GREEN AND COOL SOMERVILLE:

A Design Guide for Expanding Somerville's Tree Canopy in Constrained Spaces

UEP FIELD PROJECTS, SPRING 2026

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Green & Cool Somerville: Sustainable Sidewalks and Trees

A Design Guide for Expanding Somerville's Tree Canopy in Constrained Spaces

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Project Partners: City of Somerville, MA: Vanessa Boukili - Public Space and Urban Forestry, Elyse Belarge - Office of Sustainability and Environment, and Brian Postlewaite - Engineering Division

Acknowledgements

We would like to thank our Field Project partners from the City of Somerville; Vanessa Boukili from the Division of Public Space and Urban Forestry (PSUF) within the Mayor's Office of Strategic Planning and Community Development, Elyse Belarge from the Office of Sustainability and Environment, and Brian C. Postlewaite from the Engineering Division. We would also like to thank the individuals who agreed to be interviewed for our case studies; Todd Mistor, Director of Urban Forestry at the Boston Parks and Recreation Department, David Lefcourt, City Arborist/Tree Warden at the City of Cambridge, and Christopher Rosa, Tree Warden at the City of Malden. Lastly, we would like to thank our teaching team, Dr. Kathryn Davies and Amy Tse, for their insightful feedback and wonderful support throughout the Field Project process.

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Executive Summary

Green and Cool Somerville: Sustainable Sidewalks and Trees" is a design guide which provides recommendations to the City of Somerville, Massachusetts for planting and maintaining healthy trees in space-constrained areas in the public right of way (ROW) — in short, it is a design guide for healthy street trees.

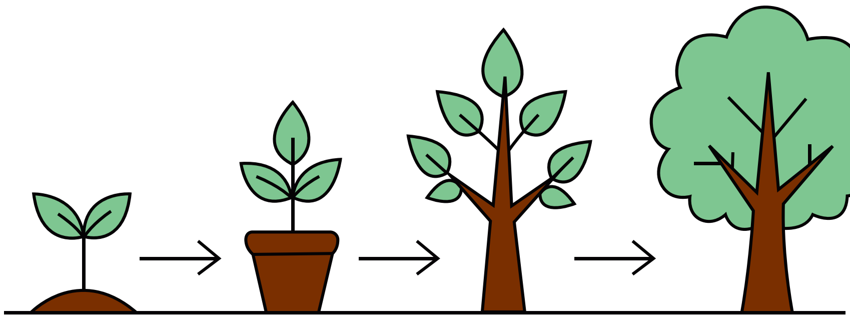
This design guide was developed as part of a Field Project course by a team of six graduate students in the Urban and Environmental Policy and Planning Program (UEP) at Tufts University, in partnership with the City of Somerville. The guide is primarily directed at employees of the City of Somerville, but it could be applicable to constrained tree-planting in other cities, or to guide tree care on private land in urban spaces. This guide focuses on tree species appropriate for urban forests in the Northeastern United States.

Our key findings and takeaways include:

- Healthy trees in constrained spaces are complicated — the literature and our Somerville-specific findings upheld that oftentimes there are design conflicts between utility infrastructure, accessibility needs, and the need for urban trees.
- With the right technologies, site selection, and species selection, trees can be planted and maintained successfully in constrained spaces.
- The optimal time to increase tree canopy in constrained spaces is during the design phase of new construction projects when tree interventions are most easily planned for and employed.

We assessed technologies and strategies that can be used in constrained spaces and presented this design guide for use in making complex tree-planting decisions.

This design guide begins with background on current conditions for Somerville, the City's tree-planting strategies, and our project research questions. These are followed by our methods and a summary of the benefits of trees. Our results are summarized in a 'decision matrix,' which displays the problems that each tree-planting strategy solves for and their relative costs. Users of this decision matrix can find more details about the strategy they are interested in in the Menu of Solutions. Should more information be needed, the users can then go into the indicated page on our literature review for the academic context and sources. With these tools, project planners and planters can find the most-relevant strategies for their specific space concerns, and successfully plant and maintain healthy urban trees.



Project Partners

Our Field Project partners represent the offices and divisions responsible for coordinating tree planting and maintenance in the City of Somerville. We worked directly with Elyse Belarge, Sustainability and Resilience Planner from the Office of Sustainability and Environment; Vanessa Boukili, Senior Urban Forestry and Landscape Planner from the Division of Public Space and Urban Forestry (PSUF) within the Mayor's Office of Strategic Planning and Community Development; and Brian Postlewaite, Director of Engineering from the Engineering Division.

Elyse Belarge (left); Vanessa Boukili (center); & Brian Postlewaite (right)

Field Project Team

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Cynthia Musuka | *Master's in Sustainability, she/her.* Prior to her graduate studies, she worked in Municipality focusing in community engagement and waste management. She holds a Bachelor of Science degree in Natural Resources Management. She is interested in renewable energy, community resilience and greenhouse gas accounting.

Joseph Smith Klein | *Master's in Urban and Environmental Policy and Planning, he/him.* He holds a bachelor's degree in History and Near Eastern Studies from Cornell University. Prior to grad school, Joseph worked in health care administration and middle school education. He is interested in the interaction between humans and their surrounding ecology.

Acronyms & Glossary

Environmental Justice (EJ) Community: A type of community which fulfills at least one of four criteria outlined by the Massachusetts Executive Office of Energy and Environmental Affairs. These communities tend to be disproportionately negatively affected by environmental pollution and climate change. See detailed definition in Section 1.2.

Geotextiles: Continuous sheets of permeable material, much like cloth fabric, used to separate the various layers of a structural soil system (Day and Dickinson 2008).

Permeable pavement: Pavement which allows rainfall and other water to infiltrate directly through the surface and into the soil below (Day and Dickinson 2008).

Right of Way (ROW): Property owned by the City, typically next to a road (MG2A 2026).

Setbacks and Back-of-Sidewalk Planting: Planting trees beyond the public ROW to increase planting space (Massachusetts DCR n.d.).

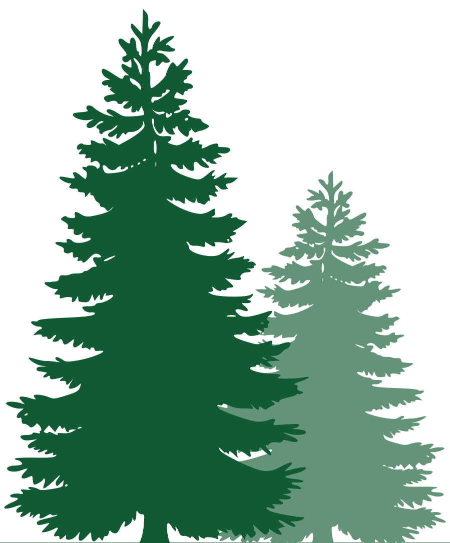
Suspended pavement systems: Creates a matrix of uncompacted soil that promotes tree health through increased root access to oxygen, water, and nutrients (Tirpak et al. 2019).

Structural soil Comprises clay soil and coarse aggregate that support pavement while allowing root growth as an alternative to traditional compacted soil (Ow and Subhadip 2017).

Urban Heat Island (UHI): An effect which occurs in urbanized areas where buildings, roads, and other infrastructure absorb and re-emit the sun's heat, particularly in areas with an the absence of greenery and water bodies that can counterbalance with cooling effects (Environmental Protection Agency 2025; City of Somerville 2020).

Urban Forest Management Plan (UFMP): The City of Somerville's 2021 published plan for managing the City's urban forest.

List of Figures and Tables



1. Introduction

Source: INFOCUS MEDIA LAB LLC 2025

1. Introduction

Urban trees play an important role in cities; they provide shade, reduce flooding and buildings' energy consumption, and improve air quality and mental health (Donovan 2017). Due to rapid urban urban development in the City of Somerville during the 20th century, most of the City's vegetated land was replaced with housing, transportation corridors, and paved surfaces (City of Somerville 2025). Nearly 78% of Somerville is covered in impervious surfaces, including buildings, roads, and parking lots, while only 14.6% of the City is shaded by tree canopy (measured in 2018) — a low number relative to other cities in the Northeast (City of Somerville 2021a; see Table 1). Additionally, the vast majority of Somerville has a moderate to high land surface temperature (Mystic River Watershed Association n.d.), and 82% of the city is a designated 'hot spot,' meaning it is within the top 5% of land surface temperatures statewide (City of Somerville Climate Forward 2023).

These hot spots frequently align with the city's Environmental Justice (EJ)-designated communities, indicating a need to consider solutions that address this inequity (Groundwork Somerville, n.d.; Commonwealth of Massachusetts 2024).

Somerville's densely built form, high proportion of impervious surfaces, and limited green space heighten vulnerability to climate change impacts, particularly extreme heat and flooding (City of Somerville 2020; City of Somerville 2023). The City is particularly susceptible to the urban heat island effect (UHI), which is observed in urbanized areas where buildings, roads, and other infrastructure absorb and re-emit the sun's heat, particularly in areas with an absence of greenery and water bodies that can counterbalance with cooling effects (Environmental Protection Agency 2025; City of Somerville 2020).

City	Canopy Cover	Study Area	Year Measured	Population Density (pop/sq mi)
Somerville, MA	14.6%	4.2 mi^2	2018	19,983
Providence, RI	24.4%	18.8 mi^2	2015	9,402
Cambridge, MA	25.3%	7.1 mi^2	2018	16,469
Boston, MA	26.5%	18.9 mi^2	2019	13,841
Worcester, MA	40.8%	38.5 mi^2	2015	4,990

Table 1. Canopy Cover in Select New England Cities (City of Somerville 2021a, 18)

Regional climate projections indicate increasing temperatures and more frequent heavy precipitation events in Massachusetts, which intensify the UHI and elevate the risk of stormwater system overload and localized flooding in dense urban neighborhoods (Massachusetts Executive Office of Energy and Environmental Affairs [EEA] 2022; Stone et al. 2010). Thus, maintaining and growing Somerville's urban forest has become an urgent strategy aimed at mitigating these risks.

As New England's most densely populated city, and one which has limited green space, planting and maintaining healthy trees to expand Somerville's tree canopy poses a significant challenge. This report provides an overview of the challenges posed by planting in space-constrained public rights of way (ROWs) and summarizes a variety of tree-planting strategies and technologies the City could employ to maintain and grow its canopy in ROWs. The report includes a discussion of cost and maintenance tradeoffs for each strategy and technology.

1.1 Background on Somerville, MA

Located northwest of Boston (see Figure 1), Somerville is a densely populated city with a total population of 82,000 (Massachusetts Municipal Association 2025; U.S. Census, B). Of Somerville residents, 66.1% identify as White alone, 4.6% as Black alone, 0.2% as Alaska Native or American Indian, 11.7% as Asian, 11.4% as Hispanic or Latino, and 9.3% as two or more races (U.S. Census, B). 10.1% of Somerville's population is estimated to be below the federal poverty threshold, compared to 9.7% in Massachusetts as a whole (U.S. Census, B; U.S. Census, A). These demographic characteristics further contextualize the importance of targeted tree canopy expansion, as risks to public health due to extreme heat and flooding are unevenly distributed across the City's communities (City of Somerville 2021a).

The spatial distributions of impervious surface and tree canopy in Somerville are not homogeneously distributed, as shown in Figures 2, 3, and 4. Areas with higher impervious surface and lower tree canopy are concentrated in the south and east parts of the City. These areas also tend to be categorized as Environmental Justice (EJ) communities (defined below), indicating inequitable distribution of trees and the benefits they provide. However, other parts of Somerville are also considered EJ communities, such as parts of north and central Somerville. The City should prioritize tree planting in areas with the highest need based on existing canopy, impervious surface coverage, and EJ status; this includes neighborhoods such as Inner Belt, Ward Two, and East Somerville.

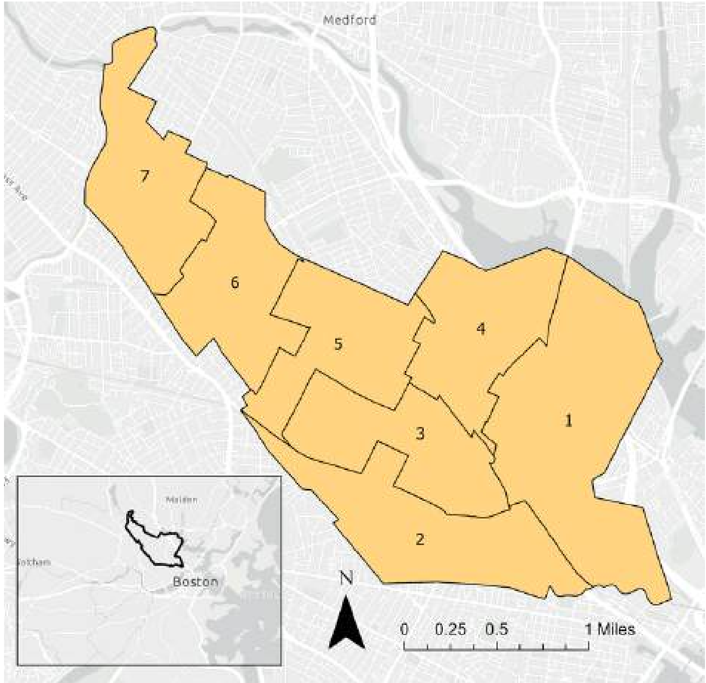


Figure 1. Map of Somerville with Ward Numbers

What is an Environmental Justice Community?

EJ communities meet at least one of the following criteria: Annual Median Household Income (AMI) of 65 percent or less of the statewide AMI; 40 percent or more of the population is minorities; 25 percent or more of households identify as speaking English less than “very well”; and minorities make up 25 percent or more of the population and the AMI of the neighborhood’s municipality does not exceed 150 percent of the statewide AMI (Mass.gov n.d.).

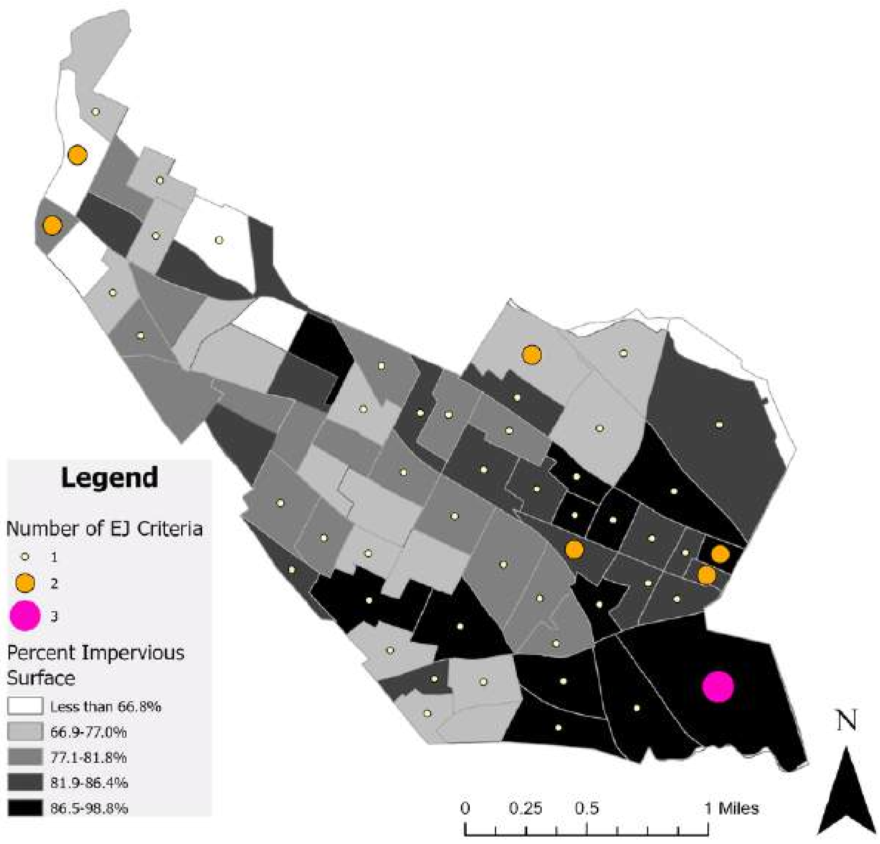


Figure 2. Map of Impervious Surface Percentages in Somerville by Census Block Group, with Environmental Justice communities identified.

