

Green Stormwater Infrastructure Landscape Design Guidebook



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Introduction

chapter **1**





1.1 Introduction

The City of Philadelphia relies in part on Green Stormwater Infrastructure (GSI) systems - comprised of decentralized stormwater management practices (SMPs) such as rain gardens, stormwater tree trenches, and green roofs - to reduce stormwater volume and pollutants delivered to the City's combined sewer system.

Vegetation is a key component of green stormwater infrastructure. Plants can improve the performance and lifespan of the SMP by reducing stormwater runoff volumes and sediment load. In addition, a successful planting can provide significant environmental, social, and economic benefits. Vegetation in urban environments can mitigate the urban heat island and reduce energy demands, improve air quality, provide habitat, improve human health, and increase land values.

A successful landscape must begin with an understanding of the site environment. Urban environments present numerous challenges for plant survival such as increased heat, extreme weather events, pollutants, and vandalism. Additionally, SMPs bring their own set of challenges including space constraints, urban soils, and hydrology. Other site considerations include site uses, preferences of partners and community groups, and maintenance schedules. Each site will have unique challenges and require unique solutions to ensure that the project is beautiful and functional.

The Philadelphia Water Department (PWD) has demonstrated various SMPs throughout the City of Philadelphia and has evaluated the success of various landscape designs. PWD monitors plant survival and performance for every GSI project. PWD has also evaluated numerous research documents and municipal guides and applied this knowledge to the specific nature of green stormwater infrastructure in Philadelphia. Finally, PWD works closely with partners and community groups to listen to their preferences. This Landscape Design Guidebook is a synthesis of knowledge to serve as a guide for City and State agency staff, design professionals, private developers, community groups, and others involved in the planning and design of SMPs in Philadelphia.

1.2 An Evolving Resource

This resource provides guidance for the most common types of GSI projects in Philadelphia. It is recognized that additional technologies and designs may be added or enhanced over time as new projects are implemented. The guidelines are based on current research and plant survival data, but

may be adjusted in the future based on new research.

1.3 How to Use this Resource

This resource provides guidance for design professionals to complete successful landscape designs for GSI projects for the Philadelphia Water Department Office of Watersheds. It should be utilized for all projects completed for the Green Stormwater Infrastructure Implementation Program. Knowledgeable landscape designers and nursery suppliers may provide additional information regarding plant selection. Because individual plants often have unique growing requirements which are difficult to convey in a generalized manner, it will be necessary to research specific information on the plant species proposed in order to ensure successful plant establishment. Variation among cultivars and varieties must also be considered. The Philadelphia Water Department Plant Inspection Guide may be used as an additional resource.

This document is divided into six sections:

1. **Introduction**
2. **Site Assessment and Landscape Guidelines:** This section includes key criteria for developing a successful landscape plan for GSI projects in Philadelphia, from site assessment to design. This includes guidelines for plant selection and for different site types.
3. **Green Stormwater Management Practices: Plant Palettes:** This section provides palettes for each type of stormwater management practice (SMP). Potential design challenges and landscape solutions are discussed.
4. **Example Scenarios and Landscape Plans:** Example scenarios of project sites and specific challenges are given along with landscape plans and plant palettes to address these challenges.
5. **Philadelphia Water Department Approved Plant List:** The list is inclusive of all plant species that may be used within the different SMPs. This section includes a large amount of data relevant to plant selection for any given location. All green infrastructure projects should reference this list for species selection. Species outside of this list may be discussed on a per project basis.
6. **Complete Plant Palette:** This section includes quick pictorial references, or Plant Tags, for each species in the Plant List
7. **References:** Pertinent references are cited.

1.4 Design Strategies for SMP Design

1. Use more than one resource.

- After the SMPs have been designed, use this manual to select the appropriate vegetation.
- This manual is to serve as a guide and is not an all-inclusive manual. Refer to Chapter 1: Introduction for further explanation.
- Consulting with knowledgeable landscape designers and nursery suppliers is highly recommended.

3. Evaluate the site context and how people use the space.

- Approaches to parks, streets, schoolyards, and recreational sites differ. Evaluate how people interact within the space. Determine what seasons that the space is most active.
- Vegetation should complement the functions of the space and relate to the neighboring spaces.
- Refer to Table 3.2.3: Site Assessment Checklist for more considerations.

SMP EVALUATION

2. Evaluate the SMP conditions.

- Obtain soil tests to ensure proper drainage.
- Conduct sun and shade analysis.
- Determine hydrologic zones within the SMP.

5. Use planting and other design strategies to develop aesthetic appeal.

- Refer to Table 2.3 and Section 3.3.3 for design guidelines.
- Plants listed in Chapter 2 represent recommended plants.

4. Consider the site's daily conditions.

- Take into consideration:
 - Levels of pollution
 - Access to maintenance
 - Overhead utilities and other impeding structures
- Refer to Table 3.2.3: Site Assessment Checklist for more considerations.

6. Select plants that are appropriate for the site conditions and the SMP.

- Refer to Chapter 5: Philadelphia Water Department Approved Plant List for plant characteristics to aid in appropriate plant selections for the site.
- Refer to Chapter 6: Complete Plant Palette for pictorial references and quick references of each plant species listed in the Approved Plant List.
- Note that all species may not be available at the time of purchase and site conditions may require alternate selection of plants due to drainage, sunlight, etc. Be prepared to select plants for substitutions. Use judgement to determine the appropriateness of the species.
- Design is an iterative process. Landscape design should be evaluated during the Concept/ Design, Installation, and Maintenance phases.

PLANT SELECTION

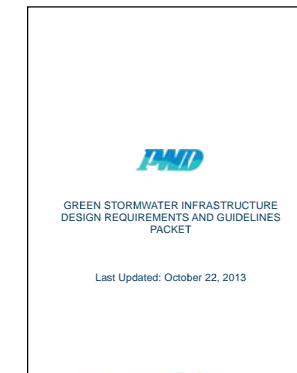
SITE EVALUATION

1.5 Relationships with Other Resources and References

The publication of the Landscape Design Guidebook follows a number of related resources. These related resources should be used by the designer for reference and additional contextual information where cross-referenced from this Guidebook. Always refer to the most current resources. See also 7.0 references for additional readings.

Relevant materials include:

1. Philadelphia Water Department. 2013. "Green Stormwater Infrastructure Design Requirements and Guidelines Packet."



This document provides requirements and guidelines to be used in the design of Green Stormwater Infrastructure (GSI) projects funded and/or maintained by the Philadelphia Water Department.

This document is available for download along with other GSI Design resources at the website below:

http://phillywatersheds.org/doc/GSI/GSI_Design_Requirements_&_Guidelines_Packet_10-22-2013.pdf

2. Philadelphia Water Department. 2014. "PWD Plant Identification Manual."



This is a field guide to plant species that are on PWD's Recommended Plant List or currently planted in one of PWD's SMPs. The guide includes multiple photographs of each plant through different life stages and seasons along with key identifying characteristics.

Download at:

http://www.phillywatersheds.org/doc/Plant_Identification_Manual_October2014.pdf

3. Philadelphia Water Department. 2014. "Green Stormwater Infrastructure Maintenance Manual."



This Manual documents typical maintenance tasks and standard operating procedures for GSI projects.

Download at:

http://phillywatersheds.org/doc/GSIManual_1stEd_HRes.pdf

4. Philadelphia Water Department. 2014. "City of Philadelphia Green Streets Design Manual."



This Manual includes figures and details of SMPs that are located in the right-of-way such as bump-outs, planters, and tree trenches.

This document is available online for download at the following location:

http://www.phillywatersheds.org/what_were_doing/gsdm

5. Green Stormwater Infrastructure Design Resources



Additional resources are available for download on the PWD Office of Watersheds website:

http://www.phillywatersheds.org/gsi_design_resources

Site Assessment and Landscape Design Guidelines

chapter 2



2.1 Introduction

This chapter covers site assessment and landscape design guidelines including general guidelines and guidelines for plant selection and for various site types.

2.2 Site Assessment

Site assessment is critical to designing and implementing successful green stormwater infrastructure projects (GSI). Whether part of a retrofit or a development project, stormwater management must fit into the larger goals for a given site. All projects should consider two scales relevant to the design of GSI landscapes: site context and site conditions.

2.2.1 Site Context

Look to the surrounding block and neighborhood to understand landscape and human systems that interact with the site.

Consider how the new SMP will fit in as part of the existing landscape. Identify existing vegetation and how the new landscape may compliment, both aesthetically and ecologically. Preserve healthy vegetation whenever possible. If construction requires the removal of vegetation, evaluate the benefit the vegetation is currently providing and seek opportunities to relocate or replace this vegetation on site to provide the same benefit. If unhealthy, hazardous, or invasive species are present on the site, even outside of the limits of disturbance, consider species removal in the scope of the project.

Understand the desires of partners and community members. Have a general understanding of the area history and cultural importance of the site. Consider current and desired views, along with safety concerns to determine sight lines that will need to be preserved (see Green Streets Guidebook for more detail on tree placement in the right-of-way). Take note of circulation systems (either formal or informal) and consider how they might intersect with the SMP. Note site uses and where and how interaction is likely to occur with the SMP (i.e. dog walking, basketball, etc).

2.2.2 Site Conditions

Planting strategies will need to respond to the specific conditions of the site where vegetation will be planted. Locate any structures that might impede or compete with plant growth. Choose mature heights and widths in a corresponding fashion.

Identify the various ecological niches that may exist within the SMP and how this will affect the plant selection. Complete a study of sun and shade distribution. Evaluate environmental factors such as soils, moisture/water issues and distribution on the property, stormwater flow paths, slopes, and expected pollutant load to the SMP including sediment and road salts.

Reference the PWD Green Master Spec and Design Plans for information about the SMP

characteristics.

Planting Soils

Plant selection will be limited by the soil medium in which plants will grow. All PWD GSI projects require soils to meet specifications outlined in the Green Master spec. To summarize:

Texture = Sandy Loam or Loamy Sand:

Sand	(0.05 to 2 mm)	40% - 60%
Silt	(0.002 to 0.05mm)	5-25%
Clay	(less than 0.002mm)	5-15%

Organic content = 2.0-10.0%

PH = 6.0 - 7.0

Structural Soils

Where structural soil is specified, the product may be either the "CU Soil" as patented by Cornell University, or the "Solite Soil" as produced locally by Mayfield Gardens and Site Contractors.

Table 2.2.3: Site Assessment Checklist

SITE CONTEXT	SITE CONDITIONS
<ul style="list-style-type: none"> ■ Landscape Character <ul style="list-style-type: none"> <input type="checkbox"/> formal garden <input type="checkbox"/> natural area <input type="checkbox"/> historic landscape <input type="checkbox"/> disturbed ■ Existing Vegetation <ul style="list-style-type: none"> <input type="checkbox"/> health of vegetation <input type="checkbox"/> species <ul style="list-style-type: none"> <input type="checkbox"/> native <input type="checkbox"/> non-native <input type="checkbox"/> invasive <input type="checkbox"/> benefits of vegetation ■ Social Factors <ul style="list-style-type: none"> <input type="checkbox"/> site uses near SMP <input type="checkbox"/> user desires <input type="checkbox"/> local history and culture ■ Views/Sight Lines <ul style="list-style-type: none"> <input type="checkbox"/> on site <input type="checkbox"/> off site <input type="checkbox"/> safety concerns ■ Circulation <ul style="list-style-type: none"> <input type="checkbox"/> pedestrian <input type="checkbox"/> bicycle <input type="checkbox"/> automobiles <input type="checkbox"/> service vehicles 	<ul style="list-style-type: none"> ■ Structures <ul style="list-style-type: none"> <input type="checkbox"/> buildings <input type="checkbox"/> overhead wires <input type="checkbox"/> utility poles <input type="checkbox"/> existing vegetation <input type="checkbox"/> other ■ Ecological Niches <ul style="list-style-type: none"> <input type="checkbox"/> sun/shade distribution <input type="checkbox"/> wind patterns <input type="checkbox"/> stormwater flow paths <input type="checkbox"/> slopes <input type="checkbox"/> expected pollutant load <ul style="list-style-type: none"> <input type="checkbox"/> sediment <input type="checkbox"/> road salt <input type="checkbox"/> other

2.3 Landscape Design Guidelines

Site assessment should lead to the planting strategy for a site. Design is often an iterative process, beginning at the planning stage of a project, adjusted during construction documentation when more information about a site is available, and reevaluated during construction given field conditions. The landscape strategy will need to be revisited throughout the process.

2.3.1 General Guidelines

Plant Sizes and Spacing:

Plant spacing is dependent on a number of variables. Plants will perform best if planted when relatively small and can adapt as they grow. It is also more economical to plant smaller sizes. However, the designer must also balance community expectations and the need for plants of a durable size given the context of a site. The spacing also varies due to the particular plants selected, depending on mature sizes. The following are the approved ranges of plant sizes for PWD GSI projects:

Table 2.3.1: Plant Sizes and Spacing

Classification	Size	Spacing
Street Trees	2-2 1/2" caliper	20'
Landscape Trees	1-1/2" - 2 1/2-3" caliper	Width of mature tree
Shrubs	#3-#5 container, with some exceptions	Width of mature plant, usually between 4-5'
Perennials/Grasses	#1-#2 container	18" - 3' depending on mature size of plant
	Seed mixes & bulbs may be used in select areas.	Broadcast seeding

Preserve and Protect Existing Healthy Vegetation

Survey existing vegetation including canopy extents. Develop tree and vegetation protection plans. Where removal is necessary, ensure the property owner is informed and develop a plan for transplantation for healthy, desirable species when possible. Create a plan for the removal of invasive or hazardous species both in and around the project area.

Choose an Appropriate Number of Species

The number of species will be determined by the desired design impact and range of environmental conditions within the SMP. While supporting these goals, the number of species should be limited by the reality of maintenance staffing and budgets. SMPs with a large number of species may be more challenging to maintain.

Plant in Massings

Plant in massings or groups, each group consisting of individuals of the same species. This will both create a strong visual impact and support maintenance efforts. Number of individuals in each grouping will vary depending on the project and overall design intent. A general rule of landscape design is to mass plants in odd numbers, such as 3, 5, 7, and so on. Odd numbers produce more unified compositions.

Define the Edge

Consider how the SMP will be distinguished from the surrounding landscape so that maintenance responsibilities are clear and pedestrian and vehicular traffic respect the SMP. Some SMPs will have a defined edge made from a physical barrier such as fences or paving. A defined edge can be created by planting shrubs around the perimeter of the SMP. This is important for areas that abut lawn, areas adjacent to considerable activity such as a schoolyard or active recreational area, and areas with steep changes in grade (for example, 4:1 slope or steeper with more than 3' of elevation change).

Maintain Lines of Sight

It may be necessary to keep vegetation low and trees limbed up to allow sight lines for visibility through the SMP. A general rule for a clear zone is between 3' and 7'. This is especially critical at streetscapes, where dense vegetation should be no greater than 3' above top of curb. Sight lines may also be important in areas where perception of crime is high or child supervision is a priority.

Design for the Users

Keep in mind the various user groups of a site. Each site will have somewhat unique requirements; embrace the diversity of aesthetics. Community meetings can gauge whether the desired aesthetic is naturalistic or ornamental, and whether trees or groundcovers are preferred.

If a Priority, Enhance Habitat

Projects in naturalized areas such as large parks provide opportunities to enhance habitat by connecting to surrounding plant communities and creating new wildlife corridors. Depending on the property owner, this may be an important priority. Philadelphia Parks & Recreation requests that only native species be used in their large parks. Multi-tiered plant communities with upper, middle, and lower story vegetation can support a diversity of habitats. Note that some sites will allow for a greater density of vegetation than others. Concern about site lines must be considered.

Choose Aggressive Species Carefully

Plants with high growth rates can be an asset to an SMP, where the environment is challenging and it may be difficult to find plants that can readily establish and prevent erosion. At the same time, be wary of plants that have the potential to become invasive at a given site. Understand how the plants spread (e.g. by rhizomes or by seed) and evaluate the potential of the plants to spread to other areas where they may not be desirable. For example, a plant that spreads by rhizomes will have minimal potential of becoming invasive if it is in a traffic island contained by concrete and asphalt, but the same plant could become a nuisance if it is planted within a large park adjacent to a naturalized area.

Select a Diversity of Tree Species

Include a diversity of tree species and avoid overused species to reduce the risk of disease or insect infestation.

Avoid Combinations of Plants that Will Harm One Another

For example, avoid planting a species that may host a fungus that attacks another selected species.

Do Not Use Plants for Food Production

Do not use plants for food production for areas that will capture stormwater runoff.

Consider How the Landscape Will Change Over Time

Design with the mature heights and widths of the species in mind, giving ample room for the plants to grow. Over time, views, sun/shade patterns, and other conditions may change. The landscape should be resilient and there should be an understanding of succession will work on the site.

Right Plant, Right Place

There may be several environmental conditions within a site, based on light availability, hydrology, and stormwater flow. This will break the site up into niches; appropriate species must be selected for each.

Design for the Seasons

Plant mostly foliage (shrubs, trees) or grass-like species that will provide form year-round. Use perennial and bulb species as accents that will provide periodic blooms. Keep in mind the time of year when the site will be most active to determine which season to emphasize the most.

Reduce Maintenance Needs

Planning ahead for maintenance helps to create designs that are more resilient and cost-effective over time. Understand PWD's maintenance tasks and schedules for the various SMP types. Typical maintenance includes removing competitive species that can hinder the growth of target plant

species; and removing sediment, trash, and debris from storage areas, piping, and other structures. Maintenance tasks may also include a range of other activities including repairing small erosion problems, pruning trees, removing graffiti, and replanting or reseeding areas.

Choose vegetation according to the hydrology of the system to eliminate needs for supplemental watering after establishment. As much as possible, design a landscape that will require minimal pruning and weeding. Choose robust vegetation for upstream areas where flow will be most heavily concentrated to eliminate need for erosion repair.

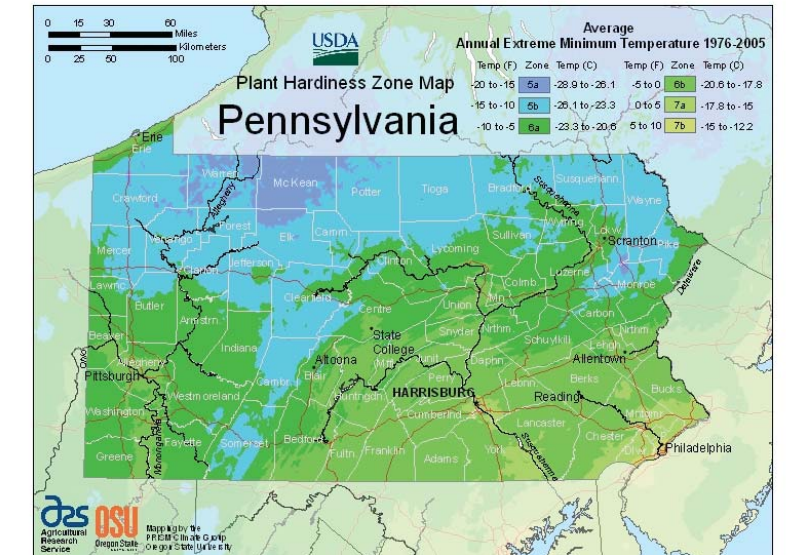
Plan for Maintenance Access

Know how and where maintenance will access clean-outs, inlets, or other features. Recognizing the need for access, be sure that selected species for these areas will not impede access. Grass-like species are recommended as they are both durable and can readily grow back.

Know the Climate

Be sure that cultivars and varieties will thrive given the local climate. The 2012 USDA Plant Hardiness Zone Map is the standard by which gardeners and growers can determine which plants are most likely to thrive at a location. The map is based on the average annual minimum winter temperature, divided into 10-degree F zones. Philadelphia is located within Hardiness Zone 6B.

Figure 2.3.2: USDA Plant Hardiness Zone Map



2.3.2 Plant Selection

Use the Philadelphia Water Department Approved Plant List for all GSI projects funded by the Office of Watersheds. This document will refer to various criteria important for selecting plant species and cultivars. The following terms are defined as they apply to this document:

Genus and Species: The genus and species of a plant make up its scientific name, reflecting the taxonomic group to which the plant belongs. Scientific names are consistent in the world and thus more reliable than common names. Scientific names may change, most often due to new research about taxonomy of plants. It can take time for these changes to filter down to the level of plant tags at nurseries. Species with (*) are considered to be native species.

Common Name: These are the local names, given by local people in their own language, for a particular plant. Because they will vary among localities, scientific names are more reliable. However, it is useful to know a plant's common name in order to communicate to community groups and partners who may not be familiar with the scientific name.

Plant Height: Plant heights (both at planting and at maturity) should be appropriate to the SMP. Where sight lines are to be preserved, especially relevant for GSI within the right-of-way, be sure there is a clear zone between 4' and 7'. Overhead utilities and soil volumes are also important considerations, especially when determining tree species.

Plant Width: Plant width will determine the number of plants required in a given system. Plant width is given as a mature size.

Bloom Time: Each site will have unique seasonal considerations depending on when it is most active. Because the exact bloom time may vary year-to-year and from location to location, this document has generalized bloom times into "early season" and "late season." For projects that will be visible throughout the season, select both early and late blooming species.

Bloom Color: Color helps to create focal points throughout the SMP. Plants may have more than one possible bloom color, especially when considering various species or cultivars.

Winter Interest: Sites that are active in the wintertime (e.g. streets, schools) should include plants that are evergreen, have berries, or colorful stems and stalks. This is not only an aesthetic consideration but also helps to alert people of changes in grade.

Fall Interest: Trees and shrubs with colorful leaves and grasses with extraordinary color are desired for sites that are active during the fall season.

Native to U.S.: The species historically occurred naturally in the United States. Environmentally

sensitive areas may require a palette of species that are native to the U.S.. All large park sites or natural areas should utilize natives only unless otherwise specified. Note that not all non-native species are likely to become invasive.

Inundation Tolerance: Describes a plant's ability to live in soils that may be fully saturated or have temporary ponding.

Drought Tolerance: Describes a plant's ability to withstand drought or dry spells.

Hydrologic Zone Elevation: Generally, plants for rain gardens should be able to withstand wet and dry periods. Most standing water should infiltrate within 24 hours, but larger storm events will bring extended periods of wet soils that plants must be able to tolerate. Likewise, plants should be drought tolerant once established.

PWD has defined three hydrologic zones for SMPs. These zones describe the degree to which an area may be inundated by water. Plants have differing tolerances to moisture levels, with some plants capable of withstanding long periods of inundation and other plants responding poorly to long-term inundation. Conversely, some species have excellent drought tolerance while others do not. PWD has adapted the hydrologic zones from the U.S. Fish and Wildlife Service Wetland Indicator Status.

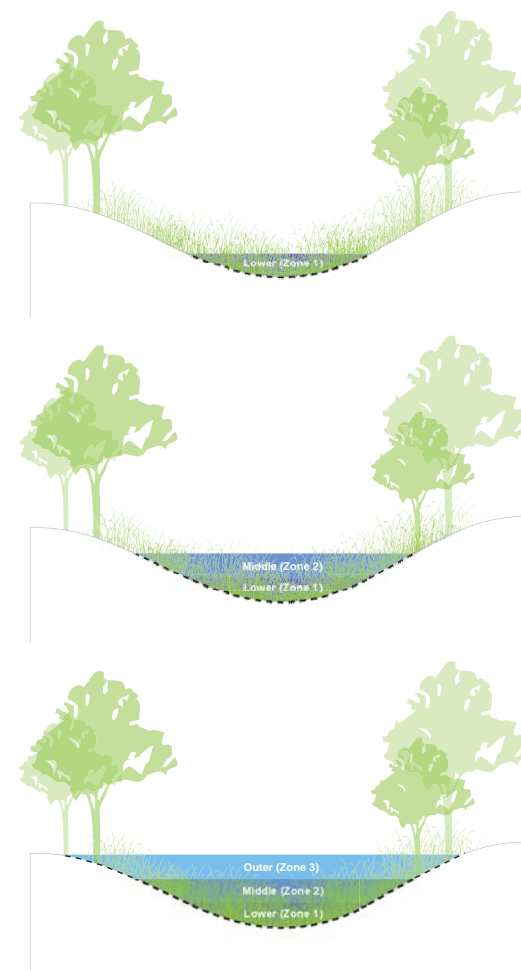
Each design plan should delineate the lowest, middle, and outer zones within the SMP. The boundaries for hydrologic zones within each SMP will depend on the designed maximum depth, steepness of the side-slopes, frequency of inundation, and infiltration rate. Smaller SMPs such as tree trenches, swales, bumpouts, or planters may only have one or two zones (either the lowest zone or the lowest and middle zones) since their planting patterns are more uniform and experience less variances in moisture levels.

Lowest Zone: This is the base of the rain garden, where ponding will frequently occur and soils will be frequently moist. This zone is appropriate for Facultative Wetland (FACW) species, those species which usually occur in wetlands (estimated probability 67-99%) and Facultative (FAC) species, which are equally likely to occur in wetlands or non-wetlands (estimated probability 34-66%) and tolerate both wetlands and moist upland soil.

