

Accepted Manuscript

Research papers

Stochastic modelling of the hydrologic operation of rainwater harvesting systems

Rui Guo, Yiping Guo

PII: S0022-1694(18)30317-2

DOI: <https://doi.org/10.1016/j.jhydrol.2018.04.062>

Reference: HYDROL 22765

To appear in: *Journal of Hydrology*

Received Date: 23 December 2017

Revised Date: 3 April 2018

Accepted Date: 25 April 2018



Please cite this article as: Guo, R., Guo, Y., Stochastic modelling of the hydrologic operation of rainwater harvesting systems, *Journal of Hydrology* (2018), doi: <https://doi.org/10.1016/j.jhydrol.2018.04.062>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Stochastic modelling of the hydrologic operation of rainwater harvesting systems

Rui Guo¹ and Yiping Guo^{2*}

Abstract: Rainwater harvesting (RWH) systems are an effective low impact development practice that provides both water supply and runoff reduction benefits. A stochastic modelling approach is proposed in this paper to quantify the water supply reliability and stormwater capture efficiency of RWH systems. The input rainfall series is represented as a marked Poisson process and two typical water use patterns are analytically described. The stochastic mass balance equation is solved analytically, and based on this, explicit expressions relating system performance to system characteristics are derived. The performances of a wide variety of RWH systems located in five representative climatic regions of the United States are examined using the newly derived analytical equations. Close agreements between analytical and continuous simulation results are shown for all the compared cases. In addition, an analytical equation is obtained expressing the required storage size as a function of the desired water supply reliability, average water use rate, as well as rainfall and catchment characteristics. The equations developed herein constitute a convenient and effective tool for sizing RWH systems and evaluating their performances.

Key words: rainwater harvesting, stochastic model, water supply reliability, stormwater capture efficiency

¹ PhD Candidate, Dept. of Civil Engineering, McMaster Univ., Hamilton ON, Canada L8S 4L7.
E-mail: guor8@mcmaster.ca;

² Professor, Dept. of Civil Engineering, McMaster Univ., Hamilton ON, Canada L8S 4L7.
E-mail: guoy@mcmaster.ca

* Corresponding Author

Download English Version:

<https://daneshyari.com/en/article/8894644>

Download Persian Version:

<https://daneshyari.com/article/8894644>

[Daneshyari.com](https://daneshyari.com)