WATERSHED PROJECT FINAL REPORT
SECTION 319 NON-POINT SOURCE POLLUTION CONTROL PROGRAM

SPRING CREEK WATERSHED MANAGEMENT AND PROJECT IMPLEMENTATION PLAN SEGMENT 3 FINAL REPORT

PROJECT SPONSOR:

PENNINGTON COUNTY
130 KANSAS CITY STREET
SUITE 200
RAPID CITY, SOUTH DAKOTA 57701

Prepared By:
Brittney Molitor
Environmental Planning Supervisor
Pennington County

OCTOBER 2017

Grant # 9998185-12, 9998185-13, 9998185-15

EXECUTIVE SUMMARY

Project Title:	Spring Creek Watershed Management and Project Implementation Plan - Segment 3
Project Start Date:	July 1, 2015
Project Completion Date:	July 31, 2017
Fiscal Grant Years	2012, 2013, and 2015

Funding Sources	**Original Budget**	**Expended**
EPA Grant:		
9998185-12	$ 68,297.17	$0.00
9998185-13	$31,182.63	$17,449.88
9998185-15	$115,000	$0.00
Total 319	**$214,479.80**	**$17,449.88**
CWSRF-WQ	$100,000	$0.00
Local Funds	$182,000	$27,627.58
Total Budget:	**$496,479.80**	**$45,077.46**

ACKNOWLEDGEMENTS

Pennington County would like to thank all of those involved with the Spring Creek Watershed Management and Project Implementation Plan. Without the efforts of individuals involved from the following organizations, this Project would not have been possible:

Black Hills Resource Conservation and Development
City of Hill City
Individual Landowners within the Watershed
Pennington Conservation District
South Dakota Department of Environment and Natural Resources
South Dakota Game, Fish, and Parks
South Dakota School of Mines and Technology
Spring Creek Advisory Group
United States Corps of Engineers
United States Environmental Protection Agency
United States Forest Service, Black Hills National Forest
United States Natural Resource Conservation Service

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

1.0 INTRODUCTION

1.1Location

Spring Creek is a perennial mountain stream located in Pennington and Custer Counties in the Black Hills of South Dakota. Spring Creek is a tributary of the Cheyenne River, which flows into the Missouri River. The drainage area of Spring Creek is approximately 425 square miles at the confluence with the Cheyenne River.

The surface area of the watershed that impacts the impaired reach of Spring Creek above Sheridan Lake encompasses approximately 93,124 acres and includes Hydrologic Units 101201090901, 101201090902, 101201090903, 101201090904. Spring Creek flows through Sheridan Lake, which is a man-made reservoir with a surface area of approximately 380 acres. The city of Hill City (population ~950) is the only municipality located in the watershed.

1.2Project Area

The project area is the Spring Creek Watershed which covers about 93,124 acres or 145 square miles and is defined as the drainage upstream of Sheridan Lake Dam and shown in Figure 1. The watershed or project area terms are used interchangeably throughout this plan. The watershed is about 18 miles long and 11 miles wide.

1.3Land Use in the Watershed

Land use in the watershed is primarily silviculture, recreation, residential, and grazing. Metamorphic slates and schists, along with granite rock, underlie a large portion of the basin and form the Central Crystalline Area of the Black Hills that covers the majority of the watershed area.

1.4Soil Types in the Watershed

The watershed's major soil types are Pactola, Buska, Mocmont, and Stovho. The Pactola series of soils, which cover most of the watershed, were formed by the weathering of materials in steeply tilted metamorphic rock. The Buska series descends from micaceous schist, while the Mocmont formed from material weathered from granite. Those two series generally occur in the upper reaches of the watershed in the Harney Peak area. The Stovho series formed from the weathering of limestone and calcareous sandstone and is found in the upper reaches of the watershed in the area underlain by the Madison Limestone Formation.

1.4Slope

Digital Elevation Models (DEMs) of the area show the average slope to be approximately 20 percent. Much of the land is located within the Black Hills National Forest and is predominantly forested with ponderosa pine; other cover includes grasslands and hardwoods.

