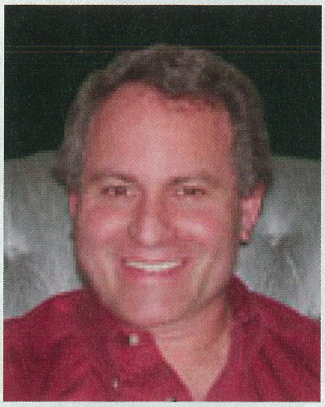
Measuring Impact



By Steven Trinkaus

Is zero-discharge storm water design feasible with LID?

Some municipalities have begun to look at storm water management requirements that mandate no increase in runoff volume for all storm events up to and including the 100-year event as a way to minimize flood issues, particularly by using low impact development (LID) strategies. There are some important questions that must be considered in this approach: Can it be achieved? Can it be done without causing unintended consequences? Should this approach be taken for all projects? Are there benefits to this approach? Each question will be explored in this article.

Native soils can have a limited capacity to infiltrate rainfall; this capacity is affected by soil type, slope, land cover and depth of groundwater. Deep, well-drained sand and gravel located on a flat to slight slope with a deep groundwater level will have significant capacity to infiltrate rainfall, while a shallow, moderately well-drained soil with a shallow perched groundwater level (less than 24 in. below ground surface) on a moderate slope (greater than 6%) will have a limited capacity to infiltrate rainfall. If the soil has the capacity to infiltrate large volumes of rainfall, will the increased infiltration cause potential issues in the soil, such as oversaturation or raising the seasonal high groundwater level? The short answer is yes to both, but the more important question is: Will either of these conditions cause a problem on the site or on adjacent properties? If the site is relatively flat, with well-drained soils, there should be no issue. If the site has moderate to steep slopes and infiltration will occur in the area above the slope, then saturation of the soils on the slope will increase the potential for slope failure and should be avoided.

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LID systems such as bioretention and permeable pavement systems have been shown to be able to infiltrate large amounts of rainfall, so it is feasible to use them in this approach. It is imperative to design them in such a way that provides sufficient storage volume to achieve the larger volume reduction while providing a factor of safety. For bioretention systems, the surface area is increased to provide an increased surface storage volume; for permeable pavement systems, a reservoir storage layer can be provided—and both systems should be modeled using a percentage of the observed infiltration rate to provide factors of safety.

As with any approach to storm water management, applicability is key for the particular site conditions. A one-size volumetric approach that does not recognize the variability of natural site conditions will likely be problematic, but a performance-based approach to be applied where site conditions are favorable would be appropriate.

One of the most obvious benefits of a zero-discharge site using LID systems is the elimination of a surface water discharge, which otherwise would contribute to downstream flooding. Other benefits include the filtering of runoff where pollutant loads are reduced, recharge of shallow groundwater levels—which provide base flow to small streams during dry times—and the elimination of components of structural drainage systems. SWS

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