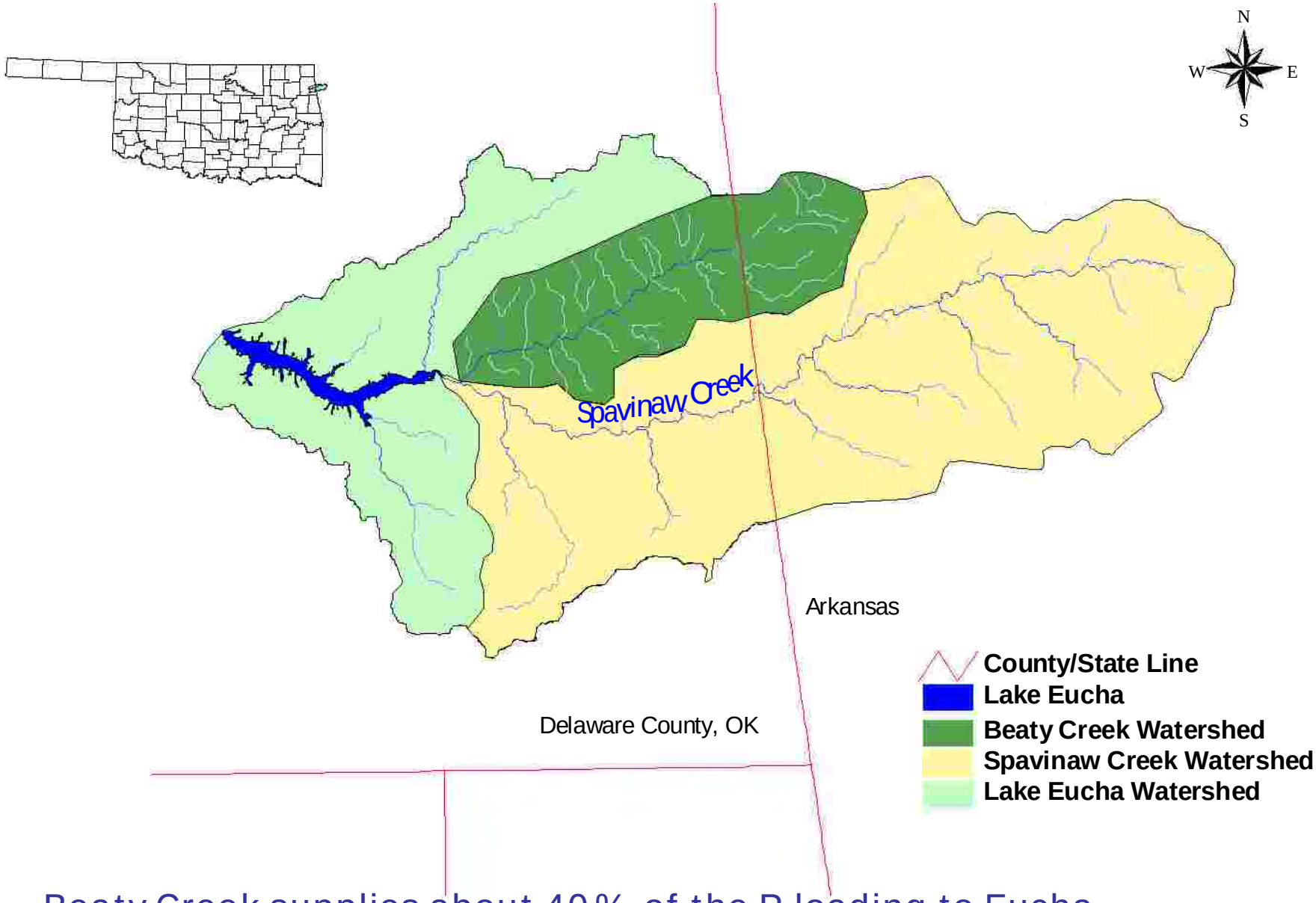
Eucha Lake Watershed Implementation Project: Beaty Creek Watershed

Oklahoma Conservation Commission

Water Quality Programs

Project Background

- 1998 319 CWA Funding nearly doubled nationwide.
- Oklahoma decided to focus 319 money into priority watersheds
- Lake Eucha was the #1 Priority for the State
  - OCC chose the Beaty Creek Watershed because it was affected entirely by NPS pollution and because Beaty Creek had the highest per unit area loading contribution to the lake.



