



## 2017 Final Report Summary Sheet

### Grantee Information

**Project Title:** Demonstration and monitoring of nutrient-removal wetlands in the Big Bureau Creek watershed (Northern/Central Illinois)

**Institution:** The Wetlands Initiative (TWI)

**Primary Investigator:** Jill Kostel, Ph.D., TWI Senior Environmental Engineer

**NREC Project #** 2015-3-860638-62

**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:**

**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:**

TWI and partners have made the desired progress on the main project components funded by NREC, farmer outreach and water quality monitoring/research. The technical assistance component of this project, however, has progressed more slowly than anticipated over 2017; on-the-ground installations of new wetland sites were delayed into 2018. With a new tactical adjustment to our outreach efforts, we anticipate a significant increase in farmer commitments to install constructed wetlands in 2018.

**Have you reached any conclusions related to this project that you would like to highlight?**  Yes  No

**If you answered "yes" please explain:**

Water quality monitoring at constructed wetland site #1 found that 1700 kg of nitrate and almost 200 kg soluble reactive phosphorus were removed over 2017, compared with 1100 kg  $\text{NO}_3^-$ -N and 100 kg SRP removed in 2016. Total nitrate removal efficiency increased substantially, from 12% in 2016 to 35% in 2017, with periods of higher removal (up to 80%) observed during the warmest months of 2017. Sediment organic matter in CW1 appears to have increased substantially from 2016 as the wetland vegetation has developed. In 2017 UIC also began a sediment tracking experiment and genetic assays in CW1 (through separate funding) to study its nutrient transport and microbial community. The first month of monitoring at constructed wetland site #2 found nitrate removal efficiency of 64%; continued monitoring in 2018 will provide the first full year of data on this wetland's performance, to be compared with CW1.

**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:**

TWI’s new Field Outreach Specialist, Jean McGuire, carried out significant one-on-one and group outreach about the wetland practice over 2017 to farmers in the targeted watersheds, their agency advisers, and “influencers” who work with farmers professionally. In addition to the wetland site visit and presentations given during NREC’s Nutrient Management Forum in June, TWI hosted two other well-attended events in Bureau County in late 2017: a “Wetland Show & Share” with TWI’s collaborative partners as the primary audience, and a half-day seminar on farm “weather-readiness” to attract more risk-averse farmers. In 2018 we will continue this farmer outreach, seeking to increase the number of contacts above the 2017 baseline, and will hold similar events, including a field expo during the third wetland site’s construction. The research team at the University of Illinois-Chicago also presented three times on the project’s findings over 2017, including NREC’s Nutrient Management Forum and two academic conferences, and a conference paper is currently in review for the World Environmental & Water Resources Congress.

As part of TWI’s direct dissemination about the ability of constructed wetlands to reduce nutrient loss, we are building a farmer-focused website ([smartwetlands.farm](http://smartwetlands.farm)) that will answer operator and landowner’s questions about the practice (i.e., What is it?, Is it worth doing?,

**Additional Notes:** Does it work?, How do I do it? etc.) and provide information through a variety of media.

## **Project Final Progress Report to the Nutrient Research & Education Council**

**March 6, 2018**

**Project Title:** Demonstration and Monitoring of Nutrient-Removal Wetlands in the Big Bureau Creek Watershed (Northern/Central Illinois)

**Report Period Covering:** March 1, 2017, through February 9, 2018

### **Project Overview**

Beginning in 2015, the Illinois Nutrient Research and Education Council has awarded the Wetlands Initiative (TWI) a \$140,000 grant each year in support of our project to advance the use of small, precisely sited constructed wetlands to naturally capture and remove excess nutrients leaving farm fields through tile drainage. Constructed wetlands are a Farm Bill-eligible practice that is extremely underused in Illinois but offers a practical, effective solution to reduce nutrient loss. This effort focuses on providing technical assistance to farmers to install several examples of the practice on their properties; collaborating with ag-sector partners on field days and other outreach to educate farmers and their advisers about the practice; and partnering with the University of Illinois at Chicago (UIC) to perform water quality monitoring and analysis of the first few wetland sites to quantify their nutrient removal effectiveness.

2017 is the third year of the nutrient-removal wetlands project. This project was initially based in the heavily agricultural Big Bureau Creek Watershed in north-central Illinois. Over 2017, TWI outreach expanded into the Vermilion River Headwaters in Livingston County, Illinois, and we anticipate implementing and beginning to monitor nutrient removal at a third wetland site in that watershed in 2018. The long-term goal is for this highly effective practice to be replicated across Illinois as a practical solution to nutrient runoff.

### **Results to Date**

Over 2017, the Wetlands Initiative and project partners made the following progress on project objectives.

#### *1) Assist farmers in installing constructed wetlands on their properties.*

In February 2017, TWI hired a 0.8-FTE Field Outreach Specialist, Jean McGuire, to take over responsibility for one-on-one and small group outreach on this project to recruit farmers to implement the constructed wetland practice. Adding a new dedicated staff person to the project has allowed project manager Dr. Jill Kostel to focus on building partnerships, more broadly raising awareness about the practice, and providing technical assistance to farmers, including designing the wetland sites. In her first month with TWI, Jean developed a comprehensive communication plan and strategy with Dr. Kostel for recruiting new farmers to implement the wetland practice.

Since March, Jean has been actively carrying out this communication plan in the Big Bureau Creek Watershed and the Vermilion River Headwaters in north-central Illinois, the current primary geographic targets for wetland installations. Jean has met with five new landowners

interested in implementing a constructed wetland, and Jean and Dr. Kostel have continued communicating with another five previously identified farmer prospects who are moving through the “leads pipeline.” Dr. Kostel has completed preliminary wetland designs for a number of these prospects. Jean also made initial one-on-one contact with an additional 18 farmers identified through events, her participation in meetings, response to TWI ads, and through personal referrals.

