

GREENING DC STREETS



Greening DC Streets

A Guide to Green Infrastructure in the District of Columbia



April • 2014



District Department of Transportation





Dear Neighbor,

Tree-lined streets and wide, open public spaces make the District of Columbia a great and green place to live, work and visit. The L'Enfant Plan—the original urban plan for the District that was developed by Pierre Charles L'Enfant in 1791—included wide city streets lined with trees as part of the capital city's design. This tradition was expanded in 1870 when the District designated the public space between the sidewalk and property line as green space and included it as part of the city's park system. To build on this legacy of using streets to define the city's green and park-like character, the District Department of Transportation (DDOT) presents "Greening DC Streets," a guide to green infrastructure in the District.



Over time, pavement on streets has contributed to excess stormwater runoff and increased levels of pollutants in the city's waterways. Green infrastructure reduces stormwater runoff and improves water quality. On city streets, we can install bioretention areas, rain gardens, permeable pavements, landscaping and plant trees to increase the city's green infrastructure.

Green infrastructure, unlike traditional "gray" infrastructure approaches to stormwater management, provides multiple benefits to communities. Planting more trees and landscaping in public spaces cleans the air, cools the city, provides more habitat for wildlife, adds green maintenance jobs, increases property values and leads to a better, healthier quality of life for District residents and visitors.

The District is striving to be the healthiest, greenest and most livable city in the nation and has established the Sustainable DC Plan to achieve greening goals. The District's public space is a valuable asset that makes up approximately 26 percent of the city's land area. By working together with residents and property owners, we intend to install green infrastructure on all streets to support the Sustainable DC Plan.

This guide to "Greening DC Streets" is to be used along with DDOT's Green Infrastructure Standards for the District's public right-of-way. These green infrastructure measures, when implemented, will ensure the District remains a green city for many years to come.

Terry Bellamy
Director

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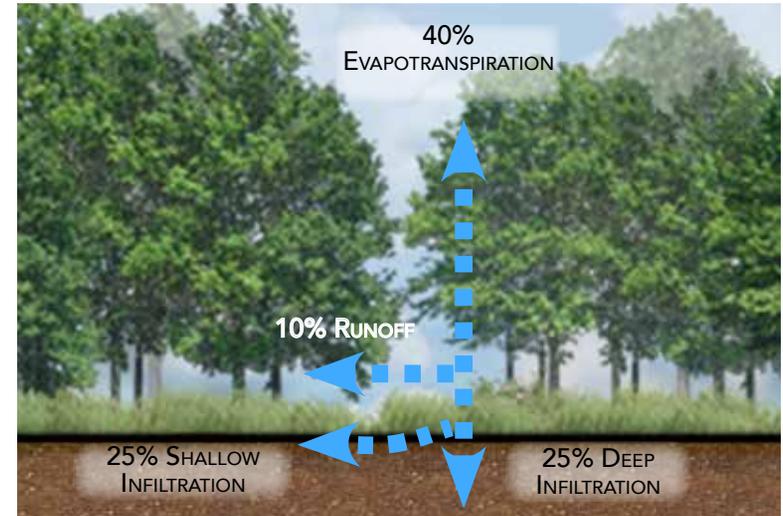
CHAPTER 1

Introduction to Green Infrastructure & Low Impact Development

1.1 THE NATURAL AND URBAN ENVIRONMENT

NATURAL AREAS

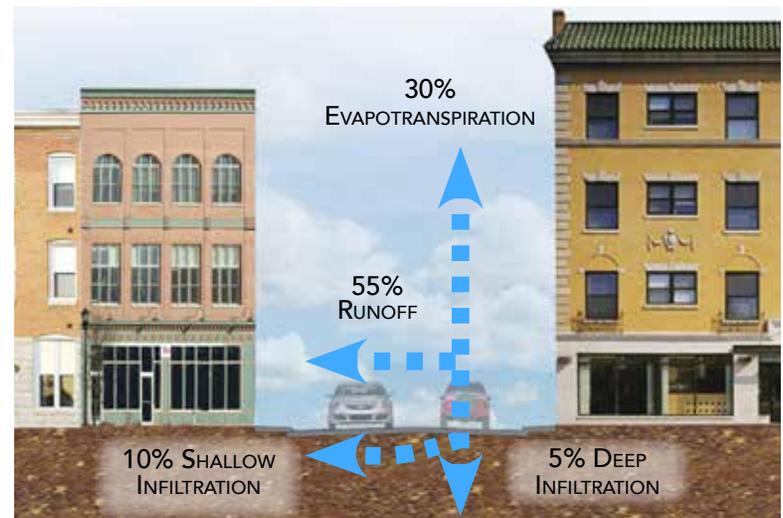
In areas such as meadows, forests, and parks, rain can soak into the ground and be used by plants. Natural areas are cooler and provide wildlife habitat. Very little rainwater runs off the ground.



Natural Area Diagram

URBAN AREAS

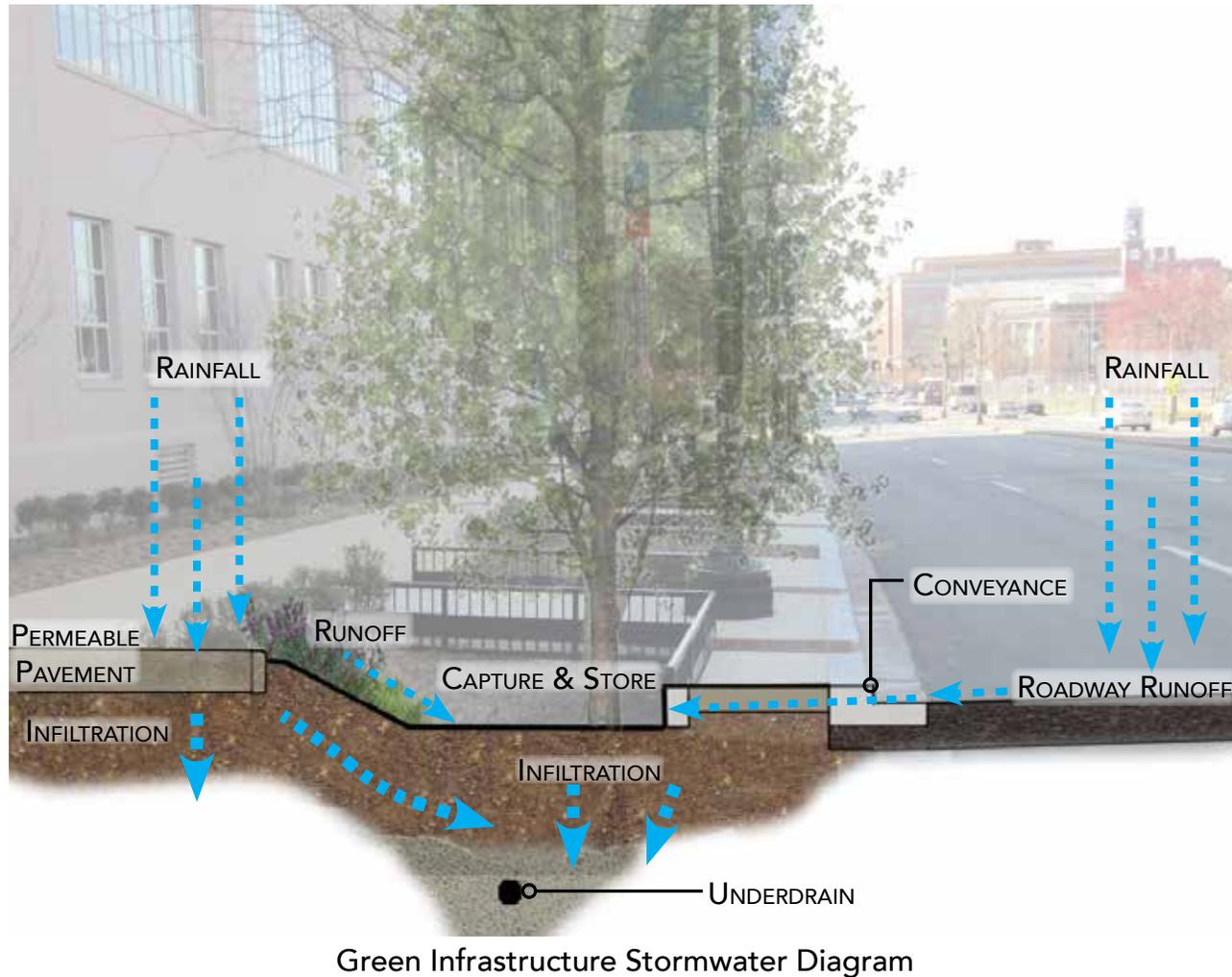
In urban areas, building rooftops, streets, alleys, sidewalks, and other paved surfaces are mostly impervious. Very little rain has a chance to soak into the ground. These paved urban areas are hotter and offer very little wildlife habitat. Most of the rain that falls in the urban areas runs off impervious surfaces as stormwater runoff into storm drains.



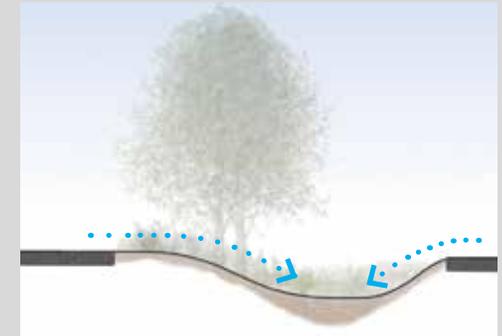
Urban Area Diagram

1.2 GREENING THE STREETS

Green Infrastructure (GI) is the living network that connects landscape areas, natural areas, and waterways. In urban areas, GI captures rainfall; cools buildings and pavement; and creates natural pathways for wildlife. GI includes Low Impact Development (LID) techniques, which mimic nature to capture and treat stormwater as close to the source as possible. GI practices for streets include bioretention (also called rain gardens), street trees, landscape areas, permeable pavement, and removing unnecessary paving. When implemented, GI creates living green streets that capture, store, and infiltrate stormwater to treat it as a resource and improve the urban environment.

