ABSTRACT

Wastewater reuse is increasingly becoming an important component of water resources management in many countries. Planning of a sustainable wastewater reuse project involves multi-criteria that incorporate technical, economic, environmental and social attributes. These attributes of sustainability is the framework upon which the decision support tool presented in this paper is developed. The developed tool employs a user friendly environment that guides the decision makers in assessing the feasibility of implementing wastewater reuse. The input data into the tool are easily obtainable while the output is comprehensive enough for a feasibility assessment of treated wastewater reuse. The output is expressed in terms of effluent quality, costs, quantitative treatment scores and perception evaluation. Testing of the developed multi-criteria decision support tool using Parow wastewater treatment works in Cape Town showed the tool to be versatile and capable of providing a good assessment of both qualitative and quantitative criteria in the selection of treatment trains to meet various non-potable reuses. The perception module provided a quick assessment of potential user’s concerns on reuse and service providers’ capacity.

Keywords: Decision Support Tool, Feasibility Assessment, Multi-Criteria Attributes, Wastewater Reuse

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INTRODUCTION

Freshwater scarcity, which is being experienced globally, needs conservation measures to maximize usage. It is a well-established fact that water demand already exceeds supply in many parts of the world, and many more areas are expected to experience this imbalance in the near future. In order to meet an ever-increasing demand for freshwater, past efforts have centered on the development of additional water resources schemes, i.e., water supply interventions such as the exploitation of distant surface water and deeper groundwater sources, construction of new dams and desalination (Friedler & Hadari, 2006). However, implementation of these measures usually requires significant capital investment (planning, construction, operation, maintenance, and replacement) and is frequently accompanied by negative long-term environmental effects such as the depletion of renewable water resources, deterioration of water quality, seawater intrusion, and alteration of ecosystem dynamics. Efforts to augment existing water supply have gone a long way to mitigate the negative effects of freshwater scarcity. However, other feasible and more environmentally attractive initiatives have been developed to complement water supply interventions. The separation of potable and non-potable water for various uses via dual reticulation systems has increasingly been investigated in many parts of the world as a means to meet the growing demand for non-potable water requirements that have traditionally used potable water (Hurlimann and Mckay, 2007).

Treated municipal wastewater represents a significant potential source of reclaimed water for some beneficial reuses. As developing country populations continue to grow from rural to urban areas, the number of centralized wastewater collection and treatment systems will also increase, creating significant opportunities to implement wastewater reuse systems to augment water supplies and, in many cases, improve the quality of surface waters (USEPA, 2004). Chang and Ma (2012) carried out a comparative analysis on the influencing factors on fresh water and reclaimed wastewater consumption in Beijing. The results show that main factors affecting the promotion of wastewater reclamation in Beijing include water price, reclaimed wastewater quality, acceptability and local administrative orders.

Agrafioti, E and Diamadopoulos (2012) presented a strategic plan on the feasibility of recycling treated municipal wastewater for agricultural irrigation on the Greek island of Crete. In order to screen out and evaluate technologies appropriate for reclamation treatment to ensure the safe reuse of reclaimed water, Wei et al. (2012) developed a toxicity-based assessment of treatment technologies while Paulo et al. (2012) presented a natural system of treating segregated domestic wastewater stream for reuse. Santos et al. (2012) also developed a simple, low-cost and easy maintenance experimental system for greywater reuse that provides high reduction of SS, COD, and BOD.

Mojid et al. (2012) reported that the wheat cultivation irrigated with wastewater in Bangladesh promotes plant leaf growth but its effectiveness in improving the leaf area index (LAI) decreased with its elevated quantity in irrigation. The levels of faecal contamination of vegetable crop irrigated with tertiary-treated municipal wastewater were studied by Cirelli et al. (2012). The results show that the microbiological quality of the products (i.e., eggplant and tomato) was generally maintained.

Treatment technologies for wastewater reuse are already well established with varied degrees of success in many countries such as Singapore, Israel, Jordan, Namibia, United States of America (USA), Australia, Germany and many European countries (Po et al., 2004). In South Africa, research on and practice of wastewater reuse for diverse non-potable uses has grown in the last 8 years (Carden et al., 2007). However, the practice of wastewater reuse system in South Africa is still in its infancy and as such, there is a paucity of reliable information relating to the costs and benefits, public opinion and decision support tools for assessing the feasibility of implementing treated wastewater reuse systems in different South
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