LAND USE/COVER CHANGE OF NAKIVUBO WETLAND AND THE VARIATION OF WATER QUALITY IN THE UPPER, LOWER WETLANDS AND THE INNER MURCHISON BAY INTERFACE, KAMPALA UGANDA

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Abstract

The degradation of Nakivubo wetland may have affected its potential to treat wastewater, run-offs and industrial influents from the City of Kampala and there is no current information related to that. As a result, this study assessed the degraded Nakivubo wetland and its ability to provide a wastewater treatment potential to protect the inner Murchison bay from pollution. The study investigated the current and past land use land cover changes in the wetland, assessed variation in the water quality within the upper and lower wetland zones and the effects on water quality in the Inner Murchison Bay interface.

The study utilized Landsat ETM+ images for 2000 and 2015 (February and July) which were downloaded from the USGS website and processed using standard remote sensing software ArcMap 10.1 (by ESRI, USA) to generate characteristic land use maps over the periods chosen for the study. Water quality assessment was carried out within the upper, lower wetland zones and in the Inners Murchison Bay interface. This comprised water quality sampling, field measurement and laboratory analysis using the standard methods for the examination of water and wastewater. Water quality parameters monitored included pH, EC, Turbidity, TSS, Temperature, DO, nutrients

(Nitrate-N, Nitrite-N, Ammonium-N, and Orthophosphate), BOD5, COD, TN, TP, and selected trace metal parameters (viz., Pb, Cd, Cr, Co, Cu, Ni, As, Zn, Al, Fe, and Mn) both in dissolved forms and bound in the sediments.

Results indicate that the Nakivubo wetland natural cover, which was originally dominated by Cyprus papyrus, decreased by 64% between 2000 and 2015 and within the same period, subsistence farming decreased by 31% while built up area increased by 53%, bush land increased by 48%, grassland increased by 35% and open water increased by 61%. The physical chemical variables did not change significantly ($p>0.05$) between the inflow (at NK-1) and out flow (LW-4) for most of the parameters monitored. This implied that the wastewater that entered the wetland reached the lake largely untreated. However, in the lake interface (at IMB-1 to IMB-3) the concentration of most parameters were significantly lower ($p<0.05$) implying that dilution played a key role in reducing the concentration of the strong effluent wastewater. The treatment potential of the wetland based on seasonal effects indicated that, in the dry season, only 16% nitrite-N was removed and only 23% of nitrite-N, was removed while for the ammonium-N, the removal was much lower (13%). On the other hand, 25% of the orthophosphate was removed while only 47% of total-P and 48% of TN were removed. Over the wet season, the results indicated that 68% of

nitrite-N, 45% of nitrite-N, 35% of ammonium-N, and 64% of total nitrogen were released in the lake interface. As for orthophosphate, 38% was removed in the wet season. At the lake interface there was significant increase in chlorophyll-a concentration showing an algal biomass accumulation. Trace metals related to anthropogenic activities (viz., Cd, Cr, As, Cu, and Co) and those abundant in the environment but common in industrial processing (Fe, Al, Zn, Mn, and Se) were detected in the upper wetland and in the lake interface in the similar concentrations. The results also indicated that these metals are causing moderate to extreme pollution in sediments in the interface. The study further found that the sediments in the lake adjacent to the wetland contain orthophosphates sufficient to sustain algal growth when re-suspended. The results of this study indicate that the degradation of Nakivubo wetland through the removal of the natural wetland vegetation like Cyperus papyrus has resulted into wastewater flowing through the wetland with little or no treatment. As a result, it is recommended that Nakivubo wetland should be restored.