



# 2019 Final Year-End Report Summary Sheet

## Grantee Information

**Project Title:** Drainage water management and saturated buffers for achieving NLRs goals Cereal Ry

**Institution:** University of Illinois

**Primary Investigator:** Laura Christianson

**NREC Project #** 2017-4-360498-168 2017-3-3

**Is your project on target from an IMPLEMENTATION standpoint and what % was planted?**  Yes  No  
 If you answered "no" please explain:

**Is your project on target from a BUDGET standpoint?**  Yes  No  
 If you answered "no" please explain:

**Based on what you know today, will you meet the objectives of your project on-time and on-budget?**  Yes  No  
 If you answered "no" please explain: It is likely we will request a one-year no-cost-extension later in 2020 if the NREC Board is amenable to that. As long as funds remain, it seems prudent to continue monitoring our saturated buffers, in particular, to collect as many site-years of N-removal performance as possible.

**How has this year's weather effected this project, and to what extent?**  Yes  No  
 If you answered "yes" please explain:

**Have you reached any conclusions related to this project that you would like to highlight?**  Yes  No  
 If you answered "yes" please explain:

**Have you completed any outreach activities related this project? Or do you have any activities planned?**  Yes  No  
 If you answered "yes" please provide details/dates for any upcoming outreach activities so that NREC staff can attend and possibly provide media exposure. See section 3b for previous outreach activities from this reporting period.

Please provide a 3-paragraph summary of this project to be shared in an NREC update bulletin. Please include any pictures or relevant tables or graphs. [See next page.](#)

## NREC January 2020 3.0 Year Report

### Drainage water management (DWM) and saturated buffers for achieving NLRs goals

PI: Dr. Laura Christianson, Assistant Professor of Water Quality, Department of Crop Sciences, University of Illinois, S322 Turner Hall, 1102 S Goodwin Ave., Urbana, IL 61801.

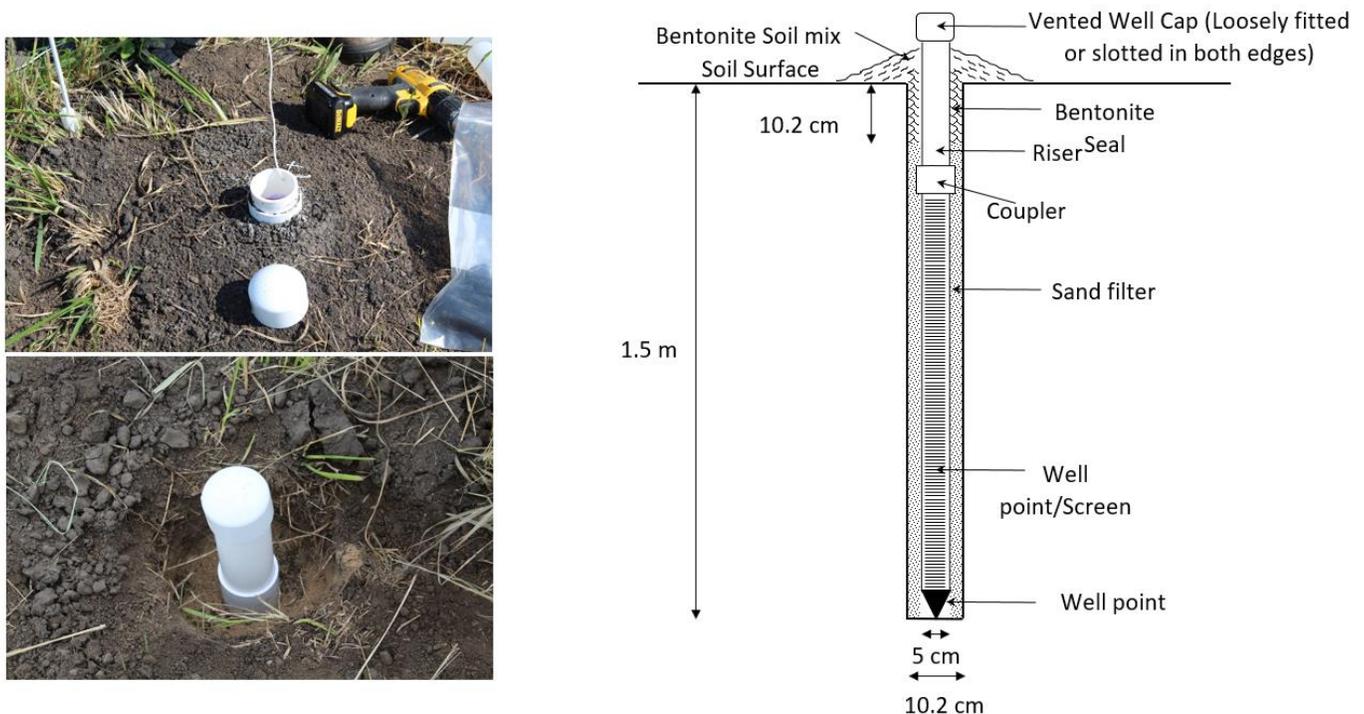
Co-PIs: Dr. Paul Davidson and Dr. Richard Cooke, Agricultural and Biological Engineering, University of Illinois