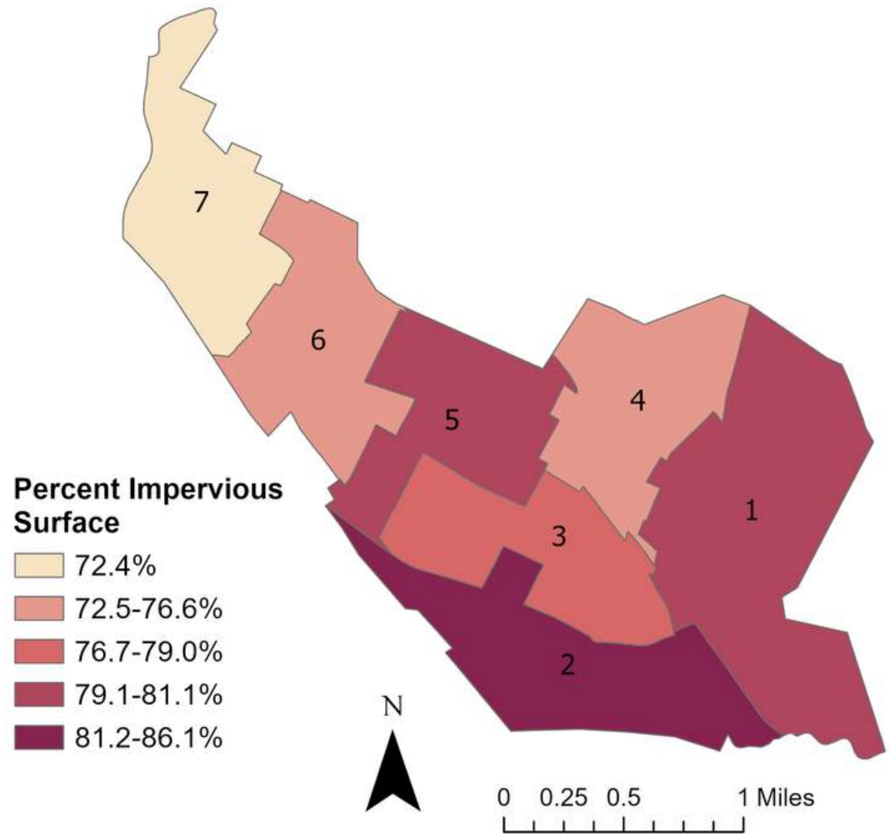


Figure 3. Map of Impervious Surface Percentages in Somerville by Ward.

1.1 Background (cont.)

Increased planting of street trees is a central component of Somerville's strategy to reduce surface temperatures, improve air quality, mitigate flooding through enhanced stormwater management, support pollinator health and biodiversity, and decrease the incidence of heat-related illness (City of Somerville 2021a; Environmental Protection Agency 2025).

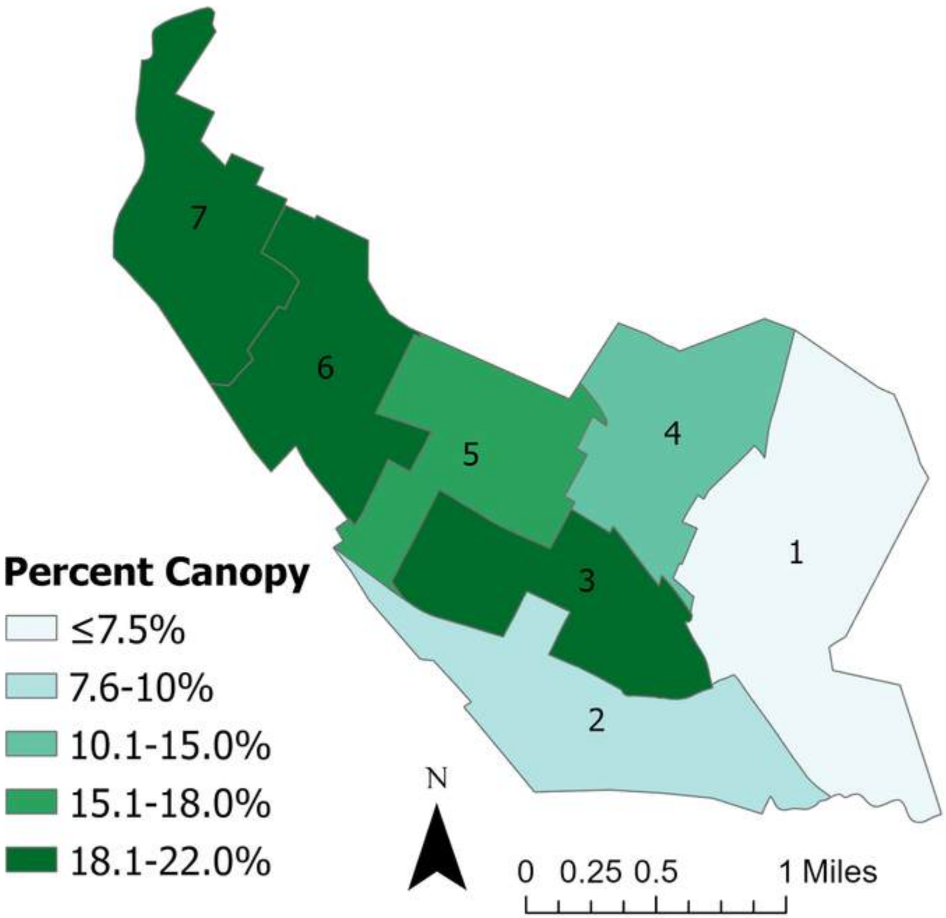


Figure 4. Somerville Tree Canopy Percent by Ward.

1.2 Somerville's Tree Planting Strategy

In 2021, PSUF and the Mayor's Office of Strategic Planning and Community Development published Somerville's first Urban Forest Management Plan (UFMP) to assess the condition and needs of Somerville's urban forest (City of Somerville 2021a). This plan describes Somerville's limited area for tree canopy due to its high population density, lack of large open spaces, and high percentage of impervious surfaces; these constraints make developing a large urban forest challenging (City of Somerville 2021a). The spatial distribution of impervious surfaces is also unequal; it is concentrated near neighborhoods like Inner Belt and East Somerville, where more land is dedicated to highways, rail lines, and industrial use.

One metric commonly used as a benchmark for measuring the quality of an urban forest is the Urban Tree Canopy (UTC), which can be calculated from satellite imagery. While 40% UTC has previously been used as a standard goal, Ian Leahy, Director of Urban Forestry at the nonprofit American Forests (2017), recommends setting targets based on context-dependent factors such as land use and development density. Somerville's UFMP set a goal of increasing its UTC from the 14.6% measured in 2018 to 16% at an unspecified date (City of Somerville 2021a). Achieving this while accounting for a 1-3% annual loss due to removal or natural mortality will require planting at least 350 trees per year, focusing on Wards 1 and 2 as the areas with the least tree canopy and highest impervious surface coverage. Statistics for each ward are shown in Table 2.

Another metric to understand Somerville's future tree canopy is the density of trees (trees per acre). Comparing which wards have higher tree density relative to their canopy coverage can reveal more detail about the spatial distribution of species, age, and health of Somerville's trees. Wards with a higher density/canopy ratio may have more tree species which tend to grow smaller canopies, more young trees which have not had time to fully grow their canopy, or more constrained growing conditions which make canopy growth difficult. The right-most column in Table 2 divides these two metrics to reveal that Wards 1 and 2 have the highest ratio. Since these wards have the lowest canopy coverage, lowest tree density, and highest impervious surface coverage in Somerville, the cause is likely related to the age of trees and the constrained growing environment due to higher impervious surface land cover.

Ward	Canopy Coverage % (2018)	Impervious Surface % (2018)	Number of Trees (2024)	Trees per Acre (2024)	Trees per Acre/Canopy Coverage
1	7.5	81.1	2980	4.5	0.60
2	9.8	86.1	1917	4.64	0.47
3	19.5	79.0	1832	5.83	0.30
4	14.6	76.6	1898	5.70	0.39
5	17.5	80.3	1696	5.40	0.31
6	22.0	74.6	2451	7.43	0.34
7	20.1	72.4	2032	6.07	0.30

Table 2. Somerville Canopy Coverage, Tree Density, and Impervious Surface Coverage by Ward

Additionally, the UFMP found that the City's theoretical maximum canopy cover is 18.7%, if trees were planted on all available public and private pervious surfaces (Ibid.). This number falls short when compared with similar New England cities (see Table 1), indicating a need for Somerville to convert impervious surfaces on public lands into planting areas, such as along streets or in parking lots, and to continue planting in available locations. This report is focused on public lands, where the City has authority and can make the most impact.

Based on the 2024 tree inventory, Somerville is dominated by three main tree species: Norway maple, red maple, and callery pear (Boukili 2026b). 44% of the trees inventoried in 2018 are native to New England, and 16% are invasive species (City of Somerville 2021a). The proportion of invasive species is likely higher now because the callery pear was re-categorized as invasive since the UFMP was published (Boukili 2026). The UFMP recommends choosing a larger variety of species based on their tolerance to harsh urban conditions and prioritizing native tree species when possible to create habitat for native wildlife (City of Somerville 2021a). Additionally, the UFMP includes an extensive list of recommended species for Somerville based on whether overhead wires are present (Ibid.).

Somerville's UFMP lays out a "right tree, right place" framework for tree planting (City of Somerville 2021a). Factors to consider include the desired function of a tree, its mature size, soil conditions, root structure, maintenance requirements, potential pest problems, and resilience to flooding, heat, and salt (Ibid.). It also includes requirements for minimum distance from utilities and other street infrastructure such as fire hydrants and stop signs (Ibid., 76; see Appendix F). Additionally, the City of Somerville requires that at least 50% of new street tree plantings be native to North America east of the Mississippi River (City of Somerville 2021b).

1.3 Guiding Questions

This report will address the following guiding questions:

What are the best practices for planting and maintaining a vibrant urban tree canopy in constrained public rights of way in Somerville, MA?

What methods have cities with similar climates and constrained spaces used to plant and maintain healthy trees in the public right of way?

What are the cost and maintenance tradeoffs of different tree-planting strategies which increase urban tree canopy while preserving sidewalk accessibility and minimizing interference with utility infrastructure?

2. Methods

Source: Weston & Sampson 2016

2. Methods

The team used a mixed-methods approach to respond to the guiding questions and produce a design guide for planting and maintaining healthy urban trees in Somerville, combining a literature review, spatial (GIS) analysis, informational interviews, and site assessments. The literature review examined best practices, challenges facing urban trees, tree planting and maintenance technologies, and case studies from similar cities to develop feasible tree-planting strategies for constrained urban environments. Informational interviews with urban forestry professionals from Boston, Cambridge, and Malden provided practical insights to complement the literature. Spatial analysis was conducted using GIS datasets — canopy cover, street tree inventory, sidewalks, and sewer infrastructure — to identify planting constraints across the city. Field assessments and on-site observations were conducted in collaboration with the project partners. These methods informed the development of a practical design guide with a decision matrix and menu of solutions which outline site selection criteria, recommended strategies, and considerations for cost, maintenance, and implementation. The methods we used provide a comprehensive approach to understanding barriers and identifying actionable solutions for urban tree planting in Somerville.

2.1 Literature Review

In order to understand the benefits and challenges of urban tree-planting, identify successful tree-planting and sidewalk design solutions applicable to Somerville, and inform our Decision Matrix and Menu of Solutions, we conducted a review of academic and gray literature on urban tree planting in constrained spaces. We searched for this literature in the Web of Science and Jumbo Search databases. Our search terms included “benefits of urban trees,” “tree planting in urban environments,” and names of tree-planting technologies such as suspended pavement and structural soils. For information on the City of Somerville, we used the City website, publicly available information on Somerville from gray literature locations, and information provided by our partners at the City of Somerville. For case studies, we drew inspiration for planting strategies and technologies primarily from cities in the Northeastern United States and Europe based on their similar climates and shared challenges of constrained environments with large amounts of impervious surface (Kuser 2007). This review informed our summaries of tradeoffs between tree health, infrastructure compatibility, and accessibility in the Menu of Solutions.

2.2 Informational Interviews

The team conducted informational interviews with staff responsible for urban forestry at the cities of Boston, Cambridge, and Malden in order to learn about their approaches to urban tree planting in constrained spaces. Interviewees included Todd Mistor, Director of Urban Forestry at Boston Parks and Recreation Department, David Lefcourt, City Arborist/Tree Warden at the City of Cambridge, and Christopher Rosa, Tree Warden at the City of Malden. Boston and Cambridge were chosen because they have urban environments and infrastructure constraints similar to Somerville. Malden was chosen as an innovative tree-planting city recommended by our project partners. Findings from these interviews were used to expand upon tree planting technology information gathered throughout the literature review and included in our Menu of Solutions as Case Studies. The Tufts University Institutional Research Board (IRB) determined that these interviews were not research as defined by the Department of Health and Human Services (DHHS) and Federal Drug Administration (FDA) regulations. This organization's IRB review and approval are therefore not required.

2.3 Spatial Analysis (GIS)

Spatial analysis was conducted using ArcGIS Pro to support discussion of the spatial heterogeneity of tree-planting needs in Somerville in Section 1. Maps of tree canopy and impervious surface percentages separated by ward were created using land cover data from Somerville's UFMP (City of Somerville 2021a). In addition, the team conducted a preliminary analysis of suitable sidewalks for planting based on existing tree locations, sidewalk widths, and sewer infrastructure, summarized in Section 7. The City of Somerville provided GIS datasets that allowed the team to analyze both tree planting opportunities and infrastructure constraints. These include:

- Land cover, including tree canopy and impervious surface (2018)
- Public street tree inventory (2024)
- Sidewalks
- Sewer infrastructure

These analyses reveal which parts of Somerville have the highest need for tree planting and which wards have the highest proportion of plantable sidewalk. This can be determined based on where impervious surface is highest, and tree canopy coverage is lowest, and where the proportion of plantable sidewalk is highest. This can support future evidence-based decision-making about where tree-planting interventions are most needed in Somerville.

2.4 Field Assessment and Site Characterization

The Tufts UEP team shadowed the City of Somerville team to learn site surveying strategies and typical challenges faced at constrained tree planting sites in Somerville. These field observations, completed on Google Street View as seen in Figure 5 below, complemented the spatial analysis and helped identify specific physical, regulatory, and logistical challenges to planting. The Tufts UEP team collected photographic documentation to illustrate examples of tree-planting strategies in the Menu of Solutions.

2.5 Decision Matrix and Menu of Solutions

The qualitative research collected in the literature review, informational interviews, spatial analysis, and field assessments and site characterizations were used to create a Decision Matrix and Menu of Solutions for use in making complex tree-planting decisions. Complimentary to each other, these two tools make up our Design Guide, which includes:

- A table showing which tree-planting strategies are associated with each problem and time frames for enacting these strategies
- Recommended solutions and the challenges they solve for, with additional notes specific to the City of Somerville
- Site selection criteria
- Considerations of cost, maintenance, and implementation

3. Benefits of Urban Trees

Source: SUGi n.d.

3. Benefits of Urban Trees

Both gray and academic literature identify the benefits of urban trees, which are particularly evident in public health, stormwater flood mitigation, and cooling through reduction of UHI. The nonprofit organization Tree Equity lists these benefits as helping to provide clean air, cleaning water by maintaining the natural water cycle, and cooling neighborhoods (American Forests n.d.). Speak for the Trees Boston, an advocacy organization, also identifies improved mental health, community building, and climate resilience as benefits of urban trees (Speak for the Trees Boston 2025).

1. Improved Public Health

Researchers have found urban trees to have a positive impact on air quality and human physical and social health. Donovan highlights that planting trees in dense areas with high air pollution has been correlated with an improvement in air quality (2017). This could reduce asthma cases, one of the leading causes of hospitalization and death in Somerville (City of Somerville and Cambridge Health Alliance 2017). Additionally, people in 'greener' areas have been found to exercise more, experience reduced stress, and feel more connected to their community when compared to those without access to green space (Donovan 2017.). It is suggested that trees are particularly impactful when located in the public right of way (Ibid.), which this project ultimately focuses on.

2. Flood Mitigation

Urban trees can act as a part of the stormwater management and flood mitigation process for their municipalities, as they reduce runoff and increase stormwater infiltration in the soil through their canopy and root systems (Zi et al. 2025). While the scale of this stormwater-reduction effect depends on the species and location of the tree, as well as whether a tree is in a constrained well or an unconstrained space, trees can provide this water-based benefit across urban areas (Ibid.). Ultimately, these stormwater and flood mitigation benefits allow urban trees to reduce water pollution and aid in erosion prevention (City of Somerville 2021a).

3. Cooling

The UHI can be reduced by additional trees in an area. Schwaab et al. identify that while the specific type of tree and the microclimate of the surrounding area can influence how significant this heat-reduction effect is, urban trees are proven to reduce temperatures in their surrounding areas through shade, transpiration, and light reflection (2021). Additionally, Donovan identifies that the cooling effects of trees can lead to reduced building energy consumption and, therefore, reduced energy costs in cities (2017).

4. Additional Benefits

Somerville's UFMP identifies several additional economic and social benefits of trees, including higher property values, successful business districts, community connections, safer streets, and crime reduction (City of Somerville 2021a). Given their multitude of benefits, trees are a vital aspect of cities' climate resilience and public health planning, and they should be prioritized as vital public infrastructure in Somerville.

4. Challenges

Source: Arborscapes n.d.

4. Challenges of Planting and Maintaining Trees in Constrained Spaces

Although trees provide a plethora of benefits to cities, successfully growing and maintaining a healthy urban forest in a city with highly constrained public ROWs like Somerville requires understanding trees' needs, staying up-to-date with modern tree-planting technologies and strategies, and thoughtfully balancing trees' needs with residents' needs.

Above-ground, trees' needs include space for canopy growth and access to light (Ow and Subhadip 2017; Weemstra et al. 2021). In an urban setting like Somerville, this means any obstructions to canopy space or light access such as overhead wires or tall buildings, can negatively impact tree health. Conversely, tree canopies can also pose a risk of damage to power infrastructure as seen on Fig. 5.
Below-ground, trees require space for root growth and air exchange, as well as access to water and nutrient-rich soil (Otero-Durán and Torres, 2024; Ow and Subhadip, 2017). In dense urban environments, trees are frequently planted in small sidewalk cut-outs surrounded by impervious surfaces, such as asphalt and concrete, which severely constrain rooting conditions, as observed above in Fig. 6 (Egerer et al., 2024). Construction activity, pedestrian and vehicular traffic, long-term pavement loading, and poorly designed soils also frequently lead to soil compaction (Ow and Ghosh 2017). This reduces the space between soil particles, which normally allows for air exchange, water infiltration, and root penetration, all of which are essential for tree establishment and long-term health (Ibid.).

