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How Green is My Valley?

Legal Strategies to Promote Green Infrastructure For Urban Stormwater Management

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Green infrastructure is defined by Illinois statute[1] as "any storm water management technique or practice employed with the primary goal of preserving, restoring, or mimicking natural hydrology." Under natural conditions, a portion of precipitation reaching the ground infiltrates into the soils instead of flowing on the ground surface as urban runoff, where it can carry contaminants into a sewer system, waterway or lake. Green infrastructure techniques attempt to replicate this natural percolation through the use of permeable paving, rain gardens and vegetated swales, in order to manage stormwater onsite so that it does not have to be transported offsite by a combined or separate sewer system. Other green infrastructure practices, such as the construction of artificial wetlands and vegetated ("green") roofs, can also help attenuate any pollutants that may be carried by urban stormwater runoff in addition to reducing the off-site release of runoff.

THE BENEFITS OF GREEN INFRASTRUCTURE

Green infrastructure may be proposed as a substitute for, or as a supplement to, conventionally engineered stormwater detention facilities – the system of curbs and gutters, street grates, underground sewers, oil and grit separators, wet- or dry-bottomed stormwater detention basins and outfalls and other stormwater control facilities that are routinely constructed on- or off-site as part of residential, commercial and industrial development in the United States. Conventional stormwater detention facilities are designed primarily for flood control purposes, and only secondarily to help achieve national water quality objectives, since the relatively short detention time of stormwater runoff within detention basins offers few opportunities for the natural attenuation of water pollutants by biological, chemical or physical processes. The limited pollutant attenuation capability of conventional stormwater detention is recognized under the federal Clean Water Act[2] by its municipal separate stormwater sewer system regulations (the US EPA's MS4 permit program) that required the phase-in of state National Pollution Discharge Elimination System (NPDES) permits for any discharges into waterways from municipal separate stormwater sewer systems in communities above specified minimum populations.[3]

Green infrastructure, in contrast, offers enhanced opportunities to improve water quality as well as delay the release of stormwater precipitation within a watershed to waterways and water bodies, by encouraging the filtration and bio- and chemical-remediation of stormwater runoff through soil percolation, plant root

[1] Green Infrastructure for Clean Water Act (2009), 415 ILCS 56/10, P.A. 96-0026, §5.
[2] 33 U.S.C. §1251 *et seq.* (1972)
[3] NATIONAL RESEARCH COUNCIL. URBAN STORMWATER MANAGEMENT IN THE UNITED STATES (2009).

uptake and evapo-transpiration. If used in concert with conventional separate stormwater sewer systems or combined stormwater and wastewater sewers, green infrastructure practices can reduce the total amount of stormwater reaching the sewers immediately after a storm. This reduction in runoff volume and pollutant loading offers several benefits: older municipalities with combined sewers may be able to reduce the severity and frequency of combined sewer overflow problems, while the separate stormwater sewer systems installed in newer municipalities could be less expensive to install and maintain since a smaller capacity would be necessary if a portion of the stormwater runoff is first diverted on-site into permeable soils before reaching the separate stormwater sewer system's grates.

THE COST-EFFECTIVENSS OF GREEN INFRASTRUCTURE

A recent review of published research on the efficacy of green infrastructure practices from the peer-reviewed scientific literature found that green infrastructure, on average, performs about as well as conventional detention practices (in terms of weighted removal efficiency) in removing total nitrogen and total suspended solids from stormwater runoff and in reducing both the rate and volume of runoff flow.[4] However, the five green infrastructure practices examined in this literature review – bio-infiltration, permeable paving, filtration, green roofs, and constructed wetlands -- were somewhat more variable in their performance than conventional urban stormwater detention practices.

This variability found in the green infrastructure performance research could be attributed to differences in the design, scaling and stormwater retention time of the green infrastructure relative to a project's drainage area. Geographic, seasonal or climatic variability in the sampling examined may also have led to the greater variability in performance. Finally, differences in maintenance may have affected the green infrastructure performance reported by the research literature. Some of these same factors may also account for the reported pollutant load removal effectiveness for only wet pond and filtration practices, as measured by the differences in influent and effluent concentrations reported in the U.S. EPA's and American Society of Civil Engineers' International Stormwater BMP Database.[5]

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[4] JAFFE M, ZELLNER M, MINOR E, GONZALEZ-MELER M, CONTNER L, MASSEY D, AHMED H, ELBERTS M, WISE S, SPRAGUE S AND MILLER B. USING GREEN INFRASTRUCTURE TO MANAGE URBAN STORMWATER QUALITY: A REVIEW OF SELECTED PRACTICES AND STATE PROGRAMS (2010) [hereafter, Illinois Green Infrastructure Study].

