Streambank Stability of Saturated Buffers

Intro

When introducing more subsurface flow along a streambank, as is done with saturated buffers, there's an added risk to the stability of the streambank. To be cautions, suitable sites are limited to areas with very stable streambanks (low probability of failure).

This study simulated hundreds of hypothetical streambanks with computer models and actual saturated buffer sites to better understand how susceptible a streambank is to sloughing if a saturated buffer was installed. Results could help increase the number of suitable saturated buffer sites throughout the Midwest.

Site & Testing

Researchers mocked up 560 streambank scenarios via computer models, to better understand factors that may cause a streambank to be or become unstable (such as soil characteristics, streambank geometry, and water seepage). These models included designs that are outside of the current NRCS Code 604 design standards as well as replicas of 5 known saturated buffer sites in Iowa so they could cross reference their simulations with the real world.

For each streambank configuration, stability was analyzed as-is (with no saturated buffer) as well as with the added hydraulics of a saturated buffer. This before and after comparison was used to see if installing a saturated buffer would have negative impacts on streambank stability. To help account for other variabilities, a safety factor of 1.3 (30% overbuilt) was used as the threshold to be considered "stable."

Results

The researchers found that the implementation of a saturated buffer to a standard riparian buffer did increase instability, but only by less than 3%. In most cases, this wasn't enough to cause a currently stable streambank to become unstable. The largest factors causing instability were buffer widths less than 6ft wide, and with non-cohesive (sandy) soils. These characteristics are already outside of the current designs and recommendations since water would move to fast through the buffer where nitrate removal would be inefficient.

Another finding was that bank height, alone, wasn't a restrictive factor in causing instability, although the overall geometry of the streambank (height, side slope, buffer width, etc.) was critical to stability. The current maximum streambank height allowed in NRCS Code 604 is 8ft.

Takeaway

Computer models are never perfect when simulating the real world, but they can be a useful tool to analyze a lot of data and scenarios in a short time. With valid assumptions and enough replications, we can play out the cause and effect of hypothetical situations to get a feel for consequences of specific actions, such as removing height restrictions for saturated buffers.

This study may not give us a complete risk assessment of a given saturated buffer, but it shows that there are many low-risk sites where this practice could be implemented that are currently considered unsuitable.

Citation:

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