

Hickory Grove Lake Watershed Project

WIRB Grant 1335-016

Final Report



Story County Conservation

Report Prepared by Amy Yoakum

Natural Resource Specialist

1335-016 Hickory Grove Lake Watershed Project

Hickory Grove Park, a 400-acre park with a 98-acre lake located in eastern Story County, is a favorite of campers, anglers, and swimmers. According to the Iowa Lakes Valuation Project, the park averaged over 71,000 visitors annually (2002-2005) who spent an average of \$6.46 million, supporting 79 jobs and bringing \$1.61 million in labor income to the region. Project location, watershed and location of improvements are shown on maps at the end of this document.

The lake has a watershed of 4,035 acres and is on the Iowa 2012 303(d) Impaired Water List due to bacteria. A Watershed Management Plan (WMP) developed by Iowa State University was approved in March 2013. The plan identified geese as the primary contributor to the bacteria impairment, and Story County Conservation (SCC) has begun to address this problem.

The grant focused on projects the plan recommended to reduce bacteria and sediment loading. These are: replacement of nine unpermitted septic systems in the watershed through a cost-share program; exclusion of cattle currently given unlimited access to over 1,600 feet of stream; stabilization of the adjoining streambank through reshaping, re-vegetation, and creation of a grassed buffer; and construction of a grade stabilization structure to trap sediment from one of the major gullies identified in the WMP. These practices, when combined, will reduce sedimentation into the lake by 286 tons per year, reduce phosphorus by 28 lbs. per year, eliminate bacteria loading from septic systems and livestock, and reduce nitrogen into the lake through installation of a saturated buffer. Phosphorus and E. coli pollutant load reductions for septic systems followed guidance from the IDNR Watershed Improvement-TMDL Section.

Financial Accountability

Watershed Improvement Funds

Grant Agreement Budget Line Item	Total Funds Approved (\$)	Total Funds Approved- Amended (\$)	Total Funds Expended (\$)	Available Funds (\$)
Saturated buffer	0	7,013	8,172	
Bioreactor	7,013	0		
Septic system upgrades	17,000	17,000	17,010	
Cattle exclusion	11,993	11,993	8,645	3,348
Streambank stabilization	157,045	157,045	135,169	29,258
Grade stabilization structure	30,044	30,044	32,630	
Totals	223,095	223,095	201,627	
Difference			21,468	

Total Project Funding

Funding Source	Cash		In-Kind Contributions		Total	
	Approved Amended Application Budget (\$)	Actual (\$)	Approved Application Budget (\$)	Actual (\$)	Approved Amended Application Budget (\$)	Actual (\$)
WIRB	223,095				223,095	201,627
Lakes IDNR	199,788				199,788	178,967
Story CCB	51,343		9,900		61,243	46,232
Story County	51,343				51,343	46,232
Story Co. Env. Health	18,000	12,937	2,160	2,160	20,160	12,937
Story SWCD	10,000				10,000	9,990
Property Owner(s)	45,000	42,555	25,000	15,950	70,000	58,505
Totals	598,569		37,060		635,629	554,490

Watershed Improvement Fund contribution: Approved amended application budget: 35 %
 Actual: 36 %

Environmental Accountability

Monitoring

The performance of the saturated buffer installed immediately below the lake has been monitored since mid-year 2016. The saturated buffer was installed in 2015, but the gates were not closed until we had fully instrumented the buffer in June of 2016. Since that time, the flow in the tile control box has been measured on an hourly basis, and water samples were taken from the tile, stream, and monitoring wells within the buffer on a bi-weekly basis. These water samples have been analyzed for nitrate in an analytical laboratory following EPA protocols.

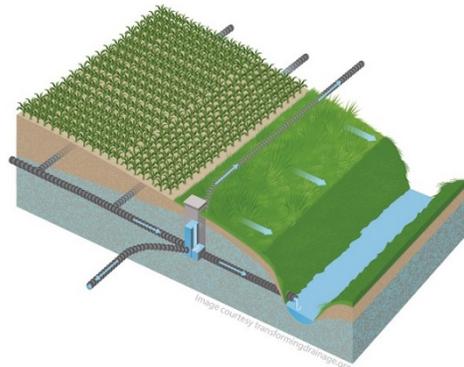


Diagram of a saturated buffer

Nearly 30 million gallons of water have drained from the field tile. Of this total, just less than 7 million gallons (or about 23% of that total) were redirected through the saturated buffer (Figure 1). The exact drainage area feeding this tile drain is unknown, so we cannot compute the fraction this drainage represents of the total precipitation falling in 2016. Also, because we did not start monitoring flow until June, we did not measure the spring tile flow.