Another objective in the communication plan is to make contact with and build relationships with “connectors” who are important trusted messengers about new practices and can help carry the message about constructed wetlands to landowners. Over the past year, Jean connected at field days and landowner events with 52 watershed advisers—which include partners in farm conservation efforts such as Soil Health Partnership, NRCS, and soil and water conservation staff—and another 40 “influencers” to farmers, a category that includes those who work directly with farmers professionally such as Certified Crop Advisers, seed dealers, and other business contacts.

Additional enrollments in the constructed wetland practice leading to on-the-ground installations did not advance as quickly as TWI anticipated over 2017. Consequently, we have made a tactical adjustment to our outreach efforts, shifting some of our focus to educating farmers’ advisers and embedding the wetland practice more deeply in farmers’ trusted networks. Together with this shift, we anticipate that the groundwork laid over the past year in farmer outreach, relationship-building, site investigations, and wetland designs will lead to a significant increase in wetland installations in 2018. We expect the next constructed wetland to be installed on a leading farm family’s land by summer 2018 in Livingston County, which would be the first implementation of this practice in the Vermilion River Headwaters. Meanwhile, Dr. Kostel is finalizing the design for a constructed wetland at Illinois Central College’s Demonstration Farm. Expected installation is spring/summer 2018.

2) Promote replication of the wetland practice by peer landowners via field demonstration days and other outreach.

With the added staff capacity, TWI has been able to participate in or organize more field days and other outreach events over 2017 to educate farmers/landowners on constructed wetlands as a nutrient-removal solution. A list of presentations given by Dr. Kostel is attached, along with a list of partner meetings and farmer outreach events in which TWI staff participated in 2017. Key events included:

- In June TWI presented on constructed wetlands at a Nutrient Management Forum hosted by NREC in Princeton, Illinois. NREC also featured TWI’s second Bureau County wetland site during the event with an onsite project tour. A large group of farmers/landowners, agency employees, and ag retail representatives viewed the wetland first-hand and heard about the practice and the water quality monitoring effort from Dr. Kostel and project partner Dr. Karl Rockne of the University of Illinois-Chicago.
- On November 20, Jean and Dr. Kostel hosted a “Wetland Show & Share” field event/discussion in Bureau County with a visit to the same Wetland #2 site. TWI’s collaborative partners were the primary audience. The goal of this event was to educate

farmers' trusted advisers on constructed wetlands and farmer communication strategies so they can better encourage adoption of the wetland practice.

- Dr. Kostel presented on constructed wetlands at the Certified Crop Advisers/Ag Masters conference on December 7 in Springfield. Building relationships with these “trusted messengers” who work with farmers professionally will continue to be a key project focus.
- On December 12, TWI held a half-day seminar in Princeton on “Making Your Illinois Farm Weather-Ready” with the Illinois State Climatologist as a featured speaker. The strategy for this event was to attract more risk-averse farmers as “middle adopters” of constructed wetlands by tying the wetland practice’s resilience to risk management. A news article from the *Bureau County Republican* on this event is attached.

Written surveys show that the majority of participants thought their knowledge increased about the constructed wetland practice, and many were interested in considering the practice for their own property. In response to a written audience survey at the Nutrient Management Forum, attendees who said they were “very aware” of the constructed wetland practice increased from 24% before Dr. Kostel’s presentation to 67% after it. Importantly, 20% of attendees said they were “very likely” to implement or recommend a constructed wetland in the next one to two years. At the farm weather-readiness seminar hosted by TWI, 90% of attendees reported the event increased their knowledge/awareness of edge-of-field practices for tile drainage treatment. Additionally, 85% of those participants said they would consider learning more about or trying edge-of-field tile treatment practices.

Over 2017, TWI also has established strong collaborative relationships with agency staff and representatives of ag-sector groups in Livingston County, which covers most of the Vermilion River Headwaters watershed. TWI selected this watershed as our second geographic target in Illinois as it is a priority watershed that already has active soil and water conservation district staff and a strong network of ag-sector entities working on conservation. This has allowed TWI to access farmer networks more quickly and effectively without “starting from scratch.”

TWI has established a working relationship with American Farmland Trust (AFT) as part of their Vermilion River Headwaters Partnership project, which seeks to improve water quality, reduce sediment and nutrient loads, and improve wildlife habitat benefits in Livingston County. We have also built strong relationships with Livingston County Soil and Water Conservation District staff, who have attended TWI events and are discussing tactics for farmer outreach in that watershed with us. Together with this outreach, we anticipate that having a wetland on-the-ground in Livingston County on a leading farmer’s property in early 2018 will greatly increase interest in this second watershed.

Additionally, TWI is initiating a partnership with the Marshall-Putnam Soil and Water Conservation District, which was recently approved for Regional Conservation Partnership Program (RCPP) funding. We were invited to be a partner on this effort given our expertise in constructed wetlands and TWI’s collaboration with other tile-treatment practice experts. In support of the RCPP, TWI has committed to provide in-kind technical assistance and outreach services, cost-share incentives, and support for outreach events related to constructed wetlands in those counties.

3) With project partner Dr. Karl Rockne of the University of Illinois at Chicago (UIC), conduct water quality monitoring to elucidate the exact processes of nutrient removal.

There were no changes in the methodology for the water quality monitoring over 2017, though UIC was able to add new research components through separate funding (see “Constructed wetland monitoring conclusions”). Results described below cover the first and second year of full operations at the first constructed wetland (CW1) installed in 2015. The second constructed wetland (CW2) was seeded with a wetland emergent mix over winter 2016-17 and then planted with native plugs (seedlings) in key locations. CW2 started receiving tile flow in late June 2017; daily monitoring with autosamplers at the inlet and outlet began in September once the plant community and permanent (normal) wetland water level were established. Continued monitoring of CW2 in 2018 will produce the first full year of data on its nutrient removal and other characteristics; its performance can then be compared with CW1 as both sites develop.

