

Modern Methods for

MODELING *the*
MANAGEMENT *of*
STORMWATER
IMPACTS

edited by William James

*Published by Computational Hydraulics International
Guelph, Ontario.*

Contents

The Editorial Committee	v
Acknowledgements	vii
Preface	ix

Education and Planning:

1. The Global Rivers Environmental Education Network and the Case of the Rouge River in Detroit, Michigan	
<i>Stapp</i>	1
1.1 The Rouge project and education	3
1.2 Two week monitoring program	5
1.3 Rouge River student congress	8
1.4 Reflections on the Rouge project	9
1.5 Significance of the project and approach to creative ways of educating youth	12
1.6 The Global Rivers Environmental Education Network (GREEN)	15
2. Educating Citizens to Understand Runoff and its Consequences	
<i>VanDyke and Vanscoy</i>	19
2.1 A conceptual framework for understanding the impact of stormwater	20
2.2 Public concern and public knowledge	21
2.3 The Bear Creek watershed project: a case study	23
2.4 Educational approaches in the future	27
2.5 Generalization of the Bear Creek Educational Efforts to other watersheds	30

3.	BMP Planner - a Tool for Developing Stormwater Management Plans	
	<i>Ahmed and James</i>	33
3.1	Literature review	34
3.2	Survey	37
3.3	Development of BMPPlanner	38
3.4	Evaluation for Ontario applications	42
3.5	Panel examination	43
3.6	Conclusions	45
4.	A Preliminary Urban Non-Point Source Management Plan: a Modeling Approach	
	<i>Wright, Nix, Hassett, and Moffa</i>	51
4.1	Introduction	52
4.2	Review of available geospatial data	54
4.3	Development of the conceptual model	56
4.4	Development of a preliminary pollution prevention plan	59
4.5	Conclusions	60
5.	The Regional Stormwater Detention Concept in Urban Drainage System	
	<i>Chen</i>	63
5.1	Introduction	64
5.2	Existing practice	65
5.3	Study area description	66
5.4	Modeling technique	68
5.5	Evaluation and discussion	70
5.6	Conclusion	75
6.	On-Site Runoff Control for Industrial Parks: A Case Study	
	<i>Rivard</i>	79
6.1	Introduction	80
6.2	Site description	81
6.3	Conceptual approach	81
6.4	Rainfall data base	83
6.5	Simulated conditions before and after development	85
6.6	Simulations with detention	87
6.7	Simplified approach	90
6.8	Conclusions	93
7.	Urban Runoff Control Costs at Ontario RAP Sites	
	<i>Cheung, Li, Weatherbe and Marsalek</i>	97
7.1	Methodology	98
7.2	Selection of model	101

7.3	Evaluation of control technologies	103
7.4	Conclusions	105
8.	Economic Evaluation of Regional Non-Point Source Load Reduction Strategies	
	<i>Franques and Townsend</i>	115
8.1	Introduction	115
8.2	Project area	116
8.3	GIS coverages	116
8.4	Literature search	116
8.5	BMP selection	117
8.6	Optimization	117
8.7	Conclusions	121
9.	Planning Level Estimates of Heavy Metals, Total PCBs and HCB Loadings to the Buffalo River, NY from Combined Sewer Overflows	
	<i>Pratt, Irvine, Marshall, Loganathan, Kumar and Sikka</i>	127
9.1	Introduction	128
9.2	Study area description	130
9.3	Methods	131
9.4	Results	139
9.5	Conclusion and recommendations	145

Modeling Water Quality:

10.	Water Quality Control Under Uncertainty	
	<i>Ponnambalam</i>	151
10.1	Introduction	152
10.2	Problem description	152
10.3	Proposed methodology	154
10.4	Results and conclusions	155
11.	Is there a Limit to Model Size and Complexity? Practical Experiences for CSO Modeling for Narragansett Bay	
	<i>Crawford, von Zweck, and Grala</i>	159
11.1	Introduction	160
11.2	Model integration	160
11.3	Modeling observations	161
11.4	Is there a limit to model complexity?	162
11.5	Conclusion	168

