SW 1:
REDUCE EXCESSIVE PAVING OF SITES

New York City Building Code
Proposal developed by the Homes Committee

Summary

Issue:
Due to excess stormwater, 27 billion gallons of sewage are released directly into New York harbor each year.[1] Paving over the ground exacerbates this problem.

Recommendation:
In new construction projects, require that half of the non-built lot be permeable.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code

1. Add a new Chapter 34 to read as follows:

CHAPTER 34
SITE AND LANDSCAPING

3402.1 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

AREA, IMPERMEABLE. Any portion of a lot on which the soil is covered with impervious materials such as asphalt or concrete, or bricks or pavers over a concrete or asphalt sub-base

AREA, NON-BUILT SITE. Any area of a lot that is not covered by a building.

3403.1 Impermeable surfaces. Sites shall comply with the following standards on impermeable surfaces:

3403.2 For new buildings, a maximum of fifty percent of the non-built site area of the zoning lot may be impermeable area.

3403.3 For alterations, the impermeable area of the non-built site area of the zoning lot shall not be increased to greater than fifty percent.

3403.3.1 Where over fifty percent of the existing non-built site area of the zoning lot is impermeable area , any impermeable area that is removed shall be replaced only with pervious materials.

Exceptions:

1. Any building classified in occupancy groups F or H and motor fuel-dispensing facilities classified under occupancy group M.

2. Subject to approval of the Commissioner, where compliance would result in flooding within existing buildings.

Effective Date: July 1, 2010

Supporting Information

Issue – Expanded
Impervious pavement is common in urban environments because it is perceived as the lowest cost solution for parking,

plazas, and other hard surfaces. However, impervious surfaces cause hardship for cities by increasing local flooding, combined sewer overflows and other environmental degradation that could avoided by through alternative paving techniques. An increasing number of design options, including pervious pavements of many sorts, can satisfy building functional needs without creating as much runoff and allowing for some re-establishment of natural process and hydrological cycles, such as infiltrations into soils, evaporation, and evapo-transpiration. Alternatives to pavement also often involve planted systems, which create habitat, and cool the city, along with restoring the hydrological cycles.

Environmental & Health Benefits
Greater surface permeability in New York City will reduce local flooding, combined sewer overflows, and allow for filtration and groundwater recharge. Permeable areas retain moisture, which evaporates during hot periods, reducing the urban heat island effect.

This proposal was found to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

Pollutants in stormwater runoff can have damaging effects on human health and aquatic ecosystems. Since New York City has a combined sewer system in many areas, and intense storms flood the system, which can result in the overflow of untreated stormwater and septic sewage (Combined Sewer Overflow) to be discharged directly into the rivers. Limiting the amount of water flowing directly into the system from intense storms can lessen the occurrences of CSOs.

This proposal was found to have no significant positive health impact.

Cost & Savings
As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to lower capital costs if implemented.

Precedents
Several cities require new and redeveloped sites to reduce impervious areas of sites and limit driveway paving.

The City of Philadelphia requires new developments and redevelopments over 10,000 square feet to reduce the impervious area of a site connected to sewers by 20% compared to preexisting conditions. Philadelphia offers the reduction of impervious areas on a lot as an option to meet criteria to reduce peak flow stormwater volumes that are led to sewers. Other structural stormwater management practices may be used that detain water and release it over a longer period of time than unabated runoff.

The City of Chicago requires redeveloped sites over 7,500 square feet that discharge to combined sewers to reduce impervious cover by 15% from previous conditions. Its stormwater management manual recommends landscaping and permeable pavement as ways to meet stricter regulation. Methods to reduce flooding on-site include vegetated filter strips, which are designed to received stormwater runoff from impervious surfaces and disperse it over permeable areas, and bioinfiltration systems, which are depressed areas containing plants, mulch, and prepared soils.

Berkeley limits the amount of paved off-street parking allowed in a yard, and requires permeable surfaces and landscape strips surrounding paved parking.[2]

Toronto provides a maximum front yard driveway width and requires 50-60% of front yards to be landscaped.[3]

LEED
LEED for Homes SS cr.4.1 states lot must be designed such that at least 70% of the built environment, excluding the area under the roof, is permeable or designed to capture water runoff for infiltration on-site.

For existing homes seeking certification under the LEED EB rating system, this proposal will facilitate achieving SS cr. 5.1 & 5.2 Stormwater Management, Rate and Quantity Reduction.

Depending on the permeable surface that is utilized, project teams may also be eligible for LEED for Homes SS cr.3 Local Heat Island Effects or LEED EB-SS cr. 6.1 Heat Island Reduction, non-roof. These sections award points to projects for reducing irrigation, tempering the outdoor environment, and reducing cooling loads.

Implementation & Market Availability
Nearly any surface that is paved with a traditional impervious surface may be converted to a porous pavement system. Porous pavements are especially applicable to sites that are in high-density area where space is too limited for other methods of stormwater management including lawns or soil beds for infiltration. A simple option for permeable driveway alternatives is crushed gravel, but where this is undesirable there are an increasing number of options available, and several systems have histories of success.

Porous asphalt was developed in the 1970's and has been implemented where standard asphalt would otherwise be used. It is installed just as standard asphalt is, but uses larger aggregate so that water can pass through voids in the material. Thomas Cahill, P.E. has used porous asphalt for projects such as walking paths at Swarthmore College and many large-scale parking lots throughout Pennsylvania. Porous asphalt has proven to be at-least as durable as impermeable pavement.

Similar to porous asphalt is porous concrete, which likewise is made of larger sized aggregate so that water can trickle through. The Florida Concrete Association developed porous concrete and it has been used in Florida and other southern states.

Porous asphalt and concrete need regular maintenance; otherwise after time the pores tend to clog up. Vacuuming or power washing annually, or using a leaf blower more frequently all satisfactorily restore permeability. During the winter months sand should never be used to increase friction because the sand will obstruct voids in the pavement. Salts may still be used though they should be used sparingly because chlorides that pass through the pavement may corrode piping and damage plant life. Permeable pavements tend to require less salt anyway because precipitation passes through instead of ponding on top thus mitigating the formation of ice.

Reinforced turf is an especially appealing alternative to paving on sites which experience relatively infrequent traffic. Reinforced turf is comprised of a grid of either plastic or concrete with openings that can be filled with soil. Turf grass can take root in this soil and aid in retaining stormwater. A popular brand of reinforced turf called "Grasscrete", marketed by a UK based company, is a concrete, heavy-duty interlocking system that has been used for decades.

If the owner or designer deems turf unwanted then permeable pavers can be used. Permeable pavers are paving units, often made of concrete, with openings in between that can be filled with relatively pervious material such as gravel. They can be combined in a variety of patterns and are suited to areas such as patios and plazas.

One need not choose a single variety of permeable pavements over others. On large-scale projects a designer would be smart to apply different permeable pavement systems where they are most appropriate. This has been accomplished very successfully at the New Sunrise Yards in Queens, a light industrial facility for NYC DOT with a need for truck access, extensive parking, and fire code access. Here a varied palette of solutions, which included permeable pavers in the parking area and Grasscrete in the side yard where fire truck access was required, limited the impermeable paving to the truck loading dock areas.

ENDNOTES:

[1] State of New York, DEC, A Gathering Storm - New York Wastewater Infrastructure in Crisis, http://www.dec.ny.gov/chemical/48803.html (last visited January 14, 2010).

[2] BERKELEY MUN. CODE § 23D.12.080 (2006), *available at* http://www.ci.berkeley.ca.us/citycouncil/2006citycouncil/packet/072506/2006-07-25%20Item%2003%20Ord%20-

%20Off%20Street%20Parking%20Yards.pdf.

[3] City of Toronto, Front Yard Parking, http://www.toronto.ca/zoning/frontyard.htm (last visited Oct. 14, 2009).

SW 2:
REDUCE STORMWATER RUNOFF FROM NEW DEVELOPMENTS

Rules of the City of New York (Department of Environmental Protection)
Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:
While wastewater discharged by the city into New York Harbor must meet increasingly stringent national and state standards, the city's own stormwater detention standards have not changed in 25 years. For this reason, DEP is considering increasing detention standards for properties with new or altered sewer connections.

Recommendation:
The Task Force supports more rigorous standards for new and altered sewer connections, which should be accompanied by model detention system designs that would meet these standards. Future permit applications and decisions should also be made publicly available. DEP began considering these measures through a process that was independent of the Task Force, prior to the issuance of this report.

Proposed Legislation, Rule or Study

Expression of Support for the New York City Department of Environmental Protection to increase storm-water detention requirements.

The New York City Department of Environmental Protection (DEP) is exploring changes to sewer regulations and codes to increase stormwater detention standards for new development. DEP is studying options to increase detention requirements because of the city's endemic problems with stormwater runoff that overwhelms sewage treatment plants, resulting in combined sewage overflows (CSOs) that pollute NYC's waterways. Detention at the source of stormwater runoff is generally more cost effective than collective detention downstream, so increasing site-based detention requirements is a good strategy.

Given these problems, the Committee supports the creation of more stringent standards, and the ones DEP is studying are in keeping with the current methodology for storm-water calculations, a methodology that is well understood by the industry. The Committee recommends that when DEP releases their proposal requirements, the agency to explain how it arrived at the specifics of its requirements and their expected impact over time. In particular, the Committee recommends that DEP analyze the impact of proposed new standards on a variety of prototypical sites. At a minimum, for each prototypical site, the analysis should assess how storage volumes would increase, how this could be accommodated on each site through one or more alternative designs, and the estimated cost. This explanatory material should be made available to the engineering and development community.

In addition, in order to promote better understanding of DEP detention requirements and means of compliance, the Committee recommends that future permit applications and DEP decisions be made available to the public.

Supporting Information

Issue – Expanded
During dry conditions, the city's sewage treatment plants can easily treat the volume of wastewater produced in New York City. When there are rainstorms, however, the addition of stormwater into pipes that carry both stormwater and sewage overwhelm the capacity of treatment plants, carrying partially treated sewage into New York Harbor – these incidents are called Combined Sewage Overflows (CSOs). CSOs undermine the ecology of the harbor and can cause illness as they contain human waste that can carry pathogenic organisms. Some of the common diseases include hepatitis, gastric disorders, dysentery, and swimmer's ear. Other forms of bacteria found in untreated waters can cause typhoid, cholera, and dysentery. Human health is also impacted when fish or shellfish that have been contaminated by combined-sewer discharges are consumed.[1]

Increased stormwater runoff from excess paving not only increases CSOs but also flooding of some city neighborhoods. More than 75% of New York City is covered with impervious services and buildings and developed lots account for 45% of the city's land area. The situation is exacerbated as runoff from low-density development (one- and two- family homes) has increased 50% since 1950 because residents have paved over their yards, often in order to obtain more parking spaces. An analysis conducted by the Department of City Planning and Department of Buildings, predicts over 52 million square feet of new development greater 10,000 square feet will be built between 2010 and 2030. Even if the

recent slowdown in construction in New York City is taken into account when interpreting these estimates, the projections
for new development make it even more urgent to address the current stormwater problems.[2]

On-site detention regulations have been in place since the mid 1980s. Since then, water standards for New York Harbor have increased in order to allow for recreation and habitat. There has been no parallel change in on-site detention requirements to match the change in water standards and increased development and paving of yards. Therefore, the detention requirements should be updated to reflect these new regulations and city conditions.

