

2004 Connecticut Stormwater Quality Manual

by

The Connecticut Department of Environmental Protection



79 Elm Street • Hartford, Connecticut 06106



Printed on recycled paper, 30% post consumer content.

The Honorable M. Jodi Rell, Governor
State of Connecticut

Arthur J. Rocque, Jr., Commissioner
Connecticut Department of Environmental Protection

Book designed by Adell Donaghue
Adell Donaghue Design

Edited by Jane A. Rothchild

Project Coordination by Cheryl A. Chase, P.E.
Connecticut Department of Environmental Protection

Project Management by Erik Mas, P.E.
Fuss & O'Neill, Inc.

Illustrations by Clay Crow and Tom Ouellette

Book Production: Adell Donaghue and Michele Holcomb

Book Production by the DEP Bureau of Water Management, Inland Water Resources Division

The Connecticut Stormwater Quality Manual is available on-line in
Adobe Acrobat (pdf) format.
<http://dep.state.ct.us>

© 2004 by the Connecticut Department of Environmental Protection



Funded in part by the CT DEP through a
US EPA Clean Water Act section 319 grant
administered by the CT DEP.



The Department of Environmental Protection is an affirmative action/equal opportunity employer, providing programs and services in a fair and impartial manner. In conformance with the Americans with Disabilities Act, DEP makes every effort to provide equally effective services for persons with disabilities. Individuals with disabilities needing auxiliary aids or services should call (860) 424-3019 or for more information by voice or TTY/TDD call (860) 424-3000.

Acknowledgements

Project Initiation

Sharon Yurasevecz, Connecticut Department of Environmental Protection

Steering Committee

Bob Bartholemew, A-N Consulting Engineers, Inc.
Jeff Caiola, Connecticut Department of Environmental Protection
Paul Corrente, Connecticut Department of Transportation
John Deering, John W. Deering, Inc.
John Gaucher, Connecticut Department of Environmental Protection
Laurie Giannotti, Executive Director, Pomperaug River Watershed Coalition, Inc.
Mary-Beth Hart, Connecticut Department of Environmental Protection
Rob Hust, Connecticut Department of Environmental Protection
Bob Jontos, Land-Tech Consultants, Inc.
Tyler Kleykamp, Connecticut Department of Public Health
Chris Malik, Connecticut Department of Environmental Protection
Lori Mathieu, Connecticut Department of Public Health
Joe Polulech, President, JEP Consulting Company
Sally Snyder, Connecticut Department of Environmental Protection
Chris Stone, Connecticut Department of Environmental Protection
Tom Torgersen, University of Connecticut

Provided comments, support and assistance

Peter Aarrestad, Connecticut Department of Environmental Protection
Larry Bradley, Town of Greenwich
Bob Brinton, Town Engineer, Town of Bloomfield
Marla Butts, Connecticut Department of Environmental Protection
Tim Coon, J.R. Russo and Associates
John Clausen, University of Connecticut
Mel Cote, US Environmental Protection Agency
Naomi Davidson, Connecticut Department of Environmental Protection
Virginia deLima, US Geological Survey
Matt Fritz, Connecticut Department of Environmental Protection
Terrance Gallagher, BL Companies
Killingly Department of Planning and Development
Dr. Michael Klemens
Lisa Krall, Natural Resource Conservation Commission
Ann Kuzyk, Connecticut Department of Environmental Protection
Mike Masayda, Connecticut Department of Transportation
Eric Ott, Connecticut Department of Environmental Protection
Elsie Patton, Connecticut Department of Environmental Protection
John Pindot, Norwalk River Harbor Commission
Denise Ruzicka, Connecticut Department of Environmental Protection
Carl Salsedo, University of Connecticut
Jo-Ann Smith, Connecticut Department of Environmental Protection
Steve Winnett, US Environmental Protection Agency
Roger Wolfe, Connecticut Department of Environmental Protection
Jennifer Zmiejewski, Connecticut Department of Environmental Protection

Project Team at Fuss & O'Neill, Inc.

