

Table of Contents

Maryland Stormwater Design Manual

VOLUME ONE

	Page
List of Tables	<i>i</i>
List of Figures	<i>ii</i>
Preface.....	<i>iv</i>

Chapter 1: Introduction to the Manual

1.0 Purpose of Manual	1.1
1.1 Why Stormwater Matters: Impact of Runoff on Maryland Watersheds.....	1.3
1.1.1 Declining Water Quality	1.5
1.1.2 Diminishing Groundwater Recharge and Quality	1.7
1.1.3 Degradation of Stream Channels	1.8
1.1.4 Increased Overbank Flooding.....	1.10
1.1.5 Floodplain Expansion	1.11
1.2 General Performance Standards for Stormwater Management in Maryland.....	1.13
1.3 How to Use the Manual	1.16
1.3.1 Volume One	1.16
1.3.2 Volume Two (Appendices)	1.17
1.4 Revising the Manual	1.19
1.5 What's New	1.19
1.6 Symbols and Acronyms	1.21

Chapter 2: Unified Stormwater Sizing Criteria

2.0 Unified Stormwater Sizing Criteria	2.1
2.1 Water Quality Volume (WQ_v)	2.2
2.2 Recharge Volume Requirements (Re_v).....	2.5
2.3 Channel Protection Storage Volume Requirements (Cp_v).....	2.8
2.4 Overbank Flood Protection Volume Requirements (Qp_2 or Qp_{10})	2.12
2.5 Extreme Flood Volume (Q_f)	2.13
2.6 Design Examples: Computing Stormwater Storage Requirements	2.14

NOTE: The Maryland Stormwater Design Manual has been revised. Changes are identified as Supplements (e.g., Supp. 1) and occur throughout the design manual. When there are conflicts between supplemental and original requirements, the newest shall supersede.

2.7	Acceptable Urban BMP Options	2.37
2.7.1	Urban BMP Groups	2.37
2.7.2	Structural BMPs that do not fully meet the WQ _v Requirement	2.39
2.8	Designation of Stormwater Hotspots	2.41

Chapter 3: Performance Criteria for Urban BMP Design

3.0	Performance Criteria for Urban BMP Design	3.1
3.1	Stormwater Ponds	3.2
3.1.1	Pond Feasibility Criteria	3.8
3.1.2	Pond Conveyance Criteria	3.9
3.1.3	Pond Pretreatment Criteria.....	3.10
3.1.4	Pond Treatment Criteria.....	3.10
3.1.5	Pond Landscaping Criteria.....	3.11
3.1.6	Pond Maintenance Criteria	3.12
3.2	Stormwater Wetlands.....	3.16
3.2.1	Wetland Feasibility Criteria.....	3.21
3.2.2	Wetland Conveyance Criteria.....	3.21
3.2.3	Wetland Pretreatment Criteria	3.21
3.2.4	Wetland Treatment Criteria	3.21
3.2.5	Wetland Landscaping Criteria	3.22
3.2.6	Wetland Maintenance Criteria	3.24
3.3	Stormwater Infiltration	3.25
3.3.1	Infiltration Feasibility Criteria	3.28
3.3.2	Infiltration Conveyance Criteria	3.28
3.3.3	Infiltration Pretreatment Criteria	3.29
3.3.4	Infiltration Treatment Criteria	3.30
3.3.5	Infiltration Landscaping Criteria	3.30
3.3.6	Infiltration Maintenance Criteria	3.30
3.4	Stormwater Filtering Systems.....	3.31
3.4.1	Filtering Feasibility Criteria	3.38
3.4.2	Filtering Conveyance Criteria.....	3.38
3.4.3	Filtering Pretreatment Criteria	3.38
3.4.4	Filtering Treatment Criteria	3.39
3.4.5	Filtering Landscaping Criteria	3.40
3.4.6	Filtering Maintenance Criteria	3.41
3.5	Open Channel Systems	3.42
3.5.1	Open Channel Feasibility Criteria	3.45
3.5.2	Open Channel Conveyance Criteria	3.45
3.5.3	Open Channel Pretreatment Criteria.....	3.45
3.5.4	Open Channel Treatment Criteria	3.46
3.5.5	Open Channel Landscaping Criteria.....	3.46

3.5.6 Open Channel Maintenance Criteria.....	3.46
--	------

Chapter 4: A Guide to BMP Selection and Location in the State of Maryland

4.0 Selecting the Best BMP at a Site	4.1
4.1 Watershed Factors.....	4.3
4.2 Terrain Factors	4.6
4.3 Stormwater Treatment Suitability	4.8
4.4 Physical Feasibility Factors	4.10
4.5 Community and Environmental Factors	4.12
4.6 Checklist: Location/Permitting Factors	4.14

