

Final Report:

“Farmers as Producers of Clean Water: Providing  
Economic Incentives for Reducing  
Agricultural Non-point Pollution”

Agency: USDA, National Research Initiative  
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## **Executive Summary:**

This final report is written in the style of AD-421 accomplishment reports. In addition to this executive summary, lists have been provided for outcomes, publications, manuscripts in preparation, presentations, participants, and target audiences. Additional information about this project can be found in the publications and presentations which are posted on the project web site: <http://www.cacaponinstitute.org/wvunri.htm>.

This project involved a field experiment conducted between 2007 and 2010 in Cullers Run watershed in Hardy County, West Virginia. This experiment was conducted to find out how actual farmers would respond to watershed level, performance-based incentives for water quality improvements. Our experiment differed from previous performance-based payment schemes in several ways: watershed-wide payments were made to a group, rather than to individual farmers; this group determined how payments were to be allocated; payments were a function of water quantity and quality; and farmers decided what, if any, ANP abatement actions to take. Farmers were presented with a payment formula based on the quantity and quality of water flowing from the watershed. Water quality was measured based on nitrate-N (NO<sub>3</sub>-N).

As specified in the project proposal, objectives of this project were:

1. Derive and assess a pricing formula based on water quantity and quality that provides an appropriate incentive for farmers to implement best management practices (BMPs) to conserve stream water resources.
2. Given the availability of incentive payments, assess changes in farmer attitudes and behavior towards BMPs that protect and conserve water resources relative to the traditional cost share approach.
3. Monitor changes in water quality and quantity in response to performance-based economic incentives and compare to monitoring in other watersheds where these incentives are not offered.
4. Compare the cost effectiveness of water quality improvements for incentive payments relative to the traditional cost share approach.

For Objective 1, the pricing formula utilized is described in Maille and Collins (2009), "Farmers as Producers of Clean Water: A Field Experiment" and assessments of this formula were provided in the 2008 presentations at the Northeast Agricultural and Resource Economics Association, American Agricultural Economics Association, and USDA-CSREES National Water Conference. The pricing formula was based on three components multiplied together: (1) the quantity of water flowing from the watershed; (2) a price of water established by a trade-off between water quality protection and agricultural revenue; and (3) a water quality adjustment factor which consisted of a ratio of NO<sub>3</sub>-N loadings with a control watershed divided by the experimental watershed. Our assessment found that on an annual basis, actual payments were within the range of simulated payments predicted prior to the experiment. Also, as described more below, the level of farmer participation and engagement in the project were high.

Objective 2 was assessed using surveys of farmer participants and non-participants described in the 2009 publication by Maille and Collins entitled: *Performance-Based Payments for Conservation: Experience from a Water Quality Field Test with Farmers*. In the surveys, farmer participants were found to have a higher level of concern for water quality than non-participants. Participation was found to be higher among farmers with more education and lower among farmers who owned prime farmland. Responses from the participant surveys in 2008 showed that payment levels were not an important determinant of participation. Rather, farmers were participating because it was “the right thing to do”.

Objective 3 is evaluated with water quality data collected prior to and during this research (see Table 1 and Figure 1). While assessment of changes in water quality are very difficult to ascertain over just a few years of data, the seasonal averages of mg/liter of NO<sub>3</sub>-N showed that water quality steadily improved from year one through year three on the experimental watershed (Cullers Run shown in Figure 1, Panel A). Dramatic reductions in concentrations were observed during the third year of the experiment. Water quality also improved in the control watershed (Waites Run shown in Figure 1, Panel B). However, these data showed more year to year variability in the summer and fall than Cullers Run data (as would be expected in a non-treatment watershed) when human impacts on water quality would be expected to occur.

Finally, fulfillment of Objective 4 has not yet been completed. As will be discussed in more detail below, for relatively little funds (just over \$16,000 was distributed to farmers), this project engaged about half of the households in the watershed with over 1/3 of the agricultural land. Also, over half of the participating farmers reported changing their practices related to water quality, with three clearly visible changes made in terms of cover crops, livestock fencing from the stream and installation of a manure shed. While none of these changes demonstrate cost effectiveness, they do show a remarkable level of engagement by farmers in the watershed. Ultimately, we hope to use data from a wetland treatment system installed at the very end of the project to assess a cost on a dollar per pound of nitrogen reduction basis.

As a brief summary of the project, fourteen farmer households, representing about one-half of the watershed farm households, signed-up to participate all three years of the field experiment. These farmers rent or own approximately 36% of the agricultural land in the watershed. Only half of the participating farmers had ever participated in government conservation programs. When asked in surveys during the project, a majority of the respondents indicated financial gains and additional income from the project had low to no impact on their decision to participate. Many participants felt their participation was “the right thing to do”.

At the start of the experiment, participating farmers decided to allocate group payments as follows: (a) a \$50 signing bonus to each participant who joined prior to June 1<sup>st</sup>, 2007, (b) 10% of each monthly payment is distributed equally among all participants, and (c) the remaining 90% is reserved to financially assist farmers who engage in NO<sub>3</sub>-N abatement with cost sharing. Any funds remaining after cost-sharing were to be distributed based on a group decision.

Participating farmers showed a willingness and ability to work jointly to address the issue of NO<sub>3</sub>-N runoff. In order to appropriately problem solve, participating farmers requested more detailed water quality information. Three watershed wide samplings were conducted to detect areas within the watershed that were contributing elevated levels of NO<sub>3</sub>-N. In one sub-

watershed with a higher than average NO<sub>3</sub>-N concentration, the farmer located within that sub-watershed installed a manure shed to control runoff. Additional intensive water quality sampling done at the behest of participating farmers, and with the cooperation of non-participating farmers, pinpointed a concentrated flow path for NO<sub>3</sub>-N runoff in the lower part of the watershed where farmland is located.

