

# GREEN INFRASTRUCTURE GUIDE

FOR PRIVATE PROPERTY  
OWNERS IN NEW YORK CITY



DEVELOPED BY RIVERKEEPER AND  
NYC SOIL & WATER CONSERVATION DISTRICT

# WELCOME

Welcome to the Green Infrastructure Guide for Property Owners in New York City!

This workbook is for private property owners, whether the property is a row home, multi-family home, college campus, or commercial/industrial building. The workbook is intended to get you thinking about a green infrastructure project on your property, and link you to the resources you need to complete it.

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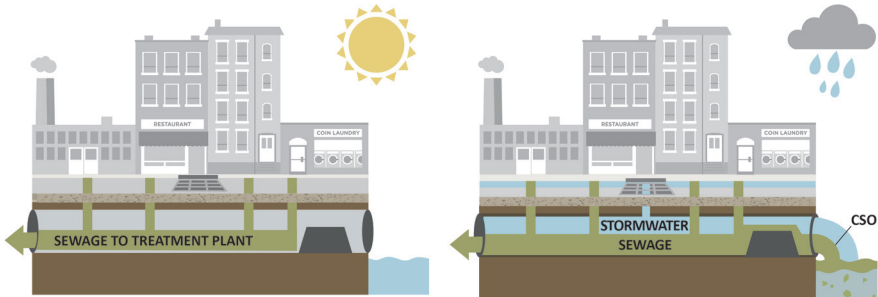
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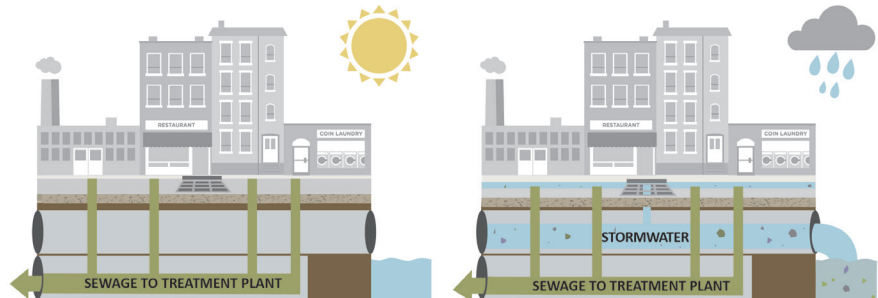
## THE ISSUE: COMBINED SEWER OVERFLOW

Most of New York City, about 70%, has a combined sewer system. This means stormwater and sanitary wastewater are conveyed to a wastewater treatment plant through the same system.



During rainstorms, combined sewer systems can become inundated with stormwater which could overload the capacity of the wastewater treatment plant. When this happens, **the mixture of raw sewage and stormwater runoff is diverted to the nearest water body through a combined sewer outfall. These events are called CSO - Combined Sewer Overflows.** Untreated sewage and stormwater makes the waterways unsafe for swimming, boating, fishing and wildlife survival.

Areas that are not part of the combined sewer system are called MS4 – Municipal Separate Storm Sewer System. In MS4 areas, storm sewers are not connected to a wastewater treatment plant, so stormwater off of buildings, streets and sidewalks run directly into the nearest waterbody untreated, carrying with it oils, metals, pet waste, trash, and other debris.





## WHY GREEN INFRASTRUCTURE?

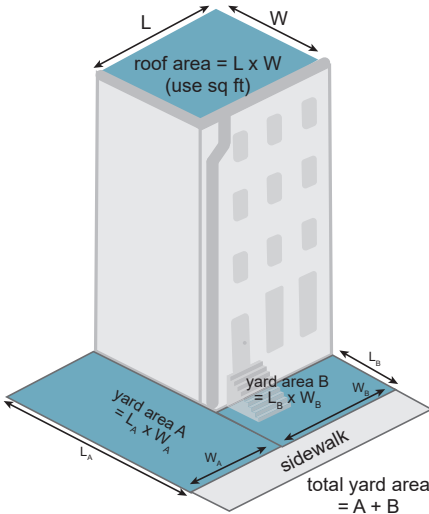
Green infrastructure (GI) uses natural systems, such as soil and plants, to reduce water from entering the sewer and stormwater system. GI can capture stormwater runoff from rooftops, sidewalks and roads through green roofs, rain gardens, planters and other constructed green spaces. GI has many additional benefits, such as filtering the air, lowering the surrounding ambient air temperature, preventing urban heat island effect, energy savings, reduced infrastructure costs, and providing habitat for wildlife. Cities across the country are utilizing GI for stormwater management. NYC has installed thousands of GI assets, most in the public right of way, and has a GI grant program and green roof tax abatement to incentivize green infrastructure on private property (see page 18).