Environmental & Health Benefits
Reduction of combined sewage overflow (CSO) reduces the risk of exposure to disease causing bacteria and viruses.

This proposal was found to have high positive environmental impact per building and to impact a small number of buildings. It was given an environmental score of 2.

This proposal was found to have no significant positive health impact.

Cost & Savings
As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.02% to 0.3%, depending on building type. It was thus categorized as incurring a low to medium capital cost increment.

Precedents
Performance standards for new construction approaches have been adopted by Chicago, Philadelphia, Seattle, Portland, and other major cities.

LEED
LEED credits retention but does not reward detention. Retention removes stormwater permanently from the system through infiltration into the site or through productive use, a strategy that is more appropriate for suburban areas where the level of paving and development is not that high. In comparison, detention temporarily detains stormwater and slowly releases it to the system and thus decreases CSOs by slowing down the flow to sewage treatment plants. Detention is a more effective technique for reducing runoff in urban areas that should be credited under LEED.

Nevertheless, various LEED credits across all the rating systems refer to detention facilities as one possible implementation to mitigate stormwater runoff. These LEED credits include:

- NC SS 6.1 Stormwater Design: Quantity Control Option 1B
- LEED for Schools SS cr.6.1 Stormwater Design: Quantity Control
- LEED ND-GCT cr.9 Stormwater Management
- LEED CI-SS cr.1B Site Selection
- LEED for Homes SS cr. 4 Surface Water Management.

Though the standards do not currently address existing building sites, LEED EB-SS cr. 5 Stormwater Management also makes reference to detention facilities. Should the standards change as a result of this proposal, these credits would be more attainable.

Should the standards be revised to implement alternative strategies such as vegetated roofs, rainwater collection, or on-site wastewater treatment, then the recommendation will also result in easier compliance with Water Efficiency credits across the various rating systems.

Implementation & Market Availability
There are no known implementation issues for this proposal.

The technology and materials required to support reductions in stormwater runoff are widely available.

ENDNOTES:

[1] CENTER FOR MARINE CONSERVATION, SEWAGE TREATMENT: AMERICA'S PIPE DREAM – A REPORT ON COMBINED-SEWER OVERFLOWS (1992).

[2] CITY OF NEW YORK, PLANYC, SUSTAINABLE STORMWATER MANAGEMENT PLAN 2008 (2008) *available at* http://www.nyc.gov/html/planyc2030/downloads/pdf/sustainable_stormwater_plan.pdf.

SW 3:
REDUCE STORMWATER RUNOFF FROM CONSTRUCTION SITES

New York City Building Code
Proposal developed by Site & Site Stormwater Committee

Summary

Issue:
While state and federal regulations limit stormwater discharge from construction sites that are larger than an acre, smaller sites are unregulated. In New York City, many construction sites are well under an acre.

Recommendation:
Require construction sites of less than an acre to reduce runoff, soil loss, sedimentation, and the generation of dust and particulate matter.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Add a new section BC 3321 to read as follows:

SECTION BC 3321

Construction Activity Pollution Prevention

3321.1 Erosion and sedimentation control plan. No permit shall be issued for the construction or demolition of a building until an erosion and sedimentation control plan in accordance with rules promulgated by the Commissioner has been approved by the department. The Commissioner shall promulgate rules establishing requirements for erosion and sedimentation control plans. In promulgating such rules, the Commissioner shall consider the standards of the 2003 EPA Construction General Permit and New York State Pollutant Discharge Elimination System and consider measures to accomplish the following objectives:

1. Prevent loss of soil during construction by stormwater runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse;

2. Prevent sedimentation of storm sewer or receiving streams; and

3. Prevent polluting the air with dust and particulate matter.

Exception: Construction or demolition projects where a total of less than 2,000 square feet of the construction or demolition site is impacted by construction or demolition, or the siting or transportation of construction materials or equipment. Such projects shall submit a site plan clearly showing the total area in which construction or demolition, or the siting or transportation of construction materials or equipment, will occur.

Supporting Information

Issue – Expanded
In New York State, stormwater discharges from construction activities that disturb one acre or more of land must receive a New York State Pollution Discharge Elimination System (SPDES) permit. These permits require the contractor to prepare a stormwater pollution prevention plan. With certain exceptions (such as construction in the "East of Hudson" watershed), sites less than one acre do not require a SPDES permit.

While a one-acre minimum may make sense as the cut-off in rural areas, very few construction sites in New York City are this large. As a result, construction sites in New York City are not covered by NYS stormwater mitigation requirements. This proposal would fill the regulatory gap by requiring all construction sites in New York City that disturb more than 2,000 square feet to develop a stormwater pollution prevention plan.

Environmental & Health Benefits
Reduced runoff results in a reduction of combined sewage overflow (CSO) that in turn reduces the risk of exposure to

disease-causing bacteria and viruses.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings
As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.05% to 0.06%, depending on building type. It was thus categorized as incurring a low to a medium capital cost increment.

Precedents
The City and County of Denver[1] as well as the Virginia Department of Conservation & Recreation[2] have stormwater management plans in place that limit the runoff of stormwater from construction sites.

Note: One acre is the common trigger for Construction Activities Stormwater Management. General permits cover smaller sites. However, it is common for special situations to require permits for disturbances typically greater than 2,500 square feet. Special situations include historic districts, environmentally sensitive areas, etc.

LEED
All projects pursuing LEED certification must meet the requirements of the EPA Construction General Permit (CGP), as this is a prerequisite of the rating systems (with the exception of LEED CI). Since the code revisions outlined in this proposal reference the EPA guidelines directly, this proposal will have a significant positive impact on achieving LEED certification.

Although the CGP only applies to construction sites greater than 1 acre. The requirements are applied to all projects for the purposes of the LEED prerequisites. Therefore, these recommended code revisions are applicable.

The following LEED prerequisites apply: NC-SS prerequisite 1 Construction Activity Pollution Prevention; EB-SS prerequisite 1 Erosion & Sedimentation Control; LEED for Schools SS prerequisite 1 Construction Activity Pollution Prevention Required; LEED for Retail (pilot program) SS prerequisite 1 Construction Activity Pollution Prevention; LEED ND (pilot program) GCT prerequisite 1 Construction Activity Pollution Prevention.

Implementation & Market Availability
There are no known implementation issues associated with this proposal.

The technology and materials required to support the reduction in stormwater runoff are widely available.

ENDNOTES:

[1] CITY AND COUNTY OF DENVER, WASTEWATER MGMT. DIV., DEP'T OF PUB. WORKS, CONSTRUCTION ACTIVITIES STORMWATER MANAGEMENT PLANS: AN INFO. GUIDE (2006) available at www.denvergov.org/Portals/528/documents/DftGuide452007.pdf.

[2] Virginia Department of Conservation & Recreation, Virginia Stormwater Management Program, http://www.dcr.virginia.gov/soil_and_water/stormwat.shtml (last visited Jan 31, 2010).

SW 4:
SEND RAINWATER TO WATERWAYS

Rules of the City of New York (Department of Environmental Protection)
Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:
Most properties located on the waterfront direct their rainwater into the sewer system, which contributes to more frequent combined sewer overflows during storms.

Recommendation:
Require waterfront properties to treat and discharge rainwater into the adjacent water body, unless it is technically infeasible.

Proposed Legislation, Rule or Study

Amendments to the Rules of the City of New York:

1. Add a new paragraph (j) to Section 19-02 of Title 15 as follows:

> (j) For properties located adjacent to tidal waterways, permits for the discharge of stormwater into public sewers shall require, at a minimum, a finding by the Commissioner that it is not feasible to discharge all or part of the site's stormwater into the adjacent waterbody in compliance with the requirements of the Army Corps of Engineers and New York State Department of Environmental Conservation and the New York State Department of Environmental Conservation.

Supporting Information

Issue – Expanded
Excess stormwater is an important environmental and health issue in New York City due to the incidence of combined sewer overflows. Sites situated next to water bodies could entirely eliminate their burden on the sewer system by discharging stormwater directly into the water body.

Sending stormwater directly to waterways is already a common practice with the Department of Environmental Protection, though it is not yet formalized in code.

Environmental & Health Benefits
Redirection of waterfront runoff results in a reduction of combined sewage overflow (CSO) that in turn reduces the risk of exposure to disease-causing bacteria and viruses.

This proposal was found to have a low positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings
As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to lower capital costs if implemented.

Precedents
As noted above, DEP has permitted many sites to discharge their stormwater directly into waterways. Projects where this has occurred include the following: 184 Kent Avenue (Brooklyn), 155 West Street (Brooklyn), Ferry Point Park (Bronx), Bronx River Greenway (Bronx), Silvercup (Queens), Fresh Kills (Staten Island) and Baker Field (Manhattan).

LEED
For existing buildings, projects must meet LEED EB-WE prerequisite 2 Discharge Water Compliance which concerns protecting natural habitat, waterways and water supply from pollutants carried by building discharge water. Under Option A, if regulated by EPA National Pollution Discharge Elimination System (NPDES) Clean Water Act requirements, a project must demonstrate NPDES permit compliance including use of any required oil separators, grease interceptors and other filtration for in-building generated discharges and proper disposal of any wastes collected. Under Option B, if the facility is not regulated by a NPDES Permit, this prerequisite is achieved.

Since this proposal requires that all discharges into waterbodies comply with the requirements of NYSDEC, the recommendations will assist in achieving LEED EB credits.

Implementation & Market Availability
There are no known implementation issues for this proposal. The technology and materials required to support the redirection of stormwater runoff are widely available.

Notes
The federal Clean Water Act requires all municipal, industrial and commercial facilities that discharge wastewater or stormwater directly from a point source into a water of the United States to obtain a National Pollutant Discharge Elimination System (NPDES) permit. All permits are written to ensure the receiving waters will achieve their Water Quality Standards. In order for this proposal to be implemented, the method of discharge must comply with existing NPDES permits.

SW 5
ENCOURAGE INNOVATIVE STORMWATER PRACTICES

Administrative Code of the City of New York
Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:
Modern stormwater control systems incorporate both civil engineering strategies, such as underground detention tanks, and landscape-based strategies, such as green roofs and natural landscaping. New York City's regulations, however, do not properly account for the impact of landscape-based strategies.

Recommendation:
Revise stormwater regulations to account for landscape-based strategies.

Proposed Legislation, Rule or Study

Amendments to the Administrative Code of the City of New York:

1. Add a new Section 24-528 as follows:

§ 24-528.1 Stormwater flow control. a. On or before Jan. 1, 2013, the department shall promulgate rules establishing runoff coefficients for green roofs, woodlands, gravel, native vegetation with prepared soils, dry bottom detention basins and wetlands. Such rules shall exclude approved best management practice areas from site flow rate calculations.

b. The runoff coefficients provided under this section shall not permit a site to provide less detention storage volume than required under rules in place on July 1, 2009.

§ 24-528.2 Stormwater volume control. On or before Jan. 1, 2013, the department shall promulgate rules, which may incorporate by reference a design manual, establishing a comprehensive system for alternative stormwater detention strategies. Such rules shall include:

a. Detention storage values for alternative strategies that may be used to decrease the size of structural stormwater detention storage facilities that would otherwise be required by the department.

b. Standard designs to simplify compliance and streamline enforcement.

c. Standard designs and detention storage values for the following alternative strategies: green roofs, rooftop runoff BMPs (planter boxes, rain barrels and cisterns), permeable paving, natural landscaping, vegetated filter strips, bio-infiltration systems, drainage swales and infiltration vaults. Such detention storage values shall only apply with respect to reductions in permissible stormwater outflow the department may enact after July 1, 2009. The detention storage values provided under this section shall not permit a site to provide less structural detention storage volume than required under rules in place on July 1, 2009. Any project that utilizes the standard designs shall receive the established detention storage credit. Rooftop runoff BMPs may not contribute more than a ten percent (10%) of the site's require detention storage volume.