The final action of this project was construction of a wetland treatment system to address this concentrated flow path for NO<sub>3</sub>-N. Initially, identification of possible source(s) of nitrates was undertaken with groundwater monitoring wells in the field adjacent to the NO<sub>3</sub>-N discharge. Groundwater quality sampling was conducted in February and March 2009. While somewhat equivocal, NO<sub>3</sub>-N results from the well closest to the stream and measured groundwater inflow to the stream indicated the presence of a subsurface flow path. A wetland treatment system was selected as a “targeted” best management practice (BMP) to investigate because of its shorter timeframe than shrub plantings and it would take a minimal area out of production (less than ¼ of an acre) on the field.

Canaan Valley Institute (CVI) was hired in July 2009 to design a wetland treatment system. The CVI engineer came up with an initial design which was modified based on discussions with and concerns of the landowner. This design called for a 0.2 acre wetland consisting of a lined, horizontal trench to be constructed parallel to the stream. The farmer group agreed to pursue a treatment wetland system as a solution to subsurface nitrate flows in August 2009. After more than two months of negotiations, the landowner (who was not a participating farmer in the project) agreed to allow construction of the wetland in October 2009. Farmer participants were instrumental in convincing the landowner to participate by both meeting with him and sending him letters.

Construction and material bids were put out in October 2009. Two bids were received and farmer group selected the lowest bid. Construction of the treatment system occurred in November 2009. A slide show of the construction is posted on the project web site. A final budget for the constructed wetland is presented below:

<u>Budget Item</u>	<u>Expense</u>
DESIGN	\$ 5,129
CONSTRUCTION OVERSIGHT	\$ 7,743
NON BID MATERIALS	\$ 3,450
LANDOWERN COMPENSATION	\$ 2,000
INSTALLATION	\$11,140
<b>TOTAL</b>	<b>\$29,462</b>

Lessons learned from this project included:

- When presented with performance-based payments, farmers decided to cost-share the bulk of these payments. This led to farmers being of great assistance in identification of problem areas within the entire watershed for NO<sub>3</sub>-N pollution and not just concerned about their own contributions.
- The decision to cost share group payments meant that the immediate financial incentives to individual farmers from water quality improvements were low, although actions resulting from cost-sharing may provide long term pay-offs. About one-half of the participants indicated that they joined for strictly non-monetary reasons.
- The payment formula utilized in our experiment employed water prices that were, in hindsight, too low because estimated water flow from Cullers Run prior to the experiment was too high. The payment formula resulted in monthly group payment calculations of \$24 and \$30 during drought conditions that occurred during the summer and fall of the first year of the experiment. Low payments were addressed in year three of the experiment by setting a minimum monthly payment at \$500.
- Farmers were willing to involve other farmers outside the participating group in water quality problem solving. Their involvement was vital in convincing a non-participating landowner to allow installation of a wetland treatment system on his land. This placement of a BMP to target a concentrated flow of groundwater NO<sub>3</sub>-N into Cullers Run was possible due to the watershed wide perspective that the farmer group took for this project.
- Farmers needed assistance in information gathering and technical solutions. This assistance was provided by project researchers and government agency personnel.
- Farmers can make water quality decisions and take action to problem solve to improve water quality. Some actions only required knowledge that the farmers already had – such as fencing and reduced litter application - that were engaged by the incentives created by this project. Other actions, such as deciding upon a wetland treatment system, required additional technical assistance and appropriate data to aid in group decision-making.
- Working as a group, farmers can put forth a solution to the concentrated NO<sub>3</sub>-N groundwater flow that would have required regulatory enforcement to solve under a command and control framework.
- Water quality experts and farmers can efficiently problem solve together. Cash incentives based on water quality turned water quality information into a tool farmers could use to make additional money, rather than a threat to their livelihood. It was this dynamic – an alignment of interests – that motivated participating farmers to cooperate with water quality experts.

This project began as a group effort to problem solve for NO<sub>3</sub>-N within a watershed. Ultimately, the project focus came down to a “single” problem area whose concentrated nitrate contribution may well have originated from dispersed landowners throughout the watershed. However, without the discovery process initiated by the group, group efforts at persuasion to the single landowner of the problem area, and a group decision to dedicate funding to this one area, no individual action would have been taken to address this “single” problem area.

Questions left unresolved at the end of this project include: Will the constructed wetland treatment system work?; Will water quality in Cullers Run be improved?; What is the system’s

cost per pound of NO<sub>3</sub>-N reduced?; and How prevalent are confined subsurface flow paths as contributors of nitrates to surface water? This last question is particularly important because it forms the basis for one way to extend this project beyond Cullers Run, i.e. by involving farmers in a watershed wide process to discover whether substantial groundwater NO<sub>3</sub>-N flows exist through extensive surface water sampling. Such a process is being planned for the Lost River watershed.

While this project has been completed, additional sampling by Cacapon Institute will continue in Cullers Run. Groundwater wells have been installed in the wetland to monitor groundwater and nitrate levels. Above and below wetland stream sampling for nitrates is planned over the next year to track any changes in water quality.

As a final note, satisfaction with the project among participating farmers was high. A project evaluation concluded that: “The research team is to be commended for providing the participants with such a high level of service, that satisfaction with the project across the board was extremely high. They (participating farmers) had a great deal of confidence in the project team and felt that the project was successful in creating awareness and was a viable means of addressing water quality issues and should be implemented in other watersheds”. A complete description of the project evaluation is in Appendix A.

## **Outcomes:**

- Over three years of the project, a total of \$16,483 was paid out in terms of performance based payments made to the farmer group. This total was much less than the \$39,750 that was budgeted in the project for farmer payments. However, the remaining funds were utilized to fund the wetland treatment system.
- Farmer participants agreed to provide \$6,288 in cost share funding for: (1) seed costs to plant cover crops on corn fields, and (2) to fence cattle out of a portion of the stream.
- Farmers utilized \$6,195 to fund a constructed wetland treatment system built to control the concentrated NO<sub>3</sub>-N groundwater flow coming from a farm field. This field was owned by a non-participating farmer who was convinced by participating farmers to allow this system on his field. This farmer was compensated for lost productivity of the field.
- Farmers paid out \$4,000 in bonus payments and equal distributions among participants.
- One farmer whose farm was located in one of largest NO<sub>3</sub>-N contributor sub-watersheds installed manure shed using NRCS cost-share assistance.
- Reported management changes among the participants included increased sale of litter outside the watershed, improved handling and application of litter, and reductions in litter application rates on agricultural land.
- Water quality improvements were observed in Cullers Run with reduced NO<sub>3</sub>-N concentrations (see Figure 1 and Table 1).

