Getting Ahead of the Storm — Understanding and Implementing Green Infrastructure

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Draft Chapter on **Green Infrastructure**

In the forthcoming book,

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Balancing Conservation and Development

By John R. Nolon, Esq.

Chapter 7: Enhancing The Urban Environment Through Green Infrastructure

I. **Green Infrastructure Definition & Checklist**
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   B. Benefits
   C. Barriers
   D. Case Studies
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III. **Planning Techniques- Right Way, Wrong Way**
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      i. Explain the goals of this type of planning:
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   B. Development strategies for different areas
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   B. Putting it into Practice: Newburgh's Urban CAC law
      i. Explain how Newburgh has the first "urban" CAC law for urban environments
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VII. **Other Case Studies**
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I. Green Infrastructure Definition and Checklist

A. Definition

Since Howard's dream of "Garden Cities", the ideal "city of tomorrow" has been envisioned as including green spaces where agricultural activities, purification of air and water, and enjoyment of nature can take place.[i] Though modern urban areas are nothing like these utopist visions of the past, there is an increasingly strong and vibrant movement on the part of local governments toward preserving and creating green pockets within the urban fabric; for agricultural purposes, stormwater management, carbon sequestration, and an increased sense of community.

Innovative municipal options for creating green infrastructure, such as designing sustainable development plans for specific areas, applying the powers of Conservation Advisory Councils (CAC's) to gray infrastructure, and utilizing the Sustainable Sites rating system, will be explored.

Green infrastructure and planning for sustainable development go hand-in-hand; both seek to protect natural resources while simultaneously enhancing the health and sense of community in an urban area.

As the U.S. population continues to increase, so too does the amount of development, which is often done with little regard for its impact on surrounding natural features. This removal of natural filtration and sequestration hubs- such as wetlands

and forests- and subsequent implementation of miles of roads, parking lots, sidewalks, driveways, and other impervious surfaces in their place, has simultaneously resulted in a dearth of natural cleaning mechanisms as well as a sharp decrease in water quality due to pollution, flooding, erosion, and sedimentation (among other deleterious effects catalogued in Chapter 4's stormwater section). EPA, in its 2013 publication *The Built Environment*, cites a 2006 study that found that of the roughly 3,035,033 square miles of the contiguous United States, 40,006 square miles was constituted by impervious surface area. For perspective, this is an area almost the size of the state of Kentucky.[ii]

Many cities in the United States have been losing their tree cover while simultaneously seeing an increase in impervious cover, with an average growth of 0.31% of impervious cover per year from the mid-to-late 2000's.72 Houston, TX, for example, saw an average increase of 0.26 percent in impervious cover, while losing 0.60 percent of its tree canopy cover every year between 2004-2009. Tacoma, Washington's impervious cover grew on average 0.89 percent while it lost 0.36 percent of its tree cover ever years between 2001-2005. Only 18 cities in the U.S. increased their tree cover and decreased their impervious cover between 2003-2009. One of these cities, Syracuse, NY, increased its tree cover on average by 0.17 percent, and reduced impervious cover by 0.09 percent per year. The cause of this phenomenon is thought to be attributed to natural regeneration and limited further development.

Snohomish and King counties, Washington***

Localities searching for a means to preserve the quality of their surrounding waterways, prevent flooding, and conserve potable water have begun to combat these problems by implementing green infrastructure solutions.[iii] The term "green infrastructure" has two different meanings, depending on the context. The generally accepted broader meaning of green infrastructure is any green addition to a city- green roofs, tree canopies, etc. The more traditional, specific definition of green infrastructure refers only to replacing "gray infrastructure" (impervious concrete etc.) with "green infrastructure" in the context of stormwater management, which mitigates the myriad effects of stormwater runoff that rely on natural systems or low-impact engineered design features to capture stormwater before it runs off the pavement and into local waterways.[iv] These stormwater management strategies, sometimes also referred to as "low-impact development" (LID) or "alternative best management practices" (BMPs), are adopted as an alternative to the impervious paving and traditional sewage systems currently used in the majority of urban infrastructure.[v]

B. Benefits

Implementing green infrastructure brings a multitude of benefits to an urban community. Beyond the significant ecological benefits of cleaner air and water, the reduction of urban temperatures, and the mitigation of the effects of climate change, green infrastructure also increases energy efficiency, cost savings, and the health and well-being of urban residents.[vi]

Benefits of Green Infrastructure

1. **Water Benefits**: cleaner water, enhanced water supplies, source water protection
2. **Air & temperature benefits:** cleaner air, reduced urban temperatures, moderate the impacts of climate change
3. **Energy efficiency & cost savings**[vii]

These practices include techniques that fall either into the category of natural green infrastructure or engineered green infrastructure. It is important to note the distinction between the two; natural green infrastructure components such as forests, wetlands, and waterways serve as natural filtration systems, while engineered green infrastructure consists of human inventions that attempt to mimic natural systems or reduce the impact of human activity on the environment. Often, these two types of complementary infrastructure are implemented together, in order to preserve as much of the original natural system as possible while simultaneously advancing eco-friendly development practices.[viii] The three designations most commonly given to a green infrastructure mechanism are determined by its method of handling the stormwater runoff; by infiltration, evapotranspiration, or capture and reuse.

1. Infiltration- Infiltration is a technique by which water permeates the ground and… These techniques help reduce problems such as flooding and…

- **Permeable pavements**: unlike traditional impervious surfaces such as asphalt, permeable pavements allow water to infiltrate into the ground below.
- **Disconnected downspouts**: allows water to…
- **Rain gardens**: stormwater is absorbed by the vegetation, allowing…

2. Evapotranspiration- The term "heat island" refers to urban areas consisting of roads, buildings, parking lots and other structures that are hotter than adjacent rural areas.[ix] This phenomenon may be mitigated by this second variety of green infrastructure, which is used to not only absorb stormwater runoff but also to clean and cool the air of the surrounding urban area.

- **Green roofs**: Green roofs are
- **Bioswales**: Bioswales, definition
- **Tree canopies**: Varying percentages of urban neighborhoods can be protected **by** tree canopies covering streets, sidewalks, private lots, parks, and other private and public lands. These trees are sometimes called urban forests and they, of course, sequester carbon.[x] Cities and villages can adopt tree canopy objectives in their comprehensive plans and dedicate themselves to increasing the percentage of the community that is shaded. In addition to sequestering carbon, urban trees provide windbreaks, reduce air conditioning costs, mitigate urban heat island effects, and make urban environments more comfortable and healthful. In heavily urbanized areas, the amount of trees and vegetation that can be preserved or added is somewhat limited but important for providing a high quality of urban life.

Maximizing urban forests in cities in the United States might increase the sequestering environment by two to three percent.[xi] While small, this is still of some importance. Increasing tree cover in urbanized areas from the current canopy coverage of twenty- seven percent[xii] to thirty-two percent over the next fifty years would sequester approximately 475 million tons of CO_2.[xiii] This would require 704 million more trees over that time: fourteen million a year.[xiv] There are approximately 40,000 municipalities in the United States. If each community, on average, planted 350 trees each year, this goal could be reached.[xv] While not all localities enjoy the same amount of municipal resources or political will to expend these resources, this average number illustrates the conclusion that promoting biological sequestration through local land use policies is a viable and real arrow in society's quiver in the fight against climate change**.**

Land use regulations and project approvals can be used to preserve urban trees. The zoning regulations of the Town of Wallingford, Connecticut, for example, require "that existing trees ... be preserved to the maximum extent possible."[xvi] Under those regulations, trees and landscaping are to be preserved and provided to reduce excessive heat, glare, and accumulation of dust; to provide privacy from noise and visual intrusion; and to prevent the erosion of the soil, excessive runoff of drainage water, and the consequent depletion of the groundwater table and the pollution of water bodies.

In Santa Monica, California, one of the purposes of the zoning regulation is to protect and enhance the quality of the natural and built environment and to ensure adequate public open space.[xvii] Development in each of the city's zoning districts is subject to certain environmental standards. These standards include maximum unit density, lot coverage, minimum lot size, setback requirements, and building spacing, as well as a requirement for open space.

Some state statutes expressly permit local planning boards to require the dedication of parklands or to collect a fee in lieu of such dedication.[xviii] Portland, Oregon's city council approved a fee schedule for new residential development that assesses park development charges ranging from $4500 for a single room occupancy unit to over $8000 for a single family home. Some states allow their local governments to require parkland dedication or set-asides as part of the subdivision-approval process.[xix] Some statutes are silent or vague regarding the matter.[xx] A few states expressly prohibit as confiscatory the dedication of land or fees to achieve open space objectives.[xxi]

In New York, state statutes authorize planning boards to ensure that the recreational needs of the occupants of residential subdivisions and site plans are met by requiring land to be set aside where a municipal study shows that there is now, or will be, an unmet need for recreational facilities in the municipality.[xxii] The planning board may require a financial contribution in lieu of a land reservation only where it specifically determines that, in a particular case, the land subject to

subdivision review is not of sufficient size or adequate character to create a suitable recreational area for the subdivision's occupants.[xxiii]

3. Capture & Reuse- The third type of green infrastructure focuses on collecting and holding the stormwater so that it may be reused at a later time. This has the twofold benefit of not only reducing the amount of runoff, but also reducing the amount of potable water used for watering landscaping etc., which in turn leads to savings for landowners on utility costs. Examples of this type of green infrastructure include:

- **Rain Barrels**
- **Cisterns**

C. Barriers To Implementing Green Infrastructure, and How Communities Can Overcome Them

Despite these myriad benefits, implementation of green infrastructure is not without barriers. Only recently has the lack of performance data started to be overcome. [cite fed civic ass'n and EPA built environment report] Also, the up-front costs associated with the initial implementation of green infrastructure such as green roofs and porous pavement may be prohibitive to developers, though these measures often save money in terms of cost-effectiveness in the long run.[xxiv]

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However, many communities have overcome these barriers in order to implement successful green infrastructure programs. Trends catalogued in communities with successful programs include the creation of different funding and incentive mechanisms, as well as the presence of a strong local leader (such as a mayor) with an environmental ethos. [CITE fed civic ass'n] The following case studies represent cities around the country that have implemented some or all of the above tactics and successfully invested in green infrastructure initiatives for stormwater and heat management.

