Abstract

An abstract of the thesis of Julie Lynn Clark for the Master of Science in Geology presented November 5, 1999

Title: Effects of Urbanization on Streamflow in Three Basins in the Pacific Northwest

Three basins in the Puget Sound-Willamette Valley lowland area of western Washington and Oregon were analyzed to see if there were significant post-urbanization differences in storm peak flows, storm volumes, and ratios of those variables to antecedent precipitation indices spanning 15 to 120 days.

Criteria for inclusion of basins included a flow record duration of at least 50 years and minimal disruption by impoundment or diversion. Basins selected included the Tualatin River (1807 km$^2$) and Johnson Creek (68 km$^2$), both near Portland, Oregon; and the Newaukum River (397 km$^2$) near Centralia, Washington. A nonurbanized basin, the Luckiamute River (614 km$^2$) near McMinnville, Oregon, was used as a reference.

Peak flow rates higher than a 1 year recurrence interval (RI) were used. The data set for each basin was broken into early and late periods. Linear regression, F and t tests, ANOVAs, and Spearman-Conley nonparametric tests were
performed on the entire data set, and on data subsets characterized by season (November-December and January-February) and by size (RI 1-1.9 years and RI 2-10 years).

Precipitation was unchanged between the early and late periods, suggesting changes in flows were due to urbanization, not climate.

The nonurbanized Luckiamute basin showed no changes in streamflow characteristics. Even after urbanization, the Tualatin showed no changes in streamflow characteristics. The Newaukum, however, had higher peaks (21% increase), storms volumes (10% increase), and (peak/volume) to antecedent precipitation ratios (18% - 22% increases). Johnson Creek had higher ratios of peak/volume (20% increase), (peak/volume) to antecedent precipitation (32% - 48% increases), and peak to antecedent precipitation (21% - 34% increase).

The Tualatin had no streamflow changes even with a 1000% increase in population. The Newaukum basin had unexpectedly large changes in basin response, given that its population density was lower than the Tualatin basin. The Johnson Creek basin was the most urbanized and showed significant streamflow increases in almost every category measured. These results suggest that the effects of urbanization on streamflow are a function of basin scale. Streamflow response to urbanization may become increasingly attenuated as basin size increases.