IA-GRUNDY

Saturated Buffer

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SITE SUMMARY

The research is conducted in the headwaters of the North Fork of the Black Hawk Creek watershed on a private farm located near Dike, IA. The field is a conventionally managed field with a corn-soybean rotation. The soil along the stream is a poorly drained Coland silty clay loam.

In August 2015, a saturated buffer was established by installing a 778-foot-long distribution pipe about 221 feet away from the stream. There was an existing buffer at this site consisting of native vegetation. The buffer occupied a slightly depressed area adjacent to the row crop field that was not farmed due to wet soil conditions.

The 6-inch diameter tile outlet was selected for interception. The drainage area for this outlet is estimated to be approximately 71 acres, but a tile map for the field did not exist. The tile outlet was intercepted about midway across the width of the existing buffer with the installation of a four chamber water-level control box. A 4-inch diameter perforated tile was installed as the distribution pipe approximately parallel to the stream at a depth of 30 inches below the ground surface, at 0% slope.

The v-notch weirs within the control box were often overwhelmed at high flow rates and flow was not measured accurately during this time. Thus, periods of flow were not measured and calculations of flow to the buffer and nitrate removed in the saturated riparian buffer are biased low.

Box 1. SITE INFO

CHARACTERISTICS

- Saturated buffer installed in 2015
- Soil: Coland silty clay loam
- Rotation: Corn-Soybean

WATER MANAGEMENT PRACTICES

- Saturated Buffer (distribution tile: depth 30 inches, length 778 feet)

MEASUREMENTS IN DATABASE

DRAINAGE SYSTEM

- Tile Flow (2016-2018)
- Tile Water Quality: Nitrate-N (2016-2018)

SOIL

- Soil moisture and temperature (2016-2018)
- Soil Texture (2015)
- Percent Sand, Silt, and Clay (2015)
- Soil Fertility: Soil Organic Carbon, Total N (2015)

WEATHER

- Precipitation (2016-2018)

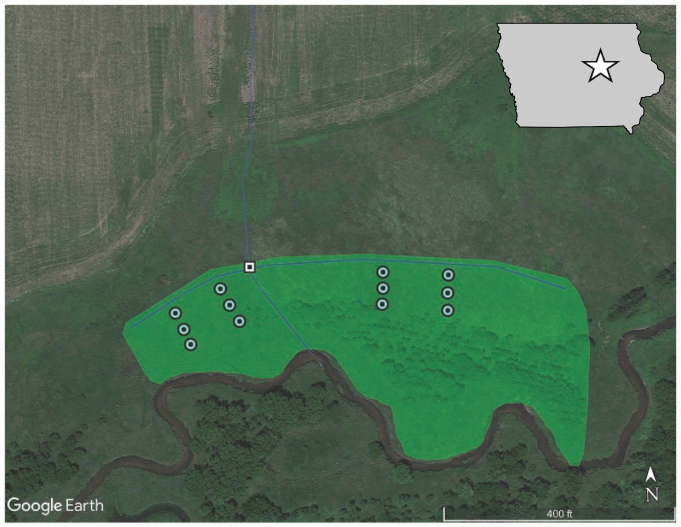

Figure 1. Map of IA-GRUNDY site near Dike, IA.

This material is based upon work that is supported by the National Institute of Food and Agriculture , U.S. Department of Agriculture , under award number 2015-68007-23193 , "Managing Water for Increased Resiliency of Drained Agricultural Landscapes", http://transformingdrainage.org. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.

SUMMARY OF RESULTS

FLOW

Flow from the field tile and any flow exiting the control box directly to the stream was measured continuously starting on September, 2016. The difference between these measured flows represent the water entering the saturated riparian buffer. Flow rates in the tile ranged from 0 to about 6500 gal/min. depending on precipitation and evapotranspiration within the field. Nitrate concentration was measured at four transects of three wells across the buffer. Nitrate concentrations in the wells decreased as water flow from the distribution pipe flowed through the shallow buffer soil to the stream. Nitrate concentrations in the tile ranged from 8 to 17.0 mg-N L^{-1} over the three years of monitoring. Nitrate concentrations in the shallow groundwater in the monitoring wells nearest the stream ranged from 0 to 3 mg-N L^{-1} . The decrease in nitrate concentrations from the distribution pipe to the stream side wells was due to denitrification and possibly some plant uptake of the nitrate in the groundwater.