# DESIGNING YOUR GREEN INFRASTRUCTURE PROJECT

## 1. PICK THE GI TYPE(S) FOR YOUR PROPERTY:

GI can be applied on any size of building and property type. Some projects you can do on your own (look for the DIY check mark ) and some will require an engineer, designer and/or contractor. Decide  where you want to do your project (rooftop, downspout, and/or yard), and what kind (page 6).



## 2. MEASURE YOUR GI PROJECT AREA:

If you're doing a rooftop or downspout project, measure the square footage of your roof. If you have multiple downspouts, check how much area contributes to each downspout.

If you're doing a yard project, measure the square footage of the GI project area.

If you're doing a project that collects rooftop and backyard runoff, make sure to add your rooftop to your GI project area.

## 3. CALCULATE VOLUME OF RAINFALL:

When designing your green infrastructure, you'll need to decide how many inches of rainfall you'll want to manage. This can be dependent on site constraints or load bearing capacity of your rooftop (requires structural analysis).

Most storms in NYC (roughly 90%) generate one inch of rainfall or less, so designing your green infrastructure for a one-inch rainfall will manage **most** storms. However, "extreme precipitation" events, or rainfall greater than two inches, are becoming more common with climate change. Designing your green infrastructure for a larger storm is certainly the most effective for reducing CSOs, though any bit helps!

Use your project area measurements to calculate the volume of rainwater managed:

$$[GI \text{ area in square feet}] \times [0.6233] \times [\text{inches of rain}] = \text{gallons of rainwater.}$$

(It is common practice to use an efficiency multiplier of 75% or 80% to account for losses due to leaks or absorption by the roofing material.)

## 4. CHECK OUT FURTHER RESOURCES:

Once you've thought about where you'd like to install GI and what types are right for your property, check the final pages of the guide for funding resources, DIY guides and a directory of GI designers/contractors.

# GENERAL CONSIDERATIONS

## INFILTRATION:

Infiltration means allowing water to soak into the ground, rather than run off into the stormwater or combined sewer system. Green infrastructure installers must pay careful attention to the topography and subsurface conditions to ensure water can infiltrate. In general, the lower lying areas on your property are the best places to site infiltration projects, because that is where water is already naturally flowing or pooling and puddling. However, you should avoid infiltration close to the foundation of your building so you do not create flooding in your basement.

Not all properties are suitable for infiltration projects; problems with infiltration may be related to a high layer of bedrock, clay or other fine soil, or a high water table. If any of these issues prevent water from infiltrating, consider an above-ground approach that does not infiltrate.

If you want to know whether you can pursue infiltration GI on your property, you can conduct a preliminary infiltration test on your own! Dig a hole one-foot in diameter and one-foot deep. Fill it with water (about 5 gallons) and watch it drain. Once fully absorbed, fill the hole with water again. If the second pour of water doesn't drain over the next 24 hours, your soil may not be ideal for an infiltration project.

For a larger project, a professional geotechnical analysis is recommended to ensure the project will not create flooding or standing water on your property.

## COST:

The cost of each green infrastructure technique can vary widely. For green and blue roofs, the cost per square foot decreases as the size of the rooftop increases (look into the City's tax abatement for green roofs to help offset green roof costs). Cisterns and rain barrels are priced according to the type and size of barrel you purchase. Permeable pavers are priced per square foot. In general there are fixed costs associated with hiring a contractor, so the larger the project, the more cost-effective it will be. Check out page 18 for financial resources to help pay for your GI project.

