2017 Final Report Summary Sheet

Grantee Information

Project Title: Dissolving uncertainty: A comprehensive evaluation of dissolved P in tile drainage

Institution: University of Illinois

Primary Investigator: Christianson

NREC Project # 2016-3-360498-549

Is your project on target from an IMPLEMENTATION standpoint? ☒ 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: We may have additional funds left at the end of the project, but it is too soon to know for sure.

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:

Have you encountered any issues related to this project? ☐ 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: We have a number of solid and interesting findings that we're excited to move through peer-review before publicizing too much. Stay tuned!

Have you completed any outreach activities related this project? Or do you have any activities planned? ☒ Yes ☐ No
If you answered "yes" please explain and provide details for any upcoming outreach: Our proposed field day presentation and factsheet are on the schedule for this year. We're tentatively planning to have the graduate student project coordinator, Mr. Allan Hertzberger, present this work at the 2018 U of IL Agronomy Day, but don't have that confirmed yet.

Additional Notes: Thank you for your support! It's exciting to see this project wrapping up this year.

NREC January 2018 2.0 Year Report

Dissolving uncertainty: A comprehensive evaluation of dissolved P in tile drainage

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.

1. List of objectives

The specific assessable objectives are to:

1. Further develop the Measured Annual Nutrients for AGricultural Environments (MANAGE) database through addition of drainage nutrient concentration data, specifically dissolved reactive P but also including other forms of P and N.
2. Statistically analyze the newly assembled nutrient concentration database to determine the effect of controllable factors and uncontrollable factors (e.g., precipitation, soil drainage class) upon P concentrations in drainage water
3. 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: 2.0 years (of 3.0 years)

3. Accomplishments

a. More than 400 total publications were reviewed and a total of 1,564 site-years were entered into the new MANAGE Drain Concentration database (**Figure 1**). Working with project collaborator, Dr. Daren Harmel (USDA ARS), the owner of the MANAGE database, we are still planning to add this new database to the existing publically available MANAGE database by the project end (end of 2018).
b. Drainage dissolved phosphorus and nitrate concentrations compiled in the database have been analyzed against variables including crop type, location, soil type, nutrient management, and tillage factors.
c. The work has been presented in 6 poster presentations at regional, national, and international conferences.
d. Mr. Allan Hertzberger, the graduate student lead, will defend his thesis of this work at 9AM Feb. 6th, 2018 in 350C ERML on the UIUC campus.
e. Two planned peer-reviewed manuscripts are nearing submission:
    i. Hertzberger, A., R.D. Harmel, and L. Christianson. (*In prep 2018*). The MANAGE Drain Concentration database: A new tool compiling North American drainage nutrient concentrations. *To be submitted to Agricultural Water Management*.
    ii. (*Invited submission*) Hertzberger, A., R.D. Harmel, R.A. Cooke, C.M. Pittelkow, and L. Christianson. (*In prep 2018*). Analysis of the MANAGE Drain Concentration database to evaluate agricultural management effects on drainage nutrient concentrations. *To be submitted to the Journal of Soil and Water Conservation*.