Beaty Creek supplies about 40% of the P loading to Eucha, Spavinaw Creek supplies about 45% of the load. Beaty Creek Watershed is about half the size of the Spavinaw Creek Watershed

Oklahoma Conservation Commission

Water Quality Problems

- Nutrients-
  - Eucha Lake and Spavinaw Creek Listed on 1998 303(d) list for nutrients
  - Eucha Lake is listed on the 2002 Integrated Report for phosphorus and low dissolved oxygen
  - 1997 OCC Clean Lakes Study determined lake was impacted by excessive phosphorus loading
- Bacteria
  - Beaty Creek listed on the 2002 Integrated Report for bacteria
- Sediment/Gravel

Eucha Lake (Beaty Creek) Watershed Implementation Project

- Objectives:
  - To demonstrate the benefits of proper animal waste application on the water resources of the Lake Eucha Watershed
- Funding:
  - 1998- $1,032,663
  - 1999- $482,337
  - 2000- $333,333
  - Total- $1,848,333

Project Overview:

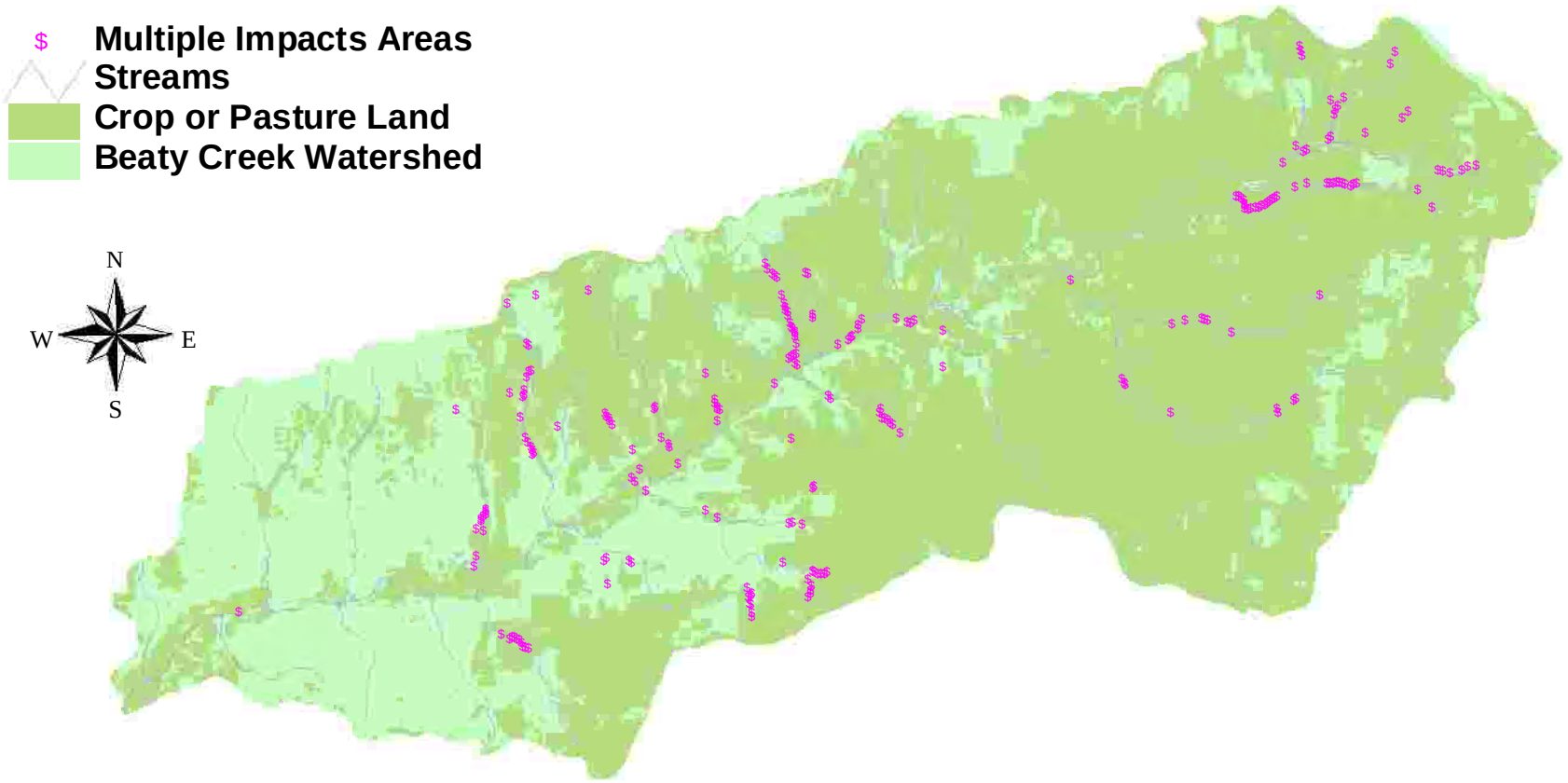
- Worked through Delaware County Conservation District and with local NRCS
  - Worked with Benton County CD in AR
- Hired On-Site Coordinator and a Conservation Technician
- Assembled a local Watershed Advisory Group

