

Little Medicine Bow River Sediment Impairment Priority Assessment Project 2015-2017

NONPOINT SOURCE POLLUTION CONTROL PROGRAM NPS SEP PROJECT FINAL REPORT

Prepared for:

**Wyoming Department of Environmental Quality
Water Quality Division
Wyoming Nonpoint Source Program
Cheyenne, Wyoming**

Prepared by:

Medicine Bow Conservation District
PO Box 6, Medicine Bow, Wyoming 82329

August 26, 2017

**Project Number: NPSSEP07
Grant Number: NPS SEP Funds**

This project was conducted in cooperation with local landowners, project participants, Lidstone & Associates ~ a Wenck Company, the State of Wyoming.

Keywords: Sediment

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Section 1.0 Executive Summary

Little Medicine Bow River Sediment Impairment Priority Assessment Project

- The following report addresses the Little Medicine Bow River Sediment and is intended to meet the guidelines established by the Wyoming Department of Environmental Quality (WYDEQ) for a Nonpoint Source Project Final Report.

Project Start and Completion Date:

- Project work began on December 11, 2015, and was completed on August 31, 2017 (all project funds expended or match funds were accrued by June 30, 2017).

Budget Summary:

- The following table contains a summary of the project budget sources and expenditures

Budget Summary	
Total SEP Funds Awarded	\$40,000
Total SEP Funds Expended	\$40,000
Total Nonfederal Match Commitment	\$23,500
Total Nonfederal Match Expended	\$17,553
Total Project Budget	\$63,500
Total Project Expenditures	\$57,553

Summary of Accomplishments:

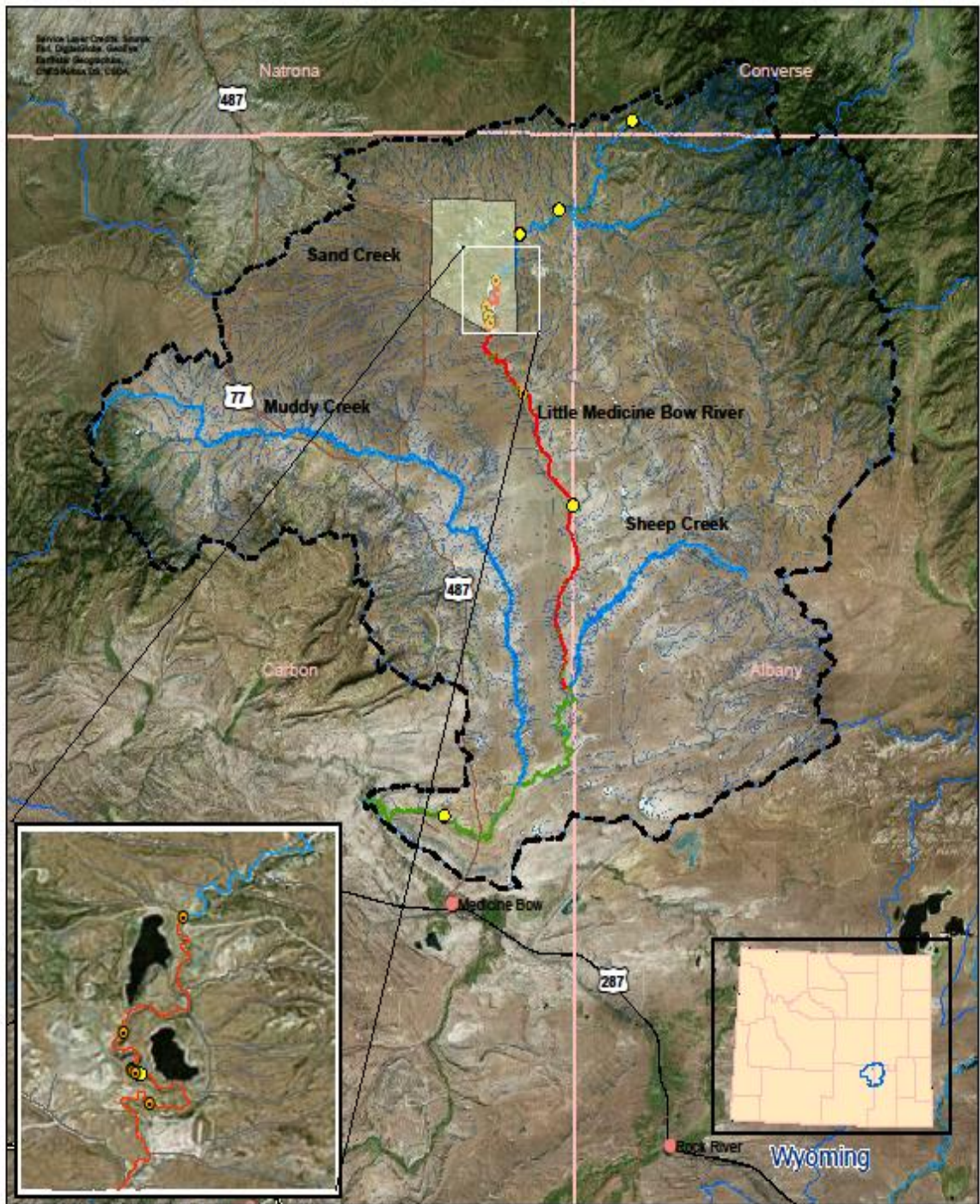
- Identified and assessed potential sources of sediment non-point source pollution within the Little Medicine Bow River (LMBR).
 - Sources of sediment considered include contributions from the upstream reclaimed mine area, remobilization of stored sediment, cattle trampling, natural hillslope erosion, channel migration, bank widening, avulsion, channel head-cutting, and degrading ephemeral drainages.
- Divided the river into sub-reaches by Channel Evolution Model (CEM) classification and ranked each by health and sediment production.
- A Multi-Criterion Decision Analysis (MCDA) tool was created to assist with ranking and can be adjusted in the future as new data becomes available.
- Sub-reaches were ranked based on watershed benefit, channel stability, aesthetic value, and cost.

