



## Floyd County CREP Wetland Monitoring

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The Iowa State University Wetland Research Group with help from the Northeast Research and Demonstration Farm monitor several CREP wetlands in Floyd County. The Iowa Conservation Reserve Enhancement Program (CREP) is a joint effort of the Iowa Department of Agriculture and Land Stewardship (IDALS) and USDA's Farm Service Agency. This program provides incentives to landowners to voluntarily restore shallow, semi-permanent wetlands in the heavily tile-drained regions of Iowa to improve water quality while providing valuable wildlife habitat.

### Materials and Methods

A unique aspect of the Iowa CREP is that nitrate reduction is not simply assumed based on acres enrolled but is calculated based on measured performance of CREP wetlands. Selected wetlands are instrumented for continuous flow measurement and automated sampling at inflows and outflows. Mass balance analyses are used to calculate mass removal rates of nitrate. The wetlands selected for monitoring span a broad range of factors affecting wetland performance including hydraulic loading rate, residence time, nutrient concentration, and nutrient loading rate.

The two wetlands presented in this report were not instrumented with continuous flow measurement and automated sampling equipment, but basically were sampled once per week, at the designated inflow and outflow locations designated on the aerial maps below. If data is missing in any particular week, it is because there was no tile drainage inflow, or outflow over the pool overflow sites. The Wilken wetland site is approximately three miles southwest of Nashua, Iowa and the Tjaden wetland site is approximately three miles northeast of Charles City, Iowa.

### Results and Discussion

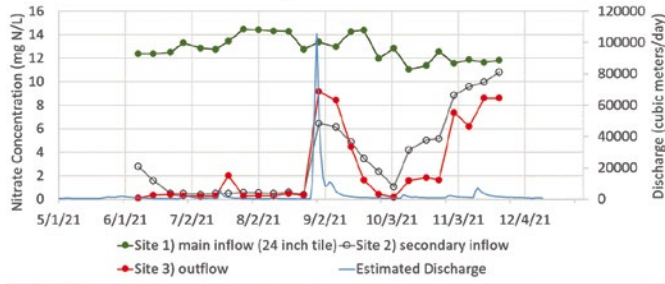
Nitrate removal depends primarily on hydraulic and nitrate loading rates which depend on location, size and weather patterns. On average, wetlands occupying 0.5-2% of a catchment can reduce long term nitrate loads by 30-70%. Nitrogen reduction is achieved primarily through the denitrifying bacteria that occur naturally in shallow wetlands. Through denitrification, the bacteria remove nitrate from the water and release it into the air as nitrogen gas (N<sub>2</sub>), of which the atmosphere is composed of about 78% nitrogen.

Precipitation in the 2021 growing season, started out somewhat dry with minimal tile drainage flow, through early August due to crop water use requirements, followed by heavy rainfall events on August 9 and 27, with above normal rainfall for August, October and November (Table 1).

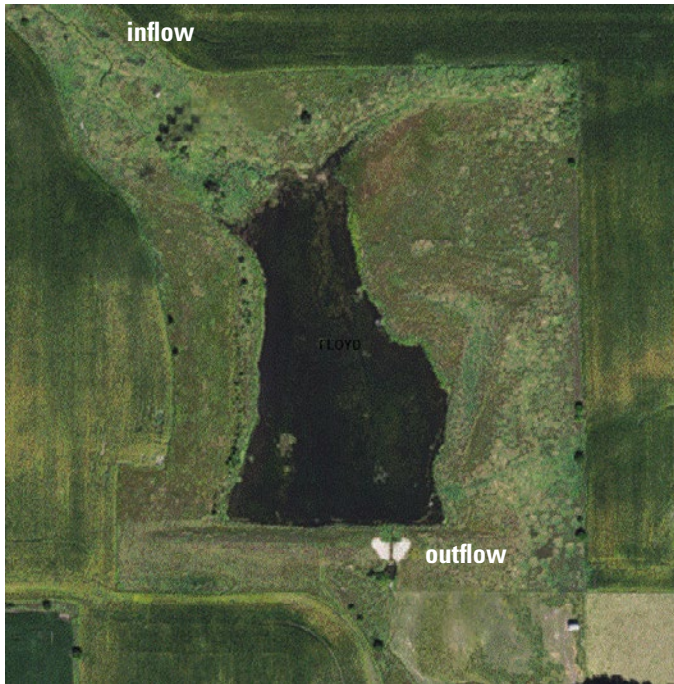
**Table 1. Precipitation (inches) during the 2021 growing season at the farm.**

