Phoenix Plaza Green Roof

GREEN INFRASTRUCTURE HANDBOOK

Best Management Practices in Hartford, Connecticut

Office of Sustainability

EXECUTIVE SUMMARY

Citywide, approximately 42% of Hartford's land area is covered in impervious surfaces, and much of the rest of the city is covered in soils with high clay content and low infiltration rates. Together, these conditions prevent effective absorption of stormwater, exacerbate runoff, and result in localized flooding, sewer backups, and sewage overflows into local waterways. Green infrastructure (GI) is an alternative approach to stormwater management that protects, restores, or mimics the natural water cycle, using water as a resource. Widespread adoption of GI techniques can help reduce the cost of eliminating sewer backups and localized flooding, while providing many co-benefits such as cleaner air, cooler city streets, increased public greenspace, and enhanced wildlife habitat, all of which improve the quality of urban life.

Hartford is particularly vulnerable to Urban Heat Island and poor air quality given the large amounts of impervious surface. This can have severe consequences on human health and safety by degrading air and water quality and contributing to aggravated asthma and heat-related illness or death. Green infrastructure, in the form of vegetation like trees and other plants, can help reduce the impacts of these problems by capturing pollutants such as particulate matter (a major asthma trigger) and cooling the area with shade and evapotranspiration.

To date, other than urban tree canopy, there have been a limited number of green infrastructure best management practices implemented within the City. The majority of these practices are green roofs within the downtown area. The Capitol Building also has eight different uses of GI on its grounds. However, other than visual checks, the efficacy of these projects has not been measured.

Barriers to the implementation of GI in Hartford include concerns that the city's clay-heavy soils (which cover 60% of the city) make these techniques impractical. However, GI can be effectively utilized within Hartford despite the high percentage of clay-heavy soils. An EPA study completed in Madison, WI revealed that pilot rain gardens were able to capture 99% of the stormwater that they had received, regardless of soil or vegetation type. Moreover, the USDA NRCS's Soil Survey indicates that Hartford has a substantial amount of Type B soils (Over 25% of the city), which have infiltration rates suitable for GI.

Another common concern is the cost of implementation and maintenance. As with any new project, there are initial construction costs for the design and installation of GI practices. These initial costs should be considered in the context of the numerous benefits GI techniques provide. In addition to green space and stormwater capture, GI also often extends the lifespan of the surrounding infrastructure such as sidewalks and roofs. In streetscape projects, green infrastructure can provide multiple uses beyond stormwater capture such as providing green space and calming traffic.

Incorporating GI BMPs will maximize economic, environmental, and social benefits and improve Hartford's climate resiliency. There are several actions that are recommended to facilitate widespread GI implementation and improve the efficiency of the city's existing infrastructure. The adoption of standardized GI guidelines (such as the National Association of City Transportation Officials Street Stormwater Guide) for streetscapes will ensure that future GI projects will be consistently structured throughout the city. Another recommendation includes the promotion of GI on private property. Rain barrels, cisterns, trees, and rain gardens are all practices that can be effective on properties of varying sizes.

As urban tree canopy is the primary source of green infrastructure benefits in Hartford at this time, it is crucial to maintain and care for trees to allow them to grow to a larger size, which will reap benefits in the short and long term. Using techniques such as structural soil or tree filtration boxes can enhance the contributions of trees and maximize their potential, while saving money in maintenance and replacement costs. In downtown Storrs, CT and within the UConn-Storrs Campus, precast stormwater planter boxes were successfully used to treat stormwater runoff coming from impervious areas. Tree care and education is also included in as a strategy.

Ultimately, it is vital to implement and maintain GI in Hartford in order to provide critical stormwater capture, pollution control, and public green space.

