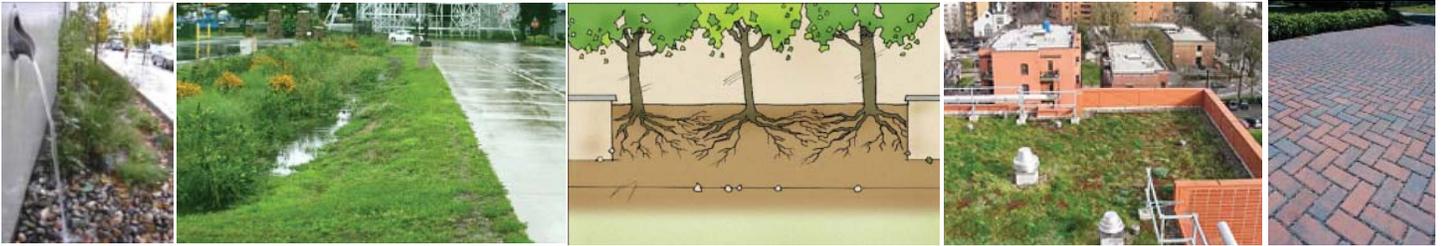


## *Green Village and Clean Hudson*



# **NYACK GREEN INFRASTRUCTURE REPORT**



**CONSENSUS OF THE NYACK GREEN INFRASTRUCTURE ROUNDTABLE  
VILLAGE OF NYACK, NY**

**June 24, 2013**

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## ACKNOWLEDGEMENTS AND STATEMENT OF SUPPORT

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### Roundtable Membership and Statement of Support

This report was prepared for presentation to the Village of Nyack Board of Trustees through a consensus process involving local stakeholders called the Nyack Green Infrastructure Roundtable. The Nyack Green Infrastructure Committee, which was organized in 2011 by Mayor Jen Laird White, initiated the Roundtable. Stakeholders representing the Nyack Planning and Building Departments, land use boards, and local citizens participated in the process through research, discussion, and successive rounds of review as the document developed.

These recommendations reflect the professional and personal views of the participants and do not necessarily carry the endorsement of the organizations and agencies to which they belong. The Roundtable's endorsement implies support of the principles and recommendations as a package and does not necessarily imply an equal level of support for each recommendation by all Roundtable members.

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## Resources

**Two key documents helped lay the groundwork for the Nyack Green Infrastructure Roundtable.**

### **Low Impact Development Code Review Worksheet**

The worksheet was originally developed by the Center for Watershed Protection in Maryland and later modified at the NYS DEC by Barbara Kendall for use in New York . We used this initial Code review to organize our committees and create a preliminary framework for our research. The version completed for Nyack can be found at the Roundtable's Google Site.

### **Town of Wappinger Low Impact Development Roundtable: Recommended Model Development Principles for Conservation of Natural Resources in the Hudson River Estuary Watershed. June 2006**

[http://www.dec.ny.gov/docs/remediation\\_hudson\\_pdf/hrewbsdwap.pdf](http://www.dec.ny.gov/docs/remediation_hudson_pdf/hrewbsdwap.pdf)

This report, completed in 2006 in a rural/suburban setting provided an important starting place in terms of structure, language and approach.

These and other resources that the committee used in developing this report can be found at the Roundtable's Google Site at <https://sites.google.com/site/nyackroundtable/resources/documents>.

## Staff

Barbara Kendall, former Coordinator of the Hudson River Watershed Alliance, facilitated the initial public presentation and committee organization.

Marcy Denker, Landscape Designer and Green Infrastructure Committee Chair, coordinated the ensuing process and development of the final report.

## Funding

Staff and technical support were provided with funding from the New York State Department of Environmental Conservation through a grant to the Hudson River Watershed Alliance.

## **INTRODUCTION**

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This report recommends a set of actions to protect the water quality of our local streams and the Hudson River, increase groundwater recharge, and contribute to reducing flooding by using green infrastructure (GI) for stormwater management in Nyack. The report was prepared over the course of more than a year, through meetings of the Nyack Green Infrastructure Committee starting in 2011 and then through the GI Roundtable process initiated in September 2012.

The Roundtable process entailed a review of existing codes, policies and practices, and an assessment of the Nyack landscape. The purpose was to identify ways to support the protection of Nyack's existing natural resources and promote widespread expansion of GI in the village in the future.

Green Infrastructure is now a priority for stormwater management in New York State. The New York State Stormwater Management Design Manual requires its use for improving stormwater quality and reducing its quantity. The recommendations in this report aim to strengthen Nyack's capacity to comply with the state requirements and exceed them where necessary through a combination of incentives, education and regulation.

Our recommendations aim to provide flexibility, support, and guidance for developers, land use boards, the Building Department, Department of Public Works, and local citizens in shaping sustainable development of the village. We recommend actions that will improve the village landscape by clarifying design opportunities and Code requirements, amending the Code in ways that small, urbanized communities like ours have done, energetically pursuing incentive opportunities, and establishing programs for public outreach and pilot projects.

Implementation of these actions will take time, money, and the ongoing commitment of Village staff, government and volunteers, starting with establishing a process and timetable for review of the recommendations by the Village Board. The Roundtable has suggested tasks that can be carried out by the Village Planner, an expanded Green Infrastructure Committee, a new Tree Commission structured and empowered to get things accomplished, and through actions of the Village Board to require phased changes to the Code in a timely manner.

## **BACKGROUND**

### **Green Infrastructure**

Green infrastructure is a term used to describe both a planning approach and a set of best management practices for stormwater management that infiltrate, evapotranspire, or reuse stormwater. Instead of conventional, engineered collection, conveyance and storage structures, GI techniques use soils and vegetation to manage stormwater. Common green infrastructure approaches include green roofs, trees, rain gardens, bioretention areas, vegetated swales, pocket wetlands, infiltration planters, vegetated median strips, reforestation, and protection and enhancement of riparian buffers and floodplains.

The New York State Stormwater Management Design Manual (Design Manual) requires the use of green infrastructure for new development and promotes its use on redevelopment projects. Recognizing the

important benefits of green infrastructure in protecting water quality and as a component of comprehensive flood management plans, communities across the region and the country are now updating their codes and in many cases have adopted laws that exceed the State requirements.

GI practices filter pollution and reduce the quantity of runoff, increasing groundwater recharge and reducing impacts on local streets and sewer systems when it rains. Beyond this, with proper design and maintenance GI practices can beautify property, reduce temperatures, lower energy costs, and provide wildlife habitat. Effective planning for stormwater will make the most of green infrastructure to help manage flooding and improve water quality while also advancing community goals for sustainable design and beautification throughout the village and revitalization of the waterfront.

## **Nyack Code Review 2010**

The Village of Nyack's Zoning Code underwent extensive revision between 2007 and 2009 in order to reflect the concepts embodied in the Village's Comprehensive Master Plan. Among other improvements, the revised Zoning Code, which went into effect in January 2010, consolidated zoning districts, revised parking regulations to reflect current standards, and organized the zoning regulation into single chapters by incorporating then-recently approved tree and stormwater management laws and environmental controls (including steep slope, erosion and sediment control, and view corridor protection regulations). As the revised Code has been implemented in practice, certain provisions – such as the use of Floor Area Ratios to regulate building size in residential zones – have since been eliminated or amended. The Roundtable process seeks to evaluate the current Zoning Code as well as other chapters in Nyack's Code in light of the best green infrastructure practices summarized above and the experience of other similarly-situated municipalities, and to offer recommendations for further improvement.

## **The Roundtable Process**

The Roundtable was initiated at a public kickoff meeting in September 2012 after the Nyack Green Infrastructure Committee had completed a preliminary Code review using the Low Impact Development Code Review Worksheet. The initial kickoff provided an opportunity for participants to voice interests and concerns related to the existing procedures and conditions and to join the Roundtable as committee members. The two committees were formed (called *Streets and Lots* and *Natural Resources*), and they eventually merged. Participants researched codes and initiatives in other communities, drafted sections of the report, discussed the developing document in meetings and online discussions through June 2013, when the final draft was circulated for approval.

## **GOALS AND OBJECTIVES**

The goals of the Roundtable were to protect Nyack's green infrastructure and promote widespread establishment of green infrastructure practices. The recommendations in this report are based on the following objectives:

- 1) Remove barriers to green infrastructure and strengthen Code provisions aimed at achieving these goals.
- 2) Facilitate the planning, evaluation and approval process through streamlining the Code sections and make GI options and requirements clear.

- 3) Define research and planning projects that will form the basis for development decisions that protect water quality.
- 4) Outline steps to expand the implementation of green infrastructure practices throughout the village through incentives and public outreach.

## ORGANIZATION OF THE REPORT

The bulk of this report is organized into two main chapters, grouping discussions related to plants, soils, and water resources under *Natural Resources*, and discussions of roofs and paved areas under *Impervious Surfaces*. A separate chapter deals specifically with the consolidation of the current sections of the Code related to stormwater management and pollution prevention and several simple updates to these provisions. Three short final chapters address illicit sewer connections, application and review procedures, and pollution prevention. The report addresses opportunities for actions to improve and protect water quality. The Roundtable had no recommendations regarding the Code chapter on flood prevention, so no discussion of it is included.

The Appendices include detailed comments on the existing Code as well as examples from other Codes that can form the basis for further review.

## HIGHLIGHTS

### Natural Resource Management

#### **Mapping and Resources for Community Planning**

Assemble stormwater infrastructure and watershed mapping to promote better oversight and planning.

#### **Tree Protection and Community Forestry**

Establish a Tree Commission, and become a Tree City. Conduct a tree inventory and develop a community forestry plan. Streamline and revise the Code sections related to trees.

#### **Sidewalk Design Guidelines**

Update and expand sidewalk guidelines to include materials and strategies for a variety of conditions such as sites where tree roots have heaved pavement and sites appropriate for permeable paving or bioretention planters.

### Impervious Areas

#### **Parking Lot Ratios**

Enable developers to set aside land for parking where reasonable to help reduce impervious surface

#### **Greener Parking Lot Landscaping**

Include landscaping requirements in the Code to maximize tree canopy cover and promote permeable paving and bioretention

#### **Strategies for Rooftop Runoff**

Provide incentives and density bonuses for incorporating green roofs for new and existing structures. Develop public outreach and support for downspout disconnection planning.

**Focused Review of Strategies for Limiting Impervious Surfaces:**

Gather and review information on actual experience in municipalities that have adopted more stringent requirements and other laws for limiting impervious surface, including 1) Maximum Impervious Coverage; 2) Specific design criteria for zero net runoff provision; 3) Lower threshold for SWPPP, to determine what provisions and policies to revise in Nyack.

**Existing Code Provisions for Stormwater Management and Pollution Prevention**

**Streamline and simplify the Code** by consolidation of chapters.

**Sewers**

**Local Law for Disconnection at Point of Sale**

Consider a local law for requiring certification of the removal of illegal connection to sanitary sewer at point of sale.

**Review and Permitting Process**

**Clarify the process**

Encourage green infrastructure by making options and requirements clear to applicants, land use boards and the Building Department.

**Pollution Prevention**

**Outreach Campaign**

Research/develop a successful outreach campaign using a variety of media.

**DPW Assessment**

Research best practices for DPWs and highway departments that can be applied in Nyack.

## PRELIMINARY RECOMMENDATIONS FOR PHASING

The following set of recommendations is preliminary. Actual actions and phasing will be determined after the Village Board and key staff review the report and establish an approved project list and timeline with the help of the Green Infrastructure Committee.

### Phase I Goals

- \_\_\_ Authorize the Planning Department to review the recommendations and establish a framework for effective collaboration with the GI Committee and a timeline for action.
- \_\_\_ Streamline the Code: Consolidate sections relating to stormwater management
- \_\_\_ Revise Code language explicitly requiring and defining green infrastructure
- \_\_\_ Plan next steps for mapping, studies and pilot projects (GI Committee, Mayor, Planning Department)
- \_\_\_ Community outreach /planning for downspout disconnection strategies using GI
- \_\_\_ Establish a Tree Commission
- \_\_\_ Become a Tree City USA

### Phase II Goals

- \_\_\_ Stormwater/watershed study and mapping project defined and funding proposal underway
- \_\_\_ Tree Commission organizes urban forestry training for tree inventory
- \_\_\_ Review Building Department handouts, compile guidance in the form of illustrated examples and checklists for applicants. (GI Committee, Building Department, Planning Board and Planning Department)
- \_\_\_ Village approves Code revisions for stormwater management and pollution control
- \_\_\_ Green Infrastructure Committee develops proposed sidewalk guidelines
- \_\_\_ Tree Commission carries out tree inventory, develops Community Tree Report using *i-Tree Streets* and prepares recommended revisions to Code related to trees
- \_\_\_ Stormwater/watershed study and mapping project underway

## **NATURAL RESOURCE MANAGEMENT**

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Nyack is an urbanized community with virtually no tracts of open space to preserve. The Hudson River and Nyack Brook, the village trees, Memorial Park, and the many small residential yards in the village comprise its key natural assets. They make up Nyack's current inventory of green infrastructure. A multipronged effort for protecting these resources is recommended. It includes Code modifications, mapping, engineering and watershed studies, public education and outreach, and a comprehensive village forestry program.