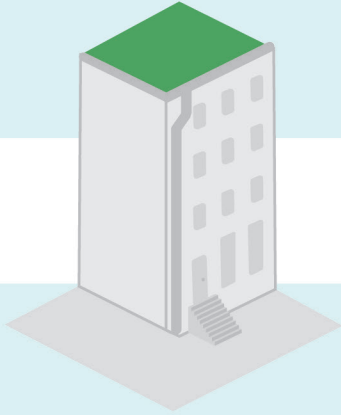
## PERMITS:

If you are altering anything on the building, you'll need a Department of Buildings permit.

If you're planning on doing any work on your downspout, consider working with a licensed plumber. Downspouts cannot be fully disconnected, only diverted. An overflow system must be installed to ensure excess water is sent to the sewer and not pooling on any surfaces.

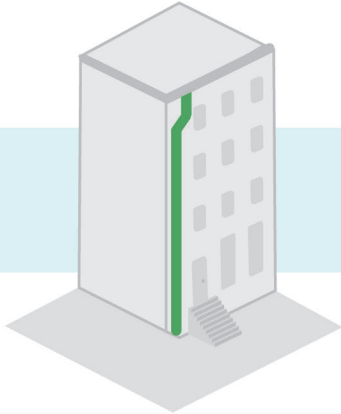


## WHAT KIND OF GREEN INFRASTRUCTURE IS RIGHT FOR YOUR PROPERTY?



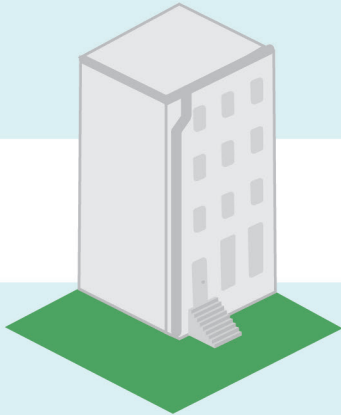
### DO YOU HAVE A FLAT OR SLIGHTLY SLOPED **ROOF**?

Look into installing a green or blue roof on your rooftop. Green roofs provide many other benefits, such as providing habitat, regulating your building's temperature and lengthening the lifespan of your roof. Blue roofs cost less, but do not offer benefits beyond temporarily storing rainwater. Green roofs can be expensive. Large roofs are more cost effective. An intensive green roof has a deeper layer of soil and can manage more water.



### DO YOU HAVE AN EXPOSED **DOWNSPOUT**?



















A cheaper and more accessible option is diverting stormwater through the downspout. You can collect water in a rain barrel or cistern for your garden, build a planter box off the downspout, or route the downspout to a rain garden. These options are great for smaller buildings, and make a great DIY project.



### DO YOU HAVE AMPLE SPACE IN THE **FRONT OR BACK YARD**?

If you have yard space or a driveway, consider de-paving the concrete and planting a garden or permeable pavers. This can be DIY or with a contractor. You'll need an infiltration test and to check for utilities before digging into the ground. These projects can be very versatile and aesthetically pleasing.

# GREEN INFRASTRUCTURE COMPARISON

	Cost	Water Capacity	DIY?	Co-Benefits
INTENSIVE GREEN ROOF	\$\$\$\$\$*			
EXTENSIVE GREEN ROOF	\$\$\$\$*			
BLUE ROOF	\$\$\$\$			
RAIN BARREL	\$			
FLOW THROUGH PLANTER	\$\$			
CISTERN	\$\$			
DE-PAVING	\$\$			
RAIN GARDEN	\$\$\$			
PERMEABLE PAVER	\$\$\$			



provides habitat



regulates building temperature

\*The City's Green Roof Tax Abatement can help offset these costs. Also look into the City's Green Infrastructure Grant for large projects. See page 18 for financial resources.