## **Publications:**

- Maille, P., A. R. Collins, and N. Gillies. 2009. “Performance-based Payments for Water Quality: Experiences from a Field Experiment.” *Water Net Resources*. Spring issue, pages 8-9, available at: [http://www.wvca.us/wvwn/wvwn\\_waternet.cfm](http://www.wvca.us/wvwn/wvwn_waternet.cfm).
- Maille, P., and A. Collins. 2009. “Farmers as Producers of Clean Water: A Field Experiment” in *Water, Agriculture and Sustainable Well-Being*, Eds. U. Pascual, A. Shah, J. Bandyopadhyay. Oxford University Press: New Delhi. Pp.93-114.
- Maille, P., and A. Collins. 2009. *Performance-Based Payments for Conservation: Experience from a Water Quality Field Test with Farmers*. VDM Verlag Dr. Muller: Saarbrucken, Germany.
- Maille, P., A. Collins, and N. Gillies. 2009. “Performance-based Payments for Water Quality: Experiences from a Field Experiment.” *Journal of Soil and Water Conservation*. 64(3):85-87.
- Maille, P. 2008. *Performance-Based Payments for Conservation: Experience from a Water Quality Field Test with Farmers*. Unpublished PhD Dissertation, West Virginia University, Morgantown, WV.

## **Manuscripts in Preparation:**

- “Group theory and behavior under performance-based water quality incentives” to be submitted to: *Ecological Economics*.
- “A Simple Approach to Calculating Performance-Based Payments for Water Quality” to be submitted to *Journal of Environment Management*.

## **Presentations and Posters:**

- “Solving Agricultural Nitrate Pollution by Conversion of Non-Point Into Point Sources”, Alan Collins and Neil Gillies, presented at the National Water Conference, Hilton Head, SC, February 24, 2010.
- “Efficiency and Watershed Payments: How will Farmers Respond?”, Peter Maille and Alan Collins, selected paper presented at the Northeast Agricultural and Resource Economics Association, Quebec City, Quebec, Canada, June 20, 2008.
- “Farmers as Producers of Clean Water: Getting Incentive Payments Right and Encouraging Farmer Participation”, Alan Collins and Peter Maille, selected paper presented at the American Agricultural Economics Association Annual Meeting, Orlando, FL, July 28, 2008.
- “Farmers as Producers of Clean Water: Getting Incentive Payments Right”, Alan Collins and Peter Maille, presented at the USDA-CSREES National Water Conference, Sparks, NV, February 5, 2008.
- “Controlling Pollution with Opportunities, not Regulations”, Peter Maille and Alan Collins, selected poster at the USDA-CSREES National Water Conference, Sparks, NV, February 3-7, 2008.
- “Farmers as Producers of Clean Water: Getting Incentive Payments Right”, Peter Maille and Alan Collins, presented at the Virginia / West Virginia Water Research Symposium, Blacksburg, VA, November 29, 2007.
- “Inducing Farmer Participation in a Watershed Level Program to Improve Water Quality”, Alan Collins, Peter Maille, and Neil Gillies, presented at the Virginia / West Virginia Water Research Symposium, Blacksburg, VA, November 29, 2007.
- “Farmers as Producers of Clean Water: Providing Economic Incentives for Reducing Agricultural Non-Point Source Pollution”, Alan R. Collins and Peter Maille, paper presented at

- USDA-CSREES National Water Conference, Savannah, GA, January 30, 2007.
- “Converting Conservation from a Threat into an Opportunity: A Demonstration of a Performance-Based Payment Approach”, Peter Maille and Alan R. Collins, paper presented at the Ninth Biennial on “Ecological Economics and Human Well-Being” International Society for Ecological Economics New Delhi, India, December 15-18, 2006.

## **Participants:**

This project had numerous participants who contributed to its success. Participants in this project are divided into how they assisted in this project.

Introductory Meetings and Farmer Recruitment: David Workman (Hardy County Extension Agent) provided support by attending and verbally supporting the project. Future Farmers of America from East Hardy H.S. provided dinners for these meetings. Ed Kesecker (NRCS District Conservationist) gave a presentation on BMP alternatives. The Mathias Ruritan Club provided a place to hold meetings. Stanly Moyer (Hardy County Commissioner) led a meeting of farmers to decide how to proceed after the project had been introduced to the farmers.

During Project: Tom Basden (Nutrient Management Specialist, WVU Cooperative Extension Service) provided technical assistance on water quality improvement practices. Gretchen Cremann (Conservation Specialist, WV Conservation Agency) reviewed surveys and materials distributed to farmers.

Construction of the Treatment Wetland: Canaan Valley Institute provided the design and construction oversight. Jared Beard, Resource Soil Scientist, and Dick Grey, District Conservationist, of the USDA, NRCS provided soil survey data and technical information.

