



MEMORANDUM

DATE: Revised – August 1, 2011
June 10, 2011

TO: Mary Dolan, Montgomery County Planning Department

FROM: Amalia Leighton, PE
Nathaniel Riedy, EIT

RE: Environmental Site Design (ESD)
Sizing Concepts for: Suburban and Urban Streets
Montgomery County Streetscape/Urban ESD
SvR Project No. 10015

This memorandum is to summarize our calculations to incorporate Environmental Site Design (ESD) into a suburban and urban road section and plan to assist the planning and implementation of ESD in response to regulatory changes:

- Updated Maryland Stormwater Manual including Environmental Site Design (ESD) guidelines.
- Montgomery County DOT recently updated Road Code

SvR worked with Montgomery County Planning Department staff to evaluate two street sections for opportunity to incorporate ESD. Incorporating ESD requires a review of the space requirements for individual road elements; compromises looking at requirements versus guidelines or standard practices may be required in order to provide the space for various ESD treatments. The findings from this evaluation are as follows:

1. **Fairland Road**, Fairland – between Marlow Farm Terrace and Marlow Farm Drive.

Fairland Road is a suburban arterial road through residential land uses. Montgomery County provided SvR with road plans and sections for this section of the corridor. SvR modified the designed road section to incorporate ESD. Based on the concept plan developed for this portion of Fairland Road, ESD is feasible to be used to meet the water quality and channel protection volume control. The conceptual calculations indicate that by incorporating a combination of the following techniques the requirements for ESD could be met along this 35 mph corridor:

- **Reduce lane widths** from 15 feet to 12 feet and the turn lane from 11 feet to 10 feet.
- **Pervious pavement hiker/biker path** (needed to meet channel protection volume, not water quality volume).
- **Microbioretention linear road filters** in the 9 feet wide planting strip.

2. **Marinelli Road** – White Flint – between Chapman Avenue and Boylston Street

This road is listed as a Business District Street in the White Flint Sector Plan Area. SvR modified Road Code Standard 2005.03 to incorporate ESD into the 90 foot right-of-way section. Based on the concept plan developed for a portion of Marinelli Road, ESD could be used to meet the water quality volume requirement. The calculations indicate

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that a combination of the following ESD techniques could be feasible along this corridor:

- **Reduce parking lane width** from 8 feet to 7 feet.
- **Reduce sidewalk width** from 10 feet to 9 feet
- **Microbioretentation ultra-urban planter boxes** could be used along the 3.5 feet wide planting strip and incorporated into proposed wider curb bulb outs. The concept uses bulb outs to accommodate ESD, losing approximately 20% of the available parking lane.

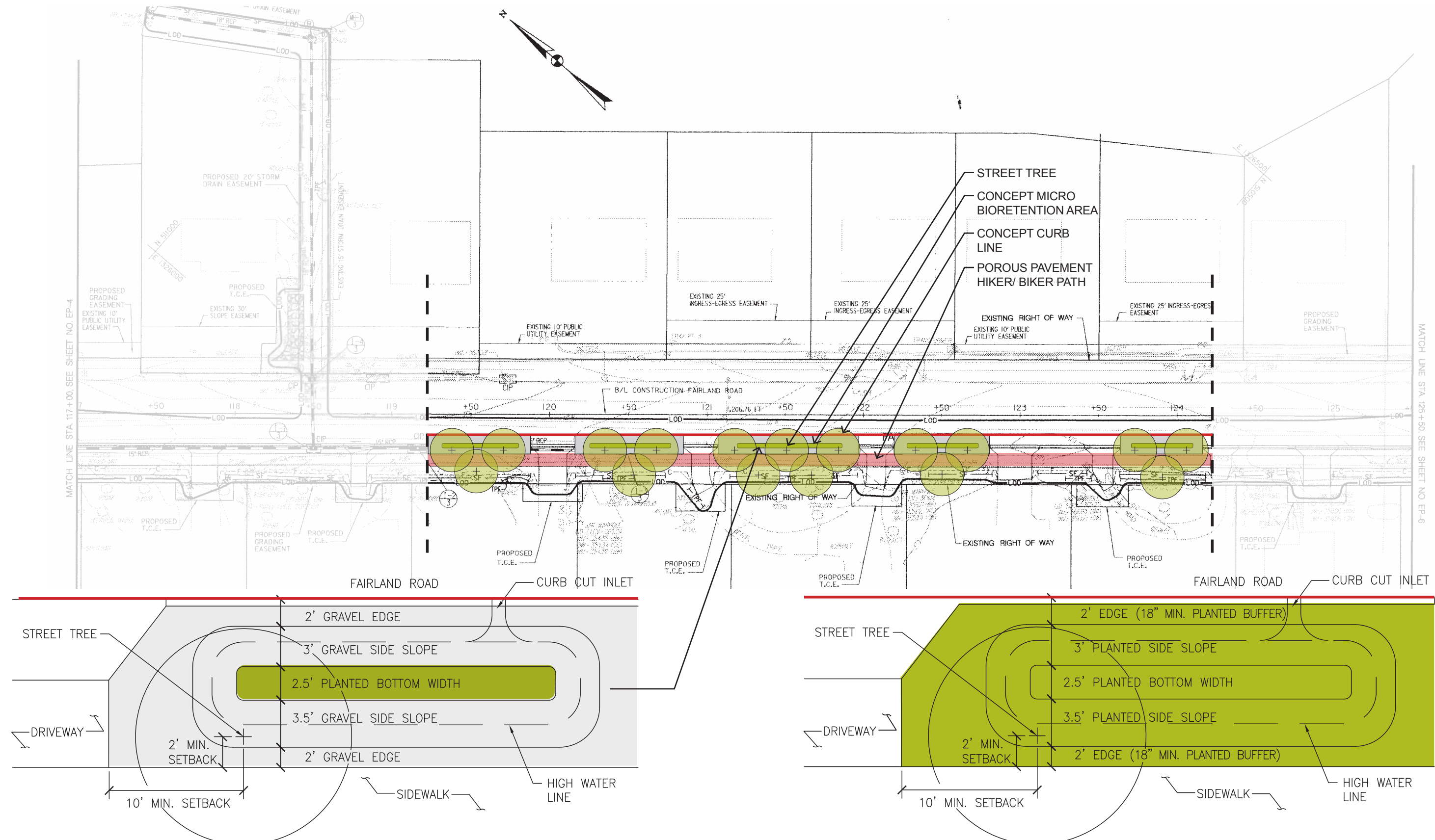
SvR has attached the modified typical cross sections, a plan view of the analyzed portion of each corridor, and our microbioretention calculations in the following attachments:

