

Application of PCSWMM to Assess Wastewater Treatment and Urban Flooding Scenarios in Phnom Penh, Cambodia: A Tool to Support Eco-City Planning

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Chair: Alan Ziegler, Department of Geography, NUS

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Place: Earth Lab (AS2 02-03), Department of Geography, NUS

Abstract

Wastewater treatment and localized flooding have emerged as two important challenges to sustainability and resiliency in Phnom Penh, Cambodia, over the past decade. As such, the Stormwater Management Model (PCSWMM) was used to explore wastewater treatment and urban flood management scenarios to help assess development paths that are more consistent with eco-city planning philosophy. Phnom Penh currently has a system of natural wetlands to treat its wastewater. Sampling was done in the largest wetland, Boeng Cheung Ek, between March, 2007 and November, 2011 to empirically evaluate treatment efficiency and provide calibration support for the model. The measured difference in mean concentration between the wetland inlet and outlet reflected reductions in the range of 44% (nitrate) to 99.97% (E. coli), with other parameters (Cu, Cr, Zn, total phosphorus, and detergents) fitting within this range.

While wastewater is treated effectively and sustainably by the wetlands, in-filling for new construction is occurring, so the capacity to treat waste potentially is being reduced while the city's population is increasing. Scenarios run in PCSWMM show that in-filling of Boeng Cheung Ek by up to 22% could negatively impact treatment, but the system still would function. The alternative of conventional activated sludge treatment is costly and energy-intensive. Increased pump capacity at the existing pump stations would reduce, but not eliminate, local surface flooding. More eco-friendly Low Impact Development technologies should be considered in addition to hard engineering to reduce localized flooding.

Boeng Cheung Ek provides a number of ecosystem services, including storage to manage urban flooding, peri-urban fisheries, and wetland agriculture. The work discussed here was able to effectively address the environmental pillar of sustainability, but an integrated, multidisciplinary approach is required to assess the economic and social pillars (and associated ecosystem services). The preservation and management approach implemented for the East Kolkata wetlands in India might be a good model for Phnom Penh.

About the Speaker



Kim Irvine is a Professor in the Geography and Planning Department at Buffalo State, State University of New York and has been in the Department for 25 years. He is the Director of the Center for Southeast Asia Environment and Sustainable Development at Buffalo State and also is an Adjunct Professor in the Environmental Engineering and Management program at Asian Institute of Technology (AIT) in Bangkok. He is on a two year sabbatical with the Humanities and Social Studies Education Academic Group at the National Institute of Education, Nanyang Technological University until July 2014. His research interests are in the areas of water quality (particularly in urban areas), sanitation, and water resources management, with projects based in North America, Cambodia, Vietnam, Thailand, Malaysia, and Singapore. He teaches courses in Hydrology, Quantitative Methods, Urban Planning Agencies and Issues, Environment and Sustainable Development Issues in Southeast Asia, and Geography of Asia at Buffalo State; Ecosystem Dynamics, Resource and Environmental Management, Urban Environmental Planning and Management, Coastal and Ocean Systems, Techniques in Geography, and Geographical

Methods and Fieldwork at NIE; and collaboratively teaches a Wastewater Treatment and Collection System Design class at AIT.

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