D. Case Studies

i. Philadelphia, PA: Green City, Clean Waters

In Philadelphia, Pennsylvania, the city's Water Department (PWD) has developed and implemented Green City, Clean Waters, a $2 billion, 25-year program to implement green infrastructure for stormwater management. PWD has forged partnerships with the Pennsylvania Department of Environmental Protection (DEP) as

well as EPA to meet their goals, which include placement of green infrastructure components such as downspout planters, green roofs, porous paving, infiltration trenches, and more across the city. The city of Philadelphia, through the PWD and the Philadelphia Industrial Development Corporation (PIDC), has also created a Stormwater Management Incentives Program (SMIP), which in 2012 awarded seven commercial businesses $3.2 million to create 65.5 greened acres of property. Finally, the PWD has sought to raise community awareness and input mechanisms by giving green infrastructure tours, hosting community events such as festivals and art contests, promoting environmental education programs in local schools, and creating an Online Community Input Form, where community members may suggest new locations for green infrastructure projects.[xxvi]

ii. Chicago, IL

In the city of Chicago, IL, many different departments are responsible for a variety of green infrastructure initiatives intended to supplement the city's pre-existing hard stormwater management infrastructure.[xxvii] In 2008, the city passed a Stormwater Ordinance, which mandates that any building larger than 15,000 square feet or any parking lot larger than 7,500 square feet must detain at least the first half inch of rain on-site. Alternatively, the building or parking lot may meet the requirements of the ordinance by reducing prior imperviousness of the site by 15 percent.[xxviii] Street improvement projects now incorporate green infrastructure design elements such as creating discharge patterns that direct stormwater into vegetative swale.[xxix] Another project, the City of Chicago Department of Planning and Development (DPD)'s Green Matrix program, provides for the funding of green roof projects, subject to a set of sustainability criteria.[xxx] As of 2006, 250 green roofs (amounting to over 13 acres) have already been constructed in the city, with another 250 planned or under construction.[xxxi] Recently, Chicago has gone even further toward making and meeting sustainable objectives. The city's "Adding Green To Urban Design Plan," a vast initiative put together by 50 outside professionals and aimed at bettering the city in all respects, won a 2011 ALSA Honor Award for Planning and Policy. Finally, Chicago has also committed to a new initiative, "Sustainable Chicago 2015," which covers a variety of critical areas including water, transportation, waste, and recycling.[xxxii]

iii. Milwaukee, WI

Milwaukee's Metropolitan Sewage District (MMSD) has invested in a number of green infrastructure building and educational projects. In 2003, MMSD released its Strategic Plan for Stormwater Runoff Reduction. The data and funding provided for this plan resulted in the 2007 release of the 2020 Facilities Plan, a capital project that takes a watershed approach to water resource management.[xxxiii] The project encompasses seventeen different types of green and engineered infrastructure approaches.[xxxiv] Through MMSD's Greenseams program, between 2002 and 2006 MMSD purchased through conservation easements 39 undeveloped properties (totaling 1,274 acres) suitable for stormwater retention.[xxxv] Though the rain garden and porous pavement pilot projects met with a mixed success rate,[xxxvi] the public education program for downspout

disconnection was quite effective; 35% of all downspouts were disconnected (126 roofs), resulting in an 8% reduction (5.64 acres) in imperviousness. This removed 20,500 cubic feet of runoff per 1 inch of rain from the Milwaukee sewer system.[xxxvii]

iv. Portland, OR

In the fall of 2008, Portland's Bureau of Environmental Services (BES) began an incentive program to fund $5 per square foot of new ecoroof construction under their Grey to Green Initiative, which has resulted in 172 ecoroofs, totaling nearly 10 acres. BES is also sponsoring a rebate program to encourage Portland residents to plant trees on their property. The five-year G2G goals include adding 43 additional acres of green roofs, as well as planting 33,000 yard trees and 50,000 street trees. Much of the tree planting BMP is a collaborative effort with a local non-profit organization, Friends of Trees.[xxxviii]

v. Seattle, WA

Seattle was the first city in the United States to supplement its hard infrastructure by retrofitting its streets with green infrastructure techniques.[xxxix] Currently, the city has multiple ongoing projects built through the Seattle Public Utilities program. It labels these green infrastructure programs "Natural Drainage Systems" (NDS).[xl] The primary emphasis of NDS is reducing the amount of impervious surface area and placing vegetation in its stead.[xli] Most of this infrastructure consists of vegetated swales and rain gardens, as well as cascading pools and small wetland ponds. To be completed, the city reduced road sizes to limit paved surfaces, and built the green structures along the roadside. One such project reduced the impervious surfaces by 11% and saw a 98% reduction of stormwater flow from a two-year storm event.[xlii]

vi. New York, NY

New York City has a number of initiatives in place to encourage green infrastructure construction within the city. The New York State Green Roof Tax Abatement Statute provides one-year tax abatement for the construction of a green roof. The abatement is $4.50 per square foot of green rof up to the lesser of either $100,000 or the total tax liability for the building for the tax year in which the abatement is claimed. Notably, this tax abatement is only applicable in cities of one million or more persons; consequently, the abatement applies only to New York City. If the program is successful, the law could eventually be amended to include other cities throughout New York State.[xliii]

New York City began an initiative to plant one million new trees throughout the city under their program MillionTreesNYC. They take requests from streets and neighborhoods that want new trees, and residents are allowed to request the ability to plant trees on their property as part of the program. Currently over 600,000 new trees have been added as a result of the program.[xliv] Another initiative by the city, PlaNYC, is intended to improve all aspects of urban life. One goal is to increase school gardens

from 70 to 150. Another is to find vacant lots that can be utilized to greater effect as urban farms. Currently only includes drought resistant plants. There are plans to convert former landfills into public parks, including Freshkills Park in Staten Island, which is over 2,200 acres in size.[xlv]

vii. Pittsburgh, PA

Pittsburgh has adopted a comprehensive plan, PLANPGH, to better all aspects of urban life. One component of the plan is working with open space to better utilize vacant lots, create greenways, and maximize the use of hills.[xlvi] Another city program is TreeVitalize, intended to spur the planting of new trees as well as the preservation and restoration of older trees. The program especially emphasizes the education of citizens about the importance of tree cover.[xlvii]

II. Land Use & Other Local Techniques

III. Planning Techniques: The Right Way/ Wrong Way To Plan For Sustainable Development

Unique development strategies are necessary to meet the needs of different locales, based on the pre-existing (or nonexistent) development in those areas. This section describes five of these distinctive regions- downtowns, edges, corridors, crossroads, and new neighborhoods- and details tailored development strategies to meet the needs of a growing population while simultaneously working with and conserving the natural resources inherent to the area. This section is intended to have an emphasis on planning because…

These plans emphasize the preservation of natural resources by embracing an area's surrounding natural features; this serves the purpose of conserving as much open land as possible, as well as incorporating the land into green infrastructure within the urban environment. Furthermore, an emphasis is placed on increasing walkability and connectivity in order to reduce carbon output. These plans create vibrant, sustainable places to work and live.

A. Downtowns

1. Defining the downtown

Downtowns are places that already contain a mix of activities associated with a complete community: places to shop, to work, civic and public spaces, and a wide variety of housing types. Municipal services (water, sewer) are in place and it is capable of accommodating some forms of transportation. A downtown is also the center for many of the important civic and commercial activities for the surrounding community. Downtowns can be of any size from rural village centers to large cities, but regardless they are all distinct and clearly identifiable as "places." New developments within

downtowns- so-called “infill” development- is an opportunity to make efficient use of existing infrastructure. New infill development in downtowns should reinforce the unique character of the place.

Downtowns Diagnostic:

[ ] People refer to this place as their “downtown” and it has the local “Main Street.”
[ ] Many of the buildings are older, dating from the mid-20th century and before.
[ ] There is a pattern of connected streets and blocks.
[ ] There are mixed-use buildings such as apartments over stores.
[ ] It is a walkable place.

“Infill development in a downtown may take a variety of forms. It may be new buildings on vacant land or redevelopment of sites with underutilized or non-contributing buildings. It should also include the adaptive re-use of structures, enabled by a flexible approach to mixed use and parking.

Within any one downtown there will be places with different character. There may be residential neighborhoods as well as mixed-use commercial areas that are more like traditional “downtowns.” Each of these will require its own regulations and guidelines. In particular, a special set of guidelines will be required for the commercial “main street” areas. In addition, there will be guidelines that create and promote the active, pedestrian-oriented environment associated with traditional “main street”: on street parking, flexible parking regulations (especially shared parking and reduced parking for small commercial businesses); uniform streetscape requirements for parking materials, signage, lighting, street streets; encouraging active ground-floor uses (especially retail), minimum requirements for transparency into ground floor stores, prohibition or limitation of auto oriented uses (such as drive-thru businesses, gas stations, car washes).

2. The Wrong/Right Ways To Develop

a. Wrong Way (Standard Development)

[X] Conventional suburban parking standards require excessive amounts of onff-street parking that make small-lot “infill development” difficult or impossible to achieve.
[X] Standard zoning regulations make it difficult to recreate the traditional mixed use “main street” type of building with people living above offices or retail
[X] Standard zoning allows uses that are not compatible with pedestrian-oriented environments, such as gas stations
[X] Standard zoning does not promote buildings that are designed to be complementary to the context
[X] Larger redevelopment areas are planned as self-contained enclaves, not integrated with the surrounding context
[X] Environmental features, especially streams, are buried or compromised.

b. Right Way (Preferred Development)

[√] At larger redevelopment areas, the surrounding street and block pattern is extended into the site and new greenways and other connections are created.
[√] Environmental features are reinforced and help organize the center. Natural features, especially stream courses, are linked to elements of urban forestry (new parks, street trees) to create new linkages and amenities for residents.
[√] Zoning regulations promote traditional, compact mixed-use developments.
[√] Design guidelines ensure compatibility with context.
[√] Flexible, creative parking regulations (shared parking, reduced requirements, location/configuration guidelines) enable contextual design solutions with high coverage and minimum setbacks.
[√] Where land and development values can support it, parking is in structures but parking structures are not allowed to compromise the pedestrian experience: garages are lines with street-friendly uses and are architecturally compatible with adjacent architecture.
[√] Buildings and sidewalks are designed to support existing or potential transit stops. This includes active streetfront for buildings, adequate space for bus stops or other transit facilities, and some increase in density near traffic stops.