Supporting Information

Issue – Expanded

How Stormwater Became A Problem

When it rains in a natural area, like a forest or grassland, most rainwater soaks into the ground or is captured by leaves, with the remainder running into rivers and streams. Stormwater is a problem in cities because hard surfaces, such as roofs and streets, reduce the area where rain can infiltrate into the soil and reduce evapotranspiration from vegetation.

In New York and many other cities, proposed developments with excess stormwater must construct onsite detention tanks and sometimes replace sewer pipes downstream of the project site to avoid flooding and sewer surcharge. This traditional approach to stormwater management addresses a problem caused by interference with the hydrological cycle (paving of permeable surfaces) by further bypassing that natural system (instead of the ground absorbing water, constructed tanks now do so).

As a result of the green building movement, some cities are now revisiting their approach to stormwater management. Many cities now seek to mimic natural systems for capturing stormwater with approaches like permeable pavement and detention basins, rather than relying solely on structural solutions to stormwater. Indeed, Staten Island's "Bluebelt" is a famous and enormously successful effort to reduce stormwater through both structural and non-structural systems such as engineered ponds, wetlands, outlet silting basins and sand filters. Cities are also beginning to treat stormwater as a potential water resource, rather than a problem that must be removed from sites.

New York City's Approach to Stormwater

The New York City Department of Environmental Protection (DEP) regulates the amount of sanitary and stormwater inputs to the combined sewer system. Specifically, the Drainage Review Section of the Division of Sewer Regulation and Control reviews new and proposed redevelopment projects to ensure that flow rates are within the carrying capacity of existing sewer pipes. These flow rates are specified in the City's Drainage Plan. Developers must submit Site Connection applications to DEP, specifying the total developed site storm flow and the amount of detention and retention incorporated into the site design. If a proposed development produces flows that are above those specified in the Drainage Plan, the developer must also produce an Amended Drainage Plan. The Amended Drainage Plan may involve replacing sewer pipes downstream of the project site in order to avoid flooding and sewer surcharge. The developer is also required to provide a certain amount of onsite detention of stormwater runoff.

DEP determines the flow rate off a building site by multiplying the site area and rainfall intensity with a runoff coefficient.[1] This "runoff coefficient" represents the ability of a surface to absorb rainfall. For example, roof surfaces have a coefficient of 1.0, whereas grass has a coefficient of 0.20 (meaning 80% of the rain is assumed to be absorbed by the ground).[2]

The amount of required stormwater detention is determined by comparing the estimated flow rate off a site (based on the types of surfaces) with its permissible flow rate under the Drainage Plan. Developers are required to provide detention that is equal to the delta between the estimated and permissible flow rates.

DEP does not, however, provide runoff coefficients for green roofs and other permeable surfaces that are now widely used by green building projects to reduce stormwater rate. In addition, DEP provides coefficients for grass areas and undeveloped areas, but no further nuance according to types of plantings and soil. In comparison, the Chicago Stormwater Ordinance Manual distinguishes between 11 types of lawns and other vegetated surfaces.[3] In addition, DEP does not credit many types of volume reduction systems such as green roofs, drainage swales and rooftop runoff BMPs (planter boxes, rain barrels and cisterns).

DEP is currently considering reducing the allowable stormwater runoff to 10% of current levels. This 900% reduction in runoff volume reflects the enormous uncertainty in calculations of sewer carrying capacity. The city's stormwater calculations evidently have sufficient uncertainty to tolerate some variability inherent in site-based stormwater management systems. Indeed, DEP is currently studying volume reduction strategies.

DEP's Upcoming Design Manual

DEP is developing a source control design manual that will contain approved designs and design considerations for use in New York City to comply with applicable codes and economic incentive packages. Many cities and states have recently published design manuals, but these do not describe New York City regulatory requirements and New York City-specific climate, geologic, hydrologic, and built conditions. The Design Manual will address different land use and building classifications; soil, bedrock, and groundwater conditions specific to different areas of New York City; climate conditions specific to New York City; and Administrative Code and permitting requirements for installing source controls, using examples from pilot and demonstration projects in New York City. The Design Manual will also include minimum maintenance requirements and procedures that will ensure effective source control performance over their design life. Maintenance requirements will take into consideration the sedimentation that can cause source controls to fail or perform less effectively over the years.

Task Force Proposal

This recommendation proposes that DEP build upon its existing efforts and enhance its own runoff coefficients by also using the nuanced coefficients developed by Chicago. It also proposes that DEP credit the detention storage capacity of site-based stormwater controls.

Environmental & Health Benefits

By facilitating the use of site-based stormwater management practices, this proposal will reduce combined sewage overflow (CSO). CSO events can expose swimmers to disease-causing bacteria and viruses, contaminate fish and shellfish and otherwise harm the New York Harbor.

This proposal was found to have no significant positive environmental impact.

This proposal was found to have no significant positive health impact.

Cost / Savings

This proposal is for a code allowance, which will have no direct impact on construction costs.

Precedents

This proposal would bring New York City closer to Chicago's Chicago Stormwater Ordinance Manual. Under the proposal, NYC would align with Chicago in terms of the types of surfaces with runoff coefficients and the types of volume reduction strategies credited. Many other cities, such as Seattle, have stormwater plans similar to Chicago. For example, the Seattle Stormwater Facility Credit program:

- Gives credit for many BMPs including: green roofs, cisterns, bioretention, pervious pavement, etc.
- Developed to recognize that stormwater flowing through privately-owned flow control or treatment systems has less impact than stormwater that directly enters the City's stormwater system or area waterways. http://www.seattle.gov/util/stellent/groups/public/@spu/@fom/documents/webcontent/spu01_003921.pdf

LEED

The effectiveness of this proposal relative to LEED certification will depend on the precise regulations that are adopted by the city when the program is implemented.

Various LEED credits across all the rating systems refer to detention facilities as one possible implementation to mitigate stormwater runoff. These LEED credits include

- NC SS 6.1 Stormwater Design: Quantity Control Option 1B
- LEED for Schools SS cr.6.1 Stormwater Design: Quantity Control
- LEED CI-SS cr.1B Site Selection; LEED for Homes SS cr. 4 Surface Water Management
- LEED EB-SS cr. 5 Stormwater Management
- LEED ND-GCT cr.9 Stormwater Management (pilot program).

This proposal will assist in achieving credits which govern the reuse of treated wastewater, recycled wastewater and graywater, or captured rainwater for landscaping:

- LEED NC-WE cr. 1.1 & 1.2 Water Efficient Landscaping
- LEED for Schools-WE cr. 1.1 & 1.2 Water Efficient Landscaping
- LEED CI-SS cr.1 Options G&H Water Efficient Irrigation
- LEED EB-WE cr.1 Water Efficient Landscaping
- LEED ND-GCT cr. 16 Wastewater Management (pilot program).

For projects that reduce potable water use for building sewage conveyance through the use of water-conserving fixtures or non-potable water, the recommendation will result in easier compliance with:

- LEED NC-WE cr.2 OPTION 1 Innovative Wastewater Technologies
- LEED CI-SS cr.1 Option I Innovative Wastewater Technologies
- LEED for Schools-WE cr.2 OPTION 1 Innovative Wastewater Technologies
- LEED for Homes WE cr.1 Water Reuse
- LEED EB-WE cr.2 Innovative Wastewater Technologies.

Implementation & Market Availability

There are no known implementation issues associated with this proposal. The technology and materials required to support the reduction in stormwater runoff are widely available.

Notes

- The Department of Environmental Protection expressed concern about providing credit for alternative strategies that may have variable capacity for stormwater detention, such as cisterns or rain barrels. Rain barrels may not function following freezing periods, and water captured during one rainfall by rain barrels and cisterns may not be used prior to the next rainfall. On the other hand, rain barrels and cisterns offer the potential for reductions not only in stormwater, but also potable water use (by providing an alternative water source for landscaping). Other cities, such as Chicago, have approached the conflicting goals of predictability in stormwater retention and maximizing opportunity for reductions by limiting the credit that may be claimed by variable BMPs. This proposal follows this same approach by limiting the detention storage for cisterns and rain barrels to no more than 10% of the allowable flow rate.
- Definitions for terms used in the proposed code language can be found in the Chicago Stormwater Ordinance Manual.
- This proposal should be considered in the context of SS5, which establishes maintenance requirements for BMPs. As a result of the maintenance requirements, some of the alternative strategies in this proposal could only be utilized by larger sites with maintenance staff.

ENDNOTES:

[1] NYC DEP'T OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER AND SEWER OPERATIONS, CRITERIA FOR DETERMINATION OF DETENTION FACILITY VOLUME, (2008) http://www.nyc.gov/html/dep/pdf/water_sewer/30.pdf.

[2] Ibid. (DEP's runoff coefficients are as follows: 1.0 roof areas; 0.85 pavement; 0.75 porous asphalt; 0.30 undeveloped areas; and 0.20 grass areas.).

[3] CITY OF CHICAGO, IL., DEP'T OF ENVIRONMENT, STORMWATER MANAGEMENT ORDINANCE MANUAL, 23 (2008).

SW 6:
MAINTAIN SITE-BASED STORMWATER DETENTION SYSTEMS

Administrative Code of the City of New York
Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:
Site-based stormwater diversion and detention systems must be properly maintained to be a reliable component of the city's stormwater infrastructure.

Recommendation:
Establish maintenance standards for site-based stormwater systems, and require property owners to verify compliance.

Proposed Legislation, Rule or Study

Amendments to the Administrative Code of the City of New York:

1. Add a new Section as follows:

Maintenance and Performance Standards.

a. No later than July first, two thousand eleven, the department shall promulgate rules establishing maintenance and performance standards for stormwater detention systems constructed pursuant to a permit or requirement issued by the department. For the purposes of this section, "stormwater detention systems" shall include, but not be limited to, detention tanks, roofwater detention systems, drywells, gravel pits and any other stormwater detention systems allowed by the department.

b. No later than July first, two thousand eleven, the department shall promulgate rules requiring the owners of buildings that have received a permit pursuant to section 24-507 of the administrative code to submit an operations and maintenance plan for any stormwater detention systems included in such permit. Such rules shall require building owners to:

1. Include in the operations and management plan any activities required to keep the stormwater detention system in compliance with the rules promulgated pursuant to subdividision (a) of this section.

2. Maintain an inspection and maintenance logbook and make such logbook available for review by the department upon request.

3. Obtain certification no less than every five years from a third-party inspector authorized by the department to inspect stormwater detention systems. The department shall develop the documentation and performance standards and the testing protocols for such certification. The department shall establish an audit program, which will inspect no less than five percent of the certification reports submitted annually. The department shall be authorized to establish fines for failure to comply with the requirements of such certification program and fees for participation.

Supporting Information

Issue – Expanded
As a result of the green building movement, some cities are revisiting their approach to stormwater management. Many cities now seek to mimic natural systems for capturing stormwater, with approaches such as permeable pavement and detention basins, rather than relying solely on structural solutions to stormwater. Indeed, Staten Island's "Bluebelt" is a famous and enormously successful effort to reduce stormwater through both structural and non-structural, site-based systems such as engineered ponds, wetlands, outlet silting basins and sand filters.