Middle Zone: This is zone where ponding may occur during larger storm events. This zone is appropriate for Facultative Upland (FACU) species. This includes plants that usually occur in non-wetlands (estimated probability 34-66%) and tolerate moist to dry soil.

Outer Zone: This is the highest part of the rain garden, generally a buffer zone between the garden and other landscaping, often at the existing grade. This area will not be inundated frequently. This zone is appropriate for Obligate Upland (UPL) species, those species which occur almost always (estimated probability >99%) in non-wetlands under

Figure 2.3.2: Planting for Hydrologic Zones



- Lowest Zone**
- Typically small systems like tree pits/trenches, planters, and bump outs
 - Plants should be able to handle fluctuating water levels and inundation

- Lowest & Middle Zone**
- Typically medium-large systems such as rain gardens or swales
 - Plants should be able to handle seasonal inundation and occasional drought

- Lowest, Middle, & Outer Zones**
- Typically larger systems such as rain gardens
 - Plants should be able to handle inundation and drought

natural conditions and tolerate dry soil.

Light Requirements: A plant's light preference is listed as Full Sun, Partial Shade, or Full Shade. In an urban environment, full sun conditions are common. However, street trees, buildings, and other structures may provide shade during some parts of the day. A sun/shade study should be completed for each site.

Full Sun: > 6 hours of continuous sunlight/day

Partial Sun: 4-6 hours of sunlight/day (i.e., areas under deciduous trees)

Shade: < 4 hours of continuous sunlight/day (i.e., areas under evergreens, raised decks)

Salinity Tolerance: The use of de-icing salts in winter to maintain safe roadways, sidewalks, driveways, and other areas is a common practice in Philadelphia. In particular, schools and snow emergency routes experience a higher application. These salts may have an adverse impact on plant material and GSI located in the right-of-way and/or receiving stormwater runoff from the right-of-way. A variety of sources were used to assess salinity tolerance, but research is still limited at this time. Plants with a high tolerance may be most appropriate to use in right-of-way.

SMP Type: Plants are recommended for each of the various SMP types: rain garden, bump-out, planter, and tree trench based on general characteristics of each SMP.

2.3.3 Site Types

This Guidebook presents key considerations for landscape design for the following site types:

- Passive Landscapes
- Recreation Facilities
- Schoolyards
- Streetscapes
- Parking Lots

Currently, these are the most common site types for green stormwater infrastructure. Additional site types may be added at a later date.

Passive Landscapes



Figure 2-1. Liberty Lands Rain Garden

Passive landscapes are what most people think of when they imagine a park. Typically they are open spaces with field and trees, pathways and seating. These are sites with natural features and without formally programmed spaces. Passive landscapes may be within a neighborhood or community park, a renovated vacant land, or along an ecological corridor. Informal uses of the space may be variable and are important considerations when designing such a site. For example, a large field may serve as a practice field for sporting events, which may not be obvious to the visitor. Other priorities may include protecting natural resources and providing ecological habitat.

Key Considerations:

Minimize impact to any sensitive natural resources.

Evaluate existing trees with an arborist. If the site is managed by Philadelphia Parks & Recreation, be sure that approval is given for any necessary tree removals.

Use only native species where habitat is a priority.

Philadelphia Parks & Recreation has asked that only native species be planted in the larger, passive parks where habitat is a priority.

Plant trees to provide shade for sidewalks and walkways.

In addition to providing stormwater management, trees provide other social and environmental benefits. Trees may fit in well with the character of the passive landscape, supporting overall design goals.

Acknowledge informal uses of open spaces.

Meeting with park leaders and/or community groups will provide insight as to how a site is currently used and what is desired for future uses. Designers can then consider these uses along with the rest of the site inventory.

Recreation Facilities



Figure 2-2. Harron Playground Rain Garden

Recreation facilities are active spaces with recreational elements such as sports courts, spray parks, or playgrounds. Often these are compact spaces where green stormwater infrastructure may be in very close proximity to active elements.

Key Considerations:

Consider barriers between the SMP and active locations.

Traditional fencing may be utilized or landscaping can create an edge. Grasses and robust shrubs with winter interest are better options than fragile herbaceous species.

Do not plant directly in the pathway of pedestrian flow.

Understanding circulation patterns will help to ensure the success of the landscape. People will almost always chose the shortest path from one destination to the next.

Select species with compact growing habit.

Select species that will stay within the bounds of the project and will not infringe on adjacent spaces.

Emphasize summer interest.

The site will likely experience the most users in the summer months; incorporate summer blooms and textures in the landscape design.

Preserve sight lines.

Keep in mind the mature heights and widths of plants so as to preserve any necessary sight lines. Avoid creating hidden areas for ease of supervision.

Schoolyards



Figure 2-3. Greenfield Elementary School Rain Garden

Schoolyards are complex sites with multiple uses. They may offer great opportunities for child and community education. Often SMPs may be in close proximity to other uses and the edge condition of the SMP will need to be carefully considered. Schoolyards are most active during the fall, winter, and spring seasons.

Key Considerations:

Preserve sight lines.

Keep in mind the mature heights and widths of plants to preserve any sight lines. Avoid creating hidden areas for ease of supervision.

Emphasize fall, winter, and spring interest.

Keep in mind that schoolyards are most active during the fall, winter, and spring. Selecting plants with early spring blooms, colorful fall foliage, and winter color such as evergreen leaves or berries will provide more learning opportunities and create a greater impact.

Consider barriers between the SMP and active locations.

Traditional fencing may be utilized or landscaping can create an edge. Grasses and robust shrubs with winter interest are better options than fragile herbaceous species.

Provide opportunities for education.

Include a diversity of plant species to provide opportunities for study and engagement. Look for opportunities to use species native to the region.

Streetscapes



Figure 2-4. Benjamin Franklin Parkway



Figure 2-5. Philadelphia Navy Yard

Streets present the opportunity to manage stormwater while maintaining the primary function of the street for vehicles and pedestrians. SMPs in the street include stormwater trees, bump-outs, and stormwater tree trenches.

Key Considerations:

Trees should be appropriate growing height and width.

Be sure that trees do not interfere with any overhead utility wires) and width (do not interfere with existing canopies, buildings, etc. See Approved Plant List for species appropriate in narrow streets, boulevards, and neighborhood streets. Tree species should be limbed up above the line of sight as they age. Multi-stemmed, low-branching or evergreen trees are not appropriate in the sidewalk.

Include a diversity of tree species.

Avoid overused species to reduce the risk of disease or insect infestation.

Preserve any lines of sight for traffic safety.

Dense vegetation (e.g. herbaceous, shrubs) should be no higher than 3' above curb elevation as requested by Philadelphia Streets Department.

Select vegetation with compact growing habits.

It is important to limit overhang into the curb or sidewalk. Plant species that have compact growing habits and will not require support to stay upright.

Plant palette should have year-round interest.

Keep in mind that streetscapes are spaces that are active year-round. Areas adjacent to curbs or other sudden changes in grade should be planted with plants that are visible year-round such as evergreen shrubs.

Plant species should have a high tolerance for salts and other road pollutants.

Stormwater runoff from the right-of-way may carry a high concentration of salts and other pollutants.

Parking Lots



Figure 2-6. Southwest Treatment Facility Parking Lot

Parking lots present the opportunity for on-site stormwater management, provide shade to cool pavement and cars, and reduce air and water pollutants. SMPs in parking lots include stormwater trees trenches, bump-outs, and rain gardens.

Key Considerations:

Trees should be of appropriate growing height.

Be sure that tree canopy is high enough to provide headroom but will not interfere with any overhead utility wires. Tree species should be limbed up above the line of sight as they age. Multi-stemmed, low-branching, or evergreen trees are not appropriate in parking lots.

Select species that tolerate urban conditions.

Stormwater runoff from parking lots may carry a high concentration of salts, hydrocarbons, and other pollutants. Keep in mind that snow may pile up around the SMP during the snow removal process. Select hardy species that can withstand the impacts of snow.

Preserve sight lines for vehicular safety.

Dense vegetation (e.g. herbaceous, shrubs) should be no higher than 3' above curb elevation as requested by Philadelphia Streets Department.

Consider edges between the SMP and vehicular zones.

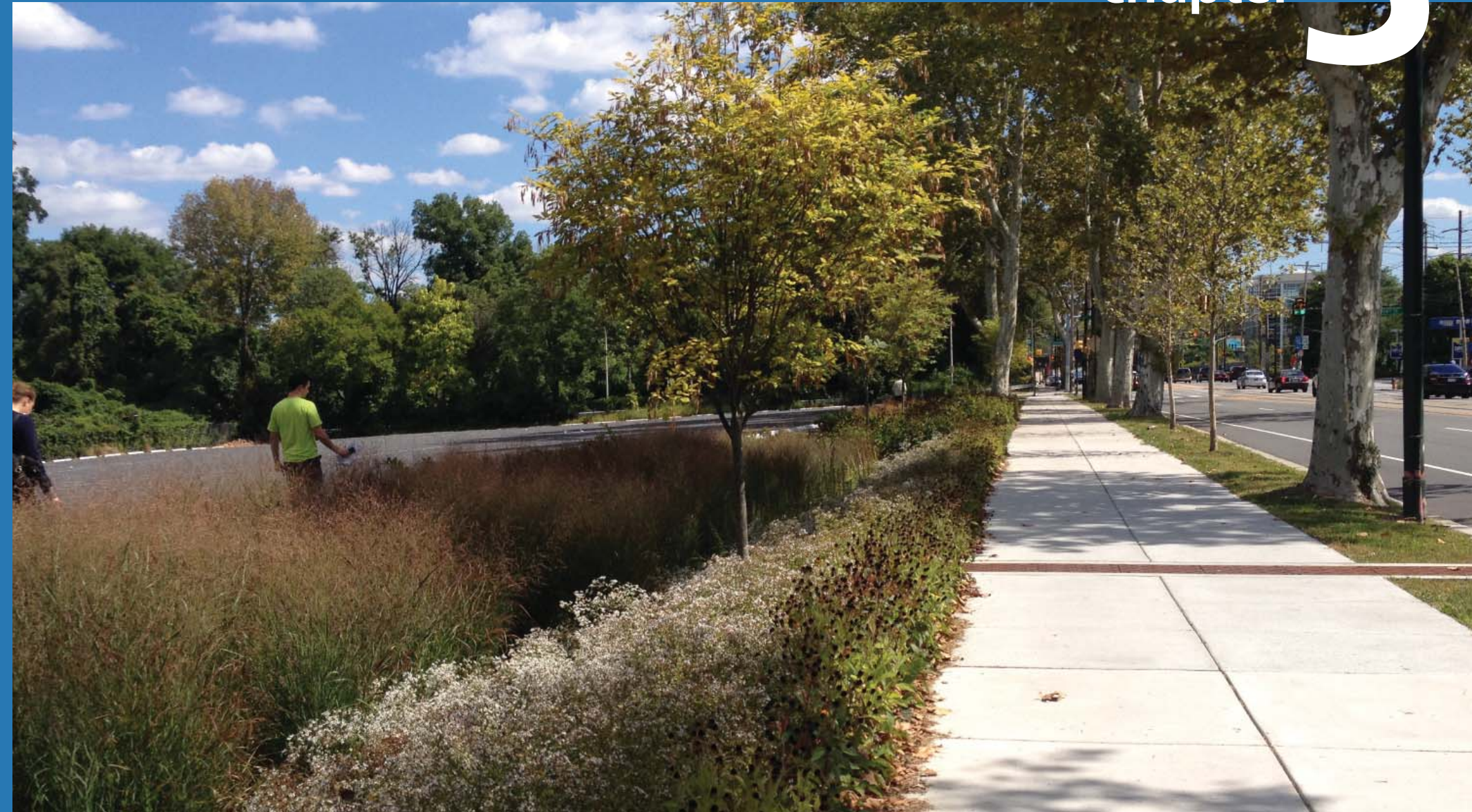
Defining the border of the SMP with edge plantings reduces vehicular damage to the vegetation while preserving vehicular functions (i.e., parking, opening doors). Choose grasses and robust shrubs over woody species and fragile perennials to resist physical impact and exhaust. Select compact vegetation to limit overhang and prevent interference with access to cars.

Diversify plant selections to have year-round interest.

Parking lots are spaces that are typically active year-round. Areas adjacent to curbs or other sudden changes in grade should be planted with plants that are visible year-round such as evergreen shrubs.

Green Stormwater Management Practices: Plant Palettes

chapter **3**



3.1 Introduction to Stormwater Management Practices (SMPs): Design Considerations and Plant Palettes

Within this section, a variety of plant palettes are presented, each corresponding to the most commonly used SMPs by the Philadelphia Water Department. While this is not a comprehensive list, the Guidebook may be expanded upon at a later date. Plant palettes provided are vetted to ensure that each species is appropriate for the SMP type and that a wide enough range of species are provided to fulfill each niche, related to hydrology, sun and shade, bloom time, and seasonal interest. This chapter is just the starting point to a successful landscape design. Species selection and layout will depend on unique site conditions. See Chapter 3: Site Assessment & Design for guidance related to site design.

3.2 Stormwater Management Practices - Frequently Used

Over the past decade, the Water Department has made a significant commitment to the design and construction of GSI demonstration projects throughout the City. By implementing a number of projects aimed at demonstrating the utility of various green stormwater control technologies in highly urbanized areas, the Water Department has helped to raise awareness of GSI among City residents and the regulatory community.

The following practices are frequently implemented within the City of Philadelphia:

- Stormwater Tree Trenches
- Stormwater Planters
- Stormwater Bump-outs
- Rain Gardens

SMP Fact Sheets

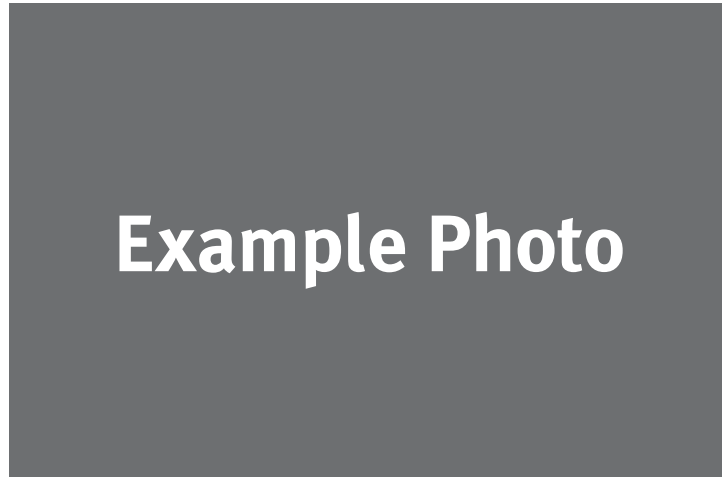


Photo Caption

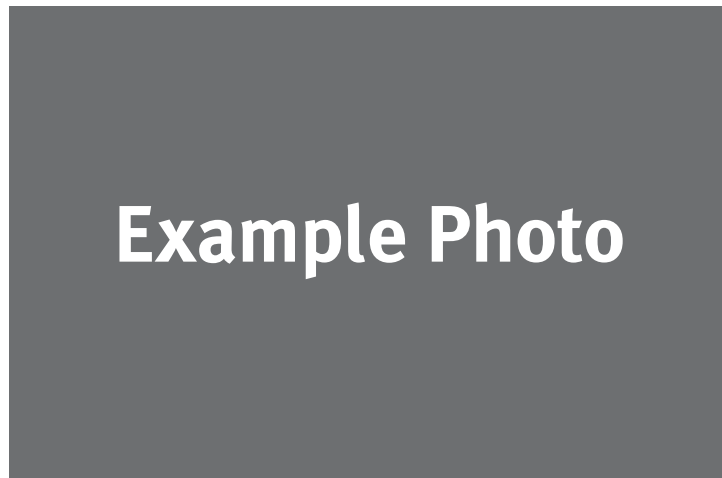


Photo Caption

Potential Challenges

- Potential constraints and challenges are provided as they relate to landscape design

Suggested Landscape Solutions

- Suggested solutions for the given challenges are provided

Plant Palettes

This page provides lists of plants appropriate for the SMP. Information about the plant's growth requirements is given on the left hand side of the species name.

LEGEND

RECOMMENDED PLANT LOCATION	{	L Lowest elevation
		M Middle elevation
		o Outer elevation
BLOOM COLOR	{	● Yellow / Orange
		○ White
		● Blue / Purple
		● Pink / Red
SEASON INTEREST	{	🍂 Fall Interest
		❄️ Winter Interest
LIGHT REQUIREMENTS	{	☀️ Full Sun
		☀️/🌑 Part Shade
		🌑 Full Shade

STORMWATER TREE TRENCH



Figure 3-1. Examples of Stormwater Tree Trenches in Philadelphia

Potential Challenges

- Trees can conflict with existing structures and overhead utilities.
- Large pits can become weedy.
- Sight lines must be maintained for safety.
- Trees may be exposed to pollutants from the street such as road salts.
- Insect and diseases pests can devastate tree populations.

Suggested Landscape Solutions

Trees

- Know the mature height and spread of tree species. Use large trees in boulevards or where space is available for the greatest stormwater function and increased shade. Use medium trees where large trees cannot fit or to increase species variety. Use small trees only in areas with restricted space, such as under wires and columnar trees for narrow streets.
- Plant a diversity of tree species to guard against the possibility of large-scale devastation by insect and disease pests.
- Select species that are tolerant of street conditions including wind, heat, salt spray, drought, and pollution.

Shrubs, Blooms, & Grasses

- Blooms, grasses and shrubs can be great additions to tree pits, adding color and texture and discouraging weeds. Be sure that any additional plants do not compete with the tree or in any way jeopardize its health.
- Limit the number of species to 1-2 for greatest design impact and ease of maintenance.
- Plant heights should be less than 3' above top of curb elevation to ensure safe visibility.
- Plant habit should be compact and not require support to avoid flopping over onto the sidewalk.

Stormwater Tree Trenches: Plant Palettes

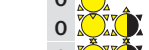
Trees: All trees are appropriate for full sun and have fall interest. Additional characteristics are noted.

Small Shade Trees (<25')		Small Flowering Trees (<25')		Columnar Trees		Large Trees	
Botanical Name	Common Name	Botanical Name	Common Name	Botanical Name	Common Name	Botanical Name	Common Name
<i>Acer buergerianum</i>	Trident Maple	<i>Amelanchier canadensis</i>	Canadian Serviceberry	<i>Acer rubrum 'Armstrong'</i>	Fastigate Red Maple	<i>Aesculus flava</i>	Yellow Buckeye
<i>Acer campestre</i>	Hedge Maple	<i>Amelanchier x grandiflora*</i>	Serviceberry	<i>Acer saccharum 'Goldspire'</i>	Goldspire Maple	<i>Aesculus hippocastanum</i>	Horse Chestnut
<i>Acer griseum</i>	Paperbark Maple	<i>Cercis canadensis*</i>	Eastern Redbud	<i>Acer x freemani 'Celebration'</i>	Celebration Hybrid Maple	<i>Carya glabra</i>	Pignut Hickory
<i>Acer tataricum</i>	Tartarian Maple	<i>Chioanthus spp.</i>	Fringetree	<i>Acer x freemani 'Scarlet Sentinel'</i>	Scarlet Sentinel Hybrid Maple	<i>Carya ovata</i>	Shagbark Hickory
<i>Acer truncatum</i>	Purpleblow Maple	<i>Cornus officinalis</i>	Japanese Cornel Dogwood	<i>Carpinus betulus 'Columnaris'</i>	Columnar European Hornbeam	<i>Cryptomeria japonica</i>	Japanese Cryptomeria
<i>Carpinus caroliniana*</i>	American Hornbeam	<i>Cornus florida*</i>	Flowering Dogwood	<i>Carpinus betulus 'Fastigiata'</i>	Upright European Hornbeam	<i>Gymnocladus dioicus (male)</i>	Kentucky Coffeetree
<i>Cotinus obovatus*</i>	American Smoke tree	<i>Cornus x rutban</i>	Aurora Dogwood	<i>Cryptomeria japonica</i>	Japanese Cryptomeria	<i>Liquidambar styraciflua*</i>	American Sweetgum
<i>Ostrya virginiana*</i>	Hop Hornbeam	<i>Cornus mas</i>	Cornelian Cherry	<i>Gingko biloba*</i>	Gingko	<i>Liriodendron tulipifera*</i>	Tulip Tree
<i>Parrotia persoca</i>	Persian Parrotia	<i>Crataegus crus-galli</i>	Cockspur Hawthorn	<i>Koelreuteria paniculata 'Fastigiata'</i>	Fastigate Goldenrain Tree	<i>Nyssa sylvatica*</i>	Blackgum
		<i>Crataegus flava</i>	Yellowleaf Hawthorn	<i>Liriodendron tulipifera 'Fastigiatum'</i>	Columnar Tulip Tree	<i>Platanus occidentalis*</i>	American Sycamore
		<i>Crataegus laevigata</i>	English Hawthorn	<i>Prunus sargentii 'Spire'</i>	Columnar Sargent Cherry		
		<i>Crataegus phaenopyrum</i>	Washington Hawthorn	<i>Quercus palustris 'Pringreen'</i>	Green Pillar Pin Oak		
		<i>Crataegus punctata</i>	Dotted Hawthorn	<i>Quercus robur 'Fastigiata'</i>	Columnar English Oak		
		<i>Crataegus viridis</i>	Green Hawthorn	<i>Quercus x warei 'Long' Regal Prince Oak</i>	Crimson Spire Oak		
		<i>Crataegus x lavellei</i>	Lavelle Hawthorne	<i>Sorbus aucuparia 'Fastigiata'</i>	Regal Prince Oak		
		<i>Maackia amurensis</i>	Amur Maackia		Upright Mountainash		
		<i>Malus spp.</i>	Crabapple				
		<i>Prunus maackii</i>	Amur Cherry				
		<i>Prunus sargentii</i>	Sargent Cherry				
		<i>Prunus serulata</i>	Japanese Cherry				
		<i>Prunus subhirtilla</i>	Higan Cherry				
		<i>Prunus virginian</i>	Common Chokeberry				
		<i>Prunus x yedoensis</i>	Yoshimo Cherry				
		<i>Styrax japonicus</i>	Japanese Snowbell				
		<i>Syringa reticulata</i>	Japanese Tree Lilac				

* = native species
 = Lowest zone
 = Middle zone
 = Outer zone

Medium Trees

	Botanical Name	Common Name
	<i>Acer saccharum</i>	Sugar Maple
M O	<i>Acer truncatum</i>	Purpleblow Maple
M O	<i>Acer x freeman</i>	Freeman Maple
M O	<i>Betula lenta</i>	Black Birch
M O	<i>Carpinus betulus</i>	European Hornbeam
M O	<i>Celtis laevigata</i>	Sugarberry
M O	<i>Celtis occidentalis</i>	Common Hackberry
M O	<i>Cercidiphyllum japonicum</i>	Katsura Tree
L M O	<i>Chamaecyparis thyoides</i>	Atlantic White Cedar
M O	<i>Cladrastis kentukea</i>	Yellowwood
	<i>Cornus kousa</i>	Kousa Dogwood
M O	<i>Corylus colurna</i>	Tree Filbert
M O	<i>Eucommia ulmoides</i>	Hardy Rubber Tree
L M O	<i>Gleditsia triacanthos var. inermis</i>	Honeylocust
M O	<i>Halesia tetraptera</i>	Carolina Silverbell
M O	<i>Koelreuteria paniculata</i>	Goldenrain Tree
	<i>Oxydendrum arboreum</i>	Sourwood
L M O	<i>Platanus x acerifolia</i>	London Planetree
M O	<i>Quercus acutissima</i>	Sawtooth Oak
M O	<i>Quercus alba</i>	White Oak
M O	<i>Quercus coccinea</i>	Scarlet Oak
M O	<i>Quercus imbricaria</i>	Shingle Oak
L M O	<i>Quercus lyrata</i>	Overcup Oak
M O	<i>Quercus macrocarpa</i>	Bur Oak
	<i>Quercus muehlenbergii</i>	Chinkapin Oak
L M O	<i>Quercus palustris</i>	Pin Oak
L M O	<i>Quercus phellos</i>	Willow Oak
L M O	<i>Quercus prinus</i>	Chestnut Oak
L M O	<i>Quercus robur</i>	English Oak
M O	<i>Quercus robur x alba 'Crimsmidt'</i>	Crimson Spire Oak
	<i>Quercus rubra</i>	Red Oak
M O	<i>Quercus shumardii</i>	Shumard Oak
	<i>Stewartia koreana</i>	Tall Stewartia
L M O	<i>Taxodium distichum</i>	Bald Cypress
M O	<i>Tilia americana</i>	Basswood
M O	<i>Tilia cordata</i>	Littleleaf Linden
M O	<i>Tilia tomentosa</i>	Silver Linden
M O	<i>Zelkova serrata</i>	Japanese Zelkova



Additional Plantings for Tree Pits

Shrubs with Winter Interest ❄️

Botanical Name	Common Name
<i>Ilex crenata</i>	"Green Luster" Japanese Holly

Early Season Blooms

Botanical Name	Common Name
<i>Ajuga reptans</i>	Bunglweed
<i>Crocus vernus</i>	Crocus
<i>Eranthis hyemalis</i>	Winter Aconite
<i>Narcissus minor</i>	Daffodil
<i>Vinca minor</i>	Periwinkle

Grasses and Grass-likes

Botanical Name	Common Name
<i>Liriope muscari</i>	Lily Turf



Figure 3-2. A community plants daffodils (*Narcissus minor*) around a tree in a stormwater tree trench. The yarn around the tree trunk is a temporary art installation.