Constitution Plaza Green Roof

2.1 RAINWATER HARVESTING (RAIN BARRELS/CISTERNS)

BENEFITS:

- ○ Water Quality
- ○ Air Quality
- ● Stormwater Capture
- ○ Habitat Creation
- ○ Heat Island Effect
- ● Water Supply

CONSTRAINTS:

- ● Poorly Draining Soils
- ● Space Limitations
- ● Steep Slopes
- ● Retrofit Use

SUITABLE FOR:

- ● Buildings
- ○ Streets
- ○ Landscape

MAINTENANCE:

Tasks:

- ○ Watering (dry months)
- ● Cleaning out debris
- ○ Weeding
- ○ Trimming
- ● Other (mulch/mow/etc.)

KEY:

- ● Most Appropriate
- ◐ Moderately Appropriate
- ○ Least Appropriate

Herb Virgo, Director of Keney Park Sustainability Project (KPSP), teaches residents about rainwater harvesting at the site

WHAT IS RAINWATER HARVESTING?

Rainwater harvesting is the collection of rainwater from impervious surfaces for later use. Rainwater collection systems require diverting roof downspouts to cisterns or rain barrels. Rain barrels and cisterns are the containers that hold the stormwater captured. Rain barrels are typically used for smaller properties such as private residences whereas cisterns are typically used for larger properties.

BENEFITS OF RAINWATER HARVESTING

- Provides water for irrigation or other non-potable uses
- Captures stormwater, decreasing urban runoff, pollution, and sewer overflows
- Reduces erosion in urban environments
- Helps reduce peak summer demands
- Diverts usage from drinking water supplies
- Helps save money on water bills, particularly during peak summer months

Rain barrels collect water for the aquaponics system at KPSP

Upcycled Rain Barrel

LOCAL EXAMPLES

In 2012, the Metropolitan District (MDC) launched a rain barrel program as a part of the Clean Water Project, which is designed to reduce local sewer backups and overflows into the Connecticut River. The rain barrel program was a success, with over 1,300 rain barrels distributed to the utility's customers. Each rain barrel can help the average homeowner save 1,300 gallons of water during the peak summer months.

As a part of the Green Capitols Project, MDC also engineered and installed the cistern at the State Capitol. Rainwater collected from the roof is stored in the cistern for future irrigation.

Keney Park Sustainability Project (KPSP), a local nonprofit, has also taken advantage of the benefits of rain barrels. Rainwater harvested from the roofs of greenhouse and aquaponics facility are used to irrigate the urban agriculture site.

To keep the rainwater clean and mosquito-free, KPSP uses goldfish to eat the mosquito larvae and algae. The fish provide an innovative and natural pest solution.

Rain Barrel Demonstration of the Hartford Public Library; Courtesy of MDC

COSTS

With their large capacity, cisterns are more likely to be suitable for larger buildings, whereas rain barrels are more appropriate for small buildings such as single family homes.

- Rain barrels can range from $35-$150 depending on size and features. You can make a rain barrel or purchase one at your local hardware store or online.
- Cisterns can range from $1,500 to over $10,000 depending on size. Cisterns can be purchased online or from a supplier. Larger cisterns can be complex and often require a professional to install. Ask your supplier whether they include installation or initial maintenance with your purchase

MAINTENANCE

Rain barrels and cisterns are fairly low maintenance. They require the following tasks:

⇒ Using the water stored your rain barrel or cistern to make room for the rainfall from the next storm

⇒ Periodically inspecting your barrel/cistern for leaks or clogging

⇒ Cleaning and sanitizing your cistern annually to remove sediment or any other contaminants

⇒ Winterizing your rain barrel (drain, disconnect, clean, and store it for the winter)

SUITABLE LOCATIONS

Rainwater harvesting is particularly useful for buildings with sloped roofs that may also require irrigation for landscaping needs. Appropriate sites may include schools or commercial buildings with landscaping.

- Rain barrels are affordable and can be installed by hand at most homes without any major constraints
- Larger cisterns require greater planning and design. Make sure to consult a certified contractor when considering a large or complex cistern system

INTERESTED IN LEARNING MORE?

