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**TO:** The Honorable Detroit City Council

**FROM:** David Whitaker, Director   
Legislative Policy Division Staff

**DATE:** October 28, 2024

**RE:** **SUSTAINABLE ROOF POLICY**

Council President Mary Sheffield has requested that the Legislative Policy Division (LPD) provide a report on a policy that would require the installation of solar panels and/or green roofs on certain new construction projects.

**BACKGROUND**

Green roofs, sometimes referred to as “vegetated roofs” or “eco-roofs,” can take a variety of forms, but they typically consist of the same basic layering components with a number of barriers to prevent water or root damage to the structure, a drainage layer to aid in water drainage, as well as a growing medium (soil) and a vegetative layer.<sup>1</sup> There are two types of green roofs: extensive and intensive. Extensive green roofs tend to be simpler with a thin layer of soil and hardy plants. They are cheaper to install, require less structural support, and require relatively little maintenance. Intensive roofs have a thicker layer of soil and contain landscaping

<sup>1</sup> <https://www.epa.gov/heatislands/using-green-roofs-reduce-heat-islands>

that often resembles a park or garden. These roofs require more up-front cost, structural support, and maintenance.

According to the US Environmental Protection Agency (EPA), green roofs provide all of the following benefits:

- *Reduced air pollution and greenhouse gas emissions:* By lowering air-conditioning demand, green roofs can decrease the associated air pollution and greenhouse gas (GHG) emissions from conventional power sources. Vegetation can also remove pollutants and GHGs from the air through dry deposition and carbon sequestration and storage, respectively.
- *Reduced energy use:* Green roofs remove heat from the air through the process of evapotranspiration, and also act as insulators for buildings, reducing the energy needed to provide cooling and heating.
- *Improved human health and comfort:* Green roofs, by reducing heat transfer through the building roof, can improve indoor comfort, and lower the incidence of heat stress associated with heat waves.
- *Improved quality of life:* Green roofs provide aesthetic value and habitat for plant and animal species. They improve human interaction with nature by introducing green space into the built environment. Such connections to nature have been shown to benefit human physical and mental health and productivity, and reduce blood pressure and hospital stays.
- *Enhanced stormwater management and water quality:* Green roofs can reduce and slow stormwater runoff in the urban environment, and also filter pollutants from rainfall. Green roofs can retain nearly all storm-related precipitation during the summer months, with lower retention during the winter months (< 20%). The actual stormwater management potential of green roofs is dependent on the season and rainfall patterns.<sup>2</sup>

Green roofs are particularly advantageous compared to other efforts to provide similar environmental benefits because they are often installed on unused or under-utilized space as opposed to setting aside and developing valuable real estate for greenspace.

Americans have used forms of green roofs dating back to some prairie homesteaders, and the US government has maintained green roofs on government buildings in Washington DC since the early 1930s that have not required replacement since their installation. Despite their utility, the implementation of green roofs was relatively uncommon in the latter part of the 20<sup>th</sup> century. However, in recent decades, many cities have utilized green roofs as a tool to combat

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<sup>2</sup> <https://www.epa.gov/heatislands/using-green-roofs-reduce-heat-islands>

climate change, reduce the strain on local water infrastructure, and improve the health of residents.

One major benefit that green roofs provide to cities is their ability to reduce the “heat island effect.” Heat islands typically occur in urban areas that are largely covered with buildings and man-made structures. These structures, often with typical dark roofs, will absorb more solar radiation than other areas that experience natural cooling from vegetation. Dark roofs can reach temperatures as high as 150°F in summer,<sup>3</sup> and highly developed areas may have annual mean air temperatures 1.8-5.4°F warmer than undeveloped surroundings.<sup>4</sup> The localized increases in temperature cause increased energy consumption, greater rates of heat-related illness and death, and increased air pollution.<sup>5</sup>

Green roofs absorb less sunlight from dark roofs, both by providing shade and through the process of evapotranspiration, which is “the movement of water from the soil both by evaporation and by transpiration,” thereby cooling the plant and the surrounding area.<sup>6</sup> Green roofs have been shown to have “surface temperatures approximately 30-40°F cooler than black surface temperatures in the summer,” and a “green roof program covering at least half the roof space in a city could result in citywide cooling throughout the day and during peak summer energy demand periods, particularly when combined with street tree planting and other large-scale greening efforts.”<sup>7</sup> Buildings with green roofs can consume 14% less energy annually, have indoor air temperatures 4°F cooler than buildings without green roofs, and reduce daily energy demand for air conditioning by an estimated 75%.<sup>8</sup> Green roofs can also reduce energy consumption during winter months by insulating structures and preventing heat loss.

