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REPLY TO DISCUSSION[1]

by David L. Rosgen[2]

"Creating False Images: Stream Restoration in an Urban Setting"[3]

Kristan Cockerill and William P. Anderson, Jr.[4]

Catalyzing a discussion on stream restoration was one of our goals in writing this paper, and therefore we thank Mr. Rosgen for his attention to our work. We want to be clear that our paper was not intended as a critique of specific restoration methods or their implementation. It is not the specific placements of boulders, root wads, or pools that concerned us, but rather the broader concept that the very idea of ecological restoration/rehabilitation/remediation is problematic, especially in an urban setting.

While Mr. Rosgen recognizes that our primary point is based on the premise of false advertising for what a project might accomplish, his use of the phrase "what it should be" in reference to the restored stream, is where we differ. Attempts to understand what a stream has been, could be, or should be are complex scientific and social endeavors. Determining what constitutes a "reference" stream is a challenge in most settings (see Dufour and Piegay, 2009), and it is especially difficult in mountainous landscapes. Moderate- to high-gradient streams have short times of concentration under natural conditions, let alone with high levels of urbanization. The urbanized stream channel is responding to this new norm and the morphology of the urban stream reflects this new dynamic. An attempt to return this urbanized stream to conditions observed in a similar non-urbanized stream, while a noble undertaking, is futile: the urban stream can only react to its new reality.

Based on a growing body of literature, including our case study, we argue that, while there are always measures that can be taken to potentially improve ecological conditions on an urban stream, the reality is that these projects often encounter physical and social constraints. In fact, the contractor who completed the work shown in Figure 3b absolutely

agrees that this design is not optimal if the goal is to improve ecological conditions, but it was the best option given landowner unwillingness to eliminate a parking lot and a building at that site. As we articulate in the paper, protecting the built environment does have benefits and is appropriate in an urban setting. Our concern rests with calling these efforts ecological, with the implication that they *can* replicate the ecology in a non-urban (reference) setting.

Additionally, no specific "on-stream" measures address the source of much degradation, which is continued development throughout the watershed. This is why promoting the on-stream efforts as ecological is so troubling because it denies the interconnections between behavior throughout the watershed and the subsequent impacts on the stream. Even if project design did introduce more shade on the creek, high temperature runoff from roads and roofs would still enter the creek. No change to the channel structure is going to reduce the amount of salt entering the stream in the winter. We suggest that being explicit about these relationships is necessary.

Thus, what we are advocating in our original paper is the need to take a larger scale, holistic, basin-wide view of stream "restoration." Current practices highlight small-scale, channel-focused projects that seek to restore a stream, which is now subject to completely different basin characteristics than those in which it formed and evolved. The question of "what it should be," then, involves a comprehensive examination of water management at the basin scale. What should the basin look like? In our Boone Creek example, increases in on-site storm water storage, perhaps through rain gardens or properly shaded retention ponds, may reduce the number and magnitude of temperature surge events and would eliminate at least some of the flashiness, which may increase flow by two orders of magnitude within 15 min.

Unfortunately, the type of restoration that we describe in our paper continues downstream of Boone Creek. A large project to eliminate erosion along a meandering section of the South Fork New River, to which Boone Creek is a tributary, is scheduled for construction in 2014. The South Fork is responding to increased runoff from the urban areas upstream and contains cut banks. Once the restoration is complete, we expect the stream to return to its eroding nature, as streams that are provided with excess runoff are wont to do. The cycle continues.

Finally, thoroughly assessing the actual communication efforts relevant to the case study we presented was beyond the scope of our project. We agree that improving communication between researchers and practitioners would be beneficial. This disconnect, however, is not unique to stream restoration and others have documented this phenomena and provided suggestions for improvement (in addition to the references cited in our paper, see Carbone and Dow, 2005; Rayner *et al.*, 2005). We too would welcome funded projects that better integrate research and practice to improve stream conditions, with more attention to scientific and social concerns and constraints in a basin-wide context.

LITERATURE CITED

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NOTES

[1]Reply No. JAWRA-14-0135-Y of the *Journal of the American Water Resources Association* (JAWRA). DOI: 10.1111/jawr.12241.

[2]Discussion No. JAWRA-14-0125-D of the *Journal of the American Water Resources Association* (JAWRA). DOI: 10.1111/jawr.12242.

[3]Paper No. JAWRA-12-0269-P of the *Journal of the American Water Resources Association* (JAWRA) 50(2):468-482.

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