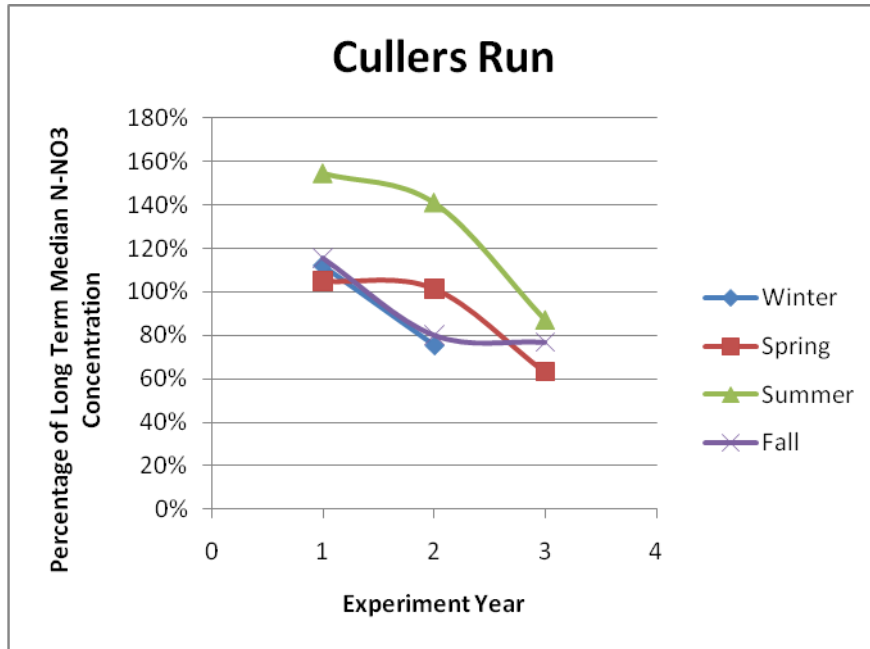
Project Evaluation: Deborah A. Boone, Ph.D., Agricultural Extension and Education program in the College of Agriculture, Natural Resources, and Design, West Virginia University.

The most important participants were the 15 farmers and farm families who took a chance and participated during this project. Most notable was the role played by the informally recognized leader of the group, Mr. Ernie Drake. Through his perseverance and leadership, Ernie had the confidence of the other farmers required to keep the project moving forward.

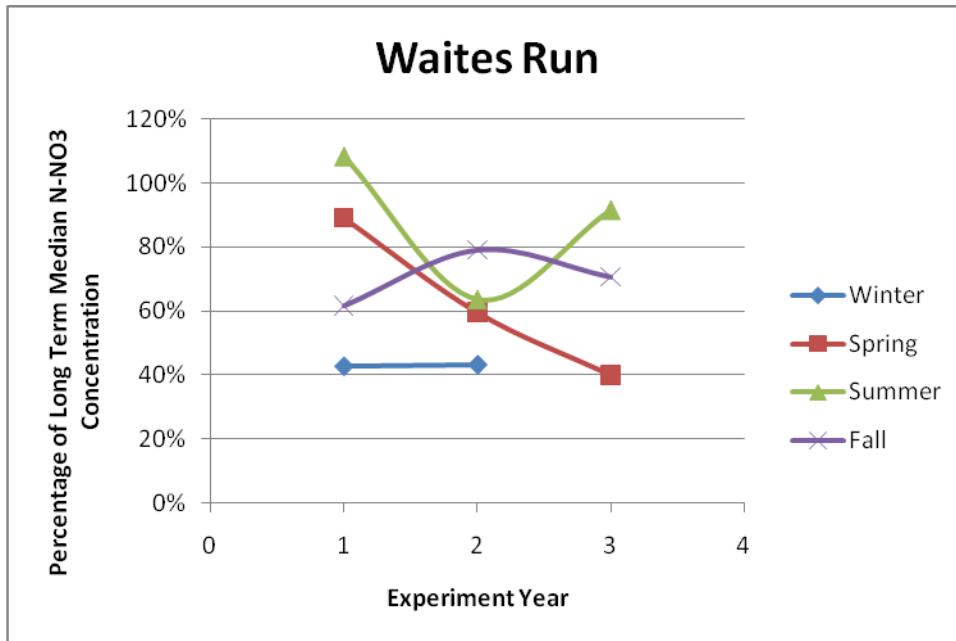
## **Target Audiences:**

Audiences targeted for this research project included: environmental and agricultural economists, state agency personnel dealing with water quality, and farmers plus farm organizations. As part of this project, presentations have been made at the national water conference and annual meetings of agricultural economists. Meetings have been held with state agency personnel from the Department of Environmental Protection and the Conservation Agency in West Virginia to inform them about this project and its progress. For the local community, a presentation about the results of this project was made to the Mathias Ruritan Club in June 2009. Our goal for continuation of this project is to extend the Cullers Run watershed project to a similar type of watershed wide process for the entire Lost River watershed. This process would involve farmers, working as a group, to identify sources of NO<sub>3</sub>-N that could be addressed with targeted BMPs.





Panel A



Panel B

Figure 1. Percentage changes in seasonal average NO<sub>3</sub>-N concentrations relative to the long term median concentration (data from 1997 to 2007).

Table 1. Seasonal average water quality data for Cullers and Waites Run watersheds, data measured prior to (1997 through 2007 for the long term median) and during the experiment.

	Cullers Run				Waites Run <sup>a</sup>			
	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall
	NO3-N mg/liter							
Long term median	1.61	1.25	1.52	1.80	0.20	0.18	0.10	0.09
Experiment Data								
Year One	1.81	1.31	2.35	2.08	0.09	0.16	0.11	0.06
Year Two	1.21	1.27	2.15	1.44	0.09	0.10	0.06	0.07
Year Three		0.79	1.33	1.38		0.07	0.09	0.07

<sup>a</sup> Used as a control watershed in this experiment

## **Appendix A**

### **Farmers as Producers of Clean Water in Cullers Run Watershed: A Look at Group Organization Comprehensive Report Prepared by Deborah A. Boone, Ph.D.**

The Cullers Run Watershed located in a rural Appalachian Mountain region of West Virginia was used as an experimental area to examine farmers' willingness and ability to respond to performance-based conservation payments. Initially, five meetings were held to present the field experiment to the farmers in the experimental watershed. Each of the meetings was attended by 20 - 30 people representing a substantial portion of farmer households in the watershed. Local, state, and federal government agency personnel, including the county extension agent were invited to the meetings. The meetings were used to describe the field test of providing financial incentives to farmers on a monthly basis for a period of two years (later increased to three) to those who chose to participate, based on water quantity and quality flowing from the watershed (Maille and Collins 2009).