Nitrate concentrations in the tile water and stream over time are shown in Figure 2. Nitrate concentrations in the tile and stream were similar and ranged from nearly 12 to about 4 mg N per liter – very typical for drainage water coming from corn/soybean fields in central Iowa. Nitrate concentrations in the monitoring wells placed within the buffer were typically below our detection limit of 0.3 mg N per liter, indicating that all the nitrate in the tile water that was diverted into the saturated buffer was removed. While we cannot be certain of the ultimate fate of this removed nitrate, our experience would indicate that the nitrate was denitrified to di-nitrogen gas and returned to the atmosphere.

By multiplying the measured flow by the measured nitrate concentration and summing over the monitoring period, we calculate that 347 pounds of nitrate as N were drained from the field through the tile, and, of that total, 80.5 pounds were removed in the saturated buffer. This is 80.5 pounds of nitrate-N that would have otherwise entered directly into the stream and, ultimately, the lake at Hickory Grove. Thus, the saturated buffer removed about 23% of the nitrate from the field tile. The performance of this saturated buffer will be monitored through at least the end of 2017.

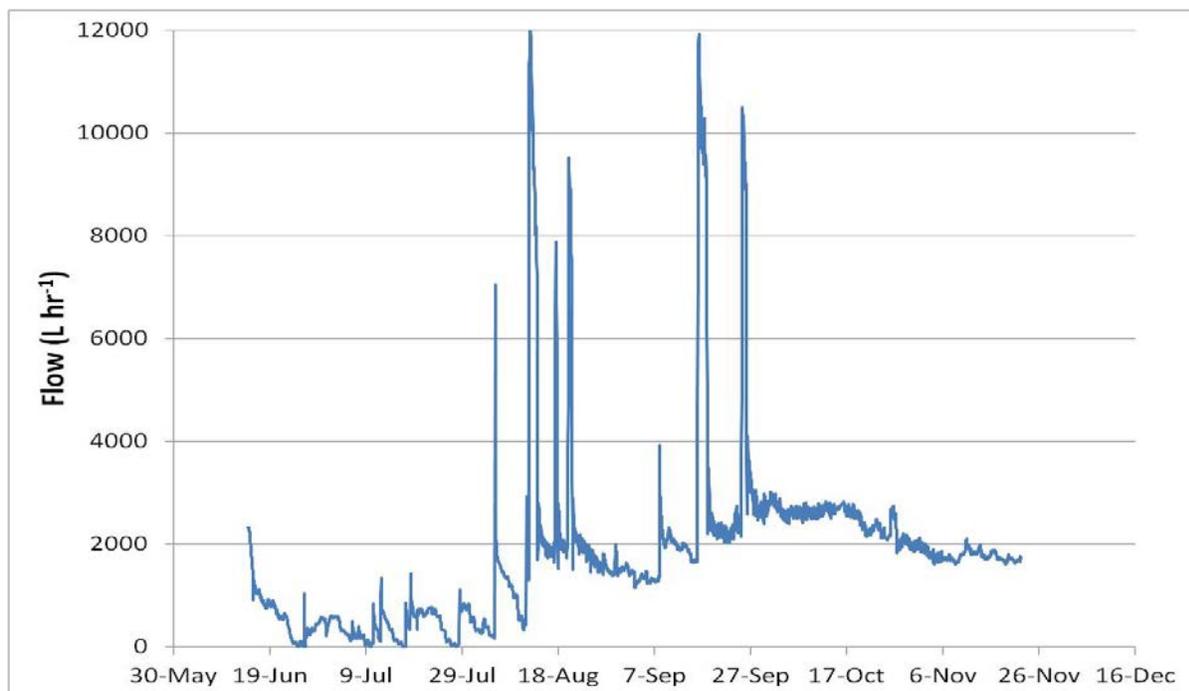


Figure 1. Flow rate of tile water diverted into the saturated buffer during 2016.

