6014-007 Lower Coldwater-Palmer Watershed
Performance-based Environmental Management Project

Project sponsor: Coldwater-Palmer Watershed Improvement Association, Inc.

Final Project Report: January 2007 - December 2009

The Lower Coldwater-Palmer watershed council developed and annually modified an innovative performance-based watershed management program that motivated 73% of watershed farmers to participate through the use of three performance measures: the Iowa Phosphorus Index, the Soil Conditioning Index and the fall cornstalk nitrate test. The use of these three measures and corresponding incentives caused cooperators to assess their environmental and agronomic performance, try new conservation management strategies and change how they think about water quality in their watershed. An additional highlight was a 30% reduction of early-season nitrate-nitrogen concentration as measured through annual water monitoring.

Lower Coldwater and Palmer creeks in Butler and Floyd counties are tributaries of the Shell Rock River that flows to the Cedar River, a public drinking water supply for about 125,000 people in the Cedar Rapids area. Both creeks, with a 39,120 acre watershed, were designated as impaired for aquatic life in the final 2004 Iowa list of Section 303(d) Impaired Waters. The causes included biological, ammonia, and organic enrichment/low dissolved oxygen. IDNR Snapshot Monitoring results during 2004 and 2005 showed Coldwater-Palmer to have nitrate + nitrite levels above the 90^{th} percentile when compared to other Cedar River tributaries. While TMDLs have not been written for Coldwater and Palmer creeks, a primary goal of a Cedar River TMDL is to achieve a 35% nitrate reduction to meet the drinking water standard. In the TMDL report, the IDNR concluded that "it's necessary to improve water quality in the entire watershed to maintain clean water in the river at Cedar Rapids".

The following report will describe how members of the Lower Coldwater-Palmer Watershed Improvement Association and project cooperators used Watershed Improvement Review Board funds to improve water quality in their watershed.

The primary goal for the watershed improvement project was reduced nutrient loading to levels that meet IDNR-established water quality standards. The objectives to achieve the goal were:

1. Develop a program of performance rewards and community support that motivates at least 60% of watershed producers to adopt performance measurements and rewards continuous improvement in controlling agricultural contaminants, especially nitrogen.
2. Reduce nitrogen inputs by 35% over 3 years by producer adoption of the Late Season Stalk Nitrate test to evaluate N application timing, N rates and improve performance of economically efficient N fertilizer and manure rates on corn.
3. Reduce phosphorus transport to surface water by 35% over 3 years by using the Iowa Phosphorus Index and Soil Conditioning Index to evaluate and improve fertilizer and P-based manure application rates and soil conservation in high-delivery areas.
4. Evaluate outcomes and document lessons learned about critical factors for the successful use of performance-based rewards in other Iowa watersheds.

Financial Accountability

The following tables demonstrate how the Watershed Improvement Fund contribution was used as part of the watershed improvement project. As stated, 73% of Lower Coldwater-Palmer watershed farm operators (46 of 63) participated in the project. However, even with the greater than expected level of participation, there was a significant difference between the funding allocated for producer incentives and expenditures on incentives. As shown in Table 1, only 60% of the producer incentives line item was spent.

Watershed Improvement Funds			
Grant Agreement Line Item	**Total Funds Approved ($)**	**Total Funds Expended ($)**	**Available Funds ($)**
Field Demonstration	1,000	1,000	0
Contractual-administrative	116,141	116,141	0
Travel Expenses	2,070	1,177	893
Supplies	3,300	1,892	1,408
Project Administration	4,500	4,082	418
Incentives-Producers	184,583	110,708	73,875
Total	311,594	235,000	76,594
Difference			76,594

Table 1. Watershed Improvement Funds budgeted and expended.

Table 2 highlights some reasons for the unspent incentive funds and how the watershed council responded with changes to the incentive program. An outcome from each council response is defined with some estimation of the resulting difference in expenditures.

