



**Ghost River
State of the Watershed Report**

Terms of Reference

January 2015

Prepared by:

Ghost Watershed Alliance Society

Ghost River State of the Watershed Report 2015

Terms of Reference

Table of Contents

- 1.0 Background
- 2.0 Vision & Goals
- 3.0 Scope
- 4.0 SOW report format
- 5.0 Methods
- 6.0 SOW project structure
- 7.0 Raising awareness and support
- 8.0 Fundraising
- 9.0 Project timeline

APPENDIX A. Draft Ghost River SOW Report Table of Contents

APPENDIX B. Draft indicators

APPENDIX C. Summary of available information and data sources.

1.0 BACKGROUND

The Government of Alberta released the *Water for Life Strategy* in 2003 that established the Alberta Water Council (AWC) and defined Watershed Planning and Advisory Councils (WPACs), such as the Bow Basin River Council, and Watershed Stewardship Groups (WSG) such as the Ghost Watershed Alliance Society (GWAS). A key principle set out in the *Water for Life* policy document is shared responsibility: “Citizens, communities, industry and government must share responsibility for water(shed) management in Alberta and work together to improve conditions within their local watershed.”

Planning is key to good watershed management and is an important mechanism for bringing stakeholders together to address watershed issues. It involves two stages:

1. Assess the state of the watershed within a State of the Watershed (SOW) Report, and
2. Identify important issues and plan how to address them within a Watershed Management Plan.

Definition of State of the Watershed Report

A SOW report can be regarded as an assessment of the cumulative effects of the various activities in the watershed. It characterizes a watershed’s current condition in a descriptive inventory of the existing natural resources and human activities within a watershed. More specifically, a SOW report:

- Is an objective tool that uses available data and information to assess conditions and concerns within a watershed;
- Provides a scientific assessment of watershed data and information that helps to make conclusions about watershed conditions;
- Identifies information or knowledge gaps;
- Identifies factors that potentially contribute to concerns within the watershed, and
- Is the first component of a watershed management package that leads to further planning, implementation of actions and evaluation.

Guidance

To guide and assist these planning efforts, in 2008 Alberta Environment published the “Handbook for State of the Watershed Reporting: A Guide for Developing State of the Watershed Reports in Alberta”. In the same year, the AWC published a report titled “Recommendations for a Watershed Management Planning Framework for Alberta”, and in 2009 the Government issued the Water for Life Action Plan. This action plan led to the preparation of the “Guide to Watershed Management Planning in Alberta”, and its companion document “Protocol to Watershed Management Planning”; in August 2013 the two latter documents are in draft stage.

Purpose of the Ghost River SOW Report

The Ghost Watershed Alliance Society (GWAS) is working to complete a State of the Watershed Report for the Ghost River to:

- Improve understanding of how natural features and processes influence watershed conditions;
- Provide insights into the linkages between watershed health and past and current land & water uses;
- Identify sensitive or at-risk areas;
- Provide basis for future watershed planning; and
- Provide direction on where GWAS should focus its efforts (i.e., prioritize activity).

2.0 VISION AND GOALS

Vision

A Ghost River State of the Watershed Report that is factual, educational and interesting to read by the scientific community and the general public alike.

The SOW Report will be used as a tool to support future watershed management planning in the Ghost River watershed.

The SOW Report will inspire readers to maintain and improve the state of the Ghost River watershed for future generations.

Goals

- 1) Complete the first Edition of the Ghost River State of the Watershed Report (2015) using a partnership approach.
- 2) Develop a State of the Watershed (SOW) Steering Committee made up of local experts that represent key watershed components.
- 3) Prepare an electronic version as well as a concise hard-copy SOW book (summary version app. 100 pages in length) that contains maps, graphics and pictures relevant to the watershed. A creative format that presents information in a unique way will be chosen by the SOW Steering Committee and GWAS BOD.

