



CITY OF CAMBRIDGE

Community Development Department

To: Planning Board
From: Community Development Department (CDD) Staff
Date: February 2, 2021
Re: **Green Roofs Zoning Petition (Oliver, et al.)**

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Overview

Petitioner: Amy Oliver, et al. (group of at least 10 registered Cambridge voters)

Zoning Section: Article 2.000 Definitions and Section 22.30 Green Roofs

Amendment Summary: Add new definitions for “Green Roof,” “Functional Green Roof,” and “Biosolar Roof” to Article 2.000; require new construction and significant rehabilitation of buildings with 20,000+ square feet to install green roof systems; set standards for green roof systems, including option to pay into a Green Roofs Fund if the standards cannot be met.

Planning Board Action: Recommendation to City Council

Memo Contents: Background information on Cambridge’s existing zoning for green roofs; green roof policies in other cities; current planning for green roofs and climate change in Cambridge; and comments on proposed amendment.

Background on Green Roofs

According to the Massachusetts Department of Environmental Protection, “A ‘green roof’ is a permanent rooftop planting system containing live plants in a lightweight engineered soil medium. These systems are designed to retain and detain precipitation where the water is taken up by plants and transpired into the air. As a result, much less water runs off the roof compared to conventional rooftops.” Green roofs can be used in combination with “cool roofs,” roofs with a high solar reflectance index surface, and with photovoltaic panels. Green roofs are also sometimes combined with “blue roofs,” which are rooftop stormwater detention systems.

Green roof systems not only help with stormwater management, but they also promote the reduction of ambient air temperature, air pollution, and building energy costs, the latter of which can help reduce both peak and total energy demand. Green roofs can also create wildlife habitat for birds and insects and increase the longevity of roof membranes. According to the U.S. Environmental Protection Agency, “They are particularly cost-effective in dense urban areas where land values are high and on large industrial or office buildings where stormwater management costs are likely to be high.”

Cambridge Zoning for Green Roofs

In 2010, the City Council first adopted zoning for green roofs ([Section 22.30 of the Zoning Ordinance](#)) based on the recommendations of a task force formed to study zoning standards that would encourage sustainable development practices. The goal of this zoning was to remove impediments to the construction of green roofs and ensure that these roofs performed an environmental function, as opposed to roof decks or gardens that would be primarily for recreation.

To this end, the zoning established a definition for Functional Green Roof Area in Section 22.32 to set standards for how the City defines a green roof. According to the Zoning Ordinance, “Functional Green Roof Area shall be defined as area atop a roof surface on a building, open to the sky and air, which is surfaced with soil and living plant materials for the purpose of retaining rainwater and absorbing heat from sunlight. The depth of soil and planted material shall be at least two (2) inches to be considered Functional Green Roof Area. For the purposes of maintaining the plant material, Functional Green Roof Area may be accessible by means of a roof entrance.”

The zoning exempts Functional Green Roof Area from Gross Floor Area (GFA) calculations. Without this clarity, Functional Green Roof Area might be counted as GFA in the same manner as “unroofed porches and balconies above the third floor.” Section 22.33.1 exempts spaces meeting the definition of Functional Green Roof Area as-of-right only if they are accessible for maintenance purposes. Section 22.33.2 exempts spaces meeting the definition of Functional Green Roof Area through a Planning Board special permit if they are intended to be accessed for use by occupants of the building or others. The purpose of the special permit review process was to ensure that the green roof was designed to be functional, even if it was also to be used by people and would not evolve into a recreational space without the environmental function. A small amount of usable deck space (up to 15% of the total Functional Green Roof Area) may also be exempt from GFA limits but requires a special permit in lower-scale residential districts. Otherwise, usable deck space counts as GFA if it is at the third story of a building or above.

