FAQs

frequently asked questions

Constructed Wetlands:

A Sustainable Option for Wastewater Treatment in the Philippines

The use of natural processes to remove pollutants in constructed wetlands has been extensively investigated and effectively applied in Western countries for decades. The low capital, operating and maintenance costs of these systems, together with good removal efficiency and simplicity in operation, make them an attractive and sustainable wastewater treatment option for developing countries such as the Philippines.

What are constructed wetlands and how do they work?

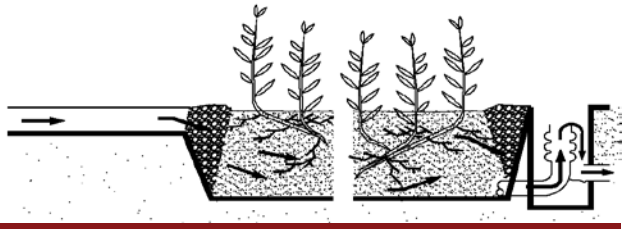
Constructed wetlands are man-made, engineered systems that utilize natural treatment processes to reduce the pollution levels in wastewater. The combination of soil, plants and microorganisms efficiently remove organic pollutants, nutrients and toxic contaminants in water using a variety of physical, biological and chemical processes. The energy that sustains all these processes is provided mainly by the sun.

Investigations on the capacity of marsh plants in the reduction of organic pollutants and nutrients in water started in the 1950's in Germany. Since then, various designs of constructed wetland systems have been developed and thousands of facilities are currently in use in Europe, Australia and the United States. Recent years have seen the proliferation of constructed wetland systems in Africa and Asia.

There are two basic types of constructed wetland: surface flow and subsurface flow. Surface flow wetlands are essentially shallow ponds planted with floating and emergent species, the water flow occurring almost entirely above the soil. The flow in subsurface flow wetlands occurs under the surface and within the soil planted with emergent species such as cattails (Typha), rushes (Juncus) and reeds (Phragmites). Subsurface flow is either horizontal with the water moving parallel to the surface, or vertical where the influent is distributed across the surface, percolates down the media and collected in a bottom layer. Subsurface wetlands are generally more efficient and require less land area.

Why build them?

The Clean Water Act provisions make it imperative for communities to undertake sewage collection and treatment in order to protect surface and groundwater resources. However, conventional wastewater treatment facilities are almost always associated with expensive capital outlays, high operating and maintenance costs, and requiring highly skilled personnel to run such systems. These translate into high recurrent costs that will be ultimately borne by the waste generator—the public. Constructed treatment wetlands offer a more sustainable option for wastewater treatment. The capital expenditure for constructing a wetland treatment facility may be equivalent or lesser than that of a conventional treatment plant, but its operating cost is minimal, depending on how much energy is required.



Conceptual diagram of a constructed wetland showing its major components: inlet, planted filter media and outlet works

How are they built?

A constructed wetland cell is typically built by digging a shallow excavation, lining it with an impermeable material such as plastic liner or concrete, filling up the space with filter media such as soil, sand or gravel and installing an influent storage/feeding and effluent collection/disposal system. Locally available construction materials are used, except for the use of plastic liner. After the civil works are completed, planting of the wetland will commence. In order to facilitate the speed of colony establishment, cuttings of the wetland plants may be gathered and rooted in an onsite nursery during the construction stage. The plants are usually acquired from local sources.

Do they have any environmental impact?

Because constructed treatment wetlands are natural systems, little environmental impact is expected. In fact, the benefits far outweigh the negative impacts if there are any. Lesser energy requirement means less greenhouse gases; in fact the plants sequester carbon dioxide into their biomass. However, special attention must be given to the choice of vegetation. Some wetland plants such as reeds (Phragmites) are regarded as noxious species which can colonize irrigation ditches and rice fields if not managed properly; factors related with their spread must be controlled. Although their seeds are usually not viable, cuttings of rhizomes or stems disposed improperly in a suitable spot can establish a reed stand in no time; manual removal is very difficult.