Section 2.0 Background

Description of Project Area:

- Study area map

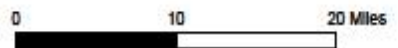
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Document Path: L:\WYAML102.3.2\GIS\LITTLE MEDICINE BOW FIGS.mxd

Legend

SHIRLEY BASIN URANIUM DISTRICT	LITTLE MEDICINE BOW WATERSHED
AML MONITORING SITES	REACH NOT ASSESSED BY DEQ
2007-2008 DEQ MONITORING SITES	IMPAIRED RIVER REACH
	LITTLE MEDICINE BOW RIVER



PROJECT LOCATION MAP LITTLE MEDICINE BOW RIVER ASSESSMENT



WDCNR Wyoming Department of Conservation and Natural Resources
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- The LMBR is a perennial stream in the upper North Platte River Basin with a contributing watershed exceeding 180 square miles. The river flows south to southwest from the west flank of the Laramie Mountain Range, through the Shirley Basin to its confluence with the Medicine Bow River near the Town of Medicine Bow.
- Primary land uses throughout the watershed are livestock grazing, hay production, and uranium mining. The LMBR is a Class 2AB water, protected for the following designated uses: cold-water fisheries, non-game fisheries, drinking water, fish consumption, aquatic life other than fish, recreation, wildlife, industry, agriculture and scenic value.
- Historic uranium mining in the Shirley Basin began in 1959 and continued until 1992. In 1972, to facilitate open-pit mining operations, The Petrotomics Company constructed a diversion channel approximately 0.5 miles west of the river's natural course, creating instability while skirting natural river grades, sinuosity, and river length. After a large precipitation event, culvert pipes directing the diversion flow were bypassed and failed, resulting in complete failure of the diversion channel around 1974. The diversion channel severely incised and widened over the following 10 to 12 years, adding large volumes of sediment to the natural channel downstream.
- The Abandoned Mine Lands Division (AML) of the Wyoming DEQ undertook responsibility for much of the mine reclamation starting in 1986. As part of the mine reclamation, the river channel was reconstructed closer to its historic channel, adding back length, sinuosity, and grade. This reconstructed channel has since moderately incised and widened through time, continuing historical mining related sediment loading to downstream river reaches.
- The reclaimed mining area is located in the upstream portion of the project reach and makes up approximately 4 miles of the impaired 26.2 river miles.

