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The improvement of water quality indicators in constructed wetland treatment systems in Latvia

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This study includes water quality monitoring data obtained since June, 2014 at the farm located in the middle part of Latvia. The water treatment system with two separate constructed wetlands was established to improve water quality in agricultural area. A surface flow constructed wetland received drainage runoff from the agricultural catchment basin. A subsurface flow constructed wetland was implemented to retain nutrients from the surface runoff collected in the area of impermeable pavements of the farmyard. As there are no other specific calculations recommended for the designing of constructed wetlands in Latvia, both wetlands were calculated basing on the surface area of the constructed wetland/catchment area ratio. The surface area of the subsurface flow constructed wetland was designed by 1.2% of the catchment area and the ratio was 0.5 % for the surface flow constructed wetland.

Water samples were collected manually by grab sampling method once or twice per month basing on a flowrate. Water quality parameters such as total suspended solids (TSS), nitrate-nitrogen (NO₃-N), ammonium-nitrogen (NH₄-N), total nitrogen (TN), orthophosphate-phosphorus (PO₄-P), and total phosphorus (TP), biochemical oxygen demand (BOD) and chemical oxygen demand (COD) were analysed to monitor the performance of both wetlands. The concentrations at the inlet and outlet were compared to evaluate the efficiency of the water treatment.

The concentrations of NO₃-N, NH₄-N and TN were reduced on average by 21 %, 35 % and 20 %, respectively for the surface flow constructed wetland. PO₄-P and TP concentrations were reduced on average by 31 % and 45 %, respectively for the surface flow constructed wetland. Total suspended solids were reduced by 17% at the outlet of the surface flow constructed wetland. However, in some cases, an increase in nutrient concentrations in water leaving the wetland was observed. The study showed the constant reduction of the PO₄-P and TP concentrations 82 % and 83 %, respectively in the subsurface flow constructed wetland. The concentrations of NO₃-N, NH₄-N and TN were reduced on average by 14 %, 66 % and 53 %, respectively for the subsurface flow constructed wetland. BOD and COD reduction on average by 93 % and 83 %, respectively in for the subsurface flow constructed wetland indicated the ability of the treatment system to be adapted for wastewater treatment with high content of organic matter under the given climate conditions. This study outlined that the farmyards should receive a special attention regarding surface runoff management.