STORMWATER PLANTER



Figure 3-3. Example of a Stormwater Planter in Summer and Winter. Evergreen shrubs help to make the planter visible year-round.



Figure 3-4. Example of a Stormwater Planter in Summer and Fall. Planter includes flowers that bloom at different times to create interest in different seasons.

Potential Challenges

- Plant heights should be less than 3' above top of curb elevation.
- Plants may be exposed to pollutants from the street such as road salts.
- The soil level within a planter is below the grade of the street and may be difficult for pedestrians to see in snowy conditions.
- Planters are adjacent to pedestrian traffic.
- Planters are relatively small in size.
- Planters may be in full sun or in part shade.

Suggested Landscape Solutions

General

- Select 1-5 species for maximum impact. Larger planters may have more species.
- For areas where a high salt load is expected, select species with salt tolerance.
- Note sun/shade patterns and select species accordingly.

Shrubs

- For larger planters, use small shrubs to fill the space of the planter. Be sure that the size of the shrub is appropriate to the size of the planter.
- Select species that are evergreen or have winter interest such as colored stems or berries.

Blooms, Grasses & Grass-like

- Compliment shrubs with colorful blooms and textures that will provide interest throughout the seasons.
- Plant form should be low and compact, to preserve sight lines and avoid flopping over onto the sidewalk or roadway.

Stormwater Planter: Plant Palette

Small Shrubs (<5' Height) with Winter Interest ❄️	
Botanical Name	Common Name
<i>Aronia spp.*</i>	Chokeberry
<i>Ilex crenata</i>	Japanese Holly
<i>Cornus sericea* (dwarf cultivars)</i>	Dwarf Dogwood
<i>Ilex spp.* (dwarf cultivars)</i>	Winterberry/Holly
<i>Physocarpus opulifoliosus* (dwarf cultivars)</i>	Dwarf Ninebark
Early Season Blooms (<4' Height)	
Botanical Name	Common Name
<i>Ajuga reptans</i>	Bungelweed
<i>Iris versicolor*</i>	Blue Flag Iris
<i>Oenothera spp.*</i>	Sundrops
<i>Physostegia virginiana*</i>	Obedient Plant
<i>Vinca minor</i>	Periwinkle
Late Season Blooms (<4' Height)	
Botanical Name	Common Name
<i>Echinacea purpurea*</i>	Eastern Purple Coneflower
<i>Monarda didyma*</i>	Beebalm
<i>Pycnanthemum virginiana*</i>	Mountain Mint
<i>Rudbeckia spp.*</i>	Black-Eyed Susan
<i>Symphoricarpos spp.*</i>	Aster
Grasses & Grass-like (<4' Height)	
Botanical Name	Common Name
<i>Acorus calamus*</i>	Sweet Flag
<i>Carex spp.*</i>	Sedge
<i>Juncus effusus*</i>	Soft Rush
<i>Liriope spp.</i>	Lily Turf
<i>Pennisetum spp.</i>	Fountain Grass
<i>Panicum virgatum*</i>	Switchgrass

STORMWATER BUMP-OUT



Figure 3-5. Example of a Stormwater Bump-out in Summer and Fall. Bump-out includes flowers that bloom at different times to create interest in different seasons.



Figure 3-6. Example of a Stormwater Bump-out in early Spring and late Summer. Shrubs provide structure while blooms accent the planting.

Potential Challenges

- Maintain visibility for traffic. Dense vegetation should be less than 3' above top of curb elevation and trees must be limbed up to 7'.
- Bump-outs may be difficult to see in snowy conditions and risk being overrun by cars or pedestrians.
- Systems may experience stormwater flows with high energy and erosion can be an issue.
- Bump-outs are relatively small in size. Too many plants can appear chaotic.
- Plants may be exposed to pollutants from the street such as road salts.
- Bump-outs are most often in full sun conditions.

Suggested Landscape Solutions

General

- Select species that can tolerate salt and full sun.
- Select 1-7 species for maximum impact.

Trees

- Trees can provide structure and shade. They are highly recommended for mid-block locations where visibility may be less of a concern; however, corner locations must preserve views according to Streets Department regulations.

Shrubs

- Choose primarily shrubs with winter interest and accent with shrubs.
- Place shrubs near the sidewalk to soften elevation changes and near the stormwater flow path to prevent erosion.

Blooms, Grasses & Grass-like

- Accent the planting with color from early and late blooms and texture from grasses and grass-like.
- Plant form should be low and compact, to preserve sight lines and avoid flopping over onto the sidewalk or roadway.

Stormwater Bump-out: Plant Palette

Small Shrubs (<5' Height)

Planting Diagram	Botanical Name	Common Name
	<i>Aronia spp.*</i>	Chokeberry
	<i>Ilex crenata</i>	Japanese Holly
	<i>Clethra alnifolia*</i>	Sweet Pepperbush
	<i>Cornus sericea* 'Kelsey', 'Farrow'</i>	Dwarf Dogwood
	<i>Hammamelis virginiana (dwarf cultivars)</i>	Dwarf Witch Hazel
	<i>Ilex spp.* (dwarf cultivars)</i>	Holly
	<i>Itea virginiana (dwarf cultivars)</i>	Sweetspire
	<i>Physocarpus opulifoliosus* (dwarf cultivars)</i>	Dwarf Ninebark
	<i>Spirea alba var. latifolia*</i>	White Meadowsweet

Early Season Blooms (<4' Height)

Planting Diagram	Botanical Name	Common Name
	<i>Ajuga reptans</i>	Bungelweed
	<i>Iris versicolor*</i>	Blue Flag Iris
	<i>Oenothera spp.*</i>	Sundrops
	<i>Physostegia virginiana*</i>	Obedient Plant

Late Season Blooms (<4' Height)

Planting Diagram	Botanical Name	Common Name
	<i>Echinacea purpurea*</i>	Eastern Purple Coneflower
	<i>Monarda didyma*</i>	Beebalm
	<i>Pycnanthemum virginiana</i>	Mountain Mint
	<i>Rudbeckia spp.*</i>	Black-Eyed Susan
	<i>Solidago rugosa 'Fireworks'*</i>	Goldenrod
	<i>Symphotrichum spp.*</i>	Aster

Grasses & Grass-like (<4' Height)

Planting Diagram	Botanical Name	Common Name
	<i>Acorus calamus*</i>	Sweet Flag
	<i>Festuca longifolia</i>	Hard Fescue
	<i>Carex spp.*</i>	Sedge
	<i>Juncus effusus*</i>	Soft Rush
	<i>Liriope spp.</i>	Lily Turf
	<i>Pennisetum spp.</i>	Fountain Grass
	<i>Panicum virgatum*</i>	Switchgrass

RAIN GARDEN



Potential Challenges

- Rain gardens often have significant grade changes and varying hydrology.
- Rain gardens may be adjacent to other site programming.
- High energy flows can cause erosion.

Suggested Landscape Solutions

General

- Rain gardens may have varying environmental conditions. A sun-shade study should be completed along with a definition of the hydrologic zones.
- Select 1-15 species depending on the size of the rain garden. Smaller gardens with little environmental variation will require fewer species than larger gardens with more variation.
- The rain garden should fit with the surrounding landscape, considering preferences of the landowner and user groups.

Trees

- If the site allows and the community is receptive, use trees to provide structure, shade, spring blooms, and fall color.
- Rain gardens present an opportunity to plant multi-stemmed as well as single-stemmed trees.

Shrubs

- Shrubs planted along the edge of the system can create a barrier from other site uses.
- Planting shrubs in the stormwater flow path helps to prevent erosion.

Blooms, Grasses & Grass-likes

- Use color and texture to create the showiest display for the time of year a site will be most active.

Woodland Rain Garden (Part Shade-Shade): Plant Palette

	<p>Shrubs</p> <p>Botanical Name</p> <ul style="list-style-type: none"> <i>Clethra alnifolia</i> * <i>Diervilla lonicera</i> * <i>Hydrangea quercifolia</i> * <i>Hypericum prolificum</i> * <i>Itea virginica</i> * <i>Ilex crenata</i> <i>Viburnum spp.</i> * 	<p>Common Name</p> <ul style="list-style-type: none"> Sweet Pepperbush Dwarfbush Honeysuckle Oakleaf Hydrangea Shrubby St. John's Wort Sweetspire Japanese Holly Viburnum
	<p>Early Season Blooms</p> <p>Botanical Name</p> <ul style="list-style-type: none"> <i>Anemone canadensis</i> * <i>Aquilegia canadensis</i> * <i>Crocus vernus</i> <i>Galanthus nivalis</i> <i>Geranium maculatum</i> * <i>Narcissus spp.</i> 	<p>Common Name</p> <ul style="list-style-type: none"> Meadow Anemone Red Columbine Crocus Snowdrop Wild Geranium Daffodil
	<p>Late Season Blooms (<4' Height)</p> <p>Botanical Name</p> <ul style="list-style-type: none"> <i>Cheloni lyonii</i> * <i>Echinacea purpurea</i> * <i>Rudbeckia spp.</i> * <i>Solidago rugosa 'Fireworks'</i> * <i>Symphotrichum spp.</i> * 	<p>Common Name</p> <ul style="list-style-type: none"> Turtlehead Eastern Purple Coneflower Black-Eyed Susan Goldenrod Aster
	<p>Grasses & Grass-likes</p> <p>Botanical Name</p> <ul style="list-style-type: none"> <i>Acorus calamus</i> * <i>Carex spp.</i> * <i>Dennstaedtia punctilobula</i> * <i>Festuca longifolia</i> <i>Liriope spp.</i> <i>Osmunda regalis</i> * 	<p>Common Name</p> <ul style="list-style-type: none"> Sweet Flag Sedge Eastern Hayscented Fern Hard Fescue Lily Turf Royal Fern

Figure 2-7. A woodland (shady) rain garden (top) and a prairie grassland (sunny) rain garden (bottom) in Philadelphia.

Prairie Grassland Rain Garden (Full Sun-Part Shade): Plant Palette

Shrubs:

L	M	O	☀️	❄️	🍃	<i>Aronia melanocarpa</i>	Black Chokeberry
L	M	O	☀️	❄️	🍃	<i>Cornus spp.*</i>	Dogwood
M	O	☀️	❄️	🍃	🍃	<i>Dasiphora fruticosa*</i>	Bush Cinquefoil
M	O	☀️	❄️	🍃	🍃	<i>Hammamelis virginiana*</i>	Witch Hazel
L	M	O	☀️	❄️	🍃	<i>Ilex spp.*</i>	Holly
L	M	O	☀️	❄️	🍃	<i>Myrica pennsylvanica*</i>	Bayberry
L	M	O	☀️	❄️	🍃	<i>Physocarpus opulifoliosus*</i>	Ninebark
M	O	☀️	❄️	🍃	🍃	<i>Rhus aromatica*</i>	Fragrant Sumac
O	☀️	❄️	🍃	🍃	🍃	<i>Rosa caroliniana*</i>	Carolina Rose
L	M	O	☀️	❄️	🍃	<i>Spiraea betulifolia*</i>	White Meadowsweet

Trees for Landscapes:

L	M	O	☀️	❄️	🌳	<i>Acer rubrum*</i>	Red Maple
M	O	☀️	❄️	🌳	🌳	<i>Amelanchier spp.*</i>	Serviceberry
L	M	O	☀️	❄️	🌳	<i>Betula spp.*</i>	Birch
M	O	☀️	❄️	🌳	🌳	<i>Chioanthus virginicus*</i>	Fringetree
L	M	O	☀️	❄️	🌳	<i>Juniperus virginiana*</i>	Eastern Red Cedar
L	M	O	☀️	❄️	🌳	<i>Magnolia virginiana*</i>	Sweetbay Magnolia
L	M	O	☀️	❄️	🌳	<i>Metasequoia glyptostroboides</i>	Dawn Redwood
M	O	☀️	❄️	🌳	🌳	<i>Nyssa sylvatica</i>	Black Gum
L	M	O	☀️	❄️	🌳	<i>Plantanus occidentalis*</i>	Sycamore
L	M	O	☀️	❄️	🌳	<i>Quercus bicolor*</i>	Swamp White Oak
L	M	O	☀️	❄️	🌳	<i>Taxodium distichum*</i>	Bald Cypress

Early Season Blooms:

L	M	O	☀️	❄️	🌸	<i>Iris versicolor*</i>	Blue Flag Iris
L	M	O	☀️	❄️	🌸	<i>Oenothera spp.*</i>	Sundrops
M	O	☀️	❄️	🌸	🌸	<i>Penstemon digitalis*</i>	Foxglove
M	O	☀️	❄️	🌸	🌸	<i>Physostegia virginiana*</i>	Obedient Plant
M	O	☀️	❄️	🌸	🌸	<i>Sedum spp.*</i>	Stonecrop

Late Season Blooms:

O	☀️	❄️	🌸	🌸	🌸	<i>Agastache rupestris*</i>	Threadleaf Giant Hyssop
O	☀️	❄️	🌸	🌸	🌸	<i>Coreopsis spp.*</i>	Tickseed
O	☀️	❄️	🌸	🌸	🌸	<i>Gallardia spp.*</i>	Blanketflower
L	M	O	☀️	❄️	🌸	<i>Monarda didyma*</i>	Bee Balm
L	M	O	☀️	❄️	🌸	<i>Perovskia atriplicifolia</i>	Russian Sage
O	☀️	❄️	🌸	🌸	🌸	<i>Pycnanthemum virginiana</i>	Mountain Mint

Grasses & Groundcovers:

M	O	☀️	❄️	🌿	🌿	<i>Andropogon spp.*</i>	Bluestem
L	M	O	☀️	❄️	🌿	<i>Calamagrostis acutiflora 'Karl Foerster'</i>	Feather Reed Grass
O	☀️	❄️	🌿	🌿	🌿	<i>Juncus spp.*</i>	Rush
L	M	O	☀️	❄️	🌿	<i>Muhlenbergia capillaris*</i>	Pink Muhly Grass
L	M	O	☀️	❄️	🌿	<i>Panicum virgatum*</i>	Switchgrass
L	M	O	☀️	❄️	🌿	<i>Pennisetum spp.</i>	Fountain Grass
L	M	O	☀️	❄️	🌿	<i>Schizachyrium scoparium*</i>	Little Bluestem
O	☀️	❄️	🌿	🌿	🌿	<i>Sorghastrum nutans*</i>	Indiangrass
M	O	☀️	❄️	🌿	🌿	<i>Sporobolus heterolepsis*</i>	Prairie Dropseed



Figure 2-8. A rain garden in Philadelphia

Table 3.1: Planting Strategies for SMPs

SMP	General	Trees	Shrubs	Blooms, Grasses & Grass-likes
Stormwater Tree Trench		<ul style="list-style-type: none"> Select small trees where there are overhead wires, columnar trees for narrow streets, and larger trees for boulevards. Plant a diversity of species. Select species that are tolerant of street conditions including wind, heat, salt spray, drought, and pollution. 		<ul style="list-style-type: none"> Be sure that additional plants do not compete with the tree or in any way jeopardize its health. Limit the number of species to 1-2. Plant heights should be less than 3' above top of curb elevation. Plant habit should be compact and not require support.
Stormwater Planter	<ul style="list-style-type: none"> Select 1-5 species. For areas where a high salt load is expected, select species with salt tolerance. Note sun/shade patterns and select species accordingly. 		<ul style="list-style-type: none"> For larger planters, use small shrubs to fill the space of the planter. Use only species with winter interest. 	<ul style="list-style-type: none"> Use perennials and grasses for color and texture. Plant form should be low and compact, to preserve sight lines and avoid flopping over onto the sidewalk or roadway.
Stormwater Bump-out	<ul style="list-style-type: none"> Select species that can tolerate salt and full sun. Select 1-7 species. 	<ul style="list-style-type: none"> Trees are highly recommended for mid-block locations; however, corner locations must preserve views according to Streets Department regulations. 	<ul style="list-style-type: none"> Use primarily shrubs with winter interest for structure. Place shrubs near the sidewalk and near the stormwater flow path. 	<ul style="list-style-type: none"> Use perennials and grasses for color and texture. Plant form should be low and compact.
Rain Garden	<ul style="list-style-type: none"> Define varying environmental conditions according to sun/shade, hydrology, etc. Select 1-15 species. The rain garden should fit with the surrounding landscape, considering preferences of the landowner and user groups. 	<ul style="list-style-type: none"> If the site allows, use landscape trees to provide structure, shade, spring blooms, and fall color. 	<ul style="list-style-type: none"> Plant shrubs along the edge of the system and in the stormwater flow path. 	<ul style="list-style-type: none"> Use color and texture to create the showiest display for the time of year a site will be most active.

Example Scenarios and Landscape Plans

chapter 4



4.1 Introduction to Example Scenarios and Landscape Plans

This section demonstrates how to apply the information in Chapters 2 and 3 of the Guidebook. Example Scenarios are given along with key challenges and landscape solutions. Note that the examples are not meant to be “drop-in” landscape plans. Rather, the examples illustrate the approach to evaluating a site and providing a unique landscape design. At the same time, the scenarios shown aim to address some of the most common challenges.

- Stormwater Tree Trench: City Neighborhood Street
- Stormwater Tree Trench: Narrow, Local Street
- Stormwater Tree Trench: Boulevard
- Stormwater Planter: Park Sidewalk
- Stormwater Planter: Recreation Center Sidewalk
- Stormwater Bump-out: Industrial Street
- Stormwater Bump-out: Residential
- Rain Garden: Traffic Triangle
- Rain Garden: Recreation Facility
- Rain Garden: Passive Landscape
- Rain Garden: Schoolyard
- Rain Garden: Parking Lot

Stormwater Tree Trench: City Neighborhood Street



City Neighborhood Street - Existing Conditions



City Neighborhood Street - Proposed Conditions (Rendering)

Challenges to SMP

Overhead utility easement

- High volumes of pedestrian traffic
- Highly visible location

Solutions

- Cornelian Cherry (*Cornus mas*) is low branching and will not interfere with overhead wires
- Holly shrub border protects trees from foot traffic
- This combination offers year-round interest

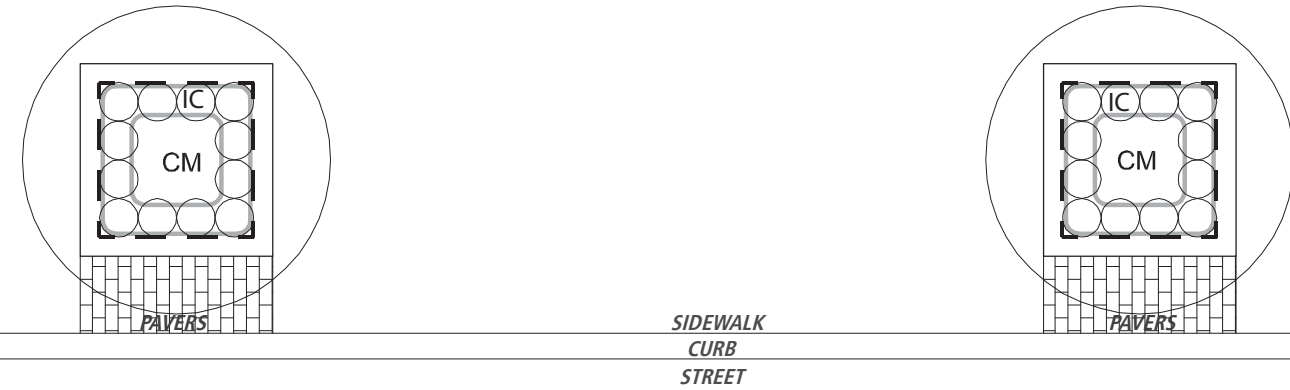
PLANT PALETTE

TREES

Key	Botanical Name	Common Name
CM	<i>Cornus mas</i>	Cornelian Cherry

SHRUBS

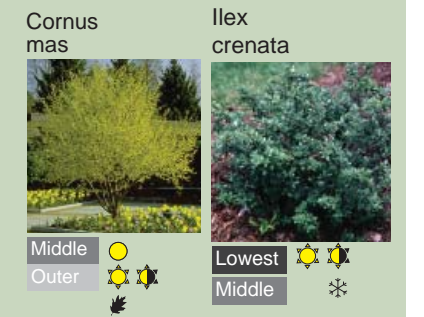
Key	Botanical Name	Common Name
BS	<i>Ilex crenata</i> 'Green Luster'	Japanese Holly



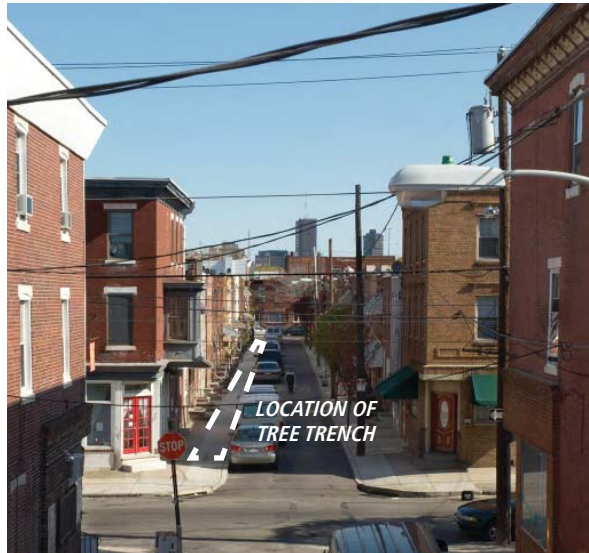
PLAN



SCALE: 1"=5'



Stormwater Tree Trench: Narrow, Local Street



Local Street - Existing Conditions



Local Street - Proposed Conditions (Rendering)

Challenges to SMP

- Narrow street
- Important to maintain views

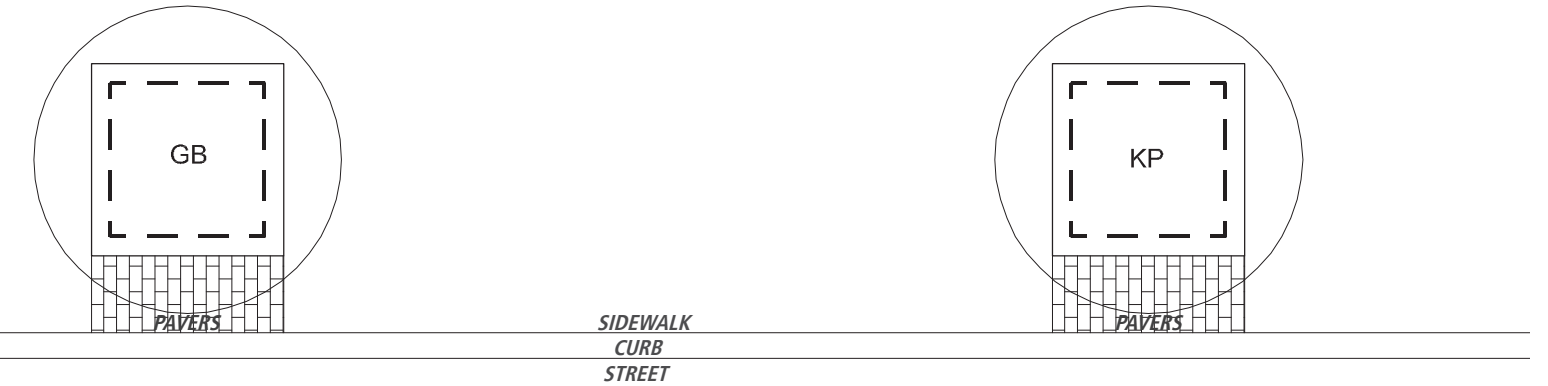
Solutions

- Maidenhair tree (*Ginkgo biloba*) and Golden Rain tree (*Koelreuteria*) have columnar growth habits, important for a narrow street
- Trees can be limbed up, if needed, to maintain views

PLANT PALETTE

TREES

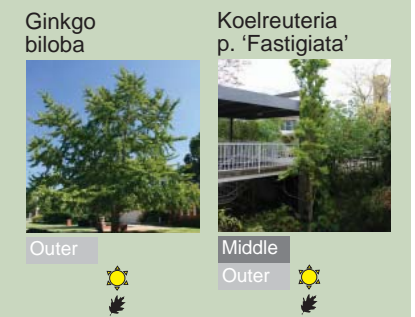
Key	Botanical Name	Common Name
GB	<i>Ginkgo biloba</i>	Ginkgo
KP	<i>Koelreuteria p. 'Fastigiata'</i>	Golden Rain Tree



