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Urbanization, channel modification and channel instability in Borrego Canyon Wash, Orange County, CA.

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Borrego Canyon Wash is a foothill stream ultimately flowing into Newport Bay about 50 km south of Los Angeles. In the early 1960s, a braided reach of 1.3km draining 6.7 km^2 was converted to agriculture with a constructed straight single channel. Gradient was slightly decreased by a drop structure at the lower end. This arrangement was fairly stable until the early 1990s when increased runoff from urbanization began to erode the channel. By 1997 when 23.5 % of the basin was urbanized, storm runoff from a 25yr event was calculated to have increased by about 22%, but such an estimate has many uncertainties.

Similar storms occurred in 1969 and 1997 with both 24 hr and 48 hr amounts at about the 25yr magnitude. While the 1969 storm did little damage, the drop structure and new channel were breached in 1997 with degradation of up to 7m and some channel cross sections increasing in area by about 10x. Only the presence of induration at a depth of about 2-4m in the upstream reach prevented more extreme erosion. Directly downstream is a reach of 450m where lateral erosion of old floodplain sediments caused cut bank retreat of up to 60m, 1992-2003. Together, both reaches produced about 140,000m3 of sediment, much of it coarse sand which was deposited within 2km downstream.

Increases of stream power, as calculated from the increase of discharge, do not appear to be large enough to initiate the rapid channel erosion. It may be that the increase of stream discharge was underestimated and/or the increase of water density as the result of sediment from upstream channel erosion increased steam power significantly.