Chapter 5: Environmental Site Design

5.0 Introduction.....	5.1
5.1 Design Process and Planning Techniques	5.4
5.2 Addressing the Unified Sizing Criteria.....	5.17
5.3 Alternative Surfaces.....	5.41
5.4 Treatment Using Nonstructural and Micro-Scale Practices	5.55
5.5 Redevelopment	5.117
5.6 Special Criteria for Sensitive Waters	5.121
Glossary	G.1
References.....	R.1

VOLUME TWO: APPENDICES

Appendix A: Landscaping Guidance for Stormwater BMPs

A.1	General Landscaping Guidance for All Stormwater BMPs.....	A.2
A.2	Specific Landscaping Criteria for BMP Groups.....	A.4
A.2.1	Ponds and Wetlands.....	A.4
A.2.2	Infiltration and Filter Systems	A.12
A.2.3	Bioretention	A.12
A.2.4	Open Channels.....	A.18
A.2.5	Filter Strips and Stream Buffer.....	A.18
A.3	Plant Selection for Stormwater Facilities	A.19
A.3.1	Hardiness Zones.....	A.19
A.3.2	Physiographic Provinces.....	A.21
A.3.3	Hydrologic Zones	A.25
A.3.3	Other Considerations in Stormwater BMP Landscaping.....	A.26
A.4	Stormwater Plant List	A.27
A.5	References.....	A.49

Appendix B: BMP Construction Specifications

B.1	NRCS-MD Code No 378 Pond Standards/ Specifications	B.1
B.1.1	Supplemental Pond and Wetland Stormwater Specifications.....	B.1.1.1
B.1.2	MDE Dam Safety Small Pond Review Criteria.....	B.1.2.1
B.2	Construction Specifications for Infiltration Practices.....	B.2.1
B.3	Construction Specifications for Bioretention, Sand Filters, and Open Channels.....	B.3.1
B.4	Construction Specifications for Environmental Site Design Practices.....	B.4.1

Appendix C: Step-by-Step Design Examples

C.1	Shallow Wetland Design Example	C.1.1
C.2	Design Example 2 – Water Quality BMPs	C.2.1
C.2.1	Design Criteria.....	C.2.2
C.2.2	Preliminary Design	C.2.2
C.2.3	BMP Design Option 1.....	C.2.8
C-2.3.1	Perimeter Sand Filter (F-3)	C.2.8
C-2.3.2	Pocket Sand Filter (F-5).....	C.2.12
C.2.4	BMP Design Option 2.....	C.2.16
C.2.4.1	Bioretention System (F-6)	C.2.17
C.2.4.2	Infiltration Trench (I-1)	C.2.18
C.2.5	BMP Design Option 3.....	C.2.21
C.2.5.1	Dry Swale (O-1).....	C.2.21

Appendix D: Assorted Design Tools

D.1	Testing Requirements for Infiltration, Bioretention, and Sand Filter Subsoils	D.1.1
D.2	Geotechnical Methods for Karst Feasibility Testing	D.2.1
D.3	Short Cut Method for a Wetland Drawdown Assessment	D.3.1
D.4	Stormwater Criteria for the Maryland Critical Area IDA Zone	D.4.1
D.5	Documentation of BMP Ability to Meet the 80% TSS Removal Requirement	D.5.1
D.6	Industrial Stormwater NPDES Permit Requirements	D.6.1
D.7	MDE/WMA Overview of the NPDES Stormwater Program	D.7.1
D.8	Miscellaneous Details for Compliance with Performance Criteria	D.8.1
D.9	MD Stream Use Designations.....	D.9.1
D.10	Method for Computing Peak Discharge for Water Quality Storm	D.10.1
D.11	Method for Computing the Channel Protection Storage Volume (C_{p_v}).....	D.11.1
D.12	Critical Erosive Velocity for Grass and Soil	D.12.1
D.13	Method for Designing Infiltration Structures	D.13.1
D.14	Eastern Shore (Delmarva) Dimensionless Hydrograph.....	D.14.1
D.15	Miscellaneous MD SHA Design Charts for Determining Pipe Inlet Control.....	D.15.1

Appendix E: Archived Material

E.1	Stormwater Credits for Innovative Site Planning	E.1.1
-----	---	-------