

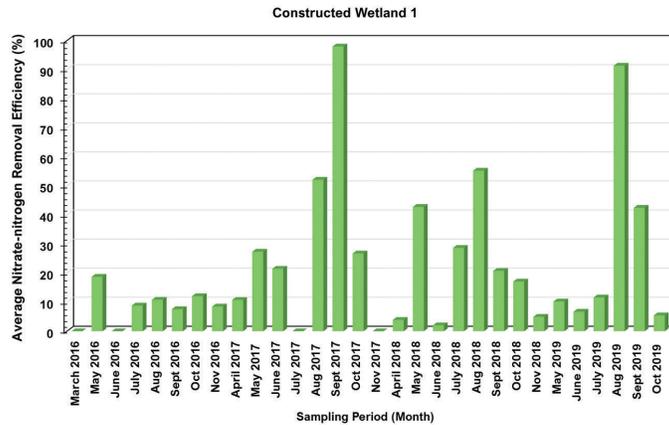
August 2020 Investment Insight

How Effective are Wetlands for Nutrient Removal?

The Wetlands Initiative is a non-profit group that received funding from NREC to investigate the value of wetlands to capture and store excess nutrient runoff from fields. Research efforts were led by Jill Kostel, Karl Rockne, and Mahsa Izadmedr in Bureau County Illinois.

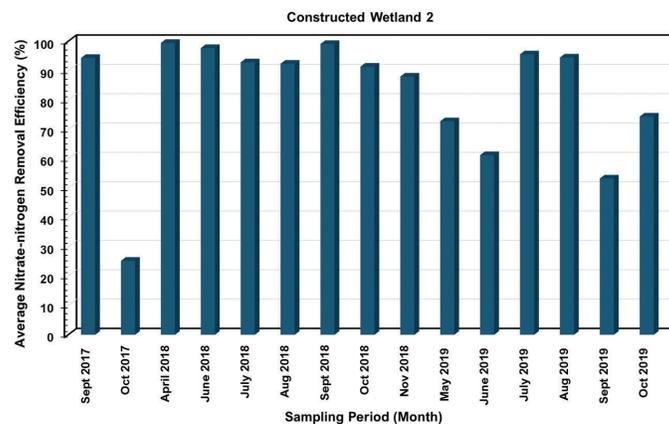
A suite of effective in-field management and edge-of-field conservation practices needs to be implemented to address agricultural runoff. Small tile-treatment wetlands can offer a practical, long-term edge of field solution to the challenge of reducing nutrient losses from cropland tile drainage runoff without taking a large amount of profitable farmland out of production.

- Two tile-treatment constructed wetlands (CW1 and CW2) were designed and built by the Wetlands Initiative in Bureau County under Illinois NRCS Practice Standard 656 to better understand wetlands' nutrient removal processes and to utilize these data to better design and site wetlands.
- Constructed Wetland 1 treatment-to-drainage area ratio) was built in August 2015 with a non-hydric growth media, and comprehensive water quality monitoring began in March 2016 using autosamplers at inlet and outlet. Monthly nitrate removal efficiency has been variable with the highest removal rates (90+%) achieved during the warmest months; improvements were



Average monthly nitrate-Nitrogen removal efficiency (%) at CW1 during 2016-2019.

observed in 2017 after the first growing season and subsequent incorporation of organic matter into the wetland sediment. Overall, the wetland removed nearly 8,000 lbs. of NO₃-N between 2016-2019. Approximately 440 lbs. of soluble reactive phosphorous (SRP) was removed during the first two years of operation with no change in 2018



Average monthly nitrate-Nitrogen removal efficiency (%) at CW2 during 2017-2019.

and a decrease in 2019, consistent with SRP removal being primarily a physicochemical process and the sediments having a limited sorption capacity.

- Constructed Wetland 2 (0.8 acre treatment area, 3.6% treatment-

to-drainage area ratio) was built in August 2016 with a hydric growth medium. Monitoring of this wetland began in September 2017 after establishment of the wetland plant community. The results to date show a much greater overall monthly NO₃-N removal efficiency (84%) than CW1, due to the greater residence time and higher availability of labile OM for the denitrifying microbial community.

- Nitrate removal efficiency substantially increased in CW1 over the sampling periods, corresponding to the increase of labile OM and higher abundance of denitrifying bacteria in the system. This is consistent with the guiding hypothesis that the presence of labile organic matter plus a competent denitrifying microbial community controls nitrate removal.
- The research shows that these tile-treatment wetlands are effective at reducing nitrate loss and can achieve up to 84% nitrate removal efficiency within two years. Presence of hydric growth media, higher treatment-to-drainage area ratio, and a shallower design may enhance the wetland's performance.

