September 2016

Camrose Source Water Protection Plan

CITY OF Camrose

CAMROSE COUNTY

YOUR PLACE TO LIVE - WORK - PLAY

STATEMENT OF APPROVAL

The Camrose Source Water Protection Plan outlines the objectives, scope of work, process and recommended management actions that will guide and support the implementation of source water protection measures for the effective drainage area of the Battle River watershed upstream of the Driedmeat Lake weir within the City of Camrose and Camrose County.

This Plan is approved by the Municipal Councils of the City of Camrose and Camrose County.

Reeve - Camrose County

Mayor - City of Camrose

County Administrator

City Manager

Cover image: Driedmeat Lake, from Highway 56 bridge (Credit: Battle River Watershed Alliance)

ACKNOWLEDGEMENTS

The Camrose Source Water Protection Initiative was led and facilitated by the core project team, which consisted of:

- Sarah Skinner (Watershed Planning Coordinator, Battle River Watershed Alliance),
- Jeremy Enarson (Director of Engineering, City of Camrose), and
- Anjah Howard (Manager of Planning and Development, Camrose County).

Thank you to the members of the stakeholder advisory committee, who dedicated much time and effort to the planning process, including conducting the source water risk assessment and drafting recommendations for the Camrose Source Water Protection Plan.

The stakeholder advisory committee consisted of:

- Brent Byers – Agricultural Producer, Camrose County *(Committee Chair)*
- Phil Buelow – Cliff's Drilling
- Greg Gillespie – Councillor, Camrose County
- Neil Larson – Losness Drilling
- Margaret Rathnavalu – Resident, City of Camrose
- Bill Sears – Councillor, City of Camrose
- Milana Simikian – Ducks Unlimited Canada

Many City of Camrose and Camrose County residents also provided input into this Plan through completion of an online survey developed by the stakeholder advisory committee. The survey results are outlined in the Public Engagement Report in Appendix A.

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1.0 INTRODUCTION

Source water protection is one component of a multi-barrier approach to drinking water protection. This approach looks at ways to improve water quality from source to tap through source water protection and improvements to drinking water treatment and distribution systems.

Integral to the concept of source water protection is the understanding that the provision of safe, secure water supplies begins with the protection of these water supplies at their source – that is, the surface and ground water systems from which we draw our water. The Battle River and Driedmeat Lake are an important water source for the City of Camrose, Braim, Ohaton, the Village of Bittern Lake, and many Camrose County residents.

Source water protection supports the protection and improvement of aquatic ecosystems and the overall health of the watershed. A healthy environment provides a strong foundation on which to build healthy communities and economies. Protecting our water sources increases the recreational value of the area, reduces public health risks associated with poor water quality, minimizes the cost of treating drinking water, and helps to ensure reliable, quality water supplies into the future. Safe and secure water supplies also contribute to viable commercial, industrial, and agricultural operations.

2.0 Camrose Source Water Protection Plan

2.1 Goals and Objectives

The overarching goal of the Camrose Source Water Protection Plan is to support the protection and improvement of surface water quality in the Battle River and Driedmeat Lake, which are critical water sources for the City of Camrose and many County residents. This Plan also considers groundwater that is hydrologically connected to surface water, as this is a potential vector through which water contamination may occur. While it is recognized that water quantity is an important consideration in source water protection, it is beyond the scope of this Plan to address issues related to floods, droughts, and water availability. These topics may be addressed through other initiatives.

The main objectives of this Plan are to identify risks to source water within the planning area and outline management actions to minimize or eliminate those risks. Implementation of these actions will support the provision of safe and secure water supplies, help to reduce the amount of treatment required at the Camrose Water Treatment Plant, and ensure the long-term protection of the Battle River and Driedmeat Lake.

2.2 Planning Area

The planning area for the Camrose Source Water Protection Plan focuses on the effective drainage area of the Battle River watershed upstream of the Driedmeat Lake weir within the City of Camrose and Camrose County. The effective drainage area is defined as the area of land that is expected to contribute runoff to the Battle River on a regular basis. Because of the regular runoff from these lands, they have the potential to greatly impact water quality in the river and are therefore critical to source water protection in the planning area.

See Figure 1 for a map of the planning area. It is recognized that the boundaries of the effective drainage area may change over time due to factors such as changing weather and drainage patterns. This Plan will incorporate changes to the boundaries of the effective drainage area as new data becomes available. Additional maps of land use in the planning area are included in Appendix B.

The Battle River originates at Battle Lake, just south of Pigeon Lake. The entire contributing area of the Battle River watershed upstream of the Driedmeat Lake weir may impact water quality within the planning area. However, much of this region is outside the jurisdiction of the City of Camrose and Camrose County. Other municipalities are encouraged to develop Source Water Protection Plans in order to ensure source water protection within the Battle River watershed as a whole. See Figure 2 for a map of the Battle River watershed upstream of the Driedmeat Lake weir. See Figure 3 for a map of the Alberta portion of the Battle River watershed.

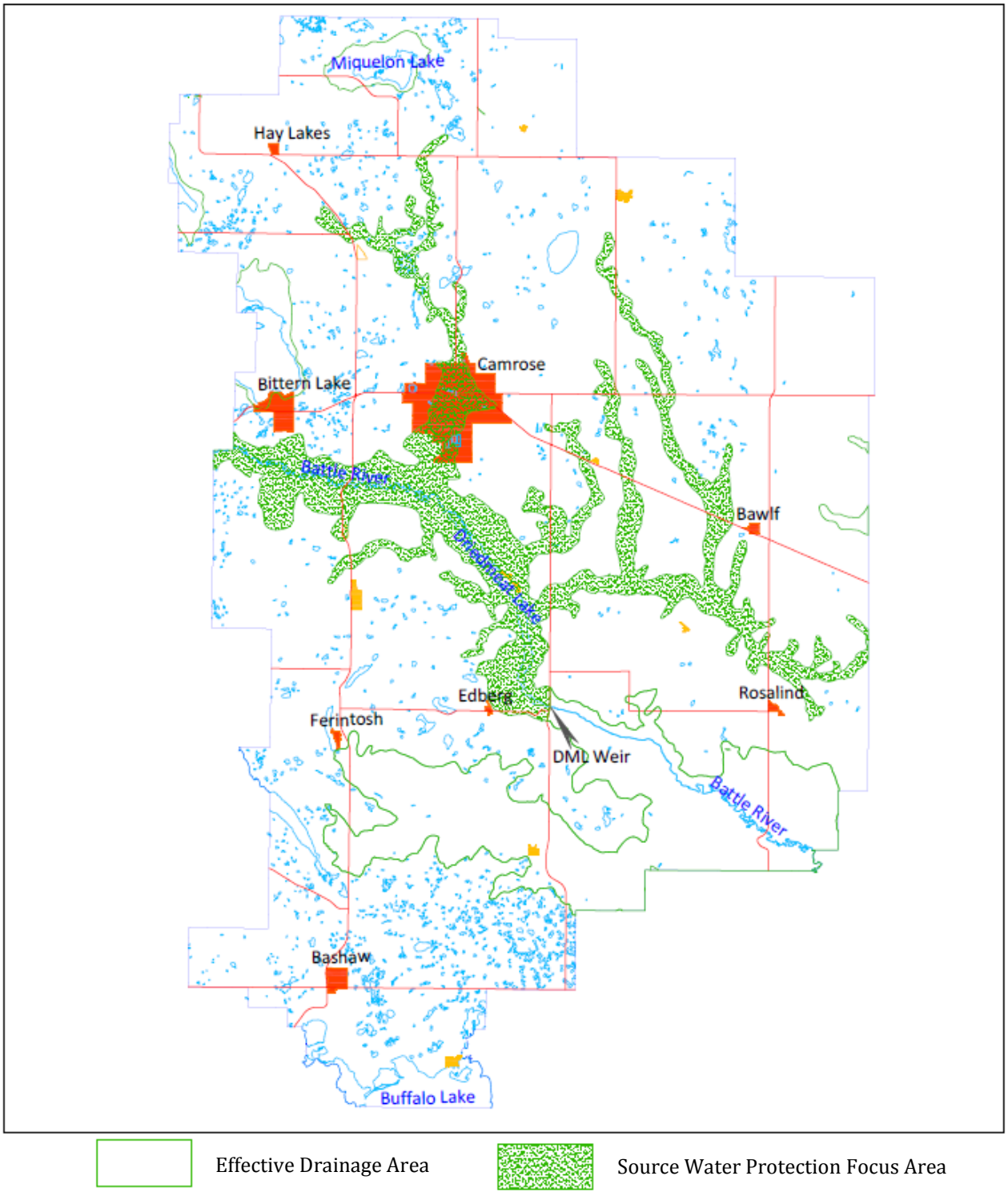


Figure 1. Effective Drainage Area and Source Water Protection Focus Area in the City of Camrose and Camrose County (Agriculture and Agri-Food Canada, 2013)

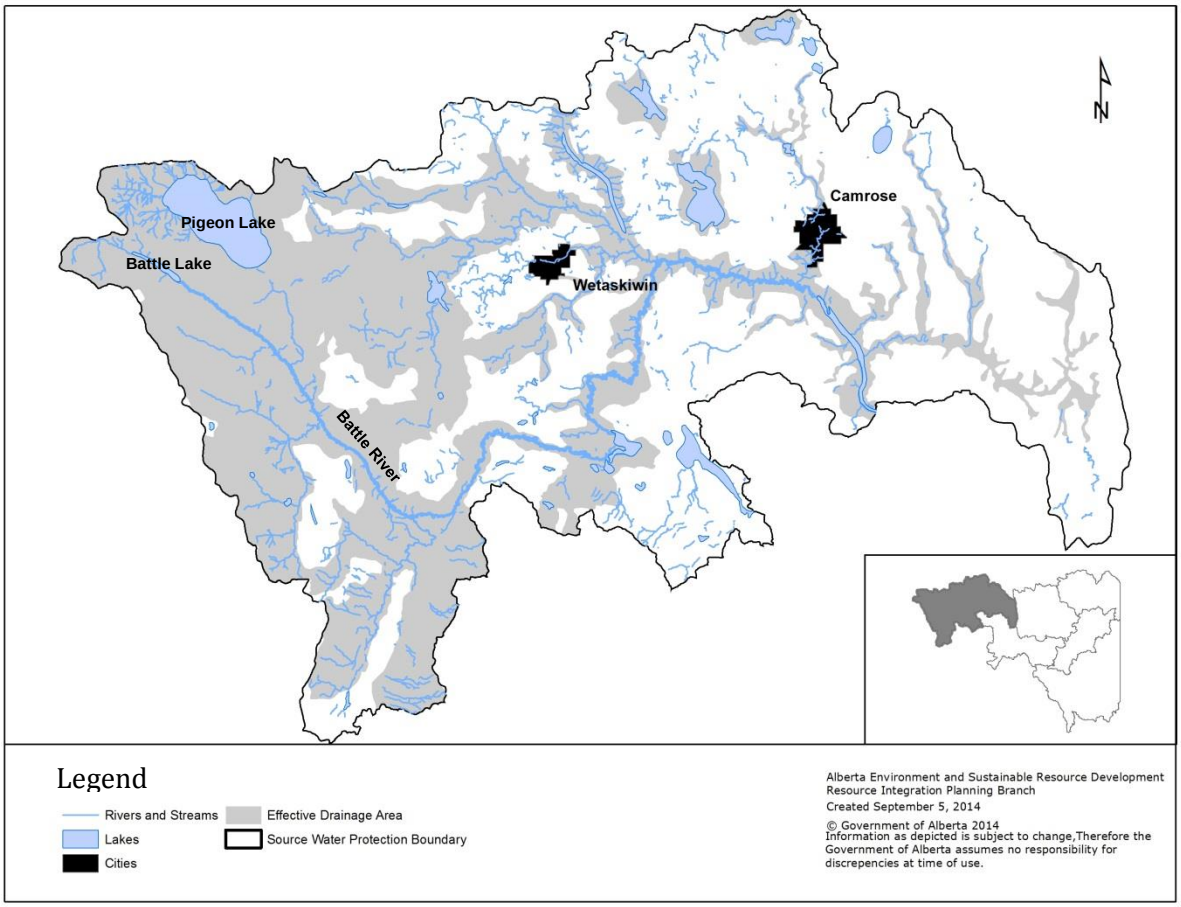


Figure 2. Battle River watershed upstream of the Driedmeat Lake Weir

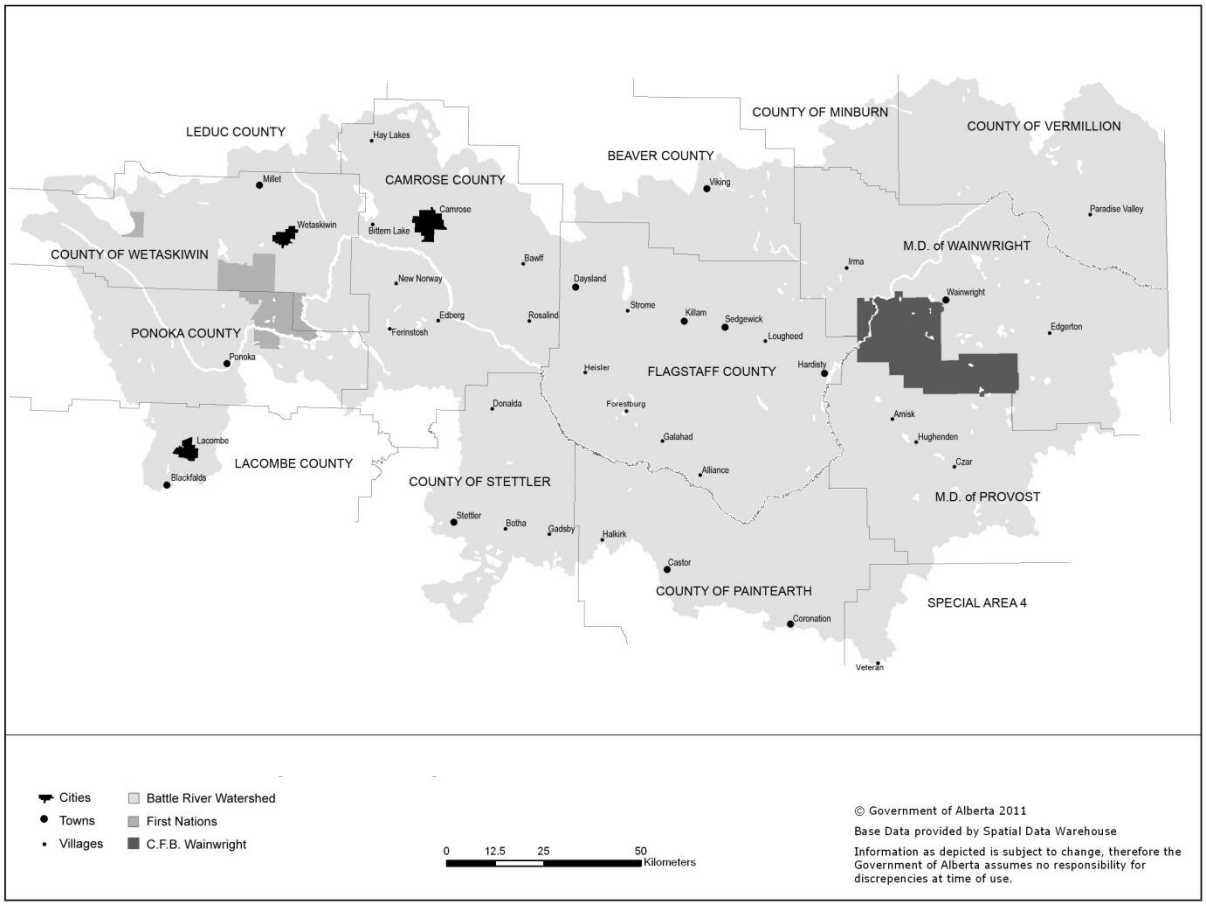


Figure 3. Alberta portion of the Battle River watershed

2.3 Risk Assessment

A source water risk assessment was completed in order to identify and rank potential risks to source water quality in the planning area. Using a risk matrix, risks were ranked according to the likelihood that they would occur and the impact they would have if they were to occur. The final "level of risk" ranking represents the level of risk to environmental and human health that would be present if no protective measures were in place (such as drinking water treatment). The following tables summarize the results of the risk assessment. See Appendix C and D for the complete risk assessment.