Attachment 1: Fairland Road Concept Plan, Section and Calculations

Attachment 2: Marinelli Road Concept Plan, Section and Calculations

Please contact Peg Staeheli (pegs@svrdesign.com) or Amalia Leighton (amalia@svrdesign.com) if you have any additional questions.

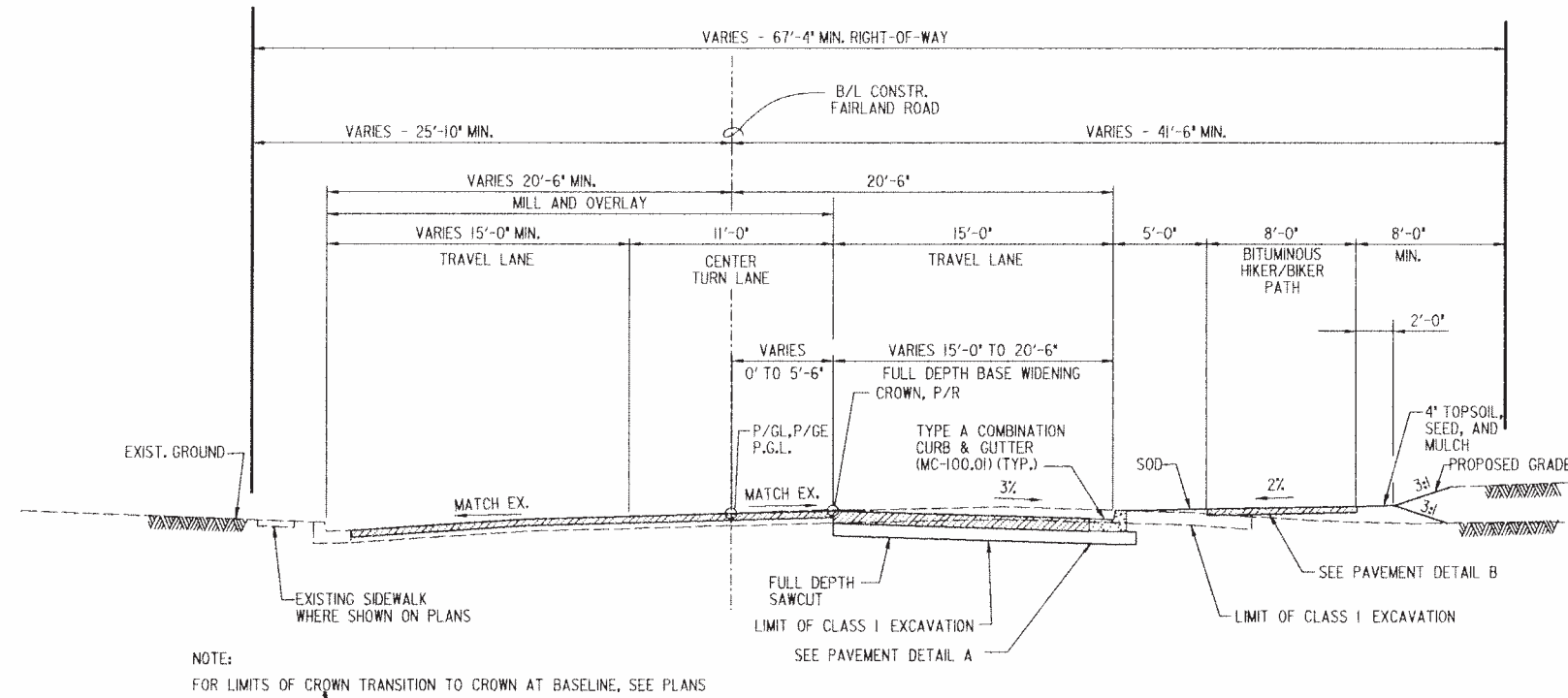
cc: Larry Cole, Montgomery County Planning Department
Mark Symborski, Montgomery County Planning Department