## GREEN ROOFS: Extensive and Intensive

*A green roof is a layer of vegetation on your rooftop that holds water, provides habitat, helps insulate your building and helps you save on energy costs. If it is made accessible to residents, it adds a lovely garden oasis amenity space, and dramatically boosts property values.*

### GOOD FOR:

Sunny roofs that are flat or have a gradual slope (less than 20%). The larger the roof the more cost effective! Industrial buildings are ideal for green roofs because they are usually flat and have a high load bearing capacity. Buildings with only a few stories will see a greater percentage of their summer AC bills slashed as the green roof will insulate a greater percentage of the total building volume.

### WATER CAPACITY:

Calculate the volume of water generated on your rooftop. The inches of rainfall that a green roof can manage will depend on the design and the structural integrity of your rooftop.

### CONSIDERATIONS:

- Green roofs will require a structural analysis by a licensed engineer.
- Green roofs will extend the lifetime of your rooftop and help regulate the temperature of your building.
- Plan to maintain your green roof. Some green roof designers will maintain for 1-2 years, and/or teach you how to maintain it.
- Using native plants will reduce maintenance time and costs, as well as provide habitat for native animals.

### GET STARTED!

Check the directory for a green roof designer to see if your rooftop can be transformed into a green roof. Green roof designers will guide you through the structural assessment process. Consider applying for a Green Infrastructure Grant to get reimbursed for your green roof or apply for the Green Roof Tax Abatement program.

### GREEN ROOF EXAMPLE:

Location: Bishop Laughlin Memorial High School, Brooklyn

Cost: \$260,000 (funded entirely by DEP GI grant)

Size: 17,000 square feet

Capacity: 18,500 gallons

Designed and installed by Highview Creations.





# BLUE ROOFS

*A blue roof is a non-vegetated roof structure that slows the flow of water into the drain by temporarily storing it. Water will slowly be released into the roof drain within 24 hours.*

## GOOD FOR:

Flat roofs. The larger the roof the better and more cost effective! Industrial buildings are ideal because they are usually flat and have a high load bearing capacity.

## WATER CAPACITY:

Calculate the volume of water generated on your rooftop. In general a blue roof can manage up to 4 inches of rainwater.

## CONSIDERATIONS:

- Like green roofs, a blue roof will require a structural analysis by a licensed engineer
- Blue roofs will extend the lifetime of your roof through waterproofing material.
- While blue roofs are cheaper than a green roof, they do not provide the environmental co-benefits that a green roof would, such as providing wildlife habitat and mitigating urban heat island effect.

## BLUE ROOF EXAMPLE: (blue/green combo)

Location: The Osborne Association; Longwood, Bronx

Cost: \$288,000 (GI grant) + \$123,000 (in kind for roof replacement)

Size: 7,200 square feet

Capacity: manages roughly 240,000 gallons per year

Designed and installed by Hazen and Sawyer. Photo by Ari Burling.



# RAIN BARREL

*Rain barrels are easy-to-install barrels that capture water from the downspout. Rain barrels are great for collecting rainwater to water your garden or plants.*



## GOOD FOR:

Small buildings with external downspouts. Have a large roof top? Consider a cistern.

## WATER CAPACITY:

Easy-to-install rain barrels usually come as 35 or 55 gallon sizes. That will fill up quickly! Larger water storage tanks are also available but installation requires more careful planning. Barrels can be combined for more water capture.

## CONSIDERATIONS:

- Any downspout diversion will have to include an overflow back into the downspout for when the barrel is full.
- Make sure to get a lid or mesh cover to prevent mosquitos.
- Maintenance is easy: empty your barrel before the next significant rainfall. Drain and disconnect in the winter.

## GET STARTED!

You can buy or order a rain barrel at most hardware stores! There are many online videos and guides to install your own.

Sometimes city council members have free rain barrel giveaways. Call your city council member to ask if there will be a giveaway in your district.



## RAIN BARREL EXAMPLE:

Three-tiered rain barrel system

Location: Bishop Laughlin Memorial High School, Brooklyn

Cost: \$1,100 (rain barrels were donated)

Capacity: 150 gallons

Designed and installed by Greenwood Robinson.

