

**Watershed Based Planning  
in Cane Creek Watershed**

**Final Report**



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### **Appendix B**

Cane Creek Quality Assessment Plan for the Environmental Data Collection Program Watershed Based Plan (Sent in separately by Strand Associates, Inc.)

### **Appendix C**

Watershed Based Plan for Cane Creek and Bayou de Chien (Sent in separately by Strand Associates, Inc.)

## Executive Summary

The Cane Creek subwatershed has stream reaches identified as impaired on the 2008 303(d) list, and is also identified as an Outstanding State Resource Water (OSRW) because it contains a federally threatened and endangered species, the relict darter. The goals of the project were to enhance the survival of the relict darter, an endangered species, improve habitat for all other species, improve water quality, reduce the threat of nonpoint source pollution from sources in the tributaries and main stem of the Cane Creek watershed making it safe for overall recreation and aquatic life through the production of a Watershed Based Plan that identifies problematic areas in the watershed and methods to address those problematic areas. By implementing the practical solutions identified in the *Cane Creek Watershed Based Plan*, there will be reduced nutrient loading in the Mississippi River Basin, a region that contributes greatly to the hypoxia problem in the Gulf of Mexico.

The project included both a water quality monitoring program to assess current conditions within the watershed and identify problematic areas and practical solutions and an educational program that targets the local community to show them the importance of water quality within the Cane Creek watershed and how individuals can positively affect water quality. Through the water quality monitoring program portion of this project, water quality samples were collected from five sites within the Cane Creek subwatershed, including dry weather and wet weather sampling events. Water quality data collected included temperature, pH, conductivity, dissolved oxygen, biochemical oxygen demand, total suspended solids, total nitrogen, ammonia, nitrate/nitrite, total phosphorus, and *E. coli*. Immunoassays were used to measure the concentrations of triazines and metalochlor in samples. Macroinvertebrate and habitat assessments were also done for each of the sampling sites. This data was analyzed by the project's consulting engineer, Strand Associates, Inc., and used during the watershed plan development portion of the project.

Through the watershed plan development portion of this project, three critical watersheds were identified, including two Cane Creek subwatersheds (14 digit hydrologic unit codes 08010201050100 and 08010201050080), and the South Fork Bayou de Chien subwatershed (14 digit hydrologic unit code 08010201050020). These critical areas represent locations where BMP implementation should focus in the future. As part of the watershed plan development process, several best management practices that would be effective in these three critical areas were developed and incorporated into the *Cane Creek Watershed Based Plan*.

The educational program of the project was hosted by Fulton County Conservation District, and targeted high school age students through a field day. This field day focused on the importance of clean water, problems in the Cane Creek subwatershed, and different ways these problems can be addressed using an EnviroScape® model.

This project has been a success; the project objectives have been accomplished, and measures of success have been met. All documents for this report are located at [www.jpf.org/wbp.htm](http://www.jpf.org/wbp.htm).

## **Acknowledgements**

The Jackson Purchase Resource Conservation and Development (RC&D) Foundation, Inc. Board of Directors acknowledges the support and assistance of the following partners. Without the cooperation of these partners, this project would not have been successfully completed.

- Four Rivers Basin Team
- Four Rivers Watershed Watch
- The Nature Conservancy
- Fulton County Conservation District
- Murray State University – Hancock Biological Station
- Murray State University – Mid America Remote Sensing Center
- Strand Associates, Inc.
- Kentucky Geological Survey
- Kentucky Division of Water
- Natural Resources Conservation Service
- US Fish and Wildlife Service

Special thanks is given to Shelly Morris and Nathan Hicklin with The Nature Conservancy for their efforts in this project, including macroinvertebrate collection and identification, habitat assessments and water quality sampling.