The project utilized a team approach to decision making, allowing decisions to be made from within the group of farmers who volunteered to participate in the project. Fifteen farmers (50%) in the watershed chose to participate in the project, representing about 36% of the agricultural land in the watershed. Joining the group (signing a contract) did not obligate participants to implement any best management practices. The research project personnel provided support and information to the participant farmers. A loose organizational structure with facilitation provided by the project team was utilized in the Cullers Run Watershed project. Performance based payments were made to "The Group" as an entity with the initial participants determining how the monthly payments would be distributed to the participants. Although funding decisions were made and approved by "The Group", the allocation rules were presented to the project investigators who were responsible for funds distribution (Collins, Maille and Gillies, 2007).

#### **Purpose of the Evaluation:**

The purpose of this evaluation was to look at the farmer participants' satisfaction with the organization of the project from recruitment to outcomes. Specific topics explored included:

- Satisfaction with project recruitment and participation.
- Factors that impacted farmers' decision to participate.
- Participants' perceptions of what the primary goal of the watershed project was and whether or not they felt that goal had been achieved.
- Satisfaction with project outcomes and distribution of funds.
- Participants' perceptions of project leadership and trust of the research staff.

- Participants' perceptions of effectiveness of the organizational structure utilized in the project and viability for other projects where farmers would set the structure for funding and self monitoring of the group.

## **Method:**

An individual who was not a part of the research project was contracted to conduct an evaluation of the program farmer participants' perceptions of the organizational structure utilized for the project and the project outcomes. A mailed questionnaire was sent to the 15 farmers involved in the project, a \$25.00 gift certificate to a local market was sent to all survey respondents. Eleven surveys were returned for a 73% response rate. Through discussions with the project coordinator it was determined those surveys not returned were ones sent to absentee landowners who do not live in the area and did not actively participate in group meetings. Surveys were returned from all active participants in the group meetings.

Survey data were entered into an Excel spreadsheet and analyzed using SPSS, descriptive statistics were run. Qualitative responses were recorded and analyzed.

## **Results:**

### Satisfaction with Project Recruitment and Participation

All of the respondents (100%) were in some level of agreement with the statement, "I am glad I decided to participate in the Cullers Run Watershed Project," with seven (63.6%) who strongly agreed. Although all of the respondents (100%) expressed some level of agreement with the statement "I would participate in a project of this type again," four (44.4%) strongly agreed, while four (44.4%) agreed. All of the respondents were in some level of agreement with the statements, "I have been encouraged to openly express my opinions about the project," and "everyone has been given the opportunity to express their opinions" with seven respondents (63.6%) indicated they strongly agree. When asked to indicate their level of agreement with the statement, "I felt my opinions were always considered," six (54.5%) strongly agreed, one (9.1%) moderately agreed and four (36.4%) agreed (see Table 1). The responses were confirmed when the respondents were asked in an open ended statement, "Given what you know now, would you still participate in this project? Why or why not?" 100% of the respondents indicated "yes" they would still have participated. Some of the responses given included: "at least we tried to do something," "It was informative," and "It helped me see some of the underlying problems with field run off that was not visually obvious".

All of the respondents (100%) indicated some level of agreement that they were able to get their questions answered and they were provided all the necessary information at the beginning of the project. Although 100 % of the respondents were in some level of agreement with the statement, "I got along with all other group participants in this watershed project," 27.3% expressed moderate to strong agreement (see Table 1). When asked if the group worked well together, 100% were in agreement, with 54.6% expressing moderate to strong agreement.

When asked to respond to the statement, “I felt the group met more than necessary,” the response was divided, with two (20%) strongly or moderately disagreeing, six (60%) disagreeing, one (10%) agreeing and one (10%) strongly agreeing. When asked if “the meetings were informational,” one (9.1%) moderately disagreed, four (36.4%) agreed and six (54.6%) moderately to strongly agreed.

All of the respondents (100%) indicated some level of agreement that the “decisions made by the group were fair,” six (54.5%) agreed while five (45.5) moderately to strongly agreed. When asked to respond to “participation in the project was easy,” 100% of the respondents were in some level of agreement with the statement, with 72.7% in strong agreement.

One hundred percent of the respondents were in some level of agreement with the statement, “participating in this project has made me feel “better off” overall.” Three (27.3%), however were in strong agreement, while four each agreed (36.4%) or moderately agreed (36.4%) with the statement.

Although 100% of the participants were in agreement with the statement, “recruitment for project participation was appropriate,” four each moderately agreed (36.4%) and strongly agreed (36.4%) while three agreed (27.3%). When asked in an open ended question “how effective were the recruitment efforts in involving key farmers along Cullers Run” responses indicated there may have been room for improvement of recruitment efforts. Responses ranged from: “all was invited to participate”, to “Not sure”. Some were hesitant to participate in the beginning for various reasons; most reasons were not valid in my opinion.” Others included, “We should have approached ALL farmers early on,” “Good, would have liked to have had a couple other farmers on team that did not participate,” “I think the incentives really helped recruitment; however there are people who don’t want to be restricted in any way by anyone, much less their neighbor.” One other comment was:

“We should have been more explicit early on to identify who is in the watershed, & meet with those not coming to meetings to encourage them to join, or to report to them on our projects-especially those who could not come because of work conflicts. I'm not sure we really opened up to all members who might have wished to present proposals-it all happened fast.”

When asked if they regularly attended meetings, six (66.7%) responded “yes” while three (33.3%) indicated “no”. Comments on why they did or did not regularly attend included: “I didn't get to attend many meetings because of health conditions,” “free meal,” “To keep abreast on the project”, “too far to travel”, “nonresident owner/farmer,” and “Thought I could help to bring about a change behavior for participants”.

#### Factors that Impacted Farmers’ Decision to Participate

Respondents were asked to indicate the level of impact various factors and individuals had on them joining the project. Of the individuals who responded 100% (9) indicated that “It was the right thing to do” and “Keeping informed about what is going on” both had a high impact on them joining the project. The “Project Team (Collins, Gillies, Maille)” had a high impact on five (62.5%) of the respondents, medium impact on two (25%) and low impact on one

(12.5%) of the respondents. Neighbors had varying degrees of impact from high impact for three (37.5%), medium impact on one (12.5%), low impact on one (12.5%) and no impact on three (37.5%).