# DOWNSPOUT PLANTER

*If you don't have anything to water with a rain barrel, you can build a planter box instead!*



## GOOD FOR:

Small buildings with exposed downspouts.

## WATER CAPACITY:

You can build or design the planter box to fit your needs! Calculate the total volume of your planter in cubic feet. Then figure out the volume of soil you will use to fill the planter. The void space –the space available for water - in your typical gardening soil is about 25% of the soil volume. If your planter is 3ft wide, 5ft long and 3ft tall and you fill your planter to the top, then your soil volume is 45 cubic feet. The volume of water that can be stored in the soil is about 11 cubic feet (or 82 gallons).

A typical row home is 1,000 square feet, which generates 623 gallons of water in a 1-inch rainstorm. A 3' x 5' x 3' planter would manage 13% of a 1-inch storm.

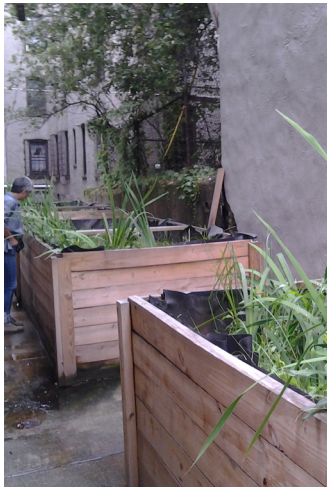
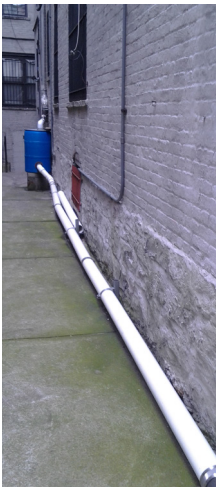
Don't forget to count the number of downspouts. Some buildings have more than one.

## CONSIDERATIONS:

- Make sure to include an overflow back into the downspout or to a rain garden so the planter doesn't get over-inundated with water and overflow.
- Use native plants for less maintenance requirements and to provide native habitat.

## GET STARTED!

Want to do it on your own? There are several DIY guides online – check the resources page! Large projects, like the example below, will require an engineer.



### DOWNSPOUT PLANTER EXAMPLE:

Location: Crown Heights, Brooklyn

Cost: \$40,000 (\$25K low interest loan, \$15K in-kind from SWCD)

Capacity: 1,720 gallons

Designed by eDesign Dynamics and installed by NYC Soil & Water Conservation District.

# CISTERN

*Cisterns are like large rain barrels. They are large rainwater harvesting systems you can use to irrigate medium to large landscapes or gardens.*

## GOOD FOR:

Large roofs, and the ability to divert multiple downspouts. These are particularly useful for school buildings to irrigate a garden or campus landscaping, or large industrial or commercial properties that can use the rainwater to wash machinery.

## WATER CAPACITY:

Use the rainwater calculation for a rooftop to determine the volume of rainwater generated. Cisterns are sized to hold hundreds to thousands of gallons. You can even find some as large as 10,000 gallons.

## CONSIDERATIONS:

- Above ground cisterns make installation simple and avoids underground utilities and the need for a pump.
- While cisterns don't provide the co-benefits a green roof would, this is a cheaper and easier solution for large rooftops, especially if there is a use for the harvested rainwater.

## GET STARTED!

You would not need a structural analysis if the cistern is placed on the solid ground, however complex projects (such as projects with multiple downspouts or pumping needs) should be done with the help of a licensed professional.



## CISTERN EXAMPLE:

Cost: ~\$5,000 (half for the tank; half for labor, and hardware)

Gallons managed: up to 500 gallons per storm

Installed by GrowNYC.



## DE-PAVING



*If your yard or driveway is paved, simply tearing up the concrete will allow it to manage some stormwater. De-paving is the first step to installing a rain garden or permeable pavers and can be done on your own!*

### GOOD FOR:

Paved areas like driveways, concrete yards or paved patios that are not in the public right of way.

