

Accelerating Implementation of Constructed Wetlands on Tile-Drained Agricultural Lands in Illinois, United States

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Development and implementation of conservation practices that effectively reduce nutrient loss from tile-drained agricultural lands have never been

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more critical in our efforts to provide healthy drinking water to growing populations and to protect increasingly threatened freshwater and marine ecosystems (Ward et al. 2005; Rabotyagov et al. 2014; Pennino et al. 2017). Small edge-of-field wetlands are highly effective at reducing nitrogen and phosphorus export from tile-drained agricultural fields (Kovacic et al. 2000, 2006; Kynkäänniemi et al. 2013; Groh et al. 2015), providing long-term, low-maintenance solutions to excess nutrient loss as well as wildlife habitat benefits. Despite their proven effectiveness, constructed wetlands are difficult to implement on private lands given that they provide downstream water quality improvements rather than direct on-farm economic and conservation benefits to agricultural landowners.

Increased adoption of effective nutrient reduction practices is especially critical in Illinois, which has the highest estimated total subsurface drainage area of any state in the Mississippi River Basin (Goolsby et al. 1999; Sugg 2007) and is among one of the highest contributors of total nitrogen (16.8%) and phosphorus (12.9%) flux to the Gulf of Mexico (Alexander et al. 2008). Illinois's goals of 15% reduction in nitrate-nitrogen loading to surface waters by 2025, and ultimately 45% reduction (IL NLRS 2015), will require a dramatic increase in the pace at which edge-of-field practices that effectively treat tile drainage are implemented (David et al. 2015).

Since 2006, The Nature Conservancy (i.e., the Conservancy) has worked with partners to construct more than 20 wetlands on private agricultural lands in central Illinois, 16 of which are designed specifically to intercept and treat tile drainage. Most recently, private and federal US Department of Agriculture Natural Resources Conservation Service (USDA NRCS) Conservation Innovation Grant funding (CIG) supported design, construction, and monitoring of 10 wetlands over five years (Lemke et al. 2017), 9 of which were the first in Illinois to be enrolled within the Conservation Reserve Program's (CRP) Farmable Wetlands Program (CP39; figure 1). We summarize our experiences navigating financial and programmatic challenges associated with constructing wetlands on agricultural lands and propose strategies to accelerate implementation of this practice.

■ Implementation Challenges

Financial and Resource Capacity. The CRP program is designed such that landowners pay all upfront practice construction costs and receive reimbursements upon completion and certification of the project. These engineered wetlands are expensive to construct, and upfront costs ranging in the tens of thousands of dollars can be a major deterrent for many landowners, especially as reimbursements can take three to six months. Excavation was the primary

Figure 1

One of nine tile-treatment wetlands constructed in the upper Mackinaw River watershed, Illinois, that were enrolled in the Conservation Reserve Program's Farmable Wetlands Program (CP39). These edge-of-field wetlands were designed for maximum water retention and for water quality monitoring at the tile inlet (lower right corner) and outlet (upper left corner).



expense and often exceeded estimated wetland construction costs by 60% to 200% due to factors such as requirements to move excavated soils off-site for wetlands constructed in the 100-year floodplain and unforeseen gravel lenses (Lemke et al. 2017).

Enrollment in new practices can be complicated and time-consuming, and participation in the process can be impractical for some landowners. Partnering with local soil and water conservation districts (SWCD) and NRCS offices was key to working through this process of outreach, site visits, enrollment, wetland design, construction, and final reimbursement. However, this iterative process assumed a tremendous commitment from agency staff that already had many demands on their time. Wetland engineering design and/or approval by NRCS can be an especially time-consuming requirement that in some cases impeded a timely enrollment process.

Siting. Central Illinois sustains highly productive agricultural lands and is a leading producer of corn and soybeans in the country. Thus, wetlands are far more practical to site on cropland that has already been removed from production (e.g., CRP filter strips). Retrofitting existing filter strips with CP39 wetlands also increases water quality benefits by treating surface and

subsurface runoff to create a fully functional edge-of-field conservation practice. Additionally, some landowners were more willing to site wetlands within flood-prone farmlands (e.g., historical floodplain habitat). Because no policy existed to retrofit CRP filter strips with wetlands and Illinois NRCS wetland guidance prohibited constructing wetlands in the 100-year floodplain, we addressed these two eligibility issues with USDA Farm Service Agency (FSA) and NRCS, respectively.