Another major benefit of green roofs is stormwater management. During heavy rainfall, rain that falls onto paved or built-on surfaces quickly flows into storm sewers and out to a nearby body of water. This can cause various environmental problems, including damaging water quality by introducing urban pollutants into bodies of water, eroding riverbanks, and flooding. This is a particular issue for cities like Detroit, which has older water infrastructure that

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<sup>3</sup>[https://www.gsa.gov/system/files/The\\_Benefits\\_and\\_Challenges\\_of\\_Green\\_Roofs\\_on\\_Public\\_and\\_Commercial\\_Buildings.pdf](https://www.gsa.gov/system/files/The_Benefits_and_Challenges_of_Green_Roofs_on_Public_and_Commercial_Buildings.pdf) - pg. 3

<sup>4</sup> U.S. EPA, *What Is An Urban Heat Island*, <http://www.epa.gov/hiri/about/index.htm>.

<sup>5</sup>[https://www.gsa.gov/system/files/The\\_Benefits\\_and\\_Challenges\\_of\\_Green\\_Roofs\\_on\\_Public\\_and\\_Commercial\\_Buildings.pdf](https://www.gsa.gov/system/files/The_Benefits_and_Challenges_of_Green_Roofs_on_Public_and_Commercial_Buildings.pdf) - pg. iv

<sup>6</sup>[https://www.gsa.gov/system/files/The\\_Benefits\\_and\\_Challenges\\_of\\_Green\\_Roofs\\_on\\_Public\\_and\\_Commercial\\_Buildings.pdf](https://www.gsa.gov/system/files/The_Benefits_and_Challenges_of_Green_Roofs_on_Public_and_Commercial_Buildings.pdf)

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[https://www.gsa.gov/system/files/The\\_Benefits\\_and\\_Challenges\\_of\\_Green\\_Roofs\\_on\\_Public\\_and\\_Commercial\\_Buildings.pdf](https://www.gsa.gov/system/files/The_Benefits_and_Challenges_of_Green_Roofs_on_Public_and_Commercial_Buildings.pdf)

<sup>8</sup> Catherine Malina, *Up on the Roof: Implementing Local Government Policies to Promote and Achieve the Environmental, Social, and Economic Benefits of Green Roof Technology*, 23 *Geo. Int'l Env'tl. L. Rev.* 437, 444 (2011)

combines the storm drainage with the sanitary sewers carrying wastewater. In these systems, a large surge of stormwater can cause a combined sewer overflow (CSO) and lead to a discharge of untreated sewage into nearby rivers and lakes. These issues are only likely to intensify with severe weather events brought about by climate change.<sup>9</sup>

Effective stormwater management is essential in urban environments to mitigate runoff and reduce the strain on drainage systems. Living roofs play a significant role in this by reducing stormwater runoff from roof surfaces by up to 65%<sup>10</sup> and delaying water flow rates by as much as three hours, however this can vary. Estimates show during summer months living roofs can retain between 70-90% of the precipitation they receive, while in winter, they can retain between 25-40%.<sup>11</sup> In turn this can help decrease the total amount of runoff entering the system. By acting as natural filters, living roofs can also help remove pollutants from rainwater, improving overall water quality if and when it enters the sewer system.

A study of the District of Columbia by the US Environmental Protection Agency found that “installing 55 million square feet of green roofs in the CSO region would reduce CSO discharges by 435 million gallons or 19% each year.”<sup>12</sup> Another study found that “an extensive green roof can reduce runoff volumes by about 65%, and intensive green roofs by about 85%” as compared to dark roofs.<sup>13</sup>

## NEW YORK CITY

After San Francisco became the first US city to require that most new buildings install green roofs or solar panels on rooftops in 2017, other cities have begun to follow suit including New York City and Denver. New York City has consistently been among the cities with the highest carbon emissions on the planet,<sup>14</sup> and its buildings account for nearly 70% of its greenhouse gas emissions.<sup>15</sup> New York City has taken substantial steps to reduce its emissions, including the adoption of the Climate Mobilization Act (CMA) in 2019. The CMA is a package of laws that seek to reduce the City’s emissions 80% by 2050.

The CMA includes Local Laws 92 and 94 which created Sustainable Roof Zones requiring green roofs, solar panels, or both on new construction and major roof renovations on

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<sup>9</sup> Jeroen Mentens, Dirk Raes & Martin Hermy, *Green Roofs as a Tool for Solving the Rainwater Runoff Problem in the Urbanized 21<sup>st</sup> Century?* 77 *Landscape & Urb. Plan.* 217, 217 (2006).