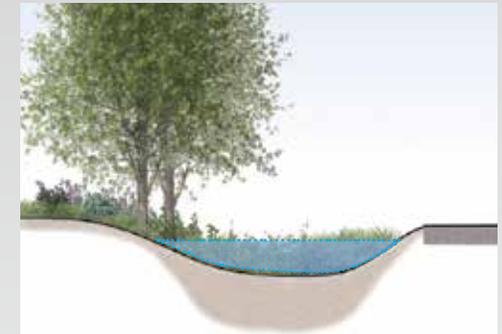


STORMWATER CAPTURE



Runoff from impervious surfacing

STORE



Stores and retains captured runoff

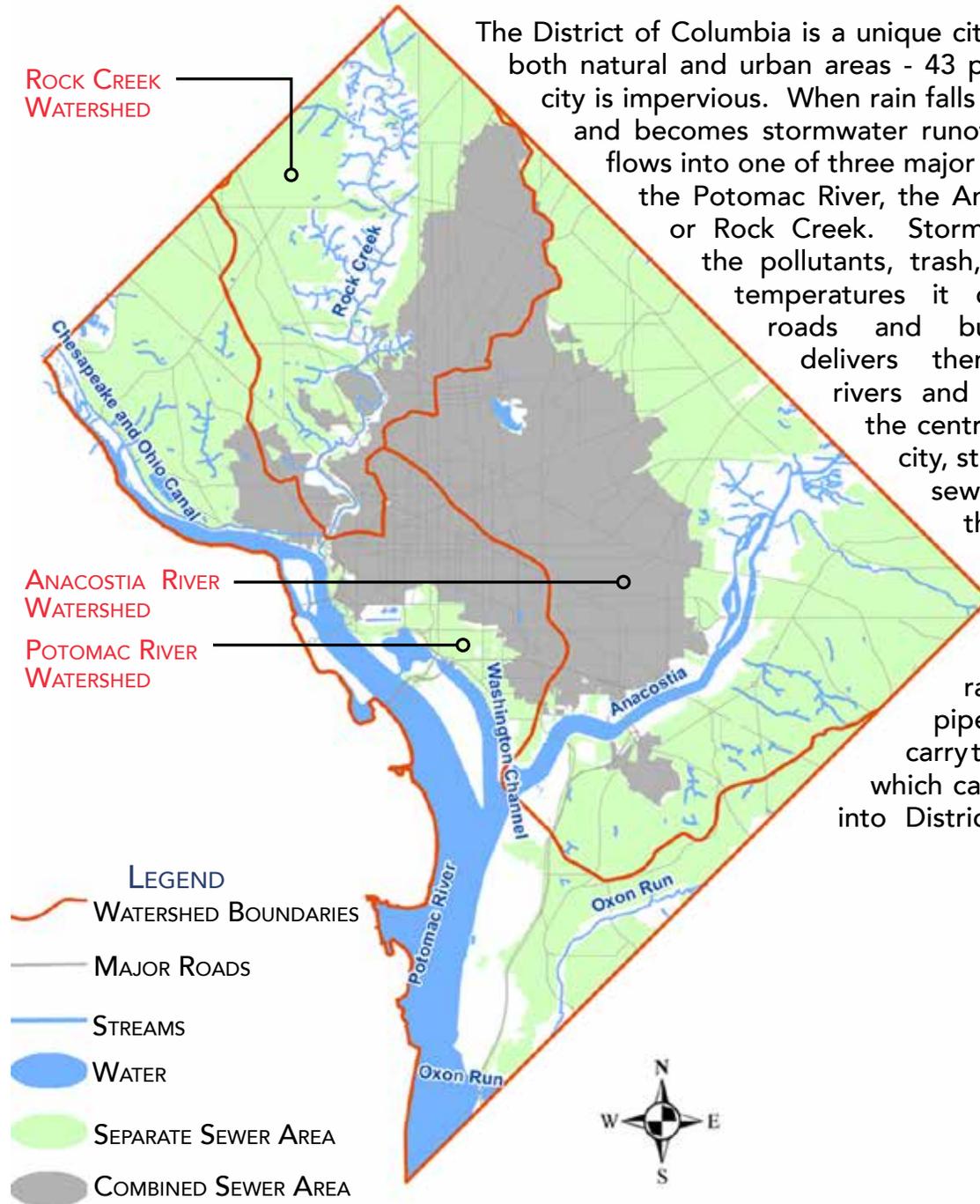
INFILTRATE



Water will infiltrate into the soils or be drained.



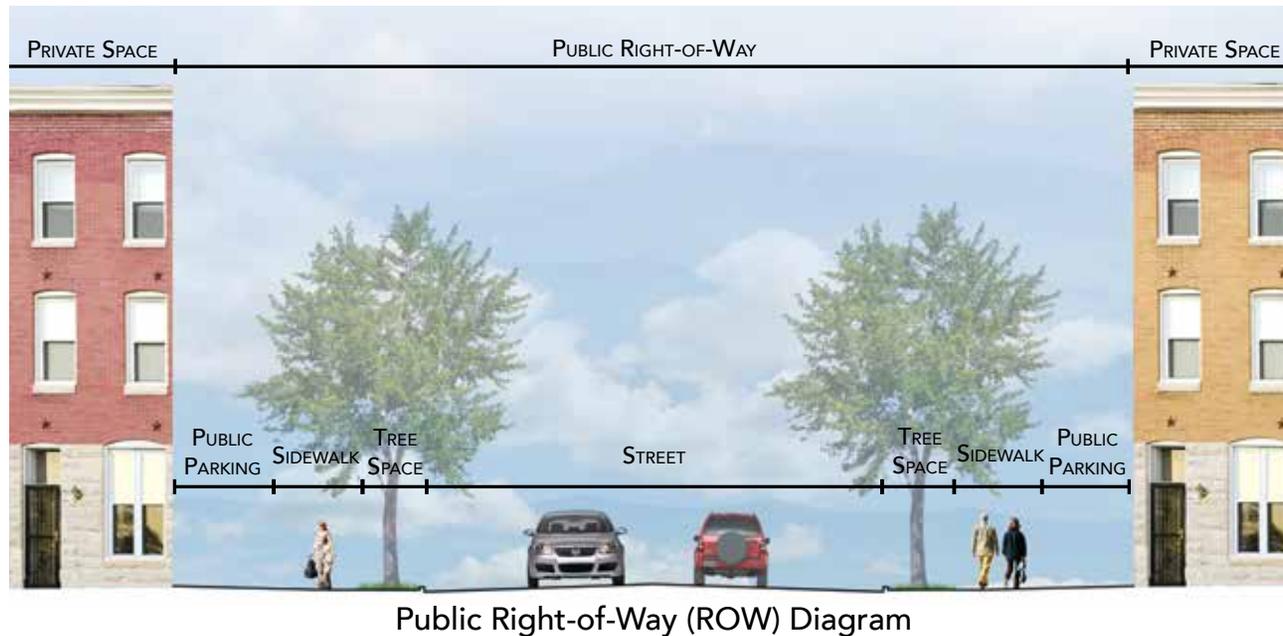
1.3 THE DC ENVIRONMENT



The District of Columbia is a unique city made up of both natural and urban areas - 43 percent of the city is impervious. When rain falls in the District and becomes stormwater runoff, much of it flows into one of three major water bodies: the Potomac River, the Anacostia River, or Rock Creek. Stormwater carries the pollutants, trash, and warmer temperatures it collects from roads and buildings and delivers them into our rivers and streams. In the central core of the city, stormwater and sewage flow into the same pipes, called the combined sewer. In heavy rainfall, the pipes cannot carry the extra water which causes overflow into District waterways.

1.4 DC PUBLIC SPACE

Stormwater runoff in the District is regulated by the Municipal Separated Storm Sewer Permit (MS-4) issued by the Environmental Protection Agency (EPA) and the Long-Term Control Plan (LTCP) for controlling combined sewer overflows (CSO). In 2013, the District published revisions to the Stormwater Management Regulations as required by the MS-4 permit. The regulations require retention of stormwater volume on site for major construction projects, including the public right-of-way (ROW)



The public ROW comprises 26 percent of the total land area in the District. This land area presents a significant opportunity to reduce runoff and improve the urban environment through green streets. This manual introduces techniques to install green infrastructure in the street, parking lane, tree space, sidewalk, and public parking. This guide and the "Green Infrastructure Design Standards," supplements to DDOT Standard Drawings, Specifications, and Design Manual should be used for all public and private project designs in the ROW.





CHAPTER 2 Tools for Greening the Street

2.1 INTRODUCTION

Green Infrastructure (GI) and Low Impact Development (LID) solutions are designed to be sustainable, attractive, and cost effective. The range of urban opportunities includes rain gardens, natural landscaping, street trees, curb extensions, permeable pavements, and green roofs. These strategies use natural processes to reduce development impacts. This chapter will focus on three areas appropriate for use in the public space.

PERMEABLE PAVEMENT

Permeable paving systems provide a hard surface, while allowing water to flow through to the underlying soils instead of into the storm sewer. It is a LID technique in which the space used for the practice can also be used for sidewalks, roads, and parking spaces.

BIORETENTION

Bioretention uses the natural functions of plants and soils to remove pollutants from stormwater runoff. The strategy uses storage, sediment capture, and biological processes to clean the water. These mimic processes that occur in nature before water reaches waterways.

TREE SPACE

Trees are a powerful green infrastructure tool due to their ability to capture water on leaves, direct it to the ground on stems, absorb it through root systems, and transpire it as water vapor directly back into the atmosphere.

COMMON DESIGN ISSUES

Design challenges that are considered in all green infrastructure projects include soil infiltration, planting design, pedestrian safety, existing slope, and utilities. These issues are highlighted on the following pages.

2.2 TYPES OF PERMEABLE PAVEMENT

WHAT IS PERMEABLE PAVEMENT?

Permeable pavement is an engineered top layer and base layer that allows water to move through it. The goal is to take rainwater as it falls and quickly move it to the lower layers of the system. Stormwater is stored in an underlying stone layer until it infiltrates into the soil below, aiding in groundwater recharge, or releases slowly to the storm sewer system. Pollutants are filtered through the pavement and base layers.



PERMEABLE UNIT PAVERS

Unlike traditional pavers, there are gaps between each paver to allow water to flow between the pavers and into the base layer.



PERVIOUS CONCRETE

Sands and "fines" are reduced in the concrete mix to allow water to flow through the pavement into a stone bed and eventually the ground. It maintains the durability of standard concrete.



POROUS ASPHALT

Porous asphalt is very similar to traditional asphalt except the sand or "fines" are reduced from the mix so water can move through the pavement.



POROUS RUBBER

Made from recycled rubber and small stones, porous rubber works like pervious concrete, but can be installed over tree roots.



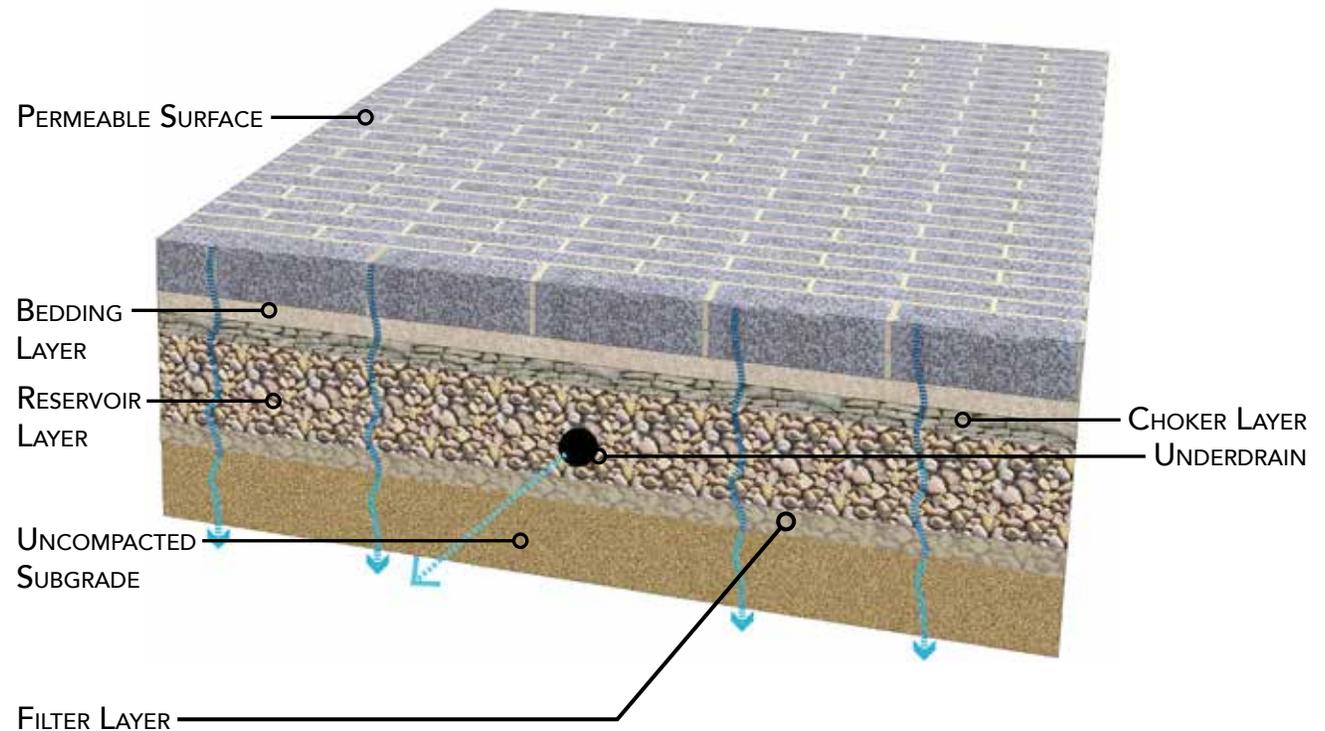
PUTTING IT TOGETHER

- **Permeable Surface:** Permeable unit pavers, porous rubber, porous asphalt, or pervious concrete.
- **Bedding Layer:** Used for pavers so they can be laid flat.
- **Choker Layer:** A medium size stone to store water and transition between the bedding and reservoir layers.
- **Reservoir Layer:** Stone to hold excess water until it infiltrates.
- **Underdrain:** Conveys excess water into sewer system when the reservoir fills.
- **Filter Layer:** A layer of stone to separate the reservoir layer from the soil below.
- **Uncompacted Subgrade:** Existing soil where stormwater infiltrates.