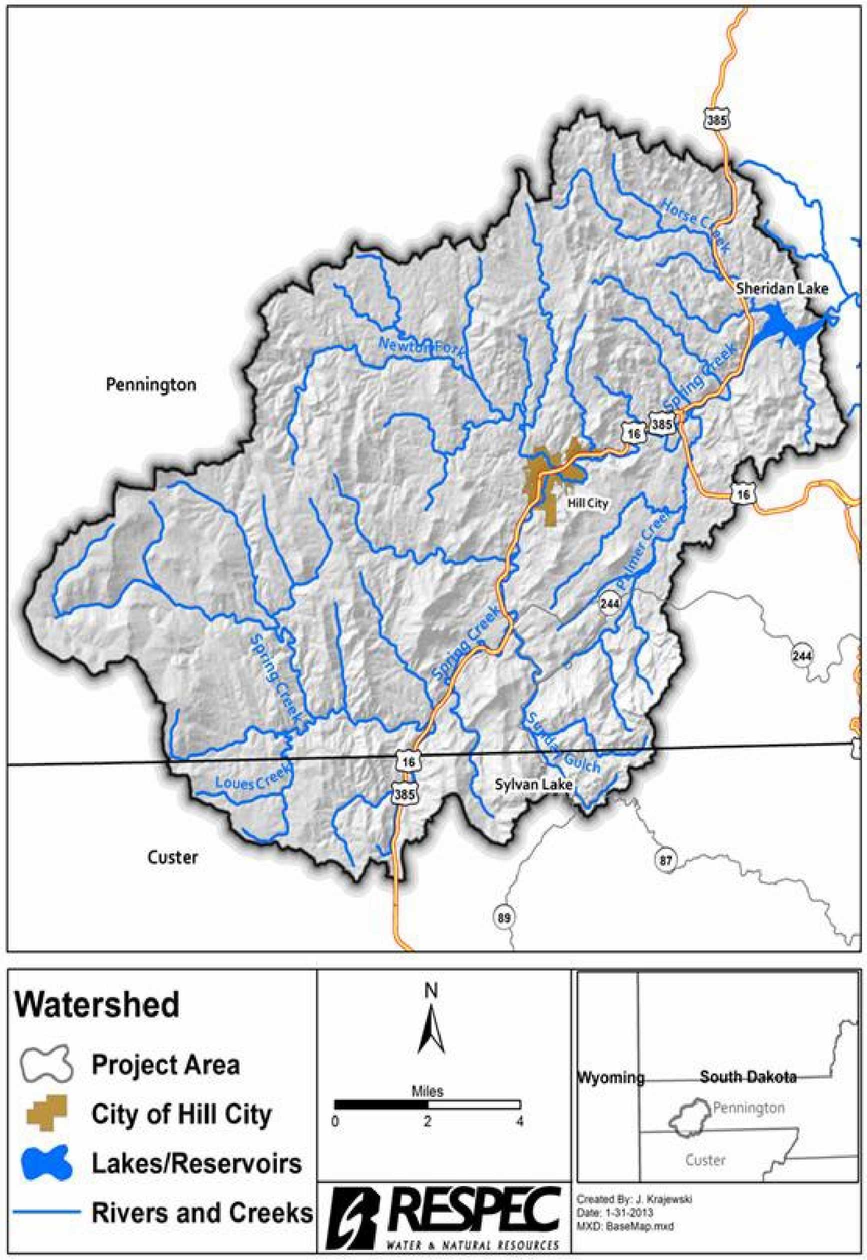


Figure 1. Project Area

The average annual precipitation in the watershed is 20.8 inches; 80 percent usually falls in April through September. Tornadoes and severe thunderstorms strike occasionally. These storms are local and of short duration and occasionally produce heavy rainfall events. The average seasonal snow pack is 27.3 inches per year.

1.6 Modeling Results

Modeling results of the initial Total Maximum Daily Load (TMDL) assessment estimated that more than half (63.5 percent) of the bacteria load originates from livestock and other agricultural land uses. The remaining load originates from urban runoff (13.7 percent) and other human sources (14.8 percent), including failing septic and leaking sanitary sewer systems (Figure 2). During Segment 1, questions were raised and concerns expressed by the Spring Creek Watershed Advisory Group (SCWAG) members regarding the accuracy of the modeling results so additional data including water-quality monitoring, land use, septic locations, and failure rates, livestock and wildlife populations, and installed Best Management Practices (BMPs) within the watershed have been collected to improve the watershed model and its results for future implementation segments.

These modeling results are incorporated and discussed in detail in the Spring Creek Watershed Storm Water Management Plan and the Spring Creek Watershed Strategic Implementation Plan. Critical conditions occur within the watershed during the summer. Typically, greatest numbers of livestock and tourist activities (i.e., trail rides, camping) occur in the watershed during summer months. Combined with the peak in bacteria sources, high-intensity storm events also occur during the spring, summer, and fall and produce a significant amount of fecal coliform load because of bacterial wash-off in the watershed.