[5] GEOSYNTEC CONSULTANTS AND WRIGHT WATER ENGINEERS, INC . ANALYSIS OF TREATMENT SYSTEM PERFORMANCE; INTERNATIONAL STORMWATER BEST MANAGEMENT PRACTICES (BMP) DATABASE [I999-2008] (2008). [www.bmpdatabase.org/Docs/Performance%20Summary%20June%202008.pdf, retrieved July 25, 2011].

Recent research also suggests that green infrastructure practices may be more cost-effective than conventional stormwater detention. For example, a report by the U.S. Environmental Protection Agency found that, in 12 of 13 case studies examined, green infrastructure practices saved between 15 and 85% in capital (construction) costs, compared to conventional urban stormwater detention technologies.[6] An economic model developed by the Center for Neighborhood Technology also found that, over its life cycle, most green infrastructure costs were 20% to 29% less than conventional detention practices depending on the type and density of the referenced development projects (e.g., whether it was a suburban single-family detached, urban attached garden apartment, or urban office building project).[7] The calculated life cycle costs were based on the net present value of the construction cost and estimated annual maintenance costs discounted by a rate of 3.1% per year over 30 years.

IMPEDIMENTS TO GREEN INFRASTRUCTURE ADOPTION

The 2009 Illinois Green Infrastructure Study[8] found five perceived impediments to the wider-spread use of green infrastructure practices, despite their equivalent efficacy and their greater cost-effectiveness when compared to conventional urban stormwater detention technologies. These were: (1) the feasibility of using green infrastructure under diverse conditions, (2) maintenance issues, (3) funding issues, (4) aesthetics, and (5) groundwater quality. These issues were identified in discussions within focus groups consisting of municipal public works officials, county stormwater managers, and staff of the Illinois Department of Transportation convened by the Chicago Metropolitan Agency for Planning in June, 2010.

The feasibility of using green infrastructure under the diverse natural conditions found in Illinois was mentioned as a significant barrier to the wider adoption of these innovative stormwater management technologies. For example, successful infiltration practices require permeable soils and these are not uniformly distributed in the morainal geology of northeastern Illinois. Clays and other soil components can drastically reduce infiltration rates of soils, limiting the effectiveness of green infrastructure practices, especially those relying on bio-infiltration or filtration as stormwater management practices. Moreover, the climate of northeastern Illinois, especially the persistence of frozen ground during the winter months, may also impede the percolation of contaminated snowmelt

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[6] U.S. ENVIRONMENTAL PROTECTION AGENCY. REDUCING STORMWATER COSTS THROUGH LID [LOW IMPACT DEVLEOPMENT] STRATEGIES AND PRACTICES (2007).

[7] CENTER FOR NEIGHBORHOOD TECHNOLOGY. NATIONAL GREEN VALUES CACULATOR. [www.greenvalues.cnt.org/national/, retrieved July 25, 2011]

[8] See note 3, *supra*.

and polluted stormwater runoff into soils as well as reduce the attenuation of these pollutants by reduced winter biological activity in constructed wetlands, by green roofs and within the soils' unsaturated zone. Many of the focus group participants were also unfamiliar with the effectiveness of green infrastructure in managing urban stormwater runoff, despite the extensive scientific literature and reported case studies in the USEPA/ASCE's International Stormwater BMP Database.

Perceived maintenance problems were also identified as a potential issue. Many local officials believed that on-site green infrastructure required special or more frequent maintenance than conventional detention facilities. Since infiltration can be impeded by clogging by fine particles (in both soils and permeable paving), periodic maintenance (such an aeration or sweeping) is needed for some green infrastructure technologies. But periodic maintenance is also needed for conventional stormwater detention facilities as well, since ponds can fill with sediment, intakes can clog with trash or leaves and outfalls can scour.

How to finance the installation and maintenance of green infrastructure was also mentioned as a potential problem by focus group members. A substantial fraction of the cost-effectiveness of green infrastructure is attributable to the avoided wastewater treatment costs and reduced flooding risks that are realized when a significant portion of the stormwater runoff is intercepted or infiltrated by green infrastructure before it reaches a separate or combined sewer system.[9] However, paying for the ongoing maintenance of some green infrastructure and monitoring its performance to ensure its ongoing efficacy may pose different administrative challenges for a municipality than the periodic billing of landowners, cleaning out of grates and rodding of sewer lines typically undertaken to support conventional stormwater collection and detention practices.

The aesthetics of green infrastructure, especially the use of rain gardens and vegetated swales using native landscaping, was also mentioned as an impediment. Some local officials feared that residents would perceive the native plants as weeds and oppose such stormwater management practices on aesthetic grounds. Moreover, using such green infrastructure, as well as permeable paving, to promote the infiltration of stormwater runoff into soils can potentially transport any contaminants carried by the runoff into groundwater if the water table lies close to the ground surface.

