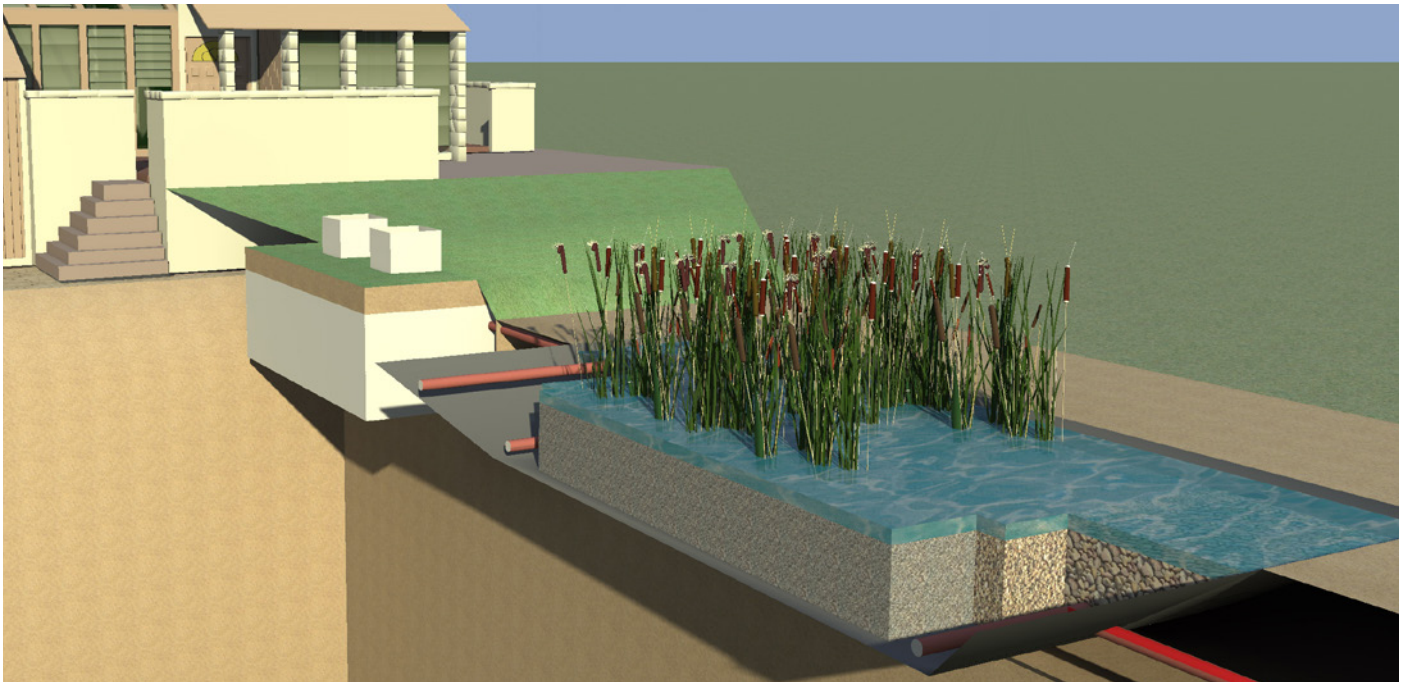
COMBINED CONSTRUCTED WETLANDS FOR WASTE WATER TREATMENT



PRINCIPLE

Constructed wetlands (CWs) combine various natural water purification mechanisms for cleaning of municipal or agricultural wastewater. First, physicochemical processes such as filtration, sedimentation and adsorption are used for reduction of sludge concentration and suspended solids.

Then the chemical and biological processes perform the elimination of organic matter (biological decomposition), nitrogen (nitrification, denitrification, plant uptake) and phosphorus (adsorption, plant uptake). CWs effectively transform and retain insoluble particles and improve the quality of treated water, however they have some limitations in nutrient (nitrogen, phosphorus) elimination.

Therefore combined CWs are used for the improvement of nutriet removal, especially from the high polluted wastewater (livestock wastewater etc.).

TECHNOLOGY APPLICABILITY

CW is a cost-effective and technically feasible approach that can be used as the primary treatment for small settlements or as tertiary treatment in large wastewater treatment plants.

Apart from municipal wastewater, its application in agriculture or industry has been proven, also rainfall collected on roads, highways and others large hard-standings, leachate, acid mine drainage, or agro-industrial waste water can be treated that way.

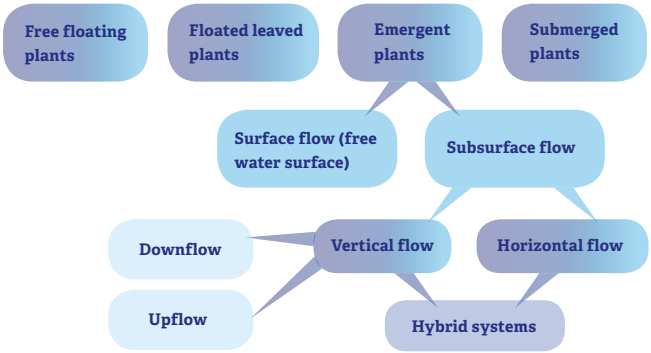
DESCRIPTION

Typical constructed wetland consists of mechanical pretreatment (septic or settling tank) and one or more filtration beds with surface or subsurface water flow. Filtration beds with subsurface flow differ in flow direction (horizontal, vertical).