- Visit the EPA *Soak Up the Rain* webpage for more resources about rain barrels
- Learn from MDC about how you can install and maintain your rain barrel. Read more here
- The EPA also has a literature review on rainwater harvesting. Check it out here

2.2 GREEN ROOFS

BENEFITS:

- Water Quality
- Air Quality
- Stormwater Control
- Habitat Creation
- Heat Island Effect
- Energy Savings

CONSTRAINTS:

- Poorly Draining Soils
- Space Limitations
- Steep Slopes
- Retrofit Use

SUITABLE FOR:

- Buildings
- Streets
- Landscapes

MAINTENANCE:

Annual Labor: 4 hrs/1,000 ft^2

Tasks:

- Watering (dry months)
- Cleaning out debris
- Weeding
- Trimming
- Other (mulch/mow/etc.)

KEY:

- Most Appropriate
- Moderately Appropriate
- Least Appropriate

Green Roof at Phoenix Plaza

WHAT IS A GREEN ROOF?

A green roof is a vegetated roof that provides environmental, economic, health, and social benefits. Green roofs have been around the U.S. since 1930, and they are becoming more common thanks to the many co-benefits they provide. For example, a green roof can be a cost-effective stormwater management alternative that also features green space and offers substantial energy savings.

BENEFITS OF A GREEN ROOF

- **Reduced Heat Island Effect**
  - Green roofs capture heat, preventing much of the heat from entering the building and surrounding areas.
- **Cost Savings**
  - Green roofs generate enough lifetime savings (primarily in energy and stormwater) to exceed the initial installation costs.
  - Green roofs have over double the average life expectancy in comparison to standard roofs
  - Green roofs reduce heat transfer and act as insulators, which cuts both cooling and heating energy needs.
- **Improved Air and Water Quality**
  - The vegetation filters the air and the water, capturing greenhouse gases, emissions, and other pollutants.
- **Ecological Benefits**
  - Rooftop gardens create habitat, food, and protection for pollinator species.
- **Public Green Space**
- **Stormwater Management**
  - Green roofs capture stormwater, decreasing stormwater fees and reducing pressure on the combined sewer system.

Draft | Sources: Portland, EPA, GSA

COSTS

Initial green roofs costs range from $10-$20 more than conventional roofs to install. However, green roofs more than compensate for these startup costs through energy savings and the increased life expectancy of the roof (over twice the typical lifespan). Over a 50-year period, green roofs generate enough stormwater, energy, carbon dioxide, and community earnings to offset and exceed the increased cost of installation, maintenance, and replacement.

MAINTENANCE

Green roofs require low to moderate maintenance (4 hours of labor for every 1,000 sf) depending on the type of plants and depth of soil medium. Typical maintenance includes:

- ⇒ Watering during dry periods (less than 1.5 inches of rainfall in a six week period)
- ⇒ Occasional weeding
- ⇒ Cleaning up litter and debris

LOCAL EXAMPLES

Green roofs have been growing in popularity in Hartford since the 1960s. Hartford's green roofs can be found at Constitution Plaza, Phoenix Plaza, Connecticut Science Center, Travelers Plaza, the Hollander, the State Capitol, and Aetna. These green roofs provides spaces for people to enjoy nature within the city, while also capturing stormwater and saving energy.

Built in 1962, Constitution Plaza is Hartford's oldest green roof. It is a 3.8 acre green space that provides lush public areas open to both building inhabitants and the community.

Phoenix Plaza has one of the most extensive green roofs in the city, with landscaped areas making up 42% of the property. These areas are self-sufficient and require irrigation only during periods of prolonged drought.

As a part of the Green Capitols Project, a green roof was installed at the Connecticut State. The area consists of vegetated modular trays that include a growing medium planted over a waterproof membrane.

SUITABLE LOCATIONS

Connecticut Science Center

UConn at Storrs—Laurel Hall. Courtesy of UConn CLEAR

Green roofs can be retrofitted on flat roofs in a variety of settings such as residential, commercial, and public buildings. Commercial plazas and parking garages are two types of structures that are common in downtown Hartford and that may benefit from green space. Public buildings such as schools are other potential options for green roofs.

INTERESTED IN LEARNING MORE?