## **Introduction & Background**

The Cane Creek watershed, located in Fulton County, Kentucky, has stream reaches identified as impaired on the 2008 303d list, with the pollutants listed as nutrient/eutrophication biological indicators, and sediment/siltation (Kentucky Division of Water, 2008). The suspected sources of these pollutants are the loss of riparian habitat, and non-irrigated crop production. This watershed also contains an Outstanding State Resource Water (OSRW) because it contains a federally threatened and endangered species, the relict darter. These factors make this an important watershed for water quality work to be performed in.

This purpose of this project was to identify significant sources of pollution in the Cane Creek watershed, develop practical solutions to address these sources of pollution, and prioritize projects for future implementation in both the impaired and unimpaired stream reaches of this watershed. These sources, solutions, and future projects were identified in the *Cane Creek Watershed Based Plan*, a planning document that can be used by the local community to address sources of water pollution in the Cane Creek watershed. The goals of the project were to enhance the survival of the relict darter, an endangered species, improve habitat for all other species, improve water quality, reduce the threat of nonpoint source pollution from sources in the tributaries and main stem of the Cane Creek watershed making it safe for overall recreation and aquatic life through the production of a Watershed Based Plan that identifies problematic areas in the watershed and methods to address those problematic areas. By implementing the practical solutions identified in the *Cane Creek Watershed Based Plan*, there will be reduced nutrient loading in the Mississippi River Basin, a region that contributes greatly to the hypoxia problem in the Gulf of Mexico.

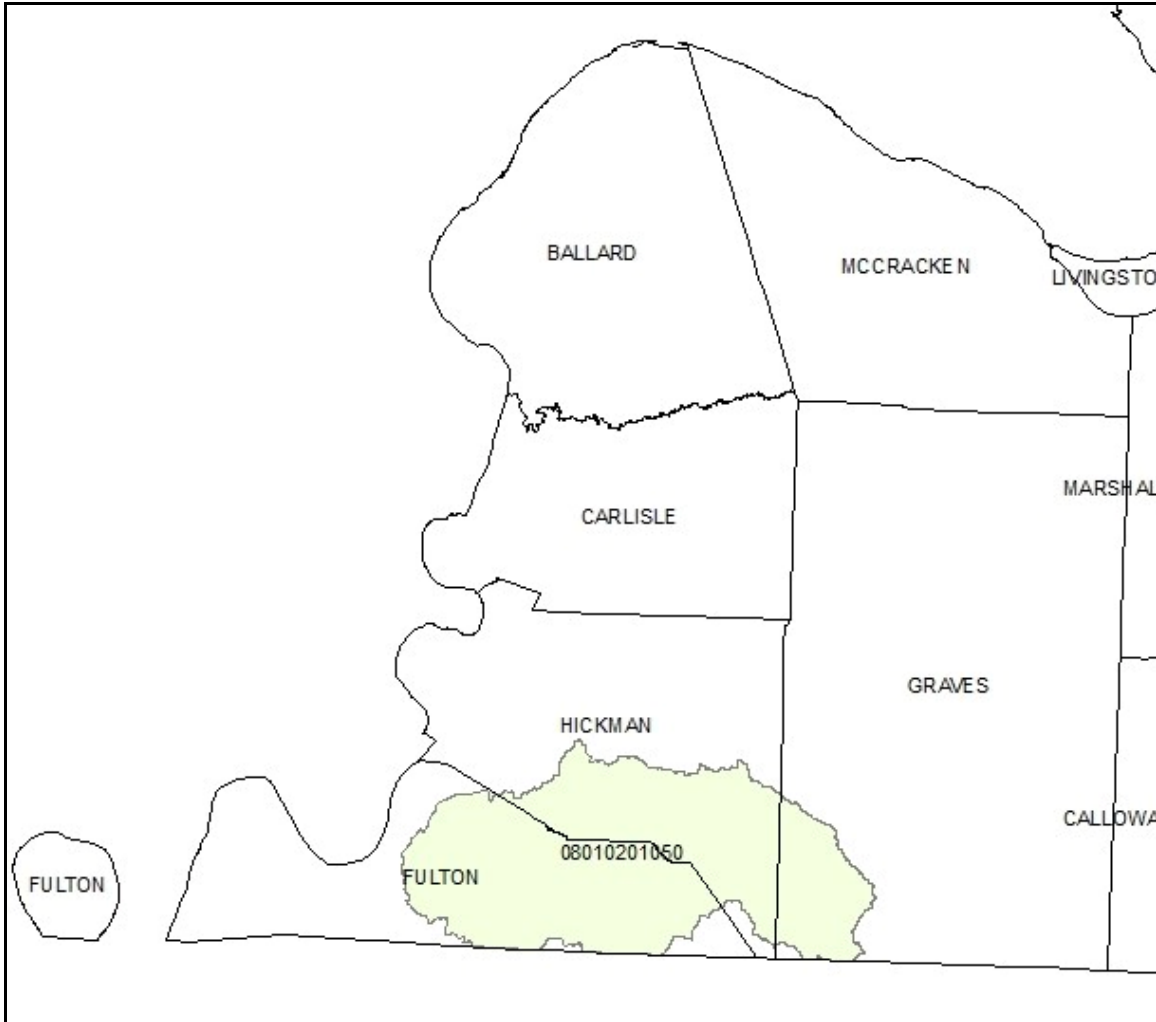
Objectives of the project that were used to meeting the accomplish the project purpose and goals include:

- Identification of the significant sources of impairments in the watershed
- Identification of significant threats to the relict darter in the watershed
- Identification of potential sites to introduce new populations of the relict darter in the watershed
- Prioritization of the sources of impairments in the watershed, based on nutrient concentration, frequency of the concentration, physical impairment, mass loadings, etc.
- Development of practical plans for reducing the identified impairments to levels within the range of healthy warm water aquatic habitats

## **Materials & Methods**

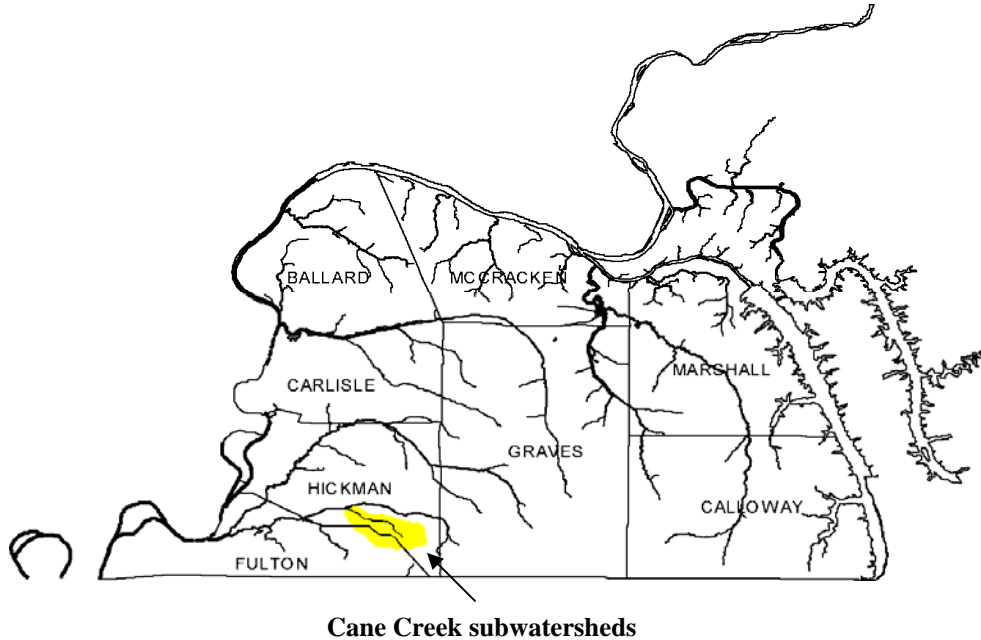
### **Project Area**

The project area for this project is located Bayou de Chien watershed (11 digit hydrologic unit code 08010201050). This project specifically focused on the smaller Cane Creek subwatersheds (14 digit hydrologic unit codes 08010201050100 and 08010201050080) (Figures 1 and 2).