<sup>10</sup> <https://www.gsa.gov/governmentwide-initiatives/federal-highperformance-green-buildings/resource-library/integrative-strategies/green-roofs>

<sup>11</sup> <https://greenroofs.org/about-green-roofs>

<sup>12</sup>

[https://www.gsa.gov/system/files/The\\_Benefits\\_and\\_Challenges\\_of\\_Green\\_Roofs\\_on\\_Public\\_and\\_Commercial\\_Buildings.pdf](https://www.gsa.gov/system/files/The_Benefits_and_Challenges_of_Green_Roofs_on_Public_and_Commercial_Buildings.pdf) - pg. 3

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[https://www.gsa.gov/system/files/The\\_Benefits\\_and\\_Challenges\\_of\\_Green\\_Roofs\\_on\\_Public\\_and\\_Commercial\\_Buildings.pdf](https://www.gsa.gov/system/files/The_Benefits_and_Challenges_of_Green_Roofs_on_Public_and_Commercial_Buildings.pdf) - pg. 19

<sup>14</sup> <https://earthobservatory.nasa.gov/images/144807/sizing-up-the-carbon-footprint-of-cities>

<sup>15</sup> [https://www.nyc.gov/assets/nycaccelerator/downloads/pdf/ClimateMobilizationAct\\_Brief.pdf](https://www.nyc.gov/assets/nycaccelerator/downloads/pdf/ClimateMobilizationAct_Brief.pdf)

existing buildings.<sup>16</sup> These laws apply to all buildings within the zone, both residential and commercial regardless of size so long as an exemption does not apply. New York City amended its building code to define “Sustainable Roof Zones,” and roof plans within the zones are subject to inspection by the NYC Department of Buildings prior to the issuance of occupancy certificates or recognition of project completion.

See below for a chart showing the path for compliance with Local Laws 92 and 94:<sup>17</sup>

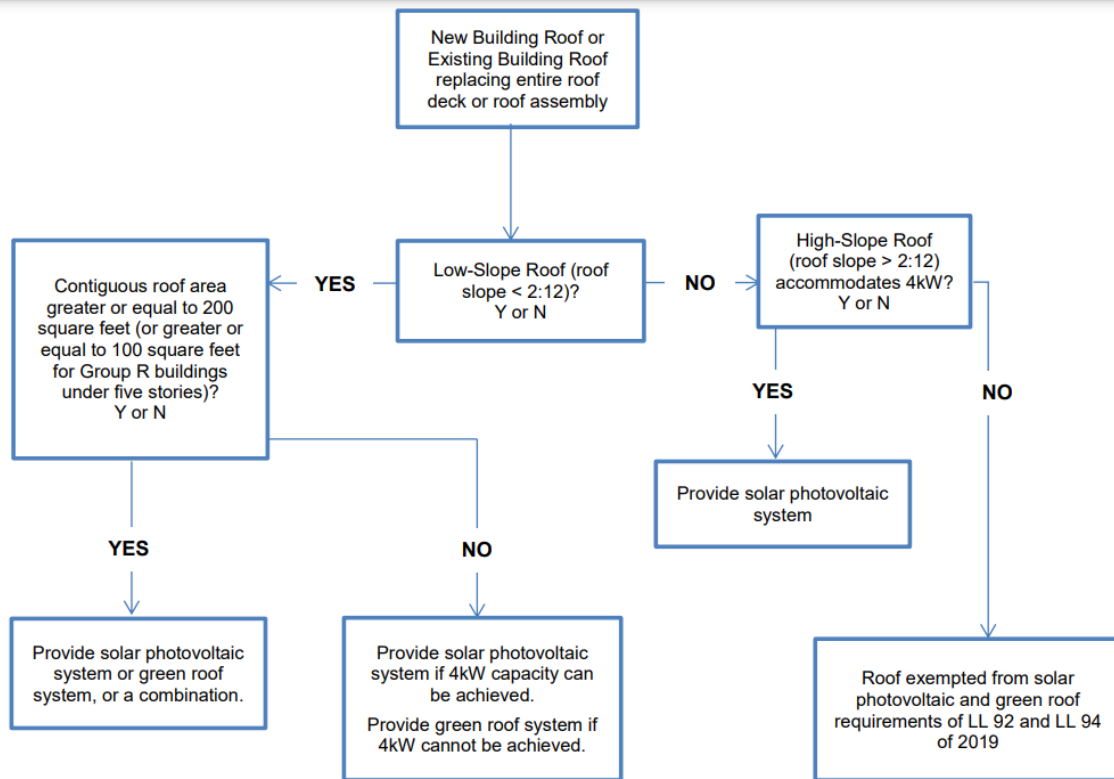


Figure 1. Compliance path for sustainable roofing zone pursuant to LL 92 and LL 94 of 2019.

