



# Rainwater and Land Development

Ohio's Standards for Stormwater Management  
Land Development and Urban Stream Protection

**\*Third Edition 2006**

*\*Updated to include all new materials,  
changes and corrections as of 11-6-14.*

Ohio Department of Natural Resources  
Division of Soil and Water Conservation

2045 Morse Road, Building B-3  
Columbus, Ohio 43229-6605  
(614) 265-6610

This publication was funded in part by the Ohio Water Development Authority through a research and development grant.



**Title:** Rainwater and Land Development: Ohio's Standards for Stormwater Management, Land Development and Urban Stream Protection

**Date:** December 2006 (Entire edition; additions & updates have occurred since that date.)

**Prepared by:** John Mathews  
Ohio Department of Natural Resources, Division of Soil and Water Conservation

**In cooperation with:**

Natural Resources Conservation Service  
United States Department of Agriculture  
200 N. High St., Room 522  
Columbus, Ohio 43215  
(614) 255-2472

Ohio Environmental Protection Agency  
Division of Surface Water  
122 South Front Street, PO Box 1049  
Columbus, Ohio 43216-1049  
(614) 644-2001

**Abstract:** Stream systems, including their corridors, and wetland resources are vital environmental features and are extremely sensitive to urbanization. The intent of this book is to allow development to occur while minimizing the impact on water resources, especially streams.

This book defines Ohio's standards and specifications for stormwater practices implemented during land development. It is an update of the previous Rainwater and Land Development book completed in January 1996. The target audience is that group of professionals involved in the design and implementation of development projects.

This book aims to integrate water resource protection into development site planning in order to maintain or improve stream integrity. Early chapters discuss practices and strategies for protecting streams and wetlands, treating stormwater pollutants, rehabilitating streams and establishing permanent runoff controls. The latter portion of the book includes chapters regarding construction-phase practices, including standards and specifications for sediment control, temporary runoff control, soil stabilization and control of pollutants other than sediment. Appendixes offer further information regarding stormwater design examples, permits, helpful contacts, and soils.

**For Copies:** ODNR Division of Soil and Water Conservation  
2045 Morse Road  
Building B-3  
Columbus, Ohio 43229-6693

Telephone: (614) 265-6610  
Fax: (614) 262-2064

# CONTENTS

<b>Preface</b>	.....	iii
<b>Chapter 1</b>	Selecting Stormwater Management Practices for Development	
	Projects Impacts of New Development on Water Resources .....	2
	Stormwater Management Objectives for Development Projects.....	8
<b>Chapter 2</b>	Post-Construction Stormwater Practices	
	<b>Management Practices</b>	
	Reduction of Impervious Areas .....	3
	Low Impact Development. ....	5
	Conservation Development. ....	11
	Wetland Setback .....	15
	Stream Setback Area.....	21
	<b>Structural Practices</b>	
	Water Quality Ponds .....	27
	Infiltration Trench.....	41
	Sand & Organic Filter .....	49
	Grass Filter.....	63
	Bioretention Area ( <i>Updated 10-2-13, page 76 updated 3-3-14</i> ). ....	69
	Permeable Pavement ( <i>added 5-4-12</i> ).....	85
<b>Chapter 3</b>	Stream Rehabilitation and Restoration - <i>see Appendix 7 for limited references.</i>	
<b>Chapter 4</b>	Permanent Runoff Control	
	Grassed Swale.....	2
	Level Spreader .....	8
	Rock Lined Channel .....	14
	Rock Outlet Protection .....	20
	Diversion.....	26
	Terrace .....	31
	Subsurface Drainage.....	38
<b>Chapter 5</b>	Temporary Runoff Control	
	Rock Check Dam. <i>(updated 3-3-14)</i> .....	3
	Slope Drain. <i>(page numbering updated 3-3-14)</i> .....	7
	Temporary Diversion. <i>(page numbering updated 3-3-14)</i> .....	10
	Stream Utility Crossing <i>(page numbering updated 3-3-14)</i> .....	15
	Temporary Stream Crossing <i>(page numbering updated 3-3-14)</i> .....	23
	Water Bar. <i>(page numbering updated 3-3-14)</i> .....	31
	De-Watering Measures. <i>(page numbering updated 3-3-14)</i> .....	33
<b>Chapter 6</b>	Sediment Control	
	Sediment Basin .....	2
	Sediment Trap.....	21
	Silt Fence .....	29
	Storm Drain Inlet Protection.....	35
	Filter Berm.....	44
	Filter Sock.....	47

