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.).