Buildings covered by the mandate must have 100% of their available roof space as a sustainable roofing zone covered in a green roofing system and/or solar panels or wind turbines. Although green roofs are more economical in the long run because they tend to last much longer than conventional roofs and they reduce energy consumption, there are larger up-front costs for the installation and maintenance of green roofs. Because it takes years to break even on these investments, New York City provides incentives to property owners to help them comply with the requirements. These include a Green Roof Tax Abatement of \$15 per square foot, and grant

<sup>16</sup> NYC Local Law 92 - [https://www.nyc.gov/assets/buildings/local\\_laws/ll92of2019.pdf](https://www.nyc.gov/assets/buildings/local_laws/ll92of2019.pdf); NYC Local Law 94 - [https://www.nyc.gov/assets/buildings/local\\_laws/ll94of2019.pdf](https://www.nyc.gov/assets/buildings/local_laws/ll94of2019.pdf)

<sup>17</sup> [https://www.nyc.gov/assets/buildings/bldgs\\_bulletins/bb\\_2019-010.pdf](https://www.nyc.gov/assets/buildings/bldgs_bulletins/bb_2019-010.pdf)

funding through the Property Assessed Clean Energy (PACE) program and the Green Infrastructure Grant Program.<sup>18</sup>

For existing buildings that do not fall under the mandate, property owners initially received a one-year tax abatement of \$5.23/square foot for the installation of a green roof, and in certain high need areas, as much as \$15 per square foot. The city has made efforts to provide an abatement of \$15 per square foot for up to 200,000 square feet. To qualify, at least 50% of the roof must be covered with a vegetation layer.

### **ADOPTION BY OTHER NORTH AMERICAN CITIES**

Several North American cities have led the way with regard to green roof implementation.<sup>19</sup> Washington D.C. has the most square footage of green roofs in North America. The city has accomplished this in large part by installing green roofs on publicly owned buildings, as the U.S. General Services Administration (GSA) maintains nearly 2 million square feet of green roofs on government buildings.<sup>20</sup> The GSA requires that all newly constructed or substantially renovated federally owned buildings must obtain a LEED Gold certification. The city also encourages the implementation of green roofs through offering credits for stormwater management and providing discounts on stormwater fees.

Chicago has the most green roofs in North America and the second most square footage of green roofs. Chicago's Sustainable Development Policy requires that development projects earn a number of points by implementing a select variety of sustainable strategies.<sup>21</sup> It applies to new developments, TIF funded developments receiving over \$1 million, or multi-family housing projects over 5 units receiving specific financial assistance. Developments are required to reach 100 points, and the menu of strategies include the following categories: health, energy, stormwater, landscapes, green roofs, water, transportation, solid waste, work force and wildlife. The green roofs will earn a project 10 points if 50-100% of the building's net roof area is covered with vegetation, or 20 points if it covers 100% of the net roof area.

Chicago utilizes the Green Roof Improvement Fund to provide a 50% grant match up to \$100,000 for green roof improvements within its TIF district. The city may also waive consultant code fees for buildings that meet strict sustainability guidelines and may allow developers to build on extra floor area where they have green roofs that cover more than 50% of the net area of the roof.<sup>22</sup>

Toronto is also a leader in North America when it comes to the implementation of green roofs. New commercial, institutional and residential developments with a minimum gross floor

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<sup>18</sup> 23 No. 6 New York Zoning Law and Practice Report NL 1.

<sup>19</sup> See \_\_\_\_\_ below for an overview of various green roof policies.

<sup>20</sup> <https://www.gsa.gov/governmentwide-initiatives/federal-highperformance-green-buildings/resource-library/integrative-strategies/green-roofs>

<sup>21</sup> <https://www.chicago.gov/city/en/sites/sustainable-development-policy/home/handbook.html>

<sup>22</sup> <https://seconcityzoning.org/resources/Chicago-Zoning-Ordinance.pdf>

area of 2000 square meters are required to have green roofs with detailed construction standards. The coverage requirements for the green roof bylaw are graduated. Buildings with larger gross floor area are required to cover more from 20% at the low end to 60% at the high end. The bylaw allows for solar rooftops by defining Available Roof Space as excluding areas for renewable energy. Developers can provide cash-in-lieu for reduced green roof area, or to avoid implementing a green roof at a cost of \$200/meter squared. To date, less than 10% of new buildings have requested any payment of cash-in lieu. The funds from developers who opt out goes to fund the Ecoroof Grant Program, which provides grants to existing building owners of up to \$100/meter squared for green roof installations. To date, more than 6.5 million square feet of green roofs have been implemented in Toronto through this policy over the past thirteen years.