**Water quality monitoring results from CW1**

**Aqueous physical and chemical parameters**

In 2017, the University of Illinois-Chicago research team continued to investigate the spatial variability in water quality parameters in the first constructed wetland site through a sampling program that included the wetland inlet, a transect of nine sites throughout the wetland (termed “wetland cell” in Table 1), the wetland outlet, and additional samples from both upstream and downstream of the outlet in the receiving stream, West Bureau Creek (Creek). A summary of the physical and chemical water quality results for 2016 and 2017 is provided in Table 1.

**Table 1.** Summary of spatial variability in non-nutrient water quality data in CW1, 2016 through 2017.

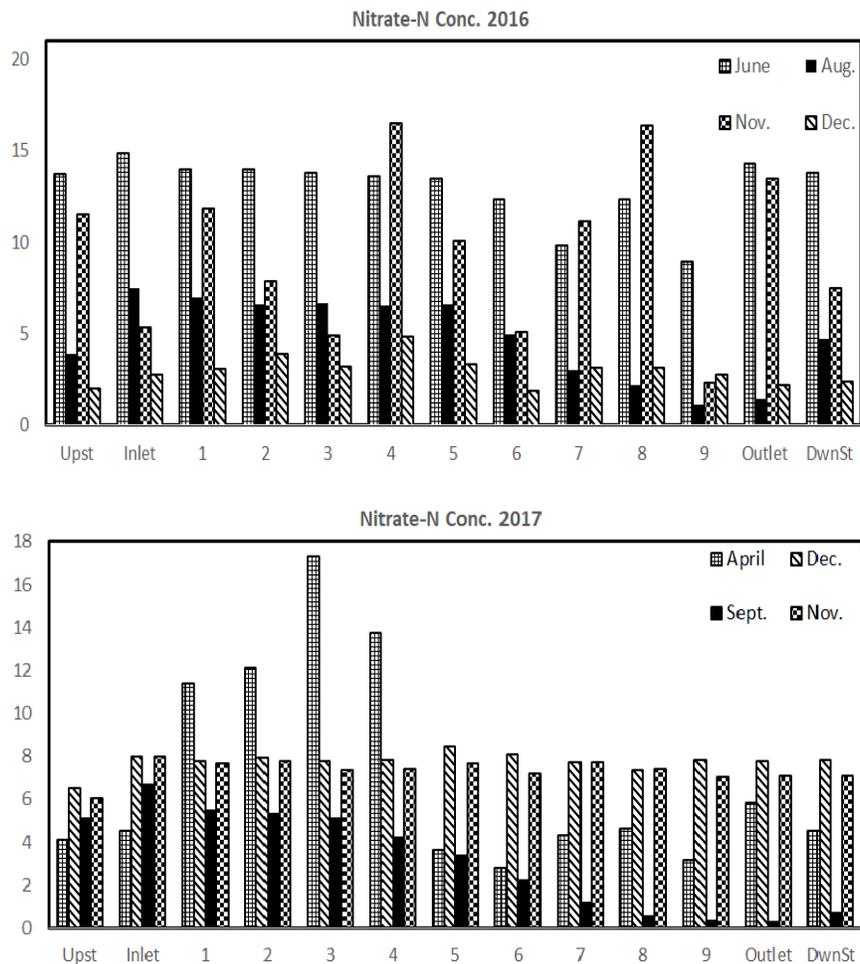
Parameter	pH	Temperature (°C)	ORP (Rmv)	DO (mg/L)
Inlet 2016	7.05 ± 0.17	13.7 ± 3.53	138 ± 32.0	10.6 ± 3.55
Inlet 2017	6.89 ± 0.31	13.1 ± 3.59	167 ± 56.8	11.7 ± 3.50
Outlet 2016	7.12 ± 0.13	13.8 ± 5.88	29.1 ± 14.2	9.59 ± 5.84
Outlet 2017	7.40 ± 0.43	18.3 ± 6.26	147 ± 78.1	12.3 ± 4.45
Wetland Cell 2016	7.09 ± 0.21	14.1 ± 4.57	99.4 ± 92.6	9.70 ± 4.77
Wetland Cell 2017	7.11 ± 0.51	15.3 ± 5.49	157 ± 146	13.0 ± 3.71
Creek Upstream 2016	7.40 ± 0.29	13.9 ± 6.30	111 ± 21.9	10.2 ± 4.48
Creek Upstream 2017	7.01 ± 1.10	14.6 ± 5.44	229 ± 208	10.9 ± 4.36
Creek Downstream 2016	7.19 ± 0.23	13.3 ± 4.95	175 ± 33.3	11.4 ± 4.77
Creek Downstream 2017	7.55 ± 0.36	15.8 ± 6.06	222 ± 215	12.0 ± 3.29

Results of non-nutrient physical and chemical water quality data from 2017 are largely in agreement with those in 2016, and the results demonstrate that the upstream water in the receiving stream had a higher oxidation reduction potential (ORP) with lower pH compared to the wetland effluent (though not statistically significantly). This resulted in a lower level of ORP downstream, following mixing with the wetland effluent (Table 1).

The other parameters also show differences within the wetland itself and the impacts of mixing of the wetland effluent with the upstream Creek water. These results are consistent

with our expectations based on the operation of the wetland. Tile influent enters the wetland at a lower temperature and pH. Rapid photosynthesis in the wetlands consumes alkalinity (thus raising the pH), while at the same time increasing dissolved oxygen (DO) at the outlet. Mixing of the wetland outlet with the Creek water generally results in water quality parameters intermediate between the two values. ORP levels were frequently low in the wetland cell as high amounts of organic matter in the sediment from the growth of plants and algae likely created a sediment oxygen demand.