3. New Commercial District

- Buildings are sited in ways that define streets and public spaces.
- Parking is in structures, behind buildings, in the centers of blocks and otherwise not along the edges of streets and public spaces.
- New buildings are designed in ways that make them compatible with existing buildings: in particular, the apparent bulk of buildings reduced through changes in massing.
- The designs of buildings should respond to particular site conditions: important corners, buildings at the terminus of important view corridors.
- There should be a comprehensive strategy for greening the center by linking green streets, parks, and landscaped urban spaces.
- Promote mixed-use buildings.

ii. Edges

1. Defining the "edges"

Edges are places into which the street-and-block network and land use patterns of a downtown can be expanded. It may be completely undeveloped land. It is more likely that it will be a place that already has some development and infrastructure but at a greatly reduced density so that there s an opportunity for a significant increase in development. New development at the edge should as much as possible feel like a

seamless extension of the existing urbanized areas and so the mix of land uses may be similar but less intensive. In the end, the objective is for the relationship between the existing center and the expansion area to be seamless.

Edges Diagnostic:
[ ] This is the edge of a downtown or the edge of an older neighborhood
[ ] The uses are not mixed the way they are in the adjacent downtown: there may be both commercial and residential uses but these are primarily larger, separate, developments.
[ ] There are almost no mixed-use buildings.
[ ] The area is developed, but the intensity of existing development is not as high as the adjacent downtown or neighborhood.
[ ] There are multiple opportunities to connect to the street grid of the adjacent downtown or neighborhood.

2. The wrong/right ways to develop existing edges

a. The Wrong Way (Standard Development)

[X] Parcels are developed in isolation so that they do not relate to each other, or worse, are not compatible in design or use.
[X] Commercial uses are auto-oriented, creating an unattractive “strip” appearance in places that should be the gateway to the town center.
[X] There is a lack of connectivity between developments and the road networks. This creates traffic problems, bottlenecks at the few existing and new intersections, and prevents the new development areas from becoming integrated with existing centers and neighborhoods.
[X] The roads are designed for the automobile, whether new arterials or existing roads that are widened. In addition to the overall lack of connectivity, there are no continuous sidewalks and crossings, lighting, landscaping or other pedestrian amenities.
[X] Residential areas are designed as cul-de-sac subdivisions rather than complete neighborhoods.
[X] The underlying ecology is ignored or compromised.

b. Right Way (Preferred Development)

[√] the underlying “green infrastructure” is used to shape the development pattern, creating a continuous green network that maintains the integrity of natural systems and becomes a community amenity, including new parks, trails and greenways.
[√] A robust street network creates connections among parcels and between the expansion area and the existing center. The network connectivity should try, as much as is practicable, to approximate the street and block pattern of the center.
[√] Streets are designed for people, with continuous sidewalks, lighting, landscaping, and other pedestrian amenities. Street landscaping/ urban forestry help maintain the

continuity of natural systems from the landscape to and through the center. Buildings are oriented towards the street.
[√] Commercial areas are designed to balance pedestrian and automotive access (see the design guidelines for commercial corridors below). Parking is located behind or to the sides of buildings as much as possible.
[√] Mixed-use development is encouraged to enable more walking between destinations.

3. Detail Plan: New Commercial Center

Although this is not village center "Main Street," it is still organized according to the same principles of connectivity, green infrastructure and mixed-use, and many of the same design principles apply:

- All buildings have a positive relationship to the street with entrances facing the street. Buildings are sited along uniform setback lines. Corner properties define the space of the intersection.
- The open spaces between the buildings are well landscaped in a coherent and coordinated way and link to the surrounding street network.
- Parking is organized into smaller interconnected lots behind retail and mixed-use buildings. Access to parking lots is rationed and cross-access agreements are promoted to minimize the number and size of driveways and minimize pedestrian-auto conflicts.
- On-street parking should be promoted where possible.
- Intersections are traffic-calmed and made pedestrian-friendly.
- Streetscape and sidewalk improvements make this a pedestrian-friendly environment.

4. Detail Plan: New Neighborhood

- Clustering and open space strategies create a continuous green network and maintain the integrity of natural systems.
- Houses are oriented towards the open spaces so that the open spaces are a shared public amenity.
- A variety of housing types are provided to promote diversity and flexibility of use over time.
- Flexible controls over home occupations and live-work create mixed uses and a more complete neighborhood.
- Where the overall density can support it, neighborhood-scale retail is encouraged. Civic uses such as elementary schools or a neighborhood center help to create a complete community.
- Streets are treated as if they are the most important public space: the automobile-related features are minimized. The presence of the automobile is minimized to create a pedestrian-friendly environment; houses have a strong relationship to, and are oriented toward, the street.

iii. Corridors

1. Defining a corridor

A commercial corridor is a road that is lined with auto-oriented commercial uses. While there may be other kinds of activities within the surrounding area, the commercial corridor is almost entirely single use. With a few exceptions in small areas, the environment is built around the automobile, so much so that auto access is excessive in scale and creates a hostile environment for pedestrians. New development along the corridor is an opportunity to balance the needs of the car with those of pedestrians and to create new connections to surrounding areas.

Corridors Diagnostic:
[ ] People refer to it as “the strip.”
[ ] The uses are almost exclusively car-oriented commercial uses.
[ ] There are very few connections from the corridor to the surrounding neighborhoods.
[ ] It is not a walkable place.

The predominance of franchise businesses and highway signage creates a “strip” appearance that lacks any sense of place or local character. Excessively liberal zoning results in inefficient use of the land for huge expanses of parking. Over time a process in which successive generations of competing businesses cannibalize one another leads to disinvestment or abandonment.

2.Transitioning existing corridors into sustainable spaces: the wrong/right ways to develop

a. The Wrong Way: Standard Development

[X] The corridor is not connected to the surrounding neighborhoods, undermining the ability to create a complete neighborhood and the ability for the retail businesses and residences to support one another as they would in a complete neighborhood.
[X] It is a completely auto-oriented environment. Thee is redundant and excessive access to each business from this arterial. Sidewalks and pedestrian accomodations are lacking. Over-sized, undifferentiated parking areas separate the buildings from the streets.
[X] Lack of connectivity in the street network exacerbates traffic, creating unnecessary car trips between destinations and further isolating the corridor from the surrounding neighborhoods.
[X] The underlying ecology is ignored; excessive paved areas drain directly into nearby streams and wetlands, mature trees and vegetation are cleared, streams and wetlands are compromised.

[X] Poorly managed signage and utilities create visual chaos and an unattractive "anywhere" appearance.

b. The Right Way: Preferred Development

[√] Through progressive redevelopment, buildings are sited uniformly along the corridor.
[√] Connections are made between parcels to minimize traffic on the commercial arterial
[√] New through connections are made between the corrior and the surrounding neighborhoods.
[√] Urban forestry (street trees, new pocket parks) are used to create a continuous greensward, protecting natural systems and enabling a network of pedestrian connections between the corridor and the surrounding areas.
[√] Parking areas are reduced in scale either by redesigning them more efficiently or by allowing shared parking.
[√] Zoning allows a diverse mix of uses.
[√] The auto-corridor is reconceived as a shared pedestrian-oriented public space. While even a well-designed commercial corridor will not be a true "Main Street," a pedestrian environment is created. There are uniform streetscape standards for lighting, paving, and landscaping; there is a complete network of sidewalks.
[√] Along important roads, there are uniform setback standards.
[√] Parking is on the sides of or behind buildings.

iv. Crossroads

*****Insert Large Graphic of Crossroads*****

1. Defining a crossroads

Crossroads are places that already have some of the ingredients of a new center but at lower densities: perhaps there are some auto-oriented commercial uses; often there may be a fire station, town hall, or other civic use; it is surrounded by developable lands that are suitable for future walkable neighborhoods. This area is already a destination for the local community. New development at the crossroads has the potential to complete the mix of land uses to create a new compact, mixed-use place with a distinct identity for the community.

Crossroads Diagnostic:
[ ] It is the intersection of two important roads.
[ ] It is a local destination for convenience shopping.
[ ] It is not intensively developed- buildings are not close enough to each other to make a compact walkable place and existing buildings are surrounded primarily by undeveloped land.
[ ] The overall land use pattern is unclear- the uses are primarily auto-oriented commercial uses, but there may be some residential uses or some civic uses such as a post office or fire station.

[ ] Infrastructure can support intensification of the Crossroads intersection and can also support compact neighborhoods around the new center.

2. The wrong/right ways to develop an existing crossroads

a. The Wrong Way: Standard Development

[X] Commercial uses are auto-oriented and site planning ignores the pedestrian experience.
[X] Buildings are not sited in a coherent way and are not oriented to the street.
[X] There is little connectivity between the commercial area and surrounding residential developments.
[X] Environmental features are ignored or compromised.
[X] There is little diversity in the land use pattern. Activities tend to be segregated.
[X] The land use pattern is one in which there are only a few land use types in segregated, single-purpose areas.

b. The Right Way: Preferred Development

[√] Land uses include a mix of activities that together comprise a complete community whith a distinctive identity: it includes a variety of housing types, institutional uses such as schools, daycare or community centers, parks, and public open spaces.
[√] Environmental features are preserved and enhanced.
[√] Parking is organized into multiple, smaller, interconnected lots behind the retail and mixed-use buildings.
[√] Design guidelines give the streets and buildings some visual coherence.
[√] Adjacent residential areas are planned and designed according to best practice principles for complete, sustainable neighborhoods: a street and block network with a high degree of connectivity; diversity of housing types; compact development patterns; protection and support of underlying natural systems.
[√] Buildings in the commercial area are planned and designed according to best practice principles for commercial corridors: ample accommodation for the pedestrian experience; high level of connectivity to surrounding areas; parking behind the commercial area and to the sides of buildings; buildings oriented toward the street; signage and other elements organized to create a coherent street front.