Figure 5. Insufficient subsurface growing space exposes roots.
Photo Credit: Manx Roots Tree Management.

Figure 6. Utility Infrastructure conflicts with canopy.
Photo Credit: West Street Blog

The presence of underground utility infrastructure, such as sewer and water lines, can also limit space for root growth. This forces roots to grow upwards and damage sidewalks—termed sidewalk heaving, making them less accessible and non-ADA compliant. Constraining trees' root space can also lead to chronic stress and increased vulnerability of trees to pests and drought (Day et al. 2010).

Figure 7, to the right, demonstrates challenges and decision points that arise when attempting to replace a dead tree. Planners and planters must consider these challenges in planting a tree, which can complicate matters of site and species selection.

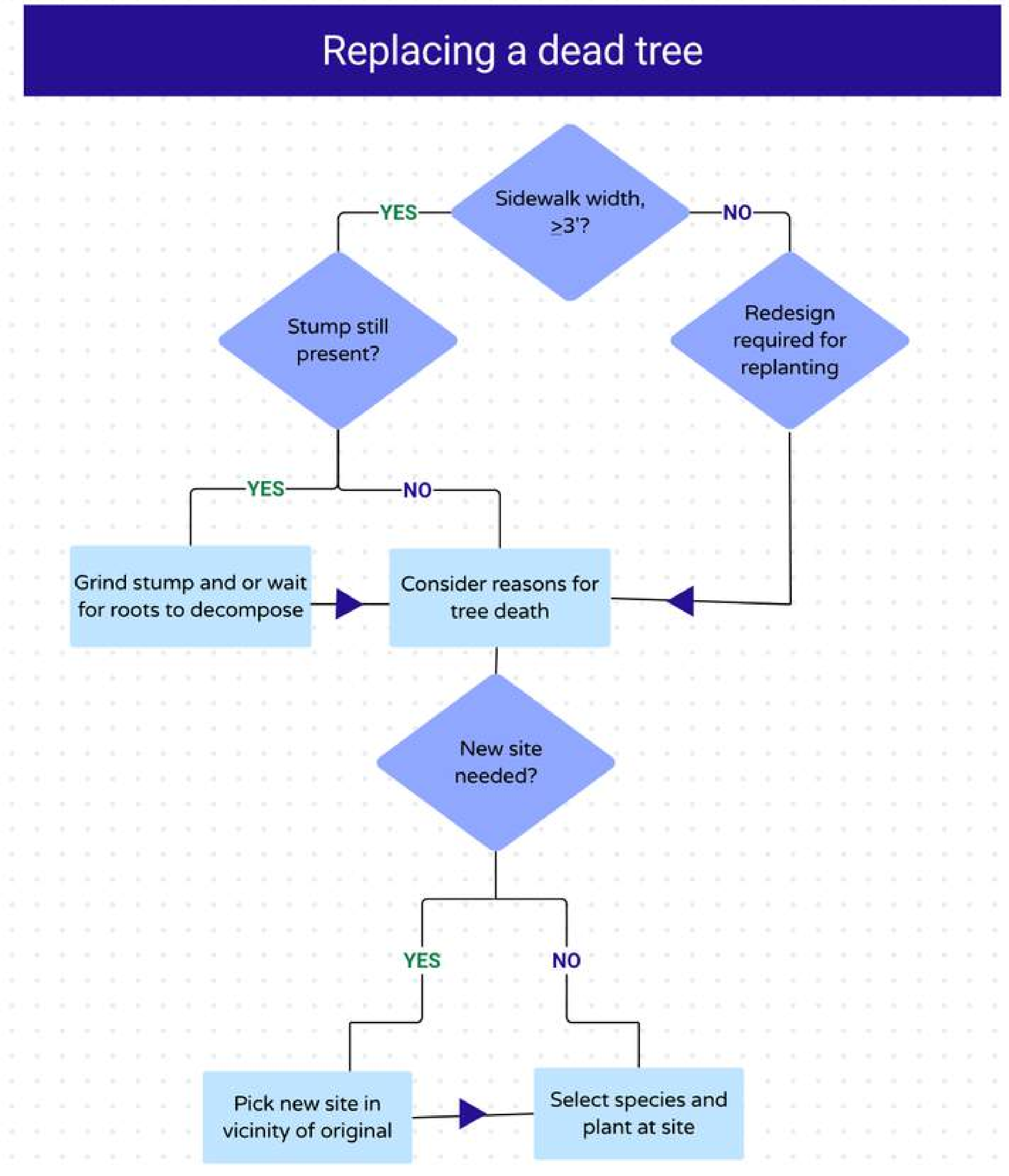


Figure 7. A flowchart of decision points that arise when replacing a dead tree. (Boukili 2026a.)

5. Decision Matrix

Source: Compass Realty n.d.

5. Decision Matrix

This Decision Matrix may be used by project planners and planters to identify which solutions are most helpful for problems that may be faced by trees, and which project stages those solutions can be selected in. Once the user has identified an appropriate solution in the Decision Matrix, they should navigate to the corresponding page in the Menu of Solutions, which provides more in-depth, technical detail on each of the solutions.

The problems included in the Decision Matrix and Menu of Solutions fall into the following categories:

- **Compacted soil:** Limited amount of soil space that normally allows for air exchange, water infiltration, and root penetration (Day et al. 2010).
- **Conflicts with utility infrastructure:** Tree interference with both overhead and subsurface utilities (such as overhead weirs, sewer mains, water pipes) (City of Somerville 2021a).
- **Drought/Limited access to water and nutrients:** Scarce water and nutrients in paved urban settings that stunt tree growth and survival (Mullaney et al. 2015).
- **Narrow sidewalks:** Limited pavement width less than 6 feet (City of Cambridge 2019).
- **Climate change:** The City is susceptible to three primary hazards: extreme heat, stormwater flooding, and coastal flooding. (City of Somerville 2023).
- **Human interaction:** Human activity around trees frequently impacts tree root systems, often decreasing tree health and reducing longevity compared to trees on natural sites. (Watson et al. 2014).
- **Sidewalk heaving:** Pavement cracking and lifting caused by expanding tree roots growing beneath the surface (Watson et al. 2014).
- **Root health:** Below-ground, trees require space for root growth and air exchange as well as access to water and nutrient-rich soil (Otero-Durán and Torres 2024).
- **Structural soil degradation:** Over time, structural soil can mix with the soil below, causing it to degrade and reducing its structural support benefits.

The decision matrix on the following pages shows which solutions apply to which challenges facing street trees. The symbols located in the intersecting boxes represent the project stages during which these solutions can be selected by planters. Postlewaite (2026) informed the project stage definitions as well as which project stage each solution is relevant to.

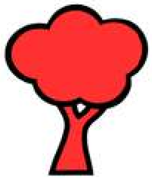
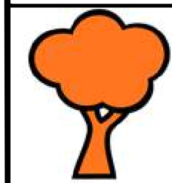
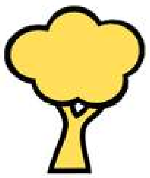
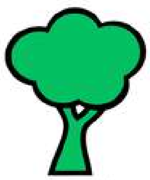
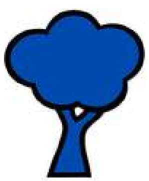
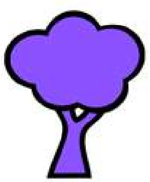
Project Stage Icon	Description
	**[1] Planning:** Decision point for whether or not project is moving forward and where it will take place
	**[2] Concept:** Conceptual design stage that identifies the big picture goals that the project aims to accomplish (e.g., whiteboarding sessions)
	**[3] Design:** Technical drawings and design (e.g., CAD)
	**[4] Pre-Construction:** Site surveys with the design team and contractor onboarding
	**[5] Construction:** Execution on the proposed designs (rare to have design changes beyond this point)
	**[6] Operations and Maintenance (O&M):** Post-construction, ongoing site maintenance

Table 3. Iconography for the Project Stages as identified by Postlewaite.

Table 4. Decision Matrix, on the following page, outlines the solutions on the right-hand column, the problems they solve for in the top row, and the project stage at which they need to be discussed by the City (see Iconography table).

PROBLEMS

SOLUTIONS

	Root Health	Structural Soil Degradation	Compacted soil	Sidewalk heaving	Narrow sidewalks	Conflicts with utility infrastructure	Climate change	Human Interaction	Drought/limited water and nutrient availability
Street Redesign									
Curb extensions and bump outs									
Setbacks & back of sidewalk planting									
Species Selection									
Tree Pit Design									
Permeable Pavement									
Suspended Pavement Systems & Soil Cells									
Structural Soil									
Root Barriers									
Geotextiles									
Pruning & Watering									
Tree Grates & Fencing									
Resident Stewardship Programs									
Alternatives to Trees									

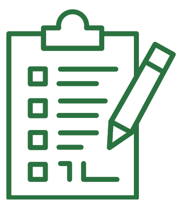
6. Menu of Solutions

Source: Somerville Tree Pros 2023

How to Navigate the Menu of Solutions

The sections below highlight each of the potential strategies for increasing the tree canopy in constrained spaces. These are categorized into three stages of intervention, following the life cycle of an urban tree: Planning & Siting, Planting, and Early Growth Through Maturity. The solutions are divided by the tree life stages, with visualizations, a description of the technology or strategy, and a list of common constraints faced, Somerville-specific notes and example sites, and relevant case studies or information from interviews with other cities. Each also includes a tag of the estimated cost ($-$$$$) and color-coded tree icons representing the Project Stage at which they would need to be discussed between the broader City teams.

Sections of the Menu of Solutions



6.1 Planning & Siting

Identifying the locations for future tree planting

6.1.1 Street Redesign
6.1.2 Curb Extensions
6.1.3 Setbacks & Back of Sidewalk
6.1.4 Species Selection

6.2 Planting Design

Site surveying, selecting the design and components of the tree pit

6.2.1 Tree Pit Designs
6.2.2 Permeable Pavement
6.2.3 Suspended Pavement and Soil Cells
6.2.4 Structural Soils
6.2.5 Root Barriers
6.2.6 Geotextiles

6.3 Growth

Ongoing tree care to increase longevity

6.3.1 Pruning & Watering
6.3.2 Tree Grates & Fencing
6.3.3 Tree Steward Programs
6.3.4 Alternatives to Trees

Menu of Solutions: Iconography

Project Stages

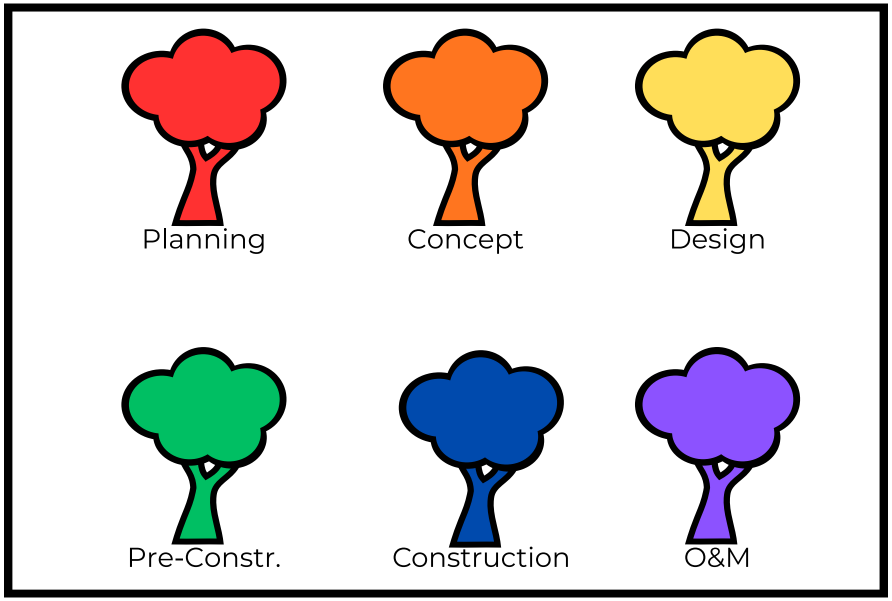


Table 5: Iconography for the Project Stages within the Menu of Solutions.

Costs

Cost Symbol	Description
$	$1-$100
$$	$100-1000
$$$	$1000-$1500
$$$$	>$1500

Table 6: Iconography for the costs within the Menu of Solutions.

Source: Lookphotos/Age Fotostock 2026.

6.1 Planning & Siting Solutions

6.1.1 Street Redesign
6.1.2 Curb Extensions
6.1.3 Setbacks & Back of Sidewalk
6.1.4 Species Selection

Siting is the process of choosing where to plant a tree. A variety of factors should be considered when siting a new tree planting within a dense urban environment. These include:

- Maintaining sidewalk accessibility and ADA compliance with a minimum of 3 feet of width
- Minimizing risk of future above- or below-ground utility conflict
- Maintaining minimum distances from infrastructure such as intersections, fire hydrants, and driveways (see Appendix F for Somerville's minimum distance requirements)
- Ensuring proper spacing from other trees and buildings for optimal tree growth based on species selection
- Assessing and potentially altering local topology to ensure stormwater will flow towards tree pits
- Removal of tree stumps to make space for new tree planting

6.1.1 Street Redesign

Planning Concept Design

$$$$

Tree Life Stage

Planning & Siting

Solves For These Problems

Conflicts with utility infrastructure
Narrow sidewalks
Human interaction

Figure 8. Intersection redesign at Powder House Boulevard and Alewife Brook Parkway (PHAB) (Image: City of Somerville 2024).

Description

Street redesigns present the opportunity to create space for tree planting that would otherwise be limited by existing site conditions. One type of redesign approach could be curb extensions, described further in section 6.1.2. On a broader scale, street redesigns can employ the Green Streets design process to manage stormwater by incorporating trees and other vegetation (EPA 2025c), as seen in Figure 8. The Complete Streets approach considers all street users (drivers, pedestrians, bikers, public transit), incorporating this framework into Green Streets will ensure that both canopy and accessibility needs are met (Smart Growth America 2026).

Streets can also be designed to account for local topology, improve stormwater capture, and thus reduce flooding. This can be done by incorporating other forms of green infrastructure, such as curb cuts, bioswales, and infiltration trenches that redirect stormwater runoff from impervious surfaces into tree pits. These designs increase soil moisture availability and support tree establishment, especially during critical early years (Day and Dickinson 2008).

Somerville Notes & Cautions

- Curbs can help divert street water away from tree/planting areas and into drains, which is particularly relevant for salt-intolerant tree species.
- Trees can serve as a protective barrier between the sidewalk, road, and bike paths.
- Redesigns present an opportunity to balance priorities among urban forestry, transportation, pedestrian accessibility, and utilities priorities during the conceptual process.
- This approach is complex and expensive,, and there is a limited timeframe when it can be employed
- Developer projects may require new streets to be designed. Somerville Zoning Code requires that developers build to certain standards (sidewalk widths, use of soil cells when planting trees, street dimensions).
- Highland Avenue has been discussed as a potential street redesign, and it's wider layout could allow for the Green Streets approach.

Cross-City Insights | Cambridge, MA

As a neighbor of Somerville, Cambridge, MA shares the same climate and many of the same tree-planting challenges, including limited sidewalk space and root conflicts with utilities and sidewalks. Cambridge's Urban Forest Master Plan Technical Report developed a set of design recommendations based on available sidewalk width that are more sustainable than the conventional tree planting practices of planting 30 feet apart (City of Cambridge 2019). For narrow sidewalks of width less than 6 feet, the report recommends altering street design to allow for more planting space.

6.1.2 Curb Extensions & Bump Outs

Design

$$$$

Tree Life Stage

Planning & Siting

Solves For These Problems

Conflicts with utility infrastructure
Narrow Sidewalks

Figure 10. Along Evergreen Street in Somerville, the addition of a bump outs created a wider sidewalk and a more spacious tree well. (Image: Google Street View 2026).

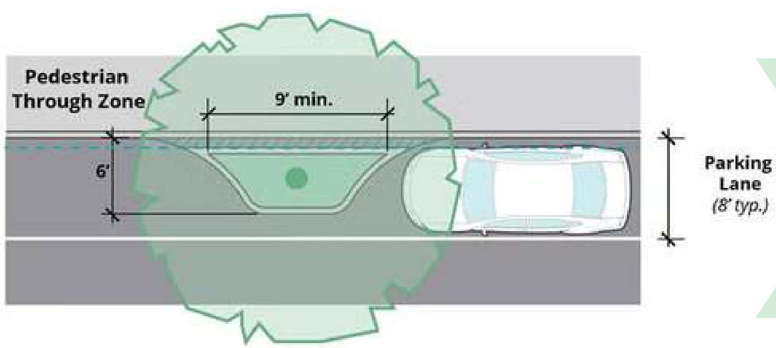
Description

Curb extensions are a relatively low-cost intervention that improves water availability for street trees in constrained urban environments (NACTO 2013). There are several common designs, including chicanes, gateways, pinchpoints, and bus bulbs (outlined in Figure 9, all of which increase the space available for plantings and street trees (NACTO 2013). All of these variations increase the amount of ROW dedicated to a street tree by moving the curb out into the roadway. Consultation with residents and local zoning may be needed if the resulting rearrangement reduces the amount of available street parking.

