Constructed Wetlands

Why in news?

Constructed wetlands emerge as a promising approach for wastewater treatment.

What is constructed wetland?

- **Artificial wetlands**- Constructed wetlands are *engineered ecosystems* that are constructed to treat sewage, greywater, storm water runoff or industrial wastewater.
- **Mimic natural wetlands**- They use vegetation, soil and water to *purify wastewater* through physical, chemical, and biological processes.

Types	
Subsurface Flow	**Surface Flow**
The wastewater is directed through gravel beds or porous media promoting microbial activity that degrades organic matter.	It demonstrates their aesthetic appeal above the water's surface with gently flowing streams and lush vegetation.

- **Pollutant removal**- They act as *biofilters*, removing pollutants such as organic matter, nutrients (nitrogen and phosphorus), pathogens, and heavy metals from water.
- **Fosters biodiversity**- They welcome a diverse array of life forms ranging from microorganisms to aquatic plants and even birds to engage in the purification process.
- **Botanical superheroes**- Plants like cattails, bulrushes, and sedges can be grown due to their significant role in absorbing nutrients.
- **Hospitable habitats**- The roots of plants like cattails, sedges and bulrushes provide a hospitable environment for bacteria, which are essential for breaking down complex molecules into simpler, less harmful compounds.

What is the significance of constructed wetland?

- **Cost-Effectiveness**- It offer a more economical option than traditional treatment facilities as construction and maintenance requires minimal energy consumption and lower operational expenses.
- **Versatility-** They can be customized to address diverse forms of industrial wastewater thus effectively managing a broad spectrum of pollutants and contaminants.
- **Eco-friendly-** They promote biodiversity conservation and contribute to ecosystem services such as flood control and carbon sequestration further enhancing their ecological significance.
- **Scalability**- Constructed wetlands are flexible in scalability, able to be adjusted to fit various industrial operations and spatial limitations.
- **Adaptability-** They accommodate both centralized and decentralized wastewater treatment methods, providing adaptability in their deployment.

What are the steps taken by India to promote constructed wetlands for wastewater treatment?

Location	Constructed wetland
Asola Bhatti Wildlife Sanctuary, Delhi	A constructed wetland system here purifies sewage from nearby settlements and supports regional biodiversity conservation.
Chennai, Tamil Nadu	The constructed wetlands (Perungudi and Kodungaiyur) are part of a decentralized wastewater treatment strategy, reducing the load on centralized facilities and lowering pollutant levels.
Kolkata East Wetlands, West Bengal	It is recognized as a Ramsar site, these wetlands treat wastewater from Kolkata, providing livelihood opportunities for locals through fishing and agriculture.
Palla village, Haryana	The constructed wetland in this village treats wastewater from Delhi before it enters the Yamuna River, improving water quality and reducing downstream pollution.
Auroville, Tamil Nadu	The international township has decentralized wastewater treatment systems, including constructed wetlands, reflecting its commitment to sustainability and ecological stewardship.
Sariska Tiger Reserve, Rajasthan	The reserve uses constructed wetlands to treat wastewater from nearby villages, supporting local sanitation needs and wildlife habitat conservation.

What are the challenges?

- **Policy incentives**- There is a lack of clear policy and regulation that encourage the adoption of constructed wetlands in industrial wastewater treatment.
- **Lack of incentives-** There is no sufficient incentives and subsidies for industries to invest in sustainable wastewater management practices.
- **Limited awareness-**There is a lack of awareness among industry professionals, regulators and local communities for implementation and operation of constructed wetlands.
- **Research**- India needs to optimise design parameters and addressing emerging challenges such as new contaminants and the impacts of climate change.
- **Community engagement**- There is a lack of active participation from community members which is essential for the success of constructed wetland projects

What lies ahead?

- India's rich biodiversity and abundance of wetland ecosystems make it an ideal location for the adoption of constructed wetlands.
- The decentralized nature of many industries in India also makes these systems an appealing option for on-site or cluster-level wastewater treatment.
- With appropriate policies, capacity-building initiatives, and community involvement, constructed wetlands can significantly contribute to sustainable industrial progress and the preservation of water resources for future generations.

Reference

[Down To Earth- Wastewater treatment solution in India]