Guadalupe River Hg – Request for use of RMP contingency funds
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Background

Objective: Characterize concentrations and loads during high flow periods to gain an accurate understanding of contaminant inputs from the Guadalupe River watershed to the Bay under all annual flow conditions and on average. See second page for a summary of work-to-date

Commentary

Our observations over the past 4 years indicate the highest total Hg concentrations occur when rainfall in the Historic Mining District is more intense (approaching or >2 in / 6 hours measured at Almaden). All observations support the hypothesis that the majority of total Hg transported in the system is derived from out of channel sources in the Historic New Almaden Mining. Only during WY 2003 (our first year of observations) did we see a large Hg release event. During that year we were still learning how to sample the system so observations could have been better. At present, we still do not fully understand the source release process and do not have a sufficient base line data set for future comparisons because we have only a few samples during larger floods when all the action occurs and when sediment concentrations are much higher. In the absence of funding from SCVWD or another local partner in the South Bay, we request that RMP contingency funds be made available in the event that a large flood occurs.

Contingency funds

The objective is to determine particle concentrations during large floods and provide baseline data for future comparisons. We propose to continue to operate the turbidity probe and USGS daily loads program at Hwy 101. We propose to take water samples for Hg analysis during floods of increasingly larger magnitudes. Initially we would sample rainfall intensity >2 in/ 6 hours (Almaden gage) or a flood >12 ft (USGS Hwy 101 gage). As data were gathered annually we would only sample larger and larger floods. Each time a larger flood occurs, a new threshold trigger discharge would be emplaced for further sampling. In this way, over the next decade we would gradually gather information on larger and larger floods. Under this option, we would only sample falling stages of floods when Hg is transported from the non-urban upper watershed areas and Historic Mining District.

Advantages:
- Cheaper than sampling all floods every year.
- Will provide baseline data for future comparisons.
- Will allow annual estimate of suspended sediment load useful for other District projects

Disadvantages:
- Relies on the present hypothesis of Hg source, release and transport
- Will be less informed about Hg and trace organic transport associated with urban areas.
- Confidence of annual loads will be lower.

Cost:
$35k per year (USGS) (every year ongoing) (Note we are still negotiating with the SCVWD)
$15k (SFEI labor) + $12k (Hg lab analysis) only when a large flood occurs = $27k
$140k full study every 5 years (next time would be in water year 2011)

Work to-date: SFEI, MLML, RSL, and USGS have been working together with funding from CEP, RMP, SCVWD, USACE, and SCVURPPP to characterize the concentrations and loads of suspended sediments and total Hg (WY 2003, 2004, 2005, 2006), and bed loads, bed sediment Hg loads, methyl Hg (WY 2005). The CEP and RMP also funded the collection of PCBs (WY 2003, 2004, 2005, 2006), OC pesticides (WY 2003, 2004), and PBDEs (WY 2005, 2006). The following observations and hypotheses have been generated with respect to water, sediment and mercury:

- Data collected at Hwy 101 indicate the watershed efficiently transports water and sediment downstream in response to rainfall and reservoir releases. Discharge and SSC respond to rainfall in the urbanized lower watershed within 30 minutes. Discharge and SSC respond to rainfall on the mountain peaks within 6 hours.
- When either the Guadalupe Reservoir or Almaden Reservoir is released, a discharge and SSC response occurs at Hwy 101 approximately 5 hours later. Data indicates that Lake Almaden (next to the District Headquarters) has little attenuating influence on the discharge or SSC signal.
- During WY 2003 - 2005, suspended sediment concentrations have varied from 5 – 1,180 mg/l and loads have varied from 4,600 – 10,800 t. WY 2006 will likely fall on the upper end of this range ~11,000-12,000 t).
- During WY 2003 - 2006, total Hg concentrations varied from DL - 18,673 ng/L (some of the highest concentrations measured in the world and indicative of mining contamination).
- Concentrations of other trace metals (e.g. Cu and Pb) and PCBs are greater when discharge is derived from urban areas whereas concentrations of Hg, Ni and Cr are greater when discharge is derived from the upper non-urban portions of the watershed.
- Highest total Hg concentrations occur when rainfall in the Historic Mining District is more intense (approaching or >2 in / 6 hours measured at Almaden).
- All observations support the hypothesis that the majority of total Hg transported in the system is derived from out of channel sources in the Historic New Almaden Mining District (could include floodplain and terrace deposits in first and second order tributaries). We do not see elevated Hg concentrations in response to high tributary flows under lower rainfall intensity conditions, or in response to reservoir releases. Other mercury sources such as runoff and channel erosion in the urban areas, erosion from Lake Almaden, atmospheric deposition, and channel erosion in Alamitos Creek and Guadalupe Creek mainstems appear to be subordinate.
- During WY 2005 and 2006 (preliminary data), concentrations of methylmercury ranged from 0.06 – 2.22 ng/L.
- Mercury concentrations in the bed load sediments of Guadalupe River ranged between 0.03 and 1.8 mg/kg (median of eight samples) and increased with decreasing grainsize. Large variation between samples indicated slugs of contaminated sediment (perhaps even chunks of cinnabar probably associated with any particle size). Maximum concentrations in the bed on the fine sediment (<0.0625 mm) approach the particulate concentrations found in the water column during smaller most common floods (e.g. WY 2004, 2005). However, under high Hg transport conditions (e.g. WY 2003), Hg in the water column well exceeds bed concentrations indicating loads, if calculated from bed sediment data, would be bias low by an unknown amount. This observation also adds further support that most Hg load in not sourced from in-channel deposits.
- During WY 2003 - 2005, total Hg loads have varied from 8 - 116 kg. WY 2006 will likely fall in the middle of this range ~ 20 - 40 kg).
- Bed sediment load was 1% and methyl Hg load was 0.5% of total Hg load during WY 2005.