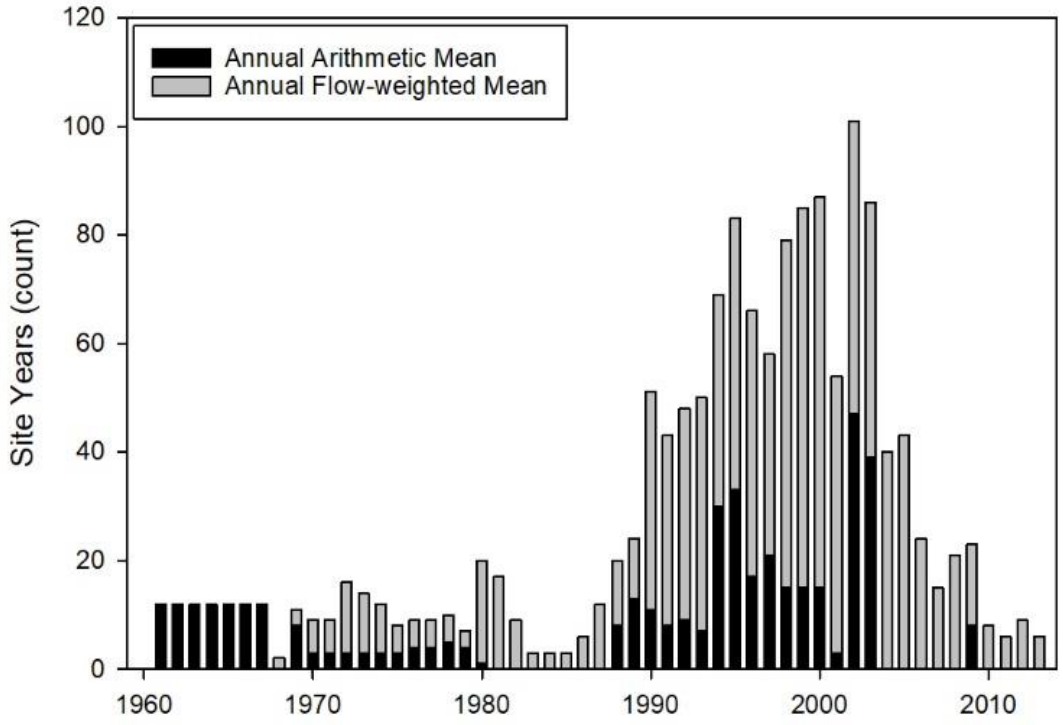

Figure 1. Histogram of MANAGE Drain Concentration database site-years by experimental year (i.e., not publication year) and mean type.

4. For first year projects, provide evidence of progress.

   Database compilation and analysis have been completed. Major outputs including a successful thesis defense, two journal manuscripts, an outreach factsheet, and a field day presentation are well on track for this final project year (**Table 1**).

Table 1. Up-to-date timeline for "*Dissolving uncertainty…*" project

	2016				2017				2018			
	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F
Recruit graduate student	✓	✓										
Objective #1: MANAGE Drain Concentration table												
Task #1: Review literature			✓	✓	✓							
Task #2: MANAGE data entry				✓	✓	✓						
Objective #2: Drainage concentration data analysis (Task #3)							✓	✓	✓			
Task #4: Writing and communicating findings												
Creation/updating of project webpage			✓	✓	✓	✓	✓	✓	✓			
Graduate student matriculation (MS thesis complete)								✓	✓			
Submission of manuscript for peer-review												
Present results at field event in Illinois												
Present results at scientific conference				✓								
Funders reports (**Objective #3**)			✓	✓			✓	✓				
Educational/Administrative activities					**Research activities**				**Communication/Outreach activities**			

How will the research benefit the environment and/or crop production, etc.? The findings based on data aggregated in the MANAGE Drain Concentration table will be able to better inform practitioners and scientists about (1) the extent of dissolved reactive P and nitrate-nitrogen in drainage, (2) controllable and uncontrollable factors impacting these nutrient concentrations, and (3) yield consequences of practices impacting its presence. For example, one important finding to date is that the highest annual flow-weighted

mean nitrate-nitrogen concentrations across the database were from corn or soybean site-years, whereas crop selection was shown not to be a significant predictor for annual average drainage dissolved phosphorus concentrations.

New questions created by this work:

We've been surprised by the large amount of arithmetic mean concentrations (as opposed to flow-weighted mean concentrations) reported in literature, especially for total phosphorus (e.g., Figure 1). This finding is an early indication of a possible recommendation calling for more standardized reporting in future field- and plot-scale drainage studies (i.e., flow-weighted values should be reported).

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

	Budgeted	Spent through 01/2018
A. Personnel		
1 UIUC MS Graduate Student	$34,603	$25,768
2 PI Dr. L. Christianson	$11,594	$10,797
B. Fringe Benefits	$7,395	$5,880
C. Travel	$1,800	$1,554
D. Equipment	$0	$0
E. Supplies	$900	$78
F. Contractual Services	$1,050	$896
G. Other	$0	$0
H. Indirect Charges	$6,370	$4,996
TOTAL COST (Year 2.0)	**$63,712**	**$49,968**
BALANCE REMAINING	***$13,743***	