RMP Sources, Pathways and Loadings Workgroup Meeting Summary

May 23, 2022 10:00 AM – 3:00 PM
and
May 25, 2022 10:00 AM – 2:30 PM
REMOTE ACCESS ONLY

Attendees

Alicia Gilbreath	SFEI
Bonnie de Barry	SMCWPPP
Bryan Frueh	City of San Jose
Chris Sommers	Santa Clara County Program, EOA
David Peterson	SFEI
Diana Lin	SFEI
Don Yee	SFEI
Ed Kolodziej	University of Washington
Emily Corwin	Fairfield-Suisun Sewer District/Solano Stormwater Alliance
Lisa Sabin	EOA
Ezra Miller	SFEI
Greg Gearheart	SWRCB
Jay Davis	SFEI
Jon Butcher	Tetra Tech, Technical Advisor
Kelly Moran	SFEI
Keunyea Song	Washington State Dept. of Ecology
Lester McKee	SFEI
Lisa Austin	Geosyntec
Lisa Sabin	EOA

Lisa Welsh	Geosyntec
Luisa Valiela	EPA Region 9
Martin Trinh	SFEI
Melissa Foley	SFEI
Richard Looker	SFBRWQCB
Rob Carson	MCSTOPPP
Robert Budd	CDPR, Technical Advisor
Seteney Frucht	SFBRWQCB
Steve Corsi	USGS, Technical Advisor
Tan Zi	SFEI
Tom Jobes	Indep advisor, Technical Advisor

Day 1

1. **Introductions and Goals for This Meeting**

Melissa Foley (SFEI) started the meeting by welcoming the workgroup members and participants, and by giving an acknowledgement that SFEI and many of the members of the RMP reside on the ancestral territory of the native peoples of the San Francisco Bay, including the numerous villages and tribes of the Ohlone, Patwin, Coast Miwok, and Bay Miwok. We recognize that through a violent history of colonization and dispossession, today, as guests, we benefit from living and working on the traditional homeland of these Native People. We wish to show our respect to them and their ancestors by acknowledging the injustices inherent to this history and by affirming their sovereign rights and their current efforts to achieve restorative justice. This land acknowledgement evolved out of the collaborative efforts of the original native peoples of the San Francisco Bay.

She then reviewed the Zoom meeting etiquette and protocols and reviewed the guidelines for inclusive engagement (adapted from Visions, Inc) to facilitate a productive discussion from all points of view. The Work Group's two returning advisors, Jon Butcher and Tom Jobes, and two new advisors Robert Budd and Steven Corsi introduced themselves. Melissa then asked attendees to identify themselves as Steering Committee and Technical Review Committee members, stormwater community, government partners, other RMP stakeholders, and SFEI staff. The day’s agenda was reviewed, which was as follows:

1. Introductions and Goals for This Meeting	10:00
2. Information: Strategy and Management Questions Review and Upcoming Update	10:15
3. Information: SF Bay Regional Water Quality Control Board Perspectives	10:25
4. Information: Permittee Perspectives	10:45
5. Scientific Updates on Current Projects: Introduction	11:05
6. Scientific Update: Integrated WATERSHED Monitoring and Modeling Strategy	11:20
Break	11:40
7. Scientific Update: Stormwater Monitoring Activities	12:20
8. Scientific Update: Watershed Dynamic Model (WDM) Development to Support Watershed Loads and Integrated Watershed Bay Modeling Strategy and Pilot Study	1:00
9. Scientific Update: Stormwater CECs Monitoring Approach	2:00
Adjourn	3:00

Melissa gave a brief background of the RMP, which has the overarching goal of collecting data and communicating information about water quality in SF Bay in support of management decisions. There are roughly 65 entities involved in any one year. There is a Steering Committee (SC) and Technical Review Committee (TRC) made up of both dischargers and regulators. Workgroups are focused on evaluating proposed projects and getting input from experts and ideas from stakeholders. The Sources Pathways and Loadings Workgroup (SPLWG) in recent years has been seeing more overlap and coordination with other Workgroups. The RMP has an annual budget of $4M, and for the 2023 calendar year $1.4M will be allocated to Special Study projects. This year's planning budget is $2M, so each Workgroup will prioritize proposed projects and send them to the TRC and SC for funding decisions.

The goal for these two SPLWG meetings was to get perspectives on stakeholder priorities, get updates on recent and ongoing projects, highlight related proposals in other Workgroups, and review and prioritize proposals for recommendation to the TRC and SC.

2. **Information: Strategy and Management Questions Review and Upcoming Update**

Alicia Gilbreath (SFEI) explained the SPLWG is currently undergoing a transition from a focus on monitoring and modeling legacy pollutants towards a greater focus on a more integrated monitoring and modeling approach, and a focus on contaminants of emerging concern (CECs). In light of this transition and the release of the new Municipal Regional Permit, it is an important time to revisit the guiding strategy and Management Questions for the Workgroup. This revision process will be funded in 2023.

In 2009 the MRP was developed, and the RMP created five SPLWG Management Questions:

> Q1. What are the loads or concentrations of Pollutants of Concern (POCs) from small tributaries to the Bay?
>
> Q2. Which are the "high-leverage" small tributaries that contribute or potentially contribute most to the Bay impairment by POCs?
>
> Q3. How are loads or concentrations of POCs from small tributaries changing on a decadal scale?
>
> Q4. Which sources or watershed source areas provide the greatest opportunities for reductions of POCs in urban stormwater runoff?
>
> Q5. What are the measured and projected impacts of management action(s) on loads or concentrations of POCs from small tributaries, and what management action(s) should be implemented in the region to have the greatest impact?

The RMP was interested in other pollutants, but the primary drivers were Polychlorinated Biphenyls (PCBs) and mercury (Hg), so questions were centered around those pollutants. These have served the SPLWG thus far, but we are facing new challenges and new ways of working together. The RMP is still interested in supporting the region in understanding PCBs and Hg, specifically for load estimation and trends in relation to management actions. As CECs come more to the forefront, the workgroup direction is simultaneously shifting focus to more integrated modeling and monitoring. More than ever the Workgroup is asking "what answers do we need from our models?" and letting that drive our monitoring design. The joint proposals being presented in this meeting regarding CEC modeling and monitoring benefit from the 20+ years of work done with PCBs and Hg, but a key difference is moving the foundational analysis to the

beginning. By understanding the necessary inputs to model a given CEC, the RMP can design a streamlined and cost effective sampling program.

The SPLWG is a “service” part of the RMP and the most integrated of the Workgroups. Eleven Special Study proposals this year span multiple Workgroups and the SPLWG is involved in almost all of those. The difference to note as the Workgroup shifts toward CECs is these are actively used products rather than legacy contaminants. The group will need to determine what sampling techniques are appropriate and best for modeling.

The SPLWG 2009 strategy and management questions need updating. First we’ll form a subcommittee that will meet a few times in early 2023, and present ideas to the full Workgroup in May 2023. By October 2023, we will have a draft strategy and Management Questions to include in the Multi-Year Plan. They will be finalized by 2024. Our progress will partly hinge on the progress of other Workgroups that are going through the same process.

3. **Information: SF Bay Regional Water Quality Control Board Perspectives**
4. **Information: Permittee Perspectives**

Richard Looker and Chris Sommers provided a history of the workgroup and framing of its needs and priorities from both the regulator perspective (Richard, Water Board) and permittee perspective (Chris, EOA/Santa Clara Urban Runoff Program). Richard explained that rather than show two opposing perspectives, they collaborated to give a consensus view this year. He said the goal of this item was to orient newer participants in the Workgroup, including new advisors, by getting back to the basics. The mission of SPLWG is to provide info to managers, so what is motivating that, and what are managers interested in?

In the early to mid 2000’s the SPLWG was motivated by the need for info associated with the PCBs and Hg TMDLs for SF Bay (legacy contaminants). Urban runoff and tributary loadings were identified as major pathways. For Hg, the Central Valley, Guadalupe watershed, and urban runoff were identified as contributing major loads. For PCBs, urban runoff was the main loading pathway. Requirements were placed in permits for urban runoff programs and wastewater dischargers to reduce loads. The other management driver for the SPLWG is contaminants of emerging concern (CECs), which is a broad category and less understood in terms of sources, transport and effects. No water bodies are currently categorized as impaired based on CECs, so there are no TMDLs in place. It’s a matter of time before the data show that some CECs are impairing beneficial uses. Managers want to identify CECs in stormwater, generate

preliminary loading estimates, identify sources and source areas, understand pollutant characteristics and transport processes, and assess performance of control measures.

A “superpower” of the RMP structure is that the work is anchored to general scientific questions that are honed into specific investigatory goals. This Workgroup’s Management Questions were developed with legacy contaminants in mind. They have been useful for more than a decade.

The first question gets at understanding concentrations and identifying pathways (so far focused on urban runoff, large rivers and tributaries). The second question asks to identify areas with high leverage. Imagine two tributaries with equal loading of Hg, one discharges to an area with immediate energetic mixing and Hg is transported out the Golden Gate. The other is discharged to a protected, shallow area with less mixing. The Hg out of that second tributary has a higher probability of being methylated and incorporated into the food web, so that second trib has higher leverage. We aren’t sure if that leverage-based thinking applies to CECs, but we’ll discuss it. The third question focuses on how loads and concentrations are changing over time on a decadal scale.The fourth question regards finding source areas/watersheds with greatest opportunity for reductions. This includes finding areas with high concentrations and loadings. The fifth question is for managers who want to know if implemented control measures are working, as well as how certain measures will be effective if implemented in the future.

Chris gave an overview of what the Workgroup has been doing and what it will be doing in the future. Prior to 2000 the RMP was focused on all pollutant pathways, but has since been entirely focused on stormwater and tributaries. We started by monitoring the largest tributary to the Bay, the Sacramento River, and provided context for local tributary inputs (identified as “small tributaries” in the Management Questions). That work directly influenced PCB and Hg TMDL development. In parallel, interest in the South Bay focused on the loading of the Guadalupe watershed which was of concern due to historical mining of Hg. We were able to build great calibration datasets. The RMP developed a turbidity surrogate method to estimate loads to the bay. The RMP also built a hydrodynamic watershed HSPF model for mercury in the Guadalupe watershed. SFEI and local municipalities teamed up to identify the best controls for PCBs and Hg in a conceptual model.