Family members had no impact on three (42.9%) of the respondents, medium impact on two (28.6) and high impact on two (28.6) in joining the project. Other landowners who joined the project were reported to have medium impact on three (50%) respondents, low impact on one (16.7%) and no impact on two (33.3%) others joining the project.

The County Commissioner and County Extension Agent each had no impact on five (83.3%) respondents and low impact on one (16.7%) respondent in deciding to join the project. Money was reported as having no impact on five (71.4%) respondents joining the project and low impact on two (28.6%). Although respondents indicated money had low to no impact on their decision to participate in the project, when asked if “the funding was a primary incentive for me to participate,” the respondents were split with five (45.5%) indicating some level of agreement that funding was a primary incentive for participating with three (27.3%) agreeing and with two (18.2%) moderately to strongly agreeing. While six (54.6%) respondents indicated some level of disagreement, with four (36.4%) strongly disagreeing that funding was a primary incentive for them joining the project. When asked if “the project offered an additional income source for my farming operation,” 100% of the respondents had some level of disagreement that the funding was an additional source of income, with four each disagreeing (40%) or strongly disagreeing (40%) and two (20%) moderately disagreeing.

When asked in an open-ended statement “Why did you decide to participate in this project?” responses included, “Dr. Alan Collins presented the information very clearly,” “I was interested in water quality,” “was asked too!”, and “believe strongly in my responsibility to collaborate with neighbors in protecting our shared natural resources”.

### Participants’ Perceptions of what the Primary Goal of the Watershed Project was and

#### Goal Achievement

Participants were asked: “What do you feel was the primary goal of the watershed project? Do you feel this goal was achieved?” Participant perceptions of the primary goal of this project was “to improve water quality in Culler Run by determining sources of nitrogen entering the stream” and “reduce nitrates in the watershed”. When asked to respond to the statement, “I feel the watershed project has met its goal,” eight (72.8%) respondents had some level of agreement, with four (36.4%) expressing strong to moderate agreement and four (36.4%) who agreed. While three (27.3%) disagreed or moderately disagreed (see Table 4). However, when asked in an open ended question, “Do you feel this goal was achieved”, three responded “yes”, four “no” and two “probably”. Comments included “goal has not been achieved to date,” “Still in process,” “I feel like public awareness was greatly increased and a universal source was located,” and “this goal will not be achieved unless Wilkins agrees to establishment of a wet land on the edge of his field.”

Ninety percent (10) of the respondents were in some level of agreement with the statement, “This group has been able to do things that an individual could not have accomplished

alone,” with six (54.5%) who strongly agreed, one (9.1%) who moderately agreed and three (27.3%) agreed, while one respondent (9.1%) disagreed.

### Satisfaction with Project Outcomes and Distribution of Funds

All of the respondents (100%) were in some level of agreement with the statements, “I am satisfied with how the group funding decisions were made,” with five (45.5%) strongly agreeing and five (45.5%) agreeing. Although all of the respondents were in agreement with the statement “the payment formula is fair to all participants,” four each agreed (36.4%), and moderately agreed (36.4%) while three (27.3%) strongly agreed. However, when asked “I am satisfied with how group funds have been distributed,” one respondent (9.1%) disagreed, while the other ten respondents (91%) were in some level of agreement, four (36.4%) moderately agreed while three (27.3%) each agreed and strongly agreed (27.3%).

All respondents (100%) had some level of agreement with the statement, “the program has been highly effective in increasing awareness of water quality issues,” with five each strongly agreeing (45.5%) and agreeing (45.5%), while one (9.1%) moderately agrees.

One hundred percent of the respondents had some level of agreement with the statement, “the project addressed a water quality problem in Cullers Run,” six (54.5%) strongly agreed. Seven (63.6%) agreed with the statement “I have talked about this project with friends and family outside of project meetings,” while three (27.3%) strongly agreed. In response to the statement, “I am satisfied with the method of distributing payments,” five (45.5%) strongly agreed, two (18.2%) moderately agreed and four agreed (36.4%).

A majority of the respondents (91%) had some level of agreement with the following statement, “I feel that I better understand water quality reports,” five (45.5%) agree, one (9.1%) moderately agrees and four (36.4%) strongly agree, while one (9.1%) disagrees. The responses to “I feel better prepared to evaluate sources of water quality,” indicated five agree (45.5%), two (18.2%) moderately agree, three (27.3%) strongly agree and one respondent (9.1%) disagreed that they were better prepared to evaluate sources of water quality. One respondent (9.1%) disagreed with the statement “participating in this project made me feel responsible for water quality in Cullers Run,” while five (45.5%) strongly agreed, two (18.2%) moderately agreed and three (27.3%) agreed. One respondent (9.1%) strongly disagreed with the statement, “my attitude toward water quality information has improved since participating in this study.” Six respondents (54.5%) agreed with the statement and four (36.4%) moderately or strongly agreed that their attitude toward water quality information had improved.

Three of the respondents (27.3%) disagreed with the statement, “cost share funding was used to “fix” the problem, while six (45.5%) agreed and three (27.3%) moderately to strongly agreed with the statement. When asked to indicate their level of agreement with the statement, “I have changed my farming practices because of the project,” three (30%) disagreed or strongly disagreed, while four (40%) agreed and three (30%) moderately to strongly agreed with the statement.

The statement, “paying farmers for water quality as a group is better than paying them individually” had three respondents (27.3%) who disagreed, three (27.3%) who agreed, one (9.1%) who moderately agreed and four (36.4%) who strongly agreed. A majority of the

respondents (90%) had some level of agreement with the statement, “with group payments, participants will “keep an eye on” on others’ farming practices,” seven (70%) strongly to moderately agreed, two (20%) agreed, while one respondent (10%) disagreed.