Subsurface horizontal flow filtration beds are the most commonly used CWs in Europe. Different types of filtration materials are used for improvement of flowing and purifying processes (sand, gravel, slag).

Wetland plants ensure many functions – they stabilize the surface, provide good condition for filtration, insulate the surface against frost, provide surface area for attached microbial growth, mediate transfer of oxygen to the rhizosphere and eliminate some nutrients by plant uptake.

CLASSIFICATION OF CONSTRUCTED WETLANDS



Potential Limitations

- Surface demand (5 m²/PE)
- Limited nutrient removal
- Sensitive to high concentrations of toxic compounds

Main advantages of the technology

- Low operational costs
- Applicable for different types of wastewater
- Effective in intermittent operation (tolerant to fluctuations in flow)
- Low maintenance requirements
- Aesthetical criteria
- Odour elimination

Services and products

- Supply of constructed wetlands with guaranteed efficiency "turnkey"
- Selection of sites suitable for construction of wetlands
- Design and delivery of tertiary systems of wastewater treatment (removal of nitrogen and phosphorus)
- Processing and proceeding of project
- Selection and planting of vegetation
- Revitalization of non-functional wetlands
- Operation and maintenance of wetlands
- Financing of CWs construction

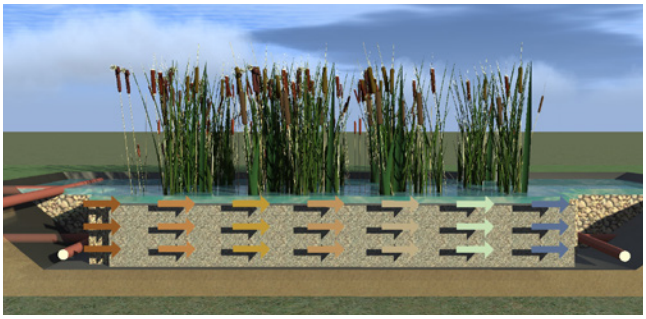
Data for system design

- Wastewater source
- Population equivalent
- Wastewater quality (BOD, TSS, microbiological pollution)
- Area available for construction
- Purified water requirements (limits)
- Water post-treatment – infiltration, irrigation, stream inflow, etc.

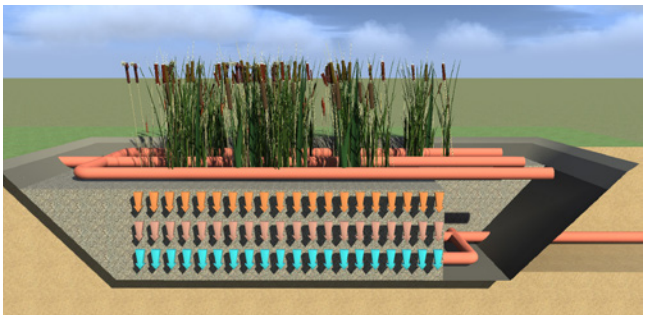
Typha latifolia

Caltha palustris

Phragmites australis



Horizontal flow filter



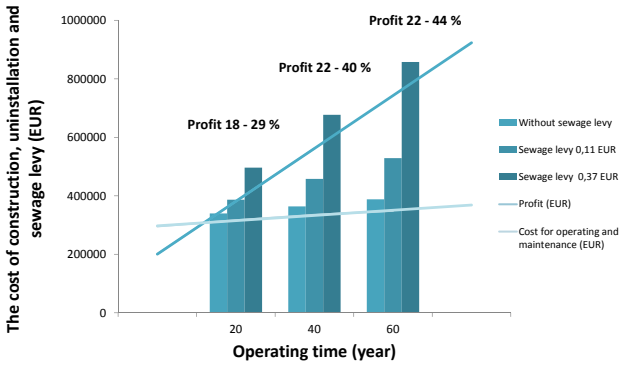
Vertical flow filter

REFERENCE PROJECT

A new type of hybrid CW for 250 PE was put in operation in 2011 in Kotenčice, Central Bohemia, Czech Republic. The system consists of 9 horizontal filters (911 m²) and 4 vertical filters with intermittent feeding (300 m²).

The filters are planted with Common Reed, Reed Canarygrass, Yellow Iris, Siberian Iris, Mannagras and Purple Loosestrife. The greenhouse with a photo reactor for the cultivation of algae and hydroponic system, sludge reed-beds and a composting field present a tertiary treatment of the new technology system.

THE TOTAL COST OF 20, 40 AND 60 YEARS OF OPERATION OF CW WITH DIFFERENT PRICES OF SEWAGE LEVY



CW EFFICIENCY DEPENDING ON ARRANGEMENT

Arrangement of CW (Elimination efficiency %)*	COD	BOD_5	P_{total}	N_{total}	N_{amon}	TSS
VF - HF	75-80	85-90	24-89	55-63	70-88	78-90
HF - HF	86-90	90-98	26-62	49-62	61-86	81-96
VF - VF - HF	84-98	91-99	65-83	78-83	71-99	89-98
HF - HF - VF	90	98	45	73	99	95

*HF - horizontal flow filter, VF - vertical flow filter

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