### **I. MAPPING AND TECHNICAL STUDIES**

Nyack's natural resources should be mapped and assessed, as should areas such as roof tops, driveways and sidewalks that offer opportunities to convert impervious areas to productive green infrastructure so the village will be in a position to set goals and develop plans to guide development in the coming years. Mapping, studies and planning can be carried out by professionals and, where appropriate, by volunteers.

### **Recommendations**

#### **A. Stormwater Infrastructure Map**

Assemble detailed mapping of Nyack stormwater infrastructure including inlets and outfalls to support the Building Department's role in oversight and maintenance needs on public and private property and as a basis for strategic planning. A 1930s map of the Nyack Brook stormwater infrastructure that was recently discovered in the Building Department would form the basis for this. Some of the research and drafting of the map could be done by an intern or volunteer. On site explorations in hazardous conditions would require paying qualified personnel.

#### **B. Watershed Study and Management**

##### **Technical Assistance and Funding**

Investigate resources and funding for watershed and green infrastructure planning. The NYS Department of State (NYSDOS) and the Hudson River Estuary Program of the NYS Department of Environmental Conservation (NYSDEC) and other organizations and agencies can provide funding and technical assistance in creating intermunicipal strategies for conserving tributary watershed resources.

##### **Drainage Study/Stormwater Management Plan**

1. Commission a drainage study of Nyack Brook watershed with recommendations.
2. Develop a watershed management plan in coordination with the Town of Clarkstown.

## **II. NYACK BROOK**

Nyack Brook is a degraded, urbanized stream that travels through pipes or armored channels for most of its way through the village. Nevertheless, the brook is an important community resource that can be improved over time through careful attention to the treatment of the lands along its edges. There are existing conditions that can be improved if property owners are requested to make changes or illegal conditions are addressed. Exploring opportunities to improve conditions along the brook or for daylighting (bringing some parts above ground) should be part of planning for redevelopment projects adjacent to it.

### **Recommendation**

#### **A. GI Subcommittee for Nyack Brook**

The Green Infrastructure Committee should establish a strategy to identify opportunities for small improvements in the short term to deal with illicit discharges, find places for retrofits to manage stormwater on site, and develop and carry out a program of public outreach and technical support.

## **III. WATERFRONT RESOURCES**

Maximize the potential of the resources on the waterfront for improving water quality and increasing biodiversity.

### **Recommendations**

#### **A. Lower Nyack Brook Buffer Zone**

The degraded edges along the mouth of Nyack Brook should be redesigned to function as healthy stream buffers. Concrete rubble should not be used to stabilize edges. Tree planting should be extended where possible as the preferred strategy for stabilizing the stream bank. Funding for technical assistance and for tree planting should be investigated.

#### **B. Waterfront Wetland**

The possibility of connecting Memorial Park to the state-owned land to the south, through the lower portion of the private parcel along the south side of Nyack Brook, has been discussed in the past and should be considered. Creating a constructed wetland to enhance stormwater management, increase habitat and biodiversity, decrease erosion, and provide a passive recreational amenity at the waterfront may be possible.

#### **C. Marina and Park Development**

Investigate opportunities and make plans to maximize the use of green infrastructure techniques such as tree planting or filtration techniques to reduce pollution from road and parking runoff. Currently §360-4.4(E)(15)<sup>1</sup> provides “if the site is adjacent to coastal waters,

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<sup>1</sup> All section and chapter references refer to the applicable sections or chapters of the Code of the Village of Nyack, unless otherwise noted.

stormwater shall be contained on-site, to the maximum extent practicable, to prevent direct discharge of runoff to coastal waters.”

#### **IV. TREE PROTECTION AND MANAGEMENT**

Trees provide many benefits including stormwater management, air cooling and purification and beautification. A carefully-crafted ordinance directs appropriate protection, selection, planting, and maintenance of trees in order to reap their benefits and avoid unnecessary costs.

The Code review process resulted in recommendations for streamlining the Code sections related to trees, refining the provisions according to guidance from the International Society of Arborists and the Arbor Day Foundation, and developing a community forestry initiative for expanding and improving the “village forest.”

#### **Recommendations**

##### **A. Establish a Tree Commission**

A tree commission composed of citizens, the Building Inspector, Supervisor of the Department of Public Works, the Village Arborist, and Village Administrator should be established. It would be organized to enable strong, efficient coordination among the members. Responsibilities of the Tree Commission would include:

1. Reviewing all sections of the Code related to trees. Preliminary recommendations for amendments to these sections are included in Appendix III.
2. Streamlining the Village’s process for review, removal of damaged/hazardous trees on private/public property and planting in the Village right of way;
3. Developing and updating the Village Forestry Plan;
4. Providing information and outreach regarding the selection, planting and maintenance of trees on public and private property;
5. Providing support for the Planning Board in reviewing site plan applications involving trees;
6. Providing support for the Building Department in monitoring the maintenance of required trees;
7. Coordinating Arbor Day programs, grants, and outreach

##### **B. Become a Tree City USA**

Arbor Day Foundation provides assistance and recognition from NYS programs for guidance and funding. The Four requirements to become a Tree City USA are:

- A Tree Board or Department
- A Tree Care Ordinance (The Village already has a very limited one.)
- A Community Forestry Program with an Annual Budget of at Least \$2 Per Capita (We are close to that now.)
- An Arbor Day Observance and Proclamation

##### **C. Code Revisions**

The Roundtable completed a preliminary review of the Code, which is included in Appendix III. The proposed Tree Commission would be expected to develop a strategy for proposing changes

to streamline and strengthen it in coordination with the Village Attorney and Village Board. Some changes could be made prior to completing an inventory and village forestry plan, and others would follow.

#### **D. Tree Inventory**

Carry out a new tree inventory using guidance from the New York State Urban and Community Forestry Council and Cornell University's Urban Horticulture Institute. The Inventory could be conducted using *I-Tree Streets*—a powerful, user-friendly computer-based program developed by the US Forest Service for inventory and assessment of street trees. The program is “an analysis tool for urban forest managers that uses tree inventory data to quantify the dollar value of annual environmental and aesthetic benefits: energy conservation, air quality improvement, CO2 reduction, stormwater control, and property value increase.”<sup>2</sup>

Several Roundtable Committee members are currently preparing a plan for conducting a community tree inventory with volunteers, including students and adults. It is recommended that the process have a paid coordinator. Funding may be available through a NYSDEC Estuary Program's Urban Forestry Grant or other sources.

Further references:

Urban Horticulture Institute Cornell University

<http://www.hort.cornell.edu/commfor/inventory/utilizing.html>).

City of Syracuse Urban Forestry Master Plan

[http://www.fs.fed.us/ne/newtown\\_square/publications/technical\\_reports/pdfs/2001/qtrne287.pdf](http://www.fs.fed.us/ne/newtown_square/publications/technical_reports/pdfs/2001/qtrne287.pdf)

#### **E. Village Forestry Plan**

Based on the inventory and report described above, the proposed Tree Commission would develop a plan for maintaining and increasing the quality and quantity of trees in the village. One key benefit of the forestry plan is that it would set priorities and provide meaningful criteria for assessing removals and requirements in terms of species and locations for replacement plantings.

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<sup>2</sup> ( <http://www.itreetools.org/streets/index.php> )

## IMPERVIOUS AREAS

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*Runoff from pavement, rooftops and other impervious areas in Nyack carries a host of pollutants including hydrocarbons, pesticides, heavy metals, and sediment into the storm drain system to the Hudson River. Impervious surfaces increase runoff volume and peak flow rates, resulting in increased flooding and sewer overflows. Promoting planning and design that will reduce the amount of impervious surface and increase pervious areas that will allow more water to infiltrate is the main goal of the revisions discussed in this section.*

*The first part of this section explores a set of regulatory approaches for limiting impervious surfaces in new development, redevelopment and alterations to properties. The following parts deal with Code provisions related streets, driveways and rooftops, and parking lots.*

### I. REQUIREMENTS FOR LIMITING AND REDUCING IMPERVIOUS SURFACE FOR NEW PROJECTS

The Roundtable looked at typical conditions in the various zoning districts when considering the regulations related to impervious surfaces that apply to each district and considered how the Code could promote better outcomes without placing an undue burden on the property owners or the Village's limited resources.

#### Overview of Existing Requirements

##### **A. All projects requiring site development plan review**

Under our current zoning regulations, even small increases in impervious surface, such as a new terrace or driveway expansion, would require site plan approval. For any such project the Code requires managing the stormwater runoff from the added impervious surface on site .

§360-4.4(E)(15 ) Amount and velocity of runoff. The amount and velocity of runoff from a site after development shall approximate its predevelopment characteristics, such that the development shall result in zero net incremental discharge of runoff from the development site. However, if the site is adjacent to coastal waters, stormwater shall be contained on-site, to the maximum extent practicable, to prevent direct discharge of runoff to coastal waters

Small projects of this kind would generally require the services of an engineer to determine percolation rates and appropriate design for detaining and infiltrating the added runoff using a drywell, permeable paving or other appropriate practice. However, the provision does not specify a criteria for calculating the volume and velocity of runoff.

##### **A. Residential Properties**

In addition to the zero net runoff provision described above , for residential properties there are setback limits and accessory building coverage maximums that limit to some

extent the amount of impervious surface allowed. Residential lots must also retain a minimum area of “usable open space” per dwelling unit, and the definition of open space includes a restriction on the amount of this area that can be roofed. However, there is no requirement that any portion of this open area be pervious. (It should be noted that lawn areas are often highly impervious, depending on the level of compaction, and should be considered semi-pervious since they do not infiltrate as well as undisturbed natural areas or other kinds of landscaped areas.)

### **C. Commercial Properties**

In the Commercial and Mixed Use Districts few pervious areas remain. Lots covered almost entirely by building are common. There are no front setback or usable open space requirements in the Downtown Mixed Use and Residential Mixed Used Districts . There is no maximum building coverage, and while there is a Floor Area Ratio (FAR) requirement, this does not necessarily limit building or impervious surface coverage. It should be noted, however, that a project that increases impervious surface on these lots would need to conform to the zero net runoff requirement mentioned above.

There is a requirement for providing a SWPPP for projects that disturb more than a quarter acre or 10,000 square feet, but commercial properties that are redeveloped and disturb less than that would not require the permit and would have little incentive to reduce impervious area if it is not a goal of the project program. Since many such properties are already highly and many cases, entirely impervious, the zero net increase requirement for these properties would have little or no impact.

### **D. Projects that require a SWPPP**

Development or redevelopment projects that disturb more than an acre of land require a SWPPP according to NYS law. A SWPPP is required by the Nyack Code for projects that disturb 10,000 square feet or a quarter acre, whichever is less.

New development projects that require a SWPPP must comply with Chapter 4 of the Design Manual, which describes Unified Sizing Criteria for water quality, peak discharge, and channel protection volumes (see Appendix V for definitions). If there is no increase in impervious surface, as in many redevelopment projects, certain requirements for peak discharge and channel protection do not apply. According to the Chapter 9 *Redevelopment Projects* in the Design Manual, where a SWPPP is required a developer would be encouraged to use green infrastructure to the maximum extent practicable to comply with standards that do apply, but a range of options would be possible, with and without GI. In any case, on a highly impervious redevelopment site where a SWPPP is required, a reduction of impervious surface would be mandated.

## **Recommendations**

The Roundtable recommends that approaches that have been incorporated into Codes in nearby communities be considered to address the gaps in the current provisions of the Village of Nyack Code to protect existing pervious surface and increase infiltration of runoff. To determine the approaches , specific design criteria, or other limits that would be best for Nyack, it is recommended that the

Building Department, Village Planner, Village Engineer and others take a steps beyond the Roundtable's research to review current practices and the experiences in Building and Engineering Departments in nearby communities where more restrictive provisions are in place in order to weigh their costs and benefits to the Building Department, property owners, developers and other stakeholders in an informed manner.

#### **A. Set limits on impervious cover by district**

Some zoning Codes (including Tarrytown's) include a maximum allowable impervious surface coverage in their dimensional requirements for residential properties. Consider an example of a homeowner who wants to add a small addition or a patio on a lot exceeding the maximum impervious cover. If permeable paving and green roofs were defined in the Code to count as partially pervious, there would still be options available that would conform to the new requirement.

The Roundtable recommends considering a limit on the amount of impervious surface to ensure that the properties retain areas for infiltration of runoff by adding a provision to §360-4.2 to limit impervious surface as a percentage of gross lot area according to district. The maximum percentages would be set by district on a sliding scale. A worksheet for calculating impervious coverage would be available for applicants. (See Appendix VII for an example.)