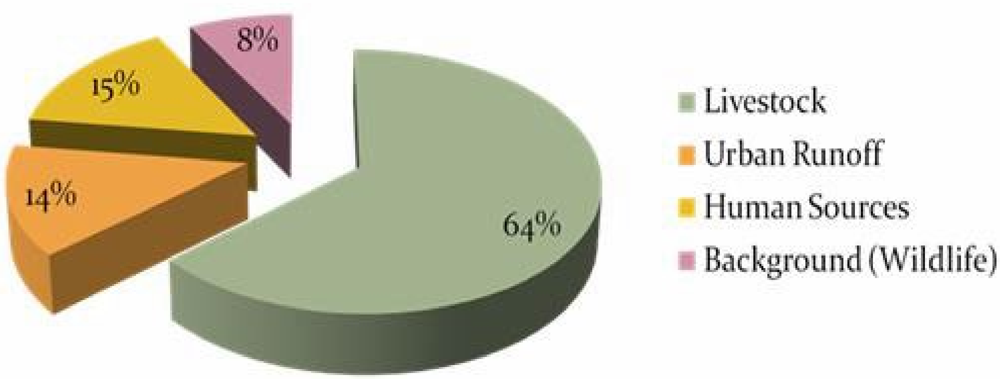


Figure 2. Modeling Results

1.7 Previous Segments

1.7.1 Segment 1

During Segment 1, Pennington County and their partners conducted baseline multiparty monitoring in 2010 for fecal coliform bacteria, E. coli, total suspended solids (TSS), total phosphorus (TP), and nitrate+nitrite (NO3+NO2) on 17 monitoring sites and again in 2011, Pennington County along with SDSM&T students, local civic groups, and project participants collected ambient and storm event water-quality samples on 16 monitoring sites.

Also during Segment 1, some unique outreach activities were completed with the Spring Creek 319 Watershed Project website launched and can be accessed at www.pennco.org/springcreek. This website received more than 1,300 unique visitors. Three direct mailings to over 1,000 watershed residents were conducted to inform them about the implementation project, water-quality monitoring, and BMP cost-share signups.

There were twelve implementation projects completed in Segment 1. Of the twelve, half were on-site wastewater treatment system improvements and the other half riparian improvements. The riparian improvements consisted of bank stabilization practices, use exclusion and access control, and water line/water facility installation.

A copy of the Segment 1 final report can be found at:
http://denr.sd.gov/dfta/wp/wqprojects/tmdl_springcreekpipseg1.pdf

1.7.2 Segment 2

During Segment 2, Pennington County conducted monitoring in 2012 and 2013 for fecal coliform bacteria, *E. coli*, total phosphorus (TP), nitrate+nitrite (NO3+NO2) and total suspended solids (TSS) on 17 monitoring sites. In 2014, Pennington County conducted monitoring for fecal coliform bacteria, E. *coli*, and TSS on 8 monitoring sites.

There were eight implementation projects completed in Segment 2. Of the eight, five were on-site wastewater treatment system improvements and the other three riparian improvements. The riparian improvements consisted of bank stabilization practices, willow planting, and grade stabilization structures.

A copy of the Segment 2 final report can be found at:
http://denr.sd.gov/dfta/wp/documents/tmdl_springcreekpipseg2.pdf

2.0 STATEMENT OF NEED

2.1 Total Maximum Daily Load (TMDL)

The South Dakota School of Mines & Technology (SDSM&T), along with the South Dakota Department of Environment and Natural Resources (SD DENR), developed and implemented an assessment project to determine the fecal coliform Total Maximum Daily Load (TMDL) for Spring Creek and the Sheridan Lake TMDL for Trophic State Index (TSI). The project started during 2002. The purpose of the assessment was to address rural and urban nutrient, sediment, and fecal coliform problems in the watershed. The overall goal was to produce a TMDL for fecal coliform in Spring Creek and a TSI TMDL in Sheridan Lake to improve water quality by reducing fecal coliform, nutrient, and sediment loading in Spring Creek. The Sheridan Lake TSI TMDL and the Spring Creek fecal coliform bacteria TMDL were approved by the Environmental Protection Agency (EPA) in 2006 and 2008, respectively.

2.2 Beneficial Uses

Spring Creek was assigned the following beneficial uses: coldwater permanent fish life propagation (above Sheridan Lake), cold-water marginal fish life propagation (below Sheridan Lake), immersion recreation, limited contact recreation, fish and wildlife propagation, recreation and stock watering, and irrigation. Sheridan Lake was assigned the following beneficial uses: coldwater permanent fish life propagation, immersion recreation, limited contact recreation, fish and wildlife propagation, and recreation and stock watering. When multiple criteria exist for a particular parameter, the most stringent criterion is used.

In addition to the EPA approved TMDLs on Spring Creek and Sheridan Lake, the SD DENR's 2010 Integrated Report and 303(d) list states that Spring Creek's coldwater permanent fish life beneficial use is impaired because of temperature, Sheridan Lake's coldwater permanent fish life beneficial use is impaired because of dissolved oxygen and temperature, and Sylvan Lake's coldwater permanent fish life beneficial use is impaired because of temperature. Spring Creek, Sheridan Lake, and Sylvan Lake are scheduled for additional TMDL development to address these impairments in 2018, 2020, and 2020, respectively.

