Please join me in support of our own Kristen Brush as she defends her thesis. Details are below, thanks!

Masters

Wednesday, July 19th at 9:00 am
Cobleigh 429 or Teams

Civil

"INFLUENCE OF DOSE VOLUME ON NITROGEN REMOVAL IN A TWO STAGE VERTICAL FLOW TREATMENT WETLAND: BRIDGER BOWL SKI AREA CASE STUDY "

Treating wastewater in remote locations should not require compromising the effluent quality discharged to the environment. A two-stage vertical treatment wetland (VFTW) with recycle fills this objective by removing high inputs of chemical oxygen demand (COD) and nitrogen (N) while requiring minimal maintenance and operator oversight. A partially saturated first stage of the VFTW removes influent COD and an unsaturated second stage nitrifies influent ammonium while recycle allows for the nitrate to be removed by denitrification in a lower saturated zone of the first stage.

A 95.2 m^2 VFTW located at Bridger Bowl Ski Area near Bozeman, MT operates only during the winter months with an influent temperature of ~ 5°C. During the 2021 – 2022 and 2022 – 2023 ski seasons the wetland operated with a 71 cm saturated zone in the first stage and a 2:1 recycle to influent ratio. System COD removal was > 95 % (influent COD > 750 mg/L) and system ammonia removal was > 98% (influent NH_4 >160 mg/L;). Previous results indicated a low COD to N ratio (COD:N) in the first stage likely limiting denitrification, hence total nitrogen removal. The goal of the current study was to increase the COD:N of the water entering the first-stage saturated zone by increasing the dose depth of influent (septic) water high in COD, thereby reducing COD removal in the unsaturated layer.

During the 21 – 22 season, ~ 900 gpd of influent septic water was applied onto the first stage in 1.2 and 2.5 cm doses. Both dose depths resulted in an average nitrogen mass removal of 7.1 g/m^2/day. During the 22 – 23 season, 1500 gpd of septic was applied onto the first stage in 0.99 and 3.98 cm doses, resulting in average nitrogen mass removals of 14.3 and 15.4 g/m^2/day, respectively. This difference was not statistically significant, indicating that septic dose depth was not a significant operating parameter in improving denitrification. However, decreasing the septic dose depth from 3.98 cm to 0.99 cm increased first stage nitrification from 20 to 48 %, and COD removal from 77 to 82 %, highlighting the importance of dose depth on system performance.