

https://dspace.org/

Enhancement of habitat heterogeneity by placement of boulders in streams

Hamuy-Blanco, Adolfo

2014-09-03
http://hdl.handle.net/10539/15372

Downloaded from a DSpace repository. https://dspace.org/

Abstract

Flow velocity and depth are important factors for the habitat requirements of many river fauna and flora. Stream channelization in the past has often homogenized the hydraulic conditions, and therefore increased the need for river rehabilitation methods that increase the heterogeneity of local velocity and depth. A study has been carried out to investigate the influence of boulder placement in a stream on the distribution of depth-averaged local velocities.

The effects of boulder size, shape, arrangement and spacing on local velocity have been assessed by simulation using RiverFLO-2D and experiments in a laboratory flume. The dimensions of the zone of influence within which the local velocity deviates within a specified amount from the undisturbed velocity were determined for single and multiple boulder arrangements. Various shapes were analysed in a wide stream and the results suggest that sharp-edged boulders have more extensive influences than rounded ones. The zone of influence was found to be increased considerably by the placement of multiple boulders in line normal to the flow direction, especially if placed close enough to induce local critical flow. The size of the zone of influence increased exponentially for the incremental addition of a boulder in a linear arrangement.

For nonlinear arrangements, the simulations indicate which boulders are most influential in modifying the flow patterns, hence enabling optimization of the placement. The width of the channel relative to boulder size, number and lateral spacing also affected the size of the zone of influence considerably, increasing it as the channel became relatively narrower. Histograms of local velocity within zones of influence were constructed for selected boulder arrangements. These showed the variance to increase considerably when the arrangement induced critical flow locally. Placing boulders close enough to cause critical flow locally therefore enhances both the size of the zone of influence of the boulder arrangement and the variance of local velocity within it, but was found to be practically effective only within a certain range of undisturbed Froude numbers.

The velocity histograms have been related to the qualitative flow classes used in South Africa for defining environmental flows. The results are presented as guidelines for preliminary design, to indicate the number and arrangement of boulders required to create desired flow characteristics over a defined stream area.

KEYWORDS: Boulder placement, velocity distribution, habitat heterogeneity

We don't grow when things are easy; we grow when we face challenges

Joyce Meyer