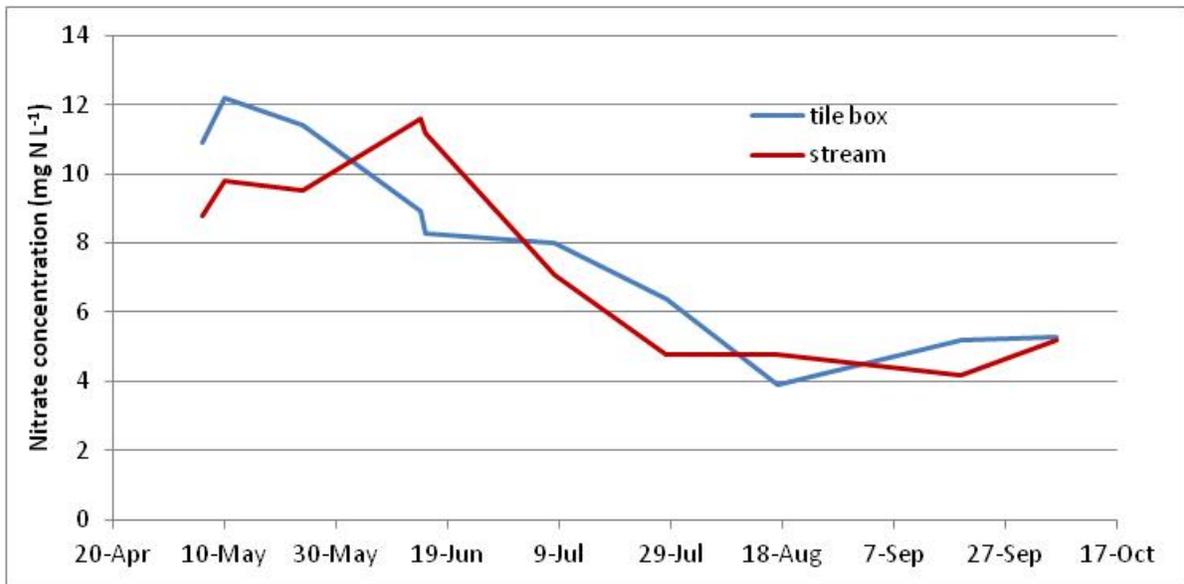


Figure 2. Nitrate concentration in the field tile, measured at the control box, and within the adjacent stream over time in 2016.

Landowners who received cost-share for septic system replacement are asked to monitor their system annually. A check of the filter will determine if the tank needs to be pumped. We also recommend they walk the lateral area (usually when cutting the grass) to make sure there are no problems.

Septic System Upgrades

The WIRB grant provided cost-share funds for nine septic systems in the Hickory Grove Lake (HGL) Watershed to be upgraded. All nine systems were completed during the grant period. A review of the Story County Environmental Health files identified ten houses within the HGL watershed that did not have any records for their septic system. Nine of those were located within the drainage district which drained to a large tile that sampled positive for clothes brighteners, indicating the presence of domestic sewage. The county initiated septic permitting in 1972, so a lack of septic records indicated an antiquated or unpermitted system. All nine parcels with old “systems” in the HGL watershed included a septic tank(s) with a discharge to a field tile, road ditch, or land surface. Most tanks were not pumped routinely and were full of solids and, therefore, not functional. The nine property owners were offered a cost share of 50% of the price to replace the septic system, with a cap of \$5,000. Funding was provided by Iowa Watershed Improvement Review Board (WIRB), Story Soil & Water Conservation District, Story County Board of Supervisors, and Story County Board of Health. WIRB funded \$1,800 per system. The soil evaluations, system designs, and inspections were conducted by the Story County Environmental Health Department. Nine septic systems were installed under this program, totaling a cost of \$82,018. Most were large parcels, with soils conducive to conventional gravity laterals.

The tenth house that did not have a septic record is located in the HGL watershed but outside the drainage tile network where the clothes brightener had been detected. Without “proof” that this house is illegally discharging untreated sewage, department protocol does not allow enforcement of septic system upgrades. In an attempt to bring this house’s system up to today’s standards, the Story County Board of Supervisors offered to cover up to \$5,000 during fiscal year 2016 for the upgrade. The system was never upgraded, and the \$5,000 was returned to the county general fund.