Denver's Green Buildings Ordinance (GBO)<sup>23</sup> aims to promote the development and increase of overall greenspace and stormwater management in the City of Denver. Passed in 2018 the ordinance applies both new buildings and existing buildings undergoing significant roof replacements to incorporate environmentally friendly features. The ordinance applies only to buildings 25,000 square feet or larger. This excludes certain exemptions like single-family homes and townhouses. The GBO offers property owners various compliance options including:

- **Green Space:** Living roofs must cover at least 10% of the building's gross floor area or 60% of the total roof area with green space.
- **On-site Solar Panels:** Developers may install solar panels if they cover at least 70% of the total roof area or enough to provide 100% of the building's estimated annual electricity usage. Other renewable energy devices can be substituted if they meet a similar generation capacity.
- **Off-site Renewable Energy Purchase:** Developers may enter a minimum 5-year contract to purchase renewable energy equivalent to 100% of the building's estimated electricity use or demonstrate a 6% decrease in energy consumption beyond Denver Building Code requirements.
- **All-electric Property and Reduced Energy Consumption:** Developers may construct an all-electric property and achieve a 12% reduction in energy consumption beyond Denver Building Code requirements.
- **Building Certification:** Achieve LEED Gold, Enterprise Green Communities, or equivalent certification.
- **Green Space and Renewable Energy Combination:** Green space and renewable energy may be combined onsite.

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<sup>23</sup> <https://www.denvergov.org/files/assets/public/v/1/community-planning-and-development/documents/ds/gbo/green-buildings-ordinance.pdf>

- **Green Space and Off-site Renewable Energy Combination:** Combine a reduced green space requirement with an off-site renewable energy purchase and demonstrate a 2.5% decrease in energy consumption beyond Denver Building Code requirements.
- **Green Space and Decreased Energy Consumption:** Combine a reduced green space requirement with an all-electric property and a 5% decrease in energy consumption beyond Denver Building Code requirements.

San Francisco’s Better Roof Requirements (BRR)<sup>24</sup> ordinance amends San Francisco’s Planning Code and Green Building Code. Passed in 2017 the BRR aims to promote the development of renewable energy and living roofs on new constructions. The ordinance allows developers to use living roofs to meet some or all of the requirements for solar-ready zones on rooftops where 15% of the roof space on most new construction must have an area dedicated to solar. Due to the implementation of the BRR, developers may choose between living roofs, solar energy systems, or a combination of the two to be in compliance. The BRR applies to most new residential and non-residential buildings that meet the following criteria:

- The building is classified as a "Large Development Project" or "Small Development Project" under San Francisco’s Stormwater Management Ordinance
- The building has a gross floor area of at minimum 2,000 square feet
- The building has 10 or fewer occupied floors
- Applications for site permits or building permits have been submitted on or after January 1, 2017

The table below provides an overview of the various green roof policies adopted by other cities:<sup>25</sup>

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<sup>24</sup><https://sfbos.org/sites/default/files/o0221-16.pdf>

<sup>25</sup> Green Roof and Wall Policy in North America: Regulations, Incentives, and Approaches 2023, pg. 35-36 - <https://static1.squarespace.com/static/58e3eecf2994ca997dd56381/t/65484bf81e7bb17aaa3e4563/1699236880900/Green+Roof+and+Wall+Policy+Guide+2023.pdf>



Location	Mandate or Regulation	Incentives						Policy Name
		Tax Credit	Funding (Grant, Rebate, or Subsidy)	Stormwater Fee Credit	Density or Floor Area Ration Bonus	Residential Stewardship Program	Other	
Austin, Texas					X			2014 - Downtown Density Bonus Program
Bellingham, Washington				X				2017 - Vegetated Roof Incentive
Cambridge, Massachusetts							Fees in lieu of greenspace on appropriate buildings	2021 - Green Roof Ordinance
Chicago, Illinois	X		Subsidy (of permit and consultant code fees)		X		Accelerated permit process	2014 - Green Permit Program 2015 - Floor area Bonus 2015 - Green Roofs Incentives 2017 - Sustainable Development Policy
Covington, Washington					X			2022 - Green Building Incentives
Denver, Colorado	X						Minimum roof pitch requirement waived	2017 - Green Building Ordinance 2023 - Green Roof Incentive
Devens, Massachusetts	X							2012 - Policy for Construction of Vegetated Roofs 2012 - Industrial Performance Standards and General Regulations: Greenhouse Gas Mitigation (974CMR 4.11 2.(c)) 2013 - Viewshed Overlay District Vegetated Rooftops and Vegetated Walls Requirement (974CMR 3.04(B) (j)5)
Ellensburg, Washington					X			2013 - Density Bonus Incentives
Fife, Washington	X						Green Factor?	2009 - Green Factor
Hoboken, New Jersey					X		Fees if stormwater performance measures are not met	2018 - Green Infrastructure Bonus Standards for Impervious Coverage
Kirkland, Washington				X??			Accelerated permit process	2013 - Priority Permit Review
Marion County, Indiana				X				2016 - Stormwater Credit
Milwaukee, Wisconsin			Grant					2019 - Green Infrastructure Partnership
Minneapolis, Minnesota				X				2017 - Stormwater Utility Fee Credit
Nashville???								MISSING LINKS apparently