### WATER CAPACITY:

Measure the area that you will be de-paving. Depending on what you do with the de-paved area and the infiltration capacity of your yard, you may be able to manage all the water that falls on it. Use the area you de-pave to calculate the volume of water you will manage.

### CONSIDERATIONS:

- You can replace paved areas with permeable or porous pavers if you would still like the area to be paved.

### GET STARTED!

Look into renting equipment from a construction equipment supplier. For asphalt, you'll need a walk-behind diamond-blade saw. For concrete, rent a jackhammer. Check out the DIY resources for how to de-pave.

Recycle or reuse your material! Asphalt will crumble and cannot be reused, but can be recycled. Asphalt recycling companies (such as Green Asphalt) will accept clean broken asphalt. Concrete is hard and can be reused.

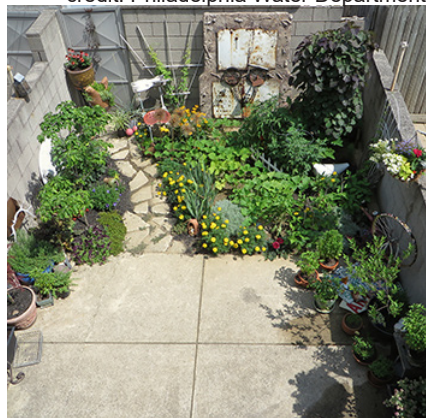
Integrate it into walkways for your garden!

### DE-PAVING EXAMPLE (in Philadelphia):

credit: Philadelphia Water Department



BEFORE



AFTER

# RAIN GARDEN



*Rain gardens are gardens with native plantings in a small depression with rainwater funneled from the downspout and/or paved areas. These gardens collect water which is then used by the vegetation through evapotranspiration or infiltrates into the soil.*

## GOOD FOR:

The low lying areas of your property. Paved areas like driveways, concrete yards or paved patios that are not in the public right of way.

## WATER CAPACITY:

Rain gardens can take on the water from your rooftop and yard. If you're able to disconnect your downspout and direct it to your rain garden, add the rooftop calculation to your rain garden volume.

## CONSIDERATIONS:

- You will have to complete an infiltration test to make sure water will infiltrate properly, and not pool and flood your property.
- Rain gardens should be at least ten feet from your home or neighbor's home and downhill of any foundations.
- Look for naturally low lying areas, or gentle slopes that receive runoff from patios or sidewalks and are in full or partial sun.

## GET STARTED!

Check the online resources for small scale rain garden ideas and designs. For a larger property, check the directory for a green infrastructure designer and consider applying for a Green Infrastructure Grant.



## RAIN GARDEN EXAMPLE:

Location: Henry Street, Lower East Side

Cost: \$15,000

Capacity: manages water from a 1,300 sq.ft. roof (800 gallons in a 1-inch storm).

This garden is part of a series of barrels and planters.

Designed and installed by WE Design, in partnership with Grow NYC, The Henry Street Settlement, and many volunteers.

# PERMEABLE PAVERS

*There are several types of permeable or porous pavers that allow water to infiltrate instead of run off the surface. These make for great driveways and patios.*

## GOOD FOR:

Permeable pavers do not have the same load bearing capacity as traditional concrete, so should only be used for parking or light foot traffic.

## WATER CAPACITY:

Measure the area that you will be replacing with permeable pavers. Depending on the infiltration capacity, you may be able to manage all the water that falls on it.

## CONSIDERATIONS:

- Stick to your yard and driveway. Anything in the public right of way (sidewalk) must use materials specified by DOT guidelines, which does not include porous pavement at this time.
- Pavers must be maintained to be effective. Dry weather vacuum sweeping helps prevent clogging. Avoid surfaces that accumulate a lot of sediment and debris.
- Choose locations sloping away from foundation, with slope less than 5%.

## GET STARTED!

Come up with a design that fits your property, but you'll need a contractor to install.

