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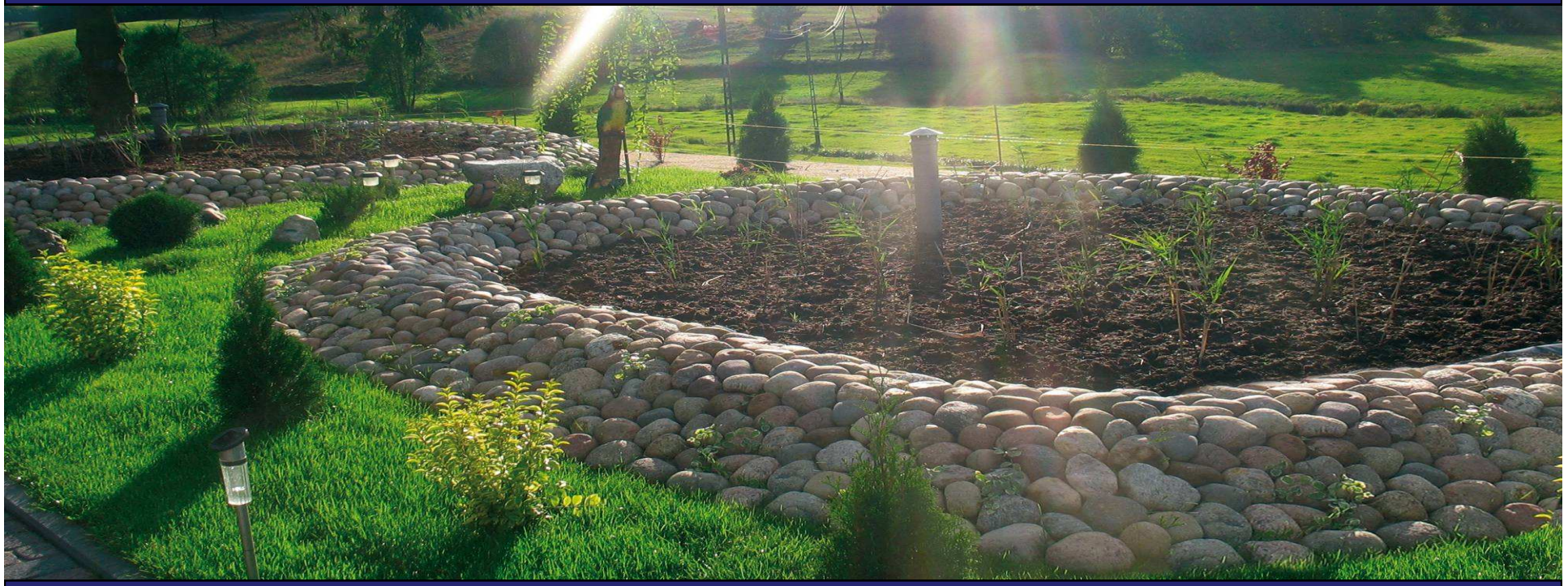
Inspiration from Wetlands



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Conference:
"Sustainable Wastewater Management in Basin Management Plans in Baltic Sea Region"

Project description

The aim of the project is to reduce eutrophication of surface waters in the surveyed catchments (Borucinka and Grabia) through analysis and presentation of innovative solutions concerning **sewage sludge management for rural areas**. This purpose will be achieved through determination of innovative technologies for sewage treatment and sludge management, estimation of natural environment potential in limitation of pollution discharge in the catchment and through elaborating solutions that integrate technological and natural potentials. An important issue in testing new solutions will be the possibility for energy recovery and closure of water and material flow in small-scale systems

Principle behing constructed wetland treatment method

In constructed wetlands plants are used, including reed, sedge, reed mannagrass, sweet flag and rush to treat wastewater. Plants have the ability to effectively incorporate biogenic compounds and heavy metals. Constructed wetland are inspired by European and North American wetland ecosystems, where natural hydraulic and habitat conditions are simulated. Wetland is an area where water level remains slightly above the ground throughout most of the year, causing a state of saturation of soil which is suitable for specific plant species. Constructed wetland method consists of mechanical - biological process with contribution of heterotrophic microorganisms and aquatic plants coexisting in the constructed wetlands or ponds. Thanks to these specific conditions, intensive oxidation and reduction processes take place. Supported by the processes of sorption, sedimentation, and assimilation they allow for removal of a substantial part of pollutants from wastewater.

