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Urban Streams

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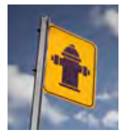

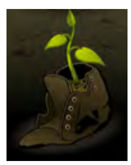

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A solar powered filatration system installed for research on Beargrass Creek in Louisville, Kentucky.

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Illicit Discharges of Pollution to Our Water Resources

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Center for Watershed Protection, Inc.

Illicit Discharges are a pervasive, silent pollution source that threatens both water resources and human health. These discharges are present in communities throughout the nation, and can severely impact water quality. This article provides an overview of both the impacts and prevention of illicit discharges, including a definition and brief background, summary of water quality impacts, a description of current regulations in most communities, and some promising new trends to better manage this pollution source.

What are Illicit Discharges?

Illicit discharges are defined in the Clean Water Act as "Any discharge to the municipal separate storm sewer system that is not composed entirely of storm water..." (Note that these discharges are only important in communities where the sewer and storm drain systems are separate. Combined Sewers, which exist in some cities, send both stormwater runoff and wastewater to the wastewater treatment plant. These system have a whole different set of problems, because sewage overflows during large storm events. These are called Combined Sewer Overflows.) 40 CFR 122.26(b)(2) (1999). There are some exceptions, such as firefighting activities and a few other small discharges, but these regulations essentially say that stormwater runoff (or rainfall that runs off the ground's surface) is the only substance that is legally permitted to enter storm drains or water bodies without being treated.

Typically, illicit discharges include sewage or industrial chemicals, which should be transported by sanitary sewer pipes and treated at a wastewater treatment plant. Since these discharges can originate from so many different potential sources, and there are different solutions to dealing with each one, it is helpful to divide them into different groups. A national guidance manual on detection and elimination of illicit discharges (Brown et al., 2004) divided these discharges into categories based on the *Frequency of the Discharge* and the *Chemical Characteristics of the Discharge*, and also considered the *Mode of Entry* (i.e., how the discharge gets into the stream or storm drain). Each of these groupings is described in detail below.

Discharge Frequency (How Often the Discharge Happens)

The frequency tells us how often a discharge is flowing, and they can be "continuous", "intermittent" or "transitory." Continuous discharges flow all the time, and may include sources such as a leaking sewer line. Continuous discharges typically contribute the most pollution, and are also the easiest to find, since they are always present. Many illicit discharges can be classified as intermittent. As the name implies, these discharges come and go, typically within a day rather than over the course of a year. One example might be wash-down from a business that occurs at the end of a work day or shift, or a house cross-connection that flows only in the morning and evening. Intermittent discharges are more difficult to find than continuous discharges since they only flow sometimes, and can be missed by regular monitoring. They can also be a significant source of pollution, since they can go on for many years undetected. Finally, transitory discharges, such as chemical spills, occur very infrequently. These discharges are usually obvious and large, and need to be handled differently than other discharges.

How do these discharges get into our streams, rivers, lakes and estuaries?

Illicit discharges can originate from an individual property or person, or from a community's sewage pipe infrastructure. And while some discharges are intentional, a majority occur either due to an error, or ongoing maintenance needs. Some typical causes include:

1. Aging or Poorly Maintained Wastewater Infrastructure: The condition of wastewater infrastructure in the United States is a crisis. The American Society of Engineers rated the nation's wastewater infrastructure a D on its "2013 Report Card for America's Infrastructure" (ASCE, 2013). According to this report, most of the United States' wastewater mains were installed shortly after World War II, and are nearing the end of their useful life. Further, it estimates that between 80% an 85% of the total investment needed to update our wastewater infrastructure is needed to repair and upgrade theses pipes, with a much smaller fraction needed to upgrade sewage treatment plants.

   One result of this aging pipe system is cracked or leaking sewage pipes that discharge sanitary wastewater either to the storm drains system (Figure 1), or directly to a waterway. In fact, sewers are designed with some leakage (called exfiltration), and this can increase over time leading to persistent leaky sewers in older systems. In addition, sewers need routine maintenance to prevent backups caused by tree roots or grease build-up. Without this upkeep, sewer pipes back up and can overflow, leading to another source of illicit discharges.

