Designing Log Erosion Barriers for Maximum Effectiveness: The Contour-Log-Basin Approach.

Larry J. Schmidt, Retired (Formerly with USDA Forest Service, Stream Systems Technology Center), 2904 La Cresta Circle, Minden, NV 89423, 775-267-6955, lpschmidt@gmail.com

Abstract: Controlling runoff from post wildfire storms is the key to reducing damaging erosion, sedimentation and flooding. In the interior West the use of contour trenches has proven effective if carefully designed and applied promptly. These structures detain runoff from high intensity short duration thunder storms providing for infiltration and delay in runoff. These are typically short term measures designed to be effective only for a few years while vegetation recovery occurs. Contour-Log-Basins (CLB) originated as a treatment that used essential principles for design of contour trenches developed by Reid Bailey and A.R. Croft at Intermountain Forest and Range Experiment Station in Utah. The principles governing the design of contour trenches are described in a paper by E.L. Noble presented at the 1963 Interagency Sediment Conference. CLB, by contrast, are designed to be constructed by hand crews taking advantage of available burned trees The expected runoff from the design storm in combination with feasible CLB capacity governs spacing of successive CLB courses applied from the top of the slope downward.

CLB's are designed to detain and infiltrate runoff captured in the basin behind the contour log. Sediment reaching streams requires first detachment of the soil by raindrop impact or overland flows and then transport by runoff or gravity (dry ravel) down slope to a channel. Accordingly, if flow is eliminated or reduced below the threshold needed for transport of eroded soil, then sediment and flood impacts will be substantially reduced.

CLB treatment functions by trapping, detaining and infiltrating runoff. When runoff from a design storm is detained on slope from the drainage divide to bottom of the slope unit, soil remains in place due to lack of transporting flows. One major advantage to this approach is that the basins may interdict several runoff events. By contrast once filled with sediment, log erosion barriers have completed their useful life, often in one storm. With CLB, only in treatments where the design storm runoff was exceeded would one expect to find sediment accumulated behind the CLB. Thus sediment accumulations are evidence of failure of the primary treatment either due to exceeding the design, improper design or application. In these cases, they will only function one time trapping of a small amount of sediment.

DESIGN PRINCIPLES

The following essential design principles should guide practitioners and researchers.

The CLB provides an interdependent network of basins to control runoff. Accordingly it needs to be designed and implemented from the top of the slope (ridge) down. Failure to follow this protocol risks exceeding runoff control capacity and ultimate failure of many successive structures down slope. Especially for storms that occur during construction. If unburned areas lie between the ridgeline and the burned area treatments could begin at the edge of the unburned area.

The CLB need to be implemented on the contour and in full contact with ground.

Effective CLB's require end sills and intermediate baffles to provide capacity for runoff detention and to reduce a risk of complete failure of a given contour log basin.

The CLB spacing and "brick coursing" is critical to effectiveness.

The infiltration behind the CLB in the basins can be enhanced by straw mulch to prevent soil puddling which reduces infiltration.

Recognize that the design is based on the ideal case and is unlikely to be fully achieved during implementation. The goal should be to approximate the capacity and spacing as closely as possible

Determine treatment slope spacing between contours where the spacing value is the distance in feet measured horizontally between courses of treatment contour log basins using the following formula:

Formula: $\text{Spacing in feet} = \text{Capacity}\ \frac{ft^3}{ft}\ x\ \frac{12}{\text{Rainfall in inches}}$

This prescription in terms of capacity and spacing when applied to slope units using proper construction techniques should effectively detain and infiltrate the design storm runoff

While the CLB are often effective, as in the emergency of burn rehab near Lowman, ID and near Helena, MT, there are many cases where the effectiveness has been questioned. The majority of cases where they were deemed ineffective can be explained by three factors: failures by practitioners to understand known principles, failure to implement fundamental design considerations and features, or storm which exceed the design. Success relies on proper design and implementation.

Also, understanding CLB systems design and implementation is fundamental to any effort of monitoring and evaluation. Any application of CLB should be predicated on a properly designed and implemented practice as the basis for evaluation of an effectiveness hypothesis.