- Use the ASU Green Roof Energy Calculator to see how much you can save with a green roof
- See how green roofs can reduce the Heat Island Effect: EPA's Reducing Urban Heat Islands: Green Roofs
- Find out about other green roofs in The International Greenroof & Greenwall Projects Database
- Read the US General Services Administration's Report on Green Roofs on Public and Commercial Buildings

Draft | Sources: GSA, DEEP, Sasaki, Phoenix, EPA | Images: NEMO

2.3 URBAN TREE CANOPY

BENEFITS:

- Water Quality
- Air Quality
- Stormwater Capture
- Habitat Creation
- Heat Island Effect
- Energy Savings

CONSTRAINTS:

- Poorly Draining Soils
- Space Limitations
- Steep Slopes
- Retrofit Use

SUITABLE FOR:

- Buildings
- Streets
- Landscape

MAINTENANCE:

Tasks:

- Watering (dry months)
- Cleaning out debris
- Weeding
- Trimming
- Other (mulch/mow/etc.)

KEY:

- Most Appropriate
- Moderately Appropriate
- Least Appropriate

Bushnell Park on Trumbull Street

WHAT IS URBAN TREE CANOPY?

Urban tree canopy (UTC) consists of the leaves and branches of the trees that cover the ground when viewed from above. Trees are among the most prevalent forms of green infrastructure found in urban areas, offering a multitude of benefits that improve the quality of life within communities. Many cities have recognized the value of trees and have set canopy goals to restore and protect their urban forests. Residents, businesses, and community groups can make a difference by planting and caring for trees.

BENEFITS OF TREES

- **Reduced Heat Island Effect**
  - Trees provide shade, which can cool the surrounding area by between 4°F - 14°F and increase the longevity of the adjacent pavement
- **Cost Savings**
  - Trees generate enough lifetime benefits and savings to exceed the initial installation costs
  - Landscaping with trees can increase property values by 20%
  - Trees can reduce A/C needs by 30% and save 20-50% of the energy used for heating
- **Improved Air and Water Quality**
  - Trees filter the air and the water, capturing greenhouse gases, emissions, and other pollutants
- **Ecological Benefits**
  - Hartford's urban forest provides habitat, food, and protection for various species
- **Public Green Space**
  - Trees improve the quality of life in a community. Spending time near trees increases energy level and decreases blood pressure and stress
- **Stormwater Management**

Draft | Sources: Portland, USFS, iTree, FAO

COSTS

Trees can vary in cost depending on the size and the species of trees. Trees purchased at local nursery or home improvement store can cost as little as $15. In contrast, larger caliper trees (>2") for commericial landscaping can cost upwards of $250. Note that smaller trees tend to establish more successfully than larger trees.

MAINTENANCE

Trees require some maintenance in the establishment period to ensure their longevity. These tasks include watering during dry periods (less than 1.5 inches of rainfall in a six week period), pruning, and mulching (avoid excess mulching).

LOCAL EXAMPLES

Trees provide vital services that improve the quality of life in our communities. Trees provide shade, which cools our buildings and neighborhoods and reduces energy costs. They remove various pollutants, improving our air and water quality. Trees also capture stormwater runoff, reduce noise pollution, and increase property values. Based on these qualities, Hartford's trees provide over $5 million in services each year. This includes the removal of 147,780 pounds of pollutants and 11,264 tons of carbon from the air and the interception of over 590 million gallons of stormwater. Moreover, as trees mature and increase in size and canopy, the benefits they provide also increase. As 10% of Hartford's largest trees (20 inches or greater in diameter) make up 50% of the city's canopy, it is crucial to care for and maintain our urban forest so that our trees can provide the same benefits for future generations.

To read more about how the city benefits from its trees, check out the 2014 study that American Forests completed on Hartford's Urban Tree Canopy.