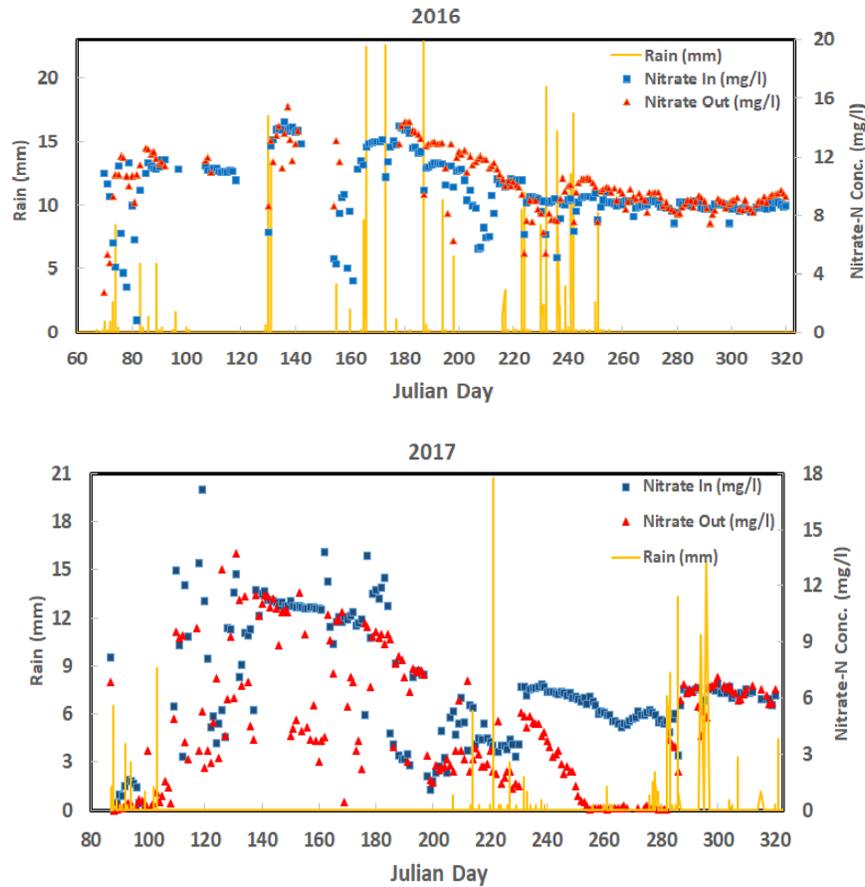
Spatial monitoring within the wetland shows substantial variation in nutrient levels. Figure 1 shows the nitrate ( $\text{NO}_3^-$ -N) concentration at nine locations within the wetland, inlet, outlet, and in the creek upstream and downstream of the wetland outlet for different months in 2016 and 2017. In August and September of both years, there was a substantial trend of decreasing  $\text{NO}_3^-$  concentrations throughout the wetland. This trend is more prominent during the summer as the nutrient removal efficiency rises.



**Figure 1.** Nitrate-N spatial concentration (mg/L) within the wetland and receiving stream during 2016 (top) and 2017 (bottom) sampling periods.

Nitrate concentrations changed significantly over the two years of operation (Figure ). The dissolved inorganic nitrogen: soluble reactive phosphorus (DIN/SRP) ratio also varied

significantly, but was typically >65. Such high DIN/SRP ratios indicate that N has a significantly greater potential for release and export via drain tiles than P. Corn was the primary crop in the tile drainage area in 2016, whereas soybeans were the primary crop in 2017. The switch to soybeans occurred at the same time as lower influent nitrate concentrations in 2017, consistent with the lower levels of fertilization required for this N-fixing crop. Nitrate levels averaged 11.7 mg/l in CW1 during 2016 with concentrations frequently >16 mg/L during the late spring and summer. Precipitation data show that 2017 was a drier year in comparison to the 2016. Large precipitation events clearly resulted in highly variable nutrient levels in the system (Figure ) as well as decreased removal and lags of several days until nitrate removal recommences.



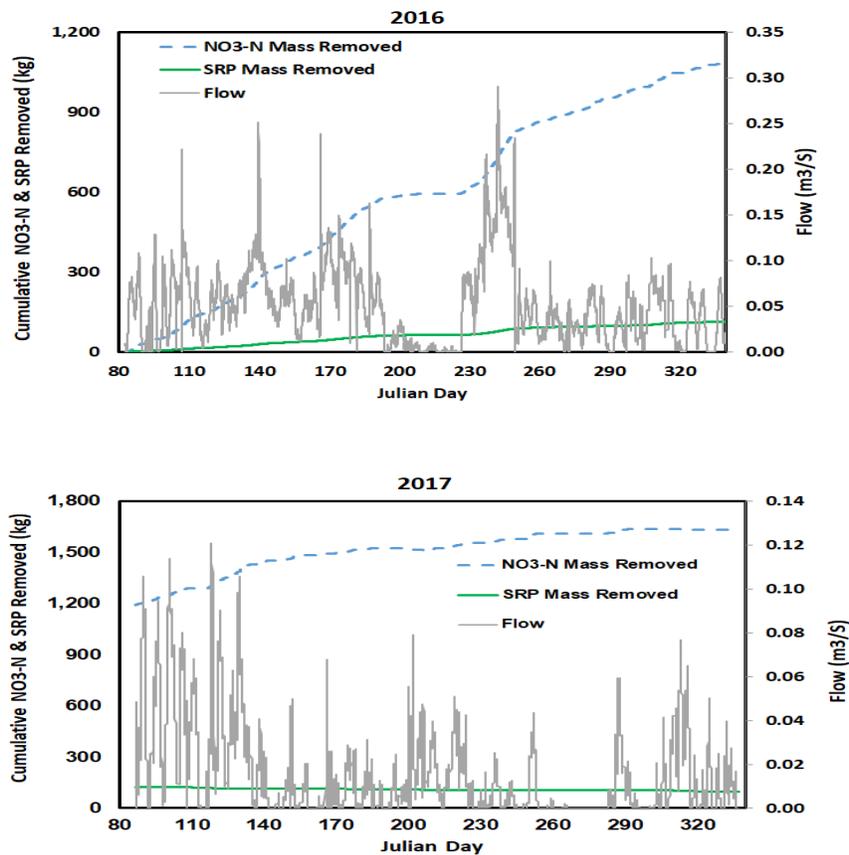
**Figure 2.** The inlet and outlet nitrate-N concentrations (mg/L) and precipitation (mm) in CW1 during 2016 (top) and 2017 (bottom) sampling periods.