Table 1: Urban Source Water Risks

Source		Description of Risk	Level of Risk
URBAN RISKS	Transportation	Roadway activities; sand/salt application and storage	High
		Snow storage and spring runoff	Moderate
	Stormwater	Runoff from urban environment	High
	Lawn Care Products	Use of lawn care products (fertilizers, pesticides, herbicides)	High
	Development and Construction	Development/construction activities	Moderate
	Green Spaces, Wetlands	Removal of upland vegetation and wetlands	High
		Removal or degradation of riparian vegetation	Moderate
	Recreation, Wildlife	Wildlife and pet activity	Low
	Wastewater	Pharmaceutical products, microbeads, etc.	Moderate

Table 2: Rural Source Water Risks

Source		Description of Risk	Level of Risk
RURAL RISKS	Land Management	Livestock grazing near water bodies	High
		Excess or inappropriate application of manure and fertilizer	High
		Chemical application on agricultural lands	High
		Runoff from Confined Feeding Operations	High
		Siting of cattle bedding, watering and wintering sites	High
		Gravel extraction activities	High
		Human/animal activity in groundwater recharge areas	Moderate

(continued on next page)

Source		Description of Risk	Level of Risk
RURAL RISKS	Oil and Gas Development	Abandoned oil and gas wells	Moderate
		Abandoned oil and gas pipelines	High
		Spills at oil and gas sites	Moderate
		Leaks from active oil and gas pipelines	High
		Inadequate or failing well casings on active oil and gas wells	High
		Oil and gas well site and pipeline construction	High
		Degradation or loss of wetlands due to oil and gas activity	High
	Transportation	Spills due to transportation corridor accidents	High
		Transportation corridor activities	Moderate
	Development and Construction	Development/construction activities	Moderate
	Green Spaces	Removal of upland vegetation	High
		Removal or degradation of riparian vegetation	High
	Wetlands	Wetland degradation or loss	High
	Recreation	Recreational activities on or near water bodies	Moderate
	Water Wells and Springs	Inadequate or failing well casings	Moderate
		Human/animal activity near natural springs	Moderate
	Wastewater	Failing or inadequate public sewage systems	Moderate
		Failing or inadequate private sewage systems	High
	Waste Disposal	Leaching from abandoned waste disposal sites	Moderate
		Leaching from active waste disposal sites	Moderate
	Wildlife	Wildlife activity	Low

2.4 Recommended Management Actions

This section describes existing actions and programs aimed at source water protection in the planning area and outlines new recommended management actions through which source water protection efforts may be enhanced. These recommendations are non-binding and voluntary, but are meant to guide and support the implementation of source water protection measures by the City of Camrose, Camrose County, and other identified partner organizations.

Rural and urban risks identified through the risk assessment have been consolidated into overarching focus areas for source water protection. The coloured bars along the left side of the tables indicate the level of risk that each management action aims to address.

Low Risk	Moderate Risk	High Risk

2.4.1 Land Management

Upland and riparian land development and management has the potential to influence how water flows across the landscape as well as the quality of that water. Natural upland, wetland and riparian areas help protect source water through water storage and filtration. While natural vegetation has been maintained in some portions of the planning area, other portions have been cleared or converted for agricultural production and commercial/industrial development. Nutrients, sediment, and other contaminants may enter water bodies as a result of these activities. Various resources and programs have been developed to support agricultural producers to implement beneficial management practices, and a number of landowner projects have already been completed in Camrose County. Several provisions in the City of Camrose and Camrose County Municipal Development Plans, Land Use Bylaws and other planning documents support environmental protection within the planning area.

	Management Action	Responsibility	Timeline
	1: It is recommended that Camrose County and partners work with landowners and agricultural producers to implement beneficial management practices (BMPs) that maintain or improve upland, wetland and riparian area health and water quality in the planning area. *This may include encouraging producers to participate in existing incentive programs to support BMP implementation.*	• Camrose County • Agricultural Producers • Landowners • Battle River Watershed Alliance • Cows and Fish • Ducks Unlimited Canada • Government of Alberta	• Short-term

	2: It is recommended that Camrose County work with landowners to identify and protect intact upland, wetland and riparian natural areas in the planning area. *This may involve designating areas under the "Watershed Protection District" of the Land Use Bylaw, identifying environmentally significant and sensitive areas, increasing educational efforts about the importance of natural areas, and providing incentives for landowners to maintain these areas on their land.*	• Camrose County • Landowners	• Medium-term
	3: It is recommended that Camrose County explore techniques to enhance water quality protection efforts where gravel mining occurs in the planning area.	• Camrose County • Gravel Mining Companies	• Medium-term

2.4.2 Oil and Gas Development

There are approximately 125 kilometers of abandoned or discontinued pipelines and about 175 kilometers of operating or permitted pipelines in the planning area. In addition, there are about 450 abandoned or suspended oil and gas wells and about 50 flowing or pumping wells in the area. Oil and gas development presents a potential avenue through which various contaminants may enter ground and surface water in the planning area. Both operating and abandoned pipelines cross the Battle River at several locations.

	Management Action	**Responsibility**	**Timeline**
	4: It is recommended that Camrose County and the Alberta Energy Regulator develop a Watershed Development Plan to guide oil and gas development in the Driedmeat Lake watershed. *A similar plan has been developed for the Battle Lake watershed.*	• Camrose County • Alberta Energy Regulator	• Medium-term
	5: It is recommended that Camrose County work with the Alberta Energy Regulator and pipeline companies to develop an Emergency Response Plan outlining actions to be taken in the event of pipeline-related leakages that may result in water quality impacts. *The Emergency Response Plan should focus on operating/permitted and abandoned/discontinued pipelines that cross the Battle River. Tributary stream crossings may also be considered.*	• Camrose County • Alberta Energy Regulator • Pipeline Companies	• Medium-term

	6: It is recommended that the City of Camrose and Camrose County work with the Alberta Energy Regulator, the Orphan Well Association and landowners to decommission abandoned oil and gas wells and pipelines in the planning area.	• City of Camrose • Camrose County • Landowners • Alberta Energy Regulator • Orphan Well Association	• Medium to Long-term

2.4.3 TRANSPORTATION

Linear developments such as roads and railways have been shown to adversely impact the overall biological integrity of aquatic ecosystems. Salt, silt and various other contaminants may enter water bodies from sidewalks, streets, roads, and other linear developments in both urban and rural settings. Potential runoff from salt and sand storage areas and snow collection areas should also be considered. The City of Camrose and Camrose County currently undertake dust, ice and snow control measures in various locations in the planning area. Environmentally-sensitive control measures may lessen the water quality impacts of transportation corridors. Adequate emergency response measures may lessen the water quality impacts associated with serious transportation incidents such as accidents or spillages.

	Management Action	**Responsibility**	**Timeline**
	7: It is recommended that the City of Camrose undertake educational efforts to inform City residents about residential sidewalk clearing requirements, appropriate sand and salt application rates, and environmentally-sensitive alternatives.	• City of Camrose • City Residents	• Short-term
	8: It is recommended that the City of Camrose increase staffing and equipment resources to expand catch basin cleaning and street sweeping.	• City of Camrose	• Medium-term
	9: It is recommended that the City of Camrose and Camrose County investigate alternative dust and ice control options, balancing both ecological and economic considerations. The City and County should also adhere to best practices related to dust and ice control application and incorporation.	• City of Camrose • Camrose County	• Medium-term
	10: It is recommended that the City of Camrose build a covered, permanent structure for sand and salt storage.	• City of Camrose	• Medium-term

	11: It is recommended that the City of Camrose and Camrose County work collaboratively to develop an Emergency Response Plan outlining actions to be taken in the event of transportation-related accidents or spillages that may result in water quality impacts.	• City of Camrose • Camrose County	• Medium-term
	12: It is recommended that the City of Camrose and Camrose County implement actions to reduce water quality impacts of roadways and walkways that cross natural waterways. *This may include environmentally-sensitive dust, snow, and ice control measures.*	• City of Camrose • Camrose County	• Short-term
	13: It is recommended that the City of Camrose enhance snow storage by implementing best practices to prevent garbage, debris, sand, salt and other contaminants from entering the stormwater system.	• City of Camrose	• Medium-term

2.4.4 STORMWATER

In the City of Camrose and Camrose County, stormwater runoff is not treated before it enters natural water bodies. As such, various contaminants from streets, sidewalks and driveways may be carried by runoff into tributary streams and onward into the Battle River. Currently, the primary mode of stormwater management is through conventional techniques such as catch basins, curbs/gutters and storm sewers. Low Impact Development techniques and "green" infrastructure may be used to provide natural stormwater storage and filtration.

	Management Action	**Responsibility**	**Timeline**
	14: It is recommended that the City of Camrose and Camrose County encourage developers to incorporate Low Impact Development stormwater management techniques into new developments. *Low Impact Development techniques may include rainwater harvesting, rain gardens, bioswales, permeable pavement, and bioretention areas.*	• City of Camrose • Camrose County • Developers	• Short-term

	15: It is recommended that the City of Camrose and community organizations undertake educational programs to increase awareness about stormwater management and products that are harmful to dispose of through storm sewers. *Trout Unlimited Canada's "Yellow Fish Road" program is one means of raising awareness about stormwater management.*	• City of Camrose • Community Organizations	• Short-term
	16: It is recommended that the City of Camrose and Camrose County encourage residents to incorporate Low Impact Development stormwater management techniques into their properties. *Property-scale Low Impact Development techniques may include rain gardens, rainwater harvesting and permeable pavement. Demonstration sites and incentive programs may be utilized to encourage residents to implement these techniques.*	• City of Camrose • Camrose County • Residents	• Medium-term

2.4.5 LAWN CARE PRODUCTS

Lawn care products such as fertilizer, pesticides and herbicides may be transported to natural water bodies via surface water runoff. Certain products may present a lesser risk to water quality than others. The City of Camrose and Camrose County do not currently have bylaws in place related to the use of lawn care products.

	Management Action	**Responsibility**	**Timeline**
	17: It is recommended that the City of Camrose encourage residents to minimize their use of lawn care products such as fertilizer, pesticides and herbicides. The City should also raise awareness about environmentally-sensitive lawn care products.	• City of Camrose • City Residents	• Short-term
	18: It is recommended that the City of Camrose investigate the possibility of developing bylaws to regulate the use of fertilizers, pesticides and herbicides within City limits.	• City of Camrose	• Medium-term

2.4.6 *Development and Construction*

The loss of vegetative cover and increased amount of bare soil associated with development and construction may contribute to soil erosion and an increased sediment load to surface water bodies in the effective drainage area of the watershed. In the planning area, developers are currently encouraged (but not required) to develop erosion and sediment control plans.

	Management Action	Responsibility	Timeline
	19: It is recommended that the City of Camrose and Camrose County require developers to develop erosion and sediment control plans for new and in-fill development.	• City of Camrose • Camrose County • Developers	• Short-term

2.4.7 *Green Spaces*

Natural green spaces within the City of Camrose and Camrose County provide recreational opportunities for residents and contribute to ecological services such as air purification, healthy riparian and upland areas, and habitat for birds and wildlife. In particular, riparian areas provide critical habitat for a diversity of wildlife, water storage and filtration, bank stabilization, and groundwater recharge.

The City of Camrose strives to maintain natural green spaces and healthy riparian areas along Mirror Lake and Stoney Creek within City limits, and many natural areas have been maintained along the Battle River, Stoney Creek, and other tributary streams within Camrose County. Riparian health assessments have been completed within the planning area along some stretches of Stoney Creek and the Battle River in order to gather information about the health of these natural areas.

	Management Action	Responsibility	Timeline
	20: It is recommended that the City of Camrose and Camrose County pursue opportunities to re-naturalize green spaces that are currently maintained as manicured grassed areas. *Potential sites may include road medians, road verges, green spaces not used for recreational purposes, and areas around Mirror Lake and in the Stoney Creek valley.*	• City of Camrose • Camrose County	• Short-term
	21: It is recommended that the City of Camrose and Camrose County determine appropriate riparian setback distances within the planning area. Setbacks should be determined for the Battle River and major tributary streams.	• City of Camrose • Camrose County	• Short-term

	22: It is recommended that the City of Camrose and Camrose County work with partners to undertake riparian health assessments on a regular basis (every 5 years) in order to monitor riparian area health in the planning area.	• City of Camrose • Camrose County • Cows and Fish	• Medium-term
	23: It is recommended that Camrose County and partners maintain or enhance natural green spaces in upland areas and along the Battle River, Driedmeat Lake and tributary streams (especially within the riparian area and flood plain).	• Camrose County • Landowners • Battle River Watershed Alliance • Cows and Fish	• Medium-term
	24: It is recommended that the City of Camrose and partners maintain or enhance natural green spaces in the Stoney Creek valley and around Mirror Lake (especially within the riparian area and flood plain).	• City of Camrose • Battle River Watershed Alliance • Cows and Fish	• Medium-term
	25: It is recommended that the City of Camrose utilize the Green Space Master Plan to ensure that wetlands, riparian areas and other natural green spaces are protected as new development and expansion occurs within City limits. *Map 6: Future Green Space Concept, in the City of Camrose Green Space Master Plan, indicates proposed future green spaces within City limits.*	• City of Camrose • Cows and Fish • Ducks Unlimited Canada	• Long-term

2.4.8 *WETLANDS*

Wetlands support high levels of biodiversity and play a key role in capturing surface water runoff and filtering out harmful contaminants such as nitrogen, phosphorus, and pesticides. In addition, they provide water storage capacity on the landscape, which is important in times of flood and drought. Wetland inventories have been completed for much of the area north of Camrose within Camrose County, and over one hundred wetland restoration projects have been completed in the County.

