

A Survey of Public Perceptions and Attitudes Towards Water in Wheatland County

June 2009

Prepared by Tracy Lee



MIISTAKIS
INSTITUTE



Prepared for:



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Miistakis Institute

c/o EVDS – University of Calgary
2500 University Drive NW
Calgary, AB
T2N 1N4

Phone: (403) 220-8968
Email: institute@rockies.ca
Web: www.rockies.ca

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INTRODUCTION

The Waters of Wheatland or WOW is a “county wide watershed group” with a mandate:

to promote the environmental sustainability of our water resources through information, demonstration, community participation, and to proactively assess the health of the water and work with local producers, partners, and residents towards the adoption of practices that help preserve water quality and quantity.

WOW activities are guided by a committee comprised of representatives from each Division of Wheatland County as well as a representative from each of the villages of Standard, Rockyford and Hussar, Siksika Nation and the Western Irrigation District. The members are local producers, local government and industry, all of whom have a vested interest in the waters of Wheatland County.

This survey establishes a baseline assessment of community perceptions and attitudes toward water issues and conservation, and was undertaken to inform the development of WOW projects and educational activities. At the request of WOW, the Miistakis Institute designed and conducted the survey. The baseline will enable WOW to assess progress in community knowledge toward water conservation issues over time through future surveys.

WOW identified the following objectives to guide the survey of public perceptions and attitudes toward water conservation:

1. Understand the demographics of Wheatland County survey respondents.
2. What is the *knowledge level (public perception)* of Wheatland County residents with regard to:
 - water conservation,
 - waters uses, and
 - water issues?
3. What are the *attitudes(level of concern)* of Wheatland County residents with regard to:
 - water conservation,
 - waters uses, and
 - water issues?
4. What are *current water conservation practices* implemented by Wheatland County residents.
5. What are existing barriers and incentives for best management practices for the residents of Wheatland County?
6. Where do Wheatland County residents get their information regarding current affairs?

BACKGROUND

Wheatland County is in south-central Alberta to the east of Calgary (Figure 1). The county is 4663 km² in size and supports a total population of 20,415 residents, composed of a rural population of 8,164 people and the town Strathmore, population 11,335 and villages of Hussar (population 187), Rockyford (population 349) and Standard (population 380).

Wheatland County occurs in the mixed grass prairie natural region, a transition zone between Aspen Parkland and Dry Mixed Grassland. Although the majority of Wheatland County is prairie, badlands occur in the northeastern corner of the county.

The county occurs within the South Saskatchewan River basin, with the Red Deer River forming the northeastern boundary and the Bow River forming the southern boundary. The area is drained by numerous streams, with Crowfoot Creek and Parflesh Creek of the Crowfoot Watershed draining into the Bow River and Serviceberry Creek and the Rosebud River of the Rosebud Watershed draining into the Red Deer River (Figure 2).

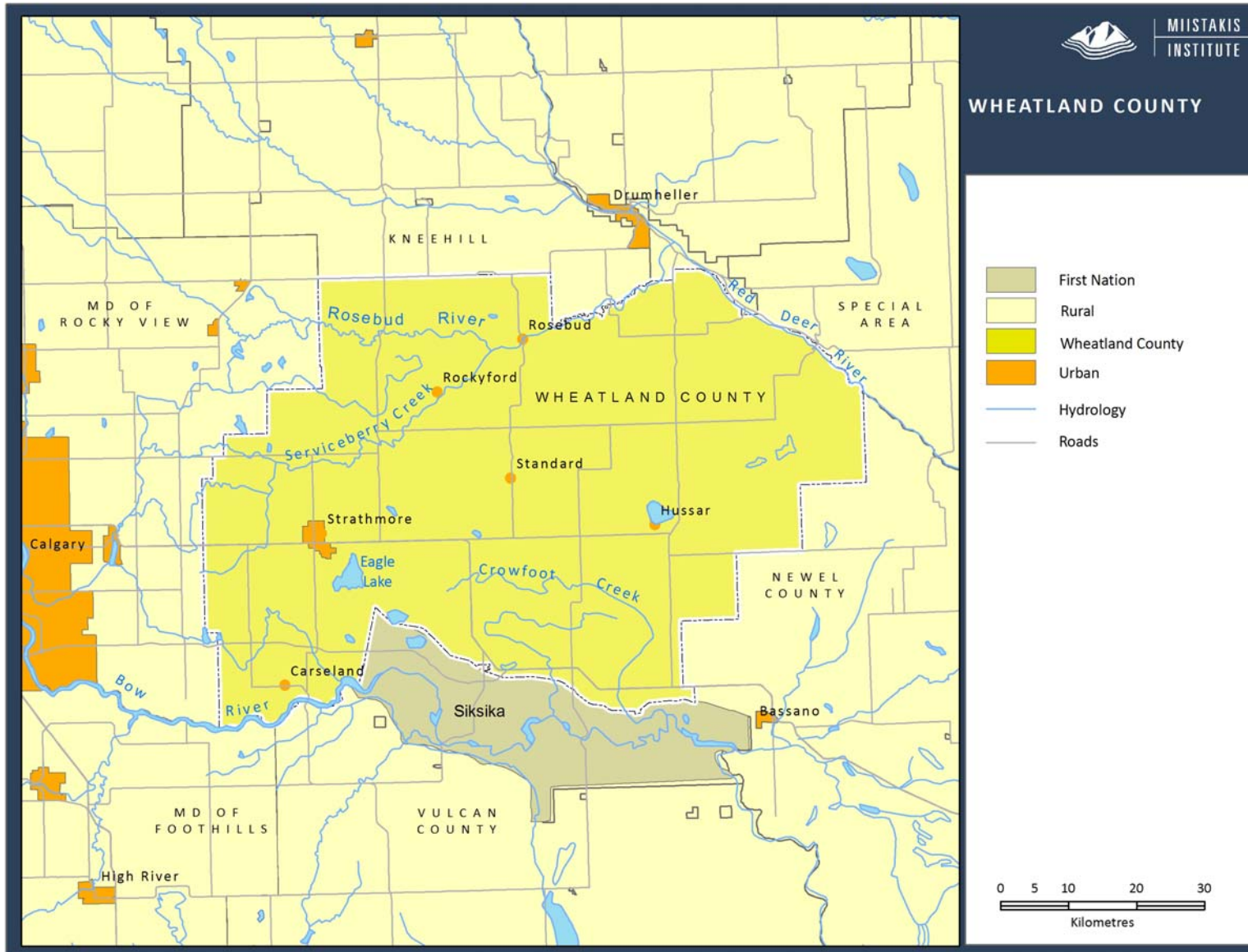


Figure 1: Wheatland County within South Central Alberta.