3.0 SCOPE

3.01 Geographical Extent

The geographical scope of the 2015 SOW Report will include the entire Ghost River watershed, from the headwaters to the confluence with the Bow River (Figure 1).

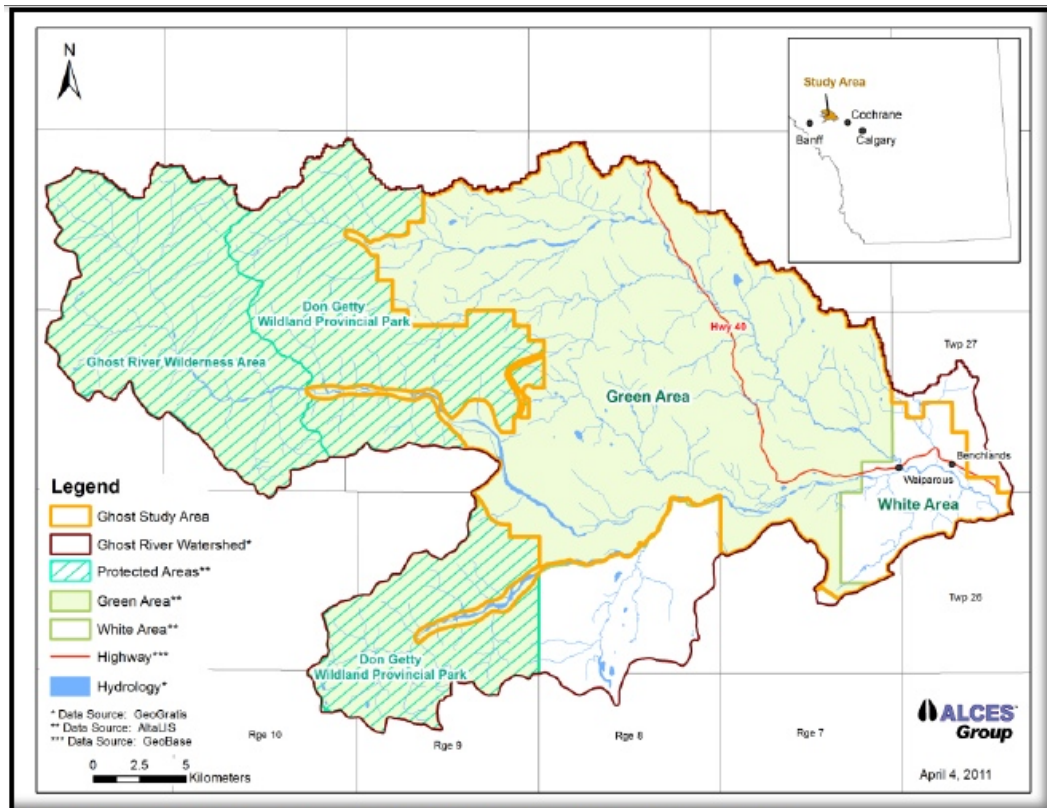


Figure 1. Map of the Ghost River watershed.

Where available, sub-basins will be used to provide a higher level of detail for some watershed information. Land-use and wildlife data may be grouped according to land management units.

3.02 Frequency

The Ghost River SOW Report will be first produced in 2015. The SOW Report should be reviewed and updated every 5, 7 or 10 years, when new data and information is available.

4.0 SOW REPORT FORMAT

The format of the Ghost River SOW Report should be formatted to reach the target audience, which includes both the public and scientific communities. A printed version of the report can accomplish this with the digital version available online. A CD or USB stick can be used to house an appendix and/or data files, photos, and relevant reports.

Published SOW Report

- **Hard Copy Version:** An appealing coffee table type book with maps, photos and human interest elements
- Expect a cost between \$40.00 to \$60.00 per copy (100 copies are aimed at to be printed, funding permitting)

Digital Copy

- PDF version of the report will be available on GWAS website.
- A CD and/or USB stick can be used to house the final .pdf version of the report, along with data files, photos and other relevant reports.
- Expect \$7.00 to \$8.00 per USB drive created. A CD copied professionally is about \$1.00 to \$3.00 per copy, but depends on quantity.