**Figure 1.** Location of the Bayou de Chien watershed (11 digit hydrologic code 08010201050).





**Figure 2.** Location of the Cane Creek subwatersheds this project focused on.

The Cane Creek subwatersheds are located within the larger Bayou de Chien Watershed, which encompasses 209.609 square miles and contains 567 river miles. The Bayou de Chien Watershed is located in Fulton, Hickman, and Graves counties of Kentucky. The Cane Creek subwatersheds that this project focused on are located in Fulton and Hickman counties. Cane Creek subwatershed 08010201050100 encompasses 15.602 square miles. Cane Creek subwatershed 08010201050080 encompasses 10.344 square miles. Information about the climate, surface water resources, ground water resources, flood plains, topography, geology, land use, transportation for the Bayou de Chien watershed and Cane Creek subwatersheds can be found in the Appendix C in the *Watershed Based Plan for Cane Creek and Bayou de Chien* Section 3.

### **Project Methods**

#### *Water Quality Monitoring Program:*

As part of this project, a water quality monitoring program was established to document and quantify sources of impairments and threats to the watershed. The water quality monitoring program focused on the Cane Creek subwatersheds. Five sampling sites were selected and sampled. Two dry weather sampling events were conducted on September 7, 2006 and October 25, 2006. Three wet weather sampling events were conducted on March 8, 2006, November 14, 2006, and February 12, 2007. Water quality parameters measured during both the dry weather and wet weather sampling events include temperature, pH, conductivity, dissolved oxygen, biochemical oxygen demand, total suspended solids, total nitrogen, ammonia, nitrate/nitrite, total phosphorus and *E. coli*. Immunoassays were used to measure the concentrations of triazines and metalochlor in samples. Macroinvertebrate sampling was conducted according to procedures outlined by the Kentucky Division of Water in *Methods for Assessing Biological Integrity of Surface*

*Waters in Kentucky* (2002). Habitat assessments were also conducted at each sampling site. For more information about the project methods, please see the *Cane Creek – Bayou de Chien Quality Assessment Plan for the Environmental Data Collection Program Watershed Based Plan* included in Appendix B.

*Educational Program:*

An educational program was developed by the Fulton County Conservation District and targeted at high school age students in the Hickman County and Fulton Independent school systems. The program focused on the importance of clean water, problems in the watershed, and ways these problems can be addressed using an EnviroScape® model.

**Project Materials**

*Water Quality Monitoring Program:*

Equipment used during the water quality monitoring program include:

- JDC Electronic USA Flowwatch System – Air or Liquid Flow Measurement Instrument
- YSI 550A™ Waterproof Dissolved Oxygen Meter
- HANNA Waterproof pH/Conductivity/TDS/Temperature Portable Mega Meter
- Kubota RTV 900G Truck and Trailer

*Educational Program:*

- Michael Strohm Design Inc. RiverLab Watershed Table
- EnviroScape® model

**Results & Discussion**

*Water Quality Monitoring Program:*

Dry weather data collected through the water quality monitoring program serve as baseline data for the watershed. Pollutant levels at three of the five sampling sites indicated that baseline pollutant levels were under the Kentucky Water Quality Criteria, except for *E. coli* levels. Wet weather data collected showed significant spikes in *E. coli* and total suspended solid concentrations, and also showed that stream temperatures were higher than the standards set in the Kentucky Water Quality Criteria. Increases were also observed in nitrogen and phosphorus concentrations during wet weather events.