COMMON DESIGN ISSUES

Soil Infiltration & Drainage: The District has a large variety of soil types. Soil infiltration testing must be done to determine how fast water will soak into the existing subgrade. If water cannot infiltrate within 72 hours for bioretention and 48 hours for permeable pavement, an underdrain is connected to a storm or combined sewer.

PERMEABLE PAVEMENT - WHAT'S UNDERNEATH?



2.3 TYPES OF BIORETENTION

WHAT IS BIORETENTION?

Bioretention is a landscape system that filters pollutants and sediment from runoff. The layers of plant material, mulch, planting media (a mix of soil, sand, and compost), and stone capture metals, nutrients, and bacteria that flow into the surrounding rivers. The rainwater is held in the planting bed until it infiltrates into the ground or evaporates. The entire system can fit into small spaces, making it adaptable to curb extensions, tree spaces along the road, medians, terraced slopes, and planter boxes.



BIORETENTION PLANTER ADJACENT TO ROADWAY

Runoff follows the existing curb line and enters the LID facility through curb cuts. Excess runoff exits through the same curb cuts or into drains located in the planting area.



BIORETENTION IN OPEN AREA

Runoff drains into the bioretention planting from the surrounding area (sidewalks, roadways, or grass). The size and shape can fit the available space.



CURB EXTENSION

Runoff follows the existing curb line and enters the LID facility directly. Excess runoff flows through the system to an outlet or overflow drain into another facility downstream.



BIOSWALE

Runoff flows directly into a bioswale which is located adjacent to the street. A bioswale will follow the slope of the street and may have check dams to make the grade step down.



WHERE TO USE?

- Street with no adjacent on-street parking.
- Where street trees are needed.
- Street where bike lane is adjacent to curb.

LIMITATIONS

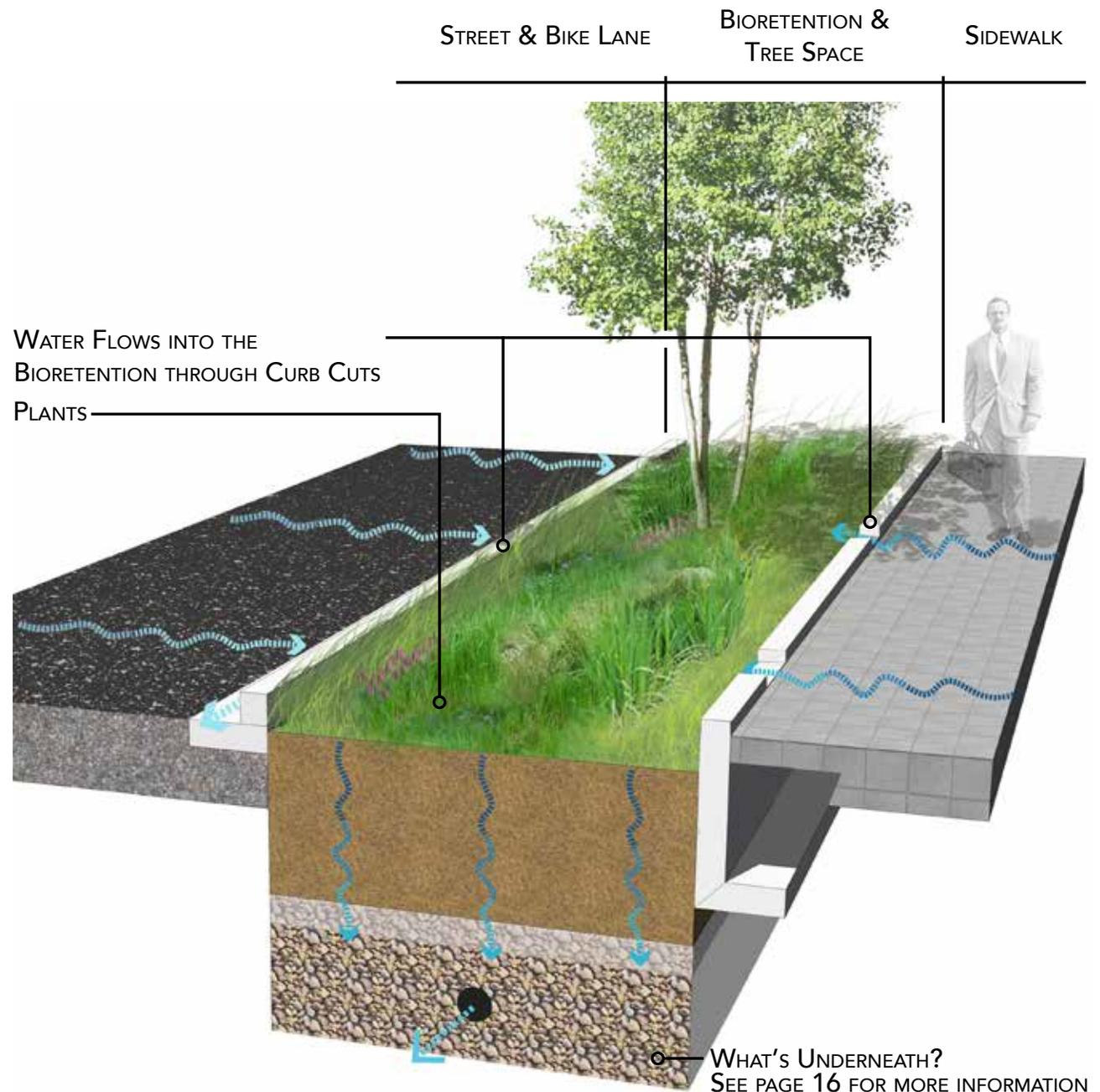
- Not for on-street parking areas.

COMMON DESIGN ISSUES

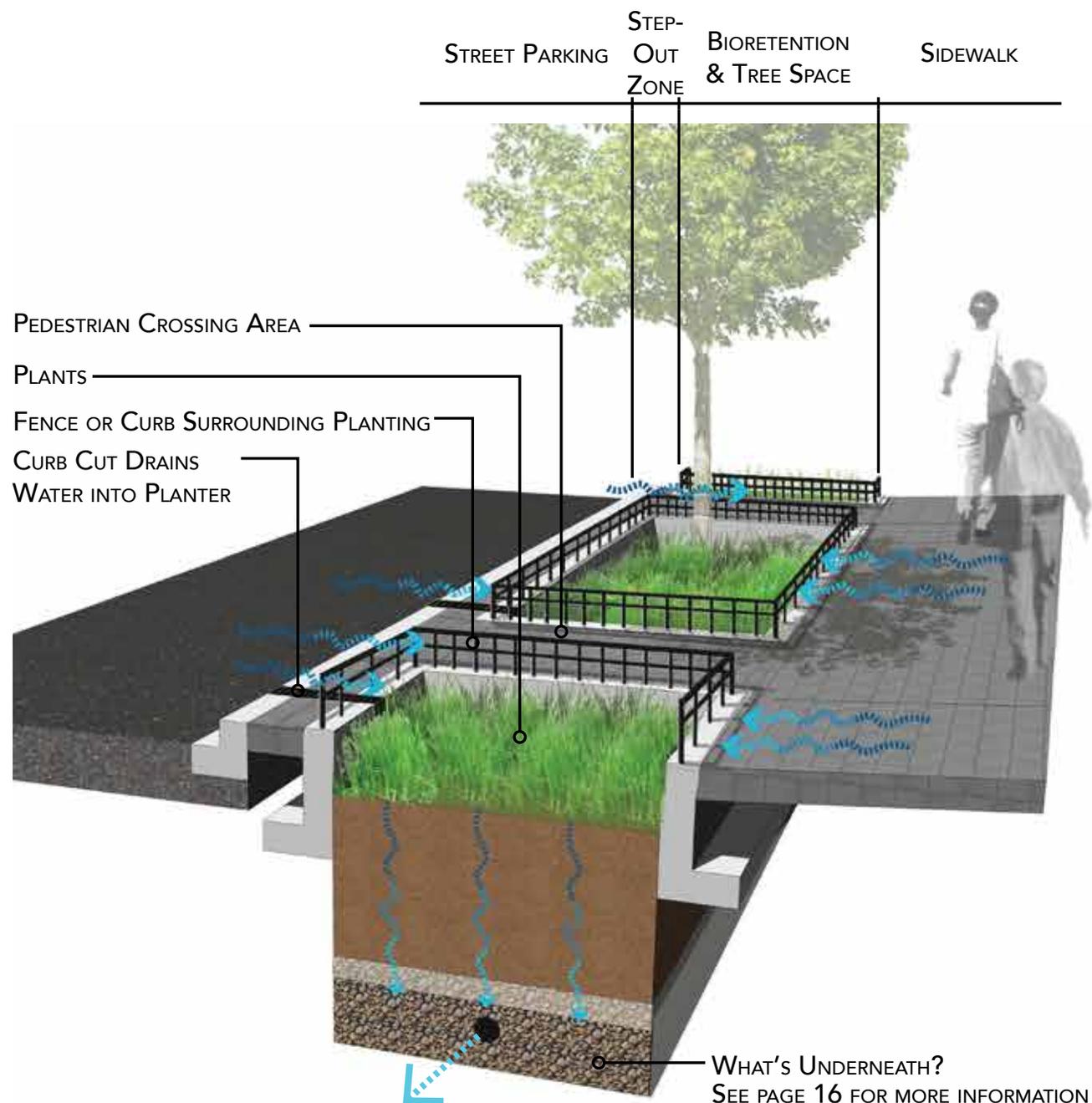
Planting Design: Bioretention adds a landscape amenity to the streetscape. Trees, shrubs, grasses, and perennials are used to create a diverse landscape suitable for the site conditions and neighborhood. Plants should be chosen based on the level of care expected at the facility. Planting design must be done to ensure sight lines are preserved for pedestrians and vehicles on the street.

See *DDOT Green Infrastructure Plant List* for suitable plant species to use in bioretention areas.

BIORETENTION PLANTER ADJACENT TO ROADWAY



BIORETENTION PLANTER WITH STEP-OUT ZONE



WHERE TO USE?

- Wide sidewalk area with adjacent on-street parking.
- High-volume pedestrian areas.
- Areas with other streetscape features (lights, bike racks, bus stops, etc.).

LIMITATIONS

- Do not disturb existing, mature trees.
- Provide low fence or curb for pedestrian safety.

COMMON DESIGN ISSUES

Pedestrian Safety: Bioretention areas in the streetscape can have dropped or sloped sides. Short fences or curbs prevent pedestrians from slipping into a recessed area. Bioretention with side slopes can use a small step-out area in place of a fence or curb. When bioretention is next to street parking areas, a step-out zone of 12-36 inches must be provided to allow access from vehicle to sidewalk. Crossing areas must be provided between street parking and the sidewalk.

WHERE TO USE?

- Areas with low on-street parking demand.
- In wide roadways.
- For traffic calming.
- In “no parking areas” on street (excluding loading zones and curb cuts).
- Next to mature trees.