5.0 METHODS

Establish SOW Steering Committee

GWAS will be establishing a formal Steering Committee comprised of stakeholders, government, local experts that represent key watershed components, several GWAS Board Members. The Steering Committee will be tasked with providing input and feedback during the development of the report and review the draft report.

Members will be asked to assist with the development of appropriate indicators for the Ghost River watershed

Steering Committee members may assist with background information for the SOW report, identify and bring forward data/information to consider in the report and generally help to promote the Ghost River SOW Report.

GWAS Executive Director will be in a coordinating role (SOW Coordinator) between the SOW Consultant, the Steering Committee and the GWAS Board of Directors. The Project Coordinator will be responsible for moving the process forward, facilitating all meetings, preparing all necessary materials for the meetings (e.g., agendas, discussion papers, etc.), and liaising with the GWAS BOD.

Compile Data

Steering Committee members will provide data for inclusion in the SOW Report as much as possible and available. The SOW Consultant will source and compile data available to them in addition.

The timeline for data presented in the report will include historical (pre-2000) and recent (2000-2015).

Write Report

The SOW Consultant will write the SOW report. The SOW Coordinator will be designated to pull submissions from the Steering Committee together to be provided to the SOW Consultant. The report will be provided in draft form before being finalized.

Review

The draft document will be reviewed by Steering Committee members, GWAS Board of Directors and by an external review team made up of two to three qualified experts.

Print and Disseminate

The final Ghost River SOW Report will be printed in hard-copy and also made available digitally. The document will be disseminated among the Ghost River watershed stakeholders, which include resource managers, government and non-government organizations, industry, landowners, leaseholders, residents, visitors among others.

6.0 SOW STRUCTURE AND ROLES

6.1 GWAS Board of Directors

The GWAS has commissioned the Ghost River State of the Watershed Report and will oversee the project to completion.

6.2 SOW Steering Committee

A Steering Committee will be established that is made up of the GWAS Executive Director in a coordinating role, government and other interested parties and stakeholders. The Steering Committee will be tasked with providing input and feedback during the development of the report and review the draft report.

Members will be asked to assist with the development of appropriate indicators for the Ghost River watershed

Steering Committee members may assist with background information for the SOW report, identify and bring forward data/information to consider in the report and generally help to promote the Ghost River SOW Report.

6.3 SOW Coordinator

The SOW Coordinator is responsible for guiding the development of the Ghost River State of the Watershed Report. The SOW Coordinator will work with the Steering Committee to develop and compile sections of the report. The SOW Coordinator will liaise between the SOW Consultant writing the report.

6.4 SOW Review Committee

An Independent Review Committee (two to three people) comprised of qualified individuals will be identified to review the final draft of the Ghost River SOW Report before it is printed and disseminated.

6.5 Other Important Stakeholders

Other stakeholders within the Ghost River watershed will be identified throughout the development of the SOW Report. Stakeholders will be invited to provide input into the SOW Report at the start of the project.

7.0 RAISING AWARENESS AND SUPPORT FOR SOW REPORT

Political Support

Progress reports should be presented to municipalities, BRBC and AESRD in person and by way of Committee members.

General Public

Open House (Kick-off), newsletter mail-outs, website, newspaper.
Final presentation of completed report – celebration.

Steering Committee

Email updates and meetings, phone conversations, individual meetings.

8.0 Fundraising

Fundraising to complete the Ghost River SOW Report should be ongoing. The following are potential sources of funding:

Alberta Stewardship Network

- Up to 10,000.00 for watershed stewardship groups

EcoAction program by Environment Canada

RBC Blue Water Project

Other potential funding sources:

- BRBC
- Direct Energy / Centrica
- Spray Lake Sawmills (SLS)
- local ranchers & landowners

9.0 PROPOSED TIMELINE

The project is aimed at being completed by December 31st 2015, funding provided.

