
PUBLIC TREE PLANTING PLAN

City of Revere, Massachusetts

Prepared for:

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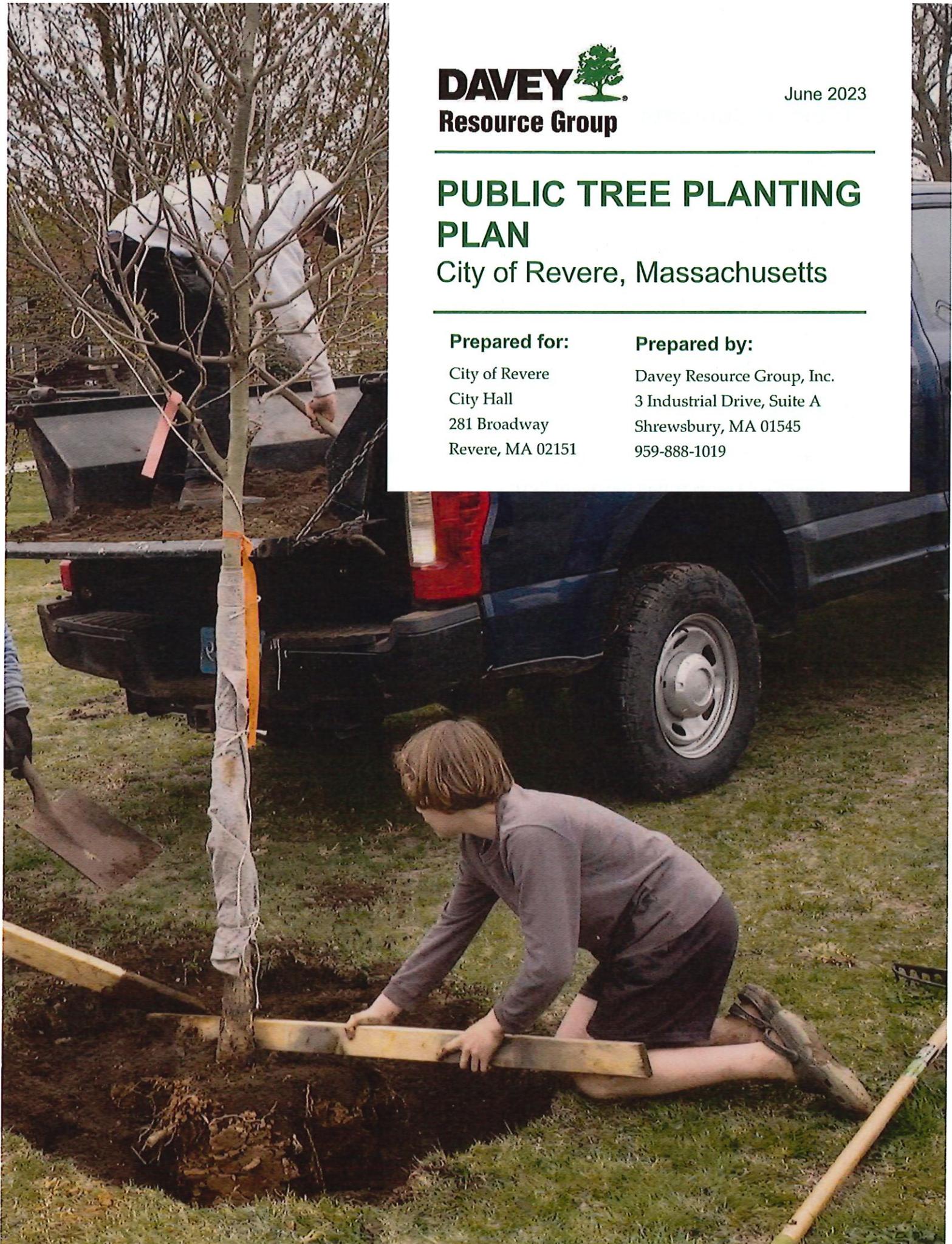


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This project supports the city of Revere’s vision to promote and enhance community well-being through public tree conservation and improved forestry management practices. This *Public Tree Inventory Analysis & Maintenance Schedule* offers expertise in preserving and expanding urban canopy so the environmental, economic, and social benefits it provides continue for generations.

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EXECUTIVE SUMMARY

The City of Revere's *Public Tree Planting Plan*, written by Davey Resource Group, Inc. (DRG), focuses on the steps involved in proper tree planting, identifying priority areas for planting within the city, and estimating the costs associated with a 1-for-1 tree removal to replacement ratio and slowly expanding new tree planting program. This report is meant to be used in conjunction with Revere's *Public Tree Inventory Analysis & Maintenance Schedule*, and more information on many of the topics touched on here, such as inventory data analysis and tree benefits, can be found in that report.

Key Findings

- Revere is facing warming temperatures and more extreme weather conditions because of climate change. Urban trees can help moderate some of the effects of changing climate and improve conditions for city residents.
- Tree species should be well matched to site conditions to provide the best chance of young tree survival and growth.
- Revere's urban forest has an overabundance of Callery pear and Norway maple trees, and these species should be planted sparingly in the future.
- Tree planting can be conducted by many different groups, including city staff, contractors, and volunteers. Regardless of who installs new trees, planting should be done to the specifications in the *ANSI A300 (Part 6)* standards.
- A 1-for-1 tree removal to replacement program would require the planting of between 88 and 136 trees each year for the next five years. The estimated cost of purchasing, planting, and watering each of these trees for one year after planting ranges from \$123,386 to \$181,634 per year.
- While a 1-for-1 removal to replacement ratio would prevent net loss of public trees, additional planting is needed to increase public tree canopy. A slow increase in new plantings may be the best way to build city planting capacity over time.

INTRODUCTION

Revere's urban forest – made up of the trees growing along streets, parks, and in private landscapes – is an integral part of the community's character and enhances the quality of life within the city. The city's trees provide wildlife habitat, help stabilize the soil by controlling wind and water erosion, and provide shade and windbreaks which reduce resident's energy costs^{1,2}. They also filter noise and air pollution³, produce oxygen, absorb carbon dioxide, increase property values⁴, reduce stress levels⁵, and improve recovery times from illness^{6,7}. Unlike other city infrastructure, **the value of city-owned trees will increase over time as trees mature and provide greater benefits**, provided that new trees are planted to replace removed trees, young trees are properly cared for, and mature trees receive proactive maintenance.

Like other cities in the United States, Revere is facing warming temperatures and altered precipitation patterns caused by climate change. From 1901 to 2021 Massachusetts saw a 2.74° Fahrenheit (F) increase in temperature.⁸ This warming trend is expected to continue and by 2050 temperatures are predicted to be 2.9 to 6.3°F warmer than they are today. Extreme heat days, classified as days with a high temperature above 90, are expected to increase by up to 29 days in that same period. Alterations in precipitation patterns are less certain, but trends indicate more

¹ USDA Forest Service. 2003. Benefits of Urban Trees—Urban and Community Forestry: Improving Our Quality of Life. *Southern Region Forestry Report R8-FR 71*. Retrieved from http://www.sci-links.com/files/Benefits_of_Urban_Trees.pdf

² Heisler, G. M. 1986. Energy Savings with Trees. *Journal of Arboriculture* 12(5):113–125. Retrieved from https://www.nrs.fs.fed.us/pubs/jrnl/1986/nrs_1986_heisler_002.pdf

³ Coder, K. D. 1996. Identified Benefits of Community Trees and Forests. University of Georgia Cooperative Extension Service: Forest Resources Unit. Publication FOR96-39. Retrieved from <https://nfs.unl.edu/documents/communityforestry/coderbenefitsofcommtrees.pdf>

⁴ Wolf, K.L. 2007. City Trees and Property Values. *Arborist News* 16(4): 34-36. Retrieved from <https://www.naturewithin.info/Policy/Hedonics.pdf>

⁵ Wolf, K. L. 1998a. Urban Nature Benefits: Psycho-Social Dimensions of People and Plants. *University of Washington: College of Forest Resources Human Dimensions of the Urban Forest Fact Sheet #1*. Retrieved from <https://www.naturewithin.info/UF/PsychBens-FS1.pdf>

