SUSTAINABLE LANDSCAPE GUIDELINES

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The GW Office of Sustainability and GW Planning, Development & Construction have collaborated with the Sustainable Landscapes Design Group, made up of faculty and students of the Sustainable Landscapes program at the College of Professional Studies partnered with Jordan Honeyman Landscape Architects, to shape the Foggy Bottom Sustainable Landscapes Guidelines. The Guidelines are intended to inspire and inform Division of Operations landscape management decisions going forward, but they are not commitments or prescriptions.

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EXECUTIVE SUMMARY

PURPOSE

These Guidelines are intended to give students and university personnel a framework for understanding the natural spaces at GW. They outline methods to review, discuss, and decide how best to maintain or improve each campus landscape space from an ecological, functional, and aesthetic perspective.

The Guidelines provide the basis for the GW Grounds Management Team to make daily and seasonal decisions to transition the campus towards a more sustainable landscape. Long term planning decisions for campus landscapes will be informed by the Sustainable Landscapes Guidelines, while adhering to the 2007 GW Foggy Bottom Campus Streetscape Guidelines.

Additionally, creating this set of guidelines will help implement the GW Ecosystems Enhancement Strategy (EES). The guidelines will impact the following focus areas outlined in the Ecosystems Enhancement Strategy:

- Strengthening habitat & optimizing natural space (EES Goal 1)
- Promoting healthy air & climate (EES Goal 2)
- Fostering clean & abundant water (EES Goal 3)
- Encouraging a natural urban environment that helps enhance physical, mental and social wellbeing (EES Goal 6)

CURRENT SITUATION

The George Washington University is a world-class institution of higher education and the campus is home to students, faculty and staff, and the Foggy Bottom community. This varied use yields building densities that differ in scale and character. In parallel with this varied density are streetscapes and greenspaces that are essentially residential in scale and character. The majority of GW's landscape exists within an established streetscape of front yards, sidewalks, and curbs edges.

ENVIRONMENTAL AND COST BENEFITS OF SUSTAINABLE GROUNDS AT GW

This resource document offers a sustainable approach to landscape design and plant selection. Landscapes are sustainable when their water, nutrient, and energy processes are balanced and require very little outside inputs. This results from appropriate design and maintenance that stabilizes the ecosystem processes over time. Once these landscapes are in place and functioning properly, the benefits quickly outweigh the costs.

In lieu of plants that require watering, fertilization, or pest treatments this resource offers alternatives in plant selections to varieties that are hardy, drought and disease-resistant. It also proposes to reduce the overall use of annuals and instead substitute perennial varieties that once established will provide color and texture in the landscape. Annuals will be utilized in key areas on campus so that a varied plant language is sustained through the seasons. With such natural resource efficiency comes cost reductions. Instead of planting large masses of seasonal annuals several times a year, perennial plant material is planted infrequently. Perennial flowers and grasses self-sow their seeds or will spread via rhizomes or root mass ensuring longevity and abundant landscapes. But the majority of planting will consist of a variety of grasses, flowers, and shrubs in order to provide color and visual interest throughout the year.

This approach does not incur immediate cost impacts but spreads out costs per normal maintenance schedules. As perennials and grasses do not require annual planting it is envisioned that overall costs will be reduced over time. These plant guidelines are envisioned as part of GW's general landscape maintenance activities. Over time plants may be replaced as beds are upgraded to sustainable varieties during usual maintenance activities.

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HIGH - IMPACT CONTEMPORARY

Function: Tough, resilient plantings that maintain their form in winter and withstand constant foot traffic and ice-melt. Aesthetic: Layered landscape with all-season interest. Large, bold plant masses match building scale. Annual displays at major intersections and special focal points.

HIGH - IMPACT TRADITIONAL

Function: Tough, resilient plantings that maintain their form in winter and withstand constant foot traffic and icemelt.

Aesthetic: Layered landscape with all-season interest. Little to no symmetry in front of buildings with traditional style gardens. Annual and perennial displays in traditional clusters.

LOW - IMPACT CONTEMPORARY

Function: Layered landscape with simple, structured plantings at a residential scale. Resilient plants withstand urban conditions and prevent erosion. Aesthetic: Inspired by native plant communities these small garden spaces provide opportunities to plant flowering pollinators. Incorporate benches and seat walls for students to gather.

LOW -IMPACT TRADITIONA

Function: Layered landscape with simple, structured plantings at residential scale. Resilient plant materials withstand urban conditions and prevent erosion. Aesthetic: Inspired by native plant communities, these small garden spaces provide opportunities to plant flowering pollinators. Incorporate seating behind low screening hedges at residential townhouses.



Plants attract pollinators and strong color blocks

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Annual display at University Yard



Bulbs provide early season interest and are reused from year to year



Front yards at residential campus

IMPLEMENTATION FRAMEWORK FOR THE GUIDELINES

The Guidelines provide a framework and make recommendations for daily and seasonal maintenance, capital development projects, and other opportunities.

1. Daily and Seasonal Maintenance: Daily and Seasonal Maintenance is at the heart of the Guidelines. The Guidelines provide a framework and recommendations for maintenance tasks by square, which will help move the campus forward towards a stable, resilient and sustainable future. The Guidelines are intended to inspire and inform landscape management decisions going forward, but they are not commitments or prescriptions. For everyday use, this document provides guidance for standard maintenance activities and simple upgrades to the existing campus landscape, to be implemented within annual operating budgets.

2. Capital Development Projects: The Guidelines provide a framework and recommendations for style of plantings, as well as plants for new sites. This can to be used as a resource by project designers and site work of all Capital Development Projects on campus identified in the GW 2007 Foggy Bottom Campus Plan. Additionally, the Guidelines provide tree canopy targets developed in partnership with Casey Trees, and aligned with the 2007 GW Foggy Bottom Campus Streetscape Guidelines. 3. Opportunities: The Sustainable Landscapes Guidelines identify existing campus spaces that lend themselves to retrofit projects that are not classified as future sites for building development. They fall into one of two categories, opportunities either for the Grounds Management Team or through grants and partnerships. The former can be implemented within annual maintenance and operating budgets. The latter includes planting interventions that would require grant funding and/ or can be implemented through partnerships with local organizations or with student groups and interns.

RECOMMENDATIONS

The overall aesthetic goal of these Guidelines is to further develop sustainable campus landscapes. The Guidelines were developed as a basis for making appropriate aesthetic decisions in plantings and design. All campus spaces are categorized as high or low impact from users on campus and designated as traditional or contemporary style. The Guidelines identify the areas, provide the plant lists, and lay out the steps for managers so they can implement the following recommendations:

• Create a hierarchical system of places with corresponding landscape recommendations that enhance the context, use and visibility of each space

- Provide a vocabulary of recommended University plant lists to establish a unified campus landscape aesthetic.
- Maintain existing trees to facilitate healthy growth and ease of maintenance.
- Establish a tree canopy coverage plan that promotes the physical enjoyment of the GW community and the ecological functions.
- Improve green places on campus to enhance the outdoor experience for all users, increasing quality of life health and well-being.
- Identify places where stormwater mitigation opportunities can be pursued.

THE ROLE OF STUDENTS

As a living document, the Guidelines provide opportunities for students to contribute new ideas and insights based on their current research as well as offer input and feedback from the larger community of stakeholders. Students played a direct and central role in developing these Sustainable Landscapes Guidelines and their continued involvement will be critical for the university to meet its sustainability vision and mission.

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WE BELIEVE THAT GW'S URBAN LANDSCAPE CAN ENHANCE THE ENVIRONMENT, THE FOGGY BOTTOM CAMPUS AND THE GREATER COMMUNITY.

INTRODUCTION

1.0

Chapter 1.0 provides the background for this document and how it relates to the GW Streetscape Guidelines and GW's Ecosystem Enhancement Strategy. Here the case is made for developing a regenerative landscape that draws from the self-healing and self-organizing capacity of natural plant communities.

These Guidelines feature an integrative and inclusive approach to landscape renewal that is consistent with GW's vision for sustainability.

SUSTAINABLE LANDSCAPE GUIDELINES

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SUSTAINABILITY AT GW

The George Washington University has declared a vision and mission for sustainability:

"The university envisions a future with healthy and thriving resource systems for all. In an effort to enhance its campus, the nation's capital, and the world at large, GW is building a greener campus, providing research and intellectual discourse on policies and technologies for sustainable systems and equipping students with the skills and knowledge to contribute to a sustainable future."



Kogan Plaza

GW ECOSYSTEMS ENHANCEMENT STRATEGY AND GW LANDSCAPES

The GW Ecosystem Enhancement Strategy is an overarching plan for incorporating sustainability into GW's operations and business practices. Ecosystems are communities where natural processes produce the water, nutrients, and energy on which we thrive. As a university in an urban setting, GW's varied landscapes are part of an ecosystem community with many challenges. It is critical, then, to address the water, nutrient, and energy processes that take place on GW's grounds, and thus contribute to the university's vision to build a greener campus.



Square 80, a former parking lot, is now a model sustainable green space.

VISION AND PURPOSE FOR SUSTAINABLE LANDSCAPES DESIGN GUIDELINES

GW Foggy Bottom will become a regenerative campus with a landscape that enriches the life of the GW community, strengthens its academic mission and benefits the environment and the community at large. Consistent with the university's sustainability vision of a future campus that has healthy and thriving resource systems for all, GW will commit to building a greener campus.

These Guidelines are intended to give students and university personnel a framework for understanding the natural spaces at GW. They outline methods to research, discuss, and decide how best to maintain or improve each campus landscape space from an ecological, functional, and aesthetic perspective.

The Guidelines provide the basis for the GW Grounds Management Team to make daily and seasonal decisions to transition the campus towards a more sustainable landscape. Long term planning decisions for campus development will be informed by the Guidelines in combination with GW Streetscape Guidelines.

GUIDELINES AND THE ECOSYSTEMS ENHANCEMENT STRATEGY (EES)

Additionally, creating this set of guidelines will help implement the GW Ecosystems Enhancement Strategy (EES). The Sustainable Landscape Guidelines will impact the following focus areas outlined in the Ecosystems Enhancement Strategy:

- Strengthening habitat and optimizing natural space (EES Goal 1)
- Promoting healthy air and climate (EES Goal 2)
- Fostering clean and abundant water (EES Goal 3)
- Encouraging a natural urban environment that helps enhance physical, mental and social well-being. (EES Goal 6)

WHAT IS A REGENERATIVE LANDSCAPE?

Regenerative design draws its inspiration from the self-healing and self-organizing capacities of natural systems. The landscape moves beyond sustainability to reverse ecosystem degradation and ultimately create environments that generate greater health and resilience. Regenerative landscapes have an embedded capacity to continuously improve and react to catastrophic events with healing resiliency. They mimic native plant communities where species cohabitate in ecological harmony, resulting in healthy ecosystems.

The Guidelines support regenerative campus site planning, applying this integrative and participatory design approach to increase energy efficiency and biodiversity. Through this comprehensive effort, regenerative planning will achieve the social, economic, educational and aesthetic landscape goals within GW's ecosystem community.

However, ongoing ecological management is needed to ensure that regenerative landscape capacity is sustained through time. A periodic review of Guidelines strategies and implementation is imperative to assess their efficacy and impact on the campus. 1.0

How to Use The Guidelines:

Adoption of the Sustainable Landscape Guidelines will have an impact on the Foggy Bottom campus in ever expanding ways, as illustrated in the diagram. The concentric circles identify direct Guideline application for strategic focus areas of campus development.

The Guidelines are intended as a tool to inform the decisions made by Division of Operations managers and designers. They are not prescriptive nor are they firm commitments.



1. Daily and Seasonal Maintenance: Daily and Seasonal Maintenance is at the heart of the diagram and is the main purpose of the Guidelines. The Guidelines provide a framework for maintenance tasks, which will help move the campus forward towards a stable, resilient and sustainable future.

2. Capital Development Projects:

The Guidelines will provide a framework for project designers and site work of all Capital Development Projects on campus. Capital Development Projects are defined as new facilities to be built on development sites identified in the GW 2007 Foggy Bottom Campus Plan.

3. Opportunities:

RTUNITIES

The Guidelines identify opportunities on campus that are outside of New Development sites and routine maintenance areas. These opportunities have the potential to contribute dramatically to a healthy ecosystem, and a productive and sustainable campus.

1. DAILY AND SEASONAL MAINTENANCE:

The Guidelines are designed to be used in tandem with the GW Streetscape Guidelines and the GW Ecosystems Enhancement Strategy. They provide goals and targets for the use and health of all plant material on the campus and in the streetscape, including routine maintenance as well as rejuvenation of existing plantings. They also advance the mission of the Ecosystem Enhancement Strategy by supporting a green campus and offering GW personnel and students a resource for understanding how to maintain a sustainable environment.

For everyday use, this document provides guidance for standard maintenance activities and simple upgrades to the existing campus landscape, to be implemented within annual operating budgets.

> Turn to **Chapter 3.0** *Guidelines and Recommendations* for Guidelines by Square.

2. CAPITAL DEVELOPMENT PROJECTS: The Guidelines provide goals and targets for the design of all outdoor spaces related to new construction on campus. The Guidelines provide a framework for landscapes relating to campus Capital Projects, including new facilities built on Development Sites identified in the 2007 Foggy Bottom Campus Plan, to conform to the aesthetic and functional goals outlined in this document, within the zoning requirements of each lot.

Turn to **Chapter 3.0** for specific recommendations for the Style and Plantings,

Turn to **Chapter 4.0** for Tree Canopy targets.

3. OPPORTUNITIES: The Guidelines identify existing campus spaces that lend themselves to retrofit projects. These spaces are not classified as Development Sites in the 2007 Foggy Bottom Campus Plan. They are: **3a. GW Grounds Management Team**

Opportunities: Spaces where suggested incremental interventions can have wide-ranging positive effects on the healthy use of the campus, and can often be implemented within annual maintenance and operating budgets.

3b. Grants and Partnerships Opportunities:

Spaces other than New Development sites, where Low Impact Design and planting interventions would require some form of investment or grant funding. Can be implemented through partnerships with local organizations such as Casey Trees and the District Department of Energy & Environment (DOEE) or through the efforts of student groups and interns with donor or grant funds.

> Turn to **Chapter 5.0** for Sustainable Design Opportunities Turn to **Chapter 6.0** for ideas and suggestions for new sustainable campus initiatives.

INTRODUCTION

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LIVING LANDSCAPE AND LIVING THE SPECIAL ROLE OF STUDENTS GUIDELINES

The Ecosystems Enhancement Strategy stresses the importance of including students and faculty in the planning process and recognizes the need for the strategy's continuous evolution. The GW Sustainable Landscape Guidelines is a dynamic document that will incorporate student and faculty input and change as more information about the campus is gathered and analyzed. Because this will require updates on the existing state of the campus, the Office of Sustainability, in conjunction with Planning, Development and Construction and the GW Grounds Management Team, will initiate a periodic review and revision of the Guidelines. This will also support GW's mission to provide the opportunity for research and intellectual discourse, and through experiential learning, prepare students for their role in a sustainable future.

As a living document, the Guidelines provide opportunities for students to contribute new ideas and insights based on their current campus research as well as offer input and feedback from the larger community of stakeholders. Students played a direct and central role in developing these Guidelines and their continued involvement will be critical for the university to meet its sustainability vision and mission.



A GW student performing research in the forest.

BENEFITS OF SUSTAINABLE GROUNDS

Landscapes are sustainable when their water, nutrient, and energy processes are balanced and require very little outside inputs. This results from appropriate design and maintenance that stabilizes the ecosystem processes over time. Once these landscapes are in place and functioning properly, the benefits quickly outweigh the costs. Sustainable grounds require less irrigation because rain water is allowed to infiltrate into the soil. They usually require no fertilizer because healthy soils and natural processes support native and adapted species. Plant replacement costs are also reduced and reactive measures for plants and trees that become stricken with disease are eliminated. All of this results in decreased costs for labor and maintenance.

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The Center for Neighborhood Technology (CNT) guide, *The Value of Green Infrastructure* provides a framework for economic valuation of Green Infrastructure practices such as green roofs, tree planting, bioretention, pervious paving and water harvesting. http://www.cnt.org/sites/default/files/

publications/CNT_Value-of-Green-Infrastructure. pdf

The Landscape Architecture Foundation (LAF) created the Landscape Performance Series and Toolkit with case studies that illustrate the benefits of LID and a searchable collection of online tools and calculators to estimate sustainable landscape performance.

http://landscapeperformance.org/benefits-toolkit

The USDA Forest Service, with many partners including Casey Trees, developed i-Tree, an online tool that provides urban forestry analysis and benefits assessment of tree canopy cover. Another tool, i-Tree Landscape, helps with tree planting prioritization and provides estimates and values of ecosystem services. http://www.itreetools.org/about.php

Based on the i-Tree assessment tool, Casey Trees and Davey Tree Expert Co created the National Tree Benefit Calculator. When a tree species and size are entered, the calculator details the benefits, including stormwater, property value, energy conservation, carbon sequestration and air quality.

http://www.treebenefits.com/calculator/

The EPA's web page on Green Infrastructure provides many case studies that demonstrate the cost-benefit analysis of LIDs. It considers costs as well as environmental, social and public health outcomes of LID. It also provides links to the Green Values, a national stormwater management calculator.

http://www2.epa.gov/green-infrastructure/ green-infrastructure-cost-benefit-resources



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2.0 CURRENT CAMPUS LANDSCAPE

A team of faculty and students walked the campus and generated detailed maps and field notes with observations and insights about the current landscape.

This chapter summarizes this information and forms the basis for the Guidelines and Recommendations to follow.

METHODOLOGY

The first steps in developing these living guidelines was to thoroughly and systematically assess the state of green spaces on GW's Foggy Bottom Campus. This process was student-centered, with support and direction from the Sustainable Landscapes faculty. Students from the 2015 Sustainable Landscapes Certificate Program conducted a square by square existing conditions inventory of the Foggy Bottom landscape. The state of existing plantings and the ecological function and health of the campus was assessed. Social factors were also evaluated, including the needs and diversity of people using the space, the importance of safe pedestrian and vehicular circulation and the status of improvements already completed on campus.

