Appendix B Maximum Extent Practicable Process for Existing Public Right-of-Way

B.1 Maximum Extent Practicable: Overview

Maximum extent practicable, or "MEP," is the language of the Clean Water Act that sets the standards to evaluate efforts pursued to achieve pollution reduction to United States waterbodies. MEP refers to management practices; control techniques; and system, design, and engineering methods for the control of pollutants. It allows for considerations of public health risks, societal concerns, and social benefits, along with the gravity of the problem and the technical feasibility of solutions.

MEP is achieved, in part, through a process of selecting and implementing different design options with various structural and non-structural stormwater best management practices (BMPs), where ineffective BMP options may be rejected, and replaced when more effective BMP options are found. MEP is an iterative standard that evolves over time as urban runoff management knowledge increases. As such, it must be assessed continually and modified to incorporate improved programs, control measures, and BMPs to attain compliance with water quality standards. As a result of this evolution, some end-of-pipe strategies that were considered to meet the MEP standard ten years ago are no longer accepted as such. Similarly, in cases where just one BMP may have gained project approval in the past, today there are many cases where multiple BMPs will be required to achieve treatment to the MEP.

Many jurisdictions have said of the MEP standard that there “must be a serious attempt to comply, and practical solutions may not be lightly rejected.” If project applicants implement only a few of the least expensive BMPs, and the regulated volume has not been retained, it is likely that the MEP standard has not been met. If, on the other hand, a project applicant implements all applicable and effective BMPs except those shown to be technically infeasible, then the project applicant would have achieved retention to the MEP.

B.2 Public Right-of-Way Projects

Public right-of-way (PROW) projects within the District of Columbia are owned and operated by the District Government. They are linear in orientation and are distinct from parcel or lot development.

PROW is defined as the surface, the air space above the surface (including air space immediately adjacent to a private structure located on public space or in a PROW), and the area below the surface of any public street, bridge, tunnel, highway, railway track, lane, path, alley, sidewalk, or boulevard, where a property line is the line delineating the boundaries of public space and private property.

The Public Parking Area or "Public Parking," is important for the following discussion. It is defined as that area of public space devoted to open space, greenery, parks, or parking that lies between the property line (which may or may not coincide with the building restriction line) and the edge of the actual or planned sidewalk that is nearer to the property line, as the property line and sidewalk are shown on the records of the District. This area often includes spaces that appear to be front yards with private landscaping, which create park-like settings on residential streets.