	Management Action	Responsibility	Timeline
	26: It is recommended that the City of Camrose, Camrose County and partners develop and deliver educational programming related to the value and functions of wetlands and the benefits of wetland conservation and restoration.	• City of Camrose • Camrose County • Ducks Unlimited Canada • Battle River Watershed Alliance • Alberta Environment and Parks	• Short-term
	27: It is recommended that the City of Camrose, Camrose County and partners determine wetland conservation priorities and objectives and work with landowners to undertake targeted wetland conservation and restoration in the planning area and other identified priority areas. *This may include utilizing or building upon existing wetland inventories for the planning area.*	• City of Camrose • Camrose County • Landowners • Ducks Unlimited Canada • Battle River Watershed Alliance • Alberta Environment and Parks	• Medium-term

2.4.9 *RECREATION*

Off-highway vehicles and other recreational activities may cause damage to natural areas and lead to water quality degradation through increased sediment transport as a result of erosion. The responsible recreational use of natural areas may lessen these impacts.

	Management Action	Responsibility	Timeline
	28: It is recommended that Camrose County undertake educational efforts to raise awareness about the potential ecological impacts of off-highway vehicles and encourage their responsible use.	• Camrose County • Alberta Off-Highway Vehicle Association	• Short-term

	29: It is recommended that Camrose County identify areas within the planning area where there is high off-highway vehicle usage and undertake management efforts to ensure that the ecological integrity of these areas is maintained. The County may also consider creating designated areas for off-highway vehicle usage and limiting off-highway vehicle access in ecologically sensitive areas.	• Camrose County • Alberta Off-Highway Vehicle Association	• Medium-term
	30: It is recommended that the City of Camrose continue to maintain and expand the use of bag dispensers and garbage bins along walking trails and encourage recreationists to keep trails and green spaces clean of waste.	• City of Camrose	• Short-term

2.4.10 Water Wells and Springs

There are over 350 water wells in the planning area. Proper well maintenance and decommissioning of wells that are no longer in use is critical to minimizing risks to source water quality and ensuring safe and secure drinking water supplies over the long-term. There are also several natural springs in the planning area. These are areas where groundwater meets surface water, and they are critical water sources contributing to the flow of the Battle River. The province-wide Working Well Program provides resources and workshops to support private landowners in properly managing their water wells. Resources and expertise related to spring development and management are available through Alberta Agriculture and Forestry.

	Management Action	**Responsibility**	**Timeline**
	31: It is recommended that Camrose County continue to provide education on water well management through the Working Well program.	• Camrose County • Working Well Program	• Short-term
	32: It is recommended that the City of Camrose and Camrose County work with landowners to decommission abandoned water wells in the planning area.	• City of Camrose • Camrose County • Landowners	• Medium-term
	33: It is recommended that Camrose County and partners build upon existing resources to deliver educational programming related to the development and management of natural springs.	• Camrose County • Battle River Watershed Alliance • Alberta Agriculture and Forestry	• Medium-term

2.4.11 WASTEWATER

Wastewater treatment plants are unable to remove certain contaminants such as pharmaceutical products and plastic microbeads through their treatment processes. As such, these products may accumulate in natural water bodies if they are disposed of through the wastewater stream. Other means of disposing of pharmaceutical products are available, and alternative personal care products that do not contain microbeads may be used.

Private septic systems are another important consideration, as most rural residents rely on these systems to manage their wastewater. Proper septic system management and maintenance is essential to ensuring that these systems do not contribute to adverse water quality impacts. A province-wide "Septic Sense" program is currently being developed to support private landowners in properly managing their septic systems.

	Management Action	Responsibility	Timeline
	34: It is recommended that Camrose County and partners develop and deliver educational programming on private septic system management.	• Camrose County • Alberta Onsite Wastewater Management Association • Septic Sense Program	• Medium-term
	35: It is recommended that the City of Camrose and Camrose County encourage residents to properly dispose of pharmaceutical products and support local drug stores in their collection of old or unused pharmaceutical products.	• City of Camrose • Camrose County • Drug Stores • Residents	• Short-term
	36: It is recommended that the City of Camrose and Camrose County undertake educational efforts related to the potential ecological impacts of microbeads found in various personal care products.	• City of Camrose • Camrose County	• Short-term
	37: It is recommended that the City of Camrose enhance monitoring, implementation and enforcement of the City's wastewater bylaws.	• City of Camrose	• Short-term

2.4.12 WASTE DISPOSAL

Old waste disposal sites that do not adhere to current standards present a risk to ground and surface water quality, as leachate from these sites is more likely to be transported via ground and surface water flows. Camrose County has begun the process of identifying the locations of nuisance grounds and landfills within the County.

	Management Action	Responsibility	Timeline
	38: It is recommended that the City of Camrose and Camrose County support the continuation of the hazardous waste round-up and look into opportunities to expand the program.	• City of Camrose • Camrose County	• Medium-term
	39: It is recommended that the City of Camrose and Camrose County identify old waste disposal sites in the planning area and undertake risk assessments to gauge potential water quality impacts from these sites. They may also initiate discussions with the Government of Alberta to explore opportunities for monitoring, modelling, and research to support improved management of these sites.	• City of Camrose • Camrose County • Government of Alberta	• Long-term

3.0 PLAN IMPLEMENTATION

The Camrose Source Water Protection Plan is a united effort of the City of Camrose, Camrose County, and the people who live and work in the area. Implementation of the source water protection measures identified in this Plan will help sustain the Battle River as a water source for present and future generations.

The Plan will be used in two key ways:

First, it will serve as an education tool to raise awareness about where our water comes from and the importance of source water protection. We all rely on water for our wellbeing and livelihood, and our actions can have consequences (both positive and negative) on our water sources.

Second, it will be used as a guide to prioritize management actions to protect and improve water quality in the Battle River and Driedmeat Lake. The Plan breaks management actions into short, medium and long-term goals to help us take quick action and build on successes over time.

While this Plan is non-binding and voluntary, the intent is for it to be used as a guidance document to direct resources towards projects that meet the short, medium, and long-term goals for source water protection (whether that be through education, volunteer support, staff time, or direct funding). Stakeholders are encouraged to use this Plan as a tool in deciding how to utilize the resources available to work towards the common goals outlined in this Plan for the benefit of the whole community.

The City and County, as managing partners on this project, will review the Plan over time to monitor progress in achieving the goals and make adjustments as necessary.

APPENDIX A: PUBLIC ENGAGEMENT REPORT

March 2016

Camrose Source Water Protection Plan: Public Engagement Results

Driedmeat Lake

CAMROSE COUNTY
YOUR PLACE TO LIVE - WORK - PLAY

CITY OF Camrose

BATTLE RIVER WATERSHED ALLIANCE

About the Camrose Source Water Protection Plan

Source water protection is one component of a multi-barrier approach to drinking water protection. This approach looks at ways to improve water quality from source to tap through source water protection and improvements to drinking water treatment and distribution systems. Integral to the concept of source water protection is the understanding that the provision of safe, secure water supplies begins with the protection of these water supplies at their source – that is, the surface and ground water systems from which we draw our water.

The Camrose Source Water Protection Plan is a joint initiative of the City of Camrose and Camrose County. The overarching goal of the Plan is to support the protection and improvement of surface water quality in the Battle River and Driedmeat Lake, which are critical water sources for the City of Camrose and many Camrose County residents. The main objectives of the Plan are to identify risks to source water within the planning area and outline management actions to minimize or eliminate those risks. Implementation of these actions will help to reduce the amount of treatment required at the Camrose Water Treatment Plant and ensure the long-term protection of the Battle River and Driedmeat Lake.

The planning area for the Camrose Source Water Protection Plan focuses on the effective drainage area of the Battle River watershed upstream of the Driedmeat Lake weir within Camrose County and the City of Camrose. The effective drainage area is defined as the area of land that is expected to contribute runoff to the Battle River on a regular basis. Because of the regular runoff from these lands, they are critical to the maintenance of water quality in the Battle River.

About This Report

The development of the Camrose Source Water Protection Plan was led by a project team consisting of staff from the City of Camrose, Camrose County and the Battle River Watershed Alliance. In May 2015, a stakeholder advisory committee was formed to support the project team in conducting a source water risk assessment to identify potential risks to source water in the planning area. The committee and project team then developed draft management recommendations based on those risks.

The project team and stakeholder advisory committee identified public engagement as a key step in the planning process, as a means of gaining feedback on draft recommendations developed and ensuring that all interested stakeholders had the opportunity to contribute to the development of the Plan. As such, a media campaign and online survey were developed in order to raise awareness about the initiative and gather information from stakeholders about potential risks to source water quality in the planning area and management actions that could be taken to address those risks.

The purpose of this report is to share the input received through the online survey.

Online Survey Results

Survey Development and Questions

SurveyMonkey, an online survey development tool, was used to create the survey. The survey was composed of the following questions:

1) In your opinion, what level of risk to source water quality is associated with the following urban activities?
   Activities could be ranked as low, medium or high risk, and included development and construction, wastewater release, stormwater runoff, dust and ice control measures, pharmaceutical products in wastewater, use of lawn care products, and degradation of natural green spaces.
2) In your opinion, what level of risk to source water quality is associated with the following rural activities?
   Activities could be ranked as low, medium or high risk, and included acreage or lake resort development, gravel development, oil and gas development, agricultural practices, transportation activities, recreational activities, abandoned waste disposal sites, private septic systems, and degradation of natural areas.
3) How important are each of the following urban management actions to protecting source water quality?
   Actions could be ranked as slightly, moderately, or very important, and included improving water management during construction/development, improving stormwater management, naturalizing public green spaces, maintaining or improving the health of riparian areas, conserving wetlands, using environmentally-friendly lawn care, dust and ice control products, and properly disposing of pharmaceutical products.
4) How important are each of the following rural management actions to protecting source water quality?
   Actions could be ranked as slightly, moderately, or very important, and included improving agricultural practices, conserving and restoring riparian areas, wetlands and other natural areas, improving gravel mining practices, developing a plan to guide oil and gas development, developing emergency response plans for transportation corridors, decommissioning abandoned water wells and oil and gas pipelines and wells, using environmentally-friendly lawn care, dust and ice control products, reducing the impact of off-highway vehicles, improving management of abandoned waste disposal sites, and appropriate maintenance and management of water wells, septic systems and natural springs.
5) Demographic Questions:
   a. Where do you live?
   b. What do you do for a living?
   c. What is your gender?
   d. What is your age?
   e. What is the highest level of education you have completed?

The link to the survey was broadly distributed to watershed residents, stakeholders and decision-makers through two newspaper articles and various City of Camrose, Camrose County, and BRWA social media posts.

Who Responded

86 people responded to all or part of the survey. Figure 1 shows the percentage of survey responses from City and County residents, as well as responses from rural communities within the County and locations outside the planning area. Figure 2 illustrates the various occupations and sectors represented by people who completed the survey. Figure 3 identifies the proportion of survey responses from males and females. Figure 4 shows the distribution of survey responses from people of different ages. Figure 5 demonstrates the level of education held by survey respondents.

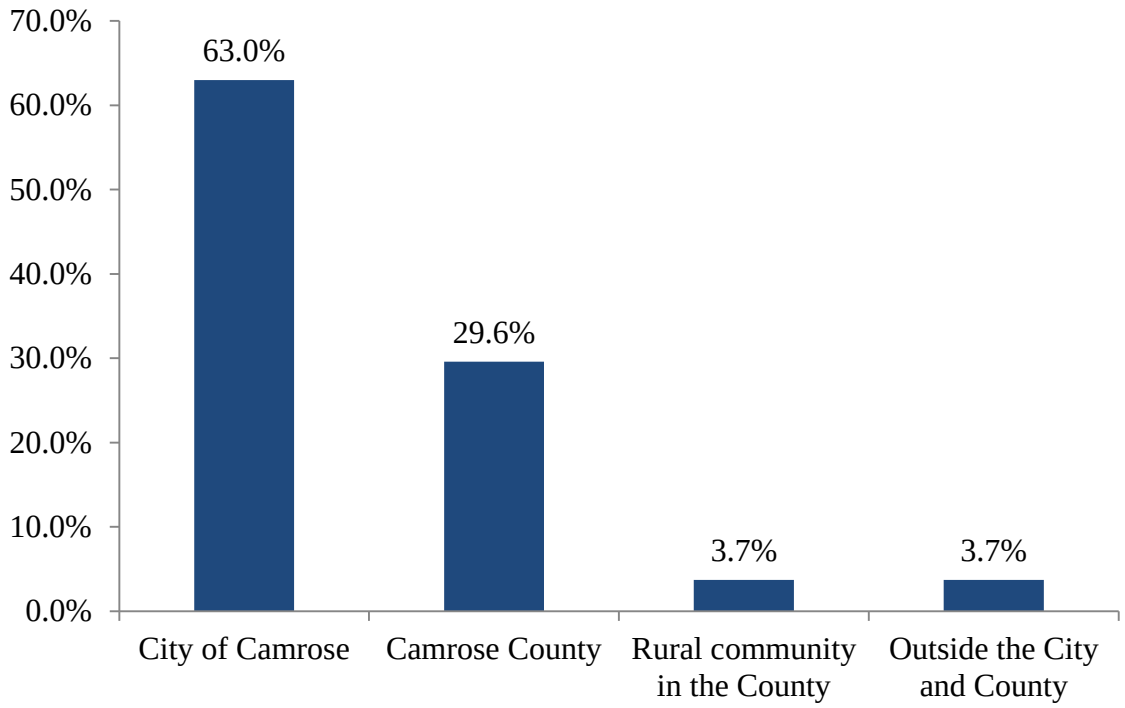


Figure 4: Survey responses by place of residence (81 respondents)

Rural community members were from Rosalind, Bawlf, and New Norway.