This foundation informed the next decade of work (2010-2019). We created strategies to get information on loadings and concentrations. We began monitoring more locations with the goal of creating a calibration dataset for regional modeling. This came to the development of the Regional Watershed Spreadsheet Model (RWSM), which gave us

best fit land use specific yields and average concentrations for specific land uses, and gave us regional sediment and pollutant loading estimates. This introduced the concept of “old industrial land uses” for pre-1980 industrial and commercial areas that are large sources of PCBs. The stormwater permittees have used these yields at the regional scale to develop more watershed specific reasonable assurance analysis (RAA) modeling. In 2015, we moved away from monitoring a few locations over multiple storms and focused on getting single samples from more places, hoping to identify disproportionate source areas. This got us closer to identifying sources at the property or subcatchment scale. The RMP and permittees collected >100 of using this reconnaissance monitoring style of monitoring to get as much geographical knowledge as possible. In 2016 the RMP produced a multi-year synthesis to document and summarize our knowledge to date. Then we refocused on tools that would identify temporal trends. Can we monitor to detect trends? To answer that, the RMP conducted a statistical analysis of the monitoring of Guadalupe River for PCBs. The level of monitoring needed to detect a change is quite large, so we might need to rely on modeling to detect temporal trends.

In the current RMP transition (2020-?) we have been trying to utilize the recon-style data records. Jay Davis and Lester McKee (SFEI) led an effort that turned our storm composite catchment-style data to normalized storm loading estimates which allowed us to prioritize catchments for controls. Jay also looked at PCB congener data to see if there were unique sources within catchments. Moving forward, CECs will be our focus while we continue to support PCB and Hg efforts. There is a deadline of 2028 and 2030 for Hg and PCB TMDLs for us to reflect on load reductions. We will build onto the RWSM with a Watershed Dynamic Model (WDM) to provide a foundation to make loading estimates that would lead to informing control measures earlier in the process. In the past we have compartmentalized the Bay vs the Watersheds and we’re now trying to merge those. We are moving away from monitoring to find sources, toward monitoring to support model development.

Members of the Workgroup took a moment to acknowledge the great impact Barbara Mahler has had on this Workgroup.

The group also gave appreciation for the positive effect that has come from long-term participation of technical staff involved in this Workgroup for basically the entirety of its existence. Thanks go to Lester Mckee who was involved from the start and Alicia Gilbreath who joined in 2006. Don Yee and Jay Davis have been strong influences throughout and Kelly joined as an advisor in 2007, and is now part of SFEI staff. It has helped with cohesion and continuity of knowledge within the Workgroup. Chris said the

RMP has done a good job of documenting our process. There's a good repository of information for those who come next (not that anyone is moving on at the moment).

Lester asked if Richard or Chris could discuss the MRP 3. What should we know as we revise our Management Questions? Chris said the Municipal Regional Permit (MRP) covers over 80 municipalities in the Bay area, which is the vast majority of urbanized area that drains directly into the Bay. There has been a major shift in monitoring approaches and requirements with the adoption of the new permit (MRP 3.0). The permittees had been spending a good amount of time looking at local tributaries, and those resources were being redirected to other types of monitoring. One of the key requirements is monitoring Green Stormwater Infrastructure/Low Impact Development (GSI/LID) to understand effectiveness of removal of PCBs and Hg as well as hydrologic effects. The RMP is not directly addressing this, but it does play into our modeling strategy. For POCs there are still requirements to collect stormwater events to characterize catchments, and that will continue at the same level as MRP 2.0. Regarding CECs, stormwater programs will collectively contribute more dollars to the RMP specifically for CEC research.

5. **Scientific Updates on Current Projects: Introduction**

The rest of the day's meeting was focused on providing updates on recent and ongoing SPLWG activities, and preparing the Workgroup for discussion on Wednesday about the proposals for 2023.

Alicia gave an overview of the following items where Lester will talk about SFEI's integrated monitoring & modeling strategy, Alicia will discuss stormwater monitoring, Tan will discuss modeling, and Kelly will discuss CECs. The work being presented is engaging other Workgroups as well. On Wednesday Kelly and Lester will discuss proposals from other Workgroups that are relevant.

6. **Scientific Update: Integrated WATERSHED Monitoring and Modeling Strategy**

Melissa framed Lester's presentation by reminding the group this was funded in 2021 to ensure the monitoring and modeling efforts are coordinated to more efficiently answer RMP Management Questions. Lester noted this project has a relatively small budget ($50K) and has collaboration at its core. The SPLWG, ECWG, and SedWG are all involved. Lester then reiterated the timeline discussed by Chris and Richard. As the focus has shifted from PCBs and Hg to CECs, this strategy will develop an integrated approach that can help streamline our PCB and Hg monitoring and incorporate a broader range of contaminants, including CECs.

The strategy is a sequential approach that begins with conceptual models. Then it lays out a “menu” of options that include Management Question evolution, GIS improvement, decision trees for sampling designs, interpretive technique decision trees for modeling, sampling methods related to Management Questions, and a trends development process. The menu and conceptual models will be used to create an integrated monitoring and modeling roadmap.

A challenge for this project is the large number of related projects being worked on across Workgroups. We see this as an umbrella project primarily for CECs, but it can also help optimize PCB and Hg work. The RMP has used modeling opportunistically, but has not approached modeling and monitoring synergistically. The most cost efficient approach going forward is to design them hand in hand. In the past, modeling efforts have had to wait years for monitoring to be completed, but there’s an opportunity with models to get answers quickly and use monitoring to refine those results.

We’re starting off with a watershed roadmap, but in the near future we could couple the watershed and Bay strategies (maybe in 3-4 years). The key management questions guiding this effort include: what is the future sediment supply in relation to climate change and landscape change? What are the trends in PCBs and Hg watershed loads? What are the more contaminated subwatersheds/properties? Where should we monitor for CECs? Is stormwater load to the Bay for a specific CEC big or small compared to other pathways?

Lester then discussed conceptual models. There are three basic ones that are useful for informing this effort. First, the 10 largest watersheds cover 74% of the area draining to the Bay. Second, the dry season is 7% of flow into the Bay on average, and if you consider dry weather flow during the wet season, that brings it up to 15%. If pollutant concentrations are high in dry weather flows, that could be significant. Third is the Bay water budget conceptual model which shows that wastewater is half the volume of stormwater coming into the Bay. Conceptual model development will hinge on two endmembers: three larger watersheds that have lots of variety in source areas, or 36 small watersheds with specific sources. This second option would require a much stronger conceptual model from the start.

The deliverable for this effort is a report that will be completed by late summer 2022. It will be written as a synthesis rather than separated by contaminant type. There's an opportunity to use this report to reduce costs in PCB and Hg analyses going forward. Lester asked if the elements discussed address the needs that founded the project.

Steve Corsi said he likes the approach of monitoring + modeling. He was involved in a 20 year project that had lots of delays from monitoring program adjustments. In general, modeling would help speed that process along. Steve noted that PCBs are primarily legacy contaminants, and Hg is not only legacy, but there are current sources. What lessons have been learned from mercury that will help with CECs? Some CECs do have legacy sources. Will any of the work done with Hg help in understanding current vs legacy processes for CECs?

Lester said they've looked at bioavailability of loads coming into the bay, and there aren't a lot of similarities with CECs as far as bioavailability. Jay mentioned they have done isotope work with Hg that tracks inputs from mining. Another project included sediment cores near watershed inputs to assess the long-term input profile, which could work for CECs. Kelly said the Bay Area has a history of mercury mining associated with the gold rush. That mercury is the primary source to the Bay, so they don't have current or recent uses influencing their work. The idea with CECs is to cut them off before they get to legacy status. Lester will explore adding an atmospheric component to the conceptual model that could be tested with Hg and possibly used for CECs.

Melissa asked if Richard or Chris are in favor of the approach for this project because they were influential in kicking off this effort. Chris said the vision was an umbrella report guiding our way at a macro scale towards how we're doing modeling and monitoring as we integrated watershed and in-bay efforts. Chris was happy with where the RMP is going with watershed modeling and bay modeling, and there's a lot of discussion of how to couple those. Tan is heavily involved with both and that's super important and needed in trying not to compartmentalize. With CECs over the last couple of years the RMP has zoomed in the focus to watershed inputs as being important pathways and sources of CECs.

Jon Butcher said the difference between PCBs/Hg and CECs is that there was already background research on PCBs and Hg and that's not true regarding CECs. For conceptual models, we should have a basic understanding of how CECs move through the environment. Kelly responded saying the CECs they're working on span water soluble, sediment binding, and have complex chemical properties.

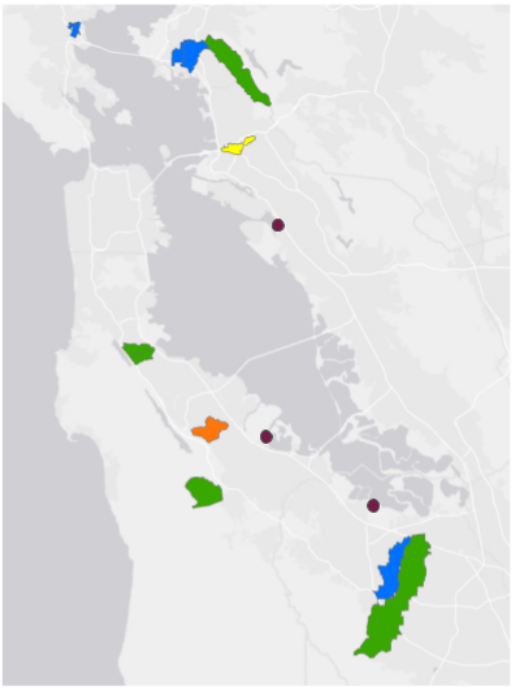
7. **Scientific Update: Stormwater Monitoring Activities**

Alicia gave an update on stormwater monitoring activities in water year (WY) 2022, including context for precipitation amounts from the past three seasons. The average rainfall in San Francisco is 23 inches. The three year period from 2020-2022 was the second lowest consecutive three year period in the 120 year record. The deficit in WY 2020 was 8.25" and in that season they sampled eight sites over two storm events. In

WY 2021 the deficit grew to 22.18”, and they sampled two sites in one storm event. Sampling in WY 2020 and WY 2021 was also inhibited by COVID. In WY 2022, the three-year rainfall deficit increased to 25.68”. The team was able to sample 11 sites in 4 storm events, including CECs in 10 watersheds. For context, the 2012-2014 dry period was the fifth lowest on record.