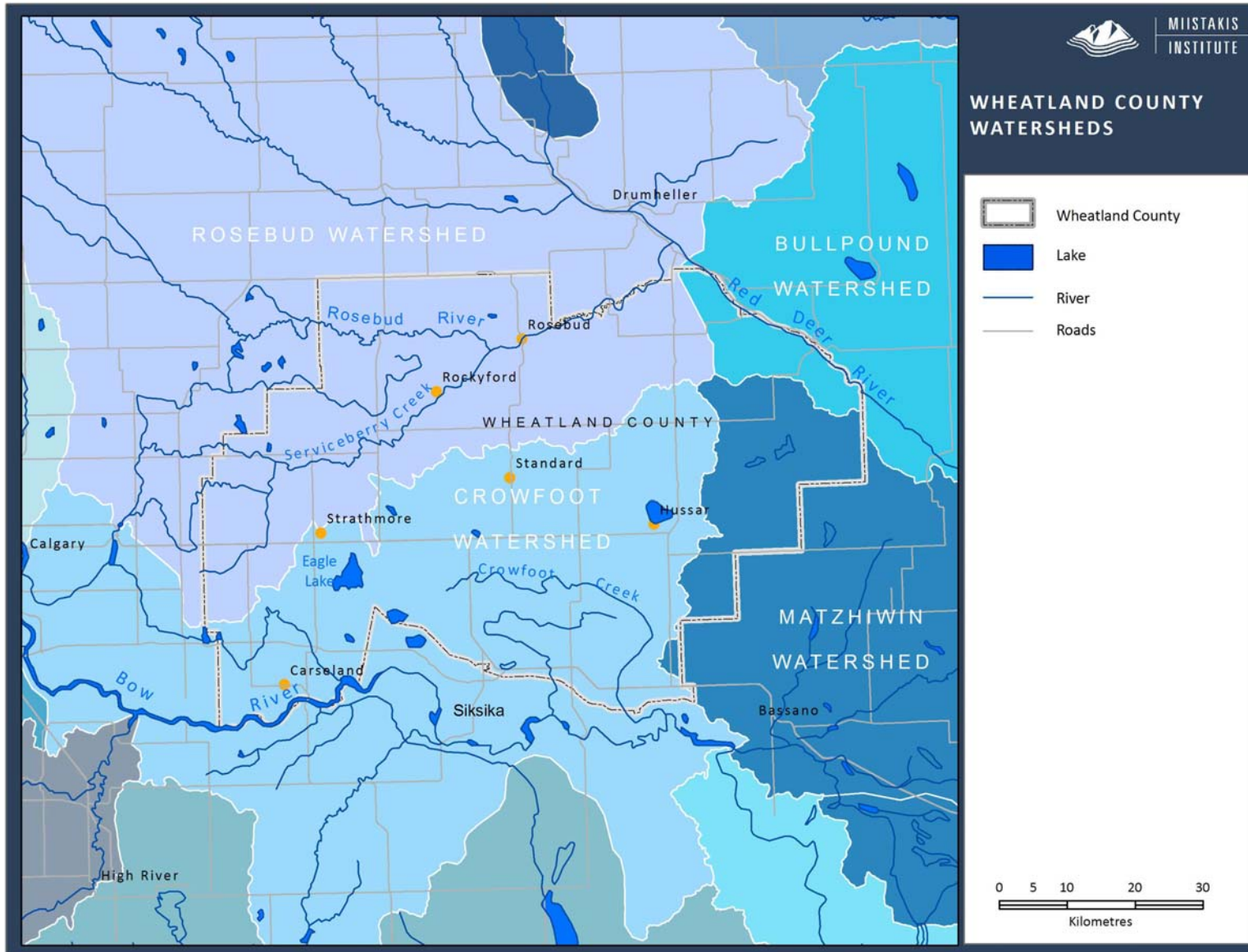


Figure 2: Wheatland County Watersheds

The primary surface water consumption in the region is from agriculture - dryland and irrigated crops, livestock operations and feedlots - with secondary consumption from the industrial sector. Primary groundwater consumption includes municipal and agricultural operations (Aquality Environmental Service Ltd. 2009).

Water Health in Wheatland County

Previous water quality and quantity surveys in Wheatland County provide some understanding of the health of water resources. Madawaska Consulting surveyed the water quality in Rosebud River, Serviceberry Creek and Crowfoot Creek in 2005. The consultants sampled nutrient loads, bacteria and salinity. Results indicate a decrease in overall water quality since 1999, due to an increase in nutrient and bacteria concentrations. Based on the AESA Scale (Alberta Environmental Sustainable Agriculture) Red-Bow Alliance Water Quality Index scale, Wheatland County water quality is rated as marginal. The consultants recommend improvements to riparian habitat and implementing best management practices on the land base (Cross 2006).

The *State of the Red Deer River* report (Aquality Environmental Service Ltd. 2009) assessed the water health of the Rosebud watershed a portion of which occurs in Wheatland County (Figure 2). The Rosebud watershed was assessed at a workshop in 2008 using nine condition indicators and three risk indicators resulting in an overall ranking of B- (based on A, B, and C rankings with + and – sub rankings). The report highlighted a number of concerns: 1. Nutrient levels that exceed water quality guidelines due to impaired riparian health, agricultural run-off and urban run-off; 2. Loss of wetlands due to conversion to agriculture, drainage, infilling and disruption of their hydrology; and 3. Conversion of the land base from natural state into crop land and pastures. The report suggests that the implementation of a water monitoring program, riparian health assessments and wetland inventory would increase the ability to understand water health in Rosebud Watershed.

Hydrological Consultants undertook a regional groundwater assessment to provide information to assist in the management of the groundwater resource within the county. The authors state "groundwater resource management involves determining the suitability of various areas in the County for particular activities. These activities can vary from the development of groundwater for agricultural or industrial purposes, to the siting of waste storage. Proper management ensures protection and utilization of the groundwater resource for the maximum benefit of the people of the county." The authors provide recommendations to improve the monitoring programs of existing water well test sites, reporting requirements and coordination among organizations, industry, provincial government and citizens monitoring wells. The limitations of the existing datasets restricted the consultants' ability to develop a ground water budget for the region. The report provided an assessment on focus areas, as requested by Wheatland County for the Hamlet of Carseland, Hussar area and Hamlet of Rosebud. The consultants report the Hamlet of Carseland is experiencing a water level decline, while the Hussar Area has naturally low level of groundwater. Consequently, for the Hussar Area the authors stress the importance of assessing the long term sustainability of the aquifer through more intensive ground water level monitoring. The authors were not able to assess groundwater water levels in the Hamlet of Rosebud and suggested more water level monitoring is required (Hydrological Consultants Limited 2003).

Public Water Surveys in Wheatland County

In 2001 the Crowfoot Creek Watershed Group developed two surveys aimed at agricultural producers within Crowfoot Creek Watershed and the residents of Standard (population 380 people). The purpose of these surveys was to raise awareness of water issues in the region and identify community concerns about water.

One hundred agricultural producers were surveyed using a questionnaire. Participants were asked a series of questions to identify the agricultural producers concerns about water quality, identify current agricultural practices being used, identify sustainable practices being used and understand the limitations to implementing sustainable practices. Details of the results are available through the Wheatland County office. The top four water concerns included;

1. impact of livestock;
2. agricultural chemicals;
3. urban wastewater; and
4. impact on water from oil and gas activity.

Half of survey respondents reported using best management practices to reduce livestock impacts on water. Cost was identified as the key barrier to implementing best water management practices (Boehme 2000).

In addition to the agricultural producers, thirty four residents of the village of Standard were surveyed using a questionnaire. Participants were asked a series of questions to identify their top concerns about water issues, understand their awareness and interest in water issues, their use of conservation practices and barriers to water conservation. The top three water concerns were securing water quantity to meet public need, proper treatment and monitoring of drinking water and preventing contamination of drinking water. The perception of the main contributors to reduced water quality in Crowfoot Creek and tributaries were livestock waste, agricultural chemicals and village wastewater. In relation to water conservation practices, the three most common ways to conserve water included the use of water saving devices, recycling and restricting lawn/garden watering to early morning. The barriers to implementing water conservation practices included time commitment, knowledge base and cost (Boehme and Tellier 2001).

The surveys developed by Crowfoot Creek Watershed Group provided an understanding of the state of knowledge and attitude of agricultural producers and residents of Standard village in 2001. Since this time a number of water quality monitoring exercises and reports on the status of water in Wheatland County have been released. WOW approached Miistakis to develop and implement a new public water survey aimed at all the residents living within Wheatland County including urban and rural residents to understand the current perceptions and attitudes towards water and to build on the knowledge gained from previous surveys.

METHODOLOGY

As outlined above, the objectives for the water survey were developed in conjunction with WOW. Miistakis then designed an on-line questionnaire based on the stated objectives which was posted on the Wheatland County website. Using the internet to conduct surveys has many advantages including speed (number of respondents in short period of time), audience (reach broad audience by posting on numerous websites), economical (cost effective way to gather, store and analyze data), extended question types (enable participants to automatically skip sections of survey depending on their response to a question) and anonymity is preserved. Some of the disadvantages include accessibility to internet in some rural areas reducing response rate, early abandonment of the survey (respondents can easily quit in the middle of the questionnaire), and dependence on software (sometimes flexibility in question design arises due to software limitations). For the WOW water survey the advantages of low cost and flexibility in analyzing data outweighed the potential disadvantages of using an on-line survey (Sue and Ritter 2007). To address the issue of alienating participants whom do not have personal computers, hard copies of the questionnaire were also made available. Completed hard-copy questionnaires were mailed to Miistakis and entered on-line by Miistakis.

The survey was posted on-line for a six month time period. WOW was responsible for all marketing of the survey within Wheatland County.

Results were downloaded in a spreadsheet format. Survey responses were analyzed using SigmaPlot 11.0 graphing and statistical package. Open-ended questions from the survey were analyzed using Hyper Research, a qualitative data software program.