#### **B. Runoff reduction/Zero net increase**

The zero net runoff provision in the current Code mandates that the runoff from additional impervious area be managed on a site. Unlike Nyack, some other municipalities require or recommend specific design criteria in their Codes for this type of project. For example, the City of Kingston has adopted a local law that requires detention of runoff from increases in impervious surface, including affected adjacent areas, for a minimum of 24 hours (see Appendix IV). The Village of Tarrytown requires sizing for the 25 year design storm. (However based on his observations as Tarrytown's Assistant Engineer, Donato Penella, P.E. believes that the criterion should be raised to the 100 year storm.)<sup>3</sup> The Roundtable recommends reviewing the current practice for projects affected by this requirement and considering adding specific design criteria to §360-4.4(E)(15).

#### **C. Requirement of Preparation of SWPPP**

The Roundtable found examples of land disturbance thresholds for the SWPPP of 1,000 square feet, and even lower.<sup>4</sup> The engineering required for a project that size was considered to be onerous for many property owners, but a threshold of 5,000 square feet appeared appropriate and reasonable. The Village of Tarrytown, with a setting comparable to Nyack's, sets the

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<sup>3</sup> Telephone conversation May 24, 2013

<sup>4</sup> For example, the Village of Mamaroneck defines Land Development Activity as: Any construction activity, including clearing, grading, excavating, soil disturbance or placement of fill, that could potentially result in soil erosion and/or any change in movement of stormwater on the site. For the purposes of this chapter, any new construction on a given lot (or reconstruction which meets the definition of substantial improvement or total reconstruction) shall assume the entire area of the lot to be subject to disturbance.

threshold at 5,000 square feet and also includes a provision for projects that would result in an increase in impervious surface of 1,000 square feet or more.

The Roundtable recommends considering redefining Land Development Activity for Stormwater Pollution Prevention Plans in this same way. In addition, the Roundtable recommends considering an additional provision so that any construction or reconstruction which meets the definition of substantial improvement or total reconstruction shall assume the entire area of the lot to be subject to disturbance.

**D. Worksheets and Factsheets** Many municipalities that promote green infrastructure have developed factsheets on practices that can be adapted for Nyack. For example, see Boston's Charles River Watershed Alliance factsheets at <http://www.crwa.org/projects/bmpfactsheets>.

## II. STREETS, SIDEWALKS, AND DRIVEWAYS

### A. Streets

An integrated approach to the design of green techniques in the street right of way has become known as the Green Streets approach. The review of the Nyack Code related to streets concentrated on improving existing provisions for residential development and considering how and where this approach can be used in Nyack.

#### Recommendations

**1. Street Widths** Residential streets should be designed for the minimum required pavement width needed to support travel lanes; on-street parking; and emergency, maintenance and service vehicle access. These widths should be based on traffic volume. Narrower street widths not only reduce impervious cover, but also promote lower vehicular speeds and increased safety and can reduce construction and maintenance costs. The Roundtable recommends revising §360-4.13 C(1) of the existing Code to require minimizing paving.

**2: Cul de Sacs** Standards for residential street cul-de-sacs should require a radius no greater than required to accommodate emergency and maintenance vehicles. The Roundtable recommends revising §360-4.13 so that alternative turnarounds are preferred, and turnarounds incorporate landscaped areas to reduce impervious cover.

**3. Green Streets** Permeable parking areas along streets and bioretention planters are key elements of green street designs that can be considered in Nyack. The Roundtable recommends that the Green Infrastructure Committee investigate potential areas for these practices and develop recommendations in conjunction with guidelines for sidewalks and trees in the right of way recommended elsewhere in this report.

## B. Sidewalks

Many areas of the sidewalks in the village have been lifted by tree roots and are hazardous for pedestrians. Property owners are required by Code to perform repairs to sidewalks, but the repairs in many cases would cause serious damage to the street trees

### Recommendations

**1. Inventory** A long term strategy for replacement of certain trees and guidance on appropriate techniques for tree selection and plantings in sidewalks should be developed based on a sidewalk inventory that could be conducted as part of the Street Tree Inventory recommended previously.

**2. Design Guidelines** Village sidewalk standards can be developed that would include materials such as structural soil and strategies for remediation in various conditions. The Roundtable recommends that the Green Infrastructure Committee compile and present model guidelines.

## C. Driveways

Overall lot imperviousness can be reduced by using permeable paving for driveways.

### Recommendations

**1. Planning Board** The Planning Board should encourage installation of pervious materials in redevelopment projects.

**2. Outreach and Education** Through public outreach and education regarding pervious driveway surfacing, homeowners should be encouraged to use permeable paving.

## III. ROOFTOPS

Because buildings represent the majority coverage on most lots in Nyack, green infrastructure techniques for managing rooftop runoff is a key area of opportunity. Rooftop runoff can be managed on the roof itself—with green roofs – or discharged to rain barrels, rain gardens or other suitably-designed and landscaped areas. A combination of these techniques can be used for detaining, filtering and infiltrating the runoff.

### A. Green Roofs

The systems known as extensive green roofs include a waterproof membrane and drainage layer below a lightweight soil mix and low-growing, drought-resistant vegetation. They can be installed on a conventional flat or sloped roof. The rooftop vegetation allows evaporation and evapotranspiration processes to reduce the volume and rate of runoff. Green roofs also provide filtration, which improves water quality of the runoff that is eventually discharged.

Many of the buildings in Nyack's commercial areas have flat roofs that may have sufficient load-bearing capacity to support an extensive green roof and would be relatively easy to convert. Some may be able to support heavier loads including deeper soil layer, planters and even trees.

Soil conditions and existing infrastructure may preclude the use of other practices in many places making green roofs the best green infrastructure option. Green roof design does, however, always require a structural assessment by a qualified structural engineer or architect. Management responsibility and management schedules for these stormwater practices should be included on approved plans.

The best time to install a green roof is when a new roof is built or the existing roofing needs to be replaced. Green roofs generally far outlast their conventional counterparts and have an array of other benefits including cooling and insulation, wildlife habitat, and aesthetic appeal.

## **Recommendations**

### **1. Nyack green roof model projects**

Designers of redevelopment projects in Nyack should be encouraged to consider incorporating green roofs for new and existing structures because, in addition to the benefits already described above, green roof construction projects can provide important local examples of this technology and help to stimulate other installations.

### **2. Density bonuses**

While municipalities typically provide density bonuses for sustainability in the form of increased Floor Area Ratio (FAR), proposed residential projects in the Village of Nyack have not been able to maximize their allowable FAR due primarily to density and building height requirements. Therefore, the Roundtable recommends allowing an increase in the number of dwelling units to encourage the installation of green roofs. Village of Nyack Planner Robert Galvin has prepared a memorandum with background and recommended text, which is included in Appendix VIII.

## **B. Downspout Disconnection to Lawns, Rain Gardens, and Storage Systems**

The Code prohibits discharging runoff from roof drains (as well as other devices) from the building onto a public sidewalk, walkway, street, alleyway or adjoining property" (Chapter 263-5(J)). Where possible, downspouts should discharge into areas where the runoff can infiltrate or be collected for use after the rain event. In many cases properties with small yards can accommodate a combination of green infrastructure practices for managing rooftop runoff.

## **Recommendations**

### **1. Outreach, Education, Support and Incentives**

Provide support and incentives to homeowners to employ green infrastructure techniques to capture and infiltrate rooftop runoff that would otherwise discharge to the storm sewer or directly onto driveways, sidewalks and streets.

### **2. Pilot Projects and Retrofit Opportunities**

Develop an inventory of retrofit opportunities on existing properties and target outreach and education. Seek funding for pilots/implementation.

### III. PARKING LOTS

New and existing parking lots present important opportunities for reducing impervious area and providing a variety of green infrastructure benefits. The review of the Code sections related to parking lots resulted in recommendations regarding parking ratios and design standards, alternative approaches to managing runoff, and landscaping requirements.

#### A. Parking Ratios

The required parking ratio governing a particular land use or activity should be enforced as both a maximum and a minimum in order to curb excess parking space construction. Existing parking ratios should be reviewed for conformance taking into account local and national experience to see if lower ratios are warranted and feasible.

Roundtable participants noted that parking ratios were revisited two years ago as part of the Zoning Code Revision process and did not see the need to take another look at them at this time. Because parking ratios usually represent the minimum number of spaces needed to accommodate the highest hourly parking at a site and can sometimes result in far more spaces than are actually needed (as recent experience has proven in Nyack), the Roundtable recommends giving the Planning Board flexibility to permit reserve parking areas in connection with commercial establishments.

#### Recommendation

To avoid providing more parking than necessary, the Code § 360-4.5 C (3) (Rules for computing minimum parking requirements) should allow development of a fewer number of required parking spaces where a smaller number can be shown to be adequate to meet the needs of a particular site and the use or uses associated with the site. The reserved area for the undeveloped spaces would be noted on the plan so that if needed in the future the Board has a basis to open up part or all of the spaces depending upon changed conditions on-site. The area designated as reserved parking must be clearly depicted on the site plan.

#### B. Parking Lot Design Standards

Zoning requirements for parking lots should be designed to minimize rainwater and stormwater runoff and preserve water quality in runoff. Overall imperviousness should be reduced by minimizing stall dimensions and incorporating efficient parking lot layouts. Angled parking lot layouts provide more opportunities for below-grade landscaped islands incorporating stormwater management practices. Trees and other landscaping should be designed, installed and maintained to maximize environmental benefits .

#### Recommendations

##### 1. The Purpose of the Design Standards

The Roundtable recommends that §360-4.5. A. should include the goal of maximizing green infrastructure, and that the design standards be significantly revised to promote this goal.

##### 2. Dimensional Requirements

The Roundtable recommends revising the standards to:

- Require a smaller minimum stall
- Permit compact stalls
- Encourage one way layouts with reduced aisle widths
- Provide a Table of dimensional requirements for alternative layouts
- Add dimensional standards for ADA compliance

**3. Drainage and Surfacing** Strengthen the language encouraging the use of pervious surfaces for all land uses and lots.

### C. Parking Lot Landscaping

Landscaping design for parking lots is an underutilized area of opportunity for improving stormwater management and the quality of the village environment through the use of green infrastructure practices. Well designed and maintained parking lot landscaping provides environmental benefits including shading, cooling and stormwater management for water quality and to reduce flooding. It provides aesthetic benefits including visually buffering views of cars and paving from adjacent streets and development and enhancing the overall appearance of development projects, and it organizes pedestrian traffic. All planting areas, especially tree plantings and bioretention practices, should be designed for high performance, with clear goals and maintenance plans. See Appendix IX for a full discussion.

### Summary of Recommendations

**1. Purpose** The Roundtable recommends revising § 360-4.5 K. (1) to articulate the goals of the high standards for parking lot landscape design.

**2. Applicability** Currently the landscaping standards apply to lots with 12 or more spaces. The Roundtable recommends revising § 360-4.5 K. (2) to reduce the size limitation on the requirements in the landscaping section as far as reasonable.

**3. Trees in Perimeter Landscaping** Perimeter landscaping requirements currently aim to provide screening of the view of cars. The Roundtable recommends adding a provision for including trees in § 360-4.5 K. (3) (Perimeter landscaping) in order to maximize opportunities for expanding the tree canopy cover for stormwater management and other benefits.

**4. Curbs** The Code currently requires curbing on landscape islands in parking lots. This standard should be revised to remove the requirement for curbed islands to allow for the inclusion of infiltration practices such as bioretention areas. The standard should encourage comprehensive and thoughtful designs that use curb cuts, bollards, rails or other features as appropriate for safety.

**5. Performance-based standards** The Code should be revised to provide flexibility within a set of design standards based on performance. Trees should be prioritized for their shading, cooling, aesthetic and biodiversity benefits. Note that in some cases stormwater management requirements might be accomplished by using permeable paving, but greening the lot with trees should still be encouraged.

a. Minimum requirement for landscaping Currently the Code requires “At least one tree per 10 spaces shall be provided within the parking lot. No more than 12 contiguous spaces shall be permitted in a row without a landscaped interruption of at least five feet, including curbing.” The Roundtable recommends that the Green Infrastructure Committee develop an alternative set of standards for landscaping. If possible, the 10 space requirement should be lowered and the requirement for landscaped area defined as a percentage of area for pervious landscape in the form of trees and planting where feasible and appropriate, and otherwise permeable paving would be required.

b. Tree canopy A requirement for tree planting to provide a specified percentage of canopy cover within a certain period should be considered, with flexibility as to the arrangement of the trees within the lot. The proposed Tree Commission should research actual experience with such provisions in communities that have them in place.

# STORMWATER MANAGEMENT & POLLUTION PREVENTION

*The review of the Code related to stormwater resulted in recommendations to make the requirements clearer and easier to find by consolidating disparate sections. Revisions and additions are proposed to strengthen requirements for implementing green infrastructure practices and addressing illicit discharges.*

## I. CONSOLIDATION AND CROSS REFERENCING

Requirements related to stormwater management should be clearly presented and easy to find in the Code. Currently the requirements are dispersed in the Code in various chapters.