Dean Audet, P.E.
Michael Gagnon, P.E.
Diane Mas, M.S.E.
Phil Moreschi, P.E.
Charlie Murphy

Table of Contents

Volume 1: Background

Chapter 1

Introduction

1.1 Purpose of the Manual	1-2
1.2 Users of the Manual.....	1-2
1.3 Organization of the Manual.....	1-2
1.4 Regulatory Basis and Use of the Manual.....	1-4
1.5 Relationship of the Manual to Federal, State, and Local Programs	1-4
1.5.1 Federal Programs	1-4
1.5.2 State Programs.....	1-5
1.5.3 Local Programs.....	1-10



Chapter 2

Why Stormwater Matters: The Impacts of Urbanization

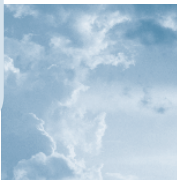
2.1 What is Urban Stormwater Runoff?.....	2-2
2.2 Hydrologic Impacts.....	2-6
2.3 Stream Channel and Floodplain Impacts.....	2-6
2.4 Water Quality Impacts.....	2-6
2.5 Habitat and Ecological Impacts.....	2-11
2.6 Impacts on Other Receiving Environments	2-11



Chapter 3

Preventing and Mitigating Stormwater Impacts

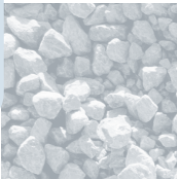
- 3.1 Introduction3-2
- 3.2 Guiding Stormwater Management Principles.....3-2
- 3.3 Site Planning and Design3-3
- 3.4 Source Control Practices and Pollution Prevention.....3-4
- 3.5 Construction Erosion and Sedimentation Control3-4
- 3.6 Stormwater Treatment Practices3-4
- 3.7 Stormwater Quantity Control3-6
- 3.8 Watershed Management.....3-7



Chapter 4

Site Planning and Design

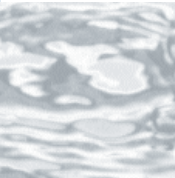
- 4.1 Introduction 4-2
- 4.2 Site Planning and Design Concepts..... 4-2
- 4.3 Alternative Site Design 4-4
 - 4.3.1 Streets and Parking Lots 4-6
 - 4.3.2 Lot Development..... 4-11
- 4.4 Low Impact Development Management Practices 4-13
 - 4.4.1 Vegetated Swales, Buffers, and Filter Strips 4-13
 - 4.4.2 Bioretention/Rain Gardens..... 4-13
 - 4.4.3 Dry Wells/Leaching Trenches 4-15
 - 4.4.4 Rainwater Harvesting 4-15
 - 4.4.5 Vegetated Roof Covers..... 4-17



Chapter 5

Source Control Practices and Pollution Prevention

- 5.1 Introduction5-2
- 5.2 Municipal Practices5-2
 - 5.2.1 Street and Parking Lot Sweeping5-2
 - 5.2.2 Roadway Deicing/Salt Storage.....5-4
 - 5.2.3 Storm Drainage System Maintenance5-7
 - 5.2.4 Other Road, Highway, and Bridge Maintenance.....5-7
 - 5.2.5 Illicit Discharge Detection and Elimination.....5-8
- 5.3 Industrial and Commercial Practices5-9
 - 5.3.1 Stormwater Pollution Prevention Plans.....5-9
- 5.4 Lawn Care and Landscaping Practices5-10
 - 5.4.1 Xeriscaping and General Landscape Management5-10
 - 5.4.2 Fertilizer and Pesticide Management.....5-12
 - 5.4.3 Animal Waste Management.....5-12
- 5.5 Model Stormwater Ordinances5-14
- 5.6 Public Education and Outreach.....5-14

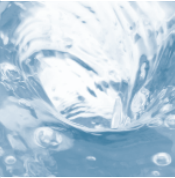


Volume 1I: Design

Chapter 6

Introduction to Stormwater Treatment Practices

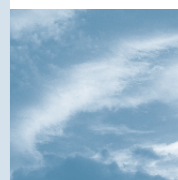
- 6.1 Introduction6-2
- 6.2 Primary Stormwater Treatment Practices6-2
- 6.3 Secondary Stormwater Treatment Practices.....6-3
 - 6.3.1 Conventional Practices6-4
 - 6.3.2 Innovative/Emerging Technologies6-4
- 6.4 Stormwater Treatment Train6-8
- 6.5 Maintenance6-8