FINDINGS

Respondent characteristics

A total of 83 individuals responded to the survey, of which 78 (or 88%) completed the survey and were included in the analysis. This represents 0.40% of Wheatland County residents. The majority of respondents entered on-line, with only 4 (5%) sending in hard copy questionnaires. The survey was aimed at all individuals living within the Wheatland County region, including villages, hamlets and towns. The low number of responses limits our ability to understand in depth the perceptions and attitudes towards water in Wheatland County. Based on the response rate, the sampling error for this survey (based on a population of approximately 20,000) is 11% (at a 95% confidence interval). The sampling error indicates the probability of

survey results changing if the entire population of interest were to be surveyed. Unfortunately, there are other sources of error that can influence survey results such as non responses (difference between survey respondents and non-respondents potentially biasing survey results), poorly designed questions, and processing errors that are often difficult to quantify. The survey results however provide WOW with a starting point for understanding future trends within the region of people’s attitudes and perceptions of water

Initially, we planned to apply a filter to responses based on where individuals live (location type) within the region to determine if there are different perceptions and attitudes toward water between urban and rural residents. Based on a definition of urban as “Persons living in continuously build-up areas having a population concentration of 1,000 or more and a population density of 400 or more per square kilometer,” and rural as “Persons living in sparsely populated lands lying outside urban areas (i.e. persons living outside places of 1,000 people or more, or outside places with population densities of 400 or more people per square kilometer ” from statistics Canada, there were 53 survey responses considered as rural and 17 as urban. The low number of survey responses (0.4% of total population residing within boundaries of Wheatland County) prevents us from assessing the results based on urban vs. rural residents. Urban residents in particular are not well represented, with less than 0.15% of the urban population being sampled.

A detailed breakdown of where respondents lived (location type) within the Wheatland County region is depicted in Figure 3. A relatively even response rate occurred between males (55%) and females (44%). In addition, 57% of respondents have lived within the region for more than 11 years.

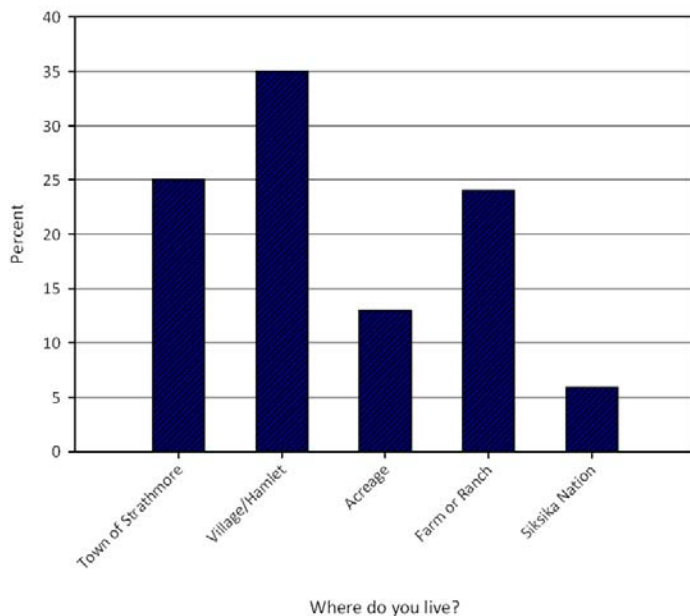


Figure 3: WOW survey responses based on the location type.

Perceptions about water

One of the objectives of the water survey was to understand the public’s current perceptions about water within Wheatland County. A series of questions were developed to understand public perception of:

- water health (quality and quantity of surface and ground water);
- activities responsible for degrading water health; and
- impacts of climate change.

Respondents were asked to rank their perception on water health based on a five rank scale, (very poor = 1, poor = 2, adequate = 3, good = 4 and excellent = 5). The mean score across the five questions about health ranged from 2.90-3.25, and variation in responses between respondents was low (standard deviation ranges from 0.88 to 1.11). The percent of responses per rank are displayed in Figures 4-8. The “dk” category in these figures refers to ‘don’t know’ and is defined as responses in

which respondents either had no opinion or indicated that they did not know the answer. There was less certainty in regard to groundwater water quality and quantity where 15% and 18% percent of respondents didn't know respectively (Table 1). The respondent's overall perception is that surface and ground water are in adequate health. The highest percentage of respondents identified their drinking water as good; however, the response rate had a higher standard deviation when compared to the other rated variables. Drinking water quality also showed the greatest variation in response with the most *very poor* and *excellent* scores compared to the other water health questions, indicating less agreement among the respondents. This result may be explained by differences in sources of drinking water among residents. However, the overall mean response rating for quality of their drinking water was 3.17, equating to an adequate rank.

Table 1: Mean ratings of perception of water health

Variable	Scale Range	Mean Rank	Median	Standard Deviation	% don't know
Quality of Surface Water	Very Poor (1) to excellent (5)	3.25	3.0	0.99	10.1
Quantity of Surface Water	Very Poor (1) to excellent (5)	2.90	3.0	0.88	7.6
Quality of Ground Water	Very Poor (1) to excellent (5)	3.19	3.0	0.89	15.2
Quantity of Ground Water	Very Poor (1) to excellent (5)	3.20	3.0	0.92	18.4
Quality of Drinking Water	Very Poor (1) to excellent (5)	3.17	3.0	1.11	3.8