It is interesting to note that there is a direct correlation between systems that do not have any septic records with systems that are illegally discharging. This limited study showed that all nine systems lacking records also lacked a working septic system. Studies of other watersheds could possibly predict nutrient and bacteria loading from septic systems based on the number of residential structures in the watershed without septic records.



Stream Improvement Property

Other than septic system upgrades, all WIRB funds were used for improvements on private property adjacent to HGP. The parcel is located on the southeast side of the park where 75% of the lake inflow comes from. Water entering the lake travels through approximately 1,465 feet of degraded stream channel where cows were permitted to be in the stream. SCC secured a permanent easement (3.5 acres) along the entire length of the stream. The easement begins in the center of the stream and extends 25’ on each side.

The primary objective on the property was to reduce the amount of *E. Coli* bacteria, nitrate, and phosphorus from entering HGL. The following practices were identified to meet the nutrient reduction goals: livestock exclusion from the stream, streambank stabilization and

restoration, grade stabilization structure, grassed buffer along the stream, and a saturated buffer. The original grant application approved a bioreactor to remove nitrates. That particular practice was changed to a saturated buffer as reflected by project amendment in December 2015.



Property before improvements



Property after improvements

Several other projects over and above the WIRB grant have positively impacted water quality at Hickory Grove Lake. The RASCAL data for gully erosion and a shoreline assessment were updated. Invasive species, such as bush honeysuckle, are being removed to stimulate native vegetation and reduce sediment loss into the lake. An extended Canada goose hunting season was created to discourage additional *E. Coli* from entering the lake. A CREEL survey was conducted during the summer of 2016 in preparation of lake drawdown for the next phase of the watershed management plan. Graduate students from Iowa State University estimated gully erosion rates and provided several management suggestions.

Practices and Activities

Practice or Activity	Unit	Approved Application Goal	Accomplishments	Percent Completion
Septic system upgrades	No.	9	9	100
Livestock exclusion	Ft.	5,142 ft	4,782	93
Streambank stabilization	Ft.	1,465 ft	1,465 ft	100
Grade stabilization structure	No.	1	1	100
Grass buffer	Acres	3 acres	3 acres	100
Saturated buffer	No.	1	1	100
Information/education	No.	5	13	100

The number *E. Coli* organisms entering HGL via failing septic systems has been reduced. Phosphorus and *E. coli* pollutant load reductions for septic systems followed guidance from the IDNR Watershed Improvement-TMDL Section. Septic system replacement will keep 3.94E + 13 organisms/year of *E. Coli* bacteria from entering the lake. Livestock exclusion is estimated to keep an additional 2.63×10^{10} organisms/day of *E. Coli* bacteria from entering the lake. The phosphorus reduction per septic system is 12.5 lbs./year. By replacing 9 septic systems, a Total-P reduction of 112.5 lbs./year has been achieved. The Water Quality Improvement Plan showed that elevated *E. coli* concentrations at the Hickory Grove Lake beach do not appear to be significantly correlated to watershed bacteria loads. However, watershed activities may still have an impact on lake water quality.

Several practices to reduce sediment loss were installed at the project location. These practices include: grade stabilization structure to capture sediment from an eroding gully (1 acre), reshaping and stabilizing the streambank which was degraded by cattle (1,465 feet), and re-vegetating the streambank via a grassed buffer (3.27 acres). The goal of these practices is to reduce sediment loading by 286 tons/year. This reduction meets 42% of the total WMP goal for sediment reduction. RASCAL data was used to calculate the current erosion rates of the gully and streambank. Those rates were then used to project the reduction in sediment after practices were installed.

As noted above, the saturated buffer has reduced nitrate input to the lake by 80.5 lbs. The project goal of nitrate-N reduction is 151lbs./year. Since monitoring of the buffer is currently in its fifth month and we have already reached 53% of our goal, we are confident the goal of 151 lbs./year is achievable.