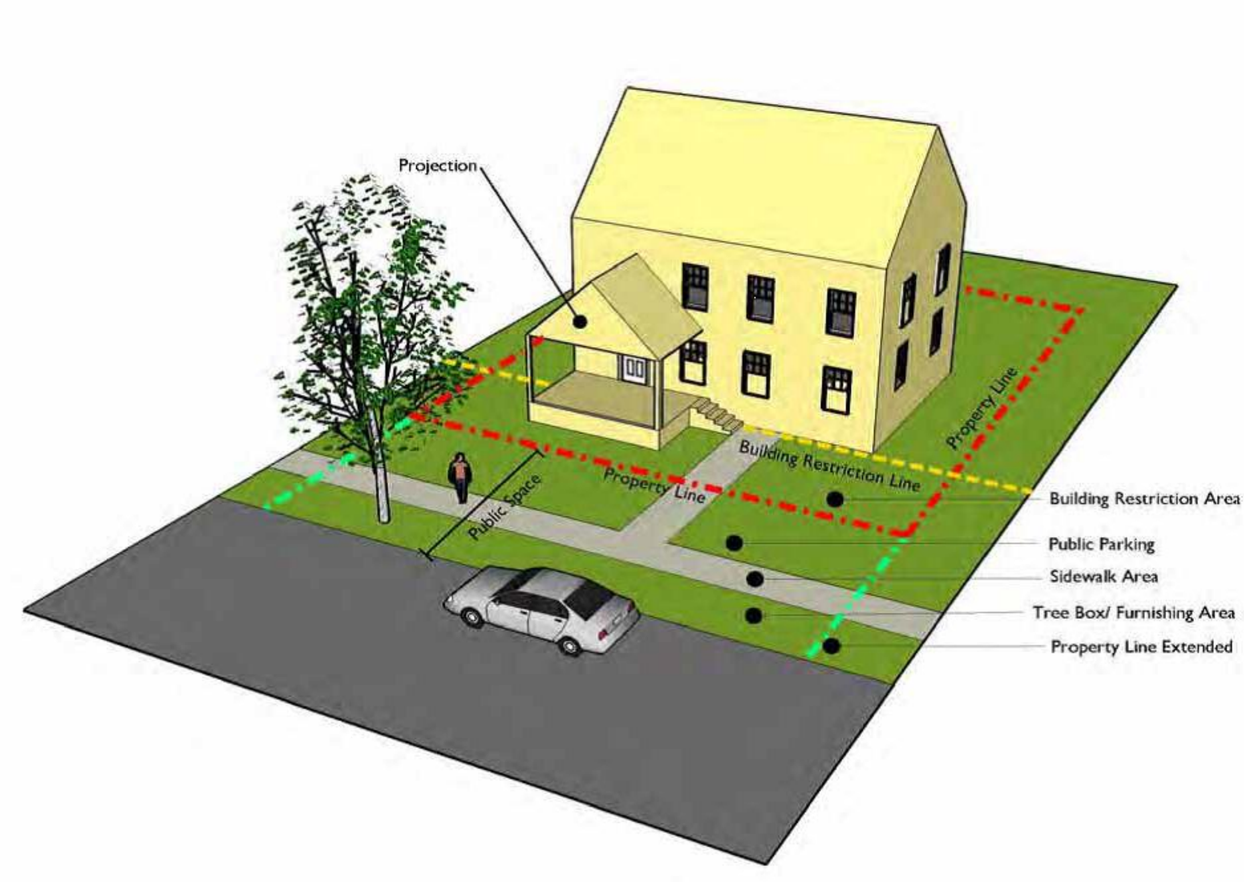

Figure B.1 Diagram of typical residential public right-of-way in the District of Columbia (DDOT Public Realm Design Manual 2011).

Public Space is defined as all the publicly owned property between the property lines on a street, park, or other public property, as such property lines are shown on the records of the District, and includes any roadway, tree space, sidewalk, or parking between such property lines.

Other important terms are the tree box area or planter area and the sidewalk area. These are defined as the area of the roadside that provides a buffer between the pedestrians and vehicles, which primarily contains landscaping such as a continuous planting strip in residential areas. The sidewalk area is sometimes known as the "pedestrian clear zone", this is the walking zone adjacent to the tree box that must remain clear, both horizontally and vertically.

In the MEP discussion that follows, a PROW project means a land-disturbing activity conducted in the existing PROW and the existing public space associated with the project. The MEP discussion applies only to those PROW projects required for the operation and maintenance of existing commercial and residential streets, existing alleyways, and other existing transportation infrastructure designed and maintained for the safe conveyance of people and commerce. Private subdivision roads or streets shall not be considered PROW projects.

Construction projects to maintain and upgrade the District's PROW are faced with a multitude of unique site constraints that vary widely. Limited space outside of the roadway restricts opportunities for infiltration and evapotranspiration, and in many cases the width of the roadway cannot be reduced to create additional space. In the roadway itself, the structural integrity of the pavement is the prime concern. The weight and volume of traffic loads may limit the use of permeable pavements.

The PROW occupy approximately 25 percent of the impervious area of the District of Columbia, making the PROW one of the most significant sources of stormwater runoff impacting District waterbodies. Stormwater runoff from roadways can present high pollutant loading. Despite the challenges to stormwater management faced by PROW projects, it is essential for the protection of District waterbodies to strive to achieve full retention of the regulated stormwater volume through the use of BMPs to the MEP on all PROW projects. This means the design process of all PROW projects shall evaluate and implement all applicable and effective BMPs except those shown to be technically infeasible.

The aim for full retention on-site of a PROW project's regulated stormwater volume is consistent with the District of Columbia Department of Transportation's (DDOT's) "Complete Streets" policy which states, "improvements to the right-of-way shall consider… environmental enhancements including, reducing right-of-way stormwater run-off, improving water quality, prioritizing and allocating sustainable tree space and planting areas (both surface and subsurface), … wherever possible". It is also an effort consistent with the District's 2012 Municipal Separated Storm Sewer System (MS4) permit which requires the retrofit for on-site stormwater retention of 1,500,000 ft^2 of PROW by 2016, which might translate to 35.5 miles of 8 foot wide pervious parking lanes or 4.7 miles of 60 foot wide full PROW cross section where the runoff is captured and managed from sidewalks, tree boxes, parking lanes, and the roadway.

The sections that follow, Design Considerations and Decision Process, are intended to provide structure for planners, designers and reviewers to evaluate whether or not a PROW project has exhausted every opportunity to achieve the full retention of the regulated stormwater volume. Achieving the regulated Stormwater Retention Volume (SWRv) in the PROW projects will be technically infeasible on many occasions, even after going through the MEP process. Given this and the compelling interest of the ongoing reconstruction of the PROW for the maintenance of public safety and well-being, PROW projects can be excluded from the requirement to use Stormwater Retention Credits (SRCs) or pay an in-lieu fee to satisfy any shortfall in attaining the SWRv if the MEP is demonstrated. These PROW projects are the only type of projects that are excluded from this requirement.

DDOE's MEP process applies to two types of projects. Type 1 projects solely involve reconstruction of the existing PROW, such as when the District of Columbia Department of

Transportation reconstructs multiple blocks of a roadway. Type 2 designates parcel-based development projects that reconstruct the adjacent, existing PROW as portion of the project. Under the MEP process for Type 2 projects, the parcel portion of the application will be reviewed under the full stormwater management performance standards defined in Chapter 2, while the PROW portion of the application will be reviewed under the MEP Type 2 approach defined in this appendix.