⁶ Ulrich, R. 1984. View through Window May Influence Recovery from Surgery. *Science* 224: 420–422. Retrieved from <https://pdfs.semanticscholar.org/43df/b42bc2f7b212eb288d2e7be289d251f15bfd.pdf>

⁷ Ulrich, R. 1986. Human Responses to Vegetation and Landscapes. *Landscape and Urban Planning* 13: 29–44. Retrieved from https://www.researchgate.net/profile/Roger_Ulrich4/publication/254315158_Visual_Landscapes_and_Psychological_Well-Being/links/0c96053a3fe7796728000000/Visual-Landscapes-and-Psychological-Well-Being.pdf

⁸ US Environmental Protection Agency. (Updated December 20, 2022). *Climate Change Indicators in the United States*. Retrieved on January 10, 2022 at <https://www.epa.gov/climate-indicators>

instances of heavy precipitation and extreme weather, which may lead to more frequent and severe flooding.^{9,10}

Although no single strategy can completely mitigate the effects of changing climate, urban trees can help to reduce the negative impact of climate change on city residents. Trees reduce atmospheric concentrations of greenhouse gases, particularly carbon dioxide, that trap and retain heat and increase global climate change. **The**

inventoried, city-owned trees in Revere store an estimated 1,374 tons of carbon and sequester (absorb) a further 28.4 tons of carbon each year. Urban trees slow stormwater runoff and help prevent flooding¹¹ – Revere’s inventoried trees divert

The **Urban Heat Island Effect** results in cities experiencing higher temperatures than outlying, more rural areas. Cities have many surfaces, such as pavement and roofs, which absorb and hold heat more effectively than soil or plants. This can lead to cities experiencing temperatures 15 to 20°F warmer than surrounding areas.

nearly 1.53 million gallons of stormwater runoff each year. Shade trees also help reduce the urban heat island effect and help reduce overall air temperatures in cities by 2 to 9°F¹². The temperature of shaded surfaces can be 20 to 45°F cooler than the temperature of unshaded surfaces.¹³

In recent years tree planting along city streets in Revere has been supplemented by the Greening the Gateway Cities Program (GGCP). The GGCP is a partnership between Massachusetts’ Executive Office of Energy and Environmental Affairs (EEA), the Department of Conservation and Recreation (DCR) Urban & Community Forestry Program, the Department of Energy Resources (DOER), the US Forest Service, and the Department of Housing and Community Development (DHCD), along with Gateway Cities and local grassroots organizations. This planting program is designed to reduce household heating and cooling costs by increasing tree

⁹ NOAA - National Oceanic and Atmospheric Administration. (n.d.). *National Centers of Environmental Information – U.S. Climate Normals Quick Access*. Retrieved on December 14, 2022 at <https://www.ncei.noaa.gov/access/us-climate-normals/#dataset=normals-annualseasonal&timeframe=30&location=MA&station=USW00094746>

¹⁰ Resilient MA – Climate Change Clearinghouse for the Commonwealth. (2018). *Massachusetts Climate Change Projections - Statewide and for Major Drainage Basins: Temperature, Precipitation, and Sea Level Rise Projections*. Northeast Climate Adaptation Science Center - University of Massachusetts Amherst. https://www.mass.gov/doc/climate-change-projections-for-major-drainage-basins-in-massachusetts/download?_ga=2.106408131.1988038156.1673230572-1121829753.1671655890

¹¹ Stormwater to Street Trees: Engineering Urban Forests for Stormwater Management, EPA publication 841 B 13 001.

¹² Akbari, H., D. Kurn, et al. 1997. Peak power and cooling energy savings of shade trees. *Energy and Buildings* 25:139-148.

¹³ Huang, J., H. Akbari, and H. Taha. 1990. The Wind-Shielding and Shading Effects of Trees on Residential Heating and Cooling Requirements. ASHRAE Winter Meeting, American Society of Heating, Refrigerating and Air-Conditioning Engineers. Atlanta, Georgia.

canopy cover in urban residential areas as well as increase the other environmental benefits provided by trees (Image 1). As of January 2023, a total of 2,035 trees have been planted out of the 2,400-tree goal. GGCP tree planting efforts have focused heavily on historically disadvantaged neighborhoods with low tree canopy cover to improve the equitable distribution of tree canopy benefits to all residents of the city.

Most of the City of Revere is designed as an Environmental Justice (EJ) Area by the Massachusetts EEA based on several factors. All EJ areas in Revere have large minority populations and some have a combination of large minority populations, low income, and English isolation (Image 2). These demographic factors have historically led to discrimination, lack of access to services, and other inequalities for these communities. Today, EJ communities often face disproportionately severe impacts of climate change and are frequently more vulnerable to climate change impacts such as high temperatures or flooding than non-EJ areas. Although GGCP planting efforts have added many trees to these vulnerable areas of the city, additional planting in these areas will continue to improve tree equity across Revere and help mitigate the greatest impacts of climate change in the city.

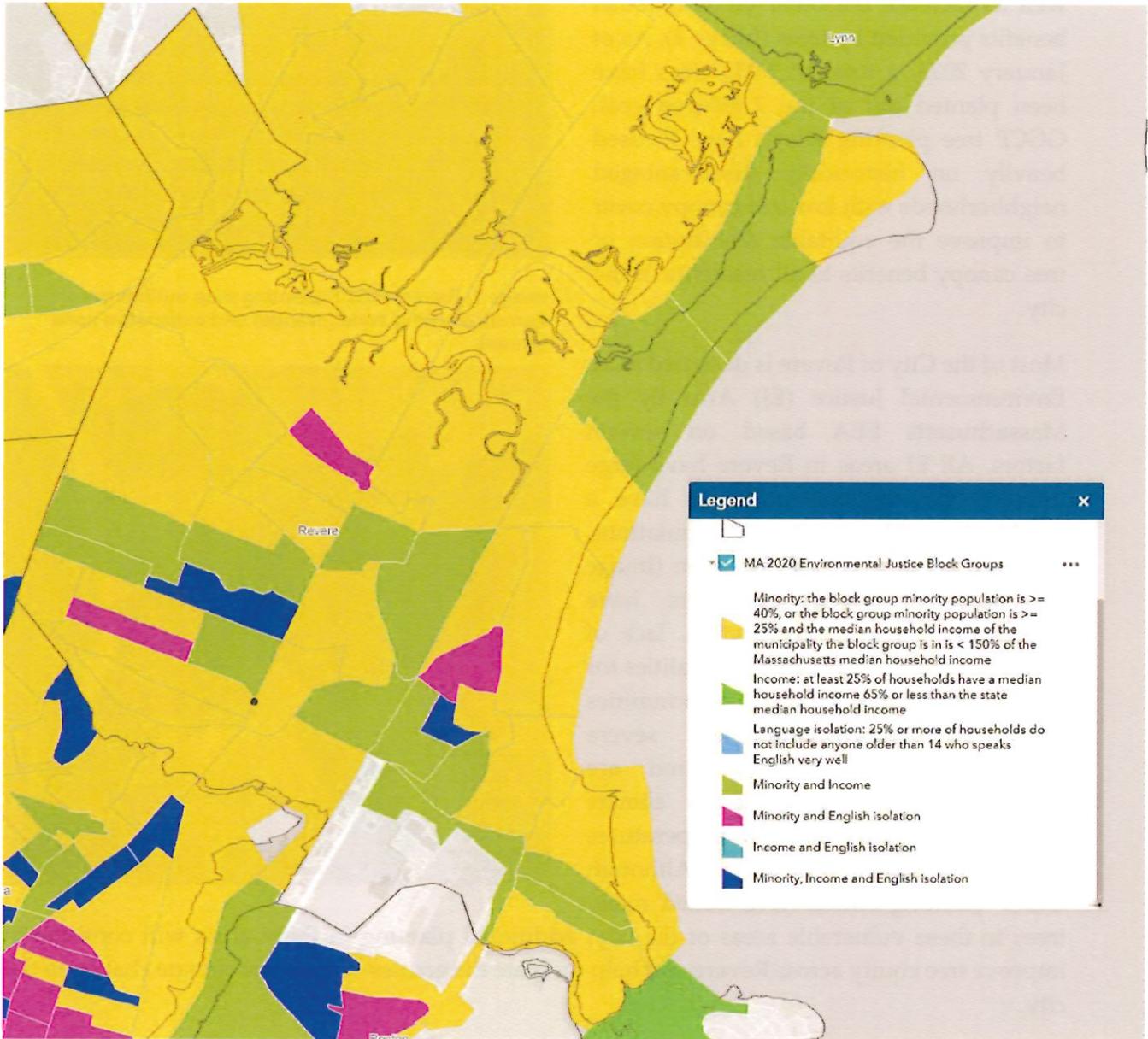
With the GGCP tree planting goal nearly met, the city should consider instituting or expanding its own planting program to take more ownership of canopy generation in the city and fill the gap that will be left when the GGCP completes planting in Revere. Historically, GGCP plants about 70% of its trees on private property, and about 30% on public property. While trees on private property contribute to Revere's urban tree canopy benefits, bolstering a city-wide planting program would also improve the numbers of planted trees in public areas, better ensuring equal access to and equal benefit from this public resource.

