Watershed Based Planning in Clarks River Watershed

Final Report

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Executive Summary

The Clarks River watershed has stream reaches identified as impaired on the 2008 303(d) list, with the impaired uses including primary contact recreation and warm water aquatic habitat. The goals of the project were to improve habitat for all species, improve water quality, and reduce the threat of nonpoint source pollution from sources in the tributaries and main stem of the Clarks River 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 Clarks River 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.

This 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 Clarks River watershed and how individuals can positively affect water quality. The water quality monitoring program included the collection of wet and dry weather samples from six different sites upstream of where Bee Creek joins the Clarks River. 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 metaloachlor in samples. Macroinvertebrate and habitat assessments were also done for each of the sampling sites. This data, along with additional data collected by Murray State University as part of a separate project, were incorporated and analyzed to obtain an accurate picture of current water quality in the Clarks River watershed.

Through the watershed plan development portion of this project, four critical watersheds were identified, including the Bee Creek subwatershed, Clayton Creek subwatershed, Damon Creek subwatershed and the Chestnut Creek subwatershed. A fifth critical area, the problematic septic area, was identified with assistance from the Purchase District Health Department and the Calloway County Judge Executive as an area with the potential for high rates of septic system failure due to income levels of the residents and poorly suited soil conditions. These critical areas represent the locations where BMP implementation efforts should focus in the future, and the *Clarks River Watershed Based Plan* identifies some of the different practices that will be effective at reducing nonpoint source pollution in these areas.

The educational program of the project targeted elementary, middle and high school age students through a variety of field days and workshops that were hosted by the Calloway County Conservation District, a project partner, about the importance of water quality. Some of these workshops included Ag Day that targeted elementary students, Environmental Science Day that targeted middle school, the River Table Workshop that targeted high school students, and the 4-H Camp Workshop that targeted elementary,

middle and high school age students. Each of these events focused on the importance of water quality, and used evaluation sheets to assess the effectiveness of the lesson

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.

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
- Calloway County Conservation District
- Marshall County Conservation District
- Murray State University – Hancock Biological Station
- Murray State University – Mid America Remote Sensing Center
- City of Murray
- Strand Associates, Inc.
- Kentucky Geological Survey
- Kentucky Division of Water
- Natural Resources Conservation Service

Special thanks are 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 Clarks River watershed, located in Calloway, Graves, Marshall, and McCracken Counties in Kentucky has stream reaches identified as impaired on the 2008 303d list. Within the Clarks River watershed in Calloway and Marshall Counties, the focus of this project, the impaired uses include warm water aquatic habitat, and primary contact recreation. The pollutants of concern include nutrient/eutrophication biological indicators, sediment/siltation, organic enrichment biological indicators, fecal coliform, nitrate/nitrite, and phosphorus. The suspected sources of these pollutants include municipal point source discharges, agriculture, channelization, crop production, failing septic systems, streambank modification/destabilization, loss of riparian habitat, and animal feeding operations. 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 Clarks River watershed in Calloway and Marshall Counties, 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 *Clarks River Watershed Based Plan*, a planning document that can be used by the local community to address sources of water pollution in the Clarks River watershed in Calloway and Marshall Counties. The goals of the project were to improve habitat for all species, improve water quality, reduce the threat of nonpoint source pollution from sources in the tributaries and main stem of the Clarks River 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 Clarks River 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 meet the project purpose and goals include:

- Identification of the significant sources of impairments in the watershed
- Identification of significant threats to habitat in the watershed
- Identification of concerns for stream bank degradation and flooding
- 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 included the portion of the Clarks River watershed (11 digit hydrologic unit code 06040006040) and the West Fork of Clarks River watershed (11 digit hydrologic unit code 06040006050) located within Calloway and Marshall Counties (Figures 1).