Another proposal from the Task Force, *SW5: Encourage Innovative Stormwater Practices*, would require the NYC Department of Environmental Protection to develop regulations that will encourage site-based stormwater detention and diversion systems. These site-based systems, however, can only become a reliable part of the overall city stormwater system if they are maintained to ensure proper function. For example, permeable pavement requires periodic cleaning to remain porous, as do rooftop detentions systems and silting basins that can become clogged or silted up.

This proposal would require the department to develop maintenance standards to ensure that site-based stormwater systems can be reliable components of the citywide stormwater system.

Environmental & Health Benefits

Reduced runoff results in a reduction of combined sewer overflow (CSO) that in turn reduces the risk of exposure to disease-causing bacteria and viruses.

This proposal was found to have a positive, indirect environmental impact.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

This proposal is for a study, which will have no direct impact on construction costs.

Precedents

The City of Durham, North Carolina requires submittal of *BMP Annual Maintenance Certifications* (http://www.durhamnc.gov/departments/works/stormwater_bmp.cfm). Additionally, a certification is required of the person making the submittal (http://www.durhamnc.gov/departments/works/pdf/bmp2_maintenance_certifier.pdf).

LEED

The effectiveness of this proposal relative to LEED certification will depend on the precise regulations that are adopted by the city when the program is implemented.

This proposal may facilitate achieving the following credits that govern the reduction of stormwater volumes:

- LEED NC-SS cr. 6.1 Stormwater Design, Quantity Control
- LEED CI-SS cr.1B Stormwater Management, Rate and Quantity
- LEED EB-SS cr.5.1 & 5.2 Stormwater Management
- LEED for Schools SS cr. 6.1 Stormwater Design, Quantity Control
- LEED for Homes SS cr.4 Surface Water Management
- LEED ND-GCT cr.9 Stormwater Management (pilot program)
- other LEED pilot programs under development.

LEED for New Construction SS cr. 6.2 Stormwater Design, Quality Control requires the implementation of a stormwater management plan to reduce or eliminate water pollution. This plan must utilize acceptable Best Management Practices (BMPs). The BMP's are considered to meet with LEED if they are in accordance with standards and specifications from a state or local program that has adopted the LEED performance standards. Therefore, revisions to the code under this proposal may result in achieving LEED credits, provided that the standards comply with the criteria outlined in the reference guides.

Implementation & Market Availability

There are no known implementation issues associated for this proposal.

SW 7:
ANALYZE STRATEGIES TO REDUCE STORMWATER RUNOFF FROM EXISTING DEVELOPMENTS

Study
Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:
To reduce combined sewer overflows, New York City must address already developed buildings and lots. These make up nearly 50% of the city's impervious surfaces, and they often release more runoff than permitted, largely due to new paving after initial construction.

Recommendation:
Undertake a study to assess the potential for reducing stormwater runoff from existing properties.

Proposed Legislation, Rule or Study

The City of New York should study options for increasing on-site stormwater management requirements for existing properties. The study should analyze and propose potential changes to the Building Code, Zoning Resolution, and sewer connection rules.

This study should focus on three specific areas:

1. Upgrades During Reconstruction. Evaluate the feasibility of requiring properties undergoing renovations to come into compliance with the requirements of the City Drainage Plan that were in effect at the time of the property's construction. Many existing properties release more runoff than their original allowance due to increased paving on-site or through a lack of maintenance for stormwater control systems. The study should determine the types, number, and location of properties that were subject to detention requirements at the time of their construction and analyze the ways that many properties have come out of compliance. The study should also evaluate methods to bring properties back into compliance and the costs associated with these actions. In addition, the study should analyze options for sites developed before any detention regulations were in place.

2. Rooftop Detention. Evaluate the feasibility of requiring buildings undergoing roof replacements to install rooftop detention systems (i.e. "blue roofs"). The study should evaluate the potential depth of water that could safely be detained on a rooftop both with and without requiring a full structural rooftop analysis. The study should analyze the effect that roof pitch and drainage configurations have on the performance of rooftop detention systems and develop recommendations for maximum allowable pitch. The study should propose a methodology to assess the storage and rate-of-flow impacts of rooftop detention. The study should also examine the effectiveness of rooftop detention systems at the time of freezing temperatures; analyze waterproofing and rooftop membrane surfacing; and offer recommendations for establishing a methodology for crediting rooftop detention systems by DEP for volume and rate of flow control.

3. Rain Barrels. Evaluate the feasibility of requiring residential properties undergoing renovations to install rain barrels on-site such that each rain barrel would be connected to the building downspout and equipped with an overflow mechanism that connects to the sewer system. The study should evaluate the size and quantity of rain barrels required by lot size; develop standards for overflow mechanisms; and examine the efficacy of rain barrels in both warm and cold weather.

For each of the three areas of investigation, the study should analyze the magnitude of renovation that could trigger a potential requirement; the threshold of property types and sizes that could be required to comply with potential new requirements; potential obstacles for adoption; and which exemptions might be necessary for adoption of these potential requirements.

The study should analyze the costs and benefits of any potential requirement. To analyze the costs of requiring on-site stormwater controls, the study should develop at least 5 scenarios showing the impact of how potential requirements could be implemented on prototypical sites. The study should also evaluate the costs for the City to review and enforce any new requirements.

This study should be a multi-agency effort, to include the Office of Long Term Planning and Sustainability (OLTPS), the Department of Buildings (DOB), and the Department of Environmental Protection (DEP).

Supporting Information

Issue – Expanded

While it is essential to reduce water runoff from new development, New York is an older and developed city so most stormwater comes from already developed sites. Buildings and developed lots account for 45% of New York City's land area. Therefore, it is essential to address runoff from existing sites and Part 1 of the study looks at how that can be achieved.

Part 2 of the study looks specifically at rooftop detention, which is a less expensive strategy for new development. Here a methodology must be developed to properly credit this detention technique. In addition, it could potentially be used as a central strategy for detention on existing sites. Because of a number of technical issues, including structural concerns, this technique needs to be studied in order to determine how and where it can be utilized.

Part 3 of the study relates to small sites. Currently, the method for controlling water runoff on small sites is too coarse. Adopting prescriptive rather than performance regulations may be the only feasible solution. The study should determine if rooftop detention and rain barrels are appropriate means to reduce runoff on small sites.

Environmental & Health Benefits

Reduced runoff results in a reduction of combined sewage overflow (CSO) that in turn reduces the risk of exposure to disease-causing bacteria and viruses.

This proposal was found to have a low, positive environmental indirect environmental impact.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is for a study, which will have no direct impact on construction costs.

Precedents

Historically, stormwater regulations have applied to new developments. However, municipalities have started to place regulations on previously developed sites to reduce runoff. For example, within the City of Portland, Oregon, projects are subject to the requirements of their 2008 *Stormwater Management Manual*[1] if they:

- propose new offsite discharges or new connections to the public system, are required to comply with stormwater requirements for the impervious area draining to the discharge point, or
- develop or redevelop over 500 square feet of impervious surface.

The Maryland Department of the Environment composed the following stormwater management requirements for all redevelopment projects:

- reduce existing site imperviousness by 20%,
- provide water quality for 20% of the site's imperviousness,
- or a combination of both.

The Code of Maryland Regulations (COMAR 26.17.02.02) defines redevelopment as any construction, alteration, or improvement exceeding 5,000 square feet of land disturbance performed on sites where the existing land use is commercial, industrial, institutional, or multifamily residential.[2]

LEED

Under the LEED for Existing Buildings rating system, this proposal will facilitate achieving SS cr. 5.1 & 5.2 Stormwater Management, Rate and quantity reduction. This proposal requires that buildings achieve the site detention of their original permits, while LEED EB requires that measures be implemented to mitigate a percentage of the annual stormwater falling on the site. Project teams must determine for each individual project whether the code revisions result in the acquisition of LEED credits.

For any project with substantial improvement that is seeking certification under another rating system, this proposal will facilitate achieving similar LEED Sustainable Sites credits for Stormwater control by utilizing pervious site surfaces.

Depending on the permeable surface that is utilized, project teams may also be eligible for LEED credits relating to Heat Island Reduction as a result of this proposal. These Sustainable Sites subsections award points to projects for reducing irrigation, tempering the outdoor environment, and reducing cooling loads.

Implementation & Market Availability

The technology and materials required to support the reduction in stormwater runoff are widely available.

There are no known implementation issues for this proposal.

ENDNOTES:

[1] CITY OF PORTLAND, OR., 2008 STORMWATER MANAGEMENT MANUAL (2008), *available at* http://www.portlandonline.com/BES/index.cfm?c=47952.

[2] MD. CODE REGS. § 26.17.02.02 (2000) *available at* http://www.dsd.state.md.us/comar/getfile.aspx?file=26.17.02.02.htm.

UE 1:
INCREASE BIODIVERSITY IN PUBLIC LANDSCAPES

Rules of the City of New York (New York City Department of Transportation and Department of Parks and Recreation)
Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:
Historically, foreign species and monocultures have been widely used in landscaping to the detriment of the urban ecology. Native and diverse plants species tend to be hardy, require little water and fertilizer, and provide habitats for birds and other native animals.

Recommendation:
Promote diverse and native plant species by requiring their use on city-owned property, including buildings, parks and sidewalks.

Proposed Legislation, Rule or Study

City agencies should revise their planting rules, specifications and design manuals to conform to the standard below.

The following requirements shall apply to planting on city owned property.

1. No plant species shall be used if it is listed as invasive as defined and identified by the New York State Department of Environmental Conservation.
2. The following requirements shall pertain to various sites:

Type of Site	Native Species Requirement	Diversity Requirement
Green Streets Medians Sites[1] < 0.5 acres	A minimum of 50% of all plant material[2] shall be native species and drought and salt tolerant	N. A.
Sidewalks	A minimum of 75% of all trees proposed to be planted shall be drought and salt tolerant; minimum 30% shall be native.	Builder's Pavement Plan to include location and species of all trees, both existing and proposed, on each affected block. No single tree species shall be used for a length of more than four blocks.[1]
0.5 acres < Sites < 5 acres	A minimum of 60% of all plant material shall be native species and drought and salt tolerant	No single species shall comprise more than 30% and not more than 50% of any genus and not more than 70% of any family of the plant material.
Sites > 5 acres	A minimum of 75% of all plant material shall be native species and drought and salt tolerant	No single species shall comprise more than 10% and not more than 20% of any genus and not more than 30% of any family of the plant material.

Exemptions:

1. Historic parks that have significant stands or allees of viable, non-invasive, non-native trees.
2. Existing trees (or shrubs) shall not be removed to bring a project into compliance.

Supporting Information

Issue – Expanded
Landscaping has traditionally involved exotic plants and vast monocultures of turf grass. Non-native species are typically brought to North America without their predators and thus often outcompete native plant species. Many non-native species are prolific seed producers, escaping cultivation and colonizing new areas. Maintaining monocultures of turf grass requires the application of fertilizers and herbicides. Non-native species that have adapted to wetter conditions than New York, can also require regular watering.