Vegetation. Several concerns arose from state-level NRCS guidance that newly constructed wetlands be planted with rhizomes, stolons, and/or wetland plants at a minimum of 1 x 1 m (3 x 3 ft) spacing. Although this science-based guidance was designed to facilitate nitrogen microbial processes and provide wildlife benefits, estimates from local nurseries showed this would increase the cost of CP39 wetlands by an additional ~\$29,700 ha⁻¹ (~\$12,000 ac⁻¹). Furthermore, increased complexity and timing requirements for wetland planting overlapped with spring farming responsibilities and increased the likelihood of prolonging reimbursement processes.

■ Addressing Implementation Challenges

Supplementing Resources. To facilitate construction of CP39 wetlands during the five-year project period, the Conservancy and McLean County SWCD used private and state funding to cover all landowner expenses not reimbursed by FSA, including unforeseen costs such as additional tile installation and crop damage. Federal reimbursements were lower than expected for the first few wetlands due to a soil cap set by FSA County Committee that did not reflect actual current excavation costs. SWCD subsequently worked with FSA to increase the soil reimbursement cap by 83% based on real-time excavation data from multiple contractors. We used federal CIG funding to contract with a private engineering firm to design and supervise wetland construction. Engineering designs and construction were approved by NRCS engineers and met NRCS Field Office Technical Guide standards and USDA FSA 2 CRP Handbook guidelines.

Siting Waivers. The Conservancy and partners initiated a waiver system with FSA to construct CP39 wetlands on existing CRP filter strips (CP21) by terminating part of the CRP CP21 contract and immediately reenrolling those acres into CRP CP39. FSA waived penalties ordinarily associated with early termination of a CRP contract. Development of a statewide or national policy that provides for retrofitting CRP filter strips with wetlands without requiring approval of individual waivers would accelerate the efficiency and scale of this practice.

NRCS floodplain siting restrictions were designed to protect public investment by ensuring wetland effectiveness and structural integrity during flood events. Given the prevalence of tiled farmland acres within the 100-year floodplain in central Illinois, we requested approval for wetland placement within several floodplain sites to evaluate benefits and potential setbacks during the project. NRCS agreed to waive the floodplain restriction for the project noting that CIG funding provided for private engineering assistance to design wetlands to structurally withstand flooding. Illinois NRCS guidance was subsequently revised to allow construction of CP39 wetlands in the floodplain provided design analyses ensured the wetlands can withstand flood events and that landowners agree to any additional maintenance requirements.

Vegetation Modifications. We reached an agreement with NRCS to explore the potential for natural regeneration of wetland vegetation, a decision partially based on documented cases where diverse aquatic plants became established in constructed wetlands in Iowa and Illinois without seeding or planting. Subsequently, NRCS modified state guidance to provide cost-effective options to establish aquatic plants, including natural regeneration, seeding, and/or transplanted macrophytes to be determined by a NRCS biologist based on site location and characteristics. Should natural regeneration fail after year one, landowners must establish wetland vegetation through seeding and/or plantings.

■ Moving the Needle

We gained valuable insights into the complexities of implementing constructed wetlands in agricultural landscapes during our work in Illinois. Foremost, it is imperative to **understand landowner/farmer perspectives** on the practicalities and economics of integrating conservation practices into their farm operations. Financial implications of converting highly productive farmland acres to wetlands was the primary constraint we encountered during this project. Farmers are stewards of the land and many are open to innovative ideas for agricultural and environmental improvements if they can fit practically into overall farming operations. Constructed wetlands are expensive and can entail substantial out-of-pocket costs for landowners, as well as potential loss of agricultural income. As such, **increased financial incentives** should be considered for landowners willing to remove highly productive farmland to install edge-of-field wetlands that benefit downstream users (Osmond et al. 2012), particularly enhanced cost-share that provides 90% to 100% of construction costs in addition to 120% annual rental rates.

Leveraging **public-private partnerships** is necessary to increase investment and support for watershed conservation. These partnerships can spur

innovative funding mechanisms and incentive programs that increase cost-effectiveness, streamline program efficiencies, and provide the consistent financial and technical resources required for implementing conservation at the scale needed to meet national water quality goals. An important component of these programs should include **technical service providers and/or software** that can streamline enrollment and accelerate design of constructed wetlands.

Reliance on voluntary participation to effectively reduce pollution concerns such as hypoxia in the Gulf of Mexico, algae blooms in the Great Lakes, and nutrients threatening local drinking water supplies will require **increased investment in outreach** by local, knowledgeable, and trusted providers. Tile-treatment practices require especially intensive hands-on outreach by agency staff that are generally overcommitted and underfunded. Supporting the development and coordination of farmer-led outreach programs that partner with SWCDs, NRCS, and university extensions should be one avenue to build outreach capacity and influence within the agricultural community. Such coordination could lead to increased implementation of conservation practices that effectively attain nutrient loss reduction goals.

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