## Case study n°1

# Wastewater treatment and reuse using a constructed wetland system at institutional level

**Country:** Botswana

**Level:** National and Local

**SDG Addressed:** SDG 6 – Clean Water and Sanitation


## Summary

The objective of this case study is to demonstrate how standards can be used for waste water treatment and re-use. This supports the achievement of the SDG target 6.3 on improving water quality by reducing pollution, eliminating dumping and minimizing the release of hazardous chemicals and materials. The government of Botswana involved the Department of Water Affairs Headquarters, which used national standards based on international standards, to treat wastewater discharged from its own headquarters.

Wastewater reuse promotes water conservation & demand management which is one of Botswana's priorities for additional water resources. The demonstration project on wastewater treatment and reuse acts as a leverage towards improving wastewater re-use by various stakeholders. This includes public knowledge on safety and hygiene on handling wastewater.

Wastewater reuse at institutional level closes the water cycle loop. This reduces pressure on fresh water usage as well as wastewater discharge into natural water resources, increasing water efficiency and preventing pollution.


## Background

Botswana is faced with water shortages due to its limited water resources. The situation is exacerbated by low rainfalls, high evaporation rates, poor water quality that is caused by the salinity of underground water, and water wastage especially in institutions such as schools. The country has reached its full potential in terms of surface water development (construction of dams). All Botswana's perennial rivers are shared with neighbouring countries. These rivers are Okavango, Zambezi, Orange-Senque and Shashe – Limpopo. As an economy in transition, Botswana requires water for economic growth in domestic, energy, agriculture, tourism, manufacturing and the mining sectors hence wastewater reuse is an alternative.

## Strategy

Effluent produced by the constructed wetland system is assessed for quality in accordance with the national water quality standards. These are the drinking water quality specifications (BOS32: 2015), wastewater discharge requirements (BOS 93: 2012) and the water quality for irrigation specifications (BOS 463:2011). These standards were developed in Botswana by the Water Quality Technical Committee through the Botswana Bureau of Standards.

The collection of samples from the wetland system is carried out in accordance with water quality sampling standards (BOS ISO 5667) which provide guidance on sampling wastewaters, sampling techniques, sample handling and preservation and guidance on design of sampling programmes. Sampling, handling of samples in the field, their preservation and transportation to the laboratory for testing are also

guided by the BOS ISO/IEC 17025 for the Competence of Testing and Calibration Laboratories.

The first trial diverted wastewater into a constructed wetland ecosystem for treatment. This is a process where solids are removed from wastewater using septic tanks and the liquid is passed through a reed bed system that consists of four beds running in parallel and receiving the same load. Three of the beds contain different types of reeds that remove nutrients such as phosphates and nitrates while the fourth contains only sand and is used as a control.

## Results and impact

The constructed wetland system was found to be effective in treating wastewater for non-portable uses such as irrigation, construction and dust suppression. It was highlighted that different plant species in the reed beds have different affinities for nutrients in wastewater. However, constructed wetland system was not effective in pathogen removal in wastewater hence coupling the system with disinfection reduced the micro–organisms to acceptable levels suitable for non- potable re- use option. In conclusion, the system when coupled with membrane filtration can treat wastewater to the acceptable water quality standards.

## Challenges and lessons learned

The operation and maintenance of the constructed wetland system requires funding and skilled manpower, to avoid constant breakdowns and blockages due to lack of preventive maintenance plans. Constant breakdowns and blockages of the system disrupts water flows, and this affects the systematic effluent sampling and quality monitoring. Low up-take of wastewater re-use by the various stakeholders due to social, cultural and religious beliefs is a challenge. Extensive research is required on wastewater re-use to determine technologies that can improve wastewater quality for the intended use, establish the consequences on cumulative pollution over extended use, as well as energy and nutrient recovery.

## Potential for Replication

Treatment of wastewater using a constructed wetland can be replicated by various institutions in Botswana to treat wastewater on site for reuse for non-potable uses.

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