Description of the Water Quality/Sediment Issue:

- The Shirley Basin has naturally occurring highly erosive soils. This factor, combined with the history of open-pit mining in the area, has resulted in elevated sediment levels in the river. As a result, the 26.2 mile reach of the LMBR between County Road 2E and the confluence with Sheep Creek does not support aquatic life other than fish and cold water fishery designated uses. The failure of the river to support one designated use is an indicator that overall river health may be deteriorating and that action to restore the river should not be delayed.
- This project is an important first step to support and provide direction in the restoration of the river to its full designated uses.

Non-point Sources of Pollution:

- Certain sources of sediment have been previously identified, such as the reclaimed uranium mining area.

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- The goal of this project was to evaluate the reclaimed mining area's role as a source of non-point source pollution and to help identify and address additional sources of sediment.
- Soils in the Shirley Basin range from well-drained sandy to gravelly sandy-clay loam to loamy sands and clays. Infrequent, short-duration, high-intensity precipitation events are common in the basin and exacerbate erosion and sediment transport.

How did this project come about? How did the project partners come together to implement it?

- The impaired reach of the LMBR is a mix of ownership and land management types.
- Local land owners and ranchers are supportive of restoration efforts that may take place on their lands.
- The stakeholders, including Wyoming Game & Fish, Trout Unlimited, AML, The Nature Conservancy, US Fish and Wildlife Service Partners Program, and private landowners are committed to implementing BMPs to reduce sediment loads.
- The District decided to complete this project in order to develop tools so BMPs could be managed, coordinated, and employed on the most appropriate river reaches by the most appropriate land stewards.

Project significance:

- This project provides the District a rational means to direct efforts by stakeholders, including the District, toward river reaches with the best opportunity for improving river health and water quality through the use of BMPs.
- Rather than randomly doing BMPs and hoping for a reduction of sediment and improved water quality, this tool will allow the District to prioritize where restoration efforts should be focused in order to optimize the benefits for the effort and ultimately improve water quality by reducing sediment loading. The tool will also allow the District to prioritize what areas should be addressed first and what methods will yield the best results with a limited budget.
- The tool can be used for 5 to 10 years to plan sediment loading reduction projects on the LMBR.

Project Developed the MCDA Tool:

- Rather than wait for a Total Maximum Daily Load (TMDL), the District has been and will continue to be proactive in dealing with the pollution problem of sediment in the LMBR.
- The creation of the MCDA tool will allow for the development of a watershed-based plan.

Section 3.0 Goals and Outcomes

Goal of the Project:

- Ultimately, restoration of the river to its full designated uses.
- Increasing water quality by reducing sediment loading.

Project Success:

- This project led to the successful completion of the MCDA tool to assist with the planning of future sediment loading reduction work on the LMBR. The project also classified the study area into sub-reaches, ranked them, and identified 5 Non-Structural and 5 Structural areas for potential BMPs.

Outcome: clear direction for stakeholders on where to direct efforts to improve water quality:

- Creation of the MCDA tool
 - Development of criteria and sub-criteria. The criteria established fall under 4 major criteria headings: Erosion and Sediment Production, Channel Stability, Water Quality, and Feasibility and Additional Benefit and each sub-reach was ranked from 1 to 3 under this criteria.
- Identification of major sediment sources and possible BMPs by sub-reach
 - The 26.2-mile reach was broken up into 10 discrete sub-reaches based on channel form, geometry and Channel Evolution Model (CEM) stage.
- Prioritization of areas to address and how to do so in order to create the most benefit towards reducing sediment loading.