Issue	**Council Response**	**Outcome**
High P Index performance in watershed - phosphorus not a priority issue	Reduced incentives on P Index performance	Only $8,000 spent on P Index incentives – approximately $20,000 less than expected
Low SCI performance due to tillage	Added incentive for strip-till and no-till	Limited adoption of reduced tillage strategies resulting in $15,000 less paid for incentives than planned
Cornstalk sampling issues in 2008 resulting in 50% fewer samples being collected than in 2007	Council members worked with local agronomists to collect samples instead of with FFA chapter	Increased sampling in 2009 – however still 30% lower than 2007 levels. Lost CNT participation due to problems in 2008.
Limited incentives for specific N management practices	Added incentives for side-dress application and moving applications from fall to spring Added an incentive for late spring nitrate test (LSNT)	8 cooperators reporting side-dress and/or moving from fall to spring application in 2009 13 cooperators used the LSNT during 2009 to refine nitrogen management

Low adoption of new grassed waterway installation	Increased incentive for grassed waterways and opened the incentive to waterway improvement during the final project year	9 cooperators completing waterway improvement and/or installation in 2009 compared to 2 cooperators in 2008 – approximately $20,000 less spent on "other incentives" than expected

Table 2. Council response to producer incentive expenditures versus budget.

The watershed council closely monitored incentive program expenditures by reviewing the participation budget at every watershed meeting and annually making modifications to the incentive program prior to fall harvest. Program modifications were typically proposed at a mid-summer meeting during a line-by-line review of incentives and then approved by the council at their last pre-harvest meeting. Increased adoption of conservation management strategies might have been obtained by increasing incentives for priority components earlier in the project. Table 3 shows producer incentive expenditures separated into five categories. A copy of the incentive program and an annual comparison of the full incentive program are provided as attachments.

Performance Program Incentives (WIRB & ICGA)				
	2007 ($)	**2008 ($)**	**2009 ($)**	**Total ($)**
Nitrogen Performance	11,425	10,770	15,098	37,293
Phosphorus Index	3,200	2,580	2,310	8,090
Soil Conditioning Index	19,780	16,710	11,370	47,860
Other Incentives	4,463	3,125	11,062	18,650
Watershed Performance	880	4,500	9,200	14,580
Total Incentives	39,748	37,685	49,040	126,473

Table 3. Producer incentive expenditures.

Total Project Funding						
Funding Source	**Cash**		**In-Kind Contributions**		**Total**	
	Approved Application Budget ($)	**Actual ($)**	**Approved Application Budget ($)**	**Actual ($)**	**Approved Application Budget ($)**	**Actual ($)**
WIRB	311,594	235,000	0	0	311,594	235,000
ICGA	60,000	36,659	0	0	60,000	36,659
ISU	0	0	56,289	30,846	56,289	30,846
CRMC	0	0	38,700	6,000	38,700	6,000
Cooperators	0	26,954	29,400	33,248	29,400	60,202
Total	371,594	298,613	124,389	70,094	512,963	368,707

Table 4. Total project funding.