WATER QUALITY

Mass removal of nitrate within the saturated riparian buffer was calculated by measuring the total flow between times of water concentration measurements and multiplying this number by the difference between the concentration in the tile minus the average nitrate concentration in the monitoring wells nearest the stream. Summing over each calendar year measured nitrate loads from the tile ranged from 6.5 to 77.7 lbs/ac draining to this tile outlet while nitrate removed within the saturated riparian buffer ranged from 5.7 to 26.3 lbs/ac. This is equivalent to a 42% removal rate when averaged over 2016 – 2018. Summed over the three years, this saturated riparian buffer removed at least 1284 lbs of nitrate-N. This is nitrate that would have otherwise entered the stream.

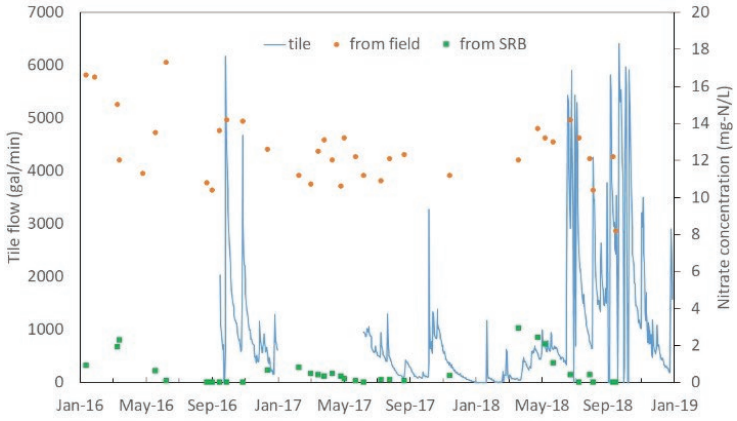

Figure 1. Water flow rate out of the field tile, nitrate concentrations in the tile water, and average nitrate concentrations in the observation wells closest to the stream. Missing flow data were due to high flows overwhelming the measurement system.

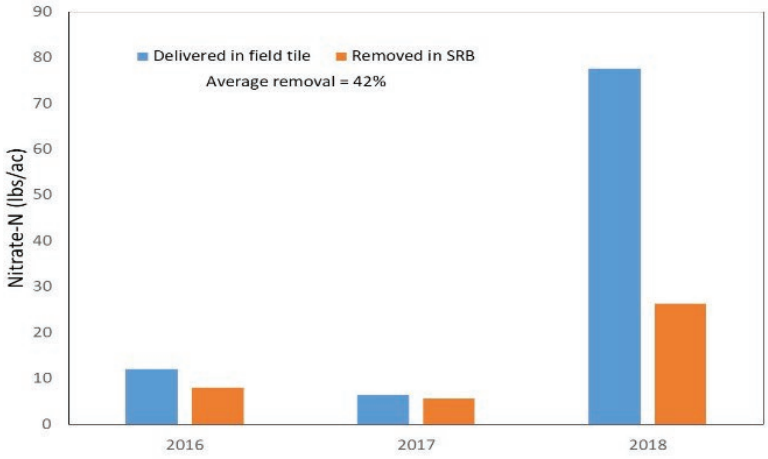

Figure 2. Total annual mass of nitrate leaving the field in the field tile at the control box and removed within the saturated riparian buffer for 2016- 2018.

Data Access

Data from this site are available through the USDA National Ag Library Ag Data Commons repository (https://doi.org/10.15482/USDA.ADC/1521092) or the interactive website at Iowa State University with visualization and querying capabilities (https://drainagedata.org).

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