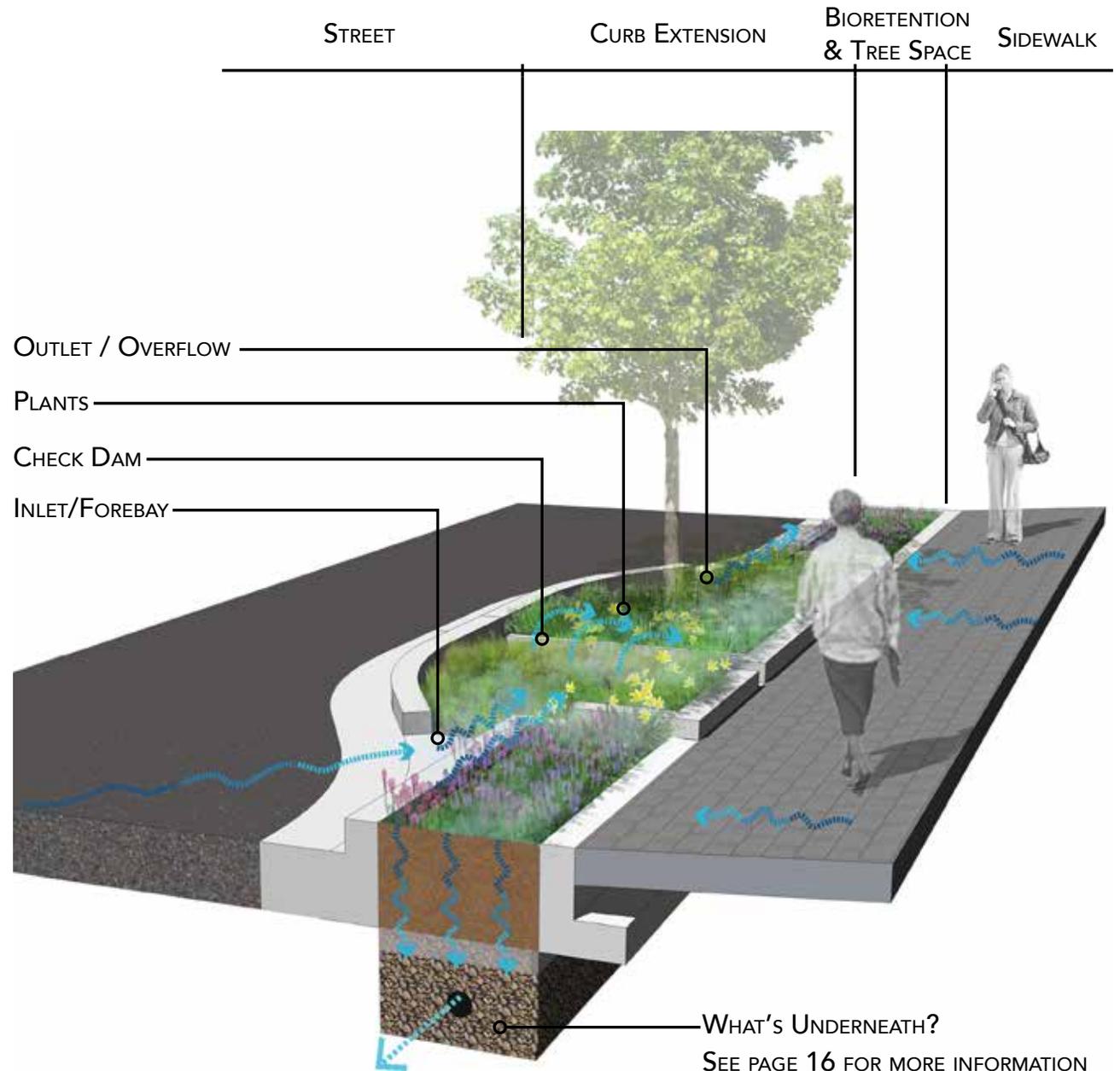
LIMITATIONS

- Sufficient street parking or off-street parking must be available to residents.
- Do not disturb existing, mature trees & root systems.
- Ensure sight lines and turning radii are preserved.

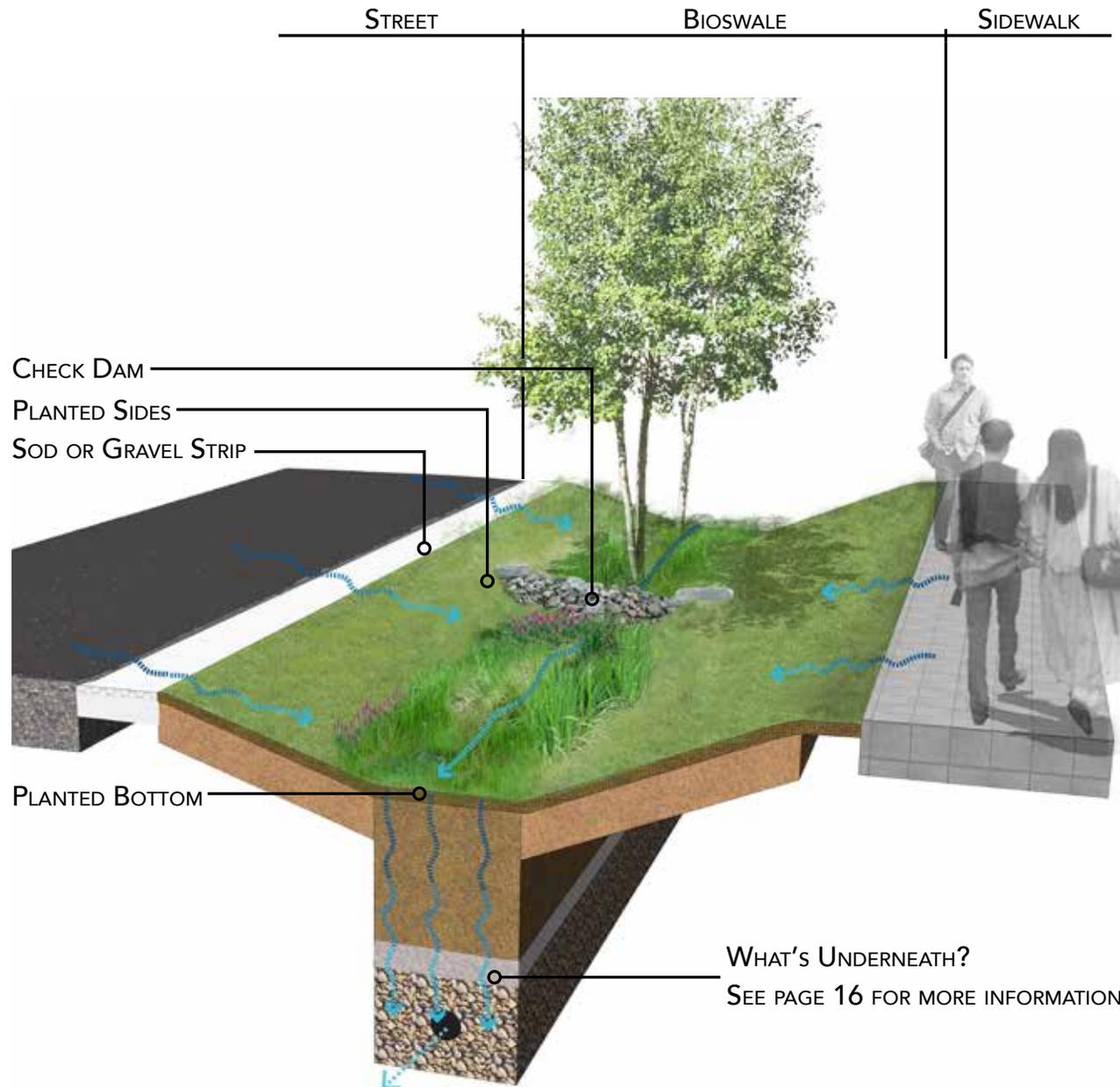
COMMON DESIGN ISSUES

Existing Trees: Existing trees are an important component of the green infrastructure of a city. Mature trees capture stormwater, provide shade, and cool pavement. Existing trees should be protected when implementing green infrastructure and not disturbed during construction.

CURB EXTENSION BIORETENTION



BIOSWALE IN OPEN AREA



WHERE TO USE?

- On street with no curb.
- In wide ROW area with or without sidewalk.
- Sloped area.
- Areas with less pedestrian use.

LIMITATIONS

- Not suitable for narrow sidewalk areas.

COMMON DESIGN ISSUES

Slope & Check Dams:

Bioretention areas are placed where street runoff is flowing and optimally before catch basins that convey water from the street to the sewer system. Many streets are sloped and bioretention may be built on sloped areas with the use of check dams. Check dams provide a ponding area and step-down points to adjust to the street slope.

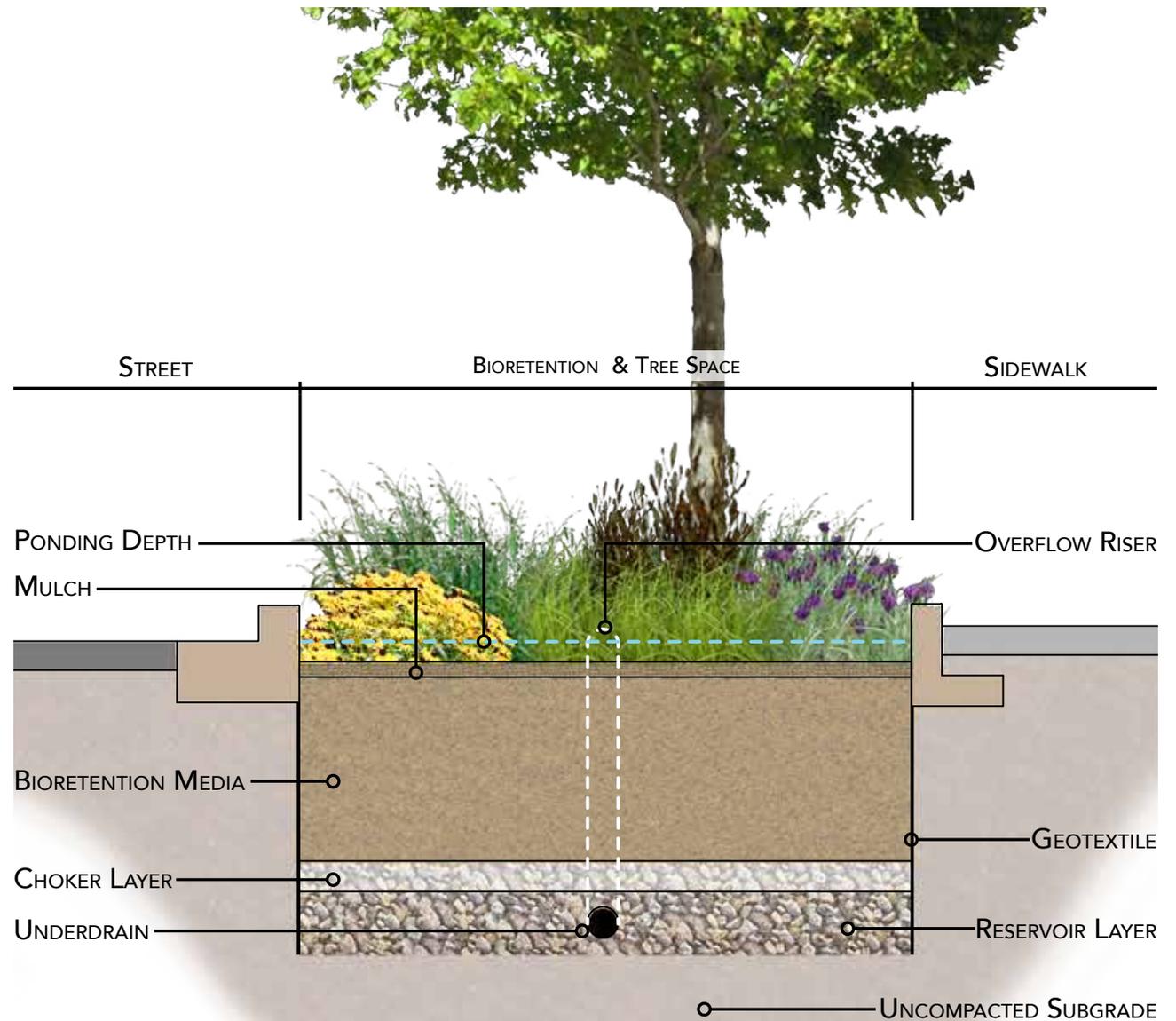
PUTTING IT TOGETHER

- **Ponding Depth:** Holds water that enters the planting area.
- **Overflow Riser:** Pipe to capture high water flow.
- **Mulch:** Shredded hardwood layer to retain water and trap pollutants.
- **Bioretention Media:** A specific blend of soil, compost, and sand to retain and drain water and support plant growth.
- **Choker Layer:** Sand and gravel to prevent media from migrating into the reservoir.
- **Reservoir Layer:** Stone to hold excess water until it infiltrates.
- **Underdrain:** Conveys excess water into sewer system when the reservoir fills.
- **Geotextile:** Prevents existing soil from migrating into the media and stone.
- **Uncompacted Subgrade:** Existing soil where stormwater infiltrates.

COMMON DESIGN ISSUES

Utilities: In the District, utility lines are common and necessary components of city infrastructure that often run under streets, sidewalks, and tree space. Utility lines should be avoided where necessary and allowed to coexist where possible.

BIORETENTION - WHAT'S UNDERNEATH?