Scion of the Charter Oak - The first-generation descendant of the famous Charter Oak

Aerial view of trees in Downtown Hartford and Bushnell Park, which is an arboretum of over 450 trees and 76 species

SUITABLE LOCATIONS

Bushnell Park North Promenade Street Trees

Trees at Constitution Plaza

Trees are among the most versatile of green infrastructure techniques. They can be planted alongside buildings and streets and within landscaping for parks and other uses. With a wide variety of trees suitable for Hartford's climate, a diverse array of trees can be planted by size, shape, color, and more. In addition, trees can be used with other green infrastructure practices such as at MDC's permeable pavement project on Main Street. Trees can also be planted in rain gardens and bioswales as well as on green roofs such as at Constitution Plaza.

INTERESTED IN LEARNING MORE?

- Want to plant your own tree? Look through the city's list of permitted trees in the Zoning Regulations (page 205)
- Proper tree maintenance is crucial in tree health and performance; learn about tree care from Casey Trees
- MyTree is specifically designed for mobile browsers, so check out this tool to see what your tree can do
- Find out how much your trees boost your property values and calculate the energy, stormwater, and air quality benefits your trees can offer using the National Tree Benefit Calculator

Draft | Sources: American Forests, Connecticut's Notable Trees

ALTERNATIVE PLANTING METHODS: TREE BOXES

DEFINITION:

Tree boxes are precast tree pits specifically designed to collect and treat stormwater.

ADDITIONAL BENEFITS:

- Longer Life Expectancy
- Increased stormwater capture

SUITABLE LOCATIONS:

- ○ Buildings
- ● Streets
- ○ Landscape

CAPITAL COST:

$12,000+ per unit

MAINTENANCE:

Annual Cost: $100-500/unit

Tasks (2 times a year):

- Clean out debris
- Check proximity of the trunk to the grating

KEY:

- ● Most Appropriate
- ◗ Moderately Appropriate
- ○ Least Appropriate

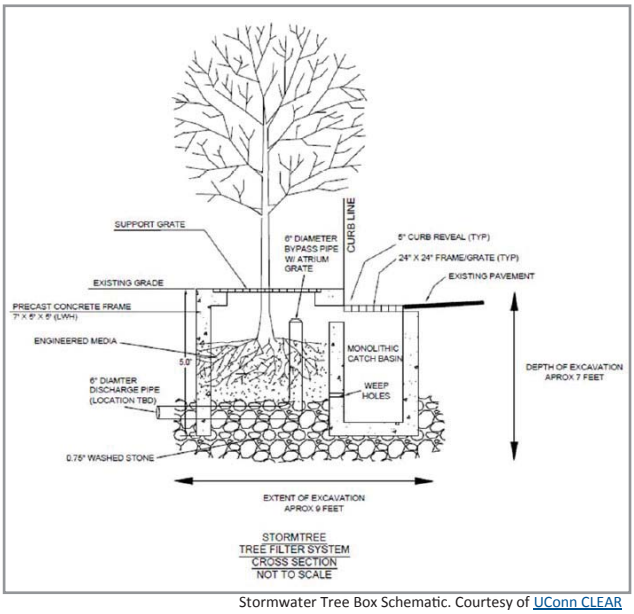
Stormwater Tree Box at UConn-Storrs. Courtesy of UConn CLEAR

UNIVERSITY OF CONNECTICUT AT STORRS: STORMWATER TREE BOXES

Tree boxes are precast tree pits specifically designed to collect and treat stormwater. In urban or built-out areas where space is limited, these tree boxes can fit within a small existing footprint as retrofit projects.

The University of Connecticut at Storrs has implemented a variety of green infrastructure techniques around campus, including three pre-cast stormwater boxes. These tree boxes treat 23,795 ft^2 of impervious area despite being only a fraction of the space (105 ft^2). These tree boxes are also highly effective at filtering pollution, with removal rates ranging from 50-85% for pollutants such as suspended solids, phosphorus, nitrogen, metals, and oil/grease.

The maintenance requirements for these tree boxes are typically limited to the removal of sediment, litter, and other debris in the spring and in autumn. Performance efficiency correlates with maintenance, which can cost as little as $100 year per tree. These tree boxes have a lifespan of 25 years.