APPENDIX A. Draft Ghost River SOW Report Table of Contents

Message from the GWAS
Ghost Watershed SOW Team
Table of Contents
List of Acronyms

1. Introduction
 - 1.1. Why a Ghost Watershed State of the Watershed Report – link to the GWAS Goals and Objectives; Report to be used as a tool for future watershed planning
 - 1.2. Scope including watershed boundary map
 - 1.3. Significance of watershed – highlights
 - 1.4. Approach and methods with a summary of indicators

2. Overview of the Ghost Watershed
 - 2.1. Topography
 - 2.2. Geology (Bedrock/Surficial)
 - 2.3. Geomorphology
 - 2.4. Hydrology & Drainage Infrastructure
 - 2.5. Ecoregions
 - 2.6. Climate
 - 2.7. Soils
 - 2.8. Land Cover
 - 2.9. Landownership/Administration

3. Socio-Economic History & Condition
(Note: this is an important chapter for the local community as well as the people with an interest in the Ghost. History events organized through GWAS have proven to be of great interest to the general public and GWAS would therefore like this chapter to be quite detailed, including input by the local community).
 - 3.1. Social history (pre-settlement, First Nations, settlement)
 - 3.2. History of human land-uses
 - 3.3. Population today
 - 3.4. Public perceptions and concerns

4. Surface Water Quantity and Allocation
 - 4.1. History of Water Management
 - 4.2. Surface Water Supply (streamflow volumes and variation in annual flow)
 - 4.3. Surface Water Allocation and Use (licenses, flow commitments, diversions)

5. Surface Water Quality
 - 5.1. Specific Conductivity
 - 5.2. Nutrients (total phosphorus, total dissolved phosphorus, nitrate+nitrite nitrogen, total kjeldahl nitrogen, total nitrogen)
 - 5.3. Total Suspended Solids (maybe turbidity)
 - 5.4. Fecal Coliform Bacteria/*Escherichia Coli* (whichever is available)
 - 5.5. Metals/Pesticides (if available)
 - 5.6. Water temperature
 - 5.7. pH

Ghost Watershed Alliance Society

6. Groundwater
 - 6.1. Groundwater Supply and Use (allocations and well density)
 - 6.2. Groundwater Quality
7. Riparian Areas and Wetlands
 - 7.1. Riparian Health Assessment (to be provided by GWAS from inventories undertaken by Cows & Fish)
 - 7.2. Wetlands inventory (incl. size, type and condition where available)
8. Biodiversity & Wildlife resources
 - 8.1. Fish and Invertebrates (if Available)
 - 8.2. Wildlife (incl. habitat requirements & connectivity/fragmentation)
 - 8.3. Vegetation
 - 8.3.1. Rare and Unique Native Vegetation
 - 8.3.2. Invasive Species
9. Air Quality (if available)
10. Land Use and Development
 - 10.1. Access
 - 10.2. Parks, Protected and Managed Areas
 - 10.3. Tourism and Recreation
 - 10.3.1. Camping and Day Use (Hiking)
 - 10.3.2. Hunting/Fishing
 - 10.3.3. Off-Highway Vehicles
 - 10.4. Commercial and Industrial Activity
 - 10.4.1. Agriculture
 - 10.4.2. Guiding/Outfitting (or place in Tourism/Recreation if not significant)
 - 10.4.3. Forestry
 - 10.4.4. Hydropower
 - 10.4.5. Oil and Gas Activity
 - 10.5. Residential
 - 10.5.1. Water supply and wastewater systems
 - 10.5.2. Distribution of population in the watershed
11. Existing plans and programs (*could be integrated in chapter 10*)
 - 11.1. Ghost Access Management Plan
 - 11.2. Municipal Development Plan
 - 11.3. Forest Management Agreement
 - 11.4. South Saskatchewan Regional Plan
 - 11.5. Other plans, policies and programs
12. Watershed Stewardship
13. Data Gaps
14. Summary and Recommendations
15. Bibliography
 - 15.1. Literature Cited
 - 15.2. Personal Communications
 - 15.3. Map Information
 - 15.4. Photo Credits
16. Technical Appendix

APPENDIX B. Draft indicators to consider in the Ghost River SOW Report and agencies/organizations that may contribute information and/or data.

