Optimizing sampling methods for monitoring pollutant trends in San Francisco Bay urban stormwater

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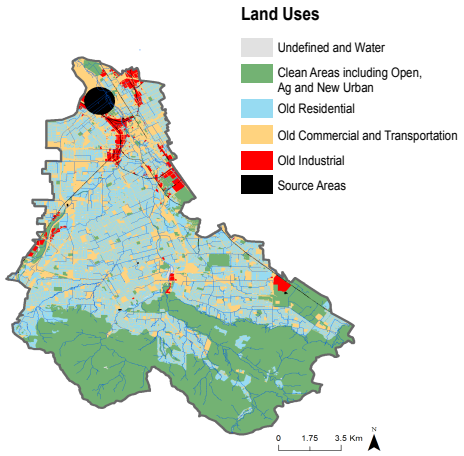
Introduction

The Small Tributaries Loading Strategy (STLS) focuses on urban stormwater loadings from small tributaries. To date, STLS monitoring has been geared towards determining concentrations and annual loads of PCBs and Hg; the sampling approach has yet to be fully optimized for detecting trends over time. Here, we evaluate the variability and statistical power for detecting future trends in PCBs based on baseline STLS data in the Guadalupe River watershed. The objective was to improve our understanding of the influence of climatic and seasonal factors on baseline stormwater pollutant conditions, and inform refinements to the STLS monitoring design for detecting trends.

Guadalupe River Watershed



Statistical Modeling and Power Analysis

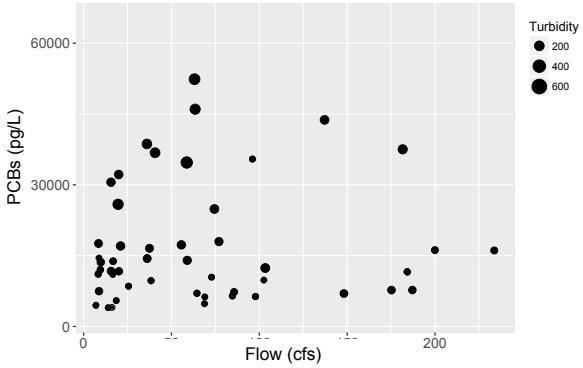


Figure 1. PCBs as a function of discharge (flow) and turbidity

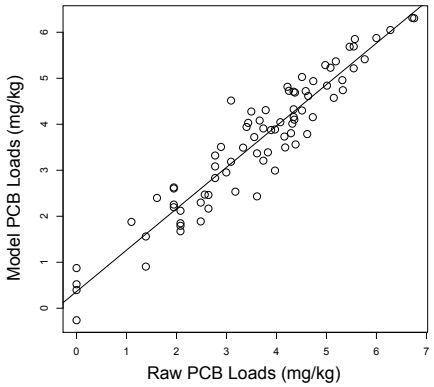


Figure 2. Raw vs. Modeled PCB Loads. Model values are the function of log (turbidity) and log (flow)

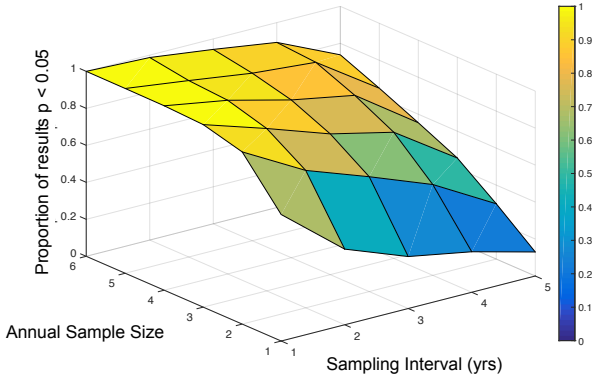


Figure 3. Power results for a 50% decline in PCB loads in 25 years. Power analysis was conducted assuming an exponential decline, based on inter-annual and intra-annual variability in the model residuals

Monitoring Design Considerations

- Turbidity and flow together explain over 80% of the variation in PCB loads at Guadalupe River
- Residual variance of modeled PCBs may be robust alternative to raw data for trend detection
- Preliminary results suggest > 80% power to detect trends in PCB loads at sample sizes of n = 4 every 3 years
- Further data modeling is underway to incorporate indicators of hysteresis and sediment dilution

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