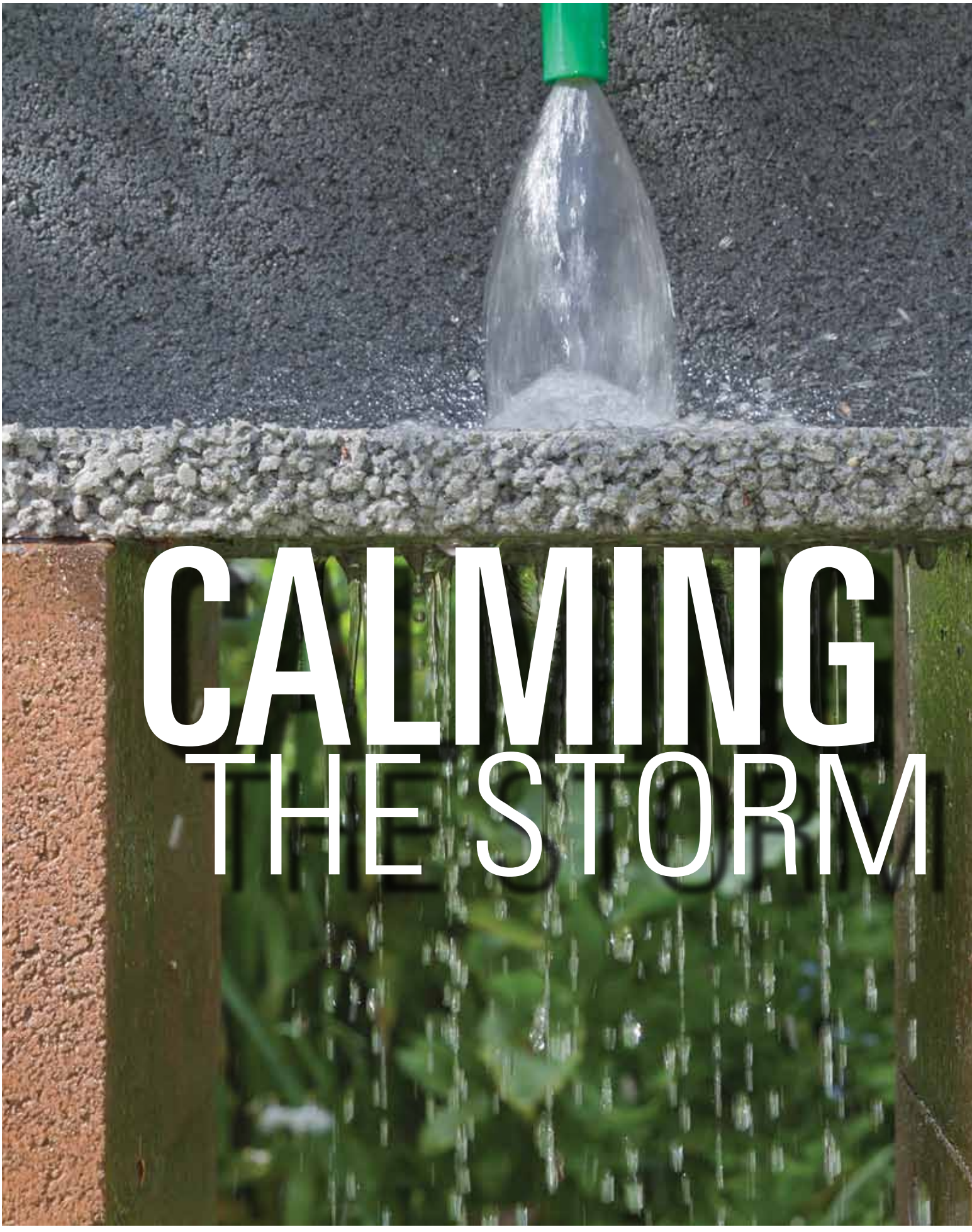

CALMING THE STORM

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Managing stormwater runoff the green way makes sense for both the environment and the bottom line.

By Seth Brown

Parking professionals view a highly-used and busy parking lot as an amenity that generates income and adds value to the property being served. Stormwater professionals, in contrast, look at the same parking lot or facility and see a source of increased water pollution, high rates of stormwater runoff, and potential negative effects on downstream aquatic systems. However, the skies are not so gloomy here. New technologies and approaches to manage stormwater runoff generated from parking areas may be able to address excessive runoff more cost-effectively than traditional approaches, and provide many other benefits beyond water quality. In some cases, these new approaches may actually be able to put money in your pocket as well.