The General Retention Compliance Calculator has a separate PROW worksheet that allows Type 2 applicants to separate parcel drainage area obligations from PROW obligations. The compliance tab also presents these drainage areas separately to simplify the review process and make it transparent. To request an MEP Type 2 review, an applicant will follow the format used to the request “relief for extraordinarily difficult site conditions” described in Appendix E, which requires a request memo with supporting evidence in addition to the completed worksheets from the General Retention Compliance Calculator.

The memo must address the six designs steps described in Section B.5. Type 2 applicants can choose to follow the same table, plan view, and narrative approach identified for Type 1 applicants without the multiple-stage review process for the 30 percent 65 percent, and 90 percent design phases. Type 1 projects will use a stormwater report that contains information in spreadsheet, plan view, and narrative formats for the submission and review of the 30 percent, 65 percent, and 90 percent design stages, typically of DDOT projects. Table B.3 indicates the information and submission format expected at each review stage.

B.3 Codes

DDOT uses a “functional street classification” system that is defined in Chapter 30 of the Transportation Design and Engineering Manual. There are five functional categories including Freeways, Principal arterials, Minor arterials, Collector streets and Local streets. Table B.1 shows relative distribution of roadway classifications in the District. Each type has design criteria that are governed by traffic volumes, land use, and expected growth. These design criteria set the acceptable ranges for geometric design elements that will govern roadway geometry. The MEP process assumes transportation design criteria govern when conflicting demands exist.

Table B.1 Roadway Classification and Extent Relative to Total Roadway System

Type	Approximate Miles	% of District Roadway System
Freeways	46	4
Principal Arterials	92	8
Minor Arterials	178	15
Collectors	152	13
Local Roads	682	60

The MEP process assumes BMP designs will comply with the District of Columbia Department of Transportation Design and Engineering Manual Chapter 33, Chapter 47, and the Design and

Engineering Manual supplements for Low Impact Development and Green Infrastructure Standards and Specifications as well as Chapter 3 in this guidebook.

B.4 PROW Design Considerations

B.4.1 Considerations in the Planning Process (limited to Type 1).

The local capital authority for PROW projects is defined in the District of Columbia's Capital Improvement Program (CIP), a six-year-plan that is updated annually. Federally funded projects are listed in the Transportation Improvement Program (TIP), which is updated every other year according to the Metropolitan Washington Council of Government National Capital Region Transportation Planning Board's (MWCOG TPB) schedule and is also coordinated with the Constrained Long-Range Transportation Plan (CLRP). Each planning stage has an amendment process. Planners shall incorporate the MEP process into all future PROW projects and shall review and revisit, as needed, existing PROW plans for MEP analysis, revisions, and amendments. The TIP and CLRP are able to be amended and modified as allowed by the MWCOG TPB. As projects move from study to design and construction, DDOT will include necessary measures to include MEP analysis and implementation.

B.4.2 Site Assessment Considerations for the Retention Standard in PROW Projects

1. **Level of Disturbance (Type 1 and Type 2).** If a PROW project includes major land-disturbing activity required for the operation and maintenance of existing commercial and residential streets, existing alleyways, and other existing transportation infrastructure designed and maintained for the safe conveyance of people and commerce, it is captured by the stormwater regulatory obligations of Chapter 5 of Title 21, of the District of Columbia Municipal Regulations, Water Quality and Pollution (2012). Routine maintenance such as surface asphalt milling of roadways, where the roadway base is not disturbed, is not considered a level of disturbance that will require compliance with the regulation.
2. **Available Space (Type 1 and Type 2).** A PROW project must first and foremost seek to maximize landscape areas, maximize available space for stormwater retention, and minimize impervious surface, while coordinating with transportation, access, safety, and other applicable requirements, such as the American Disability Act (ADA) requirements and emergency vehicle needs. Street widths should be reduced to the appropriate minimum width while maintaining multi-modal transportation needs, parking, and public safety. A rule of thumb used in some cities (e.g. Los Angeles, Portland, Seattle, and Philadelphia) equates the expected landscape space to a minimum percentage of the imperviousness within each drainage area within the PROW project limits of disturbance. This percentage ranges from 4 percent to 10 percent.

   In the District of Columbia several hundred triangular islands, less than one acre in area, are created by diagonal street intersections. A PROW project must consider the opportunity for stormwater retention within traffic islands, or triangle parks, that fall within, or adjacent to, the project limits of disturbance. Streets that end as cul-de-sacs, are less prevalent in the District, however, when present cul-de-sacs within, or adjacent to, the limits of disturbance of a PROW project must be evaluated for stormwater retention opportunities. In the District "paper streets" exist throughout, as areas of the City dedicated as streets but not useable as transportation passageways. These areas, under the control of the DDOT, may be created by the intersection of streets with parks and streams, and are often mowed grass areas. “Paper streets” within, or adjacent to, the limits of disturbance of a PROW project must be evaluated for stormwater retention opportunities.