Watershed Advisory Group (WAG)

- Made up of local interests in the watershed (cattlemen, poultry growers, homeowners, etc. from both OK & AR- also included Mayor of Tulsa, and minority and nonprofit group representatives)
- Purpose is to recommend BMPs and cost-share rates to offer in the project and reviewing plans and agreements written as part of the project.

“Targeting”

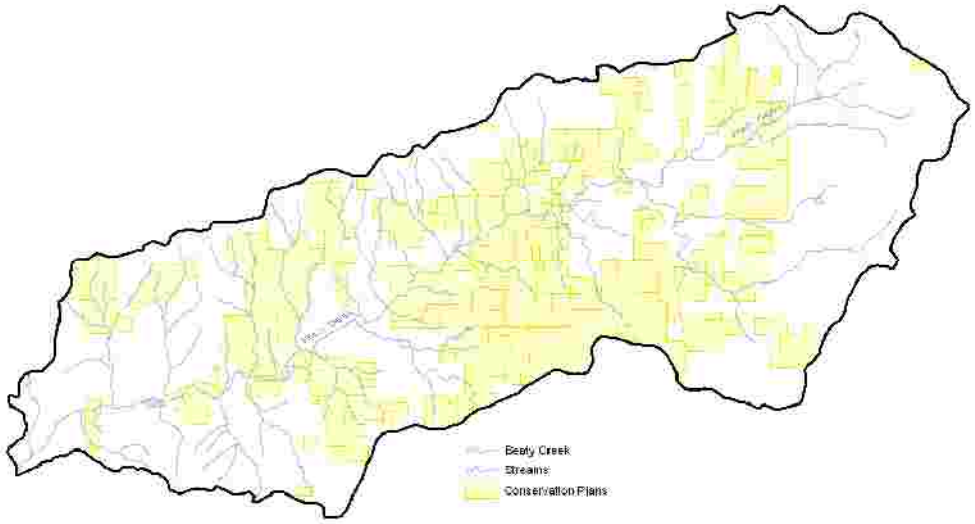
Multiple Impacts to Riparian Zone



Practices and Cost-Share Rates Offered:

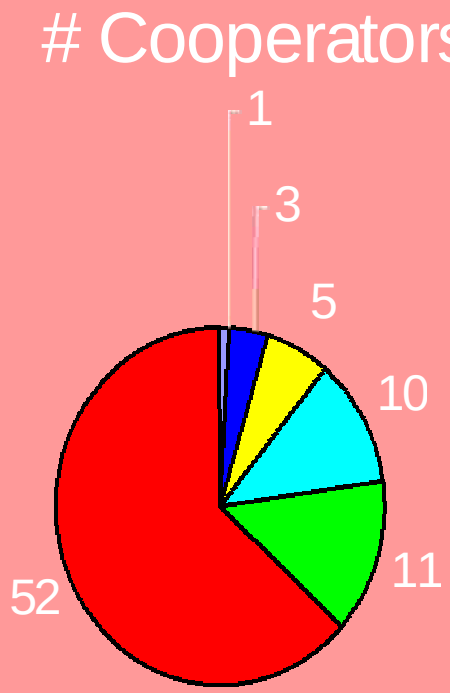
- Riparian Area Management- 90%
- Buffer/Filter Strip Establishment- 80%
- Streambank Stabilization- 80%
- Composters/Animal Waste Storage Facilities- 50%
- Pasture Establishment / Management- 75%
- Proper Waste Utilization- $.06, $.08, $.15 per pound to use litter on farm, elsewhere in watershed, or outside of watershed
- Heavy Use Areas- 80%
- Rural Waste Systems- 80%