The final stage in the campus landscape inventory and analysis led to characterizing campus space in terms of original use, design, environmental and social attributes and the current condition of plantings. On the following pages, current campus landscapes are categorized according to specific Organizing Principles that help set up the Guidelines and Recommendations in Chapter 3.0.

The findings from this exhaustive inventory are insightful. As a steward of the environment, GW has made tremendous progress towards transforming the Foggy Bottom campus into a healthy, attractive and engaging place for students, faculty, staff and neighbors. Current efforts have been especially important in supporting GW's vision and mission as outlined in the 2012 GW Ecosystems Enhancement Strategy. These include pollinator gardens, the edible GroW garden, planting herbs as annuals, the introduction of beneficial insects for pest control, xeriscaping and a 'grass to garden' initiative. And from a policy and planning perspective, GW has mandated that, where applicable, all new construction in the future will retrofit adjoining streetscapes according to the GW Streetscape Guidelines.

There are great opportunities for taking this effort to the next level. From upgrading street tree boxes to improving small frontage landscapes and replacing fragments of remnant grass, to removing unnecessary paving, to adding layers of cool and lush plantings, opportunities abound for turning our campus into a regenerative landscape.



SUSTAINABLE LANDSCAPE GUIDELINES



Social Use of Space



High Visibility/Circulation

Buildings and gathering spaces, including Premium Layer intersections (as described in the GW Streetscape Guidelines), that are highly visible to the public and attract a variety of users for campus functions and special events. This designation also includes areas that experience intense pedestrian foot traffic on a regular basis, by students, faculty, staff and neighbors.



Well-Used Space

Outdoor gathering spaces, circulation routes or landscapes that are frequently and appropriately used for various intended purposes. Uses include academic, social and community purposes by students, faculty, alumni, visitors, patrons, non-GW employees, Metro commuters and community residents.



Underused Space

Outdoor spaces not functioning at their maximum potential due to various factors, including but not limited to, location, design and function.

54 40 I Street Street 24th Stree Z U 101 H Street 102 G Street 121 F Street **Development Sites**

CURRENT CAMPUS LANDSCAPE

Plants and Design

Exemplary Planting and Design

Well-designed landscapes and/or spaces featuring appropriate landscape elements, a comfortable scale and a thoughtful sense of place. These landscapes include plant specimens and arrangements that exemplify pleasing aesthetics and appropriate design and function for their setting. Examples of this principle are planting designs that incorporate diversity in species, multiple layering and complexity of plant palette, along with a significant presence of native plant material.



Planting Opportunities

Planting beds that offer opportunities for additional plants, or improvement of planting arrangements to resolve or mitigate barren spots, compacted or eroded soil, inadequate soil volume, high concentration of non-native plants, or high maintenance issues associated with specific plants and remnant lawn fragments.

2.0



Design Opportunities

Landscapes that offer opportunities for design improvements to resolve poor pedestrian circulation patterns and function, uncomfortable and underutilized space, poor connectivity and sense of place, inadequate plant palettes and ecological function. An example of this principle is a landscape that offers the opportunity for implementation of appropriate low impact design elements to increase infiltration and/or reduce stormwater runoff volume.



Existing LID

Existing low impact design elements that increase infiltration and/or reduce stormwater runoff volume.

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GUIDELINES & RECOMMENDATIONS

The overall goal of the Guidelines is to create a campus of sustainable, maintainable, and beautiful landscape spaces. The Guidelines are based on six design principles that create a foundation for making appropriate, practical, and aesthetic landscape decisions for the campus. In order to achieve this, the landscape has been divided into a hierarchy of spaces or categories based on traditional and contemporary landscape styles and high and low impact usage. A unified campus landscape aesthetic is then defined by both this hierarchy and a sustainable plant species vocabulary, thus creating the basis for design decisions. Existing trees are identified to remain, and with the addition of new trees, will support a campus wide tree canopy cover. Enhancing the outdoor experience for all users is emphasized. Areas for stormwater mitigation are identified as potential water control landscapes.

The Guidelines are detailed on a city square by square basis.

DESIGN PRINCIPLES

Create a **hierarchical system of places** with corresponding landscape recommendations that enhance the context, use and visibility of each space. (See Chapter 3.0)

Provide a vocabulary of standardized University plant lists to establish a **unified campus landscape aesthetic**. (See Chapter 3.0)

Maintain **existing trees** and facilitate healthy growth and ease of maintenance. (See Chapter 4.0)

Establish a **tree canopy coverage plan that promotes** the physical enjoyment of the GW community and the ecological functions of wildlife habitat, biodiversity, and clean air that benefit the greater ecosystem. (See Chapter 4.0)

Improve green places on campus to **enhance the outdoor experience** for all users, increasing quality of life health and well-being. (See Chapter 5.0)

Identify places where **stormwater mitigation** opportunities can be pursued. (See Chapter 5.0)

HIERARCHY OF SPACES

The overall aesthetic goal of these Guidelines is to create a campus of high quality urban spaces. The Guidelines were developed as a basis for making appropriate aesthetic decisions in plantings and design. All campus spaces are organized into one of the following Landscape Styles:

- High Impact Traditional Landscape
- High Impact Contemporary Landscape
- Low Impact Traditional Landscape
- Low Impact Contemporary Landscape

Landscape Styles reflect both Use and Function (from Chapter 2.0, Organizing Principles) and the Traditional or Contemporary style of existing buildings in each block. Details behind these findings are articulated in the Appendix. Each Landscape Style offers design objectives based on the use and style of collective campus buildings.



UNIFIED CAMPUS AESTHETIC

To create a consistent and unified campus aesthetic, the designated traditional landscape style is derived from the distinguishing characteristics of the gardens of Colonial Revival and Romantic style gardens. Similarly, a shared contemporary garden aesthetic is proposed for Art Deco style buildings and new buildings on campus. For simplicity and consistency, in many instances a single aesthetic is adopted for the entire block even if there are one or two buildings within the block that exhibit a different style.

HIGH IMPACT LANDSCAPES Continued in detail on page 18

LOW IMPACT LANDSCAPES Continued in detail on page 20

High Impact Contemporary Landscape Low Impact



Traditional Landscape

Contemporary Landscape

Low Impact Traditional Landscape

Development Sites

HIGH IMPACT LANDSCAPES

HIGH IMPACT LANDSCAPES

Spaces and streetscapes that are highly visible and experience heavy year-round urban use. Users often include neighborhood residents, commuters, the general public as well as students and faculty commuting between campus buildings. Both pedestrian safety and plant protection are important parameters in these spaces, demanding more intense maintenance to keep them at their peak. Year-round aesthetic includes intense use of annuals at key locations.

A HIGH-IMPACT CONTEMPORARY LANDSCAPE:

Design parameters:

Functional: Tough and resilient plantings that maintain their form in winter months and withstand constant foot traffic and ice-melt. **Aesthetic:** Layered landscape with all-season interest. Plantings should be in large, bold masses to match the scale of the buildings. Continued use of annual displays at special intersections and around GW busts and public art installations.

Spaces surrounding Art Deco era buildings to new developments on campus

Plantings: Emphasis should be placed on:

- Intense use of annual displays
- Strong blocks of color and texture in foliage and flowering native plants
- Long season perennials and grasses
- Plants to attract pollinators
- Native flowering understory trees
- Native shade trees



Plants to attract pollinators and strong blocks of color.



Native flowering understory trees with long season perennials and grasses.

HIGH-IMPACT TRADITIONAL LANDSCAPE:

Design parameters:

Functional: Tough and resilient plantings that maintain their form in winter months and withstand constant foot traffic and ice-melt. **Aesthetic:** Layered landscape with all-season interest. Little to no symmetry is found in front of buildings with traditional style gardens. Annual and perennial displays in traditional clusters.

Spaces surrounding Colonial Revival and Romantic era campus buildings

Plantings: Emphasis should be placed on:

- Intense use of annual and perennial displays
- Evergreen backdrops and hedges, including some foundation planting
- Groundcovers, evergreen preferred
- Specimen native ornamental trees and shrubs
- Native shade trees



3.0



LOW IMPACT LANDSCAPES

Spaces and streetscapes that experience normal urban use, including peripheral blocks with dorms and townhouses. These spaces require a lower intensity of regular maintenance, and should present a tidy look full of color and texture at a human scale.

B LOW-IMPACT CONTEMPORARY LANDSCAP	'E:
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Design parameters:

Functional: A layered landscape with simple, structured plantings at a residential rather than institutional scale. Use of resilient plant materials that withstand urban conditions and groundcovers that prevent erosion. Aesthetic: Inspired by native plant communities as regenerative ecosystems, these small garden spaces provide opportunities for experimentation with herbaceous and flowering plants and pollinators. Where appropriate, incorporate inviting places for students to gather by strategically placing benches and seat walls. Spaces surrounding Art Deco era buildings to new developments on campus

Plantings: Emphasis should be placed on:

- Bulbs for early season interest
- Long season perennials and grasses
- Pollinator plants
- Groundcovers, evergreen preferred
- Flowering understory trees
- Native shade trees



Layered landscape at SEAS Courtyard



Bulbs on GW Campus provide early season interest and are reused from year to year.

D LOW-IMPACT TRADITIONAL LANDSCAPE

Design parameters:

Functional: A layered landscape with simple, structured plantings at a residential rather than institutional scale. Use of resilient plant materials that withstand urban conditions and groundcovers that prevent erosion. Aesthetic: Inspired by native plant communities as regenerative ecosystems, these small garden spaces provide opportunities for experimentation with herbaceous material, flowering plants and pollinators. Understanding that students like to gather where they can see and be seen, gardens should incorporate inviting places to sit behind very low screening hedges, especially at residential townhouses.

Spaces surrounding Colonial Revival and Romantic era campus buildings

Plantings: Emphasis should be placed on:

- Bulbs for early season interest
- Simple perennial patches with intense color
- Conical evergreens
- Low evergreen screening hedges at sidewalk edge
- Flowering understory trees
- Native shade trees





Front yards at residential townhouses on campus.

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INTRODUCTION

Guidelines By Square: The following pages present a city square-by-square set of detailed recommendations for maintenance and upgrade of the GW Foggy Bottom campus landscape. A series of icons on each square indicates the different types of recommended planting and maintenance activities. The activities are explained in general on the opposite page and in detail for each site on the following pages. All the recommendations in the Guidelines are aligned with GW's Ecosystem Enhancement Strategy as listed on the opposite page.

Plant Lists: The preceding High-Impact/Low-Impact and Contemporary/Traditional landscape analysis has informed the creation of specialized sustainable plant lists for each of the four types of campus landscapes. For example, a more dramatic native plant list is appropriate for a High Impact garden space, while a Low Impact site plant list includes more delicate or fine textured plants. Plant lists for garden areas listed as Traditional contain more conventional evergreen materials than those listed as Contemporary. It is the intent that plant lists are closely aligned with the visual quality and function of each space, street and block.

		CATEGORY	GENERAL RECOMMENDATIONS
ANCE		TREES	Plant native shade trees
LEN		PLANTINGS	Diversify plantings
	(Å)	TURF	Grass to Gardens initiative (G2G)
\geq		SOILS	Improve soil conditions
Ŋ		URBAN AGRICULTURE	Increase urban agriculture/edible landscape
ANNI NNI		DESIGN	Improve campus wide unifying themes, overall aesthetics, user experience, circulation and plantings
PLA		LOW IMPACT DEVELOPMENT (LID)	Install BMP's as appropriate such as rain gardens, pervious paving, rainwater harvesting

ECOSYSTEM ENHANCEMENT STRATEGY (EES) GOALS AND TARGETS:	ADDITIONAL INFORMATION
Target 2.1: Enhance tree canopy and green cover to increase sequestration potential and outdoor air filtration capacity Target 2.1A: Offset sq. ft. /acreage loss of existing tree canopy and green cover from natural causes or development with new plantings. (Increase native tree canopy coverage)	TREES: Chapter 4.0 GW's Urban Tree Canopy
Target 1.2: Enhance campus biological richness/diversity. Target 1.2A: Create habitat friendly spaces that promote non-invasive plants	PLANTINGS: Plant lists at the end of Chapter 3.0
Target 1.2: Enhance the biological richness/diversity of the campus.	TURF: Plant lists at the end of Chapter 3.0
Target 1.2: Enhance the biological richness/diversity of the campus.	SOILS: Soil notes in Appendix D
Target 4.1: Produce food on campus	URBAN AGRICULTURE: Opportunities in Chapters 5.0 and 6.0
Target 1.2A: Create habitat friendly spaces that promote non-invasive plants	DESIGN: Opportunities in Chapters 5.0 and 6.0
Target 3.2: 10% absolute increase in permeable space over 10 years from FY11 baseline. Target 3.3: Retained stormwater reuse for greywater systems, cooling towers, and irrigation by 2021. Target 3.4: Encourage watershed replenishment projects that qualify for water quality trading schemes. Projects will decrease erosion, improve stormwater infiltration and improve water quality.	LOW IMPACT DEVELOPMENT: Concept ideas in Chapters 5.0 and 6.0

GUIDELINES BY SQUARE Sustainable Landscape Guidelines Recommendations





#39





Plantings

Replace non-native plants such as crape

myrtles, beautyberry and daylillies with native alternatives. Refer to Plant List A.

LID's

Propose more pervious paving or infiltration methods in front of School of Public Health entrance.



KEY PLAN

-Milken Institute School of Public Health



#40

GUIDELINES BY SQUARE Sustainable Landscape Guidelines Recommendations







Remove grass on south side of hospital building.

Incorporate more native plants in shrub and groundcover layers in I Street Mall. Refer to Plant List A. 4

Frees

Remove Bradford pear trees and replace with native shade trees. Refer to Plant List A.



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Str

Improve soil absorption with better plant bed preparation. Decrease mounding grade and add compost.



Develop improved design for I Street Mall to improve user experience, aesthetics, circulation and plant diversity. See Opportunity #9. Consider interactive therapy or fragrance garden in the GW Hospital property which abuts the I Street Mall.

Design new LID features for stormwater containment as per DC Water Clean Rivers Program.



LID's

Intercept stormwater run off with channel drains and redirect into plant beds for infiltration.

#40 HIGHLIGHTS KEY PLAN

-The George Washington University Hospital


GUIDELINES & RECOMMENDATIONS

3.0





Plantings

Incorporate more native plants in shrub and groundcover layers along 23rd Street. Refer to new design and Plant List A.

Design

- Generate a planting design to improve
 - aesthetics, scale and function of east side of
 - Ross Hall on 23rd Street. Refer to Plant List A.
 - Design planters to deter undesired use of
 - space. See Opportunity #10.
 - Develop a design to improve seating area by GroW garden - corner of 24th and H Street.



Soils

Improve infiltration and decrease erosion by additional plants with fiberous roots, adding compost and aerating. Refer to Plant List A.



Plant densely to decrease erosion.

Intercept stormwater run off with channel drains and redirect into plant beds for infiltration. Intercept or collect stormwater run off for reuse to



KEY PLAN

-Himmelfarb Health Sciences Library -Ross Hall School of Medicine



GUIDELINES BY SQUARE Sustainable Landscape Guidelines Recommendations





Trees

Increase canopy cover 40% by planting large

shade trees around Varsity Place Plaza. Refer to Plant List B.

Plantings

Increase biodiversity and incorporate more

- native plants in shrub and groundcover layers
- on north and west side of Amsterdam Hall
- particularly behind hedge.
 - Refer to Plant List B.
 - Incorporate more native plants in shrub and
 - groundcover layers around Varsity Place
 - Plaza to complement new tree plantings.
 - Refer to Plant List B.



Design

- Enlist GW Landscape Design program to
- provide a pro-bono planting design for St.
- Mary's Episcopal Church on 23rd Street to
- improve aesthetics, scale and biological
- diversity. See Community Outreach
- Opportunity #1.

#42 HIGHLIGHTS

KEY PLAN

-Philip Amsterdam Hall -Hillel Center -Lerner Health and Wellness Center





Plantings

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Virginia

Incorporate plantings in Shenkman Hall courtyard. Refer to Plant List B.



Design

- Develop design to improve user experience \Box
- and scale in Shenkman Hall courtyard. See Ð
 - Opportunity #11.
 - Incorporate planters and above ground
 - planting beds in Shenkman Hall courtyard to
 - increase green space. Refer to Plant List B.



LID's

Intercept/capture surface water and divert to planting beds for irrigation and infiltration.

#43 HIGHLIGHTS **KEY PLAN**

-Shenkman Hall



SUSTAINABLE LANDSCAPE GUIDELINES

GUIDELINES BY SQUARE Sustainable Landscape Guidelines Recommendations



Trees

If the existing trees, crape myrtles, need to

be replaced in the future, replace with native

trees such as Amelanchier 'Autumn Brilliance'.

Refer to Plant List A.

Plantings

Incorporate more native plants in shrub and

groundcover layers on 22nd Street and H

Street. Refer to Plant List A.





Trees

Plant large shade trees on south side of

Funger Hall to improve terrace experience to either replace or augment existing crape myrtles. Refer to Plant List A.



Plantings

- Increase biodiversity by incorporating more
- $\ \$ native plants in shrub and groundcover layers
- ① on H Street. Refer to Plant Lists B and D.
 - Add native plants in the planting beds up by
 - Tompkins Hall. Refer to Plant List A.
 - Add native plants in front of the retaining wall on 23rd Street. Refer to Plant List A.



) Turf

- Remove grass between retaining wall and sidewalk on 23rd Street.
- Remove grass on H Street.
- Refer to Plant List B.



Improve user experience, scale and aesthetics in the School of Business corridor by adding an urban meadow. See Opportunity #12.



Increase permeable surface on terrace of Funger Hall. Collect and reuse stormwater runoff for other planting beds below.



-Tompkins Hall School of Engineering -Duques Hall School of Business -Funger Hall -Madison Hall



Sustainable Landscape Guidelines Recommendations **GUIDELINES BY SQUARE**







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Plant shade trees to increase tree canopy and

improve scale and aesthetics on the south

façade Smith Center. Refer to Plant List B.

Plantings

 \bigcirc Incorporate more native plants in shrub and

groundcover layers on 23rd Street. Refer to Plant List A.