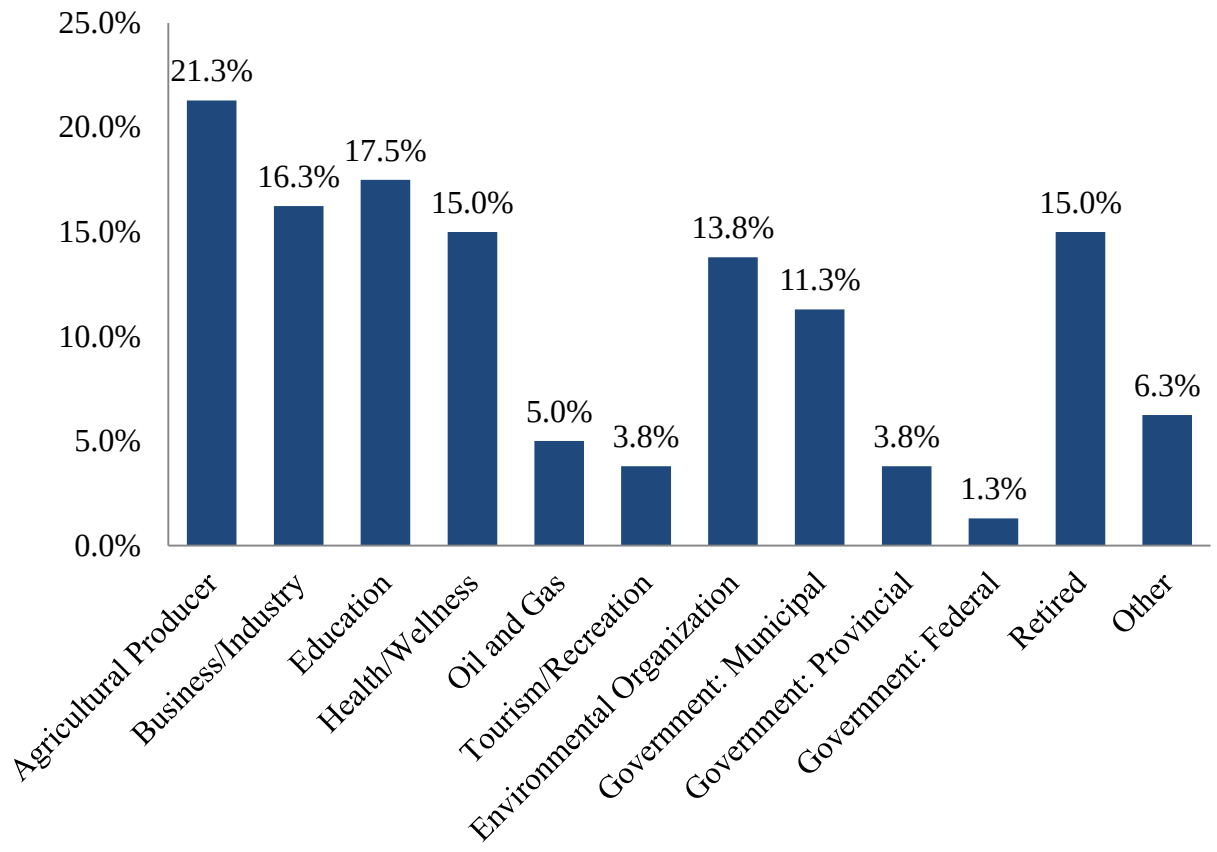


Figure 5: Survey responses by occupation (80 respondents)

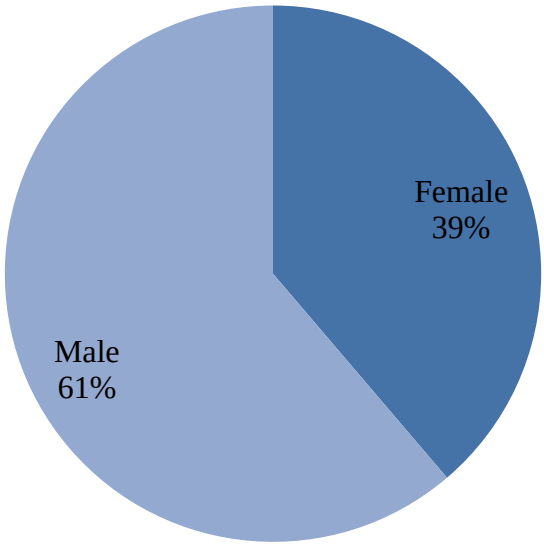


Figure 6: Survey responses by gender (80 respondents)

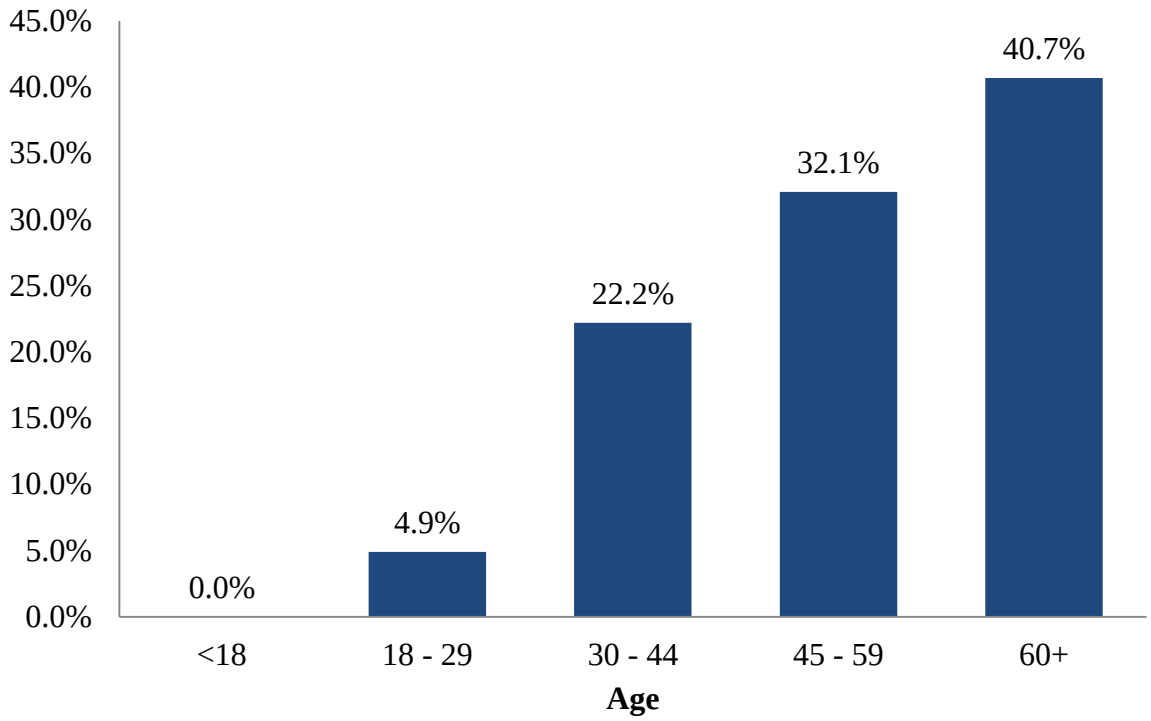


Figure 7: Survey responses by age (81 respondents)

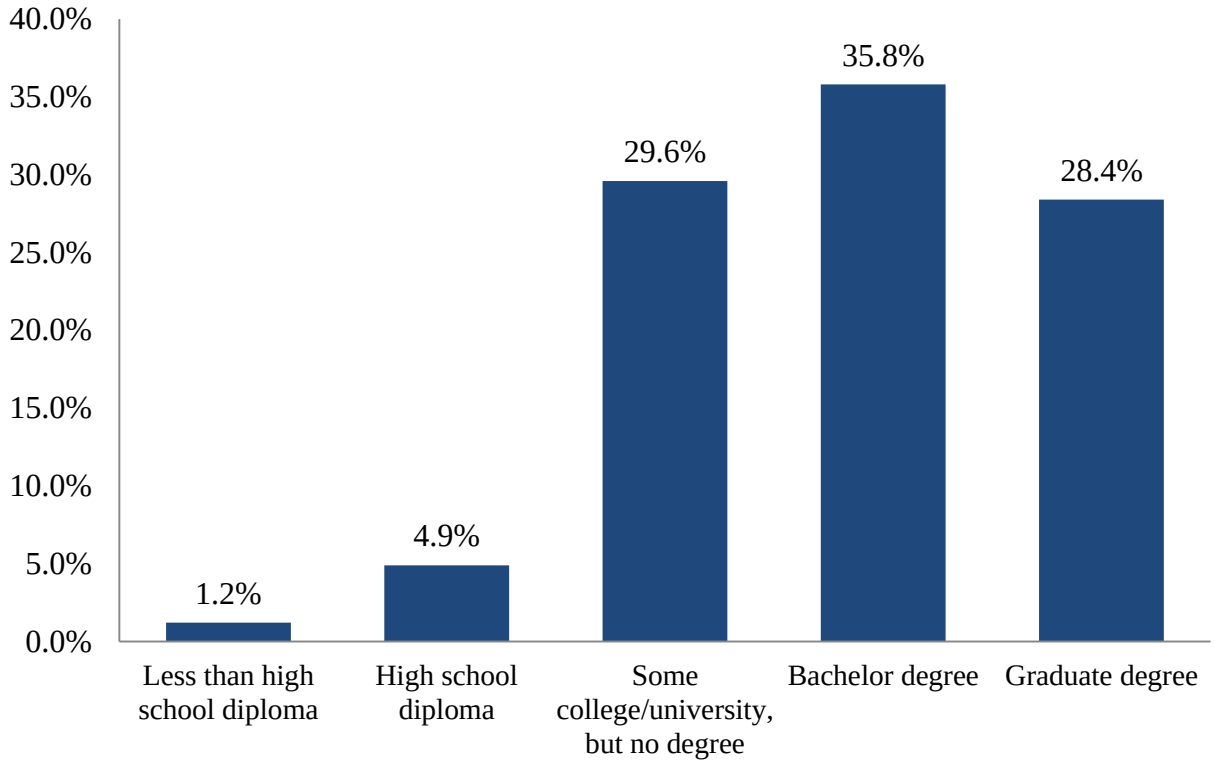


Figure 8: Survey responses by level of education (81 respondents)

Survey Responses

Question 1: Urban Risks to Source Water Quality

Survey respondents were asked to identify the level of risk to source water quality they associated with a number of urban activities.

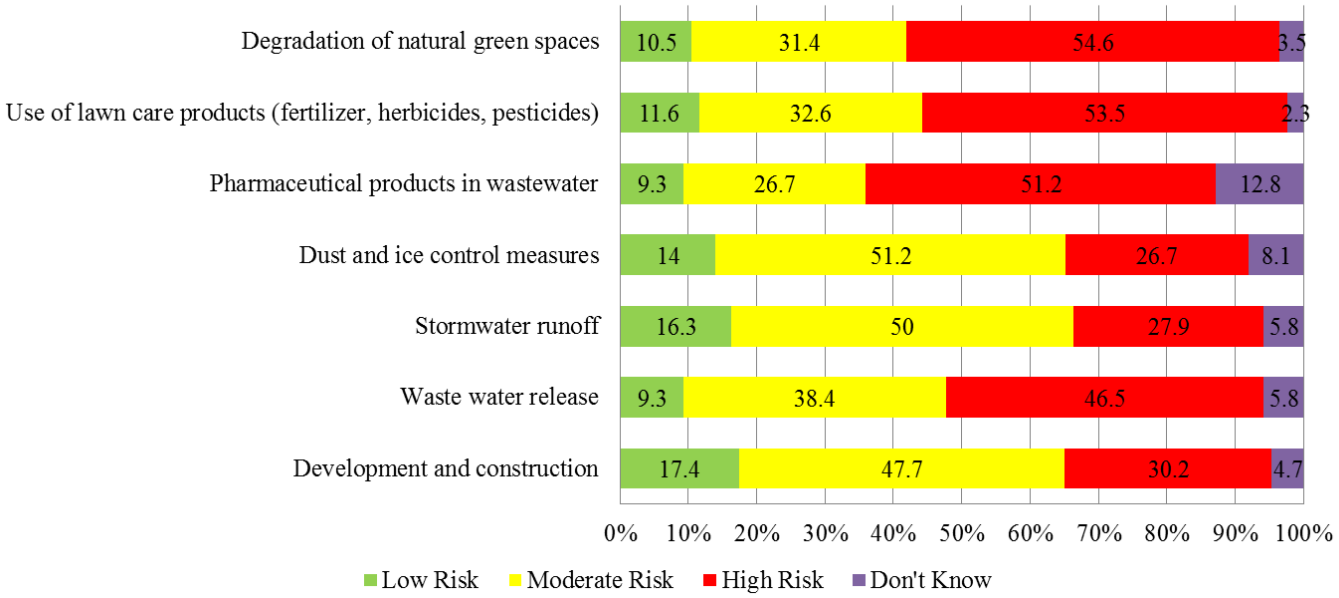


Figure 9: Level of risk to source water quality associated with various urban activities (86 respondents)

The urban activities that survey respondents identified as being the highest risk to source water quality were:

- Degradation of natural green spaces,
- Use of lawn care products (fertilizer, herbicides, pesticides), and
- Pharmaceutical products in wastewater.

Dust and ice control measures and stormwater runoff were identified by the majority of respondents as being a moderate risk to source water quality.

Survey respondents were also invited to identify other urban risks that they thought should be considered. Two additional urban source water risks were identified through these comments:

- microbeads and other micro plastics in the water system, and
- use and disposal of household products/chemicals (cleaning products, paint, oils, etc.).

Question 2: Rural Risks to Source Water Quality

Survey respondents were asked to identify the level of risk to source water quality they associated with a number of rural activities.