2.4 Additional Impairments

Individual parameters determine the support of these beneficial uses. South Dakota has narrative standards that may be applied to the undesired eutrophication of lakes and streams. Administrative Rules of South Dakota (ARSD) Article 74:51 contains language that prohibits the presence of materials causing pollutants to form, visible pollutants, taste- and odor-producing materials, and nuisance aquatic life. Reduction of nutrients in Spring Creek, specifically phosphorus, was addressed in the TSI TMDL developed for Sheridan Lake and is included in the scope of this watershed implementation project.

2.5 Location of Impairments

The impaired (303(d) listed) segment (Figure 3), for fecal coliform, E. *coli*, and TSS, of Spring Creek has a length of 31 miles and flows through Mitchell Lake, which has a surface area of about 7 acres. This segment ends where Spring Creek empties into Sheridan Lake, approximately 4 miles downstream of Mitchell Lake. The drainage area of the 303(d) listed segment is approximately 425 square miles.

Figure 3. Impaired Segment of Spring Creek *(in blue)*

3.0 PROJECT GOALS AND OBJECTIVES

The project goal was to bring Spring Creek into compliance with state water quality standards for fecal coliform bacteria, E. *coli* and Total Suspended Solids (TSS) by implementing the recommended BMPs by 2021. The goal of Segment 3, as set forth in the Spring Creek and Sheridan Lake Total Maximum Daily Load (TMDL) studies, included the following:

- ✓ Implementation of riparian, manure management, and on-site wastewater treatment system (OWTS) BMPs in the watershed to reduce fecal coliform bacteria and E. *coli* from the headwaters of Spring Creek to Sheridan Lake.
- ✓ Demonstration of BMP projects for storm water, forestry, and lake rehabilitation that will help encourage BMP implementation and expand public outreach efforts.
- ✓ Conducting public education and outreach to stakeholders within the Spring Creek Watershed.
- ✓ Performed water-quality monitoring to aid in tracking watershed conditions.

3.1Milestones

Objective 1. Implement BMPs Recommended in the Fecal Coliform Bacteria TMDL for Spring Creek.

This objective consisted of three tasks: (1) improving riparian vegetation and manure management techniques, (2) improving stormwater management and (3) implementing on-site wastewater treatment system (OWTS) improvement projects. The products of this objective included completing riparian vegetation/streambank protection projects, storm water projects, on-site wastewater treatment system improvements, and manure/grazing management projects.

This objective consisted of two riparian vegetation/streambank protection projects, one stormwater project, and three on-site wastewater treatment projects.

Objective 2. Public Outreach and Project Management.

This objective consisted of three tasks: (1) public outreach, (2) implementation record keeping, and (3) report and future grant writing. The products of this objective included public meetings, project tours, Advisory Group meetings, conservation plans and agreements, administration, and travel.

This objective consisted of one public meeting, one tour, eight advisory group meetings, and six participant conservation plans and agreements.

3.2 Evaluation of Goal Attainment

Segment 3 success was evaluated by comparing project outputs and outcomes with the planned milestones. All of the objectives established for this Project were not reached. The following products were completed:

- Completion of two OWTS improvement projects.
- Completion of one riparian-vegetation project.
- Evaluation and ranking of cost-share applications.
- Completion of site visits with property owners to discuss water quality, project goals, and BMP funding by Pennington County, and watershed consultant.
- Maintenance of the Spring Creek Watershed §319 Project website.
- Completion of educational brochure for Riparian Buffers (see Appendix A).
- Completion of two Grant Reporting and Tracking System (GRTS) Final Reports.
- Completion of Segment 3 Final Report.

4.0 BEST MANAGEMENT PRACTICES

Implementation of the BMPs recommended in *Fecal Coliform Bacteria Total Maximum Daily Load for Spring Creek, Pennington County, South Dakota* was initiated during this Project. BMP installations were funded by local property owners, Pennington County, City of Hill City, United States Forest Service – Black Hills National Forest, and Natural Resource Conservation Service. Table 1 provides the BMP projects installed within all Segments of the Project.