Sedimentation Tank

- It serves as a preliminary mechanical treatment of waste water. In the tank readily falling suspended matter undergoes sedimentation (deposition) and accumulates in the bottom of the reservoir where it ferments. An old sedimentation tank can be used, provided it is water tight. Otherwise a new one has to be built.

Pumping Station

- It is composed of concrete circles and connected via e.g. a pipe with the sedimentation tank, so that waste water overflows without any suspended solids. In the vicinity of the tank a source of power supply to the pump should be prepared. With the use of a buoyancy pump waste water is pumped from the pumping station into the Wetland Filter. It is important to adjust the size of the pump so that the effluent is distributed evenly on the filter.

Wetland Filter

- It is a key element of the treatment plant, in which fundamental processes of wastewater treatment take place. The filter is formed in a hollow made partly in the ground and partly surrounded by embankment from extracted earth. The bottom is covered with a thick plastic foil. Drainage pipes, which are placed at the bottom of the filter, drain the treated effluent which is further discharged into the pond. The filter consists of at least two layers of gravel fractions of different grain diameter (with thicker fraction at the bottom). The ventilation pipe is lead from the drainage pipe out over the surface. Filtering layers are covered with at least a 10 cm thick layer of humus (peat mixed with bark). The surface of the filter is planted with specifically chosen macrophytes (reed, sedge, reed mannagrass, sweet flag, rush). It is recommended to use reed from lake shorelines and local wetlands.

Pre-filter

- It is built from concrete circles and placed next to the affluent side of the wetland filter. Thanks to the filling material - so called dual porosity gravel – the pre-filter aerates the sewage and retains minor suspended matter. Effluents are discharged into the inlet section of the wetland filter.

Pond

- Oval shaped pond serves as a polishing element and allows treated water to be discharged to the soil. It is covered up to about 40 - 50 cm of height with thick foil, above which a discharge of treated waste water into the soil may take place. The entire pond can be lined with stones, which combined with planted vegetation, including flower, can give the impression of a natural reservoir.