Section 4.0 Task Activities

Task #	Task Title	Task Description	Actual Deliverables
1	Administration	Administer project efficiently and effectively, submit reimbursement requests, keep all records, file all reports, and obtain any necessary permits. In addition to the above description, the district will also be the communication hub between DEQ, Lidstone and Associates, and all involved landowner/land managers.	Quarterly reimbursement requests, complete progress reports with each reimbursement request, annual reports, annual MBE/WBE reports, final project report, other documentation as requested, all necessary permits.
2	Obtain Landowner Consent / Permissions	Work with all private landowners and land managing agencies within the 26.2 mile reach on the 303d list to gain signed consent to collect data and access the river.	Data trespass forms and signed consent forms.
3	Desktop River Evaluation and Field Assessment Preparation	Prepare and study aerial mapping for potential sediment sources, anthropogenic influences, geologic features, sub-drainage areas, varying flow regime river characteristics, changes in channel planform over time, and travel logistics.	Field maps, assessment forms, areas of interest, access plans, equipment needs/list, before/after aerial comparisons at areas of interest.
4	QAPP and SAP Development and Approval	Develop a project specific Quality Assurance Project Plan (QAPP) and Sampling and Analysis Plan (SAP). Work with the WDEQ for plan reviews, revisions, and approval.	An approved QAPP and SAP for use and reference in the Field Investigation task.
5	Field Investigation	Complete the river assessment field investigation, includes personnel travel, lodging, incidentals, equipment, monitoring supplies, and meetings with landowners.	River reach and sub-reach assessments completed over the study length. Photographic logs and inventory. GPS reach delineation and area of interest points.
6	Post Processing and Analysis of Collected Data	Review, analysis, investigation, and evaluation of field assessment sheets and field observation data. Reach characterization. Data entry into	River reach delineation, inventory, and characterization summary. Google Earth georeferenced photo KMZ files.

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Task #	Task Title	Task Description	Actual Deliverables
		MCDA matrix. Review and compilation of photographic records.	
7	MCDA Development	Identify and weighting of criteria that will serve as a framework for the district's MCDA. Sub-criteria will be selected to dictate the scoring. Expect two draft MCDA analyses and reviews with the Conservation District Manager and basin stakeholders.	Completed MCDA tool with suggested BMP applications for sediment control benefits.
8	Final Report	Compile and organize field data set. Summarize river assessment methodology and results. Executive summary of overall project approach and description of MCDA tool value and use.	Written report and data compilation package along with digital files as appropriate.

Section 5.0 BMP Implementation

Not Applicable

Section 6.0 Monitoring Results

Monitoring objectives:

- To provide a baseline to measure overall reach condition and health as well as identify possible sources of excess sediment.
- To record basic water quality parameters during the river assessment to develop a baseline water quality data set that will allow for analysis and comparison with future measurements.
- To supplement existing data and will be used to determine areas of the impaired river reach that are most beneficial to consider best management sediment control projects.

Sampling and analysis method:

- SAP and QAPP: see attached
- Sampling points were determined and selected based on field conditions and visual observations. Samples were taken near the center of the river on an approximately ½-mile frequency. All monitoring locations were recorded using GPS coordinates and photos. Surface water measurements and observations collected at each sample location were recorded but no grab samples were collected.
- Sampling occurred during spring runoff and samples were taken.
- The following parameters were measured at each sample site location:

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- pH
- Specific Conductivity (EC)
- Temperature
- Turbidity
- Water quality monitoring was performed as in-situ measurements taken with portable water quality meters.
 - An Oakton waterproof pH/CON 10 series water quality meter (Serial No. 533243 and backup unit No. 406856) was used for pH, conductivity, and temperature measurements. The meter was calibrated before each work day according to manufacturer recommendations.
 - An Orion AQ3010 Turbidity Meter (Serial No. 2269155) was used to measure turbidity and was calibrated daily to manufacturer recommendations.
 - Calibration logs were kept for the equipment (see attached).
- Discharge data was gathered for the time period of monitoring from the newly installed USGS stream gage, just downstream of County Road 2E.

