Treatment Performance of Bioretention Swale

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***Abstract*—This paper presents effectiveness of a modular bioretention swale performance in terms of treating stormwater runoff. Runoff samples were collected from inlet and outlet after rain events for duration of three months and tested for pH, temperature, turbidity, conductivity, total suspended solids, total phosphorous and nitrates. The results showed significant reduction for turbidity (97%) and total suspended solids (95%) and substantial reduction for total phosphorous (73%) from the stormwater conveyed through the bioretention swale.**

Keywords-component;bioretention swale; runoff treatment; turbidity; total suspended solids; total phosphorous

Introduction

Jointly collaborated with NUS Department of Civil and Environmental Engineering, under Polytechnic Students Research Programe (PSRP), the project is aimed to investigate the treatment performance of a modular bioretention swale, located in NUS High School of Mathematics and Science, Singapore.

Bioretention swales are well known to improve quality of stormwater and facilitate the conveyance of stormwater while reducing the flow and velocity. The swale component removes medium to coarse particles while the bioretention system removes those that are finer with their associated contaminants [1].

Methods

In this project, stormwater samples were collected from inlet and outlet of the bioretention swale after rain events for duration of 3 months from May 2014 to July 2014. At each rain event, samples from outlet were collected every 30 seconds for duration of 4 minutes up to 1 hour & the number of inlet samples collected ranged from 1 to 9 depends on the availability. Stormwater samples were brought back to laboratory for further analysis.

Turbidity was measured by Turbidimeter (HACH, 2100N, USA) and pH, temperature & conductivity were measured using multimeter (Mettler Toledo). Lovibond photometer and HACH colorimeter were used to measure total suspended solids and nitrate concentrations, respectively. Total phosphorous were measured based on acid pursulfate digestion method using reactor (HACH, DRB 200, USA) and spectrophotometer (HACH, DR 3900, USA).

Results

Results for all seven parameters tested are presented in Fig. 1 to 7. There were no significant difference between pH and temperature values in inlet and outlet, while significant changes were recorded for other parameters tested. Among the parameters tested, turbidity and total suspended solids were reduced significantly, up to 97% and 95%, respectively. Slightly high (73%) total phosphorous removal was also recorded for total phosphorus. The bioretention swale performed the best on 26th May 2014.

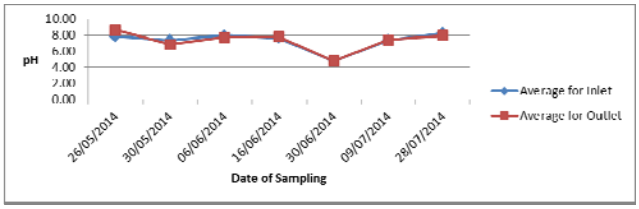

Figure 1 pH values

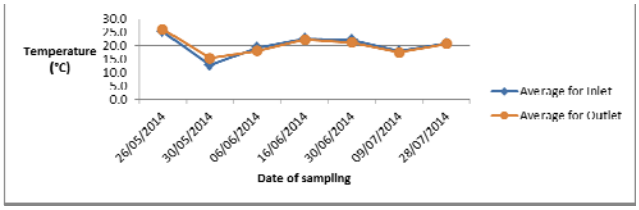

Figure 2 Temperature values

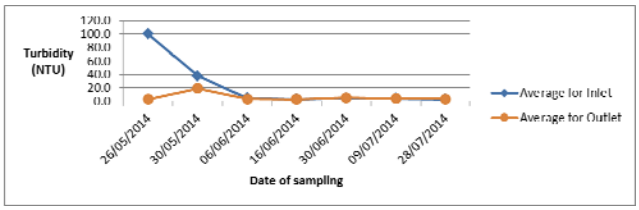

Figure 3 Turbidity vaules

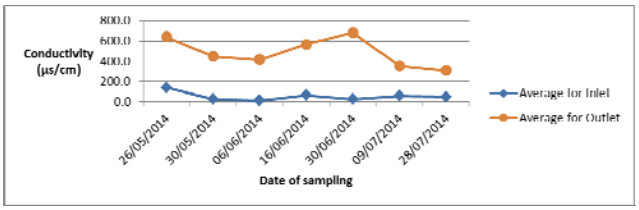

Figure 4 Conductivity values

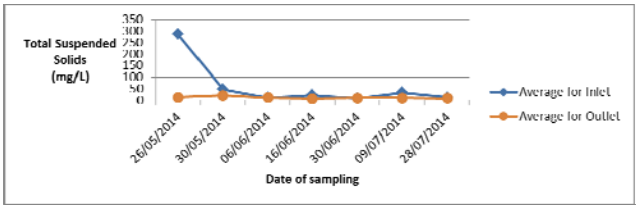

Figure 5 Total suspended solids concentrations

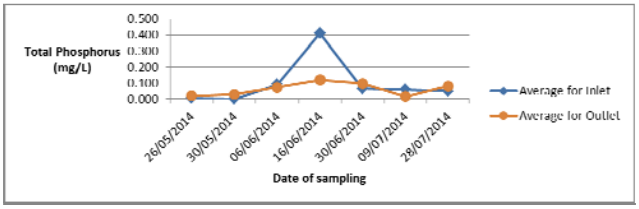

Figure 6 Total phosphorous concentrations

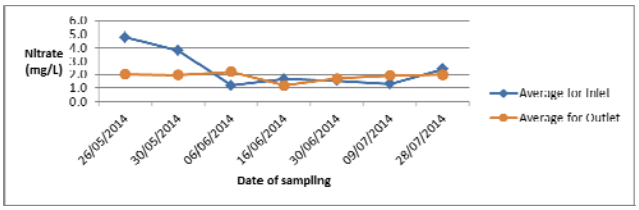

Figure 7 Nitrate concentrations

Conclusion

Treatment efficiency of the bioretention swale was compared against stormwater quality objectives for Singapore, PUB. The total suspended solids and total phosphorous in the stormwater from bioretention swale outlet has achieved the PUB targets; 80% removal or less than 10 ppm and 45% removal or less than 0.08 ppm for total suspended solids and total phosphorous, respectively [2].

ACKNOWLEDGMENT

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REFERENCES

[1] Engineering Procedures for ABC Waters Design Features, PUB, Singapore, pp 6-48.

[2] ABC Waters Design Guidelines, 2nd Edition, PUB, Singapore, 2011 , pp 13.