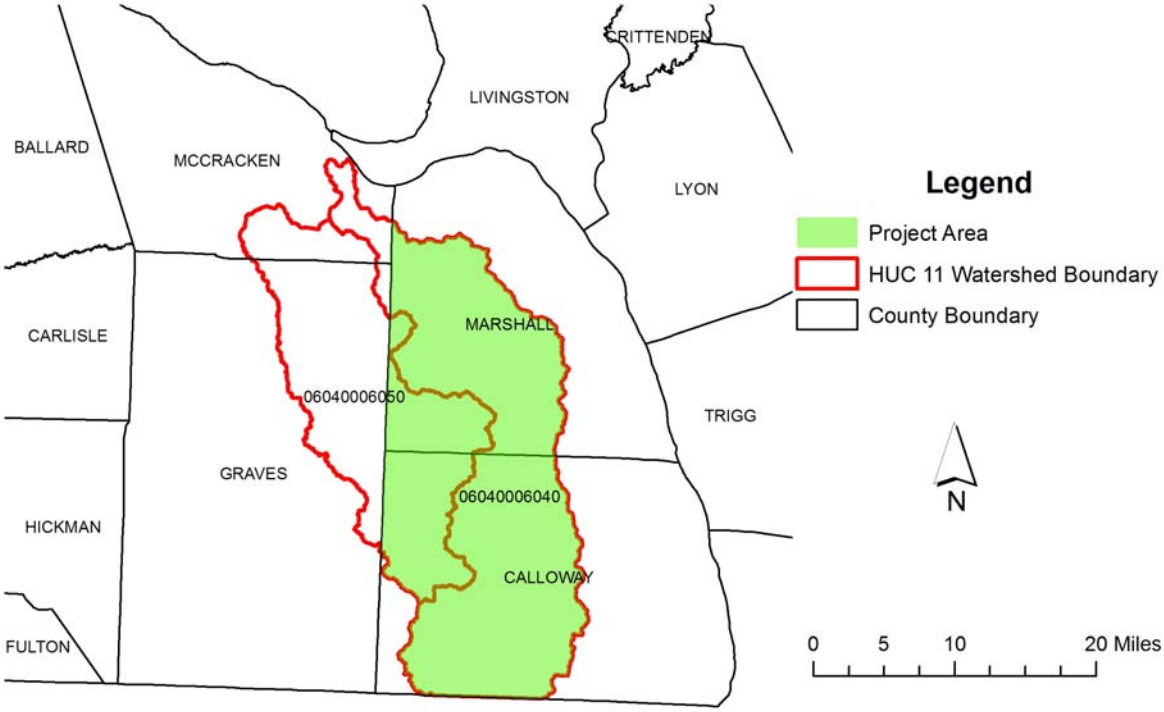

Figure 1. Location of the Clarks River watershed (11 digit hydrologic unit code 06040006040) and West Fork Clarks River watershed (11 digit hydrologic unit code 06040006050). This project focuses only on portions of these watersheds within Marshall and Calloway Counties (indicated in green).

Both the Clarks River and the West Fork of Clarks River watersheds are located in Calloway, Marshall, Graves, and McCracken Counties, although this project focused only on the portions of those watersheds in Calloway and Marshall Counties. The entire Clarks River watershed encompasses 303.98 square miles and includes 889 river miles. The entire West Fork of Clarks River watershed encompasses 222.66 square miles and includes 691 river miles. Water quality samples for this project were collected at six sites

by the Calloway County Conservation District. These sampling sites focused on the Clarks River subwatersheds located upstream of where Bee Creek joins the Clarks River in Calloway County. Murray State University, through a separate project, collected water quality samples at an additional 52 locations throughout the Clarks River and the West Fork of Clarks River watersheds. This data served to supplement the data collected through this project. Information about the climate, surface water resources, ground water resources, flood plains, topography, geology, land use, transportation for the Clarks River and West Fork of Clarks River watersheds can be found in the Appendix C in the *Watershed Based Plan for Clarks River* 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 Clarks River subwatersheds located upstream of where Bee Creek joins the Clarks River, including the Clayton Creek subwatershed (14 digit hydrologic unit code 06040006040200 and 06040006040180), the Clarks River subwatershed (14 digit hydrologic unit code 06040006040170), the Farley Branch subwatershed (14 digit hydrologic unit code 06040006040130), the Middle Fork of Clarks River subwatershed (14 digit hydrologic unit code 06040006040160), and the East Fork of Clarks River subwatershed (14 digit hydrologic unit code 06040006040010). Five sampling sites were selected and sampled. One dry weather sampling event was conducted on 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 metaloachlor 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 *Clarks River Quality Assessment Plan for the Environmental Data Collection Program Watershed Based Plan* included in Appendix B.