Somerville Notes & Cautions

- It may be difficult (or not feasible) to remove parking spots and redesign streets to accommodate this style.
- Somerville does not plant trees within 20 feet of a street intersection.
- Curb extensions and bump-outs are expensive and require cross-departmental support.
- This strategy may require removing or moving sidewalk street signs, parking spaces, drains, and utility wiring, which can increase cost and face community pushback.

Figure 9. Curb extension design options highlighted in yellow, including (from left to right): Gateway, Pinchpoint, Chicane, and Bus Bulb. (NACTO 2013).



Cross-City Insights / Portland, OR

The Portland Bureau of Transportation is collaborating with the Parks & Urban Forestry Team to build tree space in the curb and parking zones (City of Portland 2026a). Their Pedestrian Design Guide (see Figure 12 to the left) highlights the benefits of planting in the curb zone, which expands potential tree well size without encroaching on pedestrian walkability (City of Portland 2026b).

Figure 12. A potential layout for tree planting in the curb zone (City of Portland 2026b)

6.1.3 Setbacks and Back-of-Sidewalk

Planning Concept Design $$$$

Tree Life Stage

Planning & Siting

Solves For These Problems

Conflicts with utility infrastructure
Narrow Sidewalks
Sidewalk Heaving

Description

Setbacks and back-of-sidewalk planting involve planting trees beyond the public ROW on private property (Massachusetts DCR n.d.). This is a useful strategy for increasing tree canopy across the city, but does not increase tree planting in the constrained public ROW (Ibid.). The DCR's Setbacks Planting Fact Sheet outlines various setbacks and requests programs that exist across Massachusetts (Mass DCR n.d.). An important limitation is that it removes municipalities' ability to oversee long-term tree care.

Somerville Notes & Cautions

- Requires working with property owners
- Potential site for this: 102 Powder House Boulevard as there is ample space
- Planting on private property (not in the public ROW) could lead to favoring neighborhoods where setbacks are possible (and where space is less constrained). This is managed by a separate urban forester at the City (Boukili 2026b).

Figure 11. Setback planting along Powder House Boulevard in Somerville (Google Street View 2026).

6.1.4 Species Selection

Pre-Constr. Design

$$$$

Tree Life Stage

Planning & Siting

Solves For These Problems

Climate Change
Conflict with utility infrastructure
Human interaction
Compacted soil
Narrow sidewalks
Drought/limited water & nutrients

Figure 12. Trees on a truck awaiting planting (City of Somerville 2021a).

Description

Carefully selecting a tree species can have a significant impact on the trees' future health and tolerance for urban conditions. At this point, the planter can consider potential interactions with utility infrastructure, pedestrians, and vehicles (Egerer et al. 2024). For example, in a location with low-hanging utility wires, a shorter tree should be selected. In a location with more space and less interaction with infrastructure, a tree with a larger canopy will provide a greater cooling effect long-term.

Somerville's PSUF leaves letters at nearby residences to inform them that a tree will be planted (Boukili 2026a). This can be helpful in ascertaining a resident's level of interest in aiding in tree health by watering the tree, which can help the planter determine whether a drought-tolerant tree may be best located in these conditions. Additionally, when planting in sidewalks directly in front of schools, hospitals, busy roads, or apartment complexes, it is recommended to select salt-tolerant trees, as those sites tend to use more road salt for winter conditions (Boukili 2026a). In analyzing both the physical conditions of the planting site and the human element, the planting team can set the tree up for future health-success.

Somerville Notes & Cautions

- The majority of Somerville's trees are currently Norway Maples, Red Maple, and Callery Pear trees (City of Somerville 2021a). The Red Maple and Callery Pear trees are both invasive species, so they are not considered for new plantings (Boukili 2026).
- Planting additional Norway Maples is also not recommended, as overreliance on specific species can lead an urban canopy to be vulnerable to pests, disease outbreaks, or other stressors (Sjöman et al. 2024).
- Future plantings in Somerville rely on the 10-20-30 rule, which states that the maximum proportion of a single species within an urban forest should not be more than 10%, a single genus no more than 20%, and a single family no more than than 30% (City of Somerville 2021a).
- Somerville's 2021 tree ordinance requires that at least 50% of new street tree plantings be native (City of Somerville 2021b).
- For more information on Somerville tree species, please see Appendix B for the Urban Forestry Tree Lists.

Cross-City Insights | Malden, MA & Cambridge, MA

Tree selection based on weather/maintenance treatments (salt) is a strategy used by Urban Forestry Departments in Cambridge and Malden. and Malden. Christopher Rosa from the City of Malden is focusing on planting trees from the Mid-Atlantic region, such as Maryland, Virginia, etc. that are adapted to warmer temperatures. If planted now, these trees will be adapted to the current MA climate and will be able to sustain future warming temperatures. The same strategy is being used in Cambridge, as mentioned by David Lefcourt, City Arborist.

Source: Canva

6.2 Planting Design

6.2.1 Tree Pit Designs
6.2.2 Permeable Pavement
6.2.3 Suspended Pavement and Soil Cells
6.2.4 Structural Soils
6.2.5 Root Barriers
6.2.6 Geotextiles

The planting design stage takes place once a suitable tree site has been identified. At this stage, the site is surveyed in more detail to assess which interventions can be worked into the tree pit and contiguous area.

6.2.1 Tree Pit Design

Pre-Constr. Design **$$$**$

Tree Life Stage

Planning & Siting

Solves For These Problems

Root health
Compacted soil
Drought/limited water & nutrients

Figure 13. In the top image, tree beds are connected underground, allowing the two trees to share nutrients and resources. In the image below, combining a curb bump out and continuous tree bed allows for a wider sidewalk and more soil. (Images: New York City n.d. (A); City of Portland 2026a (B)).

Description

Urban trees often struggle to get sufficient water and nutrients, and stormwater gets conveyed into sewer systems rather than infiltrating into tree root zones (Egerer et al. 2024). Research has shown that planting trees closer together and connecting the pits through soil allows them to share resources and achieve better health outcomes (City of New York Parks and Recreation 2016). As seen in Figure 13 above, tree pits can be connected either above or below ground to expand soil availability. Underground connected pits can be combined with soil cells for the best results (see section 4.2.3).

Somerville Notes & Cautions

- Somerville recommends a minimum of 18 square feet of open soil for new tree wells in existing sidewalks and 36 square feet of open soil for new tree wells in new sidewalks (City of Somerville 2021a, 76).
- It is worth considering whether a new tree will grow directly adjacent to a parking spot, particularly on one-way streets where the driver-side of the car would be blocked by a tree (Boukili 2026).

Cross-City Insights

New York City, Malden, Cambridge, & Stockholm

The **NYC DOT Street Design Manual** encourages the implementation of connected tree beds wherever possible, in place of singular tree pits. As outlined in this manual, a connected tree bed provides a continuous area of soil in order to provide increased rooting area and stormwater detention (New York City Department of Transportation n.d.). NYC's Street Trees Planting Standards document also outlines the benefits of group plantings, where trees are planted closer than 20 feet from each other, which reduces soil compaction and increases shading (City of New York Parks and Recreation 2016, 7). Where space allows, Somerville could adopt this planting strategy to improve tree health and increase UHI benefits. New York City's standard tree pit size is 50 square feet (City of New York Parks and Recreation 2016, 6).

Malden's forestry team looks for new tree planting sites in close proximity to one another, opening the opportunity for connected tree pits and reducing the labor required for maintenance costs by consolidating pruning, watering, mulching, and inspections into a single visit rather than mobilizing separately for each spatially dispersed tree.

Cambridge's Urban Forest Master Plan Technical Report recommends incorporating continuous planting strips, expanding soil volume under sidewalks for improved root growth (City of Cambridge 2019).

Stockholm recommends a standard planting bed size of 21 square feet (minimum 15.5 square feet) (City of Stockholm 2022, 14).

6.2.2 Permeable Pavement

Design

$$

Tree Life Stage

Planning & Siting

Solves For These Problems

Sidewalk heaving
Narrow sidewalks
Drought/limited water & nutrients

Figure 14. Permeable pavement can consist of a grid-like system that allows water to pass through into the soil. (Image: Billy.com n.d.)

Description

Permeable or pervious pavement is an alternative to traditional impervious pavement. It reduces stormwater runoff by allowing water to infiltrate, which leads to increased water access for trees, healthier root growth, and reduced sidewalk heaving while maintaining structural functionality of the pavement (Day and Dickinson 2008; Johnson et al. 2019). Permeable pavement has also been found to mitigate UHI and reduce slippery conditions during winter thaw by increasing evaporation and reducing water pooling (Fini et al. 2022; Kranz 2020).

There are two types of permeable pavement: permeable pavers and composite materials such as FlexiPave. Permeable pavers have gaps which allow water and gas exchange (as shown in Figure 14). Examples include interlocking concrete curbs, grass grid pavements, and gravel grid pavements (Fini et al. 2022). FlexiPave is an aggregate of stone, recycled tires, and a binding agent (Boukili 2026b). It is able to expand and contract with freeze-thaw cycles, potentially making it less susceptible to cracking than traditional pavement (Bocksor 2019).

Somerville Notes & Cautions

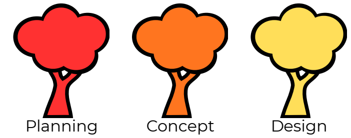
- Installation is typically across the width of the sidewalk at the surface level and can be placed up to large tree trunks and within a few inches of smaller tree trunks (Boukili 2026b). The permeable pavement is layered on top of a gravel subbase layer, which can further improve water infiltration and promote deeper root growth (Mullaney et al. 2015; Johnson et al. 2019). The depth of this layer should be determined based on precipitation levels and desired stormwater storage (Bocksor 2019).
- The durability of FlexiPave should be investigated further; within one season of installation in Somerville, FlexiPave was flaking apart on some streets. It also needs to be vacuumed annually to maintain permeability (Boukili 2026a).
- Permeable pavement is more expensive than cement or asphalt, so in Somerville it has primarily been used for older trees to mitigate sidewalk heaving (Boukili 2026b.).

Cross-City Insights
Boston, Malden, Cambridge

The usage of FlexiPave is becoming more common in urban environments as a pavement supplement (not replacement). Boston, Malden and Cambridge have reported its efficacy in resolving sidewalk ADA compliance and root coverage damage.

Specifically in Boston, the use of FlexiPave is still in trial for new tree plantings. Maintenance is challenging and expensive.

6.2.3 Suspended Pavement Systems & Soil Cells



$$$$

Tree Life Stage

Planning & Siting

Solves For These Problems

Sidewalk heaving
Compacted soil
Root health
Drought/limited water & nutrients

Figure 15. A cross-section diagram of a tree planted with soil cells.
(Image: GreenBlue Urban n.d.)

Description

For highly constrained sidewalk environments where excavation space is minimal, suspended pavement systems create a matrix of uncompacted soil that promotes tree health through increased root access to oxygen, water, and nutrients (Tirpak et al. 2019). Suspended pavement systems are a strategic approach to supporting pavement or ground surface, allowing soil below to remain uncompacted for tree roots and stormwater management (Environmental Protection Agency 2013). There are various approaches to suspended pavement system design, but the overarching principle is to create a subsurface space that is filled with soil for root growth (Marritz 2014).

A key component to many suspended pavement system designs are soil cells, which maximize usable soil volume while supporting surface infrastructure (GreenBlue Urban 2025). These systems use modular frames to prevent soil compaction, which promotes natural aeration. This method supports long-term root development and tree health (Ow and Subhadip 2017; Washington State Department of Transportation 2006).

Somerville Notes & Cautions

- Soil cells have only been used in Somerville for new tree plantings, and trees planted with this approach have been observed to thrive after 5+ years of growth (Boukili 2026a).

- The brand name for soil cells is Silva Cells. These are relatively expensive, which is why they have only been used in select new sites and private developer sites (Boukili 2026a).

- Soil cells are not recommended for use around existing large trees, as there is too much risk of damaging roots during installation (Boukili 2026b).

6.2.4 Structural Soil

Planning Concept Design $$$$

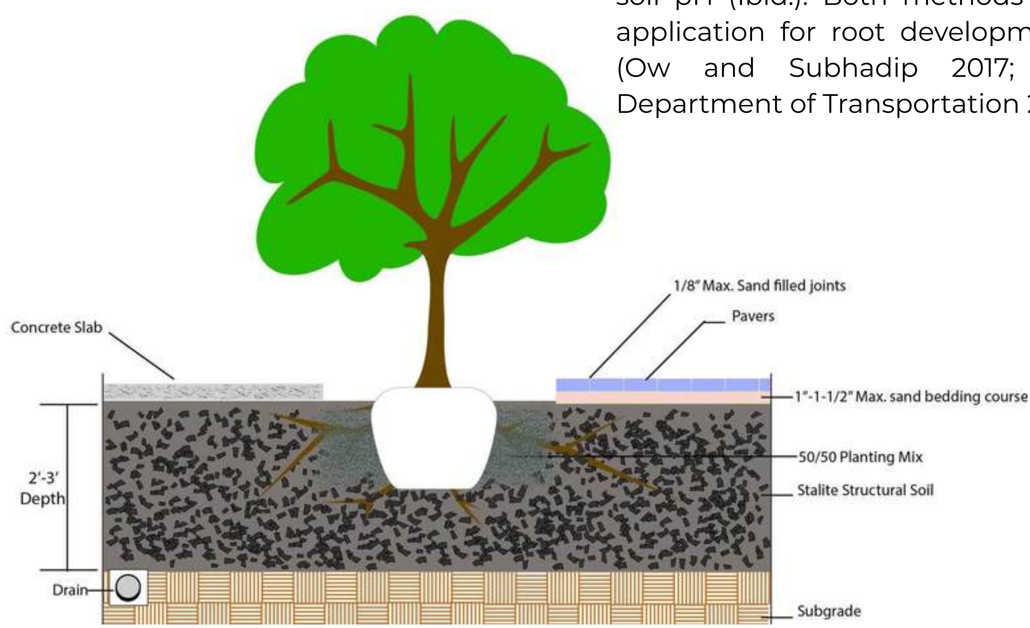
Tree Life Stage

Planning & Siting

Solves For These Problems

Sidewalk heaving
Compacted soil
Root health
Drought/limited water & nutrients

Figure 16: An example of how structural soil might be layered into the overall tree pit design. (Image: Stalite Environmental n.d.)



Description

Structural soil can be used to mitigate soil compaction due to pavement traffic and subsequent negative effects on root health (Ow and Subhadip 2017). This is composed of clay soil and coarse aggregate that supports pavement while allowing root growth as an alternative to traditional compacted soil (Ibid.). As a part of a suspended paving system, the stone component forms load-bearing units that meet engineering requirements to support pavement, while the soil component provides the nutrients and additional rooting space (Washington DOT 2006). When applying this technique, it is important to consider the pH of the structural soil, which can vary depending on local mineral soils (Day and Dickinson 2008). The selected tree species should be able to tolerate the structural soil pH (Ibid.). Both methods demonstrate critical application for root development and tree health (Ow and Subhadip 2017; Washington State Department of Transportation 2006).

Notably, prior studies have shown that structural soils do not provide sufficient nutrients for long-term tree health as compared directly with suspended pavement systems and soil cells, which significantly outperform structural soils (Marritz 2011).

Somerville Notes & Cautions

- Structural soils are not recommended for use around existing large trees, as there is too much risk of damaging roots during installation (Boukili 2026b).

Cross-City Insights / The Stockholm Solution

A 2001 survey revealed that the majority of trees within Stockholm's historic city center were in poor health due to poor surface and subsurface conditions, so a program for planting and maintaining trees in urban environments was developed, called the Stockholm Solution (City of Stockholm 2022, 2). This method relies heavily on designing or redesigning the subsurface environment to be more conducive for tree growth, through the use of structural soil (City of Stockholm 2022, 8-9). Stockholm demonstrates that despite the difficulties urban environments pose for healthy tree development it is possible to build a flourishing urban tree canopy within them.

6.2.5 Root Barriers

Design

$$$$

Tree Life Stage

Planning & Siting

Solves For These Problems

Sidewalk heaving
Narrow sidewalks
Conflicts with utility infrastructure

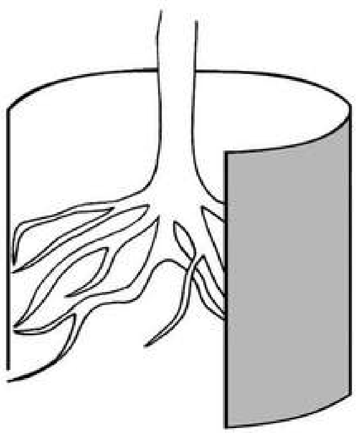


Figure 17: Examples of root barrier systems. From left to right, linear, circular, and three-dimensional root barriers (Morgenroth 2008)

Description

One of the main concerns when planting trees in an urban environment is their interaction with other subsurface infrastructure needed for urban life, such as electrical conduits, gas pipes, and sewer lines. The latter is of particular concern due to the risk of trees damaging pipes in their quest for water and nutrients. In combination with structural soil, root barriers can be used to direct roots to the available environment (Zairuddin et al. 2020). Three types of root barriers (traps, inhibitors, and deflectors) can be used to limit root growth in unfavorable areas, such as gray infrastructure (Morgenroth 2008).