### Wetland hydraulics and nutrient mass removal rates

During much of 2016 and early 2017,  $\text{NO}_3^-$  removal was not high in constructed wetland site #1. Outlet  $\text{NO}_3^-$  concentrations decreased substantially from August to September 2017 during a period of lower precipitation. These maximal denitrification rates occurred at times of lower flow, circumneutral pH (Vymazal 2007), and increasing temperatures, which are consistent with other studies that show a correlation between denitrification and these conditions (Poe et al. 2003). Wetland water levels were much shallower in these months, suggesting that lower levels may play a role in denitrification as well (García et al. 2005). Shallower water depths may likely result in greater mass transfer of  $\text{NO}_3^-$  to the sediment (Phipps and Crumpton 1994).

Wetland flow in CW1 varied considerably during the period of study (Figure 3) with average calculated flows of 0.05 m<sup>3</sup>/s in 2016 and 0.02 m<sup>3</sup>/s in 2017. Bromide tracer studies were performed in April 2016 and 2017. These studies found hydraulic retention times (HRT) of 17.5 hr and flow rate of 0.011 m<sup>3</sup>/s in 2016, and an HRT of 8.5 hr and flowrate of 0.023 m<sup>3</sup>/s in 2017. These hydraulic retention times were shorter than our expectations, a result we attribute to flow short-circuiting before wetland plants had sufficiently established in the first year. Plant establishment also necessitated manipulation of water depths, which caused large variations in flow as shown in Figure 3. These flowrates were coupled with inlet and outlet nutrient data to determine the substantial cumulative removal of NO<sub>3</sub><sup>-</sup> and soluble reactive phosphorus (SRP) during the study period.

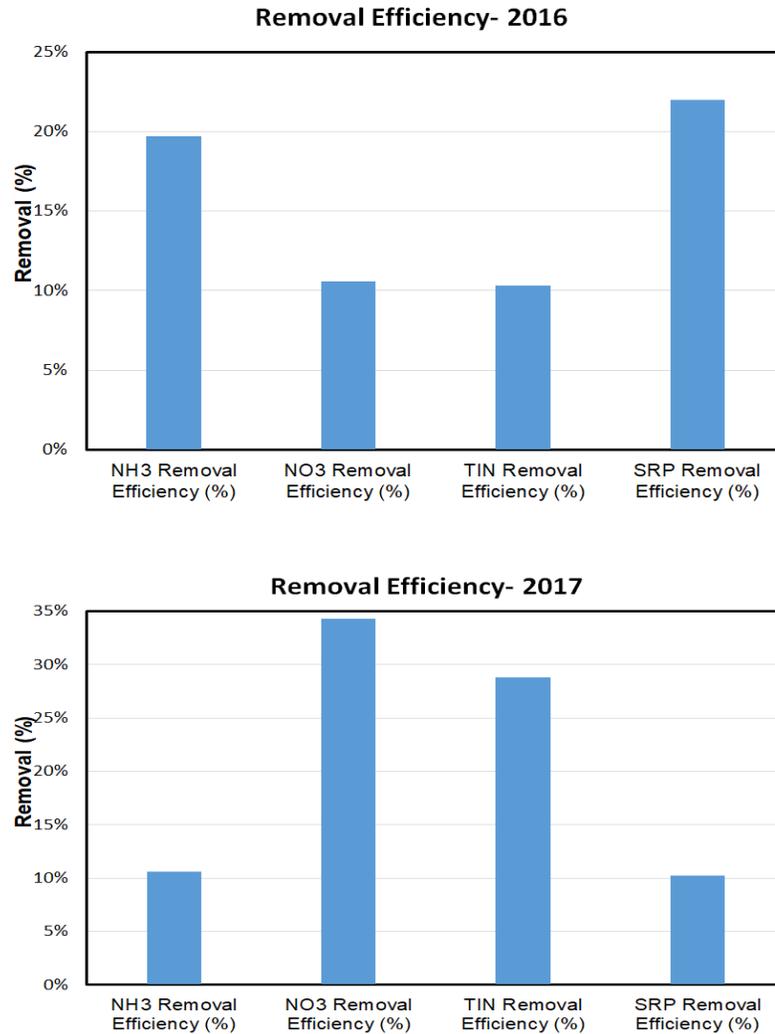
In 2016, 1100 kg NO<sub>3</sub><sup>-</sup>-N and 100 kg of SRP were removed. Removal increased in 2017 to 1700 kg N and almost 200 kg SRP. Less precipitation occurred in 2017, and it is not clear if removal was impacted by the lower flows and resultant hydraulic retention times. Alternatively, NO<sub>3</sub><sup>-</sup> removal may have been impacted by the lower influent NO<sub>3</sub><sup>-</sup> concentrations or possibly increased denitrification due to the buildup of organic matter in the sediment from the previous year's plant growth.



**Figure 3.** Nitrate-N and SRP cumulative mass removal (kg) and flow data (m<sup>3</sup>/s) in the wetland during 2016(top) and 2017(bottom) sampling periods.

Total NO<sub>3</sub><sup>-</sup> removal efficiency increased substantially from 2016 to 2017 from 12% to 35% (Figure ). Periods of higher removal (70-80%) were observed during the warmest period of 2017.

Interestingly, NH<sub>3</sub>-N and SRP removal decreased from 2016 to 2017. The latter result is consistent with the idea that SRP removal is primarily from plant uptake and increasing SRP removal may not continue once the system becomes “saturated” with wetland plants.