Stormwater Tree Box Schematic. Courtesy of UConn CLEAR

2.4 BIORETENTION (RAIN GARDENS/BIOSWALES)

BENEFITS:

- Water Quality
- Air Quality
- Stormwater Capture
- Habitat Creation
- Heat Island Effect
- Energy Savings

CONSTRAINTS:

- Poorly Draining Soils
- Space Limitations
- Steep Slopes
- Retrofit Use

SUITABLE FOR:

- Buildings
- Streets
- Landscape

MAINTENANCE:

Annual: 20.7 hrs/acre treated

Tasks:

- Watering (dry months)
- Cleaning out debris
- Weeding
- Trimming
- Other (mulch/mow/etc.)

KEY:

- Most Appropriate
- Moderately Appropriate
- Least Appropriate

Bioswale at UConn School of Law

WHAT IS BIORETENTION?

Bioretention is the use of vegetation and soils to capture and filter stormwater runoff. A rain garden is a form of bioretention typically used in landscaping; it is a depressed area that collects rain water and allows it to soak into the ground. A bioswale is an urban rain garden with additional storage underneath; this technique can be installed along streets and parking lots.

BENEFITS OF RAIN GARDENS AND BIOSWALES

- **Reduced Heat Island Effect**
  - Replacing impervious areas with green space helps reduce the heat that pavement typically radiates
- **Improved Air and Water Quality**
  -Plants filter the air and the water, capturing greenhouse gases, emissions, and other pollutants
- **Ecological Benefits**
  - Rain gardens and bioswales can provide habitat for various species
- **Public Green Space**
  - Greenery improves the quality of life in a community. Spending time near trees increases energy level and decreases blood pressure and stress
- **Stormwater Management**
  - Bioswales and rain gardens capture stormwater and excess runoff, which reduces pressure on the city's combined sewers and subsequently decreases the frequency of flooding and drainage issues such as combined sewer overflows

Draft | Sources: Portland, EPA[1], EPA[2]

COSTS

Simple rain gardens can cost as little as $5 per square foot. More complex designs requiring a contractor can cost up to $45 per square foot. UConn NEMO has developed a rain garden cost calculator to estimate potential costs (find link below).

Due to a lack of standard specifications, bioswales in the right-of-way or on private property may require engineering designs or other additional capital costs. EPA's Opti-tool estimates that bioretention costs $15.46 per square foot. This includes the cost of construction and a 35% design/engineering/ contingency cost.

MAINTENANCE

Once established, rain gardens and bioswales typically require little maintenance. EPA's Opti-tool estimates maintenance needs to be 20.7 hours per year for every acre of impervious cover treated (rain gardens can treat impervious areas six times their size).

- During the establishment period, plants should receive an inch of water per week for 1-2 months if it does not rain
- Remove any weeds, invasive species, dead branches or dead vegetation
- Avoid adding excessive amounts of mulch as it can inhibit water flow or storage
- Inspect for erosion or sediment buildup, adding rocks or removing sediment as needed

LOCAL EXAMPLES

In Hartford, rain gardens and bioswales have been placed at residential, commercial, public areas. The Classical Magnet School and UConn's School of Law in West End boasts two rain gardens each. The Keney Park Sustainability Project (KPSP) also has two rain gardens on site, one of which has edible plants like blueberries, and thyme. These gardens, in combination with the addition of gutters and downspout disconnection, have resolved chronic basement flooding issues.

Volunteers installing a rain garden. Courtesy of KPSP

Completed Edible Rain Garden. Courtesy of KPSP

SUITABLE LOCATIONS

Rain Garden at CT State Capitol

Rain gardens are highly adaptable and can be installed in any area that is unpaved. Rain gardens can be added to schools, parks, and in the yards of homes. Rain gardens can also be planted with native and edible plants, allowing for harvesting and educational opportunities.

Bioswales can occupy spaces as narrow as one foot, which makes this green infrastructure technique particularly adaptable to streetscape projects. Other cities such as New York and New Haven are installing bioswales by the hundreds in order to reduce issues such as combined sewer overflows and localized flooding.

