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Michael S. Rolband
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Dear Mike:

I am writing regarding my professional impressions of the Snakeden Branch stream restoration project. My feedback is based on my review of the design drawings, as well as site tours prior to and during restoration construction (4 May 2007 and 17 July 2009).

My initial impressions of Snakeden Branch prior to the stream restoration was that it was highly impacted by upstream urbanization. Increases in stormwater runoff volume, rate, and frequency had obviously caused extensive channel downcutting to bedrock. This channel downcutting likely lowered the local groundwater table, impacting riparian habitat. Since the channel had reached a more resistant bedrock layer, it is likely the channel would have widened in the future, despite the mature riparian forest adjacent to the channel. This would have resulted in undercutting and toppling of these trees and continued channel erosion. This sequence of channel degradation is commonly observed in urbanized areas, due to the increase in paved areas and the associated stormwater management systems. While stream channels will eventually adjust to such dramatic changes in watershed hydrology, the process typically takes decades to centuries to complete.

The underlying goals of stream restoration are to balance sediment and energy within the channel, considering constraints such as buildings and transportation infrastructure. In urban stream systems, these considerations require providing a channel bed that will not erode and maximizing energy dissipation while utilizing as many natural materials as possible.

While I have not reviewed your design calculations in detail, I have developed an understanding of your design approach based on the construction drawings and our conversations regarding the project. Unlike many stream restoration designs, which would have consisted primarily of reconstructing the channel at the degraded streambed elevation, your design approach was to construct a “threshold” channel at the historic streambed elevation by rebuilding the channel with a gravel mixture. I believe this approach will provide the most ecological benefits to the stream for multiple reasons. Given that the watershed hydrology is permanently altered and that the stream cannot migrate extensively without jeopardizing urban infrastructure (bridges, roads, etc.), a threshold channel bed that will not erode is the only practical design option. While the channel bed elevations will likely change little, the gravel mixture placed in the channel bed will allow better hyporheic exchange between local groundwater and the stream. This exchange will encourage the development of a healthy biological community within the stream and will improve water quality. Additionally, by raising the stream channel, the water table elevations in the adjacent floodplain will also increase, enhancing wetlands and further improving water quality. My observations on our site visit in July confirm that this increase in groundwater elevations is occurring. I was particularly impressed during our site visit that natural stream processes were already occurring. I observed the development of stable vertical and undercut banks, which provide wonderful habitat. I also observed extensive sediment sorting and alternating bar development. By providing the stream a base sediment layer with a range of sediment sizes, you have given the stream the "blocks" to rebuild itself.

Typical methods for dissipating hydraulic energy are to increase boundary roughness (dense vegetation), increase the channel wetted perimeter by providing the stream ready access to the floodplain, decrease channels slope by increasing channel meandering, and utilize step-pool structures to safely reduce the streambed elevation. Your restoration design utilizes all of these approaches. I was impressed by the amount of vegetation growth that had occurred during the past two years. This dense vegetation will greatly increase channel stability and will enhance aquatic habitat. While my personal preference is to minimize the number of "hard" structures in stream restoration designs, given the steep valley slopes, the high hydraulic energy of the stream system, and the desire to minimize the removal of mature riparian trees, I believe your extensive use of step-pool structures is appropriate. I am hopeful this project will provide the stream engineering community with much needed design guidance for these types of structures. As we have discussed, my colleagues and I at Virginia Tech are currently seeking funding from the National Science Foundation to develop a full scale stream laboratory to improve our theoretical understanding of stream structures and stream restoration techniques. Unfortunately, stream restoration science has not yet been able to keep pace with stream restoration practice.

In conclusion, based on my observations of the construction drawings and the site itself, I believe your design techniques are not only sound, but cutting-edge. I intend to use your design as an example in the graduate-level stream restoration design course Dr. Hession and I will teach next spring semester. Good luck with the rest of the project.

Sincerely,

Tess Wy

Tess Wynn, PhD
Assistant Professor