## EXAMPLES

photos and prices from Rutgers University



**GRASS  
PAVERS**

\$16-18/sq ft



**POROUS  
ASPHALT**

\$12-22/sq ft



**PERMEABLE  
PAVERS**

\$18-28/sq ft

# CAN'T DO GREEN INFRASTRUCTURE ON YOUR PROPERTY?

*There are other ways to help out!*



## CONSERVE WATER DURING RAINSTORMS

In combined sewer systems, both sewage and stormwater inundate the sewer system when it's raining. If you can't do anything on the stormwater side, you can always contribute by conserving water when it's raining. Wait to shower, do laundry, or do dishes until the rain passes.



## TAKE CARE OF STREET TREES

Street trees are green infrastructure! The soil in street tree beds manage stormwater, but dense urban environments often choke street trees with compacted soil and confined space. A little street tree care can go a long way to providing more stormwater management and a healthier tree canopy:

- Loosen compacted soil with a trowel. Gently scrape at the soil (being careful to not damage any exposed tree roots). This will increase porous space for water retention.
- Apply mulch or compost. This helps the tree bed retain moisture. Look for local compost from a Botanic Garden or community garden.
- Become a street tree caretaker through Trees New York's Citizen Pruner Tree Care Course (available in all 5 boroughs).



## KEEP LITTER OUT OF STREETS

Litter on sidewalks and streets enters the stormwater and sewer system and ends up in waterways when it rains. Keep your block clean and sweep up trash and pet waste.



## DIY RESOURCES

*Start here for installation guides to build your own green infrastructure project. These guides were much of the inspiration for this guide!*

**GROW NYC** has a Green Infrastructure Toolkit that covers green infrastructure techniques and basic design considerations:

[www.grownyc.org/gardens/green-infrastructure-toolkit](http://www.grownyc.org/gardens/green-infrastructure-toolkit)

And an in-depth rainwater harvesting how-to guide:

[www.grownyc.org/files/osg/RWH.how.to.pdf](http://www.grownyc.org/files/osg/RWH.how.to.pdf)

**IOBY** Guide to Green Infrastructure walks through several techniques for your backyard:

[www.ioby.org/blog/wp-content/uploads/2014/05/Green\\_Infrastructure-5x5\\_FINAL.pdf](http://www.ioby.org/blog/wp-content/uploads/2014/05/Green_Infrastructure-5x5_FINAL.pdf)

**PHILADELPHIA WATER DEPARTMENT'S** Rain Check program (run through the Pennsylvania Horticultural Society) provides instructions and designs for small green infrastructure projects:

[www.phillywatersheds.org/whats\\_in\\_it\\_for\\_you/residents/raincheck/gettingstarted](http://www.phillywatersheds.org/whats_in_it_for_you/residents/raincheck/gettingstarted)

**PRINCE GEORGES'** Rain Check program has fact sheets and guidelines for a variety of green infrastructure techniques:

[www.princegeorgescountymd.gov/324/Eligible-Practices](http://www.princegeorgescountymd.gov/324/Eligible-Practices)

## OTHER RESOURCES

**NYC Department of Environmental Protection** has many resources available on its green infrastructure webpage, including:

- Stormwater Calculator (download from the guidelines page)

[www.nyc.gov/html/dep/html/stormwater/stormwater\\_management\\_construction.shtml](http://www.nyc.gov/html/dep/html/stormwater/stormwater_management_construction.shtml)

- Green Infrastructure guidelines

[www.nyc.gov/html/dep/pdf/green\\_infrastructure/stormwater\\_guidelines\\_2012\\_final.pdf](http://www.nyc.gov/html/dep/pdf/green_infrastructure/stormwater_guidelines_2012_final.pdf)

- A fact sheet about rooftop detention

[www.nyc.gov/html/dep/pdf/rooftop\\_detention.pdf](http://www.nyc.gov/html/dep/pdf/rooftop_detention.pdf)

## FINANCIAL RESOURCES

**NYC Department of Environmental Protection (DEP) Green Infrastructure Grant** is a reimbursement grant for large green infrastructure projects anywhere in the city. Apply if you:

- Are the owner of a large property
- Can commit to a 20 year restrictive covenant
- Think your project will cost >\$30,000
- Able to maintain for 20 years




Apply at: [www.nyc.gov/dep/grantprogram](http://www.nyc.gov/dep/grantprogram)

**NYC Green Roof Tax Abatement** is a one-year tax abatement, or tax relief, of \$5.23 per square foot (up to \$200,000 or the building's tax liability, whichever is less). This abatement is currently available through March 15, 2018.




