Water WoRDs

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Green Infrastructure and Water Quality

In our June 2013 Water WoRDs, the Water Resources Division (WRD) described the general concept of green infrastructure. This week's post delves further into one particular function of green infrastructure – runoff volume control. The end of the article includes a promotion for an upcoming DEQ conference to further advance our knowledge of green infrastructure.

The water quality benefits of runoff volume control are many. By controlling volume, stream channels are protected from erosion and scour, which in turn, protects property, supports healthy fish and wildlife habitat, and reduces water pollution. Before we dive into the details on controlling runoff volume, here is a bit of a primer on rivers and streams.

Streams are generally shaped by water movement. Water scours soil from the streambed and banks, especially when the water is high and streambanks are not well vegetated. Changes in flow conditions (e.g., increased flow caused by land use changes) lead to unstable streams, which experience more rapid than normal changes in the shape and character of the stream. Unstable streams commonly experience rapid flow increases following storms and very low flows during drought. Excessive streambank erosion follows.

By comparison, stable streams tend to have moderate flow fluctuations, stable well-vegetated banks, and they often have good water quality.

Examples of stable (left) and unstable (right) streams

Impervious surfaces like rooftops, roads, and parking lots lead to unstable streams because they contribute increased runoff volume to the stream. Storing the extra runoff is most

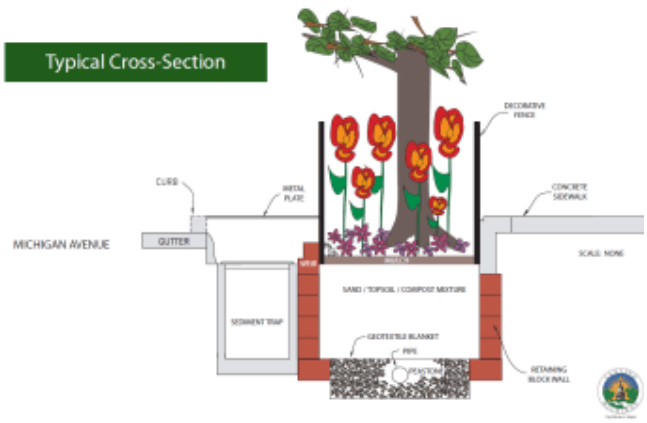
commonly done in detention ponds that are built as part of the storm sewer system. Unfortunately, these ponds are not well designed to protect streams from becoming increasingly unstable.

Detention ponds reduce flooding by reducing the rate (not volume) that storm water enters rivers and streams. Storm water runoff flowing onto the surface of a water-filled detention pond behaves very much like it does when if falls on an impervious surface. Most detention ponds are not designed to get rid of water volume, except through the discharge pipe. Any volume loss from infiltration along the bank or through evaporation is a small percentage of the water coming in the inlet and back out the discharge pipe.

Unlike detention ponds, green infrastructure (aka Low Impact Development) helps to keep excess water volume on-site, near to where it fell as rain or snow. Green infrastructure methods can be designed to control both rate and volume, and better match the conditions existing before land development. This gives streams a better chance to remain stable. Stable streams lead to better water quality because of less streambed and bank scour. Reduced volume also carries less of a pollutant load off the land, which improves water quality.

The most common green infrastructure methods include plants and soils to absorb and infiltrate water, keeping it out of the storm sewer system; cisterns, rain barrels, and green roofs, that store water for beneficial uses on-site; and porous pavements that pass water through to underlying soil instead of directing it to storm sewers. Properly planned, designed, and maintained green infrastructure can control water volume enough to protect stream channels, reduce combined sewer overflows, reduce pollutant loading to surface waters, and also help reduce flooding.

The Michigan Avenue rain gardens in Lansing are a good example of how plants and soils can reduce the runoff water volume from an impervious surface like Michigan Avenue. These rain gardens are essentially concrete-lined pits filled with about 3 feet of soil, and planted with native vegetation. The pits are underdrained by a perforated pipe that collects the water after it percolates through the soil. The gardens take in runoff and discharge it again, roughly like a detention pond does, but the soils and plants help to reduce runoff volume and peak flow rate by an average of 23 percent and 50 percent respectively, for 90 percent of storms.



Cross Sectional drawing (above) and photo (right) of Michigan Avenue Rain Gardens

In an effort to promote green infrastructure and low impact development, the DEQ is hosting the Michigan Green Infrastructure Conference in Lansing on May 8th and 9th. More information about the conference is available online at www.michigan.gov/deqworkshops, click on "DEQ Workshops."