Special Study Proposal: Small Tributaries Loading POC Trends Strategy and Trends Monitoring

Summary: The goal of the Small Tributaries Loading Strategy (STLS) Program over the next few years is to continue to provide information to RMP Stakeholders and the public that directly supports the identification and management of PCBs and Hg sources, concentrations, and loads, and the determination of trends in relation to management efforts and beneficial uses impacts in San Francisco Bay. To support stormwater concentration and loading trends evaluation, the outcomes of this proposal will be provision of an improved dataset (more samples targeted at improving the description of source, release, and transport processes at selected tributary monitoring sites) following the monitoring design laid out at the conclusion of the 2016 Trends Strategy workplan, data evaluation to prepare refine the monitoring plan for subsequent winter seasons (i.e., 2018 and 2019), and further evaluation of data and information to continue the dialogue on the ultimate design of a long-term monitoring program for trends.

Estimated Cost: Option 1: $150,000; Option 2: $200,000
Oversight Group: STLS/SPLWG
Proposed by: Lester McKee, Alicia Gilbreath, Jennifer Hunt (SFEI)

PROPOSED DELIVERABLES AND TIMELINE

Task	Deliverable	Due date																				
		2016					2017											2018				
		S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
A	Site selection	!																					
B	Wet season monitoring		!	!		!		!	!														
C	QA & Data Management									!!													
D	Analysis & reporting														!!		!	!!		!		!!	

[MQ] = Management Questions given in Provision C.8.f. of the Municipal Regional Stormwater Permit (MRP 2.0)
! = STLS check in for review and course corrections
!! = SPLWG oversight and review

Background

The San Francisco Bay Hg and PCBs TMDLs call for reductions in loads by 50% and 90% by 2028 and 2030, respectively. In response, the first Municipal Regional Permit for Stormwater (MRP) Provision C.8.f. (SFRWQCB, 2009) called for a range of actions including gaining a better understanding of which Bay tributaries contribute the most loading to sensitive areas of biological interest on the Bay margin, better quantification of loads of sediments and trace contaminants on a watershed basis and regionally, a better understanding of how and where trends might best be measured, and an improved understanding of which management measures may be most effective in reducing impairment. These same needs were reflected in the Small Tributary Loading Strategy (STLS) (SFEI, 2009). On November 19, 2015 the second MRP was issued and provided an updated set of management questions (provided below) (SFRWQCB, 2015). With an increased focus on finding tributaries and sources with disproportionally high concentrations and loads of PCBs and Hg, and the transition from the pilot testing phase of BMP selection to focused implementation, it was recognized that a Strategy for monitoring trends was needed for stormwater concentrations and loads, connecting management effort on land with water quality improvements in the Bay.

During 2015, the RMP funded the first phase of developing the Small Tributaries Loading Strategy-Trends Strategy (STLS-T). Beginning in July 2015 and continuing through April 2016, a series of five STLS-T meetings occurred that resulted in the development of a series of interim products including a refined trends strategy workplan, a mission statement, the development of three key trends strategy

management questions, a list of potential stormwater quality indicators, a number of conceptual models including a conceptual model of how those indicators relate to watershed scale, selection of the indicators and scales on which to focus initial power analysis efforts, collation of available data, and development and implementation of a power analysis work plan. In April 2016 the first draft of the STLS-T strategy document was prepared ready for the STLS team review along with the results of the power analysis.

The draft power analysis indicated the following general preliminary results. In relatively "clean" watersheds which exhibit relatively low concentration variability, >80% power to detect a continually declining trend of just 25% over 25 years with 95% confidence is possible with just 2 samples every 4 years or 5 samples every 5 years. However, the interest and focus is more on watersheds that currently exhibit greater leverage for improvement (disproportionally higher concentrations, particle ratios and pollutant loads relative to their watershed area, usually with a history of older urban and industrial land use). For these types of watersheds, the preliminary results of the power analysis suggest that to obtain 80% power, at least 15 samples every three years (equivalent to 5 annually, or 8 biennially) would be needed to see a continual 90% decline over a 25 year period.

To increase the power to detect trends, a number of data stratification exercises were evaluated including removing base flow samples, stratifying for early versus late season (based on season-to-date rainfall less than or greater than 50% mean annual rainfall for each unique sampling site), and rising and falling stage (before and after peak storm flow for each unique storm at each unique site). The results of this analysis along with graphical inspection of scatter plots of flow versus concentration and particles ratios led to the conclusion that the current baseline data are insufficient to provide high enough sample numbers for some strata and, that overall, for several of the more polluted sites (Sunnyvale East Channel watershed and Pulgas Creek Pump Station watershed), the existing baseline data do not fully describe all the underlying source-release-transport processes. External peer review of the power analysis will occur in June, and may lead to revised power estimates.