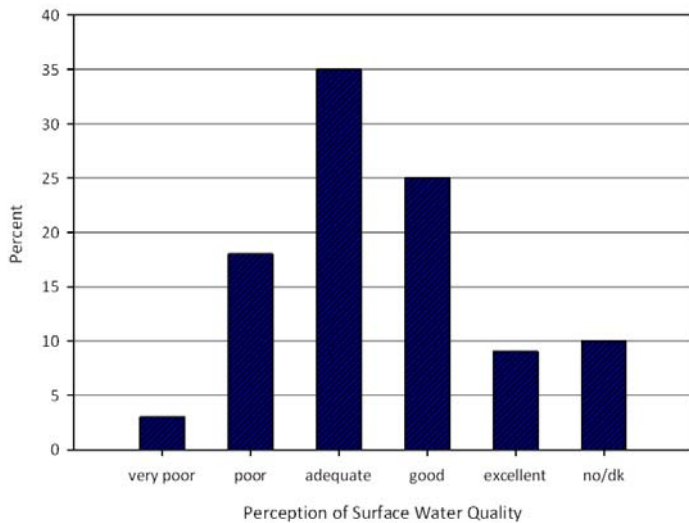


Figure 4: Respondents perceptions of surface water quality

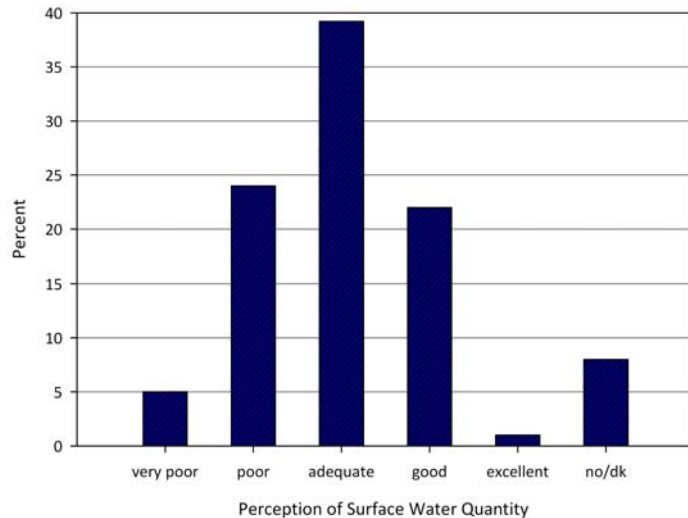


Figure 5: Respondents perceptions of surface water quantity

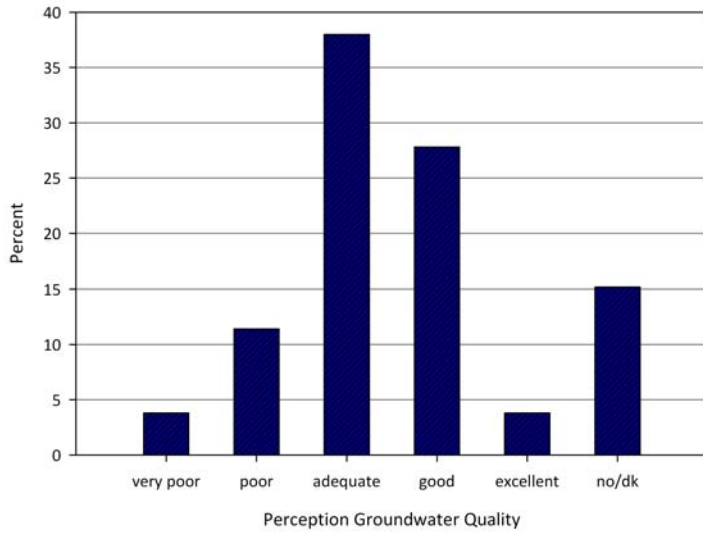


Figure 6: Respondents perceptions of groundwater quality

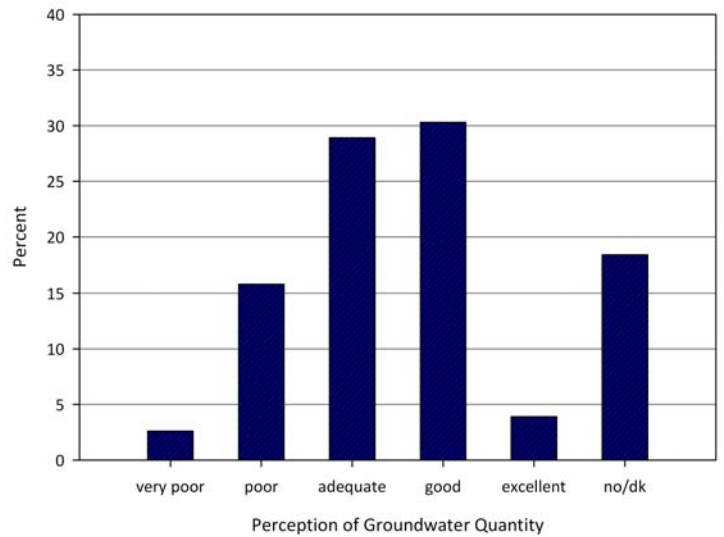


Figure 7: Respondents perceptions of groundwater quantity

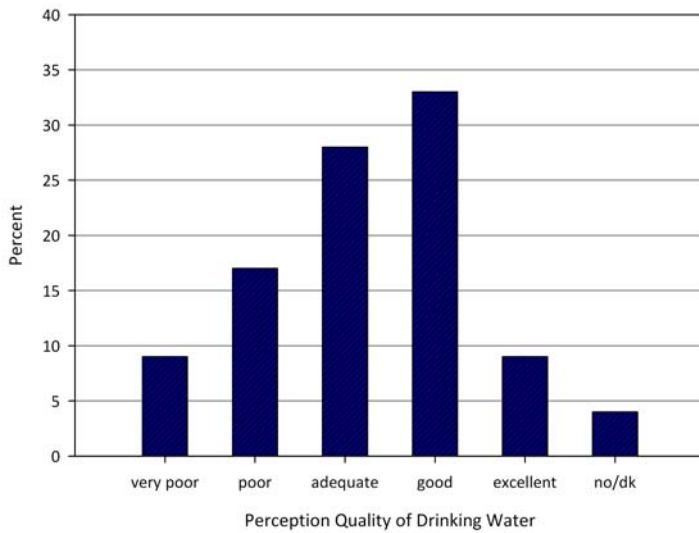


Figure 8: Respondents perceptions of drinking water quality

Water bodies of concern to residents

Survey participants were asked in an open-ended question to identify water bodies of concern in the region. Forty six percent of participants answered, indicating over half of the respondents skipped the question. It is not clear if this indicates that respondents are not concerned about water bodies in Wheatland County or if they did not feel knowledgeable enough to identify specific water bodies. The water bodies and reason for concern were extracted from the responses, and tallies were recorded for the number of times each water body was mentioned by a different respondent. Three categories of concern were created: low level of concern (1-2 responses), medium level of concern (3-5 responses) and high level of concern (>6

responses). Categories medium and high levels of concern are displayed on Figure 9. Two water bodies that respondents were most concerned about included the Bow River and Eagle Lake. The concerns for the Bow River were pollutants from upstream users (Calgary, Banff, Chestermere) and effluent from the town of Strathmore. The concerns expressed about Eagle Lake included the 'scummy' nature of the water and its' closure to public swimming for health reasons; cattle were mentioned as a possible source of contaminants as well. Water bodies of medium concern in the survey included Rosebud Creek, Service Berry and Crowfoot Creeks and the Western Irrigation District Canals due to their proximity to agriculture. Other water bodies mentioned by respondents included, Red Deer River, Hartell Coulee, Carseland aquifers, Severn dam, Chimney Hills Springs, Gleichen Reservoir and Cheadle Creek.

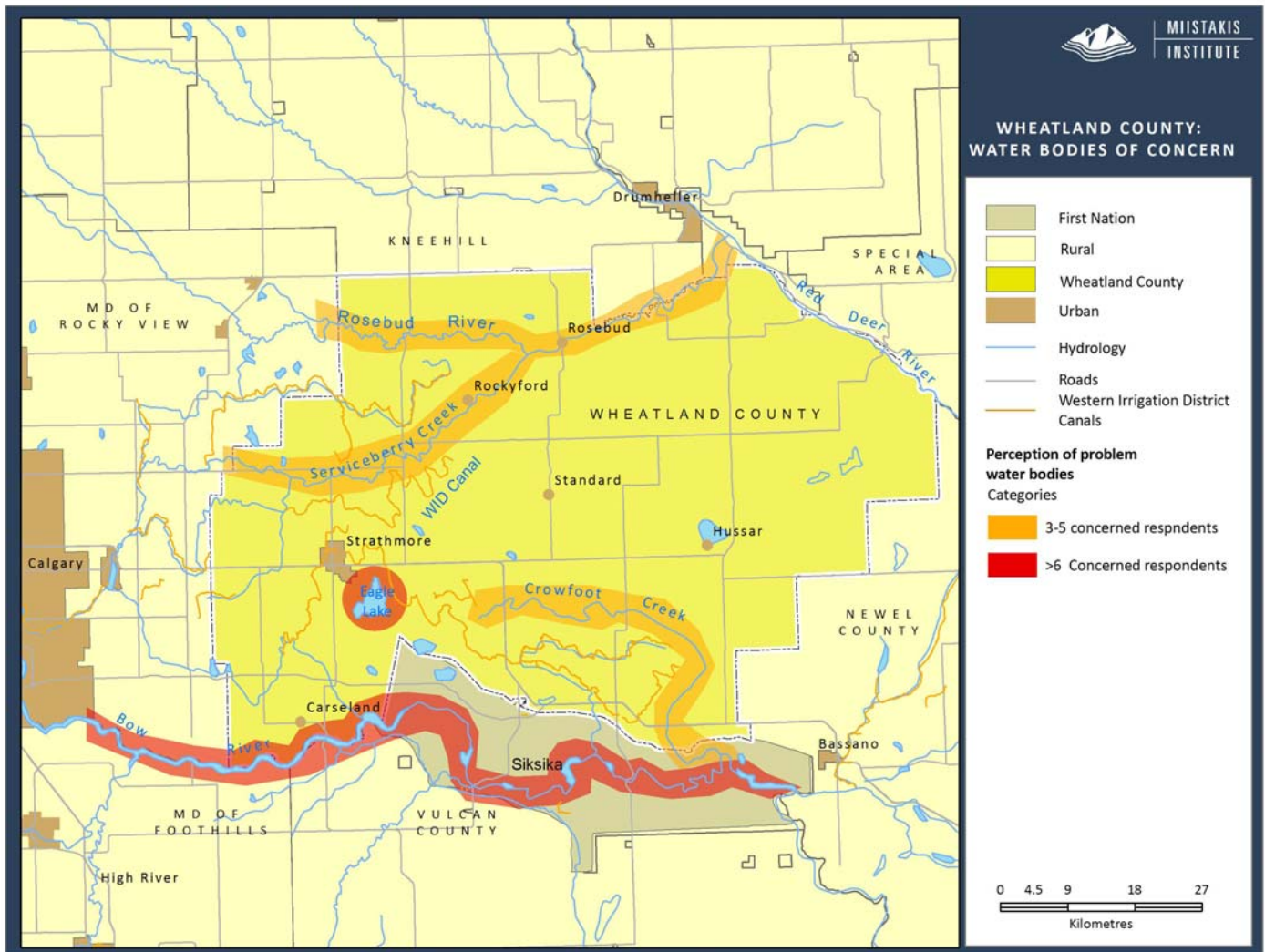


Figure 9: Public perception of water bodies of concern in Wheatland County.