3. Detail: New Rural Commercial District

A new rural commercial center is a looser aggregation of small and medium-sized buildings than the small “downtown” where zero lot line buildings line “main streets.” It is still organized according to the same principles of connectivity, green infrastructure, and mixed-use, and many of the same design principles apply:

- Parking is organized into smaller interconnected lots behind retail and mixed-use buildings.
- In some areas on-street parking may be appropriate.
- Pedestrian connections may be a combination of sidewalks and winding paths which create a comprehensive pedestrian experience.
- Intersections are traffic-calmed and made pedestrian-friendly.
- The open spaces between the buildings are well landscaped in a coherent and coordinated way and link to the surrounding green network.
- Buildings are sited in different ways and there are no uniform setbacks, but al buildings have a positive relationship to the street with entrances clearly facing the street.
- Design guidelines disallow highway-type signage in favor of neighborhood-scale signage.

v. New neighborhoods

1. Defining a new neighborhood

New neighborhoods are places that are largely undeveloped, but are still appropriate for new development. These are mainly residential places with a variety of housing sizes and types. But to become "complete communities" it is important to add some amount of neighborhood retail and services, opportunities for live-work space, and civic uses. Although these are primarily residential areas, the objective is to create a complete community that includes a variety of housing types and some mix of commercial and institutional uses. New development here can capture development that would otherwise go to higher value landscapes such as productive farmlands and critical watersheds.

New Neighborhoods Diagnostic:
[ ] There may already be some existing houses scattered about on larger lots.
[ ] It is mostly un-built countryside.
[ ] Infrastructure can support intensification.
[ ] It can be developed without compromising natural systems or visual qualities of the landscape.

Inevitably, there will be new appropriate neighborhoods in the landscape, located in places based on the larger regional, Smart Growth scale analysis. Although a fully formed new "center" is not contemplated, to be "complete communities" some new mix of uses and housing types is necessary.

2. The wrong/right way to sustainably develop an existing new neighborhood

a. The Wrong Way: Standard Development

[X] There are no commercial or institutional uses that would make this place a complete community.
[X] There is little or no diversity of housing types.

[X] Properties are developed into stand-alone, cul-de-sac subdivisions that do not connect to each other or relate to the street.
[X] Properties are developed without regard to environmental resources; stands of mature trees are cleared, steep slopes are compromised, properties impinge on water bodies.

b. The Right Way: Preferred Development

[√] Clustering and open space strategies between subdivisions are coordinated so that a continuous green network maintains the integrity of natural systems.
[√] Houses are oriented towards the green network so that it is a shared amenity, not privatized.
[√] A variety of housing types is provided to promote diversity and flexibility of use over time.
[√] The street network within each neighborhood creates a high level of connectivity among and between neighbors and destinations.
[√] There are multiple points of connectivity between the neighborhood and the arterial network. New through-streets between and through neighborhoods increase the connectivity within the larger network of arterial roads.
[√] Flexible controls over home occupations and live-work create mixed use and a more complete neighborhood.
[√] Where the overall density of a group of neighborhoods can support it, neighborhood-scale retail is encouraged. Civic uses such as elementary schools or a neighborhood center help create a complete community.
[√] Each neighborhood and the neighborhoods collectively, respond to the underlying "green infrastructure" of the site: streams and wetlands are buffered; steep slopes are not built upon; mature stands of trees and vegetation are preserved; passive storm water management techniques are used including bioswales and stormwater harvesting; impervious surfaces are minimized.
[√] Streets are treated as if they are the most important public spaces. The presence of the automobile is minimized to ensure a pedestrian environment; houses have a strong relationship to the street and are oriented toward the street.

3. Detail: new neighborhood center

- Parking is organized into smaller interconnected lots behind retail and mixed-use buildings.
- Sidewalks create a comprehensive pedestrian experience within the neighborhood center and from the center to surrounding neighborhoods or greenways.
- The open spaces between the buildings are well landscaped in a coherent and coordinated way and link to the surrounding green network.
- All buildings have a positive relationship to the street with entrances clearly facing the street.
- A variety of residential building types create housing diversity.

- Design guidelines disallow highway-type signage.

IV. LEED-ND

A. Introduction- talk about LEED's good points/shortcomings ("sustainable siting" is spotty)

The Leadership in Energy and Environmental Design (LEED®) Green Building Rating System is a third party certification program originally created in 2000 by the U.S. Green Building Council (USGBC) using a consensus-based approach.[xlviii] LEED® 2009, the most current version of the program, offers third party verification of green building practices for a variety of building types, both new construction and major renovation, existing buildings, commercial interiors, core and shell, schools, homes, retail, and hospitals. LEED® has even developed a system for rating neighborhood sustainability- Insert reference here to LEED-ND® discussion in Chapter 3 once I know exactly what we're putting in that chapter.

The LEED® Rating Systems
New Construction
Existing Buildings Operation & Maintenance
Commercial Interiors
Core & Shell Development
Retail
Schools
Homes
Neighborhood Development
Healthcare

The system's premise is point-based. Building projects must first satisfy certain non-negotiable, non-point-earning prerequisites in order to qualify for certification (e.g. not being located on a greenfield). After these are met, projects then earn points by satisfying a variety of criteria (which will vary depending on the program) in five different green building categories.

The Five Categories of LEED® Green Building Credits[xlix]
Sustainable Sites (SS): "encourage strategies that minimize the impact on ecosystems and water resources"
Water Efficiency (WE): "promote smarter use of water, inside and out, to reduce potable water consumption"
Energy & Atmosphere (EA): "promote better building energy performance through innovative strategies"
Materials & Resources (MR): "encourage using sustainable building materials and reducing waste"
Indoor Environmental Quality (IEQ): "promote better indoor air quality and access to daylight and views"

One more category, Innovation in Design (ID), addresses sustainable building expertise as well as design measures not covered under the five environmental categories. Additionally, it is also possible for a project to achieve certain "regional points"; bonus points available to projects located within certain areas that exhibit distinct regional environmental priorities. The total amount of points a project earns then dictates the project's level of certification. There are four different levels on the LEED certification scale.

LEED® Green Building Certification Levels

There are 100 base points: 6 possible Innovation in Design and 4 Regional Priority Points

Certified: 40–49 points
Silver: 50–59 points
Gold: 60–79 points
Platinum: 80 points and above

The LEED® system is perhaps the most comprehensive green building certification program in the country for green building design. However, while the Sustainable Sites category addresses site sustainability in some areas, the overall focus of LEED is on the buildings themselves (not the surrounding landscape), and so a complete view of the site's sustainability as a whole is lacking.

V. Sustainable Sites

A. Introduction- what it is/why it was made/what it addresses

The inconsistencies found in the LEED program when looking at the sustainability of the building site as separate from the building itself is addressed by another rating system, the Sustainable Sites Initiative (SITES™). SITES™ was created to "promote sustainable land development and management practices that can apply to sites with and without buildings."[l] The seeds of the program began in 2005, when the Sustainable Design and Development Professional Practice Network of the American Society of Landscape Architects (ASLA) and the Lady bird Johnson Wildflower Center collaborated to host a Sustainable Sites Summit in Austin, TX. The following year, the U.S. Botanical Garden (USBG), joined the initiative as a third major partner

SITES™ provides planners, developers, lawyers and other stakeholders with a toolbox of best management practices and land use techniques that can be implemented on the local level to address global issues such as climate change. The "central message" of the initiative is that any landscape, no matter its location, scale, or surrounding environment, "holds the potential to both improve and to regenerate the natural benefits and services provided by ecosystems in their undeveloped state."[li]

Places Encompassed by the SITES™ Initiative

Open spaces: local, state, and national parks, conservation easements, buffer zones, and transportation rights-of-way

Sites with buildings: industrial, retail, and office parks, military complexes, airports, botanical gardens, streetscapes and plazas, residential and commercial developments, and private campuses[lii]

SITES™ Areas of Focus

Hydrology

- Protect and restore existing hydrologic functions
- Manage and clean water on-site
- Design stormwater features to be accessible to site users
- Design the site to minimize or eliminate use of potable water for irrigation

Soils

- Preserve and protect healthy soils
- Use plant trimmings as compost to nourish soils
- Improve health of degraded soils

Vegetation

- Protect and use existing vegetation
- Use vegetation that promotes a regional identity and a sense of place
- Use vegetation to lower energy consumption
- Manage landscapes effectively to reduce potential damage

Materials

- Use existing materials
- Purchase local and sustainably-produced plants and materials
- Consider the full life cycle of materials
- Work towards zero net waste
- Consider the urban heat island effect
- Reduce air pollution

Human Health & Well-Being

- Make the site user-friendly
- Focus on natural views
- Educate site users and keep culture and history alive
- Provide spaces for mental restoration, social interaction, and physical activity

B. Rating system

C. Case studies

Cleveland's Public Garden: Modeling Sustainability in the Rust Belt (Cleveland, OH)
Hunts Point Landing (Bronx, NY)

VI. Urban Conservation Advisory Councils: A Revolutionary Role In Preserving Green Infrastructure

A. Evolution/Background & Purpose

Environmental advisory committees (EACs), known as conservation advisory councils (CACs) in New York, are created by local legislatures to advise on the development, management, and protection of local natural resources. The CAC is to cooperate with other official municipal bodies active in the area of community planning and development approvals.

CACs are created to study and protect local open areas, including those areas characterized by natural scenic beauty which, if preserved, would enhance the value of surrounding development, establish a desirable pattern of development, achieve objectives of the comprehensive plan, or enhance the conservation of natural or scenic resources. CACs are directed to keep an inventory and map of all local open areas and obtain information pertinent to their proper use. The inventory should identify open areas and list them in order of priority for acquisition or preservation. The map is to identify open areas designated for preservation, including those having conservation, historic or scenic significance.