# DIRECTORY

*Consider these experienced green infrastructure designers for your project!*




**Alive Structures:** Design and install green roofs, gardens terraces and roofs. They specialize in the use of native plant species and creating a naturalistic design.

 [www.alivestructures.com](http://www.alivestructures.com)  
 [marni@alivestructures.com](mailto:marni@alivestructures.com)  
 (718) 902-5243

**DLANDstudio:** Interdisciplinary design firm with an innovative approach. Projects range from streetscapes to modular green infrastructure to campuses and master planning.

 [www.dlandstudio.com](http://www.dlandstudio.com)  
 [info@dlandstudio.com](mailto:info@dlandstudio.com)  
 (718) 624-0244




**eDesign Dynamics:** Water resource modeling, planning and design; green stormwater infrastructure design; habitat restoration and assessment; resilience planning and design.

 [www.edesigndynamics.com](http://www.edesigndynamics.com)  
 [info@edesigndynamics.com](mailto:info@edesigndynamics.com)  
 (646) 688-3113




**Greenwood Robinson:** Landscape design, horticultural services, irrigation/ rainwater management, greenhouse/tree house construction.

 [www.greenwoodrobinson.com](http://www.greenwoodrobinson.com)  
 [samuel@greenwoodrobinson.com](mailto:samuel@greenwoodrobinson.com)  
 (917) 513-3113




**Highview Creations:** Green roof design/build firm with several completed projects funded by the DEP green infrastructure grant.

 [www.hvcnyc.com](http://www.hvcnyc.com)  
 [info@hvcnyc.com](mailto:info@hvcnyc.com)  
 (646) 481-9012




**Thread Collective:** Architecture, landscape, urban design and interiors. Projects range from ground up architecture to urban and landscape design.

 [www.threadcollective.com](http://www.threadcollective.com)  
 [gita@threadcollective.com](mailto:gita@threadcollective.com)  
 (718) 484-0065

**Urbanstrong:** Design, build and maintain Green Roofs. Brooklyn based. Free site visits for NYC residents. Specialize in beautiful systems that save money and boost property value.

 [www.urbanstrong.com](http://www.urbanstrong.com)  
 [aburchell@urbanstrong.com](mailto:aburchell@urbanstrong.com)  
 (215) 480-2210

**WE Design:** Landscape Architecture, Green Infrastructure Design, Master Planning, Urban Design, Community Engagement, Greenway Design and Planning, Design Guidelines

 [www.wedesign-nyc.com](http://www.wedesign-nyc.com)  
 [tmartin@wedesign-nyc.com](mailto:tmartin@wedesign-nyc.com)  
 (347) 236-0142

This publication was developed by Riverkeeper and the NYC Soil & Water Conservation District.



**RIVERKEEPER** was founded in 1966 to protect the environmental, recreational and commercial integrity of the Hudson River and its tributaries, and safeguard the drinking water of nine million New York City and Hudson Valley residents.

[Learn more at www.riverkeeper.org](http://www.riverkeeper.org)



**NEW YORK CITY SOIL & WATER CONSERVATION DISTRICT** is a political subdivision of the New York State government charged with conserving and protecting soil, water and related natural resources in New York City.

[Learn more at www.soilandwater.nyc](http://www.soilandwater.nyc)

For questions about this booklet, contact:  
[korin@nycswcd.net](mailto:korin@nycswcd.net)



**Hudson River  
Estuary Program**

A Program of the New York State Department of Environmental Conservation

This Project has been funded in part by a grant from the New York State Environmental Protection Fund through the Hudson River Estuary Program of the New York State Department of Environmental Conservation.