 CONCEPT MICRO BIORETENTION AREA - Montgomery County Standard

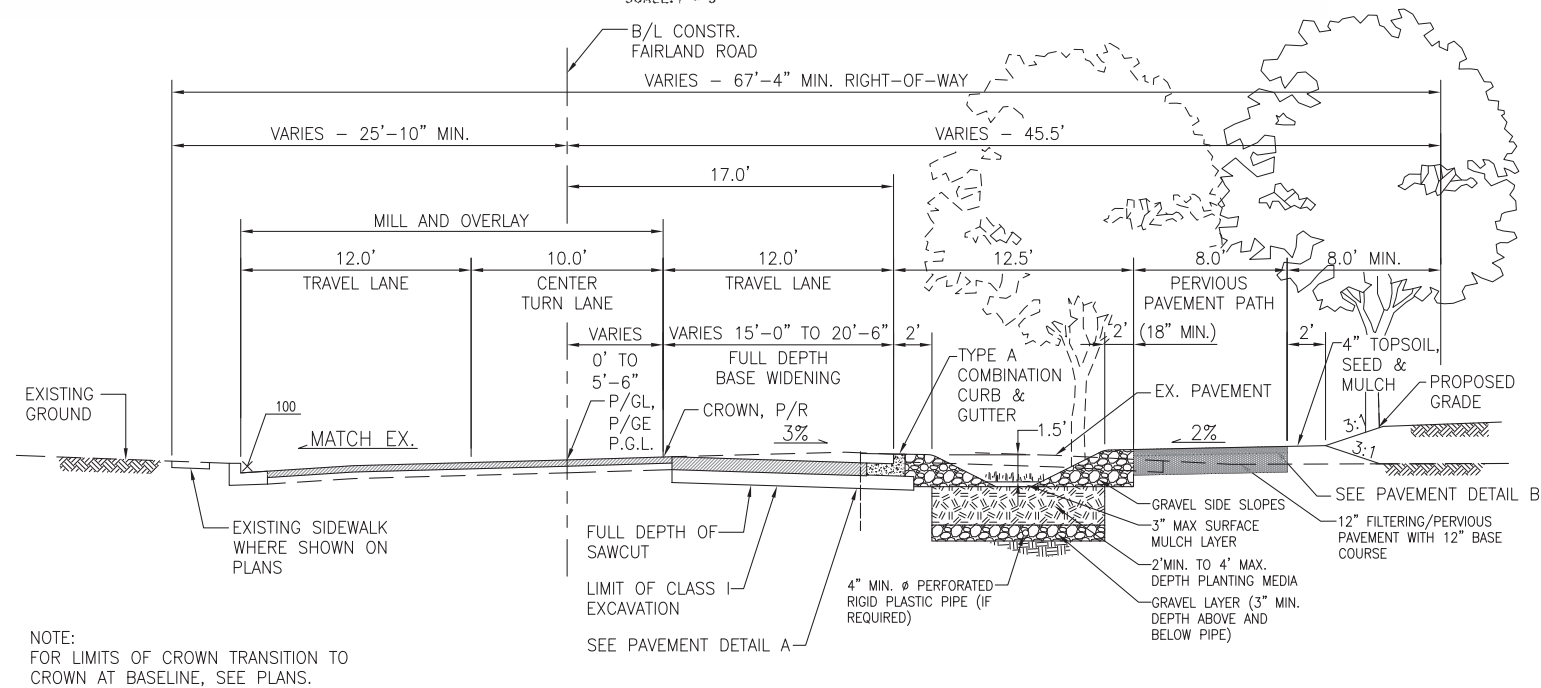
 CONCEPT MICRO BIORETENTION AREA - Recommended Vegetated





EXAMPLE: FAIRLAND ROAD - 70% SUBMITTAL PROVIDED BY MONTGOMERY COUNTY

BASE WIDENING - SHIFTED CROWN
STA. 115+91.86 TO STA. 125+88.00
SCALE: 1" = 5'



ESD CONCEPT: FAIRLAND ROAD - WITH ESD

BASE WIDENING - SHIFTED CROWN
STA. 115+91.86 TO STA. 125+88.00
SCALE: 1" = 5'



CALCULATION SHEET

500 Linear Feet of Fairland Road Between Marlow Farm Place and Marlow Farm Road



Montgomery County Planning Department
#10015
ESD Concept Design

Abbr.

MSDM Maryland Stormwater Design Manual (Revised 2009)

PP Porous Pavement (MSDM Chapter 5 pg 5.48)

BioRet Micro-Bioretention (MSDM Chapter 5 pg 5.96)

*All other abbr. per MSDM.

Assumptions:

Hydrologic Soil Group is estimated as B based on USDA National Resources Conservation Service Web Soil Survey

1yr 24hr Storm for Montgomery County = 2.6inch - MSDM pg 2.11

Based on Conceptual Section by SvR the DA to the BioRet would 40 ft, 50% impervious (not including driveways).

Based on 70% Submittal Plan driveways account for approximately 16% of the road length.

With driveways, %I = $0.16*100 + 0.84*50 = 58\%$ (Use 60% for Table 5.3)

Since effective RCN for PP is 55 which meets CPv, MSDM pg 5.48, PP areas are removed from the DA for the BioRet calculations

So without PP the DA is 38% impervious (not including driveways)

With driveways, %I = $0.16*100 + 0.84*38 = 48\%$ (Use 50% for Table 5.3)

Max 20,000 sf DA to each BioRet facility - MSDM 5.98

Therefore 40ft wide area would require at least one BioRet for every 500 feet

Assumes 12-inch subbase depth for permeable pavement in accordance with MSDM.

