

**AN ANALYSIS OF THE INFLUENCE OF THE FIELD
LEVEL HYDRAULIC PROPERTY APPROXIMATIONS
IN STORMWATER MODELLING**

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Degree of Master of Philosophy

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Sri Lanka

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Date

The above candidate has carried out research for the MPhil thesis under my supervision.

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Professor N. T. S. Wijesekera

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Date

An analysis of the influence of the field level hydraulic property approximations in stormwater modelling

ABSTRACT

This study analyses the effect of the catchment field approximations for accurate flood hydrograph prediction. Considering the availability of gauged data, the Karasnagala watershed of Attanagalu Oya, located in Gampaha district in the Western province of Sri Lanka was modelled with EPA SWMM 5. Following an event based approach, 3 days Minimum Inter event Time (MIT) and 0 mm/day Minimum inter Event Depth (MED) were used as the threshold. Fifty events were separated from the 1971 to 1982 period. Concave method and constant slope method were compared for baseflow separation in this study. Four major field approximation types were identified as stream geometrical parameters approximations, soil infiltration parameter approximations, approximation of watershed intermittent storages, and subcatchment delineation approximation. Quantitative representation of the catchment intermittent storages and qualitative representation of the connectivity of the catchment intermittent storages were identified as the objectives of the layout parameter optimization. Soil parameter approximations and the stream network geometry parameter approximations were verified by the field observations. Model calibration and verification revealed that EPA SWMM5 can be successfully used to develop regional Karasnagala watershed model with mean ratio of absolute error (MRAE) 0.289 for calibration, and 0.375 MRAE for verification. Incorporation of intermittent storages with optimized model layout obtained best fitting of hydrograph recession MRAE 0.167. Evaluation of available models and the modelling carried out with calibration & verification revealed that EPA SWMM 5 can be used to develop a rural watershed model. Field approximation for subcatchment lumping with a 16 sub basin configuration showed the marginal increment of modelling error when compared with distributed modelling. Stream parameter approximations revealed that the head water streams/lesser order streams parameters sensitivity is higher than the higher order streams. In soil parameter approximations, saturated hydraulic conductivity of the soil was the most influencing parameter.

Key Words: Field approximations, SWMM, Rural watershed, MIT

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DECLARATION	i
ABSTRACT	ii
ACKNOWLEDGEMENT	iii
List of Figures.....	ix
List of Tables	xi
List of Abbreviations	xii
List of Appendices	xiii
1 INTRODUCTION	1
1.1 Research Problem.....	2
1.2 Overall Objectives of the Research	4
1.2.1 Specific objectives of the research	4
1.3 Scope of the Work.....	4
1.4 Study Area	5
2 LITERATURE REVIEW.....	8
2.1 Model Selection.....	8
2.1.1 Storm Water Management Model (SWMM)	12
2.1.1.1 General Description	12
2.1.1.2 SWMM Model parameters.....	14
2.1.1.3 SWMM Runoff generation	16
2.1.1.4 Flow Routing.....	18
a. Kinematic wave routing	19
b. Dynamic wave routing	19
c. Steady routing.....	19
2.2 Catchment Characteristics	20
2.2.1 Catchment delineation	20

2.2.2	Catchment description	20
2.2.3	Land use pattern	21
2.3	Identify the State of the art Stormwater Modelling.....	21
2.4	Stormwater Modelling Issues.....	23
2.5	Field level Approximations.....	24
2.6	Parameter Optimization	26
2.7	Calibration and Verification	27
2.7.1	Calibration.....	27
2.7.2	Verification	28
2.7.3	Objective function	28
2.8	Baseflow Separation.....	30
2.9	Event Identification	32
2.9.1	Event Duration	32
2.9.2	Inter Event Time.....	33
2.9.3	Threshold Rainfall	33
2.10	Hydrograph Recession.....	34
3	METHODOLOGY.....	35
3.1	Introduction.....	35
3.2	Study Area and Data Requirement.....	35
3.3	Model Development	36
3.4	Methodology Flow Chart.....	38
4	DATA.....	39
4.1	Data from Literature	39
4.2	Data from Institutions.....	39
4.3	Field Data.....	40

4.3.1	Field data collection issues.....	43
4.4	Data Checking	44
4.5	Preparation of GIS Data.....	45
5	ANALYSIS.....	49
5.1	Model Selection.....	49
5.2	Event Identification	51
5.3	Baseflow Separation.....	53
5.3.1	Baseflow Behaviour.....	54
5.3.1.1	Event Runoff Coefficient Calculation	56
5.4	SWMM Model Development for the Study Area	57
5.4.1	Subcatchment Delineation	57
5.4.2	Stream network representation.....	58
5.4.3	Catchment Parameter Identification	61
5.4.3.1	General.....	61
5.4.4	Model Calculation Time Step	63
5.4.5	Routing method Selection.....	64
5.4.6	Calibration and verification data	65
5.4.6.1	Distribution of Events.....	65
5.4.6.2	Flow Duration and Flow Types.....	66
5.4.7	Objective function selection.....	67
5.4.8	SWMM Model Computations	68
5.4.9	Model Layout Development.....	68
5.4.9.1	Model Parameters.....	69
5.4.9.2	Number of Subdivisions in the Watershed	70
5.4.9.2.1	Layout Option Selection	70

