3 Rivers Wet Weather
Improving our region's water quality

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June 14, 2013

Dear Colleague:

Green infrastructure, such as preserved open space, rain gardens, trees, permeable pavement, and green roofs offers a broad range of advantages when used in place of or in combination with traditionally-engineered stormwater management structures. These benefits include reducing sewer overflows, recharging groundwater, decreasing the amount of energy needed for heating and cooling, improving air quality, potential cost savings over "gray" infrastructure, removing pollutants from stormwater, and beautifying neighborhoods. As communities across the United States look to incorporate green practices, one of the first steps is to review local codes and ordnances for barriers and facilitators to green infrastructure.

At the request of 3 Rivers Wet Weather, the University of Pittsburgh's Environmental Law Clinic performed a review of many of Allegheny County's local municipal codes and ordinances. Their general observations and analysis are in a report available on our website: http://www.3riverswetweather.org/municipalities/municipal-tools

Also available on our website with the report is an Excel spreadsheet which provides specific findings by municipality on the codes and ordinances that were reviewed (62 of the communities are included in the spreadsheet).

Well-crafted ordinances can be an effective means to reduce impervious surfaces, sprawl, and stormwater runoff. We suggest that you begin now to consider ways to integrate more sustainable stormwater management into your municipality's requirements. This report provides some ideas of how to do this, for example, by further evaluation of your ordinances for opportunities to reduce impervious surface requirements or to incentivize the use of best management practices such as vegetated islands or permeable paving material.

We hope that communities in our region will support activities and approaches to development and redevelopment that encourage and require sustainable stormwater management, in particular, to increase the infiltration of rainwater where it falls, and to decrease sewer overflows.

Below is the link for the EPA's *Water Quality Scorecard*, an excellent guide for municipalities to incorporate green infrastructure practices.

http://www.epa.gov/smartgrowth/water_scorecard.htm

We are distributing the link for this report by e-mail to managers, engineers, solicitors and designated elected official for ALCOSAN service area communities, and to the managers of all other communities within Allegheny County. Please feel free to forward this email to others in your community, such as members of Zoning Boards, or to your municipal Environmental Advisory Council.

After you have a chance to review the Law Clinic's report, please contact us if you have questions or comments, or if you need assistance in making your ordinances more "stormwater friendly." We will also be working with the Local Government Academy to provide municipal webinars/workshops to present the topic in more detail.

Sincerely,

John W. Schombert
Executive Director

STORMWATER ORDINANCE REVIEW

BARRIERS AND FACILITATORS TO GREEN INFRASTRUCTURE AND LOW-IMPACT DEVELOPMENT IN ALLEGHENY COUNTY, PENNSYLVANIA

June 2013

Prepared by the University of Pittsburgh Environmental Law Clinic for 3 Rivers Wet Weather

Stormwater Ordinance Review:
Barriers and Facilitators to Green Infrastructure and Low-Impact Development in Allegheny County, Pennsylvania

TABLE OF CONTENTS

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This report is for informational purposes only and is not for the purpose of providing legal advice to any person or entity. The recommendations are general; anyone interested in implementing any of the recommendations should assess whether to seek legal advice.

Stormwater Ordinance Review:
Barriers and Facilitators to Green Infrastructure and Low-Impact Development in Allegheny County, Pennsylvania

EXECUTIVE SUMMARY

This report was prepared at the request of 3 Rivers Wet Weather by the University of Pittsburgh Environmental Law Clinic[1] based on its review of municipal ordinances in Allegheny County, Pennsylvania. The purpose of the research was to review all of the ordinances relevant to stormwater management, and to categorize them as either barriers or facilitators to green infrastructure and low-impact development (hereinafter, "GI" and "LID"). Those categorizations were then used to propose updates to municipal ordinances that will further facilitate GI/LID practices.

This review is intended to be used by Allegheny County municipalities to help address problems with Combined Sewer Overflows (hereinafter, "CSOs"). Combined sewer systems, still present in many of the oldest parts of the country, mix stormwater flow and sanitary flow in the same underground pipes. Constructed before the development of regional sewage treatment systems, they were designed to convey flow to the nearest river or stream. As regional treatment systems were developed, flow control structures were installed at each point of connection and designed to direct dry weather flow to the sewage treatment plant and to bypass the increased stormwater and sewage mix to a waterway to protect the system. As development expanded and increased impervious surfaces, these systems overflow more frequently even in small rainfall events. Because the stormwater pipes also carry sewage, the resulting discharge is a hazard to human health and the environment. The Allegheny County Sanitary Authority (hereinafter, "ALCOSAN") has been ordered by the U. S. Environmental Protection Agency to come up with a plan for an updated system by 2013, and to solve the problem by 2026.

Learning from the example of other major cities in the U.S. that have integrated GI/LID into their Wet Weather Plans (Kansas City, Philadelphia, Chicago, Cincinnati, Washington D.C, et al.), 3 Rivers Wet Weather is evaluating the role that facilitating GI, source reduction and LID can play to help address the CSO problem by substantially reducing the volume of stormwater entering the sewer system. Combining GI/LID practices with traditional "gray" infrastructure, such as large pipes and storage tanks, may lower the immediate cost of construction and the future cost of operations and maintenance. In addition, GI comes with other benefits, such as enhancing neighborhoods, and reducing utility costs for heating and cooling buildings, and reducing pumping and treating costs for wastewater.

[1] Mr. Neil Bakshi, a Certified Legal Intern at the Environmental Law Clinic, is the principal author of this report. Assisting Neil in the research and preparation were: Mr. George Thompson, Certified Legal Intern; Ms. Rayza Santiago, Certified Legal Intern; Mr. Eric Delio, Certified Legal Intern; Professor Emily A. Collins, Esq., Supervising Attorney; Mr. Tim Estep, Esq., Legal Fellow; Mr. Oday Salim, Esq., Staff Attorney. Ms. Rylee Kercher, undergraduate intern, also assisted in the collection and organization of the ordinances.

Zoning and development standards have a major impact on watersheds, stormwater management strategies, and the built environment. This report contains recommendations for practical and effective implementation through changes in municipal ordinances. The recommendations are intended to be of relatively low financial burden to the municipalities that implement them, and of high benefit to sustainable stormwater management in the region. The recommendations are also designed to allow freedom of action. They have been designed as "facilitators," rather than an imposition of restraints that could turn into barriers themselves further down the road.

Methodology

This review was conducted in 2012-2013 by procuring the relevant ordinance sections from municipalities, inspecting them, and categorizing them. The categorization was informed by numerous conversations with engineers and green infrastructure experts. Ordinances were categorized in two ways. First, they were categorized based on which "topic" of GI or LID they impacted; for instance, vegetation or parking lots. They were then labeled as either a barrier or a facilitator to that category. The results were maintained in a spreadsheet format for easy access.

Ordinance Updates

Updates are recommended in many key areas. The recommendations focus on changes that are administratively easy to implement, and that have a large effect on GI or LID. In this way, the burden-reward ratio for municipalities is most favorable.

In general, the recommendations favor clearly-defined standards. This is because the people who rely on these ordinances, such as developers, need to quickly and easily understand how to comply. An example is to use numerical standards instead of vague wordings. Municipalities are also encouraged to adopt the standards of the Pennsylvania Department of Environmental Protection's *Pennsylvania Stormwater Best Management Practices Manual*,[2] in the same way that they adopt the Uniform Construction Code.[3] PADEP's manual is highly regarded by green infrastructure professionals, and provides a multitude of standards that can be referenced in a single ordinance section.

More specifically, the recommendations attempt to minimize impervious surfaces and maximize open space. As will be explained in more detail below, impervious surfaces prevent stormwater from infiltrating naturally into the ground, and increase the speed of runoff into the sewer system. This is a double-edged sword. Therefore, it is recommended that the surface area of streets, sidewalks, and parking lots be limited as much as possible. Vegetated islands in parking lots are encouraged, but fewer large islands are preferable to many small ones. Codes should

[2] Pennsylvania Department of Environmental Protection, *Pennsylvania Stormwater Best Management Practices Manual*, DEP Doc. No. 363-0300-002 (2006) (hereinafter "PA SW BMP Manual").

[3] For an example, see Bridgeville Borough, Pa. Chap. 17 § 301(8), which states that all regulated activities must incorporate the techniques set out in the Department's manual. For an example of an ordinance section adopting the standards of the Uniform Construction Code, see Churchill Borough, Pa. Part II § 142-1.1.

protect large trees and other natural features which are difficult to replace and serve as natural stormwater control systems.

Ordinance updates can have greater value if they are made part of a municipality's comprehensive plan.[4] The comprehensive planning process is a municipality's opportunity to "dream big," and offers an opportunity to design ordinance reform that can combat the current CSO problem. The Pennsylvania Municipalities Planning Code provides that a comprehensive plan must consider future land use and development with an eye toward housing, transportation, facilities, utilities, and open space, and the interrelationships between the elements of the plan.[5] Although not legally required, it is preferable that such planning be done on a watershed basis, involving communication between municipalities and with county and state governments.[6]

[4] *Pennsylvania Municipalities Planning Code*, 53 P.S. § 10101 et seq.
[5] Ibid. at §§ 10301-10307.
[6] Ibid. at §§ 10301, 10301.3, 10301.4.

I. METHODOLOGY

A. PROCESS

The basic process used to create this report was as follows: gather ordinances, categorize relevant sections, and recommend the most important changes. The Environmental Law Clinic chose those municipal codes and ordinances that affect development and redevelopment, and those that potentially facilitate, impede, or even prohibit more effective stormwater management. The chosen ordinances governed topics such as:

- Zoning
- Subdivision Planning
- Street Design
- Parking Areas
- Building Codes
- Stormwater Management and Drainage Criteria
- Floodplains
- Environmental Protection
- Landscaping and Trees
- Erosion and Sediment Control
- Grading
- Parks and Planned Open Space

1. Gathering Ordinances

Future practitioners who are interested in creating a similar report should set aside vast amounts of time and preparation for the gathering process. Municipalities in Allegheny County have many different methods for storing their ordinances, some of which are very easy for a visitor to access, and some of which are less so.