Gateway Cities are urban centers which serve as anchors for regional economies. They are often historic industrial centers which offered manufacturing jobs and a "gateway" to the American Dream. Many of these cities now face difficult social and economic challenges as they recover from the loss of the local manufacturing industry.

Image 1. Revere GGCP planting map outlining current planting zone (orange) and expansion zone (green).



Image 2. EJ areas within the City of Revere.

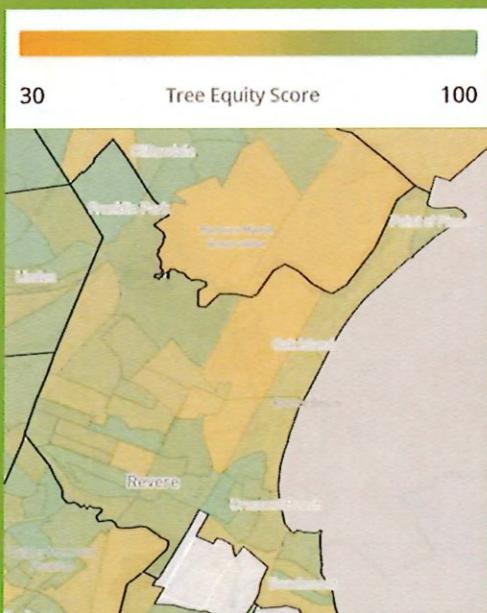


TREE EQUITY

Tree equity refers to the idea that all parts of a city should have enough trees to provide crucial health, economic, and climate benefits to residents.

Too often, areas with low tree cover are also low-income with high populations of people of color. Historic inequality and discrimination have left a legacy of poor tree canopy in places where residents could benefit most from tree benefits like shading/cooling, air pollution reduction, and stormwater runoff diversion.

The map from the American Forests Tree Equity viewer below shows tree equity scores for block groups in Revere. Areas with a high equity score are in green and areas with a low equity score are in orange. Revere's overall equity score is 77 out of 100, but ranges by block group from 53 to 100 with lower scores in the densely populated city center.



Since trees can provide such significant and important benefits, the City of Revere should aim to increase public tree canopy cover city-wide (Image 3). The city should use a systematic and organized approach to planting which will allow it to proactively replace trees which must be removed due to poor condition or development pressures, increase the tree canopy in the city's urban areas over time, and improve the survivability of new plantings through appropriate follow-up care during establishment and early growth. The city should focus on diversifying new plantings to reduce the damage caused by insects and diseases, planting large-stature trees to maximize the benefits provided by the urban forest, and planting in key locations where the impacts of greater canopy cover will be most beneficial to the community.

Image 3. Density of Revere's inventoried trees (brighter green indicates greater tree density).



SECTION 1: COMPONENTS OF A PLANTING PROGRAM

SITE SELECTION

The first step in any planting project is to identify the location that new plantings will be installed. Potential sites should be assessed to determine the growing space available for a tree and any factors that might influence tree selection, such as reflected heat from nearby hardscape, use of salt or other deicing agents, and soil type and quality. Choosing the right tree for the right place can help improve tree health and longevity and minimize conflicts with surrounding infrastructure such as roads, sidewalks, and overhead and underground utilities.

VACANT PLANTING SITE SIZES

Small Vacant Sites: These sites are appropriate for trees that will grow to 30 feet tall or less at maturity. The smallest dimension of small vacant sites is generally 3-4 feet. Small vacant sites may have overhead utilities present.

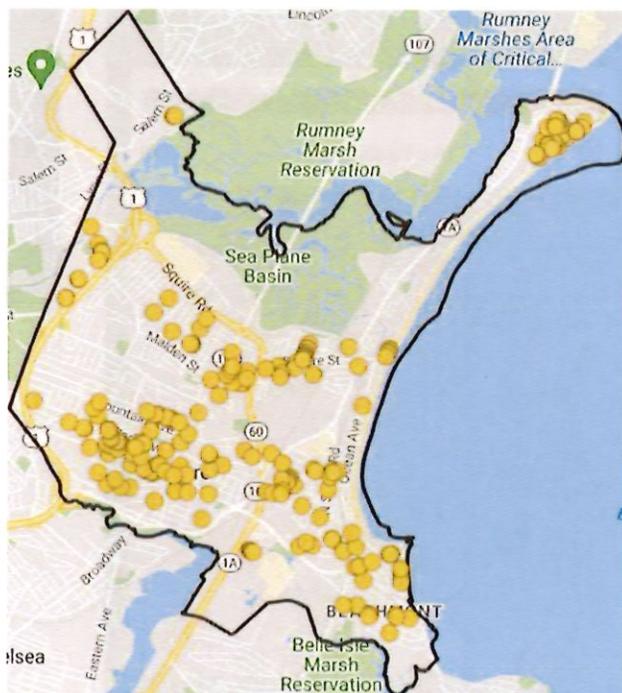
Medium Vacant Sites: These sites are appropriate for trees that will grow to between 30 and 45 feet tall at maturity. The smallest dimension of the planting site is 6 to 8 feet. Medium vacant sites should not have overhead utilities present.

Large Vacant Sites: These sites are appropriate for trees that will grow to larger than 45 feet at maturity. The smallest dimension of the planting site is no less than 8 feet, and the site should not have overhead utilities present.

Since the available growing space both above and below ground can be a significant limiting factor in the health of public trees, potential planting sites should be assessed to determine what size mature tree can be supported by the site. To maximize the benefits provided by city trees, large- or medium-sized trees should be planted wherever there is sufficient space to support them.

Potential planting sites in the city's right-of-way were recorded during the 2023 Revere public tree inventory (Note: As per the collection criteria for this survey, only vacant tree pits were collected as vacant sites during DRG's inventory. Additional planting locations may be available in tree lawns or behind the ROW or sidewalk where the ROW is sufficiently wide). The address of each vacant planting site was noted, as was the

Image 4. Map of vacant planting sites identified for the City of Revere.



maximum size of tree appropriate for the space and the presence or absence of overhead utilities. In total, 215 planting sites were identified. Due to hardscape limitations and utility conflicts, small tree plantings were recommended for all 215 sites. Revere's high percentage of hardscape may make it difficult to plant in the most advantageous locations. Cutting new tree pits may be an effective way to improve the tree canopy cover in underserved neighborhoods. Expanding the size of Revere's existing tree pits may also help improve the survivability of street plantings and allow for the planting of larger trees. Alternatively, increased tree planting in parks or engaging in a city-run, setback planting program with residents may help Revere achieve its planting goals while simultaneously fostering public relations and garnering public interest.