5.4.9.2.2	Criteria for layout Evaluation	71
5.4.9.3	Intermittent Storage modelling.....	76
5.4.9.4	Fundamental model layout.....	77
5.4.9.5	Spatially aggregated storages connectivity modelling	79
5.4.10	Model Calibration and Verification.....	82
5.4.10.1	Calibration Parameters.....	83
6	RESULTS.....	85
6.1	Stream parameter approximation	85
6.2	Baseflow separation and Event runoff coefficients.....	86
6.3	Model schematic development.....	86
6.3.1	Optimum number of subdivisions in the watershed	90
6.3.2	Model calculation time step selection.....	91
6.3.3	Spatially Distributed Storages Representation Method Identification .	92
6.3.3.1	Spatially aggregated storages connectivity	93
6.3.3.2	Modelling error with different storage connectivity options	94
6.3.4	Recession limb matching improvement.....	95
6.4	Model performance during calibration.....	97
6.5	Verification Results	98
7	DISCUSSION.....	99
7.1	Event separation	99
7.2	Baseflow behaviour and Event runoff coefficient.....	99
7.3	Delineation of sub catchments	100
7.4	Model calculation time step	102
7.5	Parameter Optimization	103
7.5.1	Model Calibration.....	104

7.5.2	Model Verification	105
7.6	Hydrograph recession improvement.....	105
7.7	Limitations of the study	106
8	CONCLUSIONS AND RECOMMENDATIONS	107
	References	108

List of Figures

Figure 1 Satellite Image of the Karasnagala Watershed	6
Figure 2 Stream Network of the Attanagalu Oya Catchment at Karasnagala Gauging Point	7
Figure 2 Stream Network of the Attanagalu Oya Catchment at Karasnagala Gauging Point	8
Figure 3 Runoff Generation of SWMM (Smith, 2004)	16
Figure 4 Methodology Flow Chart	38
Figure 5 GPS Data collection along the streams	41
Figure 6 Impervious landuses digitized on the study area	47
Figure 7 Pervious landuses digitized on the study area	48
Figure 8 One day synthetic unit hydrograph for Karasnagala watershed	52
Figure 9 Stream Ordering according to Strahler Method	58
Figure 10 Stream network representation in the model	59
Figure 11 Third Order Stream Nodes (Blue colour) and Fourth Order Stream Nodes (Red colour) according to Strahler Method.....	60
Figure 12 Land use percentages in subcatchment 1 & subcatchment 2	62
Figure 13 Seasonal event rainfall variation with type of the event peak	66
Figure 14 Natural breaks of the flow duration curve of high, medium, and low in peak of event.....	67
Figure 15 Karasnagala watershed model layouts – Fully Distributed (a), 16 subcatchment semi-lumped (b), 4 subcatchment semi-lumped (c), and fully lumped (d).....	73
Figure 16 Conceptualization of Detention storage option and Node ponding option	77
Figure 17 Fundamental model layout for Karasnagala watershed	78
Figure 18 Sample subcatchment storages spatial distribution	80

Figure 19 Schematic representation of the subcatchment storage distribution and the stream connectivity	80
Figure 20 Model verification process	84
Figure 21 Distributed, 16 subcatchment semi-lumped, 4 subcatchment semi-lumped and lumped subcatchment model layouts results comparison for sample rainfall-runoff event	87
Figure 22 Optimization of the number of subcatchments in the model.....	91
Figure 23 Sample subcatchment storages spatial distribution	93
Figure 24 Schematic representation of the subcatchment storage distribution and the stream connectivity	93

List of Tables

Table 1 Model Comparison.....	9
Table 2 SWMM parameters	14
Table 3 Sample Field Data Collection Sheet.....	42
Table 4 Physical parameters of the Streams.....	46
Table 5 Model selection criteria	49
Table 6 Model Evaluation	50
Table 7 Baseflow separation method evaluation criteria	53
Table 8 Evaluation of Baseflow Separation Methods.....	55
Table 9 Subcatchment Parameter Values.....	63
Table 10 Percentage Change of Streamflow Peak at Different Time Steps	64
Table 11 Fully Distributed, 16 subcatchment semi-lumped, 4 subcatchment semi-lumped, and fullylumped subcatchment layouts comparison	74
Table 12 Approximations done in the model layout development.....	75
Table 13 Sample Event time series data	79
Table 14 Stream bed and bank roughness effect on event outflow hydrograph peak	85
Table 15 Fully Distributed, 16 subcatchment semi-lumped, 4 subcatchment semi-lumped and fully lumped subcatchment layouts results analysis	88
Table 16 Model number of subcatchment optimization	90
Table 17 Average L_{cpd} values for the optimization	93
Table 18 Average L_p values for the optimization	93
Table 19 Calibration events overall hydrograph matching MRAE for schematic (a)	94
Table 20 Calibration events overall hydrograph matching MRAE for modified schematic (d)	95
Table 21 Recession Curve MRAE of 50 Rainfall-runoff Events for Schematic (a) ..	96
Table 22 Recession Curve MRAE of 50 Rainfall-runoff Events for Modified Schematic (d).....	96

Table 23 Calibration events optimized parameter values	97
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List of Abbreviations

Abbreviation	Description
BFI	Baseflow Index
DEM	Digital Elevation Model
EPA SWMM	Environmental Protection Agency Storm Water Management Model
GIS	Geographic Information System
GPS	Global Position System
HEC-HMS	Hydraulic Engineering Center –Hydrologic Modelling System
ILLUDAS	Illinois Urban Drainage Area Simulator
LID	Low Impact Development
MED	Minimum -inter-Event Depth
MIT	Minimum Inter-event Time
MOUSE	Model for Urban Sewers
MRAE	Mean Ratio of Absolute Error
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
NS	Nash-Sutcliffe efficiency coefficient
SD	Standard Deviation
SF _{Peak}	Streamflow Peak
UH	Unit Hydrograph
USD	United States Dollars
WBM	Water Balance Model