Educational Program:
Educational programs for this project were developed by the Calloway County Conservation District. These programs targeted elementary, middle and high school age students. Programs developed include:

- Ag Day: This program focuses on soil erosion. An enviroscape model is used during this program to educate students about watersheds and how they function.
- Environmental Science Day: This program focuses on how water can impact soil and landscapes. This program also shows how macroinvertebrates can be used as indicators of water quality.

- River Table Workshop: This program focuses on how waterways can affect landscapes. The program also shows how water volume and flow can impact landscapes.
- 4-H Camp Workshop: This program shows how macroinvertebrates can be used as indicators of water quality. The program also has a water conservation component, showing students the importance of water conservation, and different methods that can be used to achieve water conservation.

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
- Toshiba 17" Laptop
- Proscope Microscope
- Kubota RTV 900G Truck and Trailer

Educational Program:

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

Results & Discussion

Water Quality Monitoring / Watershed Plan Development Program:

Dry weather data collected by the Calloway County Conservation District and Four Rivers Watershed Watch through the water quality monitoring program serve as baseline data for the watershed. Data collected by Murray State University throughout the Clarks River and West Fork of Clarks River watersheds served to supplement the baseline data collected through this project for the two watersheds. Pollutant levels at two of the five dry weather sampling sites indicated that baseline pollutant levels were under the Kentucky Water Quality Criteria, except for *E. coli* levels. Phosphorus levels were ranged from low to moderate, but there is no Kentucky Water Quality Criteria for this pollutant. Wet weather data collected by the Calloway County Conservation District 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 four pollutants in the watershed identified through the water quality monitoring program include:

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

All water quality monitoring program results, including sampling results from the Calloway County Conservation District and supplemental data collected by Murray State University, were incorporated into one document, the *Watershed Based Plan for Clarks River Watershed*, instead of two separate documents, a water quality data report and a watershed plan. This was done for ease of reporting, and to lower production costs for the final materials.

For more discussion about the water quality monitoring program results, please see the *Watershed Based Plan for Clarks River Watershed* Section 5 included as Appendix C. The water quality monitoring program results were analyzed by the consulting engineer for this project, Strand Associates, Inc. and used in the development of watershed plan for this project. The *Watershed Based Plan for Clarks River Watershed* was developed by Strand Associates, Inc., and a draft version of this report was provided to the Four Rivers Basin Team, a project partner providing technical support, for review. Comments suggested by the Four Rivers Basin Team were incorporated by Strand Associates, Inc. into the final draft submitted to the Kentucky Division of Water.

As part of the watershed plan portion of this project, the consulting engineer and the Four Rivers Basin Team selected critical areas in the project area where best management practices should be focused (Figure 2). These critical areas included the Clayton Creek subwatershed in Calloway County (14 digit hydrologic unit code 06040006040180), the Bee Creek subwatershed in Calloway County (14 digit hydrologic unit code 06040006040220), the Damon Creek subwatershed in Calloway County (14 digit hydrologic unit code 06040006040160), and the Chestnut Creek subwatershed in Marshall County (14 digit hydrologic unit code 06040006050670). A problematic septic area was also identified with cooperation from the Calloway County Judge Executive and the Purchase District Health Department. This area represents an area with potentially high rates of failing septic systems that contribute *E. coli* to the Clarks River Watershed.

The critical areas were identified through the watershed plan development portion of this project represent areas where best management practices should be focused because of current pollutant loads they contribute to the Clarks River Watershed. Watershed goals and objectives for each subwatershed were developed by Strand Associates, Inc. and the Four Rivers Basin Team during the watershed plan development portion of this project, and are included in the *Watershed Based Plan for Clarks River* 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.