The Storm is Coming

The amount of impervious cover in the U.S. is equal to about the same area as the state of Ohio. Impermeable pavement associated with parking and roadway surfaces comprises up to 70 percent of the total paved area in an ultra-urban setting. That means the area between Toledo, Columbus, and Cincinnati approximates the total amount of parking and transportation surface in the U.S. The effects of these surfaces—increased urban heat and water quality troubles downstream—has become more evident in recent years. Why that is and what we can do about it are the focuses of stormwater managers across the country.

Initially, correcting water quality problems targeted "point source pollution," which includes discharges from factories and wastewater treatment plants. Put another way, point source equals pipe. At the time, these pollution sources were most closely tied to the nation's water quality woes. The most notable example is the Cuyahoga River in Cincinnati catching fire in 1969.

The good news: current regulations and tactics have successfully addressed these pollutant sources. The bad news: in many parts of the country, water quality has continued to degrade. It is clear that pollutant sources beyond industrial discharge and wastewater effluent are adversely affecting our waters.

Recently, the National Academies of Science's National Research Council (NRC) looked into this matter, specifically studying the Environmental Protection Agency's (EPA's) stormwater program. The NRC report, released in 2009, concluded that attempts to control and treat stormwater in urban areas have been ineffective, and that changes are needed to adequately address this growing source of water quality impairment. The same study states, "roads and parking lots can be the most significant type of land cover with respect to stormwater."

Paving Paradise

Parking and roadway surfaces play a significant role in how stormwater runoff affects our environment. These surfaces often collect polycyclic aromatic hydrocarbons (PAHs) associated with petroleum products, bacterial

contamination, and metals associated with brake pad wear, among other pollutants. These pollutants wash off the surface during rainfall and flow into downstream waters without the chance to infiltrate into the ground as would happen under natural conditions.

In some cases, the pavement itself is the dominant pollutant. Coal tar pavement sealants used to resurface parking lots have been linked to elevated levels of PAHs in air and water near parking lots. A recent study by the United States Geological Survey (USGS) found the concentrations of carcinogenic PAHs in house dust in residences adjacent to coal-tar sealed parking lots were 14 times higher than in dust from homes adjacent to unsealed parking lots. Similarly, PAHs associated with coal-tar sealants constituted one-half of all PAHs in urban lakes, according to a study that sampled the sediment from 40 lakes from Anchorage to Orlando. Coal-tar sealants are now banned in the state of Washington, which is not a striking action considering that they are used primarily east of the Continental Divide. However, more recent bans on the use of coal-tar sealants have been enacted in the south, the midwest, and the east coast in areas such as Washington, D.C., and several communities in Minnesota, Wisconsin, Texas, and New York.

The parking industry can play a strong role in helping communities meet stormwater management requirements while providing additional benefits to the community and the environment.

The increased volume and flow of stormwater also dramatically affects downstream conditions. On an undeveloped site with normal soil and vegetation, only between five and 10 percent of the rainfall that hits the ground will run off the surface; the remaining 90 to 95 percent is intercepted by vegetation or soaks into the ground. But if this site were covered by an impervious surface such as a parking lot, the amount of runoff increases by a factor of five to 10—possibly more—because less water soaks in. The result of this redistribution is less groundwater, which provides streams with "base flow" (the flow in streams not associated with rain events). Reductions in base flow greatly affect the quality of stream ecosystems. Another result of redistribution is a huge increase in the amount and rate of rainfall entering drainage infrastructure or receiving waters, which leads to aggressive channel erosion and significant effects on downstream properties and infrastructure.

Rules of the Road

Urban stormwater management was first regulated in 1990 under the National Pollutant Discharge Elimination System (NPDES) and the universe of regulated communities increased in 2003. EPA is currently working to develop a national performance standard—the first of its kind—that could affect every square inch of the country for development sites larger than a certain size (one acre is the most likely threshold). Also, many urban areas will likely be required to develop stormwater retrofit plans, which describe actions taken to mitigate the ongoing effects of existing and anticipated amounts of impervious cover on water quality. While these changes are sweeping, the urban retrofit component may be the most contentious element of the anticipated regulation update, as it is expected to be costly. This will likely affect the parking industry directly, and efforts to find cost-effective solutions using market-based approaches may prove fruitful for those in the parking industry.

The EPA has suggested that this new standard will be a departure from previous plans to manage stormwater. Early approaches focused on conveying runoff quickly and efficiently into ponds or basins, which would treat the water. These ponds, which remain dry or very shallow until storms come, often provided flood control and storage to reduce downstream flooding effects, too. The use of ponds as the sole practice to mitigate the effects of impervious cover in this era—which continues today in many areas—has resulted in a huge number of these facilities bordering parking lots and roadways. While ponds, basins, and other traditional stormwater infrastructure have helped, streams in urban areas still are severely eroded, intersections are chronically flooded, and lakes still have reduced biotic integrity.