This analysis does not take into account offsite run-on. (WQv for offsite areas is not required - MSDM pg 2.2)

Rev Requirement is fulfilled through ESD Treatment of the WQv - MSDM pg 2.5

CALCULATION SHEET

500 Linear Feet of Fairland Road Between Marlow Farm Place and Marlow Farm Road

For Channel Protection Volume (CPv):

Without PP Hiker/Biker Path	
Hydrologic Soils B	
I	58 %
Pe	2 in
RCN*	55
Qe=Pe*Rv	
Qe	1.144 in
PP	
Length	0 ft
BioRet	
Pe=Af/(.075*DA)	
Pe	2 in
DA	20000 sf
Af	3000 sf
Width	9 ft
Length	333 ft
ESDv=(Pe*Rv*DA)/12	
ESDv	1907 cf
Check Max Ponding:	
Max Pond	11 in
Eq. Stor.	5.3 sf
Length	360 sf OK

With PP Hiker/Biker Path	
Hydrologic Soils B	
I	48 %
Pe	1.8 in
RCN*	55
Qe=Pe*Rv	
Qe	0.8676 in
PP	
Length	4000 ft
BioRet	
Pe=Af/(.075*DA)	
Pe	1.8 in
DA	16000 sf
Af	2160 sf
Width	9 ft
Length	240 ft
ESDv=(Pe*Rv*DA)/12	
ESDv	1157 cf
Check Max Ponding:	
Max Pond	11 in
Eq. Stor.	5.3 sf
Length	105 sf OK

<- MSDM pg 5.21

<- MSDM Table 5.3

<- Target

<- Rv=0.05+.009(I)

<- MSDM pg 5.48

<- 8ft wide sidewalk

<- MSDM pg 5.96

<- Af=Pe*(.075*DA)

<- Top width of BioRet

<- Equivalent Area of Ponding Storage Incl. 30% of Gravel Area

CALCULATION SHEET

500 Linear Feet of Fairland Road Between Marlow Farm Place and Marlow Farm Road

For Water Quality Volume (WQv) only:

WQ Treatment is for 1 inch of rainfall - MSDM pg 2.3

Without PP Hiker/Biker Path	
Hydrologic Soils B	
I	58 %
Pe	1 in
RCN*	55
Qe=Pe*Rv	
Qe	0.572 in
PP	
Length	0 ft
BioRet	
Pe=Af/(.075*DA)	
Pe	1 in
DA	20000 sf
Af	1500 sf
Width	7 ft
Length	214 ft
ESDv=(Pe*Rv*DA)/12	
ESDv	953 cf
Check Max Ponding:	
Max Pond	11 in
Eq. Stor.	5.3 sf
Length	180 sf OK

With PP Hiker/Biker Path	
Hydrologic Soils B	
I	48 %
Pe	1 in
RCN*	55
Qe=Pe*Rv	
Qe	0.482 in
PP	
Length	4000 ft
BioRet	
Pe=Af/(.075*DA)	
Pe	1 in
DA	16000 sf
Af	1200 sf
Width	7 ft
Length	171 ft
ESDv=(Pe*Rv*DA)/12	
ESDv	643 cf
Check Max Ponding:	
Max Pond	11 in
Eq. Stor.	5.3 sf
Length	58 sf OK

<- MSDM pg 5.21

<- Target

<- Rv=0.05+.009(I)