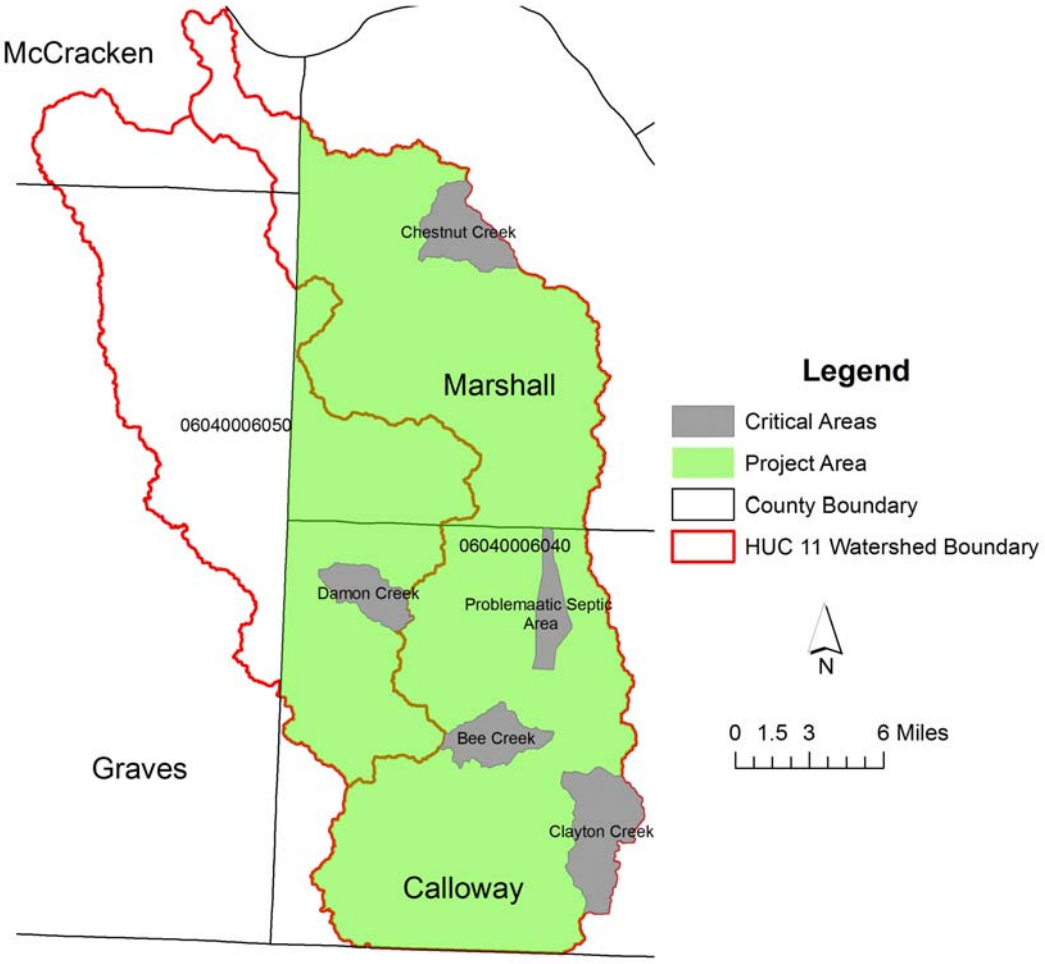

Figure 2. Location of critical areas located within Calloway and Marshall Counties that were identified during the watershed plan development portion of this project.

Educational Program:

Educational programs were developed by the Calloway County Conservation District. The target audiences for the programs and measurements of audience knowledge from the programs addressed in the programs include:

- Ag Day: This program targets elementary age students and focuses on soil erosion. An enviroscape model is used during this program to educate students about watersheds and how they function. Audience knowledge was measured with evaluation sheets that were given to students after the program.
- Environmental Science Day: This program targets middle school students and focuses on how water can impact soil and landscapes. This program also shows how macroinvertebrates can be used as indicators of water quality. Audience knowledge was measured with evaluation sheets that were given to students after the program.

- River Table Workshop: This program targets high school age students and focuses on how waterways can affect landscapes. The program also shows how water volume and flow can impact landscapes. Audience knowledge was measured with evaluation sheets that were given to students after the program.
- 4-H Camp Workshop: This program targets elementary, middle and high school age students and shows how macroinvertebrates can be used as indicators of water quality. The program also has a water conservation component, showing students the importance of water conservation, and different methods that can be used to achieve water conservation. Audience knowledge was measured with evaluation sheets that were given to students after the program.