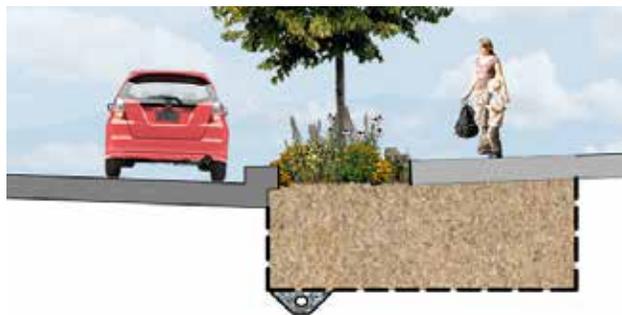


2.4 TYPES OF TREE SPACE DESIGN

WHY ARE TREES IMPORTANT?

Trees make a streetscape feel welcoming, help manage stormwater, and reduce the urban heat island effect by providing shade. Trees have the ability to capture rain on leaves, direct it to the ground on stems, absorb it through root systems, and transpire it as water vapor directly back into the atmosphere.

Trees in the typical urban environment are confined to small planting areas where they struggle to reach a mature size or live a long life. Through the use of Structural Soil, Structural Cell, or Suspended Sidewalk techniques, soil volumes and space for tree roots to grow uninhibited can be greatly increased. These techniques also allow for more water and air to reach the tree roots.



STRUCTURAL SOILS

A specific mix of stone and soil that supports the sidewalk while allowing tree roots to grow normally.



STRUCTURAL CELLS

Manufactured cells support the sidewalk allowing uncompacted soil to promote tree roots to grow below.



SUSPENDED SIDEWALK

Thickened sidewalk with reinforcement and/or footings can be used allowing tree roots to grow below the sidewalk.



SOIL VOLUME SIZING

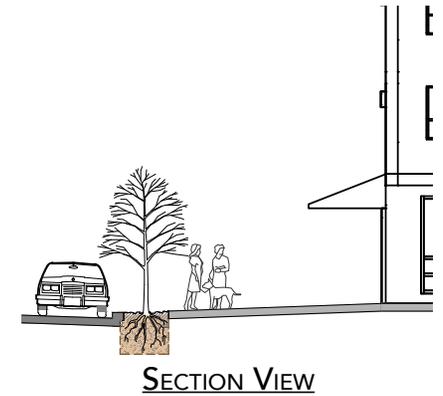
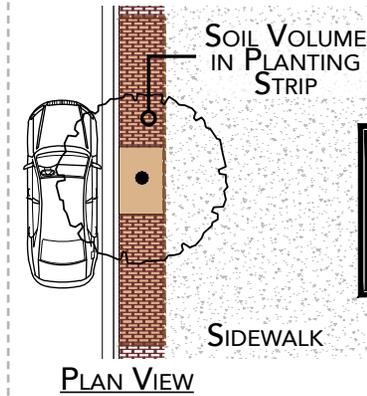
- Adequate soil space provides the nutrients, water, air, and root space that trees need to have a long, successful life.
- The soil volume required depends on the fully-grown tree size (generally two cubic feet of soil per one square foot of the tree's mature drip line area).

- Soil for trees should be three-feet deep; the length and width must ensure the appropriate volume for the tree species and size.

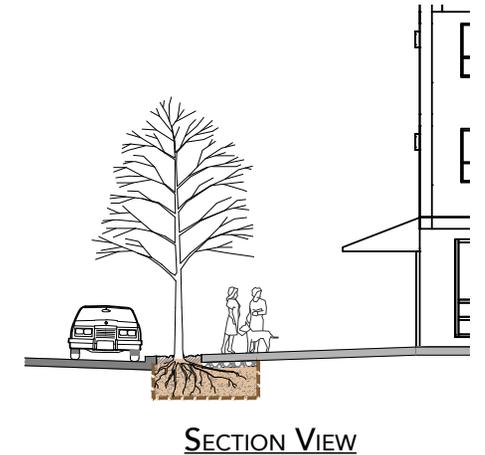
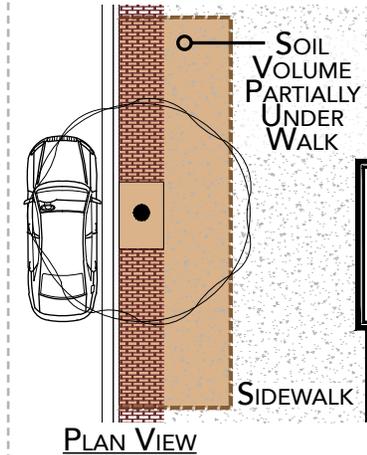
OTHER CONSIDERATIONS

- Provide as much open space as possible for the tree to allow the tree to grow and access water.
- Providing structural soils, suspended sidewalks, or structural slabs to edges of paved areas encourages tree roots to extend further and into adjacent green areas (lawns, planting beds, etc.).

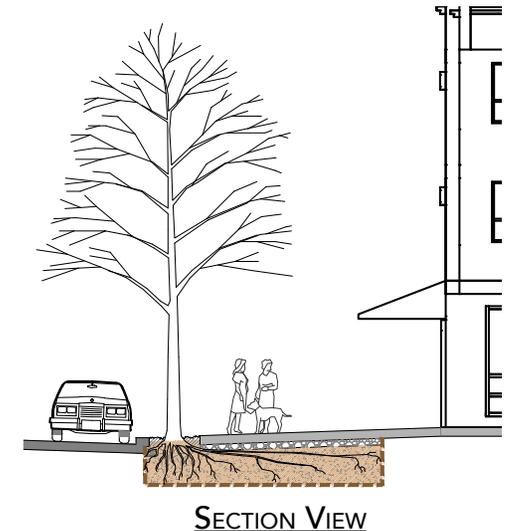
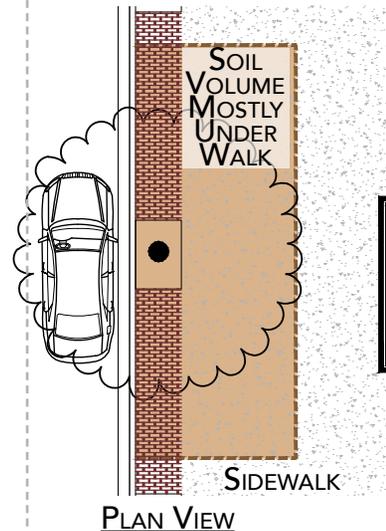
SMALL TREE
VOLUME REQUIREMENTS:
600 CUBIC FEET



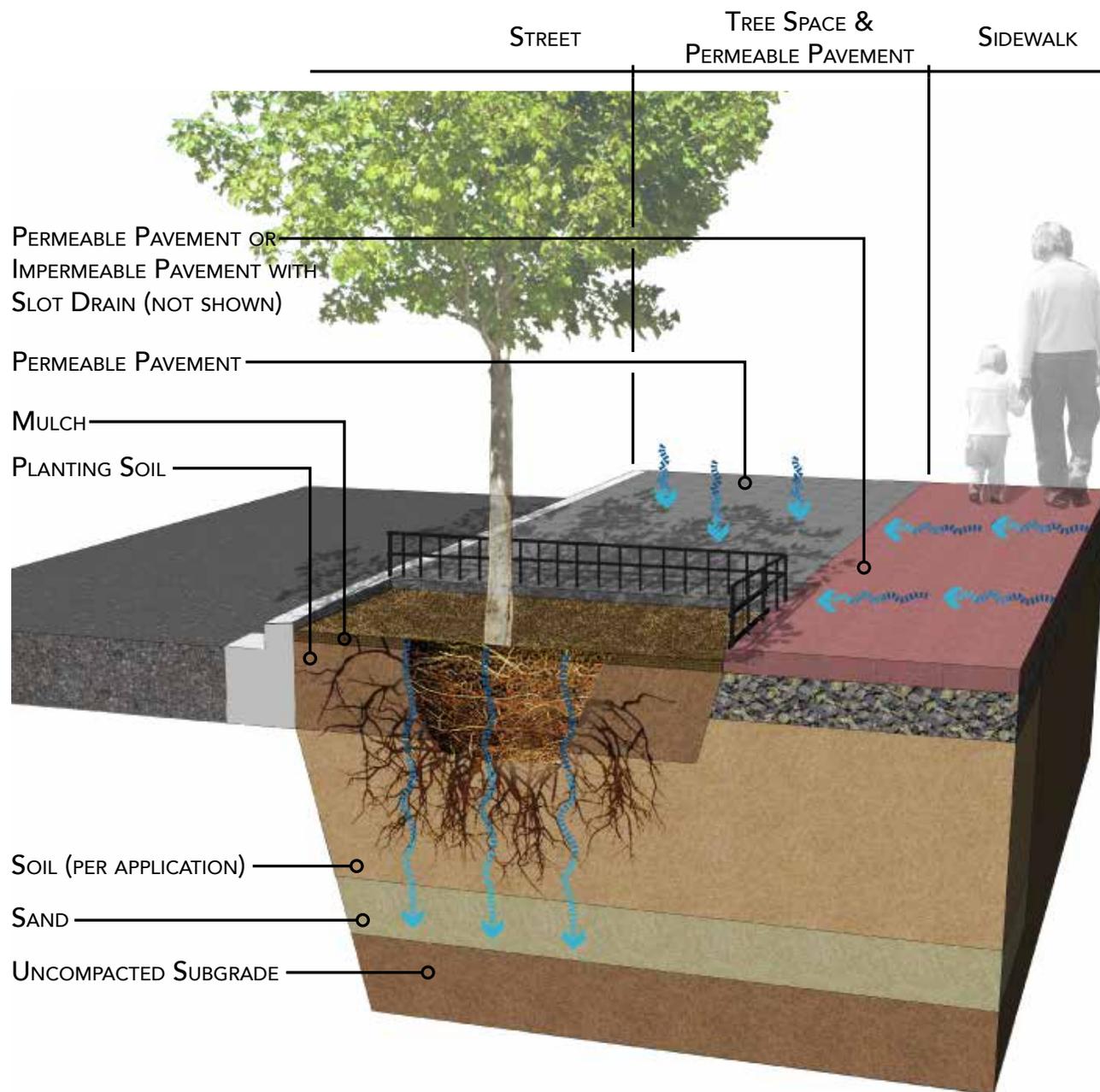
MEDIUM TREE
VOLUME REQUIREMENTS:
1,000 CUBIC FEET



LARGE TREE
VOLUME REQUIREMENTS:
1,500 CUBIC FEET



TREE SPACE DESIGN - WHAT'S UNDERNEATH?



PUTTING IT TOGETHER

- **Permeable Paver:** Permeable pavers allow water to infiltrate into the soil to be used by the trees.
- **Slot Drain:** Can be implemented in conjunction with impermeable pavement to catch runoff and direct it into soils.
- **Mulch:** Shredded hardwood layer to retain water and trap pollutants.
- **Planting Soil:** Uncompacted, soil mix used in open areas or with structural cells or suspended sidewalks and allows root growth.
- **Structural Soil:** Supports pavement and allows root growth.
- **Sand:** Acts as a drainage layer for excess stormwater (when needed).
- **Uncompacted Subgrade:** Existing soil where stormwater infiltrates.

WATERING TREES WITH STORMWATER

In addition to large soil volumes, trees need sufficient water, air, and nutrients to be successful in the urban environment. Tree space design includes integrating opportunities for directing stormwater under pavement systems.

CHAPTER 3

Green Infrastructure Design Examples

3.1 INTRODUCTION

Implementing Green Infrastructure (GI) and Low Impact Development (LID) within the public space requires a number of considerations to create an amenity that is attractive while treating stormwater from the surrounding streets and sidewalks.



Public agencies, businesses, residences, utilities, and pedestrians use the space between the curb and buildings (both above and below the ground) for numerous activities and needs. Common limitations including existing trees, utilities, poor infiltration, street parking, slope, etc. for all sites need to be analyzed to determine if it is a design constraint. Since each street is unique, there are different opportunities and limitations for installing permeable pavement, bioretention, and tree space design.

This section examines different types of streetscapes in the District and appropriate GI and LID practices. Suggested solutions illustrate how various techniques fit into each streetscape.



Bioretention • NPR Building, L Street NE • Washington, DC



Bioretention Planting • Nebraska Ave NW • Washington, DC

OPPORTUNITIES

- Space in parking lane.
- Available off-street parking.
- Adding street trees.
- Street narrowing.
- Catch basin location.
- Overhead utilities (reduce below ground conflicts).