Design

Generate a planting design with more shade trees to improve aesthetics and scale of south façade of Smith Center along F Street. Refer to Plant List B.

#57 HIGHLIGHTS **KEY PLAN**

-Charles E. Smith Center -Townhouse Row







Plantings

Incorporate more native plants in shrub and groundcover layers on 22nd Street and Virginia Avenue in front of International House. Refer to Plant List D. Incorporate more native plants in shrub and

groundcover layers on GW-owned properties

22nd Street and F Street. Refer to Plant List D.



KEY PLAN

-International House -Newman Center -GW Townhouses



3.0







GUIDELINES & RECOMMENDATIONS

Trees

Enlarge tree boxes in Kogan Plaza to current standards, plant by using structural soils and pervious paving for walkway areas. Replace existing Hornbeams and Japanese Maple near Veterans Park in Kogan Plaza with

native shade trees. Refer to Plant List A.

Intersperse shade trees among existing

planted shrubs behind blue pavilion (north side). Refer to Plant List A.

Plant new shade and understory trees north

of Staughton Hall to increase tree canopy coverage. Refer to Plant List A.



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Plantings

Incorporate more native plants in shrub and groundcover layers.

- South side of townhouses on G Street.
 Refer to Plant List D.
- ─ G Street Park. Refer to plant list B and D
- Hall of Government for vegetables and
 LID. Refer to Plant List A.
- Interior of Kogan Plaza. Refer to Plant List A.
- Create wildlife habitat for birds and
- $\overrightarrow{-}$ pollinators through the use of native
 - ⁾ plantings in G Street Park, behind 714 21st
- **O** Street and Staughton Hall.



Remove turf and install diverse plantings to improve aesthetics and scale on the west side of Gelman Library on 22nd Street. Refer to Plant List B. Remove turf and install an aesthetically engaging design which withstands high use by Lisner Auditorium. Refer to Plant List A. Remove turf west of Staughton Hall and install diverse plantings. Refer to Plant List A.



Decrease soil compaction and erosion at G Street park.

Increase soil volume in tree boxes with existing cherry trees in Kogan Plaza to improve the health of the trees. See tree notes.

Improve soils through use of compost under existing southern magnolias to improve tree health.



Potential location for GroW Garden - Mid campus Quad. Potential location for GroW garden - G Street Park.

See Opportunity #20.



Conversion to a 'Green Street' on H Street between 21st and 22nd Streets. See Opportunity #13. Stone planter box/seat wall and dogwood tree in front of Gelman Library on H Street (old library entrance). See Opportunity #15.

Improve biodiversity function and aesthetics in Theatre and Dance Courtyard. See Opportunity #17.

Design to improve scale, function and aesthetics in G Street Park. See Opportunity #6.



Decrease amount of impervious paving at corner of 22nd and G Street, and in Kogan Plaza,and/or install interceptor drains to redirect water to reduce run off and increase infiltration.

Collect and/or infiltrate run off from downspouts on buildings along G Street via cisterns, rain barrels. Construct rain garden behind 714 21st Street and Monroe Hall, and on north side of Staughton Hall to collect and infiltrate stormwater runoff from rooftop and surrounding landscape. See Opportunity # 16.

Construct rain garden / bio swale on south edge of G Street Park to collect and infiltrate runoff and reduce existing erosion issues.



RECOMMENDATIONS

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GUIDELINES

#80

es when Square 80 is a potential location for containerized urban agriculture cultivation and distribution on terrace behind townhomes. See Opportunity #20.

Create a planting design for a new landscape to replace existing grass around Strong Hall on G Street and 21st Street. See Opportunity #3. Enlist GW Landscape Design program for a sustainable planting design to replace existing grass on corner of F Street and 22nd Street. Enlist GW Landscape Design program to provide a sustainable planting design for hillside at 21st and F Street to decrease erosion and improve aesthetics and biodiversity. See Opportunity #18.

Urban Agriculture



Install interceptor drains to redirect water to reduce run off and increase infiltration.

Increase infiltration on corner of 21st and F Street. Install structural retaining wall and plants.

Trees

Plant native shade and understory trees when non-native trees need to be replaced.



- Incorporate more native plants in shrub and
- groundcover layers along F Street. Refer to
- Plant List D.

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- ⊂ Create a design template to include hedge,
- seating area and patio with native shade trees
- \bigcirc and plants in townhouse front yards along
- 22nd Street. See 611 22nd Street as example. Refer to Plant List D.



 \mathcal{C}

- Turf
- $^{
 m O}$ Remove grass around Strong Hall on G Street
- $_{\ensuremath{\bigcirc}}$ and 21st Street. Refer to new planting design
- and Plant List C.
- \bigcirc Remove grass in front of 22nd and F Street.
- \prec Refer to new planting design and Plant List D.

Soils

- Decrease soil erosion on corner of 21st and F
- Street through use of compost socks or other
 soft terracing techniques and plantings. Refer
- to Plant List C.



GUIDELINES BY SQUARE Sustainable Landscape Guidelines Recommendations

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Plantings

Incorporate more native plants in shrub and groundcover layers in the following areas:

- Anniversary Park
- In front of 2142-2150 F Street
- Along F Street in front of the Dakota

Refer to Plant List B and design notes below.



Decrease erosion and increase infiltration in front of 2142-2150 F Street by adding good soil amendments such as compost during planting.



Design

Enlist GW Landscape Design program for a sustainable planting design to improve aesthetics, user experience and event space in Anniversary Park. See Opportunity #19.

Create a design template to include low hedge,

- seating area, patio with native shade tree and
- plants in GW owned townhouse front yards (D)
- along 2142-2150 F Street. See 611 22nd Street as
- example. Refer to Plant List D.





GUIDELINES & RECOMMENDATIONS

3.0

and 21st	Trees Increase tree canopy in University Yard by adding native shade trees behind Samson Hall and wherever possible throughout Yard.
3 Street Square 102 between 20th	 Plantings Incorporate more native plants in shrub and groundcover layers. Front of Corcoran & Samson Halls on 21st Street. Refer to Plant List C. 700 20th Street, on corner of G and 20th Street. Refer to Plant List C. Law Library and Stockton Hall on 20th Street. Refer to Plant List B. Stockton Hall terrace, facing University Yard. Refer to Plant List A. Lerner Hall on corner of H Street and 20th Street. Refer to Plant List A.

SUSTAINABLE LANDSCAPE GUIDELINES

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GUIDELINES BY SQUARE Sustainable Landscape Guidelines Recommendations









rees

Increase tree canopy on west side of Old Main by adding native shade trees.

Plantings

Incorporate native plants in shrub and groundcover layers in the following areas:

- West side of Old Main.
- Along 19th St.
- In front of Thurston Hall.
- Refer to Plant List C.



Remove grass at west side of Old Main.

Remove grass at side of Thurston Hall on 19th St. (\mathbf{D})

Remove grass in front of Mitchell Hall \mathbf{D} on 19th St. Refer to Plant List C.



Decrease soil erosion and secure grade in 0

front of Thurston Hall by installing additional

plants. Refer to Plant List C.



Create a planting design for Old Main to enhance user experience and increase biodiversity. See Opportunity #8.

Create a planting design for a new landscape to replace existing grass on side of Thurston Hall on 21st Street.

Create a planting design for a new landscape to replace existing grass in front of Mitchell Hall on 21st Street.



-1959 E Street



Collect and/or infiltrate run off from Old Main downspouts for reuse in landscape or rain garden.

#122 HIGHLIGHTS	KEY PLAN
-Old Main -Alumni House -Thurston Hall -Mitchell Hall -Elliott School of	

PLANT LISTS

TS Highly Recommended Plants

Red Maple

48

INTRODUCTION

Plant Lists: The Guideline Design Principles, use and function of each campus space were used to compile the plant lists at the end of this chapter. Failproof plants with the highest aesthetic and wildlife value are highlighted with photographs in the following pages. The plants are mostly a reflection of Mid-Atlantic natural plant communities; use of these plants will move GW's landscape towards a resilient and self-healing ecosystem that will improve with the years. The Contemporary Landscape Plant Lists (lists A and B) include native plants along with a few nonnative evergreens and favorites that reflect a modern landscape aesthetic. More non-invasive, non-native plants are found in the Traditional Landscape Plant Lists (lists C and D), selected with sensitivity to traditional architectural context and complementary period gardens.

The Plant Lists are a guide for the GW Grounds Management Team (GMT) as they continue to work towards more sustainable goals. This will not preclude the GMT from the occasional use of conventional, non-native plant varieties when the need arises. For example, in instances where crowd control requires a particularly tough or spiny plant. For new construction, consulting landscape architects and designers are expected to adhere to the Plant Lists.



Acer rubrum

Fast growing, easy to establish, excellent fall color Nesting site, food for birds, mammals, insects



llex opaca

Screening, evergreen, attractive fruit Cover for wildlife, red drupes for wintering birds



Betula nigraRiver BirchHandsome bark, good fall colorPollen producer, food for birds, mammals, insects



Black Tupelo

Outstanding summer and fall foliage and habit Pollen producer, food for winter birds

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Quercus bicolorSwamp White OakExcellent drought resistance, good fall colorExcellent source of caterpillars (557 species)



Carpinus carolinianaAmericHeavy shade tolerant, attractive bark





Chionanthus virginicus Distinctive showy flowers, air pollution tolerant Provides good understory cover



Amelanchier x grandiflora 'Autumn Brilliance' Edible fruits, excellent fall color, attractive bark Early spring nectar source, food for birds, mammals



Cercis canadensis Showy flowers Pollen/nectar producer, food for birds



Redbud Cornus florida

Dogwood

Showy flowers, attractive bark and fall color Excellent food source for wintering birds

SUSTAINABLE LANDSCAPE GUIDELINES

PLANT LISTS Highly Recommended Plants



Magnolia grandifloraSouthern MagnoliaEvergreen, screen, hedge; fragrant, showy flowersCover for birds and mammals



Clethra alnifoliaSweet pepperbushFast growing, adaptable, good for rain gardensIdeal for nectaring butterflies



sh Ilex glabra

Inkberry



Magnolia virginianaSweetbay MagnoliaEvergreen to semi-evergreen, attractive flowersHost to sweetbay silk moth

Hydrangea quercifoliaOakleaf hydrangeaShowy flowers, shade tolerant, good fall colorGood source of early summer pollen & nectar

Evergreen for hedges and massing, accent plant Berries for winter birds, nectar for native bees



llex verticillata

Winterberry

Winter interest, rain garden, informal hedge Food for more than 49 bird species



Itea virginicaVirginia SweetspireAttractive fragrant flowers, best in massesExcellent source of pollen & nectar for native bees



Myrica ceriferaSouthern BayberryEvergreen, drought and salt tolerantFood source for wintering birds



Rhus aromatica 'Gro Low'Gro Low SumacTolerates poor soil, good fall colorFood source for wintering birds



Viburnum nudum 'Winterthur' Smooth Witherod Dense, lustrous foliage, showy berries and flower Excellent source of berries and caterpillars for birds



Amsonia hubrichtiiArkansas AmsoniaBlue spring flowers, showy fall color, best in massesGood butterfly nectar plant



Asclepias tuberosa Butte Long bloom period, drought tolerant Larval host for monarch butterfly

Butterfly Milkweed

SUSTAINABLE LANDSCAPE GUIDELINES

PLANT LISTS Highly Recommended Plants



Aster laevis Easily self seeds, late autumn flowers Attractive to butterflies



Purple Coneflower Echinacea purpurea Highly adaptable plant, attractive long blooming Excellent source of midsummer pollen & nectar



Heuchera villosa Hairy Alumroot Good ground cover, attractive foliage Provides cover for wildlife



Chelone glabra Distinctive flower, suitable for rain gardens Larval host of Baltimore Checkerspot butterfly

Turtlehead

Eupatorium dubium 'Baby Joe' Dwarf Joe Pye Weed Showy flowers in late summer/early fall Attractive to butterflies



Osmunda cinnamomea Cinnamon Fern Attractive fronds Good for bird cover and nesting sites

Smooth Blue Aster



Panicum virgatumSwitchgrassAdaptable, attractive fall color & winter interestProvides nesting material for grassland birds



Rudbeckia fulgidaOrange ConeflowerExcellent bloom and color for late summerGood for pollinators and winter birds



Phlox paniculataTall Garden PhloxMany varieties, colors. Fragrant, long bloomingProvides nectar for hummingbird sphinx moth



Solidago rugosaGoldenrodAttractive fall blooming, good for rain gardensProvides cover, seed, food for 115 caterpillar types

GW makes every effort to purchase plants that have not been treated with neonicotinoids.

Neonicotinoids are systemic insecticides that are often used as seed or soil treatments in nursery plants as well as agricultural crops. Systemic insecticides are taken up by plant tissues, and can persist in soil for months or years after application. Neonicotinoid residues have been found in pollen and nectar consumed by pollinators such as bees and butterflies. These insecticides are currently under the EPA risk assessment review process for bees and other pollinators.^{1,2}

²www.xerces.org/neonicotinoids-and-bees/

¹www.epa.gov/pollinator-protection/schedule-review-neonicotinoidpesticides

	PLANT LISTS	Hig	gh In	npact Contemporary Plant List	
Pla	nt Name		ē	Notes and Cultivar Information	
Botanical Name	Common Name	Native	Adaptiv	Street Tree Evergreen	
	T	REES			
Acer rubrum	Red Maple	✓			•
Betula nigra	River Birch	\checkmark			
Betula lenta	Sweet Birch	\checkmark			
Cladrastis kentukea	Yellowood	\checkmark			
Gleditsia triacanthos var. inermis	Thornless Honeylocust	✓			
Gymnocladus dioica	Kentucky Coffeetree	✓		Male podless preferred	
Juniperus virginiana	Eastern Red Cedar	✓			_
Liquidambar styraciflua	Sweetgum	✓		Seedless cultivars 'Rotundiloba' 'Cherokee'	
Nyssa sylvatica	Black Tupelo	✓		'Red Rage', 'Forum'	_ _
Platanus occidentalis	Sycamore	✓			¶
Quercus alba	White Oak	✓			
Quercus bicolor	Swamp White Oak	✓			
Quercus palustris	Pin Oak	✓			¶
Quercus phellos	Willow Oak	✓			
Quercus rubra	Red Oak	✓			
Thuja occidentalis	Arborivitae	✓			A
Ulmus americana 'Liberty'	American Elm Disease Resistant	\checkmark			
	FLOWERING / U	JNDER	STOR	Y TREES	
Amelanchier arborea	Downy Serviceberry			x grandiflora 'Autumn Brilliance'	
Amelanchier canadensis	Shadblow Serviceberry				

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Pla	ant Name		le le	Notes and Cultivar Information
Botanical Name	Common Name	Native	Adaptiv	Street Tree Evergreen
	FLOWER	ING / UNDE	RSTOF	RY TREES
Cercis canadensis	Sweet Birch	✓		
Cornus florida	Dogwood	✓		Cloud 9, Ozark Spring
Sassafras albidum	Sassafras	✓		
		SHRUB	S	
Cephalanthus occidentalus	Dwarf Button Bush	✓		Sugar Shack
Clethra alnifolia	Sweet Pepperbush	✓		
Cornus sericea	Red Twig Dogwood	✓		Arctic Fire
Fothergilla gardenii	Dwarf Fothergilla	✓		
Hydrangea quercifolia	Oakleaf Hydrangea	✓		Pee Wee, Snowflake, Ruby Slippers, Sike's Dwarf
llex glabra	Inkberry	✓		
llex verticillata	Winterberry Holly	✓		Red Sprite, Winter's Red, males to pollinate
ltea virginica	Virginia Sweetspire	✓		Little Henry, Henry's Garnet
Myrica cerifera	Southern Bayberry	✓		
Myrica pensylvanica	Northern Bayberry	✓		
Rhus aromatica 'Gro low'	Gro low Sumac	✓		
Rhus copallinum	Winged Sumac	✓		
Virburnum nudum 'Winterthur'	Smooth Witherod	✓		
	GROU	NDCOVER P	EREN	NIALS
Amsonia hubrichtii	Arkansas Amsonia	✓		
Andropogon virginicus	Virginia Broomsedge			

	PLANT LISTS		yn in	ipact Contemporary Plant List
Pla	nt Name	Native	Adaptive	Notes and Cultivar Information
Botanical Name	Common Name			
	GROUNDCO	OVER P	EREN	NIALS
Aquilegia canadensis	Red Columbine			species and 'Little Lanterns'
Aruncus diocicus	Goat's Beard			
sarum canadense	Wild Ginger			
sclepias incarnata	Swamp Milkweed			
sclepias syriaca	Milkweed			
sclepias tuberosa	Butterfly Milkweed			
ster laevis	Smooth blue aster			
ster novi-belgii	New York Aster			
thyrium filix-femina	Lady Fern			
Carex pensylvanica	Pennsylvania Sedge			
Chelone glabra	Turtlehead			host plant to endangered Baltimore Checkerspot
Pennestaedtia punctilobula	Hay Scented Fern			
eschampsia caespitosa vivipara	Tufted Hair Grass			
Pryopteris marginalis	Eastern Woodfern			
chinacea purpurea	Purple Coneflower			species and Magnus Star
chinacea purpurea 'White Swan'	White Coneflower			
upatorium coelestinum	Hardy Ageratum			used w/ Asclepias assists in Monarch reproduction cycle
upatorium dubium	Dwarf Joe Pye Weed			Baby Joe
upatorium hyssopifolium	Hyssop-leaf Thoroughwort			
-upatorium perfoliatum	Boneset			