The top three pollutants in the watershed identified through the water quality monitoring program include:

1. *E. coli*
2. TSS
3. Nutrients

For more discussion about the water quality monitoring program results, please see the *Watershed Based Plan for Cane Creek and Bayou de Chien* Section 5 included as Appendix C. This document also describes the critical areas identified in the watershed, including the Cane Creek subwatersheds (14 digit hydrologic unit codes 08010201050100 and 08010201050080), and the South Fork Bayou de Chien subwatershed (14 digit hydrologic unit code 08010201050020). These critical areas were

identified as areas where best management practices should be focused. Watershed goals and objectives for each subwatershed were also identified in the *Watershed Based Plan for Cane Creek and Bayou de Chien* Sections 6 and 8 included in Appendix C. Best management practices were identified for each subwatershed that would allow these watershed goals and objectives to be met.

#### *Educational Program:*

An educational program was developed by the Fulton County Conservation District and targeted at high school age students in the Hickman County and Fulton Independent school systems. The program focused on the importance of clean water, problems in the watershed, and ways these problems can be addressed using an EnviroScape® model. Some of the Kentucky Education Reform Act goals addressed in the programs described above include (Kentucky Department of Education, 2006):

- PL-HS-3.1.4  
Students will compare consumer actions (reuse, reduce, recycle, choosing renewable energy sources, using biodegradable packaging materials, composting) and analyze how these actions impact the environment (e.g., conserving resources; reducing water, air, and land pollution; reducing solid waste; conserving energy).
- SC-HS-4.7.3  
Students will:
  - Predict the consequences of changes to any component (atmosphere, solid Earth, oceans, living things) of the Earth System;
  - Propose justifiable solutions to global problems.Interactions among the solid Earth, the oceans, the atmosphere and living things have resulted in the ongoing development of a changing Earth system.

## **Conclusions**

The objectives of the project that were used to meet the project purpose and goals, and the results of each objective include:

- **Identification of the significant sources of impairments in the watershed** – This objective was accomplished through the water quality monitoring program of this project. The main contaminants of concern for this watershed include *E. coli*, total suspended solids, and nutrients. The suspect sources of these contaminants for the Cane Creek watershed include agriculture, septic systems, and stream bank erosion. More information about these sources can be found in Section 5 of the *Watershed Based Plan for Cane Creek and Bayou de Chien* included in Attachment C. The sources of contaminants can vary on a subwatershed scale, however. More information about specific sources for each of the critical subwatersheds can be found in Section 6 of the *Watershed Based Plan for Cane Creek and Bayou de Chien* included in Attachment C.
- **Identification of significant threats to endangered species in the watershed** – This objective was accomplished through the water quality monitoring program of this project. Habitat assessments, macroinvertebrate assessments, and water quality monitoring were conducted throughout the watershed to determine

- specific threats to the relict darter populations. Results of these assessments showed that the main threats include land use and loss of potential habitat. More information about these results can be found in Section 5 of the *Watershed Based Plan for Cane Creek and Bayou de Chien* included in Attachment C.
- **Identification of potential sites to introduce new populations of the Relict Darter species** – This objective was accomplished through collaborative efforts by the Four Rivers Basin Team, Strand Associates, Inc. and Jackson Purchase RC&D Foundation. The Four Rivers Watershed Watch site number 216, which is located where Cane Creek crosses under Highway 1529. This site is ideal because it has appropriate habitat, including shaded areas, stream strata, and fairly stable banks.
  - **Prioritization of the sources of impairments in the watershed, based on nutrient concentration, frequency of the concentration, physical impairment, mass loadings, etc.** – This objective was accomplished by the Four Rivers Basin Team, Strand Associates, Inc. and the Jackson Purchase RC&D Foundation, Inc. Pollutants of concern were ranked based on sampling results and pollutant load rates, and then potential sources of those pollutants were prioritized. The top three pollutants of concern identified through the water quality monitoring program of this project include *E. coli*, total suspended solids, and nutrients. The main sources of these pollutants were identified and prioritized. More information about this prioritization can be found in Section 5 of the *Watershed Based Plan for Cane Creek and Bayou de Chien* included in Attachment C.
  - **Development of practical plans for reducing the identified impairments to levels within the range of healthy warm water aquatic habitats** – This objective was accomplished in Sections 7 and 8 of the *Watershed Based Plan for Cane Creek and Bayou de Chien* included in Attachment C. More specific conservation plans and practices will be developed in a subsequent document, a BMP implementation plan for the Cane Creek and Bayou de Chien watersheds.