Stormwater Studies WY 2022

Study	Oversight WG	# of samples collected in WY 2022
POC Reconnaissance	SPLWG	4
POC discrete sampling	SPLWG	1
CECs in stormwater	ECWG	10
Priority Margin Unit	PCBWG	1
Sediment SEP	SPLWG	Flow monitoring only
SF bioretention project (Next Gen Urban Greening)	SFEI	0
S&T post-storm monitoring	RMP	3



A four year CEC study just concluded this year, which included five CEC families: tire-related contaminants, OPEs, bisphenols, ethoxylated surfactants, and PFAS. Of the sites sampled in WY 2022, two were reference sites and eight were urban sites. Additionally for the Status and Trends study, three near-field Bay (location where stormwater and Bay water mix), and four open Bay sites were sampled. Of the tire contaminants, 1,3-diphenylguanidine (DPG) had the highest concentrations in urban stormwater runoff. As samples moved away from that spatially or temporally, concentrations were lower, but exposure times for organisms may have lasted days to weeks. 6PPD-quinone and hexa-(methoxymethyl)melamine (HMMM) followed similar patterns. Other CECs might not follow this exact trend because these three are from tires, but the data informs the conceptual model.

For WY 2023 the proposed PCB and Hg monitoring includes intensive load monitoring at two locations with flow gauges to support modeling, and continued monitoring in the

Priority Margin Units (PMUs). Sediment loads monitoring sites only have funding through 2022, so early season events may be able to be captured. A remote sampler could be used to monitor tidal areas and possibly for the proposed PFAS stormwater pilot locations, both of which are outlined in proposals for 2023.

Study	# of samples	Analytes
POC Loads Monitoring	6	PCB, Hg, SSC
PMU, plus add on	11*	PCB, SSC
POC Sampling in Tidal Areas	4	PCB, Hg, SSC
PFAS pilot	4	PFAS
S&T *post-storm* sampling	6	PFAS, OPEs, Bisphenols, Vehicle-related contaminants
Sediment Loads (only through end of 2022)	6*	SSC
SF Bioretention Project	8	Metals, PCB, vehicle-related contaminants, MPs, pesticides
Santa Clara Bioretention	2	Metals, PCB, nutrients, MPs

*Getting some help from local consulting firms.
Proposed studies this year.

Lisa Austin asked if the values for CEC reference sites and open Bay were below the detection limit. Most reference samples were below the reporting limit, but some reference sites did have detectable concentrations. Highest concentrations were at creek mouths. In the summer, the open Bay samples were low or below the reporting limit. Wet season open Bay samples had regular detections of DPG and HMMM. 6PPD-Q was below the reporting limit, which could either be due to dilution or degradation (half life not yet known). It is compelling to see contaminants from a single product (tires) in the center of the Bay 10 days after a storm. Lisa asked if the chemicals were sediment bound or in the dissolved phase. Kelly said they are soluble, but cannot confirm these are purely dissolved because the smallest tire particles could pass through the filters in the lab.

Chris wanted everyone to be aware that the variability in stormwater runoff is important here as well. It's important to define spatial and temporal variability in the watersheds. These results show there is good mixing in the Bay. It would be good to know what bay edge areas look like three or six months out, although that might not be feasible right now.

Tom Jobes asked if the chemicals are coming from tire particulates, is it worth looking at sediment? He asked how much is settling out vs degrading. Kelly said the particles are very small, and she will get into that on Wednesday. Melissa mentioned that sediment monitoring is done on a regular basis for Status and Trends. The current plan doesn't include tire contaminants in margins close to stormwater runoff, but that may change prior to our monitoring in 2023.

Lester commented that the SPLWG opened with an estuarine phase pilot study in 1998-2000, and he's excited to revisit this. Estuarine concentrations were used to derive first estimates of loads to the Bay from Coyote Creek and Guadalupe watersheds. Those watersheds were later sampled and increased load estimates. This is an approach that could be used for CECs.

Don Yee commented that Bay edge dry season sampling might be somewhere where we have to consider air deposition (major highway and urban areas near shore). Jon Butcher said high variability in stormwater runoff suggests the concentration might depend on the time since the last rain event due to gradual buildup. Tom said that's especially applicable to road washoff.

Lester asked about the size of tire related particles and noted 50% of the SSC that comes into the bay is 5 microns or less. Kelly said tire particles are <100um, with most mass between 5-100 um, but numerically most particles in the <1 um size range. The relative surface areas (proportional to chemical release into water) of the small vs. the large particles is unknown.

Steve said they've been seeing tire particles in streambed sediment and are sometimes the dominant microplastics. Sediment might be worth looking at. How long those chemicals leach out of tire particles is unknown. The boxplot of 6PPD-quinone looks lower than what we've seen in the literature in other areas. Is that representative of what we'll see going forward or do we need more data? Kelly said we definitely need more data. The four-year stormwater CECs project collected more samples than Alicia presented today, which are just from 2021. Alicia said this is not much data and it doesn't cover a large gradient of urbanization or transportation land uses. This is the end of a four year study, in total we have 26 urban sites and four reference sites.

Chris asked if we have an idea of environmental significance levels yet. Ezra Miller (SFEI) informed the group that we know very little of 6PPD-quinone toxicity, but a recent publication looking at freshwater rainbow trout (same species as steelhead) provides LC_{50} values (lethal concentration that kills half the fish). Sublethal toxicity data are not

yet available. We understand that such studies are in progress. To provide insights on toxicity, Ezra explained that it is possible, but highly uncertain, to estimate the likely range of sublethal effects concentrations using LC_{50} values. This estimation indicates that it is possible that observed concentrations at nearfield Bay locations may exceed protective thresholds for this contaminant, meaning 6PPD-quinone could be environmentally relevant in stormwater and the Bay edge. Current data suggest DPG and HMMM are less toxic than 6PPD-quinone, and our sample concentrations are probably below protective thresholds. Kelly added that tires are complex particle-chemical mixtures. There are data available regarding tire particles and tire leachate toxicity as a whole for a variety of species at total tire material concentrations that the authors believe to be environmentally relevant, but we don't have local monitoring data to do comparisons with these other studies.

Luisa noted that the literature is expanding quickly. Are species being studied in both freshwater and saline systems? Are there species-specific studies that need to be tracked in both those types of systems? Ezra said some groups are doing estuarine species in addition to freshwater species. We expect to see lots more data to help us evaluate effects of these chemicals in the Bay. Luisa asked if it is all academia? And Ezra confirmed that it is. The EPA and states aren't doing this work. There are some individual studies in Washington or Canada, but no organized effort.

8. **Scientific Update: Watershed Dynamic Model (WDM) Development to Support Watershed Loads and Integrated Watershed Bay Modeling Strategy and Pilot Study**

Tan Zi discussed ongoing modeling efforts. He paused for discussion after each section of his presentation, which included Watershed Dynamic Model (WDM) sediment modeling results, WDM PCBs and Hg model setting & assumptions, integrated watershed and bay modeling strategy & pilot study, and other related modeling projects.

<u>WDM Sediment Modeling Results</u>

The Modeling Implementation Plan was developed in 2019 to prioritize the regional watershed model for PCB and Hg load and trend evaluation. The original goal of the WDM was to look at PCB and Hg loads and trends at a regional scale. The hydrologic model was finished in 2020 and the sediment model in 2021. The focus for 2022 was PCB and Hg baseline load modeling. The proposal for 2023 is to look at control measure modeling for PCBs and Hg, as well as another proposal to begin work on CEC load estimation.

The application of the WDM has extended beyond the loads and trends of PCBs and Hg. For example, the model was used to produce forecast-based flow predictions and provide flow boundary conditions for the in-bay hydrodynamic model. It has also been used to estimate sand supply from local tributaries. The flow and sediment load from the WDM has been used by Anchor QEA for in-Bay sediment transport modeling. Future goals for the model include estimating loads and trends for CECs and providing a linkage to in-Bay modeling efforts.

Tan reviewed the basic structure of the model, which is based on Hydrologic Response Units (HRU) that represent a combination of soil type, land use, and slope, imperviousness, geology. Using this construct, the model was delineated into 204 local watersheds that flow into the bay for the 1995-2020 timeframe for flow and sediment at an hourly time step.

The general approach for sediment modeling is to divide erosion and sediment transport processes into two categories, upland watershed and instream. Tan ran simulations to predict suspended sediment yield (SSY) from different land uses and compared those to our previous study (McKee et al., 2009). The ranking of SSY from land use groups was consistent with the previous study, especially for urban land use.

The in-stream sediment transport process is based on hydraulic simulation of the model. Shear stress was calculated for each stream segment and calibrated the thresholds of shear stress to determine when deposition or scour occurs.

Tan calibrated the model with five gauged watersheds that have USGS daily suspended sediment load data available. These were Guadalupe, Coyote, Alameda, San Lorenzo, and Corte Madera. Most of the calibration watersheds were in the Central and South Bay, and one in the northern portion of the Bay. Tan showed graphs of flow, SSC, and SSL, and they followed the patterns of observed data well. Simulations were within +/- 10% of observed. Annual loads from the model were compared to a previous study (Schoelhammer et al., 2018) that used a rating curve based method to determine average annual load for water years 1995-2016. The Schoelhammer study had 1.3 Mt/yr of loading to the Bay, and the WDM modeled 1.25 Mt/yr, with a similar spatial distribution.

Tan acknowledged existing model uncertainties that may include monitoring data gaps and data quality, channel geometry, and in-stream processes.

