

## **Nature Based Solutions for Wastewater Treatment**

### **Introduction**

Nature-based solutions (NBS) for wastewater treatment can harness the power of ecosystems to purify water. These use natural processes and systems, such as anaerobic digestion, constructed wetlands, wastewater treatment ponds, and soil infiltration systems to filter and clean wastewater. Green roofs and vertical gardens can also be used to treat greywater, providing a source of irrigation water.

These solutions are cost-effective and sustainable. They also offer a practical solution for wastewater treatment. These are particularly useful in areas where traditional, conventional infrastructure is lacking or is inadequate. Here are some examples:

Constructed and natural wetlands: Wetlands are effective at removing pollutants from wastewater, including bacteria, heavy metals, and high levels of nutrients.

Wastewater treatment ponds: These ponds use natural processes to treat wastewater. They can be particularly effective in rural areas.

Soil infiltration systems: These systems use the natural filtering ability of soil to treat wastewater.

Green roofs and vertical gardens: These can be used to treat greywater, providing a source of irrigation water.

Biological systems: Some NBS use biological systems, like root zones, or sustainable materials like gravel and coconut husks for filtration. The water may also be treated through biological enzymes.

### **How can nature-based solutions be designed to treat wastewater?**

How do we scale implementation of nature-based systems for wastewater treatment?

Scaling the implementation of nature-based solutions (NBS) for wastewater treatment involves several key steps:

Understanding the context: It is important to understand the local context. This includes the type of wastewater that needs to be treated, the local climate, and the available resources.

Technical knowledge: Stakeholders need to understand the design parameters, removal efficiencies, costs, co-benefits for both people and nature, and trade-offs for consideration in their local context. This knowledge can be gained through technical references, case examples, and guidance.

Combining traditional and nature-based solutions: It can be beneficial to combine traditional infrastructure, like an activated sludge treatment plant, with an NBS such as treatment wetlands.

Partnerships: Collaboration between governments, civil society organizations (CSOs), and the private sector can help scale up the use of NBS.

Policy support: Governments can play a crucial role in promoting NBS by providing policy support and incentives.

Learning from case studies across the globe can provide practical insights into the variety of potentially applicable solutions. Cost-effective design and implementation of ecosystems in wastewater treatment exists. It has the potential to be further promoted globally as a sustainable and practical solution.

Look at traditional and existing NBS for treating wastewater. Suggest solutions that might work in the Indian context. Particularly examine the following:

1. How can NBS and conventional treatment modules be combined for creating hybrid technologies that bring the advantages of both types of systems, e.g., the space efficiency of conventional systems, and the robustness & cost efficiency of NBS systems.
2. Ideas for overcoming some of the challenges of NBS systems, which include space requirements, reduced process control, improving output quality, reducing initial capex, lack of contractor ecosystem, etc.
3. Make a case for NBS, for different regulatory standards based on end use OR scale of the plant, economic case based on co-benefits and lifecycle costs, etc.