The project measures of success for this project included:

1. **Education of residents about the interdependency of watershed health** – These education efforts were taken on by Fulton County Conservation District through their different educational programs for high school age students of the Hickman County and Fulton Independent school systems.
2. **Education efforts will be judged by participation** – Multiple schools and classes within Hickman County and Fulton Independent school systems participated in the educational programs held by the Fulton County Conservation District. Many of these schools and classes have participated in educational programs multiple times.
3. **Identification of the nonpoint sources of impairment and threats in the watershed** – The identification of sources and threats in the watershed was a collaborative effort between the Four Rivers Basin Team, Strand Associates, Inc. and the Jackson Purchase RC&D Foundation. Major sources and threats were identified and discussed in the *Watershed Based Plan for Cane Creek and Bayou de Chien* included in Attachment C.

4. **Identification of the nonpoint sources of excess nutrients/pesticides contributing to impairment** – The identification of these sources in the watershed was a collaborative effort between the Four Rivers Basin Team, Strand Associates, Inc. and the Jackson Purchase RC&D Foundation. Major sources were identified and discussed in the *Watershed Based Plan for Cane Creek and Bayou de Chien* included in Attachment C.
5. **Identification of threats to the endangered species in the watershed** – The identification of threats was a collaborative effort between the Four Rivers Basin Team, Strand Associates, Inc. and the Jackson Purchase RC&D Foundation. Major threats were identified and discussed in the *Watershed Based Plan for Cane Creek and Bayou de Chien* included in Attachment C.
6. **Identification of the point source pollution origins and threats in the watershed** – The identification of these sources in the watershed was a collaborative effort between the Four Rivers Basin Team, Strand Associates, Inc. and the Jackson Purchase RC&D Foundation. Major sources were identified and discussed in the *Watershed Based Plan for Cane Creek and Bayou de Chien* included in Attachment C.
7. **Location of potential sites for repopulation of the Relict Darter** – Potential locations for repopulation were identified through efforts by the Four Rivers Basin Team, Strand Associates, Inc., the US Fish and Wildlife Service and the Jackson Purchase RC&D Foundation.
8. **Estimation of load reductions for identified sources** – Estimations of load reductions required to meet the water quality goals set by Strand Associates, Inc. were identified and discussed in the *Watershed Based Plan for Cane Creek and Bayou de Chien* included in Attachment C.
9. **Development of a practical Watershed Based Plan for reducing the impairments to acceptable levels within the watershed** – This document was developed through collaborative efforts by the Four Rivers Basin Team, Strand Associates, Inc. and the Jackson Purchase RC&D Foundation. The *Watershed Based Plan for Cane Creek and Bayou de Chien* has been attached in Appendix C.
10. **Production of a Watershed Based Plan denoting the sources and threats to the watershed and the suggested approaches to reducing or eliminating them** – The *Watershed Based Plan for Cane Creek and Bayou de Chien* has been attached in Appendix C.
11. **Production of a Watershed Based Plan that includes estimates of implementation costs, sources of assistance, and possible financing sources to obtain the goals** – The *Watershed Based Plan for Cane Creek and Bayou de Chien* has been attached in Appendix C.
12. **Plan success will be evaluated by the funding designated to address issues** – Funding for BMP Implementation in the Cane Creek and Bayou de Chien watersheds will be targeted in the future.

This project has been a success; the project objectives have been accomplished, and measures of success have been met. One important lesson learned in this project pertains to identification of the source of a pollutant. In this project, the main pollutant of concern

identified was *E. coli*. The suspected source of this pollutant is agriculture, but without further testing, such as bacterial source tracking, the source can not be definitively identified. Future projects will include bacterial source tracking of *E. coli* to more accurately identify the source because without an accurate identification of the source, BMPs and conservation practices addressing *E. coli* can not be determined.

