Application of the integrated wastewater resource recovery model: A case at the Burgersfort WWTF

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Rivers in Africa have experienced dire pollution as a result of the poor management of wastewater effluent emanating from water resource recovery facilities (WRRFs). An integrated wastewater resource recovery model was developed and applied to identify ideal wastewater resource recovery technologies that can be used to recover valuable resources from a mixture of wastewater effluents in a case study in the Burgersfort WRRF in the Limpopo province, South Africa. This novel model incorporates the process of biological nutrient removal (BNR) with an extension of conventional methods of resource recovery applicable to wastewater. The assessment of results of effluent quality from 2016 to 2022 revealed that ammonia, chemical oxygen demand, total coliform, faecal coliform, and Escherichia coli levels were critically non-compliant with the permissible effluent guidelines, indicating a stable upward trend in terms of concentrations, and scored a poor wastewater quality index rating. All variables assessed showed a significant loading, except for orthophosphates, and significant correlations were observed among the variables. The results of the integrated wastewater resource recovery model revealed a high probability of reclaiming recoverable resources such as nutrients, sludge, bioplastics, biofuel, metals, and water from wastewater, which have economic, environmental, and social benefits, thereby improving the effluent quality of a WRRF.