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Plar	nt Name		é	Notes and Cultivar Information
Botanical Name	Common Name	Native	Adaptiv	Street Tree Evergreen
	GROU		ERENI	NIALS
Geranium maculatum	Wild Geranium	✓		great for early pollinators
Geranium 'Rozanne'	Cranesbill	✓		
Heuchera villosa	Hairy Alumroot	✓		Autumn Bride
Liatris spicata	Spiked Blazing Star	✓		
Liriope spp.	Lilyturf		✓	Big Blue, Silver Dragon, Variegata
Lobelia siphilitica	Great Blue Lobelia	✓		
Opuntia humifusa	Eastern Prickly Pear	✓		
Osmunda cinnamomea	Cinammon Fern	✓		
Pachysandra procumbens	Alleghany Spurge	✓		
Pachysandra terminalis	Japanese Spurge		✓	
Packera aurea	Golden Groundsel	✓		
Panicum virgatum	Switchgrass	✓		
Parthenocissus quinquefolia	Virginia Creeper	✓		
Penstemon digitalis 'Husker Red'	Beard Tongue	✓		Husker's Red
Phlox panicultata	Tall Garden Phlox	✓		David, Jeana, David's Lavender
Polygonatum pubescens	Solomon's Seal	✓		
Pycnanthemum muticum	Mountain Mint	✓		
Rudbeckia fulgida	Orange Coneflower			

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	PLANT LISTS		gh In	npact Contemporary Plant List
	Plant Name		é	Notes and Cultivar Information
Botanical Name	Common Name	Native	Adaptiv	Street Tree Evergreen
	GROUNDCO	OVER P	EREN	NIALS
Solidago rugosa	Goldenrod			Fireworks, Little Lemon
Sporobolus heterolepis	Prairie Dropseed			
Thelypteris novoboracensis	New York Fern			
Tradescantia ohiensis	Spiderwort			Sweet Kate, Concord Grape

Plant Name			é	Notes and Cultivar Information
Botanical Name	Common Name	Native	Adaptiv	Street Tree Evergreen
		TREES		
Acer rubrum	Red Maple	✓		
Betula lenta	Sweet Birch			
Betula nigra	River Birch			
Cladrastis kentukea	Yellowood	✓		
Gleditsia triacanthos var. inermis	Thornless Honeylocust			
Gymnocladus dioica	Kentucky Coffeetree			male podless preferred
Juniperus virginiana	Eastern Red Cedar			
Liquidambar styraciflua	Sweetgum			Seedless-Rotundiloba, Cherokee
Nyssa sylvatica	Black Tupelo			Red Rage, Forum
Platanus occidentalis	Sycamore			
Quercus alba	White Oak			
Quercus bicolor	Swamp White Oak			
Quercus palustris	Pin Oak			
Quercus phellos	Willow Oak			
Quercus rubra	Red Oak			
Taxodium distichum	Baldcypress			
Thuja occidentalis	Arborivitae	✓		
Jlmus americana 'Liberty'	American Elm Disease Resistant			

	PLANT LISTS	Lo	w Im	pact Contemporary Plant List
Plant Name			é	Notes and Cultivar Information
Botanical Name	Common Name	Native	Adaptiv	Street Tree Evergreen
	FLOWERING / L	JNDEF	RSTOR	RY TREES
Amelanchier canadensis	Shadblow Serviceberry			
Asimina triloba	Paw Paw			
Carpinus caroliniana	American Hornbeam			
Cercis canadensis	Redbud			
Chionanthus virginicus	VA Fringe Tree			
Cornus florida	Dogwood			Cloud 9, Ozark Spring
Cornus mas	Cornelian Cherry		 ✓ 	
Crataegus crus-galli 'Inermis'	Thornless Hawthorn	 ✓ 		
Magnolia grandifolia	Southern Magnolia			i i i i i i i i i i i i i i i i i i i
Magnolia virginiana	Sweetbay Magnolia			i i i i i i i i i i i i i i i i i i i
Ostrya virginiana	Eastern Hophornbeam			
Parotia persica	Persian Parotia			
Sassafras albidum	Sassafras			
	SI	HRUBS	5	
Aronia arbutifolia	Red Chokeberry			
Ceanothus americanus	New Jersey Tea	\checkmark		
Cephalanthus occidentalus	Dwarf Button Bush	 ✓ 		Sugar Shack
Clethra alnifolia	Sweet Pepperbush			
Cornus sericea	Red Twig Dogwood			Arctic Fire
Fothergilla gardenii	Dwarf Fothergilla			

Plant Name			le le	Notes and Cultivar Information
Botanical Name	Common Name	Native	Adaptiv	Street Tree Evergreen
		SHRUB	S	
Hydrangea quercifolia	Oakleaf Hydrangea	✓		Pee Wee, Snowflake, Ruby Slippers, Sike's Dwarf
lex glabra	Inkberry	✓		Densa, Compacta
lex verticillata	Winterberry Holly	✓		Red Sprite, Winter's Red, males to pollinate
tea virginica	Virginia Sweetspire	✓		Little Henry, Henry's Garnet
_indera benzoin	Spicebush	✓		
Mahonia aquifolium	Oregon Grape Holly	✓		
Myrica cerifera	Southern Bayberry	✓		
Myrica pensylvanica	Northern Bayberry	✓		
Physocarpus opulifolius	Ninebark	✓		
Potentilla fruticosa	Bush Cinquefoil	✓		
Rhus aromatica 'Gro low'	Gro low Sumac	✓		
Rhus copallinum	Winged Sumac	✓		
Vaccinium angustifolium	Lowbush Blueberry	✓		
Viburnum acerfolium	Mapleleaf Viburnum	✓		
Viburnum dentatum 'Blue Muffin'	Dwarf Arrowwood	✓		
/irburnum nudum 'Winterthur'	Smooth Witherod	✓		
Yucca filamentosa	Adam's Needle	✓		
	GROU	JNDCOVE <u>R P</u>	EREN	NIALS
Amsonia hubrichtii	Arkansas Amsonia	✓		
Andropogon virginicus	Virginia Broomsedge			

3.0

mon Name GROUNI Columbine	DCOVER PE	Adaptiv	Street Tree Evergreen
GROUNI Columbine		REM	
Columbine			NIALS
t's Board			species and 'Little Lanterns'
	✓		
Ginger	✓		
mp Milkweed	✓		Ice Ballet
weed			
erfly Milkweed			
oth Blue Aster	✓		
York Aster			
/ Fern			
ısylvania Sedge			
ehead	✓		host plant to endangered Baltimore Checkerspot
scented fern			
ed Hair Grass			
ern Woodfern			
le Coneflower			species and Magnus Star
te Coneflower			
Jy ageratum	✓		used with Asclepias assists in Monarch reproduction cycle
rf Joe Pye Weed			Baby Joe
	York Aster Fern Isylvania Sedge ehead scented fern ed Hair Grass ern Woodfern le Coneflower e Coneflower ly ageratum rf Joe Pye Weed	YORK Aster Y Fern Isylvania Sedge ehead scented fern ed Hair Grass ern Woodfern le Coneflower e Coneflower ly ageratum rf Joe Pye Weed	York Aster Y Fern Isylvania Sedge ehead scented fern ed Hair Grass ern Woodfern le Coneflower e Coneflower ly ageratum rf Joe Pye Weed

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Plant Name			e	Notes and Cultivar Information
Botanical Name	Common Name	Native	Adaptiv	Street Tree Evergreen
	GROUNDC	OVER P	ERENI	NIALS
Geranium maculatum	Wild Geranium			great for early pollinators
Geranium 'Rozanne'	Cranesbill			
Heuchera villosa	Hairy Alumroot			Autumn Bride
Hibiscus moscheutos	Pink Rose Mallow			Anne Arundel
Liatris spicata	Spiked Blazing Star			
Liriope spp.	Lilyturf			Big Blue, Silver Dragon, Variegata
Lobelia cardinalis	Cardinal Flower			
Lobelia siphilitica	Great Blue Lobelia			
Monarda fistulosa	Beebalm			
Opuntia humifusa	Eastern Prickly Pear			
Osmunda cinnamomea	Cinammon Fern			
Pachysandra procumbens	Alleghany Spurge			
Pachysandra terminalis	Japanese Spurge			
Packera aurea	Golden Groundsel			
Panicum virgatum	Switchgrass			
Parthenocissus quinquefolia	Virginia Creeper			
Penstemon digitalis 'Husker Red'	Beard Tongue			Husker's Red
Phlox panicultata	Tall Garden Phlox			David, Jeana, David's Lavender

Botanical Name	Common Name	tive	aptive	Street Tree Evergreen		
		Nat	Ada			
GROUNDCOVER PERENNIALS						
Pycnanthemum muticum	Mountain Mint	✓				
Rudbeckia fulgida	Orange Coneflower	✓				
Rudbeckia hirta	Black Eyed Susan	✓				
Schizachyrium scoparium	Little Bluestem	✓				
Sedum ternatum	Stonecrop	✓				
Solidago rugosa	Goldenrod	✓		Fireworks, Little Lemon		
Sporobolus heterolepis	Prarie Dropseed	✓				
Thelypteris novoboracensis	New York Fern					
Tradescantia ohiensis	Spiderwort			Sweet Kate, Concord Grape		
/ernonia lettermann	Iron Weed	✓	ļ	Iron Butterfly		
/ernonia noveboracensis	New York Ironweed					

	Plant Name		U	Notes and Cultivar Information	
Botanical Name	Common Name	Native	Adaptiv	- Street Tree Evergreen	
		TREES			
Acer rubrum	Red Maple	✓			:
Cladrastis kentukea	Yellowood				
Gymnocladus dioicus	Kentucky Coffeetree			male podless preferred	
Liquidambar styraciflua	Sweetgum			Seedless-Rotundiloba, Cherokee	
Nyssa sylvatica	Black Tupelo			Red Rage, Forum	
Platanus occidentalis	Sycamore				
Quercus alba	White Oak				
Quercus bicolor	Swamp White Oak	✓			
Quercus palustris	Pin Oak				
Quercus phellos	Willow Oak				
Quercus rubra	Red Oak	✓			
Thuja occidentalis	Arborivitae				4
Ulmus americana 'Liberty'	American Elm Disease Resistant				
Ulmus parvifolia	Lacebark Elm		✓		
	FLOWERING	/ UNDEF	RSTC	DRY TREES	
Amelanchier arborea	Downy Serviceberry			x grandiflora 'Autumn Brilliance'	
Amelanchier canadensis	Shadblow Serviceberry	✓			
Cercis canadensis	Redbud				
Cornus florida	Dogwood			Cloud 9, Ozark Spring	
Prunus serrulata 'Kwanzan'	Kwanzan Cherry		✔		

Plant Name				Notes and Cultivar Information			
Botanical Name	Common Name	Native	Adaptive	Street Tree Evergreen			
FLOWERING / UNDERSTORY TREES							
Prunus subhirtella 'Autumnalis'	Autumn Blooming Higan Cherry						
Prunus x incamp 'Okame'	Okame Cherry						
Prunus x yedoensis	Yoshino Cherry						
		SHRUB	S				
Abelia x grandiflora	Glossy Abelia			Rose Creek, Edward Goucher			
Aucuba japonica	Spotted Laurel						
Buxus sempervirens	Vardar Valley Boxwood						
Camellia japonica	Japanese Camellia						
Clethra alnifolia	Sweet Pepperbush						
Fothergilla gardenii	Dwarf Fothergilla						
Hydrangea quercifolia	Oakleaf Hydrangea			Pee Wee, Snowflake, Ruby Slippers, Sike's Dwarf			
llex glabra	Inkberry						
ltea virginica	Virginia Sweetspire			Little Henry, Henry's Garnet			
Myrica cerifera	Southern Bayberry						
Osmanthus heterophyllus 'Gulftide'	Gulftide False Holly						
Prunus laurocerasus	Cherry Laurel		✓				
Rhus aromatica 'Gro low'	Gro low Sumac						
Taxus baccata repandens	Repandends English Yew						
Taxus cuspidata	Japanese Yew		\checkmark				
Viburnum burkwoodii 'Conoy'	Conoy Viburnum						

Plant Name			e	Notes and Cultivar Information		
Botanical Name	Common Name	Native	Adaptiv	Street Tree Evergreen		
	SI	HRUBS				
Virburnum nudum 'Winterthur'	Smooth Witherod	✓				
GROUNDCOVER PERENNIALS						
Amsonia hubrichtii	Arkansas Amsonia					
Aquilegia canadensis	Red Columbine	✓		species and 'Little Lanterns'		
Asarum canadense	Wild Ginger	 ✓ 				
Carex pensylvanica	Pennsylvania Sedge	 Image: A start of the start of				
Dennestaedtia punctilobula	Hay scented fern					
Dryopteris erythrosora	Autumn Fern					
Dryopteris marginalis	Eastern Woodfern					
Echinacea purpurea	Purple Coneflower			species and Magnus Star		
Echinacea purpurea 'White Swan'	White Coneflower					
Geranium 'Rozanne'	Cranesbill					
Heuchera villosa	Hairy Alumroot			Autumn Bride		
Liriope spp.	Lilyturf		\checkmark	Big Blue, Silver Dragon, Variegata		
Nepeta racemosa	Low Catnip			Walker's Low		
Osmunda cinnamomea	Cinammon Fern					
Pachysandra procumbens	Alleghany Spurge		\checkmark			
Pachysandra terminalis	Japanese Spurge					
Parthenocissus quinquefolia	Virginia Creeper	\checkmark				
Penstemon digitalis 'Husker Red'	Beard Tongue					

SUSTAINABLE LANDSCAPE GUIDELINES

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Botanical Name Ommon Name Omega bit Street Tree Evergreen GROUNDCOVER PERENNIALS	
GROUNDCOVER PERENNIALS	
Phlox panicultata Tall Garden Phlox 🖌 🖌 David, Jeana, David's Lavendar	
Phlox stolonifera Creeping Phlox 🗸	
Polygonatum pubescens Solomon's Seal 🗸 🖌	
Rudbeckia fulgida Orange Coneflower 🗸	
Rudbeckia hirta Black Eyed Susan 🖌 🖌	
Thelypteris novoboracensis New York Fern 🖌	i

	PLANT LIST	S Lo	w Im	pact Traditional Plant List	
	Plant Name		ē	Notes and Cultivar Information	
Botanical Name	Common Name	Native	Adaptiv	Street Tree Evergreen	
		TREES			
Acer rubrum	Red Maple	✓			.
Cladrastis kentukea	Yellowood	✓			
Gymnocladus dioicus	Kentucky Coffeetree			male podless preferred	
Liquidambar styraciflua	Sweetgum	✓		Seedless-Rotundiloba, Cherokee	• •
Nyssa sylvatica	Black Tupelo			Red Rage, Forum	• •
Platanus occidentalis	Sycamore				
Quercus alba	White Oak				
Quercus bicolor	Swamp White Oak				
Quercus palustris	Pin Oak				e
Quercus phellos	Willow Oak				e
Quercus rubra	Red Oak				
Taxodium distichum	Baldcypress				
Thuja occidentalis	Arborivitae				A Contraction of the second se
Ulmus americana 'Liberty'	American Elm Disease Resistant				•
Ulmus parvifolia	Lacebark Elm			Allee, Dynasty	•
	FLOWERING	/ UNDEI	RSTO	RY TREES	
Amelanchier arborea	Downy Serviceberry			x grandiflora 'Autumn Brilliance'	
Amelanchier canadensis	Shadblow Serviceberry				
Carpinus caroliniana	American Hornbeam				
Cercis canadensis	Redbud				

			PLANT LISTS	Lo	w Im	pact Traditional Plant List	
1		Pla	nt Name		e	Notes and Cultivar Information	
	Botanical Name		Common Name	Native	Adaptiv	Street Tree Evergreen	
			FLOWERING /	UNDEF	RSTOR	Y TREES	
	Chionanthus virgini	Cus	VA Fringe Tree				
	Cornus florida		Dogwood			Cloud 9, Ozark Spring	
	Crataegus crus-gall	i 'Inermis'	Thornless Hawthorn				
	Magnolia grandifoli	ia	Southern Magnolia		 ✓ 		Å
	Ostrya virginiana		Eastern Hophornbeam				
	Parotia persica		Persian Parotia				
	Prunus serrulata 'Kw	vanzan'	Kwanzan Cherry		 ✓ 		
	Prunus subhirtella 'A	Autumnalis'	Autumn Blooming Higan Cherry		 ✓ 		
	Prunus x incamp 'O	kame'	Oakme Cherry				
	Prunus x yedoensis		Yoshino Cherry				
			S	HRUBS	5		
	Abelia grandiflora		Glossy Abelia		 Image: A start of the start of	Rose Creek, Edward Goucher	Å
	Aucuba japonica		Spotted Laurel		 Image: A start of the start of		<u></u>
	Buxus sempervirens	S	Vardar Valley Boxwood		\checkmark		<u></u>
	Camellia japonica		Japanese Camellia		 ✓ 		<u></u>
	Clethra alnifolia		Sweet Pepperbush				
	Fothergilla gardenii	i	Dwarf Fothergilla				
	Hydrangea quercifo	olia	Oakleaf Hydrangea			Pee Wee, Snowflake, Ruby Slippers, Sike's Dwarf	
	llex glabra		Inkberry				<u> </u>
	ltea virginica		Virginia Sweetspire			Little Henry, Henry's Garnet	

	PLANT LISTS	Lo	w Im	pact Traditional Plant List
Plan	Plant Name	Ť	é	Notes and Cultivar Information
Botanical Name	Common Name	Native	Adaptiv	Street Tree Evergreen
	S	HRUBS	5	
Mahonia aquifolium	Oregon Grape holly	 Image: A start of the start of		
Myrica cerifera	Southern Bayberry			
Osmanthus heterophyllus 'Gulftide'	Gulftide False Holly			
Potentilla fruticosa	Bush Cinquefoil			
Prunus laurocerasus	Cherry Laurel		 ✓ 	
Rhus aromatica 'Gro low'	Gro low Sumac			
Taxus baccata repandens	Repandends English Yew		 Image: A start of the start of	
Taxus cuspidata	Japanese Yew			
Vaccinium angustifolium	Lowbush blueberry			
Viburnum burkwoodii 'Conoy'	Conoy Viburnum		 ✓ 	
Virburnum nudum 'Winterthur'	Smooth Witherod	✓		
	GROUNDCO	VER P	EREN	NIALS
Amsonia hubrichtii	Arkansas Amsonia			
Aquilegia canadensis	Red Columbine	\checkmark		species and 'Little Lanterns'
Asarum canadense	Wild Ginger			
Carex pensylvanica	Pennsylvania Sedge	\checkmark		
Dennestaedtia punctilobula	Hay Scented Fern	\checkmark		
Dryopteris erythrosora	Autumn Fern		 ✓ 	Brilliance
Dryopteris marginalis	Eastern Woodfern			
Echinacea purpurea	Purple Coneflower			species and Magnus Star