Several municipalities have posted their ordinances online. For the most part, the online versions include the entirety of a municipality's ordinances, and thus there is no need to actually visit the municipal offices. This made ordinance review extremely easy, as it could be done from any location at any time, and copies could be made and marked up for further research.

Other municipalities have their ordinances stored in bound books or in files. Reviewing these ordinances was more time-consuming, because stormwater management ordinances are not a topic that most municipal officials routinely search through. It occasionally required some cooperation between a researcher and a municipal official to make sure all the relevant ordinances had been collected. Many officials were kind enough to fax or scan the ordinances, which allowed us to make electronic copies for further research.

Ultimately, this report does not cover all of the municipalities in Allegheny County, because some ordinances were difficult even for the municipal officials to locate. Seventy-two municipalities were reviewed. Some Allegheny County municipalities have combined sewer

systems, while others have separated systems; some municipalities are within ALCOSAN's jurisdiction, and some are not.[7] Accordingly, priority was given to municipalities served by combined sewer systems, and those within ALCOSAN's jurisdiction.

2. Categorizing Ordinance Sections

After the relevant sections had been identified, they were entered into spreadsheets for categorization. There is one spreadsheet for each municipality, plus a master spreadsheet containing all collected data. The goal was to provide a product that was searchable and that allowed basic analysis such as counting and averaging.

Partly to ensure consistency of data entry, and partly to enable future analysis, numerical codes were assigned and used in the spreadsheet where appropriate. The "GI Code" refers to the topic that an ordinance section touches on: for example, trees, sidewalks, or parking lots. The "Beneficial Code" was used to label an ordinance section as a barrier or a facilitator.

The GI Code was adapted from the Environmental Protection Agency's *Water Quality Scorecard*, which is a tool developed by the EPA to assist municipalities in evaluating their ordinances.[8] Some of the sub-categories were changed to fit the research as it evolved. However, the basic structure of the Water Quality Scorecard remains. The goal was to align the GI Code with a format that could be easily recognized by municipalities and the EPA alike.

Although it was not ultimately necessary for this report, it is worthwhile to note that the GI Code allows routine numerical analysis as well. For instance, a user can count how many times a certain code arises, how many barriers versus facilitators exist for that code, or which codes have the most barriers.[9]

3. Recommending Changes

The final recommendations made in this report are the result of many discussions with professional engineers and green infrastructure experts. The focus was ultimately to make legal determinations, but they were still highly dependent on the real-world experience of the engineers. The resulting analysis is firmly grounded in practicality.

Following from those conversations, priority was given to changes that had the most appropriate balance between the burden on the public (including developers), and enforceability. Burden on the public (and developers) includes financial cost, delays, and substantial deviation from current

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[7] For a map of the combined and separate sewer systems and ALCOSAN's jurisdictional area, see the web site of ALCOSAN at http://www.alcosan.org/Portals/0/Wet%20Weather%20Docs/June2012/System-wide%20Map_June2012.pdf.

[8] Environmental Protection Agency, *Water Quality Scorecard: Incorporating Green Infrastructure Practices at the Municipal, Neighborhood, and Site Scales*, EPA 231B09001 (2009), available at http://www.epa.gov/dced/water_scorecard.htm (last visited Aug. 17, 2012) (hereinafter "Water Quality Scorecard").

[9] This report does not include such analyses. This is due to a number of reasons. The biggest is that the review did not encompass every municipality in Allegheny County, so any count would not be representative of the whole.

practices. Enforceability is improved by including specific standards that can be easily identified by a permittee and an inspector. Additionally, the recommended changes are designed to minimize re-writing of the existing ordinances. The changes are based on existing ordinance provisions that were considered ubiquitous.

B: CATEGORIES

Ordinance sections were entered into a spreadsheet, where they were indexed based on two criteria: the categories of GI/LID that they impacted, and whether they were barriers or facilitators to those categories. Ordinance sections were given a separate entry for each category they impacted. Short descriptions of the categories are as follows.

Beneficial Code

Whether an ordinance section was a barrier or a facilitator to GI/LID was listed as follows:

Facilitator
Uncertain / Multiple Effects
Barrier

In some cases the ordinance section contains a quantitative element that could not be evaluated without an engineer or other qualified professional, and this was noted as a "Q" in the Municipal Ordinance Summary spreadsheet.

GI Code

The topic of green infrastructure or low-impact development that an ordinance section touched on was listed as follows:

1. Natural Resources:

The Natural Resources section is comprised of subcategories that relate to natural features of the environment such as open space, trees, vegetation, and wetlands. These features have the potential to allow for better stormwater management practices through stormwater infiltration and less impervious surfaces.[10]

A. Natural Resources: This includes natural features such as rivers and streams, critical habitats, wetlands, and floodplains.

B. Open Space: This includes open space such as fields and greenways.

[10] Water Quality Scorecard, supra note 8 at 11-22.

C. Trees and Vegetation: This includes trees and all other vegetation, such as ground cover, bushes, and landscaping.

D. Buffer Areas: Buffers are defined areas, usually on the borders of zoning districts, which are required to be planted with grass and trees. They also function as setbacks when their width is expressly prescribed.

2. Development Patterns and Infill:

The Development Patterns and Infill section includes ordinances that apply to community development and construction. Well-crafted ordinances can be an effective means to reducing impervious surfaces, sprawl, and stormwater runoff.[11]

A. Direct Development to Previously-Developed Areas: This refers to ordinances that encourage or discourage development on previously-developed sites, such as a brownfield or a vacant lot.

B. Direct Development to Areas with Existing Infrastructure: This refers to ordinances that encourage or discourage new development on sites with existing infrastructure, such as sewer pipes and power lines.

C. Mixed-use Development: This refers to ordinances that either encourage or discourage the coexistence of business, residential, and industrial uses in the same area. In particular, orienting development around public transit lessens the need for parking lots.

D. Planned Residential Development: This includes residential subdivisions which are planned and built as a single project.

E. Grading and Excavation: This refers to all intentional land disturbances by developers, including the flattening of land, slopes, and fill. These ordinances often place technical requirements on vegetative cover, erosion controls, and slope angles.

3. Streets, Driveways, and Sidewalks:

This category refers to ordinances that impose design requirements on streets, driveways, and sidewalks. These construction requirements affect the amount of impervious surfaces in the community and the manner in which stormwater flows from these structures.[12]

A. Street Width: This refers to street widths in a given municipality.

B. Street and Driveway Construction Requirements: This includes types of street surfacing, slopes, and drainage methods, such as storm sewer grates and vegetated curbs.

[11] Ibid. at 23-28.
[12] Ibid. at 29-35.

C. Sidewalks: This would include sidewalk surfacing requirements, width, and curb standards. These ordinances can impact stormwater infiltration and runoff patterns.

4. Parking Areas and Parking Requirements

This category refers to ordinances that impose requirements on parking areas. Examples of these ordinances are provisions that require a certain number of parking spaces, parking lot surface requirements, and parking area landscape requirements. These ordinances impact stormwater infiltration, amount of impervious spaces, and stormwater runoff patterns.[13]

A. Alternative Parking Requirements: This refers to ordinances that allow or disallow flexible parking arrangements in response to demand for parking. Examples of flexible parking arrangements include shared parking, encouraging bicycle parking areas, and including on-street parking in the calculation of total spaces.

B. Required Alternative Measures: This subcategory refers to ordinances that require the measures included in 4A.

C. Parking Area Landscaping Requirements: This subsection includes requirements for vegetative cover on parking lots. These types of ordinances may require developers to equip parking lots with a certain amount of vegetation. These ordinances can be used to increase or decrease the amount of stormwater infiltrating the soil or being directed to a stormwater collection system.

D. Spread Out v. Clustering Landscape Requirements: This subsection is a subset of 4C, focusing on whether landscaping is spread out over many small islands or clustered into a few large islands.

5. Stormwater Management Provisions

This category refers to ordinances that relate to stormwater management generally. This category includes ordinances that utilize both gray and green approaches to stormwater management.[14]

A. Statements of Intent or Purpose: This refers to declarations by the municipality that actions benefiting stormwater management are approved, encouraged, and/or required. These declarations are often intended to be used to construe the rest of the municipality's ordinances in favor of proper stormwater management, wherever ordinances may be ambiguous.

B. Monitoring, Tracking, and Maintenance Requirements: The practical counterpart to 5A, this refers to concrete methods by which a municipality will enforce the proper management of stormwater. This includes runoff calculation methods, Best Management Practices, and requirements to keep stormwater management facilities in good condition.

[13] Ibid. at 36-42.
[14] Ibid. at 43-50.

6. Green Infrastructure

This category refers to ordinances that relate specifically to green infrastructure solutions for stormwater management.

A. Downspout Disconnection: This refers to the disconnection of rainwater downspouts from the sewer system, and re-direction of the water to a rainwater harvesting method, such as a rain barrel, or to a lawn or rain garden.

B. Infiltration: This includes all structures designed to infiltrate water into the soil, including vegetated swales, ditches, French drains, and large open plots of land.

C. Rain Barrels and Other Water Harvesting Techniques: This refers to ordinances that encourage or discourage water harvesting methods, including rain barrels, rain gardens, or other techniques designed to collect stormwater for private use.