LIMITATIONS

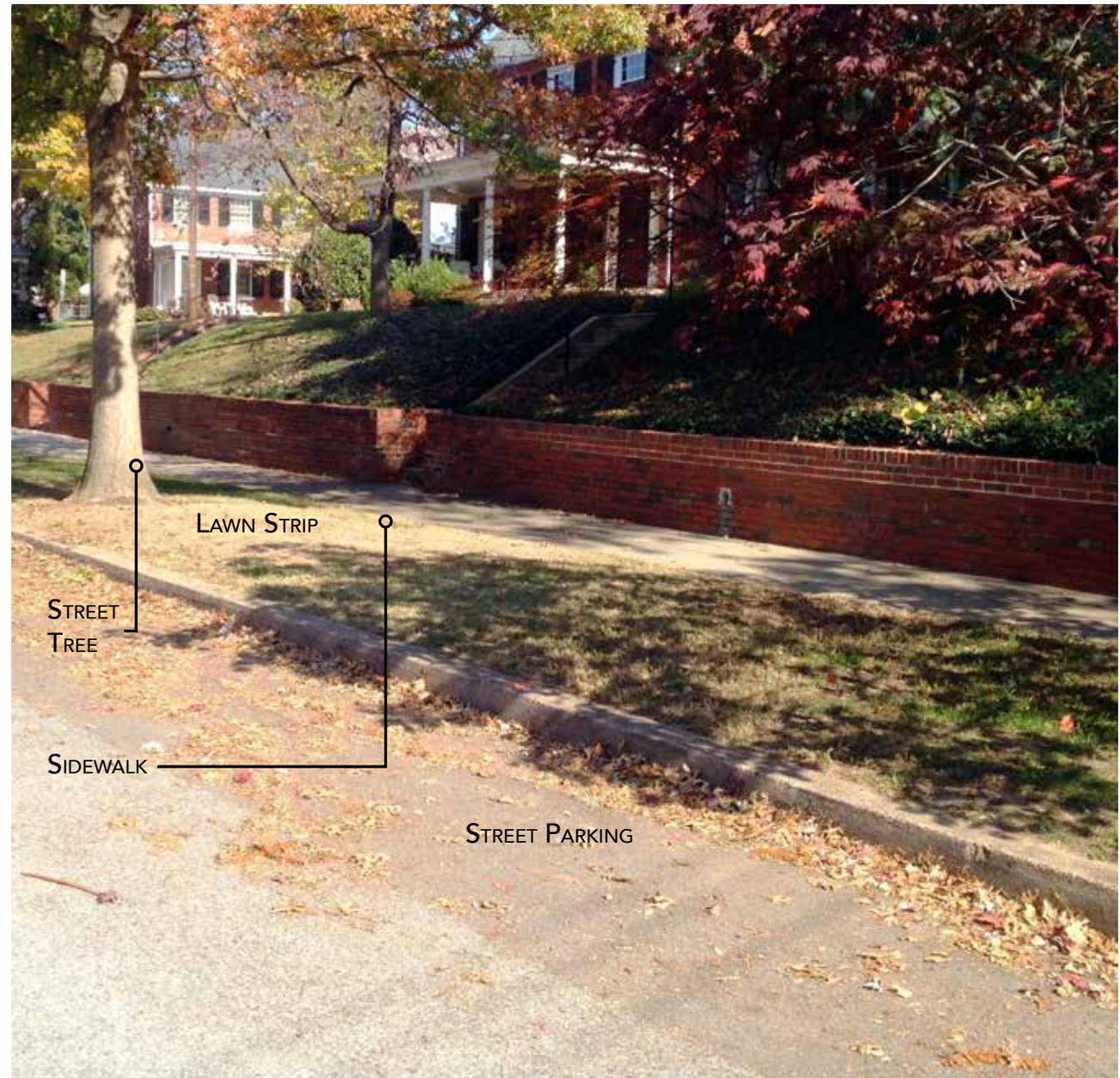
- Residential driveways.
- Do not block street parking.
- Maintain sufficient parking for residents.
- Avoid subsurface utilities or ensure offsets can be met.
- Existing, mature trees.
- Location of storm sewer for underdrain connection.

PLANTING DESIGN

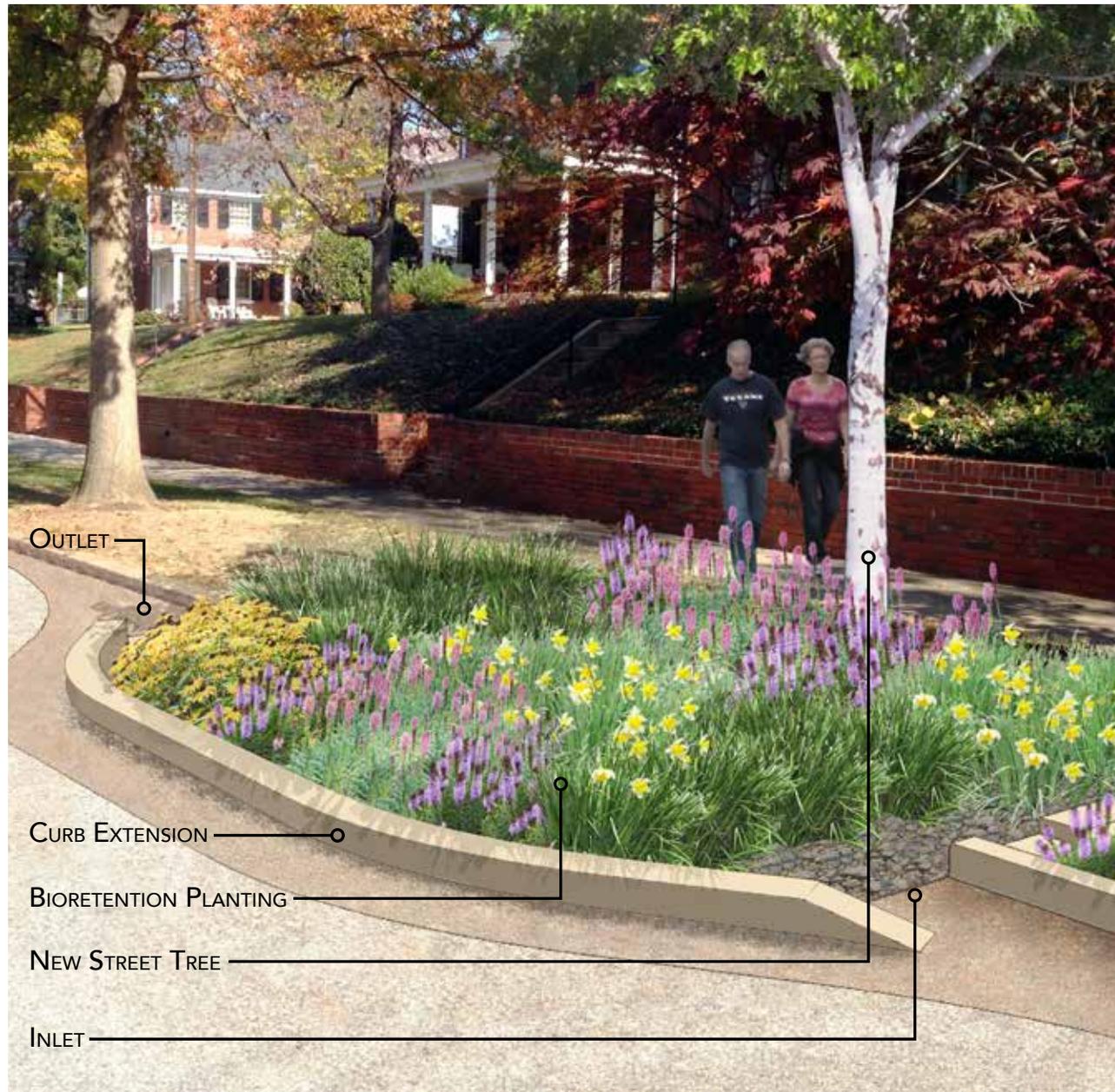
- Low to medium level of care.

3.2 RESIDENTIAL STREET WITH DETACHED HOUSES

EXISTING

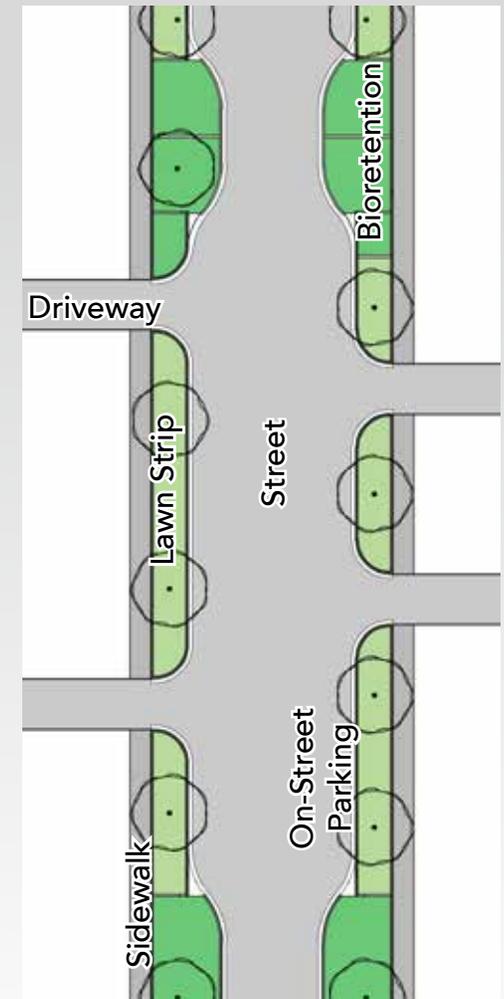


3.2 RESIDENTIAL STREET WITH DETACHED HOUSES WITH GREEN INFRASTRUCTURE



CURB EXTENSIONS

Curb extensions are appropriate solutions in neighborhoods where available on-street parking meets or exceeds needs. Curb extensions enhance the streetscape, can be built around existing trees, and can provide traffic calming.



OPPORTUNITIES

- No-parking zone at intersection.
- Traffic calming.
- Improve pedestrian safety at crosswalk.
- Capture water before catch basin.
- Pavement removal.

LIMITATIONS

- On-street parking needs.
- Protect mature trees.
- Subsurface utility locations.
- Fire hydrant locations.
- Bus stop access.
- Maintain sight lines.
- Maintain turning radius.

PLANTING DESIGN

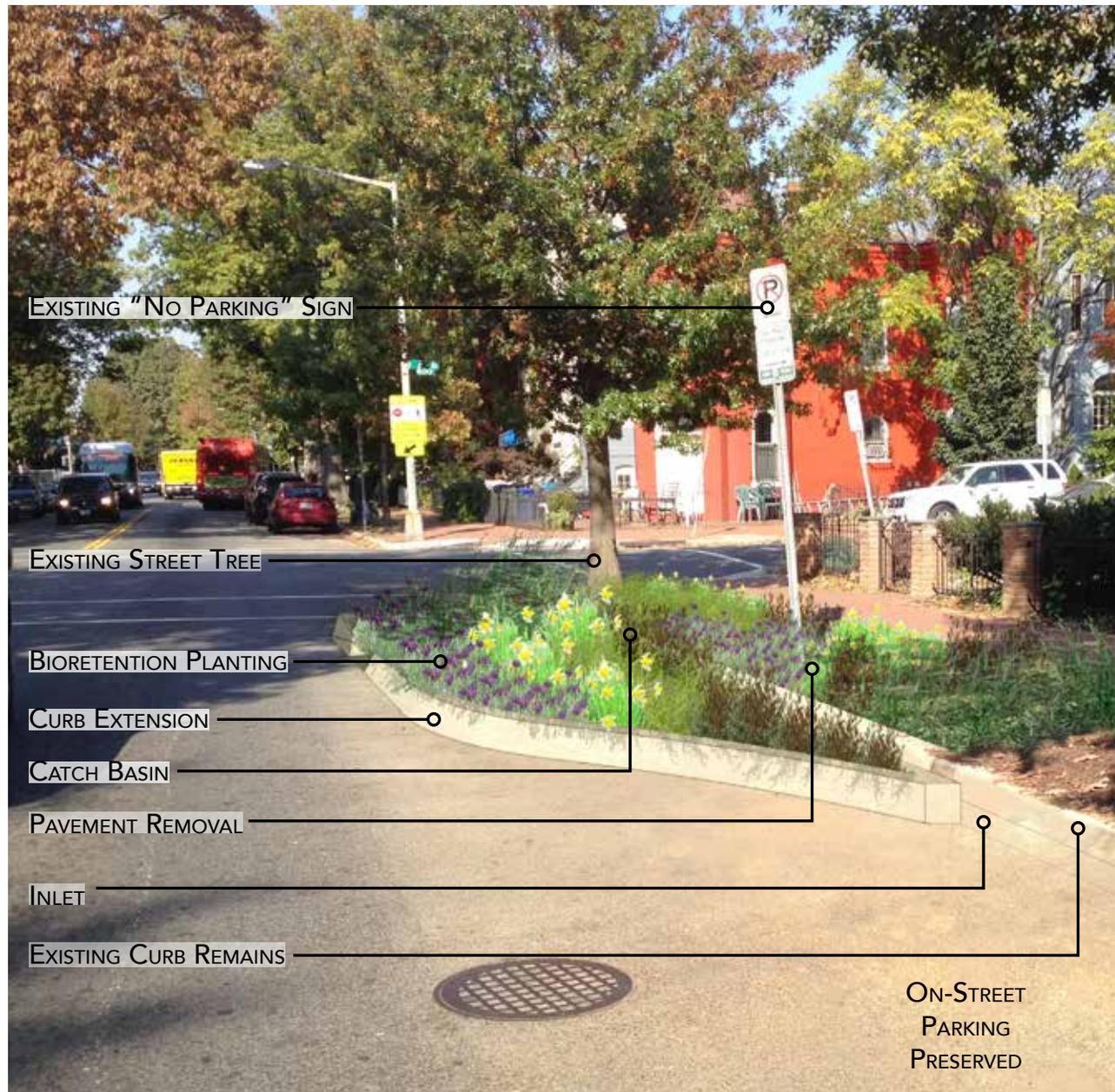
- Low to medium level of care.