Once the local legislative body has received and approved the CAC's open area inventory and map, it may re-designate the CAC as a conservation board. At this juncture, the inventory and map become the official open-space index of the municipality and the conservation board can be assigned additional duties to assist the community with its open-area planning and to assure the preservation of its natural and scenic resources. These duties include:

- the review of applications made to other local bodies that seek approval to use or develop any area on the open-space index; and
- the submission of a report on such requests for approval regarding the impact of the proposal on the listed open area and on the open area objectives of the locality.

Both CACs and conservation boards are authorized to perform other duties assigned to them by resolution of the local legislative body as long as they are consistent with their general statutory advisory role regarding the development, management, and protection of local natural resources.

The formation of a CAC provides an opportunity for the legislature to appoint local experts in this subject matter to an official advisory body that can assist, guide, and encourage other local bodies in protecting and preserving open areas and natural resources. An effective CAC identifies and collects needed data regarding the community's natural resources, open areas, and historic and scenic assets. Once accepted by the local legislature, a CAC's open-area inventory and map becomes the official index of these assets and expresses the community's commitment to their responsible management and protection.

CACs and conservation boards may also assist the planning board, special board, or local legislature in preparing or amending the comprehensive plan with respect to open-area information, policy, and protection. CACs and conservation boards can help prioritize the importance of open areas and advise their legislatures regarding effective

strategies for protecting open areas, including acquisition, cluster development, overlay zoning, and critical environmental area designation. They can also assist local lead agencies in assessing and mitigating the adverse environmental impacts of development approvals and other local actions.

B. Tools: Natural Resource Inventory (NRI), the Open Space Inventory (OSI), and the Annual Report

The natural resource inventory (NRI) is required by the state enabling lesgislation for CAC's. It acts as a database to be used in local planning and project review, as well as a basis for long-term planning (such as comprehensive planning) within a community. The NRI is primarily used to predict impacts of development on natural resources. This makes it a useful tool in advising localities engaged in the New York State Environmental Quality Review Act (SEQRA)- discussed in detail in Chapter 9- which mandates environmental considerations be evaluated in the planning processes of local and state agencies. A CAC may play an important role in this process by advising the local planning board on whether an environmental impact statement (EIS) will be necessary to mitigate the effects of development in an area of the community.

An NRI is prepared through gathering scientific data including topography, geology, soils, surface and groundwater, land use, vegetation, wetlands and wildlife. Charts and maps may be prepared from this data. The collection methods must be an objective assessment of the area's natural resources. Additional considerations, such as historically significant elements, may be added if relevant to the community's interests. This inventory should be periodically updated to reflect any changes in the environmental elements of the area.[liii]

An open space inventory (OSI), a map of all open spaces within the municipality, must be kept on file and regularly updated by the CAC. Open spaces may include recreational areas, topography ill suited for development (such as cliffs and wetlands), conservation education areas, agricultural land, watersheds, and historic sites.

The General Municipal Law requires every CAC to file an annual report. This report should summarize all projects and accomplishments of the CAC over the past year. This not only gives the CAC an opportunity to educate lawmakers and citizens about the CAC's contributions to the community, but also gives the CAC the chance to alert the community to any pressing environmental issues. Finally, the annual report may also set up goals and objectives for effectively meeting these concerns in the future.

C. Newburgh's Urban CAC Law: Revolutionizing the Preservation of Green Infrastructure

The City of Newburgh, NY is undergoing a revitalization effort in order to create a more investment ready community. One important part of the process is its streamlining of land use approval processes. One component of this effort to streamline is combining

two existing committees, the Waterfront Advisory Committee (WAC) and Shade Tree Commission (STC), into a single, new Conservation Advisory Council (CAC). The CAC will act as an advocate for all of Newburgh's important natural resources.

Talk about how it's being put into place to revitalize an urban area: applied to gray infrastructure, capture the resources available in existing built infrastructure from a well-developed city (pockets of green). The city is choosing to use its creation of a CAC to actively confirm its commitment to preserve existing green pockets within the city as well as green infrastructure initiatives…

III. Final Conclusion to the Chapter

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[i] Ebenezer Howard, *Garden Cities of To-Morrow*.

[ii] EPA Built Environment Report, p. ??, cite 69

[iii] Managing Wet Weather With Green Infrastructure Action Strategy 2008).

[iv] Green Infrastructure Report: Fed Civic Ass'n; Managing Wet Weather With Green Infrastructure Action Strategy 2008.

[v] Green Infrastructure Report: Fed Civic Ass'n

[vi] From Managing Wet Weather With Green Infrastructure Action Strategy 2008; the EPA Built Environment Report 2013

[vii] From Managing Wet Weather With Green Infrastructure Action Strategy 2008

[viii] From the Green Infrastructure Guide.

[ix] United State Environmental Protection Agency ("U.S. EPA"), *Urban Heat Island*, http://www.epa.gov/hiri/ (last visited July 12, 2012).

[x] Rowan **A.** Rowntree **&** David **J.** Nowak, *Quantifying the Role* ***of*** *Urban Forests in Removing Atmospheric Carbon Dioxide, 17* **J.** ARBORICULTURE **269, 270 (1991)** ("[T]he net amount of carbon sequestered **by** urban forests in the United States is estimated at about **6.5** million tons/year."). This translates into **26** million tons **of C02.**

[xi] **HUGH** T. **SPENCER,** CLIMATE **CHANGE** MITIGATION **STRATEGIES** FOR KENTUCKY POLICY **OPTIONS** FOR **CONTROLLING GREENHOUSE** GAS EMISSIONS THROUGH THE YEAR 2020 **AD 111 (1998),** *available at* http://epa.gov/statelocalclimate/documents/pdf/ky_2_fin
.pdf.

[xii] **EPA GREENHOUSE** GAS INVENTORY, *supra*note 4, at 7-49.

[xiii] "Total carbon storage **by** urban trees in the coterminous United States is estimated at **700** million tonnes." David **J.** Nowak **&** Daniel **E.** Crane, *Carbon Storage and Sequestration***by** *Urban Trees in the* ***USA,*** **116 ENVTL. POLLUTION 381, 387** (2002). In urban settings, **EPA** found that there is "an average tree canopy cover of **27** percent." **EPA GREENHOUSE** GAS INVENTORY, *sufna* note 4, at 7-49. Thus, to achieve a total increase of five percent, the current urban tree canopy coverage would have to **be** expanded **by** approximately eighteen percent. Assuming the amount of carbon stored in all of this new vegetation is stored in amounts similar to the amounts of carbon stored in the existing urban trees, a five percent increase in urban tree canopy cover would store an additional **129,629,630** tons of carbon. To reach this result, the desired increase in canopy coverage is divided **by** the existing canopy coverage, and then multiplied **by** the current carbon storage amount to calculate the amount stored in the added canopy.
Working from this projection, the amount of carbon dioxide that these additional trees would consume can also be projected. As "[c]arbon comprises 12/44 of carbon dioxide **by** weight," **EPA GREENHOUSE** GAS INVENTORY, *supra* note 4, at **ES-3,** these additional trees would have to consume at least **475,308,462** tons **of C02** to **be** able to obtain the requisite amount of carbon. To reach this result, the projected carbon storage is multiplied **by** the inverse of the elemental carbon to carbon dioxide weight ratio.

[xiv] "The number of trees within UAs of the United States is estimated to be **3.8** billion." **JOHN** F. DWYER **ET AL.**, CONNECTING PEOPLE WITH ECOSYSTEMS **IN** THE 21ST CENTURY: **AN ASSESSMENT** OF OUR **NATION'S URBAN** FORESTS **32** (2000). If **3.8** billion trees result in a **27%** tree canopy cover, then an additional 704 million trees would constitute a **5%** increase in tree canopy coverage. That would require 14 million trees added per year for **50** years.

[xv] **If** 40,000 municipalities, then **350** trees per year per municipality for fifty straight years.

[xvi] TOwN OF WALLINGFORD, **CONN.,** ZONING **CODE** *§* **7.2(E) (2011).**

[xvii] CITY OF **SANTA MONICA, CAL., ZONING** ORDINANCE *§* 9.04.02.020(b), **(d) (2011).**

[xviii] **CONN. GEN. STAT. ANN.** *§* 8-2 5(a) (West **2011);** NEv. REv. **STAT. ANN.** *§* **278.4979** (West **2011); N.C. GEN. STAT. ANN.** *§* **160A-372** (West **2011).**

[xix] **MONT. CODEANN.** *§***76-3-621** (West**2011).**

[xx] **FLA. STAT. ANN.** *§* **163.3161(3)** (West 2011); **IND. CODE ANN.** *§§* **36-7-4-700** to **-712** (West **2011).**

[xxi] **MASS. GEN.** LAWSANN. ch. 41, *§* **81Q** (West 2011).

