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Geomorphic Field-based Methods for Assessing the Impacts of Hydromodification on Stream Channels

Balance Hydrologics developed geomorphic field-based methods for assessing existing impacts and predicting future impacts of hydromodification on stream channels that discharge to San Francisco Bay. The term "hydromodification" refers to changes to the natural streamflow hydrograph due to watershed disturbances and changes in land use, particularly urbanization. The increase in impervious area coverage and drainage density associated with urbanization reduces infiltration of rainfall and increases the peak rate and volume of runoff to local streams. These changes can negatively effect stream channel morphology, including causing reach-wide erosion of the streambanks and down-cutting of the channel bed, resulting in transport of significant volumes of sediment from upland areas downstream to the bay and estuary system.

Balance Hydrologics conducted sediment transport studies and geomorphic surveys in two different San Francisco Bay watersheds: 1) the Thompson Creek subwatershed of the Coyote Creek watershed, in eastern Santa Clara County; and 2) the Laurel Creek watershed in southern Solano County. The purpose of the field work was to compare sediment transport rates and channel conditions in urbanized (lower) and un-urbanized (upper) portions of the watershed.

Balance staff installed several continuous-recording stream gages along the main stem and tributary channels of the two watersheds and conducted stream reconnaissance surveys to evaluate channel stability and identify areas of active, reach-wide erosion. During water years 2003 through 2005, we measured streamflows and collected samples of suspended and bedload sediment at all stations to estimate sediment discharge rates. These data were also used to estimate the volume and size distribution of sediment entering and passing through the watersheds, to evaluate bank stability related to sediment transport findings, and to compare sediment transport findings between the two studied watersheds.

Preliminary results for the Thompson Creek subwatershed suggest that most of the sediment transported at the lower end of the subwatershed originates in urbanized areas along the main stem of Thompson Creek, rather than from the upper watershed. This finding is supported by numerous field observations of reach-wide incision and bank erosion in the urbanized reaches. There was less difference in sediment transport rates between the upper and lower watershed stations in the Laurel Creek watershed, presumably due to less urbanization and a more robust riparian corridor, which strengthens streambanks and provides greater resistance to hydromodification effects.