Table 1. BMPs Installed in Segment 3

Best Management Practice	BMP Units
On-site Wastewater Treatment System	2 each
Streambank Protection	270 linear feet
Grade Stabilization Structure	1 each

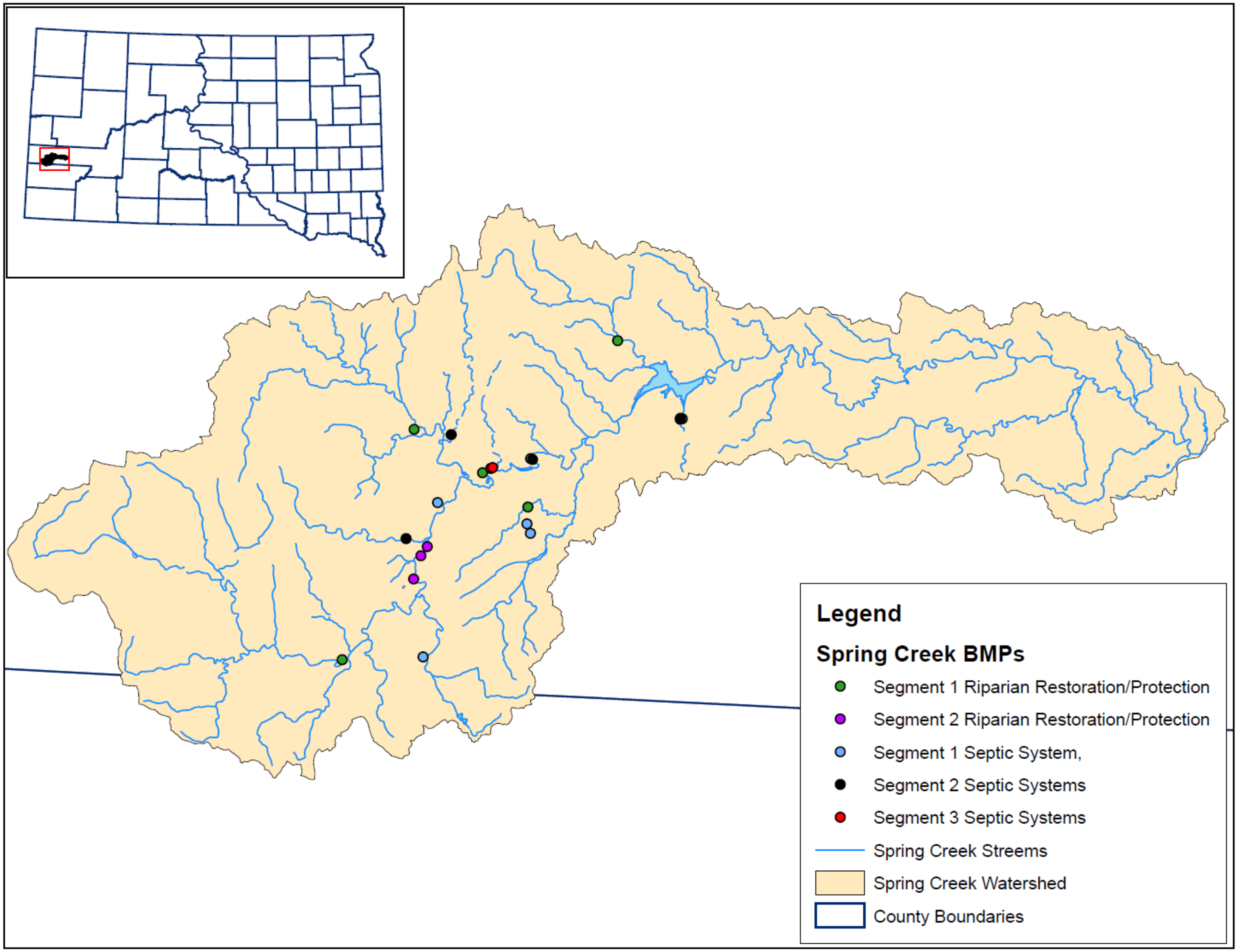


Figure 4. Location of BMP Projects (Segments 1 through 3)

4.1 Results of Best Management Practices Operation and Maintenance

Pennington County was responsible for ensuring that BMPs cost shared with the Clean Water Act Section §319 grant funds were installed. Verification of the BMPs and their performance were photo documented during the Project. Figures 4 through 7 show the BMPs installed in Segment 3.

Figure 5 and 6. Grade Stabilization Structures

Figure 7. Bank Stabilization

Figure 8. New Onsite Wastewater Treatment System (OWTS) Installations for Segment 3

5.0 POLLUTANT LOAD REDUCTIONS

BMPs implemented and approved within the Segment 3 contributed in an effort to obtain the goals as set forth in the Spring Creek and Sheridan Lake TMDL studies. BMPs installed focused on reducing fecal coliform/E. *coli* bacteria loads to begin attaining the load reductions identified in *Fecal Coliform Bacteria Total Maximum Daily Load for Spring Creek, Pennington County, South Dakota.*

Table 2. Pollutant Load Reductions for BMPs Implemented during Segment 3.