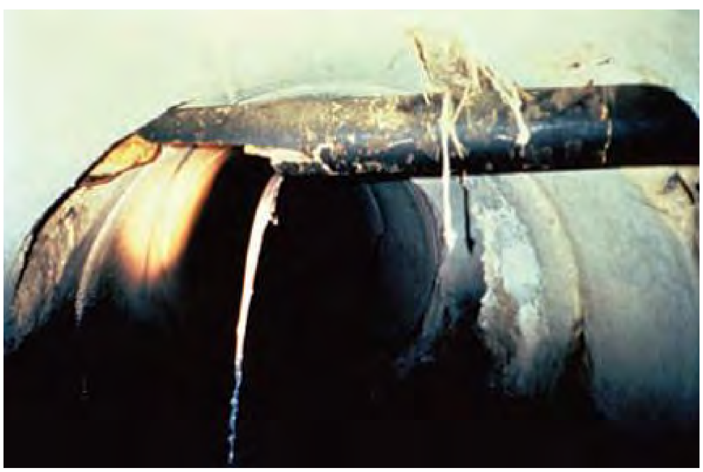

Figure 1.

2. Cross Connections: On occasion, pipes that carry sewage, wash water or industrial wastes can mistakenly be connected to the storm drain system instead of the sanitary sewer. This can happen within a building during a renovation, so that either a floor drain or even a washing machine is connected to the storm drain in error. On occasion, though, cross connections can occur during new construction so that an entire building or home is cross connected. Finally, the cross connections can occur within the pipe network, so that a sewer line serving several properties is untreated. This typically happens during major public works projects such as sewer repairs or upgrades, or separation of combined sewers.

3. Poor Housekeeping: Some discharges never make it to a sewer pipe, but are caused by ongoing human actions. Some examples from businesses include hosing down polluted areas or mishandling chemicals. These discharges can also happen on private homes, such as by washing cars directly next to a storm drain.

4. Spills or Dumping: These discharges typically occur only once, and are either the result of a mistake, such as spills occurring during a vehicle or construction accident, or the result of deliberate dumping.

Chemical Characteristics

Depending on the source, the chemical characteristics of illicit discharges can be very different. Some researchers (Pitt, 2004) have made efforts to create a "chemical fingerprint" library that would allow a community to trace a discharge to its source based on the chemicals found in the discharge, as well as other characteristics such as the odor or color. Although these characteristics can be helpful, most communities use a few key parameters to distinguish between wastewater (i.e., human sanitary sewer) sources versus washwater (e.g., industrial wastes or laundry; See Figure 2 for an example).

Water Quality Impacts

Even though the flow from illicit discharges is small compared to the volume of stormwater runoff, illicit discharges have very high pollutant loads because they flow for a much longer period of time than runoff events (sometimes all day for a period of years), and their pollutant concentrations are much higher than those in stormwater runoff. The transitory discharges, which are rare events, may not represent a huge portion of the total pollution delivered to a waterway, but they can create serious problems in a localized area, such as fish kills due to high toxicity or rapid oxygen depletion. In addition, since illicit discharges flow during both wet and dry weather, they can be a serious problem if chronic pollution is an issue. For example, some beach closures only occur during days when bacteria levels are too high, and often this happens only during rainfall events. In these waters, illicit discharges can elevate the amount of bacteria in streams so that they are not safe to swim in even during dry weather.

Some studies have also found that illicit discharges of sewage are a significant contributor of pollutant loads in some water bodies, and that removing these discharges is a very cost-effective strategy. For example, a recent study of Baltimore streams (Kaushal et al., 2011) found that approximately 13.5% of the nitrogen load in Baltimore streams is from sewage sources. Another study completed by the Center for Watershed Protection focused on Western Run, a stream in the City of Baltimore that needs to reduce bacteria to meet water quality standards. This study found that removing illicit discharges identified during a field study of this watershed would get the City half way there to meeting these standards (Lily et al., 2012). An analysis