Site Selection Recommendations

- Assess conditions at each location being considered for planting and note what factors should be accounted for when choosing appropriate species for that location (e.g. available growing space, use of salt or other deicing agents, reflected heat, local weather/climate conditions, presence of overhead or underground utilities, soil conditions, etc.)
- Keep the tree inventory updated when trees are removed or planted to maintain an accurate list of potential planting sites along public roads within the city.
- Where possible, enlarge existing planting sites in tree wells to support larger stature trees and improve tree health and longevity.
- Create new planting sites, particularly in densely populated and historically disadvantaged neighborhoods with limited vacant planting sites.
- Although vacant planting sites were not inventoried in public parks and on other public grounds during the inventory, there may be many places where parks could benefit from additional tree planting. Assess the need for tree planting in Revere's parks and public grounds and add potential planting sites in these areas to the inventory.
- If possible, contact Dig Safe to verify planting sites are free from underground utilities before ordering trees. This will allow the city to have a finalized list of exactly which trees and how many are able to be planted and to avoid ordering more trees than can be installed in a given planting season.
- Consider a setback program whereby the city can offer to plant more trees on private property parcels that still serve the public good.
- Increase the number of tree pits along Revere's public streets.

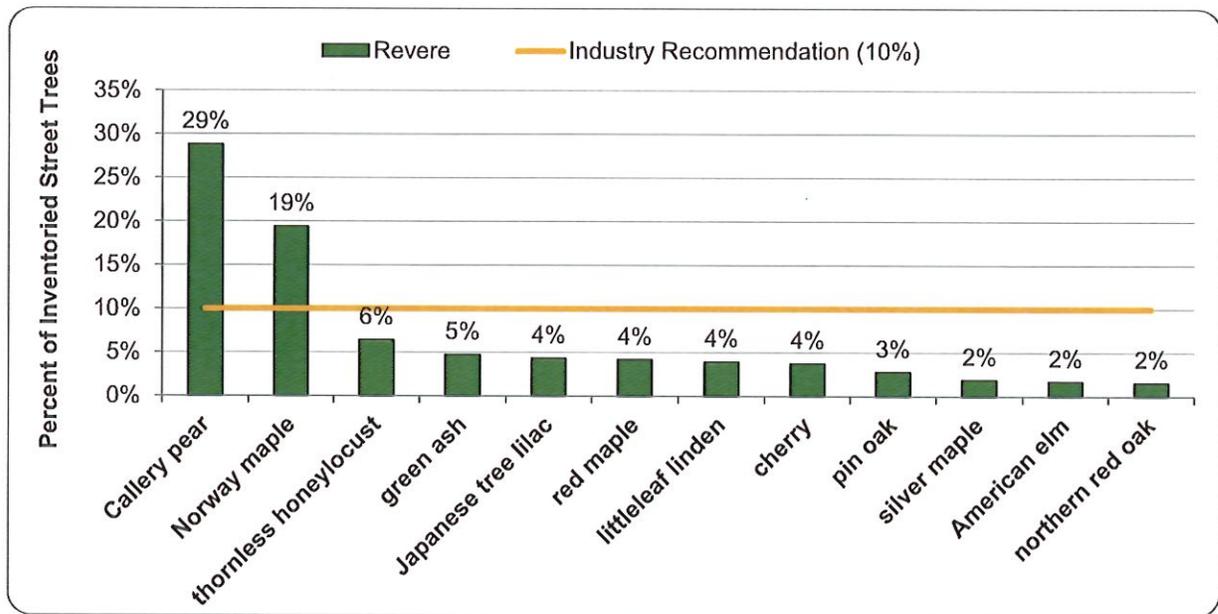
SPECIES SELECTION

Once planting sites have been identified, appropriate tree species must be selected for planting at each planting site. **Trees should be selected to withstand the challenges specific to each site.** For example, trees with high salt tolerance should be planted where road salt is likely to build up in soils; trees with high heat tolerance should be planted where heat radiation off surrounding hardscape is likely to impact the tree; and so on. Choosing trees which are well-suited to the site

will improve survival rates and decrease the costs associated with maintaining trees throughout their lifetime while maximizing the benefits those trees can provide to the city.

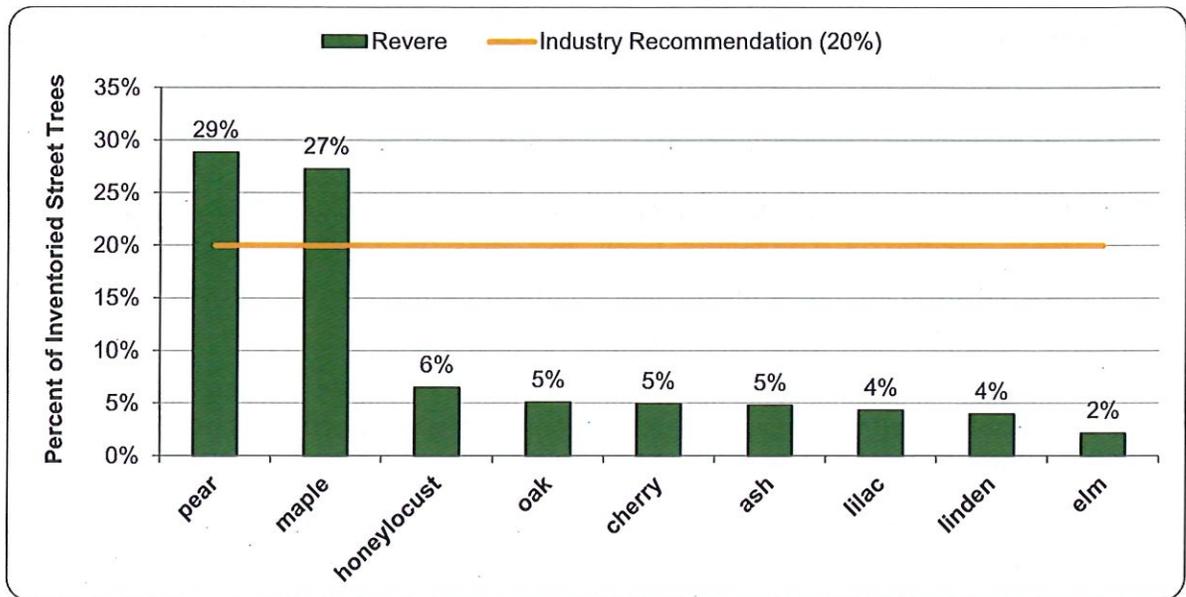
Tree susceptibility to pests and diseases is another important consideration in the selection process. Many communities in the Commonwealth and throughout the United States have seen massive losses of urban canopy due to introduced pests and diseases such as Dutch elm disease or the emerald ash borer. Tree species for planting should be selected for good resistance to known insect and disease threats and overplanting of any single species or genera should be avoided to prevent major losses of canopy in the future as new threats arise.

Table 1. Most common street tree species in Revere. Numbers over 10% indicate species which are overabundant.



Revere currently has an overabundance of *Pyrus calleryana* (Callery pear) and *Acer platanoides* (Norway maple) among its street tree plantings (Figure 1). Both pear and maple are overrepresented across the city on the genus level as well (Figure 2). Planting of these two genera should be avoided until their numbers fall within the recommended industry guidelines. It is important to note that other tree species may be in overabundance in smaller pockets around the city. The species and genus of trees in the immediate vicinity of any planting should also be considered during the selection process. Where possible, new plantings should aim to diversify the species and genera makeup of both individual neighborhoods and Revere as a whole. However, in some areas, finding diverse species which can withstand challenging site conditions may be difficult or impossible and planting more of a species or genera which is proven to survive will be more important than diversification.

Table 2. Most common street tree genera in Revere. Numbers over 20% indicate genera which are overabundant.



Species Selection Recommendations

- Limit planting of pear and maple trees until their numbers fall within industry guidelines.
- Select tree species and cultivars which are well adapted to existing site conditions. Consider temperature, wind, soil, salt, and growing space, among other factors, when choosing species. Also consider how conditions may change over the tree's lifetime and ensure that species selections can withstand projected changes in temperature, weather patterns, or site design.
- Choose species or cultivars which are resistant to pests and diseases of concern. For example, elms selected for planting should be resistant to Dutch elm disease. Some species or genera, such as ash, may need to be avoided entirely due to the presence of damaging pests or diseases in the landscape.
- Diversify planting selections to improve the urban forest's ability to adapt to environmental changes and avoid monocultures which may be at risk from pests or diseases that are introduced in the future.
- Consider using both native and non-native trees. While locally native trees may provide better wildlife value, non-native trees are often better suited for harsh urban environments. There is space for both in the urban forest.