Location	Mandate or Regulation	Incentives						Policy Name
		Tax Credit	Funding (Grant, Rebate, or Subsidy)	Stormwater Fee Credit	Density or Floor Area Ration Bonus	Residential Stewardship Program	Other	
New York (State)		X						2008, revised 2013, 2019 - Green Roof Property Tax Abatement Program
New York City, New York	X	X	Grant			??see green roof information		2011 - Green Infrastructure Grant Program 2019 - Green Roofs for New Construction 2019 - Green Roof Information 2019 - Green Roofs on Smaller Buildings 2022 - The Clean Water, Clean Air, and Green Jobs Environmental Bond Act of 2022
Northeast Ohio Regional Sewer District				X				Revised 2016 - Impervious Area Reduction Credit
Onondaga County, New York			Grant					2018 - Green Improvement Fund
Palo Alto, California			Rebate					2017 - Stormwater Measures Rebate Program *GREEN ROOF REBATES ON HOLD
Philadelphia, Pennsylvania		X	Grant	!!! need year	X			2007, revised 2016 - Green Roof Tax Credit 2018 - Stormwater Grants 2021 - Philadelphia Home Rule Charter ss.14-702(16)
Portland, Maine				X				2015, latest update 2021 - Stormwater Credit Manual
Portland, Oregon	X					X		2018 - EcoRoof Requirement
Prince George County, Maryland								2013 - Rain Check Rebate Program
Redmond, Washington					X			2011 - Green Building and Green Infrastructure Incentive Program
Saint Laurent, Quebec	X							2016 - Règlement sur le zonage no RCA08-08-001
San Francisco, California	X						Green Factor?	2017 - Better Roofs Ordinance 2019 - Central SOMA Plan Living Roof and Solar Requirement
Seattle, Washington	X		Grant and Rebate	?	X	X	GF?	2007 - Green Factor 2022 (as amended) - Land Use Code
Shoreline, Washington							Waiving of application and pre-application fees, reduced Transportation impact fees, Departures from Development Code allowed, accelerated permit process	2022 - Deep Green Incentive Program
Toronto, Ontario	X		Grant					2009, amended 2011 - Green Roof Bylaw 2016 - Eco-roof Incentive Program
Washington, DC	X		Rebate	X				2007, revised 2016 - Riversmart Green Roof Rebate Program 2013 - Stormwater Retention Credit Training Program 2017 - Green Area Ratio

## POLICY APPROACHES

There are three main ways that local governments approach green roof policies:

1. Pilot projects to test feasibility and cost-effectiveness;
2. Financial incentives to stimulate the market and mitigate the cost of implementation; and
3. Mandates that require the installation of solar panels and/or green roofs

The following are common implementation tools to encourage or require green roof installation:<sup>26</sup>

- Grant Funding – up-front funding to cover initial costs for installation of green roofs and solar panels. Typically \$7.50 to \$15 per square foot and may be capped depending on the size of the project. Also may provide funding for initial loading assessments for existing buildings.
- Rebates or subsidies to aid with initial costs.
- Mandates – green roofs or solar required under specific circumstances and must meet specific standards, typically for stormwater management and/or green space requirements.
- Residential Stewardship Programs – Financial incentives and technical support to inspire property owners to volunteer to install and/or maintain green infrastructure and stormwater management techniques.
- Stormwater Fee Credit – Provide property owners with credit on their annual stormwater fee due to the reduction in stormwater runoff provided by the green roof.
- Tax Credits/Abatements – Deductions from taxes (credit) or reduction of taxes (abatement) for the construction of a green roof. Amount calculated as a percentage of the cost of construction, or as a dollar amount per square foot of green roof constructed up to a certain limit.
- Green area factor - The regulatory authority assigns different targets for green space across the city. When a major development or retrofit occurs, the owner must meet the targeted green space requirement, using different types of green infrastructure, each of which has a different benefit value assigned to it. This approach provides flexibility and steadily increases the overall green space in the city. For example; if a building with a 5,000 square foot footprint is in an area with a green factor target of 8, then they must

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<sup>26</sup> Green Roofs for Healthy Cities, Green Roof and Wall Policy Guide 2023, pg. 23-24.

design the green infrastructure on and around the building to achieve (0.8 x 5,000sf) 4,000 square feet of coverage. If a green wall is constructed that is 1,000 square feet and its benefit value is 0.7, this results in 700 square feet (1000 x -0.7). With the addition of an intensive green roof that is 4,000 square feet with a benefit value of 0.9 this would yield an additional 3,600 square feet (4,000 sf x 0.9). Together the green roof and wall total 4,300 square feet, which exceeds the green factor target for that area. In addition to green roofs and green walls, trees, planters and porous pavement are also included as options to meet the green area factor targets.