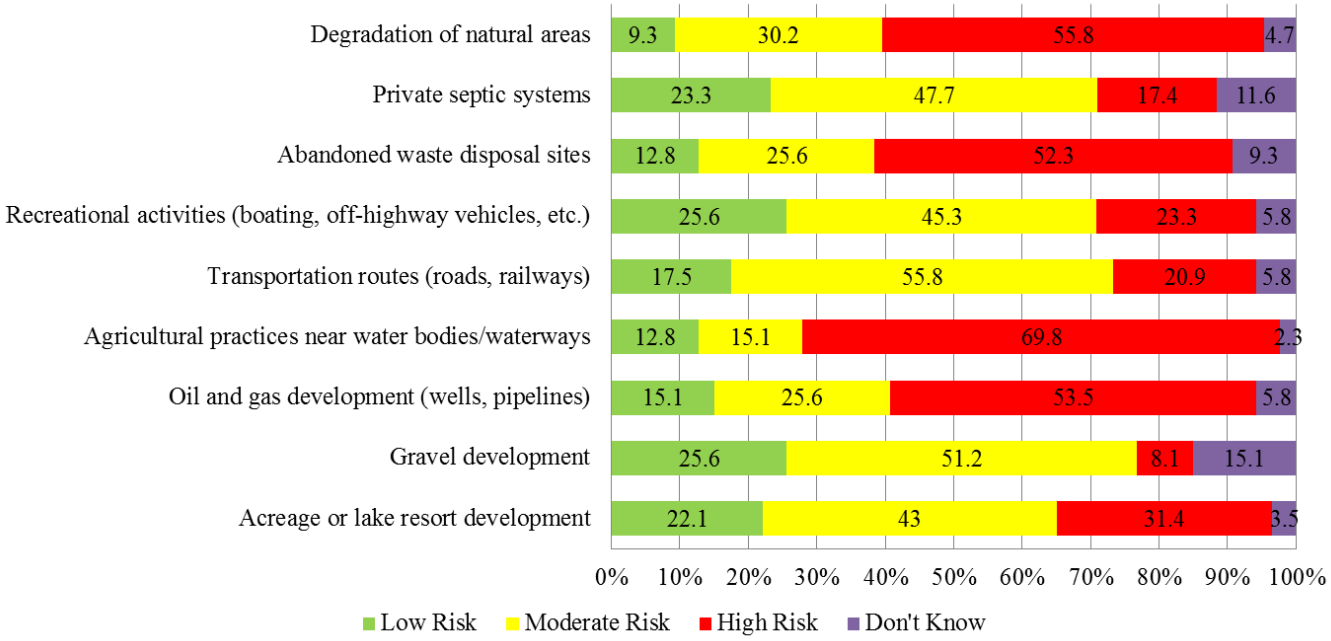


Figure 10: Level of risk to source water quality associated with various rural activities (86 respondents)

The rural activities that survey respondents identified as being the highest risk to source water quality were:

- Agricultural practices near water bodies/waterways,
- Degradation of natural areas,
- Oil and gas development (wells, pipelines), and
- Abandoned waste disposal sites.

Transportation routes (roads, railways) and gravel development were identified by the majority of respondents as being a moderate risk to source water quality.

Survey respondents were also invited to identify other rural risks that they thought should be considered. Hunting, camping and trapping were identified as additional recreational activities that may impact source water.

Question 3: Urban Management Actions to Protect Source Water Quality

Survey respondents were asked to identify the importance of a number of urban management actions in protecting source water quality.

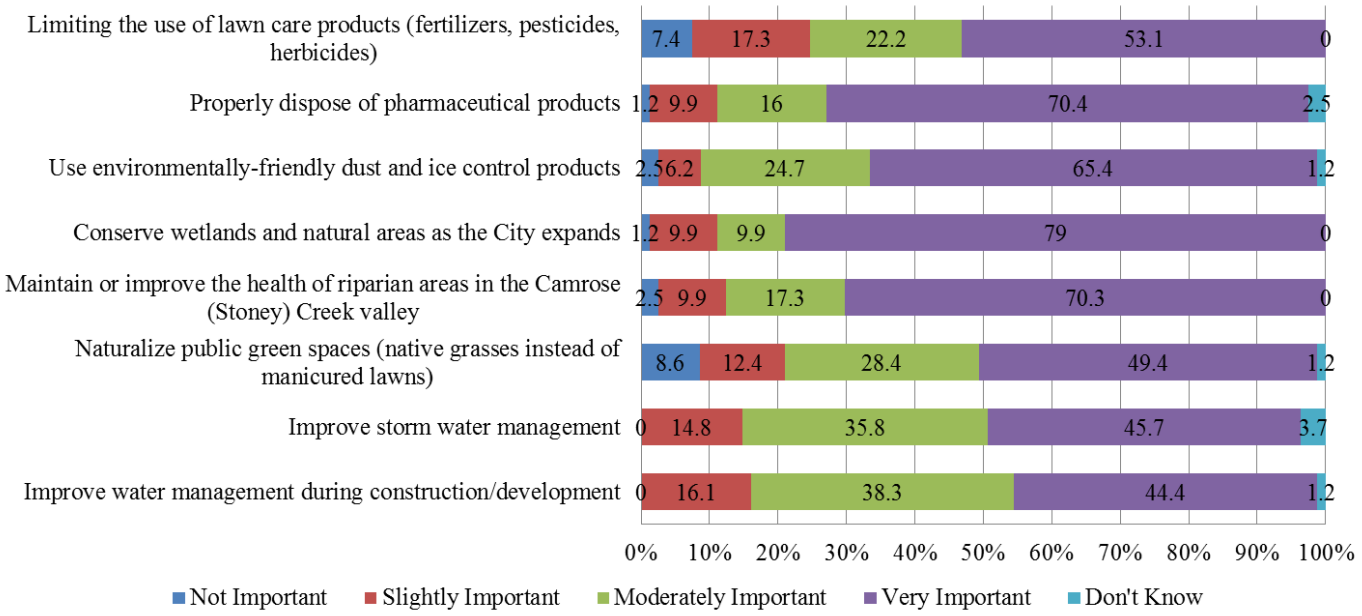


Figure 11: Level of importance of various urban management actions to source water quality protection (81 respondents)

The urban management actions that survey respondents identified as being the most important to source water quality protection were:

- Using environmentally-friendly dust and ice control products,
- Conserving wetlands and natural areas as the City expands,
- Maintaining or improving the health of riparian areas in the Camrose (Stoney) Creek valley, and
- Properly disposing of pharmaceutical products.

Survey respondents were also invited to identify other urban management actions that they thought should be considered. Four additional urban management actions were identified through these comments:

- Education to raise awareness about where the City's water comes from and the importance of source water protection,
- Controlling pets and disposal of associated waste,
- Testing wastewater for residual herbicides, and
- Using wastewater for irrigation purposes.

Question 4: Rural Management Actions to Protect Source Water Quality

Survey respondents were asked to identify the importance of a number of rural management actions in protecting source water quality.

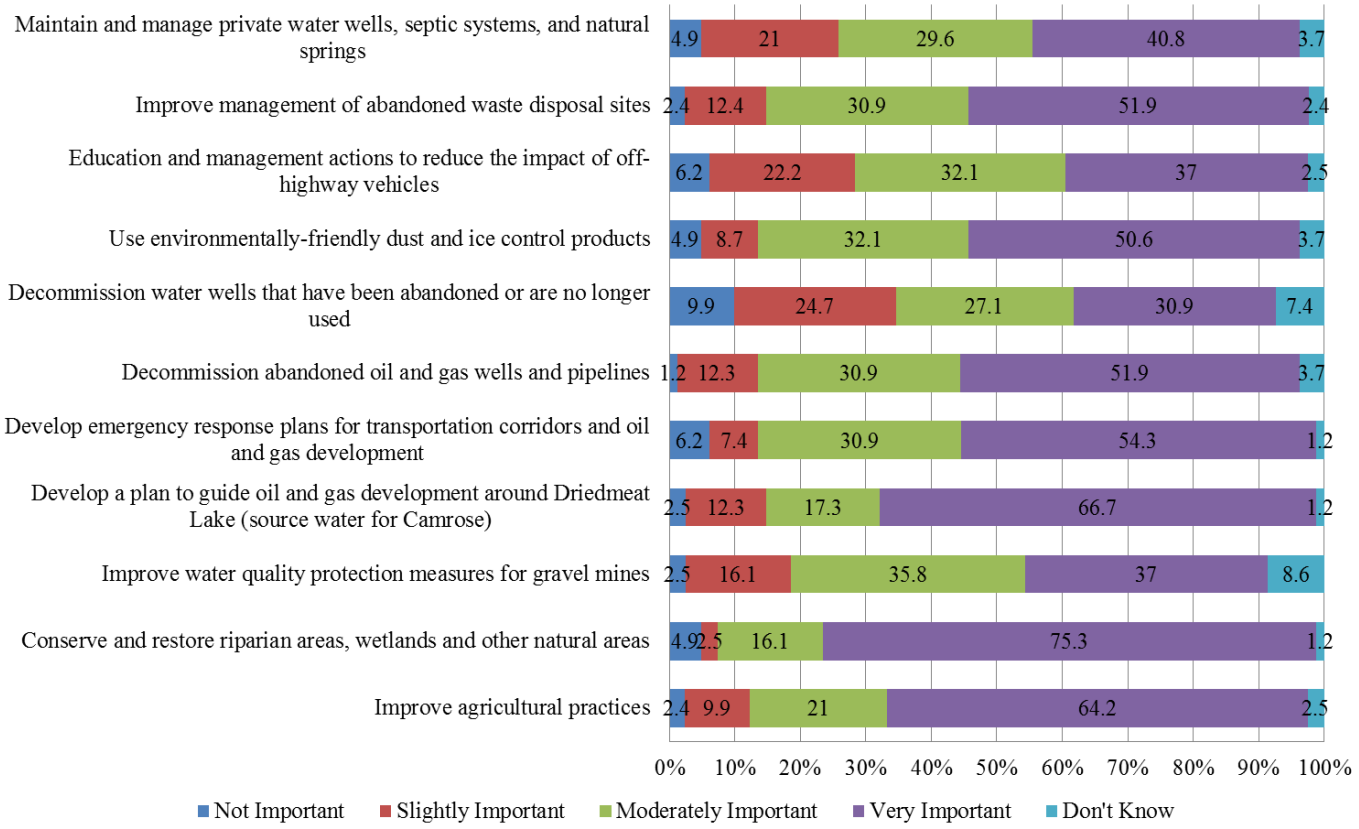


Figure 12: Level of importance of various rural management actions to source water quality protection (81 respondents)

The rural management actions that survey respondents identified as being the most important to source water quality protection were:

- Conserving and restoring riparian areas, wetlands and other natural areas,
- Improving agricultural practices,
- Developing emergency response plans for transportation corridors and oil and gas development, and
- Developing a plan to guide oil and gas development around Driedmeat Lake.

Decommissioning abandoned oil and gas wells and pipelines, improving management of abandoned waste disposal sites, and using environmentally-friendly dust and ice control products were also identified as having high importance for source water protection.

Survey respondents were also invited to identify other rural management actions that they thought should be considered. Two additional rural management actions were identified through these comments:

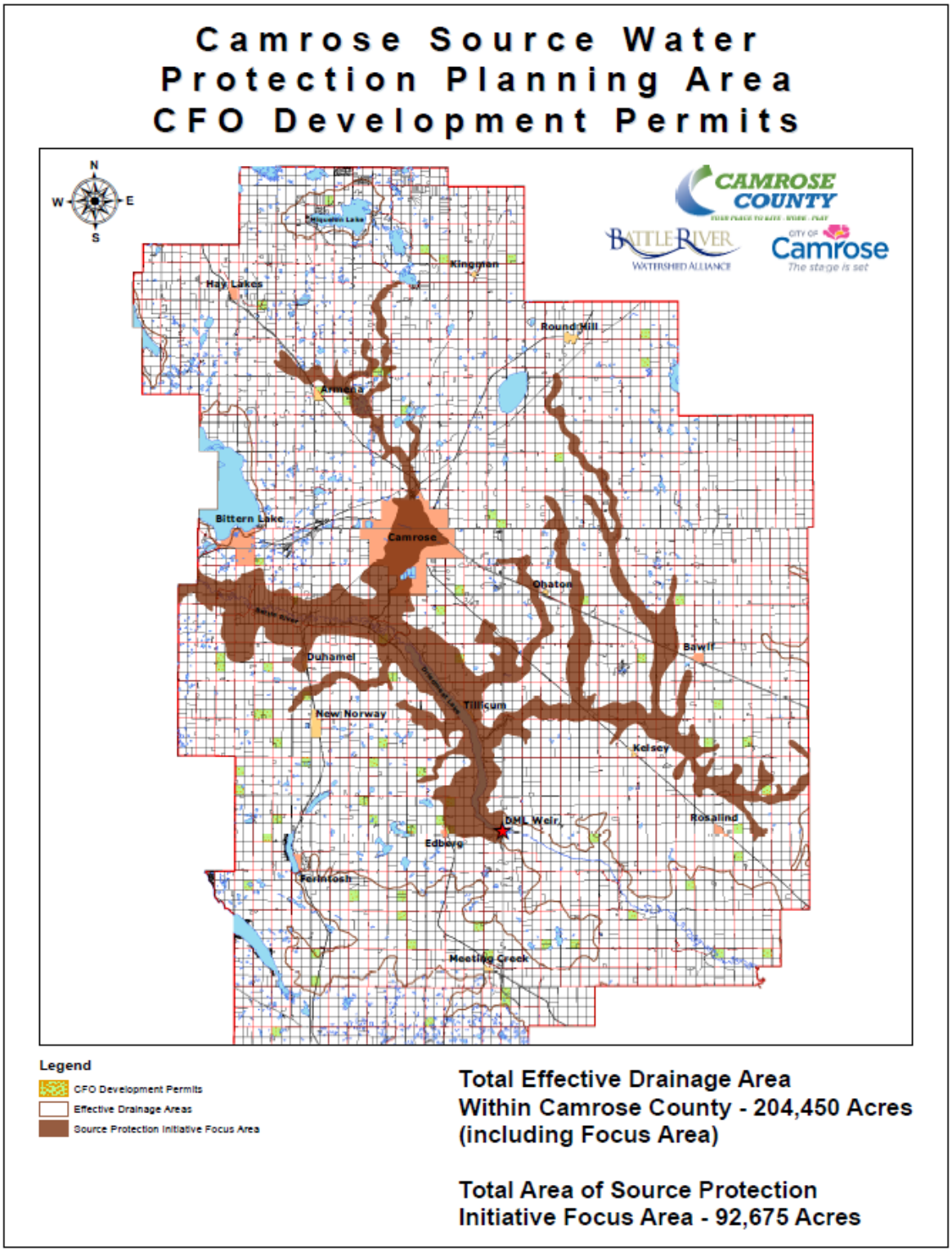
- Strict management of campsites and other recreational activities, and
- Reduced ditch spraying programs; incentives for residents to maintain weeds mechanically.

