

Our Actions, Our Estuary
9th Biennial State of the San Francisco Estuary Conference
POSTER ABSTRACTS: Sediment & Stormwater

Literature Review of Unconsolidated Sediment in San Francisco Bay and Nearby Pacific Ocean Coast

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A review of the geologic literature regarding sedimentation in the San Francisco Bay estuarine system shows that the main part of the bay occupies a structural tectonic depression that developed in Pleistocene time. Eastern parts, including San Pablo Bay and Suisun Bay, have had sedimentation throughout late Mesozoic and Tertiary. Carquinez Strait and the Golden Gate may represent antecedent stream erosion. Sedimentation has included estuarine, alluvial, and eolian deposition. The ages of estuarine deposition includes the modern high sea level stand and earlier Pleistocene interglacial periods. Sediment sources can be generally divided into the Coast Ranges, particularly the Franciscan Complex, and "Sierran". Much of the estuarine system is floored by very fine sediment, with local areas of sand floor. Near the Golden Gate, sediment size decreases in both directions away from the deep channel. Bedforms include sand waves (submarine dunes), flat beds, and rock and boulders. These are interpreted in terms of dominant transport directions. Near the Golden Gate is an ebb-tidal delta on the outside (including San Francisco bar) and a flood-tidal delta on the inside (parts of Central Bay). The large tidal prism causes strong tidal currents, which in the upper part of the estuary are normally much stronger than river currents, except during large floods. Cultural influences have altered conditions, including hydraulic mining debris, blasting of rocks, dredging of navigation channels, filling of the Bay, and commercial sand mining. Many of these have served to decrease the tidal prism, correspondingly decreasing the strength of tidal currents.

Key Words - *Sediment*

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Vessel-based LIDAR to monitor coastal change and offshore dredge efforts at Ocean Beach, CA.

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Previous studies have identified an erosion “hot spot” at the southern end of Ocean Beach, which threatens beach width, recreation usage and coastal infrastructure including a sewage outflow pipe. The 2004 Ocean Beach Coastal Processes Study monitoring, mapping and modeling effort revealed possible shoreward sediment transport at an undersea region just offshore of south Ocean Beach. In 2005, a test dredge disposal site was implemented in the region identified by the 2004 Ocean Beach Coastal Process

Study with a goal to reduce sediment loss and beach erosion at Ocean Beach. The purpose of this research is to determine the current state of the Ocean Beach topography relative to its state in 1998, and to determine the efficiency of vessel-based topographic LIDAR for mapping coastal geomorphology. My approach has been to analyze 2009 vessel-based LIDAR data and 1998 NOAA airborne LIDAR data to quantify the spatial distribution of coastal erosion and deposition at Ocean Beach. The 2009 data are currently being compared to data from 1998 using raster subtraction in ArcGIS. Results will be ready for disclosure at the upcoming San Francisco Bay Estuary Conference in September.

Theme: Sediment

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A Legacy of Contaminants in SF Bay and Wetland Cores

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With residence times often on the order of decades or even longer, sediments can serve as a reservoir of legacy pollutants long after new inputs have been greatly reduced or stopped altogether. San Francisco Bay has been listed as impaired by pollutants, including mercury, copper, and PCBs. A previous study found these and other pollutants in cores of deeper Bay sediments at a few depositional locations, a potential reservoir of legacy contaminants that could threaten ecosystem health if these areas were later exposed by erosion. Since it has been over 15 years since that investigation, a new coring study was undertaken to characterize the Bay at a wider range of sites. Cores were collected from 6 wetland and 11 sub-tidal Bay sites, radiodated, and analyzed for a suite of trace metal and organic pollutants. Cores from depositional wetland areas showed sharp peaks in concentrations of pollutants such as copper and mercury, generally corresponding to expected periods of high pollutant loads and ambient concentrations. In contrast, subtidal cores from open-water areas of the Bay showed generally elevated pollutant levels, but with less distinct or no peaks in concentration. These patterns suggest long-term dispersion and mixing of past loads in Bay open waters, which would require cleanup of less concentrated but ever larger sediment volumes with passing time, or waiting many more decades for concentrations to dilute or disperse to levels that no longer impair the ecosystem. Although deep sediment contamination appears not to be as widespread or severe as once feared, these results underscore the importance of controlling pollutants at or near their sources, where management actions can be applied most effectively and efficiently.

Key Words - *sediment; pollutant; core*

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Green Infill Clean Stormwater

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Detrimental impacts of stormwater runoff from transportation infrastructure have been well documented. The Green Infill Clean Stormwater Project promotes sustainable green streets and parking lots by developing approaches to reduce impacts of water pollution from road runoff. The reductions will be achieved through the construction of rain gardens, bio-swales, infiltration- and flow-through planters, curbside extensions, or a combination of these techniques and monitoring to evaluate their effectiveness. A first set of samples was collected during storm rainfall in the winter and spring of 2009 from a parking lot/recreational complex prior to the implementation of best management practices. Concentrations of trace metals were high during the pre-construction sampling, from 7 (Ni) to 296 (Zn) times higher in runoff from the parking lot compared to the 14-year Central Bay average from the Regional Monitoring Program for Water Quality in the San Francisco Estuary (RMP). Concentrations for total Hg, dissolved Hg, and MeHg were also high, between 5 (HgT) and 15 (Hg diss) times higher than found in the Bay. The relatively toxic gasoline additives benzene, toluene, and xylene or BTX were not detected in any of the collected samples. The highest concentrations for diesel (5,000 ug/L) and gasoline (3,000 ug/L) did not exceed LC50s for *Daphnia magna* (LC50 = 19.2 mg/L), chironomid larvae (LC50 = 238 mg/L), *Viviparus bengalensis* (LC50 = 185 mg/L), or freshwater fish (LC50 32 – 30,000 mg/L).

