

Title: Environmental Flow Modeling Challenges for Rapidly Urbanizing Watersheds

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Abstract: It is a challenge for land use planners and water resource managers to balance water needs that support urban growth and economic development of a growing population and yet maintain ecological flow needs. Urban growth and the associated water resources development in a watershed directly influence environmental flows as more water is diverted from rivers or retained behind dams for public water supplies. Converting forest land to urban areas increases the percent of impervious land surfaces in the form of rooftops, driveways, and parking lots. Increased impervious cover also causes serious hydrologic alterations (e.g., increased surface runoff, decreased infiltration and groundwater recharges) that affect the health of aquatic ecosystems. Determining environmental flows is challenging when watershed conditions are changing and when natural hydrologic regimes are altered by urbanization and the demand for municipal water supply is increasing. It is impractical to determine environmental flows as a percentage of historical stream flows when a watershed is experiencing rapid urbanization and associated demands for water. In such cases, a suitable approach is to allocate environmental flows within a watershed-wide water allocation program, which is implemented in an overall watershed planning and management strategy. A two-stage modeling approach is proposed. The first stage simulates the effect of alternative urban development and water resources development and management scenarios on water availability and water quality. The second stage allocates water to multiple users to ensure that environmental flows of sufficient quantity and quality are available to aquatic habitats and organisms.