Invasive species have cause millions of dollars in damage to agriculture, wetlands, water bodies and livestock. Ecologists estimate that invasive species overtake 3 million acres per year at a cost of $123 billion annually: zebra mussel can shut down electrical utilities by clogging water intake pipes; leafy spurge causes $144 million in livestock forage damage annually in Montana, North and South Dakotas and Wyoming; invading sea lampreys caused the collapse of the lake trout and other Great Lakes fisheries, costing the US and Canada approximately $13 million annually to control; the Asian long-horned beetle required the destruction of 2000 trees in Brooklyn, costing the federal, state and city governments $5 million (as of 1999).

In contrast, native species are already adapted to the local climate and ecosystem. They typically require less water than exotic plants and are hardier. When plantings are diverse, there is less need for pesticides and fertilizers. Native plants also provide habitats for local birds, insects and other animals.

Environmental & Health Benefits
Native and diverse plantings require less water and fertilization and are more likely to survive drought conditions and pathogens.

This proposal was found to have a low, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have no significant positive health impact.

Cost & Savings
This proposal is not expected to have any significant impact on capital costs.

Prohibiting the use of invasive, non-native species reduces labor cost associated with grounds maintenance and reduces the cost of replanting after intended species have been overrun by invasive, non-native species.

Much greater savings are attributable to curtailing or suppressing the spread of invasive species and/or host pests that have destroyed natural areas such as forests, wetlands, water bodies, and economic resources such as fisheries, agriculture and timber production.

Precedents
The Federal Report of the National Performance Review, 1994, recommends "environmentally beneficial landscaping" at federal facilities and federally funded projects. The recommendations, which were incorporated into all federal programs and practices by February 1996, propose that federal agencies use regionally native plants for landscaping in a way that minimize adverse effects on the natural habitat.

Executive Order #13112 passed on February 3, 1999 promulgated during the Clinton administration states that a federal agency cannot authorize, fund or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States. This same Executive Order created the National Invasive Species Council that posts a list (updated every 2 years) of invasive species. Any state agency receiving federal funds, such as NYS DOT, must uphold the native planting requirement.[3]

The guidance highlights that using native plants and employing landscaping practices that conserve water and prevent pollution will minimize the adverse effects of landscaping on the environment.[4]

The current approved list of Street Trees published by NYCDPR 2009 contains 66% of native tree species.

New York State and New York City have a number of different groups focused on identifying invasive plant species. Unlike many other states, NYSDEC has yet to publish a list if invasive plants. Until such time, it is recommended to use the Brooklyn Botanic Garden list and the Cornell Cooperative Extension Invasive Species Clearinghouse.[5]

LEED
This recommendation may assist in achieving:

- LEED NC-SS cr.5.1 Site Development, Protect or Restore Habitat
- LEED EB-SS CR.4 Reduced Site Disturbance, Protect or Restore Open Space
- LEED for Schools-SS cr. 5.2 Site Development, Protect or Restore Habitat
- LEED ND (pilot program)-GCT cr.7 Minimize Site Disturbance during Construction.

These credits include options that require protecting a portion of the site area with native/adapted vegetation.

In addition, LEED EB-SS cr.1 Green Site and Building Exterior Management includes protecting natural areas among the possible measures to include in the management plan for obtaining this credit.

Implementation & Market Availability

There are no known implementation issues associated with this proposal.

Wholesale and retail nurseries and plant growers are greatly expanding the availability of native plant species.

Notes

A native species is:

- A species that reproduces in a region without human intervention;
- A species that co-evolves with and depends on other regional plants and animals for survival;
- A plant not transplanted to the region by humans accidentally or purposefully;
- A species that, with respect to a particular ecosystem, that historically occurred or currently occurs, other than as a result of human introduction, in that ecosystem.

ENDNOTES:

[1] Note: Site area is the unbuilt area of the site, and refers to both building sites and parks.

[2] Note: Plant material includes trees, hedges, shrubs, and perennial plants.

[3] Press Release, US Dept. of Agriculture, President Clinton Expands Federal Effort to Combat Invasive Species (Feb. 3, 1999), available at http://www.ladwpnews.com/go/doc/1475/182533/.http://www.nps.gov/plants/alien/pubs/eopress.htm.

[4] Dep't of Transp., Fed Highway Admin., Memorandum on Environmetally Beneficial Landscaping (Apr. 26, 1994) http://www.fhwa.dot.gov/environment/042694em.htm.

[5] Brooklyn Botanic Garden, Pest Alert: Worst Invasives in the New York Metropolitan Area, available at http://www.bbg.org/gar2/pestalerts/invasives/worst_nym.html. (last visited Oct 20, 2009).

UE 2:
INCREASE BIODIVERSITY IN SIDEWALK PLANTINGS

NYC Zoning Resolution
Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:
Where groundcover is required under the Zoning Code, such as in sidewalk planting strips, standard practice is to use turfgrass. But, turfgrass is a water-intensive monoculture that requires pesticides and fertilizers.

Recommendation:
Prohibit the use of turfgrass within the sidewalk planting strips required in new developments.

Proposed Legislation, Rule or Study

Amendments to the New York City Zoning Resolution

1. Add the following definitions to Section 12-10 (Definitions):

Low Herbaceous plants

A "low herbaceous plant" is part of the family of plants that lack a permanent woody stem, are low-growing or creeping and include: grasses, native ground covers, "steppables" (herbaceous ground covers tolerant of limited foot traffic), herbs, perennials, annuals and vegetables. Both evergreen and deciduous plants may be herbaceous plants.

Native Meadow

A "native meadow" is a combination of native, warm-season grass types which may or may not contain perennials (flowers). Warm-season grasses have extensive root systems which make them far more drought tolerant than cool-season grasses that comprise turfgrass. Mature height ranges of the plants contained in a meadow typically vary from 8 inches to 36 inches depending on seed mix.

No-mow grass

"No-mow grass" is a spreading or stoloniferous grass (such as SR3100 Hard Fescue, Scaldis Hard Fescue, Dawson Red Fescue, Creeping Red Fescue or Sheep fescue) that ranges in mature height from 4 to 8 inches.

Turfgrass

"Turfgrass" is a spreading or stoloniferous grass that is comprised of cool-season grass seeds and requires regular mowing.

2. Amend Section 26-11 as follows:

26-11
General Purposes

The urban design guidelines are established to strengthen, at street level, the relationship of new developments with existing buildings and to improve the quality of the streetscape by:

(a) maintaining the visual continuity of new developments at street level;
(b) enhancing the visual character of the neighborhood; [and]
(c) reducing conflict between pedestrian and vehicular circulation[.]; and
(d) improving the environmental quality through sustainable landscape practices.

3. Amend Section 26-23 as follows:

26-23
Requirements for Planting Strips and Trees

A minimum three-foot wide planting strip shall be provided adjacent to and along the entire length of the required curb. Within the required planting strip, one tree of at least three inches in caliper shall be planted for every 25 feet of length of such planting strip. Driveways are permitted to traverse such planting strips, and utilities are permitted to be located within such planting strips. Within this planting strip, no #turf grass# shall be permitted.

4. Amend Section 26-42 as follows:

26-42
Planting Strips

In accordance with applicability requirements of underlying district regulations, the owner of the #development#, #enlargement# or converted #building# shall provide and maintain a planting strip. #Street# trees required pursuant to Section 26-41 shall be planted within such planting strip. In addition to such #street# trees, such strip shall be fully planted with [grass or groundcover] #native meadow# plantings, #no-mow grass#, #low herbaceous plants# or native ground covers, except that #street# trees within the planting strip shall have a minimum of a 3 foot diameter mulch bed at their base. #Native meadow# or other grasses shall be mowed once per year. Such planting strip shall be located adjacent to and extend along the entire length of the curb of the #street#.

Supporting Information

Issue – Expanded
32 million acres in the United States are planted in turfgrass, more than the acreage planted with crops. Although ubiquitous in private and public gardens across the country, turfgrass has many negative environmental attributes. It requires excessive amounts of water, causes water and air pollution, and has very low biodiversity.

Each day, approximately 7.9 billion gallons of potable water are used throughout the U.S. to irrigate landscapes that are largely comprised of turfgrass. In the Northeast, just 1000 square feet of turfgrass requires 624 gallons of water weekly and often more than 10,000 gallons over the course of the growing season. Almost 10% of the potable water in urban areas is used for landscaping.

Often, turfgrass is also fertilized with nitrogen and phosphorus. Both of these highly water soluble chemicals runoff into receiving waters with heavy rain or excessive irrigation. Phosphorus causes algal blooms that devastate fish and other organisms and upsets the ecology of aquatic systems. A 1000 square foot area of bluegrass requires 6 pounds of nitrogen fertilizer weekly. Pesticides used to treat turfgrass are also highly toxic and water soluble. About 7 million birds are estimated die annually throughout the US as a result of exposure to lawn pesticides.

In addition, lawnmowers are highly polluting and consume 58 million gallons of gasoline each year in the U.S. A typical lawn mower operating for one hour produces the same amount of air pollution as one new car running for 11 hours.

Finally, most turfgrass seed species are not native to the Northeast and as a result, insects do not feed on the grass blades. This reduces the presence of birds and other animals in New York City.

Environmental & Health Benefits
Reduced noise and air pollution from mowers and blowers; less damage to tree trunks from mowers; longer lifespans for street trees; greater habitat from diversified species.

This proposal was found to have a low, positive environmental impact per building and to impact a small mumber of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings
This proposal is not expected to have any significant impact on capital costs.

Precedents
There are no known precedents for this proposal.

LEED
This recommendation may assist in achieving credit for:

- LEED NC-SS cr.5.1 Site Development, Protect or Restore Habitat;
- LEED EB-SS CR.4 Reduced Site Disturbance, Protect or Restore Open Space;
- LEED for Schools-SS cr. 5.2 Site Development, Protect or Restore Habitat; and
- LEED ND (pilot program)-GCT cr.7 Minimize Site Disturbance during Construction.

These credits include options that require protecting a portion of the site area with native/adapted vegetation.

For previously developed sites, LEED requires that a project utilize local and regional governmental agencies, consultants, educational facilities, and native plant societies as resources for the selection of appropriate native or adapted plant materials. LEED prohibits plant materials listed as invasive or noxious weed species. A project seeking these relevant LEED credits must support with research that turfgrass is in fact an invasive species.

This recommendation will also assist in achieving credit for:

- LEED NC-WE cr.1.1 & 1.2 Water Efficient Landscaping;
- LEED EB-WE cr.1.1 & 1.2 Water Efficient Landscaping;
- LEED for Schools-WE cr.1.1 & 1.2 Water Efficient Landscaping;
- LEED for Retail NC (pilot program) WE cr.1.1 & 1.2 Water Efficient Landscaping; and
- LEED ND (pilot program) GCT cr.3 Reduced Water Use.

These credits limit or eliminate the use of potable water for landscape irrigation, and include the selection of climate-tolerant plants.

Implementation and Market Availability

"No mow" grasses and native meadow grasses are readily available from multiple suppliers. Internet resources and botanical gardens offer extensive information on appropriate plant and seed selection, planting procedures, care and maintenance of turfgrass alternatives. University web sites such as University of Massachusetts, Rutgers Univeristy and University of Connecticut offer such resources.

Notes
Selection of the appropriate types of herbaceous plants depends on the soil type and sun and shade conditions but will typically survive without irrigation under normal annual rainfall in New York City. Selection of species should consider appropriate height, salt and drought tolerance and resistance to foot traffic.

For native meadows, annual mowing is required to prevent growth of woody plants. Mowing should be done in the fall and should retain between 6"-8" height of stems. Selection of the appropriate types or combinations of native grasses and wildflower perennials depends on the soil type and sun and shade conditions but will typically survive without irrigation or supplemental water under annual rainfall in New York City. Selection of species should consider appropriate height, salt tolerance, and resistance to foot traffic.