PLAN



SCALE: 1"=5'



Stormwater Tree Trench: Boulevard



Boulevard - Existing Conditions



Boulevard - Proposed Conditions (Rendering)

Challenges to SMP

- Wide street
- Few pedestrian crossings
- High pollutant load
- Important to maintain views

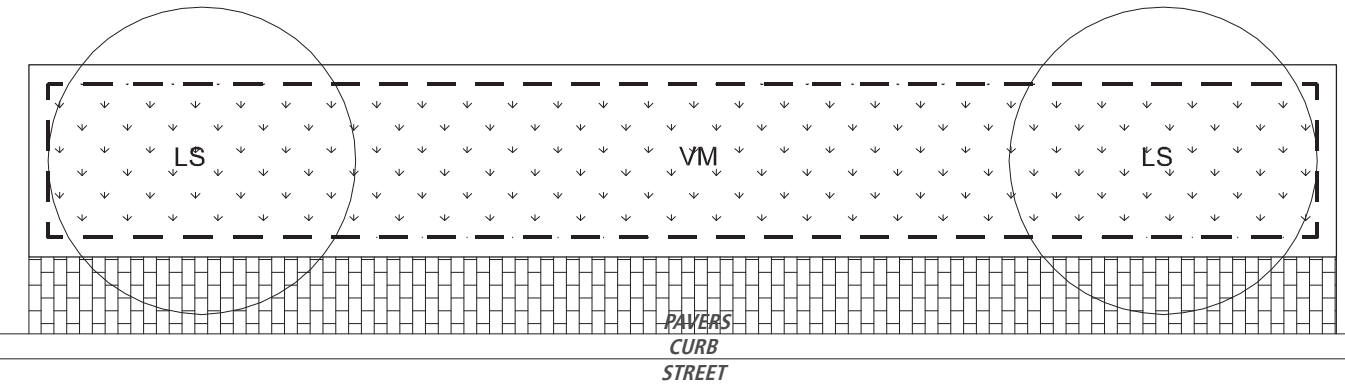
Solutions

- Sweetgum (*Liquidambar styraciflua*), fruitless variety, is a large fast-growing tree
- Sweetgum can be limbed up, if needed, to maintain views
- Periwinkle (*Vinca*) is a low groundcover that spreads quickly, providing a lush green appearance year-round with colorful spring blooms

PLANT PALETTE

TREES



Key	Botanical Name	Common Name
LS	<i>Liquidambar styraciflua</i>	Sweetgum, fruitless
VM	<i>Vinca minor</i>	Periwinkle



PLAN



SCALE: 1"=5'

<p>Liquidambar styraciflua</p>  <p>Lowest Middle Outer</p>	<p>Vinca minor</p>  <p>Lowest Middle Outer</p>
--	--

Stormwater Planter: Park Sidewalk



Stormwater Planter - Pre-Construction Conditions



Stormwater Planter - Post-Construction Conditions

Challenges to SMP

- Planter soil is below the sidewalk level
- High volumes of pedestrian traffic
- Important to maintain views
- High pollutant load
- Variable hydrology
- Partial shade

Solutions

- Inkberry (*Ilex glabra*) and Fox Sedge (*Carex vulpinoidea*) grow quickly to fill in the planter
- Inkberry provides year-round color
- Inkberry can be found in dwarf cultivars to maintain views
- Both plants can handle variable hydrologic conditions and high pollutant loads
- Plants thrive in part shade conditions

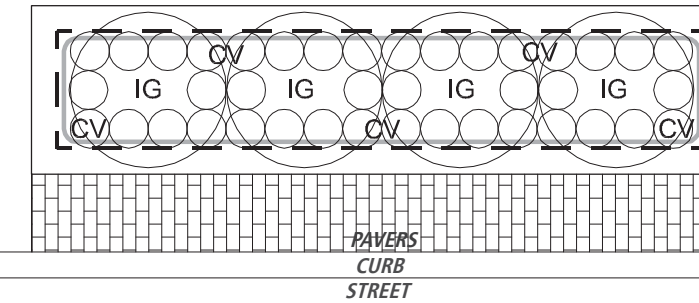
PLANT PALETTE

SHRUBS

Key	Botanical Name	Common Name
IG	<i>Ilex glabra</i>	Inkberry

GRASS/GRASS-LIKES

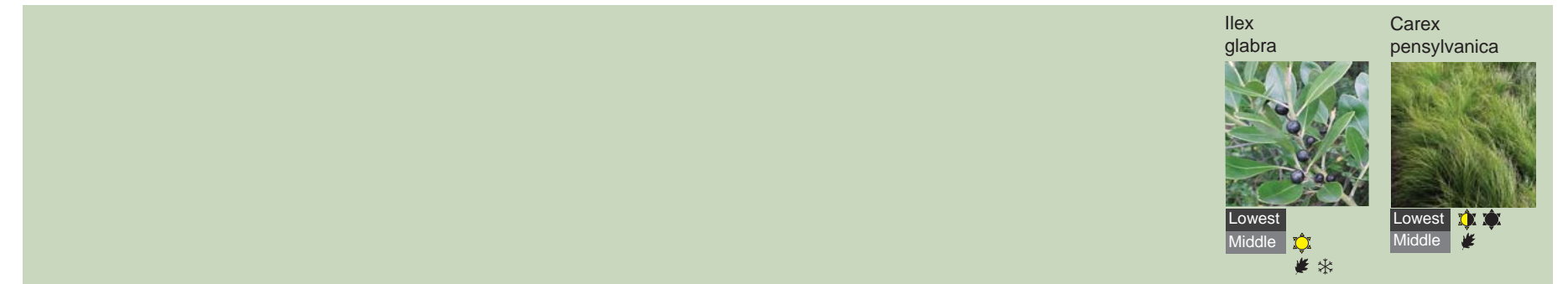
Key	Botanical Name	Common Name
CV	<i>Carex vulpinoidea</i>	Fox Sedge



PLAN



SCALE: 1"=5'



Stormwater Planter: Park Sidewalk Corner



Park Sidewalk - Pre-construction Conditions



Park Sidewalk - During Construction

Challenges to SMP

- High volumes of pedestrian traffic
- Has 2 hydrologic zones
- Highly viewed
- Stormwater flow is concentrated through the center of the system
- Full sun

Solutions

- Many plants provide seasonal interest and a variety of textures and colors, making this an interesting and interactive space
- Shrubs planted along the edge form a barrier
- Plants do not block views
- Plants are appropriate to each hydrologic zone and full sun conditions

PLANT PALETTE

SHRUBS

Key	Botanical Name	Common Name
IV	<i>Ilex verticillata</i> 'Red Sprite'	Winterberry
DL	<i>Potentilla fruticosa</i>	Cinquefoil
VL	<i>Viburnum lentago</i>	Viburnum

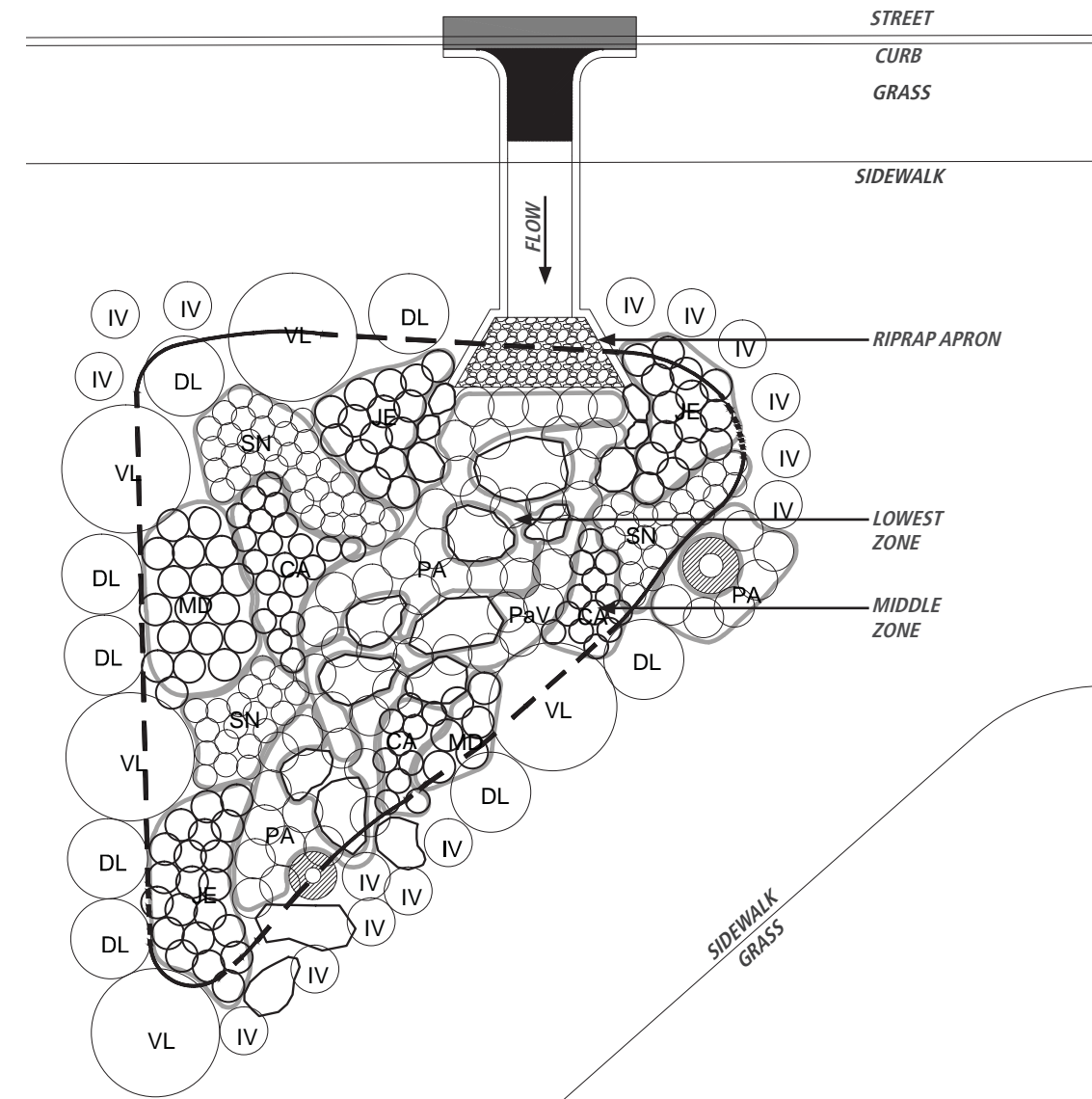
HERBACEOUS

Key	Botanical Name	Common Name
MD	<i>Monarda didyma</i>	Bee Balm
SN	<i>Symphotrichum novae-belgii</i>	Newfoundland Aster

GRASS/GRASS-LIKES

Key	Botanical Name	Common Name
CA	<i>Carex vulpinoidea</i>	Fox Sedge
JE	<i>Juncus effusus</i>	Soft Rush
PaV	<i>Panicum virgatum</i>	Switch Grass
PA	<i>Pennisetum alopecuroides</i>	Dwarf Fountain Grass

Stormwater Planter: Park Sidewalk Corner



PLAN

0 ft 6 ft 12 ft 24 ft 36 ft

SCALE: 1"=12'

<p>Ilex verticillata</p> <p>Lowest Middle</p>	<p>Potentilla fruticosa</p> <p>Middle Outer</p>	<p>Viburnum lentago</p> <p>Lowest Middle</p>
<p>Monarda didyma</p> <p>Lowest Middle</p>	<p>Symphotrichum novae-angliae</p> <p>Lowest</p>	
<p>Juncus effusus</p> <p>Lowest</p>	<p>Panicum virgatum</p> <p>Lowest Middle</p>	<p>Pennisetum orientale</p> <p>Lowest Middle</p>

Stormwater Bump-out: City Neighborhood Street



City Neighborhood Street - Existing Conditions



City Neighborhood Street - Proposed Conditions (Rendering)

Challenges to SMP

- Highly visible location year-round
- Important to maintain views

Solutions

- Dogwood (*Cornus* spp.) is colorful year-round
- Black-eyed Susan (*Rudbeckia*) blooms in the summer and Aster (*Symphotrichum*) blooms in the fall
- *Liriope* provides a continuous, colorful groundcover
- None of the plants block views
- All plants have fast growth and spread rate to provide visual interest

PLANT PALETTE

SHRUBS

Key	Botanical Name	Common Name
CS	<i>Cornus sericea</i> 'kelseyi'	Red Twig Dogwood

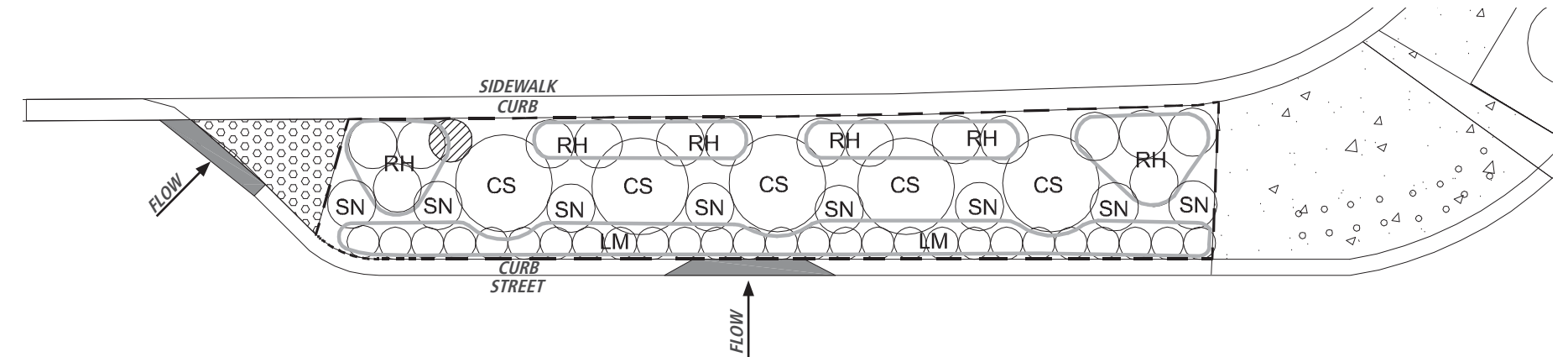
HERBACEOUS

Key	Botanical Name	Common Name
RH	<i>Rudbeckia hirta</i>	Black-eyed Susan
SN	<i>Symphotrichum novae-belgii</i>	Newfoundland Aster

GRASS/GRASS-LIKES

Key	Botanical Name	Common Name
LM	<i>Liriope muscari</i>	Lily Turf

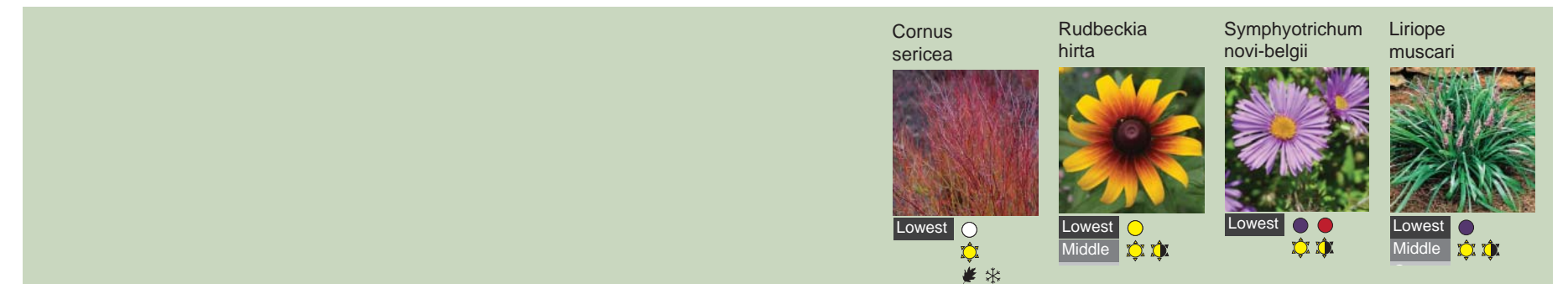
Stormwater Bump-out: City Neighborhood Street



PLAN



SCALE: 1"=5'



Stormwater Bump-out: Auto-Oriented Commercial/Industrial Street



Industrial Street - Pre-construction Conditions



Industrial Street - Post-Construction Conditions

Challenges to SMP

- Low maintenance planting desired
- High pollutant load
- Full sun

Solutions

- Grasses are widely adaptable and resilient
- The plantings will form a dense mat to keep out weeds

PLANT PALETTE

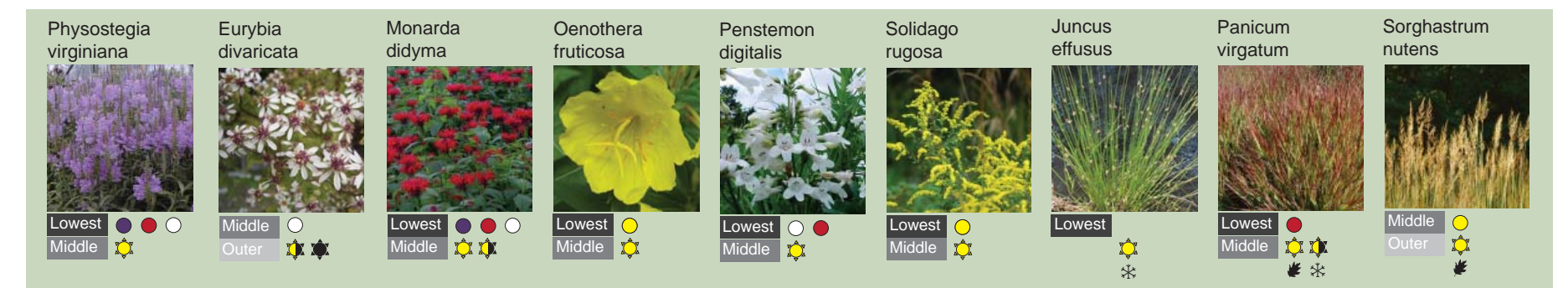
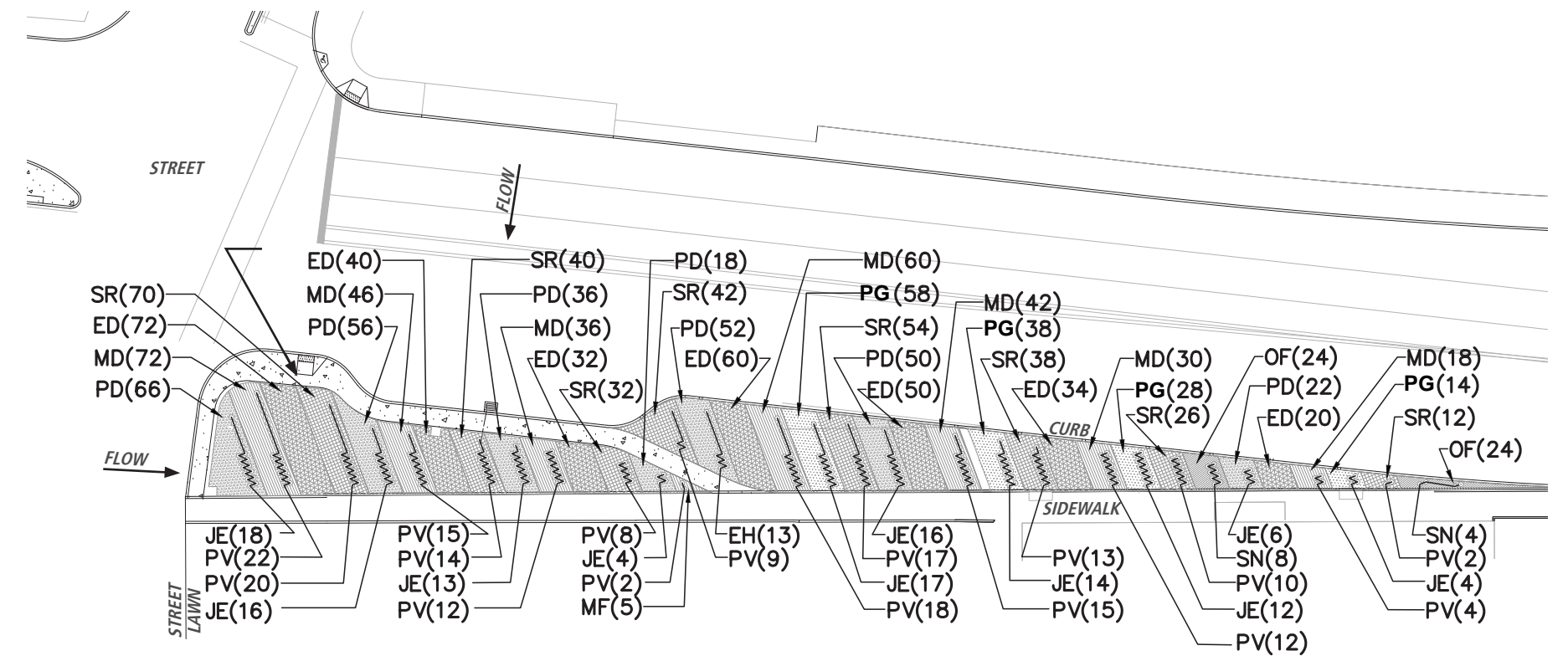
HERBACEOUS

Key	Botanical Name	Common Name
ED	<i>Eurybia divaricata</i>	White Wood Aster
MD	<i>Monarda didyma</i>	Bee Balm
OF	<i>Oenothera fruticosa</i>	Sundrops
PD	<i>Penstemon digitalis</i>	Foxglove Beardtongue
PG	<i>Physostegia virginiana</i>	Obedient Plant
SR	<i>Solidago rugosa</i> Fireworks'	Fireworks Goldenrod

GRASS/GRASS-LIKES

Key	Botanical Name	Common Name
JE	<i>Juncus effusus</i>	Soft Rush
PV	<i>Panicum virgatum</i>	Switchgrass
SN	<i>Sorghastrum nutans</i>	Indian Grass

Stormwater Bump-out: Industrial Street



Rain Garden: Traffic Triangle



Traffic Triangle - Pre-construction Conditions



Traffic Triangle - Post-construction Conditions

Challenges to SMP

- High pollutant load expected
- System has 3 zone changes
- Highly visible location
- Stormwater flow is concentrated through the center of the system

Solutions

- All plants are tolerant of many urban conditions
- Plants in lowest section of system are zone 1 plants (inundated often)
- Plants in middle sections of system are zone 2 plants (inundated sometimes)
- Plants in outer section of system are zone 3 plants (inundated rarely)
- Much of herbaceous and some grasses were selected for bloom color and times since system is viewed often
- Trees and shrub border provide buffer to prevent tripping hazard, and a border to enclose plants that may spread
- Plants in the flow path have stronger root systems to withstand the flow
- Combination of plants provides multi-seasonal interest

PLANT PALETTE

TREES

Key	Botanical Name	Common Name
QB	<i>Quercus bicolor</i>	Swamp White Oak

SHRUBS

Key	Botanical Name	Common Name
IV	<i>Ilex verticillata</i> 'Red Sprite'	Winterberry
DL	<i>Potentilla fruticosa</i>	Bush Cinquefoil