D. Green Roofs: This refers to ordinances that allow or encourage property owners to construct green roofs on buildings.

7. Other

This category applies to ordinances that do not fit within the other categories but are still relevant to note. An example of an ordinance that fits within this category is the adoption of the Uniform Construction Code. Although this ordinance does not fit into any of the other categories, it is tangentially relevant to LID because it affects how buildings are planned and constructed.

C: ASSUMPTIONS

The recommendations in this report are grounded in practicality. Numerous conversations with engineers have resulted in the following assumptions about GI and LID, which formed the logical basis of this report. Site-specific considerations will always be a part of the implementation of GI and LID, so that what is best for one neighborhood might not be best for another. However, it was necessary to base the review on uniform decision-making standards in order to make clear comparisons. There are certain fundamental principles of GI and LID that are true for all locations, regardless of site-specific anomalies. Those principles are as follows.

1. General Goals

The most basic purpose of using GI and LID to address the combined sewer overflow problem is to remove stormwater from the combined sewer system.[15] This can be done in two ways: for stormwater that falls on impervious surfaces, capturing it and sequestering it from the combined

[15] Clean Water America Alliance, *Barriers and Gateways to Green Infrastructure*, 2 (2011).

sewer system; for stormwater that falls elsewhere, allowing it to filter naturally through the soil and thereby return to the hydrologic cycle.[16]

2. Open Spaces

When stormwater infiltrates naturally through the soil, two beneficial processes occur. First, it moves through underground pathways and re-enters rivers and streams, thereby staying out of the sewer system.[17] Second, the soil actually filters out a multitude of pollutants. Stormwater that migrates through soil comes out cleaner, giving benefits to the whole hydrological cycle, including cleaner streams and cleaner runoff.[18] Maximizing the amount of open space in a municipality is beneficial for stormwater management.

3. Impervious Surfaces

Impervious surfaces prevent stormwater from infiltrating naturally through the soil, and increase the velocity of runoff into the sewer system.[19] The roofs of buildings often comprise a large percentage of the impervious surface in a municipality, but other contributors include streets, parking lots, sidewalks, and driveways.[20] Stormwater running off impervious surfaces frequently picks up pollutants, such as tar from roofs, bacteria, motor oil, metals, and other debris.[21] There are legitimate correlations between human illnesses and bacteria from stormwater runoff in drinking water.[22] Velocity of runoff is also detrimental because it can cause erosion of stream banks, which can thereby stir up sediment and kill aquatic organisms.[23] Limiting impervious surfaces is beneficial for stormwater management.

4. Vegetation

Plants soak up stormwater, thereby keeping it from entering the sewer system. Their roots create openings in the soil that encourage infiltration.[24] Vegetation of every kind is valuable because it cannot be replaced once it is built over with impervious surfaces. Trees, in particular, soak up more water than any other plant.[25] Trees' capacity for water increases as they grow, which makes them an investment that appreciates over time.[26]

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[16] Am. Soc. of Landscape Architects, et al., *Banking On Green: A Look at How Green Infrastructure Can Save Municipalities Money and Provide Economic Benefits Community-Wide*, 4-5 (2012) (hereinafter "Landscape Architects"); Nat. Res. Def. Council, *Rooftops to Rivers*, 7-10 (2006) (hereinafter "NRDC"); Milwaukee Metropolitan Sewage District, *Fresh Coast, Green Solutions: Weaving Milwaukee's Green & Grey Infrastructure Into a Sustainable Future*, 12-13 (2010) (hereinafter "Milwaukee").

[17] NRDC, supra note 16 at 9; Milwaukee, supra note 16 at 12.

[18] NRDC, supra note 16 at 9; Milwaukee, supra note 16 at 12.

[19] NRDC, supra note 16 at 4-5, 9; Milwaukee, supra note 16 at 13.

[20] NRDC, supra note 16 at 4-5; Milwaukee, supra note 16 at 12-13.

[21] Landscape Architects, supra note 16 at 28-29 (2012); ECONorthwest, *Economic Benefits of Green Infrastructure*, 6 (2011) (hereinafter "Economic Benefits").

[22] Landscape Architects, supra note 12 at 28-29.

[23] NRDC, supra note 16 at 2.

[24] NRDC, supra note 16 at 8-9; Milwaukee, supra note 16 at 12-13.

[25] Milwaukee, supra note 16 at 12.

[26] NRDC, supra note 16 at 8.

In addition, increasing the amount of vegetation in a city or town has benefits beyond stormwater management.[27] As might be expected, an increase in vegetation improves air quality throughout a city.[28] Vegetation can provide a cooling effect to the surrounding pavement and buildings, both through shade and through transpiration.[29] In this way, removing pavement and replacing it with vegetation compounds the benefit to help reduce the "heat island effect" that causes city buildings to over-use air conditioning during the summer.[30] Vegetation can increase property values by giving a city the reputation of being a "nice" place to live.[31] And increased vegetation can also dampen urban noise, which improves quality of life.[32]

For all these reasons, maximizing the amount of vegetation in a municipality is very beneficial. In particular, native vegetation is more beneficial than non-native vegetation. The Department of Conservation and Natural Resources maintains a list of invasive plants for reference.[33] See Appendix B of the *Pennsylvania Stormwater Best Management Practices Manual* for a list of plant species that are native to Pennsylvania and are suitable for planting in green infrastructure installations.[34]

5. Grading

The ground has natural pathways that lead stormwater to rivers and streams. Disturbing these pathways can prevent stormwater from reaching its natural destination, and cause it to enter the storm sewer system instead. Therefore, disturbing the natural course of the land – especially replacing it with impervious materials – can increase the load on the sewer system. Steep slopes can also increase the velocity of runoff into the sewer system. Therefore, it is important for municipalities to manage the extent to which natural features are disturbed.

6. Rainwater Harvesting

Roofs of buildings comprise a large percentage of the impervious space in urban areas, and therefore generate a large amount of stormwater runoff.[35] This can contain pollutants from tar and shingles, and "heated water" discharges.[36] It is important to find ways to remove this runoff from the system.

Disconnecting down spouts can allow the stormwater to be captured and re-used.[37] Rain barrels can capture stormwater for use as "gray water" in buildings (often used for non-potable purposes

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[27] NRDC, supra note 16 at 12; Milwaukee, supra note 12 at 24 (containing a table and explanation of the various benefits of GI and LID).
[28] Landscape Architects, supra note 16 at 5-6; Economic Benefits, supra note 21 at 28-29.
[29] Landscape Architects, supra note 16 at 16-20; Economic Benefits, supra note 21at 5.
[30] Landscape Architects, supra note 16 at 31-32; Economic Benefits, supra note 21 at 5.
[31] Economic Benefits, supra note 21 at 9; Landscape Architects, supra note 16 at 33.
[32] Economic Benefits, supra note 21 at 9.
[33] Pa. Dept. of Conserv. and Nat. Res., *Invasive Exotic Plants in Pennsylvania List*, available at http://www.dcnr.state.pa.us/forestry/invasivetutorial/List.htm (accessed Nov. 15, 2012).
[34] PA SW BMP Manual, supra note 2 at Appendix B
[35] NRDC, supra note 16 at 3-5; Economic Benefits, supra note 21 at 1-2.
[36] NRDC, supra note 16 at 3-5; Milwaukee, supra note 16 at 12-13.
[37] NRDC, supra note 16 at 10, 25-26; Milwaukee, supra note 16 at 12-13.

such as flushing toilets), and they are well-suited for both residential and commercial properties.[38] This saves money on water bills.[39] Downspouts can also be re-directed to rain gardens, which are designed to handle an increased amount of stormwater and work to beautify the surrounding property.[40] For larger and commercial developments, onsite rainwater storage in cisterns should be considered.

For all these reasons, incentivizing or requiring downspout disconnection wherever feasible is very beneficial for stormwater management.

II. CURRENT ORDINANCES

A. INTRODUCTION

The following is a listing of ordinance sections that we recommend municipalities either adopt, repeal, or re-word. The list is intended to be a user-friendly guide to facilitating green infrastructure.

Each listing begins with at least one example, sometimes as many as four. These examples are taken from the ordinances of Allegheny County municipalities. Where practical, the original text of actual ordinance sections has been used, although some have been edited to improve readability or to shorten sentences. Most of them are copied verbatim.

At the end of some sections, we have included suggested changes. These are intended to be fully-functional ordinance sections that can be adopted as they are written, unless otherwise indicated. Such indications are made within brackets or parentheses, or in the explanatory text.

There were significantly more ordinances relevant to LID than to GI. This is to be expected. LID encompasses development of every kind, including every building, sidewalk, and driveway. On the other hand, GI consists of specific stormwater-related technologies and practices, which were not as widely-used when these ordinances were written as they are today.

Readers must therefore keep in mind the clear distinction in the application of GI and LID facilitators. LID practices will come into play as new areas become developed, or as old ones are re-developed. Since so much of Allegheny County has already been developed, and since much of the remaining topography is unsuitable, the application of LID will be phased in over time. But when it does occur, it will have dramatic effect. On the other hand, GI technologies can be applied to the existing built environment. Rain barrels, rain gardens, green roofs, vegetated swales, and curb cuts can all be applied to properties without waiting for development to occur.

[38] NRDC, supra note 16 at 25-26.
[39] Economic Benefits, supra note 21 at 3-4.
[40] Milwaukee, supra note 16 at 12-13.

In reviewing existing ordinances and enacting new ones, municipal officials should consult with the engineer as necessary to ensure technical practicality.[41]

B. DEFINITIONS

Mundane though they may be, definitions of terms are critical. The way an ordinance is interpreted is how it will be implemented. Therefore, municipalities must take great care to ensure that their definitions are updated.

The following is a list of common terms. The definitions here have largely been selected from existing Allegheny County ordinances. Municipalities should adopt these to ensure that updates to the substantive ordinance sections, which will be detailed in the next section C, have the proper effect.