There are a variety of materials used to construct root barrier systems, including physical (geomembranes, concrete, metal screens), chemical (fabrics saturated with herbicides), and geosynthetic clay liners (geotextiles combined with bentonite clay) (BMP Geomembrane 2025). Root barrier durability ad longevity depends heavily on which material is used, as well as environmental factors like soil moisture, UV exposure, and temperature (Ibid.). Geomembranes are used most commonly as they can last 50 years or more in the right conditions (Ibid.).

Somerville Notes & Cautions

- Even if a resident requests a tree (like at the location highlighted in Figure 21), the presence of subsurface water and sewer infrastructure can hinder tree planting. This is not only because of planting challenges, but also because later in the tree's life cycle, fallen debris could clog the drain on the street.
- BPM Geomembrane provides specific detail on considerations for site characteristics, chemical, and design considerations when using root barriers.

Cross-City Insights London

In the United Kingdom, sewer pipes are allowed to be within canopy reach of a tree if adequate preventive measures are taken, such as use of welded polyethylene pipes and liners to discourage root growth around the sewer (Trees in Action Group, Chartered Institution of Building Services Engineers et al. 2014, 115). Liners have the advantage of being employable even in situations where pipe is not being laid or replaced (Ibid.). Somerville is replacing its aging, largely root-damage-susceptible clay plumbing infrastructure with pipes made of more modern materials like PVC (Postlewaite 2026). This presents an opportunity to reevaluate certain sites previously deemed to be too constrained (Trees in Action Group, Chartered Institution of Building Services Engineers et al. 2014, 115). Use of liners offers a potential mitigation effort for dealing with the concerns associated with planting trees in a constrained space, even when the planting is preceded by the replacement of subsurface infrastructure.

6.2.6 Geotextiles

Planning Concept Design

$$$$

Tree Life Stage

Planning & Siting

Solves For These Problems

Structural soil degradation
Conflicts with utility infrastructure

Description

Geotextiles are a permeable synthetic fabric material that can be used to prevent the co-mingling of structural soil and subsoil and provide additional structural reinforcement (Day and Dickinson 2008). An example of the use of geotextiles is shown in Figure 18 (Day and Dickinson 2008). If placed between the natural soil and the base of the structural soil, they can also cause surface separation by preventing roots from penetrating too deeply (Day and Dickinson 2008). This approach has also been used by the City of Stockholm to prevent fine particles from infiltrating the plant bed (City of Stockholm 2022).

Somerville Notes & Cautions

- Geotextiles should not be attached to the trunk or directly to roots.
- Geotextiles are not a permanent solution for structural reinforcement and layer separation as the material can break down over time.
- Somerville has used geotextiles in combination with soil cells that were installed as part of the Somerville Utility and Streetscape Improvement (SAUSI) project (Boukili 2026b).

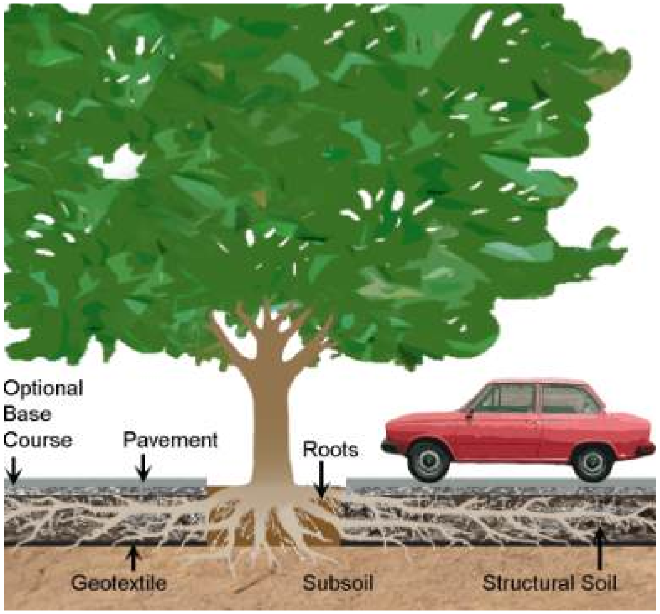
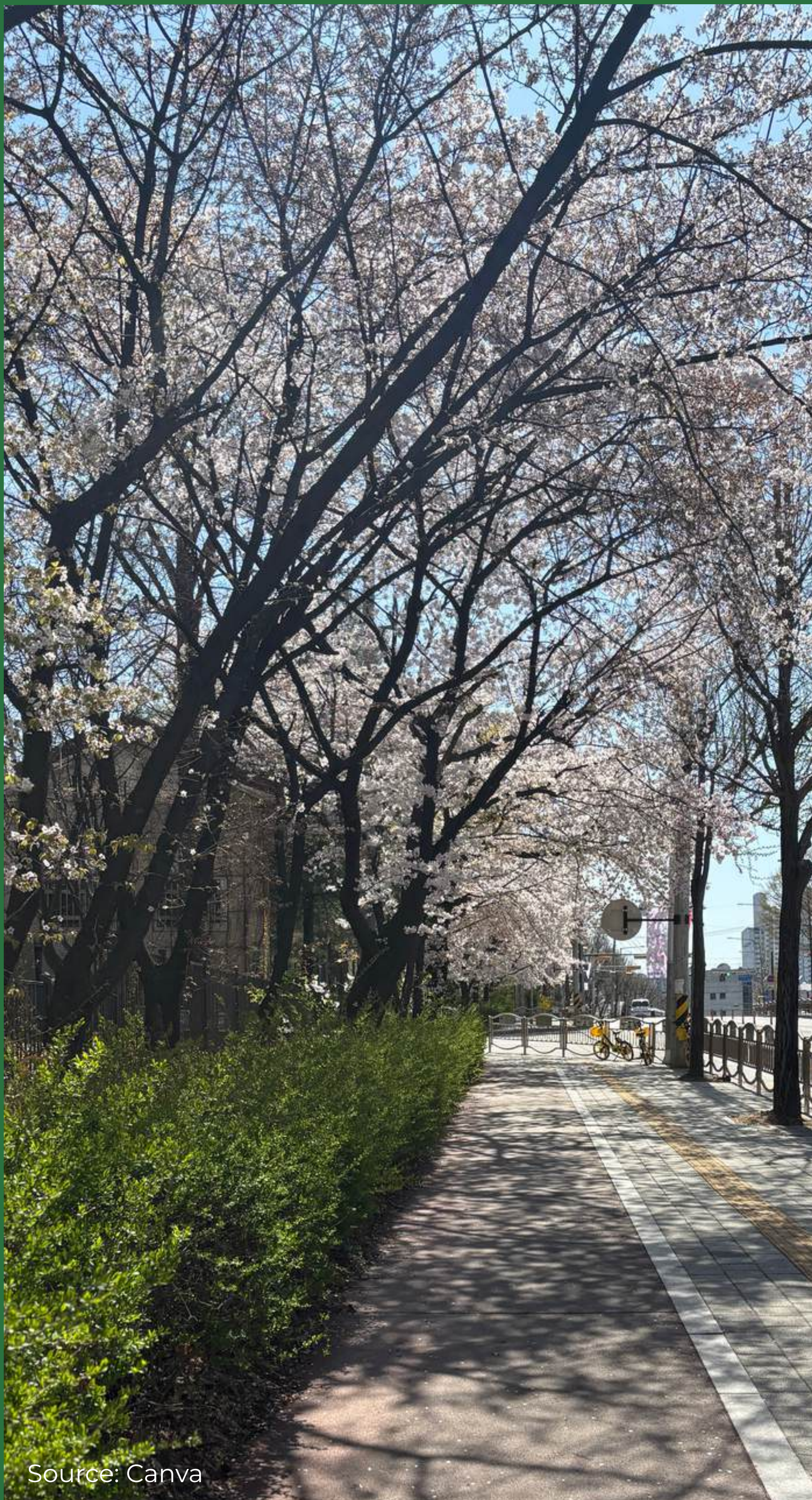


Figure 18: Example of suspended pavement system which uses structural soil and geotextiles (Day and Dickinson 2008).



6.3 Growth

The Growth stage occurs after a tree has been planted. The strategies outlined in this section aim to increase the longevity of the trees, as well as alternatives to tree planting that may still address lack of green space and/or heat resiliency efforts.

6.3.1 Pruning & Watering

O&M $$$$

Tree Life Stage

Planning & Siting

Solves For These Problems

Drought/limited water & nutrients
Conflicts with utility infrastructure
Climate change

Figure 19. Newly planted tree with irrigation bags. (Image: City of Cambridge 2024).

Description

Early structural pruning during the first several years after planting, which helps guide branch architecture, can reduce future conflicts with infrastructure and minimize the need for large, damaging corrective cuts later in a tree's life (Watson et al. 2014). Tree maintenance should be conducted by trained and certified personnel to reduce improper cuts and mechanical damage (Egerer et al. 2024). Training programs and certification standards, such as those promoted by professional arboricultural organizations, improve pruning quality and reduce the risk of pest and disease entry associated with improper technique (Watson et al. 2014).

Improper pruning, especially when carried out by untrained personnel or delayed due to budget constraints, can weaken tree structure, increase susceptibility to pests and diseases, and shorten overall lifespan, undermining long-term canopy goals (Watson et al. 2014). When considering tree canopy interference with wires, trimming trees and tree topping (the removal of the top sections of trees at full growth) is a common maintenance approach (Bloniarz and Ryan 1993). However, this can increase the risk of insect and disease damage, shortening the potential lifespan of street trees (Ibid.).

In addition to proper pruning practices, adequate watering is essential as young trees are highly susceptible to drought stress in dense urban environments, particularly during the first two to five years after planting (Vogt et al. 2015). Studies show that consistent watering during these first five years significantly improves survival, particularly in locations with compacted soils and high evaporative demand (Ibid.).

Somerville Notes & Cautions

- Somerville uses irrigation bags on their new trees, similar to the photo above (Boukili 2026a).
- Somerville has a Young Tree Training program, through which all young trees in the city are pruned for proper structure on a 3-year cycle (Boukili 2026b).

6.3.2 Tree Grates & Fencing

O&M $$$$

Tree Life Stage

Planning & Siting

Solves For These Problems

Human interaction
Compacted soil
Root health

Description

Ongoing human pressures, including pedestrian traffic and informal use of planting areas, can be mitigated through surface design interventions that clearly delineate tree space. Tree grates and fencing around tree pits can reduce foot traffic directly on soil, reducing soil compaction, protecting trunks, and limiting root zone disturbance in high-use public spaces (Watson et al. 2014; Egerer et al. 2024).

Figure 20. Example of a metal tree grate (Image: GreenBlue Urban 2026).

Somerville Notes & Cautions

- Tree fencing can limit the amount of sidewalk space, and grates can create uneven sidewalk surfaces, both of which are important considerations for ADA accessibility (Boukili 2026a).
- Tree grates and fencing can lead to girdling if left on the trees too long. When placing grates or fences, plan to maintain or remove them, or choose openings that will provide proper spacing for the trunk at full maturity (Boukili 2026a).

6.3.3 Resident Stewardship Programs

O&M $$$$

Tree Life Stage

Planning & Siting

Solves For These Problems

Drought/limited water & nutrients
Human interaction

Figure 21. An example of Somerville's Adopt-A-Tree signage (Image: City of Somerville 2026).

Description

The success of urban tree planting goes beyond physical constraints such as infrastructure and soil. In constrained urban planting locations, resident involvement in tree planting and watering improves street tree vitality while increasing environmental education (Egerer et al. 2024). Local governments can encourage resident stewardship by hosting tree-care programs and posting signage welcoming residents to care for the trees in their neighborhoods. Programs like these could include:

- Resident Stewardship Programs (Adopt-A-Tree)
- The New York City Tree Map resources page provides guidelines for posting signage around trees, including notes about tree species, cautioning pedestrians around the tree bed, and instructions for proper tree care and watering (NYC Parks n.d.).
- Partnerships with organizations like TreesMedford that offer free native shade trees to residents. Residents can request a tree for their home or apartment if they have a suitable planting site.

Somerville Notes & Cautions

- Somerville has an Adopt-A-Tree program.
- Somerville residents can request a tree be planted in front of their home by calling 311.
- Mystic River Watershed Association has been working with the City of Somerville to plant trees on private property (Boukili 2026b).
- These types of programs require labor from community members. If considering this approach, the City could offer participants a stipend for their time.
- Although stewardship programs can be a great method to involve the community in tree care, they are likely not sufficient to ensure proper city-wide tree maintenance.

Cross-City Insights

Boston Tree Alliance (MassAudubon) offers private property planting and will help support trees for the first 3–5 years.

With the **Cambridge Forest Friends** program, residents adopt and care for nearby trees. Similarly, their Junior Forester Program for ages 5–13 encourages tree education and adoption. Lastly, the Cambridge Committee on Public Planting holds monthly meetings to discuss tree planting efforts.

In **Malden,** the Tree Steward Program trains resident in planting, and pruning. They also update the 'Malden Tree Warden' Facebook page, which has more than 2,000 followers and 10K–20K views/post. Additionally, residents can request trees via SeeClickFix.

6.3.4 Alternatives to Trees

Planning Concept Design

$$$$

Tree Life Stage

Planning & Siting

Solves For These Problems

Drought/limited water & nutrients
Conflicts with utility infrastructure
Narrow sidewalks

Figure 22. Bioswales with small vegetation where there isn't enough space for a tree pit (Image: Cornell University 2026).

Description

For site conditions that do not offer sufficient space for tree planting and where constraints limit viable workarounds, there may be opportunities to incorporate alternative vegetation that offers similar benefits to urban trees (Living Architecture Monitor 2021). Green roofs, living walls, bioswales, hedges, and other forms of green infrastructure can support stormwater management and reduce the urban heat island effects even in highly constrained environments (Ibid.).

Figure 23. The site characteristics near 402 Broadway Street include high percentages of impervious surfaces and long sun exposure. (Image: Google Street View 2026).

Somerville Notes & Cautions

- Where there are concrete or brick retaining walls along sidewalks, heat bounces off the walls and can stress the tree(s) (Boukili 2026a).
- Green walls could be used to cool trees in spaces like this, but this could require cross-departmental support and plans for New England's seasons (freeze/thaw) (Ibid.)
- Living Architecture's Winter 2021 article highlights successful species selection and designs

Cross-City Insights

Strategic species selection, root protection, irrigation, and directional position have been successful approaches for year-round, outdoor living walls in northern cities like **Boston, Chicago, Toronto and Halifax** (Living Architecture Monitor 2021).

Similar to the United States' concept of Complete Streets, the Greater London Authority's (GLA) Healthy Streets initiative aims to improve the distribution of street greenery in the city and reduce pedestrian exposure to vehicular air pollution (Greater London Authority 2019, 10). In their 2019 report, GLA recommends using vertical greenery other than trees, such as hedges, to reduce the effect of pollution on pedestrians in areas where building height is more than double the road width and air quality at street level is worse than air quality above the surrounding buildings (Ibid., 20). Since roots of hedges do not take up as much space, choosing to plant them in place of trees would eliminate subsurface space constraints. However, to serve as an effective pollution reduction method, a continuous row of hedge plantings is needed at a site.

7. Spatial Analysis of Trees and Planting Sites in Somerville

Source: BestNeighborhood.org 2026

7. SPATIAL ANALYSIS OF TREES AND TREE PLANTING SITES IN SOMERVILLE

Somerville's UFMP includes an analysis of potentially plantable areas based on existing pervious surfaces which are suitable for planting (excluding recreational fields, cemeteries, etc.) (City of Somerville 2021a, 25). Since this analysis did not account for the possibility of land cover change through de-paving, and it included both public and private land, we conducted a separate spatial analysis to determine potential planting sites in the public ROW that may require de-paving.

The suitability analysis narrows down potential tree planting sites in the public ROW using conditions based on recommendations in Somerville's UFMP (City of Somerville 2021a). The conditions are the following:

- On a public sidewalk that is at least 6 feet wide—based on the 3-foot ADA requirement and the recommended 3-foot wide tree pit
- At least 30 feet from an existing tree, based on the recommended distance from a medium-sized tree, using the 2024 tree inventory (including stumps)
- At least 2 feet from a sewer main
- At least 36 square feet large (minimum recommended tree pit size for new tree wells in new sidewalks)

This analysis resulted in the table and figure to the right and below (Table 5 and Figure 28), which shows plantable sidewalks that may or may not require de-paving as a percent of total sidewalk area in each ward. Wards 1 and 3 were found to have the most 'low-hanging fruit,' or sidewalk that is easily plantable based on the criteria used, while Wards 6 and 7 have the least. This means that focusing planting efforts in Wards 1 and 3 can potentially help the City reach its tree planting goals and test strategies discussed in this report in more favorable conditions for tree health.

Ward	Area of Plantable Sidewalk (sq. ft)	Percent of Sidewalks That are Plantable (%)
1	3896	0.3506
2	772	0.0855
3	4927	0.4104
4	563	0.0588
5	1795	0.2106
6	373	0.0362
7	135	0.0151

Table 7. Amount of plantable sidewalks in each Somerville Ward.