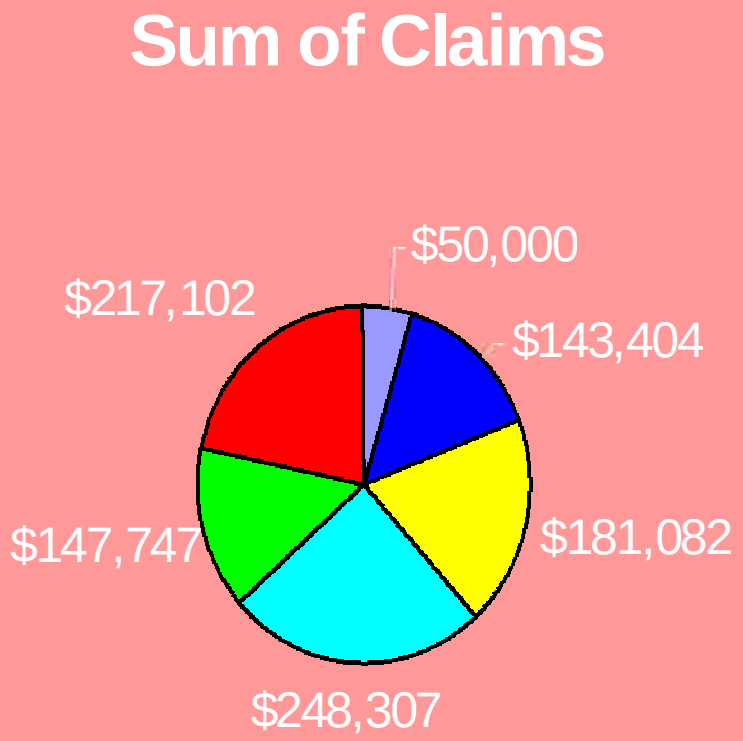
Project Results:



- 89 contracts written- 71 in OK; 18 in AR
- $1,042,415 federal and state dollars invested in BMPs
  - Cooperators share (29%) $426,311
  - Total funds expended- $1,468,727
- Average Contract $12,850

Agreement Amounts





Riparian and Buffer Areas

- Total Exclusion- 93 ac.- $18,720
- Hay Production- 18 ac.- $3,285
- Limited Grazing- 219.5 ac.- $22,385
- Grass Planting- $226
- Off-site watering- $124,241
  - 14 wells, 3 ponds, 17 freeze proof tanks & pipeline
- Filter Strip Incentive payments- 5 ac.- $450
- Fencing- 9.4 miles $68,222
- Total of 28 landowners, 335.5 ac. and $238,110

Animal Waste Storage Facilities- Litter Cakeout and Cleanout

- 4 facilities constructed- 4 landowners
- $33,544 federal
- $36, 575 landowner
- $70,119 total

Pasture Establishment/Management

- Pasture Planting- 1,683 ac.- $218,192
- Prescribed Grazing & Nutrient Management- 7,135 ac.- $132,730
- Cross Fencing- 27 miles $152,876
  - Pond excavation- 25 ponds $48,628
  - Freeze-proof tanks- 101 tanks $140,027
- Windbreaks/Shade for cattle- 3- $10,811
- Total- 72 landowners, $703,264

Proper Waste Utilization*

- Litter produced and used on farm- 70,471 lbs P- $4,654
- Litter used somewhere else in watershed- 337,004 lbs. P- $37,013
- Litter applied outside of watershed- 27,823 lbs. P- $3,576
- Total: Properly applied 465,045 lbs. of P; $48,613- 16 landowners

* Only offered the first few years of program (until State reg.s took effect)

Septic Systems

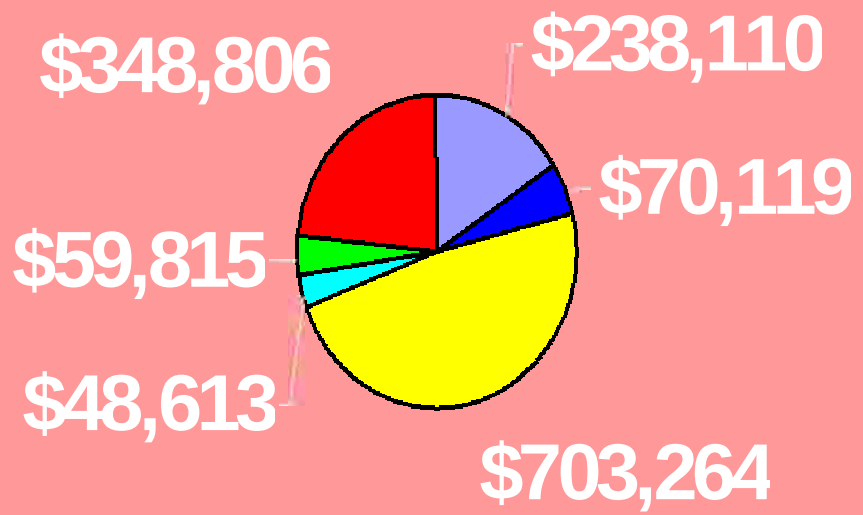
- Replaced 25 inadequate tanks and/or lateral fields