- Procurement - New and or existing government facilities, or the facilities of government funded agencies, boards and commissions are required to install green roofs during new construction and/or when re-roofing occurs, if structural support is sufficient.

### **PERCEIVED BARRIERS**

The largest perceived barrier to implementing a green roof policy is the initial cost of installation. Green roof installation is roughly twice the price of a conventional roof, although the price per foot decreases as the size of the roof increases.<sup>27</sup> However, green roofs have a much longer lifespan and will not have to be replaced nearly as often. In addition to the substantial savings from the longevity of green roofs, the energy savings are significant and the General Services Department states that green roofs provide payback in terms of savings in an average of 6.2 years.<sup>28</sup> The savings may also be greater where property owners can receive a reduction of stormwater fees based on the stormwater retention provided by the green roof.

In addition to installation costs, property owners may also be concerned about the cost of the maintenance requirements for green roofs. Outside of buildings that incorporate a more extensive landscape design, maintenance costs are relatively modest and anticipatable. The GSD states that after the initial establishment period, the typical labor requirement is 4-person hours per 1,000 square feet per year and will likely require 2 visits per year.<sup>29</sup>

Another perceived barrier to implementation is that there may be a lack of local expertise and the need to adopt or develop construction standards for green roofs. Organizations such as Green Roofs for Health Cities<sup>30</sup> provide a wealth of information to aid municipalities in implementing green roof incentives and requirements. Additionally, there is now a plethora of

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<sup>27</sup> General Services Administration, The Benefits and Challenges of Green Roofs on Public and Commercial Buildings, May 2011 - [file:///C:/Users/kellerp/Downloads/The\\_Benefits\\_and\\_Challenges\\_of\\_Green\\_Roofs\\_on\\_Public\\_and\\_Commercial\\_Buildings.pdf](file:///C:/Users/kellerp/Downloads/The_Benefits_and_Challenges_of_Green_Roofs_on_Public_and_Commercial_Buildings.pdf)

<sup>28</sup> <https://www.gsa.gov/governmentwide-initiatives/federal-highperformance-green-buildings/resource-library/integrative-strategies/green-roofs>

<sup>29</sup> General Services Administration, The Benefits and Challenges of Green Roofs on Public and Commercial Buildings, pg. 69-70.

<sup>30</sup> <https://greenroofs.org/>

cities that have adopted building codes that incorporate green roofs, which can be adapted to suit local needs.

## PRACTICES FOR IMPLEMENTATION

Because there is likely to be resistance from developers for any requirements that create additional construction costs, municipalities seeking to require green roofs must be able to articulate and demonstrate that the benefit of green roofs outweigh the cost. Likelihood of success for a green roof policy is dramatically improved if defensible financial analysis is at the forefront of the effort.

First, municipalities must address fears about upfront costs and provide examples of successful implementation as discussed above. Additionally, the city should complete a cost-benefit analysis up front. See the following examples:

- San Francisco Living Roof Cost-Benefit Study<sup>31</sup>
  - \$15-100 million in tax revenues as a result of improved property and biophilic value.
  - Between 60,000 and 385,000 tons of carbon emissions avoided or sequestered over 15 years. This is the equivalent of sequestration from 3,600-24,000 acres of forest, the energy used by 400-2700 homes, or taking 800-5400 cars off the road.
  
- Denver Cost Benefit Report<sup>32</sup>
  - Creation of 25,000 jobs.
  - Over \$200 million in energy savings.
  - Nearly \$100 million in real estate benefits.
  
- Toronto Cost Benefit Analysis of the Green Roof By-Law and Economic Roof Incentive Program between 2009 and 2018<sup>33</sup>
  - 222 million litres of stormwater retained annually
  - 225 tons of carbon sequestered annually
  - 3.2 million kWh of annual electricity savings for buildings with green roofs.
  - 1.6 million kWh of annual electricity savings for surrounding buildings due to a reduction in the urban heat island effect.
  - 1,618 FTE jobs in construction.

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<sup>31</sup> San Francisco Living Roof Cost-Benefit Study, ARUP, 2016 - [https://static1.squarespace.com/static/5feb6d2cab06677bba637eba/t/60d0cddd1355a0273c3786ce/1624296936456/greenroofs\\_lam\\_2018winter.pdf](https://static1.squarespace.com/static/5feb6d2cab06677bba637eba/t/60d0cddd1355a0273c3786ce/1624296936456/greenroofs_lam_2018winter.pdf)

<sup>32</sup> Denver Cost Benefit Report, Green Roofs for Healthy Cities, 2017 - [https://static1.squarespace.com/static/5feb6d2cab06677bba637eba/t/60d0cddd1355a0273c3786ce/1624296936456/greenroofs\\_lam\\_2018winter.pdf](https://static1.squarespace.com/static/5feb6d2cab06677bba637eba/t/60d0cddd1355a0273c3786ce/1624296936456/greenroofs_lam_2018winter.pdf)

<sup>33</sup> Green Roofs for Healthy Cities, Green Roof and Wall Policy Guide 2023, pg. 6

- 25 FTE jobs annually in maintenance.