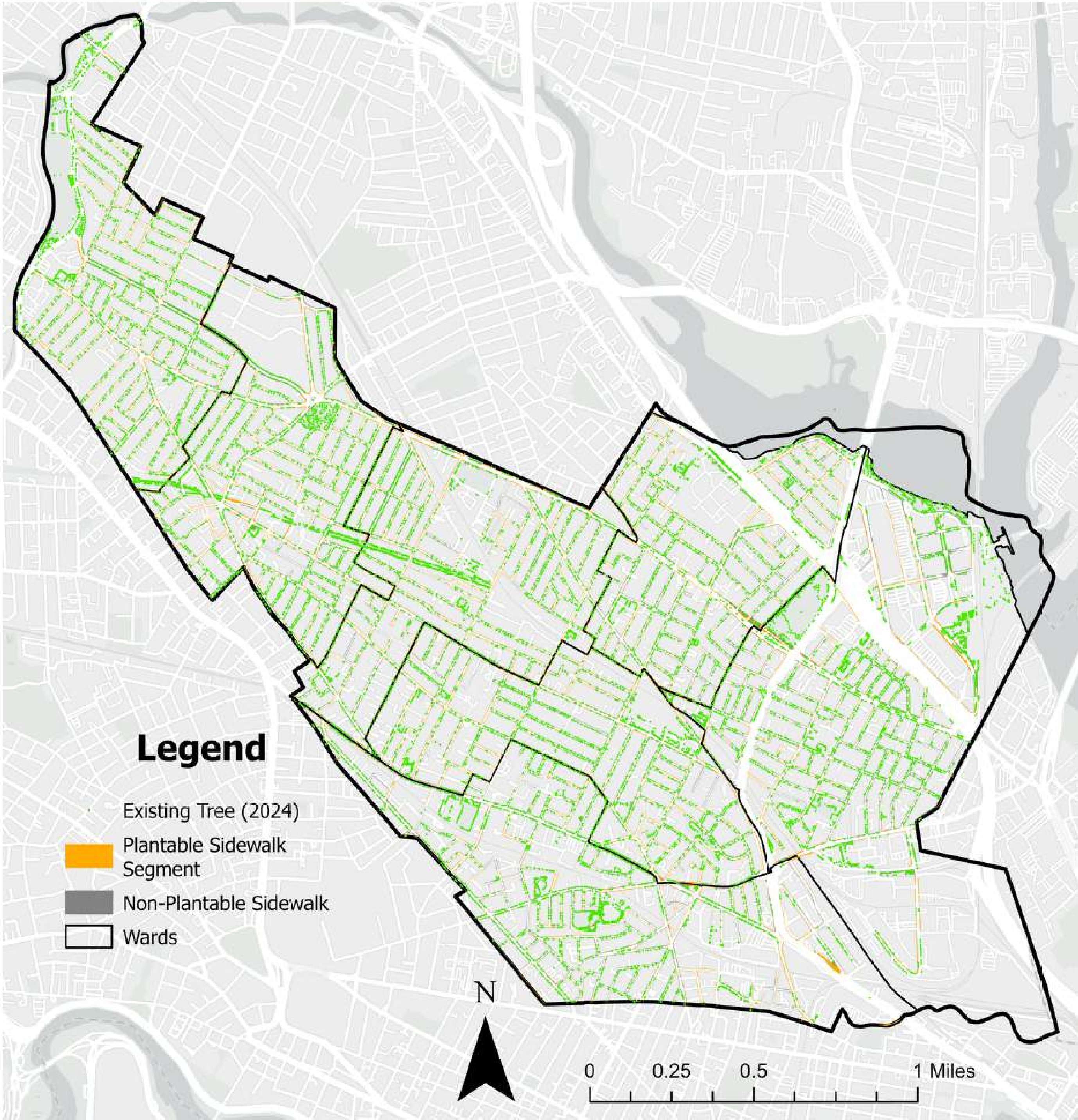


Figure 24. Plantable Sidewalk Segments in Somerville

8. Conclusion

Source: Trulia 2026

8. Conclusion

Urban street trees play a critical role in advancing Somerville's climate resilience goals by mitigating extreme heat, reducing flood risk, and delivering measurable public and environmental health benefits. Expanding tree canopy coverage, particularly in Environmental Justice communities and low-canopy wards, represents both a climate adaptation strategy and a public health intervention. Although dense urban infrastructure and limited planting space pose ongoing challenges, case studies from other cities in similar climates and constrained spaces offer solutions Somerville can adopt. The strategic use of suspended pavement systems that incorporate structural soils, soil cells, permeable pavement, geotextiles, and thoughtful species selection, paired with long-term maintenance planning, provides a viable pathway to equitably increase tree canopy citywide.

Source: MilNeill 2025

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Appendices

Source: MilNeil 2025

Appendix A: Literature Review

1. Challenges and Solutions for Planting Trees in Constrained Spaces

Although trees provide a plethora of benefits to cities, successfully growing and maintaining a healthy urban forest in a city with highly constrained ROWs like Somerville requires understanding trees' needs, staying up-to-date with modern tree-planting technologies and strategies, and thoughtfully balancing trees' needs with residents' needs.

Above-ground, trees' needs include space for canopy growth and access to light (Ow and Subhadip 2017; Weemstra et al. 2021). In an urban setting like Somerville, this means any obstructions to canopy space or light access such as overhead wires or tall buildings could negatively impact tree health. Conversely, tree canopies can also pose a risk of damage to power infrastructure.

Below-ground, trees require space for root growth and air exchange as well as access to water and nutrient-rich soil (Otero-Durán and Torres 2024; Ow and Subhadip 2017). In dense urban environments, trees are frequently planted in small sidewalk cut-outs surrounded by impervious surfaces such as asphalt and concrete, which severely constrain rooting conditions (Egerer et al. 2024). Construction activity, pedestrian traffic, long-term pavement loading, and poorly designed soils also frequently lead to soil compaction (Ow and Ghosh 2017). This reduces space between soil particles which normally allows for air exchange, water infiltration, and root penetration, all of which are essential for tree establishment and long-term health (Ibid.). Presence of underground utility infrastructure, such as sewer and water lines, can also limit space for root growth. This forces roots to grow upwards and damage sidewalks, which makes sidewalks less accessible and non-ADA compliant. It also leads to chronic stress and increased vulnerability of trees to pests and drought (Day et al. 2010).

The following sections discuss a variety of tree siting, planting, and maintenance strategies which address these challenges to growing and managing an urban forest in constrained spaces. Each section includes a summary of the strategy and a short discussion of tradeoffs or examples where they have been used.

(a) Siting

Siting is the process of choosing where to plant a tree. A variety of factors should be considered when siting a new tree planting within a dense urban environment. These include:

- maintaining sidewalk accessibility and ADA compliance with a minimum of 3 feet of width
- minimizing risk of future above- or below-ground utility conflict
- maintaining minimum distances from infrastructure such as:
  - intersections
  - fire hydrants
  - driveways
- ensuring proper spacing from other trees and buildings for optimal tree growth based on species selection

(a) Siting (cont)

- assessing and potentially altering local topology to ensure stormwater will flow towards tree pits

In their UFMP, Somerville identified priority planting locations based on these factors and more, including UHI index, soil erosion factor, and proximity to bus routes and bike lanes (City of Somerville 2021, 75).

Curb Extensions

Curb extensions are a relatively low-cost intervention that improves water availability for street trees in constrained urban environments (NACTO 2013). There are several common designs, including chicanes, gateways, pinchpoints, and bus bulbs (outlined in Figure 25), all of which increase the space available for plantings and street trees (NACTO 2013). All of these variations increase the amount of ROW dedicated to a street tree by moving the curb out into the roadway. Consultation with residents may be needed if the resulting rearrangement reduces the amount of available street parking.

Tree Pit Size

Somerville recommends a minimum of 18 square feet of open soil for new tree wells in existing sidewalks and 36 square feet of open soil for new tree wells in new sidewalks (City of Somerville 2021, 76). This is comparable to Stockholm’s standard planting bed size of 21 square feet (minimum 15.5 square feet), but significantly smaller than the more spacious New York City’s standard 50 feet square feet tree pit size (City of Stockholm 2022, 14; City of New York Parks and Recreation 2016, 6).

(b) Planting

In response to the spatial and infrastructural constraints described above, the literature outlined below identifies a range of planting and design interventions intended to improve tree survival and performance within highly constrained urban rights-of-way.

Species Selection

Careful tree species selection can help ensure tree survival in a dynamic urban environment, reduce risk of canopy or root interactions with utility infrastructure, pedestrians, and vehicles, and increase climate resilience (Egerer et al. 2024).

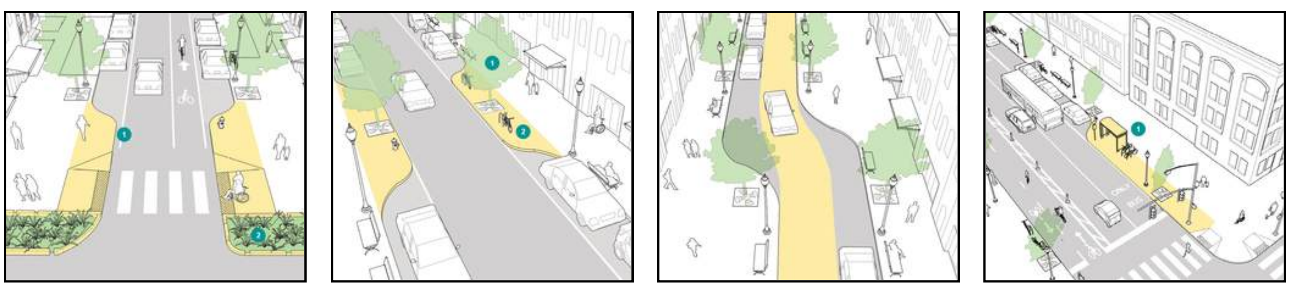


Figure 25. Curb extension design options highlighted in yellow, including (from top left to bottom right): Gateway, Pinchpoint, Chicane, and Bus Bulb. (NACTO 2013).

Increasing tree biodiversity by choosing a variety of tree species is a key strategy for reducing tree vulnerability to pests, disease outbreaks, and climate-related stressors, improving overall resilience of an urban forest (Watson et al. 2014). Low species diversity (large number of trees of the same species) can lead to severe losses in the event of species-specific epidemics, such as the devastating results of Dutch elm disease (caused by Ophiostoma novoulmi) throughout New England and the Midwest (City of Somerville 2021a). Somerville's UFMP recommends using the 10-20-30 rule for species selection, which states that the maximum proportion of a single species within an urban forest should not be more than 10%, a single genus no more than 20%, and a single family no more than 30% (City of Somerville 2021, 46). As discussed in Section 3: Project Background, the majority of Somerville's street trees are Norway maples, red maple, and callery pear trees (City of Somerville 2021). While these species have historically been favored for their tolerance to urban conditions, 14.1% of trees in Somerville's public ROW are Norway maples, exceeding the recommended 10% share for one species (Ibid., 39). Thus, Somerville should expand its species selection for new tree plantings, as recommended in the UFMP (City of Somerville 2021).

Choice of species can reduce risks of interference between tree roots or canopy with city infrastructure. Planting smaller, slower-growing species or columnar forms, such as downy serviceberry or eastern redbud, can reduce conflicts with overhead and below-ground infrastructure and minimize long-term maintenance requirements (Watson et al. 2014). However, slower-growing trees may take longer to provide UHI benefits, which is an important tradeoff to consider. Trees with narrower crowns, upright growth forms, and high tolerance for pruning in constrained sidewalk environments can also be chosen, although they pose the same limitation of less canopy leading to a smaller cooling effect (Watson et al. 2014).

Climate change is another consideration in species selection. It further intensifies existing stressors on urban street trees by increasing the frequency and duration of extreme heat events, altering precipitation, and amplifying storm intensity, all of which disproportionately affect trees planted in constrained urban environments (Schmack et al. 2024). Heat stress is particularly damaging for species with low heat tolerance or shallow rooting systems, as elevated surface and air temperatures increase evapotranspiration demand while impervious surfaces limit soil moisture replenishment (Ow and Ghosh 2017). Species traditionally favored for urban planting in temperate cities, such as certain maples, birches, and ashes, have shown heightened sensitivity to prolonged heat and drought, especially when planted in compacted soils with limited rooting volume (Ow and Ghosh 2017; Watson et al. 2014). Thus, Somerville should shift species selection toward trees with demonstrated tolerance to heat, drought, salt, and compacted soils such as bald cypress (Taxodium distichum), black tupelo (Nyssa sylvatica), swamp white oak (Quercus bicolor), and hackberry (Celtis occidentalis) as identified in the UFMP (City of Somerville 2021). Species with deeper rooting systems and higher resistance to water stress are better suited to narrow sidewalks and high-radiation corridors (Watson et al. 2014).

Tree Pit Design

In constrained urban environments, strategic configurations combined with the right planting medium can support tree growth. Tree pits are a type of bioretention facility that holds individual trees (City and County of Denver Public Works n.d.). They can be located above or below ground, depending on site characteristics (GreenBlue Urban 2025). Alternatively, narrow open planting strips combined with soil cells that extend under the sidewalk can reduce above-ground space while providing sufficient subsurface support. This can also be achieved by corner and offset designs that encourage tree root growth in only one direction (GreenBlue Urban 2025).

The NYC DOT Street Design Manual encourages the implementation of connected tree beds wherever possible, in place of singular tree pits. As outlined in this manual, a connected tree bed provides a continuous area of soil in order to provide increased rooting area and stormwater detention (New York City Department of Transportation, n.d.). NYC's Street Trees Planting Standards document also outlines the benefits of group plantings, where trees are planted closer than 20 feet from each other, which reduces soil compaction and increases shading (City of New York Parks and Recreation 2016, 7). Where space allows, Somerville could adopt this planting strategy to improve tree health and increase UHI benefits.

To address altered urban hydrology and limited water availability in tree root zones, cities can increasingly integrate green infrastructure and stormwater capture systems into street tree design. Stormwater is typically conveyed rapidly into sewer systems rather than infiltrating into tree root zones, limiting water availability for urban trees (Egerer et al. 2024). One effective correction is the use of curb cuts, bioswales, and infiltration trenches that redirect stormwater runoff from impervious surfaces into planting areas, thereby increasing soil moisture availability and supporting tree establishment during critical early years (Day and Dickinson 2008).

Permeable Pavement (FlexiPave)

Tree roots can damage the landscape of sidewalk pavement when they do not have sufficient space to grow. Damage should be fixed readily to ensure the sidewalks are accessible, but care should be taken to ensure tree roots are not severed in the process, or the tree may die (City of Somerville, 2021). One solution to this issue is to add a gravel layer beneath sidewalks, which helps deter root growth, provides structural support, and manages stormwater (Johnson et al

further intensifies existing stressors on urban street trees by increasing the frequency and duration of extreme heat events, altering precipitation, and amplifying storm intensity, all of which disproportionately affect trees planted in constrained urban environments (Schmack et al. 2024). Heat stress is particularly damaging for species with low heat tolerance or shallow rooting systems, as elevated surface and air temperatures increase evapotranspiration demand while impervious surfaces limit soil moisture replenishment (Ow and Ghosh 2017). Species traditionally favored for urban planting in temperate cities, such as certain maples, birches, and ashes, have shown heightened sensitivity to prolonged heat and drought, especially when planted in compacted soils with limited rooting volume (Ow and Ghosh 2017; Watson et al. 2014). Thus, Somerville should shift species selection toward trees with demonstrated tolerance to heat, drought, salt, and compacted soils such as bald cypress (Taxodium distichum), black tupelo (Nyssa sylvatica), swamp white oak (Quercus bicolor), and hackberry (Celtis occidentalis) as identified in the UFMP (City of Somerville 2021). Species with deeper rooting systems and higher resistance to water stress are better suited to narrow sidewalks and high-radiation corridors (Watson et al. 2014).

Figure 26 Permeable pavement can consist of a grid-like system that allows water to pass through into the soil. (Image: Billy.com n.d.)

Suspended Pavement Systems, Structural Soils, and Soil Cells

Another factor that affects trees planted in pavement is the constraint on their root systems caused by the proximity of below-ground structures such as utilities (Ow and Subhadip 2017). The presence of these structures limits soil and water availability. This affects soil porosity and water drainage, and therefore tree health (Egerer et al. 2024; Ow and Subhadip 2017).

Suspended pavement systems are a strategic approach to supporting pavement or ground surfaces, allowing the soil below to remain uncompacted, benefiting tree roots and stormwater management (Environmental Protection Agency, 2013). Suspended pavement systems can prevent root damage to sidewalks by providing structural support that encourages root growth below the surface (Rahardjo et al. 2016). A benefit of suspended pavement systems (beyond those directly related to urban tree growth) is the uncompacted soil beneath the system, which promotes pavement stability and stormwater control (Page et al., 2015).

For highly constrained sidewalk environments where excavation space is minimal, soil cell systems (as part of the larger suspended pavement system) provide an alternative that maximizes usable soil volume while supporting surface infrastructure (GreenBlue Urban 2025). These systems use modular frames to prevent soil compaction, which benefits natural aeration. Both methods demonstrate critical application for long-term root development and tree health (Ow and Subhadip 2017; Washington State Department of Transportation 2006).

