Constructed wetlands for water treatment

Challenge: Water pollution **Adaptation response:** Improved water treatment capacity

Description

Constructed wetlands make use of the natural purification processes of vegetation, soils and microbes to remove contaminants from discharge. Uses of constructed wetlands for water purification include applications in industrial wastewater and municipal wastewater and storm water treatment. This relatively low-cost technology improves water security and access, making it important for climate change adaptation. Additionally, green spaces created by wetlands produce habitats for wildlife and may improve recreational value.

There are two main types of constructed wetlands: subsurface flow and surface flow. Both are constructed on top of an impermeable basin that is placed in the ground. Subsurface flow wetlands filter and purify water under the surface of the soil, and are therefore filled with porous soils and sand. Water is either purified vertically through the soil and collected in pipes in the underlying basin, or goes through the soil layer in a more diagonal direction due to a slant, after which it is also collected in pipes and sent to an external reservoir. Surface flow wetlands consist of more impervious, silty soils that keep water above the soil. The water moves slowly in a horizontal pattern through the vegetation and top soil, removing sediment and contaminants before it is collected in pipes at the wetland's end.

Implementation

Site selection typically includes a low-lying area so that discharge can be easily collected for example, next to a road, near municipal water-storage tanks, or similar locations. Key variables to consider include required land size, expected (and desired) water retention capacity and water retention time, based on site capacity and purification needs. Construction activities typically include placing underlying basin at the site, topping the basin with soil (tailored to the respective requirements of surface and subsurface wetlands), and planting vegetation. Preference is usually given to native species, which can tolerate high moisture and which have good ability to retain contaminants. Monitoring and maintenance of the wetland includes removal of invasive species, clearing clogs, and monitoring water flow and water quality (pollution removal efficiency).

Environmental Benefits

- Provides water purification and biological control and improves water quality.
- Establishes green spaces, providing habitat for a wide range of wildlife (particularly surface flow wetlands) – and creating biodiversity benefits.
- Provides water regulation in extreme conditions, such as during floods and droughts.

Socioeconomic Benefits

- Provides aesthetic, educational and recreational value for local populations.
- Reduces water treatment costs.
- Improves climate change adaptation to extreme conditions.

Opportunities and Barriers

Opportunities:

- Construction and operation is often much cheaper than conventional treatment plants, lowering energy costs
- Lowers investments in treatment infrastructure
- Often operated at the community level – decentralized solution
- Produces multiple benefits, including climate change adaptation and biodiversity benefits (achieves multiple targets and has multipurpose applications)
- Subsurface wetland systems filter water without attracting mosquitos that transmit malaria and other vector borne diseases

Barriers:

- Wetlands require relatively large areas, which can make it difficult and expensive to gain land tenancy rights
- Wastewater containing high volumes of contaminants, particularly metals, can have negative effects on plants and animals and may not be suited for wetland treatment t
- Surface wetland systems could provide habitats for mosquitos, increasing risk of vector-borne diseases
- Unexpected disease or invasive species may disrupt habitat functions

Implementation considerations*

Technological maturity:	3-5
Initial investment:	2-3
Operational costs:	1-2
Implementation timeframe:	2-3

* This adaptation technology brief includes a general assessment of four dimensions relating to implementation of the technology. It represents an indicative assessment scale of 1-5 as follows:
Technological maturity: 1 - in early stages of research and development, to 5 – fully mature and widely used
Initial investment: 1 – very low cost, to 5 – very high cost investment needed to implement technology
Operational costs: 1 – very low/no cost, to 5 – very high costs of operation and maintenance
Implementation timeframe: 1 – very quick to implement and reach desired capacity, to 5 – significant time investments needed to establish and/or reach full capacity
This assessment is to be used as an indication only and is to be seen as relative to the other technologies included in this guide. More specific costs and timelines are to be identified as relevant for the specific technology and geography.

Sources and further information

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