Key Words - *stormwater; San Francisco Bay; contaminants*

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Implementing Sustainable Green Streets and Parking Lots in San Mateo County

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Problem Statement: Roads and parking lots provide important opportunities for managing stormwater because they constitute as much as 70 percent of the total impervious cover in ultra-urban landscapes. In 2007 San Mateo Countywide Water Pollution Prevention Program (SMCWPPP) initiated the Sustainable Green Streets and Parking Lots Program to help implement stormwater treatment measures and low impact development (LID) in San Mateo County, and to particularly address the adverse impacts of transportation infrastructure on water quality and beneficial uses. Approach: SMCWPPP developed the San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook to help municipal staff identify and realize green street and parking lot opportunities, by providing visual simulations of green street opportunities, solutions to common implementation barriers and guidance on how to design, construct, and maintain successful projects. SMCWPPP has also provided a green streets training workshop, and offered grant funding to construct LID measures for two parking lot and four roadway improvement projects in the County. The green streets and parking lots program is funded with a vehicle license fee, with a long-term goal of bringing about small but widespread changes that will improve the health of San Mateo County's watersheds. Results: The Guidebook, training workshop and grant funding have led to the implementation of green street and parking lot projects, which have been constructed or are currently in the design or construction phases in San Mateo County. Conclusions: The visual simulations and design guidance in the Guidebook, training workshop, and real-world low impact development examples of green street and parking lot projects, are helping to demonstrate practical, sustainable stormwater designs that can be implemented throughout San Mateo County and beyond.

Key Words - *Stormwater runoff and innovative treatment; green streets; low impact development*

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Water Sensitive Schoolyards in San Francisco

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The San Francisco Public Utilities Commission (SFPUC) received an Administrative Civil Liability (ACL) Complaint from the San Francisco Bay Regional Water Quality Control Board for an unauthorized discharge during a significant rainstorm in the winter of 2006. The ACL included the option to develop Supplemental Environmental Projects (SEPs). In an effort to turn the incident into an opportunity to implement green infrastructure in San Francisco and educate residents about stormwater issues, the SFPUC formed a partnership with two local non-profits, the Green Schoolyard Alliance and Life Frames, Inc., and the San Francisco Unified School District to implement stormwater-related projects in five of San Francisco's public elementary schools. These projects will be multi-purpose: they will include a rainwater harvesting component, which will both manage stormwater and provide a water source for school gardens; they will remove impervious surfaces, which will minimize stormwater runoff from schoolyards, allow stormwater to percolate into the ground, and allow for planting of natives and edibles; and they will include outdoor classrooms for students, teachers, and garden coordinators. The final element funded through this effort is the creation of a San Francisco-specific, watershed-based curricula to help teachers around the district introduce students to their local watersheds. If looked at individually, the five projects appear isolated from one another. But taken together, they embody an approach that aims to retrofit San Francisco's urban watersheds site by site. These schools join a growing number of projects, both retrofits and new developments, which are using stormwater as a resource and increasing permeability city-wide. By collecting rainwater for use in the schoolyard, increasing pervious surfaces across the district, and educating part of a new generation of San Francisco watershed stewards, each small project brings San Francisco closer to becoming a water sensitive city.

Key Words - *Stormwater management, rainwater harvesting, watershed stewardship, green schoolyards, watershed education*

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The Lathrop Urban Drainage Study: Background and Study Design

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Urban development in the Sacramento- San Joaquin River Delta has converted agricultural land into urban communities. This has resulted in an increase in impervious cover, which translates to higher flows of runoff with high concentrations of contaminants flowing directly to the rivers and sloughs. The focus of this study is on Lathrop, a small community in the south delta. Because Lathrop is small, we will be able to assess current land use and water quality conditions and be able to monitor changes in this community as it continues to grow. By doing this, we will be able to use Lathrop as a model for other small communities that are growing in the delta.

Sampling will be conducted during storm events, taken along the San Joaquin and Old Rivers and in Lathrop's pumping stations. These stations pump Lathrop's stormwater from the city out to the San Joaquin River, which flows directly into the estuary. Samples along the rivers will be grab samples collected by boat; samples in the pumping stations will be collected by autosamplers. Analysis of the data will be focused on environmental and drinking water quality constituents of concern. A land use analysis will use GIS to determine the overall impervious cover of Lathrop. This study is still in its beginning stages. Sampling will start in the fall of 2009 and will continue for at least 2 years.

This study will provide a good understanding of how urban growth of cities like Lathrop affects the estuary's water quality. This information is vital to developing well informed policy decisions about water quality in the delta.

Key Words - *urban drainage; south delta; carbon loading*

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