

**Little Sac Restoration and Improvement Project
G14-NPS-02**

Final Report

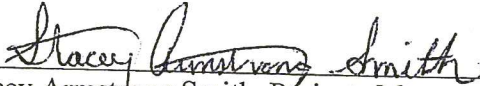
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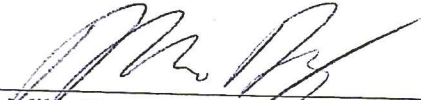
Approval Sheet

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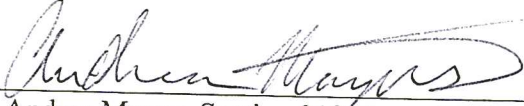
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1.0 Project Background

The Little Sac River watershed based plan (WBP) accepted by the department July 10th, 2010 and Total Maximum Daily Load (TMDL) focuses on the bacteria levels within the river. To follow the approved TMDL, the majority of the management measures in the watershed plan are focused on reducing the bacteria/E.coli present in the river. The management measures also address other water quality issues such as education, stormwater runoff, nutrients and sediment.

The Little Sac River begins at the north edge of Springfield and Strafford to form Fellows and McDaniel Lakes. On its journey north into Stockton Lake, the Little Sac's 41.5-mile channel gains flow through springs and its major tributaries: Slagle Creek, North Dry Sac, South Dry Sac and Asher Creek. The 390-square mile watershed encompasses the towns of Willard, Walnut Grove, and Morrisville. This watershed has a diverse land use that changes from very urbanized/high density population in the upper, southern part of the watershed to rural agricultural land use in the middle two-thirds, and recreational areas surrounding Stockton Lake. The three lakes (Stockton, Fellows, McDaniel) are public drinking water sources for Springfield and Greene County residents. The lakes also provide recreation, fishing, and hunting opportunities for thousands of users annually.

1.1 Project Goals and Objectives

The purpose of the project was to implement best management practices (BMPs) to improve water quality, decrease soil erosion, and improve aquatic life. The project also included water quality monitoring and nonpoint source/project-specific educational activities. The portion of the HUC 12 watershed in Greene County (Upper Little Sac River) was the project focus area for implementation. Listed below are the project goals and objectives as outlined in the subgrant agreement.

Best Management Practices:

- One Demonstration Longitudinal Peaked Stone Toe Protection (LPSTP) Practice
- Three Prescribed Grazing Systems with an approximate total of 240 acres completed
- Vegetative Buffer Strips (quantity depends on size of practices and funding available)
- Stream Restoration Practices (quantity depends on size of practices and funding available)

Water Quality Monitoring:

- Weekly samples May through September at a minimum of 5 sites on the Upper Little Sac River and its tributaries by City Utilities of Springfield
- Quarterly samples October through March at a minimum of 5 sites on the Upper Little Sac River and its tributaries by City Utilities of Springfield
- WCO to provide a watershed map marking where monitoring will occur

Project focused education:

- One project specific HUC 12 watershed factsheet
- Three developed press releases and newsletters
- One nonpoint source BMP workshop, public meeting
- One project webpage, and one project specific sign located at the Watershed Center
- Two canoe tours for county, city and WCO officials to see before and after affects from projects
- Light refreshments (e.g., chips, pretzels, cookies, fruit, and/or lemonade, water) for nonpoint source focused BMP tours and workshops

1.2 Target Audience

Our target audience for our educational hands on workshops during project construction was local contractors, inspectors, engineers, and residents in the watershed interested in learning more about stream restoration/improvements. We were successfully able to reach our audience which we were able to document by the registrations for the workshop.

1.3 Activities Conducted to Achieve Project Goals and Objectives

The grant activities were effective in reaching our target audience and fulfilling the project's goals and objectives. The activities were important components of the project to demonstrate and educate our targeted audience on water quality best practices on their land. The activities and list of projects are summarized in the charts below.

Activity/Product	# Produced	Description
Project Workshops	2	Stream stabilization workshops were held as part of the hands-on learning for the LPSTP.
Steering Committee Meetings	8	Meetings with grant committee of local representatives to help guide project decisions
Newsletters	11	Articles providing grant updates in the WCO quarterly newsletter

		publication
Project Specific Sign	1	Educational water quality sign at the David C. Murray Ozark Greenways Trailhead
Press Releases	2	Press releases were sent during the start of the grant and for the stream stabilization project.
Project Canoe Tour and Field Day	1	A two mile stretch of the Little Sac River was floated with MDC staff to conduct hydrilla monitoring and fish demonstration
Stream Clean-ups	2	Stream clean-ups on the Little Sac River, one conducted by the Boy Scouts and one by WCO
Quality Assurance Project Plan (QAPP)	1 technical report	WCO worked with CU and DNR to create the QAPP for the grant
Soil and Water Assessment Tool (SWAT) simulated flow and bacteria in Little Sac Watershed: A Best Management Practice Assessment	1 technical report	Ozarks Environmental and Water Resource Institute (OEWRI) did the modeling and SWAT report
Bacteria Source Tracking to Support Watershed Planning, Little Sac River, Southwest Missouri	1 technical report, 5 sites sampled twice for human, bovine, goose, chicken and dog	Data and report by Ozarks Environmental and Water Resource Institute (OEWRI) Missouri State University
Upper Little Sac Watershed Management Plan	1 watershed plan	EPA nine element plan for Upper Little Sac Watershed
Little Sac River Priority Watershed 2013 Sampling Summary Report	1 document, 9 sites sampled during summer 2013 to assess aquatic/benthic community	Resource Assessment and Monitoring (RAM) by Missouri Department of Conservation Fisheries Division-Southwest Region
Water Quality Data Collection	6 sites sampled, full sample details in QAPP	Water quality data was collected and analyzed by City Utilities of Springfield
Quarterly Reports	22	Quarterly report updates to