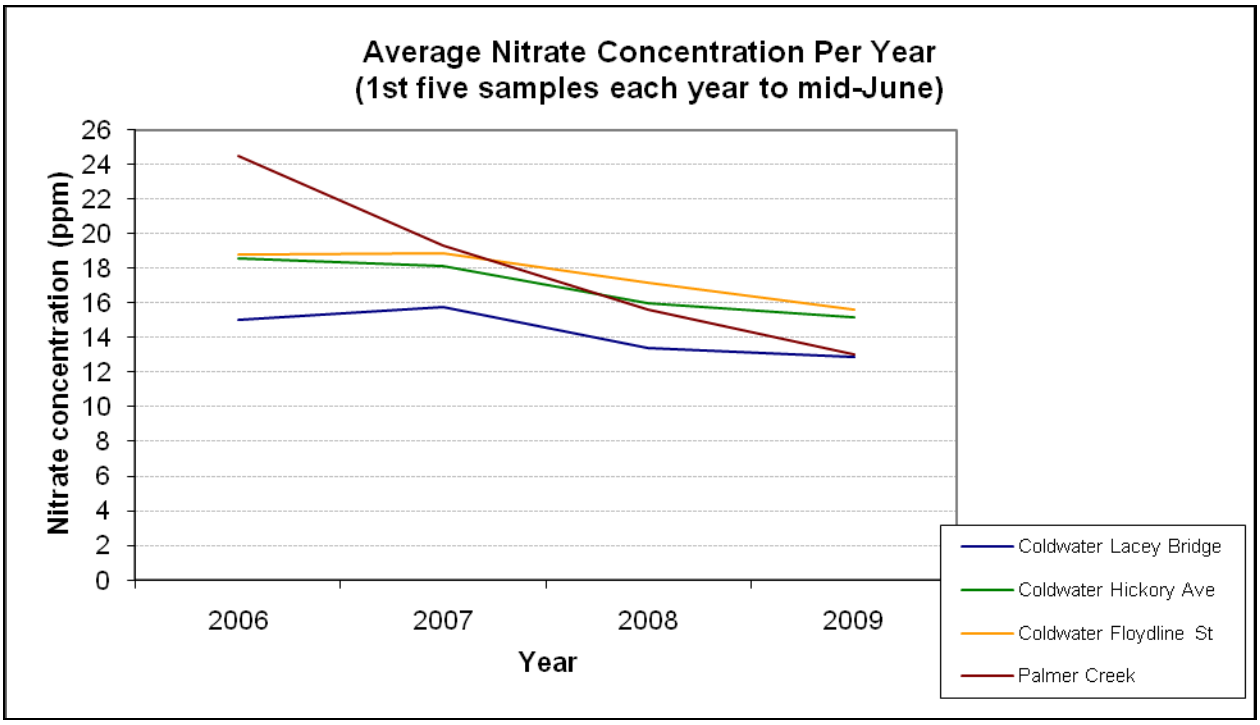
Watershed Improvement Fund contribution: Approved application budget: 61%
Actual: 64%

The final Watershed Improvement Fund contribution, shown in Table 4, was similar to the budgeted percentage; however, there were some significant shortfalls in contribution from some sources while documented contributions by cooperators were double planned levels. Funding from the Iowa Corn Growers (ICGA) was targeted to provide incentives not covered by WIRB funds. Since incentive expenditures were lower than planned less ICGA funding was used. The watershed council will use excess ICGA funds to extend the watershed improvement project at least one year.

In-kind monitoring support initially provided by the Cedar River Monitoring Coalition was reduced by over $20,000 when their plans to provide monitoring changed. Limited nitrate-nitrogen monitoring continued throughout the project through less costly local sources. Also, in-kind contribution by Iowa State University was reduced when federal funding supporting project staff was exhausted.

Environmental Accountability

To gauge water quality improvement progress, the watershed council contracted with a watershed resident to collect water samples at four locations during each growing season. An attached map shows the monitoring locations. Samples were analyzed by the U of I Hygienic Lab. Sampling was initiated during March of each year and typically progressed through September with an average of 8 samples being collected annually from each location.