NURSERY STOCK SELECTION

Whether Revere plans to install new trees using city staff or contractors, **careful selection and inspection of nursery stock for planting is essential to protecting the city's investment in planting new trees.**

Nursery Stock Selection Recommendations

- Prepare a list of desired trees and provide it to the nursery as far ahead of planting as possible. Early selection of plant material will allow time for changes to be made to planting plans if desired trees are not available and will help ensure that the nursery can hold the desired species and number of trees the city requests.
- Be ready with alternatives to less common tree species – many species are not readily available at all nurseries and recent supply chain difficulties have made some formerly common options scarce.
- Determine and define who is responsible for selecting and inspecting nursery stock to be used in planting projects. Clearly defined roles will aid in ensuring that no important steps of the planting process are skipped.
- Inspect all trees closely, either at the nursery, when taken off the delivery truck, or near the time of planting. Look for major issues such as large trunk wounds or cankers, severe girdling roots, crown dieback, major branch breakage, or loss of the main leader. Any trees with major defects should be rejected for planting and replacements requested from the nursery.
- Work with nurseries to access less common tree selections. Often, the reason that nursery tree selections are limited is due to nursery concern about their ability to sell uncommon species. Revere may be able to partner with a local nursery to purchase less common tree stock. It may take several years for a nursery to acquire and grow young trees to sale size, so forward planning and a good relationship with the nursery will be required.
- 2 to 2.5" caliper trees are typically the preferred caliper for street tree planting. Smaller trees may be suitable for planting in parks or other more sheltered areas.
- Consider the type of nursery stock you wish to purchase – bareroot, balled and burlapped (B&B), or containerized. Bareroot is less commonly available but generally provides a more intact root system. These trees need to be planted promptly to avoid the root system drying out. B&B trees are the common standard and provide good stability for newly planted trees but typically result in the loss of most of the young tree's root mass during the digging process. Containerized trees retain their root mass and are typically easy to transport but are highly prone to girdling roots. Be prepared for the challenges each type of tree is likely to provide.

TREE INSTALLATION

Tree installation may be carried out by city staff, contractors, volunteers, or a combination of these options. Each option presents different costs, benefits, and challenges.

- **City Staff:** In-house tree planting can be a cost-effective method to plant smaller numbers of trees. The equipment necessary for tree planting is relatively minimal (although mechanical aids such as backhoes, augers, or lifts can significantly reduce the physical effort planting crews must expend) and staff can be easily trained on tree planting best practices. However, city staff often have many other tasks to complete and may not be able to devote large amounts of time to tree planting.
- **Contractors:** Although the costs of hiring contractors may exceed those of using in-house staff or volunteers, there are many benefits to using contracted labor for tree planting. Contractors can spearhead the entire planting effort, from contacting Dig Safe through young tree care, saving city staff time and effort. They are highly effective when large numbers of trees are to be planted in a single season, as they can devote their time entirely to the task of tree planting. It's important to ensure that contract language for contractors is specific enough to ensure that a quality job is done and any errors or problems which arise are the contractor's responsibility. A several-year warranty on all trees is an effective way to ensure that contractors plant trees well and correctly, as is hiring a second, impartial contractor to provide project quality control and oversight.
- **Volunteers:** Bringing in community volunteers to plant trees can be a wonderful method of outreach to the community and an opportunity to teach residents about the benefits that trees can provide as well as tutor them on how to care for young trees in their neighborhoods. The drawbacks to using volunteers for planting include inconsistency in the quality of the work, slow progress, and limited capacity to plant large numbers of trees.

Tree planting should follow established best management practices, which are provided in the *ANSI A300 (Part 6) – Planting & Transplanting* standards. The International Society of Arboriculture (ISA) has a wealth of free and open-source technical specifications and guides for planting trees under a wide variety of circumstances, available online at:

<https://www.isa-arbor.com/education/onlineresources/cadplanningspecifications>

Tree Installation Recommendations

- Use a combination of city staff, contractors, and volunteers, to plant trees within Revere. Match the scope of the planting project with the abilities of the group who will do the planting.
- Follow established *ANSI A300* planting standards and require that any contractors hired to plant trees in the city follow the same applicable standards.
- Provide quality control checks on any planting, regardless of who is installing the trees, to ensure that planting is done to Revere's internal standards. City staff may be able to conduct these checks for smaller planting projects, while a third-party contractor may be a better option for quality control on larger planting projects.

YOUNG TREE CARE

While selecting appropriate tree species, picking high-quality nursery stock, and enforcing proper planting practices set a young tree up for success, it is the follow-up care of young trees that will ultimately determine whether they survive and thrive. **Staking, mulching, watering, and training young trees are as important, if not more important, than the task of installing them.**

- **Staking:** Staking of newly planted trees helps provide support while the root systems establish. In some cases, staking can also help reduce or prevent damage or vandalism of young trees. There are a variety of materials available for staking and guides on various staking materials and arrangements can be found at:

<https://www.isa-arbor.com/education/onlineresources/cadplanningspecifications>

It is important to avoid tying staking materials tightly around tree stems, as this can inhibit growth and girdle the tree. Staking materials should be removed from young trees after the root system is established (typically 1 to 2 years). If staking materials are left on the tree too long, they can inhibit the development of good stem taper and well-established roots as well as girdle the tree.

- **Mulching:** Proper mulching helps retain moisture in the critical root zone of newly planted trees, reduces compaction and soil temperature, and returns nutrients to the soil as the mulch breaks down. Mulch should be spread 2 to 4 inches thick over the footprint of the planting hole but should be pulled back slightly from the stem. Mulch which is piled against the stem can encourage the growth of harmful bacteria and fungi and encourage small mammals to chew at basal bark. Mulch should be refreshed as needed throughout the tree's establishment.
- **Watering:** Providing consistent and sufficient access to water is the single most important and effective method to ensure young trees survive and establish well. Trees should be watered deeply to encourage deeper root growth – shallow watering, as is common in lawn irrigation, can cause trees to develop shallow root systems which are more prone to uprooting when winds are high and the soil is saturated. Recently planted trees should receive around 3 gallons of water per inch of tree caliper 3 to 4 times per week for the first growing season¹⁴. As the tree becomes established, the volume of water should increase but frequency of watering can decrease. After 3 to 4 years, the tree's root system should be adequately established, although supplemental watering during dry periods is still beneficial and can help trees survive droughts. Contractors are often retained to provide watering services on a weekly basis for the first few years after tree installation, and working with local residents to get them to help keep young trees watered can be highly effective. Watering bags can help provide a consistent source of water which is released

¹⁴ Urban & Community Forestry Program, Caring for New Trees1–2 (n.d.). Boston, MA; Bureau of Forestry.

slowly over time but must be installed correctly, refilled frequently, and checked to ensure that they are still releasing water.

- **Training:** Young tree training, or structural pruning, aims to help young trees develop a strong, central leader and good form as they mature. Early structural pruning helps prevent significant structural defects such as codominant leaders as the tree matures, improving the overall health and appearance of the tree, proactively mitigating tree-related risk, and reducing the cost of maintaining the tree over its lifetime. New trees should be structurally pruned several years after installation and ideally every three years thereafter until they reach mature size or are too tall to prune from the ground using pole tools.

Young Tree Care Recommendations

- Incorporate the costs of young tree care into planting budgets or grant applications. Lack of funding for this critical step can lead to low survival rates of young trees or trees which mature with structural defects that cost more to mitigate once the tree is large than would have been spent on early care.
- When contracting out planting work, include watering for the first several years in the contract.
- Make sure to remove staking materials after several years of tree establishment.
- Educate residents of areas with planned tree planting on what they can do to help care for newly planted trees. Supplemental watering, as well as extra eyes on the new trees, can help young trees establish successfully, reduce the workload on city staff, and give residents a sense of ownership in the urban forest.