3.3 RESIDENTIAL STREET WITH ROW HOUSES

EXISTING

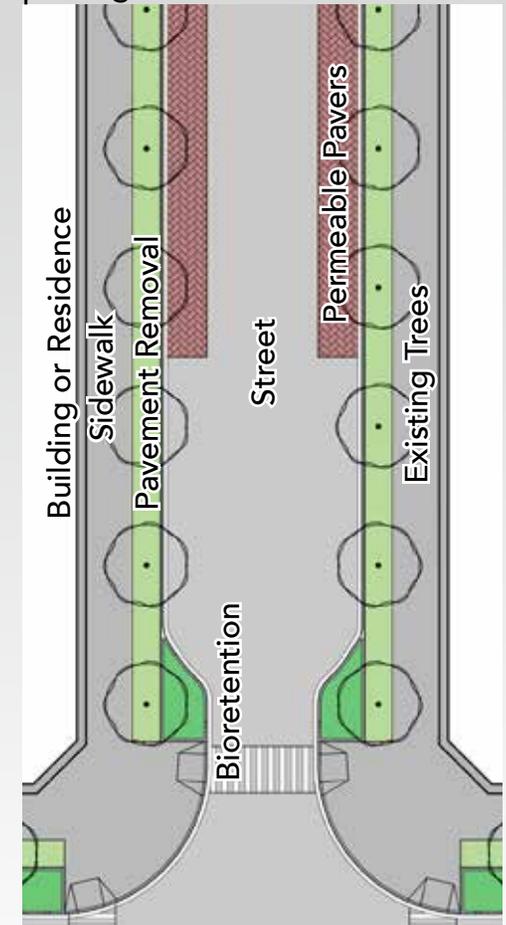


3.3 RESIDENTIAL STREET WITH ROW HOUSES WITH GREEN INFRASTRUCTURE



CURB EXTENSIONS & PERMEABLE PAVEMENT

In neighborhoods with high demand for street parking, curb extensions can be placed in the no parking zone at intersections to reduce street parking loss. Permeable paving in the sidewalks and parking lanes can capture stormwater from the street while maintaining street parking.



OPPORTUNITIES

- Wide sidewalks can be narrowed.
- Remove pavement in front of building.
- Use street tree area to capture stormwater.
- Provide tree soil volume under pavement.
- Property owner or business improvement district may maintain landscaping
- Streetscape fixtures can be surrounded by permeable pavement.

LIMITATIONS

- Subsurface utility locations.
- Street parking (provide step-out zone and pedestrian crossing).
- Streetscape fixture placement (streetlights, meters, trash cans, bike racks, bus stops, etc.).
- Building entrances.
- Sidewalk cafés.
- Safety barrier.

PLANTING DESIGN

- Medium to high level of care.

3.4 COMMERCIAL STREET WITH WIDE SIDEWALK

EXISTING



3.4 COMMERCIAL STREET WITH WIDE SIDEWALK WITH GREEN INFRASTRUCTURE



GREENING THE PUBLIC SPACE

PERMEABLE PAVEMENT IN PEDESTRIAN CROSSING

CURB

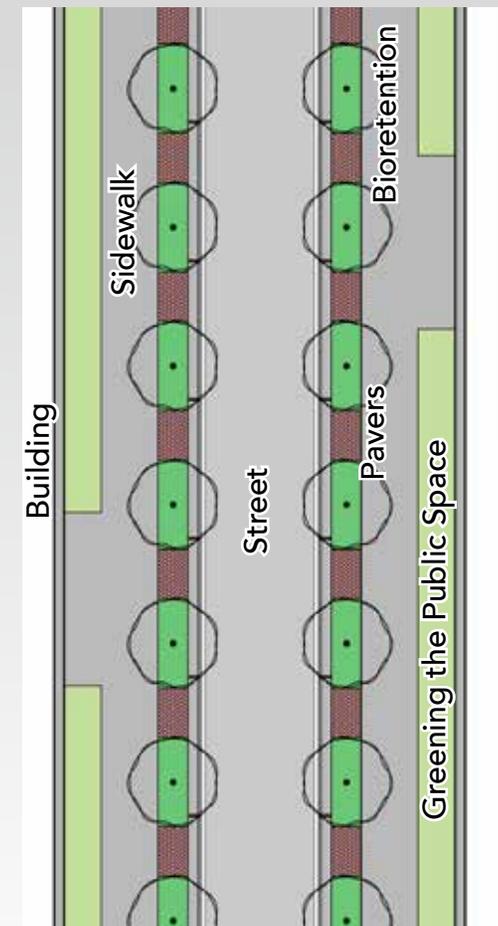
BIORETENTION PLANTING

STEP OUT ZONE

CURB CUT WITH METAL TRENCH DRAIN COVER

BIORETENTION WITH STEP-OUT ZONE & TRENCH DRAINS

In commercial areas with wide sidewalks, integrating tree space design with LID enhances the streetscape while treating stormwater. Notice the design maintains on-street parking while removing impervious surfaces from the streetscape.



OPPORTUNITIES

- Permeable pavement requires no horizontal space.
- Permeable pavement coexists with other streetscape fixtures.
- Space is available for street trees.
- Expand street tree soil volume under pavement.

LIMITATIONS

- Maintain pavement for pedestrian circulation.
- High parking demand and parking lane use.
- Streetscape fixture placement (streetlights, meters, etc.).
- Historic District requirements (paving, aesthetics).
- Subsurface utility locations.

PLANTING DESIGN

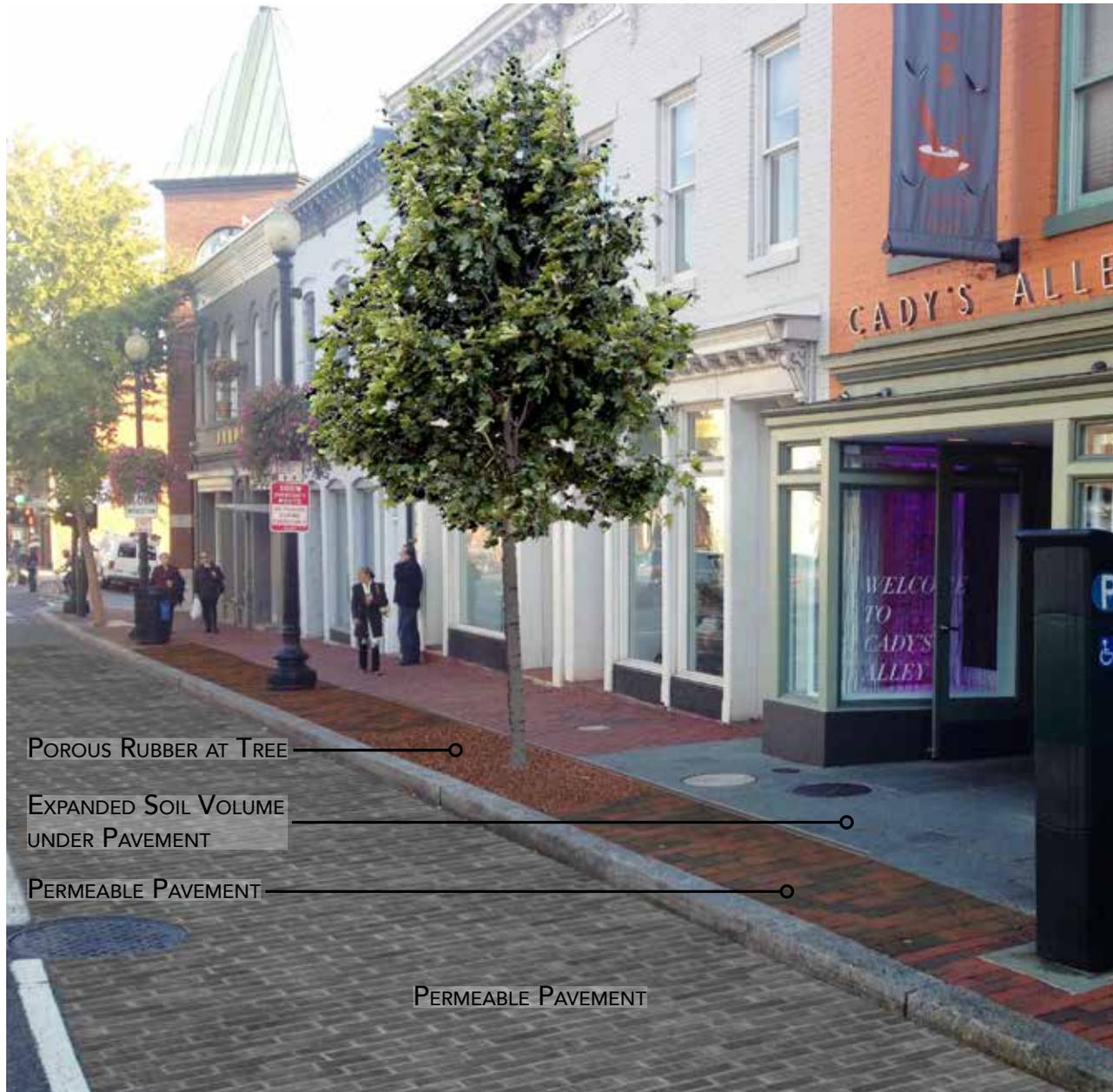
- Medium to high level of care.

3.5 COMMERCIAL STREET WITH NARROW SIDEWALK

EXISTING

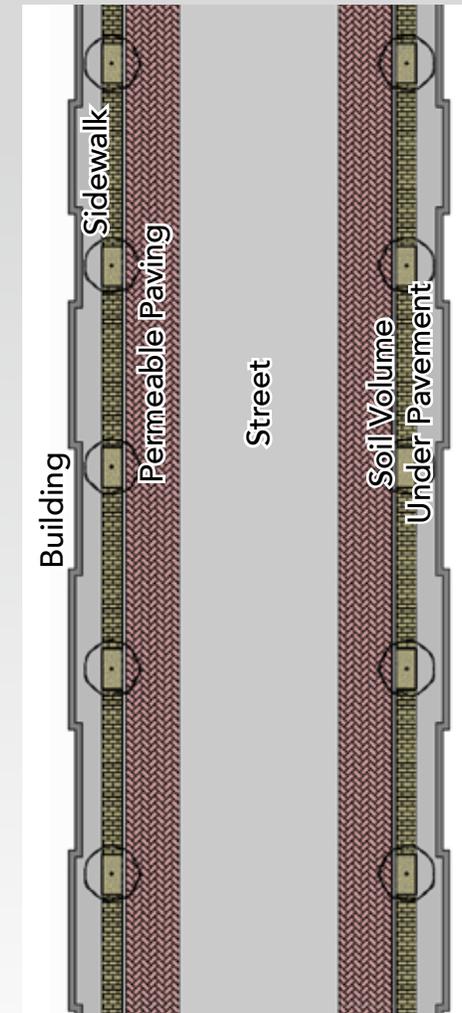


3.5 COMMERCIAL STREET WITH NARROW SIDEWALK WITH GREEN INFRASTRUCTURE



TREE SPACE DESIGN & PERMEABLE PAVEMENT

In urban and commercial areas with narrow sidewalks, a mixture of LID techniques, including permeable pavement and tree space design can be used to maintain pedestrian circulation and on-street parking.