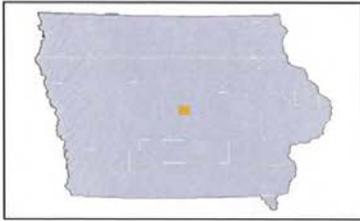
Program Accountability

This project has been received well by all stakeholders and by the public. It exemplifies a strategic approach to partnering for water quality improvements. The public private partnership illustrates the mutual roles we face in improving our waters. This multi-faceted partnership also created unexpected delays at some critical junctures in the project. Future efforts should provide added time for coordination. We recommend that projects on private property have written tentative agreements in place prior to funding application and not rely on verbal agreements. We were very fortunate to work with supportive landowners for both the stream portion and the septic portion of the project. Due to the critical nature of role of the streambank portion landowner, we were fortunate that that landowner was supportive of the end goals of the project.

The educational outreach goal for the project was to distribute five articles about the grant and its progress to the public. Through print and social media outlets, 15 articles were distributed during the grant period. The watershed project was also highlighted during a radio interview on KHOI Community Radio in Ames. Several presentations were given to special interest groups who

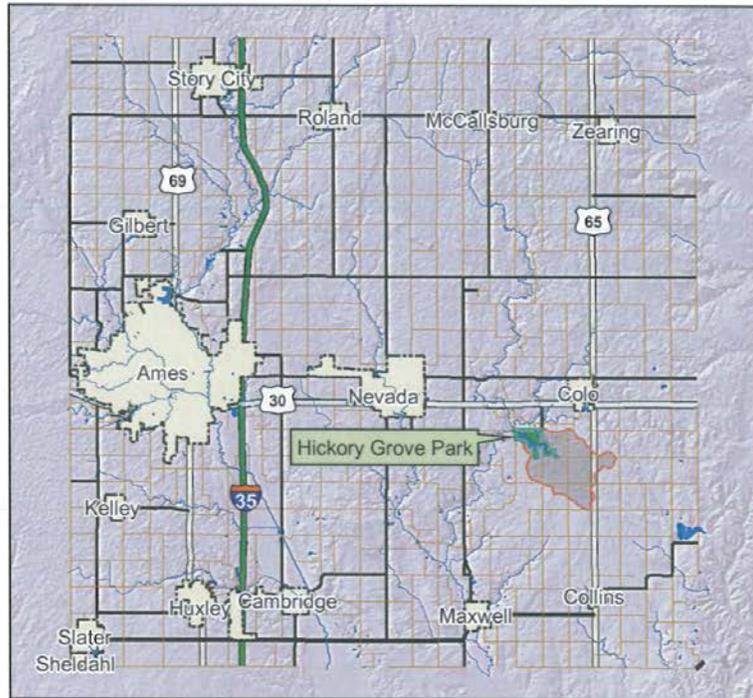
requested a speaker from SCC. Staff will offer a presentation on this project at the 2017 Iowa Water Conference.

Project updates sent out through the SCC newsletter, *Prairie Horizons*, reached 2,438 individuals. The total number of people reached through various social media outlets was 1,514. Information was also displayed on the SCC website; the page was viewed 370 times since the grant began in July 2014. The project was also discussed in numerous public meetings including Story County Board of Supervisors, Story County Conservation Board Story County Board of Health, and 2014-2015 Story County Conservation Legislators Receptions.

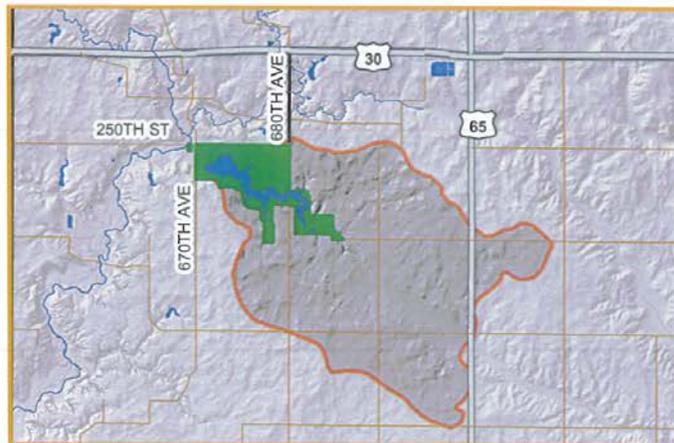


Location in Iowa

Project Location Hickory Grove Lake Watershed



Location in Story County



Hickory Grove Park Watershed

Location of Improvements on Private Property