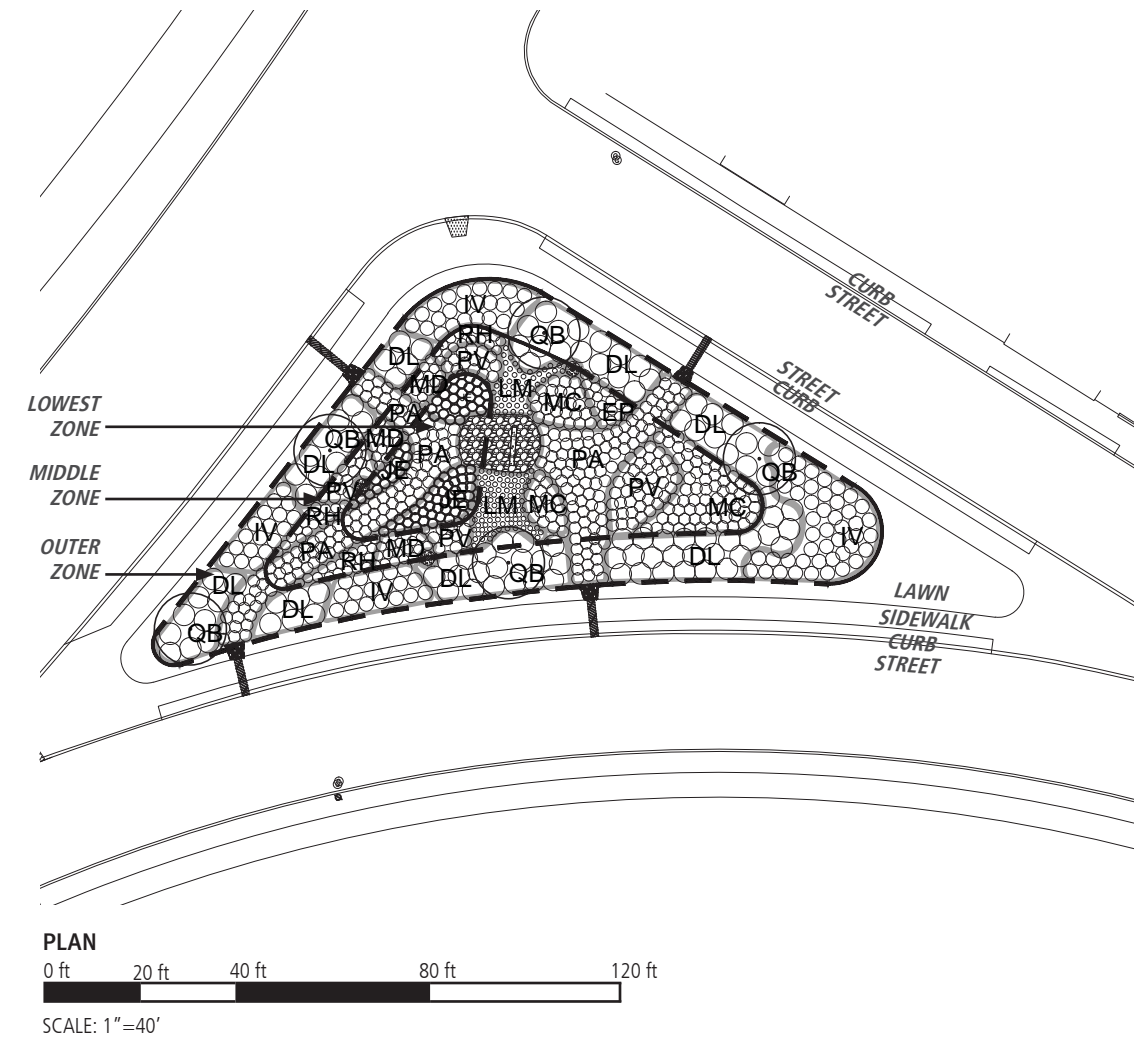
HERBACEOUS







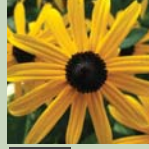




Key	Botanical Name	Common Name
EP	<i>Echinacea purpurea</i>	Eastern Purple Coneflower
MD	<i>Monarda didyma</i>	Bee Balm
PV	<i>Physostegia virginiana</i>	Obedient Plant
RH	<i>Rudbeckia fulgida</i>	Black-eyed Susan

GRASS/GRASS-LIKES

Key	Botanical Name	Common Name
JE	<i>Juncus effusus</i>	Soft Rush
LM	<i>Liriope muscari</i>	Lily Turf
MC	<i>Muhlenbergia capillaris</i>	Pink Muhly Grass
PA	<i>Pennisetum alopecuroides</i>	Dwarf Fountain Grass

Rain Garden: Traffic Triangle



	Quercus bicolor	Lowest Middle
	Potentilla fruticosa	Middle Outer
	Ilex verticillata	Lowest Middle
	Echinacea purpurea	Middle Outer
	Monarda didyma	Lowest Middle
	Physostegia virginiana	Lowest Middle
	Rudbeckia fulgida	Lowest Middle Outer
	Juncus effusus	Lowest
	Liriope muscari	Lowest Middle
	Muhlenbergia capillaris	Middle Outer
	Pennisetum alopecuroides	Lowest Middle

Rain Garden: Active Recreation Site



Local Active Recreational Site - Existing Conditions



Local Active Recreational Site - Proposed Conditions (Rendering)

Challenges to SMP

- SMP is located within an active recreational site, with two edges abutting active uses
- Visibility is important
- SMP footprint is a small and rectilinear
- Maintenance Tier I

Solutions

- Evergreen shrub borders define the edges where the SMP abuts the active uses
- Underplanting with lirope helps to keep the border well-defined and limit the need for weeding
- Robust grasses are planted along the stormwater flow path
- Planting plan contrasts with form of the SMP footprint with its curved design, maximizing aesthetic value
- Plant species are compact and provide ornamental interest appropriate to a small site
- Limited to 7 species
- Selected plants are appropriate for both hydrologic zones in the garden, zone 1 and zone 2 (inundated often or sometimes)
- Dense vegetation is low in height to minimize blockage of site lines

PLANT PALETTE

SHRUBS

Key	Botanical Name	Common Name
IG	<i>Ilex crenata</i> 'Compacta'	Japanese Holly

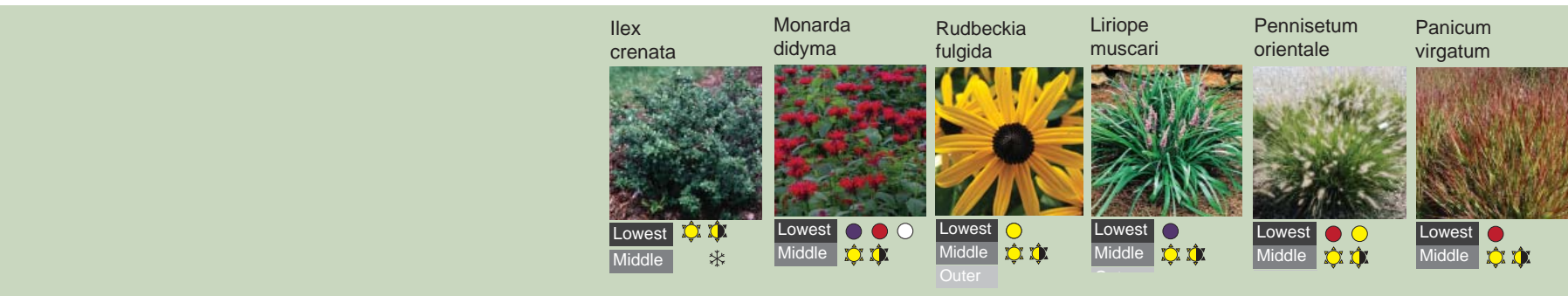
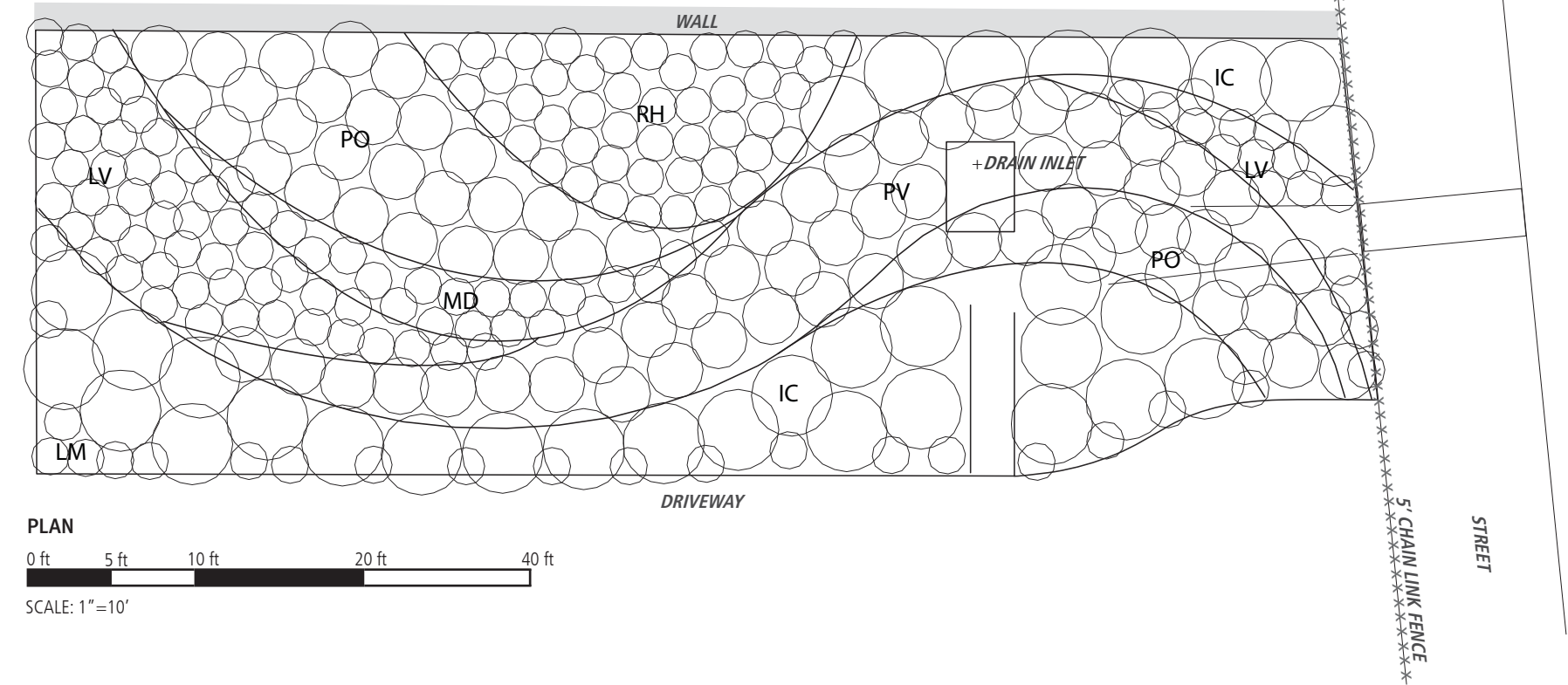
HERBACEOUS

Key	Botanical Name	Common Name
MD	<i>Monarda didyma</i>	Bee Balm
RH	<i>Rudbeckia fulgida</i>	Black-eyed Susan

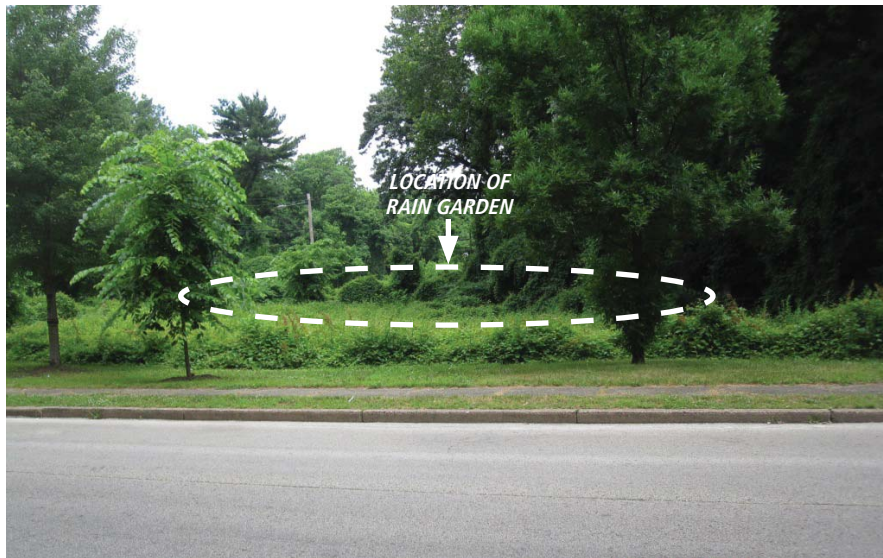
GRASS-GRASS-LIKES

Key	Botanical Name	Common Name
LV	<i>Liriope muscari</i> 'Veriegata'	Lily Turf
LM	<i>Liriope muscari</i> 'Big Blue'	Monkey Grass
PO	<i>Pennisetum orientale</i> 'Karley Rose'	Fountain Grass
PV	<i>Panicum virgatum</i>	Switch Grass

Rain Garden: Active Recreation Site



Rain Garden: Passive Park



Local Passive Park Site - Pre-construction Conditions



Local Passive Park Site - Post-Construction Conditions

Challenges to SMP

- Large stormwater basin
- Viewed from the street
- Within a large passive park
- Maintenance Tier II

Solutions

- Native species support ecological goals of the park
- Shrubs underplanted with perennials creates structure and interest along the upper edge of the garden, where it will be most visible
- Bottom of basin is planted with low-maintenance *Juncus* species

PLANT PALETTE

SHRUBS

Key	Botanical Name	Common Name
AA	<i>Aronia arbutifolia</i> 'Brilliantissima'	Red Chokeberry
CA	<i>Clethra alniifolia</i>	Sweet Pepperbush
MP	<i>Myrica pennsylvanica</i>	Northern Bayberry
SA	<i>Spiraea betulifolia</i>	White Spiraea
VD	<i>Viburnum dentatum</i> 'Blue muffin'	Arrowwood Viburnum

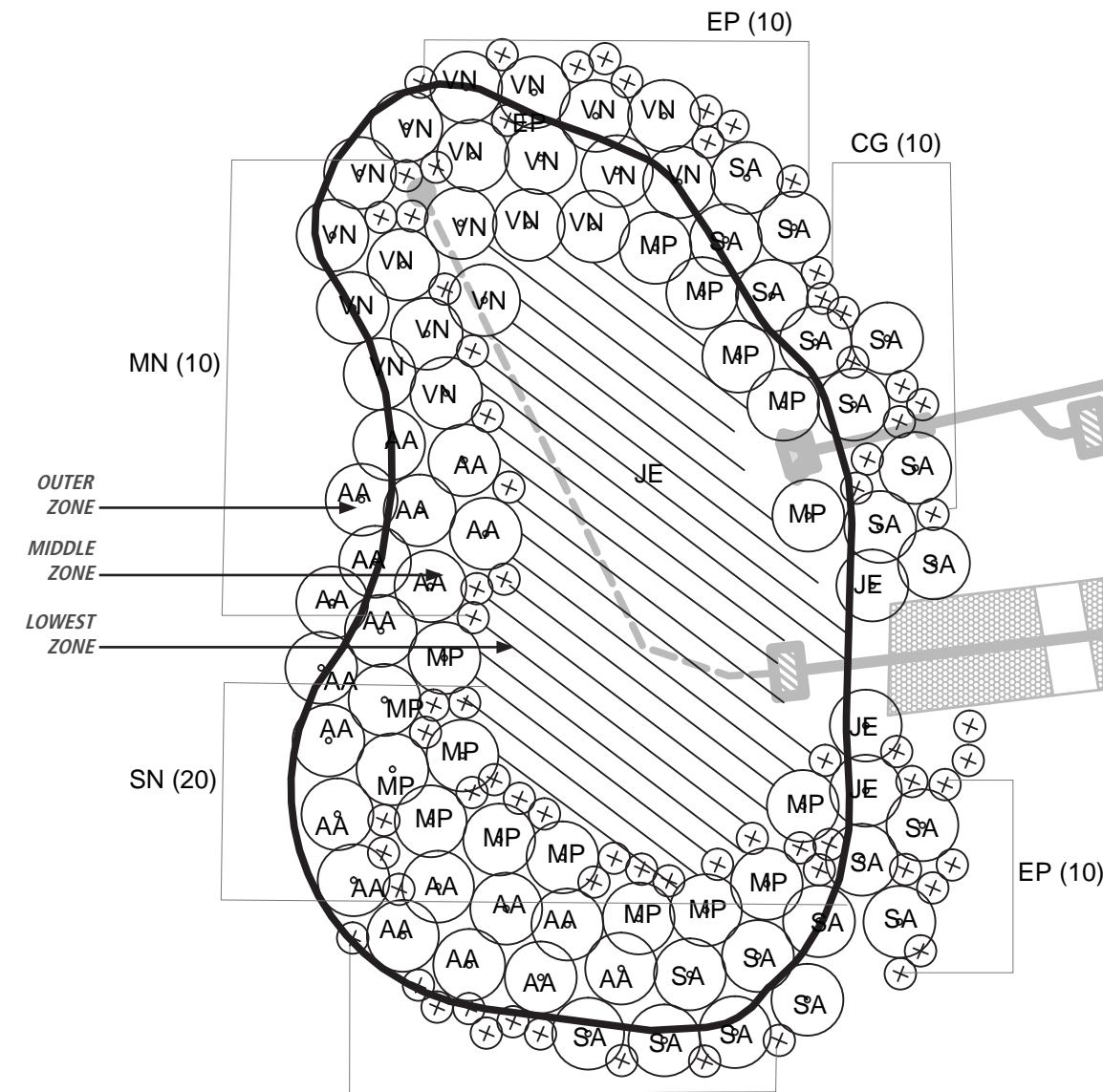
HERBACEOUS

Key	Botanical Name	Common Name
CG	<i>Coreopsis grandifolia</i>	Large-Flowered Tickseed
EP	<i>Echinacea purpurea</i>	Purple Coneflower
MD	<i>Monarda didyma</i>	Bee Balm
SN	<i>Symphyotrichum novae-angliae</i>	New England Aster

GRASS/GRASS-LIKES

Key	Botanical Name	Common Name
JE	<i>Juncus effusus</i>	Soft Rush

Rain Garden: Passive Park



PLAN
0 ft 10 ft 20 ft 40 ft 60 ft
SCALE: 1" = 20'

<p>Aronia arbutifolia</p> <p>Lowest <input type="radio"/> <input type="radio"/></p> <p>Middle <input checked="" type="checkbox"/> <input checked="" type="checkbox"/></p>	<p>Clethra alniifolia</p> <p>Lowest <input type="radio"/> <input type="radio"/></p> <p>Middle <input checked="" type="checkbox"/> <input checked="" type="checkbox"/></p>	<p>Myrica pennsylvanica</p> <p>Lowest <input type="checkbox"/> <input type="checkbox"/></p> <p>Middle <input checked="" type="checkbox"/> <input checked="" type="checkbox"/></p>
<p>Spiraea betulifolia</p> <p>Lowest <input type="radio"/> <input type="radio"/></p> <p>Middle <input checked="" type="checkbox"/> <input checked="" type="checkbox"/></p> <p>Outer <input checked="" type="checkbox"/></p>	<p>Viburnum lentago</p> <p>Lowest <input type="radio"/> <input type="radio"/></p> <p>Middle <input checked="" type="checkbox"/> <input checked="" type="checkbox"/></p> <p>Outer <input checked="" type="checkbox"/></p>	<p>Coreopsis grandifolia</p> <p>Outer <input checked="" type="checkbox"/></p> <p>Middle <input checked="" type="checkbox"/></p>
<p>Echinacea purpurea</p> <p>Middle <input checked="" type="checkbox"/> <input checked="" type="checkbox"/></p> <p>Outer <input checked="" type="checkbox"/></p>	<p>Monarda didyma</p> <p>Lowest <input type="radio"/> <input type="radio"/></p> <p>Middle <input checked="" type="checkbox"/> <input checked="" type="checkbox"/></p>	<p>Symphyotrichum novae-angliae</p> <p>Lowest <input checked="" type="checkbox"/> <input checked="" type="checkbox"/></p>
<p>Juncus effusus</p> <p>Lowest <input checked="" type="checkbox"/></p>		

Rain Garden: Schoolyard



Local Schoolyard - Existing Conditions



Local Schoolyard - Proposed Conditions (Rendering)

Challenges to SMP

- Active play area adjacent to an edge of the SMP
- Desire to promote educational opportunities and support habitat
- Site is most active in fall, winter, and spring
- Maintenance Tier I

Solutions

- Evergreen shrub borders define the edges where the SMP abuts the active uses.
- Diverse plant community with natives to Pennsylvania provides educational opportunities
- Shrubs with colorful stems and berries provide winter interest. Shrubs and grasses provide massing year-round.
- Partnership with the school community allowed for a more complex planting design

PLANT PALETTE

TREES

Key	Botanical Name	Common Name
CR	<i>Cornus florida</i>	Flowering Dogwood
LS	<i>Liquidambar styraciflua</i>	Sweetgum, fruitless
MV	<i>Magnolia virginiana</i>	Sweetbay Magnolia
TD	<i>Taxodium distichum</i>	Common Bald Cypress

SHRUBS

Key	Botanical Name	Common Name
AA	<i>Aronia arbutifolia</i> 'Brilliantissima'	Red Chokeberry
CA	<i>Clethra alnifolia</i>	Sweet Pepperbush
CS	<i>Cornus sericea</i>	Red Twig Dogwood
PF	<i>Dasiphora fruticosa</i> 'Abbotswood'	Cinquefoil
IC	<i>Ilex crenata</i>	Japanese Holly
JC	<i>Juniperus conferta</i>	Shore Juniper
JV	<i>Juniperus virginiana</i> 'Emerald Setinel'	Eastern Red Cedar
MP	<i>Myrica pennsylvanica</i>	Northern Bayberry
VD	<i>Viburnum dentatum</i> 'Blue Muffin'	Arrowwood Viburnum
VN	<i>Viburnum nudum</i> 'Winterthur'	Witherrod Viburnum

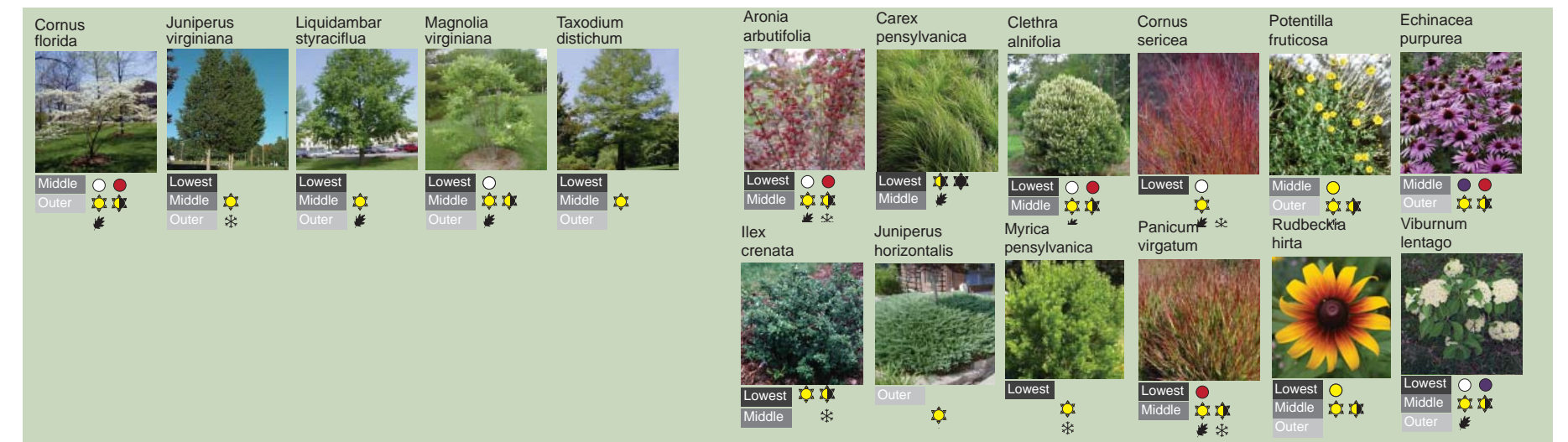
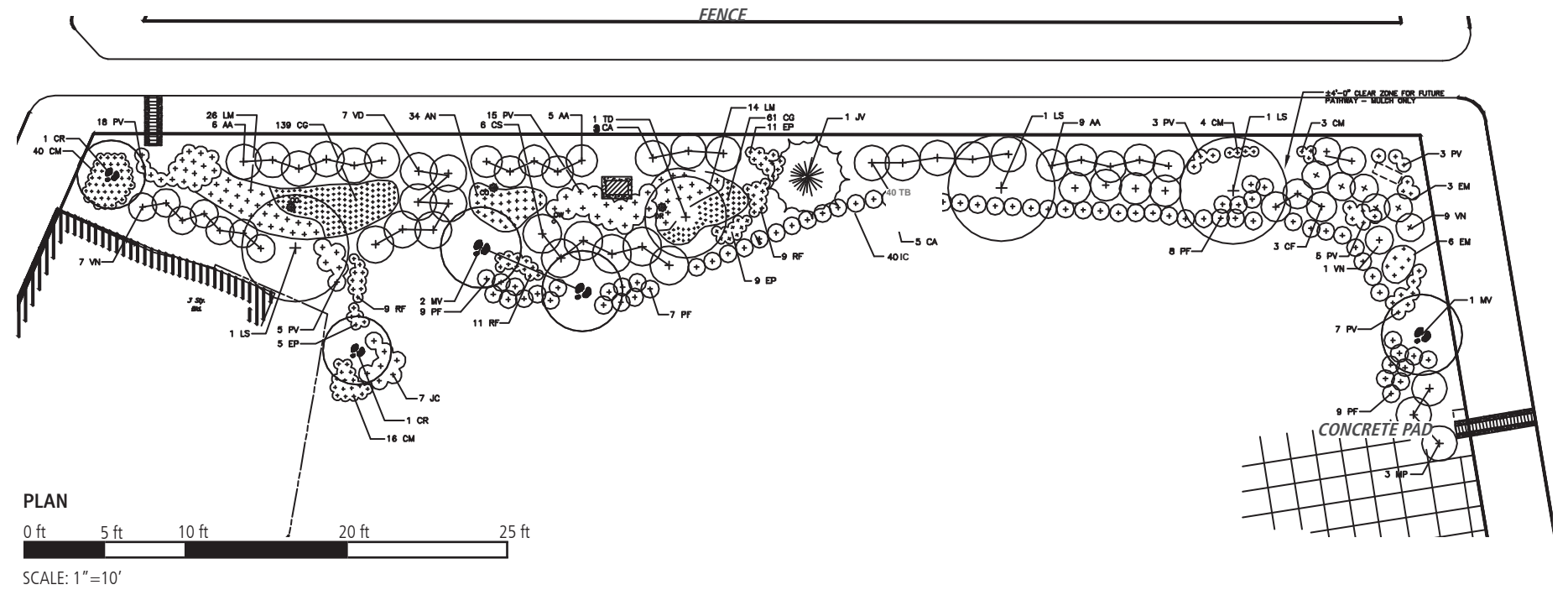
HERBACEOUS

Key	Botanical Name	Common Name
EP	<i>Echinacea purpurea</i>	Eastern Purple Coneflower
RF	<i>Rudbeckia hirta</i>	Black-eyed Susan

GRASS/GRASS-LIKES

Key	Botanical Name	Common Name
CM	<i>Carex pennsylvanica</i>	Pennsylvania Sedge
PV	<i>Panicum virgatum</i>	Switch Grass

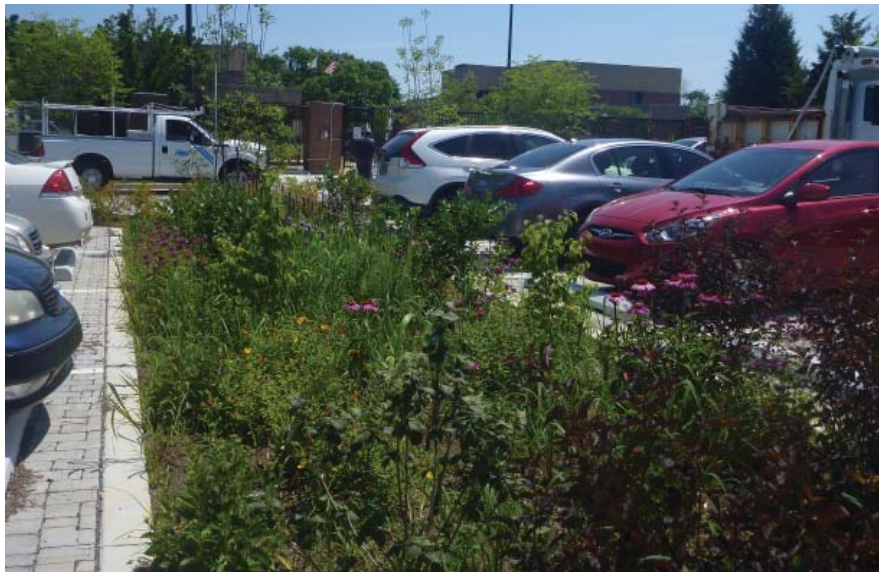
Rain Garden: Schoolyard



Rain Garden: Parking Lot



Local Parking Lot - Existing Conditions



Local Parking Lot - Post-Construction Conditions

Challenges to SMP

- Active vehicular circulation around SMP
- High concentrations of salt, hydrocarbons, and other pollution
- Site is active year round
- Full sun

Solutions

- Hardy grasses along the edges withstand possible impacts by cars and define the borders of the SMP.
- Dense vegetation is low to maintain safety and sight lines.
- Selected species have high tolerances to salt, pollution, and drought.
- Herbaceous perennials with staggered blooming periods and shrubs with winter interest provide color and visual interest throughout the year.