PUBLIC OUTREACH AND EDUCATION

Engaging with members of the community can be a valuable tool to both enhance the health, preservation, and growth of the urban forest and foster connections between city staff, departments, and residents. Teaching the community about urban forestry can help bolster public support for city tree planting and maintenance, encourage diverse voices to share their experiences and expectations of public trees, and give residents a sense of ownership in their urban canopy. Outreach includes actions such as providing applicable education for all learning levels, offering accessible stewardship opportunities, and promoting discussions and feedback regarding urban forestry decisions. Tree planting is a popular volunteer activity – when led by a trained person or group, volunteers of all ages and abilities can participate in installing a tree up to best management practices standards.

Targeted or innovative outreach strategies are often required to reach an accurate representation of a city's population. Success has been found in meeting people where they are already at, such as presenting at neighborhood association meetings, schools, or clubs, rather than hosting new meetings or events. Providing outreach in multiple languages can also help reach parts of the community that are often absent from discussions about city trees due to language barriers.

Public Outreach & Education Recommendations

- If one does not already exist, Revere should consider adding a staff member dedicated to urban forestry outreach and education. These tasks often require a great deal of time, effort, and experience to make successful, and having personnel allocated to this job can help ensure that it's done well and that diverse groups throughout the city receive similar levels of effort and engagement.
- Continue existing outreach and education activities (such as Arbor Day activities) and slowly grow their scope over time.
- Partner with local groups to provide outreach in multiple languages and to reach groups which may not be as inclined to participate in events run by the city.
- Meet people where they're at – try to incorporate urban forestry into existing community meetings, schools, or clubs.
- Provide higher levels of care to existing public trees. City residents who dislike public trees often do so because the trees in their neighborhoods are poorly maintained¹⁵. Seeing city staff maintaining public trees in better condition can help improve public perceptions of trees in the urban environment.

¹⁵ Gordon, J., Maddox, T., & Martin, A. (2022, December). *Risk Governance and Equity in Urban Forestry Management*. *Tree Fund Webinar Series*.

SECTION 2: PRIORITY PLANTING AREAS

Several priority areas for tree planting within Revere have been identified. Priority areas were selected both through discussion with city tree managers and from analyzing the results of the 2023 public tree inventory.

BROADWAY & SHIRLEY AVE

Broadway and Shirley Avenue are downtown corridors that have been identified by city tree managers as priorities for tree planting. Increasing canopy along these streets can help them become green corridors – green networks which link parks, open space, commercial, and residential areas within a city. Green corridors can provide a number of benefits, including increasing the area and connectivity of urban wildlife habitat, encouraging walking and biking and reducing use of personal vehicles for travel, protecting pedestrians from harmful air pollution and providing shade to mitigate the risk of heat illness, and increasing social integration and interaction of residents¹⁶.

CITY PARKS

City parks were identified as another priority area for planting by city tree management staff. Parks are an important resource for city residents, providing recreation opportunities and access to the benefits of public trees even in areas where street tree planting is made difficult by existing infrastructure. Parks also form a key component of the 3-30-300 rule – a new school of thought on urban tree equity and how to structure a well-stocked public tree

¹⁶ Lambert, R. (2019, September). *Green corridors - essential urban walking and natural infrastructure*. Green Corridors - Essential urban walking and natural infrastructure -. <https://naturalwalkingcities.com/green-corridors-essential-urban-walking-and-natural-infrastructure/>

3-30-300 RULE

The 3-30-300 Rule is a new standard proposed by Professor Cecil Konijnendijk van den Bosch. This guideline aims to provide a simple, measurable metric for urban areas that wish to integrate more trees into the built environment. The components of the rule are:

3 trees visible from every home: the ability to see green infrastructure from home has been demonstrated to provide mental health benefits. The COVID19 pandemic, where many people were limited to their home or immediate neighborhood for months, highlighted the need for trees to be present in every part of cities.

30 percent canopy cover in every neighborhood:

Greener cities have many advantages – trees reduce air and noise pollution, mitigate stormwater runoff, and cool air and surface temperatures. 30% canopy cover per neighborhood is the minimum goal set by this new metric.

300 meters or less to a public greenspace:

The European Regional Office of the World Health Organization recommends a maximum distance of 300 meters (about 1,000 feet) to the nearest green space. The ability to walk to a greenspace easily and safely has been shown to have mental health benefits, encourage outdoor recreation and exercise, and increase community engagement.

resource¹⁷. Revere’s parks currently contain around 7.6% of the city’s inventoried public trees. In conjunction with street plantings, increasing this number could only benefit the urban canopy as a whole.

REVERE STREET

The area surrounding Revere Street has some of the lowest canopy cover in the city, ranging from 3-8%. The American Forests tree equity scores for this area ranges from 53 to 57, which are also some of the lowest tree equity scores in the city. The diversity of tree species is low in this area as well (Image 5), with the public tree canopy dominated by Callery pear, maples, and honeylocust. These conditions combined suggest that this area might benefit greatly from an increased investment in tree planting.

Image 5. Map of inventoried trees in the neighborhoods surrounding Revere Street



NEIGHBORHOODS LACKING YOUNG TREES

An ideally structured urban forest has more young trees than mature trees to provide a large pool of trees to replace aging ones as they decline, die, and are removed¹⁸. Image 6 provides an overview of size of trees in the neighborhoods around Grover Street, which was identified as an area with a low percentage of young trees. Increased planting in this and other such areas will ensure that the neighborhood’s urban canopy doesn’t diminish over time.

Image 6. Relative size/age of inventoried trees in the neighborhoods surrounding Grover Street.



¹⁷ Konijnendijk van den Bosch, C. (2021, February 19). *Promoting health and wellbeing through urban forests – introducing the 3-30-300 rule*. IUCN Urban Alliance. <https://iucnurbanalliance.org/promoting-health-and-wellbeing-through-urban-forests-introducing-the-3-30-300-rule/>

¹⁸ Richards, N.A. 1983. "Diversity and Stability in a Street Tree Population." *Urban Ecology* 7(2):159–171.

SECTION 3: SAMPLE PLANTING SCHEDULE AND BUDGET

If the City of Revere wants to avoid a net loss of public trees, then a 1-for-1 ratio of tree removal to tree replacement will be required. 119 public trees are recommended for removal due to declining health or conditions which may cause them to fail, impact people or property, and cause considerable damage. In addition to trees which were recommended for removal during the inventory, the city should also plan to compensate for natural mortality of public trees, which can range from 1 to 3% of the population per year. The companion report, *Revere's Public Tree Inventory Analysis and Maintenance Schedule*, lays out the recommended tree removals and estimated natural mortality (2% per year) over the next five years along with estimated tree removal costs. The costs to replant after these removals are restated in Table 1.

While a 1-for-1 removal to replacement ratio will prevent net loss of public trees, additional planting is needed if the city wishes to increase the overall number of public trees and their associated benefits. Since Revere is just starting a more structured city-run planting program, it may be best to start with a small number of new tree plantings each year and slowly increase capacity while building staff knowledge and public support. City tree care staff indicated their ideal number of new plantings per year would be between 75 and 100 to start and would increase over time. Table 2 shows the costs of implementing a slow-building new tree planting initiative and assumes that, at least for the first five years, half of all new plantings will require the creation of a new tree pit to increase canopy cover in areas which are heavily covered in hardscape. After five years, all inventoried vacant sites are projected to be filled, and all new street tree plantings will require a new pit to be created.

Keep in mind that, while Tables 1 and 2 provide estimated costs to purchase, plant, and water new trees for one year, the follow-up care for newly planted trees is essential for their survival and growth. Watering young trees for an additional few years and young tree training every third year are not included and will require additional funding. These estimates are meant to demonstrate the scope of funding that will be needed to implement a planting program in Revere and may not be accurate if contractor costs, inflation, or other factors affect work pricing. Fortunately, a wide variety of funding sources are available to help the city facilitate a planting program, including additional DCR grants such as the Urban and Community Forestry Challenge Grant Program and the Greening the Gateway Cities Implementation Grant. The recent Inflation

Table 1. Number of replacement plantings and funding needed for a 1-for-1 tree removal to replacement ratio.

Year	Number of Replacement Plantings	Cost*
2024	88	\$123,386
2025	91	\$130,172
2026	99	\$140,638
2027	100	\$147,654
2028	136	\$181,634
Total	514	\$723,484

*Cost includes purchase and planting of tree and one year of watering.

Table 2. Number of new tree plantings and cost per year for a gradual increase in public trees.