**Figure 4.** Nutrient removal efficiency for 2016 (top) and 2017 (bottom) sampling periods.

### Sediment characterization

In the Fall 2016 interim report, we described sediment core sampling from the wetland sediments. These samples were analyzed for organic matter to determine the extent to which wetland plant growth contributes to increasing organic matter, which then serve as potential electron donors to stimulate denitrification. The overall average of organic matter was 3.79 ± 0.45% in surface sediments for 2016. Further analysis of these samples by differential scanning calorimetry indicated that this organic matter contained high amounts of refractory organic matter, meaning it was not highly labile to biodegradation.

Our preliminary data indicate that wetland sediment organic matter has increased substantially in 2017. These measurements are ongoing and will include an analysis of labile

components for comparison to the 2016 data. These results would be consistent with the higher amounts of nitrate removal we have observed in 2017.

Magnetic/fluorescent sediment tracer particles were placed in both constructed wetlands in Fall 2017. These tracers include both high- and low-density with two particle sizes to track the transport of low-density particles which are rich in organic matter and high-density mineral particles. Sizes covered are silt and sand-sized. We employed a grid of rare-earth magnets in both wetlands to capture particles at the sample points over time. These were sampled at the end of the 2017 study period. In addition, sediment grabs will be obtained in 2018 and processed for recovery of the tracer particles. This will allow us to compare transport in both an Eulerian and Lagrangian framework.

### ***Water quality monitoring of constructed wetland #2***

The second constructed wetland (CW2) started receiving water flow in June 2017 after the wetland plant community became established from natural regeneration and seeding. The inlet and outlet auto-samplers were placed in the field and began taking daily samples starting in September 2017 once the normal wetland pool water level was established. Wetland water and sediment samples have been taken at various locations within the wetland to provide an initial dataset prior to commencement of operations to provide a baseline for comparison.

We have put into place several of our lessons learned from the first constructed wetland. These include establishment of plants prior to full hydraulic operations and more precise and accurate measurement of water flow in the system. Initial results suggest that this second constructed wetland has substantial nutrient removal. During the period from September to October 2017, the nitrate removal efficiency was 64%.

### ***Constructed wetland monitoring conclusions***

Constructed wetlands typically require at least five years of operation for the wetland plant community to become fully mature and for the adaptation of microbial populations. The wetland plants at constructed wetland #1 rapidly grew in the first summer and created a high-value wetland habitat for wildlife. Nutrient removal efficiency was variable during the wetland establishment period over the first year of operation, but substantial N and P removal occurred. Improvements in nutrient removal efficiency were observed in 2017 after a complete year of plant growth, die-back, and subsequent incorporation of organic matter into the wetland sediment.

It is likely that denitrifying bacteria need time to grow and adapt to the wetland conditions with abundant  $\text{NO}_3^-$  levels. More specific information on the denitrifying microbial community structure would improve our understanding of the biological limitations on the denitrification process, if any. This information includes gene assays that quantitatively track the concentrations of denitrifying genes in the sediment using molecular biological techniques.

While microbial research was outside the scope of this project, the UIC team was able to leverage the NREC-funded project for a coordinated molecular biological study of the

microbial community structure in the wetland sediments. This effort is being done by UIC PhD student Mahsa Izadmehr under a fellowship funded by the Illinois Water Resources Center. Currently DNA has been extracted from 250 sediment samples and amplified using quantitative polymerase chain reaction (qPCR). These will be sequenced using Illumina sequencing technology to obtain information on how the denitrifying bacteria community changes over time, at depth in the sediment, and spatially throughout the wetlands for comparison to the wetland performance. The scope of this effort when completed will possibly be one of the most comprehensive studies of the denitrifying community in a constructed wetland.

### ***Publications and outreach***

To disseminate the research findings to date, the UIC research team has given five presentations over the period of the study (listed below). A paper is also currently in review for publication by M. Izadmehr et al. in the proceedings of the World Environmental & Water Resources Congress 2018, EWRI- ASCE, June 2018.

- Presentation and outreach to farmers at NREC Nutrient Management Forum meeting on June 27th, 2017 in Princeton, IL by Prof. Rockne and Dr. Kostel
- Presentation to the Society of American Military Engineers (SAME) in February 2017 by Prof. Rockne
- Presentation at the StormCon 2016 conference in August 2016 in Indianapolis, IN by D. Buckley and M. Izadmehr, with the resulting manuscript published in the October 2016 issue of *Stormwater* magazine (Buckley et al. 2016).
- Presentation at the Illinois Water Conference in October, 2016 by M. Izadmehr
- Presentation at the Battelle Contaminated Sediments conference in New Orleans, LA, January 15, 2017 by M. Izadmehr

### **Next Steps in 2018**

Over 2018, project partner UIC will continue to monitor nutrient removal achieved at CW1 to determine whether the increased nutrient removal will be sustained. They will also continue monitoring CW2 to finish gathering the first year of data on the new site's performance. This data will be compared with results from CW1 to analyze differences in their performance and assess the effect of improvements made to the design. Depending on the timing for implementation of the third wetland site in Livingston County, water quality monitoring could begin at the new site by late summer.

Meanwhile, TWI will finalize the designs for and install constructed wetlands on the new Livingston County farmer's property and on the Illinois Central College (ICC) demonstration farm. Working closely with Dr. Kostel, Jean will carry out the strategies identified in the project communication plan to recruit additional farmers to implement wetlands in both the Big Bureau Creek and Vermilion watersheds. Over the coming year, we will work to steadily increase the number of contacts reached in the farmer, watershed adviser, and "influencer" categories above their 2017 baseline. TWI will continue to build awareness by organizing field expos in each of the watersheds to show wetlands being built, hosting other educational seminars, and having a presence at agriculture-related events such as the Farm Progress Show.