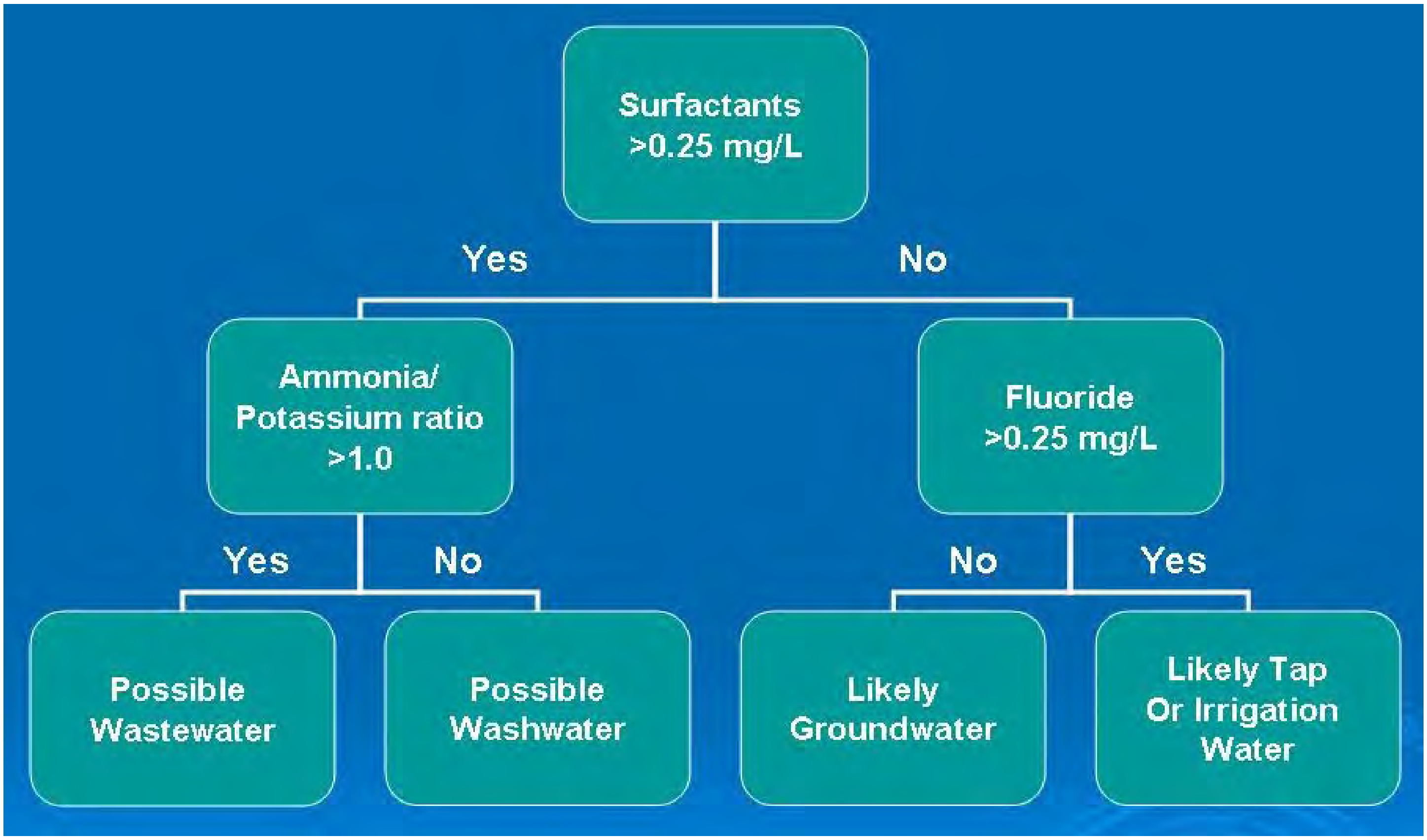

Figure 2.

of data collected from Sligo Creek, a suburban watershed in Montgomery County, Maryland compared the cost of removing the nitrogen and phosphorus in illicit discharges identified during field work, versus removing the same amount of pollution (nitrogen and phosphorus) using other practices. It was estimated that removing illicit discharges is between five and fifty times more cost-effective than removing the same amount of pollution using stormwater practices (Figure 3).

Regulations and Programs to Detect and Remove Illicit Discharges

Almost all communities have some law on the books that outlaws discharging sewage or "putrescence" to the stream. These laws are typically part of the Health Code or Sanitary Code, and some states have other overarching regulations. In addition, if a community has either a large population, or is within a Census Urbanized Area, it is subject to additional regulations under the Clean Water Act's National Pollutant Discharge Elimination System (NPDES) regulations for Municipal Separate Storm Sewer Systems (MS4s). Under these regulations, the community (or "MS4 Operator") is required to have an Illicit Discharge Detection and Elimination (IDDE) program that includes: 1) A map of all storm drain outfalls to the stream system 2) A legal prohibition of illicit discharges and enforcement authority 3) A plan for identifying and addressing the discharges; and 4) Public education and outreach.