PLANT PALETTE

TREES

Key	Botanical Name	Common Name
MV	<i>Magnolia virginiana</i>	Sweetbay Magnolia

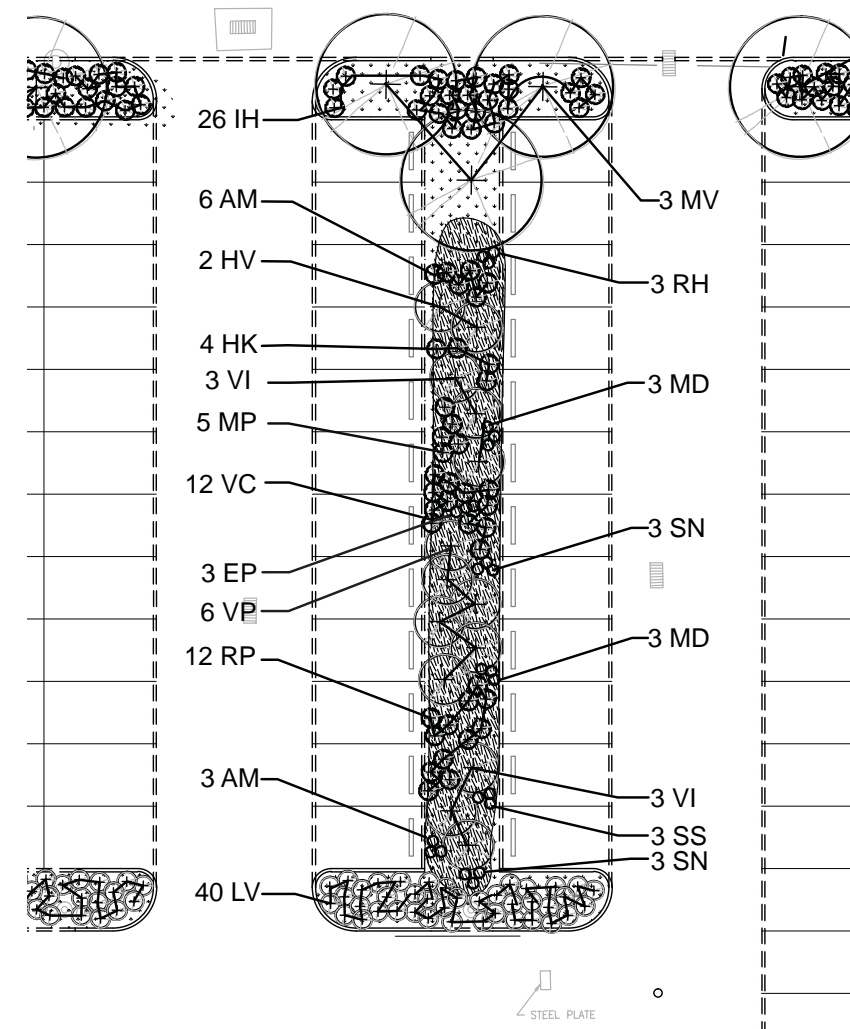
SHRUBS

Key	Botanical Name	Common Name
AM	<i>Aronia melanocarpa</i>	Black chokeberry
IV	<i>Ilex verticillata</i> 'Red Sprite'	Winterberry
IH	<i>Itea virginica</i> 'Henry's Garnet'	Henry's Garnet Virginia Sweetspire
HV	<i>Hamamelis virginiana</i>	Witch Hazel
HP	<i>Hypericum kalmianum</i>	St. John's Wort
VL	<i>Viburnum lantana</i>	Wayfaring Tree
VP	<i>Viburnum prunifolium</i>	Blackhaw

HERBACEOUS

Key	Botanical Name	Common Name
AM	<i>Achillea millefolium</i>	Yarrow
SN	<i>Symphyotrichum novae-angliae</i>	New England Aster
EP	<i>Echinacea purpurea</i>	Purple Coneflower
MD	<i>Monarda didyma</i>	Bee Balm
RH	<i>Rudbeckia hirta</i>	Black-eyed Susan
SS	<i>Solidago sempervirens</i>	Goldenrod

Rain Garden: Parking Lot



Magnolia virginiana Lowest Middle Outer	Aronia melanocarpa Lowest Middle Outer	Ilex verticillata Lowest Middle Outer	Itea virginica Lowest Middle Outer	Hamamelis virginiana Middle Outer
Hypericum kalmianum Lowest Middle Outer	Viburnum lantana Lowest Middle Outer	Viburnum prunifolium Lowest Middle Outer	Echinacea purpurea Middle Outer	
Monarda didyma Lowest Middle Outer	Symphyotrichum novae-angliae Lowest Middle Outer	Rudbeckia hirta Lowest Middle Outer	Solidago sempervirens Lowest Middle Outer	

Philadelphia Water Department Approved Plant List

chapter

5



6.1 Introduction to PWD Approved Plant List

The following plant list is recommended by the Philadelphia Water Department for GSI systems. All landscape plans for the Philadelphia Water Department Office of Watersheds should be selected from this list unless directed otherwise. Refer to Chapter 2.3.2: Plant Selection for definitions of commonly used terms.

Plant Name			Form		Bloom Color				Seasonality		Adaptation							SMP Type			
Genus	Species	Common Name	Height	Width	White	Red/Pink	Purple/Blue	Yellow/Orange	Winter Interest	Fall Interest	Native to US	Inundation Tolerance	Drought Tolerance	Hydrologic Zone Elevation	Light Requirements	Salinity Tolerance	Bumpout	Planters	Rain Garden	Tree Trench	
EARLY SEASON BLOOM HERBACEOUS																					
<i>Ajuga</i>	<i>reptans*</i>	Bugleweed	6"	1'			●		❄️		-	Seasonal	High	Lowest/Middle/Outer	☀️🌑	Low	X	X	X	X	
<i>Anemone (also Anemonidium)</i>	<i>canadensis* (also canadense)</i>	Meadow Anemone	1-2'	2-3'	○						Yes	Seasonal	Low	Lowest/Middle	☀️🌑	High	-	-	X	-	
<i>Aquilegia</i>	<i>canadensis*</i>	Red Columbine	2-3'	1'		●					Yes	Seasonal	Moderate	Middle/Outer	☀️	High	-	-	X	-	
<i>Crocus</i>	<i>vernus</i>	Dutch Crocus	6"	6"	○		●				-	-	High	Outer	☀️	Low	-	-	X	X	
<i>Eranthis (also Helleborus)</i>	<i>hyemalis</i>	Winter Aconite	6"	6"				●			-	-	High	Outer	☀️🌑	High	-	-	X	X	
<i>Galanthus</i>	<i>ivalis</i>	Snowdrop	6"	6"				●	❄️		-	Seasonal	High	Outer	🌑🌑	Low	-	-	X	X	
<i>Geranium</i>	<i>maculatum*</i>	Wild Geranium	1-2'	1-2'		●	●				Yes	Seasonal	High	Middle/Outer	☀️🌑	High	-	-	X	-	
<i>Geranium</i>	<i>macorrhizum</i>	Bigroot Geranium	.5-1'	1-2'							-	Seasonal	High	Middle/Outer	☀️🌑	Low	-	-	X	-	
<i>Iris</i>	<i>versicolor*</i>	Blueflag Iris	1-2'	1'			●				Yes	Regular	Moderate	Lowest	☀️🌑	High	X	X	X	-	
<i>Narcissus</i>	<i>minor</i>	Miniature Daffodil	6"	6"		●	●	●			-	-	High	Outer	☀️🌑	Low	-	-	X	X	
<i>Oenothera</i>	<i>fruticosa*</i>	Sundrops	1-2'	1-2'			●	●			Yes	Seasonal	High	Lowest/Middle	☀️🌑	High	X	-	X	-	
<i>Oenothera</i>	<i>perennis*</i>	Sundrops	1-2'	1-2'				●			Yes	Seasonal	High	Lowest/Middle	☀️	High	X	-	X	-	
<i>Penstemon</i>	<i>digitalis*</i>	Foxglove Beardtongue	2-3'	1-2'	○		●				Yes	Seasonal	High	Lowest/Middle	☀️🌑	Low	-	-	X	-	
<i>Physostegia</i>	<i>virginiana*</i>	Obedient Plant	3-4'	2-3'	○	●	●				Yes	Seasonal	Low	Lowest/Middle	☀️	High	-	X	X	-	
<i>Sedum</i>	<i>x *</i>	Stonecrop	1-2'	1-2'	○	●			❄️		Yes	Seasonal	High	Middle/Outer	☀️	High	-	-	X	-	

Plant Name			Form		Bloom Color				Seasonality		Adaptation							SMP Type			
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<i>Vinca</i>	<i>minor</i>	Periwinkle	6"	24"			●		✱		-	-	High	Middle/Outer	☀️☀️☀️	High	X	X	-	X	
LATE SEASON BLOOM HERBACEOUS																					
<i>Agastache</i>	<i>rupestris*</i>	Threadleaf Giant Hyssop	1-2'	1'		●		●			Yes	-	Moderate	Outer	☀️	Low	-	-	X	-	
<i>Chelone</i>	<i>lyonii*</i>	Turtlehead	3-4'	4-5'							Yes	Seasonal	Low	Lowest	☀️☀️☀️	Low	X	X	X		
<i>Coreopsis</i>	<i>grandiflora*</i>	Largeflower Tickseed	1-2'	1-2'				●			Yes	-	High	Outer	☀️	High	-	-	X	-	
<i>Coreopsis</i>	<i>lanceolata*</i>	Lanceleaf Tickseed	1-3'	1-3'				●			Yes	-	High	Outer	☀️	High	-	-	X	-	
<i>Coreopsis</i>	<i>verticillata*</i>	Whorled Tickseed	1-3'	1-3'		●		●			Yes	-	High	Outer	☀️	High	-	-	X	-	
<i>Echinacea</i>	<i>purpurea*</i>	Eastern Purple Coneflower	2-5'	1-2'		●	●				Yes	Seasonal	Low	Middle/Outer	☀️☀️☀️	Low	X	X	X	-	
<i>Eurybia (also Aster)</i>	<i>divaricata* (also divaricatus)</i>	White Wood Aster	1-2'	1-2'	○	●					Yes	Seasonal	High	Lowest/Middle/Outer	☀️☀️☀️	Low	X	-	X	-	
<i>Gaillardia</i>	<i>aristata*</i>	Blanketflower	1-3'	1'		●		●			Yes	-	Moderate	Outer	☀️	High	-	-	X	-	
<i>Gaillardia</i>	<i>x grandiflora*</i>	Blanketflower	1-3'	1'		●		●			Yes	-	Moderate	Outer	☀️	High	-	-	X	-	
<i>Monarda</i>	<i>didyma*</i>	Bee Balm	2-4'	2-3'	○	●	●				Yes	Seasonal	High	Lowest/Middle	☀️☀️☀️	High	X	-	X	-	
<i>Perovskia</i>	<i>atriplicifolia</i>	Russian Sage	3-5'	2-4'			●				-	-	High	Outer	☀️	High	-	-	X	-	
<i>Pycnanthemum</i>	<i>virginiana</i>	Mountain Mint	2-3'	2-3'							Yes	Seasonal	Moderate	Lowest	☀️☀️☀️	Low	X	X	X		
<i>Rudbeckia</i>	<i>fulgida*</i>	Orange Coneflower	2-3'	1-3'				●			Yes	Seasonal	Moderate	Lowest/Middle/Outer	☀️☀️☀️	Low	X	X	X		

Plant Name			Form		Bloom Color				Seasonality		Adaptation							SMP Type			
Genus	Species	Common Name	Height	Width	White	Red/Pink	Purple/Blue	Yellow/Orange	Winter Interest	Fall Interest	Native to US	Inundation Tolerance	Drought Tolerance	Hydrologic Zone Elevation	Light Requirements	Salinity Tolerance	Bumpout	Planters	Rain Garden	Tree Trench	
<i>Rudbeckia</i>	<i>hirta*</i>	Blackeyed Susan	2-3'	1-3'	○			●			Yes	Seasonal	Moderate	Lowest/Middle/Outer	☀️☀️☀️	Low	X	X	X		
<i>Rudbeckia</i>	<i>subtomentosa</i>	Sweet Coneflower	2-5'	1-3'				●			Yes	Seasonal	Moderate	Lowest/Middle/Outer	☀️☀️☀️	Low	X	X	X		
<i>Solidago</i>	<i>rugosa 'Fireworks'*</i>	Wrinkleleaf Goldenrod	2-3'	2-3'				●			Yes	Seasonal	High	Lowest/Middle	☀️☀️☀️	High	-	-	X	-	
<i>Solidago</i>	<i>sphacelata 'Golden Fleece'</i>	Goldenrod	2-4'	2-3'				●			Yes	Seasonal	High	Lowest/Middle	☀️☀️☀️	High	-	-	X	-	
<i>Solidago</i>	<i>x 'Little Lemon'</i>	Little Lemon Goldenrod	1-2'	1-2'				●			Yes	Seasonal	High	Lowest/Middle	☀️	High	-	-	X	-	
<i>Symphyotrichum (also Aster)</i>	<i>cordifolium*</i>	Common Blue Wood Aster	1-6'	2-3'		●	●				Yes	Seasonal	Moderate	Lowest	☀️☀️☀️	Low	X	-	X	-	
<i>Symphyotrichum (also Aster)</i>	<i>novae-angliae*</i>	New England Aster	1-6'	2-3'		●	●				Yes	Seasonal	Moderate	Lowest	☀️☀️☀️	Low	X	-	X	-	
<i>Symphyotrichum (also Aster)</i>	<i>novi-belgii*</i>	New York Aster	1-6'	2-3'		●	●				Yes	Seasonal	Moderate	Lowest	☀️☀️☀️	Low	X	-	X	-	
GRASSES & GRASS-LIKES																					
<i>Andropogon</i>	<i>gerardii*</i>	Big Bluestem	3-6'	1-5'				●	✱	🍂	Yes	-	High	Middle/Outer	☀️☀️☀️	Low	-	-	X	-	
<i>Andropogon</i>	<i>virginicus*</i>	Broomsedge Bluestem	2'-5'	1-5'		●		●	✱	🍂	Yes	-	High	Middle/Outer	☀️☀️☀️	Low	-	-	X	-	
<i>Calamagrostis</i>	<i>acutiflora 'Karl Foerster'</i>	Feather Reed Grass	3-5'	1-2'				●	✱		-	Regular	Moderate	Lowest/Middle	☀️☀️☀️	Low	X	X	X	-	
<i>Carex</i>	<i>laxiculmis 'Hobb'</i>	Bunny Blue Sedge	1-3'	2'						🍂	Yes	Seasonal	High	Lowest/Middle	☀️☀️☀️	High	X	X	X	-	
<i>Carex</i>	<i>morrowii</i>	Japanese Sedge	1-3'	2'						🍂	-	Seasonal	High	Lowest/Middle/Outer	☀️☀️☀️	High	X	X	X	-	
<i>Carex</i>	<i>pennsylvanica*</i>	Pennsylvania Sedge	1-3'	2'						🍂	Yes	Seasonal	High	Lowest/Middle	☀️☀️☀️					-	

Plant Name			Form		Bloom Color				Seasonality			Adaptation							SMP Type			
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<i>Dennstaedtia</i>	<i>punctilobula*</i>	Eastern Hayscented Fern	1-2'	2-3'					❄️		Yes	Seasonal	Moderate	Lowest	☀️🌑	High	-	-	X	-		
<i>Juncus</i>	<i>effusus*</i>	Common Rush	3'	2-4'					❄️		Yes	Regular	Moderate	Lowest	☀️	High	X	X	X	-		
<i>Liriope</i>	<i>muscaria</i>	Lily Turf	1-1.5'	1'			🟡			-	Seasonal	High	Lowest/Middle/Outer	☀️🌑	Low	X	X	X	X			
<i>Muhlenbergia</i>	<i>capillaris*</i>	Pink Muhly Grass	2-3'	2-3'		🟡				🍂	Yes	Seasonal	High	Middle/Outer	☀️	High	-	-	X	-		
<i>Osmunda</i>	<i>regalis*</i>	Royal Fern	2-3'	2-3'					❄️		Yes	Regular	Low	Lowest	☀️🌑	Low	-	-	X	-		
<i>Panicum</i>	<i>virgatum*</i>	Switchgrass	3-6'	2-3'		🟡			❄️	🍂	Yes	Seasonal	Moderate	Lowest/Middle	☀️🌑	Low	X	X	X	-		
<i>Pennisetum</i>	<i>alopecuroides</i>	Fountain Grass	2-5'	2-5'		🟡	🟡		❄️	🍂		Seasonal	High	Lowest/Middle/Outer	☀️🌑	Low	X	X	X	-		
<i>Pennisetum</i>	<i>orientale</i>	Fountain Grass	2-5'	2-5'		🟡					-	Seasonal	High	Lowest/Middle/Outer	☀️🌑	Low	X	X	X	-		
<i>Schizachyrium</i>	<i>scoparium*</i>	Little Bluestem	2-3'	2'							Yes	-	High	Outer	☀️	Low	-	-	X	-		
<i>Sorghastrum (also Andropogon)</i>	<i>nutans*</i>	Indiangrass	4-6'	1-2'			🟡			🍂	Yes	-	Moderate	Middle/Outer	☀️	High	-	-	X	-		
<i>Sporobolus</i>	<i>heterolepis*</i>	Prairie Dropseed	2-4'	2-3'							Yes	Seasonal	Low	Middle/Outer	☀️	Low	-	-	X	-		
SHRUBS																						
<i>Aronia</i>	<i>arbutifolia*</i>	Red Chokeberry	2-8'	3-6'	○	🟡			❄️	🍂	Yes	Seasonal	Moderate	Lowest/Middle	☀️🌑	High	X	X	X	-		
<i>Aronia</i>	<i>melanocarpa*</i>	Black Chokeberry	2-8'	3-6'	○	🟡			❄️	🍂	Yes	Seasonal	Moderate	Lowest/Middle	☀️🌑	High	X	X	X	-		

Plant Name			Form		Bloom Color				Seasonality			Adaptation							SMP Type			
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<i>Clethra</i>	<i>alnifolia*</i>	Sweet Pepperbush	3-8'	4-6'	○	🟡				🍂	Yes	Seasonal	High	Lowest/Middle	☀️🌑	High	X	X	X	-		
<i>Comptonia (also Myrica)</i>	<i>peregrina</i>	Sweet Fern	2-4'	4-8'					❄️		Yes	Seasonal	High	Middle/Outer	☀️🌑	High	-	-	X	-		
<i>Cornus</i>	<i>alba</i>	Red Twig Dogwood	2-8'	4'	○				❄️	🍂	Yes	Seasonal	Moderate	Lowest	☀️	Low	X	X	X	-		
<i>Cornus</i>	<i>sericea*</i>	Redosier Dogwood	2-8'	4'	○				❄️	🍂	Yes	Seasonal	Moderate	Lowest	☀️	Low	X	X	X	-		
<i>Hibiscus</i>	<i>moscheutos*</i>	Rose Mallow	4-5'	4-5'							Yes	Seasonal	Low	Lowest		Low	X	X	X	-		
<i>Hamamelis</i>	<i>virginiana 'Little Susie'*</i>	Dwarf Witch Hazel	2-4'	2-4'			🟡			🍂	Yes	Seasonal	Low	Middle/Outer	☀️	High	-	-	X	-		
<i>Hydrangea</i>	<i>quercifolia*</i>	Oakleaf Hydrangea	4-8'	5'	○	🟡				🍂	Yes	Seasonal	Low	Lowest/Middle	☀️🌑	High	-	-	X	-		
<i>Hypericum</i>	<i>densiflorum*</i>	St. John's Wort	1-6'	1-5'			🟡				Yes	Seasonal	Low	Lowest/Middle	☀️🌑	High	X	X	X	-		
<i>Hypericum</i>	<i>kalmianum*</i>	Kalm St. John's Wort	2-4'	2-4'			🟡				Yes	Seasonal	Low	Lowest/Middle	☀️🌑	High	X	X	X	-		
<i>Ilex</i>	<i>crenata</i>	Japanese Holly	2-8'	2-8'					❄️		No	Seasonal	High	Middle/Outer	☀️🌑	High	X	X	X	X		
<i>Ilex</i>	<i>glabra*</i>	Inkberry	3-8'	3-8'					❄️	🍂	Yes	Seasonal	Moderate	Lowest/Middle	☀️	High	X	X	X	-		
<i>Ilex</i>	<i>verticillata*</i>	Winterberry	3-15'	3-12'	○	🟡			❄️	🍂	Yes	Seasonal	Moderate	Lowest/Middle	☀️	High	X	X	X	-		
<i>Itea</i>	<i>virginica*</i>	Virginia Sweetspire	3-5'	3-5'	○					🍂	Yes	Regular	Low	Lowest	☀️	Low	X	X	X	-		
<i>Juniperus</i>	<i>chinensis</i>	Juniper	1-10'	3-8'					❄️		No	Seasonal	High	Middle/Outer	☀️	High	X	X	X	X		
<i>Myrica (also Morella)</i>	<i>pensylvanica*</i>	Northern Bayberry	5-12'	3-12'					❄️		Yes	Seasonal	High	Lowest	☀️🌑	High	-	X	X	-		
<i>Physocarpus</i>	<i>opulifolius*</i>	Ninebark	3-10'	4-6'	○	🟡			❄️	🍂	Yes	Seasonal	High	Lowest/Middle	☀️🌑	Low	X	X	X	-		