Watershed Component		Indicators	Measure	Watershed Linkage
Upland Ecosystems	Land Cover	Native Vegetation	Percent cover	Native vegetation provides an indication of overall watershed condition. High percent native vegetation cover supports formation of soil, water supply, water quality and biodiversity.
	Land Use	Access	Road and trail density	Linear developments fragment the landscape and habitat.
			Invasive Species	These areas conserve historical and natural features and provide wildlife refuge. Important for human health and well-being.
		Tourism & Recreation Activity	Number of visitors to serviced areas	Indicates pressure placed on natural resources by people recreating, including hunting and fishing.
			Number of anglers and hunters recreating	
		Agricultural Activity	Crop footprint	Indicates land conversion from native vegetation to annual crops.
			Number of agricultural producers	Indicates economic well-being within the community.
			Farm size	
		Forestry	Rangeland Condition (Health Assessment scores)	Indicates area in permanent cover. Healthy rangeland supports water supply, water quality, soil quality and biodiversity.
			Harvested area	Indicated the level of disturbance on the landscape, including habitat fragmentation.
			Reclaimed area	
	Oil & Gas Activity	Buffer Use and Width	Indicates the level of disturbance on the landscape, including habitat fragmentation due to associated linear developments	
		Number of oil and gas wells		
Length of pipelines				
Cumulative Linear Disturbance	Age of pipelines	Indicates a cumulative impact from all land uses on watershed process and function.		
	Length/area of linear disturbance.			
Riparian Ecosystem	Wetlands (Lentic)	Presence & Condition	Area and density Classification Riparian Health Assessment (scores)	Functioning riparian areas contribute to flood control, water supply, water quality, stream channel stability (lotic systems) and biodiversity.
	Riparian Areas (Lotic)	Presence & Condition	Riparian Health Assessment (scores)	
Aquatic Ecosystem	Surface Water	Water Supply	Annual streamflow measurements	Streamflows should reflect a normal range of condition and support channel processes (erosion, building of streambanks), aquatic life and riparian areas.
			Degree of alteration from range of natural flow	
	Water Allocation & Use	Reservoirs (and associated water loss through evaporation) (?)	Number of water licenses, registrations, and temporary diversion licenses and associated volume; water use reports	Water supplies support aquatic life, communities and economic activity.
Water Quality		Nutrients, sediment, metals, pathogens (maybe dissolved oxygen, temperature)		

Ghost Watershed Alliance Society

Watershed Component		Indicators	Measure	Watershed Linkage	
	Groundwater	Water Supply	Number of wells	Indicates land use pressure on the groundwater resource. Deviation of water level or yields from natural/historical can indicate exploitation of the resource.	
			Number of licenses and registrations		
Water level and yield					
		Water Quality	Nutrients, metals and pathogens (Other?)	Groundwater is an important water source for rural residents.	
Biodiversity	Fish and Invertebrates	Species composition	Species diversity and relative abundance	Aquatic and upland ecosystems that support a diverse fish, invertebrate, wildlife and vegetation community are more resilient to ecological adversity or changes to environmental condition. A change in abundance, species composition or community structure indicates a change in watershed condition.	
	Amphibians	Northern Leopard Frog, salamanders	Population		
	Wildlife	A variety of seasonal, migratory and resident species.	Population		
			Linear disturbance thresholds		
Vegetation	Rare, Invasive and Disturbance Plants	Occurrence and distribution			
Community	People	History	Social History	Establish connection with landscape	
		Population	Number of people in the watershed Demographics	People influence many of the natural processes and functions within watersheds. Watersheds should be livable places that can sustain people, and nature, through time.	
		Economics	Local employment opportunities		
		Stewardship	Number of people participating in stewardship programs (e.g., Environmental Farm Plan, Growing Forward)	Dollars spent on stewardship initiatives in the watershed	Stewardship programs are available to help residents, landowners, leaseholders, non-profit organizations and industry maintain and improve watershed conditions.
				Area (ha) of land managed by EFP participants	
				Industry participation in stewardship initiatives/ programs	
				Participation in stewardship groups	

APPENDIX C. Summary of available information and data sources.