<- MSDM pg 5.48

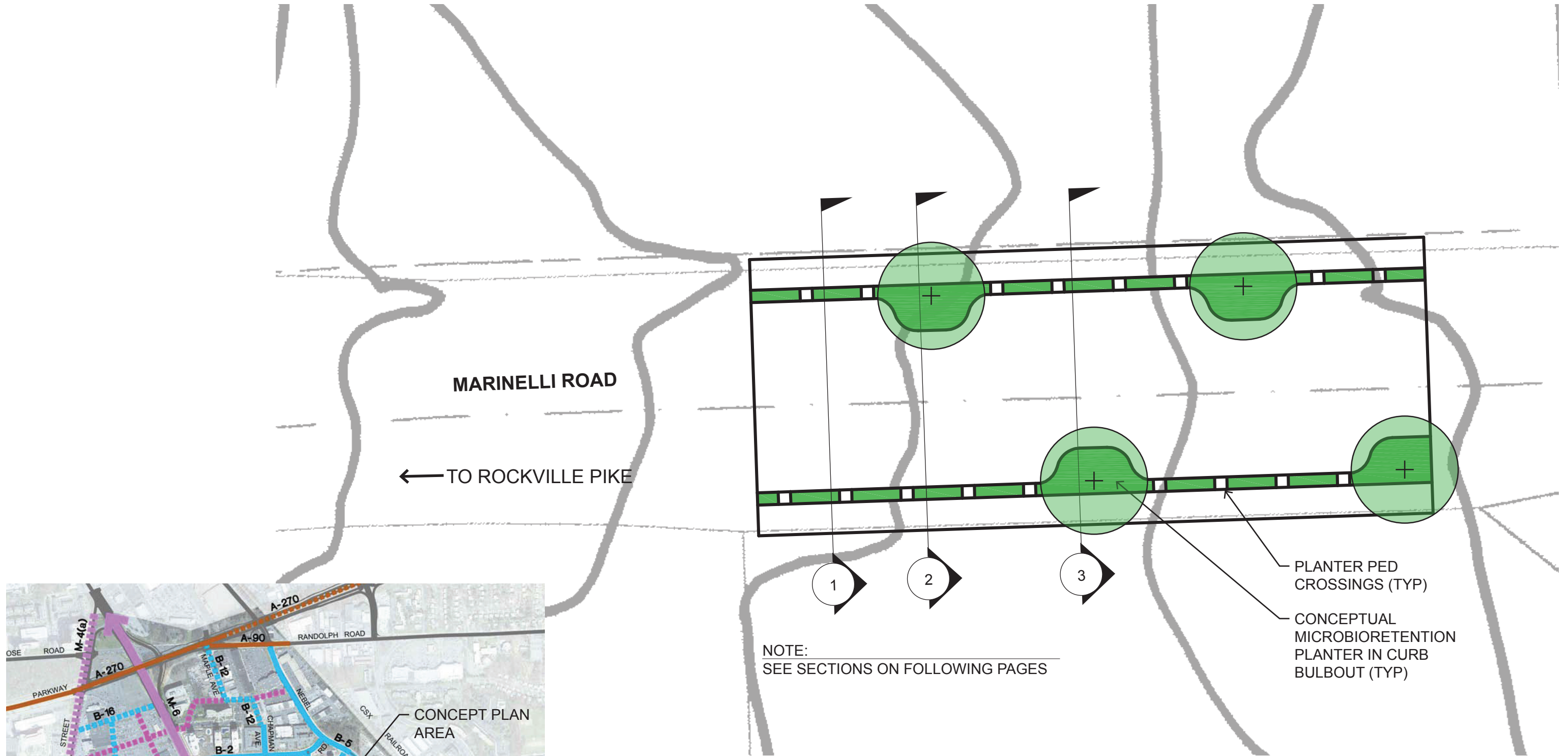
<- 8ft wide sidewalk

<- MSDM pg 5.96

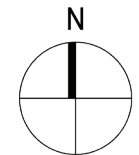
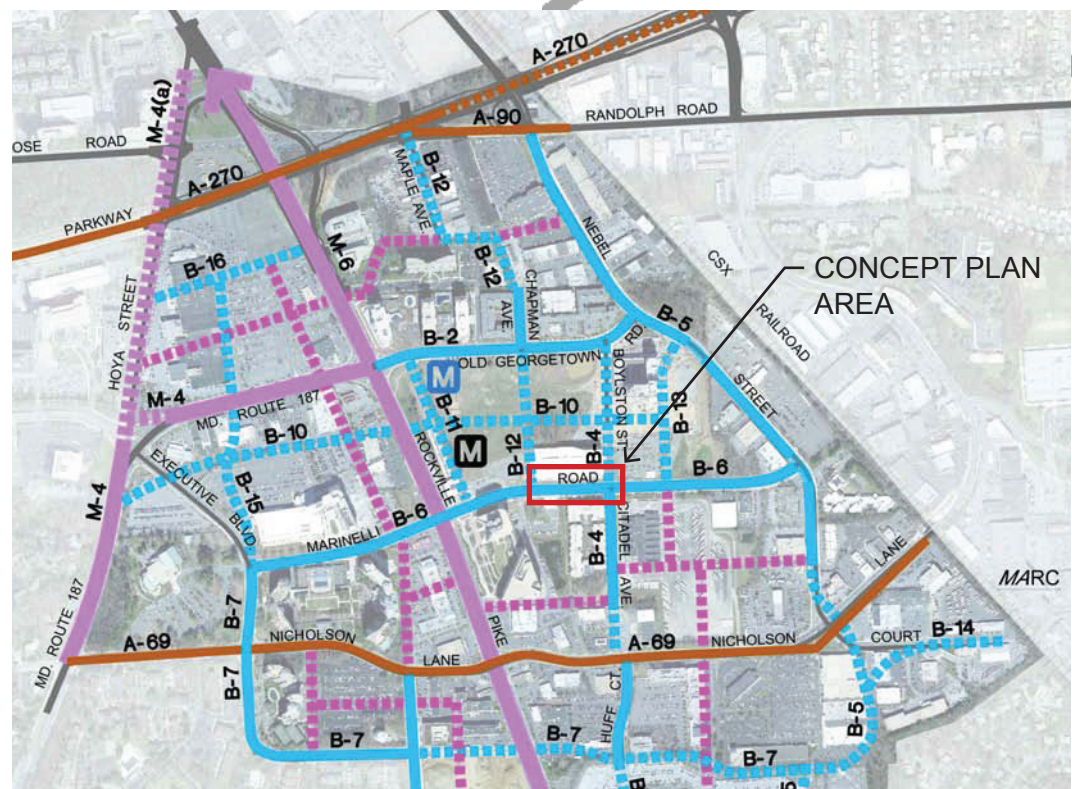
<- Af=Pe*(.075*DA)