		PLANT LISTS	Lo	w Im	pact Traditional Plant List
	Pla	ant Name		ė	Notes and Cultivar Information
	Botanical Name	Common Name	Native	Adaptiv	Street Tree Evergreen
		GROUNDCO	VER P	ERENI	NIALS
	Echinacea purpurea 'White Swan	White Coneflower			
	Eupatorium coelestinum	Hardy Ageratum	>		used with Asclepias assists in Monarch reproduction cycle
	Eupatorium perfoliatum	Boneset	~		
	Geranium maculatum	Wild Geranium	✓		great for early pollinators
	Geranium 'Rozanne'	Cranesbill	\checkmark		
	Heuchera villosa	Hairy Alumroot	✓		Autumn Bride
	Hibiscus moscheutos	Pink Rose Mallow	\checkmark		Anne Arundel
	Liriope spp.	Lilyturf		 Image: A start of the start of	Big Blue, Silver Dragon, Variegata
	Lobelia cardinalis	Cardinal Flower	\checkmark		
	Lobelia siphilitica	Great Blue Lobelia	\checkmark		
	Monarda fistulosa	Beebalm	\checkmark		
	Nepeta racemosa	Low Catnip		 Image: A start of the start of	Walker's Low
	Osmunda cinnamomea	Cinammon Fern	✓		
	Pachysandra procumbens	Alleghany Spurge	✓		A
	Pachysandra terminalis	Japanese Spurge		~	<u> </u>
	Parthenocissus quinquefolia	Virginia Creeper	\checkmark		
	Penstemon digitalis 'Husker Red'	Beard Tongue	\checkmark		
	Phlox panicultata	Tall Garden Phlox	\checkmark		David, Jeana, David's Lavender
	Phlox stolonifera	Creeping Phlox	\checkmark		
	Polygonatum pubescens	Solomon's Seal	\checkmark		

	PLANT LISTS			Low Impact Traditional Plant List			
	Plant Name			/e	Notes and Cultivar Information		
	Botanical Name	Common Name	Native	Adaptiv	Street Tree Evergreen		
	GROUNDCOVER PERENNIALS						
	Rudbeckia fulgida	Orange Coneflower	\checkmark				
	Rudbeckia hirta	Black Eyed Susan	✓				
	Sedum ternatum	Stonecrop	✓				
Ā	Thelypteris novoboracensis	New York Fern	\checkmark		<u> </u>		

GUIDELINES & RECOMMENDATIONS



4.0 TREES

Trees play a vital role in creating a regenerative campus landscape because they provide such a rich variety of ecosystem services. This chapter provides guidance on maintaining and enriching the tree canopy on Foggy Bottom campus. It also places the Guidelines for tree planting on campus in the context of GW's Ecosystem Enhancement Strategy as well as the District of Columbia's stated goal of reaching 40% tree canopy coverage.



SUSTAINABILITY AND TREES

Trees play a vital role in sustainability because they provide such a wide array of ecosystem services. In an urban setting like the Foggy Bottom Campus, tall trees with large crowns, called overstory or shade trees, provide the shade from the summer sun for buildings, sidewalks and natural spaces, which helps reduce the Urban Heat Island effect in the city. Smaller trees can flourish under shade trees as understory trees. Understory trees often produce flowers that add to the beauty and aesthetic interest of the campus. Both types of trees are necessary, as they filter air, improve water quality, sequester carbon, and provide wildlife habitat and corridors for wildlife movement.

Trees perform all of these functions for very low cost over their lifetime. However, they often go unnoticed even as they greatly contribute silently and steadfastly to the natural spaces around them. Trees can play an important role in the four GW Ecosystems Enhancement Strategy focus areas (addressed later in this chapter). For these reasons, trees and their preservation should be a primary goal of the Sustainable Landscapes Guidelines. This chapter provides guidance for the maintenance and enhancement of GW's tree canopy coverage in each of the strategic focus areas for campus development identified in Chapter 1.0. It provides recommendations for the continuing partnership with Casey Trees, and places the guidelines for campus tree planting on campus in the context of the GW Ecosystem Enhancement Strategy.



In their natural settings, both shade and flowering trees grow together, virtually doubling the ecosystem benefits in the same space.

MAINTENANCE

Guidelines for Daily and Seasonal Maintenance (see Chapter 3.0)

- Focus on maintaining existing trees, especially large shade trees.
- Minimize compaction via foot and vehicular traffic.
- Implement the most advantageous tree protection strategies during construction projects.
- Ensure an ISA certified arborist evaluates mature trees annually.
- Replace failing trees according to Tree Planting Program.

GW Campus Trees

Campus trees are those located on campus grounds owned and maintained by GW. These trees are predominantly understory or flowering trees and in the aggregate make up only 5% of the GW's total Tree Canopy Coverage (Figure 1). These trees are found in Zone 4 of the GW Streetscape Guidelines.

As urban trees, those on the street and campus face many challenges. They live in a minimal amount of soil, can suffer from soil compaction around their roots, and may have insufficient water during establishment or times of drought. The site analysis conducted by GW students for these Guidelines suggests that the overall health of the campus trees is good, due to proper maintenance and care.

GW has the potential to ensure the continued health of these trees. The first step is to develop an accurate inventory of street and campus trees and develop systems to monitor their status and health. The Additional Tree Care Actions later in this chapter present several opportunities to provide additional care through student engagement and strategic partnerships . Annual reviews by a consortium of stakeholders such as GW Grounds Management Team, Casey Trees and Office of Sustainability will evaluate tree-related programming and develop future programming to ensure the long term success of Foggy Bottom tree health.

GW Street Trees

In the District of Columbia, the District Department of Transportation (DDOT) has ownership over all "street" trees, defined as those located between the curb of a street and the sidewalk. These trees also correspond to Zone 2 in the GW Streetscape Guidelines. Street trees are regulated by the Urban Forestry Administration (UFA) in DDOT, which has a mission to "manage and increase the District's street trees, and to maintain healthy trees."¹

On the Foggy Bottom Campus, street trees are significant as they provide more than 50% of the campus's Tree Canopy Coverage (TCC) (Figure 1) and contribute to all the ecosystem services described later in this chapter. Although GW does not have direct responsibility over the maintenance of these trees, they should be monitored.

1. District Department of Transportation, "Urban Forestry Administration." Accessed at http://ddot.dc.gov/page/ddot-urban-forestry-administration-ufa.

Additionally, partnerships with the UFA and Casey Trees, a key external partner to the GW Ecosystem Enhancement Strategy, can lead to creative solutions to increase the health and survivability of its street trees furthering both the District's and GW's goal of increasing tree canopy coverage.

Block Key

Tree Canopy and Plantable Space Summary of George Washington University's Foggy Bottom Campus

Block	Canopy	Canopy not including street trees	Plantable space
1	40.9%	24.3%	0.0%
2	8.3%	6.0%	0.4%
3	4.3%	0.0%	5.1%
4	4.6%	2.1%	0.0%
5	6.7%	0.0%	1.7%
6	10.2%	2.4%	2.3%
7	9.6%	4.4%	0.0%
8	5.0%	0.0%	4.3%
9	11.6%	2.6%	4.2%
10	9.7%	4.9%	7.7%
11	19.6%	13.8%	10.2%
12	5.8%	0.5%	0.0%
13	7.8%	0.0%	0.0%
14	15.3%	10.5%	5.3%
15	10.6%	2.1%	2.0%
16	9.6%	6.8%	0.0%
17	14.4%	6.5%	0.0%
18	5.3%	0.8%	0.0%

Figure 1: Casey Trees' Tree Canopy and Plantable Space Summary

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Planting

TREE PLANTING

Guidelines for Daily and Seasonal Maintenance (see Chapter 5.0 and 6.0)

- Prioritize planting native trees.
- Prioritize planting shade trees over flowering trees in new construction or in replacement plantings to increase tree canopy coverage (see Tree Canopy Coverage Plan).
- Mimic natural systems with layered tree plantings by planting shade trees amongst existing flowering trees to increase biomass, ecosystem services and long term benefits for campus (see Tree Planting Program).
- Implement clear establishment practices for newly planted trees to include monitoring and using watering bags (Gator Bags) as needed to provide supplemental water.

In addition to maintenance, GW can contribute significantly to the overall Tree Canopy Coverage (TCC) through a robust Tree Canopy Coverage Plan (TCCP) for campus trees. Adopting a TCCP and a proactive and rigorous tree planting program will help GW achieve its own goal for a greener campus and contribute to the goals set by the District of Columbia.



Densely planted mixture of native shade trees and understory trees with native groundcovers at St. John's College

Tree Canopy Coverage Plan (TCCP)

As described in the GW Ecosystem Enhancement Strategy, GW's operations are part of the greater ecosystem in the District of Columbia. The Sustainable DC Plan recently instituted a goal of reaching 40% canopy coverage by 2032, addressing the decline in tree canopy coverage over the past 65 years. GW can participate in this action plan by increasing the TCC on its grounds to benefit its own community, the surrounding neighborhood and the city as a whole. There are incentives and grants to help individuals and institutions meet the District's TCC goal of 40% such as DDOE's RiverSmart Schools and RiverSmart Communities Tree Rebate programs.

A maintenance program for newly planted trees protects the school's expenditures; unlike architectural retrofits, as the trees grow they provide an increasing return on the investment. In the Casey Trees GW Landcover Analysis (Figure 2), the Foggy Bottom campus is situated in a highly urbanized core of the city and has only 12% TCC with 9% plantable space. Plantable space is defined as any space that is bare earth or grass, not including impervious surfaces. Maintaining large trees is critical since they are the largest contributors to the success of TCC, as evidenced by the Casey Trees Tree Canopy and Plantable Space Summary. For example, Square 39 (Block #1 in Figure 1) has one mature oak tree that provides 24.3% of the total 40.9% TCC of that block.

Based on Casey Trees' Landcover Analysis, we project that planting 22 shade trees on the Foggy Bottom campus would effectively increase our TCC by 1%¹.

The Guidelines advocate for increasing the Foggy Bottom Tree Canopy Cover by 1% per year until we have used all our plantable space. Alternatively, this goal can be achieved by planting shade trees elsewhere in the District of Columbia, such as the Mount Vernon Campus or local parks, as volunteer outreach to under-served communities.

¹Assuming 800sf of TCC per shade tree, 22 shade trees will cover 1% of the Foggy Bottom Campus. Since we have 9% plantable space, it would take 9 years to maximize our TCC.



Miles

Figure 2: Casey Trees' GW Landcover Analysis

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Planting

Tree Planting Program

Maintaining the existing trees is not enough, however. GW will need to conduct a Tree Planting Program that specifically increases the number of shade trees on campus.

GW Goal : Increase the Use of Shade Trees versus Flowering Trees

A Mid-Atlantic deciduous forest is primarily made up of shade trees such as Oak, Maples, Hickory, Tulip Poplar and Pines. These shade trees can reach between 40 feet and 120 feet high at maturity, with canopies that provide a corresponding amount of shade. Once established, a shade tree often naturally sheds its lower branches so that there is a clear line of sight underneath, a valuable feature in urban environments where personal safety is of great concern.

Flowering trees grow under larger shade trees in the forest, and also at the forest's edge. Mature flowering trees range between 18 feet and 40 feet high. Their canopies span from 10 to 50 feet wide depending on the species and cultivar. Most flowering tree species require pruning of the lower branches to improve sight lines and increase security. Of course, designers intentionally use small flowering trees to create a desired effect and place them in locations where security may not be an issue.

The Foggy Bottom campus features flowering trees such as crape myrtles and dogwoods throughout the campus that add beauty and seasonal color. These small trees do provide some ecosystem benefits, but shade trees, with their vastly larger canopy size, provide exponentially greater benefits.

Cost Benefit Analysis

The installation cost of both flowering trees and shade trees are roughly the same, but the shade tree provides three times the ecosystem services. Both types of trees need about the same amount of space to mature, usually take about the same amount of inputs to get established and need roughly the same amount of soil volume to become mature trees.

All species of trees have different life spans; generally speaking a shade tree can live 100+ years but a flowering tree can have one-third that life span unless specially cared for, like the cherry trees around the Tidal Basin. Though the recent DDOT Green Infrastructure Standards² indicate a small flowering tree requires 600 cubic feet of soil volume and a large tree requires 1500 cubic feet of soil volume, we recommend that the GW Tree Program implement larger soil volumes, 1000 cubic feet for small trees and 2000 cubic feet minimum for larger trees to insure the longer life of trees.

Where to Plant Trees

Field observations throughout the campus reveal many locations where shade trees can be planted. In Chapter 3.0 of these Guidelines, a "Trees" icon is used to identify locations on campus where trees can be inserted into the landscape fabric of the campus. They include spots for new and replacement tree plantings, such as:

- Open spaces for new tree planting. For example, the following locations have been identified as having appropriate soil volume and aerial space for shade trees. See Chapter 3.0 Squares 41,42,55,56,57,79,80,81,102,103,122.
- Replacement tree planting: typically a location where a small flowering tree or shade tree has declined or died and can replaced with a shade tree.

2. http://ddot.dc.gov/sites/default/files/dc/sites/ddot/publication/attachments/2014-0421-DDOT%20Green%20Infrastructure%20Standards.pdf

- Expanded tree box planting: an existing tree box needs to be modified to increase the available soil volume for the tree. This might mean increasing the planter area for the tree or removing existing paving and putting structural soils in place with paving above the soil.
- Layered shade / flowering tree planting: a location where an existing flowering tree is planted but a shade tree could be planted in conjunction with it to provide the overstory layer.
- By design: GW could commit to designing in appropriately sized tree spaces in all their new building and major renovations.

In addition, GW advancement efforts can contribute to the TCCP by:

- Implementing a Legacy Tree program to install native shade trees on campus.
 - -Name and sponsor existing mature trees. -Name, sponsor and plant new shade trees.
- Creating a Memorial Tree program for the campus to streamline the process currently in place as part of an overall tree planting process that could fund future trees.





Examples of potential tree planting locations on campus.

TREES

Recommended Trees

What Trees to Plant

The Guidelines offer master plant lists for the Grounds Management Team to use when planning for new or replacement plantings. Shade and understory trees are shown here. It is highly recommended that Capital Projects also use the tree lists when specifying trees adjacent to new buildings.

Plant Name			/e	Notes and Cultivar
Botanical Name	Common Name	Native	Native Adaptiv	Information
Acer rubrum	Red Maple	<		'Red Sunset'
Gleditisia triacanthos var. inermis	Thornless Honeylocust	<		
Liquidambar styraciflua	Sweetgum	<		'Rotundiloba'
Nyssa sylvatica	Black Tupelo	<		'Wildfire'
Platanus occidentalis	Sycamore	<		
Quercus bicolor	Swamp White Oak	<		
Quercus palustric	Pin Oak	<		
Quercus phellos	Willow Oak	>		
Ulmus americana 'Liberty'	American Elm Disease Resistant	✓		
Ulmus parvifolia	Lacebark Elm		\checkmark	'Allee'

Notes and Cultivar Information **Plant Name** FLOWERING /UNDERSTORY TREES Adaptive Evergreen Native **Botanical Name Common Name** Amelanchier canadensis Shadblow Serviceberry x grandiflora 'Autumn Brilliance' Amelanchier arborea Downy Serviceberry Asmina triloba Paw Paw Carpinus caroliniana American hornbeam \checkmark Cercis canadensis Redbud \checkmark Chionanthus virginicus Virginia Fringe Tree Cornus florida Dogwood **** Cornelian Cherry Cornus mas \checkmark \checkmark Crataegus crus-galli 'Inermis' Thornless Hawthorn \checkmark Magnolia virginiana Sweetbay Magnolia Magnolia grandifolia Southern Magnolia \checkmark Ostrya virginiana Eastern Hophornbeam \checkmark Parotia persica Persian Parotia \checkmark Prunus x incamp 'Okame' **Okame Cherry** \checkmark \checkmark Sassafras albidum Sassafras

TREES

Partnerships

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TREE PARTNERSHIPS: CASEY TREES AND STUDENT ENGAGEMENT

Additional Tree Care Actions

The Guidelines recommend a list of additional actions that can be performed on both street and campus trees. Many, if not all, of the actions represent a prime opportunity for student engagement. With Faculty and Grounds Management oversight, tree inventories, inspection of trees for soil compaction and health issues, and research can be conducted by undergraduate and graduate students as service or research projects. A prime candidate for a student capstone project that crosses many disciplines could be the creation of a tree alert system. Training students, staff, and faculty to use this system could serve as an ongoing service project during Arbor Day, for example. Financial support and expertise could come from Casey Trees or other foundations.



Action	Responsibility	Special Considerations	
Inventory all GW campus trees	Potential for student engagement to take the lead with GW Grounds Management for oversight	Coordination with Casey Trees for training	
Obtain an inventory of all street trees at Foggy Bottom	Potential for student engagement to take the lead with GW Grounds Management for oversight	Requires coordination with UFA/DDOT and Casey Trees	
Develop simple updating system for GW grounds man- agers to track the health of individual campus trees	Potential for student engagement with GW Grounds Management for oversight	In coordination with Casey Trees, using existing applications such as opentreemap	
Identify universal issues with campus trees that lead to decline in tree health	GW Grounds Management; some potential for stu- dent engagement	Coordination with Casey Trees for training	
Track condition on tree by tree basis, to be completed on an annual basis	Potential for student engagement to take the lead with GW Grounds Management for oversight	Coordination with Casey Trees database	
Ensure reliable water source for street trees when newly planted and during times of drought	GW Grounds Management identifies working water systems like hose bibs or other sources; coordinates for Gator bags if necessary	Requires coordination with UFA/DDOT and Casey Trees	
Ensure adequate soil volume and compaction for street trees	GW Planning, Development & Construction coordinates inspections and enforcement from UFA/ DDOT during new construction	All new buildings or developments to exceed District regulations for soil volume with use of structural soils, connected tree boxes' soils below paving.	
Create Tree Alert system available to students, staff, facilities to identify trees issues	Potential for Student Engagement with GW Grounds Management for oversight		
Research & implement mulching practices that promote good soil biology health	GW Grounds Management; some potential for stu- dent engagement		
Implement robust tree preservation practices that exceed District requirements	SL Guidelines GW Grounds Management Team enforces		

TREES AND THE ECOSYSTEM ENHANCEMENT STRATEGY (EES)

EES Goal #1 Strengthen habitat and optimize natural space

Provide Wildlife Habitat

When a native tree is planted, the entire food chain benefits. Native trees provide an abundance of wildlife habitat such as food, shelter, nesting and sometimes water. One white oak tree supports more than 534 butterfly and moth species, one birch tree supports 413 butterfly and moth species.³ More than 96% of terrestrial birds depend on insects as their food source and insects depend on native plants.