<b>Chapter 7</b>	Soil Stabilization	
	Phased Disturbance.....	3
	Clearing & Grubbing.....	7
	Tree and Natural Area Preservation.....	10
	Construction Entrance.....	17
	Dust Control.....	21
	Grade Treatment.....	25
	Topsoiling.....	29
	Temporary Seeding.....	33
	Mulching.....	37
	Permanent Seeding.....	41
	Sodding.....	47
	Temporary Rolled Erosion Control Products.....	51
	(Erosion Control Matting)	
	Turf Reinforcement Matting.....	57
<b>Chapter 8</b>	Additional Construction Site Pollution Controls & Small Lot Building Sites	
	Additional Construction Site Pollution Controls.....	2
	Small Lot Building Sites.....	9
<b>Appendicies</b>		
	1. Post Construction Stormwater Design Examples ( <i>added 5-4-12</i> )	
	2. NPDES Permits for Stormwater Discharges from Construction Sites	
	3. Development Permitting and Approval Process in Ohio	
	4. Overview of Stream/Wetland Regulations ( <i>updated 5-4-12</i> )	
	5. Resource Agencies ( <i>updated 11-6-14</i> )	
	6. Soils with Greatest Potential Use for Infiltration	
	7. Planning for Streams	
	8. Glossary	
	9. Adjusting Hydrologic Soil Group for Construction ( <i>added 5-4-12</i> )	
	10. Alternative Pre-treatment Options for Dry Extended Detention Ponds ( <i>updated 11-27-12</i> )	
	11. The Critical Storm Method ( <i>added 5-4-12</i> )	

We want to acknowledge all of the people who deserve credit for helping prepare this significant improvement to Ohio's *Rainwater and Land Development* manual – they were many.

Initially there were the ODNR Division of Soil and Water Conservation's traditional conservation partners: Ohio's soil and water conservation districts, the Ohio Environmental Protection Agency, the USDA Natural Resources Conservation Service and The Ohio State University Extension. Ultimately, many other individuals, representing the development and consulting industry, and local government became involved. They contributed suggestions, photos and content for this manual. Some helped by participating on a Rainwater and Land Development committee or subcommittee, by writing material or perhaps by reviewing drafts as they were developed. All who have contributed their time and efforts have our sincere thanks for their contributions. And we hope all will remain involved in our work to make further improvements in the future. Finally, from within the ODNR, we thank John Mathews for his leadership.



Samuel W. Speck, Director  
Ohio Department of Natural Resources



David Hanselmann, Chief  
Division of Soil and Water Conservation



## PREFACE

### **Rainwater?**

When rain falls, runoff supplies and influences Ohio's rivers, creeks and lakes. The land that rainwater encounters and the manner in which it is managed strongly influences the health and integrity of these receiving waters. If we recognize that streams are, in many ways, the most valuable environmental feature of a landscape, how land uses are planned, and how land is developed, becomes critical to continuing the many natural benefits streams provide. The benefits that healthy stream systems provide - water quality services; a natural infrastructure for drainage; a source of biological diversity and environmental productivity - are all diminished if our management of rainwater is inadequate during and after development.

Few activities alter a watershed more or have more potential to permanently lower the quality of streams than urbanization. Historically, the first efforts to offset these impacts focused on strategies controlling peak flow from large, infrequent storm events (i.e., flood control). Concern about the sediment contributed to runoff during construction practices resulted in erosion and sediment control regulations to minimize erosion and capture eroded sediment at construction sites. Experience also showed that historic stormwater controls were not adequately treating runoff.

Urbanization changes watersheds in a multitude of ways, and generic solutions cannot manage all the impacts. Traditional approaches alone fall short of maintaining the integrity of water resources. Success depends on recognizing the characteristics of specific water resources, understanding the relevant impacts, and tailoring a comprehensive array of tools to individual situations. Success requires going beyond a narrow focus on a single problem to undertaking a comprehensive water resource protection strategy. The difference is as great as the difference between rare storms and common rainwater.

### **Purpose**

This book offers a comprehensive source of general standards that can be implemented as land is being developed to avoid, minimize or compensate for impacts to water resources. These practices range from control of specific pollutants, like sediment generated during construction, to practices that help maintain the natural functions of a healthy stream system.

The practices and terminology in this book generally revolve around the movement and dynamics of water. The terms used here should be consistent with hydrologic or engineering usage. A glossary has been provided at the end of this book for terms that are less common or particular to Ohio situations or programs.

### **Intended Audience**

This book should prove most useful to site designers as they attempt to maintain the integrity of Ohio's rivers, creeks and lakes. Additionally local officials, agency staff, planners, and the public will find applications not only to individual sites, but also may assist with land use planning and resource management.

How land is initially developed has tremendous bearing on the prospective quality of urban streams. This material will assist site designers and development plan reviewers in choosing and judging the appropriate practices for a particular site's conditions. Certainly not all the practices in this book are necessary or practical on all sites, therefore site designers must evaluate site conditions and the potential adverse effects of their project on water resources, along with state and local requirements while planning and implementing development projects. Additionally, this book will assist local governments who must determine which issues in addition to site improvements must be addressed to ensure the quality of our water resources.

### **Authority of this book**

In 1979, Ohio's Division of Soil and Water Conservation was charged by Ohio Revised Code (ORC) Chapter 1511 with defining standards to abate erosion and related degradation of the waters of the state. The Natural Resources Conservation Service has a long-standing reputation nationally for defining technically sound standards for conservation practices. Finally Ohio EPA, by ORC Chapter 6111, is responsible for administering the NPDES program to which storm water was added by amendments to the Water Quality Act in 1987. With much input from people in industry, academia, local storm water programs and other states, these three agencies have defined standard practices for the State of Ohio.

The standards themselves are not requirements. In Ohio, responsibility for regulating storm water is held by both local and state authorities. Locally, municipalities, townships and counties all have authority to regulate storm water. Ohio EPA administers the state regulations that require storm water permits for construction sites.