Some of the Kentucky Education Reform Act goals addressed in the programs described above include (Kentucky Department of Education, 2006):

- SC-EP-3.4.3
  Students will describe the basic structures and related functions of plants and animals that contribute to growth, reproduction, and survival. Each plant or animal has observable structures that serve different functions in growth, survival, and reproduction. For example, humans have distinct body structures for walking, holding, seeing and talking. These observable structures should be explored to sort, classify, compare, and describe organisms.
- SC-EP-4.7.1
  Students will describe the cause and effect relationships existing between organisms and their environments. The world has many different environments. Organisms require an environment in which their needs can be met. When the environment changes some plants and animals survive and reproduce and others die or move to new locations.
- SC-05-1.1.1
  Students will describe the physical properties of substances (e.g., boiling point, solubility, density). A substance has characteristic physical properties (e.g., boiling point, solubility, density) that are independent of the amount of the sample.
- SC-05-2.3.1
  Students will:
    - describe the circulation of water (evaporation and condensation) from the surface of the Earth, through the crust, oceans and atmosphere (water cycle);
    - explain how matter is conserved in this cycle.

  Water, which covers the majority of the Earth's surface, circulates through the crust, oceans and atmosphere in what is known as the water cycle. This cycle maintains the world's supply of fresh water. Students should have experiences that contribute to the understanding of evaporation, condensation and the conservation of matter.
- SC-05-2.3.2
  Students will explain interactions of water with Earth materials and results of those interactions (e.g., dissolving minerals, moving minerals, and gases). Water dissolves minerals and gases and may carry them to the oceans.

- SC-05-3.5.2
  Students will understand that all organisms must be able to obtain and use resources, grow, reproduce, and maintain stable internal conditions while living in a constantly changing external environment.
- SC-05-4.6.2
  Students will understand that the Sun is a major source of energy for changes on Earth's surface. The Sun loses energy by emitting light. A tiny fraction of that light reaches Earth, transferring energy from the Sun to Earth.
- SC-05-4.7.1
  Students will:
    - describe and categorize populations of organisms according to the function they serve in an ecosystem (e.g., producers, consumers, decomposers);
    - draw conclusions about the effects of changes to populations in an ecosystem.

  Populations of organisms can be categorized by the function they serve in an ecosystem. Plants and some microorganisms are producers because they make their own food. All animals, including humans, are consumers, and obtain their food by eating other organisms. Decomposers, primarily bacteria and fungi, are consumers that use waste materials and dead organisms for food. Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem. Using data gained from observing interacting components within an ecosystem, the effects of changes can be predicted.
- SC-06-2.3.3
  Students will compare constructive and destructive forces on Earth in order to make predictions about the nature of landforms. Landforms are a result of a combination of constructive and destructive forces. Collection and analysis of data indicates that constructive forces include crustal deformation, faulting, volcanic eruption, and deposition of sediment, while destructive forces include weathering and erosion.
- SC-07-4.6.1
  Students will understand that Earth systems have sources of energy that are internal and external to the Earth. The Sun is the major external source of energy.
- SC-07-4.6.3
  Students will understand that waves are one way that energy is transferred. Types of waves include sound, light, earthquake, ocean and electromagnetic.
- SC-08-1.1.4
  Students will describe interactions which cause the movement of each element among the solid Earth, oceans, atmosphere, and organisms (biogeochemical cycles). Earth is a system containing essentially a fixed amount of each stable chemical atom or element that can exist in several different reservoirs. The interactions within the earth system cause the movement of each element among reservoirs in the solid Earth, oceans, atmosphere, and organisms as part of biogeochemical cycles.
- SC-08-1.2.1

Students will describe and explain the effects of balanced and unbalanced forces on motion as found in real-life phenomena. Objects change their motion only when a net force is applied. Newton's Laws of Motion are used to describe the effects of forces on the motion of objects.

- 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.

An adult educational program was intended to be implemented as part of a Watershed Plan rollout, discussing the results of the water quality monitoring program, the sources of the pollutants, and the practices that could be implemented to address those sources. Due to time constraints during the grant period, however, this workshop was not held during the project period. It will be held during the implementation phase of the project after the BMP Implementation Plan has been approved, in order to educate the community about the water quality monitoring program results, and the role the community and individuals can play in addressing those results.