One example of this difference in wildlife hosting is a native vs nonnative dogwood. Nonnative Kousa dogwood supports zero insects versus native Florida dogwood that supports 117 moths and butterflies.⁴ There is evidence to suggest that new native plant installations in suburban settings have begun to reverse the decline in at-risk bird populations.

3. Douglas W. Tallamy, Bringing Nature Home (Portland: Timber Press, 2007), 147.

4. Douglas W. Tallamy, http://www.dgif.virginia.gov/habitat/butterfly-gar-den.asp

5. Sylvan Kaufmann, "George Washington University's Foggy Bottom Campus in a Regional Context" (Unpublished Paper, 2015.)

Maintain Wildlife Corridors

The Foggy Bottom campus lies at a very strategic point in the District of Columbia and Chesapeake Bay watershed. The campus is within ½ mile of Rock Creek Park, the Potomac River, the National Mall, and Theodore Roosevelt Island, and can be easily traversed by birds, bats, bees and other flying insects. Thus, native landscape plantings and enhanced natural spaces on campus can serve as part of a corridor through which these species can more easily cross than other inhospitable parts of the city landscape.⁵



EES Goal #2: Promote Healthy air and climate.

<u>Filter the Air</u>

Trees act as "living filters" by absorbing gaseous pollutants from the air through the leaf surface. ⁶ Research indicates trees can reduce street level particulate matter by 60%.⁷

Sequester Carbon

Trees act as a "carbon sink" because they are effective at removing carbon dioxide (CO_2) from the atmosphere,. They "sink" CO_2 , a greenhouse gas, by capturing it from the atmosphere and storing it as cellulose in their trunks, branches, leaves, and roots. A single tree, such as the black walnut at the Dance Studio Entrance on G Street, can store as much as 48 pounds of CO_2 every year.⁸

Minimize the Heat Island Effect

Temperatures under tree canopies are cooler than the surrounding area. Tree branches and leaves block up to 90% of the sunlight from hitting the surfaces below the tree canopy. A multi-month study measured maximum surface temperature reductions ranging from 20 to 45°F (11-25°C) for walls and roofs at two buildings.⁹

EES Goal #3: Foster clean and abundant water. Improve Water Quality

Trees mitigate the negative effects of stormwater runoff in numerous ways such as intercepting rainwater, reducing erosion, absorbing water and cooling stormwater. Trees absorb water through their roots and leaves and transform water into water vapor through a process called evapotranspiration. The evapotranspiration rate of trees varies dramatically based upon tree species, climatic and soil conditions. For example, a large oak tree can transpire 40,000 gallons of water a year ¹⁰ and a river birch can transpire 500 gallons a day during hot summer months. The relative cost to install and maintain a tree for stormwater management compared to the cost of building a Low Impact Development facility, such as a rain garden or pervious paving, is much lower. This clearly favors the installation of trees.

6. District of Columbia Draft Urban Tree Canopy Plan (2013).
International Society of Arboriculture, "Benefits of Trees," Tree Care Bulletin. (International Society of Arboriculture, 2004).
7. Dr. Kim D. Coder, "Identified Benefits of Community Trees and Forests" (University of Georgia Cooperative Extension Service Forest Resources Unit Publication FOR96-39, October, 1996).
8. Coder, "Benefits of Community Trees and Forests," (October, 1996).
9. Environmental Protection Agency, "Reducing Urban Heat Islands: Compendium of Strategies: Trees & Vegetation" Akbari, H., D. Kurn, S. Bretz, and J. Hanford. 1997. Peak power and cooling energy savings of shade trees. Energy and Buildings. 25:139-148.

EES Goal #6: Encourage a natural urban environment that helps enhance physical, mental and social well-being.

<u>Student Health</u>

As an educational institution, there is an additional incentive to plant more trees as research indicates there are benefits to health and well-being. Trees on an urban college campus improve quality of life and increase emotional health by creating enjoyable outdoor spaces, offering something natural to view from classroom and office windows and helping to provide a human scale in relationship to tall urban buildings. Research has indicated that students who walked in an arboretum or were in other ways exposed to trees performed 20% better on a cognitive assignment. Current research has shown that an additional ten trees on a block corresponds with 1% increase in "how healthy residents felt". ¹¹

 EPA report http://www.epa.gov/hiri/resources/pdf/TreesandVeg-Compendium.pdf
 http://www.newyorker.com/tech/elements/what-is-a-tree-worth Marc Berman Scientific Reports



SUSTAINABLE DESIGN OPPORTUNITIES

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Carefully chosen incremental landscape improvements can have wide repercussions for advancing a healthy and sustainable campus environment. This chapter provides ideas for projects that are easily undertaken within an annual operating budget, and that can increase learning, usage and enjoyment of the outdoor spaces on GW campus. Additionally, the chapter provides seeds of ideas for larger projects that can be adopted by student groups or classes, developed and submitted for competitions or grant funding.

HIME

GW GROUNDS MANAGEMENT TEAM

 Square 56: Funger Hall Frontage
 Square 56: Tompkins Hall Sidewalk and Grass
 Squares 58, 79, 80, 81, 103: Small Townhouse Front Gardens
 Square 77: Academic Center Park
 Square 79: Kogan Plaza at Gelman Library
 Square 79: G Street Park
 Square 103: Parking Lot Behind Support Building
 Square 122: Old Main Lawn The following concepts or opportunities can be conceived as incremental landscape improvements with wide repercussions for advancing a healthy and sustainable campus environment. The Grounds Management Team could undertake one or more concepts per year, within the operating budget; examples include re-using benches and other site furnishings on hand or propagating and dividing perennial plants. The concepts identified have the potential of increasing the usage and enjoyment of the outdoor spaces on campus while providing opportunities for community engagement and education about sustainable methods in site design.

1. FUNGER HALL FRONTAGE

Installing shade trees in street-level landscape beds along G street NW in front of Funger Hall will improve canopy coverage and scale along the building. Providing shade over the terrace creates a cool and inviting space along the façade of Funger Hall to wait for the University Shuttle.



- Creating a comfortable and cool place to wait for the shuttles
- Shading the south facing façade of Funger Hall
- Providing a new venue to enjoy the outdoors
 - Increasing potential gathering space on game days at the Smith Center
 - Providing new reasons to sit outside Funger/Duques Hall along 22nd and G
 Street

2. TOMPKINS HALL SIDEWALK AND GRASS

SQUARE 56

Even though this is a designated Development Site in the 2007 Foggy Bottom Campus Plan, existing pedestrian circulation could be greatly improved with wider sidewalks at this choke point. Replacing remnant grass with tough native plantings could help contain pedestrian flow on the sidewalks and reduce the unsightly appearance of highly compacted, bare earth.



Advantages: (in spite of this being a future development site)

- Improving pedestrian circulation on
- public sidewalk in a High-Impact zone
- Promoting safer pedestrian experience on public sidewalk, correcting trip and slip hazards
- Improving visual impact of university to public
- Enhancing health of street trees

3. SMALL TOWNHOUSE FRONT GARDENS SQUARES 58, 79, 80, 81, 103

Whether in front of traditional or contemporary buildings, the small entry gardens at many campus townhouses are used for sitting outside, sometimes with picnics and outdoor grills. Many of these spaces can be very simply enhanced by establishing a safe hard or porous surface for gathering, with a simple planted screen or very low hedge to create a sense of privacy and visual separation from the street.



- Providing students with visible gathering spaces where they can see and be seen
- Capturing a sense of the historic period of the house where appropriate
- Providing the potential for learning about architectural styles and corresponding landscapes
- Taking advantage of opportunities for stormwater capture and infiltration

SUSTAINABLE DESIGN GW Grounds Management Team

ACADEMIC CENTER PARK SQUARE 77

Since this is a Development Site, in the short term this space has the potential for much greater casual use by current students, faculty and staff at very minor expense. Introducing simple landscape elements could improve the user experience. Designating clear walkways with a curvilinear lawn and adding benches in social clusters to encourage daily use of the space would make this a popular spot to gather, eat, and just breathe.



The National Institute of Health campus uses simple materials & plantings to provides a restful place for employees and visitors.

- **Advantages** (in spite of being a future development site):
- Providing a much-needed hang-out space along the busy I-Street corridor
- Creating a more usable oasis of shade and nature among busy venues
- Providing an outdoor space for organized art exhibits, as well as casual leisure
- Transforming a neutral visual garden into an engaging, useful gathering space

OPPORTUNITIES FOR SPECIAL PROJECTS

4.

5. KOGAN PLAZA AT GELMAN LIBRARY SEE SQUARE 79 MAP

Since this plaza must continue to accommodate large tented gatherings and festivals, the wide-open paved surface at the base of the library steps must remain unimpeded. However, simple retrofits can be made to increase the soil volume in plaza tree planters, in order to capture stormwater sheet runoff and improve tree health.



- Demonstrating simple rainwater capture methods
- Enhancing growth and shading potential of the trees by improving their health and viability

6. **G STREET PARK** SQUARE 79

Until this space is developed, this small park has great potential for simple and temporary but high impact uses such as a GroW garden, a pollinator garden and an apiary habitat. These uses can coexist with and even improve the park facility for the events and tailgates that currently use the space. They would provide learning opportunities for both GW and School Without Walls students by offering volunteer and engagement options for the campus.

7. PARKING LOT BEHIND SUPPORT BUILDING SQUARE 103

With the understanding that this is a future development site, improving the already heavy student circulation through this space would make for a safer, cleaner pathway for current students. Installing 'Pop-up Venues' such as GroW garden squares, recreation or a temporary park, would add interest and life to this parking lot, in its new incarnation as a programmed event space.



Advantages:

- Enhancing the potential for more uses as gathering, exhibit, festival space
- Enhancing the potential for learning about nature, pollination, beekeeping, and more
- Engaging high school students in the life of the campus



Parking lot space at Union Market in DC features vegetable/he planters, a mobile drink stand, cornhole, and seating.

- Providing a venue for student-initiated,
- fun, temporary activities
- Turning a mostly utilitarian space into an interesting fun, art or productive place
- Providing a fun and attractive space for hosting university events
- Improving safety and functionality of a heavy circulation path

SUSTAINABLE DESIGN GW Grounds Management Team

8. OLD MAIN LAWN

Simple changes to the planting scheme in the Old Main front yard would improve the design and user experience for all its occupants. Reducing the lawn to a usable area for seating and lounging, placing benches in critical spots and surrounding the lawn with layered plantings in a period style would bring a sense of place and user comfort to this underused but substantial open space.



Barrett Library in Old Town Alexandria features multiple entry paths, seating area, and planting beds

Advantages:

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- Improving the gathering potential of the garden with usable and inviting design
- Enhancing the historic character of the building by providing a suitable and appropriate period garden for building occupants and students
- Providing an opportunity for learning about architecture and corresponding landscape history

FOR SPECIAL PROJECTS

GRANT AND PARTNERSHIP OPPORTUNITIES:

9. Sq. 40-41: I Street Mall
10. Sq. 41: Planters at Ross Hall
11. Sq. 43: Shenkman Hall Courtyard
12. Sq. 56: School of Business Corridor
13: Sq. 77-79: H St Between 21st and 22nd St
14. Sq. 77: Music Department Garden
15. Sq. 79: Planter Boxes at Old Library Entrance
16. Sq. 79: Kogan Plaza Stormwater
17. Sq. 79: Theater and Dance Courtyard
18. Sq. 80: Eroded Hillside at 21st and F St
29. Sq. 81: Anniversary Park
20. GroW Gardens
21. Street Planter Boxes

9. I STREET MALL

SQUARES 40 & 41

Redesign the Metro plaza between GW Hospital and Ross Hall to improve its stormwater management facilities, circulation, native plant palette and overall aesthetics. As these design ideas are implemented, there is great potential to showcase GW's commitment to sustainability and good design in a high visibility intersection with the larger urban community.

Potential Funding Partners: DC Water, Casey Trees, UFA, Foundations

The following opportunities suggest more intensive improvements with wide repercussions for advancing a healthy and sustainable environment on campus. These concepts require an infusion of effort and investment, and are more likely to be implemented using strategic partnerships, competitions and grant funding. The ideas identified have the potential of increasing usage and enjoyment of outdoor spaces on campus. They can also provide opportunities for student groups to initiate community engagement, to compete in competitions like the EPA's annual Campus RainWorks Challenge, or to develop strategies to attract private donors. Each concept is described with a short summary describing the advantages for its implementation. Students and groups are encouraged to take these ideas, research them, broaden their scope and impact, and create implementation plans to gain the best possible outcome for GW and its stakeholders.



entrance to Tanner Springs park in Portland, Oregon

ADVANTAGES:

- Demonstrating GW's commitment to sustainable design and outreach to its community
- Offering an amenity to all users of this busy space, GW students, faculty, staff, hospital users, metro users and pedestrians.
- Offering an even better venue for festivals, farmers' markets and outward- facing events.

SUSTAINABLE DESIGN Grants and Partnerships

10. PLANTERS AT ROSS HALL SQUARE 41

This street side landscape is made up of planting beds that are sloping downwards from street to building. While the plantings are attractive, there are secluded nooks in the building façade that provide shelter for undesirable public use. Several of these nooks can be treated as extensions of the planted areas and irrigated by rainwater. Existing drainage channels can be used to underdrain excess water away from the building.



Stormwater planters along K Street capture runoff and beautify the space between the sidewalk and building

Advantages:

- Reducing undesired uses of sheltered nooks in the façade of Ross Hall
- Demonstrating interesting use of rainwater
- Extending green space closer to building windows
- Demonstrating GW's commitment to sustainability as a core belief on our campus

DESIGN OPPORTUNITIES

11. SHENKMAN HALL COURTYARD SQUARE 43

The experience in this outdoor gathering and dining space can be improved by a more varied design. Suggested options might be increased plantings via the use of multi-layered planters, outdoor recreation equipment or dining furnishings and cooking appliances.



Monoux College, Walthamstow, UK

- Providing opportunities to be outdoors within the dorm environment
- Providing opportunities for gatherings, cook-outs and parties
- Shading a very uncomfortable paved urban space
12. SCHOOL OF BUSINESS CORRIDOR SQUARE 56

Improve the appearance and use at the corner of G and 22nd Streets by decreasing the extent of vast concrete entryways and terraces, adding planters, redesigning the adjacent landscape and site amenities, removing existing pavers and installing an urban meadow, very much like a green roof installation.

Potential Partners: candidate for EPA Campus RainWorks Challenge



The Belo Center for New Media at UT Austin captures and cleans water while creating wildlife habitat in an urban campus

Advantages:

- Creating a comfortable and cool place to wait for the shuttles
- Shading the south facing façade of Funger Hall
- Providing a new venue to enjoy the outdoors
- Increasing potential gathering space on game days at the Smith Center
- Providing new reasons to sit outside of Funger/Duques along 22nd and G Streets

13. H STREET BETWEEN 21ST & 22ND STREET SQUARES 77 & 79

Transform H Street into a Green Street. Working toward the goals of the 2007 Foggy Bottom Campus Plan, consider opportunities to make H Street more of an academic, pedestrian experience at the heart of campus. Wider crosswalks and changes in paving and plantings would prioritize people over vehicular traffic. Investigate strategies for managing food trucks, the potential for oneway or limited automobile circulation, or occasional street closings to favor Universitywide events and gatherings.



Streets transformed into pedestrian corridors provide event space and maintain emergency access at Columbia University.

Advantages:

- Demonstrating GW's commitment to recognizing H Street as the heart of a pedestrian campus
- Developing Streetscape Guidelines concept that the east-west streets are dedicated to campus uses in contrast to the north-south streets on campus
- Creating a safer campus for students and all visitors to our public venues
- Demonstrating GW's commitment to sustainability as a core belief on campus
 Potential partners: Casey Trees, DOEE, ASLA, EPA Campus RainWorks Challenge

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SUSTAINABLE DESIGN Grants and Partnerships

14. MUSIC DEPARTMENT GARDEN SQUARE 77

Redesign the sunken garden along the side of Phillips Hall to enhance user experience and strengthen the garden's relation to the music department.

Potential partners: Casey Trees, Arts and Humanities grants

15. PLANTER BOXES AT OLD LIBRARY ENTRANCE SQUARES 77 & 79

The old entrance to Gelman Library is now empty dead-end space at H Street. Transforming one or two of the stairways into built-up planters would alleviate the empty feeling. A consistent look on this side of the library would be created and the outdoor experience at the coffee shop would be enhanced. Existing stone walls could extend across the steps to the building face. Dogwood trees and under-plantings would be installed to match others in this series of planters.



Advantages:

- Seizing an opportunity to create an outdoor venue for the music department
- Protecting existing tree canopy and carving out a hidden contemplative oasis
- Using the space to the greater advantage of its community
- Demonstrating GW's commitment to sustainability as a core belief on our campus



Dogwoods would be planted to match existing planters

Advantages:

- Presenting a more unified look along H Street
- Disguising the old library entrance, and redirecting attention to Kogan Plaza entrance
- Taking advantage of existing structure to create a new rejuvenated look

Potential Partners: Casey Trees, private donors

16. KOGAN PLAZA STORMWATER SQUARE 79

As the preeminent gathering and festival space for GW's Foggy Bottom campus, Kogan Plaza can also play a central role in projecting the image of a healthy, sustainable campus that engages constituents in all aspects of sustainability. The plaza is an excellent site for creative thinking about stormwater mitigation and reuse. It can continue to be studied as an urban regenerative landscape and submitted for competitive Climate Change contests. **Potential Partners:** candidate for EPA's Campus Rain Works Challenge



Innovative stormwater treatment becomes an amenity on UPenn campus.

