Woodchip Bioreactor to Reduce Nitrate from Tile Drains
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Construction Fall 2012

Subsurface trench lined with plastic

Drainage control structures

Filled 3-ft high woodchips; 4 PVC wells

Topped with geotextile and 1-ft topsoil

Research and Monitoring

1. Evaluate the bioreactor as an effective means for nitrate reduction in tile drainage
2. Determine the effect on phosphorus
3. Monitor environmental factors that can impact the rate of nitrate reduction
4. Calculate hydraulic settings such as flow, retention time and hydraulic gradient

Operation strategy and water levels

Sept 2012 Jan 2013 Feb 2013 April 2014

Bioreactor in April 2013

2013 Results 2014

NITRATE was completely removed 10 out of the 13 discharge events. Nitrate-N concentrations above 10 mg/L can cause harm to aquatic ecosystems.

PHOSPHORUS (P) is leaching into the effluent water. This suggests that in the anoxic environment, organic-P in the woodchips is being converted to soluble inorganic-P.

Average DRP* concentrations after the "flushing":
Influent = 0.02 mg P/L vs. Effluent = 1.4 mg P/L

* (Dissolved reactive phosphorus)

Dissolved oxygen (DO) in the water decreases from an average 10 mg/L to 0.6 mg/L as it flows through the bioreactor. This suggests the bioreactor is almost always an anoxic environment (<2 mg/L) where denitrification can occur.

The oxidation reduction potential (ORP) measured in the water decreases as water flows through the bioreactor. A more negative ORP suggests the nitrate is being reduced to nitrogen gas.

pH drops as water flows through the bioreactor; levels have increased from 2013-2014. A low pH (<6.0) could suggest the production of methylmercury, nitrous oxide, and/or sulfuric acid if coupled with high DO and low temperatures.