A majority of the respondents (77.8%) had some level of disagreement with the statement, “my farming practices affect the payment level to the entire group,” six (66.7%) disagreed; one (11.1) strongly disagreed, while two respondents (22.2%) agreed or strongly agreed with the statement. A majority of the respondents disagreed (20%) or strongly disagreed (40%) with the statement, “this project made me worry about what others might say concerning the impact of my farming on water quality.” Three respondents (30%) agreed and one (10%) moderately agreed with the statement.

When asked if they were satisfied with the progress made by the group on the Cullers Run Watershed project, six indicated “yes” and one responded “no”. Comments included: “I think the group made wise decisions and the members truly interested in improving water quality worked hard,” “I feel like more needs to be done, but the educating of the group as to the problems and the posting of stream testing has led to positive changes,” and “we will not have final reduction until we receive results from Wilkins project.”

When asked about how satisfied they were with economic incentives provided to participants, comments included “No problem with me. But a neighbor, nonparticipant said he would sign up for \$5000.00. I assume he saw the size of the total grant.” “I was little disappointed.” “Economic incentives were very fair,” and “The way the money was pooled for cost-share was good, but it provided less economic incentives for me”.

Respondents differed on how much they felt the project had impacted the water quality on Cullers Run. Seventy percent (7 respondents) indicated “somewhat,” while one each (10%) responded “Don’t know”, “Not at all” and “A lot”. A majority of the respondents (62.5%) indicated there was never a time when they questioned the distribution of cost share funds, while three (37.5%) indicated yes there was a time when they questioned the distribution. Comments that questioned the distribution were related to one cost share project funded by the farmer group whose implementation did not take place right away, but took over one year to put in place.

#### Participants’ Perceptions of Project Leadership and Trust of the Research Staff

Response to the statement, “from my observations, a leader emerged from within the group,” 100% had some level of agreement, four (40%) agreed, while 60% moderately to strongly agreed. However, when responding to the statement, “I took a leadership role in the group,” one (11.1%) agreed, two (22.2%) agreed, while four (44.4%) disagreed and 2 (22.2%) moderately to strongly disagreed. When asked to respond to the statement, “I was never sure who to approach with questions,” four (40%) disagreed, four (40%) strongly disagreed, while one each moderately (10%) to strongly agreed (10%). All of the respondents (100%) had some level of agreement with the statement, “I judge the project team (Collins, Gillies & Maille) to be trustworthy, with eight (72.7%) indicating strong agreement.

When asked who they perceived to be the leader of the project, eight indicated Ernie Drake, six Alan Collins, three Neil Gillies, two Peter Maille and one Judy Fansler. When asked who they went to when they had questions about the watershed project, five went to Dr. Collins



and Ernie Drake respectively, one each to Ernie Drake and Peter Maille, while one respondent commented, “I mainly attended meetings and asked questions there of Neil, Peter or Dr. Collins, I also asked Ernie Drake some questions. All of the respondents never felt they were not getting honest answers to their questions.

When asked “Did you feel the group had a leader?” 100% who responded to the statement indicated yes, but when asked to name the leader, five listed Ernie Drake, one listed Neil Gilles, one listed Dr. Collins and one stated, clearly Alan and then Ernie. All of the respondents felt the person they saw as the group leader was the right person to represent their group.

Respondents were asked to indicate their level of confidence in the individuals in providing accurate information on the Cullers Run Watershed Project. When considering their confidence in accuracy of information from Dr. Alan Collins, six (54.5%) of the respondents, had a great deal of confidence, four (36.4%) were confident and one (9.1%) was somewhat confident. With regard to confidence in accuracy of information from Neil Gillies eight (72.7%) had a great deal of confidence, 1 (9.1%) was confident and two (18.2%) were somewhat confident. Seven (63.6%) had a great deal of confidence in Peter Maille, three (27.3%) were confident and one (9.1%) was somewhat confident in the accuracy of information he provided. Of those who listed specific group members four (80%) had a great deal of confidence in Ernie Drake and one (20%) indicated confidence in Judy Fansler.

Comments on the confidence of the accuracy of information provided were very positive and included the following statements such as, “Well organized and run. Everyone had input. If someone did not understand an item, answers were given. Some of the information received was very technical and difficult to understand.” “Ernie Drake played a key role and did it very well – he has /had all our trust.” and “I think Ernie emerged as a group leader. Although not diplomatic, he does get to the heart of an issue and gets business done in a timely manner”.

Dr. Alan Collins, Neil Gillies, Ernie Drake and the group members were all perceived to be “very important” to facilitation of the project. Peter Maille was perceived to have “significant” role in project facilitation. Two specific group members were viewed as of “medium importance” in facilitation of the project, while the County Extension agent was rated as “somewhat important”. The County Commissioners were viewed to be “not important” in facilitating the project. Respondents indicate they were “very satisfied” with the role that Dr. Alan Collins, Neil Gillies and Peter Maille, took in the watershed project.

#### Participants’ Perceptions of Organizational Structure and Viability for Other Projects

Respondents all (100%) had some level of agreement with the statements, “I was kept well informed of what was going on in the project,” “the project offers an alternative to water quality regulation in agriculture,” and “I think this type of project organization could be successful if applied in other watersheds.” The respondents were also all (100%) in some level of agreement that “paying farmers based on water quality and quantity is good way to address the water quality problems,” and “I would recommend this type of group project for other government programs,” with six (54.5%) indicating strong agreement with both statements.

All of the respondents (100%) indicated some agreement with the statement, “this project had a process in place to offer ideas and suggestions,” with seven agreeing (63.6%) and four (36.4%) expressing moderate to strong agreement. One respondent (9.1%) disagreed with the statement “this project showed me that farmers can work together to improve water quality,” while the majority had some level of agreement, where three (27.3%) agreed, three (27.3%) moderately agreed and four (36.4%) strongly agreed with the statement.