[xxii] N.Y.**GEN.**CITYLAW*§*33(4)(2011);N.Y.**TOWN**IAw*§***277(4)**(McKinney2011); N.Y.**VILLAGE** LAW *§* **7-730(4)** (McKinney **2011).**

[xxiii] Tree canopy text taken from Nolon, Managing climate change p. 38

[xxiv] Fed Civic Ass'n pg. 11-12

[xxv] Fed Civic Ass'n pg. 11-12

[xxvi] Green City, Clean Waters, Year In Review: 2011-2012, Philadelphia Water Department. http://issuu.com/phillyh2o/docs/green-city-clean-waters-2012-year-in-review?e=6553272/2621487

[xxvii] Fed Civic Ass'n pgs. 20-2…

[xxviii] Fed Civic Ass'n: see the ordinance and regulations at: http://egov.cityofchicago.org/city/webportal/portalContentItemAction.do?BV_SessionID=@@@@1157922782.1183052303@@@@&BV_EngineID=ccceaddlfkljlfcefecelldffhdffn.0&contentOID=536951042&contenTypeName=COC_EDITORIAL&topChannelName=Dept&blockName=Environment%2FI+Want+To&context=dept&channelId=0&programId=0&entityName=Environment&deptMainCategoryOID=

[xxix] Fed Civic Ass'n p. 27

[xxx] 7 City of Chicago 2007 Budget: Program and Budget Summary, p. 83; http://egov.cityofchicago.org/city/webportal/portalContentItemAction.do?BV_SessionID=@@@@0352909816.1183046376@@@@&BV_EngineID=cccdaddlfklmgdhcefecelldffhdfhg.0&contentOID=536912719&contenTypeName=COC_EDITORIAL&topChannelName=Dept&blockName=Planning+And+Development%2FGreen+Buildings%2FGreen+Roofs%2FI+Want+To&context=dept&channelId=0&programId=0&entityName=Planning+And+Development&deptMainCategoryOID=-536884767 *Both of these sources from Fed Civic Ass'n article

[xxxi] The city's website discusses the plan in depth and has a 6 month update to show the progress made so far. http://www.cityofchicago.org/city/en/progs/env.html

[xxxii] *Id.* ***make sure to go onto website to cite more specifically to components of the plan!!!

[xxxiii] Fed Civic Ass'n, citing Milwaukee Metropolitan Sewerage District 2007 Annual Budget, p. 118.

[xxxiv] Fed Civic Ass'n, citing Milwaukee Metropolitan Sewerage District, *Memorandum: Evaluation of Stormwater Reduction Practices*.

[xxxv] Fed Civic Ass'n, citing Milwaukee Metropolitan Sewerage District 2007 Annual Budget, p. 57

[xxxvi] Fed Civic Ass'n, citing Milwaukee Metropolitan Sewerage District, Stormwater Runoff Reduction Program: Final Report, February 28, 2007, p. 10-39.
[xxxvii] Fed Civic Ass'n, citing Milwaukee Metropolitan Sewerage District, Stormwater Runoff Reduction Program: Final Report, February 28, 2007, p. 10-39, 46.
[xxxviii] Portland: http://www.portlandoregon.gov/bes/article/298042 ***make sure to go onto website to cite more specifically to components of the plan!!!
[xxxix] Fed Civic Ass'n pg.39, citing James N. Levitt and Lydia K. Bergen, "Using Nature's Plumbing to Restore Aquatic Ecosystems: The City of Seattle's Natural Drainage System," The Report on Conservation Innovation. The Program on Conservation Innovation at the Harvard Forest, Harvard University, Fall 2004, p. 11. http://harvardforest.fas.harvard.edu/research/pci/RCI_Fall_2004.pdf.
[xl] Fed civic Ass'n pg.38
[xli] *Id.*
[xlii] http://www.werf.org/liveablecommunities/studies_sea_wa.htm ***make sure to go onto website to cite more specifically to components of the plan!!!
[xliii] http://www.nyc.gov/html/gbee/html/incentives/roof.shtml
[xliv] http://www.milliontreesnyc.org/html/home/home.shtml
[xlv] http://www.nyc.gov/html/planyc2030/html/theplan/natural-systems.shtml
[xlvi] http://planpgh.com
[xlvii] http://www.pittsburghpa.gov/neighborhoodinitiatives/greenup/resources.htm
[xlviii] http://www.usgbc.org/sites/default/files/Docs3330.pdf
[xlix] From: http://www.usgbc.org/leed/rating-systems
[l] http://www.sustainablesites.org/about/
[li] http://www.sustainablesites.org/why/
[lii] http://www.sustainablesites.org/why/
[liii] *Id.*; NYS DEC *Natural Resource Inventory: A Guide to the Process* (out of print but on file in the Westchester County Environmental Management Council office).

The Performance of Green Infrastructure Under Extreme Climate Conditions
-A focus on the impacts of Sandy and Irene on the Nashville Greenstreet-

Drexel/CCRUN: Dr. Franco Montalto, PE, Lauren Smalls-Mantey, Kimberly DiGiovanni, Ge Pu
NYC Department of Parks & Recreation:Bram Gunther, Nette Compton, Nandan Shetty

Summary:
This case study describes the monitored performance of a stormwater capture "Greenstreet" in Cambria Heights, Queens during Superstorm Sandy, in October 2012, and Hurricane Irene, in August of 2011. Known as "Nashville," the site receives runoff from adjacent street and sidewalk surfaces, as well as direct precipitation. Sensors installed at the site provide real-time monitoringof the amount of rainfall and runoff entering the site, and how much of it infiltrated, evaporated, or overflowed to nearby catchbasins. During both of these extreme climatic events, Nashville infiltrated the vast majority of rainfall and runoff directed to it. It retained 100% of total inflow during Sandy, and 79.3% of total inflow during Irene.

Background:

New York/New Jersey is investing heavily in green infrastructure (GI), generally defined as decentralized efforts to engineer, enhance, or protect multifunctional landscape features. GI programs result in wetlands getting restored, parks getting enhanced, street trees getting planted, and a wide range of distributed stormwater management facilities getting built. If integrated appropriately into the built environment, different kinds of GI can alternatively dampen waves, attenuate wind, intercept rainfall, block the sun, and wick heat away from the city. Regional GI programs thus have the potential to build up regional resilience to a wide range of climate–related risks.

This report summarizes stormwater capture performance of a vegetated "Greenstreet" in Cambria Heights, Queens during Sandy and Irene. Launched in 1996 through a partnership between NYC Parks and NYC Department of Transportation, the Greenstreets program began as an urban beautification initiative that has, to date, converted over 2500 patches of unused concrete and striped roadway surfaces formed by the city's intersecting streets into small, vegetated triangles, medians, and curbside bumpouts, otherwise known as "pint-sized" parks. In 2008, the Greenstreets' program began experimenting with active stormwater capture sites, which led to an ARRA in grant in 2009 to build these types of sites in flooding zones. Beginning in 2010, the Greenstreets program became the Green Infrastructure Unit of NYC Parks, and began to deliberately and routinely direct urban stormwater to these sites, as a means of reducing the city's combined sewer overflow problem.

Design Details:

The Greenstreet located at Nashville Blvd & 116th Rd, Queens, NY was installed in the fall of 2010. It consists of two separate planting beds, each receiving street and sidewalk runoff through separate curbcuts. An extensive monitoring system was installed by Drexel University in Region I (blue triangle in Figure 1), including an onsite climate station, a flume to measure flow through the curbcut, a shallow well to measure the depth of ponding and occurrence of overflows from the Greenstreet to thesewer, and soil moisture sensors. The vegetated area of Region I is 125 m^2 (1,345.5 ft^2). It receives runoff from a 475 m^2 (5113 ft^2) paved section of street, at a hydraulic loading ration of 3.8 to 1. The site's total catchment area is thus 600 m^2 (6,458.3 ft^2)

Figure 1: Nashville Site Plan

Impacts of Sandy and Irene

Figures 1-6 visually depict the hydrologic performance of the Nashville site to Irene (left) and Sandy (right). Table 1 summarizes key attributes of the two storms and Nashville's performance.

Table 1: Performance of Nashville Greenstreet during Hurricane Irene and Superstorm Sandy

	Hurricane Irene		Superstorm Sandy		Ratio (Irene/Sandy)
Observation period	8/27/11 - 8/29/11		10/29/12 - 10/31/12		1 / 1
Cumulative depth of precipitation	163 mm	6.4 in	33 mm	1.3 in	5 / 1
Volume of precipitation on Region I	20.4 m3	5,382 gal	4.1 m3	1,083 gal	5 / 1
Volume of flow into Region I through the curbcut	8.2 m3	2,166 gal	146.9 m3	38,806 gal	1 / 17.9
Total volume of rainfall and runoff directed to Region 1	28.6 m3	7,555 gal	151.0 m3	39,890 gal	1 / 5.3
Total duration of overflow to sewer	20 minutes		0 minutes		20 / 1
Estimated volume of overflow	5.9 m3	1,570 gal	0 m3	0 gal	NA
Estimated volume of retention	22.7 m3	5,996.7 gal	151.0 m3	39,890 gal	1 / 6.6
Percent of storm rain plus runoff retained	79.3%		100%		1 / 1.2
Effective area over which entire storm captured (area)	0.02 ha	0.05 acres	0.46 ha	1.1 acres	1 / 25
Effective area over which entire storm captured (% of Greenstreet and tributary drainage area)	30%		762%		1 / 25
Effective area over which entire storm captured (% of Greenstreet area)	140%		3,660%		1 / 25

Figure 2: Cumulative precipitation & flow through curbcut during Irene (left) and Sandy (right)

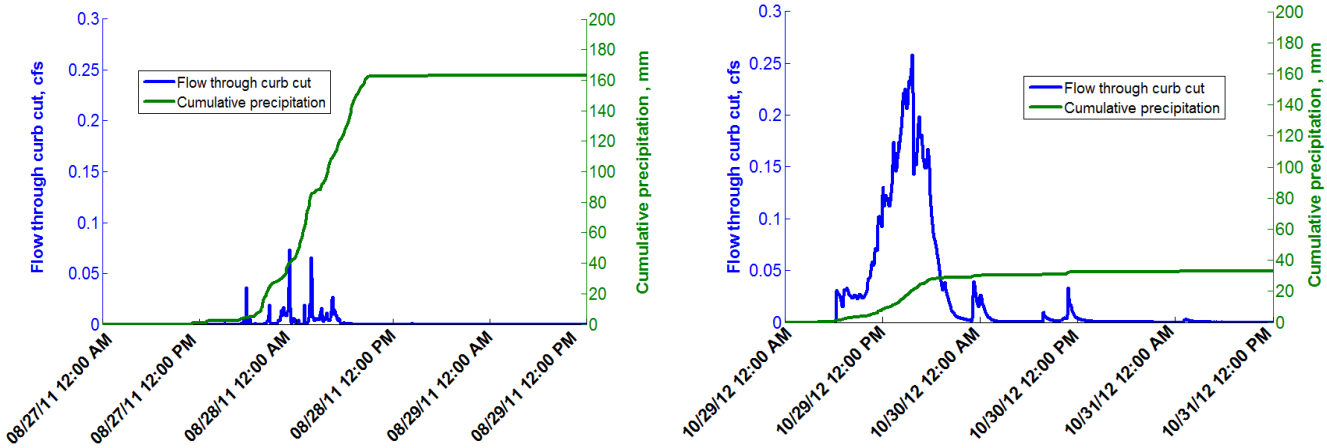


Figure 3: Depth of ponding inside Region I during Irene (left) and Sandy (right)