OPPORTUNITIES

- Infrastructure improvement.
- Reduce runoff from paved alleys.
- Provide connections for cars, bikes, and pedestrians.
- Create access to buildings and residences.
- Mitigate drainage problems.
- Soil infiltration.

LIMITATIONS

- Protect building foundations from water infiltration.
- Location of storm sewer for underdrain connection.
- Subsurface utility locations.
- Historic District requirements (paving, aesthetics).

3.6 ALLEY EXISTING

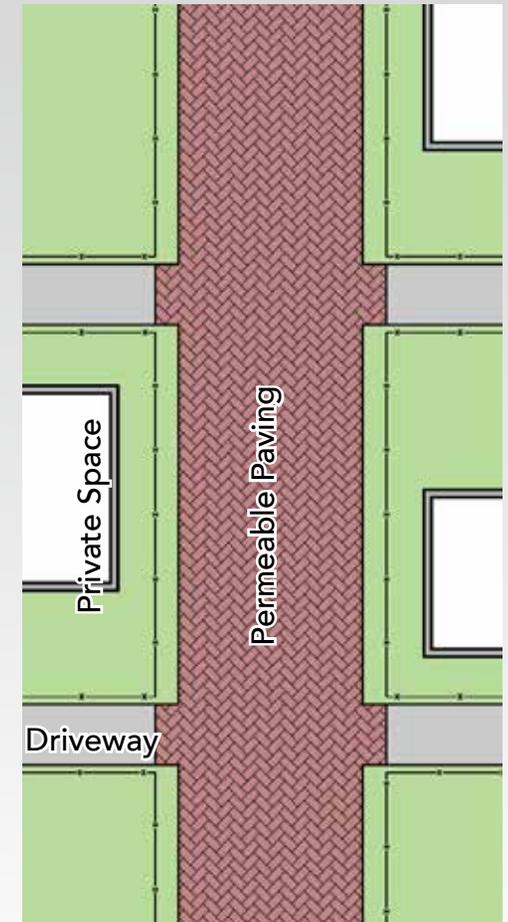


3.6 GREEN ALLEY WITH GREEN INFRASTRUCTURE



PERMEABLE PAVEMENT

Most blocks in the District include alleys in the rear properties for service access. The District's alleys may be paved, gravel, or unimproved and may not have drains. Stormwater runoff usually drains into the streets. Green Alleys with permeable paving can provide pavement for service access and reduce runoff.



OPPORTUNITIES

- Large open, green spaces.
- No parking adjacent to triangle.
- Limited pedestrian circulation.
- Tree planting.

LIMITATIONS

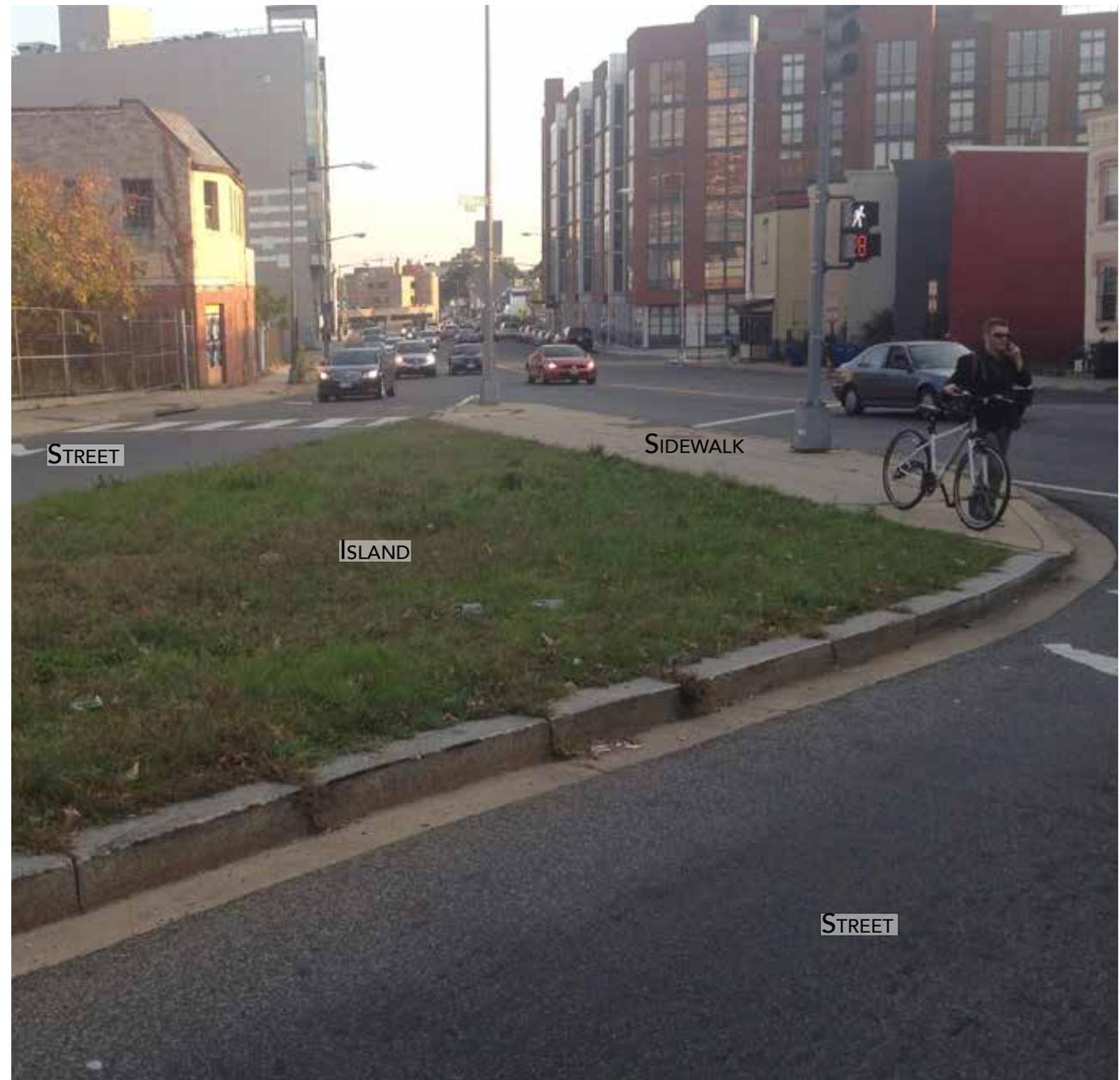
- Slope of roadway (must drain toward island).
- Subsurface utility locations.
- Pedestrian access and circulation.
- Location of storm sewer for underdrain connection.

PLANTING DESIGN

- Low level of care.

3.7 TRAFFIC TRIANGLE

EXISTING

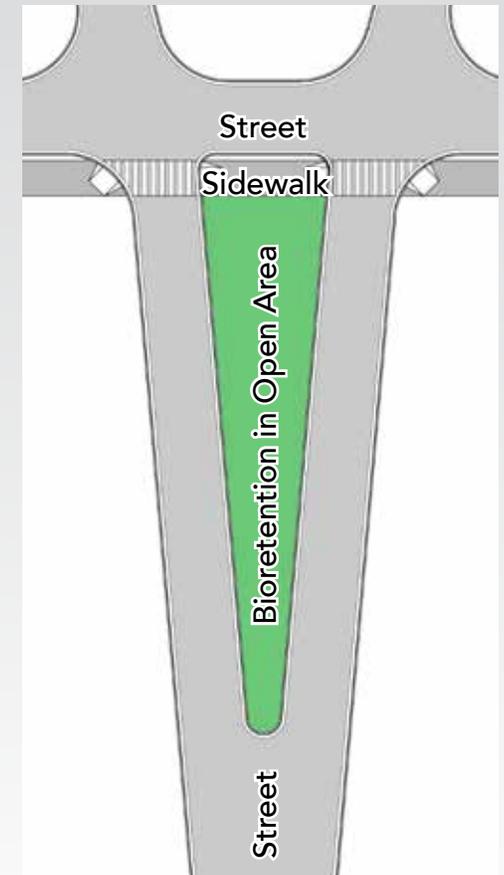


3.7 TRAFFIC TRIANGLE WITH GREEN INFRASTRUCTURE



BIORETENTION IN OPEN AREA

The District's grid layout with diagonal streets creates small open spaces such as traffic triangles that are optimal for implementing Green Infrastructure (GI). Many streets include medians which separate lanes of traffic where GI can be added.



CHAPTER 4

Implementing Green Infrastructure in DC

4.1 DESIGN AND CONSTRUCTION

The “Sustainable DC Plan,” adopted in 2013, sets long-range goals for making the District the greenest city in the nation. The plan calls for increasing green infrastructure in the public right-of-way (ROW) and taking actions to improve the health of the city’s waterways.

District Stormwater regulations require stormwater volume retention on all major construction projects. Both public and private projects constructing in the ROW are required to retain stormwater to the maximum extent practicable. Designers must examine all uses of public space and place stormwater management where space and use allows.

DDOT is installing Green Infrastructure (GI) as part of regulated construction projects and retrofit projects to reduce stormwater runoff in more areas of the city. Green Street and Green Alley projects utilize GI techniques and may be constructed where watershed and infrastructure improvements are prioritized. DC Water is including GI as part of the Long Term Control Plan to control stormwater runoff in the combined sewer overflow area and reduce overflows.



4.2 MAINTENANCE

Implementing Green Infrastructure (GI) and Low Impact Development (LID) practices requires maintenance to keep them attractive and functioning. Maintenance levels of care should be considered during the design phase and plants selected from DDOT's GI plant list according to the following levels:

- Low level of care: Annual maintenance; no irrigation
- Medium level of care: Quarterly maintenance; some water available
- High level of care: Monthly maintenance; site is potentially irrigated

DDOT is responsible for maintaining publicly-installed GI and LID facilities. Private installations must have a maintenance covenant from the owner. Residents can help with GI/LID maintenance by removing trash and weeds, and watering sites during dry periods.

Type of Maintenance	Bioretention	Permeable Pavement	Tree Space
Inspect after storms	●	●	
Remove trash/sediment/leaves	●	●	●
Clean inlets/outlets	●		
Adjust mulch and/or stone	●		
Water for establishment	●		●
Weed/remove invasive species	●		●
Prune (as needed)	●		●
Replace mulch (3" depth)	●		●
Street sweeper/vacuum (annually)		●	





REFERENCES

DDOT – Green Infrastructure Standards, (2014), includes the following:

- Supplement to DDOT Design & Engineering Manual
- Supplement to DDOT Standard Drawings
- Supplement to DDOT Standard Specifications for Highways and Structures
- Green Infrastructure Plant List
- Green Infrastructure Maintenance Schedule

ddot.dc.gov/GreenInfrastructure

DDOT – Public Realm Design Manual, (2011)

ddot.dc.gov/PublicRealmDesignManual

DDOT – LID Action Plan, (2010)

ddot.dc.gov/GreenInfrastructure

DDOT – Sustainability Plan, (2010)

ddot.dc.gov/SustainabilityPlan

DDOT – Urban Forestry Administration

ddot.dc.gov/page/DDOT-Urban-Forestry

DDOE – Stormwater Management Rule and Guidebook, (July 19, 2013)

ddoe.dc.gov/swregs

DDOE – Green Area Ratio

ddoe.dc.gov/GAR

Sustainable DC Plan

sustainable.dc.gov/FinalPlan

Casey Trees – Tree Space Design

caseytrees.org/resources/publications/treespacedesign

District of Columbia Tree Canopy Plan

ddoe.dc.gov/sites/default/files/dc/sites/ddoe/page_content/attachments/Draft_Urban_Tree_Canopy_Plan_Final.pdf

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