We now have a calibrated dynamic watershed sediment model for the Bay Area! It can provide sediment load for the whole region and for specific watersheds at an hourly

scale. It gives us sediment yield from different land uses. It represents channel and flow dynamics. It can also be used to test and evaluate potential future effects of management actions, land use change, and climate change. We also now have the basic model structure for both particulate and dissolved contaminants.

Jon Butcher asked Tan to clarify he's using a sediment delivery ratio, not simulating sediment delivery based on depth of flow. Tan said the sediment delivery ratio is used for sediment model calibration. The sediment delivery is based on the depth of flow. Tan used the sediment delivery ratio derived from the index of connectivity method at the grid scale and summarized it at the HRU level to guide the calibration on sediment delivery. Jon said a potential concern is that kind of calibrated sediment delivery ratio is to some extent an extension of the flow regime. If you're looking at climate change, that might not be appropriate.

Tan asked if he has any suggestions for exploring climate change and sediment delivery. Jon said if you were simulating overland transport based on flow depth, it would change as rainfall patterns change. Tom mentioned in the early phases of the Chesapeake Bay watershed modeling program, they used USLE to generate calibration targets for field scale erosion (from the literature), and then calibrated the overland flow depth to reach that annual load. Then they further applied a delivery ratio to get from field scale to watershed scale. He was not familiar with the methodology they used to generate those delivery ratios. Jon said there have been some revisions to that. It's an intensive process that should give more details in the report. Tan said a draft report will be sent out for review in June.

Rob asked if stream substrate was accounted for in the model. Tan said channels were classified into types (artificial vs natural) and adjusted for roughness. Jon suggested Tan look at the hydro modification management program that did detailed studies of channels in Santa Clara and other counties.

Lester asked Jon and Tom if there is anything special about the Bay Area's tectonics that wouldn't allow learnings from the Chesapeake Bay to be directly applied to the SF Bay. Jon said that when you simulate sediment delivery based on flow depth, you have to get the surface and subsurface flow exactly right to make it work. That's also important for contaminant transport, and a good thing to do. Being tectonically active, uplift provides additional sediment sources that are difficult to model. You can deal with those to some extent by adding sediment sources. You can't predict when landslides will happen, so it's a background rate that's added. Tom added the complexity of tectonics on bank sloughing is hard to predict. It's more of a poisson event distribution rather than a normal distribution. You can only build it into the bed scour if you assume the whole

wetted perimeter will erode. The Chesapeake Bay values won't apply, but the methodology does.

Chris mentioned that deposition, storage and erosion is being accounted for in streams to some extent, but we aren't modeling by a HEC-RAS approach. That finer segment-by-segment resolution and calibration that would be needed is beyond our current modeling approach. Tan said our current verification of the channel sediment storage is done by looking at monitoring data from flood control analysis. We identify channels that most of the sediment passes through, and those that capture more sediment. We can qualitatively compare channel segments in that way.

WDM PCBs and Hg model setting & assumptions

WDM stormwater contaminant loading is divided into dissolved load and particulate load. Dissolved load is equal to flow volume times dissolved pollutant concentration. Particulate load is equal to suspended sediment load times pollutant concentration in sediment.

PCB and Hg data are being collected from RMP, CD3/CEDEN, CW4CB, and municipal stormwater monitoring programs. Spatial distribution of water and sediment reconnaissance data have good coverage of urban areas around the bay. Load monitoring includes five sites for Hg (0.4% of modeling domain), and seven sites for PCBs (4.5% of modeling domain).

Because our predominant data type is reconnaissance, calibration of PCB and Hg data was divided into two tiers, first at the HRU level and second at the watershed scale. For HRUs we want to parameterize potency factors in sediment and dissolved concentration. We will pool the reconnaissance data for calibration. Samples with delineated drainage areas will have the distribution of HRUs within that area, sediment yield, and flow. We can then assign concentrations to HRUs and compare with monitored data to calibrate the model.

For PCBs, the sum of 40 will be used as a surrogate for the sum of 209 congeners. We will use a fixed partitioning ratio for particulate and dissolved portions of PCBs. For Hg, the Guadalupe watershed data will not be used due to mining impacts. Dry and wet atmospheric deposition will be added to the Hg model for both HRUs and reaches.

The model is simulating total mercury (HgT) because the TMDL was based on HgT so there are less management and policy drivers for other Hg species.

Bonnie de Berry (EOA) noted that almost all of the load and reconnaissance monitoring stations were selected because they are assumed to have high PCBs loads based on land use. What impact (if any) do you think this has on the model? Tan said yes, we want to specify which areas have high loadings and separate those out to avoid the high bias of monitoring data.

Tan clarified the assumption of no contaminant phase change in the model. We assume there won't be a large change in attachment of PCB or Hg to sediment. It comes out at the same fractionation as it comes in.

Chris Sommers questioned the assumption on which we're basing the concept of separating PCBs and Hg into a dissolved phase and sediment-bound. Tan said we have some data that identify what portion will be in sediment and how much dissolved. If we just simulate contaminants in sediment, we might miss the dissolved phase in total loadings. Monitoring data will be used to give approximate proportions. Chris emphasized that this is an important concept. The model will eventually be used to understand the treatability of pollutants, which depends on how pollutants adhere to sediments.

Lester noted that stormwater agencies during the Proposition 13 grant did collect dissolved phase data, but ~90% of Hg is transported in the particulate phase. We haven't finished our deliberations on how we bring that into the model. Jay said we had discussions of this for conceptual model reports for PMUs. We did review the available info in those reports, although those were based on PCBs and we didn't have enough local info to make that dynamic. For Hg we have a little better understanding. Jon said in general you're okay here. The bulk of the PCBs will be sorbed. A challenge is the solubility varies across congeners. It would be nice to get into more detail, but can't really do that here. Chris again noted that we just need to make sure our assumptions are clear moving forward. Make sure we base this on what we can do and make assumptions based on best available information, then clearly document that. Lester mentioned a further complication: the relationship between dissolved and particulate does change during storms. But the question is do we need to bring that into the model now or can we address it later?

Don asked Tan how quickly could you turn on dynamic partitioning in the model if it becomes important for CECs? Tan said it is easy to turn that on, but to decide how to parameterize it is difficult. We need data to support that parameterization. Don suggested, to get started, maybe test some initial values and experiment with results.

<u>Integrated Watershed and Bay Modeling Strategy & Pilot Study</u>

The Main goal of this project is to develop a strategy to integrate different models (mostly watershed and in-Bay models) to better support future modeling and monitoring. In the second year, a pilot study will be implemented to test the strategy on one or more contaminants. The strategy will speak to what we can do now, what we can do in the near future, and what are our long term modeling goals.

Watershed models include the WDM and RWSM, which can provide stormwater flow, sediment supply, and contaminant load to the Bay. We also have the GreenPlan-IT tool that focuses on urban hydrology and urban contaminant load. It can simulate Green Stormwater Infrastructure/Low Impact Development (GSI/LID) impacts on load reductions. It can optimize GSI/LID for cost-effectiveness.

For in-Bay modeling, the Nutrient Management Strategy (NMS) has developed a 3D hydrodynamic model that will be coupled to a comprehensive fate and transport model that integrates stormwater and wastewater loads. It is currently able to model the dissolved phase of contaminants, but we have a strategy to develop a whole-Bay sediment fate model in the next 3-5 years.

We have developed a modeling Council of Wisdom (COW) to guide us in this work. Our first meeting was last week. There will be a draft modeling strategy for review in Fall 2022, and a modeling roadmap for the next five years will be ready by the end of 2022.

Jon asked if there had been thoughts about the feedback between the in-Bay and watershed models. It will be important to use the in-Bay model to inform the watershed model as well. Tan said that is a very good point, and currently we are focusing on the one-way input for providing the boundary conditions. Tan and Jon will connect to further discuss how the info from the in-Bay modeling can inform the watershed model.

<u>Other Modeling Updates</u>

The final modeling project update included the CEC modeling evaluation that will provide suggestions for future CEC modeling. A draft report will be produced in the second half of 2022.

The ABAG land use update should be released in 1-2 months, which will allow the SEP-funded update to the RWSM to proceed. The RWSM update will incorporate new land use data and rainfall forcing data.

Lester said it's exciting to have a regional dynamic sediment model for the Bay. It's something we've wanted for 20 years. With the linkages to all other modeling work, the value will be well beyond what we've spent. It's exciting to see how that will drive the understanding of other bay processes.

Jay gave a preview of where the in-Bay strategy is going. The PCB Workgroup is interested in San Leandro Bay. It's had a lot of monitoring and is of high regulatory interest. That will be a prime place to start linking the watershed and in-bay model. Estimated loads from the watershed are lower than what is being seen in the data, suggesting watershed load estimates need to be revised.

9. **Scientific Update: Stormwater CECs Monitoring Approach**

Kelly Moran gave an update on the stormwater CECs monitoring approach. This strategy was funded in 2022 as a two year effort. It is the first project to be developed that explicitly integrates monitoring and modeling. This is a cross-Workgroup project with SPLWG (monitoring) and ECWG (contaminants and conceptual models). Kelly introduced the ECWG team, which includes herself, Dr. Rebecca Sutton, Dr. Ezra Miller, Dr. Diana Lin, and Miguel Mendez (SFEI). The Workgroup's expert advisors are Dr. Bill Arnold (University of Minnesota), Dr. Miriam Diamond (University of Toronto), Dr. Derek Muir (Environment & Climate Change Canada), Dr. Dan Villeneuve (US EPA), Dr. Lee Ferguson (Duke University), and Dr. Heather Stapleton (Duke University). She also shouted out Dr. Ed Kolodziej, who isn't an advisor, but has been a valuable academic partner at the University of Washington.

Near-term priority management questions for stormwater CECs are:

1. Presence. Is a specific CEC or CEC family present in local stormwater runoff?
2. Load. Is the local watershed runoff load to SF Bay of a specific CEC big or small as compared to loads from other pathways (e.g., municipal wastewater)?

The RMP's efforts to establish a long-term stormwater monitoring network to estimate CECs loads to a surface waterbody is novel.

This Stormwater CECs Monitoring Approach Project has two elements:

1. Prioritization approach (ECWG) to select CEC families for monitoring
2. Stormwater CECs sampling design process (SPLWG & ECWG) that incorporates modeling

The deliverable will be a manual to guide future work, with a draft in spring 2023 and final in fall 2023. Kelly noted this project will not be a list of CECs for monitoring and it won't give a sampling plan. Each CEC family is unique and contains complex chemicals.