#### Three paragraph summary:

In early 2019, a process formalizing the procedure for suggesting a conservation practice be added to the Illinois Nutrient Loss Reduction Strategy was developed by the NLRs Science Team (Objective 4b), and it is likely the practice of saturated buffers will be one of the first to undergo this process. Key data were processed ahead of the PhD student project manager's (Mr. Janith Chandrasoma) PhD preliminary exam which helped establish a general direction for what a typical N loss reduction value for saturated buffers in Illinois may be (Objective 4a). This work is still considered preliminary and at least one more year of monitoring is necessary to provide more precision in the ultimate recommended value. The two primary monitored saturated buffers had different performance.

The practice of drainage water management is working as expected to reduce nitrogen loss, but the main objective of this study is still under investigation. Water balances are being developed and refined to help answer the primary research question about lateral seepage caused by this practice. The practice is primarily reducing nitrate loss by reducing the volume of drainage water leaving through the tile outlet. This makes addressing the water balance even more important because the water that does not leave through the tile outlet needs to be accounted for. Monitoring wells are a central part of this project (**Figure 1**).

We thank NREC for their continued funding and look forward to continuing to discover more about these practices in 2020.



**Figure 1.** Example monitoring well used to estimate lateral seepage at the drainage water management sites and monitoring nutrient removal at the saturated buffers.

## 1. List of objectives

The specific assessable objectives are to:

1. **Monitor drainage water management (2) and saturated buffer (2) sites** for nutrient loss reduction and crop yield impacts.
2. **Develop a water balance** at the drainage water management sites to better quantify lateral seepage impacts upon the overall nutrient loss reduction.
3. **Perform an economic evaluation** of these two practices (\$ per acre treated and \$ per pound of nitrogen removed).
4. **Evaluate if these practices should be added to the IL NLRs.** And if so,
  - a. Develop an appropriate N loss reduction value to add to the NLRs tables.
  - b. Develop a procedure and seek approval for adding drainage water management and/or saturated buffers to the NLRs.
5. Per the RFP, the final objective is *“to include a final report at the conclusion of this project to address each of the objectives stated above.”*

2. **Length of project - number of years completed:** 3.0 years (of 4.0 years)