As mentioned above, TWI staff have made an important tactical adjustment to the project that is already being carried out. We are shifting some of our focus in 2018 to embedding ourselves and the wetland practice more fully into the networks farmers rely on to gather information and make farm management decisions. This tactical adjustment has informed our specific plans for 2018 such as building a constructed wetland at the ICC demonstration farm, which will allow us access to training classes and a wide variety of student and professional audiences; targeted outreach events to educate farmers' advisers on the practice and communication strategies; and creating a comprehensive farmer web portal with information on constructed wetlands through a variety of media. The website will provide fact sheets, the latest UIC water quality monitoring data, sample wetland designs, and photos and video of constructed wetlands. It is currently being built out and can be viewed at <https://www.smartwetlands.farm/>.

Over 2018, TWI will continue to build partnerships with influential ag-sector groups who can help spread the word about constructed wetlands. For example, through our partnership with the Illinois Corn Growers Association on this project, TWI was invited to join the new Illinois Sustainable Ag Partnership (ISAP), and is now a member of its Steering and Science Advisory committees. ISAP focuses on messaging, training, and education for farmers and their trusted advisers around on-farm conservation issues. An ISAP website will provide information and contacts from all members to support farmer use of conservation practices ([ilsustainableag.org](http://ilsustainableag.org)).

TWI staff also have had multiple meetings with American Farmland Trust and Illinois Soybean Association to discuss our project, and we anticipate one of these groups to become a full project partner in 2018 to assist with outreach and education.

Finally, under the new RCPP recently awarded to Marshall-Putnam Soil and Water Conservation District, TWI will partner on field days, farmer outreach, and technical assistance for the constructed wetland practice in those counties beginning in 2018 and over the next several years. This spring TWI will model possible locations for edge-of-field tile treatment practices (including constructed wetlands) in Marshall and Putnam counties, and we are developing outreach/event plans with local agency contacts. These collaborations are crucial to building the broader support for constructed wetlands that will ultimately bring this practice to scale in the targeted watersheds and across Illinois.

### **Potential Impact of Project**

Constructed treatment wetlands can offer a practical edge-of-field solution to the challenge of reducing nutrient losses from tile drainage, without taking a large amount of farmland out of production. Converting marginal land along streams or drainage ways to a wetland can actually boost a farm's profitability by eliminating costly inputs into revenue-negative land. Our communications about the wetland practice focus on how constructed wetlands can not only be an effective tool for reducing nutrient loss, but also economically feasible as part of a productive farming operation.

Over the coming year, all our objectives are anticipated to lead to broadly increased farm-sector knowledge about and interest in the constructed wetland practice and use of these wetlands spreading to at least two distinct watersheds in Illinois. Success in driving

implementation of nutrient-removal wetlands could be replicated to produce cleaner water in similar watersheds throughout Illinois and the Upper Midwest. Our research on the nutrient removal effectiveness of constructed wetlands will build the knowledge base of their exact nutrient removal processes and can be used to optimize this practice to achieve the greatest on-farm nutrient loss reduction.

### **Budget Update and Analysis**

In addition to the continued NREC grant, major funding for the project this year is provided by a two-year award from The McKnight Foundation's Mississippi River program; a two-year grant from the Walton Family Foundation Mississippi River program; and a continued commitment from the Illinois Corn Growers Association. In late 2016, TWI was also awarded a new two-year, \$120,000 grant from the National Fish and Wildlife Foundation's Conservation Partners program, primarily to cover the technical assistance that project manager Dr. Jill Kostel is providing to farmers. Together with smaller grants, these income sources provided all Year 3 funding needed for the project.

Attached is a table that compares the 2017 project budget with actual project expenditures (starting March 1, 2017, to avoid overlap with the 2016 grant period and expense reporting). There have been no significant changes to the project budget. However, total expenditures for supplies (mainly seed), the engineering contractor, and farmer cost-share were lower than anticipated because the timeline for implementing additional wetland sites was pushed back to 2018. These costs are reflected in the 2018 project budget, and we expect farmer commitments for constructed wetland installation to accelerate in the coming year. The higher actual cost for the UIC contractor line reflects the increased expenses for monitoring two wetland sites, as well as 25% of the cost for the purchase of a nutrient analyzer that will allow the needed chemical analyses to be performed more efficiently over time.



## **List of Report Attachments**

List of References Cited in Report Narrative

2017 Project Budget vs. Project Actual Expenditures

2017 Presentations by Dr. Kostel on Constructed Wetlands/TWI's Project

2017 TWI Staff Participation in Partner Meetings and Farmer Outreach Events

*Bureau County Republican* Article on Farm Weather-Readiness Event



### **List of References Cited in Report Narrative**

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- Poe AC, Piehler MF, Thompson SP, Paerl HW. 2003. Denitrification in a constructed wetland receiving agricultural runoff. *Wetlands* **23**:817-26
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**2017 Project Budget vs. Project Actual Expenditures (as of 2/7/2018)**

