



Formulation of design guidelines for the cost-effectiveness of constructed wetlands in improving water quality

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ABSTRACT

Constructed wetlands (CWs) are artificially engineered ecosystems designed and developed to manipulate the biological processes within a semi-controlled natural environment. CWs were beneficial for having uncomplicated operation and maintenance activities, providing a wildlife habitat in urban and suburban areas and an aesthetic value within the local environment. However, there were current limitations on the CWs operations such as few design guidelines, limited performance results regarding the pollutant attenuation and the absence of long-term comprehensive mass balance analysis. The objective of this research was to analyze the reduction performance of various CWs with regard to the respective monitoring data and develop the necessary design guidelines based on the similar trends analyzed from the mentioned CWs. The formulated design guideline would be suitable for CWs treating various wastewaters. In order to develop the design guideline, various CWs in Korea and other countries were investigated with respect to three scenarios namely site survey, water quality and ecosystem monitoring and performance reports. Based on the results, using the CW design characteristics (i.e., surface area, catchment area, etc.) and pollutant reduction capabilities (i.e., pollutant removal efficiency, HRT, vegetation coverage, etc.) the derivation of the formula needed to calculate the appropriate CW size, forebay size, vegetation coverage was developed. For the cost-effectiveness of the CW, the economic feasibility of the investigated CWs was evaluated with respect to the CW formation costs and was compared with the particulate removal efficiency.

Keywords: Constructed wetland; Cost-effective; Design guideline; Water quality

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