It’s difficult to determine exactly how many functional green roofs have been built in Cambridge as-of-right but based on consultation with Inspectional Services Department (ISD) staff, they seem to be rare despite the allowances in zoning. There tends to be more interest in developing “roof gardens,” for recreational use, which might have some amount of planting but not enough to meet the functional standards in zoning. Larger developments in Kendall Square and Alewife often provide greenery adjacent to amenity spaces for tenants or residents. Even if they do not meet the definition of Functional Green Roof Area, if they are below the third floor, they do not count as GFA.

To date, there are only two projects that have been granted a special permit for functional and usable green roofs. One is 350 Third Street (PB-275), otherwise known as the Watermark Building, which received approval to construct a 2,300-square-foot green roof comprised mostly of structural lawn, with some hardscape. The other project is 950 Massachusetts Avenue (PB-298), which received approval to construct a 1,232-square-foot green roof comprised mostly of drought-tolerant grasses, with two pre-existing concrete decks remaining. In both cases, the special permits were for the conversion of existing paved area to Functional Green Roof Area in residential buildings.

The most extensive green roof installations tend to be found mostly on institutional buildings. For example, Harvard University's graduate residences, Information Systems and Division of Engineering and Applied Sciences building, and Smith Center all have different types of green roofs, and Massachusetts Institute of Technology's Sloan School of Management also has a green roof.

Green Roofs in Other Cities

Much like Cambridge, many cities have recognized the multiple benefits of green roofs by incentivizing or mandating green roofs using density bonuses, expedited permitting, zoning or building code requirements, funding programs, tax credits and rebates, and stormwater fee credits, among other policy tools.

In 2017, San Francisco became the first U.S. city to mandate solar and green roofs. The zoning is applicable to non-residential new construction with a gross floor area of 2,000 square feet or more and residential new construction with 10 or fewer occupied floors. These standards require that 15% of the roof space is solar, or 30% of the roof space is a Living Roof (i.e. green or vegetated roof) or combination of the two.

- See "Zoning Administrator Bulletin: Better Roofs Ordinance":
https://default.sfplanning.org/publications_reports/ZAB_11_Better%20Roofs_051517.pdf.

Taking a different approach to mandating green roofs, in 2019, New York City amended its building code to require new buildings, new roofs resulting from the enlargement of existing buildings, and existing buildings replacing an entire existing roof deck or roof assembly to be provided with a "sustainable roofing zone." Like with San Francisco's regulation, this zone can consist of a solar photovoltaic electricity generating system, a green roof system, or a combination of the two. Unlike San Francisco, New York City requires that all of the roof space is sustainable, but with exceptions for areas occupied by structures, recreational space, stormwater systems, sloped roofs, and other areas deemed "unfavorable" by the Building Department for solar or green roofs.

- See "Buildings Bulletin 2019-010":
https://www1.nyc.gov/assets/buildings/bldgs_bulletins/bb_2019-010.pdf.

It is worth noting that other cities' approaches to incentivizing and requiring green roofs is fluid, with many revising their initial requirements after a few years. For example, Denver passed a green roof ordinance in 2017 that required new and existing buildings over 25,000 square feet to install a green roof either as the building was constructed or when the roof was replaced (for existing buildings). However, implementation of the ordinance revealed several limitations, including legal challenges surrounding rainwater retention, the inability of many existing buildings to support the weight of a green roof, and high construction costs. In response, the city passed a new ordinance in 2018 at the recommendation of a green roofs review task force that includes more flexible, cost-effective options. Portland has also revised its Green Building Policy three times since it was first adopted in 2001.

Current Planning for Green Roofs in Cambridge

Through several initiatives, the City is working to adapt to and manage the impacts from climate change. The basis for this work is the Climate Change Vulnerability Assessment (CCVA), a technical study released in 2017 that analyzed Cambridge's physical and social vulnerabilities to increasing temperatures and extreme heat, more intense storms leading to street and riverine flooding, and storm surge flooding associated with sea level rise. The Climate Change Preparedness and Resilience (CCPR) Plan, which is scheduled to be released later this year, promotes green roofs as a way to cool buildings and decrease ambient air temperatures through evapotranspiration, as well as to improve stormwater quality and retain water during peak rain events. The City is also committed to achieving carbon neutrality by 2050, with a focus on reducing greenhouse gas emissions from building operations.