Advantages:

- Demonstrating GW's commitment to Sustainability as a core belief on our campus
- Advancing GW's commitment to being a leader in Sustainable DC's initiatives
- Providing a learning tool for the artful retention and reuse of stormwater

17. THEATER AND DANCE COURTYARD SQUARE 79

This is a little garden space on G Street NW, between the firehouse and the GW Deli. There is great potential for making this a charming treasure of a garden for the use of the academic programs that inhabit the buildings surrounding it.

Potential Partners: EPA competitions and grants



Advantages:

- Turning a little-used space into an amenity for program use, such as an outdoor classroom or performance space for the Theater and Dance studios.
- Demonstrating the reuse of stormwater
- Demonstrating the use of native and pollinator-attracting plants

SUSTAINABLE DESIGN Grants and Partnerships

18. ERODED HILLSIDE AT 21ST AND F STREET SOUARE 80

Develop an erosion control plan with specific plantings plan, and/or retaining wall.

Potential partners: Historic preservation grant

19. ANNIVERSARY PARK SOUARE 81

Already a popular venue for organized gatherings and cook-outs, this park could become a beloved gathering space at the southern edge of campus. This could be accomplished by creating a more comfortable atmosphere through hardscape and plantings; consider developing a layered forest planting all around the periphery and background of the park, and improving the hardscape area at the center to accommodate heavy usage. **Potential Partners:** Casey Trees, DOEE, EPA Campus RainWorks challenge candidate

Rendering of Sherman Street Plaza in Denver shows flexible seating, varied hardscape materials, and planting pockets

Advantages:

- Protecting old and venerable trees
- Protecting soil and preventing erosion
- Resolving a visual blight

Advantages:

- Vastly improving the park as a venue for university events, festivals and exhibits
- Providing a showcase for biodiversity, while accommodating big events, proving that the two can be compatible



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Increase number of GroW Gardens throughout the campus. GroW gardens can be dedicated community gardening spots like the successful garden managed by the Food Justice Alliance on H street. They can also be continued initiatives by the Grounds Management Team to add edible plants to campus spaces as annual ornamental plants, a very successful initiative so far.

Potential Partners: Founding Farmers, FarmFresh Markets, GW Food Justice Alliance

21. STREET TREE PLANTER BOXES WHERE NEEDED

In partnership with DC Water and DOEE, these are projects that upgrade our campus green infrastructure and advance the District of Columbia's goals for stormwater infiltration. Such projects will also help to maintain and increase the Urban Tree Canopy through enhanced street tree health. The projects would focus on enlarging street tree boxes and backfilling root zones with structural soils that can withstand intense foot traffic on the sidewalks.



Raised planters in Mandell Park in a Houston, TX neighborhood provide vegetable gardening space

Advantages:

- Turning a little-used space into an amenity for program use, such as an outdoor classroom
- Demonstrating the reuse of stormwater
- Demonstrating the use of edible plantings as pollinator-attracting plants

Selected Locations:

 Square 80 Plaza, Kogan Plaza, Mid-Campus Quad, G Street Park, Corner of 24th and H Street



Large street tree boxes in Portland, OR support tree health and a larger tree canopy

Advantages:

- Demonstrating GW's commitment to Sustainability as a core belief on our campus
- Advancing GW's commitment to be a good neighbor to the Foggy Bottom neighborhood
- Contributing to the greater Sustainability goals of the District of Columbia

Potential Partners: Casey Trees, DC Water, DOEE, others

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COMMUNITY INVOLVEMENT AND OUTREACH

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This chapter suggests a number of potential activities that foster engagement with the Foggy Bottom community. The activities can be adopted and adapted by staff, students or faculty for volunteering, community outreach or educational projects.

COMMUNITY ENGAGEMENT ACTIVITIES

- 1. Outreach to churches abutting GW property
- 2. Outreach to local fraternities and sororities within GW property
- 3. Develop Educational Programming for School Without Walls (SWW)
- 4. Broaden the scope of GW's GroW Gardens
- 5. Foggy Bottom Garden Club Partnership



1. Outreach to churches abutting GW property

Several places of worship are located in and around the GW campus. The Sustainable Grounds project team has noted that the landscape surrounding these buildings and abutting GW property are often poorly maintained, showing compacted, bare soil or ailing plantings. This is frequently a consequence of low maintenance budgets, and understandably low priority placed on garden maintenance.

GW can help by:

- Offering design services through courses in the Landscape Design program at CPS
- Providing volunteer GW students to install and maintain the new landscapes, through the Center for Civic Engagement and Public Service

2. Outreach to local fraternities and sororities within GW property

Several fraternity and sorority houses are located in and around the campus. Many of the houses belong to the Greek organizations and are not maintained by GW Grounds Management Team. In some instances, little to no upkeep is visible, and compacted bare ground, eroded slopes, and poor plantings are the result.

GW can help by:

- Developing a landscape design template that mirrors these Guidelines, featuring:
 - Low maintenance plantings
 - Low cost of installation
 - Meets social, functional and aesthetic goals of the organizations
- Implementing a Greek Landscape Outreach Program that would provide guidance and mentoring for fraternities and sororities, through the Center for Student Engagement.
 - Providing service credit for volunteer hours spent on improving the landscape surrounding Greek houses
 - Developing an on-going "Green Care" program for external spaces on or near campus.

3. Develop Educational Programming for School Without Walls (SWW)

There are great partnership and mentorship opportunities for GW students who wish to engage with high schoolers at the School Without Walls. These opportunities can enhance the close relationship that already exists between GW and the School Without Walls.

GW can help by:

- Developing and implementing student stewardship programs that satisfy community service requirements
- Offering work opportunities in the GW GroW Gardens, and volunteering at preferred environmental organizations such as Casey Trees and the Dumbarton Oaks Park Conservancy
- Environmental Stewardship on Campus
 - Curriculum Development for in-class education
 - Living Labs on Campus, using specific planting beds in Square 80 Plaza
 - Understand Sustainable Features on Campus
 - Office of Sustainability Summer Internship(s) focusing on Core Urban Environmental Issues

4. Broaden the scope of GW's GroW Gardens

Building on the success of GW's first community garden on H Street, programming can be developed that bridges Public Health issues with Biology, Plant Science, Nutrition and the Humanities.

GW can help by:

- Working with GroW Gardens leadership & Sustainable Landscapes Program to create new educational programs such as the following:
 - GW Community and community based educational workshops on food security and healthy living
 - GroWing Vegetables 101
 - Cooking with vegetables, healthy eating on campus



5. Foggy Bottom Garden Club Partnership

Investigate the potential to partner with a local Garden Club to engage the community in our efforts at creating a sustainable landscape. Neighbors that find a hospitable, dynamic and attractive landscape on campus will feel more secure and comfortable as they interact with GW.

GW can help by:

- Creating small scale seating areas for the enjoyment of students and neighbors
- Offering adopt-a-garden opportunities for maintenance of small gardens
- Providing student-led workshops for neighbors on topics like container gardening, food production, and nutrition.



APPENDICES

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A. Related Documents and Background Research B. Site Inventory Analysis C. Master Plant List

APPENDIX A

REFERENCE DOCUMENTS

These Guidelines build on the concepts set forth in related GW planning documents including:

- A Vision for the Future: the George Washington University Foggy Bottom Campus Plan 2006-2025, including a Historic Preservation Plan
- GW Ecosystems Enhancement Strategy: Fall 2012
- Streetscape Guidelines: Draft, August 2010

The Guidelines also emphasize compliance and encourage potential partnerships with municipal regulators and their published guidelines including:

 Greening DC Streets: A Guide to Green Infrastructure in the District of Columbia, District Department of Transportation, April 2014



A Vision for the Future, The George Washington University Foggy Bottom Campus Plan: 2006-2025,

HI CTORETWIST INCIDENT/CATTORY



Streetscape Guidelines: The George Washington University, Foggy Bottom Campus, Draft 2010



GW Ecosystem Enhancement Strategy, 2012



Greening DC Streets: A Guide to Green Infrastructure in the District of Columbia, 2014

The Guidelines reflect a strong ecological basis for the rejuvenation, growth and performance of our campus landscape. Analysis performed by Sylvan Kaufman, Ph.D. provides this basis as well as samples of Plant Collections Management Plans used by institutions and public gardens for the stewardship of their plants and arboreta.

The Guidelines present a separate focus on trees, where the urban tree canopy is presented as an ecological resource, identifying potential goals such as developing an arboretum, improving our street trees, making physical connections with the surrounding DC tree network. Sources include:

- The work and expertise of Casey Trees
- Trees USA

BENCHMARKING

The Guidelines team researched sustainable landscape practices as reported on other campuses around the US. This list of campuses included GW's Market Basket schools, schools with well-known sustainable programs and practices, additional schools acknowledged by AASHE (Association for the Advancement in Sustainability in Higher Education), and other schools referred to us or discovered during the research process. A comprehensive look at documentation available on their websites revealed that while all institutions on our list publicized their efforts towards sustainability, including the incorporation of generalized landscape practices, none addressed them in sufficient detail to guide the routine maintenance and renovation work that are the building blocks of a sustainable landscape practices include:

- American University
- Cornell University
- Duke University
- George Mason University
- Harvard University
- Northwestern University

- Oberlin College and Conservatory
- Princeton University
- Purdue University
- Seattle University
- Tufts University
- Tulane University



CASEY TREES - WASHINGTON, D.C.

Casey Trees is a non-profit organization working "to restore, enhance and protect the tree canopy of the nation's capital."



USE AND FUNCTION

High Impact Landscapes: Spaces and streetscapes that are highly visible, experience heavy use and often include neighborhood residents, commuters, the general public as well as university stakeholders. Spaces and streetscapes that experience heavy use are mainly traveled by students and faculty commuting between campus buildings. Both pedestrian safety and plant protection are important parameters in these spaces, demanding more intense maintenance to keep them at their peak.

Low Impact Landscapes: Spaces and streetscapes that experience normal urban use,like including peripheral squares with dorms and townhouses. These spaces should require a lower intensity of regular maintenance

BUILDING STYLE

Traditional: For the purpose of classifying the campus landscape into meaningful style categories, the Traditional definition used here will not necessarily follow GW's designation of campus buildings as Historic Landmarks, or the proposed Historic District identified in the campus Historic Preservation Plan. These Guidelines attempt to unify the treatment of garden areas in simple and



7.0

straightforward ways while respecting the historic or contemporary style of our buildings. Several traditional building styles exist on our campus, including:

Colonial Revival style: many dorms and academic halls were built in this style, dating back to the early 20th century. Examples include Madison, Lafayette and Strong Halls.

Romantic style: many townhouses and standalone houses were built in this style, which includes Italianate, Romanesque, Queen Anne and Second Empire building types built in the mid to late 19th century. Examples include the string of townhouses along 22nd Street opposite the Smith Center, and along G Street between 21st and 22nd streets.

Federal style: 3 houses in this style were identified on campus, the F Street House originally built in1849, Alumni House and the Lenthall Houses.

Contemporary: All other campus buildings that are non-historic, new or relatively new. This category includes buildings in the late Art-Deco style such as Lisner Auditorium and the Hall of Governments, which were built in the 1940s, some of the midcentury dorms, such as Munson and Onassis Halls, as well as all new construction on campus.



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		APPEN	DIX C	Mas	ter Plant	List			
Plar	nt Name	Chara	cteristics	Conc	ditions		e	Notes and Cultivar Information Street Tree	Evergreen
Botanical Name	Common Name	Height	Spread	Light	Moisture	Native	Adaptiv	AHigh Impact Contemporary Plant ListCHigh Impact Traditional Plant ListBLow Impact Contemporary Plant ListDLow Impact Traditional Plant List	
Acer rubrum	Red Maple	40-70'	30-50'	Ö.		~		'October Glory', 'Autumn Flame'	A C B D
Betula lenta	Sweet Birch	40-70'	40-60'	Ŵ		~			AB
Betula nigra	River Birch	40-70'	40-60'	<u>پې</u>		~			A B
Cladrastis kentukea	Yellowood	30-50'	40-55′	پ		~			A C B D
Gleditsia triacanthos var. inermis	Thornless Honeylocust	60-80'	60-80'	Ж		~			A B
Gymnocladus dioicus	Kentucky Coffeetree	60-80'	40-55'	Ж		~		male podless preferred	A C B D
llex opaca	American Holly	15-30′	10-20'	Ö.		~		'Jersey Princess,' 'Old Heavyberry'	C
Juniperus virginiana	Eastern Red Cedar	30-65'	8-25'	ب		~			A B

TREES

					Master	Plant Lis	t			
S	Plant	t Name	Charac	teristics	Cond	litions		e	Notes and Cultivar Information 👷 Street Tree 🔺 Evergreer	۱
TREE	Botanical Name	Common Name	Height	Spread	Light	Moisture	Native	Adaptiv	A High Impact Contemporary Plant List C High Impact Traditional Plant List B Low Impact Contemporary Plant List D Low Impact Traditional Plant List	
	Liquidambar styraciflua	Sweetgum	60-80′	40-60'	ب		~		Seedless-Rotundiloba, Cherokee	
	Nyssa sylvatica	Black Tupelo	30-50′	20-30'	<u>پې</u>		~		Red Rage, Forum	0
	Platanus occidentalis	Sycamore	75-100'	75-100'	ب		~			
	Quercus alba	White Oak	50-80′	50-80'	چ		~		ACB	
	Quercus bicolor	Swamp White Oak	50-60′	50-60'	پ		~			
	Quercus palustris	Pin Oak	50-70'	40-60	پ		~			
	Quercus phellos	Willow Oak	40-75′	25-50′	Ж		~			
	Quercus rubra	Red Oak	50-75'	50-75'	ش		~		ACB	

				Mas	ter Plant	List			
Plant	t Name	Charao	cteristics	Conc	litions		ve	Notes and Cultivar Information Street Tree 🛓 Evergreen	1
Botanical Name	Common Name	Height	Spread	Light	Moisture	Native	Adapti	A High Impact Contemporary Plant List C High Impact Traditional Plant List B Low Impact Contemporary Plant List D Low Impact Traditional Plant List	
Taxodium distichum	Bald Cypress	50-70′	20-45'	پ		~		B	
Thuja 'Green Giant'	Green Giant Arborvitae	40-60'	12-18'	Ö			~		
Thuja occidentalis	Arborivitae	20-40'	10-15′	Ö,		~		A B	
Ulmus americana 'Liberty'	American Elm Disease Resistant	60-80′	40-70'	ب		~			C
Ulmus parvifolia	Lacebark Elm	40-50"	25-40'	پ			~	'Allee', 'Dynasty'	

TREES

					Master	Plant Lis	t			
S	Plant	Name	Charao	cteristics	Conc	litions		e	Notes and Cultivar Information Street Tree	Evergreen
TREE	Botanical Name	Common Name	Height	Spread	Light	Moisture	Native	Adaptiv	A High Impact Contemporary Plant List C High Impact Traditional Plant List B Low Impact Contemporary Plant List D Low Impact Traditional Plant List	
TORY	Amelanchier arborea	Downy Serviceberry	15-25	15-25	<u>پَنْ</u>		~		x grandiflora 'Autumn Brilliance'	A C B D
IDERS	Amelanchier canadensis	Shadblow Serviceberry	15-25	15-25′	<u>پ</u>		~			A C B D
NU/DN	Asimina triloba	Paw Paw	15-30′	15-30′	<u>ڳ</u>		~			В
WERIN	Carpinus caroliniana	American Hornbeam	20-35"	20-35'	*		~			BD
FLO	Cercis canadensis	Redbud	25-30′	25-35'	پېزې		~		'Forest Pansy', 'Hearts of Gold'	A C B D
	Chionanthus virginicus	Virginia Fringe Tree	12-20′	12-20′	Ö		~			BD
	Cornus florida	Dogwood	15-30′	15-30′	ÖÖ		~		'Cloud 9', 'Ozark Spring'	A C B D
	Cornus mas	Cornelian Cherry	15-25'	15-20'	<u>ڳ</u>			~		В

				Mas	ter Plant	List		
Plant	t Name	Chara	cteristics	Conditions			je	Notes and Cultivar Information 👷 Street Tree 🛔 Evergreen
Botanical Name	Common Name	Height	Spread	Light	Moisture	Native	Adaptiv	A High Impact Contemporary Plant List C High Impact Traditional Plant List B Low Impact Contemporary Plant List D Low Impact Traditional Plant List
Crataegus crus-galli 'Inermis'	Thornless Hawthorn	20-30′	20-35′	Щ.		~		BD
Magnolia grandifolia	Southern Magnolia	60-80'	30-50'	پې پې		~		B D
Magnolia virginiana	Sweetbay Magnolia	10-35′	10-35′	ÖÖ		~		B
Ostrya virginiana	Eastern Hop Hornbeam	25-40′	20-30'	<u>يناني المناطقة</u>		~		BD
Parotia persica	Persian Parotia	20-40'	20-30'	Щ.			~	D
Prunus serrulata 'Kwanzan'	Kwanzan Cherry	25-30′	25-30'	Ö.			~	
Prunus subhirtella 'Autumnalis'	Autumn Blooming Higan Cherry	20-35'	15-30′	<u>پې</u>			~	
Prunus x incamp 'Okame'	'Okame' Cherry	15-20′	15-20′	پې پې			~	C

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FLOWERING/UNDERSTORY TREES

			Master	Plant Lis	t					
S	Plant	t Name	Charac	teristics	Conc	litions		e	Notes and Cultivar Information 🛖 Street Tree 🔺 Evergree	n
Ш	Botanical Name	Common Name	Height	Spread	Light	Moisture	ive.	aptiv	A High Impact Contemporary Plant List	
T R							Nat	Ada	B Low Impact Contemporary Plant List D Low Impact Traditional Plant List	
IORY	Prunus x yedoensis	Yoshino Cherry	30-40'	30-40'	Ö,			~		C D
NDEKS	Sassafras albidum	Sassafras	30-60	25-40′	<u>ڳ</u> پ		~		AB	