An established wetland will attract various animals such as amphibians, birds and even reptiles. These are essential elements of a wetland ecosystem and should be welcomed. Mosquitoes can be a concern in surface flow wetlands and should be dealt with accordingly. Because the water is "invisible"

in subsurface flow wetlands, mosquitoes are not a problem, as well as disturbing smell, which will not be observed. It must be noted that natural existing wetlands, despite their inherent pollution assimilative capacity, should not be intended as receiving bodies of untreated waste water.

What makes constructed wetlands more attractive than other wastewater treatment alternatives?

Compared to conventional treatment systems, constructed wetlands have lower energy and chemical requirements. A wetland is fundamentally powered by the sun, and if topography allows, water flow occurs by gravity. Plants obtain their nutrients from the wastewater so fertilizer application is generally not needed.

Another attraction of constructed wetlands is simplicity in operation, with less need for highly skilled manpower in day-to-day operations.

Constructed wetlands do not appear like conventional wastewater treatment systems that have an industrial look. They can be incorporated into the rural or urban landscape quite effectively, even in difficult terrain.

In tropical countries such as the Philippines, where the annual variation of temperature is not very wide, the plants and their associated microorganisms do not encounter seasonal changes common in temperate countries. Given a relatively warm and stable climate, microbial degradation kinetics are higher and fairly constant throughout the year, thus making wetlands a reliable system for removing biochemical oxygen demand and nutrients all year round.

Are there any cases where constructed wetlands are not applicable? What are its disadvantages?

Constructed wetlands are passive systems and generally require large areas of land compared to conventional systems. As a rule of thumb, one to five square meters of land is required per population equivalent. Consequently, constructed wetland systems are not suitable in areas where the cost of land is high.

Variable wastewater flow rates from domestic sources or tourism establishments can be a problem for subsurface flow wetlands where flow short circuit may occur. This is usually solved by designing a flow-equalization basin.

Constructed wetlands generally require a long start-up period. The plants take several months to establish and colonize a wetland cell although there may be cases where wastewater feed can commence as early as three months after planting.

Sewage and similar types of wastewater may need pre-treatment prior to feeding to a wetland. Solids removal is essential to ensure that the wetland media will not clog resulting in lesser pollutant removal efficiency. Well-designed septic tanks or sedimentation chambers are common pre-treatment options for removing suspended solids in sewage.

There may be instances where the use of water for sanitation purposes may be impractical, such as in dry mountainous areas with very little water supply. In this case, an ecosan dry-toilet system may be more suitable.

BAYAWAN CITY'S CONSTRUCTED WETLANDS: THE VERY FIRST FOR MUNICIPAL SEWAGE TREATMENT IN THE PHILIPPINES

In 2004, the City of Bayawan, Negros Oriental acquired 7.4 hectares of land exclusively for the development of a Gawad Kalinga community where fisherfolk affected by the city's coastal road project will be relocated. In compliance with the provisions of the Clean Water Act, the LGU established a sewage treatment system composed of three-chamber septic tanks and two-cell constructed wetland to reduce the pollution load generated by the 700-household community.

The GTZ (German Technical Cooperation Agency), through its Water and Sanitation Program, provided technical assistance in planning, design and capacity building. The total capital outlay for the sewage treatment facility was approximately ten million pesos. The constructed wetland, planted with the local variety of tambo (Phragmites), covers an area of approximately 3,000 square meters and is composed of a series of vertical flow and horizontal flow reed beds, completed in mid-2006. Because the community is located on low-lying land adjacent to the sea, the pre-treated sewage from the village's main sump is lifted by pump to the first constructed wetland cell. Other than this, there are no significant energy requirements as the wastewater flows by gravity, hence the low operation cost. The treated effluent is intended to be reused for landscape irrigation and firefighting.

The Bayawan sewage treatment facility is the first constructed wetland system for municipal sewage in the Philippines. Two more constructed wetlands are being planned by the city.

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