3. **Impervious Cover Removal (Type 1 and Type 2).** The elimination of impervious surface may be accomplished by closing diagonal roadways adjacent to triangle parks to create larger parks. Diagonal roadways that are adjacent to triangle parks and fall within, or are adjacent to, a PROW project must be evaluated for stormwater retention opportunities. PROW projects must evaluate the opportunity to integrate traffic calming measures including but not limited to, median islands, pedestrian curb extensions, bump outs and chicanes, and turning radius reductions that may double as areas for impervious surface removal and BMPs.

   Replacing impervious cover with landscape area in the contributing drainage area converts the runoff coefficient from 95 percent to 25 percent in essence decreasing that area’s contribution to stormwater runoff by 70 percent without the use of an active stormwater facility. If an area can be converted to “natural cover” through conservation and reforestation strategies that area’s contribution to stormwater runoff is reduced to zero. Consult Appendix N for minimum thresholds and other required for each land cover designation. Further opportunities to reduce stormwater runoff in these drainage areas should be explored with adjacent property both public and private as source control may be the most cost effective approach to managing stormwater runoff, see Section 3.4 Impervious Surface Disconnection.

4. **Drainage Areas (Type 1 and Type 2).** Overall conceptual drainage plans for PROW projects should identify drainage areas outside of the project’s limits of disturbance that generate runoff that may comingle with on-site runoff. The project is not required to consider off-site runoff in the calculation for the regulated Stormwater Retention Volume (SWRv); however BMPs sized for retention of comingled off-site runoff can be used to off-set the inability to capture and retain the SWRv in areas within the project for which significant constraints prevent retention.

   For example, a typical city block will have at least two distinct drainage areas created by the crown in the center of the road. While one side of the road may have significant obstacles to the implementation of retention practices the other may not. If the limits of disturbance are defined by the boundaries of the sidewalks on either side of the roadway this is the area that is used to calculate the SWRv. However, in many circumstances stormwater runoff is entering the sidewalk and roadway from adjacent properties, both public and private, creating a comingled stormwater runoff. Under these conditions the side of the street that has the greater opportunity to implement retention strategies shall be designed to manage that comingled volume up to the full SWRv.

   Type 1 and Type 2 projects must prioritize capturing roadway runoff. For Type 2 projects, where limits of disturbance do not extend into the roadway, the capture of roadway runoff from adjacent roadway drainage areas may be accomplished with curb cuts or sidewalk trenches used to direct roadway runoff from the curb line into sidewalk BMPs within the project’s limits of disturbance. This must be the first consideration to satisfy the SWRv calculated for the project’s PROW portion.

5. **Ownership of Land Adjacent to Right-of-Ways (limited to Type 1).** The opportunity to incorporate stormwater retention may depend on the ownership of land adjacent to the right-of-way. Acquisition of additional right-of-way and/or access easements may only be feasible if land bordering the project is publicly owned. PROW project must identify public lands and public rights of way adjacent to the project's limit of disturbance. PROW project planners and managers may need to consult with adjacent public property owners and managers to evaluate opportunities to direct stormwater runoff from the project drainage area to adjacent public lands.

6. **Location of Existing Utilities (Type 1 and Type 2).** The location of existing storm drainage utilities (grey infrastructure) can influence the opportunities for stormwater retention in PROW projects. Utilizing the existing grey infrastructure for the conveyance of large events with under drain connections and curb line overflows can reduce costs. Using existing grey infrastructure where possible frees funds for drainage areas within the project limits of disturbance where grey infrastructure does not exist or is more challenging to utilize. Standard peak-flow curb inlets, such as catch basins, should be located downstream of areas with potential for stormwater retention practices so that water can first flow into the BMP, and then overflow to the downstream inlet if capacity of the BMP is exceeded. It is more difficult to apply retention practices after water has entered the storm drain. The location of other utilities will influence the ability connect BMPs to storm drains, and may limit the allowable placement of BMPs to only those areas where a clear pathway to the storm drain exists.

   The following outlines an approach to take when considering the design and location of BMPs in the existing PROW relative to existing utilities: 1) avoidance; 2) mitigation; 3) relocation; and 4) acceptance.

   Avoidance. Whenever possible, locate BMPs to avoid a conflict that either jeopardizes the functionality and longevity of the utility or complicates future utility maintenance. Consult with each utility company on their recommended offsets which will allow utility maintenance work with minimal disturbance to the BMP. A consolidated presentation of the various utility offset recommendations can be found in Chapter 33.14.5 of the District of Columbia Department of Transportation Design and Engineering Manual, latest edition. Consult the District of Columbia Water and Sewer Authority (DC Water) Green Infrastructure Utility Protection Guidelines, latest edition, for water and sewer line recommendations. Avoidance of utility conflicts may mean one BMP type is selected over another. It may mean the sizing of a BMP is altered.

   Mitigation. Under the mitigation approach the BMP design is adjusted to mitigate utility concerns. A BMP design may need to be resized or otherwise altered to satisfy utility offsets. This may include moving, adding, or deleting a key design feature of the BMP such as check dams, inlets, outlets and trees.