There are a lot of elements of this project. There is a need to do foundational research for many of these contaminants. Foundational work includes literature review and conceptual models, a chemical list and analysis selection, and a modeling-based sampling design.

Conceptual models are based on literature reviews. We also need to think about fate and transport issues. Jon mentioned the fugacity models, and one challenge we have in stormwater is non equilibrium conditions, so fate and transport is more complicated. Any prior monitoring data will be used in developing the conceptual model as well.

Process-based modeling will look for monitoring needs as we develop our study design and sample site selection. We recognize we need remote samplers and a formalized stormwater sampling database that has more information on each sampling site.

After monitoring, we'll take the data and our conceptual model to build the load estimates. We'll consult with stakeholders and we expect one of three possible responses: 1. that the load estimate is too uncertain and we need to modify the design, 2. that the load estimate is important, or 3. that the load estimate is unimportant and we can stop monitoring it. If the load is important and stakeholders decide to go forward, stakeholders may want to further investigate sources and refine loads with a more detailed approach.

For load monitoring, models will likely need many samples at the same location and from diverse sample locations. Sampling at sites with flow gauges has advantages. There are new flow gauges being installed around the Bay Area. We need to consider staff capacity, as training requirements for CECs monitoring are higher than usual. Storm availability is key (typically just 2-5 storms per year meet the current RMP mobilization criteria). Finally, we need to generate information quickly and cost effectively.

We are seeking feedback on our working concept for load monitoring design, developed for budgeting purposes:

1. Remote automated samplers
2. 12 locations (2-3 reference)
3. Monitoring location selection driven by information specific to pollutant family
4. 2 storms/year
5. 2 year minimum.

Kelly said going forward she expects that the effort in progress to update the RMP CECs Strategy and its associated tiered, risk-based framework will result in moving

some CEC groups up in importance, helping us prioritize. We have yet to evaluate vehicle contaminants in the RMP's tiered risk-based framework. Kelly said we're hoping we can initiate loads monitoring of CECs in Water Year 2024. A key next step is to buy or build remote samplers. There is a lot of energy for work in this area, and because of that energy, we were requested to prepare a pilot project proposal even though we are at a very early phase of our work on the stormwater CECs strategy.

Kelly went over the potential timeline for this work. At any time we could do presence/absence monitoring. We'll do foundational work for one CEC family (possibly PFAS) in 2023, and buy remote samplers. Then we would move on to integrated monitoring and modeling, which would be a multi-year effort for Water Years 2024 and 2025 (i.e., starting in fall 2023). In 2026 we would have a load estimate for the first CEC family. We could tier and add on other families of chemicals, but need to be careful not to overload the project. We are working on if the budget levels are in the right range.

We are particularly eager to get feedback on the overall approach. What tradeoffs should we evaluate? Monitor more or fewer sites? What are the tradeoffs between speed to get management answers vs chemical breadth and cost?

Tom Jobes said the general approach is good. Do you have a general sense of what is the next CEC to add to the list? Kelly said that's up in the air. It is a balance between what are the priorities for the bay and what is feasible. PFAS is the pilot because it has a lot of stakeholder interest. It is also the most daunting of the chemicals in terms of its breadth and depth of complexity. It is a favorite because there is a lot of literature available. The other one that is likely to be in the top tier when the RMP's tiered risk-based framework for CECs is updated is OPEs (organophosphate esters), which will be difficult to approach because literature is just starting to be developed for outdoor uses.

Steve asked if there is perennial flow at these sites, and if low flow as well as storm flow would be monitored. Low flow could contribute a large part of the load. Kelly said we still need to select the sites. There are 50 to choose from, some have perennial, and some don't. It isn't part of the pilot project work plan to monitor low flow. Lester said for the Bay Area's wet/dry conditions, we see 7% of flow volume during dry months, if we add wet season dry weather flow that doubles to 15%. If actual flow volume is so small compared to storm volume, it might not be as important, but something to think about. Rob commented that dry weather loading is important to consider. In his experience in pesticide monitoring in southern California, annual loading of dry season is often greater than from the flashy storms when averaged across the year. Kelly thanked Steve and

Rob for these comments and committed to considering them in the development of the stormwater CECs monitoring approach.

Steve weighed in on the question: Is 12 sites enough? Depends on contaminants and how predictable the relationship is between contaminant presence and parameters such as land use. Will depend on variability of parameters. It's a tough decision.

Rob noted that regarding design, it's important to get the first flush. That's the driving force of getting contaminants off the landscape. Rob asked if the new gauges being put online are all USGS? Kelly said the Water Board did an updated flow gauge map last year. Some flood districts are putting them in to monitor flood flows and climate change. Most of the gauges are in eastern Alameda county and eastern Santa Clara county. Most are not USGS gauges. Kelly will share the map with Rob.

Rob then asked about the three reactions to load estimates that Kelly mentioned. What would cause your estimates to be uncertain and what could you do to proactively address those? Kelly said we've had this happen, and the biggest concern is not enough samples. The other is not enough confidence in modeling. Rob suggests trying to handle that upfront. Kelly said yes, and we're looking for feedback on what level of uncertainty is acceptable. A lot hinges on being able to analyze the available monitoring data, which is part of the anticipated workflow.

Ed advocated for sampling baseflow if possible. It's useful to have some baseflow samples in the sampling matrix. There are also dry weather irrigation influenced flows. It would be remiss not to have any data in that space. He also emphasized the importance of first flush, which may not be the first storm. The first big storm or two of the year can result in mostly subsurface infiltration, with later storms having higher overland flow. He isn't sure how that translates to the Bay Area. Lester mentioned in urban areas, it can take half an inch of rain to generate runoff, and in more pervious and agricultural areas, it can take 5-7 inches of rain to create runoff. Steve said the importance of first flush is site dependent. It depends on where you're sampling in the watershed. If it's a small watershed, the first flush could dominate flow. In large watersheds the first flush higher in the watershed doesn't get to your sampling point until later in the hydrograph. How you define your first flush is important. Most important thing is to cover the entire hydrograph with sampling to properly compute loads.

Steve concurred that spreading out different contaminants over multiple years is a good idea for cost effectiveness and limiting the potential for overwhelming logistics. He suggested customizing the sampling design each year. Kelly said we are hoping to have

some overlap, which might mean we'd be less custom for each contaminant each year. We don't yet know how different each CEC family might be.

Bonnie commented she's not sure how accurate the RWQCB map of gauges is. It's also risky to rely on gauges installed by flood control districts. Have you considered installing and maintaining your own stream gauge(s) (or supporting another organization in this effort)? This approach could open you up to conducting loads monitoring in creeks with the ideal mix of land uses. It could also benefit other RMP studies. Kelly said a significant part of the budget in the proposal will go toward building up the database. We are not taking on installing and maintaining our own gauges due to the large expense. We're confident we'll be able to rely on flow gauges from others.

Kelly asked if stakeholders in the Workgroup could comment on uncertainty of load. What kind of information would you need to give us input on that? Tom said it's difficult to have an agency to have a sense of how to approach uncertainty. They don't know how to interpret the uncertainty so they prefer an answer. Lester asked if there are situations where re-running the model would address the uncertainty rather than the time-costly collection of more monitoring data? Tom suggested it could be the case and that uncertainty analysis can provide feedback to the conceptual model too. The uncertainty may be due to the conceptual model being too simple. You could add new pathways or improve parameters. Kelly notes there is the potential for PFAS to be transported in subterranean flow from contaminated sites, such as those in the Water Board's database, and that might not be something we include at the start, but could add later on.

Ed said the biggest uncertainty might be extrapolating low/uncertain concentrations over long times. Combinations of analytical and flow error might have significant effects on load estimates, especially if baseflow load is somewhat large and contaminant loadings are temporal.

Steve mentioned that whenever he can, he designs a two year study. It's risky to have one year of data to make conclusions and decisions.

Richard said we can possibly draw from Lester's advanced data analysis, which normalizes storms to rank watersheds. To frame climate related uncertainty for the stakeholder discussion, we could catalog things leading to uncertainty–was it due to storm size, location, timing, etc. Kelly said that's a good idea, and we might lay out a table of sources of uncertainty.

Day 2

10. Summary of Yesterday and Goals for Today

Melissa Foley started the day by recapping Day 1 of the Workgroup meeting. The goals for Day 2 and the agenda are listed below.

- Brief recap of yesterday's discussions and outcomes
- Update on the tires strategy
- Brief update on projects or proposals from other workgroups that have connection to the SPLWG
- Presentation of proposals for fiscal year 2023.
- Discuss and recommend/prioritize which special study proposals should be funded in 2023 and provide advice to enhance those proposals

10.	Summary of Yesterday and Goals for Today	10:00
11.	Scientific Update: Tires Strategy Update	10:15
12.	Other Workgroup Projects/Proposals with Connections to SPLWG	10:30
13.	Summary of Proposed SPLWG Studies for 2023	10:40
	LUNCH	12:00
14.	Discussion of Recommended Studies for 2023 - General Q&A, Prioritization	12:30
15.	Closed Session - Decision: Recommendations for 2023 Special Studies Funding	1:20
16.	Report Out on Recommendations	2:20
	Adjourn	2:30

11. Scientific Update: Tires Strategy Update

Kelly presented an update on the MPWG-funded Tires Strategy, a short-term multi-year plan to address tire-related water pollution. She noted the stakeholders here have been represented in other Workgroups, so the short time for this presentation is mainly for science advisor input. We are looking for high level feedback at this time.

The RMP and Ocean Protection Council funded a synthesis of microplastic sources and pathways in urban runoff, including a conceptual model for tires based on a literature review. SFEI's tire-related work is uniquely management focused, so there have been a lot of presentation requests. At the SETAC North America conference, Kelly co-organized a tires session that was the most well attended session at the conference, which is a strong indicator of the interest in the work.