Pollutant Type *	Pollutant Reduction Target	Current Year Pollutant Reduction	Cumulative Pollutant Reduction Achieved (Numerical)	Units	TMDL yes/no
POLLUTANTS					
Fecal Coliform	400 cfu/100 ml	2015-2017	$8.8e10^{9}$	cfu/100mL	YES
E. Coli	235 cfu/100 ml	2015-2017	$3.6e10^{9}$	cfu/100mL	YES
ADDITIONAL POLLUTANTS					
Total Suspended Solids	53 mg/L	2015-2017	8	tons/yr	YES
Total Phosphorus	10 ug/L	2015-2017	26	lbs/yr	NO
Total Nitrogen	n/a	2015-2017	71	lbs/yr	NO

Streambanks/Shorelines

☒ **Streambank and Shoreline Protection**

Description	Current Year	Cumulative Total	Units
Streambank and Shoreline Protection	2015-2017	270	Feet

6.0 SUCCESSES AND CHALLENGES OF THE PROJECT

During the Project there were significant public outreach opportunities. These included meetings, mailings, and tours. The stakeholders in the watershed are aware of some of the concerns and issues related to water quality on Spring Creek. Continued efforts from stakeholders to implement future BMPs can reduce pollutant loads to the creek and ultimately reach load reduction goals.

In addition, during the Project a large data set was collected that can be utilized for future studies and verification of BMP successes. During large storm events, implemented BMPs performed as designed in comparison to unimproved streambank areas. In 2014, the data reflected an overall reduction in the percentage of exceeded water quality criterion.

One of the biggest challenges during the Project was commitments from the property owners to move forward past the initial approval of the BMP. During this Segment of the Project, issues arose regarding best management practices related to riparian improvements along Spring Creek. There was concern that these practices were a "landscaping" practice and not a best management practice to moderate flow, temperature, nutrients, bacteria, and sediment in the watershed. Several Letters to the Editor in the local newspaper, the Hill City Prevailer, accused local landowners of using the Project to landscape their land.

In addition, there was a change in the consultant that managed the Project. The previous consultant had formed relationships with many of the residents in the watershed. During Segment 3, these relationships had to be reestablished, which took a considerable amount of time and therefore impeded the ability to get BMPs implemented in a timely manner.

7.0 SEGMENT 3 PROJECT BUDGET/EXPENDITURES

Table 3. Segment 3 §319 Budget

Project Objective and Task Description	319 Funds		SWSRF-WQ	Total
	Participants	Consultants		
Objective 1. Implement BMPs Recommended in the Spring Creek Watershed TMDL				
Task 1. Riparian, Stormwater, Livestock, and Grazing Improvements				
Products 1a-1c BMPs, Engineering				
Engineering		25,000	0	25,000
1a. Three Riparian / Vegetation / Streambank Protection Projects	18,586		0	18,586
1b. One Stormwater Project	14,000		0	14,000
Task 1 Totals	**32,586**	**25,000**	**0**	**57,586**
Task 2. *On-site Wastewater Treatment System (OWTS) Improvements*				
Product 2. OWTS BMPs				
Three OWTS BMPs	20,000		0	20,000
Task 2 Totals	**20,000**		**0**	**20,000**
Objective 2. Public Outreach and Project Management				
Task 3. Public Outreach, Implementation Record Keeping, and Reports				
Products 3a-3d. Project Management/Public Outreach				
3a. Public Education and Outreach		5,000	0	5,000
3b. Project Management		9,000	0	9,000
3c. Administration		5,000	0	5,000
3d. Travel		1,000	0	1,000
Task 3 Totals		**20,000**	**0**	**20,000**
TOTAL	**52,586**	**45,000**	**0**	**97,586**

Table 4. Segment 3 Expenditures

Project Expense	**319**	**Pennington County**	**Local Funds**	**Total**
Administration		$2,760.32		$2,760.32
Project Management		$2,436.18		$2,436.18
Travel		$167.98		$167.98
OWTS Improvements	$10,113.95	$80.64	$13,935.60	$24,130.19
Riparian Improvements	$7,335.93	$843.79	$5,009.30	$13,189.02
Information & Education		$2,393.77		$2,393.77
Total	**$17,449.88**	**$8,682.68**	**$18,944.90**	**$45,077.46**

8.0 OVERALL FINAL PROJECT EXPENDITURES

Pennington County received $875,152.71 in EPA Section §319 Grant funding for the Project through the SD DENR to implement BMPs recommended by Kenner and Larson [2008], prepare planning documents for stormwater, on-site wastewater treatment systems, and a strategic plan, and to monitor water quality. Figure 9 and Table 5 reflect the final expenditures for the Project.