This led the Strategy Team to recommend further baseline data collection over the next three wet seasons to provide an improved dataset but this is yet to be peer-reviewed by our new STLS_T Strategy advisors. The sampling design will be determined during the next three months with conclusion of the 2016 work plan after obtaining that review. Tasks left to complete in 2016 include:

1. The completion of a draft report outlining the results of the power analysis
2. Peer-review of the draft report by external experts (Bob Hirsch and Lori Sprague of USGS have agreed to provide support).
3. Preparation for and completion of a special SPLWG meeting on June 21-22 focused on the trend strategy (At the request of Bob Hirsch, the meeting package will include detailed site descriptions including maps of land uses and source areas and existing baseline data for our monitoring sites with good flow records). During the peer-review step and this meeting, we will be aiming to get advice on:
    a. on how to ensure that, if concentration or particle ratios are used as trends indicators, there is an explicit linkage to loads
    b. how to ensure the trends program is practically implementable and representative of both space and time
    c. the use of composite versus discrete sampling design
    d. methods of sample site selection and if such decision can be made a-priori.
4. Development of a monitoring design and sampling and analysis plan (SAP) for the WY 2017 wet season
5. Any needed reconnaissance and site selection
6. Any needed equipment purchase and installations ready for monitoring to begin October 1st

Study Objectives and Applicable RMP Management Questions

The main study objectives are three fold:

1. Develop and implement a sampling program to provide suitable baseline data to support the final design of a monitoring program to identify trends in concentrations and loads over appropriate spatial and temporal scales, connecting management effort on land with water quality improvements in the Bay
2. Complete further data evaluation to adjust the monitoring plan for subsequent monitoring seasons (i.e., 2018 and 2019), and
3. Further evaluation of data and information to continue the dialogue on the ultimate design of a long term monitoring program for trends.

The proposed Trends Strategy work plan will directly address management question (MQ5), but will also provide improved data for calibration of the Regional Watershed Spreadsheet Model (RWSM) (MQ4), and to a lesser extent, provide information that might help us to continue to evaluate the nature of sources in the watersheds selected for monitoring (MQ1) and the impacts to areas on the Bay Margin downstream (MQ2) especially if the selected watersheds are drain to a priority margin unit (PMU).

MRP 2.0 Q1: Source Identification / Leverage: Which sources or source areas provide greatest opportunity for load reductions?
MRP 2.0 Q2: Impairment: Which source areas contribute most to impairment of Bay?
MRP 2.0 Q3: Management effectiveness: Provide support for planning future management actions or evaluate existing actions.
MRP 2.0 Q4: Loads: Assess POC loads, concentrations, or presence/absence.
MRP 2.0 Q5: Trends: What are the spatial and temporal trends in loads or concentrations?

Approach

1. Design and carry out a wet season field monitoring program at selected sites.
   - The design of the program will be determined during the conclusion of the 2016 work plan with input from SPLWG advisors
   - The number of sites is yet to be determined but will be influenced by the funding level awarded by the RMP, the monitoring design (number of samples, timing relative to storms, the use of composite versus discrete water samples, the analyte list, and the need for including flow and/or turbidity monitoring).
2. Carry out data interpretation based on the recommendations from our SPLWG advisors. These could include further experimentation with:
   - Further power analysis that includes modeling out the impacts of within and between season climatic variation or
   - Perhaps a modification and implementation of the Weighted Regressions on Time, Discharge, and Season (WRTDS) software developed by Bob Hirsch and his USGS team (Hirsch et al., 2010). This software is designed specifically to determine trends in systematically collected water quality data but would need to be modified to cope with 15 minute data and the flashiness of our Bay Area streams – doable based on our read of the literature.

Reporting

A draft report will summarize the findings from trends monitoring and provide information to support the monitoring design for subsequent years and a more general dialogue of how to design a long term monitoring design for trends in stormwater concentration and loads. After review by the SPLWG and external reviewers, a final report will be prepared.

Linkages to Other RMP Strategies

Some of the sampling sites may be selected in the watersheds of the Priority Margin Units (PCBWG) or monitored for emerging contaminants with funding from the ECWG.

References

Hirsch, R.M., Moyer, D.L., and Archfield, S.A., 2010. Weighted Regressions on Time, Discharge, and Season (WRTDS), with an Application to Chesapeake Bay River Inputs. JAWRA Journal of the American Water Resources Association 46 (5), 857 – 880.

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