Applicant: A landowner or developer who has filed an application for development, including his/her heirs, successors and assigns.

Best Management Practices (BMPs): Schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants to waters of the United States. BMPs also include treatment requirements, operating procedures, and practice to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Buffer Area: A landscaped area of a certain depth specified by this chapter, which shall be planted and maintained in trees, grass, ground cover, shrubs, bushes or other natural landscaping material, or else an existing barrier, natural or constructed, which duplicates the effect of the required plantings.

Stream buffer: The area of land immediately adjacent to any surface water body measured perpendicular to and horizontally from the top-of-bank on both sides of a stream that must remain or be restored to native plants, trees, and shrubs.

Channel: A perceptible natural or artificial waterway which continuously or intermittently contains moving water, or which forms a connecting link between two bodies of water. A channel has a definite bed and banks which confine the water.

Cistern: Large, underground or surface containers designed to hold large volumes of water (500 gallons or more). Cisterns may be comprised of fiberglass, concrete, plastic, brick or other materials.

Construction Contractor: Party responsible for carrying out the contract per plans and specifications. The Plans, Standard Specifications and Special Provisions contain storm water protection requirements that the contractor must address.

Construction Site: The area involved in a construction project as a whole.

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[41] See *Municipalities Planning Code*, 53 P.S. § 10107 (defining the term "municipal engineer"), § 10201 (giving an example of the engineer's duties).

Culvert: A closed conduit for the free passage of surface drainage under a highway, railroad, canal or other embankment.

Design Storm: The magnitude and temporal distribution of precipitation from a storm event measured in probability of occurrence (e.g., a five-year-storm) and duration (e.g., 24 hours), used in the design and evaluation of stormwater management systems. Also see "return period."

Detention: The volume of runoff that is captured and released into the waters of this Commonwealth at a controlled rate.

Detention Pond: A pond or reservoir, usually small, constructed to impound or retard surface runoff temporarily.

Development: Any human-induced change to improved or unimproved real estate, whether public or private, for which a permit is required, including but not limited to construction, installation, or expansion of a building or other structure; land division; street construction; drilling; and site alteration such as dredging, grading, paving, parking or storage facilities, excavation, filling, or clearing. Development encompasses both new development and redevelopment.

Developer: The person, persons or any corporation, partnership, association or other entity or any responsible person therein or agent therefore that undertakes the activities associated with changes in land use. The term "developer" is intended to include but not necessarily be limited to the term "subdivider," "owner" and "builder" even though the individuals involved in successive stages of a project may vary.

Discharge: A measure of the amount of water flow at a particular point, e.g. the flow of water in a stream or in a pipe.

Daily Discharge: The discharge of a pollutant measured during any 24-hour period that reasonably represents a calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged during the day. For pollutants with limitations expressed in other units of measurement (e.g., concentration) the daily discharge is calculated as the average measurement of the pollutant throughout the day (in compliance with 40 CFR 122.2).

Diffused Drainage Discharge: Drainage discharge not confined to a single point location or channel, such as sheet flow or shallow concentrated flow.

Driveway: The area that provides vehicular access to a site. A driveway begins at the property line and extends into the site. In parking areas, the driveway does not include vehicular parking, maneuvering, or circulation areas.

Encroachment: Any structure or activity which in any manner changes, expands or diminishes the course, current or cross section of any watercourse, floodway or body of water.

Erosion: The wearing away of land surface, primarily by wind or water. Erosion occurs naturally as a result of weather or runoff, but can be intensified by clearing, grading or excavation of the land surface.

Groundwater: The term usually refers to the “saturated” zone in the ground where all the pore space between the soil particles is occupied by water.

Hazardous Material: Any material or combination of materials that, because of the quantity, concentration, or physical, chemical, or infectious characteristics, may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or that may pose a present or potential hazard to human health, safety, or welfare, or to animal or aquatic life or the environment when improperly used, stored, transported or disposed of, or otherwise managed. For purposes of chemical regulation by this manual, moderate to high toxicity and confirmed human carcinogenicity are the criteria used to identify hazardous substances.

Illicit Discharge: Any discharge to a municipal separate storm sewer or stormwater conveyance that is not entirely composed of stormwater.

Impervious Surface: A surface which substantially precludes the infiltration of water, such as concrete, asphalt, tile or compacted gravel.

Infiltration: The passage, movement or percolation of water into and through soil surfaces, including soil surfaces on roofs and in landscaped areas.

Outfall: The point where a sewer or drainage discharges into a receiving waterway.

Peak Discharge: The maximum rate of stormwater runoff from a specific storm event.

Peak Flow: The maximum flow.

Pervious Pavement: Types of alternative pavement systems that allow stormwater to percolate through them and into subsurface drainage systems or the ground (e.g., permeable pavers, pervious asphalt, and pervious concrete).

Point Source: Any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock concentrated animal feeding operation (CAFO), landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural stormwater runoff.

Nonpoint Source Discharge: Discharge from a diffuse pollution source (i.e., without a single point of origin or not introduced into a receiving stream from a specific outlet).

Retention Pond: A basin, usually enclosed by artificial dikes, that is used to store water permanently.

Return Period: The average interval in years over which an event of a given magnitude can be expected to recur.

Sediment: Organic or inorganic material that is carried by or is suspended in water and that settles out to form deposits in the storm drain system or receiving waters.

Stormwater: Runoff from rain storms, melting snow, and surface runoff, and drainage.

Stormwater Management: The overall culmination of techniques used to reduce pollutants from, detain, retain, or provide a discharge point for stormwater to best preserve or mimic the natural hydrologic cycle, to accomplish goals of reducing combined sewer overflows or basement sewer backups, or to fit within the capacity of existing infrastructure.

Stormwater Management Facility: Any structure, natural or manmade, that, due to its condition, or design or construction, conveys, stores, or otherwise affects stormwater runoff. Typical stormwater management facilities include, but are not limited to, detention and retention basins, open channels, storm sewers, pipes, and infiltration facilities.

Swale: A low-lying stretch of land which gathers or carries surface water runoff.

Vegetated Swale: A swale with vegetation designed to retain and partially treat stormwater, attenuate flooding potential and convey stormwater away from critical infrastructure.

Rainwater Harvesting: A method of collecting, storing, and conserving local surface runoff rain water. This can include, but is not limited to, rain gardens, rain barrels, and other storage tanks specifically designed to collect rainwater.

Watershed: The entire region or area drained by a river or other body of water whether natural or artificial. A "designated watershed" is an area delineated by the Pennsylvania DEP under the Stormwater Management Act, for which counties are required to develop stormwater management plans.

Wetland: Those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, including swamps, marshes, bogs, fens, and similar areas.

Watercourse: Any channel for conveyance of surface water having a defined bed and banks, whether natural or artificial, with perennial or intermittent flow.

C: RECOMMENDED ORDINANCE UPDATES

1. Natural Resources:

This category is dedicated to preserving the natural landscape. It includes natural features as large as meadows and hillsides, and as small as individual trees. Preserving natural features is the most important factor in managing stormwater with GI and LID.

Protecting open space is critical for the simple reason that the stormwater must be allowed to infiltrate into the ground. Maximizing the total area of open ground therefore protects this part of the hydrological cycle.

Protecting vegetation is important for two reasons. First, vegetation does its own work by soaking up stormwater from the ground. Second, vegetation is valuable because it cannot be replaced once it is built over with concrete, asphalt, or buildings. Trees, in particular, draw up more water from the ground than grass or bushes do, and larger trees draw more than smaller trees. This is why preserving the vegetation that currently exists avoids the fixed costs of replacing it at a later time and waiting for it to re-grow.

~ Facilitators ~

General statements of intent

> ***Example:***
> *"It is the intent of the municipality to preserve natural features, and prevent sprawl."*

These statements of intent are very encouraging from a legal perspective. If a declaration like this exists in an ordinance chapter, and any section of that chapter is challenged in court, a judge may take this declaration into account when interpreting the challenged section.[42] It can thus be a powerful tie-breaker where the application of the law is unclear. It can also be a guide to city council members in future generations, who may not be informed of the green infrastructure initiatives of the current time, but who will be bound by the text of the municipal code.

However, declarations such as this have no "teeth." They do not contain any performance criteria, nor do they contain any penalties for failing to meet their philosophical goals. To rectify this problem, they should be paired with enforceable performance criteria, to strengthen those other provisions and render them more defensible in court.

Preservation of natural features

> ***Example 1***
> *"In order to prevent the denuding of the landscape, wherever practicable, large trees and other natural features constituting important physical, esthetic and economic assets to existing or impending suburban development shall be preserved."*
>
> ***Example 2***
> *"No more than 50% of any woodland, exclusive of public streets and rights-of-way, shall be cleared or developed. The remaining 50% shall be maintained as permanent open space."*

The first example is similar to the "general statements of intent" discussed above. Ordinance sections such as this one are encouraging from a theoretical perspective, but difficult to enforce. For instance, "wherever practicable" is a highly debatable term, and therefore leaves open the possibility that all the natural features could be removed. Equally debatable is how to judge when a large tree constitutes an "economic asset." Most problematic is the word "and," which suggests

[42] Pennsylvania's Statutory Construction Act gives weight to such statements of intent through several of its provisions. 1 Pa.C.S. § 1901 et seq. For instance, the interpretation of one provision must not render another provision ineffective. Ibid. at § 1921(a). Also, where terms are ambiguous, the purpose of the statute or legislative provision must be respected, which has been held by courts to include preambles and declarations. Ibid. at § 1921(c). See, e.g., Comm. v. Ostrosky, 909 A.2d 1224, 1232 (Pa. 2006); Allegheny Cnty. Dept. of Admin. Servs. v. A Second Chance, Inc., 13 A.3d 1025, 1034-40 (Pa.Cmwlth. 2011); Bowling v. Office of Open Records, 990 A.2d 813, 824 (Pa.Cmwlth. 2010); Comm. v. Campbell, 758 A.2d 1231 (Pa.Super.Ct. 2000). As long as the Act is deemed to govern municipal legislation in the same manner as state legislation, such statements of intent such as the one quoted here are very important.

that a tree must be a "physical, esthetic, *and* economic asset" at the same time in order to be protected.

