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EVALUATION OF GREEN ROOF AS AN OPTION OF GREEN TECHNOLOGY  
FOR URBAN STORMWATER QUANTITY AND QUALITY CONTROLS

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① Runoff — Management  
② Water quality management

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## DECLARATION

I hereby declared that this thesis, submitted to Universiti Tenaga Nasional as fulfillment of the requirements for the award of the degree of Master of Civil Engineering has not been submitted to any other university for any degree. I also certify that the work describe herein is entirely my own, except for quotations and summaries sources of which have been duly acknowledged.

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19 August 2013

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## ABSTRACT

Promoting green design, construction, reconstruction and operation of buildings has never been more critical than now due to the ever increasing greenhouse gas emissions and rapid urbanizations that are fuelling climate change more quickly. A sustainable approach to construction and development is adopted nowadays in order to minimize the negative impacts of climate change.

Driven by environmental needs, Green Building Index (GBI) was introduced in Malaysia to drive initiative to lead the property industry towards becoming more environmental friendly. Therefore, Green Building Index is Malaysia first comprehensive rating system for evaluating the environment design and performance of Malaysian buildings. Green roof system is one of the assessment criteria of this rating system which is under category of sustainable site planning and management. Green roofs (roof with vegetated cover) are gaining attention in the Malaysian society as a versatile new environmental friendly mitigation technology. Green roofs have been implemented and studied widely in overseas and interest in data on the environmental performance of these systems under local climate is growing, particularly with respect to urban heat island mitigation and stormwater quantity and quality controls.

An extensive green roof was constructed in Humid Tropics Center (HTC) Kuala Lumpur as one of the components for Stormwater Management Ecohydrology (SME) in order to obtain scientific data of the system. The objective of this study is to evaluate the performance of extensive green roof at Humid Tropics Center in reducing peak discharge under local tropical climate. This study also monitors thermal performance of the green roof system in reducing indoor temperature of the building which enables the building consumes less energy. In addition, green roof's ability in improving water quality of runoff produced is investigated. Simulations show that the peak discharge was reduced up to 47% for design storms and 26% for actual storms relative to impervious brown roof. Its reduction ability decreased for storms with intense rainfall. The results show an increment of pH for the runoff generated from the green roof and the runoff water quality ranged between class I and II under WQI. High concentrations of phosphate were found in the runoff samples and substrates (fertilized planting soil) might be the potential contributor. Findings indicate that there was a reduction of around 1.5°C for indoor temperature of the building after installation of green roof.

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### **APPENDIX B – ASTM Green Roof Design Standards**

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**APPENDIX E- Results of Water Quality Analysis**

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