- $59,815

Heavy Use Areas/Cattle Feeding Facilities and Waste Storage

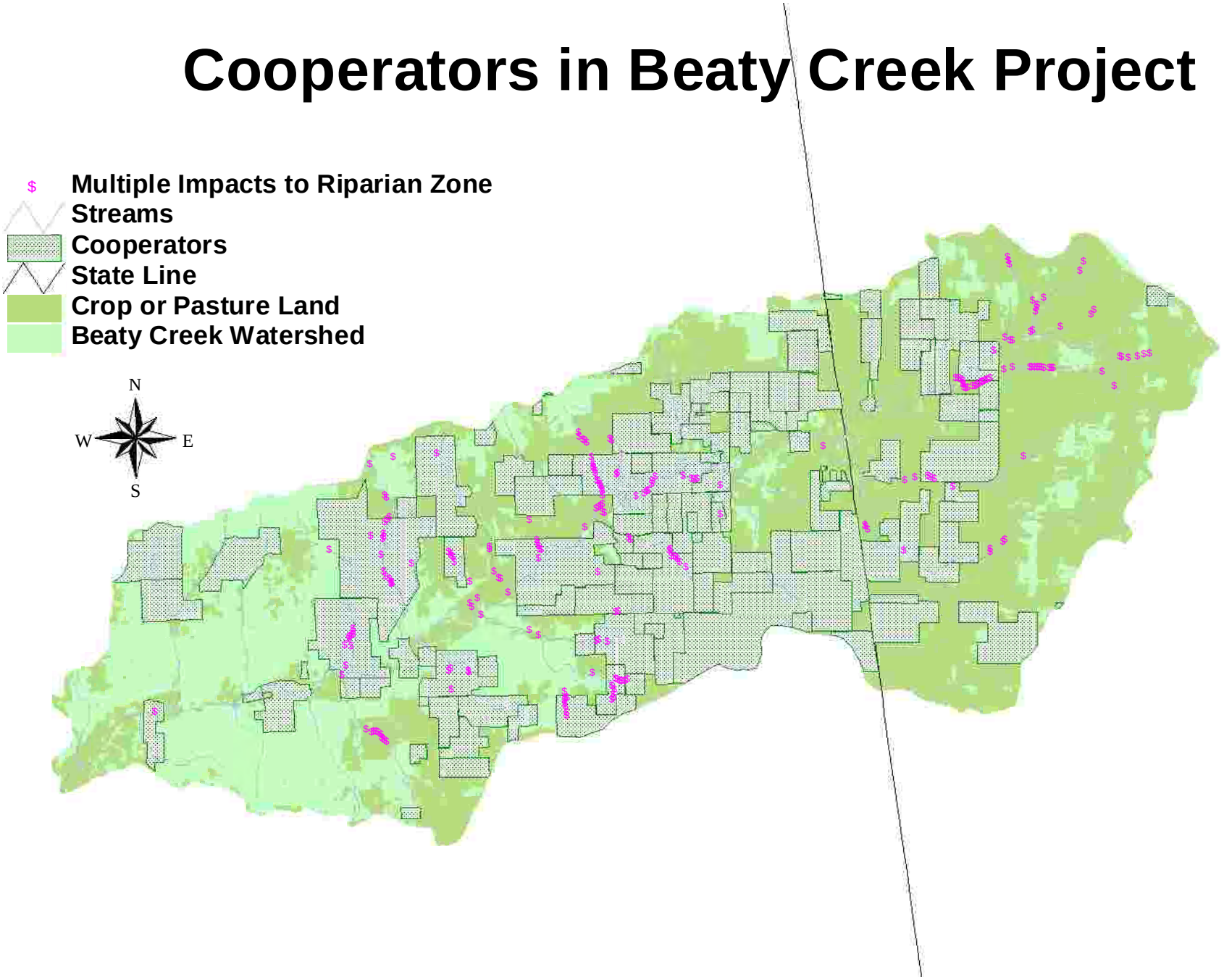
- 45 Areas- Heavy Use Areas
  - $157,023
- 14 Waste Storage/Cattle Feeding Facilities
  - $191,783