LEGAL STRATEGIES TO PROMOTE GREEN INFRASTRUCTURE

[9] THE CIVIC FEDERATION. MANAGING URBAN STORMWATER WITH GREEN INFRASTRUCTURE: CASE STUDY OF FIVE U.S. LOCAL GOVERNMENTS (2007).

A number of regulatory requirements and incentives can be considered by municipal attorneys and local officials to address some of the perceived issues associated with promoting the use of green infrastructure for urban stormwater management. The issue of ensuring green infrastructure effectiveness under diverse conditions has been addressed by many communities by establishing volumetric controls for on-site stormwater management, usually a requirement that the first ½- to 1-inch of precipitation must be retained on-site (an approach used in Illinois by the City of Chicago, Kane and Will Counties, and proposed for Cook County in a draft ordinance developed by the Metropolitan Water Reclamation District of Greater Chicago). Landowners can use detention, green infrastructure, or a combination of both practices to achieve the volumetric standard. Stormwater management ordinances adopted by DuPage, Kendall and Lake Counties incorporate a stormwater volume reduction hierarchy which stresses the use of green infrastructure practices to reduce the amount of stormwater runoff being transported off-site.

Two approaches to addressing the maintenance issues associated with green infrastructure have been adopted in Illinois. The first strategy is to create a stormwater utility, which charges landowners for stormwater facility maintenance and for the treatment costs of runoff pollutant loading to public sewers. The charges may be based on the amount of impervious surface on the parcel (as is done in the City of Bloomington, Illinois) or through a fixed fee (as is done in the City of Moline for parcels up to two acres in size, with a sliding fee imposed on larger parcels based on the amount of impervious surface on the site). The City of Bloomington allows a credit against its stormwater utility fee for green infrastructure practices employed on the parcel that reduce the volume of stormwater reaching the sewers, thus creating a financial incentive for landowners to employ these green practices.[10]

The second strategy is to create a stormwater Special Service Area, or special assessment district, to fund the maintenance of stormwater infrastructure, including green infrastructure. In some communities in Kane County, Illinois, landowners pay a fee, earmarked for stormwater infrastructure maintenance and improvement, based on the size of their parcel and the extent of the impervious surface area on their lots. This fee is similar to the private assessments charged to homeowners by a Home Owners' Association for privately-maintained common features in residential subdivisions.

[10] CITY OF BLOOMINGTON, ILLINOIS. STORMWATER CREDIT MANUAL (2006).

The aesthetics of green infrastructure can be addressed by amendment of municipal weed and landscaping ordinances to expressly exempt native landscaping materials employed in stormwater management practices from being classified as "weeds." This simple amendment would go far in immunizing landowners who employ native plant materials in rain gardens and drainage swales from municipal nuisance abatement actions or misdemeanor charges and fines.

Designing and sizing green infrastructure properly and siting it in locations where there is sufficient depth to the water table to allow pollutant attenuation in the soils' unsaturated zone (through biological, physical, and chemical processes) can greatly lessen any possible groundwater pollution risks. Adopting appropriate review standards for green infrastructure practices in municipal stormwater management ordinances can address these issues.

CONCLUSIONS

Green infrastructure, either in concert with or as a replacement for conventional stormwater detention, offers many more environmental services than does traditional "grey infrastructure" stormwater facilities. Besides providing volume reduction, pollutant attenuation and flood storage functions, green infrastructure practices can be designed and sited to also provide habitat and open space benefits.

State general permits that govern compliance with the U.S. Environmental Protection Agency's MS4 regulations are usually drafted broadly enough to accommodate, of even to encourage, green infrastructure practices as permissible municipal stormwater management strategies that help municipalities meet state stormwater discharge permit conditions. The agency is also promoting green infrastructure practices in its Low Impact Development guidelines and in the stormwater management regulations governing larger-scale federal projects.

Although green infrastructure has proven to be more cost-effective than conventional stormwater detention practices, and, on average, works about as well as conventional detention in reducing stormwater runoff rates and volumes and in removing suspended solids and nitrogen, many local officials remain wary of these practices. They are still cautious about issues associated with the efficacy, maintenance, financing, aesthetic and pollution risks of green infrastructure, issues that can be readily addressed in local stormwater management ordinances.

Municipal attorneys can help assuage these concerns by paying attention to any inadvertent barriers to the use of green infrastructure in local stormwater management ordinances and in other, ancillary ordinances (such as weed control laws) that may impede the use of these innovative practices. As interest in these green techniques grow, these green practices can easily be integrated into, and can even be actively promoted by, simple amendments to existing municipal stormwater management ordinances and programs.