Next Steps

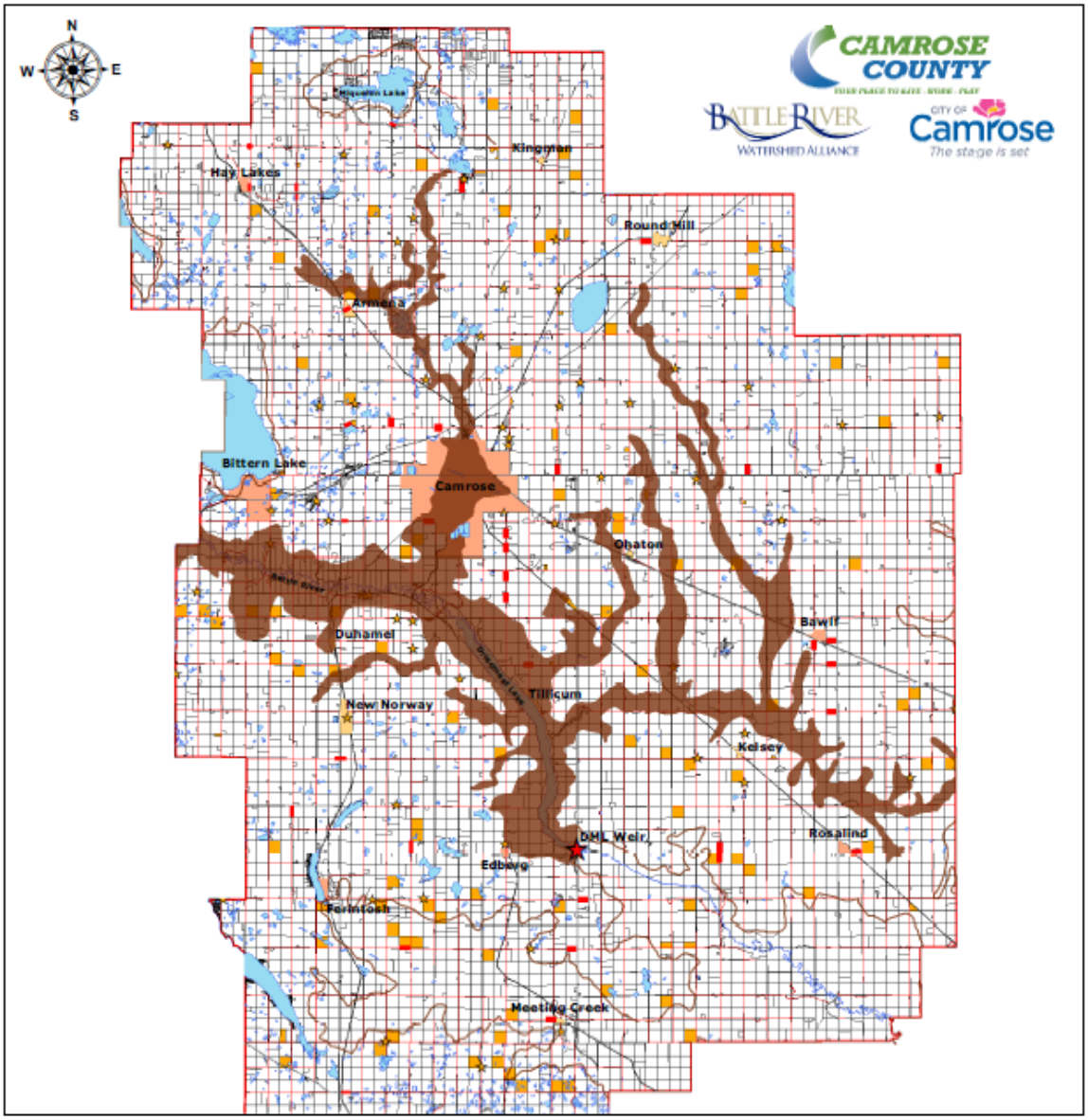
The project team and stakeholder advisory committee will take all survey responses into consideration in developing the draft Camrose Source Water Protection Plan. This Plan will then be presented to the City of Camrose and Camrose County Councils for their review and feedback. Based on this feedback, the draft Plan will be updated and presented at a joint City and County Council meeting for final approval.

APPENDIX B: MAPS OF LAND USE IN THE PLANNING AREA

High resolution maps are available upon request.



Camrose Source Water Protection Planning Area Dust Control Locations



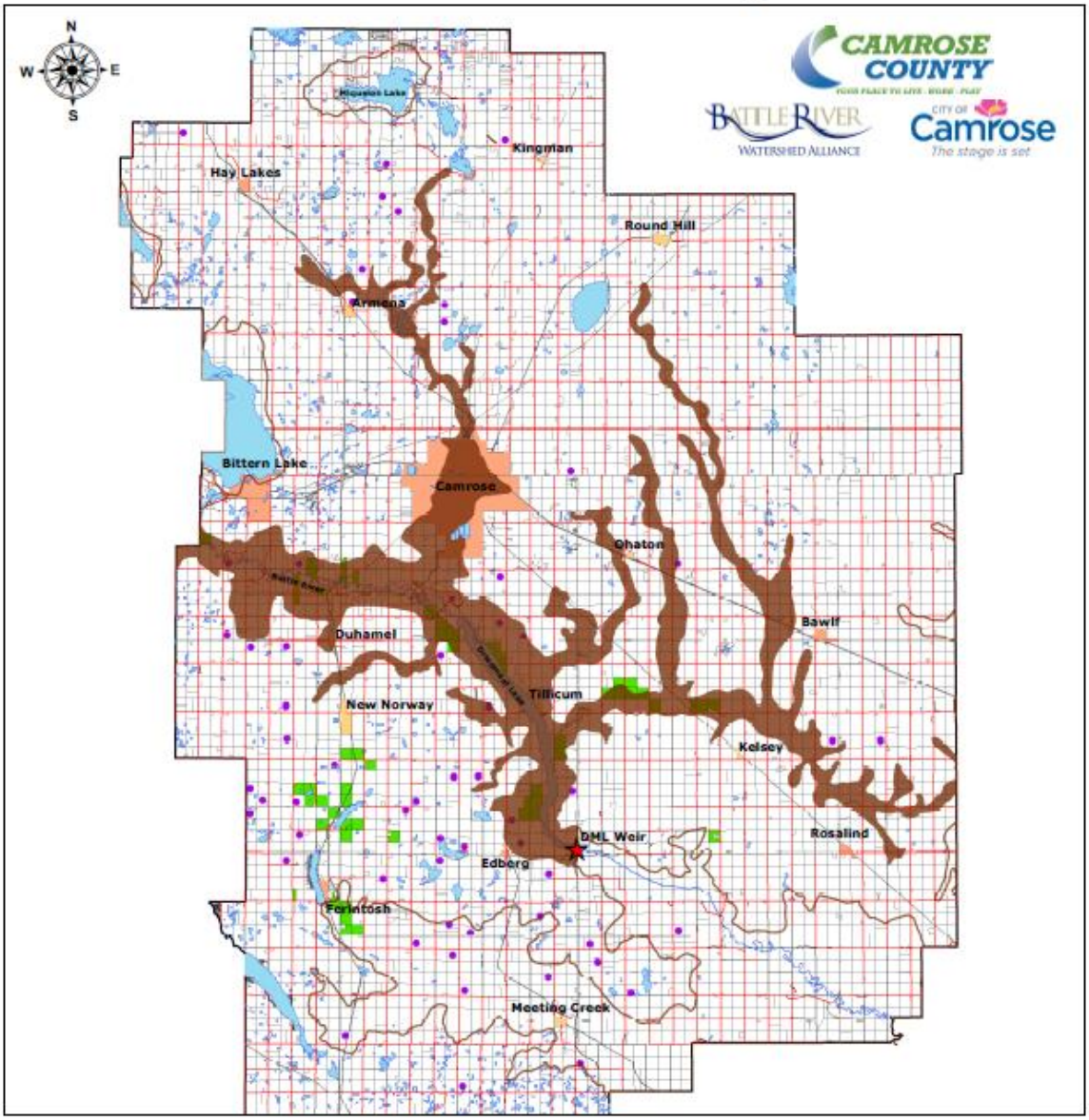
Legend

- County Calcium Locations
- Private Calcium Locations
- ☆ Private Calcium Locations
- Effective Drainage Areas
- Source Protection Initiative Focus Area

Total Effective Drainage Area Within Camrose County - 204,450 Acres (including Focus Area)

Total Area of Source Protection Initiative Focus Area - 92,675 Acres

Additional Land Uses in the Camrose Source Water Protection Planning Area



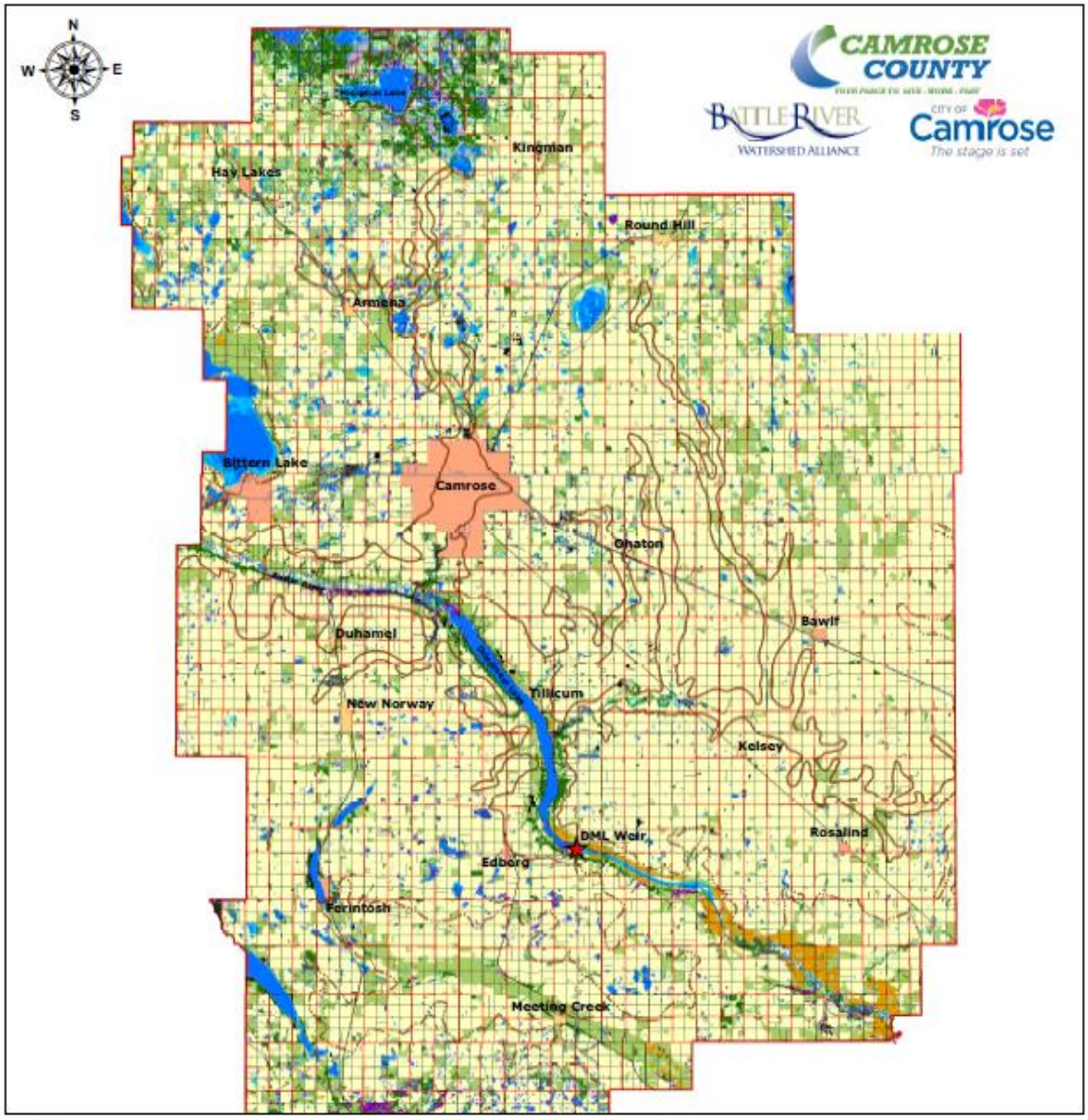
Legend

- Source Protection Initiative Focus Area
- Effective Drainage Areas
- Gravel Pits
- Confined Feeding Operations

Additional Land Uses Within Source Protection Initiative Focus Area

Gravel Pits - 4565 Acres
Confined Feeding Operations - 8

Land Cover in the Camrose Source Water Protection Planning Area



Legend

- Effective Drainage Areas
- Source Protection Initiative Focus Area

2014 AAFC Annual Crop Inventory

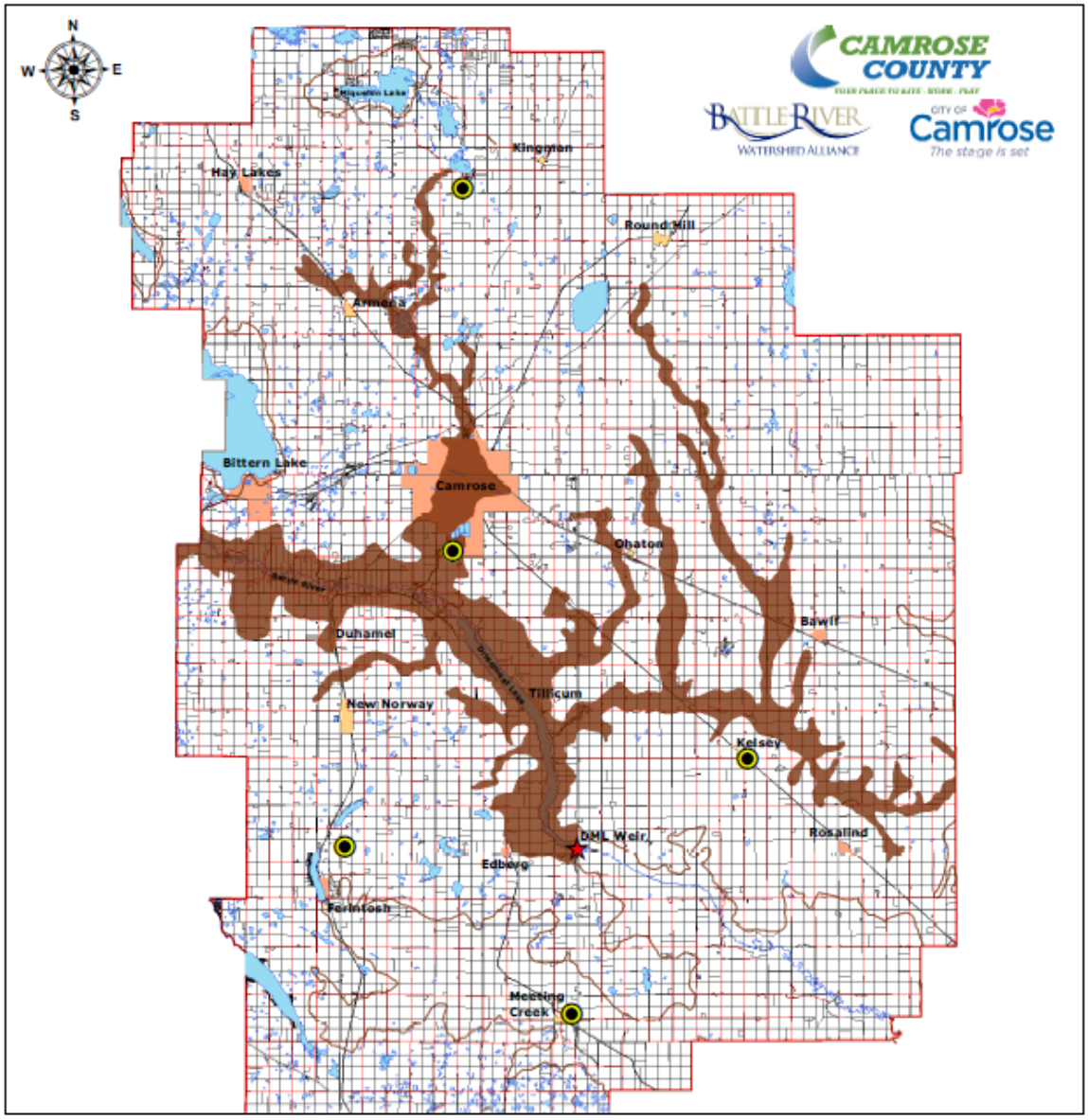
Land Cover Value

- No Data
- Water
- Bare Earth/Fallow
- Urban/Built-Up
- Shrubland
- Wetland
- Grassland
- Annual Crops
- Perennial Crops
- Coniferous Trees
- Deciduous Trees
- Mixed Trees