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Annual Reports and MBE/WBE Reports	5 of each	grant manager Annual grant updates and forms to grant manager
Final Reports	1	Final report updates to grant manager

1.3.1 Projects Produced

Project	# Produced	Description
Longitudinal Peaked Stone Toe Protection Stream Stabilization	1	LPSTP is a form of windrow revetment, with stone placed along the existing streambed rather than on top bank.
Prescribed Grazing Systems	7	Grazing systems were designed by Soil and Water District and installed on land in the watershed.
Vegetated Buffer Strips	3	Installing vegetated buffer strips in Little Sac River watershed following NRCS standards
Riparian Corridor Plantings	1	Enhanced Little Sac River riparian corridor on landowner property by planting 380 native seedlings

2.0 Evaluation Measures

1. All project sites were documented photographically, from before implementation through construction phase to final construction and monitoring.
2. A post-survey was given to participants of the workshop to develop an understanding of the landowner's perception of implementing project specific nonpoint source practices.
3. Education/Outreach efforts were quantified by the amount of materials distributed and information requested. Evaluation of overall effectiveness and repeatability of outreach projects in the area was accomplished through comprehensive post-project surveys of the general public.
4. Efforts were made to evaluate the BMPs, assess their effectiveness in the watersheds, and potential influence on pollutant loading. Calculations of load reductions were done indirectly based on the application of modeling results to assumptions of load reduction strategies at the watershed-scale.

2.1 Water Quality Monitoring Activities

Water quality monitoring for this project followed the Environmental Protection Agency (EPA) Volunteer Water Quality Monitoring (VWQM) protocol to conduct bacteria (total coliform and *E. coli*; IDEXX Colisure method) monitoring. The EPA VWQM quality assurance project plan (QAPP) was utilized as a template, with the addition of the IDEXX Colisure method, to create this project specific QAPP. Water quality was assessed with weekly samples May through September at 6 sites over the project period on the Upper Little Sac River and its tributaries by City Utilities of Springfield; quarterly samples were taken October through March at 6 sites over the project period on the Upper Little Sac River and its tributaries as well. Discharge, temperature, conductivity, turbidity, dissolved oxygen, and pH will were assessed at the stream site at the time that the water samples were collected. Nitrate-nitrogen, phosphorus, total coliform, and *E. coli* were assessed at the City Utilities Laboratory within six hours of water sample collection. For non-bacterial indicators, a single estimate was determined on each date. For bacteria, the geometric mean of replicate non-zero values from each stream site (up to six replicates and dilutions), and the geometric mean of five grabs in a 30-day period (from each stream site) was assessed. A tabular report format includes data for bacteria and the other water quality indicators with reference to good water quality ranges for each parameter. The Department's WPP Monitoring and Assessment Unit provided technical assistance, when needed, in selecting the monitoring site locations and other water quality monitoring concerns. All monitoring is described in the detail in the Quality Assurance Project Plan (QAPP) and includes instream monitoring. The QAPP can be found in the attachments.

Bacteria Source tracking sampling was conducted by Ozarks Environmental and Water Resource Institute (OEWRI) at Missouri State University. The purpose of this study was to collect water samples throughout the watershed and evaluate bacteria DNA using real-time PCR for specific marker genes that can help identify specific bacteria sources from different locations in the Little Sac River watershed. Water samples were collected from five different locations in the Little Sac River Watershed. Samples were collected two weeks apart on September 22 and October 6, 2017. IDEXX *E. coli* samples were also collected at all sample sites. The results showed some variability in the *E. coli* concentrations between the two sample periods. Four out of five sites had positive results for at least one of the markers examined for the bacteria source tracking. The full results for this study can be found in the 'Bacteria Source Tracking to Support Watershed Planning, Little Sac River, Southwest Missouri' technical report in the attachments.

2.1.1 Load Reduction Calculations and Summaries

The Missouri Department of Natural Resources assisted with BMP load reduction calculations for the BMPs/projects implemented using STEPL.

Pollutant	Reduction	Method Used
Sediment	58.3 tons of sediment	STEPL
Nitrogen	1119.2 lbs.	STEPL
Phosphorus	142.2 lbs.	STEPL

2.2 Other Environmental Field Activities Conducted

All project sites were documented photographically, from before implementation through construction phases to final construction. Before and after photos were used for any public participation and volunteer projects such as the riparian tree planting and canoe trip, as well as photographs of volunteers involved in the work. Educational events and activities such as workshops were photographed for inclusion in project reports and for media distribution.