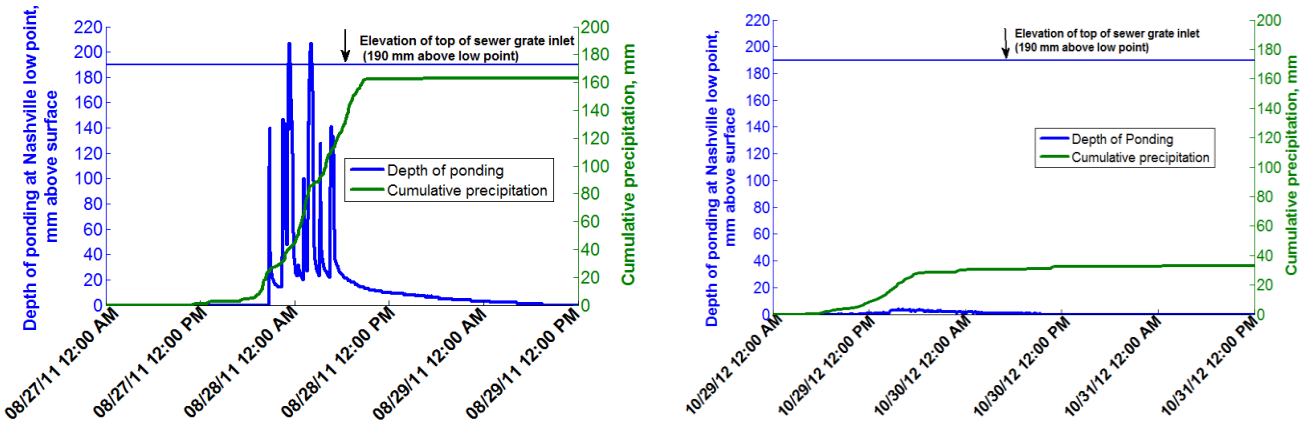


Figure 4: Impact of Irene (left) and Sandy (right) on groundwater table below Nashville

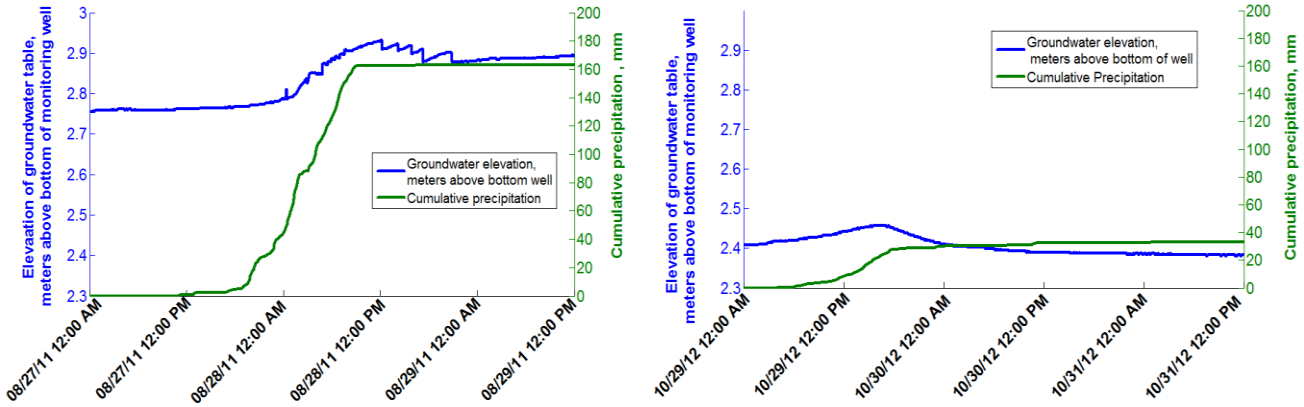
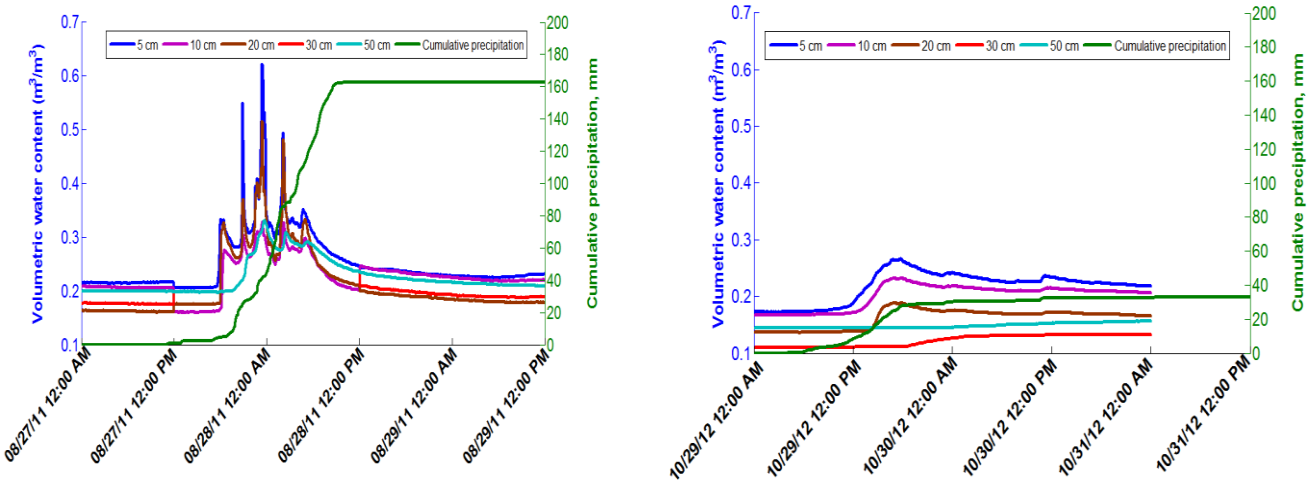


Figure 5: Impact of Irene (left) and Sandy (right) on Greenstreet soil moisture



Lessons learned and impact on future projects

The Nashville Greenstreet significantly reduced the stormwater load that these two extreme events would have had on the local combined sewer system. The site infiltrated 100% of the total amount of rainfall and runoff directed to it during Sandy, and 79.3% of the total inflow during Irene.

Figure 2 shows that although Irene deposited more rain on the Nashville Greenstreet, inflow through the curbcut was much greater during Sandy. The greater relative inflow during Sandy is attributed to clogged catchbasin and drain inlets located upgradient of the green hatched area shown in Figure 1. The lesser relative inflow during Irene is attributed to Nashville's curbcut inlet being partially clogged. As a percent of the combined area of Region I, and its tributary drainage area, the site infiltrated 30%, and 762% of the total volume of precipitation from Irene, and Sandy, respectively.Stated differently, Nashville completely captured the storm over an area that was 140% the size of Region I during Irene. During Sandy, it treated an area that was 3,660% of its own size.

Despite the lesser amount of inflow through the curbcut, ponding inside Region I was greater during Irene than during Sandy. This difference is attributed to the greater overall intensity of Irene's precipitation, which appears to have exceeded the infiltration capacity of Nashville's soil causing the ponding of water on the surface. The depth of ponding overtopped the concrete curb separating the Greenstreet from the local catchbasin during two different 10 minute periods (Figure 3), discharging a total of 5.9 m3 (1,570 gal) to the combined sewer system. The rapid and repeated drawdown of ponded water during both storms is evidence of significant infiltration capacity of the soils at this site.

Though large quantities of precipitation and runoff were infiltrated at Nashville, neither storm appears to have resulted in more than a 20 cm temporary increase in the water table elevation (Figure 4). The soils were wetter during Irene than during Sandy, but in both cases returned to near their pre-storm values within about 24 hours of the most intense precipitation (Figure 5).

On an annual basis, hydrologic and hydraulic modeling efforts suggest that annual retention rates at this site vary from 74-86%, depending on the distribution, timing, and amount of precipitation, as well as on assumptions regarding inlet bypass conditions (both upgradient and at the curbcut). Other Greenstreets with similar infiltration capacities, hydraulic loading ratios, and depression storage values to Nashville can be expected to perform similarly. The monitoring effort suggests that Greenstreets can be effective strategies for reducing the impact of extreme precipitation events on combined sewer systems, and should be considered a key component of efforts to build up regional resilience to climate risks.

Meet our New Curtin Fellow!

The Planning and Law Division is proud to announce this year's Curtin Fellow, Abby Kirkbride. Abby is in her third year of the Juris Doctor/ Master of Urban and Regional Planning joint-degree program at the University of Colorado. Her primary professional interest is the exploration of land use issues in the local government context.

Abby has completed internships with a Wyoming-based nonprofit, where she studied oil and gas issues, and with Clarion Associates, where she drafted zoning codes. Currently, she is an intern for the Colorado Department of Public Health and Environment, working on an initiative to increase the amount of local foods in K-12 schools. Abby serves as a student delegate to APA's Colorado Legislative Committee, is a member of the Colorado Journal of International Environmental Law and Policy, and of APA's Student Representatives Council.

Abby is a native of Wyoming, where she grew up on her family's cattle ranch. She attended college at John Brown University in Arkansas, graduating cum laude with degrees in history and journalism. She currently lives in Denver with her husband.

Abby will work on several PLD initiatives; she has already begun work on membership recruitment efforts, as she leads PLD's newly formed Membership Retention Committee.