Impacts from land-based activities

Respondents were asked to rate which activities from a predefined list they perceive to most adversely impacted water quality. The perception is agriculture, municipal and industrial activities all adversely affect water quality. The top five activities in order of concern were confined livestock operations, oil and gas activity, pesticide and fertilizer application, livestock access to water bodies and urban wastewater (Figure 10).

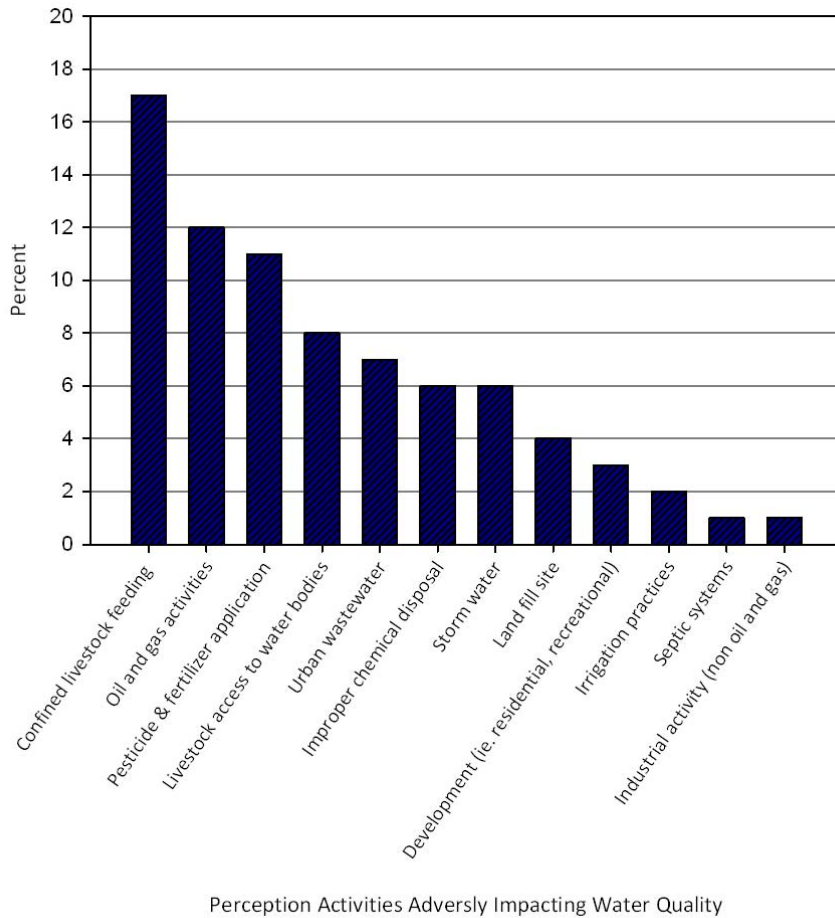


Figure 10: Public Perception of activities that most adversely effect water quality.

Potential impacts from Climate Change

The majority of respondents felt climate change would results in less water availability (52%), although 14% did not know (Figure 11). Over 53% think the highest month of precipitation is in June, while 24% thought May was the highest month. Most respondents (62%) think the majority of water is from precipitation, while an equal number of respondents (16%) think the majority of water is from either snow or equal parts snow and rain.

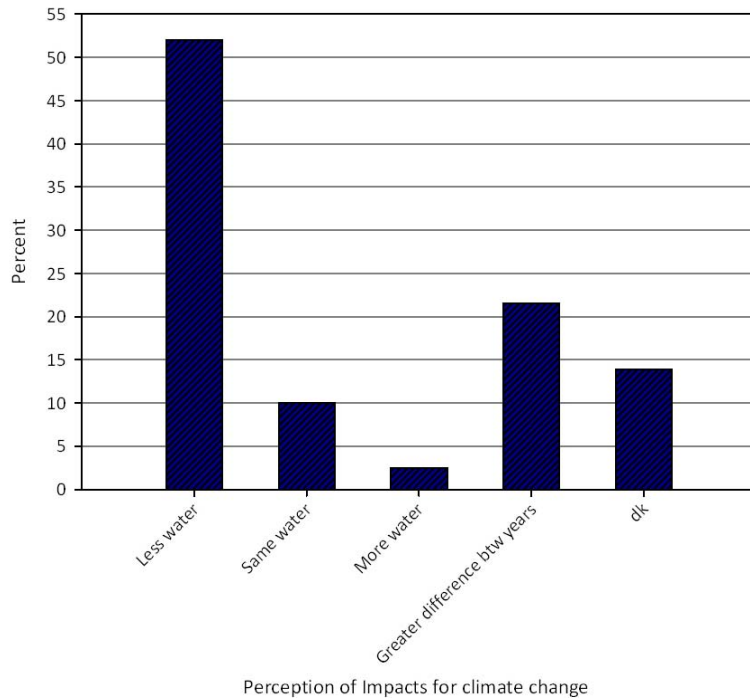


Figure 11: Perceptions on the impact of climate change on water availability.

Attitudes towards water

One of the objectives of the water survey was to understand the public's current attitude toward water issues within Wheatland County. A series of questions were developed to understand the public's attitude toward water in the following areas:

- top concerns about water in Wheatland County;
- responsibility for water resources in Wheatland County; and
- the importance of monitoring water resources.

Participants were asked in an open-ended question to list their top three concerns about water quality. Eighty five percent of respondents answered the question. Responses were analyzed using qualitative software where each response was assessed and coded according to common messages. Responses were coded similarly when they implied the same meaning. Codes were fit into broader themes and the number of codes occurring within a theme were tallied (response count) to determine the main concerns about water in Wheatland County. Broader themes were developed because individual responses varied in their level of detail, for example some individuals notes water quality was their biggest concern while others where more specific and identified the impacts of urban waste water on water quality. Figure 12 displays broad themes of concern and their associated codes:

1. water quality (e.g. run-off from urban areas, hamlets and acreages, pollutants (pesticides, fertilizers and herbicides), sewage effluent, dinking water, smell and taste of water land fill and quality of groundwater);
2. water quantity (e.g. water availability and/or water shortages);
3. water sustainability (e.g. over use, lack of water conservation measures, over allocation of water for urban, agricultural and industrial use);
4. impacts on ecological processes (e.g.: loss of habitat (marshes, wetlands, riparian, open water), impact on wildlife and impacts of global warming);
5. water access (e.g. restrictions on licenses, water bans and urban areas dictating use);
6. agricultural impacts (e.g. livestock access to streams, run-off from feedlots);
7. industrial impacts (e.g. oil and gas activity);
8. development (e.g. occurring in flood plain, in areas where water availability is low); and

9. lack of citizen engagement .

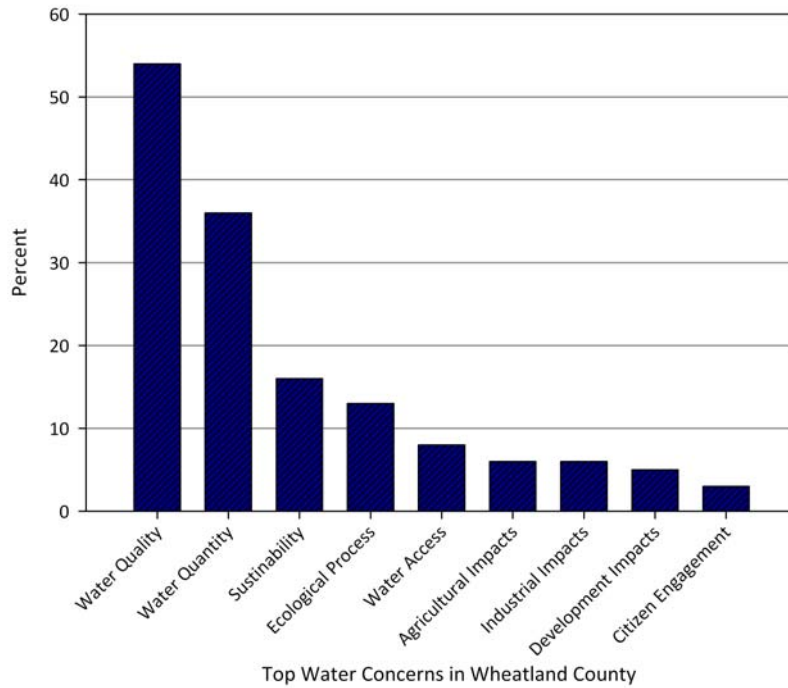


Figure 12: Respondents top concerns about water quality within Wheatland County

Responsibility and performance in managing water

When asked who was most responsible for ensuring water quality and quantity (health) the majority of respondents indicated either the provincial or municipal government, while 21% indicated citizens were most responsible for ensuring water health (Figure 13). Most respondents were unsure how each of the different entities are performing in managing water as a resource (Figure 14). However, in general the Federal government, the Provincial government, industry and citizen groups were rated as poorly managing water health while the Municipality, the Irrigation district and watershed groups were seen as managing water well.