The first and third elements of the NPDES regulations, the mapping and planning components, focus on the "storm drain outfall" (i.e., the location where stormwater pipes discharge to a surface water body) as an important management unit for tracking down illicit discharges. Most communities that are regulated by an NPDES MS4 Permit have a regular outfall screening procedure. Outfall screening typically includes a visual assessment of each outfall during dry weather conditions, at a rate sufficient to visit all outfalls over a 5-year permit cycle. In addition, communities track down discharges in response to odor or other citizen complaints.

While this combination of local, state and federal regulations starts to address the issue of illicit discharges, it is by no means a guarantee that the discharges will be detected or eliminated. For example, while federal and state regulations require that communities screen their outfalls, typically there is no requirement that chemical monitoring is used, which parameters are needed, or what size outfalls need to be screened. As a result, many communities do not find persistent discharges that may not be detectable without a tailored outfall screening program. In Sligo Creek in Montgomery County, MD, for example, the community had a comprehensive stream assessment program, with professional staff walking streams on a regular basis, but many discharges were missed simply because chemical monitoring for illicit discharges was not used in concert with this visual stream assessment. In addition, their intermittent nature

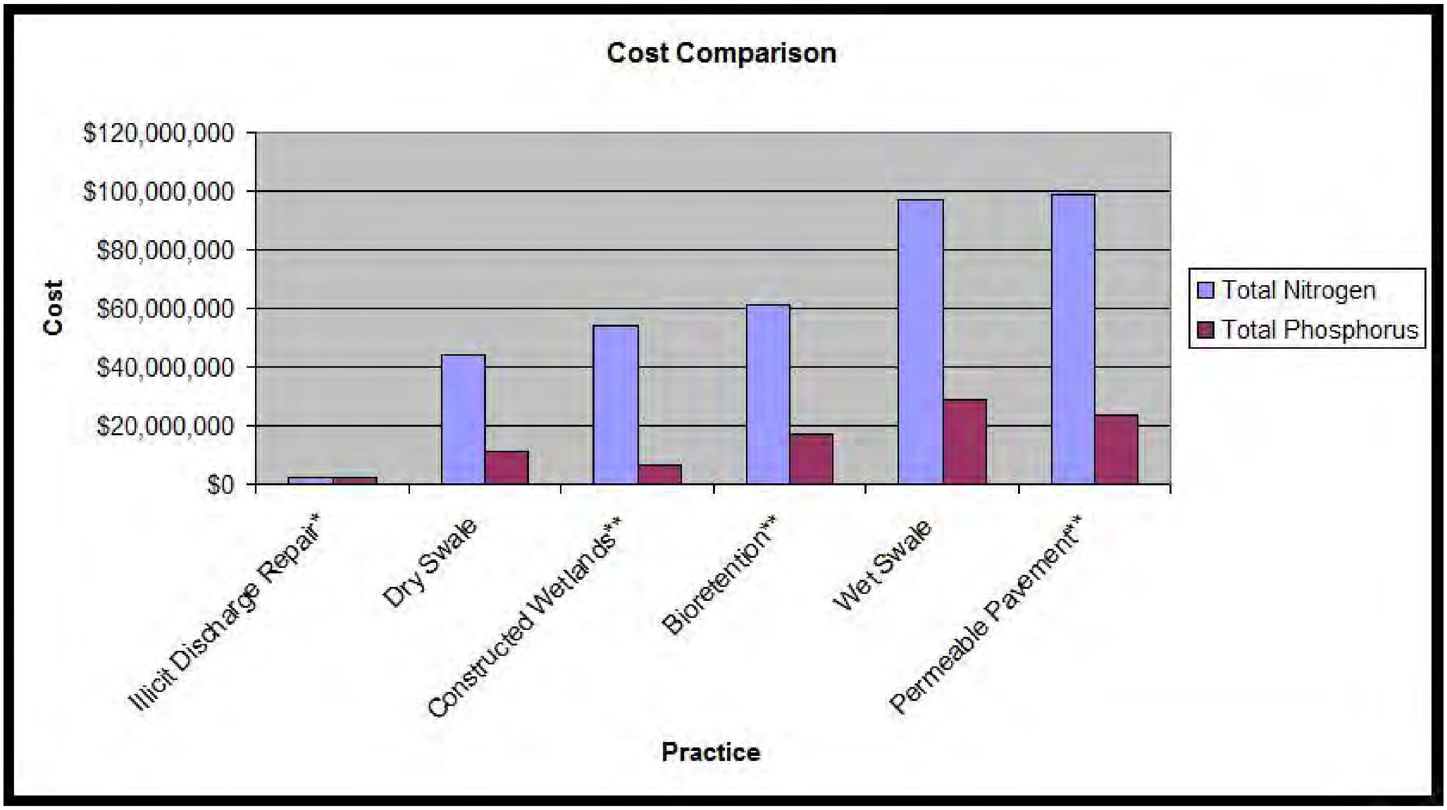

Figure 3.

makes them difficult to identify even if chemical monitoring is used to track them.