The purpose of the PLD Daniel J. Curtin, Jr. Fellowship is to foster increased interest in the study of land use planning and its interrelationship with the law at the graduate, and law school levels; increased participation in the planning profession; and ultimately, greater service to communities across the nation. ◆

STUDENT RESEARCH MEMORANDA

This new section of the Planning & Law Newsletter features memoranda written by students working at the Land Use Law Center of Pace University School of Law. Memos selected for inclusion will cover a wide range of topics of national interest. We hope you enjoy this first edition of "Student Research Memoranda!"

Knitting Green Infrastructure into the Urban Fabric: An Overview of Municipal Policies

by Annie Kline

Annie Kline is a third year law student at Pace Law School and is in the second year of her masters degree in environmental policy at Bard College, where she is focusing in the topic of Green Infrastructure as part of her masters thesis. She plans to work in land use and urban redevelopment after graduation.

Green infrastructure has attained widespread appeal – especially on the municipal level – as an alternative to the high costs of grey infrastructure and as a means of combating climate change. Green infrastructure can be defined as a network of connected green and natural space that maintains ecosystem values and functions, sustains clean air and water, and directly benefits people and wildlife. Not limited to wildlife corridors and recreational opportunities, green infrastructure is also effective in urban environments, like in the regeneration of vacant properties for new parks, the planting of street trees, or the installation permeable pavement.

Several municipalities have adopted strategies that seek to incorporate green infrastructure into their urban fabrics to combat stormwater runoff and meet water quality requirements while achieving community goals and counteracting environmental justice issues. Some salient examples of cities that have adopted such plans are New York City, Philadelphia, and Portland, Oregon.

Portland

It is widely accepted that Portland, Oregon has been the most successful at creating and implementing a green infrastructure plan. According to the Natural Resources Defense Council, Portland is considered the nation's leader in green infrastructure, in part, because of "its willingness to experiment with green infrastructure initiatives, adapt its programs based on implementation experience, and explore solutions that are tailored to the needs of particular watersheds in the city."

Portland has been using green infrastructure since 1993 when it allowed homeowners to disconnect their downspout from the City's combined sewer system (CSS) so that stormwater could flow to vegetated areas. Not only did the city provide the service of disconnecting the downspout, but it also provided utility fee discounts for participants, a program that resulted in more than 56,000 disconnected downspouts from at least 26,000 properties within its combined sewer overflow (CSO) areas from 1993 to mid-2011. Between 1.2 and 1.5 billion gallons of stormwater runoff now infiltrate naturally into the ground every year.

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CELLULAR ANTENNAS

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Furthermore, the Order emphasizes that isolated denials should not be deemed to "have the effect of prohibiting the provision of personal wireless service" unless the decision demonstrates the implementation of a policy designed for that purpose.

Ordinances Requiring Variances

The last material issue addressed in the Order is whether zoning ordinances that require essentially all cellular zoning applications to obtain a variance represent an unreasonable barrier to market participation. This issue implicates both subsection (B)(i) of the Law and Section 253 of the Telecommunications Act. Although the telecommunications industry requested the FCC to find all "blanket variance" ordinances *per se* unreasonable, the Order holds that each ordinance should be evaluated on its own merits and in light of the specific context in which it is applied by the local government.

Case Law Experience

Generally, the case law interpreting Section 704(a) of the Telecommunications Act has demonstrated that local governments which treat cellular zoning applications similarly to all other applications, and apply objective standards in a non-discriminatory manner, tend to be successful in defending denials of zoning relief. For this reason, it is important to remind your zoning board, plan commission and/or corporate authorities to review these applications dispassionately since courts can easily pierce thinly veiled decisions which are rooted in a pre-existing bias against wireless facilities. Certainly, the zoning authority must perform its homework and create a written record upon which to base its decision, but notwithstanding claims to the contrary federal courts have respected results reached in good faith based on a wide variety of traditional land use criteria.

"Cellular Antennas, Shot Clocks, and Zoning: Two Years Later" was originally published in the In the Zone e-newsletter, a publication of the Zoning and Land Use Group of Ancel Glink, in which active PLD members David Silverman and Julie Tappendorf are partners. In the Zone is designed to inform local government officials about current trends in Illinois land use law and provide resources to promote planning and zoning practice throughout the state. To subscribe to In the Zone, please send an email to inthezone@ancelglink.com with the subject: SUBSCRIBE IN THE ZONE. ◆

GREEN INFRASTRUCTURE

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Portland has also been constructing vegetated swales and curb extension bump-outs since 1998. In 2003 the city developed the Northeast Siskiyou Green Street project that converted 590 square feet of street pavement into vegetated roadside swales. Both sides of the block were excavated to 14 inches below grade and filled with a soil mix and drought tolerant plants. Originally designed as a retrofit for existing streets, the project cost the city less than $20,000 and took just two weeks to build.

Other City policies relating to green infrastructure include a green building policy requiring all new city-owned buildings to have a green roof for at least 70 percent of their rooftop space. The City's 2007 Green Streets Resolution recognizes the importance and effectiveness of managing stormwater runoff on-site. It also cites the presence of green infrastructure on streets as a means of improving water quality and recharging groundwater as well as enhancing neighborhood livability by creating a safer and more attractive pedestrian environment.

A city and county regional Climate Action Plan, developed in 2009, uses green infrastructure as one of its guiding visions to substantially reduce carbon emissions. It includes an outreach component to educate residents about green infrastructure and sets a goal of increasing Portland's tree canopy from 26 percent to 33 percent by 2030.

More recently, in 2010, the city developed the Grey to Green Initiative – which is a five year, $50 million program that calls for 43 acres of green roofs, 920 green streets, 88,000 street and yard tree plantings, 419 acres of land acquisition, and 350 acres of natural area plantings. In its 2011 Fall Update, Portland's Bureau of Environmental Services announced that 6.5 acres of green roofs had been installed, with an additional 8.4 acres approved under the program and NRDC reported an additional 14 acres of green roofs developed throughout the city as of May 2011. Additionally, 546 green streets were constructed and 26,400 trees were planted, 17,465 through the Grey to Green Initiative specifically. Finally, 261 acres of open space land had been purchased, and over 110,000 tree seedlings were planted on more than 2,800 acres, well above target.

Portland is financing its green infrastructure through operating capital, system development charges, and debt, which is repaid through the public utility fees on developed property,. Portland residents pay the highest CSS rates in the nation.

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GREEN INFRASTRUCTURE
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The City also charges higher stormwater rates for new residential, commercial, industrial, and multifamily developments under its Stormwater System Development Charge, not only to increase revenue for other green infrastructure projects but also to increase the incentive for developers to construct onsite green infrastructure, for which they can qualify for credits.

Additionally, the City uses credit and incentive programs that are paid directly to ratepayers. For example, in order to increase the number of green roofs, Portland established a credit of up to $5 per square foot of green roof installed on approved projects.
In 2010, Portland also developed a Treebate program, which provides homeowners with a credit of up to $50 on their utility bill for every tree planted in their yard. With minimal cost and effort, Portland promoted the program through local home and garden centers. In 2010, 1,000 trees were planted under this program.

New York
In 2007, under initiative by Mayor Bloomberg, New York City adopted PlaNYC 2030, a strategy for making the entire city more environmentally conscious. Under PlaNYC, the New York City Department of Environmental Protection (DEP) was charged with developing a green infrastructure plan, which was adopted in 2010. With nearly 72 percent impervious cover in CSS areas, DEP has a marked interested in increasing green cover throughout the City. Subsequent analysis has shown opportunities for green infrastructure in 52 percent of the City's land area, an amount that would more than meet DEP's ten percent capture goal.

Other PlaNYC goals include reducing CSO volume by 3.8 billion gallons per year, minimizing urban heat island effect, and decreasing energy use so as to increase property values and improve air quality. To achieve these goals DEP developed five objectives: (1) build cost effective grey infrastructure; (2) optimize the existing wastewater system; (3) control runoff from ten percent of impervious surfaces through green infrastructure; (4) institutionalize adaptive management, model impacts, measure CSOs, and monitor water quality; and (5) engage and enlist stakeholders.

EACH ACRE OF LAND WITHIN THE CSS AREA IMPROVED BY GREEN INFRASTRUCTURE HAS THE POTENTIAL TO STOP 80 TO 90 PERCENT OF POLLUTION FROM RUNOFF.

One reason New York City is so interested in looking into the green infrastructure approach for stormwater management is its cost-effectiveness. The green strategy costs $0.45 per gallon reduced while the grey strategy costs $0.62 per gallon of CSO reduced. Although DEP acknowledges higher initial costs under the green strategy, long term operations and maintenance costs under the grey strategy are higher.

Philadelphia
As part of its goal to be the greenest city in the country, Philadelphia published *Green City Clean Waters* in June 2011, an amended plan setting forth a 25-year vision for green infrastructure development. The Philadelphia Water Department (PWD) developed the plan to ensure compliance with water quality requirements of the Clean Water Act. According to PWD, a green stormwater infrastructure-based approach provides maximum return in environmental, economic, and social benefits within the most efficient timeframe.

Specific goals of the plan include large-scale implementation of green infrastructure to curb runoff and reduce demand on existing infrastructure systems, introduction of a street tree program to improve aesthetics and manage stormwater, increased access to recreation along waterfronts, preservation of open space, restoration of stream habitat, and increased incentives for responsible redevelopment. Each acre of land within the CSS area improved by green infrastructure has the potential to stop 80 to 90 percent of pollution from runoff.

Conclusion
Community and stakeholder involvement, pilot projects, careful monitoring, documentation, and strong leadership are all elements of a successful municipal green infrastructure plan. Green infrastructure can help improve the quality of life of municipalities throughout the country. With proper planning and policy implementation cities can control stormwater runoff and help reach carbon reduction goals, while making themselves comfortable and pleasing places to live, work, and play. ◆

Job Announcements

PLD Newsletter Job Announcements allow planning and law related job seekers and employers to connect.

Please send your job postings to pld.newsletter@gmail.com and we'll include them in our next newsletter.

Be sure to include the name of the employer, position, contact information, and deadline for applications.