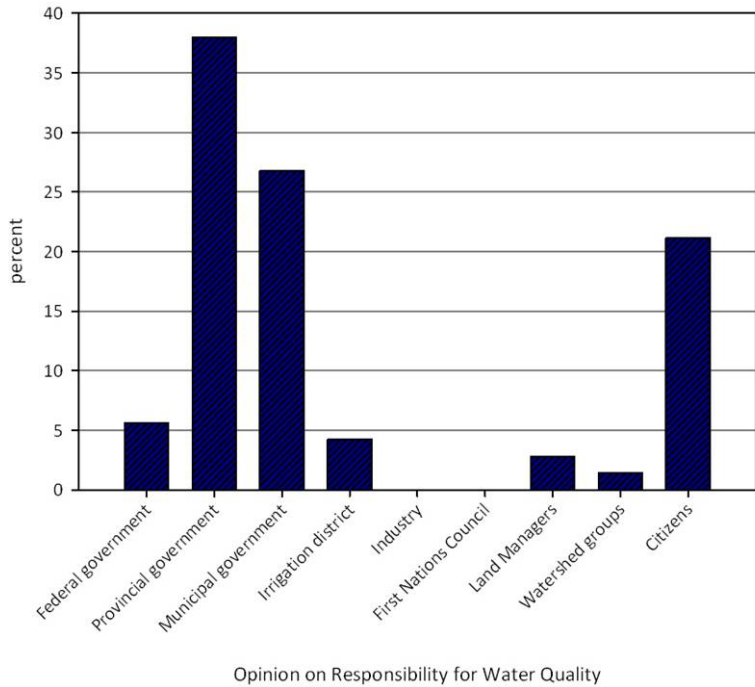


Figure 13: Perceptions of who is most responsible for ensuring water health in Wheatland County.

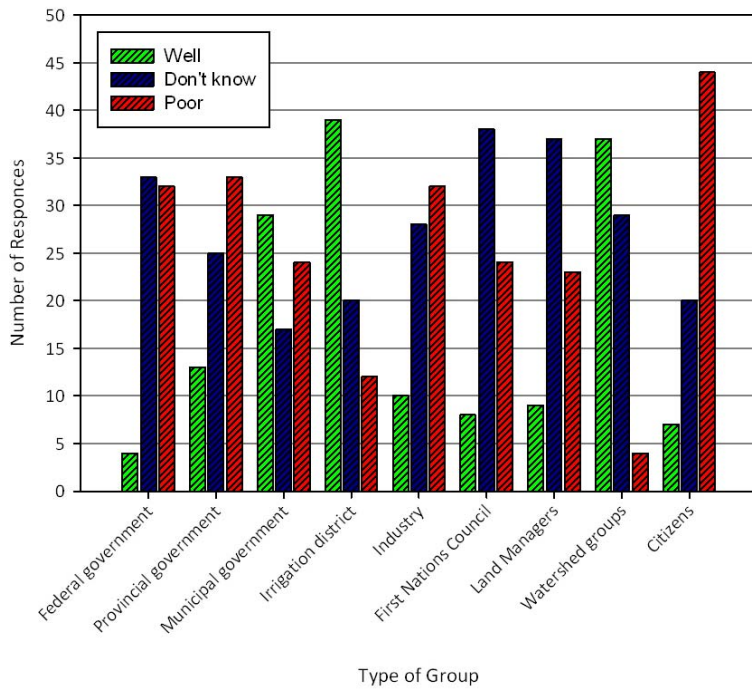


Figure 14: Performance in protecting water quality and quantity

Importance of riparian areas

Respondents were asked to rate the importance of riparian areas to the maintenance of watershed health. Eighty six percent (86%) felt it was important, while 9% thought it was moderately important and the rest of the respondents (6%) did not know if riparian area were important. In addition the majority of respondents (90%) felt it was important to monitor ground and surface water quality and quantity.

WATER CONSERVATION PRACTICES

One of the objectives of the water survey was to understand the public’s current attitude toward water conservation practices within Wheatland County. A series of questions were developed to understand the public’s knowledge and willingness to implement water conservation measures in the following topic areas:

- drinking water;
- common water conservation measures in the home;
- barriers to implementing water conservation measures in the home;
- best farm management practices; and
- preferences for learning about water.

Drinking water

The majority of respondents felt their drinking water was of adequate to good quality (Figure 8). When respondents were asked to identify their drinking water supply, the majority obtain drinking water from ground water wells (46%), municipal water supply (31%) or an irrigation canal (13%) (Figure 15). Of the respondents that use ground water wells, 74% test the quality of their wells every 2- 5 years, 23% annually and 3% have never tested their wells.

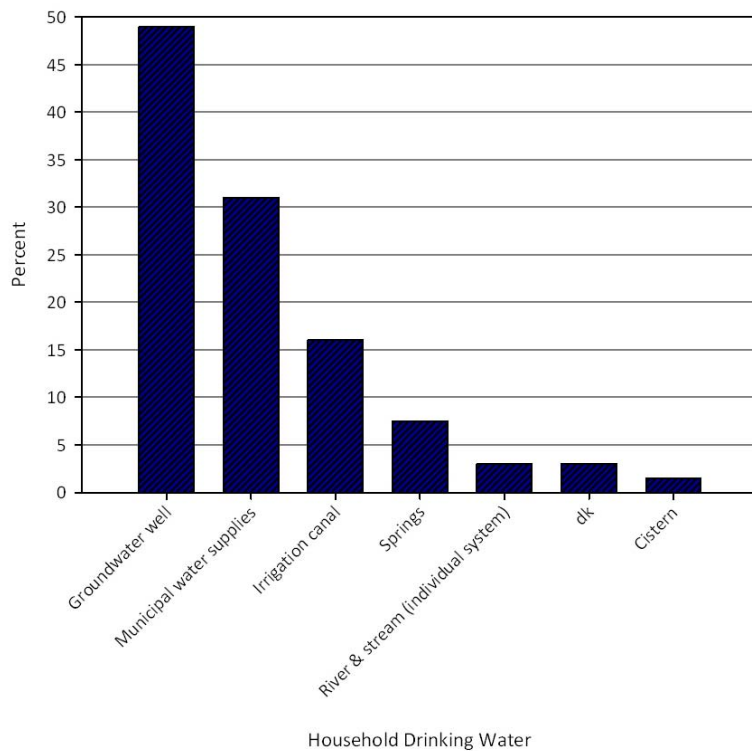


Figure 15: Source of household drinking water

Respondents were asked if they are more likely to drink water directly from the tap, drink bottled water or drink filter tap water (Figure 16). The preferred drinking source was from the tap (40%), but many also prefer bottled water (36%).