As a way to mitigate the aforementioned effects on soil and root health, Ow and Subhadip (2017) explore the use of structural soils, which comprise clay soil and coarse aggregate that support pavement while allowing root growth as an alternative to traditional compacted soil

As part of a suspended paving system, the stone component forms load-bearing units that meet engineering requirements to support pavement, while the soil component provides the nutrients and additional rooting space (Washington DOT 2006). When applying this technique, it is important to consider the pH of the structural soil, which can vary depending on local mineral soils (Day and Dickinson 2008). It’s vital to ensure that selected tree species can tolerate the structural soil pH (Ibid.). Both methods demonstrate critical application for long-term root development and tree health (Ow and Subhadip 2017; Washington State Department of Transportation 2006).

Figure 27. A cross-section diagram of a tree planted with soil cells. (Image: GreenBlue Urban n.d.)

Root Barriers

In combination with structural soil, root barriers can be used to direct roots to the available environment (Zairuddin et al. 2020). Three types of root barriers (traps, inhibitors, and deflectors) can be used to limit root growth in unfavorable areas, such as gray infrastructure (Morgenroth 2008).

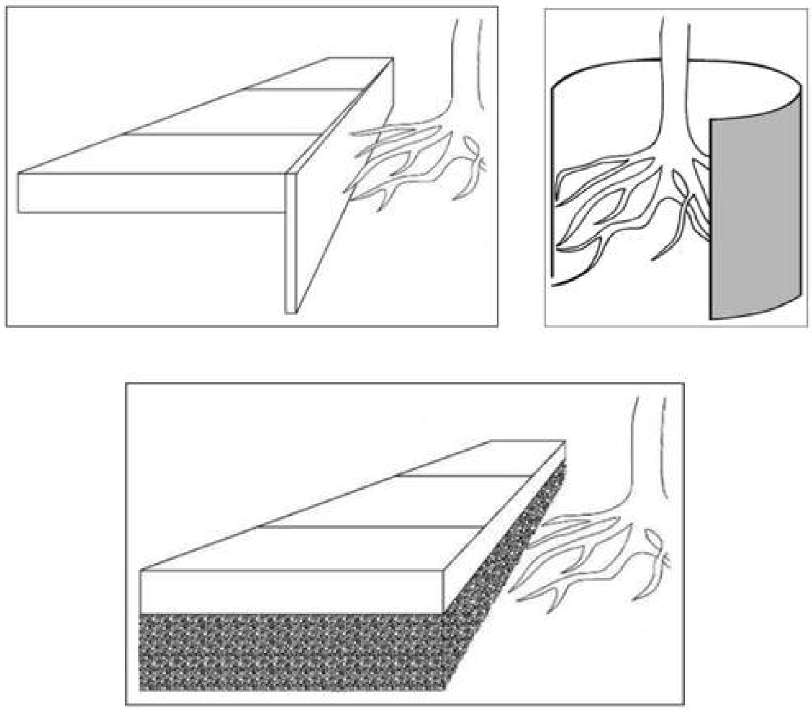


Figure 28. Examples of linear (top left), circular (top right), and three-dimensional (bottom) root barrier systems (Morgenroth 2008).

Geotextiles

Geotextiles have been explored as a subsurface planting technology in combination with structural soils and soil cells. They are continuous sheets of permeable material, much like cloth fabric, used to separate the various layers of a structural soil system, as seen in Figure 29 (Day and Dickinson 2008). If placed between the natural soil and the base of the structural soil, they can offer both structural reinforcement and surface separation (Day and Dickinson 2008). This approach has been explored by the City of Stockholm as a method to prevent fine particles from infiltrating the plant bed (City of Stockholm 2022).

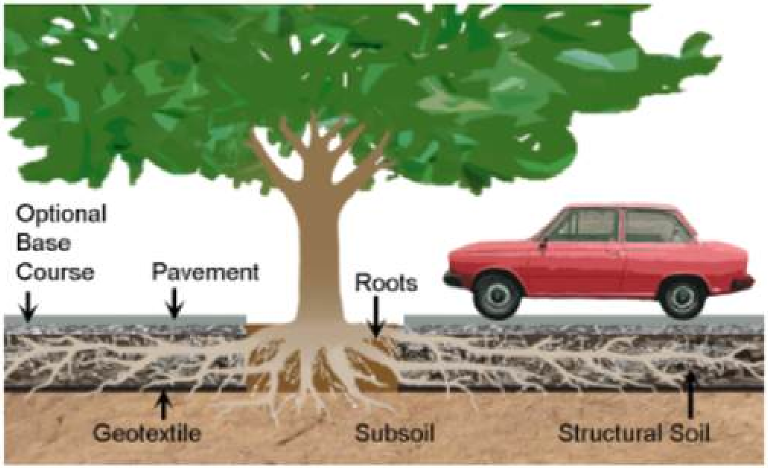


Figure 29. A suspended pavement system employing the use of structural soils and geotextiles (Day and Dickinson 2008).

(c) Early Growth to Maturity

Tree Guards and Gates

Ongoing human pressures, including pedestrian traffic and informal use of planting areas, can be mitigated through surface design interventions that clearly delineate tree space. Tree guards, raised curbs, and reinforced tree grates reduce soil compaction, protect trunks, and limit root zone disturbance in high-use public spaces (Watson et al. 2014).

Maintenance

When trees are successfully installed, long-term survival depends heavily on consistent maintenance and protection from disturbance. Tree mortality rates are highest within the first several years after planting, when disturbances are most impactful (Roman et al. 2014). Inadequate post-planting care, including poor pruning practices, insufficient watering, and unclear maintenance responsibility, further exacerbates stress on urban trees (Schmack et al. 2024).

Improper pruning, especially when carried out by untrained personnel or delayed due to budget constraints, can weaken tree structure, increase susceptibility to pests and diseases, and shorten overall lifespan, undermining long-term canopy goals (Watson et al. 2014). Early structural pruning during the first several years after planting, which helps guide branch architecture, can reduce future conflicts with infrastructure and minimize the need for large, damaging corrective cuts later in a tree's life (Watson et al. 2014). When considering tree canopy interference with wires, trimming trees and tree topping (the removal of the top sections of trees at full growth) is a common maintenance approach (Bloniarz and Ryan 1993). However, this can increase the risk of insect and disease damage, shortening the potential lifespan of street trees (Ibid.).

In addition to proper pruning practices, adequate watering is essential as young trees are highly susceptible to drought stress in dense urban environments, particularly during the first two to five years after planting (Vogt et al. 2015). Studies show that consistent watering during these first five years significantly improves survival, particularly in locations with compacted soils and high evaporative demand (Ibid).

Inspections are essential to uncovering potential problems with trees. They should be performed by a qualified arborist who is trained in the art and science of planting, caring for, and maintaining trees. Arborists are knowledgeable about the needs of trees and are trained and equipped to provide proper care (City of Somerville, 2021). Training programs and certification standards, such as those promoted by professional arboricultural organizations, improve pruning quality and reduce the risk of pest and disease entry associated with poor technique (Watson et al. 2014).

Resident Stewardship Programs

The success of urban tree planting goes beyond physical constraints such as infrastructure and soil. In constrained urban planting locations, resident involvement in tree planting and watering can both improve street tree vitality while increasing environmental education (Egerer et al. 2024). Local governments can encourage resident stewardship by hosting tree-care programs and posting signage welcoming residents to care for the trees in their neighborhoods (City of Cambridge Urban Forestry 2026).

2. Municipal Case Studies

What methods have cities with similar climates and constrained spaces used to plant and maintain healthy trees in the public right of way?

Balancing highly constrained urban space with the need for the many benefits provided by trees is a problem in cities around the world. In this literature review, we draw inspiration for planting strategies and technologies primarily from cities in the Northeastern United States and Europe based on their similar climates and shared challenges of constrained environments with large amounts of impervious surface (Kuser 2007, 115).

Stockholm, Sweden

Given that one of the key impediments for expanding Somerville's tree canopy using the ROW is the dominance of impervious surfaces in those spaces, the experience of Stockholm, Sweden, is particularly insightful. The central part of Stockholm is dominated by impervious surfaces similar to Somerville's 4.4% of open space (Naturvårdsverket 2023; City of Somerville 2025, 22). A 2001 survey revealed that the majority of trees within Stockholm's historic city center were in poor health due to a lack of permeable surfaces and poor subsurface condition. In response, the city developed a program for planting and maintaining trees in urban environments that has become known as the Stockholm Solution (City of Stockholm 2022, 2). The method relies heavily on designing or redesigning the subsurface environment to be more conducive for tree growth, through the use of structural soil (City of Stockholm 2022, 8-9).

Stockholm demonstrates that while urban environments are difficult environments for fostering healthy tree development due to high amounts of impervious surfaces, it is possible to build a flourishing urban tree canopy.

London, United Kingdom

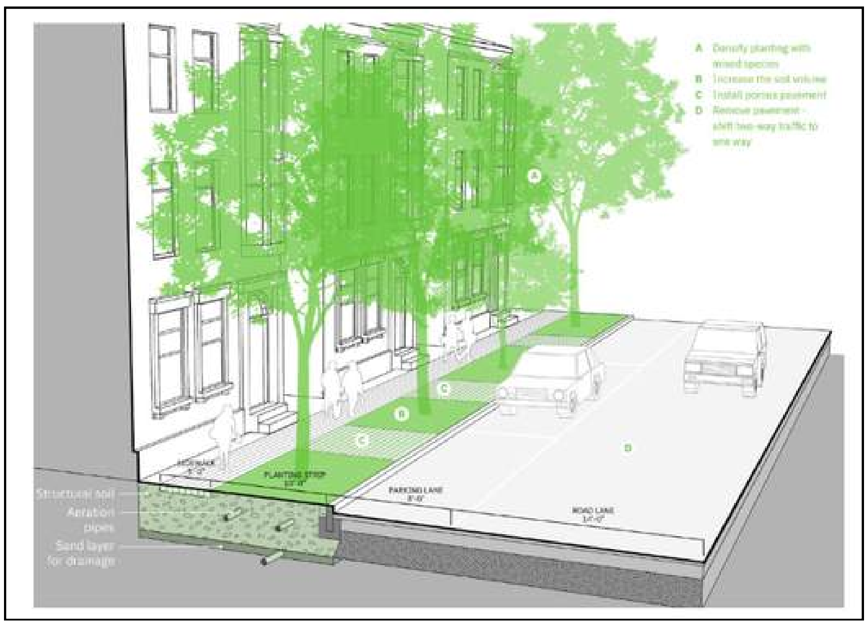
As mentioned in Section I: Challenges and Solutions for Planting Trees in Constrained Spaces, one of the main concerns when planting trees in an urban environment is their interaction with other subsurface infrastructure needed for urban life, such as electrical conduits, gas pipes, and sewer lines. The latter is of particular concern due to the risk of trees damaging pipes in their quest for water. In the United Kingdom, sewer pipes are allowed to be within canopy reach of a tree if adequate preventive measures are taken, such as use of welded polyethylene pipes and liners to discourage root growth around the sewer (Trees in Action Group, Chartered Institution of Building Services Engineers et al. 2014, 115). Liners have the advantage of being employable even in situations where pipe is not being laid or replaced (Ibid.). Therefore, the ongoing process of Somerville replacing its aging plumbing infrastructure where a high percentage consists of clay pipes, (Postlewaite 2026) that are more susceptible to intrusion and forms of root damage, with pipes made of more modern materials like PVC presents an opportunity to reevaluate certain sites previously deemed to be too constrainedTrees in Action Group, Chartered Institution of Building Services Engineers et al. 2014, 115). While use of liners offers a potential mitigation effort for dealing with the concerns associated with planting trees in a constrained space, even when the planting is preceded by the replacement of subsurface infrastructure.

London, UK (cont)

Additionally, as part of their Healthy Streets initiative, comparable to Complete Streets in the United States, the Greater London Authority (GLA) has been working to improve the distribution of street greenery in the city, with the larger aim of reducing pedestrian exposure to vehicular air pollution (Greater London Authority 2019, 10). In their 2019 report, GLA recommends using vertical greenery other than trees, such as hedges, to reduce the effect of pollution on pedestrians in areas where building height is more than double the road width and air quality at street level is worse than air quality above the surrounding buildings (Ibid., 20). Since roots of hedges do not take up as much space, choosing to plant them in place of trees would eliminate subsurface space constraints. However, to serve as an effective barrier, a continuous row of plantings is needed at a site.

Cambridge, MA

As one of the cities neighboring Somerville, Cambridge shares the same climate and many of the same tree-planting challenges, including limited sidewalk space and root conflicts with utilities and sidewalks. Cambridge's Urban Forest Master Plan Technical Report developed a set of design recommendations based on available sidewalk width that are more sustainable than the conventional tree planting practices of planting 30 feet apart (City of Cambridge 2019). For narrow sidewalks of width less than 6 feet, the report recommends altering street design to allow for more planting space. This could involve removing a travel lane entirely or intermittently, removing parking, making shared streets, and depaving yards to maximize pervious surface and support root growth (Ibid.).



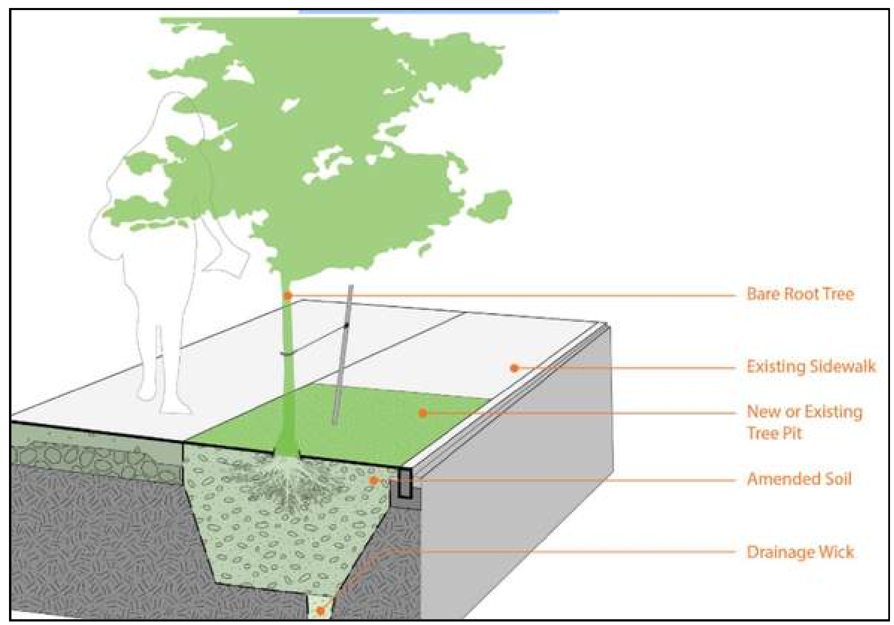


Figure 30. Proposed Strategy of Reducing Roadway to Increase Planting (City of Cambridge 2019, 161) [Left] & Figure 31. Example of recommended tree planting design (City of Cambridge 2019, 156) [Right.]

Cambridge, MA (cont)

In general, the report recommends planting bare root trees and amending soils in place when full reconstruction is not feasible to encourage faster tree adaptation and lower costs (Ibid.). It also recommends incorporating continuous planting strips, expanding soil volume under sidewalks for improved root growth, and planting multiple stories of vegetation where there is no parking to reduce soil compaction (Ibid.). These recommendations incorporate green infrastructure technologies such as structural soils, aeration pipes, pervious pavement, and suspended pavement (see Figures 30 and 31).

New York City, NY

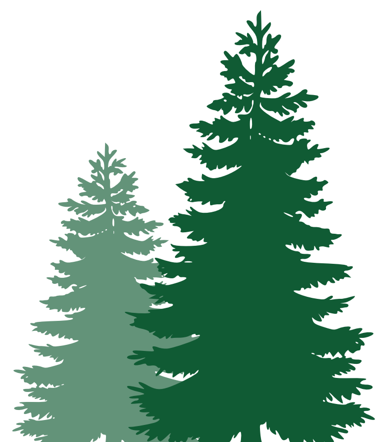
In 2005, the NYC Department of Parks & Recreation partnered with the nonprofit New York Restoration Project to implement the MillionTreesNYC campaign based on research findings on the benefits of trees in urban settings, particularly in residential areas, and a tree survey (Campbell et al. 2014).

Urban trees in New York City also encounter constrained spaces. As for technologies, NYC Parks encourages the use of structural soils and soil cells where appropriate. They apply it as a base material under hard surfaces such as concrete, permeable pavement, or permeable pavers. Permeable pavement or pavers are also suggested, especially in areas where stormwater flooding occurs frequently.

Similarly, bioswales and green infrastructure installed on the right-of-way help collect and manage stormwater runoff from streets and sidewalks by directing stormwater to engineered systems that typically feature soils, stones, and vegetation (City of New York Parks and Recreation 2016).

3. Conclusion

Urban street trees play a critical role in advancing Somerville's climate resilience goals by mitigating extreme heat, reducing flood risk, and delivering measurable public and environmental health benefits. Expanding tree canopy coverage, particularly in Environmental Justice communities, represents both a climate adaptation strategy and a public health intervention. Although dense urban infrastructure and limited planting space pose ongoing challenges, case studies from other cities in similar climates and constrained spaces offer solutions Somerville can adopt. The strategic use of suspended pavement systems that incorporate structural soils, soil cells, permeable pavement, geotextiles, and thoughtful species selection, paired with long-term maintenance planning, provides a viable pathway to equitably increase tree canopy citywide.