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, nutrients, and temperature. The suspect sources of these contaminants for the Clarks River watershed include agriculture, septic systems, stream bank erosion, and NPDES facility effluents. More information about these sources can be found in Section 5 of the *Watershed Based Plan for Clarks River Watershed* 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 Clarks River Watershed* included in Attachment C.
- **Identification of significant threats habitat in the watershed** – This objective was accomplished through the water quality monitoring program of this project. Habitat assessments were conducted at each monitoring site to determine specific

threats to habitat. Results of these assessments ranged from marginal to suboptimal. The main threats to habitat include land use, channelized stream, and development. More information about these results can be found in Section 5 of the *Watershed Based Plan for Clarks River Watershed* included in Attachment C.

- **Identification of concerns for stream bank degradation and flooding** – This objective was accomplished through the water quality monitoring program of this project. Habitat assessments, temperature, and total suspended solid concentrations indicated less than ideal bank conditions. These concerns will be addressed through best management practices in the BMP Implementation Plan that will be submitted.
- **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 four pollutants of concern identified through the water quality monitoring program of this project include *E. coli*, total suspended solids, nutrients, and temperature. 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 Clarks River Watershed* 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 Clarks River Watershed* included in Attachment C. More specific conservation plans and practices will be developed in a subsequent document, a BMP implementation plan for the Clarks River watershed.

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 the Calloway County Conservation District through their different educational programs for elementary, middle and high school age students of the Calloway County and Murray Independent school systems.
2. **Education efforts will be judged by participation** – Multiple schools and classes within Calloway County and Murray Independent school systems participated in the educational programs held by the Calloway 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 Clarks River Watershed* 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 Clarks River Watershed* included in Attachment C.
5. **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 Clarks River Watershed* included in Attachment C.
6. **Estimation of load reductions for identified sources** – Estimations of load reductions required to meet the water quality goals set through by the Strand Associates, Inc. were identified and discussed in the *Watershed Based Plan for Clarks River Watershed* included in Attachment C.
7. **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 Clarks River Watershed* has been attached in Appendix C.
8. **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 Clarks River Watershed* has been attached in Appendix C.
9. **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 Clarks River Watershed* has been attached in Appendix C.
10. **Plan success will be evaluated by the funding designated to address issues** – Funding for BMP Implementation in the Clarks River watershed has already been secured through a second EPA 319(h) grant to the Jackson Purchase RC&D Foundation, Inc. The grant will be administered through a partnership with the Calloway County Conservation District.

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* cannot 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	November, 2008
Summarize monitoring data	May, 2008
Conduct a watershed education workshop	December, 2008
Classroom watershed awareness module instruction	June, 2008

Completion of all field work	October, 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:

Budget Categories (itemize all categories)	**Section 319(h)**	**Non-Federal Match**	**TOTAL**	**Final Expenditures**
Personnel	$68,430	$40,620	$109,050	$106,365.85
Supplies	$5,000	$3,900	$8,900	$11,313.54
Equipment	$6,800	$5,260	$12,060	$21,757.90
Travel	$6,100	$4,000	$10,100	$1,201.93
Contractual	$6,900	$3,950	$10,850	$11,829.00
Operating Costs	$15,070	$14,470	$29,540	$31,498.19
Other	$0	$0	$0	$0
TOTAL	$108,300	$72,200	$180,500	$183,966.41
	60%	40%	100%	$100

The Jackson Purchase Resource Conservation and Development Foundation, Inc. was reimbursed $108,300.00. 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.

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
Toshiba 17" Laptop Computer	1	$729.00
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
Proscope Microscope	1	$604.00

***One-half of the total cost of these items were expensed to this project while the other half was expensed and shared with the Cane Creek 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 Toshiba 17" Laptop computer was used by the technical specialist for the project. 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 Proscope Microscope was purchased for both the water quality monitoring portion of the project, and as an education tool for the education program of the 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, which has already received funding from the Kentucky Division of Conservation through the 319 (h) program. As of September 30, 2009 the estimated value of the Kubota RTV 900G is $9,840.

Appendix B

Clarks River 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 Clarks River

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.