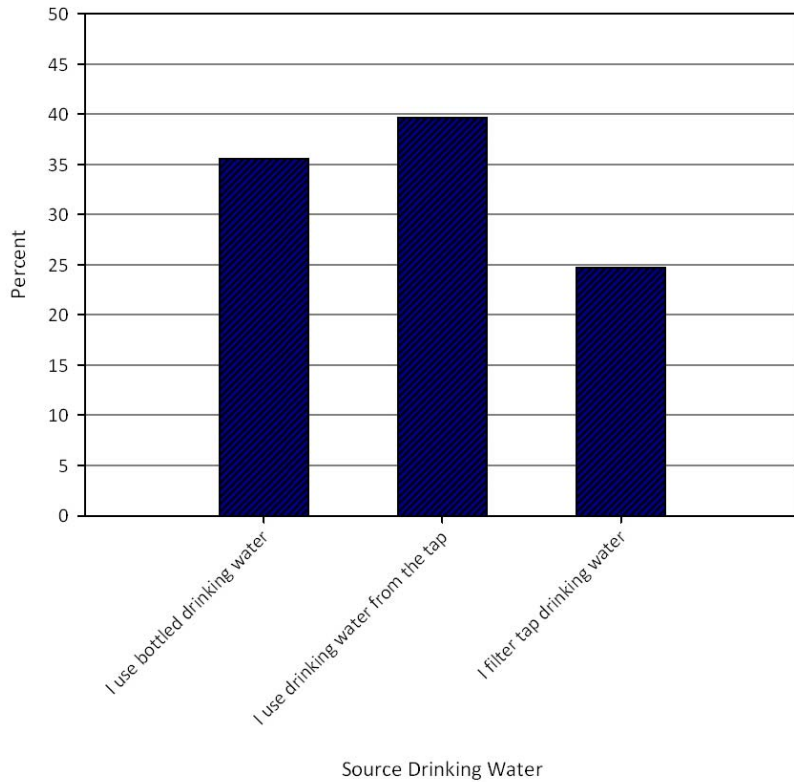


Figure 16: Preferred type of drinking water

Water conservation measures in the home

Survey participants were asked to indicate water conservation measures implemented in their homes. Of the 78 survey participants, 89% had implemented one or more water conservation measures listed in Figure 17. The top three water conservation measures implemented for households were 1) water conservation devices (85%) which included low-flow showerheads, toilets and low water-use appliances, 2) restrict lawn watering to early am or pm (74%) and, 3) the use of rain barrels (60%). Far fewer respondents are using the waste round-up program (25%). The 'other' category identified respondents who reported no longer watering their lawns (6%). In addition, 89% of survey respondents reported using at least one water quality improvement measure (Figure 18).

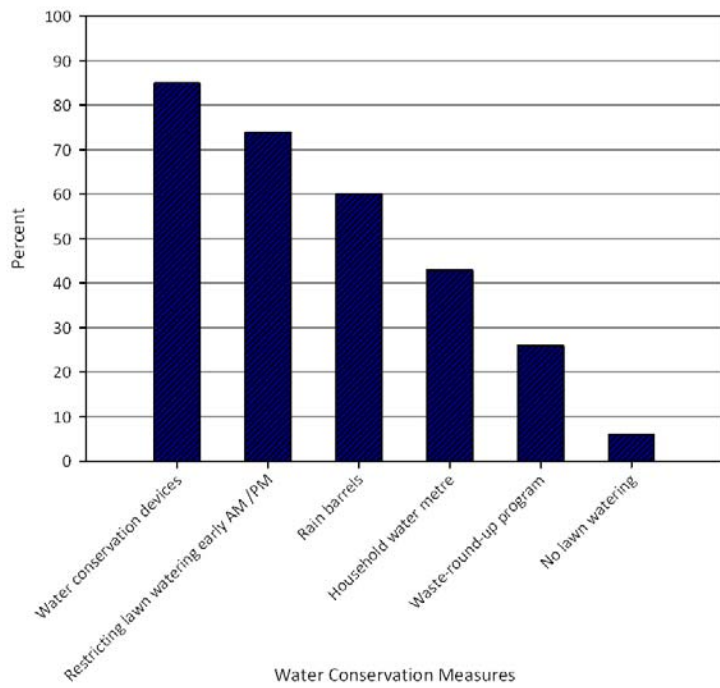


Figure 17: Percent of respondents implementing water conservation measures.

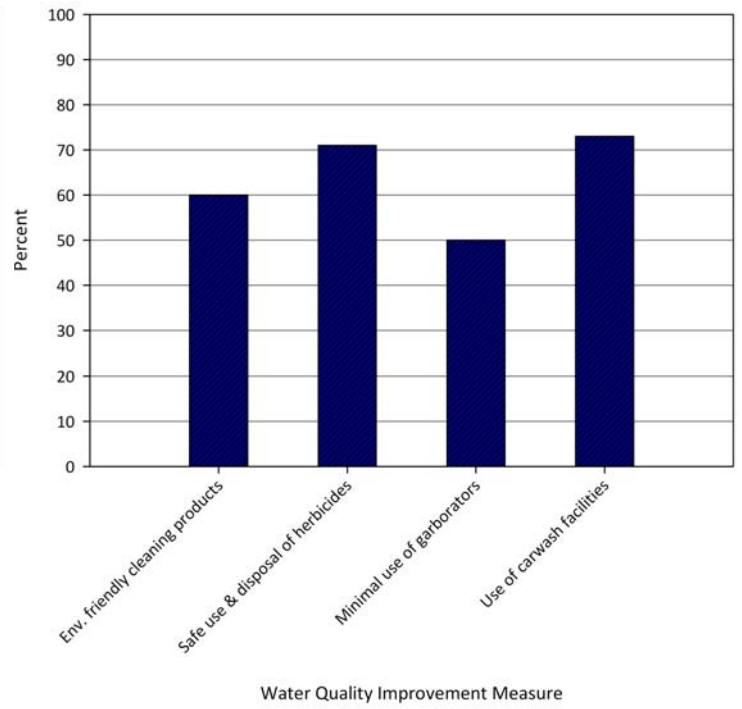


Figure 18: Percent of respondents implementing water quality improvement measures.

Barriers to implementing water conservation measures

The top three barriers to implementing water conservation measures within households, based on a tally of responses where barriers ranked one were given a score of 3, barriers ranked second a score of 2 and barrier ranked third a score of 1, were: cost, lack of incentives and lack of knowledge about water conservation measures. Very few respondents stated they were not interested in the implementing water conservation measures (Figure 19).

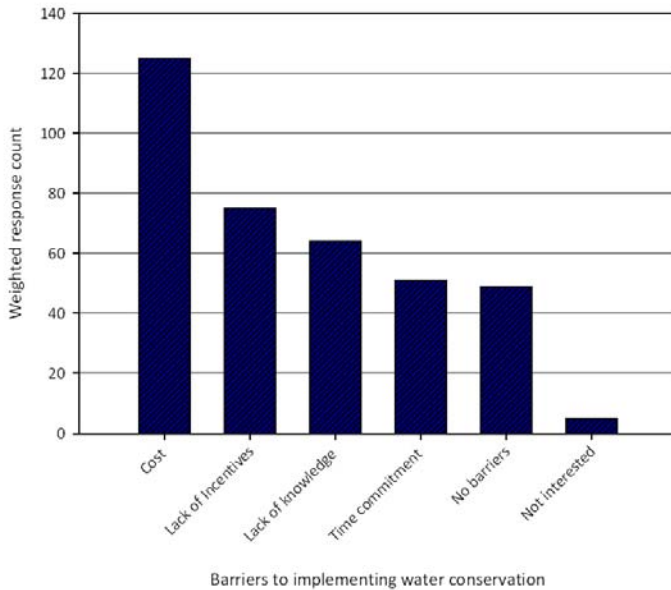


Figure 19: Barriers to implementing water conservation measures

Farm Best Management Practices

Agriculture is one of the main industries within Wheatland County. A series of questions were asked of agricultural producers to assess their attitudes, perceptions and willingness to implement best management practices to protect water. Of the 78 respondents, 17 (19%) owned a farming operation. This is a very low sample size and, as such should not be interpreted as being representative of the entire farming community. The type of farming operations reported were predominately dryland farming (55%), cow and calf operations (42%) and hayland (37%); other less common types included irrigation farming, horse and confined feeding operations (Figure 20). The size of the farming operations ranged from 10 to over 2000 acres (Figure 21).