Appendix B: Somerville Tree Species Classifications, 2026

Species Not to Plant (Invasive or Vulnerable to Emerald Ash Borer)			
Common Name	**Scientific Name**	**Status**	**Notes**
Amur Cork Tree	*Phellodendron amurense*	Likely Invasive	None in Somerville
Amur Maple	*Acer ginnala*	Invasive in Nearby States	
Black Locust	*Robinia pseudoacacia*	Invasive	
Black Pine	*Pinus thunbergii*	Invasive	None in Somerville
Callery Pear	*Pyrus Calleryana*	Likely Invasive	
Chinese Elm	*Ulmas parvifolia*	Invasive in Nearby States	
Fringe Tree	*Chionanthus virginicus*	Vulnerable to Emerald Ash Borer	None in Somerville
Goldenraintree	*Koelreuteria paniculata*	Invasive in Nearby States	
Green Ash & White Ash	*Fraxinus spp.*	Vulnerable to Emerald Ash Borer	Any ash species
Hedge Maple	*Acer campestre*	Invasive in Nearby States	
Norway Maple	*Acer platanoides*	Invasive	
Sawtooth Oak	*Quercus acutissima*	Invasive in Nearby States	
Siberian Elm	*Ulmus pumila*	Invasive in Nearby States	
Sycamore Maple	*Acer pseudoplatanus*	Invasive	
Tree-of-Heaven	*Ailanthus altissima*	Invasive	

Table 8: Species Not to Plant in Somerville (Boukili 2026B).

Native Species	
Common Name	**Scientific Name**
Allegheny Serviceberry	*Amelanchier laevis*
American Beech	*Fagus grandifolia*
American Bladdernut	*Staphylea trifolia*
American Crabapple	*Malus coronaria*
American Elm	*Ulmus americana*
American Holly	*Ilex opaca*
American Hophornbeam	*Ostrya virginiana*
American Hornbeam	*Carpinus caroliniana*
American Linden	*Tilia americana*
American Smoketree	*Cotinus obovata*
American Sycamore	*Platanus occidentalis*
American Yellowwood	*Cladastis kentukea*
Armstrong Red Maple	*Acer x freemanii*
Atlantic Whitecedar	*Chamaecyparis thyoides*
Bald-Cyprees	*Taxodium distichum*
Balsam Fir	*Abies balsamea*
Bigleaf Magnolia	*Magnolia macrophylla*

Native Species (continued)	
Common Name	**Scientific Name**
Black Cherry	*Prunus serotina*
Black Gum	*Nyssa sylvatica*
Black Maple	*Acer saccharum subsp. nigrum*
Black Oak	*Quercus velutina*
Black Walnut	*Juglans nigra*
Bur Oak	*Quercus macrocarpa*
Carolina Silverbell	*Halesia tetraptera*
Cherrybark Oak	*Quercus pagoda*
Chestnut Oak	*Quercus montana*
Chestnut Oak	*Quercus michauxii*
Chinkapin Oak	*Quercus muehlenbergii*
Common Chokecherry	*Prunus virginiana*
Common Persimmon	*Diospyros virginiana*
Cucumbertree Magnolia	*Magnolia acuminata*
Darlington Oak	*Quercus hemisphaerica*
Douglas-Fir	*Pseudotsuga menziesii*
Downy Serviceberry	*Amelanchier arborea*

Native Species (continued)	
Common Name	**Scientific Name**
Eastern Arborvitae	*Thuja occidentalis*
Eastern Redbud	*Cercis canadensis*
Eastern Redcedar	*Juniperus virginiana*
Eastern White Pine	*Pinus strobus*
Franklinia	*Franklinia alatamaha*
Green Hawthorn	*Crataegus viridis*
Grey Birch	*Betula populifolia*
Hackberry	*Celtis occidentalis*
Honeylocust	*Gleditsia triacanthos*
Kentucky Coffeetree	*Gymnocladus dioicus*
Loblolly Pine	*Pinus taeda*
Mountain Stewartia	*Stewartia ovata*
Overcup Oak	*Quercus lyrata*
Pagoda Dogwood	*Cornus alternifolia*
Pawpaw	*Asimina triloba*
Pecan	*Carya illinoensis*
Pin Oak	Quercus palustris

Native Species (continued)	
Common Name	**Scientific Name**
Prairie Crabapple	*Malus ioensis*
Red Buckeye	*Aesculus pavia*
Red Maple	*Acer rubrum*
Red Oak	*Quercus rubra*
River Birch	*Betula nigra*
Sassafras	*Sassafras albidum*
Scarlet Oak	*Quercus coccinea*
Shagbark Hickory	*Carya ovata*
Shagbark Hickory	*Carya laciniosa*
Shingle Oak	*Quercus imbricaria*
Shortleaf Pine	*Pinus echinate*
Shumard Oak	*Quercus shumardii*
Slash Pine	*Pinus elliottii*
Sourwood	*Oxydendrum arboreum*
Southern Magnolia	*Magnolia grandiflora*
Striped Maple	*Acer pensylvanicum*
Sugar Maple	Acer saccharum

Native Species (continued)	
Common Name	**Scientific Name**
Sugarberry	*Celtis laevigata*
Swamp White Oak	*Quercus bicolor*
Sweet Birch	*Betula lenta*
Sweetbay Magnolia	*Magnolia virginiana*
Sweetgum	*Liquidambar styraciflua*
Tuliptree	*Liriodendron tulipifera*
Umbrella Magnolia	*Magnolia tripetala*
Virginia Pine	*Pinus virginiana*
Washington Hawthorn	*Crataegus phaenopyrum*
White Fir	*Abies concolor*
White Oak	*Quercus alba*
Willow Oak	*Quercus phellos*
Yellow Birch	*Betula alleghaniensis*
Yellow Buckeye	*Aesculus flava*

Table 9. Native Species Recommended for Planting in Somerville (Boukili 2026a)

Appendix C: Costs

Species Selection Costs (Massachusetts Department of Transportation 2026)	
Species Median of Median	$960.00
Species Mean of Median	$796.86
Species Median of Mean	$987.07
Species Mean of Mean	$813.56

Table 10. Cost breakdown for species selection (MA DOT 2026)

Selection Costs by Individual Species (Massachusetts Department of Transportation 2026)		
Species Name	Median Price	Mean Price
Arborvitae 5-6 Feet	$513.00	$485.43
Cedar - Red 7-8 Feet	$1,195.00	$1,243.57
Pine - White 5-6 Feet	$687.50	$722.93
Linden - Little Leaf 2-2.5 Inch Caliper	$965.00	$1,015.56
Locust - Honey - Skyline 2-2.5 Inch Caliper	$1,030.00	$1,058.33
Maple - Red 8-10 Feet / #15	$800.00	$752.57
Maple - Red 2-2.5 Inch Caliper	$1,019.00	$1,047.23

Selection Costs by Individual Species (Continued)		
Species Name	Median Price	Mean Price
Maple - Red - Armstrong 2-2.5 Inch Caliper	$1,100.00	$1,088.57
Maple - Red - October Glory 2-2.5 Inch Caliper	$987.50	$980.00
Maple - Red - Red Sunset 2-2.5 Inch Caliper	$960.00	$1,008.33
Oak - Northern Red 1.5-2 Inch Caliper	$949.00	$987.07
Oak - Pin 2-2.5 Inch Caliper	$960.00	$1,008.33
Oak - White 2-2.5 Inch Caliper	$1,175.00	$1,235.63
Planetree - American 2-2.5 Inch Caliper	$1,000.00	$1,031.67

Selection Costs by Individual Species (Continued)		
Species Name	Median Price	Mean Price
Sweetgum - Fruitless 1.5-2 Inch Caliper	$1,000.00	$1,048.80
Sweetgum - Fruitless 2-2.5 Inch Caliper	$1,000.00	$979.38
Cherry - Sargent Columnar 1.5-2 Inch Caliper	$900.00	$916.88
Hawthorn - Winter King 1.5-2 Inch Caliper	$850.00	$886.88
Lilac Tree - Japanese Ivory Silk 1.5-2 Inch Caliper	$1,060.00	$1,070.31
Serviceberry - Autumn Brilliance 4-5 Feet	$490.00	$505.00
Serviceberry - Autumn Brilliance 7-8 Feet	$1,100.00	$1,180.00

Selection Costs by Individual Species (Continued)		
Species Name	Median Price	Mean Price
Tulip Tree 2-2.5 Inch Caliper	$1,050.00	$1,050.71
Tupelo 1.5-2 Inch Caliper	$1,300.00	$1,276.80
Rhodo - Rosebay 2-2.5 Feet / #3	$270.00	$253.17
Bayberry Shrub - Northern 2-3 Feet / #3	$175.00	$188.33
Dogwood - Redosier 2-3 Feet / #3	$160.00	$165.00
Sumac Shrub - Fragrant-Gro-Low 2-3 Feet / #2	$140.00	$133.64
Summersweet Shrub 3-4 Feet / #3	$173.00	$171.83

Selection Costs by Individual Species (Continued)		
Species Name	Median Price	Mean Price
Sweetfern #1	$100.00	$101.43

Table 11. Cost breakdown per species (MA DOT 2026)

Bumpout Costs (Massachusetts Department of Transportation 2026)	
Category	Cost
All Curb Median of Median, excluding edging	$99.00 per ft
All Curbs Mean of Median, excluding edging	$272.00 per ft
32 Evergreen St Curb Median of Median (~58ft)	$5,742.00
32 Evergreen St Curb Mean of Median (~58ft)	$15,788.89
Cement Concrete Median of Median	$110.00 per syd
Cement Concrete Mean of Median	$116.91 per syd
32 Evergreen St Sidewalk Median of Median (~62 syd)	$6,820.00

Bumpout Costs (Massachusetts Department of Transportation 2026)	
Category	Cost
All Curb Median of Median, excluding edging	$99.00 per ft
All Curbs Mean of Median, excluding edging	$272.00 per ft
32 Evergreen St Curb Median of Median (~58ft)	$5,742.00
32 Evergreen St Curb Mean of Median (~58ft)	$15,788.89
Cement Concrete Median of Median	$110.00 per syd
Cement Concrete Mean of Median	$116.91 per syd
32 Evergreen St Sidewalk Median of Median (~62 syd)	$6,820.00

Bumpout Costs (Continued)	
Category	Cost
32 Evergreen St Sidewalk Median of Mean (~62 syd)	$7,475.96
32 Evergreen St Sidewalk Mean of Mean (~62 syd)	$7,366.63

Table 12. Cost Breakdown for Bumpouts (MA DOT 2026)

Tree Grates and Fences (Massachusetts Department of Transportation 2026)	
Category	Cost
Frame and Grate Median of Median	$1,300.00
Frame and Grate Mean of Median	$1,250.00
Frame and Grate Median of Mean	$1,235.16
Frame and Grate Mean of Mean	$1,216.35

Table 13. Cost Breakdown for Tree Grates and Fences (MA DOT 2026)

Geotextile Costs (Massachusetts Department of Transportation 2026)	
Category	Cost
Geotextile Median of Median	$7.30 per syd
Geotextile Mean of Median	$7.37 per syd
32 Evergreen St Sidewalk Median of Median (~11 syd)	$80.30
32 Evergreen St Sidewalk Mean of Median (~11 syd)	$81.03
Geotextile Median of Mean	$7.15 per syd
Geotextile Mean of Mean	$7.11 per syd
32 Evergreen St Geotextile Median of Mean (~11 syd)	$78.65

Tree Grates and Fences (Massachusetts Department of Transportation 2026)	
Category	Cost
32 Evergreen St Geotextile Mean of Mean (~11 syd)	$78.17

Table 14. Cost Breakdown for Geotextiles (MA DOT 2026)

Appendix D: Interview Methods & Findings

Guiding Questions

- What are the best practices for cultivating a vibrant urban canopy in constrained spaces in the Northeastern United States?
- How can cities create a vibrant urban canopy while preserving sidewalk accessibility?
- Which design tree planting strategies implemented have shown the most viable results, that could be considered as options/opportunities for Somerville?

How effective has the community engagement programs been in tree planting strategies?

City	Similarities with Somerville	Identified technologies or design strategies that have been proposed or are currently implemented
Boston	• Limited growing space (above and below) • Soil compaction and poor soil • Conflict with underground utilities • Climate change	• Engineered soil mixes and underground support systems • Tree inventory databases • Tree watering bags • Heat-tolerant species • Community involvement • The Boston Urban Forest Plan involves community input and engagement. • Boston also has the Boston Tree Alliance, which is a coalition of community-based organizations (CBOs) and non-profits dedicated to tree planting and maintenance on private land in Boston. The Alliance provides funding, technical assistance, and educational opportunities to organizations in partnership with Boston residents and property owners.
Cambridge	• Constrained sidewalks • Climate Change	• Structured soils • Pervious soils • Suspended pavements • Planting bare-root trees • Canopy cover • Cooling corridors • In 2025, Cambridge reported a 30% canopy cover increased over the last five years (since 2019, Master Plan implementation)
Malden	• Canopy cover • Disease • Tree maintenance • Climate Change	• Commercial street redesign • Urban forestry

Table 15. Interview Cities, similarities with Somerville, and identified technologies.

Urban Forestry Interview Findings

Topic	Boston Todd Miston, Director · March 1, 2026	Cambridge David Lefcourt, City Arborist · March 16, 2026	Malden Christopher Rosa, Tree Warden · April 15, 2026
Constrained space			
Tree pits	• Enlarged to 3×8 ft (24 sq ft) • Replant older trees after expansion	• Smaller caliper trees, faster establishment, less root space needed • Structural soils around pits to increase below-surface volume	• Correct planting depth (exposed root flare) prevents most damage • Homeowner easements, plant at the front yard or the city/private boundary
Pavement & infrastructure	• Flexipave, permeable rubbery paving; early-stage trials; costly; annual cleaning required(considering to introduce them) • Permeable pavement and structural soils targeting the city standard • Collaboration with Public Works & Planning Depts.	• Planting sites identified during street reconstruction (utilities, curbs, sidewalks) • Avoid tall species under overhead utility wires; target 30–35 ft mature height • Private developers required to contribute to tree maintenance	• Flexipave restores ADA 3 ft walkway; ~$10/sq ft total; covers raised roots without tree removal • Bump-outs, extend curb into street for planting space • Sidewalk widening (expensive, last resort)

Species selection			
Native vs. non-native	• Native-first, not native-only • No invasive species • Climate-change strategy is yet to be formalized	• 50/50 native/non-native balance • Non-native is better adapted to harsh urban conditions • Block-level species diversity to avoid monocultures	• Native preferred but many natives failing (ash, elm, chestnut, beech, sugar maple) • Non-native does not mean invasive, important distinction • Opposed to native-only planting laws
Climate adaptation	• Species diversity driven by nursery availability • A systematic future strategy is yet to be established	• Selects species tolerant of higher temps with winter resilience • Warming-climate species increasingly prioritized	• Assisted migration of southern species (yellowwood, Kentucky coffee tree) introduced as the climate warms • Species diversity is essential given climate change
Salt tolerance	• Prioritized for heavily salted areas	• Considered in species selection	• Considered in species selection

Community engagement			
Programs & outreach	• Boston Tree Alliance (MassAudubon) private property planting; supports trees for the first 3–5 years	• Forest Friends residents adopt & care for nearby trees • Junior Forester Program ages 5–13, education + adoption • Committee on Public Planting, monthly meetings	• Tree Steward Program resident training in planting, pruning, MA General Law Ch. 87 • Facebook 'Malden Tree Warden' more than 2,000 followers, 10K–20K views/post • SeeClickFix, an online tree request platform

Planting approach			
Strategy & outcomes	• Replant & expand existing pits • Experiment with Flexipave and turn it into a standard • Data collection on survival rates is ongoing	• Integrate planting into street reconstruction projects • Maximize planting locations during each project cycle	• Street-scale planting— 1 request triggers 15–20 trees on the full street • Canopy coverage grew from 13% to 19%
Maintenance model			
Staffing	• Certified arborists manage city contractors and in-house staff	• In-house crews for routine pruning & inspections • Contractors for specialized or larger tasks	• City tree warden oversees contractors • Community stewards support day-to-day care
Gaps & challenges			
Open issues	• Survival rate data from using advanced planting strategies is still pending • Root damage to sidewalks is ongoing	• Resident preferences vs. species diversity goals • Utility wire conflicts limit species choice in many locations	• Flexipave permeability clogs easily; not a substitute for fully permeable pavement • Native species viability declining under climate stress
Shared solutions	• Structural soils beneath paved surfaces to expand root volume and reduce sidewalk damage • Flexipave as a pavement supplement (not replacement) for ADA compliance and root coverage • Salt-tolerant species selection in heavily treated road corridors • Contractor + in-house hybrid maintenance model • Community stewardship programs to extend city care capacity • Species diversity to guard against monoculture pest and disease vulnerability		

Interviews conducted by Cynthia Musuka & Laura Del Valle Rosario, Tufts University — Urban Planning & Sustainability

Table 16. Informational Interviews -Compilation of Findings

Appendix E: Somerville Tree Planting Distance Requirements

Object/Infrastructure	Minimum Distance Required (Feet)
Intersection, Crosswalk, or Stop Sign	20
Fire Hydrant or Utility Pole	5
Streetlight	10
Driveway or Walkway	3
Underground utilities (ex. gas and water)	1 (from edge of tree well, at least 4' to tree trunk)

Table 17. Minimum distances from utilities and infrastructure that trees must be planted in Somerville (City of Somerville 2021, 76)