   Relocation. Under the relocation approach an attempt is made to coordinate with utility companies to allow them to replace or relocate their aging infrastructure while BMPs are being implemented. Where the capital budget and priorities of the utility can be aligned with the larger construction in the PROW, there are potential benefits, including cost savings, for both the utility and the entity undertaking the reconstruction of the PROW. The age of the utility line is a factor in selecting this solution. While a utility relocation during a street reconstruction project may be advantageous to the utility provider, it is understood that the utility may not be able to align its capital budget or may be otherwise unable or unwilling to take advantage of the relocation opportunity.

Acceptance. When the first three approaches are inadequate to achieve the required stormwater retention, consider a fourth approach, acceptance of conflicts that do not jeopardize the functionality, longevity and vehicular access to manholes and other key points of utility maintenance. This does not preclude the typical public right-of-way PROW BMP such as street trees, bioretention, or permeable pavement which the utility would be expected to replace if maintenance in those areas was required. In this scenario, a BMP location and design that complicates utility maintenance should be considered acceptable if it does not compromise the utility function, longevity, and major access points. When accepting utility conflict into the BMP location and design, it is understood the BMP will be temporarily impacted during utility work but the utility will replace the BMP or, alternatively, install a functionally comparable BMP according to the specifications in the current version of this Stormwater Management Guidebook and the District of Columbia Department of Transportation Design and Engineering Manual with special attention to Chapter 33, Chapter 47, and the Design and Engineering Manual supplements for Low Impact Development and Green Infrastructure Standards and Specifications. To clarify whether a conflict jeopardizes the functionality, longevity and access to a utility consider the latest editions of the District of Columbia Department of Transportation Design and Engineering Manual and the District of Columbia Water and Sewer Authority (DC Water) Green Infrastructure Utility Protection Guidelines.

7. **Grade Differential Between Road Surface and Storm Drain System (Type 1 and Type 2).** Some BMPs require more head from inlet to outlet than others; therefore, allowable head drop may be an important consideration in BMP selection. Storm drain elevations may be constrained by a variety of factors in a roadway project (utility crossings, outfall elevations, etc.) that cannot be overcome and may override Stormwater Retention Volume considerations.

8. **Longitudinal Slope (limited to Type 1).** The suite of BMPs which may be installed on steeper road sections is more limited. Specifically, permeable pavement and swales are more suitable for gentle grades. Other BMPs may be more readily terraced to be used on steeper slopes. Check dams and weirs should be incorporated into BMP designs on steeper slopes.

9. **Potential Access Opportunities (limited to Type 1).** A significant concern with the installation of BMPs in high speed, high volume PROW is the ability to safely access the BMPs for maintenance considering traffic hazards. A PROW project involving high speed, high volume PROW should include a site assessment to identify vehicle travel lanes and areas of specific safety hazards for maintenance crews. Subsequent steps in the preparation of the stormwater management plan (SWMP) for the PROW project should attempt to avoid placing BMPs in these areas.

10. **Tree Canopy and Vegetation (Type 1 and Type 2).** Concern for the preservation of existing mature trees is a reasonable consideration when determining where and how to direct stormwater runoff from the curb line for retention goals in a PROW project. In general, stormwater retention practices should be installed outside the drip line of existing trees (more specific guidance is provided in Section 3.14). A guiding principal for PROW projects

should be the improvement and maintenance of the most robust tree canopy possible along the PROW. The planting of trees and the preservation of trees should look to the latest science on the soil volume requirements, spacing needs and methods to connect stormwater runoff to tree roots to support healthy vigorous tree growth. PROW projects should clearly identify existing healthy trees and detail how to prevent tree losses during construction. Additionally, diseased and dead trees should be removed. Soils in tree planting areas should be amended and volumes expanded whenever trees are replaced or new trees are planted.

11. **Infiltration (Type 1 and Type 2).** Infiltration practices have very high storage and retention capabilities when sited and designed appropriately. Designers should evaluate the range of soil properties during initial site layout and seek to configure the site to conserve and protect the soils with the greatest recharge and infiltration rates. In particular, areas of Hydrologic Soil Group A or B soils shown on NRCS soil surveys should be considered as primary locations for infiltration practices. When designing a PROW project consult Appendix O, Geotechnical, and Chapter 3.7, Infiltration, as well as chapters on specific BMPs under consideration in this Stormwater Management Guidebook (SWMG) for specific design details and constraints.

    In areas where a qualified professional engineer, soils scientist or geologist determines during an initial feasibility test the presence of soil characteristics which support the categorization as D soils, no further investigation is required. A designer of a PROW project should first consider reducing the impervious surface area draining to these poor soil areas. Other soil types may require further analysis to determine infiltration feasibility. It is important to understand that areas with poor soils may still be sites for BMPs that are designed with underdrains.

    If the seasonally high water table is determined to be less than two feet from the bottom of the proposed BMP, infiltration may not be appropriate. This may be determined through a comparison of historic and actual elevations. If the site is one of known soil contamination or receiving uncontrolled stormwater runoff from a land use hotspot, as determined by guidance in Appendix P. Stormwater Hotspots, infiltration must not be used.