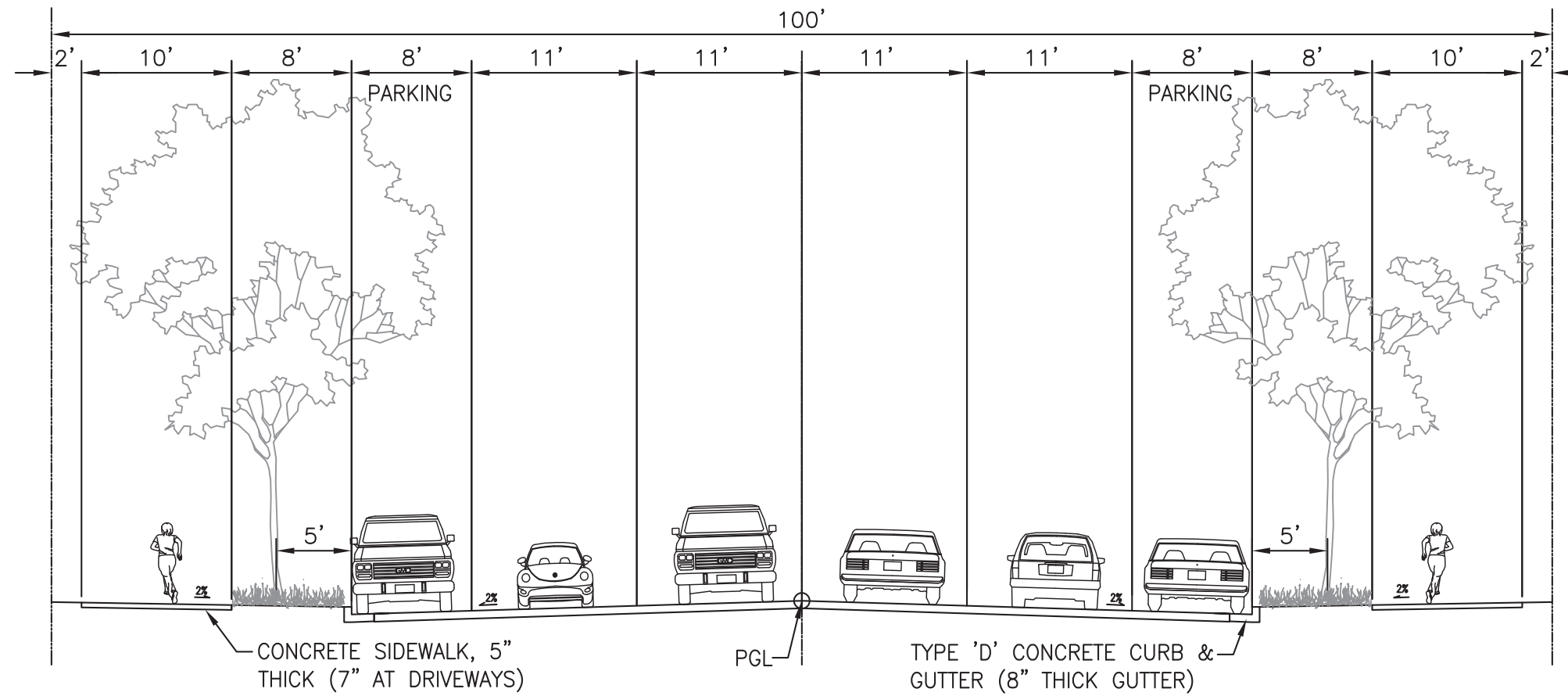
<- Top width of BioRet

<- Equivalent Area of Ponding Storage Incl. 30% of Gravel Area

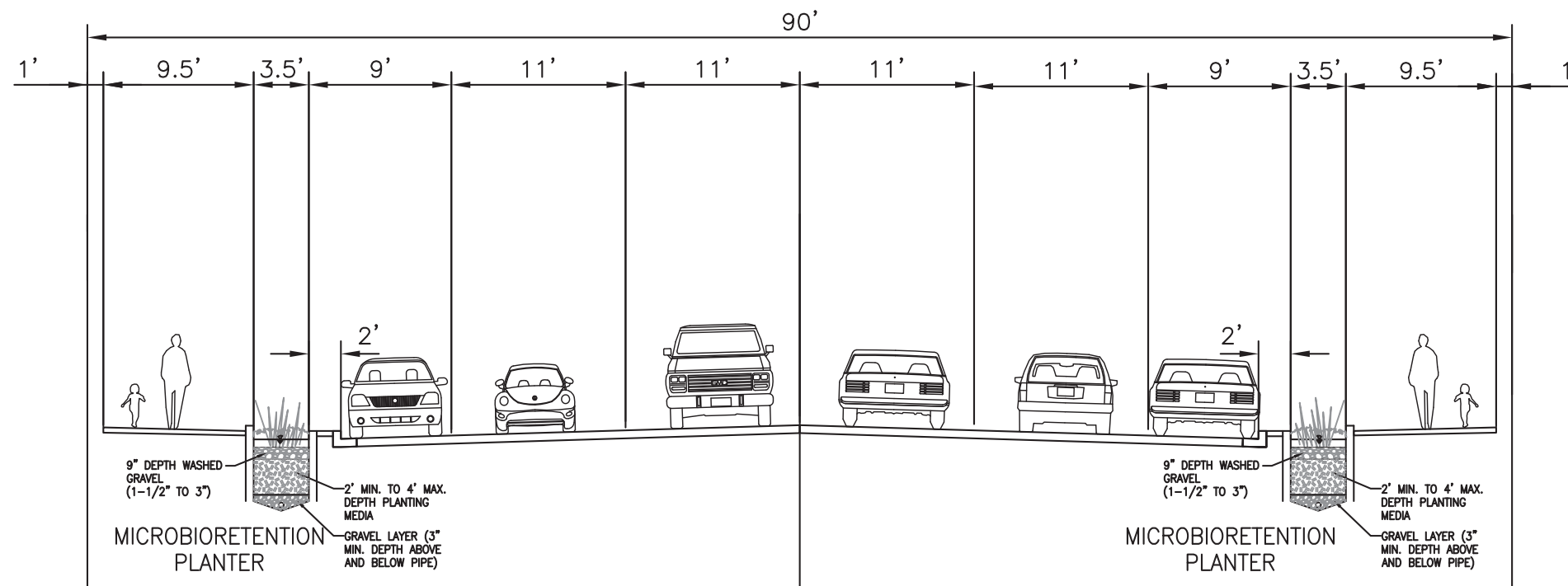


NOTE:
SEE SECTIONS ON FOLLOWING PAGES

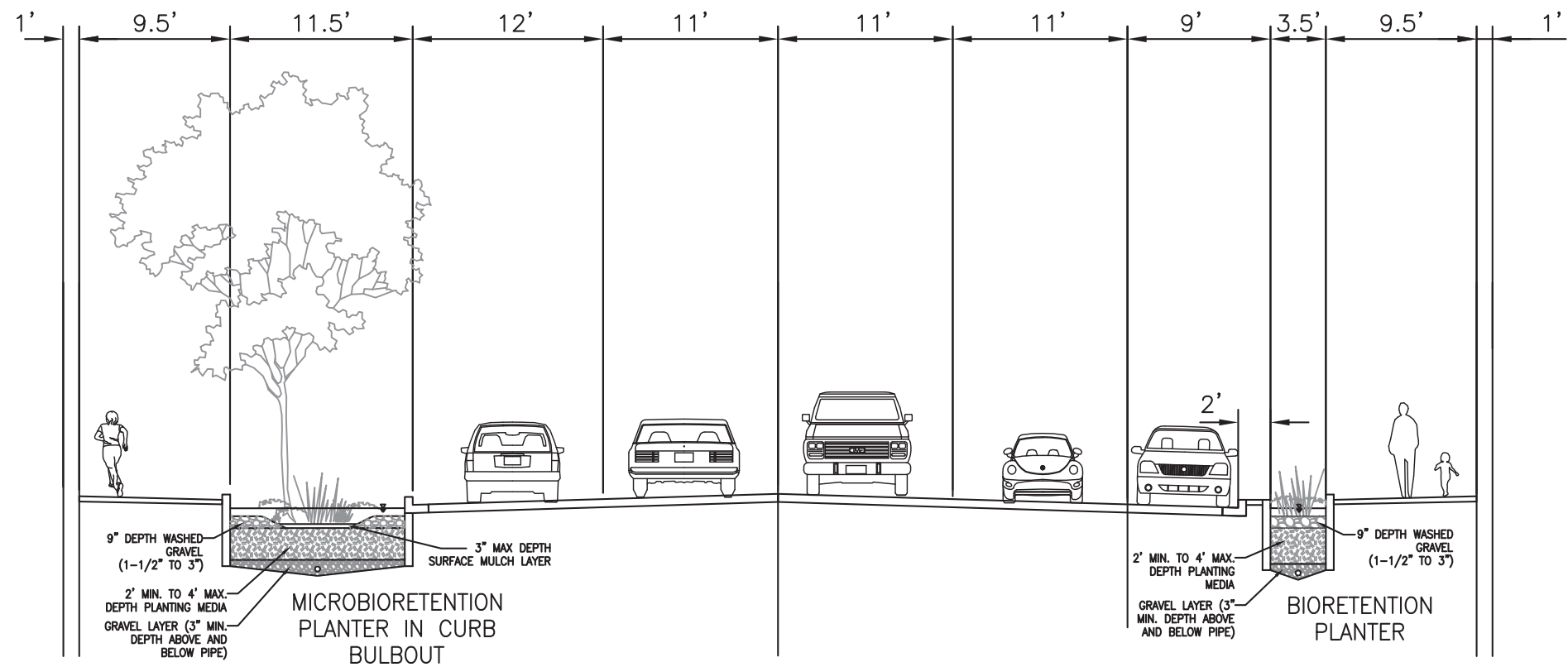




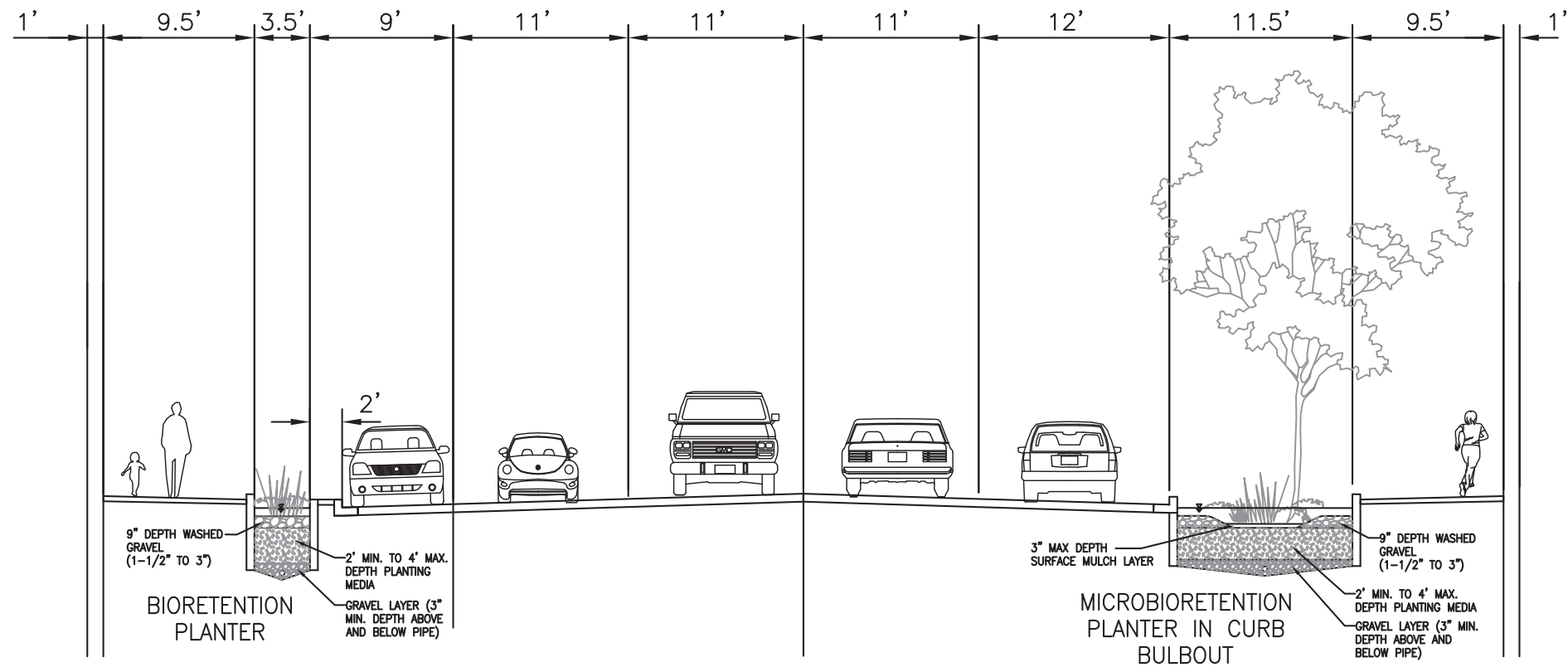
STANDARD NO. MC-2005.03 – BUSINESS DISTRICT STREET (FOR REFERENCE)