Year	Number of New Plantings	Cost*
2024	75	\$59,280
2025	80	\$65,664
2026	85	\$72,352
2027	90	\$80,028
2028	95	\$88,084
Total	425	\$365,408

*Cost includes pit cutting (50% of sites), purchase and planting of tree and one year of watering.

Reduction Act has also supplemented state funding for tree planting projects, with awards available from \$100,000 to \$50 million.

CONCLUSIONS

As climate change continues, urban areas will become hotter and less hospitable for residents, particularly those in the most densely populated areas. Urban trees can help mitigate some of the effects of climate change by reducing surface and air temperatures, curbing air pollution, and minimizing stormwater runoff and flooding. Expanding, or at least maintaining, the current number and extent of public trees in Revere will provide numerous benefits to the people who live, work, and recreate in the city.

Over the past decade or so, most of the tree planting done in Revere has been conducted by the Greening the Gateway Cities Program. However, the GGCP planting goal is nearly met, and the city will need to implement their own planting program if tree planting in the city is to be continued. Implementing a long-term planting program is not an easy feat – there are many essential components and steps to proper tree planting and young tree care, and expenses which go with them. The city will need to secure staffing and funding to effectively run a planting program.

Revere has already taken some critical steps in the process, including conducting a full tree and planting site inventory, commissioning an inventory analysis and maintenance schedule and budget, and crafting this planting plan. Next steps will include identifying and securing funding, determining who will be responsible for planting trees, and selecting planting locations and species for the first round of city planting. The city is on its way to a planting program that will build the urban canopy, provide equitable benefits to all residents, and be a centerpiece of the city's urban forestry program for generations to come.

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APPENDIX A SUGGESTED TREE SPECIES

Diverse trees planted in appropriate locations are a critical component of the atmosphere, livability, and ecological quality of a community's urban forest. The tree species listed below have been evaluated for factors such as size, disease and pest resistance, seed or fruit set, tolerance to urban conditions, and suitability for planting in USDA Plant Hardiness Zones 6 and 7. The following list is offered to assist all relevant community personnel in selecting appropriate tree species for a variety of sites.

LARGE TREES

DRG defines a "large" tree as one which typically grows taller than 45 feet at maturity. Large trees should be planted in locations with a minimum growing space dimension of at least 8 feet between hardscape features. This allows sufficient soil volume for the tree to develop a robust root system and ample space for large structural roots to grow without damaging hardscape features.

Botanical Name	Common Name	Example Cultivars	Street Tree
<i>Abies concolor</i>	white fir	'Candicans'	No
<i>Abies fraseri</i>	Fraser fir		No
<i>Acer saccharinum</i>	silver maple	'Silver Queen', 'Skinner'	No
<i>Acer saccharum</i>	sugar maple	Apollo®, Commemoration®, 'Green Mountain', Legacy®	Potential
<i>Acer x freemanii</i>	Freeman maple	Autumn Blaze®, Celebration®, 'Marmo', Scarlet Sentinel®	Yes
<i>Aesculus flava</i>	yellow buckeye	'Homestead'	No
<i>Aesculus hippocastanum</i>	horsechestnut	'Baumanii'	No
<i>Betula alleghaniensis</i>	yellow birch		Potential
<i>Betula lenta</i>	sweet birch	subspecies <i>uber</i>	Potential
<i>Betula nigra</i>	river birch	City Slicker®, Heritage®	Potential
<i>Carya illinoensis</i>	pecan	'Green River', 'Major'	No
<i>Carya ovata</i>	shagbark hickory		No
<i>Catalpa speciosa</i>	northern catalpa	Heartland®	No
<i>Cedrus libani</i>	cedar-of-Lebanon		No
<i>Celtis occidentalis</i>	hackberry	'Chicagoland', Prarie Sentinel®	Yes
<i>Cercidiphyllum japonicum</i>	katsura tree	'Morioka Weeping'	No
<i>Cryptomeria japonica</i>	Japanese cedar	'Yoshino', 'Sekkan'	Potential
<i>Ginkgo biloba</i>	ginkgo	'Autumn Gold', Princeton Sentry®	Yes
<i>Gymnocladus dioicus</i>	Kentucky coffeetree	Espresso®, True North®	Yes
<i>Ilex opaca</i>	American holly	'Canary', 'Jersey Princess', 'Miss Helen'	Potential
<i>Juglans nigra</i>	black walnut		No

Botanical Name	Common Name	Example Cultivars	Street Tree
<i>Liquidambar styraciflua</i>	American sweetgum	'Cherokee', Emerald Sentinel [®] , 'Rotundiloba', 'Slender Silhouette'	Yes
<i>Liriodendron tulipifera</i>	tuliptree	Emerald City [®] , 'Fastigiatum'	Potential
<i>Magnolia acuminata</i>	cucumber magnolia	hybrids, 'Fertile Myrtle', 'Urbana'	Potential
<i>Metasequoia glyptostroboides</i>	dawn redwood	Jade Prince [®] , 'National', 'Urban Spire'	Potential
<i>Picea orientalis</i>	Oriental spruce	'Aureospicata', 'Skylands'	No
<i>Pinus densiflora</i>	Japanese red pine		No
<i>Pinus nigra</i>	Austrian pine	'Arnold Sentinel'	No
<i>Pinus strobus</i>	eastern white pine	'Fastigiata', 'Glauca'	Potential
<i>Pinus sylvestris</i>	Scotch pine	'Gold Coin'	No
<i>Pinus taeda</i>	loblolly pine		No
<i>Platanus occidentalis</i>	American sycamore		No
<i>Platanus x acerifolia</i>	London planetree	'Bloodgood', Exclamation! [®] , 'Liberty'	Yes
<i>Quercus acutissima</i>	sawtooth oak		No
<i>Quercus alba</i>	white oak		Potential
<i>Quercus bicolor</i>	swamp white oak	American Dream [®] , Beacon [®]	Yes
<i>Quercus cerris</i>	turkey oak		Potential
<i>Quercus coccinea</i>	scarlet oak		Yes
<i>Quercus imbricaria</i>	shingle oak		Yes
<i>Quercus lyrata</i>	overcup oak	Marquee [®] , Resilience [®] , Streamline [®]	Yes
<i>Quercus macrocarpa</i>	bur oak	Urban Pinnacle [®]	Yes
<i>Quercus michauxii</i>	swamp chestnut oak		Yes
<i>Quercus nuttallii</i>	Nuttall oak	Esplanade [®] , Sangria [®] , Solshine [®]	Yes
<i>Quercus palustris</i>	northern pin oak	Green Pillar [®] , Promenade [®]	Yes
<i>Quercus phellos</i>	willow oak	Ascendor [®] , Kingpin [®]	Yes
<i>Quercus robur</i>	English oak	Heritage [®] , Regal Prince [®] , Skymaster [®]	Yes
<i>Quercus rubra</i>	northern red oak		Yes
<i>Quercus shumardii</i>	Shumard oak	Madison [®] , Prominence [®]	Yes
<i>Quercus velutina</i>	black oak		Potential
<i>Taxodium distichum</i>	bald cypress	'Prairie Sentinel', Shawnee Brave [®]	Yes
<i>Thuja occidentalis</i>	eastern arborvitae		Yes
<i>Tilia americana</i>	basswood	'Redmond'	Yes
<i>Tilia cordata</i>	littleleaf linden	Greenspire [®] , Summer Sprite [®]	Yes
<i>Tilia tomentosa</i>	silver linden	Green Mountain [®] , 'Silver Lining', 'Sterling'	Yes
<i>Ulmus americana</i>	American elm	Colonial Spirit [®] , 'Jefferson', 'New Harmony', Prairie Expedition [®]	Yes

Botanical Name	Common Name	Example Cultivars	Street Tree
<i>Ulmus davidiana</i>	David elm	Accolade®, 'Patriot', Triumph®	Yes
<i>Ulmus parviflora</i>	Chinese lacebark elm	'Allee', Emerald Flair®, Everclear®	Yes
<i>Zelkova serrata</i>	Japanese zelkova	City Sprite®, Green Vase®, 'Halka', 'Musashino', Wireless®	Yes

MEDIUM TREES

DRG defines a “medium” tree as one which is typically 30 to 45 feet tall at maturity. Medium trees should be planted in locations with a minimum growing space dimension of at least 6 feet between hardscape features.