QA/QC:

- To attain quality assurance, the Wyoming Department of Environmental Quality (WDEQ) Manual of Standard Operating Procedures for Sample Collection and Analysis was closely followed throughout the assessment.

Results:

- Brief summary of WQ results with chart examples.
- See attachment: Water Quality monitoring report.
- All data submitted as hard copy and electronic.
- Full report is attached.

Section 7.0 Partners

Partners:

- Medicine Bow Conservation District
- Public and private landowners
- Lidstone and Associates - A Wenck Company (LA)
- RESPEC, who has recently completed a Level 1 Watershed Study of the Medicine Bow River under District sponsorship on behalf of the Wyoming Water Development Commission.
- Wyoming DEQ/AML Division.

Contributions:

- Coordination of the project was overseen by the District
- The District worked with private and public landholders for access consents

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- Lidstone and Associates - A Wenck Company (LA) was responsible for the actual inventory and assessment.
- RESPEC consulting delivered the GIS and public resource data that LA utilized for the initial desktop river evaluation.
- Wyoming Game and Fish, Trout Unlimited, The Nature Conservancy, US Fish and Wildlife Service Partners Program, and landowners in the area expressed their support for targeted BMPs and their interest in working together to improve water quality in the LMBR.

Funding sources:

Source	Amount	Federal or Non-Federal?	Status
MBCD	\$7000	Non-Federal	In hand
Lidstone and Associates, Inc.	\$5000	Non-Federal	in-kind
Abandoned Mine Lands	\$2500	Non-Federal	in-kind
Lidar data	\$500	Non-Federal	in-kind
Stream gage funding	\$7000	Non-Federal	in-kind
MBCD/WWDO	\$1500	Non-Federal	in-kind

Successes and/or shortfalls:

- All partners involved contributed as expected when needed.

Partnerships continuing into the future:

- All partners involved are committed to assist implementing BMPs where identified and Structural and Non-Structural improvements that are well suited for the conditions observed in the LMBR study reaches.

Section 8.0 Information and Education

- Meeting with landowners / ranchers on project intent, consents, and areas of interest.

Section 9.0 Complications

- River float assessment was not possible, used ATV in August – very low and in some case no water so WQ measurements were not possible in some locations.

Section 10.0 Recommendations

- Sediment producing areas identified.
 - Suggested BMPs (map)
- Overall conclusions about the LMBR system.

Section 11.0 Financial Summary

Task #	Title	Amount SEP Funds	Amount Nonfederal Match	Total Task Cost	Other Federal Funds
1	Administration	\$ 4,308.37	\$ 0.00	\$ 4,308.37	\$ 0.00
2	Obtain Landowner Consent / Permissions	\$ 500.00	\$ 1,500.00	\$ 2,000.00	\$ 0.00
3	Desktop River Evaluation and Field Assessment Preparation	\$0.00	\$3,254.50	\$3,254.50	\$0.00
4	QAPP and SAP Development and Approval	\$0.00	\$3,505.00	\$3,505.00	\$0.00
5	Field Investigation	\$19,256.14	\$1,500.00	\$20,756.14	\$0.00
6	Post Processing and Analysis of Collected Data	\$4,966.15	\$0.00	\$4,966.15	\$0.00
7	MCDA Development	\$4,998.50	\$0.00	\$4,998.50	\$0.00
8	Final Report	\$5,970.90	\$7,793.50	\$13,764.40	\$0.00

Section 12.0 Attachments

- Monitoring and Assessment Report
 - Tables
 - Figures
 - Appendix with photo log
 - MCDA (hard copy and electronic)
- Sampling and Analysis Plan
 - By reference: Quality Assurance Project Plan
- Field Investigation
 - Field Data Sheets
 - Equipment Calibration Logs
 - Water Quality Meter
 - Turbidity Meter
 - Stationing Reach Description Table
- Photos
- Google Earth photos KMZ file
- Best Management Practices Tool