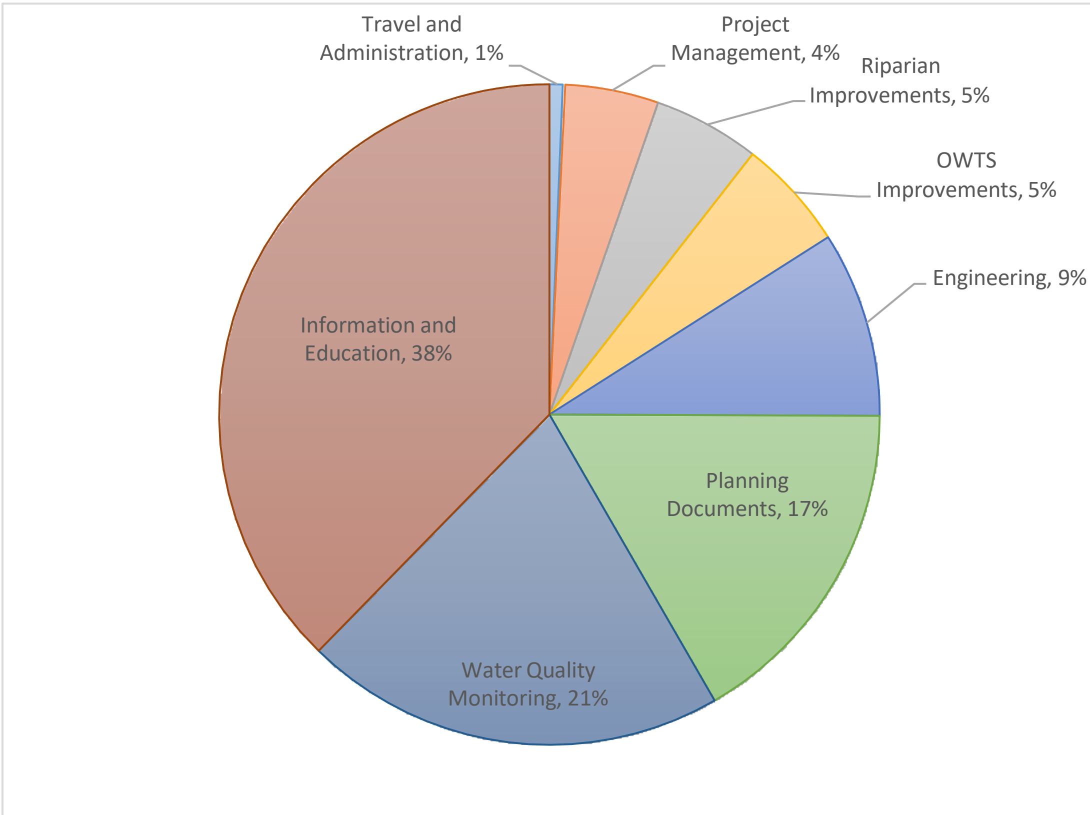


Figure 9. Final §319 Expenditure Percentages

Travel and Administration	$	6,680.00
Project Management	$	40,000.00
Riparian Improvements	$	45,632.26
OWTS Improvements	$	47,512.51
Engineering	$	79,500.00
Planning Documents	$	145,300.00
Water Quality Monitoring	$	180,707.94
Information and Education	$	329,820.00
Total	**$**	**875,152.71**

Table 5. Final §319 Expenditure Amounts

10.0 REFERENCES

Administrative Rules of South Dakota 74:51:01. 2015. Surface Water Quality Standards.
…, 74:51:03. 2015. Uses Assigned to Streams.
…, 74:51:02. 2015. Uses Assigned to Lakes.

Kenner, S. J. and A. M. Larson, 2008. *Fecal Coliform Bacteria Total Maximum Daily Load for Spring Creek, Pennington County, South Dakota*, prepared by the South Dakota School of Mines and Technology, Rapid City, SD and the South Dakota Department of Environment and Natural Resources, for the South Dakota Department of Environment and Natural Resources, Pierre, SD.

Krawjewski, J. W. and A. J. Rutz, 2014. *Spring Creek Watershed Management and Project Implementation Plan Segment I Final Report*, RSI-2415, prepared by RESPEC, Rapid City, SD for Pennington County, Rapid City, SD.

Krawjewski, J. W. and P. P. Rausch, 2014. *Spring Creek Watershed Total Maximum Daily Load Strategic Implementation Plan,* RSI-2416, prepared by RESPEC, Rapid City, SD, for Pennington County, Rapid City, SD.

Oswald, J. K., 2010. *Spring Creek Watershed Management and Project Implementation Plan Segment I*, RSI/P-2576, prepared by RESPEC, Rapid City, SD, for South Dakota Department of Environment and Natural Resources, Rapid City, SD.