### Recommendations

1. Consolidate the requirements related to stormwater by incorporating 360-4.12 (Stormwater Pollution Prevention) and Chapter 338 (Watercourses and Ponds) into Chapter 295 (Stormwater Management), as shown in Table 2. In addition, the revised chapter should include a cross reference to Chapter 294 Storm Sewers).
2. Amend the Code to reflect the proposed reorganization (see Appendix X ).

TABLE 2	
EXISTING SECTIONS	PROPOSED CHAPTER 295 (additions and changes shown in bold)
<p><b>Ch. 294. Storm Sewers</b></p> <p><b>Ch. 295 Stormwater Management.</b></p> <p><b>360-4.12 Stormwater Pollution Prevention</b></p> <p><b>Chapter 338. Watercourses and Ponds</b></p>	<p><b>Ch. 295 Stormwater Management and Pollution Prevention</b></p> <p><b>GENERAL REFERENCES</b></p> <p><b>Storm Sewers – See Ch. 294.</b></p> <p><b>§ 295-1. Findings of fact.</b></p> <p><b>§ 295-2. Purpose.</b></p> <p><b>§ 295-3. Statutory authority.</b></p> <p><b>§ 295-4. Applicability.</b></p> <p><b>§ 295-5. Exemptions.</b></p> <p><b>295-6. Definitions.</b></p> <p><b>295-8. Stormwater Pollution Prevention</b></p> <p><b>295.9 Watercourses and Ponds</b></p>

## II. GREEN INFRASTRUCTURE REQUIREMENTS

Green infrastructure requirements and descriptions of practices should be made clear and explicit in the Code.

### Recommendations

#### 1. Give preference to GI techniques as part of site development plan review.

**Revise §360-5.7 D (6) Criteria for Site Development Plan Approval to mandate use of green infrastructure**

Existing Language:

Adequacy of stormwater and drainage facilities.

Suggested Revision:

Adequacy of stormwater and drainage design and practices that employ green infrastructure to the maximum extent practicable.

#### 2. Include Explicit Descriptions of Green Infrastructure. Make the accepted design standards clear and help all applicants understand and maximize the use of GI.

a. Schedules of GI Practices from the Design Manual

Require specific descriptions of the green infrastructure practices proposed.

Add Schedules A-1, A-2 and A-3 from the Design Manual to the Code. These schedules describe the recommended green infrastructure practices (see Appendix X).

b. Suggested Language for SWPPP:

When a full SWPPP is required by New York State, the SWPPP must include a description of each post-construction stormwater management practice, including documentation of the five-step planning process for runoff reduction using green infrastructure as outlined in the New York State Stormwater Management Design Manual, most current version or its successor, using the practices in Schedules A-1, A-2 and A-3.

#### 3. Emphasize pollution prevention as a key component of stormwater management.

See Appendix X for detailed recommendations.

## SEWERS

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*The Village of Nyack has separate stormwater and sanitary sewer systems, but sewage overflows often occur. Problems with the size and age of the sewer infrastructure are being addressed by the Town of Orangetown. In addition, the Town and the Village have begun to address the problem of illegal connections of downspouts and basement drains to the sanitary sewer system. The Town has conducted smoke tests to identify illegal connections and has issued violations. In 2012 the Town and the Village worked together on a public education campaign that included an article in Nyack News and Views and a handout that was delivered door-to-door.*

### Recommendations

#### **A. Require a discharge compliance certificate**

The Village Code currently prohibits connection of downspouts and basement drains to the sanitary sewer. As an additional tool, a requirement for a plumber's certification of compliance is recommended. Examples of the requirements for discharge compliance certificates are included in Appendix XI. Some of these are triggered at the point of sale and the responsibility can be negotiated between the buyer and seller.

#### **B. Continue and expand public outreach and education**

The Town, Village, and the Green Infrastructure Committee should continue to coordinate a campaign to inform property owners of the need to check connections and provide user-friendly information about the options for managing stormwater on site properly. Targeted outreach to landscapers should be included, and a recognition program for compliance should be considered.

## APPLICATION PROCEDURES AND DESIGN GUIDELINES

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*The Roundtable noted that there is strong support for developing a set of materials to help all parties make the most of the opportunities for creating sustainable design presented during development projects. It should be noted that good quality design for green infrastructure goes beyond standard engineering approaches and often requires landscape design expertise.*

### Recommendations

1. Develop a process for the Green Infrastructure Committee to coordinate with the Building Department, Planning Board and Village Planner to review Building Department handouts and compile guidance in the form of checklists for applicants.
2. Create a compendium of illustrated examples of model projects to better inform all involved.

## **MAXIMIZE OPPORTUNITIES FOR POLLUTION PREVENTION**

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*Promoting and maintaining good housekeeping and landscape practices are crucial for improving the quality of stormwater runoff. Residents, business, and municipal staff—especially the Department of Public Works (DPW) – can take steps to keep fertilizers, sediments, oils, heavy metals, pet waste, and other common pollutants out of stormwater.*

### **Education**

Some municipalities have readily accessible information on their websites describing alternatives to practices and products, such as detergents for car washing, fertilizers, road salt, and pet waste that degrade water quality. The best of these make the information part of a broader campaign, and use video and other media to get out the message. For example, the Village of Zebulon, N.C. recently purchased a new, highly effective street sweeper and wrapped it with a graphic that ties in with the brochures, fliers, and t-shirts that they give to the public, making the sweeper like a rolling billboard.

### **Public Works**

Public Works facilities, equipment and practices can contribute in many ways to stormwater pollution. A thorough review of street sweeping equipment and schedules, equipment maintenance, and facility housekeeping practices can reveal many opportunities to reduce the pollutant load.

It should be noted that stormwater management—including maintenance of equipment, inspections, staffing—is an excellent candidate for intermunicipal collaboration and sharing. New York State places a high priority on encouraging and funding projects for this, potentially saving taxpayers money.

## **Recommendations**

### **1. Outreach**

Research exemplary websites and other outreach materials with the help of interns of other volunteers and develop a proposal for outreach to property owners.

### **2. DPW Assessment**

Research best practices used in Public Works and Highway Departments elsewhere to control pollution, and assess policies and practices used by the Nyack DPW and recommend changes where needed.

# APPENDICES

## APPENDIX I: DEFINITIONS

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### GREEN INFRASTRUCTURE

**Current Language:**

None

**Suggested Language:**

Green infrastructure approaches infiltrate, evapotranspire or reuse stormwater, using soils and vegetation rather than hardscape collection, conveyance and storage structures. Common green infrastructure practices include green roofs, trees and tree boxes, rain gardens, bioretention areas, vegetated swales, pocket wetlands, infiltration planters, vegetated median strips, reforestation, and protection and enhancement of riparian buffers and floodplains. Individual green infrastructure practices shall be defined according to the current New York State Stormwater Management Design Manual.

### IMPERVIOUS SURFACE

**Current Language:**

**360-6.1 IMPERVIOUS SURFACE**

A ground covering, improvement or structure that cannot effectively infiltrate rainfall, snowmelt and/or water.

**Suggested Language:**

A surface that has been compacted or covered with a layer of material so it is highly resistant to infiltration or percolation of water. This includes, but is not limited to, roofs, asphalt, concrete, stone drives, sidewalks and patios. Pavers, gravel, and highly compacted soil and other semipermeable surfaces shall be considered impermeable to the extent that they materially alter the surface water runoff characteristics of the site. Increases in stormwater runoff from these surfaces shall be calculated using the appropriate runoff curve numbers. Decks constructed above the ground surface that allow one-hundred-percent pass-through of stormwater to the ground surface below decks shall be considered to be permeable.

## LAND DEVELOPMENT ACTIVITY FOR STORMWATER POLLUTION PREVENTION PLAN

### **Current Language**

Land development activities, including clearing, grading, excavating, soil disturbance or placement of fill that results in land disturbance of equal to or greater than 1/4 acre or 10,000 square feet, whichever is less, or activities disturbing less than one acre of total land area that is part of a larger common plan of development or sale, even though multiple separate and distinct land development activities may take place at different times on different schedules.

**Suggested Language** The following provision from the Village of Tarrytown Code includes a reference to a lower threshold for requiring a SWPPP than currently in the Code and an provision for increasing impervious cover by 1,000 square feet or more. See page 16 of this report for recommendations regarding changes to the Code related to impervious surface and the requirement for a SWPPP.

Construction activity including clearing, grading, excavating, soil disturbance or placement of fill that results in land disturbance of equal to or greater than 5,000 square feet, or activities disturbing less than 5,000 square feet of total land area that is part of a larger common plan of development or sale that results in a land disturbance of equal to or greater than 5,000 square feet in the aggregate (even though multiple separate and distinct land development activities may take place at different times on different schedules), or activities that result in the creation of impervious (nonpermeable) cover equal to or greater than 1,000 square feet, whether those activities occur in association with new development, a modification or expansion of existing development, or redevelopment of a previously developed site. Any construction or reconstruction which meets the definition of substantial improvement or total reconstruction shall assume the entire area of the lot to be subject to disturbance.

## **NATURAL BUFFER**

### **Current Language:**

None

### **Suggested Language:**

Zone of variable width designed to provide a protective natural area.  
(NYS Design Manual)

**APPENDIX II–  
TABLE OF GI CATEGORIES AND SPECIFIC PRACTICES**

**TABLE A-1 Green Infrastructure Planning General Categories and Specific Practices  
From: New York State Stormwater Management Design Manual, Table 3.1**

<b>Group</b>	<b>Practice</b>	<b>Description</b>
<b>Preservation of Natural Resources</b>	Preservation of Undisturbed Areas	Delineate and place into permanent conservation easement undisturbed forests, native vegetated areas, riparian corridors, wetlands, and natural terrain.
	Preservation of Buffers	Define, delineate and place in permanent conservation easement naturally vegetated buffers along perennial streams, rivers, shorelines and wetlands.
	Reduction of Clearing and Grading	Limit clearing and grading to the minimum amount needed for roads, driveways, foundations, utilities and stormwater management facilities.
	Locating Development in Less Sensitive Areas	Avoid sensitive resource areas such as floodplains, steep slopes, erodible soils, wetlands, mature forests and critical habitats by locating development to fit the terrain in areas that will create the least impact.
	Open Space Design	Use clustering, conservation design or open space design to reduce impervious cover, preserve more open space and protect water resources.
		Restore the original properties and porosity of the soil by deep till and amendment with compost to reduce the generation of runoff and enhance the runoff reduction performance of practices such as downspout disconnections, grass channels, filter strips, and tree clusters.
<b>Reduction of Impervious Cover</b>	Roadway Reduction	Minimize roadway widths and lengths to reduce site impervious area.
	Sidewalk Reduction	Minimize sidewalk lengths and widths to reduce site impervious area.
	Driveway Reduction	Minimize driveway lengths and widths to reduce site impervious area.
	Cul-de-sac Reduction	Minimize the number of cul-de-sacs and incorporate landscaped areas to reduce their impervious cover.
	Building Footprint Reduction	Reduce the impervious footprint of residences and commercial buildings by using alternate or taller buildings while maintaining the same floor to area ratio.
	Parking Reduction	Reduce imperviousness on parking lots by eliminating unneeded spaces, providing compact car spaces and efficient parking lanes, minimizing stall dimensions, using porous pavement surfaces in overflow parking areas, and using multi-storied parking decks where appropriate.

**TABLE A-2 Green Infrastructure Techniques Acceptable for Runoff Reduction  
(From: New York State Stormwater Management Design Manual, Table 3.2)**

<b>Group</b>	<b>Practice</b>	<b>Description</b>
<b>Runoff Reduction Techniques</b>	Conservation of natural areas	Retain the pre-development hydrologic and water quality characteristics of undisturbed natural areas, stream and wetland buffers by restoring and/or permanently conserving these areas on a site.
	Sheetflow to riparian buffers or filter strips	Undisturbed natural areas such as forested conservation areas and stream buffers or vegetated filter strips and riparian buffers can be used to treat and control stormwater runoff from some areas of a development project.
	Vegetated open swale	The natural drainage paths, or properly designed vegetated channels, can be used instead of constructing underground storm sewers or concrete open channels to increase time of concentration, reduce the peak discharge, and provide infiltration.
	Tree planting / tree box	Plant or conserve trees to reduce stormwater runoff, increase nutrient uptake, and provide bank stabilization. Trees can be used for applications such as landscaping, stormwater management practice areas, conservation areas and erosion and sediment control.
	Disconnection of rooftop runoff	Direct runoff from residential rooftop areas and upland overland runoff flow to designated pervious areas to reduce runoff volumes and rates.
	Stream daylighting for redevelopment projects	Stream daylight previously-culverted/piped streams to restore natural habitats, better attenuate runoff by increasing the storage size, promoting infiltration, and help reduce pollutant loads.
	Rain garden	Manage and treat small volumes of stormwater runoff using a conditioned planting soil bed and planting materials to filter runoff stored within a shallow depression.
	Green roof	Capture runoff by a layer of vegetation and soil installed on top of a conventional flat or sloped roof. The rooftop vegetation allows evaporation and evapotranspiration processes to reduce volume and discharge rate of runoff entering conveyance system.
	Stormwater planter	Small landscaped stormwater treatment devices that can be designed as infiltration or filtering practices. Stormwater planters use soil infiltration and biogeochemical processes to decrease stormwater quantity and improve water quality.
	Rain tank/Cistern	Capture and store stormwater runoff to be used for irrigation systems or filtered and reused for non-contact activities.
Porous Pavement	Pervious types of pavements that provide an alternative to conventional paved surfaces, designed to infiltrate rainfall through the surface, thereby reducing stormwater runoff from a site and providing some pollutant uptake in the underlying soils.	

