods, analytical methods, or lab performance are conducted.

Online Data Access
CD3 (cd3.sfei.org) is an online visualization tool that makes the RMP data available to water quality managers, stakeholders, scientists, and the public. A data download tool allows users to customize their queries, generate charts, and easily download large quantities of data.

Recent Noteworthy Findings
The RMP's over 25-year dataset contains more than 6.5 million records standardized across all years. All data are stored in SFEI's Regional Data Center database, are comparable to statewide standards, and are regularly exchanged with CEDEN and WQX.

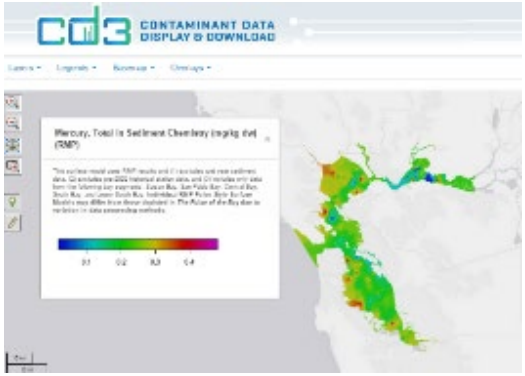
CD3 provides public access and visualizes RMP data along with relevant datasets from other programs.

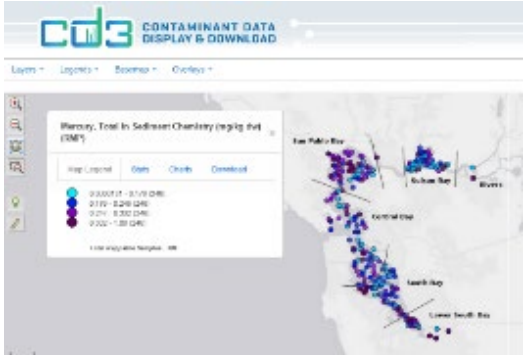
DMMO Database and Website
In 2018, the Dredged Material Management Office (DMMO) dredged sediment testing database and website were transferred to SFEI's Regional Data Center. Near-term priorities include developing standardized data templates, uploading a backlog of data to the database, and integrating DMMO data into CD3. Ongoing costs include uploading new data and hosting and maintaining the system.



Priority Initiatives for the Next Five Years

- Efficiencies in Data Uploading and Formatting
- Enhancement of Data Access, Reporting, and Visualization Tools
- Coordination with SFEI's Environmental Informatics Program
- Hosting, managing, enhancing, and providing access to DMMO data





RMP STUDIES ASSISTING PERMITTEES WITH ADDRESSING SPECIFIC PERMIT CONDITIONS

Dredgers

Policy	Provision	Study
2011 Programmatic Essential Fish Habitat Agreement, Measure 7	Conduct bioaccumulation testing evaluations for in-Bay sediment disposal. Clearly define bioaccumulation triggers for testing and subsequent permitting decisions.	S&T Sediment Monitoring– determine ambient bay sediment concentrations for bioaccumulation testing thresholds
PCBs TMDL	Monitor PCB loads in dredged materials disposed in-Bay relative to TMDL allocation	S&T Sediment Monitoring – determine deep bay and margins sediment concentrations for in-Bay disposal limits; review of PCB bioaccumulation testing threshold; evaluation of PCB concentrations, masses, and movement from dredged areas
Mercury TMDL	Monitor mercury loads in dredged materials disposed in-Bay relative to TMDL allocation	S&T Sediment Monitoring– determine deep bay and margins sediment concentrations for in-Bay disposal limits
Long-Term Management Strategy	Establish how much dredged material can be disposed of in-Bay and where; review sediment guidelines for the beneficial reuse of dredged sediment; review requirements for PCB bioaccumulation testing	Sediment Conceptual Model, USGS Suspended Sediment Monitoring, Bay sediment budgets, Beneficial Reuse workshop, Floating Percentile Method assessment of chemistry results from dredged sediment, PCB bioaccumulation threshold analysis

RMP STUDIES ASSISTING PERMITTEES WITH ADDRESSING SPECIFIC PERMIT CONDITIONS

Industrial Wastewater Treatment Plants

Policy	Provision	Study
Mercury Watershed Permit	Better understand mercury fate, transport, the conditions under which methylation occurs, and biological uptake	S&T mercury monitoring in sediment and biota
Copper Action Plan	Investigate copper site specific objectives for water	S&T copper in water
North Bay Selenium TMDL	Monitor selenium in the food web to inform the TMDL	North Bay Selenium in Water, Clams, and Sturgeon

RMP STUDIES ASSISTING PERMITTEES WITH ADDRESSING SPECIFIC PERMIT CONDITIONS

Municipal Wastewater Treatment Plants

Policy	Provision	Study
Mercury Watershed Permit	Better understand mercury fate, transport, the conditions under which methylation occurs, and biological uptake	S&T mercury monitoring in sediment and biota
Copper Action Plan	Investigate copper site specific objectives for water	S&T copper in water
Nutrient Watershed Permit	Characterize nutrients and nutrient-related parameters in the Bay	Contributions to Nutrient Management Strategy studies

RMP STUDIES RELATED TO SPECIFIC PERMIT CONDITIONS

Urban Stormwater

MRP link: https://www.waterboards.ca.gov/sanfranciscobay/board_decisions/adopted_orders/2022/R2-2022-0018.pdf

Policy	Provision	Study or linkage
Municipal Regional Stormwater Permit (MRP)	C.8. Pollutants of Concern Monitoring	Stormwater sampling for PCBs, Hg, and other POCs
		Emerging contaminants in stormwater, including PFAS, organophosphate esters, bisphenols, stormwater CECs (including tire ingredients), and ethoxylated surfactants. Development of a stormwater CEC monitoring and modeling plan
	C.11a/12.a. Assess Mercury / PCB Load Reductions from Stormwater	Stormwater sampling for PCBs and Hg at key locations around the Bay, develop the Watershed Dynamic Model POC module
	C.11e/12.f. Plan and Implement Green Infrastructure to Reduce Mercury / PCB loads	Stormwater sampling for PCBs and Hg; update the Regional Watershed Spreadsheet Model; develop the Watershed Dynamic Model POC module
	C.11f/12.h. Prepare Implementation Plan and Schedule to Achieve TMDL Wasteload Allocations	Update of the ABAG/MTC Bay Area land use layer and development of the Watershed Dynamic Model
	C.12.i. Fate and Transport Study of PCBs: Urban Runoff Impact on San Francisco Bay Margins	PCB Conceptual Models and field studies for Priority Margin Units—Emeryville Crescent, San Leandro Bay, and Steinberger Slough/Redwood Creek; In-Bay fate and transport modeling for PCBs, sediment, and CECs; Bay margins included in S&T sampling design for PCBs and CECs