## 3. Accomplishments

- a. Drainage water management sites
  - i. University of Illinois Agricultural Engineering Farm: Monitoring continues successfully. Lateral seepage monitoring wells have been replaced as needed.
  - ii. Private farm in Macon County: Monitoring continues successfully.
  - iii. Private farm near Effingham: Monitoring continues successfully at five fields, with four practicing DWM. This is a bonus site beyond the two proposed.
- b. Saturated buffer sites
  - i. Knox County saturated buffer: Monitoring continues successfully.
  - ii. Piatt County saturated buffer: Monitoring continues successfully.
  - iii. Animal Science Farm: Monitoring continues despite the saturated buffer control structure stop log's being set very low to prevent back-up of drainage within the research plots. Nevertheless, it's still an important site to monitor given the few saturated buffers currently being monitored.
- c. The PhD student project manager, Mr. Janith Chandrasoma, successfully passed his PhD preliminary exam (“prelims”) in fall 2019.
- d. This work was presented during this period at (presenter in bold):
  - i. **Christianson, L.** 2019. Soil Science Society of America Invited Session: Coupling and feedback of phosphorus and nitrogen in soil and ecosystem. Nitrogen, phosphorus, and tile drainage, oh my! A case for edge-of-field practices. Tri-Societies Annual Meeting. San Antonio, Texas. 10-13 November 2019. Abstract # 206-1.
  - ii. **Chandrasoma, J., R. Christianson, and L. Christianson.** Al Boyd Drainage Water Management Field Day. Cisco, Illinois. 07 August 2019. ≈30 in attendance.

**Table 1. Up-to-date timeline for “Drainage water management and saturated buffers ...” project**

	2017				2018				2019				2020			
	W	Sp	Su	F												
Hire field technician	✓	✓														
Hire 2 MS students / Graduation			✓		✓	✓										
<b>Objective #1: Monitor DWM and SB sites</b>																
Task #1: Install flow monitoring equipment and wells		✓	✓	✓												
Task #2: Monitor water quality and flow at all sites																
Weekly grab samples from control structures				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Monthly DWM piezometer grab samples				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Monthly SB well grab samples				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Task #3: Calculate annual N load reduction effectiveness							✓				✓					
<b>Objective #2: Develop water balance at DWM sites</b>																
Task #3ai: Compare seepage around free vs. DWM plots												✓				
<b>Objective #3: Perform economic analyses on practices (Task #4)</b>																
<b>Objective #4: Evaluate practices for inclusion in IL NLRs (Task #5)</b>																
Task #6: Develop procedure for NLRs practice addition																✓
<b>Objective #5: Funders reports (Task #7)</b>																
Peer-reviewed manuscript development/submit (2)		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Field days and factsheet																

Educational/Administrative activities

Research activities

Communication/Outreach activities

How will the research benefit the environment and/or crop production, etc.? This work seeks to establish the validity of drainage water management and saturated buffers as N loss reduction practices for potential inclusion in the IL NLRs. If either or both practices demonstrate consistent N loss reduction, it is thought that enhancing their status to “recommended” within the IL NLRs will aid in their adoption state-wide, which will improve water and environmental quality in an economically cost effective way that allows maintained (or even improved, in the case of DWM) agronomic yields.

New questions created by this work: We have heard of multi-lateral saturated buffers in Iowa and are intrigued this idea. We also have some questions about internal N cycling within the saturated buffer’s soil especially given cycles of wetting and drying that may occur. We’re in early stages of possibly designing a mesocosm experiment around related questions.

**Table 2. Budget analysis showing expenditures aligned with budget categories.**

	Budgeted	Spent through 12/2019
A. Personnel	\$182,527	\$141,155
B. Fringe Benefits	\$50,783	\$17,323
C. Travel	\$30,928	\$7,168
D. Equipment	\$0	\$0
E. Supplies	\$72,616	\$47,001
F. Contractual Services	\$2,000	\$11,978
G. Other (Investment income, Expense budget pool)	\$5,709	\$0
H. Indirect Charges	\$37,650	\$56,747
<b>TOTAL COST (Year 3.0)</b>	<b>\$382,213</b>	<b>\$281,373</b>
	<b>BALANCE REMAINING</b>	<b>\$100,841</b>