**TABLE A-3 Stormwater Management Practices Acceptable for Water Quality**

<b>Group</b>	<b>Practice</b>	<b>Description</b>
<b>Pond</b>	Micropool Extended Detention Pond (P-1)	Pond that treats the majority of the water quality volume through extended detention, and incorporates a micropool at the outlet of the pond to prevent sediment resuspension.
	Wet Pond (P-2)	Pond that provides storage for the entire water quality volume in the permanent pool.
	Wet Extended Detention Pond (P-3)	Pond that treats a portion of the water quality volume by detaining storm flows above a permanent pool for a specified minimum detention time.
	Multiple Pond System (P-4)	A group of ponds that collectively treat the water quality volume.
	Pocket Pond (P-5)	A stormwater wetland design adapted for the treatment of runoff from small drainage areas that has little or no baseflow available to maintain water elevations and relies on groundwater to maintain a permanent pool.
<b>Wetland</b>	Shallow Wetland (W-1)	A wetland that provides water quality treatment entirely in a shallow marsh.
	Extended Detention Wetland (W-2)	A wetland system that provides some fraction of the water quality volume by detaining storm flows above the marsh surface.
	Pond/Wetland System (W-3)	A wetland system that provides a portion of the water quality volume in the permanent pool of a wet pond that precedes the marsh for a specified minimum detention time.
	Pocket Wetland (W-4)	A shallow wetland design adapted for the treatment of runoff from small drainage areas that has variable water levels and relies on groundwater for its permanent pool.
<b>Infiltration</b>	Infiltration Trench (I-1)	An infiltration practice that stores the water quality volume in the void spaces of a gravel trench before it is infiltrated into the ground.
	Infiltration Basin (I-2)	An infiltration practice that stores the water quality volume in a shallow depression before it is infiltrated into the ground.
	Dry Well (I-3)	An infiltration practice similar in design to the infiltration trench, and best suited for treatment of rooftop runoff.
<b>Filtering Practices</b>	Surface Sand Filter (F-1)	A filtering practice that treats stormwater by settling out larger particles in a sediment chamber, and then filtering stormwater through a sand matrix.
	Underground Sand Filter (F2)	A filtering practice that treats stormwater as it flows through underground settling and filtering chambers.
	Perimeter Sand Filter (F-3)	A filter that incorporates a sediment chamber and filter bed as parallel vaults adjacent to a parking lot.
	Organic Filter (F-4)	A filtering practice that uses an organic medium such as compost in the filter in place of sand.
	Bioretention (F-5)	A shallow depression that treats stormwater as it flows through a soil matrix, and is returned to the storm drain system.
<b>Open Channels</b>	Dry Swale (O-1)	An open drainage channel or depression explicitly designed to detain and promote the filtration of stormwater runoff into the soil media.
	Wet Swale (O-2)	An open drainage channel or depression designed to retain water or intercept groundwater for water quality treatment.

**APPENDIX III:  
SUGGESTED REVISIONS TO EXISTING CODE PROVISIONS FOR TREES**

*The Roundtable completed a preliminary review of the Code, shown below. The proposed Tree Commission would be expected to develop a strategy for proposing changes in coordination with the Village Attorney and Village Board.*

**REORGANIZATION AND CONSOLIDATION**

Standards for trees appear in several parts of the Nyack Code. We recommend streamlining the Code by consolidating existing sections and expanding and revising the ordinance to include a Standards and Specifications Section with the purpose of providing information on planting, maintenance and removal in the form of requirements. See Table I below.

The Standards and Specifications section would be specifically developed for the Village. Components would follow the tree work standards established by the International Society of Arboriculture. Planting stock standards can be taken from the Association of Nurserymen’s American Standard for Nursery Stock. Tree planting details can be selected from the best examples available. As mentioned above, other sections could be incorporated into this one for better organization.

<b>TABLE I</b>		
EXISTING SECTIONS	ACTION	PROPOSED ADDITIONS TO 360-4.4
§ 299-17 Shade trees.	Move	add sections [5]-[7] by moving <b>[5]</b> 299-17 Shade Trees A. B.C.
§ 299-18 Trimming trees.	Move to 360.4.4	Required maintenance of trees
§ 360-5.18 <a href="#">Tree removal permit.</a>	Move to 360.4.4	Tree removal permit
360-4.5 K. Parking area landscaping	Do not move	
360-4.7 Street trees	Move	Street Trees
	Add new section	Standards and Specifications

## RECOMMENDED REVISIONS

### **Administration and Jurisdiction**

Revise sections of the Code regarding authority or jurisdiction as appropriate to eliminate discrepancies.

#### **Revise 299-17 A.**

##### Current language

No person shall cut down or trim any shade or ornamental tree upon or along any public street or place in said Village, without the permission of the Board of Trustees of said Village, unless in compliance with § [299-18](#) of the Village ordinances.

##### Suggested revision

Instead of permission of the Board of Trustees, require the permission of the Building Inspector, Village Arborist or other designee of the Village Board of Trustees.

#### **Revise 360-4.4 C. (4) (d)**

##### Current language

##### **(d)**

Where a significant tree that is cut, removed or destroyed in violation of this chapter is located within a conservation easement required by the Planning Board as a condition of subdivision or site plan approval, fines may be doubled by the Planning Board.

##### Suggested revision

Since the Planning Board does not set fines, this provision should be changed to indicate the proper authority.

### **2. Definitions**

Terms used for trees should be consistent and clear across all parts of the Code. Currently trees are called shade trees, ornamental trees, street trees, and significant trees. The Code should be revised so that specific terms for trees are aligned with goals and guidance for their management established in the proposed standards and specifications section, which would designate types of tree according to specific characteristics—small, medium, large sizes for example— based on the principle of “right plant right place.”

#### **Revise definition of Significant Tree 360-1.1 {175}**

##### Current language

*Significant tree*

A tree at least eight inches in diameter as measured six inches above the highest root stem; or a tree, shrub, hedge or plant shown or described to remain or be planted on a proposed or approved planting plan, landscape plan, site plan, subdivision plan or a plan approved by the Planning Board or Zoning Board of Appeals; or a tree, shrub, hedge or plant required to be planted in satisfaction of the requirements of §360-4.7 of this chapter.

Suggested revision

The definition should be revised to conform to a standard practice for measuring diameter. The accepted methods can be included in the proposed Standards and Specifications section. In addition, the definition of Significant tree should eventually exclude trees that the inventory and assessment categorize as low priority. If the goal is to maximize a healthy and diverse inventory with appropriate species and age distribution, and at the same time reduce the onus on property owners this requirement should be revised accordingly.

#### **4. Tree Protection during development**

##### **Revise (3)**

Current language

Protection of trees during development or construction. All significant trees indicated to remain as part of the landscaping plan of an approved subdivision or site plan shall be protected by a temporary four-foot-high fence constructed of two-inch-by-four-foot posts and rails around the dripline, wrapped with orange plastic mesh, before construction or site work begins.

Suggested revision

There should be a performance standard for tree protection. The developer should be required to develop site specific specifications for tree protection to be submitted for review by the Village Arborist.

#### **5. Performance Bonding**

Damage to tree roots during construction may not be apparent, and symptoms may appear years later. Developers should be required to post performance bonds for trees that are to be retained. According to the International Society of Arborists:

A relatively long bonding period, preferably 5 years or more, should be used so that the impacts of construction on tree health can be adequately evaluated. The fact that a retained tree is still alive is not an adequate performance standard; performance bonds should not be released if retained trees show any decline in vigor or condition. In order to document changes in tree condition, tree ratings should be made prior to construction and shortly before the end of the bonding period.<sup>5</sup>

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<sup>5</sup> **Guidelines for Developing and Evaluating Tree Ordinances**  
<http://www.isa-arbor.com/tree-ord/>, page79.

The Roundtable noted that the proposed Tree Commission should review other model tree ordinances that require a long bonding period and clearly define the responsibilities of the developer. Trees included in a plan as a green infrastructure practice for stormwater management plan should be maintained and, if necessary, replaced even after the end of the bonding period.

## **6. Fines**

### Current language

Where the Building Inspector determines that any person violates or refuses to comply with this chapter, that person shall be subject to a fine not to exceed \$10,000, per offense, upon conviction. Each significant tree cut, destroyed or removed shall constitute a single offense.

### Suggested revision

The fine and methods of evaluating tree value should be reviewed .

## **7. Tree Fund**

A fund should be established for tree planting and maintenance. Fines collected for violations should be placed in a tree fund.

## **8. Mitigation**

### **Revise 360-4.4 C. (4) (b)**

#### Current language

Any person convicted of violating this chapter shall also be referred to the Planning Board for the purpose of presenting a tree remediation plan, showing the existing and proposed landscaping conditions on the premises in question, and which shall be designed to mitigate the effects of the offense. The Planning Board may require such remedial or protective measures to be undertaken as may be necessary to protect the balance of the original landscaping status of the premises in question, such as, but not limited to, the use of snow fencing, chain link fencing, or other protective measures, including replacement of trees destroyed or removed.

#### Suggested revision

Provide for cases where large trees have been removed, thereby changing the stormwater management and necessitating a new stormwater management plan.

### **Revise 360-4.4 C. (4) (e)**

#### Current language

Where a person is convicted of violating this chapter, and the prohibited activity upon which the conviction is based involved a tree, shrub, hedge or plant shown or described to remain or be planted on a proposed or approved planting plan, landscape plan, site

plan, subdivision plan or a plan approved by the Planning Board or Zoning Board of Appeals, then no further action may be taken by the Planning Board or Zoning Board of Appeals on the lot or lots upon which the violation occurred for a period of one year from the date of conviction.

Suggested revision

Remove the provision.

**9. Maintenance**

The proposed tree commission should develop a set of provisions and guidelines for maintenance of trees required as part of a landscaping or stormwater management plan and a regular program for evaluation and maintenance of the trees within the right of way or in the parks.

**10. Street tree design guidelines**

The standard for street trees in § 360-4.7 requires a set spacing of 40 feet for street trees. The Planning Board should have flexibility in siting and determining types and size of trees using the advice of the proposed Tree Commission. Street tree guidelines should be developed that include standards for small, medium and large trees.

**APPENDIX IV:  
CITY OF KINGSTON LOCAL LAW FOR RUNOFF REDUCTION**

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**35-11.1 Stormwater runoff reduction**

A.

All newly constructed impervious surfaces, including adjacent impacted surfaces, shall be regulated such that stormwater runoff generated by said improvements shall not exceed previously existing conditions. Differential runoff generated as a result of site improvements shall be detained on site by suitable means approved by the Kingston Building Department for a period of not less than 24 hours.

B.

For differential runoff as a result of the ten-year three-hour storm event from an improved typical City lot (5,000 square feet) with 60% impervious cover amounts to 4,000 gallons, deviations from the baseline improvement shall be regulated on a proportionate basis.

C.

The following activities are hereby exempt from conformance with § 353-11.1A:

(1)

Existing impervious surfaces;

(2)

Where physical lot constraints make on-site retention technically unfeasible as determined by the City Engineer;

(3)

New impervious surfaces under 100 square feet already in planning; and

(4)

Improved gravel driveways.

D.

New porous pavement shall be provided a fifty-percent impervious surface credit.

E.

This provision shall be enforced by the City of Kingston Building Safety Division.