Chapter 7

Hydrologic Sizing Criteria for Stormwater Treatment Practices

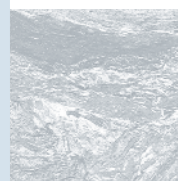
7.1 Introduction	7-2
7.2 Criteria Applicability.....	7-2
7.3 Criteria Summary.....	7-4
7.4 Pollutant Reduction.....	7-4
7.4.1 Water Quality Volume (WQV).....	7-4
7.4.2 Water Quality Flow (WQF).....	7-5
7.5 Groundwater Recharge and Runoff Volume Reduction	7-5
7.5.1 Groundwater Recharge Volume (GRV)	7-6
7.5.2 Runoff Capture Volume (RCV)	7-7
7.6 Peak Flow Control	7-8
7.6.1 Stream Channel Protection.....	7-8
7.6.2 Conveyance Protection	7-9
7.6.3 Peak Runoff Attenuation	7-9
7.6.4 Emergency Outlet Sizing.....	7-10
7.6.5 Downstream Analysis.....	7-10
7.7 Sizing Example.....	7-10



Chapter 8

Selection Criteria for Stormwater Treatment Practices

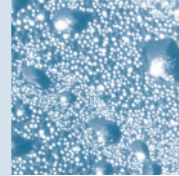
8.1 Stormwater Management Effectiveness	8-2
8.2 Land Use Factors.....	8-3
8.3 Physical/Site Feasibility Factors.....	8-5
8.4 Downstream Resources.....	8-6
8.5 Maintenance Factors	8-10
8.6 Winter Operation.....	8-10
8.7 Nuisance Insects and Vectors.....	8-11
8.8 Natural Wetlands and Vernal Pools.....	8-13



Chapter 9

Developing a Site Stormwater Management Plan

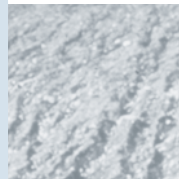
9.1 Plan Development	9-2
9.2 Plan Content	9-2
9.2.1 Applicant/Site Information.....	9-3
9.2.2 Project Narrative	9-3
9.2.3 Calculations	9-4
9.2.4 Design Drawings and Specifications	9-6
9.2.5 Construction Erosion and Sedimentation Controls.....	9-7
9.2.6 Supporting Documents and Studies	9-7
9.2.7 Other Required Permits.....	9-7
9.2.8 Operation and Maintenance.....	9-7



Chapter 10

Stormwater Retrofits

10.1 Introduction	10-2
10.2 Objectives and Benefits of Stormwater Retrofits.....	10-2
10.3 When is Retrofitting Appropriate?.....	10-2
10.4 Stormwater Retrofit Options.....	10-2
10.4.1 Stormwater Drainage Systems.....	10-3
10.4.2 Stormwater Management Facilities	10-4
10.4.3 Storm Drain Outfalls.....	10-6
10.4.4 Highway Rights-of-Way.....	10-6
10.4.5 Parking Lots	10-9
10.4.6 In-stream practices in Drainage Channels.....	10-9
10.4.7 Wetland Creation and Restoration	10-9



Primary Treatment Practices.....	11-2
Secondary Treatment Practices.....	11-3
Primary (P) Treatment Practices	
11-P1 Stormwater Ponds.....	11-P1-1
11-P2 Stormwater Wetlands.....	11-P2-1
11-P3 Infiltration Practices.....	11-P3-1
11-P4 Filtering Practices.....	11-P4-1
11-P5 Water Quality Swales.....	11-P5-1
Secondary (S) Treatment Practices	
Conventional Practices	
11-S1 Dry Detention Pond.....	11-S1-1
11-S2 Underground Detention Facilities.....	11-S2-1
11-S3 Deep Sump Catch Basins.....	11-S3-1
11-S4 Oil/Particle Separators.....	11-S4-1
11-S5 Dry Wells.....	11-S5-1
11-S6 Permeable Pavement.....	11-S6-1
11-S7 Vegetated Filter Strips/Level Spreaders.....	11-S7-1
11-S8 Grass Drainage Channels.....	11-S8-1
Innovative/Emerging Technologies	
11-S9 Catch Basin Inserts.....	11-S9-1
11-S10 Hydrodynamic Separators.....	11-S10-1
11-S11 Media Filters.....	11-S11-1
11-S12 Underground Infiltration Systems.....	11-S12-1
11-S13 Alum Injection.....	11-S13-1

Appendices

Appendix A: Plant List	A-1
Appendix B: Water Quality Flow and Flow Diversion Guidance	B-1
Appendix C: Model Ordinances	C-1
Appendix D: Site Stormwater Management Plan Checklist	D-1
Appendix E: Maintenance Inspection Checklist	E-1
Appendix F: Glossary	F-1