Non-RMP scientific activity is mostly focused on aquatic toxicity. Some environmental monitoring and chemistry work is happening. For mitigation, with the exception of DTSC's anticipated Safer Consumer Products Program actions on 6PPD, almost the entire conversation is around treatment and very few other strategies are being

discussed. Little is happening in the fate and transport area, and as a result in the continued knowledge gap around tire wear particle surface area, it's not clear whether or not treatment right at highway road sides that is envisioned by many outside of the Bay Area as the primary response will be effective. We know 6PPD-quinone is lethal to coho, and a recent paper found lethal toxicity to rainbow trout (same species as steelhead). Kelly shared a summary of tire particle and leachate toxicity data, all of which is very recent (2021 and 2022), and more research is coming. None of these tire particle and tire leachate studies include chemical identification work due to the cost and complexity of the required chemical analysis, which is typically out of reach for toxicology labs. Research has been done on a wide variety of species that cover fresh and saltwater. The data show multiple types of adverse effects to multiple species at concentrations that the authors believe to be environmentally relevant. We can't draw a specific conclusion right now, as we do not have whole tire material monitoring data, so we cannot compare these results to our monitoring data, but there is a growing body of evidence that supports the conclusion that tire particles and chemicals are harmful to aquatic organisms.

The multi-year plan will include a brief summary of management decisions and recent findings, as well as a budget and brief descriptor of high priority work in subsequent years. A draft will be shared in mid 2022.

Kelly outlined the known management drivers of the work. The Department of Toxic Substances Control (DTSC) Safer Consumer Products Program just announced the nation's first tire regulation to protect salmon from 6PPD-quinone. To implement their work plan, they are eager to get monitoring data on both tire chemicals and microplastics. The California statewide Microplastics Strategy recently adopted by the Ocean Protection Council includes a tires sector pollution prevention strategy to be developed by 2023. The EPA trash free waters program has a tires work plan in the works. Regulations are not expected to come directly from that effort.

Kelly outlined the contents of RMP multi-year plans, focusing on the two elements where we are requesting feedback today, the proposed management question driving the plan and the list of special studies envisioned during the plan's five-year timeframe. The special studies list is based on the proposed management question: Do tire contaminants have the potential to adversely affect beneficial uses in the SF Bay? We are seeking input on this management question. In other workgroups, we received feedback that consideration should be given to broadening this question to include particles as well as chemicals, recognizing that the chemicals are inextricably linked to the particles that contain them.

Kelly described the draft special studies plan, which has three elements. The first is to continue the monitoring for the current group of tire and vehicle chemicals in the Bay and its margins in conjunction with the Bay wet season pilot study that we started this past winter (the information Alicia reviewed in Day 1). To respond to DTSC's request for monitoring data for other tire-related chemicals, there is a placeholder for a future special study to monitor additional chemicals of interest. We're also proposing special funding for the next five years to continue to track literature, identify other tire contaminants that could be monitored, and provide scientific information to management agencies. Based on feedback from the Emerging Contaminants and Microplastics Workgroups, there is interest in including a study proposal for measuring whole tire content of water samples in the Bay, and possibly in watersheds, in order to be able to compare Bay data to toxicity studies. This will also help link particles and chemicals.

Steve said everything they've seen in the literature is consistent with what Kelly is presenting. They are pursuing a way to do similar work in their area, and he's glad they're putting in the effort. Melissa asked if Steve is working on both particles and chemicals. Steve said their proposals focus on chemicals in runoff, not particles in sediment yet.

Rob commented on the proposed sampling. It's Bay focused and doesn't go upstream. It is important to go into watersheds to see sources and loads in the areas where affected organisms might reside. That seems like a missing piece.

Luisa Valiela (EPA) asked why the draft management question is focused on beneficial uses. It seems broad and could send you down a lot of paths. She was wondering if it's being framed appropriately at this point or if we want to be more specific and tie it directly to a management action. Luisa said beneficial uses can be fishable, swimmable, etc. Are we thinking about people or animals? Maybe our broad signal is that all of these need work, but the RMP may not be the place to fund all of them. Kelly has been thinking about endangered species habitat. So far there is evidence for direct effects on organisms. There has been some research on shellfish toxicity, which isn't a big issue in the bay because consumption is low. Richard added that the beneficial uses question is broad because it reflects a level one RMP question. For instance: are concentrations at levels of concern or are impacts likely? You don't make a judgement about the mechanism.

Keunyea Song (Washington State Department of Ecology) said that Washington has the same problem with 6PPD-quinone, so they've been going through a similar process to develop a monitoring plan to understand the potential impact. Keunyea's concern is

that 6PPD-quinone has a short half life (note: this was not confirmed by others in the meeting), which may be an important factor for monitoring design. The RMP conceptual model for tire contaminants includes transport in both dissolved and particulate phases, the latter where chemicals can continue to be released. It's not clear when or where that release is happening. Keunyea noted they have a 6PPD workgroup in Washington. Kelly said they've been tracking that workgroup, and will be in touch with Keunyea.

12. Other Workgroup Projects/Proposals with Connections to SPLWG

Kelly gave an overview of three proposals from other Workgroups that are relevant to the SPLWG.

The first is the stormwater CEC monitoring strategy that was split into a two year project, funded by the RMP through the Emerging Contaminants Workgroup. The motivation is to develop a long term stormwater monitoring approach. Kelly presented this project on Day 1.

The second is an Emerging Contaminants Workgroup proposal for monitoring tire contaminants in wet season Bay water. Motivation for this work was the detection of tire-related chemicals at nearfield Bay sites in 2021. We have the option for the next two years to leverage pilot Status and Trends wet season monitoring, so we want to take advantage of that. Deliverables will be a short report and data uploaded to CEDEN. The budget is $40k for Year 1, $80k total.

Those first two projects were highly rated by the Emerging Contaminants Workgroup.

The third project is a proposal from the Microplastics Workgroup to evaluate fiber emissions from household dryers to estimate loads to urban stormwater and the Bay. Because fibers are one of the primary types of microplastics we need to understand if tumble dryers are a major source of fibers. The proposal includes seed funding from Patagonia, and they have expressed interest to partially fund the project over the next few years. The proposed Year 1 budget for the RMP is $71,500.

13. Summary of Proposed SPLWG Studies for 2023

2023 RMP SPLWG Special Study Proposals included:

1. Stormwater PCBs and Hg Monitoring to Support Modeling
2. Remote sampler development for tidal areas and pilot testing
3. CECs monitoring in stormwater: PFAS
4. WDM to Support Watershed Loads and Trends for Hg and PCBs (year 2)
5. Stormwater CECs modeling: PFOS/PFOA pilot

Small Tributaries Legacy Pollutant Discrete Monitoring to Support Modeling

Alicia started by stating the motivation for this proposal is to learn more about PCBs and Hg to model loads, assess trends, and identify areas for management actions. Load monitoring is important for calibrating the WDM. Very few load monitoring stations are currently available for calibrating the model. Further, there will be a reevaluation of PCB TMDL in 2028 and Hg in 2030. The reconnaissance data only include concentration, not flow. Only by pairing concentration with flow data can we see if modeled loads are correct. In addition, the sampled calibration watersheds are highly urban and don't have a diverse HRU distribution, which is needed for the model.

The proposal includes selecting two stations with existing flow gauges and sampling six storm events over two years. During each storm four discrete samples would be collected over the course of the hydrograph. Alicia showed a map of potential watersheds to select. Guadalupe River is a good option for assessing trends, while the other proposed sites would increase spatial heterogeneity of monitoring. Deliverables include a concise technical report and data delivered to the modeling team. The budget is for $90k in the first year, $140k in second year (includes data QA and synthesis in the second year). There are $80K of carryover funds from this year's sampling, so we only need $10K for 2023.

Rob asked how many HRUs need to be represented in sampling for the model. He also commented that if sites are picked based on available flow data, does that limit the representation of HRUs? Tan said that most existing monitoring locations are industrial, impervious, and commercial. There is a big proportion of atmospheric deposition for Hg, so there will be loading from rural areas. We hope to have signals from those areas, but we are still looking at the combination of HRUs in the watersheds. Jon mentioned that when picking sites, if you prioritize based on type of land cover, there might be an argument for prioritizing watersheds with forest cover.

Jon asked which are more complicated and have higher laboratory costs: discrete samples or composite? Alicia said that from the monitoring standpoint, discrete are easier to collect but have higher laboratory costs. We need paired flow data to get a flow-weighted composite, which is harder to do. Jon suggested collecting large samples and making composites after the fact. For model calibration, it's better to have load over storm than the load within the storm. Composite has some advantages for that.

Chris said we should think about the reasons we're doing this. We want to inform trends. But there may be an information gap in understanding contributions from non-urban areas. In watershed selection, Sunnyvale East was presented as second tier, but it is one of the major sources of PCBs in that watershed. There has been work at

the Superfund site since previous monitoring was done there. We could maybe see a big change there, and it would be a good proof of concept watershed. Alicia said that they'll take all of that into account and do more work on analyzing HRU diversity before choosing a watershed.

Tidal Area Sampling Remote Sampler Development and Pilot Testing

Alicia showed a map of old industrial PCB source areas, and noted that it represents 3.5% of the landscape, but contributes 64% of PCB loading. Over half of this area is within 1 km of the Bay's edge, where it's tidally influenced. The motivation for the project is that permittees still need to identify source areas for management actions. Tides make sampling very difficult using our current sampling methods. Low tides must align with a storm event. If there is alignment at all, often the timing window of a storm event happening at a very low tide is very small, and it's hard to get a team there to capture it. We have found a sampler that's been tested and used by the EPA, and we think we could modify it to use successfully in tidal areas. It consists of a micro pump inside a Pelican case with an intake tube and a strainer that sucks samples into bags. It's held at mid depth by a buoy and a weight on the channel bed. EPA has used it over 100 times. USGS this fall/winter will be adding telemetry and other modifications.

We propose to pilot test one sampler from EPA/USGS or build our own and include a salinity sampler to only trigger sampling during stormwater flows. We want to test them at four locations around the Bay with field replicates and blanks at every site. Deliverables include quality analyzed data available through the CD3 web tool, and a methods report. The proposed budget is $85k.