Implementation Funding Summary



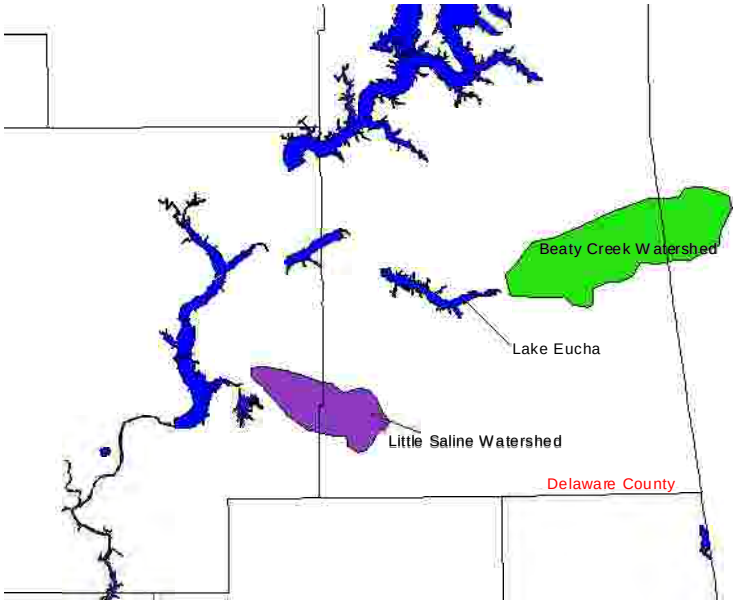
- Riparian/Buffer Area
- Litter Storage Sheds
- Pasture Management
- Proper Waste Utilization
- Septic Systems
- Heavy Use Areas