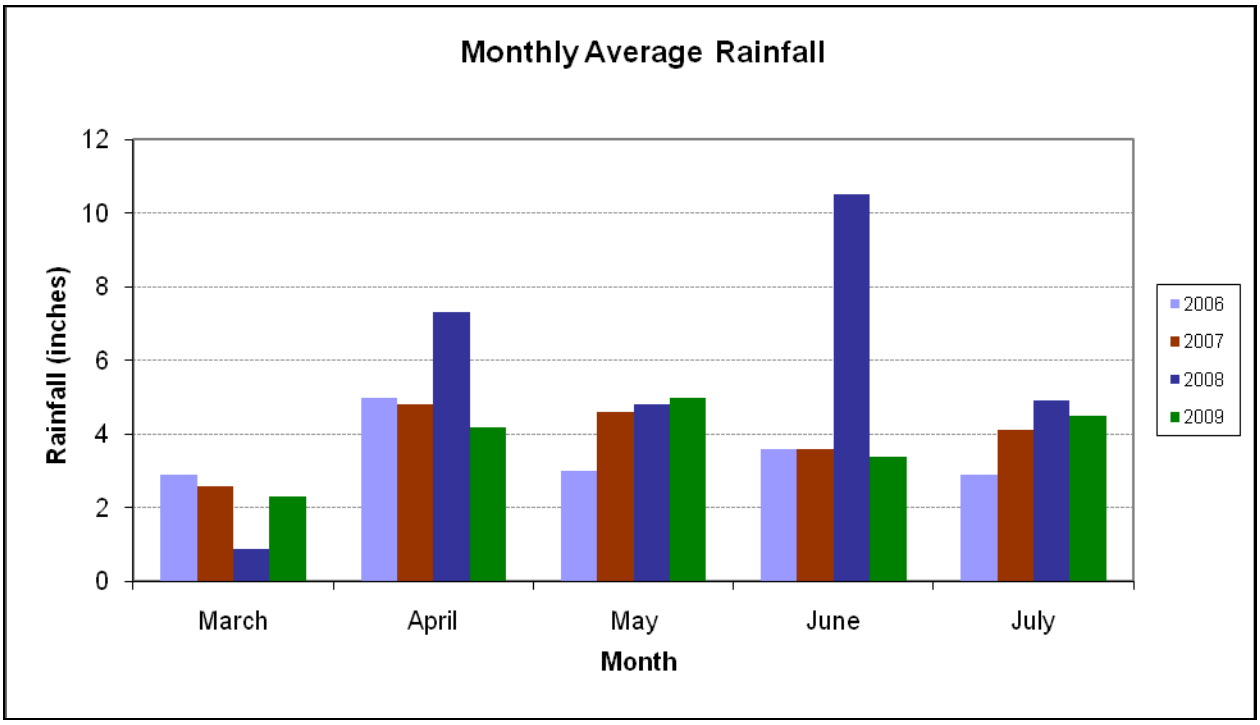


Graph 1. Early season nitrate-nitrogen concentration.

The highest nitrate concentrations occurred during the early part of the growing season, April – June. The Coldwater-Floydline St site was near the upper end of the watershed and typically had higher nitrate concentration than the other two Coldwater sites. The Palmer Creek site did occasionally go dry during low rainfall periods. As shown in Graph 1, average early season

nitrate concentration decreased by an average of 2 parts per million NO_3-N annually. The four site average was 20 ppm NO_3-N in 2006 and 14 ppm NO_3-N in 2009. The range of concentrations in 2009 was 9.5 to 18 ppm NO_3-N compared to 9.2 to 31 ppm NO_3-N in 2006.

The reduction in nitrate concentration at the Palmer Creek site is remarkable with nearly 50% reduction. Area rainfall data was examined to determine if extreme events affect monitoring results; however, rainfall was fairly consistent by year, with 2008 being an exception. Estimated rainfall shown in Graph 2 was summarized from data produced by the Iowa Department of Agriculture State Climatologist.



Graph 2. Estimated watershed average rainfall by month.

Annual Average Cornstalk Nitrate Test Results				
Year	**Stalk NO3-N (ppm)**	**Stalk NO3-N Range (ppm)**	**Estimated Yield (bu/a)**	**Number of samples**
2009	1,157	20 – 7,800	--	48
2008	2,751	540 - 7,986	170	32
2007	2,041	151 – 7,275	174	69
2006	3,231	28 – 11,000	193	63

Table 5. Annual cornstalk nitrate test results.

Cornstalk nitrate testing (CNT) was initiated by the watershed council in 2006. The council contracted with the Rockford FFA to work with cooperating farmers to complete sampling. The activity was quite successful in 2006 and 2007 with over 60 samples being collected each year. Cooperators could designate up to 4 sampling areas each season. In 2007, twenty-eight farms were sampled. Advisor changes with the FFA resulted in new instructor priorities and the

cornstalk sampling effort was not completed as planned in 2008. Responding to the situation, the watershed council worked with local agri-businesses to collect late spring soil nitrate samples, in addition to the cornstalk nitrate test samples in 2009. The number of samples increased in 2009 with plans to further increase sampling efforts in 2010.

Annual Watershed Average Performance Results						
Year	**# fields**	**Acres**	**PI**	**SCI**	**Soil Test P,ppm**	**Stream Distance,ft**
2009	327	14,861	1.05	0.41	33	2,611
2008	321	14,600	1.06	0.39	34	2,623
2007	254	11,659	1.08	0.39	35	2,515
2006	151	6,859	0.98	0.42	31	2,187

Table 6. Phosphorus Index and Soil Conditioning Index annual performance results.