Promising Approaches

Although illicit discharges remain a problem, some new approaches and policies show promise to more effectively find and remove illicit discharges. These include innovative technologies, crediting approaches at the federal level, and cooperative approaches at the local level.

Innovative Technologies

Techniques for detecting and tracking down illicit discharges have improved in the last few years, making detection faster and more cost-effective. These changes range from testing more cost-effective chemical analysis methodologies (e.g., Irvine et al., 2011) to completely new techniques such as sewage-tracking canines (Murray et al., 2011). As these methods improve, the most challenging aspect of the IDDE program (i.e., tracking the discharge to its source) will become simpler and more cost-effective.

Illicit Discharge "Crediting" in the Chesapeake Bay Watershed

As a part of the Chesapeake Bay Total Maximum Daily Load (TMDL) strategy, states in the Chesapeake Bay Watershed need to document programs and practices that reduce nitrogen, phosphorus and sediment reaching the Chesapeake Bay. Until this year, however, states could not claim credit for removing illicit discharges. This gap was primarily because no protocol had been established to quantify the benefits of elimination. Some key issues to resolve included the amount of monitoring data to document the load from a discharge, and required follow-up data to confirm discharge removal. An expert panel, led by the Chesapeake Stormwater Network (CSN), developed a strategy for crediting advanced IDDE programs using a phased-in approach (CBP- USWG, 2014). In this approach, communities are first granted an interim nutrient removal credit based on implementing an "advanced" IDDE program that meets minimum criteria such as effective monitoring protocols. In future years, however, pollutant removal credits will only be granted by documenting removal of individual discharges, and the guidance defines documentation and monitoring methods for different discharge types.

This change in policy by the Chesapeake Bay Program represents a huge shift for state and local governments. Even though available data suggest that removing discharges is an extremely cost-effective way to reduce nutrient loads, state and local governments had no real incentive to implement an IDDE program that went beyond the bare minimum without an approved method to claim credits for these nutrient reductions.

Citizen Monitors

One of the greatest challenges to effectively screening outfalls is the sheer time required to do the job effectively, particularly since some discharges occur outside of regular

business hours. Until recent years, IDDE monitoring was viewed as a government function, but citizen monitoring groups have taken on (or expanded) this role in some communities. One example is, Blue Water Baltimore, which completes regular outfall screening and monitoring in the City of Baltimore (Flores, 2014). A key to effective citizen monitoring for illicit discharges is working closely with the local government. While citizens can be an excellent asset to help detect discharges at the outfall, they will need to be tracked down to pinpoint the source. Source tracking typically involves popping manholes within the storm drain network, and sometimes requires access to private property. Government employees or contractors will be the only workers with necessary authority to complete these activities.

Conclusion

Illicit discharges are a serious problem for our nation's urban and suburban waterways, and represent a serious threat to human health. Although there are rules that ban them in most communities, there are still plenty of gaps that can be filled by citizens who care about their streams, lakes, rivers and estuaries. Collaborative policy approaches at the local, state and federal levels can help to improve management of this challenging pollution source.

Deb Caraco has been an employee of the Center for Watershed Protection since 1996, and currently works from Ithaca, New York. Deb's areas of expertise include Illicit Discharge Detection and Elimination (IDDE), pollutant modeling, watershed analyses, stormwater design and stormwater program development. In her current role at the Center, Deb's primary focuses are developing stormwater standards and compliance tools for state and local governments, and developing and maintaining the Watershed Treatment Model, a pollutant load analysis tool. Deb has also led and participated in workshops on a broad range of stormwater management and watershed planning topics.

Deb's other recent positions have been as a Stormwater Management Specialist for the New York State Soil and Water Conservation Committee and as a Project Engineer with T.G. Miller Engineers in Ithaca, NY. Deb has a Masters of Engineering in Biological and Environmental Engineering from Cornell University.

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