Tom Jobes said this is a very exciting endeavor and useful for characterizing loads and distinguishing boundary conditions. He asked if the salinity sensor was the only modification. Don Yee said that the salinity sensor is a first order modification, but they're thinking about building around a platform called Mayfly, which has many water quality capabilities. They could tag on things for flow weighted composites or depth that could trigger sampling.

Lisa Austin commented that this could be an important tool for the stormwater programs to identify PCB source properties that discharge directly to the Bay.

Jon noted that this proposal was brought up last year, and asked if there were changes. Alicia said this is a similar proposal, but learning about the new sampler has been a major breakthrough. Lester added that last year's proposal was to completely invent a sampler. This is now a slight modification of an existing sampler.

Richard recalled the conversation from last year regarding contaminant movement up and downstream (“sloshing back and forth”) in tidal influenced edge areas, and he wanted to cover those bases to ensure a sound sampling method. There is a potential challenge of distinguishing pollutant signals from upstream of the sample point vs stuff that has gone past and is being swirled back up and sampled a second or third time. Alicia said that the salinity sensor will only monitor during freshwater flow. Because of that her hunch is that we’ll only see signals coming downstream. Richard said that contaminated sediment is taken back upstream and deposits. He wanted to know how significant this might be. Rather than seek perfection, is there a bounding exercise to reassure people interpreting data? Don said even with perfect knowledge of the processes it’s hard to know how to sample that point. If you knew percentages of up- vs downstream load, and tried to separate out tidal influence, you’d likely miss new loads during a storm event.

Richard wondered if you could pair that info with a sampling point further upstream with much less potential of the confounding problem, and compare estimates. You could do it as a confirmatory study, not at every site. Don and Lester mentioned that this proposal is planning to sample at outflow locations, so there is no upstream option. By sampling further upstream, you would eliminate the source you were trying to get. Maybe taking samples way downstream would help–if it’s higher downstream, then sloshing is important, and if it’s lower that would be in the direction we expect from dilution. Another option is to take sediment samples and compare the concentrations in the sediment to the concentrations in the stormwater sediment. If concentrations are higher in the stormwater sediment, that would tell you there is an upstream source greater than the source from the bed. Richard wrapped up the discussion by saying thanks for the thoughts on the "sloshing" problem. It is not something that troubles him deeply, but he thinks it makes sense to take some reasonable measures to try and account for it to aid in interpretation of the results. He would definitely appreciate a less-than-perfect answer for these tidally-influenced sites.

Steve said a potential solution is to have a flow monitoring device, like velocity and stage. Then you could compute an estimate of flow in real time and do flow composite sampling. It will accumulate negative when it is going upstream. Then you’d wait until you accumulate positive to take the next subsample. You’ll never get the perfect answer, but it’s better than sampling without flow. That is extra effort and expense, so we need to decide how important it is. Ultimately the advantage is you get a load with flow.

Jon asked if there are certain sites where you could combine the tidal sensor with measurements from storm drains with one-way flap gates that keep out most Bay water.

Private property access seems to be the challenge here. Richard noted that it is not worth the Water Board's effort to require access through the tidal properties.

CECs Monitoring in Stormwater: PFAS

Before starting this item, Kelly addressed a question from Jon Butcher who had asked for clarification on the process of how we choose CECs to monitor. Our emerging contaminants work is guided by the RMP CECs strategy developed through the RMP's Emerging Contaminants Workgroup. It includes a tiered risk-based framework for evaluating and prioritizing contaminants. The process includes consideration of chemicals in commerce, their potential aquatic toxicity, and pathways to the Bay. We start in the Bay because we're the "Bay Monitoring Program."

Kelly began by informing the group that the team is planning to re-scope this proposal based on pre-meeting conversations with Technical Advisors, Tom Mumley, and Chris Sommers. . At the Emerging Contaminants Workgroup meeting, we heard a lot of energy for moving this program forward. Subsequent conversations have clarified that we were overly ambitious in thinking we could launch a pilot project next year right when we're so early in the development of the stormwater monitoring approach. Tom Mumley, the Steering Committee Chair, has recommended that we an idea to replace the current project scope with something less specific that would lay the groundwork for our upcoming stormwater CECs monitoring. We will work out the details as we go with the goal of monitoring in Fall 2023. We seek input today on what should be included in that revised proposal.

To illustrate the complexity of CECs monitoring, she described the process necessary to prepare a sampling and analysis plan for a single CECs chemical family. First we need to determine the analyte list, which is one of the outcomes of the groundwork that we have called the "conceptual model" development. Then we need to find a reliable analytical lab capable of processing the number of samples we generate in a timely, high quality manner and provide results for all the necessary analytes with useful reporting limits. This can be a challenge for novel chemical families and may require a year or more of laboratory method development before monitoring can begin.. Then we need to determine sampling equipment and methods that won't contaminate samples. There are many things to consider! For instance, SFEI's neighbor is a carpet contractor that could emit chemicals like PFAS and OPEs that could contaminate our equipment and prevent use of our lab for blank testing.

We are looking for input on:

1. What investments do we need to make to get from where we are to implementing our CECs monitoring?
2. Are there missing elements we haven't considered sufficiently?

Some parts of the proposal in your packet are specific to PFAS, such as the conceptual model chemical analysis methods. Other aspects provide general groundwork for our CECs monitoring design, such as the stormwater sites database and remote sampler development. As this proposal is being modified, we'll need to put more budget into the sampler than originally planned, as we have discovered that we will need to build our own samplers and that we may need completely different samplers for PFAS, as the primary strategy to avoid contamination when sampling other CECs is to use all teflon (PFAS-containing) parts.

One option to move forward would be to switch the pilot sampling from PFAS to the tire and vehicle contaminants that we are monitoring in the Bay. Focusing on tire related contaminants would reduce costs because a conceptual model has already been developed and a reliable lab partner for that work exists (UW). Those cost savings would allow more funds for other areas, such as remote sampler development.

Kelly asked for feedback on how we as a group want to structure this program and move forward as quickly as possible and do it in a quality way. Discussion for this proposal is in item 14 below.

<u>Regional Model Development to Support Assessment of Watershed Loads and Trends (phase 2)</u>
Tan Zi presented the modeling proposals. Based on the Multi-Year Modeling Plan, the proposal for 2023 builds upon the baseline load modeling being done in 2022 and evaluates control measures. The proposed approach is SWMM + WDM simulations. The EPA SWMM model will be used for specific GSI simulation to quantify load reduction. We will summarize load reductions for specific GSI at the HRU scale, and apply that to the WDM.

Data gathering and processing will be done in the first quarter. Three stakeholder meetings will be held to discuss local knowledge and model assumptions, as well as gather feedback for early stage setup of the WDM to update the RWSM. The deliverables are a regional GSI data layer and a report, with a $130k budget. The report will be available by the end of the year.

Jon asked if Tan envisioned coming up with a single efficiency factor for each GSI type or something more dynamic? Tan said that different types of GSI will have different

efficiency factors, and they will be summarized for each HRU. It's challenging to represent the dynamics in WDM, even though we can do it in SWMM. Jon suggested there might be an intermediate point to think about. A lot of the pollutants that get past GSI are in large flows that can bypass treatment systems. You could divide the loading when it gets above a certain volume or rate of flow. Richard said he read the reasonable assurance analysis reports from different permittees and they followed a similar HRU approach. A lot involved figuring out a bypass component. Tan said he already has the RAA reports, and we can rely on those previous studies.

Chris said Jon brings up a good point. We should manage our expectations on what data and resolution of data we have on facilities. He's not sure whether or not there are many GIS data layers for these data. Tan said we haven't seen the data layer yet, but one crucial thing we need is the drainage area of GSI, and we might need to make assumptions. Lisa Austin said that in Contra Costa and Alameda counties, drainage area delineated will depend on the area treated. A large regional facility will possibly have a drainage area delineated. Often, there are multiple GSI on a parcel, and we only have the GSI boundaries, not drainage areas.

Stormwater CECs modeling: PFOS/PFOA pilot

Tan said we may need to rescope this modeling with the monitoring study presented by Kelly. The general methodology is to: 1. Develop an approach for screening-level stormwater loading estimation for one or two members of the PFAS family or other CECs, 2. Pilot a load estimation approach, and 3. Identify data gaps.

PFAS is a complicated family of chemicals, as discussed earlier in this meeting. The idea is that once we work through this family, we can apply that process to other chemicals, speeding up our work in the future. Piloting the load estimation approach would rely on the other project that was proposed to provide a conceptual model. That conceptual model will be necessary to support the CEC modeling exploration and we'll do literature review to provide model assumptions. Then we'll calibrate using monitoring data. We have 33 PFOS/PFOA grab samples from 2010/2011 at 10 sites. From 2019-2022 we collected 26 CEC urban stormwater samples and four reference samples that were analyzed for a variety of PFAS, including PFOS and PFOA.

In general we hope the conceptual model will help identify key fate and transport characteristics, and what type of watersheds we should look at. Literature review will focus on stormwater monitoring methods, validity of local conditions, and basic information from monitoring results.

The proposed approach is a hybrid modeling scheme that includes a conceptual model. We will pair the flow output from the WDM to concentration monitoring data to derive EMC based mean concentrations. This will give us simple first order load estimations.

Deliverables include a technical report and ECWG and SPLWG presentations. The budget is $100k. Melissa noted that this proposal will likely change in step with Kelly's CEC monitoring project.

Tom observed that it depends heavily on conceptual model development. That is the most difficult part of PFAS. We don't know if there is enough information to inform the conceptual model for that family yet. Tan said we have a conceptual model for tire particles, but less monitoring data. Tom asked Tan to speculate on how much the reduced dataset will affect the reliability of first order estimates. Tan didn't think it would be a big difference because it hinges on the conceptual model. Although we have more data for a few chemicals in the PFAS family , it's still very limited, and it won't change data analysis much.

Keunyea asked what the baseline reference condition for monitoring and modeling will be. PFAS is everywhere, and the dominant PFAS compound differs by land use type. Will you develop a model and monitoring to consider those land uses? Kelly said we have criteria for reference sites and have data from those sites far upstream from sources. There are 26 urban sites, and 4 reference. We will evaluate baseline conditions with the full dataset later this summer. Our existing data doesn't include all outdoor use PFAS. Tan adds that we haven't figured out whether it is entirely land use based or if there are other factors. That will be derived from the conceptual model. Keunyea asked if sampling will be from MS4 outfall or receiving water monitoring? Kelly said because we're looking at loads it will be receiving water monitoring. The Bay area differs from Washington in that most creek flow during storm events is urban runoff.