No-mow grass does requires mowing once or twice a year to prevent growth of woody plants. Selection of the appropriate type of no-mow grass depends on the soil type and sun and shade conditions but will typically survive without irrigation or supplemental water under annual rainfall in New York City. Select mixes that are appropriate for New York City's climatic zone (Zone 6) and use at least 3 seed types in the mix. Available and appropriate species are inherently salt and drought tolerant.

Turfgrass requires regular mowing, fertilizer and pest control-applications, and constant water application of at least 1" per week of supplemental water from a potable water source.

UE 3
CONSTRUCT SUSTAINABLE SIDEWALKS

Rules of the City of New York (New York City Department of Transportation and Department of Parks and Recreation)
Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:
Sidewalks have the potential to reduce runoff, mitigate the urban heat island effect, promote the use of recycled materials and increase the longevity of trees. However, city rules and regulations for sidewalks are inconsistent and are, in some cases, impediments to green sidewalks

Recommendation:
Create a single consistent sidewalk standard that includes permeable strips, water storage capacity, increased planting and recycled materials.

Proposed Legislation, Rule or Study

The Department of Transportation and Department of Parks and Recreation should revise their sidewalk rules, specifications and details to conform to the standard below. In addition, information on agency websites should be coordinated and made consistent.

Proposed Sidewalk Standard:

1. Permeable Strip. Sidewalks shall include a continuous permeable strip at the curb side. The permeable strip shall conform to the following requirements:
   i. Dimension shall be a minimum of 1/3 the sidewalk width (aka. the distance between the lot line and the curb) but not less than three feet wide along the curb side length of the sidewalk from lot line to lot line.
   ii. Tree planting Zone within permeable strip: Planting zone shall be the minimum length and depth as defined by DRP in Tree Planting Standards: Sample Tree Pit Configurations, p. 20. Planting zone shall be backfilled with topsoil per same reference standard p.9-11. Planting may include single tree, grouped trees with or without shrubs or ground covers.
   iii. Existing trees: Where existing trees are encountered in construction of a new permeable strip, the root mass shall be left undisturbed within the Critical Root Zone. Structural soil shall be placed outside of the Critical Root Zone.
   iv. Tree Planting Spacing: Trees shall be planted either individually or in groups with a minimum distance of 10 feet on center to a maximum of 25 feet. Other spacing requirements shall be as defined by DOT, DPR, FDNY and MTA with the exception that a pattern book be developed to determine tree spacing from intersections based on sight lines, traffic direction and traffic control.
   v. The Builder's Pavement Plan shall show all existing trees on the block, indicating the species, and show the proposed new trees, indicating the species.
   vi. Requirements for non-planted permeable strips:
      a. Surface material shall be permeable based on DOT material options applicable to neighborhood classification that are in the process of development by DOT.
      b. Backfill Beyond Planting Zone within permeable strip: Between planting zones and within the full extent of the permeable strip, the backfill shall be Structural Soil as defined by DPR p. 4-7 with a depth no less than 24 inches from finished grade. The use of recycled concrete aggregate shall not be permitted due to its potential to alter the pH of the soil beyond the acceptable range for trees.
   vii. Requirements for planted permeable strips:
      a. Within this planting strip, no turf grass shall be permitted. Plants shall consist of: native meadow plantings, low herbaceous grasses or native ground covers, except that street trees within the planting strip shall have a 3 foot diameter/square mulch bed at their base.
      b. Meadow or other grasses shall be mowed once per year.

Exceptions:
1. Sidewalk zones where the distance between the curb and the lot line is less than 9′ - 0″ wide.
2. Areas within any sidewalk which contain sub grade structures including but not limited to subway vents or

structures, critical utility infrastructure, sidewalk vaults, and electrical vaults.
3. Areas within curb cuts.
4. Historic sidewalks constructed of brick or granite or bluestone slabs.
5. Locations where rock is present within 3 feet below sidewalk grade.

2. Sidewalk zone beyond permeable strip shall conform to the following requirements:
i. Concrete shall consist of Type IIA Portland Cement, fly ash or blast furnace slag, size no.57 stone with recycled concrete, and Type 1A Natural sand. It shall achieve a compressive strength of 3,200 PSI 28 days after the pour. For weather ability, it is to be air entrained, having an air content of 6.5% give or take 1.5%. The concrete mixture shall contain a maximum of 400 lbs. of Portland cement per cubic yard of concrete. After July 1, 2013, this maximum shall be lowered to 300 lbs. of Portland cement per cubic yard of concrete. The aggregate mixture shall contain size no. 57 stone mixed with a minimum of 10% recycled concrete, measured by weight. The recycled concrete shall be no larger than .75 inches, with no more than 1% deleterious material.

ii. All unsatisfactory material shall be removed and replaced with suitable material. Organics such as grass and other plant material must be removed. The entire sub base must be compacted until firm. The sub grade should be wet down thoroughly and should be damp at the time of pouring.

iii. It is required that a minimum of six (6) inches of No. 3 (1/2") stone or gravel, with a minimum of 15% recycled concrete, recycled asphalt, or glass cullet, be placed under the sidewalk. After July 1, 2013, this minimum shall be raised to 25%. The recycled concrete shall be no larger than .75 inches, with no more than 5% deleterious material, and the glass shall be a maximum of .375 inches. Recycled asphalt shall not exceed 5% of the total weight, glass cullet shall be no more than 30% of the total weight, and there is no maximum for recycled concrete. The foundation must be sufficiently compacted.

iv. Alternatively, the foundation may be consist of a minimum of six (6) inches of Structural Soil as defined by the Department of Parks and Recreation.

Exception: The requirements for use of recycled materials shall be waived if recycled material cannot be obtained for less than a 10% premium over the cost of virgin material.

Supporting Information

Issue – Expanded
Sidewalks in NYC make up 8% of the city - over 24 square miles in total. This means that a small change related to the design and structure of sidewalk systems will have significant environmental, micro-climate, and health impacts. New sidewalks are regularly installed, while old ones are constantly being fixed, repaired, and replaced.

The Department of Transportation is responsible for regulating sidewalks, while the Department of Parks and Recreation is responsible for regulating the trees planted in those sidewalks. Their jurisdiction overlaps on issues such as the location of street trees, size of tree pits, materials within tree pits, and extent of structural soil within tree pits. Both agencies provide specifications and details (drawings) on tree pits and these documents are not consistent with each other.[1] In addition, the Department of Design and Construction has two sets of specifications for tree pit soil and plantings. The School Construction Authority uses details that are consistent with those of the Department of Transportation, and its own specifications for tree pits. All told, between the various city agencies and public authorities, there are at least 10 sets of inconsistent and sometimes conflicting specifications and drawings for sidewalk trees and tree pits.

This proposal would provide one standard sidewalk specification that would increase tree cover, reduce stormwater runoff, and decrease greenhouse gas emissions. It would require that the outer third of all sidewalks be permeable with at least 24"of structural soil below, referred to as "linear tree pit." As structural soil is 30% void, it can serve as a repository for storm water; almost all the rain in a 2" storm would be captured by a sidewalk designed to the proposed specification. By reducing stormwater runoff, the permeable strip will reduce flooding in sewers, subways, and roads, and reduce the pollution carried into waterways. It will also provide more root space for trees, ensuring a healthier tree canopy.

The specification also proposes that trees be planted closer together, increasing the number of trees in sidewalks. This will reduce urban heat island effect, increase natural shading and cooling through evapo-transpiration, and provide more pleasant sidewalks.

Finally, the proposal recommends that sidewalks use a concrete mixture with 50% less cement than typically used. Cement production is an energy intensive process that results in significant carbon dioxide emissions -1 ton of cement causes the release of 1 ton of CO_2 emissions. Capping the amount of cement used in NYC sidewalks will reduce greenhouse gas emissions from cement manufacturing, while not decreasing performance. Using recycled material in sidewalks will also increase the amount of construction and demolition that is recycled, and reduce the amount of

environmental damage caused by quarrying.

Environmental & Health Benefits
This proposal will provide numerous environmental and health benefits, including reductions in greenhouse gas emissions, a decrease in stormwater, and a healthier, more widespread tree population.

This proposal was found to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

This proposal was found to have no significant positive health impact.

Cost / Savings
As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.
This proposal was estimated to increase first capital costs by 0.005%. It was thus categorized as incurring no capital cost increment.

Savings will ultimately be derived from reduced energy demand and reduced demand on sewage treatment plants.

Precedents
City of Los Angeles: Department of Public Works and Environmental Affairs jointly recommend investigation of technologies for permeable pavement systems and associated pilot projects, May 2008.[2]

US EPA: Advocates for permeable surfaces to control selected pollutants especially Total Suspended Solids, nutrients and metals in the National Management Measures to Control Nonpoint Source Pollution from Urban Areas, November 2005.[3]

FHWA: Provides diagrams and descriptions of permeable pavements, infiltration trenches and biofiltration in Stormwater Best Management Practices in Ultra urban Setting.[4]

Seattle: Currently revising its Stormwater Management Manual for Western Washington to account for advances in urban stormwater management. Anticipated to be passed in late 2009. Changes to the current code to include permeable pavement, bioretention and vegetated roofs.
http://seattle.gov/dpd/Planning/Stormwater_Grading_and_Drainage_Code_Revisions/Overview/default.asp

LEED
This recommendation may assist in achieving various LEED credits.

The following credits include options that require planting a portion of the site area with native/adapted vegetation:

LEED NC-SS cr.5.1 Site Development, Protect or Restore Habitat; LEED EB-SS CR.4 Reduced Site Disturbance, Protect or Restore Open Space; LEED for Schools-SS cr. 5.2 Site Development, Protect or Restore Habitat; and LEED ND (pilot program)-GCT cr.7 Minimize Site Disturbance during Construction.

Utilizing recycled concrete will assist in obtaining the following credits:

LEED NC- MR cr.4.1 & 4.2 Recycled Content; LEED CI-MR cr. 4.1 & 4.2 Recycled content; LEED EB-MR cr.2 Optimize use of Alternative Materials; LEED for Schools MR cr.4.1 & 4.2 Recycled Content; LEED for Homes MR cr. 2 Environmentally Preferable Products; and credits under the various pilot programs. Additionally, for concrete recycled on site, LEED MR credits relating to Construction Waste Management are available for diverting waste from disposal.

Various LEED credits refer to detention facilities to mitigate stormwater runoff. These LEED credits include:

NC SS 6.1 Stormwater Design: Quantity Control Option 1B; LEED for Schools SS cr.6.1 Stormwater Design: Quantity Control; LEED ND-GCT cr.9 Stormwater Management; LEED CI-SS cr.1B Site Selection; and LEED for Homes SS cr. 4 Surface Water Management; and LEED EB-SS cr. 5 Stormwater Management.

The following LEED credits address mitigation of the heat-island effect through the use of permeable site surfaces:

LEED NC-SS cr. 7.1 Heat Island Effect, non-roof; LEED CI-SS cr.1D Heat Island Effect, non-roof; LEED EB-SS cr.6 Heat Island Reduction; LEED for Schools SS cr.7.1 Heat Island Effect, non-roof; LEED for Homes SS cr.4.1 Surface Water Management; LEED ND-GCT cr.10 Heat Island Reduction (pilot program).