Botanical Name	Common Name	Example Cultivars	Street Tree
<i>Acer miyabei</i>	miyabei maple	Rugged Ridge®, State Street®	Yes
<i>Acer rubrum</i>	red maple	Armstrong Gold®, 'Brandywine', 'Columnare', 'Morgan', 'New World', Redpointe®, Summer Sensation®	Yes
<i>Aesculus x carnea</i>	red horsechestnut	'Briotii', 'Fort McNair'	No
<i>Callitropsis nootkatensis</i>	Nootka false cypress	'Pendula', 'Green Arrow'	No
<i>Carpinus betulus</i>	European hornbeam	Emerald Avenue®, 'Fastigiata'	Yes
<i>Chamaecyparis thyoides</i>	Atlantic whitecedar		No
<i>Cladrastis kentukea</i>	American yellowwood	'Perkins Pink'	No
<i>Corylus colurna</i>	Turkish filbert		Yes
<i>Diospyros virginiana</i>	persimmon	John Rick', 'Killen'	No
<i>Eucommia ulmoides</i>	hardy rubber tree	Emerald Pointe®	Potential
<i>Gleditsia triacanthos</i>	honeylocust	'Moraine', 'Shademaster', Skyline®, StreetKeeper®	Yes
<i>Ilex x attenuata</i>	topal holly	'Foster No. 2', 'Savannah'	Yes
<i>Juniperus virginiana</i>	eastern red cedar	'Burkii', 'Providence'	Potential
<i>Koelreuteria paniculata</i>	golden rain tree	'Coral Sun', 'Fastigiata', 'Summerburst'	Potential
<i>Maclura pomifera</i>	osage-orange	'White Shield', 'Wichita'	Yes
<i>Magnolia grandiflora</i>	southern magnolia	'Edith Bogue', 'Little Gem', 'Victoria'	Potential
<i>Magnolia macrophylla</i>	big leaf magnolia	subspecies <i>ashei</i> , 'Julian Hill'	No
<i>Morus rubra</i>	red mulberry		Potential
<i>Nyssa sylvatica</i>	black gum	Afterburner®, Firestarter®, White Chapel®	Yes
<i>Picea omorika</i>	Serbian spruce	'Bruns', 'Silberblau'	Yes
<i>Pinus flexilis</i>	limber pine	'Vanderwolf's Pyramid'	Potential
<i>Pistachia chinensis</i>	Chinese pistache	'Keith Davey', 'Sarah's Radiance'	Yes
<i>Quercus stellata</i>	post oak		Potential

SMALL TREES

DRG defines a “small” tree as one which is typically 30 feet tall or smaller at maturity. Small trees should be planted in locations with a minimum growing space dimension of at least 4 feet between hardscape features, although 3 feet may be workable where wider spaces are not possible. Small trees are good candidates for planting under utility lines. In some cases, small cultivars of large or medium trees are available, such as the City Sprite® and Wireless® zelkovas or the Summer Sprite® littleleaf linden.

Botanical Name	Common Name	Example Cultivars	Street Tree
<i>Acer buergerianum</i>	trident maple	Aeryn®, Blood Moon®, Valynor®	Yes
<i>Acer campestre</i>	hedge maple	Jade Patina®, Metro Gold®, Streetside®	Yes
<i>Acer griseum</i>	paperbark maple	Cinnamon Girl®, Fireburst®	Yes
<i>Aesculus pavia</i>	red buckeye	'Humilis', 'Splendens'	No
<i>Amelanchier arborea</i>	downy serviceberry	Pink Damsel®	Yes
<i>Amelanchier laevis</i>	allegheny serviceberry	Cumulus', 'Snowcloud', Spring Flurry®	Yes
<i>Amelanchier x grandiflora</i>	hybrid serviceberry	Princess Diana', 'Robin Hill'	No
<i>Asimina triloba</i>	paw paw	Potomac®, Wabash®	No
<i>Carpinus caroliniana</i>	American hornbeam	Native Flame®, Rising Fire®	Yes
<i>Cercis canadensis</i>	redbud	Pink Pom Poms', 'Merlot'	Yes
<i>Cornus florida</i>	flowering dogwood	'Appalachian Joy', Cherokee Brave®, 'Rubra'	Potential
<i>Cornus kousa</i>	Kousa dogwood	Prophet®, Scarlet Fire®	No
<i>Cornus mas</i>	Cornelian cherry	'Golden Glory'	No
<i>Cornus x rutgersensis</i>	hybrid dogwood	Aurora®, Celestial®, Stellar Pink®	No
<i>Cotinus obovatus</i>	American smoketree	Cotton Candy®, 'Grace'	No
<i>Crataegus crus-galli</i>	cockspur hawthorn	'Inermis'	No
<i>Crataegus phaenopyrum</i>	Washington hawthorn	'Washington Tree'	Potential
<i>Crataegus viridis</i>	green hawthorn	'Winter King'	No
<i>Halesia carolina</i>	Carolina silverbell	'Rosea'	No
<i>Hamamelis virginiana</i>	common witchhazel	'Harvest Moon'	No
<i>Hamamelis x intermedia</i>	hybrid witchhazel	'Diane', 'Jelena', 'Sunburst'	No
<i>Heptacodium miconioides</i>	Seven-son flower		Potential
<i>Ilex 'Nellie R. Stevens'</i>	Nellie R. Stevens holly	'Golden Nellie'	Potential
<i>Maackia amurensis</i>	Amur maackia	Maacnificent®, 'Starburst'	Yes
<i>Magnolia stellata</i>	star magnolia	'Centennial', 'Royal Star', 'Waterlily'	Potential
<i>Magnolia tripetala</i>	umbrella magnolia		No
<i>Magnolia virginiana</i>	sweetbay magnolia	Emerald Tower®, 'Keltyk'	Potential
<i>Magnolia x soulangeana</i>	saucer magnolia	'Alexandrina', 'Amabilis', 'Rustica Rubra'	Potential

Botanical Name	Common Name	Example Cultivars	Street Tree
<i>Malus x</i>	crabapple	'Adirondack', Golden Raindrops®, Red Jewel®, 'Prairifire', 'Purple Prince', Royal Raindrops®, Raspberry Spear®, 'Prairie Rose'	Potential
<i>Ostrya virginiana</i>	hohornbeam	Autumn Treasure®, Sun Beam®	Yes
<i>Oxydendrum arboreum</i>	sourwood		No
<i>Parrotia persica</i>	Persian parrotia	Golden Belltower®, 'Vanessa'	Yes
<i>Pinus cembra</i>	Swiss stone pine	'Chalet', 'Stricta'	No
<i>Pinus parviflora</i>	Japanese white pine	'Aoi', 'Glauca'	No
<i>Prunus sargentii</i>	Sargent cherry	'Accolade', 'Columnaris', Pink Flair®	Yes
<i>Prunus serrulata</i>	Japanese flowering cherry	'Amanogawa', 'Kanzan', 'Sunset Boulevard', 'Ukon'	Yes
<i>Prunus subhirtella</i>	Higan cherry	'Pendula Plena Rosea'	No
<i>Prunus virginiana</i>	chokecherry	Canada Red Improved', Sucker Punch®	Potential
<i>Prunus x yedoensis</i>	Yoshino cherry	'Akebono'	Potential
<i>Sciadopitys verticillata</i>	umbrella pine	'Wintergreen'	No
<i>Stewartia pseudocamellia</i>	Japanese stewartia		No
<i>Styrax japonicus</i>	Japanese snowbell	Prystine Spire®, Snowcone®	Potential
<i>Syringa reticulata</i>	Japanese tree lilac	Ivory Pillar®, 'Ivory Silk', 'Summer Storm'	Yes

The Tree Book by Michael A. Dirr & Keith S. Warren was consulted to compile this suggested species list. Cultivar selections are suggestions only – many other suitable cultivars may be available. DRG recommends building flexibility into planting plans as desired trees may or may not be available in local trade at the time of planting.