14. Discussion of Recommended Studies for 2023 - General Q&A, Prioritization

After a break, discussion resumed with the CEC monitoring project, presented earlier by Kelly. Diana Lin (SFEI) briefly joined the meeting as a PFAS expert.

Rob asked if the project switches to tire contaminants instead of PFAS, does that alter the aspects of the design or proposal? Kelly said it allows us to transfer funds from development of a conceptual model to other activities such as pilot testing remote samplers. It would provide for cost savings and simplification. In terms of sampler design, sampling for PFAS has been worked out in wastewater, not stormwater. And there are lots of other considerations for PFAS as it's a more daunting and difficult chemical family for a pilot.

Jon asked if PFAS have a significant loading pathway versus wastewater systems. He noted some of them are quite mobile in groundwater. Diana said the goal of study is to better understand these pathways. Jon added that tire compounds are soluble and likely have a groundwater pathway.

Rob wondered about the utility of samplers in a stream setting. Sampling could occur in low flow or high flow streams. Base flows are often two feet or less. With the design of this sampler suspended between a cement block and buoy, there needs to be some perennial flow depth to make these workable. A lot of streams won't be viable. The other extreme is high flow like Walnut Creek or Guadalupe River during storm events. They have had high debris flows that can cause entire ISCOs to be lost. And how will you reach them at the end of the event when baseflow is still high? Rob said the remote samplers will be awesome for the tidal project, but how will they be used in streams for the CEC monitoring project? Don said we can't get something perfect for all situations. For low flow it could be used like a quick setup ISCO as opposed to floating design. For high flows, the sampler could be placed behind a hard structure. Samplers might not get fully into the main stem, but turbulent flow would give us a reasonable estimate of loads. We might need to validate with cross sectional studies.

Kelly said the intent is to use telemetry or flow-based triggering, so it wouldn't be turned on during low flow. Rob noted the main concern is you'd select sites based on where samplers will work rather than based on other site characteristics. Kelly said that is a good reason why we need a pilot to compare these remote samplers to ISCOs.

Chris stressed that this will start out at the pilot scale, and we will figure out applications that work well. Storm-driven monitoring in the Bay Area is of focus right now, including for macro trash monitoring in LID. We're getting on average three storms per year, so to hit our storm event goals we have to get multiple sites rather than a single site. Remote samplers are helping. He could see that some high flow situations with lots of sediment movement could bury a system. High flow events are needed for model calibration, so perhaps we have to think we will need people out in the field. Whatever we do with automated samplers vs crew sampling methods, make sure those methods are comparable. We will need to use contractors to cover this large amount of work, so it's important to be realistic about what we can achieve.

Chris said the Municipal Regional Stormwater Permit (MRP) requires LID monitoring, so we also have to go through methodology issues in the next year or so. LID monitoring is required to be in deployment by fall 2024. If we go away from PFAS, is there other work that could help the methodology development, including sampling, storage, and

processing methods? Kelly said if we start with another pollutant, we could pick up PFAS a year later. If we take on tire contaminants now, we could make PFAS the second pollutant because of high stakeholder interest. Diana added we are monitoring PFAS in wastewater in a separate project and learning how to collect samples. There are certain analytical methods available at commercial laboratories; what we can measure is a small subset of the broad class of PFAS.

Diana discussed the targeted analysis method, which ranges from 30-70 analytes. The Total Oxidizable Precursor (TOP) method incorporates more PFAS compounds by converting the oxidizable PFAS to terminal products. In the wastewater study, the TOP method measured concentrations an order of magnitude greater than the targeted method. That gives us an idea of the importance of looking at other PFAS we aren't capturing with the targeted method.

Steve asked what kind of information is known about groundwater/surface water interaction in the systems being considered. Will the mobility of PFAS in groundwater influence monitoring? Lester said we haven't done much groundwater analysis, but Tan could explore it with the WDM. We could draw from the expertise of water district staff. Kelly said that to avoid the influence of polluted groundwater, part of monitoring location selection for PFAS would be to identify and avoid areas with known PFAS contaminated sites.

Steve asked Diana if they have done a comparison of PFAS samples of stormwater in the area or just wastewater? Diana said we don't know how they compare yet as we are waiting for the rest of the stormwater monitoring data.

Steve wondered if there were any surprise hotspots. In the Great Lakes, they didn't find major hot spots in the 70-80 sites sampled in ambient monitoring. The most important findings were from evaluating upstream and downstream of sewage treatment plants. Depending on the type of treatment, they found a big jump in PFAS downstream. Airports upstream dominated the signal in a few cases. Lester asked if Steve found influence in areas where there are septic systems. It will be important to know the contributions of rural areas.

Steve said the EPA has used auto samplers in small streams (even 1 ft water). They can be adjusted for the type of stream. For instance, you could put a cap on end if it's exposed tubing and put a purge at the beginning of the cycle. High flows are a big concern. Can you run a chain back to the bank of stream or set an anchor of some sort? Lester said we've been lucky not to have lost equipment yet, but we've seen less plastic and debris now compared to over the past 20 years. After the pilot sampling of micro

samplers in Bay margins, that might become an easier method than sampling during high flow upstream. If that's the case, we could deploy them prior to a storm in 30-50 locations and it could completely change how we think about sampling design.

Chris asked for clarification on how the timing of CECs stormwater monitoring and modeling fit together. Kelly said that if we don't do them hand in hand then we won't be able to know how to do the monitoring to best inform the modeling or vice versa. Chris asked if they are a package deal. Kelly said if we stop one it will affect the scope and budget of the other. We're trying to build a program that integrates both.

Tom asked about the scalability of monitoring projects, especially those with a large budget. He also asked if switching to tire contaminants (that already has a conceptual model) would increase scalability. Kelly said the proposed budget is based on a preliminary conversation with the Steering Committee Chair. We want to be ready to implement full scale monitoring next year. She added that if we shifted to tire and vehicle contaminants, we could allocate the savings in conceptual model development to areas we under-bugeted like piloting samplers and the sampling locations database. It's a moving target because we're still learning. What do we need to do and at what scale? That's a conversation we still want to have and need to meet the expectation of stakeholders a year from now to be out there at full scale.

Rob noted CEC families are very dispersed and unrelated. He asked how will the info from the pilot be applied to full scale monitoring studies? Remote samplers might need to be different for each CEC family. Kelly said the budget will be used for the groundwork needed to design sampling plans. The following year would involve the foundational work for the next contaminant family. The process approach would be ready for the following years.

Steve said there is a lot of emphasis on PFAS around the country, so it's somewhat pressing to get information on that family. We need to identify if there are PFAS at high levels and which sites have dominant signals. We also need to include effort on developing general sampling methods for CECs. A fraction of PFAS chemicals are likely to be sorbed to sediment. Is it feasible to sample a bunch of sites for sediment (more straightforward) and to inform future efforts of water sampling after the CEC methods are in place. Kelly stated that there are many different PFAS with diverse uses and chemical properties. Unfortunately, it would be unlikely that learning about the PFAS in sediment would inform understanding of the different PFAS that occur primarily in water. Another consideration is that the State Water Board operates a statewide sediment monitoring program called the Stream Pollution Trends (SPoT) program, which is monitoring PFAS in sediment. Kelly wanted to think more about this, but was not sure

we'd get a leg up by doing sediment sampling at this point. Steve said that focusing on different chemicals makes a difference. We've found that total PFAS goes up and down in water and sediment, just different chemicals show up. Steve said that work was using the targeted method. Kelly said that given the wastewater results which revealed many new insights with the broader suite of PFAS and the TOP methods, we want to make sure we have the breadth provided by the TOP method and additional analytes. Melissa mentioned we will be monitoring PFAS as part of Status and Trends sediment sampling.

The discussion then shifted to the other proposals. Alicia gave a clarification of the small $10k budget for the small tributaries loading monitoring. It's a two year study, and the first year is three storms at two sites with a $90k cost, but $80k is carryover from the prior year. Data quality analysis, interpretation, and reporting will be asked for next year for $140k.

Melissa then gave an overview of planning dollars. The planning budget is $335k, which is the sum of the four proposals not including the CECs stormwater monitoring project. That proposal is in the planning budget of the Emerging Contaminants Workgroup, but we would like the SPLWG to give their input on how to prioritize that work. The Special Studies are all funded from one pot, so there are some artificial constructs for relative budget guidance for each Workgroup.

15. Closed Session - Decision: Recommendations for 2023 Special Studies Funding

Workgroup members discussed and prioritized the proposed studies while those who presented the proposals stepped out.

16. Report Out on Recommendations

Chris Sommers reported the workgroup's conclusions.

He began by saying the Workgroup thinks all of this is a priority, which makes it difficult to prioritize. First, the extra $10k to spend toward discrete monitoring was an easy investment and was a priority. The regional dynamic model was deemed important and ranked as number two. Then it became harder to prioritize the rest. The group agreed the tidal area remote sampling was important for legacy contaminants as well as informing work for CECs in the future. Monitoring properties at the edge of the bay will help inform models too.

The CEC stormwater monitoring project was ranked fourth. Ultimately, it came down to pacing of the sequential process of monitoring and modeling. Monitoring held a higher priority as we staggered monitoring and modeling. If monitoring gets funded, the

Workgroup was generally supportive of switching the focus from PFAS to tire contaminants. We still want to track scientific progress on PFAS. Finally, the group suggested that a reduced budget for first order CEC loads modeling could be sufficient (~$25k). The group is hopeful all projects are funded in combination with SPLWG, ECWG and supplemented with water quality improvement funds (EPA).

Melissa thanked everyone for taking the time to attend and participate in this two day meeting. Special thanks went to the science advisors for their great input. Alicia and Tan will follow up after the TRC and SC meetings to communicate the final funding decisions. As the CEC stormwater monitoring and modeling proposals evolve, Kelly and Tan may reach out for further input.