In contrast, the second example is better from a stormwater management perspective. The requirement of "50%" is measurable, and therefore enforceable on a practical level. It also declares protection of open space as the first example does. The word "permanent" solves the problem that the first example's "wherever practicable" causes. As long as "woodland" is clearly defined, this ordinance section is preferable from a stormwater management perspective.

Municipalities are encouraged to adopt sections supporting the preservation of natural features, and to bolster them with metrics that are observable and enforceable, particularly those discussed under Category 5 (Stormwater Management Provisions) below.

Protection of streams

Example 1
"No person shall restrict or impede the flow of any stream, creek, or other watercourse."

Example 2
"Where a subdivision or land development is traversed by a natural watercourse, there shall be provided a drainage easement or right of way conforming with the line of the watercourse and wide enough to preserve natural drainage."

Naturally-occurring streams are important to carry stormwater away to larger waterways. Also, damage to streams can increase the build-up of sediment in larger waterways, which exacerbates the negative effects of the combined sewer overflow problem. The first example quoted above is beneficial because it prohibits such damage. However, the inflexible prohibition also serves as a barrier in certain circumstances, if it prevents certain BMPs involving watercourses. An improvement over this example is given below.

The second example adds the requirement to protect streams with an easement or right of way, in order to make the intent of the law more enforceable.[43] An improved version might look as follows (changes in italics):

"No person shall restrict or impede the flow of any stream, creek, or other watercourse, *except when necessary to conform to Best Management Practices as published by the Pennsylvania Department of Environmental Protection, "Best Management Practices for Stormwater Management," Document No. 363-0300-002 (2006).* Where a subdivision or land development is traversed by a natural watercourse, there shall be provided a drainage easement or right of way conforming with the line of the watercourse and wide enough to preserve natural drainage."

[43] *See footnote 44 below.*

Landscaping requirement

Example 1
"All areas of property not paved or occupied by buildings must be landscaped."

Example 2
"A landscaping plan shall be required which includes sufficient plantings for the required open space, planting strips, screenings, formal gardens, shade trees and natural barriers."

Landscaping is preferable to a plain grass lawn from a stormwater management perspective. This is because larger plants draw up more water from the ground than grass does. Therefore, increasing the number of bushes and trees on a property increases its contribution to overall stormwater management in the municipality.

The first example quoted above requires the landscaping of open areas. The second example regulates the manner in which landscaping is done. Municipalities are encouraged to adopt both of these. The inclusion of "shade trees" is particularly beneficial, since trees have such great capacity to soak up stormwater.

It is also beneficial to require that landscaping plans be approved by the municipality or a commission, for example a Shade Tree Commission. This can improve the effectiveness of the landscaping.

Tree planting requirement

Example:
"One shade tree shall be planted in the front yard of each lot for each 50 feet of lot frontage, or part thereof, along all public right-of-ways."

As mentioned in the introduction to this section, trees are the most beneficial vegetation for stormwater management. Requiring trees to be planted within the municipality, as appropriate, is therefore unquestionably beneficial. The example given here is for residential developments, but such provisions should also be considered for all developed areas within a municipality. In determining the placement and species of trees, one should consider the location of utilities.

"Conservancy" Zoning District

Example:
"The purpose of the Conservancy [Zoning] District is to encourage conservation of open space, steep slopes, and other natural features."

A conservancy district (also called a "Conservation District" in some existing ordinances) is a zoning district with special requirements designed to preserve the natural landscape. Municipalities are highly encouraged to create these zones wherever feasible. They are an improvement over site-by-site requirements, in that they maintain consistency over a wide area and provide a background on which all other decisions are based. Conservancy districts often include special requirements for lot sizes, yard dimensions, building coverage, and limited property uses.

Required vegetation in each lot

Example:
"No less than 60% of the front yard width must be maintained with either grass or other ground cover vegetation."

This provision is beneficial as another way to prioritize vegetation over impervious surfaces and bare dirt. It is particularly effective when coupled with the landscaping provision discussed above. The example quoted above is designed for a residential zoning district. Municipalities are encouraged to adopt such requirements for all zoning districts, with modifications based on each district.

Buffer Areas

Example 1
"Buffer Area A shall be a minimum of 10 feet in depth measured from the property line and shall be comprised of one row of plantings which are a mixture of 30% deciduous and 70% evergreen trees spaced within the row 10 feet apart…"

Example 2
"If existing conditions are adequate to meet the intent of the required buffer area, the applicant may be required to record a conservation easement to guarantee that the existing topography and/or vegetation will not be disturbed or removed from the approved buffer area."

Many municipalities require buffer areas to separate residential districts from other districts that may pose disturbances to the quiet enjoyment of residential homes, for instance industrial districts. These are encouraged because they give an opportunity to include more vegetation and open space.

Some municipalities also have established different types of buffer areas (for example, buffer areas A, B, and C), to be used in different circumstances. These typically have different requirements for the species of trees, the spacing between them, and the setback from the edge of the yard, among other factors. This practice is encouraged, because it affords the opportunity to include vegetation that may be feasible in some areas, even though it is not feasible in all.

Some existing buffer area ordinances also state that stormwater management facilities may be located within a buffer area. This is beneficial because it gives another location where stormwater management facilities may be placed, and it avoids the unfortunate circumstance of canceling out a stormwater management facility that may need to extend into a buffer area.

Some municipal ordinances mention the option of recording conservation servitudes to protect land in perpetuity. Many options are available to municipalities to achieve this goal. Technically speaking, the best option might be an easement, a negative easement, or a restrictive covenant.[44] Municipalities are encouraged to consult with legal experts to determine which option suits their individual needs.

~ Uncertain Effect ~

Prohibition against cutting vegetation

Example 1
"It is unlawful to break, bruise, or cut any shade tree growing within the lines of the streets."

Example 2
"No person in attendance at a park shall…injure, deface, remove, cut, or damage any of the trees, plants, shrubs, turf…or any other property of the Borough located within the park."

Because vegetation is critical to stormwater management, especially large trees, protecting it from damage is very beneficial. Sections such as these are highly encouraged for every municipality.

The second example brings up a potential problem, because green infrastructure in a park can be hampered by wild overgrowth. For instance, if a drainage swale becomes overgrown with cattails, its ability to infiltrate stormwater will be reduced. The wording of the section quoted above solves this problem, because it says "No person *in attendance*." This allows park maintenance employees to take care of the green infrastructure without violating the ordinance, because employees are not "in attendance" in the same way as recreational visitors. Municipalities should adopt protective ordinances such as these with an eye toward maintenance of vegetated green infrastructure.

Prohibition against vegetation within a right-of-way

Example:
"No hedges, shrubbery, or planting (other than trees and grass) shall be within the right of way of a street."

[44] For comprehensive summaries of the subject, see John Walliser, "Conservation Servitudes," 13 *J. Nat. Res. & Envtl. L.* 47, 65-76 (1997); Gerald Korngold, "Privately Held Conservation Servitudes: A Policy Analysis in the Context of in Gross Real Covenants and Easements," 63 *Tex. L. Rev.* 433, 435–437 (1984).

Sections such as this could be barriers to Low Impact Development/Green Infrastructure. The obvious benefit is to prevent vegetation from obstructing view of the roadway. One negative consequence may be the prohibition of some vegetation that could assist in stormwater management. Some vegetation may be so low-growing or slow-growing that it will not pose a safety problem.

Municipalities are encouraged to make the following improvement (changes in italics):

> No *vegetation* (other than trees and grass) shall be within the right of way of a street, *unless:*
>
> *(a) The vegetation does not exceed a height of thirty-six inches; or*
>
> *(b) It is clear that the vegetation will not grow in such a manner as to obstruct proper sight triangles, in conformity with the street design standards contained in [reference to relevant ordinance provision]*.

2. Development Patterns and Infill

This category deals with developed land. It touches on construction methods, density of buildings, and the grading of the land. It also impacts the total amount of impervious material used within a municipality.

In general, development should be planned so as to preserve as much open space as possible. Clustered and mixed-use development strategies are encouraged. Locating development near transit hubs improves those strategies. Also, choosing to redevelop previously-developed areas instead of moving to new undeveloped areas preserves untouched natural landscapes, which are significantly more valuable than developed land for stormwater management.

During construction, existing natural features such as large trees and streams should remain undisturbed. As mentioned in the discussion of Category 1(Natural Resources), trees draw more water from the soil than smaller plants, and trees are also much more difficult to replace due to their cost and the time it takes to reach maturity. Integrating these priorities into construction practices is therefore highly encouraged.

Some municipalities also include zoning options that are very beneficial for stormwater management. These include two distinct types: conservation subdivisions, which have special requirements for open space and natural features, and conservation districts, which are entire zones designed to preserve the natural landscape.

~ Facilitators ~

<u>General statements of intent</u>

> ***Example:***
> *"The purposes of this chapter are…to conserve natural resources and open space, to encourage innovations in housing design, provide variety in housing types, and encourage a more efficient use of land."*

Municipalities often include general statements of intent at the beginning of their land development ordinances. Many of them promote things that are very beneficial for stormwater management. As mentioned in the discussion of Category 1 (Natural Resources), these statements of intent are very encouraging from a legal perspective. However, they have no "teeth." These sections are most effective when paired with enforceable performance criteria, to strengthen those criteria and to provide interpretive tools to those who seek to understand the intent of the performance criteria.