According to a report from the Director of Current Planning for San Francisco in 2018, incentives are more useful when encouraging emerging markets before there are examples of successful implementation.<sup>34</sup> After the model is proven to be successful, mandates establish the markets by providing a more predictable demand that professionals and developers can scale up to. The predictability will result in “more rapid local job growth, and a dramatic drop in the cost of delivery over the shortest period of time.”<sup>35</sup> Mandates streamline the process, making them simpler and cheaper to administer. Also, mandates requiring green roofs at a city-scale provide substantial benefits compared to the benefits quantified at a project level.

When providing the option to comply by either installing a green roof or solar panels, incentives and regulations should aim to make the cost relatively equal where a combination of both is the goal. If there are specific areas that require more stormwater retention and/or greenspace, then incentives could be structured to encourage green roofs over solar. To ensure maximum compliance, incentives must be at least roughly equal to the cost of implementation. Also, if the regulations provide a method to buy out of the green roof requirement as many jurisdictions allow for the sake of flexibility, the cost of the buyout must be equal to or greater than the cost of compliance with the mandate.<sup>36</sup>

## FUNDING SOURCES

There is a variety of funding sources that may aid the implementation of a green roof policy, including:

- EPA Clean Water Act Nonpoint Source Grant (Section 319 Grants)<sup>37</sup>
- EPA Clean Water State Revolving Fund (CWSRF)<sup>38</sup>
- Department of Energy (DOE) Weatherization and Intergovernmental Program<sup>39</sup>
- DOE Energy Efficiency Savings
- Department of Housing and Urban Development (HUD) Community Development Block Grant (CDBG) Program<sup>40</sup>
- HUD Section 108 Loan Guarantee Program<sup>41</sup>

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<sup>34</sup> Living Architecture Monitor, Volume 20, Issue 4, Winter 2018, pg. 9-11 - [https://static1.squarespace.com/static/5feb6d2cab06677bba637eba/t/60d0cddd1355a0273c3786ce/1624296936456/greenroofs\\_lam\\_2018winter.pdf](https://static1.squarespace.com/static/5feb6d2cab06677bba637eba/t/60d0cddd1355a0273c3786ce/1624296936456/greenroofs_lam_2018winter.pdf)

<sup>35</sup> Green Roofs for Healthy Cities, Green Roof and Wall Policy Guide 2023, pg. 11

<sup>36</sup> Green Roofs for Healthy Cities, Green Roof and Wall Policy Guide 2023, pg. 30

<sup>37</sup> <https://www.epa.gov/nps/319-grant-program-states-and-territories>

<sup>38</sup> [https://19january2017snapshot.epa.gov/cwsrf\\_.html](https://19january2017snapshot.epa.gov/cwsrf_.html)

<sup>39</sup> <https://www.energy.gov/scep/office-state-and-community-energy-programs>

<sup>40</sup> [https://www.hud.gov/program\\_offices/comm\\_planning/communitydevelopment](https://www.hud.gov/program_offices/comm_planning/communitydevelopment)

<sup>41</sup> [https://www.hud.gov/program\\_offices/comm\\_planning/communitydevelopment](https://www.hud.gov/program_offices/comm_planning/communitydevelopment)

- HUD Sustainable Communities Regional Planning Grants<sup>42</sup>

Additionally, the City could seek funding under Michigan's Property Assessed Clean Energy Act.<sup>43</sup> Commercial Property Assessed Clean Energy (C-PACE) financing was used to install a green roof on the Letts Industries Building in Detroit, which was the first use of C-PACE funding for a green roof in Michigan.<sup>44</sup>

Please contact our office if you require any further assistance.

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[https://www.hud.gov/program\\_offices/economic\\_development/sustainable\\_communities\\_regional\\_planning\\_grants](https://www.hud.gov/program_offices/economic_development/sustainable_communities_regional_planning_grants)

<sup>43</sup> MCL 460.391 *et seq.*

<sup>44</sup> [https://info.counterpointesre.com/hubfs/CaseStudies/CSRE/CSRE\\_CASESTUDY\\_Letts.pdf](https://info.counterpointesre.com/hubfs/CaseStudies/CSRE/CSRE_CASESTUDY_Letts.pdf)