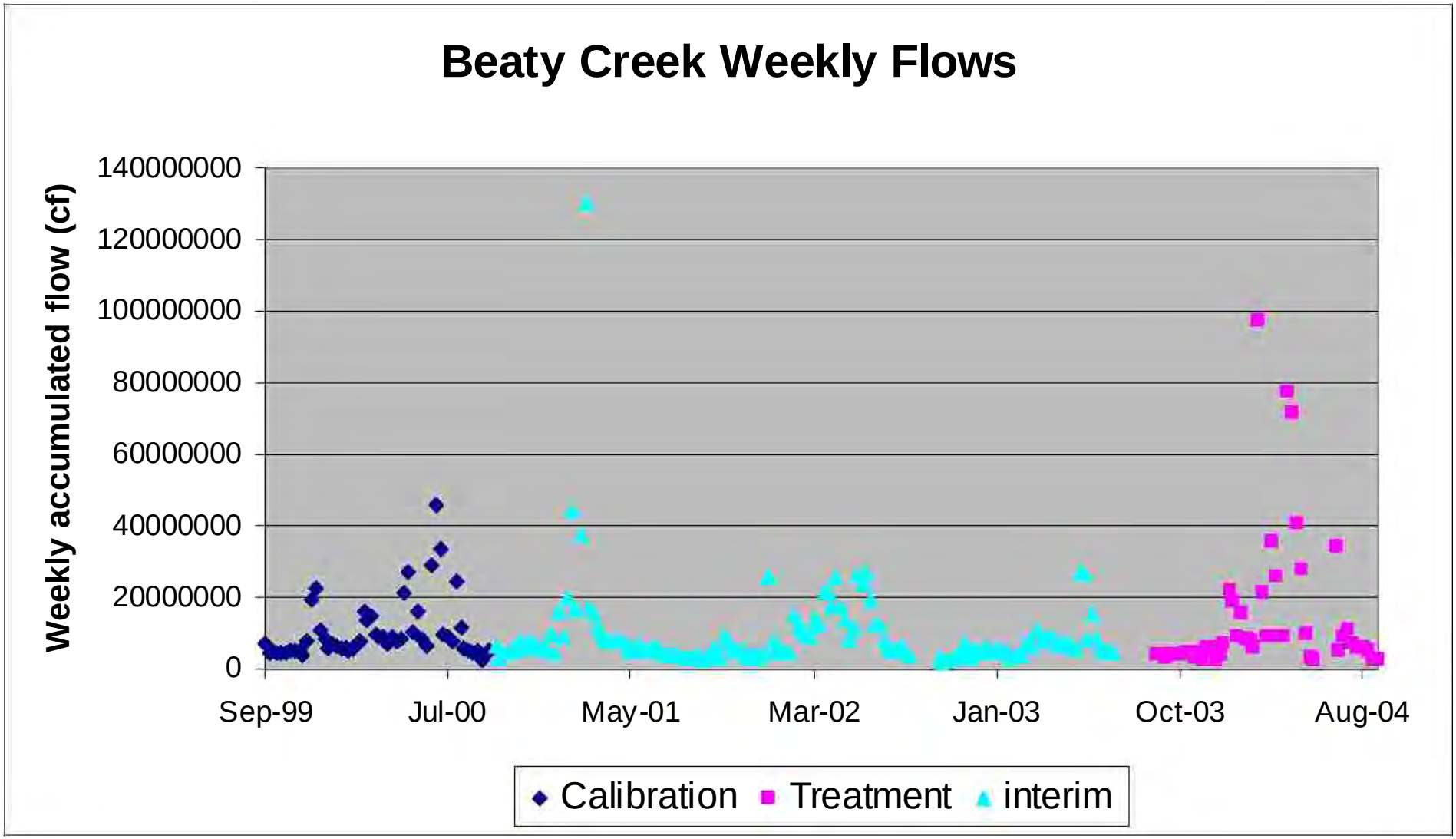
Cooperators in Beaty Creek Project



Water Quality Monitoring

- Monitored sites on Beaty Creek and Little Saline (reference stream) beginning in Aug. ’99 -
  - Water Quality
    - Monthly grab sampling
    - Automated samplers
  - Fish
  - Benthic Macroinvertebrates
  - Streambank erosion





- Calibration period highest flows were in June while Treatment period highest flows in March/April
- Treatment period total flow was eighteen percent greater than calibration period

- EPA method 841-F-93-009 developed by J. Spooner and J.C. Clausen from North Carolina State University and University of Connecticut.

United States Environmental Protection Agency | Office of Water Washington, D.C. 20460 | 841-F-93-009 September 1993

EPA

Paired Watershed Study Design

INTRODUCTION

The purpose of this fact sheet is to describe the paired watershed approach for conducting nonpoint source (NPS) water quality studies. The basic approach requires a minimum of two watersheds - control and treatment - and two periods of study - calibration and treatment. The control watershed accounts for year-to-year or seasonal climate variations, and the management practices remain the same during the study. The treatment watershed has a change in management at some point during the study. During the calibration period, the two watersheds are treated identically and paired water quality data are collected (Table 1). Such paired data could be annual means or totals, or for shorter studies (<5 yr), the observations could be seasonal, monthly, weekly, or event-based. During the treatment period, one watershed is treated with a best management practice (BMP) while the control watershed remains in the original management (Table 1). The treated watershed should be selected randomly by such means as a coin toss. The reverse of this schedule is possible for certain BMPs; the treatment period could precede the calibration period. For example, the study could begin with two watersheds in two different treatments, such as "BMP" and "no BMP". Later both watersheds could be managed identically to calibrate them. Since no calibration exists before the treatment occurs, this reversed design is considered risky.

Table 1. Schedule of BMP implementation.

Period	Watershed Control	Watershed Treated
Calibration	no BMP	no BMP
Treatment	no BMP	BMP

The basis of the paired watershed approach is that there is a quantifiable relationship between paired water quality data for the two watersheds, and that this relationship is valid until a major change is made in one of the watersheds. At that time, a new relationship will exist. This basis does not require that the quality of runoff be statistically the same for the two watersheds; but rather that the relationship between paired observations of water quality remains the same over time except for the influence of the BMP. Often, in fact, the analysis of paired observations indicates that the water quality is different between the paired watersheds. This difference further substantiates the need to use a paired watershed approach because the technique does not assume that the two watersheds are the same; it does assume that the two watersheds respond in a predictable manner together.

EXAMPLE

To illustrate the paired watershed approach, data taken from a study in Vermont will be used. The purpose of the study was to compare changes in field runoff (cm) due to conversion of conventional tillage to conservation tillage.

Paired Watershed Requirements

- Watersheds should be similar in size, slope, location, soils, and land cover
- Watersheds should be small enough to obtain uniform treatment over the entire watershed
- Watershed outlets should have a stable channel and should not leak at the outlet
- Each watershed should have relatively stable landcover prior to the study so they are in steady-state.