Shifting Gears

The new approach to stormwater management, as spelled out by the NRC study and implemented by some forward-thinking communities, is to slow down the water and capture runoff on-site through infiltration or "harvesting" of rainwater. Instead of pooling water as in a pond system, this approach lets the rain soak in as quickly as possible after it lands. The performance standard to be associated with EPA's proposed rulemaking is expected to include a requirement to retain a certain percentage of all flows experienced on a site.

An example of an on-site retention requirement is spelled out in Washington, D.C.'s new stormwater permit program, which requires the retention of 1.2 inches on-site. This amount of capture is equivalent to the 90th percentile rainfall amount, which is the volume of precipitation delivered by nine out of 10 storms in any given year.

Practices used to provide this on-site capture are often referred to as "green infrastructure" or "low-impact development." Bioretention, vegetated swales, permeable pavement, green roofs, and rainwater harvesting systems are a few examples. While the specific function of each practice varies, the common property among these measures is that they have a generally small footprint, use vegetation and filter media/soil to treat water, and retain water on-site through infiltration or storage.

Another difference between traditional management and low-impact development or green infrastructure is how it is applied on the landscape. Traditionally, inlets, pipes, and curb-and-gutter systems capture and convey water downstream to a single large facility. The

new approach is to reduce the need for "grey" drainage infrastructure (inlets and pipes) and instead rely on a series of green infrastructure practices that work systematically to slow water and treat it through filtration and infiltration.

A parking facility may be able to reduce overall runoff volume by using permeable pavement for overflow parking areas (which are used less frequently) and capture a majority of the surface runoff by removing curb-and-gutter to allow sheet flow into water quality swales that lead to a series of bioretention facilities. When applied correctly, these smaller and more distributed measures can offset the need for large detention ponds and provide many benefits that go beyond water quality and quantity control. These benefits include reduced urban heat island effects, improved air quality, energy savings, aesthetic enhancements, and increases in property values. Philadelphia's plan to spend $1 billion on green infrastructure over the next 20 years was shown to return benefits 20 times greater than the traditional approach to managing runoff.

There's More

Many assume the green approach is always the more expensive option. More and more evidence is surfacing that this assumption does not apply to green infrastructure in most circumstances.

Two examples from the University of New Hampshire's Stormwater Center, as reported in *Banking on Green*, a report on green infrastructure economics, highlight the savings potential. "Boulder Hills, a residential development in New Hampshire, reduced its construction costs by 6 percent while generating additional resident lots within the same development project while establishing a 'zero discharge' site through low impact development techniques and green infrastructure practices. Greenland Meadows, a commercial 'big box' site, reduced construction costs by nearly $1 million, which translates to 10 percent of total construction costs, by using pervious asphalt, which limited the amount of drainage inlets and pipes, and a constructed wetland, which provided enhanced stormwater management over conventional treatment techniques," it said.

Beyond cost savings, using infiltration-based practices may actually pay you in the future. The District of Columbia Department of the Environment (DDOE) is proposing a new regulatory framework that targets runoff volume—the parameter that is at the heart of urban stormwater pollution.

Under this framework, regulated sites must capture a minimum of 50 percent of the required stormwater runoff volume on site. Beyond this threshold, sites will have the option to use off-site retention, which can be in the form of Stormwater Retention Credits (SRCs), purchased from the private market, or in-lieu fee, paid to DDOE.

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The basis of this market approach is that a majority of future land development within D.C. will be in the form of high-rise buildings in the downtown urban core district. Controlling runoff onsite in these areas will rely on relatively costly practices, such as green roofs and rainwater harvesting systems. Areas outside the urban core, however, are likely to be able to provide the requisite stormwater treatment for a significantly lower cost. The practices expected in the outlying areas include bioretention facilities and water quality swales that can be applied to areas such as large parking lots.

Following this framework, owners of parking lots will be able to generate SRCs that can be sold on the market, thus generating revenue. Also, DDOE allows for a reduction in stormwater fees for up to 55 percent when using these practices on-site, which is an additional benefit to parking lot owners. This market is proposed to start sometime in 2013, and if successful, may be a template for others cities to meet their stormwater requirements in a cost-effective manner.

An Evolving Landscape

The EPA projects that between 800,000 and 1 million acres of land will be developed annually over the next 30 years to meet demands for housing, transportation, and industrial activities. This development will affect water quality and is driving the need for aggressive change in how stormwater is managed and treated. The parking industry can play a strong role in helping communities meet stormwater management requirements while providing additional benefits to the community and the environment. And if some new and innovative market-based programs prove to be successful, the parking industry may find even more reasons to start integrating more green infrastructure on its sites.

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