12. HSP-F Simulation of a Constructed Wetland Stormwater Best Management Practice for Urban Highway Runoff	
<i>Bishop and Scheckenberger</i>	173
12.1 Background information	174
12.2 Best management practices	176
12.3 Constructed wetlands	177
12.4 Analysis	178
12.5 Results and Discussion	181
12.6 Conclusions	182
13. Modeling the Water Column, Sediment and Biota Concentrations of the Detroit River	
<i>Lin and Kummler</i>	189
13.1 Model theory	190
13.2 Model application	198
13.3 Model calibration and verification	199
13.4 Conclusions	202
14. Indicator Bacteria-Sediment Relationships: Implications for Water Quality Modeling and Monitoring	
<i>Irvine, Pettibone and Droppo</i>	205
14.1 Previous research on bacteria-sediment interactions	206
14.2 Study methods	210
14.3 Results and discussion	213
14.4 Conclusion	225
15. Development and Application of a Full Phosphorus Cycle Water Quality Model to Lake Champlain	
<i>Mendelsohn and Rines</i>	231
15.1 Introduction	232
15.2 Phosphorus model development	233
15.3 Exchange coefficients	234
15.4 Conservation of constituent mass	237
15.5 Phosphorus cycle kinetics	239
15.6 Application to Lake Champlain	242
15.7 Exchange rate coefficients	243
15.8 Phosphorus cycle kinetics calibration	245
15.9 Conclusions	253

16. A Simplified Stream Temperature Model for Evaluating Urban Drainage Inputs	
<i>Weatherbe</i>	259
16.1 Introduction	259
16.2 The Laurel Creek watershed study	260
16.3 Heat balance considerations	262
16.4 Hydraulic relationships	264
16.5 Spreadsheet model	266
16.6 Application of the model	266
16.7 Conclusions	272

Data Models and Practical Issues:

17. Characteristic Width and Infiltration for Continuous SWMM	
<i>Brink and TenBroek</i>	275
17.1 Traditional internal routing	276
17.2 Problem with using width parameter for routing	278
17.3 Possible solutions	278
17.4 System routing alternative	279
17.5 Summary	281
18. City of Poughkeepsie NY Combined Sewer Overflow Monitoring Plan	
<i>VanGelder and Barlow</i>	283
18.1 SPDES permit requirements	284
18.2 Existing system	285
18.3 Model development	288
18.4 SWMM model simulations	295
18.5 Conclusions	301
19. Database Management Model for SCADA Systems	
<i>Dent and Davis</i>	303
19.1 Introduction	304
19.2 Computerized monitoring devices	305
19.3 Man-machine interface software	307
19.4 Open database model	308
19.5 Case study	310
19.6 Conclusions	312

20. GIS in Stormwater Management	
<i>Shamsi and Fletcher</i>	315
20.1 Introduction	315
20.2 Watershed GIS	320
20.3 Results and discussion	327
20.4 Conclusions	334
21. An Error-Control Decision Support System for SWMM	
<i>James and James</i>	335
21.1 Introduction	336
21.2 Sensitivity analysis	340
21.3 Calibration and error analysis	343
21.4 Future directions	345
21.5 Conclusions	346
22. Taking Hydraulic Models for a Test Drive - Side by Side Comparison	
<i>Vitasovic, Dumont, Charowski, Ji and Strand</i>	349
22.1 Introduction	350
22.2 Brief description of models	351
22.3 SWMM4 EXTRAN model	352
22.4 SPIDA model	353
22.5 RUNSTDY model	353
22.6 Test description	354
22.7 RUNSTDY vs. SPIDA	355
22.8 RUNSTDY vs EXTRAN	357
22.9 Summary and conclusions	360
23. A Comparison of Dual Drainage Modeling Techniques	
<i>Pankratz, Leblanc and Newcombe</i>	361
23.1 General model setup and assumptions	362
23.2 Measured calibration events and historic rainfalls	369
23.3 Model calibration	369
23.4 Comparison of results	375
23.5 Suitability of models	377
23.6 Conclusions	377
24. Provision of Parking-Lot Pavements for Surface Water Pollution Control Studies	
<i>Thompson and James</i>	381
24.1 Introduction	381
24.2 Background	382
24.3 Instrumented pavements	386
24.4 Instrumentation, sampling and monitoring	391
24.5 Conclusions and recommendations	393

25. City of Etobicoke Exfiltration and Filtration Systems Pilot/ Demonstration Project	
<i>Candaras, Carvalho and Koo</i>	399
25.1 System development rationale	400
25.2 System description	401
25.3 Pilot/demonstration project	405
25.4 System monitoring	411
25.5 Preliminary modeling results	416
25.6 Conclusions	418
26. Guide to 309 Papers of some ASCE Specialty Conferences, 1970-1989	
<i>James</i>	421
26.1 Introduction	421
List of conferences	423
Group topics	424
Classification of papers	426
Listing of papers	427
Glossary	437
Acronyms	459
Programs and Models	463
Index	465