1. Guidance documents

- Handbook for SOW Reporting
- Guide to Reporting on Common Indicators
- Indicators for Assessing Environmental Performance of Watersheds in Southern Alberta
- Draft Guide to Watershed Management Planning in Alberta
- BRBC Web-based State of Watershed Report and Summary Report

2. Government data & information

- Hydrological data for the Ghost and Waiparous (Environment Canada and ESRD)
- Historical river flow data (Environment Canada)
- Surface water allocations and diversions
- Climate and precipitation data for the Ghost basin (Environment Canada)
- Groundwater data
- City of Calgary water quality data collected from the Ghost River in Benchlands
- ESRD water quality data by data sonde
- Inventory of grazing dispositions and allotments
- Inventory of recreation leases
- Range health assessments (AMEC in 2000, and ASRD in 2007)
- Forest management agreement (FMA) with SLS and related documents
- Ghost Area Management Plan (GAMP) for motorized use of the Ghost PLUZ
- MD Bighorn Municipal Development Plan (MDP)

3. GWAS Studies

Ghost Cumulative Effects Study prepared by ALCES Group - Phase I & II (2010 – 2012):

Phase I investigated a business as usual scenario projected into the future

Phase II investigated the potential outcome of applying beneficial management practices to the Ghost Watershed.

Riparian Health Inventory of the Ghost Watershed undertaken by Cows & Fish - Phase I & II (2010 – 2011):

Phase I: Waiparous Creek sub-basin area of the Ghost Watershed.

Phase II: Remaining part of the Ghost Watershed and its tributaries.

Ecosystem-based Conservation Plan, Phase I prepared by Herb Hammond of Silva Ecosystem Consultants (2009 - 2010):

Ecosystem analysis of the Ghost Watershed, and a Phase I assessment of the Waiparous Creek sub-basin including a comprehensive map set describing the character of the region. The goal was to gain a better understanding of the composition, structure and function of the Ghost Watershed's Ecosystem and to identify thresholds.

Data scoping report by Mistakiis Institute (2007)

4. Other relevant studies

Water Quality Study of Waiparous Creek, Fallentimber Creek and Ghost River

Prepared by Daniel Andrews Ph.D., Clearwater Environmental Consultants Inc. Alberta Environment (Feb 2006)

Increased use of the Ghost-Waiparous basin for random camping and off-highway vehicles (OHVs) has raised concerns among stakeholders that these activities are affecting water quality in the Ghost, Waiparous and Fallen Timber Rivers.

Forest Reserve Multi-Use Dialogue - A one-year information gathering process to identify issues of multi-use within the Ghost River Forest Reserve (1999):

The MD of Bighorn submitted the Forest Reserve Multi-Use Dialogue (FRMUD) report to the Minister of Environment.

Crossings Study by Alberta Conservation Association (2004):

ACA mapped and inventoried trail crossings on most existing trails in the Ghost Waiparous region, rating their condition (report not available in digital format).

High Conservation Value Forest Report: Commissioned by Spray Lake Sawmills, 2011

Alberta's Wet Area Mapping Initiative (2010?): By the University of New Brunswick, Commissioned by Alberta Sustainable Resource Development (results have not been made available to GWAS at this time).

5. Other data and information sources

Detailed Forest Management Plans (DFMP) by SLS

Fish surveys by Trout Unlimited Canada (TUC)

South Saskatchewan Regional Plan