Total Effective Drainage Area Within Camrose County - 204,450 Acres (including Focus Area)

Total Area of Source Protection Initiative Focus Area - 92,675 Acres

Camrose Source Water Protection Planning Area Nuisance Grounds/Landfills



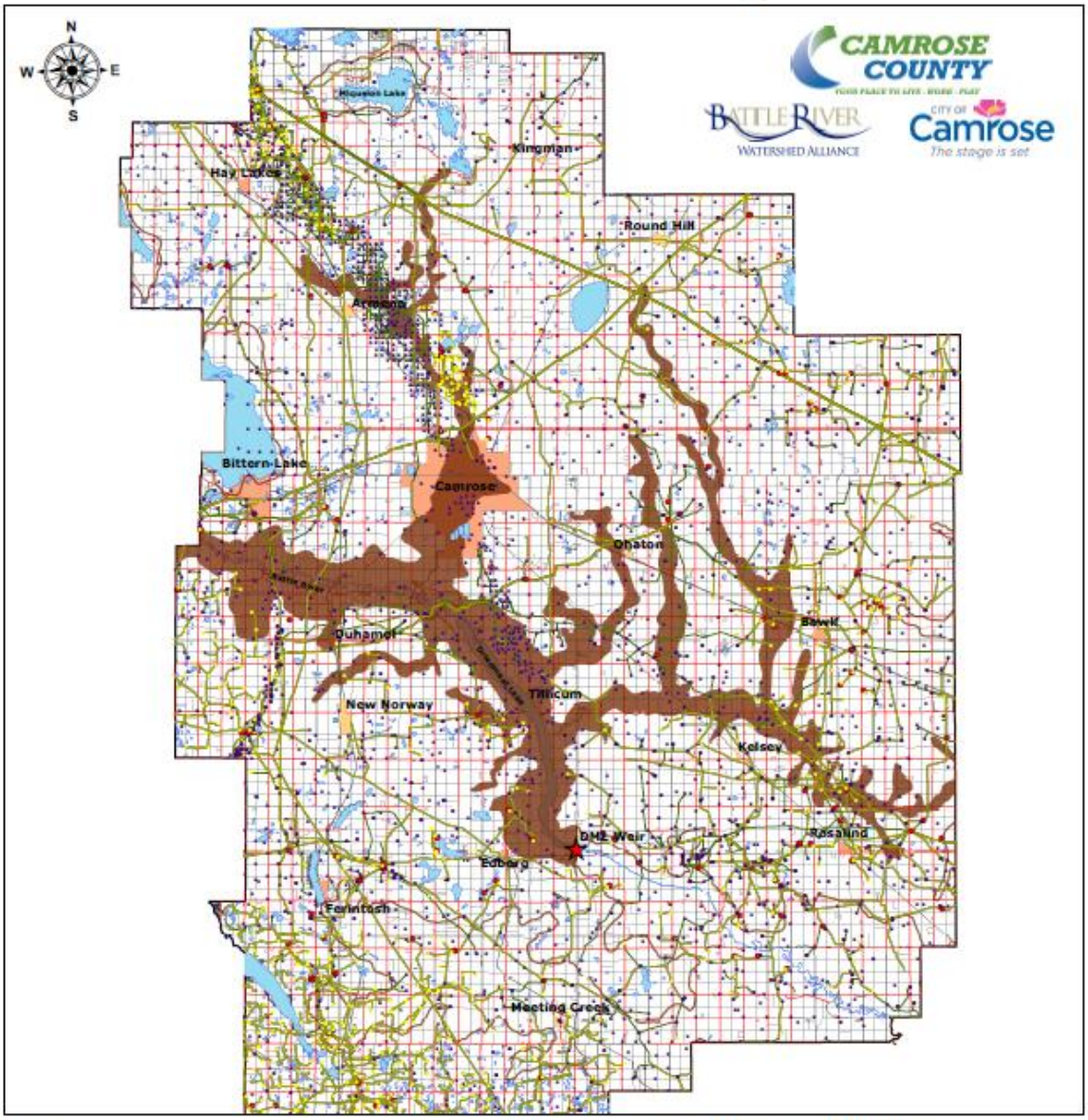
Legend

- Nuisance Grounds/Landfills
- Effective Drainage Areas
- Source Protection Initiative Focus Area

Total Effective Drainage Area Within Camrose County - 204,450 Acres (including Focus Area)

Total Area of Source Protection Initiative Focus Area - 92,675 Acres

Oil and Gas Development in the Camrose Source Water Protection Planning Area



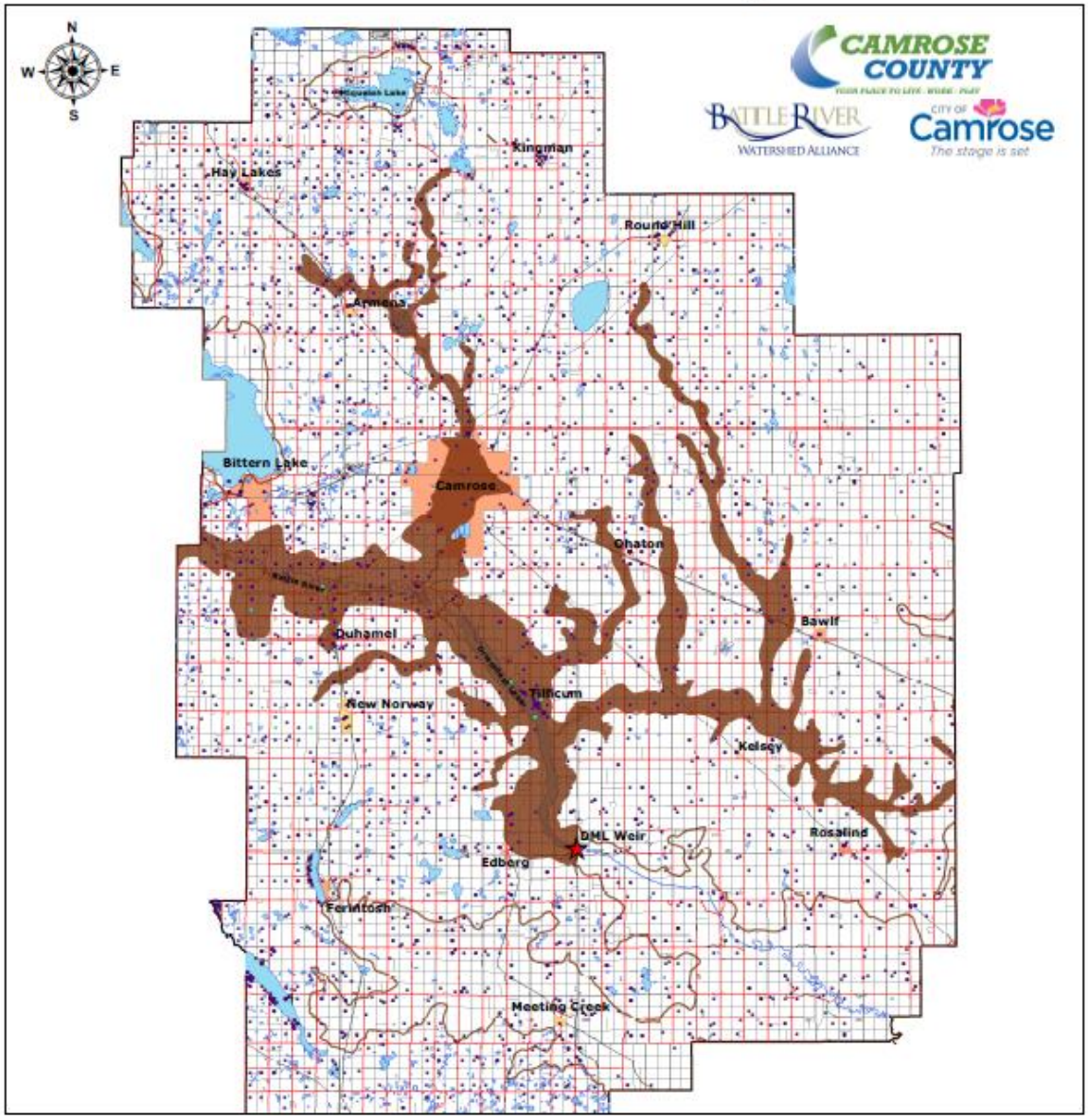
Legend

- Source Protection Initiative Focus Area
- Effective Drainage Areas
- Abandoned/Suspended Wells
- Flowing/Pumping Wells
- No Status Wells
- Oil & Gas Facilities
- Abandoned/Discontinued Pipelines
- Operating/Permitted Pipelines

Oil & Gas Development Within Source Protection Initiative Focus Area

Abandoned/Suspended Wells - 451
Flowing/Pumping Wells - 54
No Status Wells - 6
Oil & Gas Facilities - 11
Abandoned/Discontinued Pipelines - 127 KM
Operating/Permitted Pipelines - 176 KM

Water Wells and Springs in the Camrose Source Water Protection Planning Area



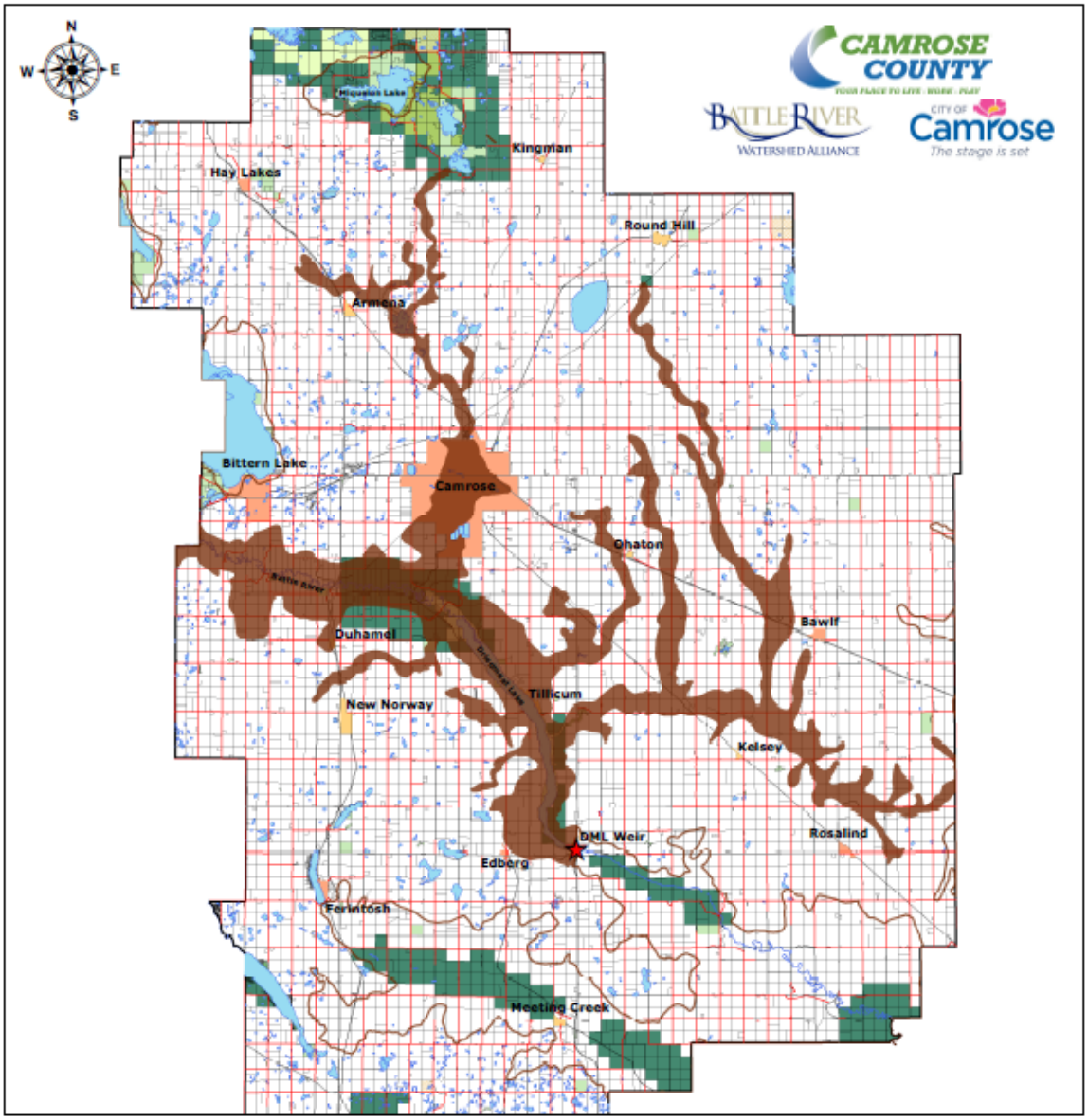
Legend

- Source Protection Initiative Focus Area
- Effective Drainage Areas
- Water Well
- Spring