INTERESTED IN LEARNING MORE?

- Download NEMO's rain garden mobile app to design your own rain garden
- Check out New York City's Bioswale Care Handbook to understand what it means to care for a bioswale in the right of way
- See what design guidelines the National Association of City Transportation Officials recommends in their Urban Street Stormwater Guide

Draft | Sources: NEMO, NACTO, New York, New Haven

2.5 PERMEABLE PAVEMENT

BENEFITS:

- Water Quality
- Air Quality
- Stormwater Capture
- Habitat Creation
- Heat Island Effect
- Water Supply

CONSTRAINTS:

- Poorly Draining Soils
- Space Limitations
- Steep Slopes
- Retrofit Use

SUITABLE FOR:

- Buildings
- Streets
- Landscape

MAINTENANCE:

Annual: 6 hours/acre

Tasks:

- Watering (dry months)
- Cleaning out debris
- Weeding
- Trimming
- Other (Vacuum)

KEY:

- Most Appropriate
- Moderately Appropriate
- Least Appropriate

Porous Asphalt at the Connecticut State Capitol

WHAT IS PERMEABLE PAVEMENT?

Traditional pavement is impervious and exacerbates urban runoff whenever it rains. Permeable pavement is an alternative option that helps capture and infiltrate stormwater runoff and snowmelt, reducing pollution to local waterways. Permeable pavement can be a cost-effective drainage approach in urban areas.

BENEFITS OF PERMEABLE PAVEMENT

- Increases infiltration and recharges groundwater
- Captures stormwater, decreasing urban runoff and filtering pollutants such as phosphorous, nitrogen, and metals
- Reduces erosion in urban environments

Pervious concrete and permeable pavers at the entrance of the CT State Capitol

Pervious concrete path at the CT State Capitol

COSTS

Costs for permeable pavers vary by type.

EPA's Opti-tool estimates that porous asphalt costs $5 per cubic foot of runoff storage (including design/engineering/contingency costs) whereas pervious concrete costs $18 per cubic foot.

MAINTENANCE

Permeable pavement is considered one of the most affordable GI techniques to maintain, requiring the vacuuming and removal of sediment once or twice a year. Annually, this translates to six hours of labor per acre. Note that these cleanings are necessary for performance efficiency. Sediment buildup will reduce or impair the performance of the product. Other considerations include:

- ⇒ Avoid sanding and salting in the winter as this can lead to sediment buildup or product deterioration. In many cases, permeable pavement requires less deicing as much of the snowmelt infiltrates rather than freezes.
- ⇒ Some pre-cast pavements will only require a power washer for cleaning.

LOCAL EXAMPLES

Hartford has several examples of permeable pavement in the city. Bushnell Park features permeable pavement both within the park and along its north promenade. In Fall 2017, MDC also installed a demonstration project on Main Street using flexi-pave, which is made of recycled material such as tires.

The most extensive example of permeable pavement in Hartford is at the State Capitol. Nearly 40,000 square feet of permeable pavement was installed onsite, including permeable pavers, porous asphalt, and pervious concrete. Porous asphalt makes up the bulk of the parking lot and driveway, whereas pervious concrete is used for the majority of the walkways. Permeable pavers are used for entrances and other pedestrian areas.

Porous asphalt parking lot and path with permeable pavers and pervious concreate on a rainy day at the CT State Capitol

POTENTIAL LOCATIONS

Porous Concrete

Permeable Pavers

Permeable pavement is extremely useful in a multitude of locations where pavement is required. The variety of permeable pavement options available (such as porous concrete and permeable pavers) allow for a greater diversity in function and aesthetics.

It is recommended that permeable pavement be used in areas with low to moderate traffic (less than 500 daily trips) to prevent sediment buildup in the system. Potential locations include park paths, sidewalks, and parking lots.

INTERESTED IN LEARNING MORE?