Preserve natural features during construction

Example 1
"During site development, large shade trees shall be adequately protected from injury and preserved to the extent practical."

Example 2
"[Construction]…shall not proceed until adequate guards have been placed around all trees that may be so affected. Activities shall proceed with caution during any excavation so as not to destroy or remove any of the large root system and minimally disturb the smaller and feeder roots."

Example 3
"The developer shall determine the presence of environmental or natural features on the site and shall meet…standards of environmental protection [for floodplains, steep slopes, woodlands, ponds, watercourses, and wetlands]."

Example 4
"No development shall be permitted within 80 feet of any pond or watercourse."

Many municipalities have provisions protecting natural features during construction activities. This is highly beneficial from a stormwater management perspective, because vegetation such as large trees are critical to the hydrologic cycle, and because natural drainage carries stormwater out to larger waterways.

All four of these examples are beneficial. The first carries with it an undesirable ambiguity, because "to the extent practical" is a determination best made by the developer, who may have an incentive to remove all the trees. The second is greatly improved in that it protects "all trees that may be so affected," which allows less argument. The requirement to place guards around the trees also brings a practical focus.

The third example is part of a longer ordinance section that contains very detailed "standards" for protecting natural features. Such detail is encouraged. The fourth example provides a specific measurement of 80 feet, which is helpful because it can be clearly followed and enforced.

Municipalities are encouraged to adopt provisions containing at least one of the strategies in these four examples of a more practical approach than the mere statement of general intent. They protect open spaces from the built environment, and give some form of performance metric that

can be enforced. Some existing versions require that this dedicated open space be free of structures used for group meetings. Although the social benefit of such structures is understandable, prohibiting them is beneficial from a stormwater management perspective.

Dedicated open space in entire subdivision

Example 1
"In no event shall the total area of open space to be dedicated to the Borough be less than five contiguous acres."

Example 2
"The recreation open space shall be a minimum of 2,000 square feet per dwelling unit or lot, an area of open space equal to at least 1,000 square feet per lot or dwelling unit shall be dedicated to the Borough for recreational purposes."

Example 3
"Not less than 25% of any planned residential area shall be devoted to common open space."

Example 4
"Where the applicant or developer elects not to offer to dedicated open space for recreation purposes, or the Borough Council determines, after review, that as a result of size, shape, location, topography, or other physical features…that the setting aside of land…is impractical…the applicant or developer may elect or shall be required to pay a fee in lieu of dedication."

The ideal situation for stormwater management would be to preserve the vegetation that existed before construction, since features such as large trees are difficult to replace. However, it is understandable that planned residential development often requires artful landscaping which may not be consistent with the pre-existing vegetation.

A revised version that preserves natural features might appear as follows:

The application materials shall be reviewed in consultation with the Engineer to determine where natural features should be retained undisturbed within the recreation open space. Where aesthetic and landscaping objectives can be achieved without disturbing natural features, the development plan shall be altered accordingly.

(a) The natural features not to be disturbed include, but are not limited to:

[Include a list of preferred natural features]

(b) Not less than [chosen percentage] of any planned residential area shall be devoted to common open space."

Requirement to limit grading

Example:
"Subdivision and land developments shall be laid out so as to avoid the necessity for excessive cut or fill."

Grading destroys naturally-occurring features. Therefore, as a general rule, excessive grading activity should be avoided. The provision quoted above does not have any "teeth," but it is still beneficial in that it guides a Planning Commission's approval of a residential development application plan. Instead of adding enforceable standards to a section like this, it is preferable to couple it with a list of natural features that should not be disturbed (see above), and reduce the sizes of improvements such as buildings and parking lots, etc. through other applicable provisions.

~ Uncertain Effect ~

Lot sizes and building coverage

Example 1
"There shall be a front yard, the depth of which shall be 35 feet."

Example 2
"In the R-1 District, the following regulations shall be observed on each lot…minimum lot width: 60 feet."

Example 3
"The coverage by the main building and accessory structures shall not exceed 40 percent of the lot area."

Requiring open space wherever possible is beneficial for stormwater management, particularly when existing tree cover is retained rather than the less pervious turf-covered areas, because this allows natural evapotranspiration and infiltration of stormwater through the soil. The combination of minimum lot dimensions and maximum building coverage ensures a certain amount of open space per lot.

However, large lot sizes contribute to suburban sprawl, which can ultimately become negative for stormwater management. As a general rule, it is preferable to collect open space into one large plot rather than many small ones. Increasing building density through clustered development can allow for larger plots of open space, with reduced costs for clustered infrastructure. Therefore, front yard provisions such as this can ultimately be barriers in some circumstances.

It is recommended that provisions such as those in the previous example, requiring open space per subdivision, be substituted for those requiring open space per lot, so that the largest possible open areas can be preserved.

In the alternative, if the example above is not adopted, then provisions should be designed to allow site-by-site determinations in the following manner. The percentage given here is only a suggested number, but some number should be included to allow developers greater certainty:

> (a) In reviewing an application for residential development, the Engineer shall consult with the developer on the arrangement of open space and, wherever it is deemed to be feasible, lot sizes shall be adjusted to increase density of development and thereby preserve larger open spaces.
>
> (b) Development should be planned so as to arrange the required dedicated open space as one single contiguous area if feasible.
>
> (c) The open space in a conservation subdivision shall constitute at least [chosen percentage] of the subdivision's total acreage.

3. Streets, Driveways, Sidewalks

This category deals with impervious surfaces in detail (excluding structures and parking lots), relating to dimensions, materials, and locations of those surfaces. From a stormwater management perspective, impervious surfaces should be as limited as possible. Managing the construction of sidewalks is therefore an important LID practice.

Some ideal reductions of sidewalks are not possible. For instance, sidewalks may not be narrower than the federal Americans with Disabilities Act (ADA) requirements.[45] Similarly, in certain locations, streets and parking lots must guarantee enough space for emergency vehicles such as fire trucks and ambulances.

Within these constraints, it is less efficient to mandate restrictions on impervious surfaces than it is to encourage voluntary reductions. For instance, reductions in sidewalk surfaces that may also result in reduced construction and maintenance costs include:

- Allowing vegetation in the public right-of-way, most commonly in between the sidewalk and the curb
- One-way streets
- Construction of sidewalks on only one side of the street in residential developments

~ Facilitators ~

<u>Vegetated Curb Areas</u>

> ***Example 1:***
> *"Sidewalks shall be located a minimum of 4 feet from the edge of any curb."*
>
> ***Example 2:***
> *"Continuous six-inch curbing is required."*

[45] Americans With Disabilities Act, 42 U.S.C. § 12101.

The first example quoted above is a facilitator because it allows space for a vegetated curb area. Placing vegetation in between a sidewalk and a road serves two important purposes. First, it is a relatively easy way to increase the amount of vegetation in a municipality, because that space usually has no other useful purpose. Second, vegetated curb areas can also deal with runoff from the street if the curb design so allows.

In contrast, the second example quoted above is a barrier to vegetated curb areas, because continuous curbs will not allow water to penetrate. It is suggested that the following language be added (in italics):

> "Continuous six-inch curbing is required. *Where vegetated curb areas are constructed, curbs shall be designed, where feasible, to allow stormwater to flow into the vegetated area, either through a curb cut, a grate, or other method approved in consultation with the Engineer."*

~ Uncertain Effect ~

Sidewalks on one side of the street

> ***Example:***
> *"Sidewalks shall be installed under the following circumstances: where sidewalks exist in the same block on the same side of the street; along the full frontage of lots located on arterial or collector streets; along local streets within all residential subdivisions; within a land development plan for multi-family residences; and within commercial or industrial development plans where sidewalks will be necessary for pedestrian safety."*

To minimize impervious surfaces, sidewalks should be eliminated wherever feasible, while also taking into consideration safety and other practical concerns such as encouraging walkable communities. One method of achieving this is to construct sidewalks on only one side of a street. The example quoted above offers an opportunity for this in the first clause. Where sidewalks do not exist in the same block on the same side of the street, and where that block does not fit into the exceptions that follow, a sidewalk is not required to be constructed.

The determination of which zones or property uses should constitute exceptions to the one-side rule involves community considerations. In particular, high-density areas should maintain sidewalks on both sides for safety reasons. In making this determination, municipalities should also strive to maintain compliance with the ADA.[46]

4. Parking Areas and Parking Requirements

This category deals exclusively with parking lots, which often constitute the largest impervious surfaces in a municipality other than roads (especially in less-urban areas), and therefore require

[46] Ibid.

a significant amount of attention. Three ways of dealing with parking lots are: reducing the size of the lot, installing vegetated islands within the lot, and changing the paving material.

Reducing the size of the lot can be done in various ways. One is to simply reduce the number of parking spaces. Many municipalities require parking spaces based on the "worst-case scenario" (for instance, holiday shopping periods), and those spaces lie unused for the remainder of the year; it is therefore quite feasible to reduce these numbers, saving cost to the developer at the same time. Provisions should be available for overflow parking during peak times. Other options include angle parking and one-way lanes.

Developers should consider pervious pavement (concrete and asphalt) and pavers wherever it is practical to do so. The runoff volume and rate control, plus the attendant reduction of pollutants, can improve the quality of stormwater discharges, reduce CSO events, and reduce localized flooding. The use of pervious pavement can potentially reduce additional expenditures and land consumption in comparison to conventional collection, conveyance, and detention infrastructure.

~ Uncertain Effect ~

Paving material

Example:
"All open off-street parking spaces shall be improved with: tar and chip; bituminous; concrete; or paving brick. The parking area must have an all-weather, dust-free surface of adequate thickness to support the weight of fully loaded vehicles."