Water Wells & Springs Within Source Protection Initiative Focus Area

Water Wells - 361
Springs - 5

Protected Areas in the Camrose Source Water Protection Planning Area



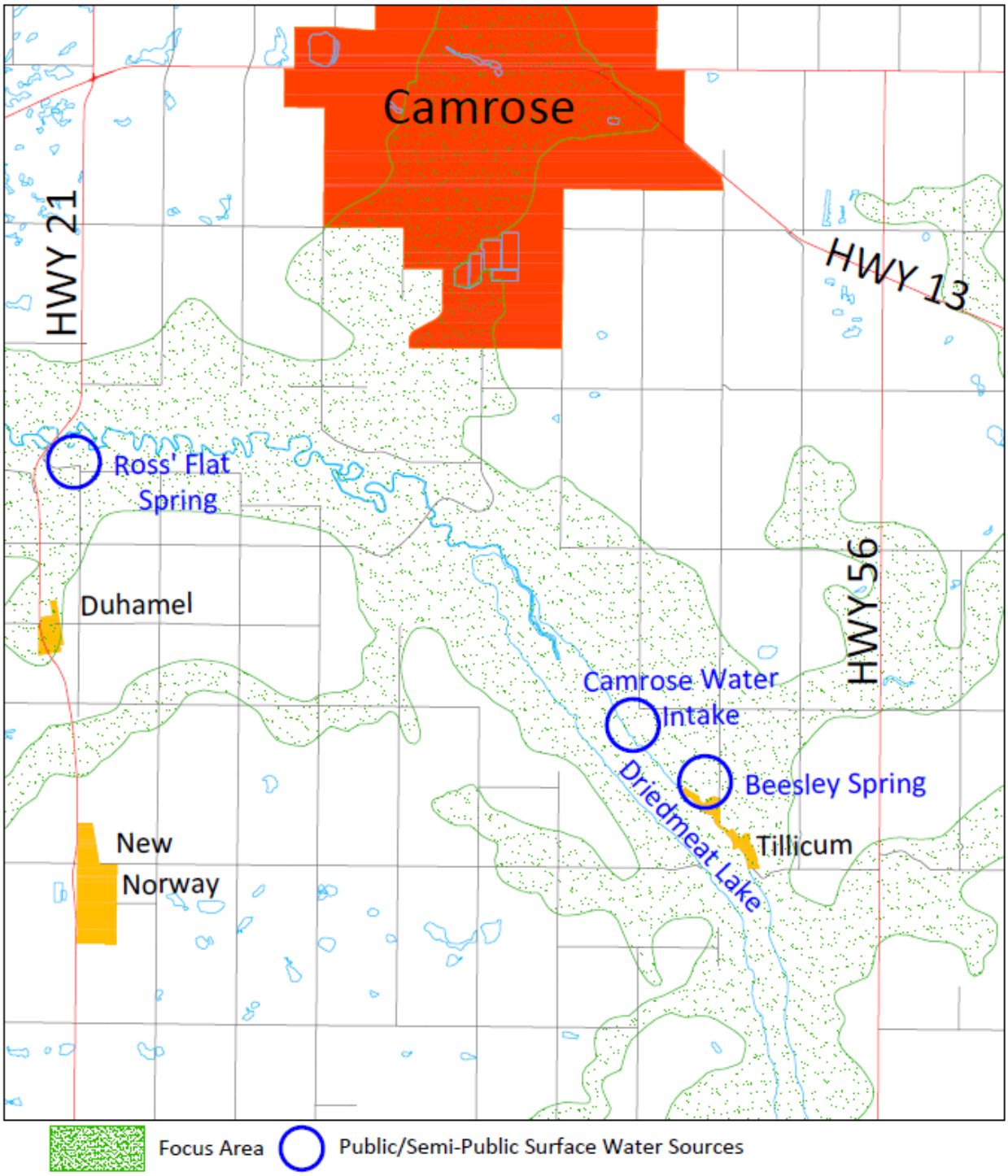
Legend

- Source Protection Initiative Focus Area
- Effective Drainage Areas
- Conservation Easement
- Crown Land
- Environmental Reserve
- Environmentally Significant Areas
- Ministik Lake Game Bird Sanctuary
- Miquelon Lake Provincial Park

Total Area Within Source Protection Initiative Focus Area

Conservation Easement - 0 Acres
Crown Land - 2,122 Acres
Environmental Reserve - 5.56 Acres
Environmentally Significant Areas - 11,865 Acres
Ministik Lake Game Bird Sanctuary - 0 Acres
Miquelon Lake Provincial Park - 0 Acres

Public Water Sources in the Camrose Source Water Protection Planning Area



APPENDIX C: RISK MATRIX AND ASSESSMENT DESCRIPTION

The risk assessment for the Camrose Source Water Protection Plan was undertaken using a risk matrix. First, potential risks to source water were identified. Second, numerical values were assigned to represent the likelihood of each drinking water risk occurring and the impact of each risk if it were to occur (see Likelihood and Impact tables below). The overall risk assessment score was then calculated by multiplying the "likelihood" score by the "impact" score (Likelihood x Impact = Risk Assessment Score).

The risk matrix is built based on all possible risk assessment scores (see Risk Matrix table below) and is used to determine the relative risk of each potential threat to source water that has been identified. Risks may be ranked or prioritized from highest risk (score of 256) to lowest risk (score of 1), and management actions determined accordingly.

Risk Matrix

		Impact of Occurrence				
	Score	Insignificant	Minor	Moderate	Severe	Catastrophic
Likelihood of Occurrence	Most Unlikely	1	2	4	8	16
	Unlikely	2	4	8	16	32
	Possible/Medium	4	8	16	32	64
	Probable	8	16	32	64	128
	Almost Certain	16	32	64	128	256

Likelihood of Occurrence for Source Water Risks

Likelihood	**Value**
Most Unlikely Extremely small chance of occurring in the next 4-5 years	1
Unlikely It is possible (but not likely) to occur in the next 4-5 years	2
Possible Just as likely as not to occur in the next 4-5 years	4
Probable It is expected to occur in the next 4-5 years but there is a small chance it may not	8
Almost Certain Confident that it will occur at least once in the next 4-5 years	16

Impact of Occurrence for Source Water Risks

Impact	Value
Insignificant No risk to environmental or human health. Water system interruption less than 8 hours.	1
Minor Minor risk to environmental or human health. Short-term or localized non-compliance; non-health related (e.g. aesthetic) or interruption 8-12 hours.	2
Moderate Moderate risk to environmental or human health. Widespread aesthetic issues or long term non-compliance; non-health related or interruption 12-24 hours.	4
Severe Severe risk to environmental or human health. Actual illness or potential short to medium term health effects; interruption 24-48 hours.	8
Catastrophic Catastrophic risk to environmental or human health. Actual illness or potential long term health effects; interruption greater than 48 hours.	16

APPENDIX D: RISK ASSESSMENT FOR THE CAMROSE SOURCE WATER PROTECTION PLAN

Urban Risks

	Risk Description	Hazard	Likelihood	Impact	L'hood Score	Impact Score	Risk Score
Transportation (Roads)	Contamination of stormwater runoff and surface water bodies from roads and sidewalks; application, handling and storage of road sand/salt; dust control	Garbage and other debris Sediment Road sand/salt Hydrocarbons	Almost Certain	Moderate	16	4	64
Transportation (Snow Removal/ Storage)	Contamination of stormwater runoff and surface water bodies due to storage of snow	Garbage and other debris Sediment Road sand/salt Hydrocarbons	Probable	Minor	8	2	16
Stormwater	Contamination of surface water due to stormwater not being treated before entering natural water bodies	Turbidity Colour Sediment Nutrients Garbage/debris Road sand/salt Hydrocarbons Pesticides Herbicides	Almost Certain	Moderate	16	4	64
Lawn Care Products	Contamination of stormwater runoff and surface water bodies due to use of lawn care products (fertilizer, pesticides, herbicides)	Nutrients Pesticides Herbicides	Almost Certain	Moderate	16	4	64

Development and Construction	Sediment load to stormwater runoff and surface water bodies due to development/construction (both new subdivisions as well as individual property development)	Turbidity	Probable	Minor	8	2	16
Green Spaces, Wetlands	Deterioration/contamination of surface water due to removal of upland vegetation and wetlands	Turbidity Colour Sediment Nutrients	Probable	Severe	8	8	64
Green Spaces	Deterioration/contamination of surface water due to removal or degradation of riparian vegetation	Turbidity Colour Sediment Nutrients	Unlikely	Severe	2	8	16
Recreation, Wildlife	Contamination of surface water resulting from wildlife and pet activity, especially wildlife and pets defecating in watershed	Microbiological contamination	Possible	Insignificant	4	1	4
Wastewater	Contamination of surface water due to pharmaceutical products, microbeads, etc. entering wastewater stream	Pharmaceutical	Probable	Minor	8	2	16

Rural Risks

	Risk Description	Hazard	Likelihood	Impact	L'Hood Score	Impact Score	Risk Score
Land Management (Agriculture)	Contamination of surface water due to livestock grazing with no restriction in access to natural waterbodies or waterways	Nutrients Bacteria	Probable	Moderate	8	4	32
Land Management (Agriculture)	Contamination of surface water due to excess application of manure, fertilizer, and biosolids from lagoons; including manure spreading on frozen soils and potential contamination via seasonal waterways	Nutrients Bacteria	Probable	Severe	8	8	64
Land Management (Agriculture)	Contamination of surface water due to chemical application	Pesticides Herbicides	Probable	Moderate	8	4	32
Land Management (Agriculture)	Contamination of surface water due to runoff from Confined Feeding Operations (especially grandfathered operations that are not following current regulations)	Nutrients Bacteria	Probable	Severe	8	8	64
Land Management (Agriculture)	Contamination of surface water due to inappropriate siting of cattle bedding, watering and wintering sites	Nutrients Bacteria	Possible	Severe	4	8	32

Land Management (Gravel Mining)	Contamination of surface and ground water as a result of gravel mining activity (surface water runoff, dewatering, removal of vegetation, leaching of materials into shallow groundwater); gravel pits that are currently operating, as well as abandoned pits that have not been properly reclaimed	Heavy metals Hydrocarbons Sediment Bacteria	Probable	Severe	8	8	64
Land Management (Groundwater Recharge Zones)	Contamination of shallow groundwater due to human/animal activity in recharge zones; contaminated groundwater may be connected to surface water	Nutrients Pesticides Bacteria	Possible	Moderate	4	4	16
Oil and Gas Development	Contamination of shallow groundwater due to abandoned oil and gas wells that were not adequately decommissioned	Hydrocarbons Heavy metals Bacteria	Possible	Moderate	4	4	16
Oil and Gas Development	Contamination of shallow groundwater due to abandoned oil and gas pipelines that were not adequately decommissioned	Hydrocarbons Heavy metals	Possible	Severe	4	8	32
Oil and Gas Development	Contamination of surface water due to spills at oil and gas well sites	Hydrocarbons Heavy metals	Possible	Minor	4	2	8
Oil and Gas Development	Contamination of shallow groundwater due to pipeline leaks (from active pipelines)	Hydrocarbons	Probable	Moderate	8	4	32

Oil and Gas Development	Contamination of shallow groundwater due to inadequate/failing well casings on wells currently in use	Hydrocarbons	Possible	Severe	4	8	32
Oil and Gas Development	Contamination of surface water due to pipeline and well site construction (disturbance of natural vegetation, bare soil)	Sediment Turbidity	Probable	Moderate	8	4	32
Oil and Gas Development	Degradation or loss of wetlands due to oil and gas activity	Hydrocarbons	Possible	Severe	4	8	32
Transportation (incidents)	Spillage due to accidents, train derailment, etc.	Chemical contamination Hydrocarbons	Probable	Severe	8	8	64
Transportation (daily use)	Contamination of surface water as a result of proximity to transport corridor (roadways and railways); potential sources include leaking vehicle fluids, application of road sand or salt, dust control	Chemical contamination Hydrocarbons Sediment	Probable	Minor	8	2	16
Development and Construction	Sediment load to stormwater runoff and surface water bodies due to development/construction	Sediment	Possible	Moderate	4	4	16
Green Spaces	Deterioration/contamination of surface water due to removal of upland vegetation	Turbidity Colour Sediment Nutrients	Probable	Moderate	8	4	32
Green Spaces	Deterioration/contamination of surface water due to removal or degradation of riparian vegetation	Turbidity Colour Sediment Nutrients	Probable	Severe	8	8	64

Wetlands	Wetland loss: increased effective drainage area, reduced water filtration within effective drainage area	Nutrients Pesticides Bacteria Heavy metals	Probable	Severe	8	8	64
Recreation	Contamination of surface water as a result of recreational activity within watershed; uncontrolled use of land or water vehicles within watershed	Sediment Nutrients Bacteria Hydrocarbons	Possible	Moderate	4	4	16
Water Wells and Springs	Contamination of shallow groundwater from surface water runoff due to inadequate water well casing (wells that are currently in use as well as those that have been abandoned); contaminated groundwater may be connected to surface water	Nutrients Pesticides Bacteria	Possible	Moderate	4	4	16
Water Wells and Springs	Contamination of surface water and shallow groundwater due to human/animal activity around natural springs	Chemical contamination Bacteria	Possible	Minor	4	2	8
Wastewater	Contamination of surface water and/or shallow groundwater due to public sewage system releases or systems that are failing or inadequate	Nutrients Bacteria	Unlikely	Moderate	2	4	8
Wastewater	Contamination of surface water and/or shallow groundwater due to private sewage systems that are failing or inadequate	Nutrients Bacteria	Possible	Severe	4	8	32
Waste Disposal (old sites)	Contamination due to leaching from waste disposal site; including unknown locations	Hydrocarbons Heavy metals Organics	Possible	Moderate	4	4	16

Waste Disposal (new sites)	Contamination due to leaching from waste disposal site	Hydrocarbons Heavy metals Organics	Unlikely	Moderate	2	4	8
Wildlife	Contamination of surface water resulting from wildlife activity in watershed (wildlife dying or defecating in watershed)	Nutrients Bacteria	Possible	Insignificant	4	1	4