## APPENDIX V: DESIGN MANUAL UNIFIED SIZING CRITERIA

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New York State Stormwater Management Design Manual 2010  
TABLE 4.1

<b>Water Quality Volume (WQ<sub>v</sub>)</b>	<b>90% Rule:</b> $WQ_v(\text{acre-feet}) = [(P)(R_v)(A)] / 12$ $R_v = 0.05 + 0.009(I)$ $I =$ Impervious Cover (Percent) Minimum $R_v = 0.2$ if $WQ_v > RR_v$ $P(\text{inch}) =$ 90% Rainfall Event Number (See Figure 4.1) $A =$ site area in acres
<b>Runoff Reduction Volume (RR<sub>v</sub>)</b>	$RR_v$ (acre-feet) = Reduction of the total WQ <sub>v</sub> by application of green infrastructure techniques and SMPs to replicate pre-development hydrology. The minimum required RR <sub>v</sub> is defined as the Specified Reduction Factor (S), provided objective technical justification is documented. <b>Default Criterion:</b> $C_{p_v}(\text{acre-feet}) =$ 24 hour extended detention of post-developed 1-year, 24-hour storm event; remaining after runoff reduction.
<b>Channel Protection Volume (C<sub>p</sub><sub>v</sub>)</b>	Where site conditions allow, Runoff reduction of total C <sub>p</sub> <sub>v</sub> , is encouraged <b>Option for Sites Larger than 50 Acres:</b> Distributed Runoff Control - geomorphic assessment to determine the bankfull channel characteristics and thresholds for channel stability and bedload movement.
<b>Overbank Flood (Q<sub>p</sub>)</b>	$Q_p(\text{cfs}) =$ Control the peak discharge from the 10-year storm to 10-year predevelopment rates.
<b>Extreme Storm (Q<sub>i</sub>)</b>	$Q_i(\text{cfs}) =$ Control the peak discharge from the 100-year storm to 100-year predevelopment rates. Safely pass the 100-year storm event.
<b>Alternative method (WQ<sub>v</sub>):</b>	Design, construct, and maintain systems sized to capture, reduce, reuse, treat, and manage rainfall on-site, and prevent the off-site discharge of the precipitation from all rainfall events less than or equal to the 95th percentile rainfall event, computed by an acceptable continuous simulation model.

**APPENDIX VI:  
VILLAGE OF TARRYTOWN IMPERVIOUS COVERAGE REQUIREMENTS**

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**§ 305-49. Impervious coverage.**

It is the intent of the Village Board of Trustees to mandate maximum impervious surface coverage limits on residential lots in order to ensure that said lots contain enough pervious surfaces to permit natural runoff to percolate into the ground. The following table regulates the maximum impervious surface coverage allowed for single-family residence districts:

District	Maximum Impervious Surface Coverage Allowed
R-80	16.75%
R-60	19.25%
R-40	21.75%
R-30	25%
R-20	29%
R-15	33.50%
R-10	37.25%
R-7.5	40.75%
R-5	43.75%

NOTE: Impervious coverage is the sum of the area of coverage or footprint of all buildings, structures, paved areas, patios or other improved surfaces on a lot preventing natural runoff to percolate into the ground. Calculation of total impervious surface area on a site shall be based upon the gross lot area, not the net developable area on a site. Legal definitions of gross lot area, pervious surface and impervious surface are provided in § 305-5 of this code.

**APPENDIX VII:  
IMPERVIOUS COVERAGE WORKSHEET FROM THE TOWN OF BENSALEM, PA**

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**CALCULATION SHEET**

All permit application for building additions, sheds, pools or other accessory structures must be accompanied by a plot plan indicating all structures and impervious surfaces that exist on the property including the proposed new addition.

In order to accurately calculate the impervious coverage for your particular project you need to know the Zoning Classification for the property. There are varying percentages used depending on the district. The calculation shown below is only an example depicting the process used for determining impervious coverage.

Please complete the following, where applicable.

- A. Square footage of house, including additions.
- B. Square footage of carport/garage.
- C. Square footage of pool.
- D. Square footage of shed(s) or detached garage.
- E. Square footage of deck
- F. Square footage of covered porch.
- G. Square footage of proposed addition.
  
- H. TOTAL SQUARE FOOTAGE OF BUILDING  
(A+B+C+D+E+F+G)
  
- I. Square footage of driveway.
- J. Square footage of sidewalk(s) including around pools.
- K. Square footage of patio.
- L. Square footage of proposed other improvements.
  
- M. TOTAL SQUARE FOOTAGE OF IMPERVIOUS COVERAGE  
(H+I+J+K+L-C-E)

**EXAMPLE CALCULATION:**

To compute the maximum square footage of building coverage allowed on a lot, multiply 0.35 X the total square footage of the lot. (example: A lot measuring 7200 SQ. FT. would have a maximum allowable building coverage of 2,520 SQ. FT.)

To compute the maximum square footage of impervious surface allowed on a lot, multiply 0.40 X the total square footage of the lot. (example: A lot measuring 7200 SQ. FT) would have a maximum allowable impervious surface of 2880 SQ. FT.

*From Building and Planning Department 2400 Byberry  
Road • Bensalem PA 19020*

<http://www.bensalemtwp.org/bandpapps.html>

## APPENDIX VIII:

### MEMORANDUM ON DENSITY BONUS FOR GREEN ROOFS

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**Village of Nyack  
Village Planner**

## Memo

**To:** Marcy Denker, Chair of Nyack Sustainability Roundtable  
**From:** Bob Galvin, AICP – Village Planner  
**CC:** Don Yacopino, Building Inspector  
**Date:** 7/1/2013  
**Re:** Density Bonus for Green Roofs

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As part of Nyack’s GI Roundtable process, I have been requested to develop a proposed amendment to the zoning Code to encourage the adoption of green roof technologies in appropriate areas in the Village. Several States and local governments across the country have used strategies such as expedited permitting, financial incentives and other zoning incentives such as bulk, height and density bonuses to encourage green building techniques. Chicago, New York, Portland, Seattle and Arlington are examples of municipalities that have used density bonuses to incentivize green roofs.

Density bonuses provide an opportunity for municipalities to tie incentives to specific local public policy priorities. These bonuses typically take the form of a percentage increase in Floor Area Ratio (FAR) or other measures of density contingent upon certification or proof of building green. These additional bonuses in density especially for urban infill projects yield both short-and long-term dividends for developers and building owners and offset the costs of initial outlays. They also provide public benefits through cost reductions in managing stormwater, improved water and air quality, heat island reductions and reductions in carbon emissions.

The literature on green roofs describes “intensive” and “extensive” green roofs. Intensive green roofs have a thick growth medium and can support a wide variety of plant species including trees and large shrubs. As the name implies, an intensive green roof requires significant structural support and intensive maintenance. Intensive green roofs are also known as roof gardens. Extensive green roofs have a thinner and lightweight growing medium that supports simpler plant materials. Extensive green roofs are also known as ecoroofs, which is the preferred term. Municipalities such as Portland and Chicago have recognized these types of simply constructed roofs as a cost effective, preferred best management practice (BMP) for reducing stormwater runoff. Studies have shown that green roofs are effective at capturing rainfall with peak runoff rates significantly lower than conventional roofs.

## The advantages of Green Roofs include the following:

- **Green Roofs tend to extend the Life of the Roof**  
While most roofs require replacement every 15 to 20 years, green roofs have a life expectancy of 30 to 35 years.
- **Increase Usable Space**  
Roofs do not need to be a useless surface. Green roofs grant the potential for roof space to provide public access.
- **Aesthetic Appeal**  
A roof no longer needs to look like a roof. Green roofs provide a natural looking environment that is both aesthetically and tangibly pleasing. Green roofs can also be designed in countless ways.
- **Noise Reduction**  
The exact amount of noise reduction is hard to quantify and depends mostly on the thickness of the soil substrate and additional factors, but overall, up to a 50 decibel noise reduction can be realized based on a study by McMarlin, May/June, 1996.
- **Improved Air-Quality**  
Green roofs, because of their very nature (green), convert carbon dioxide into oxygen.
- **Reduce the Urban Heat Island Effect**  
Heat Island effect refers to the difference in temperature between an urban area and its surrounding areas. The difference can be as significant as 10 degrees. Green roofs combat the urban island effect due to the increased vegetation they bring to the urban landscape. Plants cool their surrounding environments through natural evaporation cycles. With more green roofs in the urban environment and less, non-porous blacktop, these areas will cool down.
- **Storm Water Retention**  
Green roofs retain up to 75% of a one-inch rainfall and therefore alleviate the pressure on sewer systems. Because green roofs retain more water, the amount of water that picks up dangerous particulates on its way to the sewers is lessened.
- **Energy Conservation**  
Green roofs have the potential to reduce the ambient air temperature in an urban area. In addition to their contribution to lower temperatures during the summer months, and the subsequent lower demand for electricity, green roofs provide important insulation during the winter months, once again resulting in a lesser demand for heat energy.

## Recommendation

While municipalities typically provide density bonuses for sustainability in the form of increased Floor Area Ratio (FAR), proposed residential projects in the Village of Nyack have not been able to maximize their allowable FAR due primarily to density and building height requirements. Therefore, we are recommending a 20 percent increase in the number of dwelling units to encourage the installation of green roofs. For commercial and office buildings, the incentive would be a bonus of 1 square foot for every square foot of green roof provided. While research indicates that green roofs provide long term cost benefits to the building owner over the life of the roof, we recognize that there is a higher initial cost in constructing green roofs and need to balance the density bonus against the more significant cost of construction.

### Definition:

**Green roof** is a [roof](#) of a [building](#) that is partially or completely covered with vegetation and a growing medium, planted over a [waterproofing membrane](#). It may also include additional layers such as a [root barrier](#) and [drainage](#) and [irrigation](#) systems. There are two types of green roofs: **intensive roofs**, which

are thicker and can support a wider variety of plants but are heavier and require more maintenance, and **extensive roofs or ecoroofs**, which are covered in a light layer of vegetation and are lighter than an intensive green roof.

**Purpose**

The Village recognizes that the installation of green roofs for commercial, office and multi-family residential buildings will further the sustainability policies of the Village and provide a positive public benefit through cost reductions in managing stormwater, improved water and air quality, heat island reductions and reductions in carbon emissions.

**Applicability**

**Green roofs are allowed in the following zoning districts: DMU, RMU, OMU, MFR-1, MFR-2, MFR-3, and CC.**

**Text**

To encourage the installation of green roofs subject to the performance standards defined in the Code, the Village and/or Planning Board will provide the following density bonus for green roofs installed on 50% of the building's total roof area or 2,000 square feet whichever is greater:

a ) for multifamily residential development, the density shall be increased up to but not to exceed 20% of otherwise allowable housing units ;

b) for commercial and office development, the density bonus will be 1 square foot for every square foot of green roof provided.

**Performance Standards**

**Water Use** - Demonstrate facility wisely uses potable water. For example,

- May use drip irrigation when needed.
- May meet at least 50% of green roof irrigation using non-potable sources such as HVAC condensate, rain-water collection, or other auxiliary water sources.

**Soil Depth** - Conserve water by retaining moisture for plant health.

- Minimum: 6 inches or demonstrate additional potable irrigation reduction.
- Demonstrate roof is sustainable with structural loading capability.

**Plant Species** - Provide appropriate plant species to save water suited to soil depth.

**IPM (Integrated Pest Management) Plan** - Reduce risk of water quality impacts.

- Include IPM Plan with submittal.
- May use a one-time, slow-release fertilizer application during plant establishment at conservative rate.
- Must not use fast-release fertilizers.
- Fertilizer use not restricted if use closed-loop rainwater harvesting system or discharge to landscaping at grade.

## **Maintenance**

- Provide maintenance access and safe conditions for users (per Building Code compliance).
- Provide permanent, ongoing maintenance of green maintenance system & benefits to roof elements. Provide commitment in a restrictive covenant.
- Must maintain at least 80% plant coverage of planted beds (within 2 years of installation).
- Commission the roof drainage system (must sustain 100-year storm, be able to handle blocked flows).

## APPENDIX IX: RECOMMENDED REVISIONS TO PARKING LOT STANDARDS

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### A. RATIOS

#### Revise § 360-4.5 C (3) (Rules for computing minimum parking requirements)

##### Suggested revision

Upon a finding by the Planning Board that the immediate need for parking spaces is substantially less than the total required by this section, the Board may temporarily waive the paving of up to one-half (1/2) of the required spaces, provided that the applicant gives assurances, satisfactory to the Village Attorney, that he will have sufficient additional spaces whenever the Planning Board makes a subsequent finding that the parking of cars connected with or visiting the use takes place on adjacent streets consistently and notifies the applicant of the additional paving required. (Village of Wappinger).

The area designated as reserved parking must be clearly depicted on the site plan.

### B. PURPOSE

#### **Purpose of the Design Standards**

The Roundtable recommends that the Code section defining the purpose of parking lot design standards should include the goal of maximizing green infrastructure, and that the design standards should be significantly revised to promote this goal as set forth below.

#### **Revise §360-4.5. A. Purpose**

##### Current Language with suggested addition in bold:

This section is intended primarily to provide for the location and design of off-street parking areas to accommodate motor vehicles, while balancing the needs of pedestrians, bicyclists and transit users. Parking areas are typically accessory to the principal land use on the site. Even in the case of a parking area that serves as the principal use on a lot, it is still secondary to the surrounding context that it is serving. As such, parking area design should reflect that relationship, reducing the visual prominence of the parking area while emphasizing the primary buildings and orienting pedestrians toward the principal entranceways and walkways. Standards in this section addressing the location and design of parking areas are intended to meet this purpose **and to promote the use of green infrastructure the maximum extent practicable.** A secondary purpose of this section is to address the quantity of parking provided. Flexibility is integrated in these standards through the various alternative parking provisions.

## C.DIMENSIONAL REQUIREMENTS

### Revise to §360-4.5 F. Size of spaces

#### Current Language:

A parking space shall measure a minimum of nine feet in width and 18 feet in length, exclusive of standing area and aisles for maneuvering.

