ATTACHMENT J. DETERMINATION OF EROSION POTENTIAL

E_p is determined as follows- The *total effective work* done on the channel boundary is derived and used as a metric to predict the likelihood of channel adjustment given watershed and stream hydrologic and geomorphic variables. The index under urbanized conditions is compared to the index under pre-urban conditions expressed as a ratio (E_p). The effective work index (*W*) can be computed in a number of different ways including simplistic work equations, material specific sediment transport equations, or more complex functions based on site calibrated sediment rating curves. One such work equation, which represents the total work done on the channel boundary, includes the following~~is computed as the excess shear stress that exceeds a critical value for streambed mobility or bank material erosion integrated over time and represents the total work done on the channel boundary~~:

$$W = \sum_{i=1}^{n} \left(\tau_i - \tau_c \right)^{1.5} \cdot V \cdot \Delta t_i$$

(1)

Where: W = effective work, τ_c = critical shear stress that initiates bed mobility or erodes the weakest bank layer, τ_i = applied hydraulic shear stress, Δt = duration of flows (in hours), V= mid-channel flow velocity, and *n* = length of flow record. The effective work index for presumed stable stream channels under pre-urban conditions is compared to stable and unstable channels under current urbanized conditions.~~Where τ_c = critical shear stress that initiates bed mobility or erodes the weakest bank layer, τ_i = applied hydraulic shear stress, Δt = duration of flows (in hours), and *n* = length of flow record. The effective work index for presumed stable stream channels under pre-urban conditions is compared to stable and unstable channels under current urbanized conditions.~~ The comparison, expressed as a ratio, is defined as the Erosion Potential (Ep)[3] (McRae (1992, 1996).

$$Ep = \frac{W_{post}}{W_{pre}}$$

(2)

where:
W_{post} = work index estimated for the post-urban condition
W_{pre} = work index estimated for the pre-urban condition

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[3] MacRae, C.R. 1992. The Role of Moderate Flow Events and Bank Structure in the Determination of Channel Response to Urbanization. Resolving conflicts and uncertainty in water management: Proceedings of the 45th Annual Conference of the Canadian Water Resources Association. Shrubsole, D, ed. 1992, pg. 12.1-12.21; MacRae, C.R. 1996. Experience from Morphological Research on Canadian Streams: Is Control of the Two-Year Frequency Runoff Event the Best Basis for Stream Channel Protection. Effects of Watershed Development and Management on Aquatic Ecosystems, ASCE Engineering Foundation Conference, Snowbird, Utah, pg. 144-162.

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Alternatively, a sediment transport function such as the Brownlie equation or the Meyer-Peter and Muller equation *(US Department of Agriculture, Natural Resources Conservation Service, 2007. Part 654 Stream Restoration Design, National Engineering Handbook, August 2007)* can be used to demonstrate appropriate Hydromodification control.

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