Paired Watershed Advantages

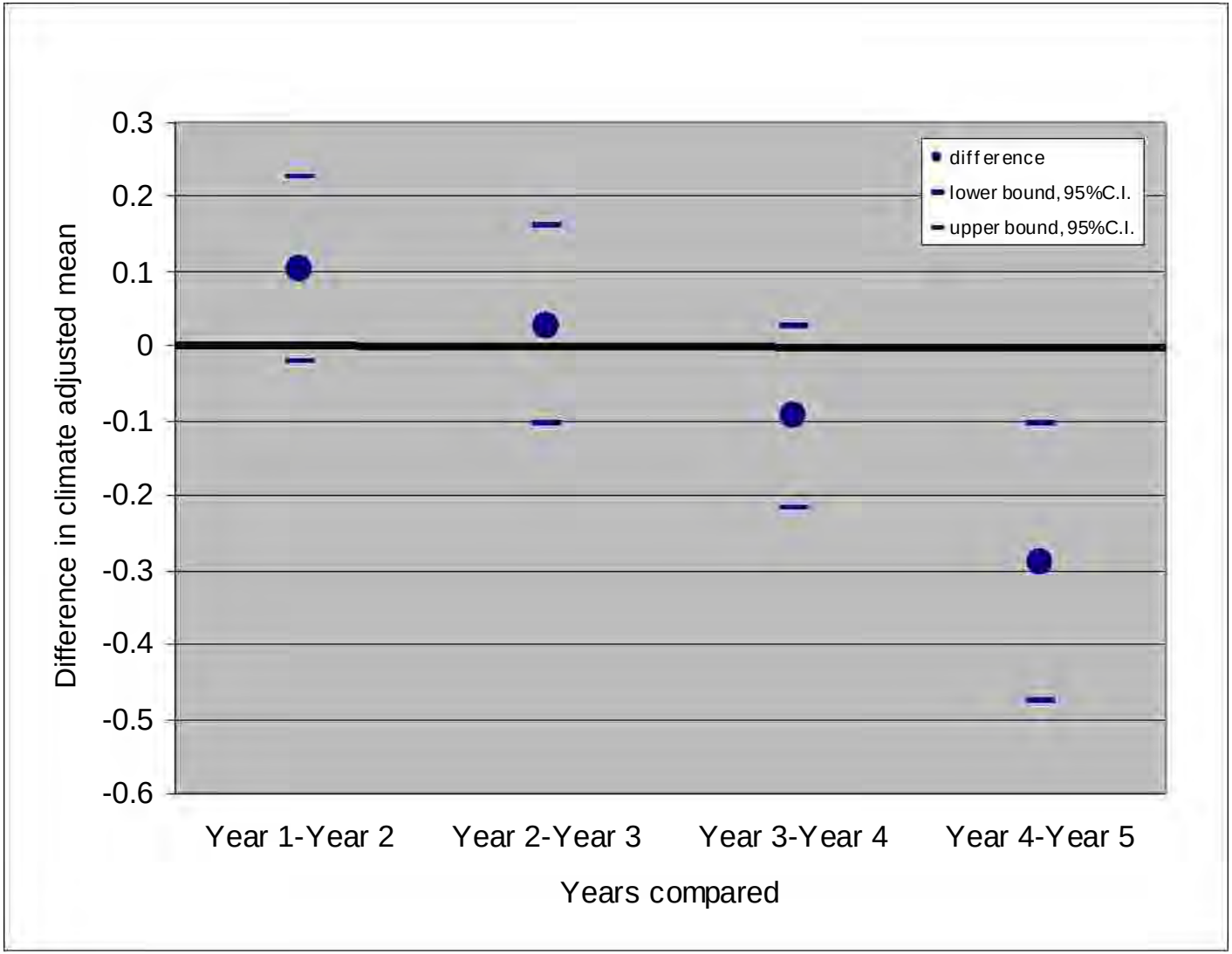
- Climate and hydrologic differences over years are statistically controlled
- Can attribute water quality changes to a treatment
- Control watershed eliminates need to measure all components causing changes
- Watersheds need not be identical
- Study can be completed in shorter time frame than trend studies
- Cause-effect relationship can be indicated

Change in Total P Load

	Mean Weekly Total P Load (lbs)	
Calibration Period		
Little Saline	30.29	
Beaty	90.66	
Treatment Period		
Little Saline	83.56	
Beaty (observed)	106.81	
Beaty (predicted)	123.60	
Change in P Load*	(predicted-observed/predicted)	-14%

* Adjusted for environmental variability as accounted for in Little Saline

Water Quality Summary- Total P Loading



Water Quality Summary

- Beaty Creek does not currently violate water quality standards- except for fecal bacteria
- Phosphorus loading in Beaty Creek is decreasing over time. This decrease:
  - is independent of weather patterns,
  - coincides with the implementation of BMPs through this project and adoption of State poultry regulations,
  - should continue to increase as more litter moves out of the watersheds, as BMPs mature, and as more BMPs are implemented

Project Summary

- At least 63% of OK Landowners and 28% of AR landowners participated in 319 project
  - More would participate if more funds had been available.
- Affected over 50% of the acreage in the watershed (over 40% of the watershed acreage is forested).
- Phosphorus loads are decreasing in Beaty Creek

Future Needs

- Continued Implementation of BMPs
  - Conservation Reserve Enhancement Program
  - EQIP
  - 319 Spavinaw Creek Priority Watershed Project
- Continue to develop alternative strategies for poultry litter
- Continue to involve local community in the search for and implementation of solutions
- Continue to monitor water quality in the watershed