#### Summary of Suggested Revisions:

The standard should be revised to:

Require a smaller minimum stall

Permit compact stalls

Encourage one way layouts with reduced aisle widths

Provide a Table of dimensional requirements for alternative layouts

Add dimensional standards for ADA compliance

#### Suggested Language for standard stalls:

Each off-street parking stall shall consist of a rectangular area not less than eight and one-half (8.5) feet wide by seventeen and one-half (17.5) feet long, or as otherwise prescribed for angled parking, as shown in Table. Angled parking layouts are permitted and encouraged where one-way circulation is possible in order to reduce the amount of paving and increase area available for tree plantings and other green infrastructure. In parking areas containing 10 or more parking spaces, with two way traffic flow and provided the aisle width according to Table , up to 20% of parking spaces need contain a rectangular area of only 7 ½ feet in width and 15 feet in length. If such spaces are provided, they shall be conspicuously designated or reserved for small or compact cars only.

#### Suggested language adding dimensional standards required for ADA compliance

Handicapped-accessible parking spaces. Parking spaces for the handicapped shall be at least eight feet in width and shall have an adjacent access aisle at least eight feet in width or as otherwise required by the New York State Uniform Fire Prevention and Building Code, as amended. The minimum number of accessible spaces shall also be as required by State Code. An eight-foot-wide access aisle may be shared by two adjacent handicap parking spaces and shall be part of an accessible route to the building or use which it is designed to serve. The minimum vertical clearance for handicapped-accessible spaces and vehicular access routes to and from such spaces shall be nine feet six inches on the entry level of any parking structure and eight feet two inches on all other levels. Such spaces shall be appropriately located and clearly identified and limited in their use by appropriate signage and pavement markings. (From Town of Wappinger).

## D. PARKING LOT DRAINAGE

### Revise § 360.-4.5 H. Drainage and surfacing

Current Language:

All open parking areas shall be properly drained and all such areas of over 10 spaces shall be provided with a dustless surface, except for parking spaces accessory to a one-family or two-family dwellings. Whenever practicable, use pervious materials to surface open parking spaces.

Suggested Revision:

Provide more detail encouraging use of permeable paving materials.

Suggested Language:

Parking areas composed of pervious surfaces are encouraged for all land uses and lots, unless there are overriding environmental limitations, and may be provided to meet all or part of any required parking spaces on a lot. Measures that shall be considered to reduce the amount of impervious surfaces in all proposed parking lots include providing pervious parking stall surfaces, pervious overflow parking, and pervious snow storage space.<sup>6</sup>

## E. PARKING LOT LANDSCAPING

### Revise § 360-4.5 K. (1) Purpose

Current Language:

Parking lot landscaping is intended to break up expanses of pavement, create shade, buffer views of parking lots from adjacent streets and development, and enhance the overall appearance of development projects.

Suggested Revision:

The revised language should take into account that parking area design provides valuable opportunities to improve stormwater management and the quality of the village environment through the use of green infrastructure practices. Conventional parking lot landscape design fails to harness these benefits. All planting areas, especially tree plantings and bioretention practices, should be designed for high performance, with clear goals and maintenance plans.

Suggested Language:

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<sup>6</sup> Adapted from The Northwest Connecticut Council of Governments (Fitzgerald & Halliday, Inc., 2003)  
CHECK

Well designed and maintained parking lot landscaping provides environmental benefits including shading, cooling and stormwater management for water quality and to reduce flooding. It provides aesthetic benefits including visually buffering views of cars and paving from adjacent streets and development and enhancing the overall appearance of development projects, and it organizes pedestrian traffic. This section is intended to provide standards for safe and attractive parking areas that maximize green infrastructure for stormwater management and to provide these other benefits.

**Revise § 360-4.5 K. (2) Applicability.**

Current Language:

All parking lots with 12 or more parking spaces in total or eight or more spaces in a single row shall be subject to the requirements of this section.

Suggested Revision:

Reduce the size limitation as far as reasonable. The Roundtable noted that the current standard has no clear basis but did not determine what the size limitation should be, if lower.

Suggested Language:

All parking lots with \_\_\_\_ spaces or more shall be subject to the requirements of this section. The following minimum standards shall be observed; however, additional landscaping may be recommended by the Planning Board. Stormwater management systems in parking lots shall be designed in accordance with Best Management Practices as described in the most recent version of the New York State Stormwater Management Manual and in accordance with the erosion and sedimentation control requirements and flood protection zone requirements and to meet the following general standards:

**Add a provision for including trees in § 360-4.5 K. (3) Perimeter landscaping**

Rationale for added provision: Perimeter landscaping requirements currently aim to provide screening of the view of cars. In order to maximize opportunities for expanding the tree canopy cover for stormwater management and other benefits, these screen planting zones should incorporate trees whenever possible and appropriate. Requirements should be flexible enough to accommodate a range of design strategies.

Suggested Language:

Perimeter landscaped strips should be wide enough to accommodate trees where possible and appropriate, in accordance with the standards in the revised tree section. Where the landscaped strip will be along a street and in any other place where it is possible to have trees, this should be encouraged. Where space is limited, tree planting design strategies for providing adequate soil volume such as structural soil or tree cells and permeable paving are encouraged.

**Revise § 360-4.5 K. (4) Interior Landscaping (a)**

Current Language:

Landscaped islands with a minimum width of eight feet and surrounded by a minimum six-inch curb shall be provided to direct the flow of traffic and to provide a place for shade trees to be planted.

Suggested Revision:

This standard should be revised to remove the requirement for curbed islands to allow for the inclusion of infiltration practices such as bioretention areas with due consideration for safety.

**Revise § 360-4.5 K. (4) Interior Landscaping (b)**

Current Language:

At least one tree per 10 spaces shall be provided within the parking lot. No more than 12 contiguous spaces shall be permitted in a row without a landscaped interruption of at least five feet, including curbing.

Suggested Revision:

The language should be revised to provide flexibility within a set of design standards based on performance. Trees should be prioritized for the shading and cooling they provide, even if they provide less stormwater management benefit than a bioswale. The best scenario is to have both. (Note that a stormwater plan could be satisfied if the parking lot was paved with permeable paving (if the conditions are right), but you still want to have green, especially trees.)

Add a requirement for tree planting to provide a specified percentage of canopy cover within a certain period should be included, with flexibility as to the arrangement of the trees within the lot.

Shade provided by trees in parking lots reduces excessive heat buildup which can adversely affect the local microclimate and air quality (Center for Urban Forest Research 2001a). Recognizing this fact, many cities have adopted ordinances that require set amounts of tree planting or shading in parking lots.<sup>7</sup>

Suggested Language:

a) Minimum requirement for landscaping. Developments with proposed parking areas with fifteen spaces or more shall provide a minimum of 10% of the total parking area as landscaped open space in the form of vegetated islands or strips designed for stormwater management, aesthetic landscape treatments, pedestrian refuge/oasis areas, and may include the perimeter buffer between the parking lot and adjacent streets.<sup>8</sup>

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<sup>7</sup> See **Guidelines for Developing and Evaluating Tree Ordinances**

<http://www.isa-arbor.com/tree-ord/> PDF version Oct 31, 2001, page 139. See pages 139-141 for further discussion..

<sup>8</sup> Adapted from **Model Zoning Regulations for Parking for Northwestern Connecticut**

Prepared Under Contract To: Northwestern Connecticut Council of Governments and Litchfield Hills Council of Elected Officials Funded By: Connecticut Department of Environmental Protection Prepared by: Fitzgerald & Halliday, Inc. 72 Cedar Street Hartford, CT 06106 September 2003.

b) Tree canopy requirement. Landscaping within surface parking areas shall include tree plantings designed to result in 50 percent shading of parking lot surface areas within 15 years.

# APPENDIX X: SUGGESTED REVISIONS TO EXISTING CODE PROVISIONS FOR STORMWATER MANAGEMENT AND POLLUTION CONTROL

---

## I. REVISIONS TO CHAPTER 295 STORMWATER MANAGEMENT

### A. Additions and Revisions to 295-2, 4, and 5

#### Recommendations

##### 1. Revise and Expand § 295-2. Purpose

This section should include the goal of employing green infrastructure in stormwater management. The purposes of the sections on pollution prevention should be included.

##### 2. Revise § 295-2 D

###### Existing language

Minimize increases in pollution caused by stormwater runoff ...

###### Suggested language:

Prevent increases in pollution caused by stormwater runoff ...

##### 3. Add Section G

Developers should explore design options that go beyond the basic requirements and offer options that contribute to solving existing problems.

###### Suggested language:

Encourage design that would reduce pollution from existing stormwater runoff

##### 4. Add Section H

The requirement to use green infrastructure and its purposes should be stated explicitly

###### Suggested language:

H. Require the use of Green Infrastructure practices to control stormwater runoff, such as protecting natural areas, reducing impervious cover, and runoff reduction techniques to the maximum extent practicable;

##### 5. Add Section I

Define the purpose as it applies to existing properties and the provisions proposed for smaller properties.

###### Suggested language:

Require calculation for stormwater detention and retention on existing properties with proposed improvements/modifications by a licensed engineer to upgrade the stormwater management practices on these properties, by requiring property owners to upgrade stormwater management systems in accordance with the requirements of this chapter and subject to the approval of the Building Inspector and/or Village Engineer, in connection with the construction of an addition to an existing structure or other land-disturbing activity so that stormwater management practices for the entire site (including retention, runoff and discharge into a public storm drain) are in full compliance with this chapter;

#### **6 . Add Section J**

Suggested language:

Control erosion and sedimentation so as to prevent it from being deposited in streams, brooks, rivers, watercourses, wetlands and other receiving water bodies;

#### **7. Add Section K**

Suggested language:

Facilitate the removal of pollutants in stormwater runoff so as to perpetuate the natural biological and recreational functions of streams, brooks, rivers, watercourses, wetlands and other receiving water bodies ;

#### **Section L**

Suggested language:

Regulate discharge of pollutants to the MS4 and promote public awareness of the hazards of the improper discharge of pollutants into the MS4.

#### **7. Revise § 295-5. Exemptions**

Suggested Revision:

Remove § 295-5 B.

This provision should be removed since it exempts silvacultural activity, of which there is none in Nyack.

## APPENDIX XI: EXAMPLE DISCHARGE COMPLIANCE REQUIREMENTS

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### Example Websites for Discharge Compliance Requirements

These are links to two website explaining the requirements in the City of Golden Valley , MN and the City of Richmond , CA. The Golden Valley page is particularly user friendly.

<http://www.goldenvalleymn.gov/homeyard/utilities/inflow-infiltration.php>

<http://www.ci.richmond.ca.us/index.aspx?nid=2129>

### Village of Mamaroneck Discharge Compliance Certificate

#### § 282-13. Issuance of discharge compliance certificate.

A. No building on real property shall be used or occupied, in whole or in part, unless a discharge compliance certificate is issued therefore. To apply for a discharge compliance certificate, a plumber's certification that complies with this article shall be submitted to the Director, together with whatever forms and other documentation may be required by the Director, and the fee for a discharge compliance certificate shall be paid. The Director can issue a discharge compliance certificate based upon a plumber's certification or any duly authorized representative of any apartment building, cooperative or condominium complex, as defined in Subsection B below, may conduct an inspection of the real property to determine whether any of the connections leading from the real property to the public stormwater sewer lines or the public sanitary sewer lines violate a requirement of the New York State Building Code or the Westchester County Sewer Act, the Westchester County Sanitary Code or the Village Code; whether there are any culverts, drains, hoses, leaders, lines, pipes or pumps on the real property that discharge liquids directly onto or directly towards a street, sidewalk or right-of-way or whether the sanitary sewer lateral pipes leading from the real property directly or indirectly allow inflow or infiltration there from into the Village's public sanitary sewer lines. By applying for a discharge compliance certificate, the owner of the real property authorizes the Director or a designee of the Director to enter upon the real property for the purpose of conducting such inspection.

B. With the Director's approval, any apartment building, cooperative or condominium complex may appoint an authorized representative who is a certified plumber licensed to do business within the County to conduct an inspection of the real property to determine whether any of the connections leading from the real property to the public stormwater sewer lines or the public sanitary sewer lines violate a requirement of the New York State Building Code, the Westchester County Sewer Act, the Westchester County Sanitary Code or the Village Code; whether there are any culverts, drains, hoses, leaders, lines, pipes or pumps on the real property that discharge liquids directly onto or directly towards a street, sidewalk or right-of-way, or whether the sanitary sewer lateral pipes leading from the real property directly or indirectly allow inflow or infiltration therefrom into the Village's public sanitary sewer lines. The results of any inspection shall be provided to the Director in order to ensure compliance and to obtain the required discharge compliance certificate.

C. A discharge compliance certificate can be issued at any time after a renewal event has occurred. A discharge compliance certificate can also be issued prior to a renewal event; however, such certificate shall expire on the 60th day after it is issued, unless the renewal event shall have occurred before its expiration date.