- Take a self-guided tour of the State Capitol's green infrastructure to see three different kinds of permeable pavement
- Find more details and design considerations can be found in CT DEEP's Stormwater Manual, Chapter 11
- The National Association of City Transportation Officials provides basic recommendations and design considerations in their Urban Street Stormwater Guide

2.6 NO MOW/LOW MOW AREAS

BENEFITS:

- Water Quality
- Air Quality
- Stormwater Capture
- Habitat Creation
- Heat Island Effect
- Energy Savings

CONSTRAINTS:

- Poorly Draining Soils
- Space Limitations
- Steep Slopes
- Retrofit Use

SUITABLE FOR:

- Buildings
- Streets
- Landscape

MAINTENANCE:

Annual Mowing in Autumn

Tasks:

- Watering (during establishment)
- Weeding (establishment)
- Trimming
- Other (Mow/etc.)

KEY:

- Most Appropriate
- Moderately Appropriate
- Least Appropriate

Low Mow Meadow at Keney Park

WHAT IS NO MOW/LOW MOW?

Low mow zones are areas planted with meadow plants instead of traditional turf, saving valuable staff time and money on lawn maintenance while increasing runoff absorption and habitat creation. Less mowing reduces the usage of fuel and equipment, leads to fewer carbon dioxide emissions, protects the atmosphere, and saves money.

BENEFITS OF MEADOWS

- **Improved Air Quality**
  - Low mow meadows filter the air, capturing greenhouse gases, emissions, and other pollutants
  - Choosing low mow grasses over regular turf or lawn reduces mowing, which decreases the cost of maintenance and related fossil fuel consumption and subsequently reduces the suspension of dust and allergens
- **Ecological Benefits**
  - Low mow meadows increase and diversify wildlife habitat by promoting wildflower and grassland growth, which attracts pollinator species of insects and birds
- **Public Green Space**
- **Stormwater Management and Improved Water Quality**
  - Meadows capture stormwater and excess runoff more effectively than turf, filtering pollutants and allowing rain to infiltrate and recharge into the groundwater supply

COSTS

Creating low mow meadows requires the purchasing and planting of meadow mix, estimated to be $10 per pound of seed. While meadow mix seeds may differ in cost from traditional turf, once established, they require much less maintenance and care.

MAINTENANCE

The initial meadow mix must be watered and maintained until the grasses have been established. After this point, meadows require no other maintenance other than mowing once a year, typically in the fall.

Low mow meadow at Batterson Park; Courtesy of Tom Baptist

LOCAL EXAMPLES

Low mow areas were first established in Hartford's parks in 2014. These areas are mowed once a year, usually in the fall. At the closed landfill, the city's largest low mow area by far, hawks, plovers, and sandpipers have been found living in the meadows.

Low mow areas can be found at the following locations around the city:

- Decommissioned Landfill (35 acres)
- Keney Park (11 acres)
- Goodwin Park (5 acres)
- Pope Park (4 acres)
- Colt Park (1 acres)
- Elizabeth Park (1 acres)
- Brackett Park (2 acres)

Keney Park Great Meadow; Courtesy of Tom Baptist

POTENTIAL LOCATIONS

35 acres of low mow meadow at Hartford's closed landfill

Low mow areas can be applied to a variety of landscaped areas across the city. Individual homes can incorporate low mow areas into their yards, reducing excess mowing and watering needs. Commercial properties can add meadow mix to their landscaping, increasing stormwater capture potential and reducing maintenance needs. Vacant lots and underutilized properties like the closed landfill can be transformed into vibrant habitats for plants, butterflies, and birds. Low mow meadows can also be extended within the existing areas of the parks system, saving the city time and money.

INTERESTED IN LEARNING MORE?

- Other cities have no mow zones too! Check out Philadelphia's tips for a no mow backyard buffer
- For maintenance guidelines, read University of Minnesota's *There is Maintenance to No Mow, Low Input Areas*
- Read Yale University and NRDC's collaborative paper *Toward Sustainable Landscapes: Restoring the Right NOT to Mow*, which describes potential legal obstacles to no mow landscapes