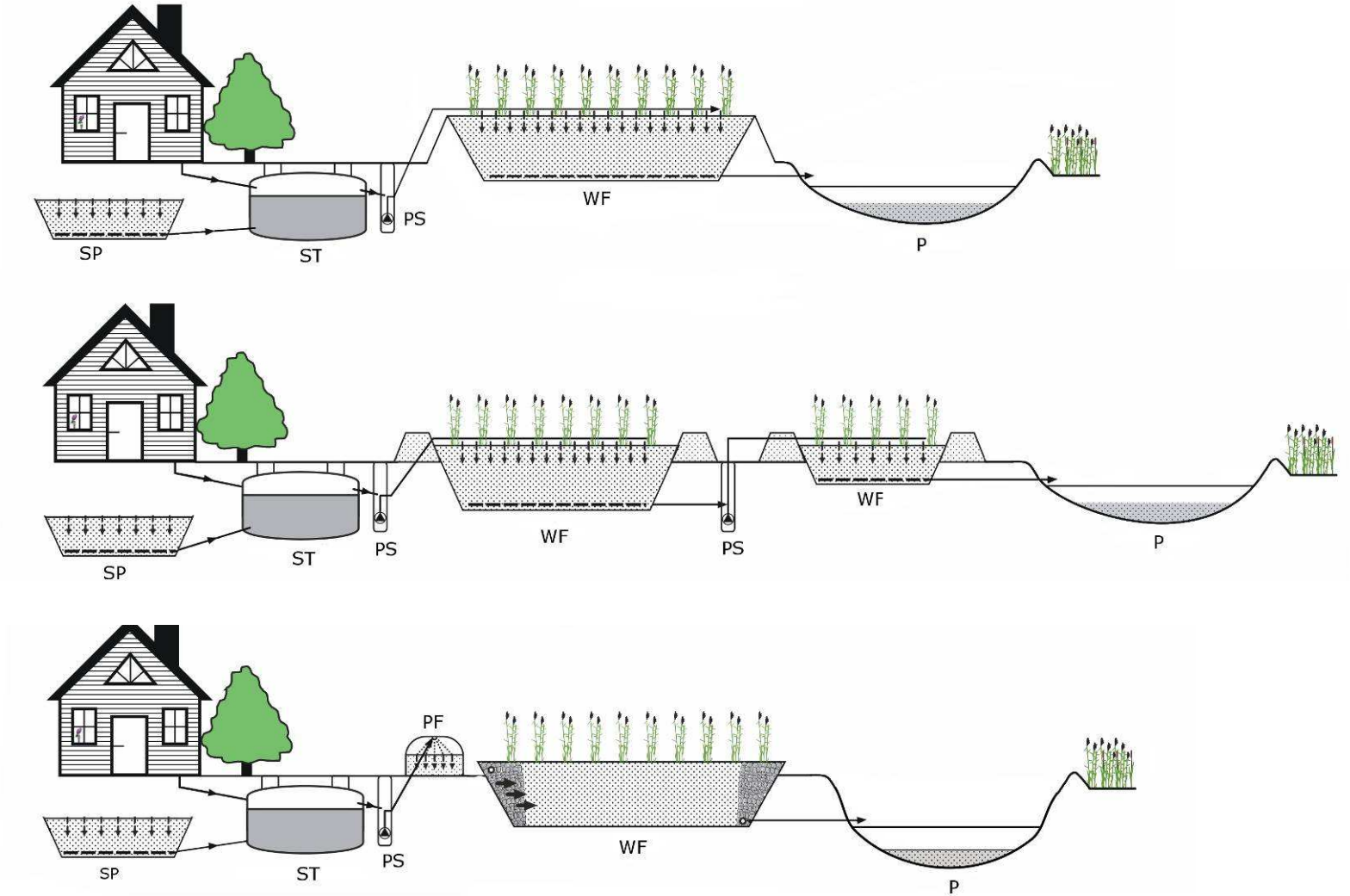
Sludge Plot

- It is a smaller cavity covered with a foil preventing sewage from penetrating to the soil. There are three layers of gravel with different granulation, with the thickest material at the bottom. Exterior walls are normally reinforced with stones. The plot is periodically filled with sewage sludge in a form of hydrated solid substance derived from the sedimentation tank and pumped out according to needs. The effluent is discharged to the pumping station or a sedimentation tank, from which it is pumped into the Wetland Filter. After dehydration and bio-transformation stabilized sewage sludge can be used as an organic fertilizer for crops.

Advantages of constructed wetlands

- competitive costs compared to conventional wastewater treatment plants
- simple construction, which does not require specialized servicing
- increased aesthetic qualities of landscape and environment
- effective mechanical and biological treatment of sewage, both in aerobic and anaerobic processes
- transpiration performed by plants significantly decreases amount of treated wastewater discharged into the environment
- treated water can be re-used for domestic purposes
- treated sewage sludge can be used as fertilizer for soil and plants
- wetlands improve retention and reduce erosion, and gradually become a suitable habitat for many animal and plant species
- the longer they work the more effective they become in removing contaminants, and their durability is estimated 50 - 100 years

Configurations (design Gdańsk University of Technology, team of prof. H. Pempkowiak-Obarska).



PL0271 - Innovative solutions for wastewater management in rural areas

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