2.3 Measuring Knowledge and/or Behavior Changes

Yes, we were able to reach our project goals. The knowledge level of the watershed residents and citizens was increased through our educational workshops and demonstration projects. Hands on learning approaches were provided by incorporating an educational workshop during the construction of our streambank restoration project.

3.0 Partners and Roles

Partner	Role
Greene County Soil and Water Conservation District	Technical advice and assistance
City Utilities of Springfield Laboratory	Water quality monitoring assistance
Missouri Department of Natural Resources	Project and technical assistance
Watershed Committee of the Ozarks	Project manager, technical assistance to landowners through education/outreach
Watershed landowners	Implement project specific BMP's for nonpoint source pollution reduction and

	water quality improvement
Ozarks Environmental and Water Resources Institute	Completed the SWAT model for the WMP update

3.1 Committees Formed

The Project Steering Committee was formed for this project. Their function helped provide guidance on project structure, details and coordination. The committee included individuals from a diverse professional and technical group. Below is a list of the steering committee members.

- Eric Morris and Will Rhodes, Greene County SWCD
- Diana Sheridan and Mark Green, NRCS
- Andy Austin, Missouri Department of Conservation
- Chuck Aderhold and Todd Brewer, City Utilities of Springfield
- Tim Davis, Greene County
- Marc Owen and Sean Zeiger, OEWRI
- Mike Kromrey and Stacey Armstrong Smith, WCO
- Andrea Mayus, MODNR

4.0 Project Overview

The primary purpose of the project was to reduce the loading of pollutants identified in the 303(d) watersheds and accompanying TMDL for the Little Sac River, as described and recommended in the WBP for that basin, by targeting the sub-watershed for the implementation of BMPs that will reduce nonpoint source pollution. The WCO implemented various practices including: LPSTP, prescribed grazing systems, and riparian restoration in the hydrologic unit code (HUC) 12 watershed of Little Sac River (102901060404). The approach of this project was to monitor the performance of the selected BMPs at regional levels in the sub-watershed, as well as estimate sub-watershed pollutant loading improvements at sub-watershed outlets, so that BMP designs and improvements can be incorporated into criteria manuals and future policies and ordinances addressing agricultural and urban water quality.

The EPA nine element Upper Little Sac Watershed Management Plan was updated as one of the milestones of this grant. OEWRI with Missouri State University created the SWAT (Soil Water and Assessment Tool) model and bacteria source tracking study as a component of the plan. Missouri Department of Natural Resources assisted in developing the bacteria load duration curve for the plan. The SWAT and load duration curve helped identify most effective BMPs and priority watersheds for future project implementation.

The WCO coordinated the project and handled all administrative duties such as accounting and record keeping, financial status reports, bidding projects, invoicing, and quarterly and final reporting. The WCO was the primary point of contact with the Department's Project Manager and financial personnel. Additional primary partners in the project, were Greene County Soil and Water Conservation District (SWCD); City Utilities of Springfield; Missouri Department of Conservation (MDC); and DNR. The WCO assembled the project steering committee, held regular meetings with the steering committee and partners to discuss project progress and problems, work with individual partners on the development of BMP installation and maintenance agreements, and gathered information from partners and participants to include in quarterly and final reports for the Department in order to satisfy the terms of the grant agreement.

The project did progress slightly more slowly than originally planned due to delayed landowner interest and participation for the stream restoration project. That challenge was overcome by finding a new project site with a landowner that was also willing to provide match for the project. The project did meet and exceed the overall project goals and objectives.

4.1 Department of Natural Resources Role

DNR helped provide the modeling calculation for the implemented BMP projects during the project. DNR grant managers also provided project guidance and assistance for questions related to the project. The degree of involvement was beneficial, and the correct amount of guidance and support needed for the project.

4.2 Suggested Changes to Project Efforts

This project was a great example of coordination with local partners, landowners and community organizations. The original site selection process for the stream stabilization did not work out due to no matching funds from the landowner. However, it provided a wonderful opportunity to work with another local landowner/business in our watershed referred to us by Greene County. The landowner became very invested financially and environmentally in the improvements in the watershed and learned a new appreciation for local water quality. The completed project site is now an active stop in many water quality field visits and tours for other community partners since the landowner is happy to have us stop by and see the progress. Major lessons learned during this project is being open to other project locations when the first site does not work. Also seize the opportunities include landowners in the design, installation, tree planting and maintenance will improve the life of the project.

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5.0 Attachments

- Photo journal
- Water Quality Data (Excel format)
- Quality Assurance Project Plan (QAPP)
- Bacteria Source Tracking Report
- Soil and Water Assessment Tool (SWAT)
- Little Sac River Priority Watershed Sampling Summary Report
- Newsletter articles
- Press Releases
- Workshop Flyers
- Project Sign