Implementation and Market Availability

There are no known implementation issues for this proposal. Multiple local suppliers carry structural soil and there are many manufacturers of permeable pavements.

Notes
Mitigation Strategy for Locations Exhibiting Poorly Draining Soils

Proper tree planting methods recommend a percolation test in every proposed tree pit. In the condition of continuous tree trenches, percolation tests should be conducted every 50 feet if poorly drained soils are suspected. Poorly drained soils are those that percolate at less than 1 inch per hour. There are multiple mitigating measures that can be employed in this instance. One is the use of a vertical sump drain in which an approximately 8 inch diameter auger drills through the poorly draining soil until it reaches better draining soil. This column is then filled with sand to allow water to move from the poorly draining tree trench into free draining soil below. Another technique is to use underdrainage, or perforated plastic pipe wrapped in filter fabric. This method would use a continuous 4 to 6 inch diameter perforated plastic [HDPE] pipe wrapped in filter fabric with a connection to an outlet pipe or sewer line. A third option is to continuously slope the tree trench to a sump or to an area of better drained soils. A fourth option is to use tree species that are more adapted to periodically saturated soil conditions.

Evapotranspiration

One of the major benefits of more sidewalk trees is their ability to return moisture (rainfall) back into the atmosphere. A 6-8 inch caliper tree with a crown diameter of 20 feet can extract 6.21 inches of water in a 31 day period in July, or 0.2 inches per day, or 4.19 cubic feet of water per day or 30 gallons per day [Trees in the Urban Landscape, p. 80]. Evapotranspiration is a major mitigating factor in reducing concerns of soil saturation.

Rainfall Interception by Trees

The leaves, branches and trunks of trees intercept rainfall. Tests demonstrate that a 9 year old tree, 28 feet tall with a 19 foot canopy spread can intercept 68% [58 gallons per square foot] of a 0.5 inch storm event [86 gallons per square foot]. [http://www.fs.fed.us/psw/programs/cufr]

Soil Volume Calculations

Current Department of Transportation (DOT) standards recommend that trees be planted in a tree pit of 5 feet by 5 feet by 3 feet depth. This is equivalent to a soil volume of 75 cubic feet. The Department of Parks and Recreation (DPR) recommends tree pits be as large as the sidewalk space permits, recognizing limitations of obstructions and required clearances. The current DPR/DOT recommended spacing of trees is 25'- 40'. Since there is no current provision for continuous trenches between trees, the tree root's ability to extend beyond the tree pit is highly compromised due to our heavily compacted and unsuitable urban soils. The calculation of appropriate soil volume is based on many criteria including the soil quality, water holding capacity, tree canopy at maturity, availability of adjacent soil into which tree roots can expand, microclimate and the like. Research has demonstrated that shade trees in NYC's climate will attain greater height and canopy spread, survive longer, and sustain drought better with more soil volume. This proposal provides the following:

Tree Trench Width/Depth	On center Tree Spacing	Soil Volume per Tree
4 feet x 24 inches	10' – 15'	80 – 120 cubic feet
4 feet x 24 inches	20' – 25'	160 – 200 cubic feet
5 feet x 24 inches	10 ' – 15'	100 – 150 cubic feet
5 feet x 24 inches	20' – 25'	200 – 250 cubic feet
6 feet x 24 inches	10' – 15'	120 – 180 cubic feet
6 feet x 24 inches	20' – 25'	240 – 300 cubic feet

The basic proposal is for a 24 inch deep continuous tree trench backfilled with structural soil beyond the immediate root ball zone. Trees planted initially at larger calipers (greater than 5 inches) will need deeper tree pits, however the trench beyond the root ball can remain 24 inches and retain effectiveness. This is due to the fact that the overwhelming majority of tree roots, particularly the feeder roots, are located within the top 6 to 24 inches of the soil. Roots only grow where the physical and chemical environment is correct in terms of temperature, moisture, aeration, pH, nutrient supply and soil moisture. Furthermore, a continuous trench between trees allows for shared root space so the actual available volume is greater. To date there is no conclusive research that allows a determination as to how much less soil volume can be specified if soil volumes are contiguous, but research shows that tree roots in natural settings extend 2 to 4 times the diameter of the crown.

Stormwater Catchment Area of Sidewalk Tree Trench

The stormwater catchment area used in the calculations in this proposal assumes a continuous and even cross slope on a sidewalk from the building face to the edge of the trench plus the water falling directly on the trench. Therefore, on a 15 foot wide sidewalk, there would be a 5 foot wide permeable tree trench and a 10 foot wide zone of impervious surface draining into the trench. This assumes in a typical 100 foot long trench a catchment area of 1000 SF of impermeable surface and 500 SF of permeable surface contributing water to the trench.

ENDNOTES:

[1] CITY OF NEW YORK ADC. LAW § 28-108 (2007) available at http://codes.lp.findlaw.com/nycode/ADC/28/1/108/28-108.1 (requires a builders pavement plan for new construction or alteration, compliance with Department of Transportation regulations, and compliance with NYC ADC LAW §19-113 &19-115 (2007). The Department of Transportation has "Standard Specifications" dated 1986 and standard detail for tree pit, topsoil and granite block pavement (H-1046) dated 1981. These are inconsistent with Department of Parks and Recreation "Tree Planting Standards" dated April 2008.).

[2] CITY OF LOS ANGELES, INTER-DEPARTMENTAL CORRESPONDENCE (May 21, 2008) available at eng.lacity.org/.../2008%2F200805%2F20080521/.../20080521_ag_br_st_san_ce_1_tr1.pdf

[3] U.S. EPA, Polluted Runoff ,Nonpoint Source Pollution, National Management Measures to Control Nonpoint Source Pollution from Urban Areas (November 2005), http://www.epa.gov/owow/nps/urbanmm/index.html#08

[4] U.S. DEP'T OF TRANSP., FEDERAL HIGHWAY ADMINISTRATION , STORMWATER BEST MANAGEMENT PRACTICES IN AN ULTRA-URBAN SETTING: SELECTION AND MONITORING (2002) available at http://www.fhwa.dot.gov/environment/ultraurb/index.htm (last visited Oct. 20, 2009).

UE 4:
PRESERVE “100-YEAR OLD” TREES

Study
Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:
Large, old trees offer significant benefits to the city by providing cooling, shade, habitat, and carbon sequestration, as well as significant aesthetic benefits.

Recommendation:
Establish a voluntary program whereby property owners can obtain plaques for their "100-year old" trees, which could also be added to a map of significant trees.

Proposed Legislation, Rule or Study

The Site & Site Stormwater Committee recommends that the Department of Parks and Recreation establish a voluntary program whereby:

1. The owner of a tree located on private property that, in the judgment of the department, is at least 100 years old may obtain a plaque recognizing the tree as a “historic tree,” including identification of the species type; and
2. The department publishes a map identifying the location of such historic trees.

Supporting Information

Issue – Expanded
Large trees make up much of New York City's urban forest and provide extensive environmental, economic, social, aesthetic and recreational benefits. A recent study by the Department of Parks and Recreation estimated the annual financial benefit of the city’s street trees at about $122 million.[1] Trees reduce the urban heat island effect, remove air pollutants and carbon dioxide, sequester runoff, alleviate flooding, provide wildlife habitat, lower energy use in buildings, and provide for more comfortable microclimates. Typically, these benefits are most evident in large trees since they have more biomass than smaller ones. Detailed information on the benefits of trees is discussed in the Notes section of this proposal.

Trees on public property fall under the jurisdiction of NYCDPR and are subject to that agency’s removal and restitution policies. Most of the city’s trees, however, are located on private property. Their care and any decision to remove them is exclusively the decision of property owners.

The voluntary program recommended in this proposal would foster community pride in the city’s oldest trees, encouraging their proper care and protection.

Environmental & Health Benefits
Any increase in tree cover retention from this proposal will provide the range of environmental and health benefits associated with trees.

This proposal was found to have a positive, indirect environmental impact.

This proposal was found to have no significant positive health impact.

Cost & Savings
This proposal is for a voluntary program and is therefore expected to not have any impact on capital costs.

Precedents
Tree ordinances that are based on the mature canopy size are currently being developed and tested throughout the United States. These canopy ordinances have several commonalities:

- Ordinance requirements are triggered by a development activity
- A pre-development tree inventory is required
- Trees being conserved must be protected throughout the construction project
- On-site inspections are made by the local government authority
- There is a maintenance requirement

As with any ordinance, the success of tree canopy preservation ordinances depends on community acceptance, compliance and enforcement. In addition, in order to facilitate successful implementation, these ordinances depend on detailed tree species lists that identify tree species worthy of preservation, expected canopy size at full maturity, and the replacement (penalty) if a tree is not protected. Example ordinances from other jurisdictions include the following:

- City of Charlotte (NC) Tree Ordinance of City Code, Chapter 21, Article III, Section 21-62
- City of Providence (RI) Code of Ordinances, Chapter 27 Zoning, Article IV Supplementary Regulations, Section 425 Landscape and Tree Preservation
- City of Pasadena (CA) Municipal Code, Title 8, Chapter 8.52 City Trees and Tree Protection Ordinance
- City of Austin (TX) Code, Title 25, Chapter 25-8, Subchapter B, Division 2. Protected Trees
- City of Thousand Oaks (CA) Municipal Code, Title 5, Chapter 24. Landmark Tree Preservation and Protection
- City of Palo Alto (CA), Municipal Code, Chapter 8.10.090, Designation of Heritage Trees.
- City of Seattle (WA), Heritage Tree Program, available at http://www.seattle.gov/transportation/heritagetree.htm[2]
- City of Johnston (IA), Code of Ordinances, Building and Property Regulations, Chapter 151, Tree Protection and Conservation.
- City of Chesapeake (VA), Landscape Ordinance, Section 19-602: Tree Preservation and canopy requirements http://livepublish.municode.com
- Athens-Clarke County (GA) Code of Ordinances, Part III, Chapter 8.7 Community Tree Management
- Prince George's County (MD) Woodland Conservation and Tree Preservation Policy http://www.pgplanning.org

LEED

This recommendation may assist in achieving LEED NC-SS cr.5.1 Site Development, Protect or Restore Habitat; LEED EB-SS CR.4 Reduced Site Disturbance, Protect or Restore Open Space; LEED for Schools-SS cr. 5.2 Site Development, Protect or Restore Habitat; LEED for Homes-SS cr.1 Minimize Disturbed Area of Site; and LEED for Retail NC (pilot program)-SS cr.5.1 Site Development, Protect or Restore Habitat. These credits include protecting a portion of the site area with native/adapted vegetation.

LEED ND (pilot program)-GCT cr.7 Minimize Site Disturbance during Construction, will specifically address protection of trees based on type, condition, horticultural value, etc. This recommendation will be directly applicable to obtaining this LEED credit.

In addition, LEED EB-SS cr.1 Green Site and Building Exterior Management includes protecting natural areas among the possible measures to include in the management plan for obtaining this credit.

Implementation & Market Availability

There are no known impediments to this voluntary program proposal.

Notes

How Big is a "100 Year Old" Tree?