South Dakota Department of Environment and Natural Resources, 2005. *Standard Operating Procedures for Field Samplers, Volume I, Tributary and In-Lake Sampling Techniques*, prepared by the South Dakota Department of Environment and Natural Resources Watershed Assessment Team, for the South Dakota Department of Environment and Natural Resources Assistance Program, Pierre, SD.

South Dakota Department of Environment and Natural Resources, 2014. *The 2014 South Dakota Integrated Report for Surface Water Quality Assessment*, prepared by the South Dakota Department of Environment and Natural Resources, Pierre, SD.

South Dakota Department of Environment and Natural Resources, 2016. *The 2016 South Dakota Integrated Report for Surface Water Quality Assessment*, prepared by the South Dakota Department of Environment and Natural Resources, Pierre, SD.

South Dakota Legislature, 2015. "Chapter 74:51:01 Surface Water Quality Standards", legis.state.sd.us, retrieved on July 20, 2015. http://legis.sd.gov/Rules/DisplayRule .aspx?Rule=74:51:01.

United States Environmental Protection Agency, 2002. "USEPA On-site Wastewater Treatment Systems Manual", EPA/625/R-00/008, prepared by the Environmental Protection Agency, Washington, D.C.

APPENDIX A

EDUCATION MATERIAL

What Can be Done to Restore Riparian Buffers?

- Increase buffer width.
- Stabilize banks.
- Manage livestock grazing.
- Establish *native* shrubs, trees and forbs.
- Control stormwater runoff from developments.

A healthy riparian buffer is an essential part of a healthy creek.

REFERENCES:

Hayes-Conroy, Jessica. n.d. *Streamway Corridors: The Improtance of Riparian Buffers Zones.* Accessed September 9, 2016. http://serendip.brynmawr.edu/biology/b103/f00/web2/hayesconroyj2.html.

Lawson, Kimberly. 2016. "Why Bother with a Buffer? The Benefits of a Forested Riparain Buffer Zone." *Farm and Dairy.* Accessed September 9, 2016. www.farmanddairy.com/columns/why-bother-with-a-buffer-the-benefits-of-a-forested-riparian-buffer-zone.html.

University, North Carolina State. n.d. *Stream Notes - Riparian Buffers.* 3. Vol. 1. Biological and Agricultural Engineering Department. Accessed September 9, 2016. http://www.bae.ncsu.edu/programs/extension/wqg/sri/riparian5.pdf.

Wesley R Horner, Bernard W. Sweeney. n.d. *The Science Behind the Need for Riparian Buffer Protection.* Pennsylvania Land Trust Association. Accessed September 9, 2016. www.conservationtools.com/guides/131-the-

For more information:
Spring Creek Watershed Implementation
Pennington County, Project Sponsor
130 Kansas City Street, Suite 200
Rapid City, SD 57701
(605) 394-2186 x 1408

PENNINGTON COUNTY

Riparian Buffers

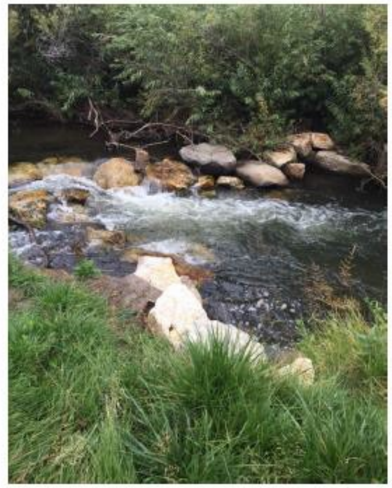
The Importance and Advantages of Riparian Buffer Restoration on Stream Health.

What is a Riparian Buffer?

The land adjacent to a stream or creek where vegetation is influenced by the presence of water. Typically, the buffer consists of a combination of trees, shrubs, grasses, and forbs.

Characteristics of a Healthy Riparian Buffer

- Width—size of buffer area—larger is better.
- Composition—types and thickness of vegetation—diverse and denser coverage.
- Use—residential, commercial, agriculture—potential stormwater runoff and types of pollutants—decrease in impervious area.



What is their Function?

The function of a riparian buffer is to:

- Prevent sediment, nutrients, and other pollutants from entering waterways.
- Provide habitat for wildlife and aquatic life.
- Slow floodwaters and protect downstream property.
- Bank stability and erosion protection.
- Provide shade and moderate water temperatures.

What are the Advantages?

The advantages of a healthy riparian buffer is:

- Reduced sediment loading.
- Reduced stormwater runoff.
- Improved water quality.
- Ecological benefits (habitat).
- Groundwater recharge & protection.
- Flood control.
- Stabilize steambank.