12. **Street Profile (limited to Type 1).** The profile of an impervious surface such as a street or an alleyway determines how stormwater runoff flows off the surface. District streets follow a crowned design with the high point in the center draining to both sides, alleyways are typically reverse crowned, draining to the center and sidewalks side shed, draining to one side. Flat drainage is a term used to denote vertical drainage through a permeable paving profile. A PROW project should consider all variations of drainage patterns when the standard drainage design does not provide retention for the full regulated Stormwater Retention Volume (SWRv). The drainage patterns of the project should be developed so that drainage can be routed to areas with BMP opportunities before entering storm drains. For example, if a median strip is present, a reverse crown should be considered, so that stormwater can drain to a median swale.

13. **Pedestrian Circulation (Type 1 and Type 2).** The design of stormwater retention facilities should harmonize with effective pedestrian circulation in PROW projects. PROW project BMPs commonly integrate the goals of stormwater retention and pedestrian safety by reducing pedestrian crossing distances, providing more space against vehicular traffic, and improving site angles at intersections. While pedestrian circulation and stormwater retention

should not be at odds, conflicts can arise with on street parking. Considerations should be given to provide adequate egress for parking adjacent to a BMP (typically 2 feet). In addition, frequent walkways across BMPs can give pedestrians sufficient access to parking zones.

Retention facilities with vertical drops of greater than six inches in a PROW projects should provide pedestrians with visual or physical signals that denote a significant drop in grade, such as a raised curb edge, a detectable warning strip or a raised railing. Railings maybe designed to perform additional functions such as seating or bicycle racks. In areas with the potential for high pedestrian volume railings may be needed to prevent pedestrians from cutting through landscaped areas, trampling vegetation and compacting soils.

B.4.3 Fundamental Tenets of MEP for PROW

A PROW project shall demonstrate a design approach that indicates stormwater retention opportunities were evaluated to the MEP, which includes the following:

a. Selecting BMPs based on site opportunities to reduce stormwater runoff volumes.

b. Sizing BMPs opportunistically to provide the maximum stormwater retention while accounting for the many competing considerations in PROW projects.

c. Prioritizing capturing roadway runoff. By managing comingled stormwater runoff within some project drainage areas to offset minimum retention achieved in other project drainage areas.

d. Developing innovative stormwater management configurations integrating “green” with “grey” infrastructure,

e. Minimizing street width to the appropriate minimum width for maintaining traffic flow and public safety.

f. Maximizing tree canopy by planting or preserving trees/shrubs, amending soils, increasing soil volumes and connecting tree roots with stormwater runoff.

g. Using porous pavement or pavers for low traffic roadways, on-street parking, shoulders or sidewalks.

h. Integrating traffic calming measures that serve as stormwater retention BMPs.

i. Reducing stormwater runoff volume by converting impervious surfaces to land cover types that generate little or zero stormwater runoff.

j. Reducing stormwater runoff volume by employing impervious surface disconnection strategies within and adjacent to the project’s limits of disturbance.

B.5 Design Process for PROW

Step 1: Identify Drainage Areas and Calculate SWRv.

a. Define the limits of disturbance for the PROW project.

b. Delineate all drainage areas both within, and contributing to, the limits of disturbance for the PROW project. Prioritize drainage areas conveying roadway runoff.

c. Identify proposed land covers within the limits of disturbance for the PROW project, including impervious cover, compacted cover, and natural cover. Area under proposed BMPs counts as impervious cover. A continuous planter strip may be consider compacted cover, or natural cover; consult Appendix N for the minimum thresholds an area needs to qualify for each designation. Individual street trees may count as compacted cover or as a BMP. Use the General Retention Compliance Calculator PROW worksheet to determine which approach provides the greatest SWRv reduction.

d. Calculate the regulated Stormwater Retention Volume (SWRv) based on land cover and area within the limits of disturbance for the entire PROW project. Calculate the portion of the SWRv for each drainage area within the limits of disturbance of the PROW project. Calculate any “unregulated” off-site stormwater retention volume contributing to the project limits of disturbance.

   Note: When off-site stormwater runoff volumes are managed their reduction will count toward a reduction in the SWRv. Off-site stormwater runoff volumes may be managed at the source or within the project’s limits of disturbance. Prioritize drainage areas conveying roadway runoff.

e. Consider land conversion and BMP designations in adjacent public lands. While these volumes are not counted in the calculation of the site’s SWRv, if controlled they will count towards the reduction of the site’s SWRv. Identify opportunities for land cover conversions or other source control measures that would reduce these off-site volumes.

f. Consider altering the drainage profile if that alteration would increase runoff capture opportunities. This consideration will typically be set aside until all other considerations have been exhausted (limited to Type 1).