Pervious pavement can serve certain beneficial purposes. It is recommended that municipalities adopt a provision in the style of the following (changes in italics):

"*Parking areas shall be paved as follows:*

(a) All open off-street parking spaces shall be improved with: tar and chip; bituminous; concrete; or paving brick. The parking area must have an all-weather, dust-free surface of adequate thickness to support the weight of fully loaded vehicles.

(b) Where the use of alternative surfaces, such as permeable pavement, would improve stormwater management, their use shall be encouraged, with consideration for the cost of construction on the developer and the burden of future maintenance on the property owner, consistent with the public interest and the purposes of this Chapter.

(1) Where alternative surfaces are encouraged, the Engineer shall evaluate the appropriateness of said surfaces based on the surfaces' capacity to support the weight of expected parking.

(2) Priority shall be given to the use of alternative surfaces in overflow parking areas."

~ Barriers ~

Number and width of parking spaces

Example 1
"The off-street parking requirements for retail or commercial uses shall be one space for every 400 square feet of floor area, or one space for every two employees, whichever is greater."

Example 2
"Each parking space in a parking lot shall be at least 9 feet wide and 18 feet long. Each handicapped parking space shall be 13 feet wide by 18 feet long. . . . Parking to serve any nonresidential use shall be located so that no required space is more than 400 feet from the building."

Many municipalities have specific and inflexible requirements for parking space design, which can unnecessarily increase the size of the parking area. Often, the requirements are based on the use of the property, such as office buildings, retail stores, or hotels. It is often the case that these numbers are over-estimated. For example, customers at drug stores typically stay for very short periods of time, whereas customers at department stores typically stay for much longer. This means that drug stores can satisfy parking demand with fewer spaces per square foot of floor area.

It is therefore recommended that developers submit a parking analysis with the site development plan. The parking analysis should take into account such details as the duration of customer visits and the availability and proximity of overflow options, such as on-street parking. Also, the parking analysis should not be geared toward creating more parking area ("whichever is greater,") but less. Smaller parking areas reduce the amount of impervious surface, which is beneficial from a stormwater management perspective, and developers will appreciate the lowered cost in constructing and maintaining smaller parking areas as well.

Because parking analyses can be expensive, it is also recommended that a threshold be established for relatively small establishments that do not expect to generate a lot of parking. In determining this threshold, municipalities are encouraged to consult the publications of PennDOT.

Such a provision might look as follows:

"The site development application shall include a parking analysis, which shall take into account the number of customers expected to be inside the store at any given time, showing the minimum, maximum, and mean expected numbers, taking into account standard deviation, and taking into account the number of employees.

(a) The parking analysis requirement may be waived where, in consultation with the Engineer, it is determined that the maximum expected number of parked cars will be less than [#]."

Design of landscaping islands

Example 1
"One internal landscape island shall be provided for every 10 parking spaces. No more than 10 parking spaces shall be provided in an unbroken row without the provisions of interior landscape islands."

Example 2
"In parking areas containing more than 20 spaces, at least 20% of the interior parking area shall be landscaped with plantings, including one tree for each 10 spaces."

Example 3
"For all parking areas, a planting strip at least 5 feet wide shall be provided between the edge of the right-of-way and the parking area."

Vegetated islands are beneficial for stormwater management, in that they provide infiltration for stormwater that would otherwise contribute to the combined sewer overflow problem. However, numerous small islands are not as effective as one very large island or a vegetated perimeter. Particularly, islands which are too small to contain trees or perform much filtration may turn out to be a negative, as they increase the size of the parking lot without adding much benefit. The infiltration capability of a vegetated island is only as effective as the surrounding curb will allow it to be; therefore, if islands are surrounded by curbs, those curbs should include cuts or grates that allow water to flow through.

The first example quoted above demonstrates this problem, as it requires numerous islands to be built. The practical effect of this is that the islands will probably be small, as the developer will probably not want to build numerous large islands. The second example is better, because it relaxes the requirements to allow for larger islands, and also includes the very beneficial requirement of trees. The third example speaks to perimeter, which could potentially replace smaller islands if it is wide enough.

Municipalities should adopt language similar to the following examples, which are intended to Work together as a whole.

"Vegetated parking islands shall be designed as follows:

(a) Parking areas containing more than [#] spaces shall also include vegetated infiltration area(s) comprising at least [#]% of the total parking area. The vegetated infiltration area(s) shall be located to capture and infiltrate as much stormwater as possible while complying with practical safety and transportation concerns.

"Vegetated parking islands shall be designed as follows:

(b) For purposes of this section, calculation of the dimensions of the parking area shall include any vegetated infiltration area(s) designed around the perimeter, so that such perimeter vegetated area(s) count toward the required [#]%. Perimeter vegetated infiltration areas of sufficient size may satisfy the requirement, so that the developer is not required to provide any vegetated infiltration area(s) in the form of islands within the paved area.

(c) The vegetated infiltration area(s) shall contain at least one tree per [#] parking spaces.

(d) The vegetated infiltration area(s) shall be designed, graded and sloped so as to maximize the capture and infiltration of stormwater. Vegetation shall be selected and arranged so as to maximize stormwater management, while complying with aesthetic design.

(e) If curbs are placed around the vegetated infiltration area(s), those curbs shall be designed to allow the passage of stormwater into the infiltration area(s), through curb cuts, grates, or other techniques approved by the Engineer."

5. Stormwater Management Provisions

This category deals with methods for implementing stormwater management. It includes general statements of intent, and specific methods for implementation. Those specific methods include monitoring, tracking, and maintenance requirements, as well as funding and enforcement penalties. This category holds the real "teeth" of stormwater management ordinances.

In general, it is recommended that municipalities rest their implementation on specific, defined standards. On the one hand, GI and LID are very site-specific, and benefit from flexible standards. But it is helpful to keep standards clearly defined wherever it is feasible.

It is also recommended that every municipality adopt the Pennsylvania Department of Environmental Protection's *Best Management Practices For Stormwater Management*, published as DEP Document No. 363-0300-002 (2006).

~ Facilitators ~

Declaration of policy to promote stormwater management

Example 1
"A comprehensive program of stormwater management, including reasonable regulation of development and activities causing accelerated erosion, is fundamental to public health, safety, and welfare and the protection of the people, their resources and the environment."

Example 2
"To accomplish these objectives, this Subchapter establishes a comprehensive stormwater management program designed to: control accelerated runoff and erosion and sedimentation problems at their source by regulating activities which cause such problems…"

Many municipalities in Allegheny County include declarations of policy to promote stormwater management, which are nearly identical to each other. These often include a broad declaration followed by specific objectives listed as sub-sections, such as controlling erosion, using the existing natural drainage system wherever possible, encouraging recharge of ground waters, and providing for the proper design, installation, and maintenance of permanent stormwater management structures, among several others.

Declarations such as these are a dream come true for proponents of green infrastructure, insofar as they establish a legislative intent through which all other sections of such ordinances should be judged. If an ordinance should ever be challenged in court, a judge may interpret the challenged section based on such a declaration.[47] Also, this is a way of setting boundaries for future legislation, because future members of city council will be bound by the declaration codified in the ordinance.

It must also be noted, however, that such declarations are hard to enforce on a practical level because they are vague. As such, a municipality that has enacted such a declaration will see no change in stormwater management unless it is coupled with enforceable standards.

General standards

Example 1
"Any landowner and any person engaged in the alternation of development of land which may affect stormwater runoff characteristics shall implement such measures as are reasonably necessary to prevent injury to health, safety or other property. Such measures shall include such actions as required to:

[1] Assure that the maximum rate of stormwater runoff is no greater after development than prior to development activities; or

[2] Manage the quantity, velocity and direction of resulting stormwater runoff in a manner which otherwise adequately protects health and property from possible injury."

[47] See note 42 above, explaining the Pennsylvania Statutory Construction Act.

This is a good example of general standards for stormwater management. Extending the criteria to all alterations and developments of land is beneficial because stormwater management must be comprehensive. The dual goals of zero-change runoff and protection from injury are also highly encouraged.

It is suggested that the first sentence be amended to prevent increased contributions to combined sewer overflows, since that issue is much stronger now than when this example was written. As a drafting issue, inserting the word "and" in between the two subsections removes the possibility that "or" might be read between them. It is crucial to stormwater management that the goal of zero-change runoff be preserved in all cases.

Municipalities are encouraged to make the following changes (in italics):

"Any person engaged in the alteration or development of land which may affect stormwater runoff characteristics shall implement such measures as are reasonably necessary to prevent *increased contribution to sewer overflow events, and to* prevent injury to health, safety, or other property. Such measures shall include such actions as are required to:

a) assure that the maximum rate of stormwater runoff is no greater after development than prior to development activities; *and*

b) manage the quantity, velocity and direction of resulting stormwater runoff in a manner which otherwise adequately protects health and property from possible injury."

Stormwater Maintenance Fund

Example:
"Persons installing stormwater storage facilities are required to pay into the Stormwater Maintenance Fund to help defray the costs of periodic inspections and maintenance expenses."

Some municipalities have created a stormwater maintenance fund to assist with inspection and maintenance of facilities. This is extremely beneficial. It is suggested that municipalities create a fund with a low burden to the applicant so that stormwater management facilities can be maintained without municipal resources from other programs.

Requirement of stormwater detention

Example:
"On all properties 1 acre or more which are proposed for subdivision, consolidation or land development under the terms of this chapter, onsite stormwater detention shall be required where post-development discharges exceed pre-development discharges and where detrimental effects may be caused downstream or on adjacent properties."

This is a very useful provision. The requirement of zero-change runoff is very preferable for eliminating the combined sewer overflow problem. The second criterion, to eliminate detrimental effects to other properties, extends the requirement to those properties which have pre-existing stormwater problems and thus would fall outside the zero-change runoff standard.