The Climate Resilience Zoning Task Force (CRZTF) has also been discussing zoning approaches to advance resilience objectives. Formed at the beginning of 2019, the CRZTF includes 20 members that represent different stakeholders including residents, institutional representatives, affordable housing providers, real estate developers, and subject matter experts. Over the course of the past two years, the Task Force has been guided by City staff and consultants to make recommendations to amend the Zoning Ordinance to address the climate change impacts identified in the CCVA, notably anticipated flooding due to sea level rise, storm surge, and precipitation, and anticipated rise in temperatures exacerbated by the urban heat island effect. For more information on the CRZTF, see the project webpage: <https://www.cambridgema.gov/CDD/Projects/Zoning/climateresiliencezoning>.

The CRZTF is currently considering a draft set of recommendations that include removing existing regulatory barriers to achieving flood resilience and heat resilience and incorporating new resilience standards for development into zoning. Green roofs and other forms of green infrastructure are key tools to mitigating both flooding and heat. Some of the draft recommendations related to green roofs include:

- Increase the minimum soil depth to four inches (currently two inches);
- Exclude Functional Green Roof Area from Gross Floor Area calculations in all cases, without requiring a special permit;
- Exempt Functional Green Roof Area from height limits; and
- Exempt headhouses used to access usable roof space from height limitations, with limitations.

One of the most discussed recommendations is a performance-based standard called the Cool Factor. Similar to performance metrics such as Seattle's Green Factor and Somerville's Green Score, the Cool Factor provides a menu of strategies, each with a different point value based on how well research shows that they mitigate heat island impact and promote cooling. Applicants achieve a Cool Factor Score based on the combination of approaches employed on the site, including (in decreasing priority) preservation of mature trees, planting of new trees (with larger trees weighted higher than smaller trees), green roofs and ground level plantings (at three levels of intensity), shade structures, and high-solar reflectivity paving. This science-based approach has driven all of the Task Force recommendations and is especially apparent in the Cool Factor scoring. Green roofs are an important contributor to the overall Cool Factor Score, particularly for smaller or mid-size development on more constrained lots with fewer opportunities for tree planting.

Many Task Force members have expressed support for a performance-based metric like the Cool Factor, as opposed to prescriptive standards, because it allows options for property owners and project designers to meet the standard in different ways, taking into account the unique circumstances of each site. Use the following link to access the November 2020 version of the Cool Factor score sheet:

<https://www.cambridgema.gov/~media/Files/CDD/ZoningDevel/OtherProjects/resiliencetaskforce/20201116coolfactorscoresheet.pdf>.

The Department of Public Works (DPW) encourages the use of green roofs as one of its Best Management Practices (BMPs) to meet stormwater quality and quantity requirements. DPW also issued an Alewife Guidance Document when the Quadrangle and Triangle areas were rezoned in 2006 that encourages the use of green roofs given the poor soil conditions and high ground water in the area which precludes infiltration.

Proposed Zoning

The proposed zoning amendment would require new construction and “significant rehabs” of buildings with 20,000 square feet or more to install green roof systems. These systems could be vegetative or a combination of vegetative and solar, referred to as “BioSolar.” The petition stipulates that the green roof system must cover 100% of the roof, though it does make exceptions for “appropriate vegetated free zones and roof gravel,” parking, and some mechanical equipment. If this standard cannot be met, the petition proposes that a payment must be made to a city-controlled “Green Roofs fund” that would be used to provide grants to property owners for the creation of green roofs on existing buildings. To support this standard, the petition proposes adding definitions for “Green Roof,” “Functional Green Roof,” and “BioSolar Roof” to Article 2.000 Definitions.