	Apr	May	June	July	Aug	Sept	Oct	Nov	Total
2021	0.63	3.48	1.42	2.53	10.58	1.61	4.50	2.02	26.77
1976-2020 average	3.68	4.52	5.47	4.57	4.67	3.56	2.68	1.74	30.89

### Summary of Wilken Wetland Nitrate Measurements

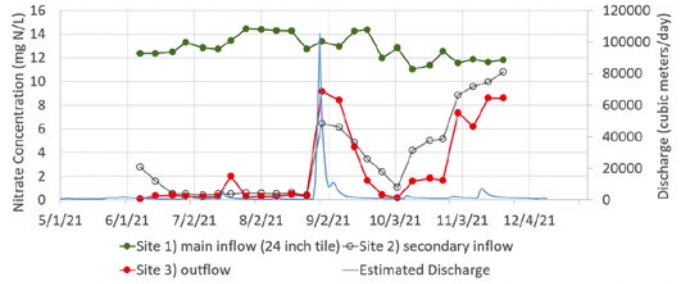


The estimated nitrate removal efficiency having nitrate concentration measurements is 43%. Because this wetland is not instrumented for flow measurement, flow was estimated from the wetland watershed area and measured flow at a nearby location. On the basis of the wetland to watershed area ratio and typical water yields for Floyd County, we estimate that this wetland would have an average nitrate removal efficiency of about 35 to 40%.



Plot of measured nitrate concentrations and estimated discharge.

### Summary of Tjaden Wetland Nitrate Measurements



The estimated nitrate removal efficiency having nitrate concentration measurements is 49%. Because this wetland is not instrumented for flow measurement, flow was estimated from the wetland watershed area and measured flow at a nearby location. On the basis of the wetland to watershed area ratio and typical water yields for Floyd County, we estimate that this wetland would have an average nitrate removal efficiency of about 45 to 50%.



Aerial photo of the Wilken wetland.

Table 1: measured nitrate concentrations.

Date	Nitrate-N In (mg N/L)	Nitrate-N Out (mg N/L)
6/7/21	14.6	7.73
6/14/21	11.91	3.51
6/22/21	6.04	0.24
7/1/21	2.84	0.25
7/8/21	2.78	0.16
7/15/21	2.91	0.12
7/22/21		0.07
8/9/21	4.61	0.16
8/29/21	9.28	5.4
9/5/21	9.38	5.39
9/12/21	5.78	2.5
9/19/21	5.28	1.68
9/26/21	4.78	0.2
10/3/21	9.99	1.35
10/10/21	5.93	1.39
10/17/21	7.94	2.44
10/23/21	8.4	5.23
10/31/21	8.07	6.81
11/7/21	8.29	6.68
11/14/21	8.86	9.21
11/21/21	8.25	8.16

Table 2: measured nitrate concentrations.

Date	Site 1 Nitrate (mg N/L)	Site 2 Nitrate (mg N/L)	Site 3 Nitrate (mg N/L)
6/7/21	12.37	2.79	0.10
6/14/21	12.37	1.59	0.35
6/22/21	12.49	0.51	0.39
6/28/21	13.28	0.51	0.31
7/6/21	12.84	0.39	0.25
7/13/21	12.73	0.50	0.29
7/19/21	13.44	0.51	2.01
7/26/21	14.45	0.58	0.27
8/2/21	14.40	0.55	0.29
8/9/21	14.30	0.50	0.30
8/16/21	14.28	0.60	0.48
8/23/21	12.74	0.40	0.33
8/30/21	13.37	6.45	9.16
9/7/21	12.97	6.14	8.42
9/14/21	14.24	4.87	4.47
9/20/21	14.38	3.46	1.62
9/27/21	11.95	2.36	0.43
10/4/21	12.83	1.06	0.17
10/11/21	11.04	4.18	1.58
10/19/21	11.37	5.02	1.83
10/25/21	12.53	5.13	1.64
11/1/21	11.56	8.85	7.36
11/8/21	11.87	9.59	6.20
11/15/21	11.63	9.96	8.59
11/22/21	11.80	10.80	8.60