## **Literature Cited**

Kentucky Department of Education. 2006. Kentucky Core Content for Assessment Version 4.1 Primary – 12. Kentucky Department of Education. Frankfort, Kentucky.

Kentucky Division of Water. 2008. 2008 Integrated Report to Congress on the Condition of Water Resources in Kentucky. Volume II: 303(d) List of Waters for Kentucky. Kentucky Environmental and Public Protection Cabinet, Division of Water. Frankfort, KY. <http://www.water.ky.gov//sw/swmonitor/305b/>

Kentucky Division of Water. 2002b. Methods for Assessing Biological Integrity of Surface Waters in Kentucky. Natural Resources and Environmental Protection Cabinet, Water Quality Branch. Frankfort, Kentucky.

## Appendix A

### Workplan Outputs:

Output	Date Finalized/Produced
Submit all draft materials to the Cabinet for review and approval	Duration
Submit advanced written notice on all workshops, demonstrations, and/or field days to the Cabinet	Duration
Develop and submit a QAPP for Cabinet approval	August, 2005
Revise QAPP	June, 2006
First project team meeting	May 26, 2005
Submit monitoring plan to Cabinet for approval	June, 2006
Begin field assessment	December, 2007
Macroinvertebrate collection	December, 2007
Laboratory analysis of samples	September, 2007
Collection of samples for fecal coliform analysis	September, 2007
Team meetings	May 26, 2005 August 25, 2005 October 27, 2005 January 26, 2006 May 31, 2006 September 13, 2006 November 11, 2006 February 2, 2007 April 5, 2007 August 9, 2007 October 25, 2007 January, 2008 March, 2008 May, 2008 June, 2008 August 28, 2008 October 2, 2008 November 13, 2008 January 23, 2009 March 13, 2009 April 28, 2009 July 28, 2009 September 22, 2009
Collection of water samples	September, 2007
Develop a watershed education workshop	February, 2007
Summarize monitoring data	May, 2008
Conduct a watershed education workshop	March, 2007
Classroom watershed awareness module instruction	March, 2007



Completion of all field work	September, 2007
Rank pollutant sources	May, 2008
Distribute monitoring summary	May, 2008
Prepare Watershed Based Plan	September, 2008
Approval of completed WBP by Four Rivers Basin Team	October, 2008
Approval of WBP by the Cabinet	September, 2009
Distribute WBP	September, 2009
Prepare Final Report	September, 2009
Upon request of the Division of Water, submit Annual Report and/or participate in the Cabinet sponsored biennial NPS Conference	Duration
Submit three copies of the Final Report and submit three copies of all products produced by this project	September, 2009

**Budget Summary:**

<b>Budget Categories (itemize all categories)</b>	<b>Section 319(h)</b>	<b>Non-Federal Match</b>	<b>TOTAL</b>	<b>Final Expenditures</b>
Personnel	\$38,000.00	\$21,050.00	\$59,050.00	\$49,256.70
Supplies	\$1,700.00	\$1,400.00	\$3,100.00	\$5,978.50
Equipment	\$4,500.00	\$3,300.00	\$7,800.00	\$13,927.73
Travel	\$3,000.00	\$3,000.00	\$6,000.00	\$3,966.13
Contractual	\$4,000.00	\$2,500.00	\$6,500.00	\$12,362.00
Operating Costs	\$8,668.00	\$8,662.00	\$17,330.00	\$16,469.50
Other	\$0.00	\$0.00	\$0.00	\$833.29
<b>TOTAL</b>	\$59,868.00	\$39,912.00	\$99,780.00	\$102,793.85
	60%	40%	<u>100</u> %	<u>100</u> %

The Jackson Purchase Resource Conservation and Development Foundation, Inc. was reimbursed \$59,868.00. All dollars were spent; there were no excess funds to reallocate. This project did generate overmatch provided by the Jackson Purchase Resource Conservation and Development Foundation, Inc. This overmatch was not posted to the Grant.