Plant Name			Form		Bloom Color				Seasonality		Adaptation							SMP Type			
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<i>Rhus</i>	<i>aromatica*</i>	Fragrant Sumac	2-6'	6-10'				●		🍂	Yes	Seasonal	Moderate	Middle/Outer	☀️	High	-	-	X	-	
<i>Rosa</i>	<i>carolina*</i>	Carolina Rose	4'-6'	5-10'		●				🍂	Yes	-	High	Outer	☀️☀️	High	-	-	X	-	
<i>Rubus</i>	<i>allegheniensis</i>	Common Blackberry	3'-6'	6-12'	○						Yes	Seasonal	Moderate	Outer	☀️	Low	-	-	X	-	
<i>Spiraea</i>	<i>betulifolia*</i>	White Spiraea	3-5'	3-4'	○					🍂	Yes	Seasonal	High	Lowest/Middle/Outer	☀️☀️	Low	X	X	X	-	
<i>Viburnum</i>	<i>dentatum*</i>	Arrowwood Viburnum	4-6'	2-12'	○		●			🍂	Yes	-	High	Lowest/Middle/Outer	☀️☀️	High	X	X	X	-	
<i>Viburnum</i>	<i>lantana*</i>	Wayfaringtree	4-6'	2-12'	○		●			🍂	Yes	-	High	Lowest/Middle/Outer	☀️☀️	High	X	X	X	-	
<i>Viburnum</i>	<i>lentago*</i>	Nannyberry Viburnum	4-6'	2-12'	○		●			🍂	Yes	-	High	Lowest/Middle/Outer	☀️☀️	High	X	X	X	-	
<i>Viburnum</i>	<i>nudum*</i>	Possumhaw Viburnum	4-6'	2-12'	○		●			🍂	Yes	-	High	Lowest/Middle/Outer	☀️☀️	High	X	X	X	-	
<i>Viburnum</i>	<i>prunifolium*</i>	Blackhaw Viburnum	4-6'	2-12'	○		●			🍂	Yes	-	High	Lowest/Middle/Outer	☀️☀️	High	X	X	X	-	
<i>Viburnum</i>	<i>trilobum*</i>	American Cranberry Bush	2-12'	2-12'	○					🍂	Yes	-	High	Lowest/Middle/Outer	☀️☀️	High	X	X	X	-	

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TREES																				
<i>Acer</i>	<i>buergerianum</i>	Trident Maple	20-25'	20-25'	S						-	Seasonal	Moderate	Middle/Outer		High	-	-	-	X
<i>Acer</i>	<i>campestre</i>	Hedge Maple	25-35'	25-35'	S						-	Seasonal	High	Middle/Outer		High	-	-	-	X
<i>Acer</i>	<i>griseum</i>	Paperbark Maple	20-30'	15-25'	S						-	-	Moderate	Outer		High	-	-	-	X
<i>Acer</i>	<i>rubrum*</i>	Red Maple	35-60'	30-50'	L						Yes	Regular	Moderate	Lowest/Middle/Outer		Low	-	-	-	X
<i>Acer</i>	<i>rubrum</i> 'Armstrong'*	Armstrong Red Maple	50-60'	15-25'	L						Yes	Regular	Moderate	Lowest/Middle/Outer		Low	-	-	X	-
<i>Acer</i>	<i>saccharum*</i>	Sugar Maple	40-80'	30-60'	L						Yes	-	Moderate	Outer		Low	-	-	-	X
<i>Acer</i>	<i>saccharum</i> 'Goldspire'*	Goldspire Maple	40-50'	12-15'	L						Yes	-	Moderate	Outer		Low	-	-	X	-
<i>Acer</i>	<i>tataricum</i>	Tatarian Maple	15-20'	15-20'	S						-	-	High	Outer		Low	-	-	-	X
<i>Acer</i>	<i>truncatum</i>	Purpleblow Maple	20-25'	15-20'	M						-	Seasonal	Moderate	Middle/Outer		High	-	-	-	X
<i>Acer</i>	<i>x freemani*</i>	Freeman Maple	40-60'	20-40'	L						Yes	Regular	Moderate	Middle/Outer		Low	-	-	-	X
<i>Acer</i>	<i>x freemani</i> 'Celebration'*	Celebration Hybrid Maple	35-60'	20-35'	L						Yes	Regular	Moderate	Middle/Outer		Low	-	-	X	-
<i>Acer</i>	<i>x freemani</i> 'Scarlet Sentinel'*	Scarlet Sentinel Hybrid Maple	40-45'	20-25'	M						Yes	Regular	Moderate	Middle/Outer		Low	-	-	X	-
<i>Aesculus</i>	<i>flava*</i>	Yellow Buckeye	50-75'	30-50'	L						Yes	Seasonal	Moderate	Outer		High	-	X	-	-
<i>Aesculus</i>	<i>hippocastanum</i>	Horse Chestnut	50-75'	40-65'	L						-	Seasonal	Low	Outer		High	-	X	-	-

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<i>Aesculus</i>	<i>x carnea</i>	Red Horse Chestnut	30-40'	25-35'	M						-	Seasonal	Moderate	Middle		High	-	-	-	X
<i>Amelanchier</i>	<i>canadensis</i>	Canadian Serviceberry	20-30'	15-20'	S						Yes	Seasonal	Low	Middle/Outer		High	-	-	-	X
<i>Amelanchier</i>	<i>x grandiflora*</i>	Serviceberry	15-25'	15-25'	S						-	Seasonal	Moderate	Middle/Outer		High	-	-	-	X
<i>Betula</i>	<i>lenta*</i>	Black Birch	40-55'	35-45'	L						Yes	Seasonal	Moderate	Middle/Outer		High	-	-	-	X
<i>Betula</i>	<i>nigra*</i>	River Birch	30-50'	25-35'	L						Yes	Regular	Low	Lowest/Middle/Outer		Low	X	-	-	-
<i>Carpinus</i>	<i>betulus*</i>	European Hornbeam	40-60'	30-40'	L						-	Seasonal	High	Middle/Outer		Low	-	-	-	X
<i>Carpinus</i>	<i>betulus</i> 'Columnaris'*	Columnar European Hornbeam	30-40'	20-30'	M						-	Seasonal	High	Middle/Outer		Low	-	-	X	-
<i>Carpinus</i>	<i>betulus</i> 'Fastigiata'*	Upright European Hornbeam	30-40'	20-30'	M						-	Seasonal	High	Middle/Outer		Low	-	-	X	-
<i>Carpinus</i>	<i>caroliniana*</i>	American Hornbeam	20-35'	20-35'	S						Yes	Seasonal	Moderate	Lowest/Middle/Outer		Low	-	-	-	X
<i>Carya</i>	<i>glabra*</i>	Pignut Hickory	50-65'	30-40'	L						Yes	Seasonal	High	Middle/Outer		Low	-	X	-	-
<i>Carya</i>	<i>ovata*</i>	Shagbark Hickory	70-90'	50-70'	L						Yes	Seasonal	Moderate	Middle/Outer		Low	-	X	-	-
<i>Celtis</i>	<i>laevigata</i>	Sugarberry	60-80'	60-80'	L						Yes	Seasonal	Moderate	Middle/Outer		High	-	-	-	X
<i>Celtis</i>	<i>occidentalis*</i>	Common Hackberry	40-60'	40-60'	L						Yes	Regular	High	Middle/Outer		High	-	-	-	X
<i>Cercidiphyllum</i>	<i>japonicum</i>	Katsura Tree	40-60'	25-60'	L						-	Seasonal	Low	Middle/Outer		High	-	-	-	X

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<i>Cercis</i>	<i>canadensis*</i>	Eastern Redbud	20-30'	25-35'	S		●	●			Yes	Seasonal	High	Middle/Outer	☀️☀️☀️	Low	-	-	-	X	
<i>Chamaecyparis</i>	<i>thyoides*</i>	Atlantic White Cedar	40-80'	5-20'	L						Yes	Regular	Low	Lowest/Middle/Outer	☀️☀️☀️	High	-	-	-	X	
<i>Chionanthus</i>	<i>retusus</i>	Chinese Fringetree	10-20'	10-20'	S						-	Seasonal	Moderate	Middle/Outer	☀️☀️☀️	N/A	-	-	-	X	
<i>Chionanthus</i>	<i>virginicus</i>	Fringetree	12-25'	12-20'	S						Yes	Seasonal	Moderate	Middle/Outer	☀️☀️☀️	Low	-	-	-	X	
<i>Cladrastis</i>	<i>kentukea</i>	Yellowwood	30-50'	40-55'	M	○					Yes	Seasonal	Moderate	Middle/Outer	☀️☀️☀️	High	-	-	-	X	
<i>Cornus</i>	<i>florida*</i>	Flowering Dogwood	20-25'	15-30'	S	○	●				Yes	-	Moderate	Middle/Outer	☀️☀️☀️	Low	-	-	-	X	
<i>Cornus</i>	<i>kousa</i>	Kousa Dogwood	15-30'	15-30'	S	○					-	-	Moderate	Outer	☀️☀️☀️	High	-	-	-	X	
<i>Cornus</i>	<i>mas</i>	Cornelian-cherry Dogwood	15-25'	15-20'	S			●			-	N/A	Moderate	Middle/Outer	☀️☀️☀️	Low	-	-	-	X	
<i>Cornus</i>	<i>officinalis</i>	Japanese Cornel Dogwood	15-25'	10-25'	S			●			-	N/A	N/A	Middle/Outer	☀️☀️☀️	N/A	-	-	-	X	
<i>Cornus</i>	<i>x rutban</i>	Aurora Dogwood	15-25'	15-25'	S	○					-	N/A	Moderate	Middle/Outer	☀️☀️☀️	Low	-	-	-	X	
<i>Corylus</i>	<i>colurna</i>	Turkish Filbert	40-80'	30-50'	L						-	N/A	High	Middle/Outer	☀️☀️☀️	Low	-	-	-	X	
<i>Cotinus</i>	<i>obovatus*</i>	American Smoke Tree	20-30'	20-30'	S						Yes	N/A	High	Outer	☀️☀️☀️	Low	-	-	-	X	
<i>Crataegus</i>	<i>crus-galli var. inermis</i>	Cockspur Hawthorn	20-35'	25-35'	S	○				❄️	Yes	Seasonal	High	Middle/Outer	☀️☀️☀️	High	-	-	-	X	
<i>Crataegus</i>	<i>flava*</i>	Yellowleaf Hawthorn	20-30'	25-30'	S	○				❄️	Yes	Seasonal	High	Outer	☀️☀️☀️	Low	-	-	-	X	

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<i>Crataegus</i>	<i>laevigata</i>	English Hawthorn	15-20'	15-20'	S	○	●			❄️	-	Seasonal	High	Middle/Outer	☀️☀️☀️	Low	-	-	-	X	
<i>Crataegus</i>	<i>phaenopyrum*</i>	Washington Hawthorn	25-30'	25-30'	S	○				❄️	Yes	Seasonal	High	Middle/Outer	☀️☀️☀️	High	-	-	-	X	
<i>Crataegus</i>	<i>punctata*</i>	Dotted Hawthorn	20-30'	20-30'	S	○				❄️	Yes	Seasonal	High	Middle/Outer	☀️☀️☀️	High	-	-	-	X	
<i>Crataegus</i>	<i>viridis*</i>	Green Hawthorn	20-35'	20-35'	S	○				❄️	Yes	Seasonal	High	Middle/Outer	☀️☀️☀️	Low	-	-	-	X	
<i>Crataegus</i>	<i>x lavallei</i>	Lavalle Hawthorn	15-25'	10-18'	S	○				❄️	-	Seasonal	High	Middle/Outer	☀️☀️☀️	Low	-	-	-	X	
<i>Cryptomeria</i>	<i>japonica</i>	Japanese Cryptomeria	50-60'	20-30'	L						-	Seasonal	Moderate	Middle/Outer	☀️☀️☀️	N/A	-	X	-	-	
<i>Eucommia</i>	<i>ulmoides</i>	Hardy Rubber Tree	40-60'	30-50'	L						-	Seasonal	High	Middle/Outer	☀️☀️☀️	High	-	-	-	X	
<i>Fagus</i>	<i>sylvatica 'Fastigiata'</i>	Pyramidal Beech	50-75'	25-35'	L						-	Seasonal	Moderate	Outer	☀️☀️☀️	N/A	-	-	X	-	
<i>Ginkgo</i>	<i>biloba (male only)</i>	Maidenhair Tree	40-50'	25-30'	L						-	-	High	Outer	☀️☀️☀️	High	-	-	-	X	
<i>Ginkgo</i>	<i>biloba 'Magyar'</i>	Magyar Upright Ginkgo	40-60'	20-30'	L						-	-	N/A	Outer	☀️☀️☀️	High	-	-	X	-	
<i>Ginkgo</i>	<i>biloba 'Princeton Sentry' (male only)</i>	Princeton Sentry Ginkgo	40-50'	20-30'	L						-	-	High	Outer	☀️☀️☀️	High	-	-	X	-	
<i>Gleditsia</i>	<i>triacanthos var. inermis</i>	Honeylocust	60-80'	60-80'	L						Yes	Seasonal	High	Lowest/Middle/Outer	☀️☀️☀️	High	-	-	-	X	
<i>Gymnocladus</i>	<i>dioicus (male only)*</i>	Kentucky Coffeetree	60-80'	40-55'	L						Yes	-	High	Middle/Outer	☀️☀️☀️	High	-	X	-	-	
<i>Halesia</i>	<i>tetraptera*</i>	Carolina Silverbell	30-40'	20-35'	M	○					Yes	-	Moderate	Middle/Outer	☀️☀️☀️	Low	-	-	-	X	
<i>Juniperus</i>	<i>virginiana*</i>	Eastern Redcedar	30-40'	10-20'	M					❄️	Yes	Seasonal	High	Lowest/Middle/Outer	☀️☀️☀️	High	X	-	-	-	

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<i>Koelreuteria</i>	<i>paniculata</i>	Goldenrain Tree	20-40'	15-35'	M						-	Regular	High	Middle/Outer		High	-	-	-	X	
<i>Koelreuteria</i>	<i>paniculata</i> 'Fastigiata'	Fastigiata Goldenraintree	20-30'	4-7'	S						-	Regular	High	Middle/Outer		High	-	-	X	-	
<i>Liquidambar</i>	<i>styraciflua</i> *	American Sweetgum	60-80'	40-60'	L						Yes	Regular	Moderate	Lowest/Middle/Outer		High	-	X	-	-	
<i>Liriodendron</i>	<i>tulipifera</i> *	Tulip Tree	60-90'	30-50'	L						Yes	Seasonal	Moderate	Middle/Outer		Low	-	X	-	-	
<i>Liriodendron</i>	<i>tulipifera</i> 'Fastigiata'*	Columnar Tulip Tree	50'	12-20'	L						Yes	-	Moderate	Outer		Low	-	-	X	-	
<i>Maackia</i>	<i>amurensis</i>	Amur Maackia	20-30'	20-30'	S						-	-	N/A	Outer		N/A	-	-	-	X	
<i>Magnolia</i>	<i>virginiana</i>	Sweetbay Magnolia	30-40'	15-25'	M						Yes	Regular	Moderate	Lowest/Middle/Outer		Low	X	-	-	-	
<i>Malus</i>	<i>spp.</i>	Crabapple	10-25'	10-25'	S						-	-	Moderate	Outer		Low	-	-	-	X	
<i>Metasequoia</i>	<i>glyptostroboides</i>	Dawn Redwood	70-100'	15-25'	L						-	Regular	Moderate	Lowest/Middle/Outer		Low	X	-	-	-	
<i>Nyssa</i>	<i>sylvatica</i> *	Blackgum	30-60'	20-30'	L						Yes	Regular	Moderate	Middle/Outer		High	-	X	-	-	
<i>Ostrya</i>	<i>virginiana</i> *	Hop Hornbeam	25-40'	20-30'	M						Yes	Seasonal	High	Middle/Outer		Low	-	-	-	X	
<i>Oxydendrum</i>	<i>arboreum</i>	Sourwood	20-50'	10-25'	M						Yes	-	Moderate	Outer		High	-	-	-	X	
<i>Parrotia</i>	<i>persica</i>	Persian Parrotia	20-40'	20-30'	M						-	-	High	Outer		N/A	-	-	-	X	
<i>Platanus</i>	<i>occidentalis</i> *	American Sycamore	75-100'	75-100'	L						-	Regular	Moderate	Lowest/Middle/Outer		High	-	X	-	-	

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<i>Platanus</i>	<i>x acerifolia</i>	London Planetree	75-100'	60-75'	L						-	Regular	High	Lowest/Middle/Outer		Low	-	X	-	-	
<i>Prunus</i>	<i>maackii</i>	Amur Chokecherry	20-30'	18-25'	S						-	-	High	Middle/Outer		High	-	-	-	X	
<i>Prunus</i>	<i>sargentii</i>	Sargent's Cherry	20-30'	20-30'	S						-	-	High	Middle/Outer		High	-	-	-	X	
<i>Prunus</i>	<i>sargentii</i> 'Spire'	Columnar Sargent's Cherry	20-30'	15-20'	S						-	-	High	Middle/Outer		High	-	-	X	-	
<i>Prunus</i>	<i>serrulata</i>	Japanese Cherry	15-30'	15-20'	S						-	Seasonal	Moderate	Middle/Outer		High	-	-	-	X	
<i>Prunus</i>	<i>subhirtella</i>	Higan Cherry	20-30'	15-25'	S						-	-	Moderate	Middle/Outer		Low	-	-	-	X	
<i>Prunus</i>	<i>virginiana</i> *	Common Chokeberry	20-30'	15-20'	S						Yes	-	Moderate	Outer		High	-	-	-	X	
<i>Prunus</i>	<i>x yedoensis</i>	Yoshino Cherry	30-40'	30-40'	M						-	-	Low	Outer		Low	-	-	-	X	
<i>Quercus</i>	<i>acutissima</i>	Sawtooth Oak	35-55'	30-60'	M						-	Seasonal	Moderate	Middle/Outer		High	-	-	-	X	
<i>Quercus</i>	<i>alba</i> *	White Oak	50-80'	50-80'	L						Yes	Seasonal	Moderate	Middle/Outer		High	-	X	-	-	
<i>Quercus</i>	<i>bicolor</i> *	Swamp White Oak	50-60'	50-60'	L						Yes	Seasonal	Moderate	Lowest/Middle/Outer		Low	X	-	-	-	
<i>Quercus</i>	<i>coccinea</i> *	Scarlet Oak	60-70'	40-50'	L						Yes	-	Moderate	Middle/Outer		Low	-	X	-	-	
<i>Quercus</i>	<i>imbricaria</i> *	Shingle Oak	40-60'	40-60'	L						Yes	Regular	High	Middle/Outer		High	-	X	-	-	
<i>Quercus</i>	<i>lyrata</i>	Overcup Oak	40-60'	40-60'	L						Yes	Regular	Moderate	Lowest/Middle/Outer		N/A	-	X	-	-	

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<i>Quercus</i>	<i>macrocarpa*</i>	Bur Oak	60-80'	60-80'	L						Yes	Regular	High	Middle/Outer		High	-	X	-	-	
<i>Quercus</i>	<i>muehlenbergii*</i>	Chinkapin Oak	40-60'	50-70'	L						Yes	-	High	Outer		High	-	X	-	-	
<i>Quercus</i>	<i>palustris*</i>	Pin Oak	50-70'	40-60'	L						Yes	Regular	Moderate	Lowest/Middle/Outer		Low	-	X	-	-	
<i>Quercus</i>	<i>palustris 'Pringreen'*</i>	Green Pillar Pin Oak	50'	15'	L						Yes	Seasonal	Low	Lowest/Middle/Outer		Low	-	-	X	-	
<i>Quercus</i>	<i>phellos*</i>	Willow Oak	40-60'	25-50'	L						Yes	Regular	High	Lowest/Middle/Outer		High	-	X	-	-	
<i>Quercus</i>	<i>prinus* (also montana)</i>	Chestnut Oak	50-70'	50-70'	L						Yes	-	High	Lowest/Middle/Outer		Low	-	X	-	-	
<i>Quercus</i>	<i>robur</i>	English Oak	40-70'	40-70'	L						-	Seasonal	High	Lowest/Middle/Outer		High	-	X	-	-	
<i>Quercus</i>	<i>robur 'Fastigiata'</i>	Columnar English Oak	50-60'	10-20'	L						-	Seasonal	High	Middle/Outer		High	-	-	X	-	
<i>Quercus</i>	<i>robur x alba 'Crimsmchidt'</i>	Crimson Spire Oak	45'	15'	L						-	Seasonal	High	Middle/Outer		High	-	-	X	-	
<i>Quercus</i>	<i>rubra*</i>	Red Oak	50-75'	50-75'	L						Yes	-	Moderate	Outer		High	-	X	-	-	
<i>Quercus</i>	<i>shumardii*</i>	Shumard Oak	40-60'	30-40'	L						Yes	Seasonal	High	Middle/Outer		High	-	X	-	-	
<i>Quercus</i>	<i>x warei 'Long' Regal</i>	Regal Prince Oak	40-60'	20-25'	L						Yes	Seasonal	High	Middle/Outer		High	-	-	X	-	
<i>Sorbus</i>	<i>aucuparia 'Fastigiata'</i>	Upright Mountain Ash	20'	7'	S						-	Seasonal	Low	Middle/Outer		Low	-	-	X	-	

Plant Name			Form			Bloom Color				Adaptation								SMP Type			
Genus	Species	Common Name	Height	Width	Size	White	Red/ Pink	Purple/ Blue	Yellow/Orange	Winter Interest	Native to US	Inundation Tolerance	Drought Tolerance	Hydrologic Zone Elevation	Light Requirements	Salinity Tolerance	Rain Garden/ Bump Out	Boulevard	Narrow Street	Typical Street	
<i>Stewartia</i>	<i>koreana</i>	Korean Stewartia	20-30'	15-25'	S						-	Seasonal	Moderate	Outer		N/A	-	-	-	X	
<i>Stewartia</i>	<i>monadelpha</i>	Tall Stewartia	20-25'	15-25'	S						-	N/A	High	Middle/Outer		N/A	-	-	-	X	
<i>Styrax</i>	<i>japonicus</i>	Japanese Snowbell	20-30'	20-30'	S						-	N/A	Moderate	Middle/Outer		High	-	-	-	X	
<i>Syringa</i>	<i>reticulata</i>	Japanese Tree Lilac	20-25'	15-20'	S						-	Seasonal	High	Middle/Outer		N/A	-	-	-	X	
<i>Taxodium</i>	<i>distichum*</i>	Bald Cypress	45-70'	20-45'	L						Yes	Regular	High	Lowest/Middle/Outer		High	-	X	-	-	
<i>Tilia</i>	<i>americana*</i>	Basswood	50-80'	30-50'	L						Yes	-	Moderate	Middle/Outer		Low	-	X	-	-	
<i>Tilia</i>	<i>cordata</i>	Littleleaf Linden	50-70'	35-50'	L						-	Seasonal	Moderate	Middle/Outer		Low	-	-	-	X	
<i>Tilia</i>	<i>tomentosa</i>	Silver Linden	50-70'	30-50'	L						-	Seasonal	Moderate	Middle/Outer		N/A	-	X	-	-	
<i>Zelkova</i>	<i>serrata</i>	Japanese Zelkova	40-60'	40-50'	L						-	Seasonal	Moderate	Middle/Outer		High	-	-	-	X	

6.2 Introduction to Plant Selection for SMPs

The following tables contain the same species that are listed in 6.1 and serve as another tool for plant selection.