Step 2: Evaluate Infiltration.

a. Determine historical and actual water table elevations to evaluate opportunities and restrictions for locating infiltration practices.

b. Consult a qualified professional engineer, soil scientist or geologist using initial infiltration feasibility tests, to identify the areas within the limits of disturbance with Hydrologic Soil groups that should be preserved and targeted for infiltration BMPs, and areas where infiltration BMPs will require amended soils and under drains.

c. Identify any areas within the limits of disturbance where there is a known issue of soil contamination. Infiltration BMPs in these areas are not allowed. Use the guidance in Appendix P. Stormwater Hotspots to evaluate adjacent land use hotspots that may be a source of uncontrolled contaminates in stormwater runoff.

Step 3: Demonstrate Full Consideration of Opportunities with Existing Infrastructure.

a. Review substructure maps and utility plans; delineate areas of potential conflict as well as areas without conflict.

b. Identify the location and elevation of the existing storm drainage system (grey infrastructure), including catch basins, drain inlets, and manholes in both the drainage areas within, and those drainage areas contributing stormwater runoff to, the limits of disturbance for the PROW project.

c. Identify all existing trees to be preserved. Identify and record tree species, size and preservation status.

Step 4: **Demonstrate Full Consideration of Land Cover Conversions and Optimum BMP Placement.**

a. Identify traffic islands, triangle parks, median islands, cul-de-sacs, and paper streets within and adjacent to the PROW project's limits of disturbance. These areas can be the focus of land cover conversions and BMP locations (unless within LOD of Type 2 this is limited Type 1).

b. Evaluate the opportunity to integrate traffic calming measures including but not limited to, median islands, pedestrian curb extensions, bump outs and chicanes, and turning radius reductions. Delineate these areas out for consideration for impervious surface removal and BMP facilities. Delineate areas available for additional tree planting. Note whether soil volume increases and amended soils are required (unless within LOD of Type 2 this is limited Type 1).

c. Evaluate right-of-way widths; identify minimum requirements for trails, alleys, roadways and sidewalks. Delineate sections where existing conditions exceed minimum requirements. These areas can be the focus of land cover conversions and BMP locations (limited to Type 1).

d. Select areas delineated as optimum opportunities for land conversion or BMP location.

   Note: Land conversions can significantly reduce the project's SWRv without the use of an active stormwater facility. Designate land conversions and recalculate SWRv at the full project scale and the scale of the individual drainage areas within the project area.

e. Select most appropriate BMP types for each area delineated as optimum opportunities for BMP locations. Consult Table B.2 for potential BMPs recommended by US EPA for "Green Streets", DDOT's AWI Chapter 5 LID, DDOT's LID Action Plan, DDOT's LID Standards and Specifications, and Chapters 3.1 through 3.12 in this Guidance Manual.

Step 5: **Size BMPs.**

a. The following process are used to size BMPs for PROW projects:

   1. Delineate drainage areas to BMP locations including any area outside the limits of disturbance contributing off-site stormwater runoff volume; prioritize roadway runoff; consider the land covers to compute optimum Stormwater Retention Volume. Consider designing to the over control retention volume, above the regulated requirement of 1.2 inches, up to the regulated ceiling of 1.7 inches.

   2. Look up the recommended sizing methodology for the BMP selected in each drainage area and using the appropriate BMP chapter of this guidance manual to calculate target sizing criteria.

   3. Design BMPs per the appropriate chapter of this guidance manual and the District of Columbia Department of Transportation Design and Engineering Manual.

   4. Attempt to provide the calculated sizing criteria for the selected BMPs.

5. If sizing criteria cannot be achieved, document the constraints that override the application of BMPs, and provide the largest portion of the sizing criteria that can be reasonably provided given constraints.

Note: If BMPs cannot be sized to provide the calculated volume for the drainage area, it is still essential to design the BMP inlet, energy dissipation, and overflow capacity for the full drainage area, including any area contributing off-site stormwater runoff volume, to ensure that flooding and scour is avoided. It is strongly recommended that BMPs which are designed to less than their target design volume be designed to bypass peak flows.

b. Aggregate the retention values achieved with the BMPs and compare with the regulated Stormwater Retention Volume (SWRv) for PROW project. If the aggregate retention value meets or exceeds the SWRv the project has meet its regulatory obligation.

c. If there is a retention volume deficiency, consider sizing BMPs to manage the comingled volume on-site.

d. If there is a retention volume deficiency, revisit Design Steps 1–4. Increase land conversion areas and BMP facilities. Depending on the extent and complexity of the PROW project this may require several iterations.

Step 6: Address Drainage Areas where Zero-Retention Practices are Installed.

It is possible, despite following the design considerations, fundamental tenants, and the iterative Steps 1–5 of the design process, that drainage areas within the proposed limits of disturbance may emerge without any retention practices. If these cases occur in the Municipal Separate Storm Sewer System (MS4), those drainage areas must incorporate water quality catch basins or other emergent technologies that provide water quality treatment for the SWRv of those drainage areas.