A watershed Coordinator was employed to assist with project implementation. The Coordinator worked with project partners and Strand Associates in the data analysis and the Watershed Based Plan review. Payroll expenses for the Coordinator were

\$13,718.88. Strand Associates personnel payroll expenses were \$20,496.25. Miscellaneous day labor was \$922.29. In-Kind match from the Four Rivers Basin Team, Nature Conservancy, Fulton and Hickman County Conservation Districts was \$14,119.28.

**Equipment Summary:**

Item	Units	Unit Price
JDC Electronic USA Flowwatch System – Air or Liquid Flow Measurement Instrument	1	\$310.00
YSI 550A™ Waterproof Dissolved Oxygen Meter	2	\$752.25
HANNA Waterproof pH/Conductivity/TDS/Temperature Portable Mega Meter	2	\$427.55
Kubota RTV 900G Trailer (½ the total price) *	1	\$947.25
Kubota RTV 900G Truck (½ the total price) *	1	\$6,216.50
Kubota RTV 900G Storage facility (½ the total price) *	1	\$1,635.00
Michael Strohm Design Inc. RiverLab Watershed Table (½ the total price) *	1	\$1,850.00
EnviroScape® model	1	\$875.00

\*One-half of the total cost of these items was expensed to this project while the other half was expensed and shared with the Clarks River Watershed Based Plan Project that was underway by the Foundation, simultaneously, as a cost savings measure toward both projects.

In lieu of the Hydrolab discussed in the project application, the YSI 550A™ Waterproof Dissolved Oxygen Meter, and HANNA Waterproof pH/Conductivity/TDS/Temperature Portable Mega Meter were purchased for the water quality monitoring portion of this project. Other water quality monitoring equipment included the JDC Electronic USA Flowwatch System. A kayak was purchased for reaching inaccessible bank sites, as discussed in the project application. The Michael Strohm Design Inc. RiverLab Watershed Table and EnviroScape® model were purchased for the educational program of the project. Only half of the cost of the Michael Strohm Design, Inc RiverLab Watershed Table was charged to this project.

The Kubota RTV 900G Trailer and Truck were purchased on November 3, 2008 to be used in the implementation phase of this project. The total price for the Kubota RTV 900G truck was \$10,933, plus an additional \$1,500 for a hydraulic bed lift kit, for a total of \$12,433. Only half of the cost of this equipment was charged to this project. The estimated value as of September 30, 2009 is \$11,189.70. The Kubota trailer was purchased November 13, 2008 for a total price of \$1,894.50. Only half of the cost of this trailer was charged to this project. The storage facility to house the Kubota truck and trailer was purchased on November 13, 2008 for a total price of \$3,270. Only half of the cost of this trailer was charged to this project. This equipment was used for site reconnaissance and evaluation during this project, and will be used in the implementation

phase for survey, design and implementation of best management practices with landowners.

The Kubota RTV 900G Truck has a current per-unit fair market value exceeding \$5,000. Disposition procedures will follow the requirements set forth in 40 CFR Part 31.32. This equipment, however, will be used in the implementation phase of the project. As of September 30, 2009 the estimated value of the Kubota RTV 900G is \$9,840.

## **Appendix B**

### **Cane Creek Quality Assessment Plan for the Environmental Data Collection Program Watershed Based Plan**

Three copies of this document were printed separately and sent directly to the Kentucky Division of Water by Strand Associates, Inc. An electronic copy of this document was also sent directly to the Kentucky Division of Water by Strand Associates, Inc.

## **Appendix C**

### **Watershed Based Plan for Cane Creek**

Three copies of this document were printed separately and sent directly to the Kentucky Division of Water by Strand Associates, Inc. An electronic copy of this document was also sent directly to the Kentucky Division of Water by Strand Associates, Inc.