				Mas	ter Plant	List			
Plan	t Name	Chara	cteristics	Cond	ditions		(J)	Notes and Cultivar Information 🛖 Street Tree 🔒 Evergree	n
Botanical Name	Common Name	Height	Spread	Light	Moisture	Native	Adaptiv	A High Impact Contemporary Plant List C High Impact Traditional Plant List B Low Impact Contemporary Plant List D Low Impact Traditional Plant List	
Abelia x grandiflora	Glossy Abelia	3-6'	3-6'	Ö.			~	'Edward Goucher', 'Rose Creek', 'Prostrata'	C D
Aronia arbutifolia	Red Chokeberry	6-8'	3-4'	ÖÖ		~		'Brilliantissima'	
Aucuba japonica	Spotted Laurel	6-10'	5-9'				~		C D
Buxus sempervirens	Vardar Valley Boxwood	2-3'	4-5'	<u>ڳ</u>			~		C D
Camellia japonica	Japanese Camellia	7-12	5-10′	ب			~	'April Series'	C D
Ceoanothus americanus	New Jersey Tea	3-4'	3-5'	<u>پ</u>	~@~@	~		B	
Cephalanthus occidentalus 'Sugar Shack'	Dwarf Button Bush	3-4'	3-4'	<i>ي</i> بي ا		~		AB	
Clethra alnifolia	Sweet Pepperbush	3-8'	4-6'	^ي ال		~		'Hummingbird'	C

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SHRUBS

120 THE GEORGE WASHINGTON UNIVERSITY

					Master	Plant Lis	t			
S	Plan	t Name	Charao	cteristics	Conc	litions		e	Notes and Cultivar Information 👷 Street Tree 🔺 🕯	Evergreen
HRUB	Botanical Name	Common Name	Height	Spread	Light	Moisture	Native	Adaptiv	A High Impact Contemporary Plant List C High Impact Traditional Plant List B Low Impact Contemporary Plant List D Low Impact Traditional Plant List	
SI	Cornus sericea	Red Twig Dogwood	6-9'	7-10′	Ö.		~		'Arctic Fire'	AB
	Fothergilla gardenii	Dwarf Fothergilla	2-3'	2-4'	Ö		~			A C B D
	Hydrangea quercifolia	Oakleaf Hydrangea	6-8'	6-8'	<u>پې</u>		~		'Pee Wee', 'Snowflake', 'Ruby Slippers', 'Sike's Dwarf'	A C B D
	llex glabra	Inkberry	5-8′	5-8'	<u>نة بن</u>		~		'Densa', 'Compacta'	A C B D
	llex verticillata	Winterberry Holly	3-12′	3-12	<i></i>		~		'Red Sprite', 'Winter's Red', males to pollinate	A B
	ltea virginica	Virginia Sweetspire	3-5′	3-5'	Ö Ö		~		'Little Henry', 'Henry's Garnet'	A C B D
	Lindera benzoin	Spicebush	6-12′	6-12'	پې پې		~			В
	Mahonia aquifolium	Oregon Grape Holly	3-6'	2-5'	.		~			B D

				Mas	ter Plant	List			
Plant	t Name	Chara	cteristics	Conc	ditions		e	Notes and Cultivar Information Street Tree	Evergreen
Botanical Name	Common Name	Height	Spread	Light	Moisture	Native	Adaptiv	AHigh Impact Contemporary Plant ListCHigh Impact Traditional Plant ListBLow Impact Contemporary Plant ListDLow Impact Traditional Plant List	
Myrica cerifera	Southern Bayberry	15-25′	15-25'	Ö, Ö		~		'Don's Dwarf', 'Fairfax'	A C B D
Myrica pensylvanica	Northern Bayberry	5-10′	5-10'	ب		~			AB
Osmanthus heterophyllus 'Gulftide'	Gulftide False Holly	8-10′	7-9''	پې پې			~		C
Physocarpus opulifolius	Ninebark	5-8′	4-6'	ÖÖ		~			В
Potentilla fruticosa	Bush Cinquefoil	1-4'	2-4'	<u>پَنْ</u>		~		'Abbotswood' 'Coronation Triumph'	BD
Prunus laurocerasus	Cherry Laurel	3-4'	6-8'	Ö			~	'Otto Luyken'	C
Rhus aromatica 'Gro low'	Gro low Sumac	1.5-2′	6-8'	پې پې		~			A C B D
Rhus copallinum	Winged Sumac	7-15′	10-20'	Ö		~			AB

SHRUBS

					Master	Plant Lis	t		
S	Plant	Name	Charac	teristics	Cond	itions		Ð	Notes and Cultivar Information 👷 Street Tree 🛕 Evergreen
HRUB	Botanical Name	Common Name	Height	Spread	Light	Moisture	Native	Adaptiv	A High Impact Contemporary Plant List C High Impact Traditional Plant List B Low Impact Contemporary Plant List D Low Impact Traditional Plant List
SI	Taxus baccata repandens	Repandends English Yew	2-4'	12-15′	Ö,			~	
	Taxus cuspidata	Japanese Yew	10-40'	10-40'	ÖÖ			~	'Densa', 'Capitata'
	Vaccinium angustifolium	Lowbush blueberry	6"-2'	2-4'	Ö.	*@*@	~		multiple varities for best fruiting, acidic soil required
	Viburnum acerfolium	Mapleleaf viburnum	3-6'	10-20'	<u>ڳ</u>		~		В
	Viburnum burkwoodii 'Conoy'	Conoy Viburnum	4-5'	7-8′	پې چې			~	
	Viburnum dentatum 'Blue Muffin'	Dwarf Arrowwood	3-5'	3-4'	ÖÖ		✓		В
	Virburnum nudum 'Winterthur'	Smooth Witherod	5-12′	5-12'	<u>ڳ</u>	~~~~	~		A C B D
	Yucca filamentosa	Adam's Needle	4-8'	2-3'-	پ		✓		B

				Mas	iter Plant	List			
Plan	it Name	Chara	cteristics	Conc	ditions		e	Notes and Cultivar Information Street Tree	Evergreen
Botanical Name	Common Name	Height	Spread	Light	Moisture	Native	Adaptiv	A High Impact Contemporary Plant List High Impact Traditional Plant List B Low Impact Contemporary Plant List D Low Impact Traditional Plant List	
Amsonia hubrichtii	Arkansas Amsonia	2-3'	2-3'	<u>نة</u> ش		~			A C B D
Andropogon virginicus	Virginia Broomsedge	2-3'	1-2'	Ö	****	~		Salt tolerance	A B
Aquilegia canadensis	Red Columbine	2-3'	1-1.5′	پې پې		~			A C B D
Aruncus dioicus	Goat's Beard	4-6'	6'			~			A B
Asarum canadense	Wild Ginger	6-12″	12-18″			~		Prefers acid soils	A C B D
Asclepias incarnata	Swamp Milkweed	3-5′	2'	<u>بة</u>		~		Pollinator host and food source 'Ice Ballet'	A B
Asclepias syriaca	Milkweed	2-4'	1'	١		~		Pollinator host and food source	A B
Asclepias tuberosa	Butterfly Milkweed	18-24″	24"	٣		~		Pollinator host and food source	A B

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GROUND COVER/PERENNIALS

					Master	Plant Lis	t			
N	Plan	t Name	Charao	cteristics	Cond	litions		e U	Notes and Cultivar Information 👷 Street Tree	Evergreen
INIAL	Botanical Name	Common Name	Height	Spread	Light	Moisture	Native	Adaptiv	High Impact Contemporary Plant List Image: Contemporary Plant List Low Impact Contemporary Plant List Image: Contemporary Plant List	
PEREN	Aster laevis	Smooth Blue Aster	3-4''	12″	Ö, Ö		~		Syn. Symphyotrichum laeve 'Bluebird'	A B
VER/F	Aster novi-belgii	New York Aster	3-5'	3'	ب		~			AB
ID CO	Athyrium filix-femina	Lady Fern	1-3′	1-2.5′			~			AB
ROUN	Carex pensylvanica	Pennsylvania Sedge	6″-12″	6″-12″	<u>پة</u>		~		Semi-evergreen	A C B D
G	Chelone glabra	Turtlehead	2-3'	1.5-2.5′	<u>ش</u>		~		Rain garden/bioretention plant Host plant to endangered Baltimore Checkerspot	A B
	Dennestaedtia punctilobula	Hay Scented Fern	1.5-2′	2-3'	*		~			A C B D
	Deschampsia caespitosa vivipara	Tufted Hair Grass	2-3'	1-2'	ب		~			A B
	Dryopteris erythrosora	Autumn Fern	18-30″	12″			~		'Brilliance'	C D

7.0 APPENDICES

				Mas	ster Plant	List						
Plar	nt Name Characteristics		Cond	Conditions			Notes and Cultivar Information Street Tree	Evergreen				
Botanical Name	Common Name	Height	Spread	Light	Moisture	Native	Adaptiv	AHigh Impact Contemporary Plant ListCHigh Impact Traditional Plant ListBLow Impact Contemporary Plant ListDLow Impact Traditional Plant List				
Dryopteris marginalis	Eastern Woodfern	12-18″	12-18′			~			A C B D			
Echinacea purpurea	Purple Coneflower	2-3'	18"	<u>ڳ</u> پ		~		white flowering: 'White Swan' 'Magnus Star'	A C B D			
Eupatorium coelestinum	Hardy Ageratum	2-3'	12″	، الله الله		~		Used with Asclepias spp. assists in Monarch reproduction cycle	A B D			
Eupatorium dubium	Dwarf Joe Pye Weed	3-4'	12″	<u>بة</u>		~		'Little Joe'	A B			
Eupatorium hyssopifolium	Hyssop-leaf thor- oughwort	2-3'	12"	Ö 🄅		~			A B			
Eupatorium perfoliatum	Boneset	3-4'	2'	<u>نة ش</u>		~		Bio-retention/rain garden	A B D			
Geranium maculatum	Wild Geranium	1.5-2′	1-1.5′	<u> پې</u>		~		Great for early pollinators	A B D			
Geranium 'Rozanne'	Cranesbill	1-1.5′	1-2'	۲		~		Long flowering season	A C B D			

GROUND COVER/PERENNIALS

					Master	Plant Lis	t			
Ś	Plant	Name	Charac	teristics	Conc	litions		e	Notes and Cultivar Information 🛛 Street Tree	Evergreen
INIAL	Botanical Name	Common Name	Height	Spread	Light	Moisture	Native	Adaptiv	A High Impact Contemporary Plant List C High Impact Traditional Plant List B Low Impact Contemporary Plant List D Low Impact Traditional Plant List	
PEREN	Heuchera villosa	Hairy Alumroot	1.5-3″	1.5-2"	Ö, Ö		<		'Autumn Bride'	A C B D
VER/I	Hibiscus moscheutos	Pink Rose Mallow	3-7′	3-4'	ب		✓		Salt tolerant Bio-retention/rain garden	BD
ID CC	Liatris spicata	Spiked Blazing Star	2-4'	9-18″	چ		~		Bio-retention/rain garden	A B
ROUN	Liriope spp.	Lilyturf	9-18″	9-18″	<u>پ</u>			~	'Silver Dragon' 'Big Blue' erosion control	A C B D
G	Lobelia cardinalis	Cardinal Flower	2-4'	1-2'	<i>ت</i> پ		~		Bio-retention/rain garden Attracts hummingbirds	BD
	Lobelia siphilitica	Great Blue Lobelia	2-3'	1-1.5′	Ö 🔅		~		Bio-retention/rain garden	BD
	Monarda fistulosa	Beebalm	2-4'	2-3'	<u>ښ</u>	*@*A	~		Attracts pollinators	A B D
	Nepeta racemosa	Low Catnip	9-12″	1-1.5′	Ö.	*@*@		~	'Walker's Low'	C

				Mas	Master Plant List				
Plant	It Name Characteristics Common Name Height Spread		Conc		e	Notes and Cultivar Information Street Tree	Evergreen		
Botanical Name	Common Name	Height	Spread	Light	Moisture	Native	Adaptiv	AHigh Impact Contemporary Plant ListCHigh Impact Traditional Plant ListBLow Impact Contemporary Plant ListDLow Impact 	
Opuntia humifusa	Eastern Prickly Pear	6-12″	6-12″	Щ		~			A B
Osmunda cinnamomea	Cinammon Fern	2-3'	2-3'	**		~			A C B D
Pachysandra procumbens	Alleghany Spurge	6-12″	1-2'	**		~			A C B D
Pachysandra terminalis	Japanese Spurge	6-12″	1-1.5″	<u>پ</u>			~	Tolerates heavy shade	A C B D
Packera aurea	Golden Groundsel	6-30″	6-18″	Ö.		~		Bio-retention/rain garden Syn. Senecio aureus	A B
Panicum virgatum	Switchgrass	3-4'	3-4'	ÖÖ		~		'Shenandoah', 'Heavy Metal' Bio-retention/rain garden	A B
Parthenocissus quinquefolia	Virginia Creeper	30-50′	5-10′	پې		~		Vine can be used as groundcover, erosion control	A C B D
Penstemon digitalis 'Husker Red'	Beard Tongue	24-30"	12-18″	پې چې		~		Salt tolerant Attractive to pollinators	A C B D

GROUND COVER/PERENNIALS

					Master	Plant Lis	t			
S	Plant	Name	Charac	teristics	Cond	litions		e	Notes and Cultivar Information 👷 Street Tree	Evergreen
INIAL	Botanical Name	Common Name	Height	Spread	Light	Moisture	Native	Adaptiv	AHigh Impact Contemporary Plant ListCHigh Impact Traditional Plant ListBLow Impact Contemporary Plant ListDLow Impact Traditional Plant List	
PEREN	Phlox paniculata	Tall Garden Phlox	2-4'	2-3'	Ö,		~		'David,' 'Jeana,' 'David's Lavendar'	A C B D
VER/F	Phlox stolonifera	Creeping Phlox	6-12″	9-18″	ÖÖ		~			C B D
D	Polygonatum pubescens	Hairy Solomon's Seal	1-3'	1′			~			A C B D
ROUN	Pycnanthemum muticum	Mountain Mint	1-3'	1-3′	Ö, Ö		~			A B
G	Rudbeckia fulgida	Orange coneflower	2-3'	2-2.5′	Ö		~		Bio-retention/rain garden 'Goldsturm', 'Little Suzy'	A C B D
	Rudbeckia hirta	Black Eyed Susan	1-2.5′	1.5-2′	Ö		~		'Prairie Sun'	A C B D
	Schizachyrium scoparium	Little bluestem	2-4'	1.5-2′	پ		~		Bio-retention/rain garden	В
	Sedum ternatum	Stonecrop	3-6″	6-8"	Ö.		~			A C B D

7.0 APPENDICES

				Mas	ter Plant	List			
Plan	t Name	Charac	teristics	Conc	litions		é	Notes and Cultivar Information 👷 Street Tree	Evergreen
Botanical Name	Common Name	Height	Spread	Light	Moisture	Native	Adaptiv	A High Impact Contemporary Plant List C High Impact Traditional Plant List B Low Impact Contemporary Plant List D Low Impact Traditional Plant List	
Solidago rugosa	Goldenrod	3-4'	2-3'	Ö.		~		'Fireworks', 'Little Lemon'	A B
Sporobolus heterolepis	Prarie Dropseed	2-3'	2-3'	پ		~			AB
Thelypteris novoboracensis	New York Fern	1-2′	6"	، الله		~			A C B D
Tradescantia ohiensis	Spiderwort	24-36"	12-18″	Ö 🔅	B	~		'Sweet Kate', 'Concord Grape'	AB
Vernonia lettermannii	Iron Weed	30-36"	3-36"	پ		~		'Iron Butterfly'	В
Vernonia	New York Ironweed	4-6'	3-4'	١. Ü		✓		Bio-retention/rain garden	
noveboracerisis									В

GROUND COVER/PERENNIALS

					Master	Plant Lis	t				
S	Plan	t Name	Charac	cteristics	Conc	litions		e	Notes and Cultivar Information	Street Tree	Evergreen
TREE	Botanical Name	Common Name	Height	Spread	Light	Moisture	Native	Adaptiv	High Impact Contemporary Landscape Low Impact Contemporary Landscape	High Impact Traditional Landsca Low Impact Traditional Landsca	ape
	Acer rubrum	Red Maple	40-70'	30-50'	Ö,		✓				•
	Betula lenta	Sweet Birch	40-70'	40-60'	پ		~				
	Betula nigra	River Birch	40-70'	40-60'	ÖÖ		~				
	Cladrastis kentukea	Yellowood	30-50'	40-55'	Ö		~				
	Gleditisia triacanthos var. inermis	Thornless Honeylocust	60-80'	60-80'	ب		~				•
	Gymnocladus dioica	Kentucky Coffeetree	60-80'	40-55'	ب		✓		male podless preferred		
	llex ораса	American Holly	15-30′	10-20′	Ö,		~				
	Juniperus virginiana	Eastern Red Cedar	30-65'	8-25'	Ж		~				

APPENDIX D Soil Notes

SOIL NOTES

APPENDICES

Soil is integral to our living landscape as it is a vital component of the infrastructure that supports biodiversity in our natural world. Complex interactions among various microorganisms and tiny insects, worms and other small animals that live in the soil create a dynamic environment that supports plant and animal life and affects larger systems that stabilize our climate. In urban settings like the GW campus, soil degradation occurs relentlessly as daily foot traffic, erosion, de-icing chemicals, and neglect cause compaction and deplete the internal air, moisture and nutrients that are imperative for balanced, healthy soil.

For all ongoing and new landscape projects on campus, provide a soil regeneration plan that addresses the physical structure and nutrient needs of the soil as well as options to prevent further soil deterioration. Specifications for planting bed soil remediation, soil for new planting areas and ongoing maintenance are found in *LATIS Planting Soil for Landscape Architectural Projects* by the American Society of Landscape Architects, 2013 pages 34-53.

Please refer to GW Design Standards, Design Standards Supporting Documents, GW Reference Standards, for LATIS specifications information.

IMAGE CREDITS

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Nyssa sylvatica: Wasowski, Sally and Andy, Lady Bird Johnson Wildflower Center

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Cornus florida: Makin, Julie. Lady Bird Johnson Wildflower Center

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