CONCEPT ESD SECTION 1 – ADD BIORETENTION PLANTERS IN CURB ZONE
 BASED ON: MODIFIED BUSINESS DISTRICT STREET (DRAFT MC-2005.03)
 4 LANES WITH PARKING ON ONE SIDE PER WHITE FLINT SECTOR PLAN (PG. 55)



ESD SECTION 2 – ADD BIORETENTION PLANTER & PLANTER BULBOUT IN CURB ZONE
 BASED ON: BUSINESS DISTRICT STREET (DRAFT MC-2005.03)
 4 LANES WITH PARKING ON ONE SIDE PER WHITE FLINT SECTOR PLAN (PG. 55)



ESD SECTION 3 – ADD BIORETENTION PLANTER & PLANTER BULBOUT IN CURB ZONE
 BASED ON: BUSINESS DISTRICT STREET (DRAFT MC-2005.03)
 4 LANES WITH PARKING ON ONE SIDE PER WHITE FLINT SECTOR PLAN (PG. 55)



CALCULATION SHEET

220 Linear Feet of Marinelli Road Between Pockville Pike and Citadel Avenue



Montgomery County Planning Department
#10015
ESD Concept Design

Abbr.

MSDM Maryland Stormwater Design Manual (Revised 2009)

PP Porous Pavement (MSDM Chapter 5 pg 5.48)

BioRet Micro-Bioretenion (MSDM Chapter 5 pg 5.96)

*All other abbr. per MSDM.

Assumptions:

Hydrologic Soil Group is estimated as D based on USDA National Resources Conservation Service Web Soil Survey

1yr 24hr Storm for Montgomery County = 2.6inch - MSDM pg 2.11

Based on Conceptual Section by SvR the DA to the BioRet would 90 ft.

Assume that planter bulbouts will occupy 20% of parking zone and planter crossings will occupy 20% of planters.

Equivalent width of planter = $0.2*15+0.8*7 = 8.6$ ft

So with bulbouts and crossings %I = $(90-(0.2*15+0.8*7))/90 = 90\%$

Max 20,000 sf DA to each BioRet facility - MSDM 5.98

Therefore 90ft wide area would require at least one BioRet for every 220 feet.

Available planter width = $8.6*220 = 1892$ sf per 220 ft of road.

This analysis does not take into account offsite run-on. (WQv for offsite areas is not required - MSDM pg 2.2)

Rev Requirement is fulfilled through ESD Treatment of the WQv - MSDM pg 2.5

CALCULATION SHEET

220 Linear Feet of Marinelli Road Between Pockville Pike and Citadel Avenue

For Channel Protection Volume (CPv):

Without PP		<- MSDM pg 5.21
Hydrologic Soils D		
I	90 %	
Pe	1.8 in	<- MSDM Table 5.3
RCN*	77	<- Target
Qe=Pe*Rv		<- Rv=0.05+.009(I)
Qe	1.548 in	
PP		<- MSDM pg 5.48
Length	0 ft	<- 8ft wide sidewalk
BioRet		
Pe=Af/(.075*DA)		<- MSDM pg 5.96
Pe	1.8 in	
DA	20000 sf	
Af	2700 sf	<- Af=Pe*(.075*DA)
Check available planter area:		
	2700 < 1892 sf?	FAIL
ESDv=(Pe*Rv*DA)/12		
ESDv	2580 cf	
Check Storage:		
Avail. Storage	1550 sf / 220 lf	<- Available Ponding Storage Incl. 30% of Cobble Area
ok?	FAIL	
% Excess	N/A	

CALCULATION SHEET

220 Linear Feet of Marinelli Road Between Pockville Pike and Citadel Avenue

For Water Quality Volume (WQv) only:

WQ Treatment is for 1 inch of rainfall - MSDM pg 2.3

Without PP		<- MSDM pg 5.21
Hydrologic Soils D		
I	90 %	
Pe	1 in	
RCN*	77	<- Target
Qe=Pe*Rv		<- Rv=0.05+.009(I)
Qe	0.86 in	
PP		<- MSDM pg 5.48
Length	0 ft	<- 8ft wide sidewalk
BioRet		<- MSDM pg 5.96
Pe=Af/(.075*DA)		
Pe	1 in	
DA	20000 sf	
Af	1500 sf	<- Af=Pe*(.075*DA)
Check available planter area:		
	1500 < 1892 sf? PASS	
ESDv=(Pe*Rv*DA)/12		
ESDv	1433 cf	
Check Storage:		
Avail. Storage	1550 sf / 220 lf	<- Available Ponding Storage Incl. 30% of Cobble Area
ok?	PASS	
% Excess	8%	