Considerations

The City has for many years identified green roofs as playing an important role in addressing climate and environmental quality, along with other environmental strategies. This zoning petition, if adopted, would reflect a significant shift in the City’s approach to regulating green roofs. Notably, it would essentially change what is currently a zoning incentive into a zoning requirement. This could raise legal issues which should be addressed with the Law Department. The following are a few other key considerations for the Planning Board in its review of this petition.

- **Practicality and Flexibility.** Green roofs have numerous benefits, but they are also not practical in all situations and will not substantially address heat and flooding by themselves. This is one of the reasons why the Climate Resilience Zoning Task Force has promoted the Cool Factor, which allows developers to choose from a range of strategies that best suit their project while still promoting cooling. A prescriptive green roof requirement and a performance-based requirement like the Cool Factor can co-exist, but they might interfere with each other in a way that makes both less effective. The Planning Board may also want to consider how a prescriptive requirement like the one proposed by the petition would interact with building code requirements, which also affect the design of rooftops and roof-level installations on a building. Generally, the City has used performance requirements such as LEED to allow enough flexibility to meet the requirements in ways that would not result in conflict with the building code.

- **Threshold.** Another consideration is whether the current petition sets an appropriate threshold for which development projects would be required to install a green roof. In current zoning, 25,000 square feet is the standard threshold for Green Building Projects that are subject to administrative review under Section 22.20 of the Zoning Ordinance (see https://library.municode.com/ma/cambridge/codes/zoning_ordinance?nodeId=ZONING_ORDINANCE_ART22.000SUDEDE_22.20GRBURE) as well as the Building and Site Plan Requirements in Section 19.50 of the Zoning Ordinance (see https://library.municode.com/ma/cambridge/codes/zoning_ordinance?nodeId=ZONING_ORDINANCE_ART19.000PRRE_19.50BUSIPLRE). Setting a slightly different threshold for one standard could be difficult to administer and result in an uneven application of environmental standards.
- **Compliance Process.** The petition takes a subtractive approach to structuring the requirement, as opposed to an additive approach. Like New York City’s green roof requirement, the petition proposes requiring green roofs over every part of a rooftop with exceptions for specific circumstances. This would be a departure from current zoning approaches, which tend to set reasonable minimum dimensions (e.g., width, area) that take into account other competing needs for space. The petition also allows exemptions that do not provide similar climate benefits to green roofs, such as rooftop parking. If the petition’s approach is legally permissible the Board could consider which approach will promote green roofs without making the zoning challenging to administer for staff or unintentionally creating barriers that would require applicants to seek zoning relief from the BZA.
- **Fund Contributions.** There are currently a few provisions in the Zoning Ordinance that require payments into discrete funds, including the following:
 - Bicycle Parking (Section 6.100):
https://library.municode.com/ma/cambridge/codes/zoning_ordinance?nodeId=ZONING_ORDINANCE_ART6.000OFSTPALORENICULACOTHTR_6.100BIPA;
 - Incentive Project Housing Contributions (Section 11.202):
https://library.municode.com/ma/cambridge/codes/zoning_ordinance?nodeId=ZONING_ORDINANCE_ART11.000SPRE_11.200INZOHNO;
 - Central Square Improvement Fund (Section 20.300):
https://library.municode.com/ma/cambridge/codes/zoning_ordinance?nodeId=ZONING_ORDINANCE_ART20.000OVDI_20.300CESQOVDI).

In each of these cases, there is a clear way to determine when the funds are required and to calculate the funding amount, as well as a direct way for the City to apply those funds for a stated purpose. The current petition is vague in those areas, which may result in confusion over how payments would be calculated, what constitutes meeting or failing to meet the proposed requirements, and how the funds would be spent. A way for applicants to “opt out” of the requirement might not serve the goals of the petition if it does not result in a clear public benefit. Finally, in order to enact this provision requiring a fund contribution it would need to be determined that such a contribution and proposed use of the fund is legally permissible.

Lastly, if the Planning Board recommends adoption of this zoning petition, staff would suggest that the Board direct City staff to conduct a careful review of the language and recommend any revisions to make it more consistent with language otherwise used in the Zoning Ordinance.