Phosphorus Index (PI) and Soil Conditioning Index (SCI) performance values were calculated annually for project participants. The PI is a risk rating for phosphorus loss on a scale of 0 to 15 with lower being preferred. The SCI is an index that predicts the trend for future organic matter accumulation. The SCI is on a scale of -1 to 1.1. Incentives were available for farm-level performance, calculated as a weighted average performance for all fields. Table 6 shows watershed average PI, SCI, soil test phosphorus and average distance from the middle of the field to the stream. With average PI near 1, very low risk for P delivery, the watershed council reduced PI incentives and focused more funding to improve SCI and nitrogen management.

Sediment and Phosphorus Delivery Reductions				
Practice	**Sediment Delivery Reduction(T/a)**	**Phosphorus Delivery Reduction(T/a)**	**Length(ft)**	**Acres Protected**
Tillage Mgmt.	116	151	--	907
Rotation Mgmt.	102	132	--	756
Waterways	835	1,085	19,265	991
Buffers/Filters	241	313	6,240	316
Total	1,294	1,681	25,505	2,970

Table 7. Sediment and phosphorus delivery reductions.

To promote management changes, annual watershed summaries were provided to cooperators listing PI, SCI and soil test P for every field enrolled in the project. The 2009 watershed summary is attached.

Cooperators did make changes that improved field and farm-level performance for both SCI and PI. The resulting changes included reducing tillage, altering crop rotations, planting field-edge buffers and installing and improving grassed waterways. Table 7 highlights sediment and phosphorus delivery reductions achieved through conservation management changes. There were not specific goals set in the original grant proposal related to individual practices.

Program Accountability

The members of the watershed council took their role as funding and program directors seriously by meeting 5-6 times per year to review budgets, set annual goals, evaluate progress and approve producer incentives. Iowa State University Extension watershed specialists provided watershed council facilitation, conducted project administration and reporting, calculated annual field, farm and watershed-level performance and developed detailed summaries for council and cooperator decision making. The council did make annual adjustments to the incentive program based on information gleaned during the previous project year and from cooperator input.

The detail of information provided by cooperators increased during the project as they learned how to use project summaries to make decisions. This was especially true for nitrogen application data. Annual cornstalk sampling summaries (see attachment) listed not only results but application rates from on-farm and commercial sources and estimated crop yields. Second year cooperators, almost universally, provided more detail than first year cooperators, including N from plow-down sources and better estimates of manure N. With incomplete beginning data it is difficult to document a 35% reduction in nitrogen inputs as stated in the objectives. On-farm denitrifying bioreactors were installed to demonstrate nitrogen delivery reduction alternatives. Results were mixed, but ICGA watershed funds were invested in a research scale bioreactor at the nearby ISU Northeast Research Farm. The council will disseminate results to producers.

Likewise, documentation of a 35% reduction in phosphorus delivery to the stream is difficult to show. Through the annual performance calculation and review process the council and watershed farmers discovered that the risk of phosphorus loss was a low priority; however, there should be concern about long term soil organic matter accumulation related to some soils. By using crop rotation and tillage management scenarios the council and cooperators were able to identify fields that would benefit from reduced or no tillage management strategies. Changing management on these fields could improve soil conditioning index levels 100 to 200%.

Producer surveys were completed by Iowa State University sociologists in 2006 and 2009 and show changes in attitude about water quality. Ninety-two percent of respondents now say that some or most people believe there is a water quality problem, this compares to just 60% in 2006. Additionally, 100% of producers believe that nitrogen threatens water quality some or a lot. The watershed council, through its 2010 incentive program and annual evaluation process, will continue to reinforce the importance of nitrogen management in the watershed.

Due to success in the Coldwater-Palmer watershed and other performance-based watershed management projects, Iowa State University received a national grant award to expand the watershed council and performance-based management approach across Iowa. Lessons learned in the Coldwater-Palmer watershed have been shared by watershed leaders and Extension specialists to state, regional and national audiences. An example presentation is attached.

Project cooperators appreciated the flexibility of the incentive program, the ability of the council to adjust the incentive program based on cooperator response and performance results; and the opportunity to be involved in watershed planning, goal setting and program evaluation. Future watershed improvement projects would benefit by increasing the opportunity for local residents to really be involved developing, guiding and implementing watershed improvement plans.