The word "detention" is ambiguous from a stormwater management perspective, because it could mean a holding pond, a drainage swale, a rain barrel, or even a green roof. However, any form of detention is beneficial as long as it maximizes infiltration.

A provision such as this should be accompanied by other provisions giving specific requirements for stormwater management facilities, such as design standards, performance metrics, and maintenance obligations. Such provisions are discussed throughout this section.

Priorities based on site conditions

Example:
"The stormwater management practices to be used in developing a stormwater management plan for a particular site shall be selected according to the following order of preferences: 1) infiltration of runoff onsite; 2) flow attenuation by use of open vegetated swales and natural depressions; 3) stormwater detention and/or retention structures. . . . A combination of successive practices may be used. Justification shall be provided by the applicant for rejecting each of the preferred practices, and said rejection shall be based on actual site conditions."

The example quoted above is very effective because it provides guidance to the developer, but also makes allowance for on-site conditions. The prioritized list of preferences is helpful because it aids decision-making, and the ability to use multiple practices prevents the list from being restrictive.

Implementation of green infrastructure is very site-specific, and therefore a provision such as this might be considered a barrier if not for the final sentence. Because that sentence is included, this provision is a very good model to follow.

Stormwater Management Plan

Example:
"Prior to final approval of a subdivision or land development, the stormwater management plan shall be approved by the Township Engineer. . . . The plan shall include evidence that the plan has been submitted to the Allegheny County Conservation District, and the final plan shall include any revisions resulting from review by the Conservation District."

Requiring a stormwater management plan for every development project is critical in solving the combined sewer overflow problem. Every development must be held to clear standards and examined on a site-by-site basis. Communication with the Allegheny County Conservation District is also extremely helpful to further holistic CSO management. The example given above continues with the details of the stormwater management plan, including soil description,

hydraulic and hydrologic calculations, on-site detention methods, and maintenance plans, among others.

Watershed-based performance standards

Example:
"The stormwater performance standards contained in this Part are intended to implement the standards and criteria contained in the [Watershed] Stormwater Management Plan. . . . If there is any discrepancy between the provisions of this Part and the standards and criteria of that plan, or if the watershed plan is subsequently amended, then the standards/criteria of the current watershed plan shall govern."

Municipalities are strongly encouraged to plan regionally instead of locally, given that the flow of stormwater knows no boundaries and travels through multiple municipalities during large storms. Watershed-based management is critical to resolving the combined sewer overflow issue in the older communities and stormwater management responsibilities of the suburban separate sewer communities. Allegheny County is currently developing a County-wide stormwater management plan.

Calculation methods

Example:
"For the purpose of computing peak flow rates and runoff hydrographs from development sites, calculations shall be performed using one of the following: SCS publication, Technical Release (TR) 55 or 20, HEC I, or Penn State Runoff Model. For the purposes of designing storm sewers, open swales and other stormwater runoff collection and conveyance facilities, any of the above listed calculation methods or the Rational Method may be used. Rainfall intensities for design should be obtained from the Pennsylvania Department of Transportation rainfall charts."

Many municipalities list approved methods for calculating performance of stormwater management facilities. This is beneficial because it gives clear guidance. Municipalities that have not yet adopted calculation methods are encouraged to do so.

Maintenance responsibility

Example 1
"A maintenance program for stormwater control facilities must be included as part of the grading and drainage plan."

Example 2
"Maintenance during development activities of a project shall be the responsibility of the contractor, developer and owner. Arrangement for maintenance of permanent stormwater control facilities after completion of development activities shall be made before approval of final plans is given by the Borough Council."

For stormwater management facilities to work properly, they must be maintained. The two examples given here are essential for proper maintenance: a defined plan, and delegated responsibility. To assure the sustainability of stormwater control and green infrastructure, the municipality can assume responsibility for maintenance, preferably through a stormwater maintenance fund, (discussed above) be implemented to defray the costs.

Stormwater Management Easements

Example:
"Stormwater management easements are required for all areas used for off-site stormwater control, unless the Engineer grants a waiver. Easements shall be provided by the property owner if necessary for access for inspections and maintenance, or preservation of stormwater runoff conveyance."

These easements are beneficial because they facilitate maintenance by the responsible parties. They can prevent future disputes about entrance onto property and the actions a maintenance worker has the right to undertake.[48]

One cautionary note about this example: municipalities should be mindful of delegating waiver authority without sufficient oversight by the municipality or planning commission.

Standard for variances

Example 1
"In a residential district, a special exception, variance, or accessory use must not unduly burden water or sewer facilities."

Example 2
"The Borough Council may grant a modification . . . if the literal enforcement will exact undue hardship because of peculiar conditions pertaining to the land in question, provided that such modification will not be contrary to the public interest and that the purpose and intent of this Chapter is observed."

It is important to ensure that variances do not thwart the purpose of a stormwater management ordinance. Both examples given above work to solve this problem. Each is successful in its approach. The first is focused on the variance's effect on the sewer system. The second is focused on the public interest and the purpose of the chapter, which hopefully includes a declaration of policy similar to the one discussed earlier.

[48] See footnote 44 above, explaining easements and restrictive covenants.

It is suggested that municipalities follow the first example, because its focus is more concrete and therefore less ambiguous. It is also suggested that municipalities replace "unduly burden" with language that more specifically addresses the combined sewer overflow issue, in the style of the following (changes in italics):

> "In a residential district, a special exception, variance, or accessory use must not *materially increase the contribution of stormwater to sewer overflow events from a 5-, 10-, or 25-year storm, or storm intensity and return frequency that is required by the municipal wet weather control plan or water quality restrictions in the receiving stream as recommended by the Engineer."*

6. Green Infrastructure

This category deals specifically with green infrastructure, which includes trenches, swales, retention ponds, vegetated curbs and islands, rain barrels, rain gardens, green roofs, and pervious pavement. Interestingly, there are very few ordinances that deal specifically with green infrastructure. The few that have significant effects are mentioned here.

~ Facilitators ~

Green roofs

> ***Example:***
> *"Landscaped roof areas devoted to recreational activities freely accessible to residents may be counted toward common space required at a value of 60 percent of the actual roof area devoted to this use."*

Incentivizing landscaped roofs is a useful way to change an impervious roof surface to a stormwater management tool. Roofs can comprise the majority of impervious surface in a densely-developed municipality. Therefore, any reduction in that impervious surface is beneficial. The value of 60 percent is also useful in that it does not merely constitute a one-for-one replacement of common open space.

Although an existing example of incentives for green roofs is not available, the example given above for landscaped roofs can be easily offered for green roofs in the same manner.

Sidewalk-curb setback

> ***Example:***
> *"Sidewalks shall be located a minimum of 4 feet from the edge of any curb."*

This example allows for vegetated curbs to manage roadside stormwater, which can be especially effective if used extensively throughout a municipality.

~ Barriers ~

Prohibition of downspout disconnection

Example 1
"Residential developments shall have down spouts and driveway drains collected and conveyed to the storm sewer system."

Example 2
"Roof drains shall not be connected to streets, sanitary or storm sewers or roadside ditches …When it is more advantageous to connect directly to streets or storm sewers, connections of roof drains to streets or roadside ditches may be permitted by the Township. Roof drains shall discharge to infiltration areas or vegetative BMPs to the maximum extent practicable."

Downspout disconnection is one of the most important of all green infrastructure practices, as it is extremely low-burden and high-reward. Therefore, it is strongly suggested that municipal ordinances like the first example, which requires property owners to connect their downspouts to the storm sewer system, be amended or repealed.

In contrast, the second example quoted above is an effective solution to the problem, which actually prioritizes downspout disconnection. It still allows connection to the storm sewer pending Township approval, and therefore it prevents situations that might be burdensome for property owners. Prioritizing discharge to infiltration areas and vegetative BMPs is extremely beneficial for stormwater management. It is suggested that rain barrels also be included in those priorities.

Prohibition of standing water

Example 1
"No person shall permit the accumulation of stagnant water."

Example 2
"Open water courses shall not be permitted within the rights-of-way of streets."

Ordinance sections prohibiting standing water may unknowingly interfere with infiltration practices. For example, a drainage swale may infiltrate water at a slower rate than the rain falls. As a consequence, water may pool in the swale for a period of several hours or one day. The sections quoted above do not distinguish between swales designed to infiltrate stormwater, and randomly-occurring pools of stagnant water, so it is possible that roadside drainage swales might be prohibited under them.

Because of the obvious public health benefit of this prohibition, which is to prevent the breeding of mosquitoes, it should not be repealed. Rather, it should be amended to allow green infrastructure that is properly constructed and maintained. A proper amendment might look as follows (changes in italics):

> "It shall be unlawful for any person to maintain or permit . . . stagnant water or pools in which mosquitoes, flies, or insects multiply, *for more than 48 hours."*

Restrictions on infiltration

> ***Example:***
> *"Infiltration systems shall not be used to handle runoff from commercial or industrial working or parking areas."*

The provision quoted above is a definite barrier to green infrastructure. Commercial and industrial areas are important locations for infiltration techniques, especially the parking lots, which are large contributors of impervious material to a municipality. Prohibiting infiltration on such properties reduces the possibilities for green infrastructure.

A distinction can be drawn between working areas and parking areas. For instance, industrial working areas may involve pollutants or other materials unsuitable for infiltration, such as metal filings. It is suggested that infiltration be allowed in industrial parking areas, but working areas be more limited, in the style of the following:

> "Infiltration systems may be used to handle runoff from commercial working or parking areas, or industrial parking areas, subject to the purposes of this Chapter and the opinion of the Engineer that such systems are safe and effective with regard to any potentially hazardous material. Infiltration systems may be used in industrial working areas if it is determined by the Engineer that such infiltration is designed such that it will involve no harmful substances or materials."