<b>Expense Categories</b>	<b>Y3 Budgeted Amounts</b>	<b>Y3 Actual Expenses</b>
<b><u>A. Personnel</u></b>		
1. Project manager (Dr. Jill Kostel)	\$69,317	\$48,125
2. GIS analyst (Jim Monchak)	\$25,623	\$11,259
3. Field outreach specialist (Jean McGuire)	\$31,000	\$28,417
4. Landowner liaison (Rick Seibert)	\$4,500	\$1,440
<b>Subtotal</b>	<b>\$130,440</b>	<b>\$89,240</b>
<b><u>B. Fringe Benefits</u></b>		
1. Fringe Benefits at 25%	\$32,610	\$22,310
<b>Subtotal</b>	<b>\$32,610</b>	<b>\$22,310</b>
<b><u>C. Travel</u></b>		
1. Dr. Kostel travel	\$2,500	\$2,633
2. Ms. McGuire travel	\$3,000	\$1,862
<b>Subtotal</b>	<b>\$5,500</b>	<b>\$4,495</b>
<b><u>D. Supplies</u></b>		
1. Equipment for monitoring & land surveying	\$3,500	\$1,151
2. Field day costs (tent rental, T-shirts, lunch)	\$4,000	\$1,245
3. Newspaper advertising for field days	\$2,500	\$1,113
4. Presentations/conferences	\$2,000	\$1,196
5. Roadside signs for wetland sites	\$5,000	\$6,017
6. Seed of milkweed and pollinator plants	\$10,000	\$1,257
7. Permits for wetland installation	\$1,500	\$0
8. Miscellaneous (postage, phone calls)	\$100	\$647
<b>Subtotal</b>	<b>\$28,600</b>	<b>\$12,626</b>
<b><u>E. Contractual Services</u></b>		
1. CBBEL (review of wetland design sets)	\$20,000	\$0
2. UIC water quality monitoring/analysis	\$47,363	\$62,456
<b>Subtotal</b>	<b>\$67,363</b>	<b>\$62,456</b>
<b><u>F. Other</u></b>		
1. Farmer cost-share for wetland construction	\$42,500	\$1,341
<b>Subtotal</b>	<b>\$42,500</b>	<b>\$1,341</b>
<b><u>DIRECT COSTS</u></b>	<b>\$307,013</b>	<b>\$192,469</b>
<b>G. Indirect Charges</b> (29.02% of salaries)	<b>\$37,854</b>	<b>\$25,898</b>
<b>H. TOTAL COST</b>	<b>\$344,867</b>	<b>\$218,366</b>

### 2017 Presentations by Dr. Kostel on Constructed Wetlands/TWI's Project

Date	Event	Audience	Estimated Attendees
1/13/2017	2017 Illinois Land Improvement Contractors Association (ILICA) Annual Meeting	ILICA contractors	30-40
3/10/2017	Presentation on nutrient credit trading	DuPage River Salt Creek Workgroup members	15
4/5/2017	Vermilion Rivers Headwaters Partnership (Ag Conservation Planning Framework)	Partnership members	12
5/27/2017	NREC Northern Illinois Strategy Meeting	Landowners, producers, NREC partners	30
11/1/2017	Leadership for Midwestern Watersheds	Agency, NGOs, TSPs	50
11/20/2017	TWI's "Wetland Show & Share" event	Agency, NGO partners	10
12/7/2017	Ag Masters/Certified Crop Advisers annual meeting	CCAs, TSPs, landowners	40
12/12/2017	TWI's "Making Your Farm Weather-Ready" event	Agency, landowners/producers	20

### 2017 TWI Staff Participation in Partner Meetings and Farmer Outreach Events

Date	Event	TWI Staff*
1/6/2017	Natural Lands Institute Workshop (Rockford, IL)	JK
1/21/2017	Vermilion River Headwaters Farmer Committee mtg	JK
2/2/2017	IL-Walton NLRS group mtg (Champaign, IL)	JK
3/15/2017	State Technical Committee mtg (Champaign, IL)	JK
3/30/2017	Alphabet Soup mtg (Decatur, IL)	JK/JM
4/5/2017	Vermilion River Headwaters Partners meeting (Pontiac, IL)	JK/JM
5/11/2017	ICC/ISAP partner meeting (East Peoria, IL)	JK
5/27/2017	NREC Northern Illinois Strategy meeting (Princeton, IL)	JK
6/13/2017	ICC and Environmental Defense Fund mtg (East Peoria, IL)	JK
6/19/2017	Alphabet Soup mtg (Springfield, IL)	JK/JM
6/27/2017	Learning Circle for Women Landowners (Saunemin, IL)	JM
6/28/2017	Illinois Soybean Association Open House event (Chicago, IL)	JK/PB
7/6/2017	TNC-Environmental Defense Fund meeting (Normal, IL)	JK/JM
7/11/2017	Livingston County SWCD Farm Tour	JM
7/12/2017	State Technical Committee mtg (Champaign, IL)	JK
7/20/2017	Illinois Soybean Association mtg (Chicago, IL)	JK/PB
8/7/2017	Livingston County Cover Crop Field Day (Livingston, IL)	JM
8/16/2017	Illinois Soybean Association "Soy in the City" (Chicago, IL)	JK/PB
8/18/2017	Illinois Corn Growers Association (Bloomington, IL)	JK/PB
8/22/2017	Nutrient Stewardship of Northern IL Field Day (Bureau Co)	JM
8/23/2017	ISAP Steering Committee mtg (East Peoria, IL)	JK
8/31/2017	Farm Progress Show (Decatur, IL)	JM
9/15/2017	Vermilion River Headwaters Advisory mtg	JK/JM
9/22/2017	Alphabet Soup meeting (Alton, IL)	JK
9/22/2017	The Watershed Game Training Workshop	JM
10/16-19/2017	Mississippi River Network Annual mtg	JK
10/25/2017	IL-Walton NLRS group mtg (Champaign, IL)	JK
11/1-2/2017	Leadership for Midwestern Watersheds workshop (Moline, IL)	JK/JM
11/13-14/2017	Changing the Narrative training with AFT (MN)	JM
11/15/2017	State Technical Committee mtg (Champaign, IL)	JK
11/28-29/2017	IL Nutrient Loss Reduction Strategy Workshop (Springfield, IL)	JK
12/8/2017	Illinois Soybean Association Partnership call	JK/PB
12/14/2017	Changing the Narrative with AFT (Livingston Co)	JM
12/19/2017	Advanced Soil Health Training 2018 mtg (Champaign, IL)	JK
12/20/2017	TNC/ILICA Edge-of-Field Practices mtg with NRCS (Champaign, IL)	JK

\* JK = Dr. Jill Kostel; JM = Field Outreach Specialist Jean McGuire; PB = Executive Director Paul Botts