Table B.2 Potential BMPs for Green Streets Projects (modified US EPA)

BMP Type	Opportunity Criteria for PROW Projects
Street Trees, Canopy Interception	▪ Access roads, residential streets, local roads and minor arterials ▪ Drainage infrastructure, sea walls/break water ▪ Effective for projects with any slope ▪ Trees may be prohibited along high speed roads for safety reasons or must be setback behind the clear zone or protected with guard rails and barriers; planting setbacks may also be required for traffic and pedestrian lines of sight.
Stormwater Curb Extensions / Stormwater Planters	▪ Access roads, residential streets, and local roads with parallel or angle parking and sidewalks ▪ Can be designed to overflow back to curb line and to standard inlet ▪ Shape is not important and can be integrated wherever unused space exists ▪ Can be installed on relatively steep grades with terracing
Bioretention Areas	▪ Low density residential streets without sidewalks; along roadways adjacent to park space; well suited for the District's triangle parks; ramp, slipways and road closings can make good conversion-sites ▪ May require more space than curb extensions/ planters, consider combing with minimized road widths to maximize bioretention area.
Permeable Pavement	▪ Parking and sidewalk areas of residential streets, and local roads If significant run-on from major roads is a possibility ensure deign and maintenance protocols to accommodate potential TSS loads ▪ Should not be subject to heavy truck/ equipment traffic ▪ Light vehicle access roads and alleyways
Permeable Friction Course Overlays	▪ High speed roadways unsuitable for full depth permeable pavement ▪ Suitable for parking lots and all roadway types
Vegetated Swales (compost amended were possible)	▪ Roadways with low to moderate slope or terraced systems ▪ Residential streets with minimal driveway access ▪ Minor to major arterials with medians or mandatory sidewalk set-backs Access roads ▪ Swales running parallel to storm drain can have intermittent discharge points to reduce required flow capacity
Filter strips (amended road shoulder)	▪ Access roads ▪ Major roadways with excess PROW ▪ Not practicable in most PROWs because of width requirements
Proprietary Biotreatment	▪ Constrained PROWs ▪ Typically have small footprint to drainage area ratio ▪ Simple install and maintenance ▪ Can be installed on roadways of any slope ▪ Can be designed to overflow back to curb line and to standard inlet
Infiltration Trench	▪ Constrained PROWs ▪ Can require small footprint where soils are suitable ▪ Low to moderate traffic roadways ▪ Infiltration trenches are not suitable for high traffic roadways ▪ Requires robust pretreatment

B.6 Summary of MEP Type 1 Submission Process

Table B.3 MEP Type 1Submission Elements and Review Points

	Stormwater Report Design Phases								
	30%			65%			90%		
Process Steps	Table	Plan	Narrative	Table	Plan	Narrative	Table	Plan	Narrative
Step 1: Identify Drainage Areas and Calculate SWRv									
DA count	I		I	R		R	F		F
DA list and SWRv per DA	I			R			F		
Project LOD		I			R			F	
DAs within LOD		I			R			F	
DAs outside LOD		I			R			F	
Land cover in LOD	I			R			F		
Volume calculated per DA inside LOD	I			R			F		
Volume calculated per DA outside LOD	I			R			F		
Will altered drainage profile increase SWRV?		I	I		R	R			F
Consider adjacent public lands		I			R	R			F
Step 2: Evaluate Infiltration									
Water table conflict per DA (Y/N)	I		I	R		R	F		F
Bedrock conflict per DA (Y/N)	I		I	R		R	F		F
Hydro soil group per DA (Y/N)	I		I	R		R	F		F
Hotspot concern noted (Y/N)	I		I	R		R	F		F
Water table impact (Y/N)					R	R	F	F	
Initial infiltration feasibility tests–opportunities and restrictions? (Y/N)					R	R		F	
Identify adjacent land use hotspots (Y/N)		I			R	R		F	
Step 3: Demonstrate Full Consideration of Existing Infrastructure									
Utility plans		I			R			F	
Utility conflicts		I			R			F	
Existing sewer infrastructure elevations		I			R			F	
Existing Trees	I	I			R			F	
Step 4: Demonstrate Full Consideration of Land Cover Conversions and Optimum BMP Placement									
Land conversion and BMP placement		I	I		R	R		F	F
Count of BMPs and land conversions	I			R			F		
Step 5: Size BMPs									

	Stormwater Report Design Phases								
	30%			65%			90%		
Process Steps	Table	Plan	Narrative	Table	Plan	Narrative	Table	Plan	Narrative
BMP drainage areas within LOD and outside LOD (Y/N)					I			R	
Consider over control of SWRV (Y/N)						I			R
Achieve BMP sizing criteria (Y/N)						I			R
Design sizing achieved (under/over)				I			R		
Sizing constraints						I			R
Step 6: Address DAs with Zero-Retention Practices Installed									
SWRv achieved per DA				I		I	F		F

Notes:
I = Initial findings and presentation; this should define known facts and best opportunities.
R = Revisions based on further investigations and review comments; this will include some firm commitments.
F = Final design decisions based on initial commitments, interim reviews and final findings.
The process outlined in this table leads to a final submission of 100 percent design SWMP as required for the building permit.
DA = drainage area, LOD = limits of disturbance, SWRv = stormwater retention volume

B.7 References

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