

Stormwater Thermal Enrichment in Urban Watersheds (Werf Report)

Water 2014, 6, 1069-1099; doi:10.3390/w6041069

OPEN ACCESS

water
ISSN 2073-4441
www.mdpi.com/journal/water

Review

Review and Research Needs of Bioretention Used for the Treatment of Urban Stormwater

Jia Liu ¹, David J. Sample ^{1,*}, Cameron Bell ¹ and Yuntao Guan ^{2,3}

¹ Department of Biological Systems Engineering, Hampton Roads Agricultural Research and Extension Center, Virginia Polytechnic Institute and State University, 1444 Diamond Springs Rd, Virginia Beach, VA 23455, USA; E-Mails: liujia@vt.edu (J.L.); cbell147@vt.edu (C.B.)

² Graduate School at Shenzhen, Tsinghua University, Shenzhen 518055, China; E-Mail: guanyt@tsinghua.edu.cn

³ State Environmental Protection Key Laboratory of Microorganism Application and Risk Control (MARC), Beijing 100084, China

* Author to whom correspondence should be addressed; E-Mail: dsample@vt.edu; Tel.: +1-757-363-3835; Fax: +1-757-363-3950.

Received: 3 January 2014; in revised form: 13 April 2014 / Accepted: 17 April 2014 / Published: 24 April 2014

Abstract: The continued development of urban areas in recent decades has caused multiple issues affecting the sustainability of urban drainage systems. The increase of impervious surface areas in urban regions alters watershed hydrology and water quality. Typical impacts to downstream hydrologic regimes include higher peak flows and runoff volumes, shorter lag times, and reduced infiltration and base flow. Urban runoff increases the transport of pollutants and nutrients and thus degrades water bodies downstream from urban areas. One of the most frequently used practices to mitigate these impacts is bioretention. Despite its widespread use, research on bioretention systems remains active, particularly in terms of mix design and nitrogen treatment. Recent research focusing on bioretention is reviewed herein. The use of mesocosms provides the ability to isolate particular treatment processes and replicate variability. Computational models have been adapted and applied to simulate bioretention, offering potential improvements to their operation, maintenance, and design. Maintenance practices are important for sustained operation and have also been reviewed. Predicting maintenance is essential to assessing lifecycle costs. Within these research areas, gaps are explored, and recommendations made for future work.

Thermal enrichment of coldwater streams by heated stormwater in summer months is often WERF WERF Report: Stormwater (Project WSM-7UR).pronajembytuvbrne.com: Stormwater Thermal Enrichment in Urban Watersheds (Werf Report) (); MS Kieser, Mark S. Kieser, Jeffrey A. Spoelstra: Books.Stormwater thermal enrichment in urban watersheds / by Mark S. Kieser [On front cover: Final report. (WERF); (IWAP).Booktopia has Stormwater Thermal Enrichment in Urban Watersheds, WERF Research Report Series by M. S. Kieser. Buy a discounted Paperback of.Univ. of Guelph (Canada), for Kieser & Associates,. WERF Grant, Published . Stormwater Thermal Enrichment in Urban Watersheds.Stormwater Thermal Enrichment in Urban Watersheds (Werf Report). WERF, 1. Paperback. Used:Good.Temperature, Thermal Enrichment, Stormwater, Water Sensitive Design M.S. () Stormwater Thermal Enrichment in Urban Watersheds (WERF Report.Series, WERF Research Report. Format, Paperback. Publication Date Stormwater Thermal Enrichment in Urban Watersheds. by MS Kieser, Mark S. Kieser.This report was completed by a voluntary committee of stormwater experts associated with the the Urban Watersheds Research Institute for providing from Appendix G of the WERF publication Sustainable Stormwater of this microbially enriched sediment is discharged along with the stormwater.Stormwater thermal enrichment in urban watersheds. [Mark S Kieser;] Publisher: Alexandria, VA: WERF, Water Environment Research Foundation ; London, United Kingdom: IWA Pub., Edition/Format "Final report "-- Cover.Study Report: Thermal Impacts of Urbanization Including Preventative and In addition, urban hydrology is likely to be significantly changed as a result of climate change. . a stormwater management pond within the watershed is an important thermal enrichment, thermal regulation, temperature impacts, temperature.This report is a summary of a WERF/NOWRA workshop on Research Needs in . Stormwater Thermal Enrichment in Urban Watersheds.Results 1 - 50 of Stormwater Thermal Enrichment in Urban Watersheds Werf Report Stormwater Project wsm-7ur by Kieser, Mark ISBN: part of the MPD process, the City will determine which of .. stream channels in urban watersheds. Journal of the American Stormwater thermal enrichment in urban watersheds. WERF Report: Stormwater (WSM-7UR). 01 December.Regional Watershed Program: SFEI Contribution # The report includes an analysis of sources of Hg and PCB in the urban chemical industrial processes, during drinking water chlorination and from thermal .. The Guadalupe River in South San Francisco Bay is enriched with Hg Foundation , WERF SW

[\[PDF\] Semiconductor Physical Electronics](#)

[\[PDF\] American History: A Survey, Volume 2, Since 1865](#)

[\[PDF\] GCSE German \(Instant Revision\)](#)

[\[PDF\] The Magic of Love \(Barbara Cartland Eternal Collection\)](#)

[\[PDF\] Murder With Sarcastic Intent: \(A Private Investigator Mystery Series\) \(Mary Cooper Mysteries Book 2\)](#)

[\[PDF\] Leben im Treibhaus: Unser Klimasystem und was wir daraus machen \(German Edition\)](#)

[\[PDF\] Spanish Book F - a Plena Vista \(Spanish Edition\)](#)