D. A discharge compliance certificate issued after a renewal event has occurred shall expire when the next renewal event with respect to that real property occurs. A discharge compliance certificate issued

prior to a renewal event that does not expire pursuant to § [282-13C](#) also shall expire when the next renewal event with respect to the real property occurs. Nothing contained in this section shall be construed as preventing the Director from revoking a discharge compliance certificate if there are grounds to do so.

## APPENDIX XII: OVERVIEW OF INCENTIVES & FINANCING

THIS TABLE GIVES AN OVERVIEW OF FINANCING AND OTHER STRATEGIES TO ENCOURAGE GREEN INFRASTRUCTURE. IT INCLUDES INFORMATION FROM THE FOLLOWING RESOURCES:

***Promoting Green Infrastructure: Strategies, Case Studies, and Resources***

Prepared for Pioneer Valley Planning Commission by Water Infrastructure Capacity Building Team  
HUD Capacity Building for Sustainable Communities Program. June 2012

***University of Maryland Environmental Finance Center website.***

<http://www.efc.umd.edu/SFOUfinoptions.html>

***How Can I Overcome the Barriers to Green Infrastructure?*** US Environmental Protection Agency  
Green Infrastructure Website. 2012.

[http://water.epa.gov/infrastructure/greeninfrastructure/gi\\_barrier.cfm](http://water.epa.gov/infrastructure/greeninfrastructure/gi_barrier.cfm)

***Managing Wet Weather with Green Infrastructure Municipal Handbook: Funding Options***, US  
Environmental Protection Agency. 2009

[http://water.epa.gov/infrastructure/greeninfrastructure/upload/gi\\_munichandbook\\_funding.pdf](http://water.epa.gov/infrastructure/greeninfrastructure/upload/gi_munichandbook_funding.pdf)

<b>Stormwater fee/utility</b>	“A stormwater utility or fee is a dedicated and separate fund created to pay for stormwater management, planning, and outreach activities within a specified area. A fee can be collected on a separate bill, added to a water collection bill, or added to the property tax bill. Usually an ordinance is passed by the council or commission for approval.” <i>University of Maryland Environmental Finance Center</i>
<b>Municipal infrastructure bonds</b>	Municipalities can finance green infrastructure projects by contracting debt through general obligation bonds. These bonds are “a method of financing debt that traditionally carries low interest rates because the County/City pledges its full faith and credit to the repayment of the bonds. Bonds are usually voted on by the public at large and then put into a Capital Improvement Program.” <i>University of Maryland Environmental Finance Center</i>
<b>Development review and impact fees</b>	Fees tied to new development are based on the fact that new development brings new infrastructure costs, for services such as roads, schools, and utilities. Called impact fees or plan review and permitting fees, these fees represent “an alternative to providing the needed public improvements rather than letting the improvements lag behind or putting the burden upon taxpayers by increasing taxes. The purpose of these charges is to shift a pro rate share of public capital improvement costs to the developments that create the need for those improvements.” <i>University of Maryland Environmental Finance Center</i>  Special assessment fees can be used to discourage development in environmentally sensitive areas or other land integral to the community’s green infrastructure plan. ‘Fees in lieu’ are so-named because these exempt developers from having to implement on-site water quality treatment practices but instead requires them to pay into a fund that the municipalities can use to finance green infrastructure projects in priority areas.  <i>Pioneer Valley Planning,, page 4.</i>

<p><b>Dedicated taxes and fees</b></p>	<p>A dedicated stormwater tax can be imposed in order to finance green infrastructure projects. Requiring approval by City or County Council or by voters via referendum, stormwater taxes are often added to and collected along with the property tax bill. “The tax is usually a general fund collection but can then be redistributed into a special stormwater fund. This money is not necessarily dedicated, however, and may be reallocated to other pressing community needs.” Advantages of a tax include that it is relatively easy for the municipality to administer and the fact that it may allow property owners a tax deduction. Other dedicated fees include real estate taxes and capital cost recovery fees.</p> <p><i>Pioneer Valley Planning, page 5.</i></p>
<p><b>Loans and grants</b></p>	<p>“Loans and grants are not considered stable or long-term solutions or fixes. They can be useful, however, as seed funding or as funding for pilot projects. Depending on loan and grant funding to support a stormwater program is not highly recommended as the funds are not sustainable, are subject to change from year to year, and are often competitively won.” <i>University of Maryland Environmental Finance Center website.</i></p>
<p><b>Private donations and sponsorships</b></p>	<p>Private funds may be available to fund green infrastructure projects, especially demonstration or pilot projects in public places. Corporate sponsorships will be most effective if the business receives publicity through signage and/ or media attention. Nonprofit organizations concerned with water quality or habitat may be helpful in recruiting donations from their members. <i>Pioneer Valley Planning, page 6.</i></p>
<p><b>Zoning and subdivision regulation</b></p>	<p>Local development Codes and ordinances are often the best place to start when a municipality wants to increase the adoption of green infrastructure practices. Even when there is political and public support for green infrastructure, “existing requirements in comprehensive plans, zoning Codes, and building standards may be silent on, ambiguous towards, or even in conflict with the principles of green infrastructure. Zoning density standards, storm sewer connection requirements, and minimum parking and road widths are just a few of the requirements that can limit opportunities for green infrastructure.” <i>EPA 2012</i></p>
<p><b>Design guidelines.</b></p>	<p>To further encourage the use of GI practices, municipalities can develop guidelines illustrating accepted designs. Design guidelines are an effective way to educate developers as well as public works staff who may not be familiar with GI techniques. Two approaches for developing design guidance are:</p> <p>1) Adopt a design manual. A manual makes a clear statement about the intent to use green infrastructure practices, but it also typically provides more flexibility and discretion to use conventional techniques instead of GI. It can be a “kinder, gentler way to introduce these techniques, especially to engineers / Departments of Public Works.” ( <i>US Environmental Protection Agency, Region 5. 2011. Using Local Codes to Cultivate Green Infrastructure and Foster Sustainable Stormwater Management webinar.</i> <a href="http://water.epa.gov/infrastructure/greeninfrastructure/gi_training.cfm">http://water.epa.gov/infrastructure/greeninfrastructure/gi_training.cfm</a>)</p> <p>2) Adopt design standards. Standards clearly delineate what is and isn’t</p>

	<p>allowed. For example, green street standards might specify allowed street width, paving material, and stormwater management designs. While standards remove ambiguity, they can be inflexible.</p> <p><i>Promoting Green Infrastructure: Strategies, Case Studies, and Resources, page 9.</i></p>
<p><b>Stormwater fee discounts</b></p>	<p>Local governments can encourage stormwater management on private property by reducing stormwater fees in exchange for desired green infrastructure practices, such as reducing impervious cover or installing cisterns, rain gardens, or trees. Fee discounts and credits provide an opportunity for property owners to reduce the cost of their stormwater fees by using green infrastructure techniques that limit impervious cover and reduce the amount of runoff generated. The public system clearly benefits when property owners manage stormwater runoff on site. If less water enters the sewer system, less money needs to be spent on treatment, maintenance, and operation expenditures. Further, discounts and credits support the fee-for-service system because property owners can reduce the amount they pay by reducing the service they receive.</p> <p><i>EPA 2009, p. 3.</i></p>
<p><b>Zoning and permitting incentives</b></p>	<p>Various incentives can be integrated into the framework of existing development Codes and regulations. Such incentives encourage private developers to implement green infrastructure practices in new or redevelopment projects, in exchange for an easier and/or cheaper permitting process. Some common types of incentives include:</p> <ul style="list-style-type: none"> <li>Density bonuses/ zoning upgrades</li> <li>Increases in floor area ratios</li> <li>Reduced parking requirements</li> <li>Reduced stormwater requirements</li> <li>Expedited permitting</li> <li>Waived fees (consultant Code review fees, application fees)</li> <li>Free consulting from in-house design experts or other staff, to help navigate the permit process</li> </ul> <p>Incentives can be offered for a wide range of desired practices. Some examples include:</p> <ul style="list-style-type: none"> <li>Green buildings and developments (as defined by the US Green Building Council or a state or local program)</li> <li>Installing green roofs, rain gardens, rain harvesting devices (barrels, cisterns), or permeable pavement</li> <li>Vegetated stream buffers</li> <li>Removing impervious cover or disconnecting impervious areas from stormwater control system via infiltration systems</li> </ul> <p><i>Pioneer Valley Planning , page 13</i></p>
<p><b>Tax abatements and credits</b></p>	<p>Municipalities may consider offering tax-based incentives to private property owners who implement specific practices, particularly in targeted areas. On</p>

	<p>the land preservation side of green infrastructure, several states (including Massachusetts) have a tax credit program from purchased and donated easements. On the stormwater side of green infrastructure, tax credits have primarily been given for green roofs. <i>Pioneer Valley Planning, page 9.</i></p>
<p><b>Rebate, Grants, and Installation financing</b></p>	<p>Rebates, grants, and installation financing are powerful mechanisms for encouraging private property owners to implement green infrastructure techniques. Such incentives can be targeted to high-priority areas, such as regions served by combined sewer systems, or they can be used to achieve community goals like “cisterns for water conservation, rain gardens to improve groundwater recharge, and green roofs to mitigate urban heat island effects.” <i>39 US Environmental Protection Agency. 2009. Managing Wet Weather with Green Infrastructure Municipal Handbook: Incentive Mechanisms, p. 4. <a href="http://water.epa.gov/infrastructure/greeninfrastructure/upload/gi_municipalhandbook_incentives.pdf">http://water.epa.gov/infrastructure/greeninfrastructure/upload/gi_municipalhandbook_incentives.pdf</a></i> Grant and rebate programs can also be an effective form of public outreach about the benefits and uses of green infrastructure. A drawback of monetary incentives is their cost to municipalities. Local water authorities and nonprofits may prove valuable partners in funding and promoting such programs. <i>Pioneer Valley Planning, page 14.</i></p>
<p><b>Awards</b></p>	<p>Awards and recognition programs highlight successful examples of green infrastructure in a community. Award winners often include businesses and property owners as well as non-profit organizations, community organizations, individuals, schools or government agencies. Awards are provided to recognize innovations in green infrastructure practices and design, and may include projects or plans that focus on water conservation and reuse, stormwater mitigation and management, landscaping and site design, watershed restoration and other sustainable strategies for water quality protection. Granting awards to local projects gives valuable recognition to innovators that help to drive the field forward. At the same time, awards increase public awareness about local projects and the ways that stormwater can be used as a valuable resource. Adding signage to award-winning projects can help further educate the public and help the public recognize its impacts and connection to the local watershed. <i>EPA 2009, p 5</i></p>

## **APPENDIX XIII: REFERENCES**

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The following key resources were used in preparing the report. These and other useful documents can be found on the Nyack Roundtable Google Site at <https://sites.google.com/site/nyackroundtable/>.

**Guidelines for Developing and Evaluating Tree Ordinances.** PDF version Oct 31, 2001  
<http://www.isa-arbor.com/tree-ord/>

**How Can I Overcome the Barriers to Green Infrastructure?** US Environmental Protection Agency Green Infrastructure Website. 2012.  
[http://water.epa.gov/infrastructure/greeninfrastructure/qi\\_barrier.cfm](http://water.epa.gov/infrastructure/greeninfrastructure/qi_barrier.cfm)

**Low Impact Development Code Review Worksheet**  
<http://nyack-ny.gov/green-infrastructure-resource-links/>

**Managing Wet Weather with Green Infrastructure Municipal Handbook: Funding Options,** US Environmental Protection Agency. 2009  
[http://water.epa.gov/infrastructure/greeninfrastructure/upload/qi\\_munichandbook\\_funding.pdf](http://water.epa.gov/infrastructure/greeninfrastructure/upload/qi_munichandbook_funding.pdf)

**Model Zoning Regulations for Parking for Northwestern Connecticut**  
Prepared Under Contract To: Northwestern Connecticut Council of Governments and Litchfield Hills Council of Elected Officials Funded By: Connecticut Department of Environmental Protection Prepared by: Fitzgerald & Halliday, Inc. 72 Cedar Street Hartford, CT 06106. September 2003.

**New York State Stormwater Management Design Manual 2010**  
<http://www.dec.ny.gov/chemical/29072.html>

**Promoting Green Infrastructure: Strategies, Case Studies, and Resources**  
Prepared for Pioneer Valley Planning Commission by Water Infrastructure Capacity Building Team HUD Capacity Building for Sustainable Communities Program. June 2012

**Town of Wappinger Low Impact Development Roundtable: Recommended Model Development Principles for Conservation of Natural Resources in the Hudson River Estuary Watershed.** June 2006  
[http://www.dec.ny.gov/docs/remediation\\_hudson\\_pdf/hrewbsdwap.pdf](http://www.dec.ny.gov/docs/remediation_hudson_pdf/hrewbsdwap.pdf)

**University of Maryland Environmental Finance Center website**  
<http://www.efc.umd.edu/SFOUfinoptions.html>