Response to the statement, “I would recommend that more direction be given on how the group should organize,” varied greatly. One respondent (10%) strongly disagreed, five (50%) disagreed, two (20%) agreed, one moderately agreed (10%) and one (10%) strongly agreed. When asked in an open-ended question, “How would you describe the structure of group organization during the project?” responses included: “loosely structured,” “very workable,” “voluntary. We began to manage our affairs more,” “quite loosely,” “good-fair to everyone,” “It started out quite formal with a lot of guidance, then phased into an informal group led effort”.

When asked “Did the group’s organizational structure change over time,” five (62.5%) replied “no,” while three (37.5%) responded “yes.” Explanations given were, “We began to manage our own affairs more,” and “it seemed that project became narrowed down to a handful of people that made decisions and felt the project was worthwhile”.

## **Conclusions and Recommendations:**

Based upon the input from those actively involved in the process, the methods used by the project team and developed by participant members, the project appears to have been very successful. The participants were overwhelmingly in agreement that they were glad they participated in the Culler’s Run Watershed project and that they would participate again should the opportunity arise. One of the respondents indicated participation, “helped me see some of the underlying problems with field run off that was not visually obvious.”

Participants were satisfied that their input was encouraged and felt their opinions were taken into consideration. Overall, the participants indicated that decisions made by the group were fair and felt that the group worked well together.

Areas to look at that might increase satisfaction is the number of meetings held and making sure meetings were informational to the lay people and not too technical in nature. Another area to consider improvements would be in the area of recruitment. Although all of the respondents were in some level of agreement that recruitment efforts were appropriate, comments on effectiveness indicate room for improvement, with comments such as, “we should have approached ALL farmers early on,” and “we should have been more explicit early on to identify who is in the watershed and meet with those not coming to meetings to encourage them to join, or to report to them on our projects.” Comments imply that the participants may wish they had taken a more active role in recruiting other farmers and that the pace with which things occurred may have also been a hindrance. They do commend the project team for their efforts and acknowledge that behavior is hard to change and that “there are people who don’t want to be restricted in any way by any one much less their neighbor.” Getting buy in by all is critical to the success of the project, particularly those who may have the greatest impact on water quality.

The factors that had the most impact on the decision to participate were, “it was the right thing to do,” and “keeping informed about what was going on.” Although a majority of the respondents indicated the money had low to no impact on their decision to participate, slightly half of the respondents indicated funding was indeed a primary incentive for them to participate. Although the majority did not perceive the project funds to be an additional source of income, the financial incentives did play a role in participation, although not significant. Comments indicate that having the information presented clearly, being asked and interest in water quality were contributing factors to participation.

The respondents’ perception of the primary goal of the project was to improve water quality in Cullers Run by determining sources of nitrogen entering the stream. While the majority indicated some level of agreement that the project has met its goal, when asked in an open-ended question if they felt the goal had been achieved, the responses indicated some variation, with the group divided between, yes, no and probably. Comments suggest that the goal has not been achieved to date, but is still in process and will not be met until a wetland is established on a non-participants farm. However, they do feel the project has created public awareness of the issue and that a source has been identified. A majority of the participants do feel that the group has been able to do something an individual could not accomplish alone.

All of the respondents had some level of agreement that they were satisfied with how group funding decisions were made and that the payment funding formula was fair to all participants. However, when asked if they were satisfied with how group funds were distributed, there was some disagreement. The disagreement appears to focus on the fact that one participant was paid in advance for a project that had not yet been completed and some felt it was “a little questionable.” Overall, participants appeared satisfied with the economic incentives provided to participants, but questioned that everyone received basically the same monthly pay regardless of their participation in the project.

The respondents were all in agreement that the program had been highly effective in increasing awareness of water quality issues and addressed water quality issues in Cullers Run, indicating they had shared information with friends and family about the project. The majority agreed their attitude toward water quality information had improved and they felt better prepared to evaluate sources of water quality as a result of their participation.

Participant response was divided on whether or not cost share funding was used to fix the problem and if paying farmers for water quality as a group was better than paying individuals. However, a majority agreed that with group payments, participants will “keep an eye” on others’ farming practices.

The project team of Collins, Gillies and Maille were judged to be trustworthy, very important to the facilitation of the project and the participants had a great deal of confidence in the information they provided. The participants were also very satisfied with the role each team member took in the project. The respondents indicated that the project was well run and everyone had input, however some of the information was very technical and difficult to understand.

According to a majority of the participants, Ernie Drake emerged as the leader from within “The Group.” A majority of the members expressed a great deal of confidence in Ernie Drake, stating “Ernie Drake played a key role and did it very well-he has/had all our trust.”

All of the participants indicated that they were kept well informed of what was going on in the project. The responses indicate that all of the participants feel that this type of project is a good way to address water quality problems and could be successful if applied in other watersheds, as it offers an alternative to water quality regulation in agriculture. The majority indicated that the project showed them farmers can work together to improve water quality.

The process appeared to be very loosely structured, while providing a process for offering ideas and suggestions. The respondents are divided on whether or not more direction should be given on how the group should organize, recognizing they started out quite formal with a lot of guidance and phased into a more informal group led effort. They began to manage their own affairs, but seemed narrowed down to a handful that made decisions and felt the project was worthwhile.

It is recommended that for future projects of this type that the following be considered:

- A process is established to create a smoother transition from team lead to group lead.
- Information is presented in layman’s terms and not too technical.
- Reduce the number of meetings held, or increase informational nature of meetings to make them more attractive to members.
- Recruitment efforts be expanded to involved interested farmers to identify and help recruit farmers in the watershed.
- Should distribution of economic incentives include those who are not actively participating in the project?
- A process needs to be established of keeping those who are unable to attend meetings more involved in the process and informed of decisions in a timely manner.

The research team is to be commended for providing the participants with such a high level of service, that satisfaction with the project across the board was extremely high. They had a great deal of confidence in the project team and felt that the project was successful in creating awareness and was a viable means of addressing water quality issues and should be implemented in other watersheds. The most significant change one could recommend is a transition from team lead to group lead, with the possibility of making the group lead process a little more formal, so there would be no confusion as to who to go to with questions and suggestions.

## References:

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