Plant Selection for SMPs (Full Shade)																	
Hydrologic Zone	Suitability for SMP Type	Early Bloom				Late Bloom				Grass				Shrub			
		Bumpout	Planter	Rain Garden	Tree Trench	Bumpout	Planter	Rain Garden	Tree Trench	Bumpout	Planter	Rain Garden	Tree Trench	Bumpout	Planter	Rain Garden	Tree Trench
Lowest	Ajuga reptans	X	X	X	X	Chelone lyonii*	X	X	X	Carex morrowii	X	X	X	Itea virginica*	X	X	X
	Vinca minor	X	X		X					Dennstaedtia punctilobus			X				
Middle	Ajuga reptans			X	X					Carex laxiculmis				Ilex crenata			X
	Aquilegia canadensis*			X						Carex morrowii			X				X
	Vinca minor			X	X					Carex pensylvanica*			X				
Outer	Ajuga reptans			X		Eurybia divaricata*			X	Carex laxiculmis			X	Ilex crenata			X
	Aquilegia canadensis*			X						Carex pensylvanica*			X				X
	Vinca minor			X						Carex morrowii			X				

Plant Selection for SMPs (Full Sun)																	
Hydrologic Zone	Suitability for SMP Type	Early Bloom				Late Bloom				Grass				Shrub			
		Bumpout	Planter	Rain Garden	Tree Trench	Bumpout	Planter	Rain Garden	Tree Trench	Bumpout	Planter	Rain Garden	Tree Trench	Bumpout	Planter	Rain Garden	Tree Trench
Lowest	Iris versicolor* Oenothera spp.* Physostegia virginiana*	X X	X X	X X		Monarda didyma* Pycnanthemum virginiana* Rudbeckia spp.* Solidago spp.* Symphytrichum spp.*	X X X X	X X X X		Acorus calamus* Calamagrostis acutiflora Festuca longifolia Juncus effusus* Liriope muscari Osmunda regalis* Panicum virgatum* Pennisetum spp.	X X X X X X X	X X X X X X X		Aronia spp.* Clethra alnifolia* Cornus spp.* Hibiscus moscheutos Hypericum spp.* Ilex spp.* Itea virginica* Myrica pensylvanica* Physocarpus opulifolius* Spirea spp.* Viburnum spp.*	X X X X X X X X X X	X X X X X X X	
Middle	Geranium spp.* Physostegia virginiana* Sedum x 'Autumn Joy'		X X	X X		Echinacea purpurea* Monarda didyma* Rudbeckia spp.* Solidago spp.*	X X X	X X X		Andropogon spp.* Calamagrostis acutiflora Festuca longifolia Hypericum spp.* Muhlenbergia cappilaris* Panicum virgatum* Pennisetum spp.	X X X X X X	X X X X		Clethra alnifolia* Comptonia peregrina* Hamamelis virginiana* Hypericum spp.* Ilex spp.* Physocarpus opulifolius* Potentilla fruticosa* Rhus aromatica* Spirea spp.* Viburnum spp.*	X X X X X X X	X X X X	
Outer	Crocus vernus Galanthus nivalis Geranium spp.* Narcissus minor Sedum x 'Autumn Joy'		X X X	X X X		Agastache rupestris* Coreopsis spp.* Gaillardia spp.* Perovskia atriplicifolia Rudbeckia spp.* Echinacea purpurea*	X X X X	X X X		Andropogon spp.* Festuca longifolia Liriope muscari Muhlenbergia cappilaris* Pennisetum spp. Schizachyrium scoparium* Sorghastrum nutens* Sporobolus heterolepis*	X X X X X X	X X X X		Comptonia peregrina* Hamamelis virginiana* Ilex spp.* Juniperus chinensis Potentilla fruticosa* Rhus aromatica* Rosa carolina* Rubus allegheniensis* Spirea spp.* Viburnum spp.*	X X X X X X X	X X X X	

Plant Selection for SMPs (Part Shade)																	
Hydrologic Zone	Suitability for SMP Type	Early Bloom				Late Bloom				Grass				Shrub			
		Bumpout	Planter	Rain Garden	Tree Trench	Bumpout	Planter	Rain Garden	Tree Trench	Bumpout	Planter	Rain Garden	Tree Trench	Bumpout	Planter	Rain Garden	Tree Trench
Lowest	Ajuga reptans Anemone canadensis* Vinca minor	X X	X X	X X	X X	Chelone lyonii* Monarda didyma* Pycnanthemum virginiana* Symphytrichum spp.* Rudbeckia spp.*	X X X X	X X X X		Acorus calamus* Calamagrostis acutiflora Festuca longifolia Juncus effusus* Liriope muscari Osmunda regalis* Panicum virgatum* Pennisetum spp.	X X X X X X	X X X X		Aronia spp.* Clethra alnifolia* Hibiscus moscheutos Hydrangea quercifolia* Hypericum spp.* Itea virginica* Physocarpus opulifolius* Spirea spp.* Viburnum spp.*	X X X X X X X	X X X X	
Middle	Ajuga reptans Anemone canadensis* Aquilegia canadensis* Geranium spp.* Vinca minor	X X	X X	X X	X X	Echinacea purpurea* Monarda didyma* Rudbeckia spp.*	X X X	X X X		Andropogon spp.* Calamagrostis acutiflora Carex laxiculmis Carex morrowii Carex pensylvanica* Festuca longifolia Panicum virgatum* Pennisetum spp.	X X X X X X	X X X X		Clethra alnifolia* Comptonia peregrina* Hydrangea quercifolia* Hypericum spp.* Ilex spp.* Physocarpus opulifolius* Spirea spp.* Viburnum spp.*	X X X X X X	X X X X	
Outer	Ajuga reptans Aquilegia canadensis* Crocus vernus Galanthus nivalis Geranium spp.* Narcissus minor Vinca minor		X X X	X X	X X	Echinacea purpurea* Rudbeckia spp.*	X X	X X		Andropogon spp.* Festuca longifolia Pennisetum spp. Carex morrowii	X X X	X X		Comptonia peregrina* Ilex spp.* Potentilla fruticosa* Rubus allegheniensis* Spirea spp.* Viburnum spp.*	X X X X	X X X	X X

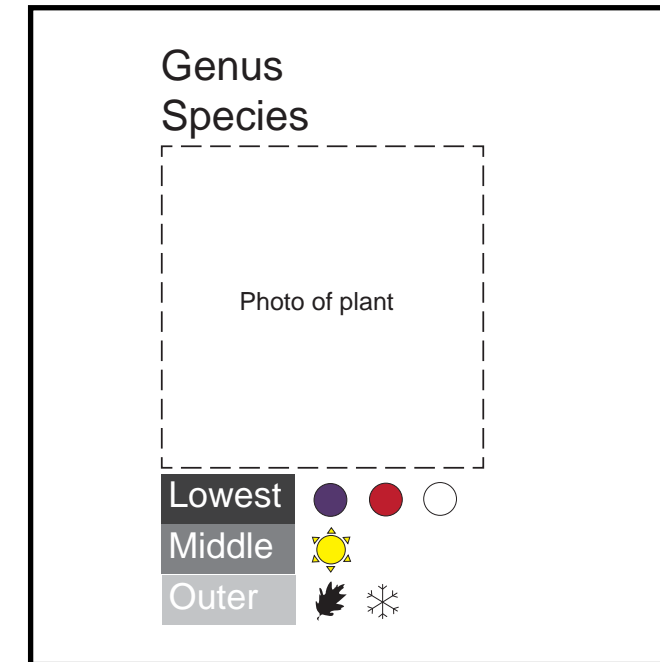
Philadelphia Water Department
Complete Plant Palette

chapter **6**



Plant Tag Key

Below is an example of a Plant Tag that will appear on the following pages in the Plant Palettes section. It is meant to serve as a quick reference for the appearance and important characteristics of a plant. For more detailed information about a specific plant, refer to the Philadelphia Water Department Plant List at the end of the document along with the Philadelphia Water Department Plant Inspection Guidebook. The Plant Tags for trees will also specify the species in addition to the genus.



LEGEND

RECOMMENDED PLANT LOCATION



Lowest
Middle
Outer

Location within the elevation of the system

BLOOM COLOR



Yellow / Orange
White
Blue / Purple
Pink / Red

SEASON INTEREST



















Fall Interest
Winter Interest

LIGHT REQUIREMENTS

















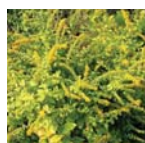

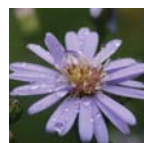
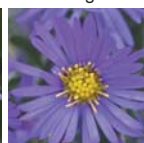
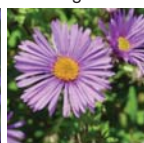


Full Sun
Part Shade
Full Shade


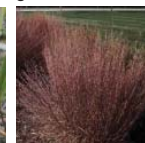

















Early Season Blooms

<i>Ajuga reptans</i>  Lowest Middle Outer	<i>Anemone canadensis</i>  Lowest Middle	<i>Aquilegia canadensis</i>  Middle Outer	<i>Crocus vernus</i>  Outer	<i>Eranthis hyemalis</i>  Outer	<i>Galanthus nivalis</i>  Outer	<i>Geranium macrorrhizum</i>  Middle Outer	<i>Geranium maculatum</i>  Middle Outer	<i>Iris versicolor</i>  Lowest	<i>Narcissus minor</i>  Outer	<i>Oenothera fruticosa</i>  Lowest Middle
<i>Oenothera perennis</i>  Lowest Middle	<i>Penstemon digitalis</i>  Lowest Middle	<i>Physostegia virginiana</i>  Lowest Middle	<i>Sedum x</i>  Middle Outer	<i>Vinca minor</i>  Lowest Middle Outer						

Late Season Blooms

<i>Agastache rupestris</i>  Outer	<i>Chelone lyonii</i>  Lowest	<i>Coreopsis grandiflora</i>  Outer	<i>Coreopsis lanceolata</i>  Outer	<i>Coreopsis verticillata</i>  Outer	<i>Echinacea purpurea</i>  Middle Outer	<i>Eurybia divaricata</i>  Middle Outer	<i>Gaillardia aristata</i>  Outer	<i>Gaillardia x grandiflora</i>  Outer	<i>Monarda didyma</i>  Lowest Middle	<i>Perovskia atriplicifolia</i>  Outer
<i>Pycnanthemum virginianum</i>  Lowest Middle	<i>Rudbeckia fulgida</i>  Lowest Middle Outer	<i>Rudbeckia hirta</i>  Lowest Middle Outer	<i>Rudbeckia subtomentosa</i>  Lowest Middle Outer	<i>Solidago r. 'Fireworks'</i>  Lowest Middle	<i>Solidago s. 'Golden Fleece'</i>  Lowest Middle	<i>Solidago 'Little Lemon'</i>  Lowest Middle	<i>Symphotrichum cordifolius</i>  Lowest	<i>Symphotrichum novae-angliae</i>  Lowest	<i>Symphotrichum novi-belgii</i>  Lowest	

Grasses & Grass-like

<i>Acorus calamus</i>  Lowest	<i>Andropogon gerardii</i>  Middle Outer	<i>Andropogon virginicus</i>  Middle Outer	<i>Calamagrostis acutiflora</i>  Lowest Middle	<i>Carex laxiculmis 'Hobb'</i>  Lowest Middle	<i>Carex morrowii</i>  Lowest Middle	<i>Carex pensylvanica</i>  Lowest Middle	<i>Dennstaedtia punctilobula</i>  Lowest	<i>Festuca longifolia</i>  Lowest Middle Outer	<i>Juncus effusus</i>  Lowest	<i>Liriope muscari</i>  Lowest Middle
<i>Muhlenbergia capillaris</i>  Middle Outer	<i>Osmunda regalis</i>  Lowest	<i>Panicum virgatum</i>  Lowest Middle	<i>Pennisetum alopecuroides</i>  Lowest Middle Outer	<i>Pennisetum orientale</i>  Lowest Middle Outer	<i>Schizachyrium scoparium</i>  Outer	<i>Sorghastrum nutens</i>  Middle Outer	<i>Sporobolus heterolepis</i>  Middle Outer			


























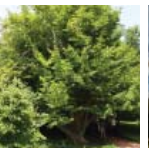



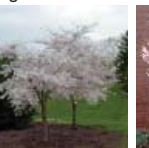
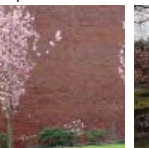






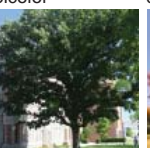
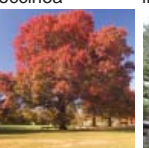
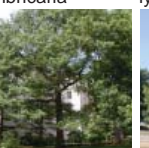

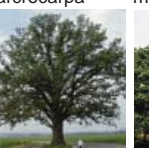


Shrubs

<i>Aronia arbutifolia</i> Lowest Middle ☉ ☀ ☀ ☀ ☀ ☀	<i>Aronia melanocarpa</i> Lowest Middle ☉ ☀ ☀ ☀ ☀ ☀	<i>Buxus sempervirens</i> Middle Outer ☀ ☀ ☀ ☀	<i>Clethra alnifolia</i> Lowest Middle ☉ ☀ ☀ ☀ ☀	<i>Comptonia peregrina</i> Middle Outer ☀ ☀ ☀ ☀	<i>Cornus alba</i> Lowest ☉ ☀ ☀ ☀ ☀	<i>Cornus sericea</i> Lowest ☉ ☀ ☀ ☀ ☀	<i>Hamamelis virginiana</i> Middle Outer ☀ ☀ ☀ ☀	<i>Hibiscus moscheutos</i> Lowest ☉ ☀ ☀ ☀ ☀ ☀	<i>Hypericum kalmianum</i> Lowest Middle ☀ ☀ ☀ ☀ ☀ ☀	<i>Ilex crenata</i> Lowest Middle ☀ ☀ ☀ ☀ ☀ ☀
<i>Juniperus conferta</i> Middle Outer ☀ ☀ ☀ ☀	<i>Ilex glabra</i> Lowest Middle ☀ ☀ ☀ ☀ ☀ ☀	<i>Ilex verticillata</i> Lowest Middle ☀ ☀ ☀ ☀ ☀ ☀	<i>Itea virginica</i> Lowest ☉ ☀ ☀ ☀ ☀ ☀	<i>Myrica pensylvanica</i> Lowest ☀ ☀ ☀ ☀ ☀ ☀	<i>Physocarpus opulifolius</i> Lowest Middle ☉ ☀ ☀ ☀ ☀ ☀	<i>Rhus aromatica</i> Middle Outer ☀ ☀ ☀ ☀ ☀ ☀	<i>Rosa carolina</i> Outer ☀ ☀ ☀ ☀	<i>Rubus allegheniensis</i> Outer ☉ ☀ ☀ ☀ ☀ ☀	<i>Spiraea betulifolia</i> Lowest Middle Outer ☉ ☀ ☀ ☀ ☀ ☀	<i>Viburnum dentatum</i> Lowest Middle Outer ☉ ☀ ☀ ☀ ☀ ☀
<i>Viburnum lantana</i> Lowest Middle Outer ☉ ☀ ☀ ☀ ☀ ☀	<i>Viburnum lentago</i> Lowest Middle Outer ☉ ☀ ☀ ☀ ☀ ☀	<i>Viburnum nudum</i> Lowest Middle Outer ☉ ☀ ☀ ☀ ☀ ☀	<i>Viburnum prunifolium</i> Lowest Middle Outer ☉ ☀ ☀ ☀ ☀ ☀	<i>Viburnum trilobum</i> Lowest Middle Outer ☉ ☀ ☀ ☀ ☀ ☀						














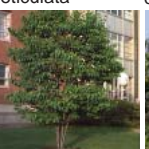



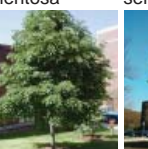
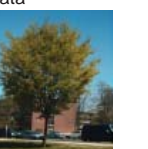
Trees

<i>Acer buergerianum</i> Middle Outer ☀ ☀ ☀ ☀	<i>Acer campestre</i> Middle Outer ☀ ☀ ☀ ☀	<i>Acer griseum</i> Outer ☀ ☀ ☀ ☀	<i>Acer rubrum</i> Lowest Middle Outer ☀ ☀ ☀ ☀	<i>Acer r. 'Armstrong'</i> Lowest Middle Outer ☀ ☀ ☀ ☀	<i>Acer saccharum</i> Outer ☀ ☀ ☀ ☀	<i>Acer s. 'Goldspire'</i> Outer ☀ ☀ ☀ ☀	<i>Acer tataricum</i> Outer ☀ ☀ ☀ ☀	<i>Acer truncatum</i> Middle Outer ☀ ☀ ☀ ☀	<i>Acer x freemani</i> Middle Outer ☀ ☀ ☀ ☀	<i>Acer x f. 'Celebration'</i> Middle Outer ☀ ☀ ☀ ☀
<i>Acer x f. 'Scarlet Sentinel'</i> Middle Outer ☀ ☀ ☀ ☀	<i>Aesculus flava</i> Outer ☀ ☀ ☀ ☀	<i>Aesculus hippocastanum</i> Outer ☀ ☀ ☀ ☀	<i>Aesculus x carnea</i> Middle ☀ ☀ ☀ ☀	<i>Amelanchier canadensis</i> Middle Outer ☀ ☀ ☀ ☀	<i>Amelanchier x grandiflora</i> Middle Outer ☀ ☀ ☀ ☀	<i>Betula lenta</i> Middle Outer ☀ ☀ ☀ ☀	<i>Betula nigra</i> Lowest Middle Outer ☀ ☀ ☀ ☀	<i>Carpinus betulus</i> Middle Outer ☀ ☀ ☀ ☀	<i>Carpinus b. 'Columnaris'</i> Middle Outer ☀ ☀ ☀ ☀	<i>Carpinus b. 'Fastigiata'</i> Middle Outer ☀ ☀ ☀ ☀
<i>Carpinus caroliniana</i> Lowest Middle Outer ☀ ☀ ☀ ☀	<i>Carya glabra</i> Middle Outer ☀ ☀ ☀ ☀	<i>Carya ovata</i> Middle Outer ☀ ☀ ☀ ☀	<i>Celtis laevigata</i> Middle Outer ☀ ☀ ☀ ☀	<i>Celtis occidentalis</i> Middle Outer ☀ ☀ ☀ ☀	<i>Cercidiphyllum japonicum</i> Middle Outer ☀ ☀ ☀ ☀	<i>Cercis canadensis</i> Middle Outer ☀ ☀ ☀ ☀	<i>Chamaecyparis thyoides</i> Lowest Middle Outer ☀ ☀ ☀ ☀	<i>Chionanthus retusus</i> Middle Outer ☀ ☀ ☀ ☀	<i>Chionanthus virginicus</i> Middle Outer ☀ ☀ ☀ ☀	<i>Cladrastis kentukea</i> Middle Outer ☀ ☀ ☀ ☀
<i>Cornus florida</i> Middle Outer ☀ ☀ ☀ ☀	<i>Cornus kousa</i> Outer ☀ ☀ ☀ ☀	<i>Cornus mas</i> Middle Outer ☀ ☀ ☀ ☀	<i>Cornus officinalis</i> Middle Outer ☀ ☀ ☀ ☀	<i>Cornus x rutban</i> Middle Outer ☀ ☀ ☀ ☀	<i>Corylus columna</i> Middle Outer ☀ ☀ ☀ ☀	<i>Cotinus obovatus</i> Outer ☀ ☀ ☀ ☀	<i>Crataegus crus-galli</i> Middle Outer ☀ ☀ ☀ ☀	<i>Crataegus flava</i> Outer ☀ ☀ ☀ ☀	<i>Crataegus laevigata</i> Middle Outer ☀ ☀ ☀ ☀	<i>Crataegus phaenopyrum</i> Middle Outer ☀ ☀ ☀ ☀

Trees

<i>Crataegus punctata</i>  Middle Outer ☀️ ❄️	<i>Crataegus viridis</i>  Middle Outer ☀️ ❄️	<i>Crataegus x lavallei</i>  Middle Outer ☀️ ❄️	<i>Crytomeria japonica</i>  Middle Outer ☀️ ❄️	<i>Eucommia ulmoides</i>  Middle Outer ☀️ ❄️	<i>Fagus s. 'Fastigiata'</i>  Outer ☀️ ❄️	<i>Ginkgo biloba</i>  Outer ☀️	<i>Ginkgo b. 'Magyar'</i>  Outer ☀️	<i>Ginkgo 'Princeton Sentry'</i>  Outer ☀️ ❄️	<i>Gleditsia triacanthos</i>  Lowest Middle Outer ☀️	<i>Gymnocladus dioicus</i>  Middle Outer ☀️
<i>Halesia tetraptera</i>  Middle Outer ☀️ ❄️	<i>Juniperus virginiana</i>  Lowest Middle Outer ☀️ ❄️	<i>Koelreuteria paniculata</i>  Middle Outer ☀️	<i>Koelreuteria p. 'Fastigiata'</i>  Middle Outer ☀️	<i>Liquidambar styraciflua</i>  Lowest Middle Outer ☀️	<i>Liriodendron tulipifera</i>  Middle Outer ☀️	<i>Liriodendron t. 'Fastigiata'</i>  Outer ☀️	<i>Maackia amurensis</i>  Outer ☀️ ❄️	<i>Magnolia virginiana</i>  Lowest Middle Outer ☀️ ❄️	<i>Malus spp.</i>  Outer ☀️ ❄️	<i>Metasequoia glyptostroboides</i>  Lowest Middle Outer ☀️
<i>Nyssa sylvatica</i>  Middle Outer ☀️	<i>Ostrya virginiana</i>  Middle Outer ☀️ ❄️	<i>Oxydendrum arboreum</i>  Outer ☀️ ❄️	<i>Perrotia persica</i>  Outer ☀️	<i>Platanus occidentalis</i>  Lowest Middle Outer ☀️	<i>Platanus x acerifolia</i>  Lowest Middle Outer ☀️	<i>Prunus maackii</i>  Middle Outer ☀️ ❄️	<i>Prunus sargentii</i>  Middle Outer ☀️ ❄️	<i>Prunus s. 'Spire'</i>  Middle Outer ☀️ ❄️	<i>Prunus serrulata</i>  Middle Outer ☀️ ❄️	<i>Prunus subhirtilla</i>  Middle Outer ☀️ ❄️
<i>Prunus virginiana</i>  Outer ☀️ ❄️	<i>Prunus x yedoensis</i>  Outer ☀️ ❄️	<i>Quercus acutissima</i>  Middle Outer ☀️	<i>Quercus alba</i>  Middle Outer ☀️	<i>Quercus bicolor</i>  Lowest Middle Outer ☀️	<i>Quercus coccinea</i>  Middle Outer ☀️	<i>Quercus imbricaria</i>  Middle Outer ☀️	<i>Quercus lyrata</i>  Lowest Middle Outer ☀️	<i>Quercus macrocarpa</i>  Middle Outer ☀️	<i>Quercus muehlenbergii</i>  Outer ☀️	<i>Quercus palustris</i>  Lowest Middle Outer ☀️

Trees

<i>Quercus p. 'Pringreen'</i>  Lowest Middle Outer ☀️	<i>Quercus phellos</i>  Lowest Middle Outer ☀️	<i>Quercus prinus</i>  Lowest Middle Outer ☀️	<i>Quercus robur</i>  Lowest Middle Outer ☀️	<i>Quercus r. 'Fastigiata'</i>  Middle Outer ☀️	<i>Quercus r. 'Crimschmidt'</i>  Middle Outer ☀️	<i>Quercus rubra</i>  Outer ☀️	<i>Quercus shumardii</i>  Middle Outer ☀️	<i>Quercus x w. 'Long' Regal</i>  Middle Outer ☀️	<i>Sorbus a. 'Fastigiata'</i>  Middle Outer ☀️	<i>Stewartia koreana</i>  Outer ☀️ ❄️
<i>Stewartia monadelpha</i>  Middle Outer ☀️ ❄️	<i>Styrax japonicus</i>  Middle Outer ☀️ ❄️	<i>Syringa reticulata</i>  Middle Outer ☀️ ❄️	<i>Taxodium distichum</i>  Lowest Middle Outer ☀️	<i>Tilia americana</i>  Middle Outer ☀️ ❄️	<i>Tilia cordata</i>  Middle Outer ☀️	<i>Tilia tomentosa</i>  Middle Outer ☀️ ❄️	<i>Zelkova serrata</i>  Middle Outer ☀️			

References

chapter 7



Philadelphia Water Department:**Green Infrastructure Design Guidelines and Requirements Packet**

(http://phillywatersheds.org/doc/GSI/GSI_Design_Requirements_&_Guidelines_Packet_10-22-2013.pdf)

This document provides requirements and guidelines to be used in the design of Green Stormwater Infrastructure (GSI) projects funded and/or maintained by the Philadelphia Water Department.

PWD Plant Identification Manual

(http://www.phillywatersheds.org/doc/Plant_Identification_Manual_October2014.pdf)

This is a field guide to plant species that are on PWD's Recommended Plant List or currently planted in one of PWD's SMPs. The guide includes multiple photographs of each plant through different life stages and seasons along with key identifying characteristics.

GSI Maintenance Manual

(http://phillywatersheds.org/doc/GSIManual_1stEd_LRes.pdf)

This Manual documents typical maintenance tasks and standard operating procedures for GSI projects.

Green Street Design Manual

(http://www.phillywatersheds.org/img/GSDM/GSDM_FINAL_20140211.pdf)

This Manual includes figures and details of SMPs that are located in the right-of-way such as bump-outs, planters, and tree trenches.

Green Stormwater Infrastructure Design Resources

(http://www.phillywatersheds.org/gsi_design_resources)

Additional resources are available for download on the PWD Office of Watersheds website.

Other:**Halophyte Database**

(www.ussl.ars.usda.gov/pls/caliche/Halophyte.query)

This searchable database provides information about salt tolerant plants. It is a cooperative effort between the USDA-ARDS U.S. Salinity Laboratory and NyPa International.

Integrated Taxonomic Information System

(www.itis.gov/index.html)

This website houses authoritative taxonomic information for plants, animals, fungi, and microbes.

Guidebook of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation, and Uses by Michael Dirr

A thorough reference on trees and shrubs.

National Wetland Plant List

(<http://rsgisias.crrel.usece.army.mil/NWPL>)

The U.S. Army Corps of Engineers maintains the National Wetland Plant List, which includes wetland indicator statuses and related documents.

The Plants of Pennsylvania by Ann Fowler Roads and Timothy A. Block

An illustrated guide to the flora of Pennsylvania.

USDA Plants

(<http://plants.usda.gov/>)

This website has plant fact sheets, information about invasive and noxious weeds, and details about wetland indicator statuses.