The size of a 100-year old tree varies greatly depending on its species, and estimating age is an inexact science. The most common method for estimating the age of a living tree is to measure its diameter, but this method can only ever be a rough estimate because:

- Growth rate is a function of the specific conditions under which a tree is growing
- There is a big difference in growth rate between hardwood and softwood trees
- Trees slow down in putting on caliper as they get older

Hardwood trees such as oak and ash may only increase in girth by ½ inch per year whereas softwood trees or faster growing species such as maple and pines can put on as much as ¾ inch per year. Below are some examples of the diameter (measured a 24" dBH – diameter at breast height – 4'-6") of a 100 year old tree of various species:

- Oak: 24" caliper DBH
- Birch: 34" caliper DBH
- Basswood: 44" caliper DBH

What Are the Benefits of Large Trees?

Larger trees provide the following specific benefits at a greater capacity than smaller trees:

- Tree canopies reduce the fast rate at which rain falls to the ground. Water enters the ground more slowly under

trees and is better absorbed and filtered into the ground than when water runs off surfaces. One hundred percent of rainfall is intercepted at the beginning of a storm event and drops to 3% at maximum rain intensity. A 28 foot tall tree with a 19 foot spread can intercept 68% of a 0.5 inch storm event.

- Tree roots absorb soil water that contain both nutrients and pollutants. Some pollutants are transformed by plant roots through metabolic processes and others are trapped in woody tissues and are released only when a tree decomposes. In one growing season, a 24" caliper maple tree can remove 120 mg of cadmium, 280 mg of chromium, 1640 mg of nickel, 10,400 mg of lead from the environment.
- Trees absorb carbon dioxide and produce oxygen through photosynthesis. Trees therefore act as a carbon sink by removing carbon and storing it as cellulose in their trunks, branches, leaves and roots while releasing oxygen back into the atmosphere. A single, mature tree can absorb carbon dioxide at a rate of 48 lbs/year and release enough oxygen back into the atmosphere to support 2 people for a year. A small tree (3" caliper) produces 6 lbs of oxygen per year; a medium tree (9-12" caliper) produces 49 lbs of oxygen per year; a mature tree (27-30" caliper) produces 148 lbs of oxygen per year or 24 times the amount of a small tree and 3 times the amount of a medium tree. Each person in the United States generates approximately 2.3 tons of carbon dioxide each year. A mature tree stores about 13 pounds of carbon annually. [3]
- Trees also remove other gaseous pollutants by absorbing them through their leaf surface. Some of these pollutants are: sulfur dioxide, ozone, nitrogen oxides and chloroflurocarbons.
- Trees evapotranspirate; thereby contributing moisture and cooling into the atmosphere,[4]

ENDNOTES:

[1] David Randall, Maybe Only God Can Make a Tree, but Only People Can Put a Price on It, N.Y. TIMES, April 18, 2007, available at http://www.nytimes.com/2007/04/18/nyregion/18trees.html. (The estimate of the total value from trees includes an assessment of the increase in property values, reduced energy consumption from shading, and carbon dioxide absorption. According to another survey of trees in three NYC neighborhoods, the estimated environmental benefit of a NYC tree is $3,225. During the summer of 2002 Citizen Pruners surveyed and mapped trees in three neighborhoods of New York City. The USDA Forest Service and SUNY used this tree data in their analysis to determine the environmental and economic benefits in each of the 3 neighborhoods surveyed. There were 322 tress surveyed in the three project sites: 50 in Hunts Point in the Bronx, 60 in the Lower East Side of Manhattan, and 212 in New Brighton on Staten Island. The value of the 50 trees surveyed in the Bronx was estimated at $26,508.00, with a mean value of $530.16. The total amount of carbon sequestration conducted by the 50 trees in the Bronx is 131.26 kg/year with a mean value of 2.63 kg/year. The total value of the 60 trees surveyed in Manhattan was $35,981.00 with a mean value of $599.68. The total amount of carbon sequestration conducted by the 60 trees in Manhattan is 182.77 kg/year with a mean value of 3.05 kg/year. The total value of the 212 trees on Staten Island was $975,969.00 with a mean value of $4,603.63. The total amount of carbon sequestration conducted by the 212 trees on Staten Island is 4,005.14 kg/year with a mean value of 18.89 kg/year. NYC Oasis Cooperative, Neighborhood Tree Survey, http://www.oasisnyc.net/resources/street_trees/default.asp) (last visited Jan. 26, 2010).

[2] CITY OF SEATTLE, WA., URBAN FOREST MANAGEMENT PLAN (2007), http://www.seattle.gov/environment/documents/Final_UFMP.pdf.

[3] David J. Nowak, Atmospheric Carbon Reduction by Urban Trees, 37:3 JOURNAL OF ENVIRONMENTAL MANAGEMENT 207-217 (1993); and DAVID J. NOWAK, USDA FOREST SERVICE GENERAL TECHNICAL REPORT, BENEFITS OF COMMUNITY TREES, BROOKLYN TREES.

[4] CENTER FOR URBAN FOREST RESEARCH, IS ALL YOUR RAIN GOING DOWN THE DRAIN? (2002), http://www.fs.fed.us/psw/programs/cufr/products/newsletters/UF4.pdf; and THE TRUST FOR PUBLIC LAND, ARGUMENTS FOR LAND CONSERVATION: DOCUMENTATION AND INFORMATION SOURCES FOR LAND RESOURCES PROTECTION (Mike McAliney, ed. 1993).

UE 5
PROTECT STREET TREES FROM CONSTRUCTION ACTIVITIES

New York City Building Code
Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:
While sidewalk sheds protect pedestrians during the construction, maintenance and inspection of buildings, they can cause considerable damage to trees. Limbs are often damaged or removed, and the trees are cut off from access to sun and moisture, often resulting in the weakening or even death of the tree.

Recommendation:
During construction, require that street trees be protected and watered, and that any pruning be performed by a professional.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Section 3302 by adding the definition of "certified arborist":

CERTIFIED ARBORIST. A person designated as a certified arborist in accordance with rules or guidelines established by the department of parks and recreation.

2. Amend Section 3307.6.3 as follows:

3307.6.3 Design of sidewalk sheds. All sidewalk sheds shall meet the following design requirements:

1. All sidewalk sheds shall be designed by an engineer.

Exception: Sidewalk sheds that follow a standard design approved by the department or the Board of Standards and Appeals.

2. If any tree trunk or tree canopy will be located within the area of a sidewalk shed, a certified arborist shall develop and submit a mitigation plan to the department prior to the construction of any sidewalk shed. Any required pruning or limb removal shall be performed by a certified arborist prior to construction of the sidewalk shed. Such mitigation plan shall:

a. include photographs of the existing street trees in accordance with the protocols of the department of parks and recreation for photographing trees;

b. describe the tree pruning and limb removal to be performed by a certified arborist along with adjustments to the design of the sidewalk shed necessary to protect and accommodate the existing street trees, including notching of any decks or railings; and

c. identify the appropriate times of year within the project schedule for any tree pruning or limb removal and a schedule/timeline for undertaking any such work.

3. Sidewalk sheds shall not extend over the crown of any tree, nor shall any tree leader be removed. No more than 20% of the limbs of any tree shall be removed during pruning.

3. Add a new paragraph 9 to Section 3307.6.4 as follows:

9. After the removal of the sidewalk shed, a certified arborist shall inspect the trees, perform any further compensatory pruning as required, and may order the removal or replacement of any trees that have been too damaged to survive. The caliper of any replacement trees shall be a minimum of 4 inches. Sign off for the project shall include documentation of any tree replacements specified by the certified arborist.

4. Add a new definition to Section 3302.1 as follows:

> DRIP IRRIGATION BAG. A polyethelene plastic bag with nylon webbing that is placed around the base of a tree to provide water.

5. Add a new paragraph 3 to Section 3307.6.5 as follows:

> 3. Trees covered by sidewalk sheds shall be equipped with drip irrigation bags to provide water and shall be refilled weekly during the period for which the sidewalk shed is erected.

Supporting Information

Issue – Expanded
Sidewalk sheds are a regular feature of the New York City streetscape due to construction activity and façade inspections. Each year, the Department of Buildings issues tens of thousands of buildings permits for new construction and building renovations and Local Law 11 requires erection of scaffolding and sidewalk sheds to perform façade inspections and maintenance. As of February 2008 there were 4500 sidewalk sheds in place throughout the 5 boroughs.

Unfortunately, sidewalk sheds can damage and even kill trees. Sidewalk sheds cast shade over sidewalk trees, prevent rainwater from reaching tree roots and damage tree crowns. The installation of sidewalk sheds or construction activity sometimes damage tree leaders (main vertical limb), resulting in permanent deformation of trees so that the tree no longer grows vertically. Broken side branches that are not removed with clean cuts provide avenues for diseases and can eventually cause the demise of trees.

Environmental & Health Benefits
Tree survival and growth will increase shading around the city, lowering the street temperature in the summer and reducing the demand for air conditioning in buildings. Trees also absorb air pollutants and carbon (NYC trees absorb 42,300 tons per years), which helps to counteract the urban heat island effect.

This proposal was found to have a low, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have no significant positive health impact.

Cost / Savings
As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.0% to 0.01%, depending on building type. It was thus categorized as incurring no to a low capital cost increment.

Precedents
The City of Hayward, California has a Tree Preservation Ordinance that requires a permit to disfigure or remove a protected tree.[1] The ordinance defines protected trees as certain species, trees of certain height and width, street trees, memorial trees, and trees that are planted to replace protected trees.[2] Several jurisdictions around the world also require protection of tree during construction, including the United Kingdom and the City of Sidney, Australia.[3]

LEED
For new construction projects, this proposal may facilitate achieving LEED NC-SS Cr.5.1 Protect or Restore Habitat. Though LEED pertains to the property itself, if adjacent sidewalks are deemed part of a "site", then street tree protection could become part of the 50% "protected" area under Option 2. LEED 2009 allows a 20% protected region for the total site (including building footprint) if that total site area exceeds the site area with the building footprint excluded.

For existing building projects, this proposal may facilitate achieving LEED EB-SS cr. 1.1 & 1.2 Green Site and Building Exterior Management. This credit requires developing a plan to preserve ecological integrity. Tree protection could be included as one component of such management plan.

This proposal may also facilitate achieving LEED for Homes SS cr. 1.2 Site Stewardship, which refers specifically to a tree or plant preservation plan; and LEED ND GCT cr.7 Option 3, Minimize Site Disturbance During Construction, which relates entirely to tree protection.

Implementation & Market Availability
The region has many ISA certified arborists that are very competitively priced. Hourly rates in the NYC area range from $16.50 to $23.50 per hour. Drip irrigation bags (gator bags) cost $16.50 per 20-gallon bag and are manufactured by many companies

Notes
Drip irrigation bags must be sized according to tree caliper. A 20 gallon-capacity bag (standard size) is recommended for a 1" – 4" caliper tree; a 50 gallon-capacity bag is recommended for a 4" – 8" caliper tree.

ENDNOTES:

[1] HAYWARD MUNICIPAL CODE § 10-15.20, available at http://www.hayward-ca.gov/municipal/HMCWEB/TreePreservation.pdf (last visited Jan 3, 2010).

[2] ID. AT § 10-15.12 (defining "certified arborist," "cutting," "damage" and "disfigurement").

[3] Town and Country Planning Act of 1990 § 8,1,1 U.K. OPSI § 197-214 (1990) available at http://www.opsi.gov.uk/acts/acts1990/Ukpga_19900008_en_1.htm (has rules and language on tree protection during construction.); (Scaffolding permits for the City of Sydney Australia also require documentation of street trees. See Application for Approval - Temporary Structures, available at www.cityofSydney.nsw.gov.au/Development/documents/forms/ApplicationForScaffolding-NewLegislation.pdf.).