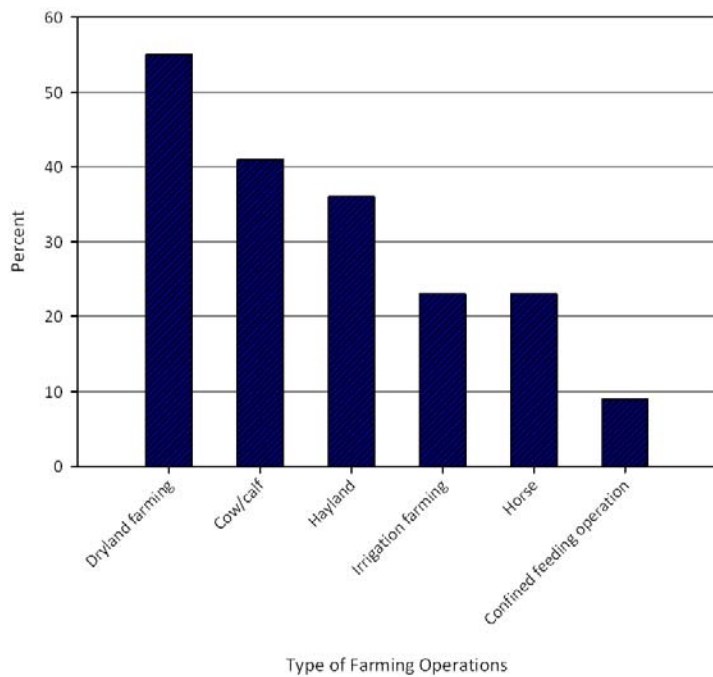


Figure 20: Types of farming operations

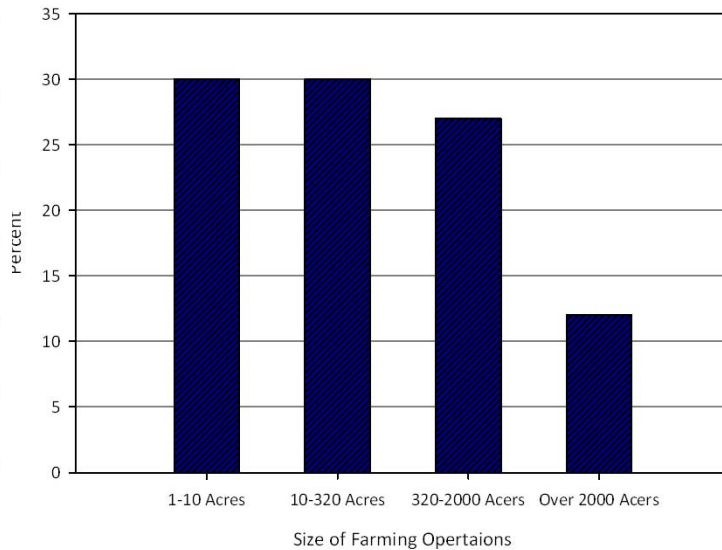


Figure 21: Size of farming operation.

Respondents were asked their perception of the impact of their farming operations on water quality. Most respondents (42%) indicated that run-off from crop and hay operations did not have a strong impact on water quality (Figure 22).

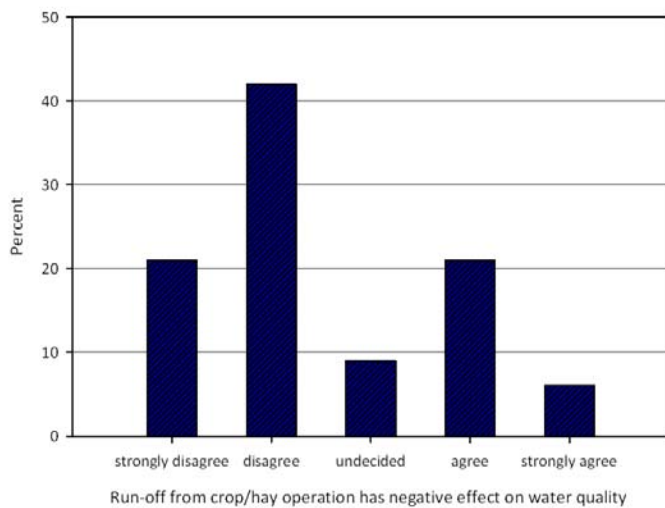


Figure 22: Run off from crop and hay operations have a negative effect on water quality in the area.

Figure 23 displays best management practices occurring on farms in Wheatland County. The top four best management practices include: spray avoidance times (65%), maintenance of riparian areas (54%), fencing or grazing practices (54%) and maintained grass waterways (54%). The least implemented best management practices included run-off diversion and area settling areas, alteration of livestock distribution and manure management plans. Given the low sample size of respondents operating farms in the area, it is difficult to determine the true rate of individuals implementing best management practices.

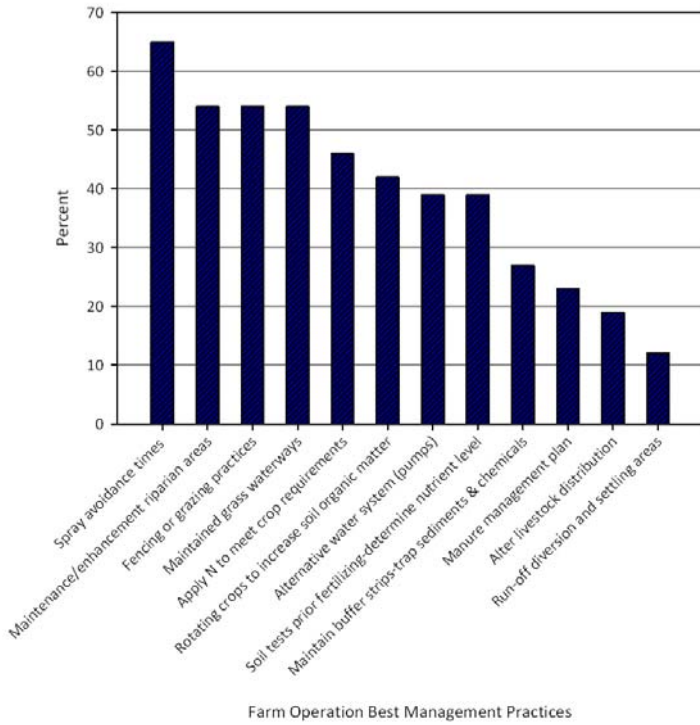


Figure 23: Best management practices on farms.

Respondents were asked to identify barriers to implementing best management practices. The top three were cost, lack of resources and lack of knowledge (Figure 24).

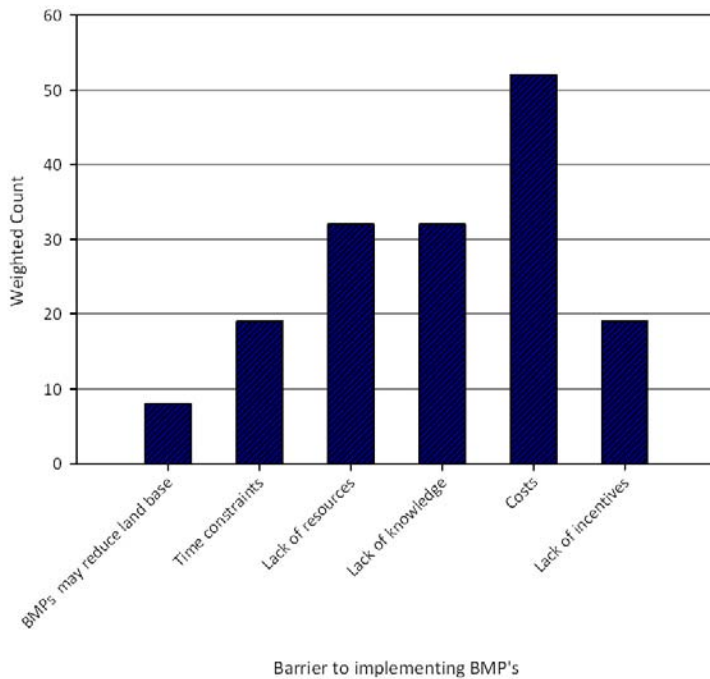


Figure 24: Barriers to implementing best management practices on farming operations within Wheatland County.

The results of this agriculture-focused section of the survey indicate there are a variety of farming types occurring within Wheatland County. Although some best management practices are being implemented it is clear that cost, lack of resources and knowledge are barriers to implementation.

Preferences for learning about water

Participants were asked to identify water topics they would like to learn about, how they prefer to learn about water issues and which water conservation activities they have participated in.

Respondents were asked in an open-ended question to list the top two water concerns they would like to learn about. Responses were coded using qualitative software and codes were tallied (Figure 25). Fifty eight percent of respondents answered this question. The respondents were most interested in:

1. understanding more about the current health of water quality and quantity in Wheatland County;
2. understanding the true impacts of different human activities on water quality and quantity; and
3. information on best management practices for agriculture (including riparian management, sustainable watering systems and irrigation practices).

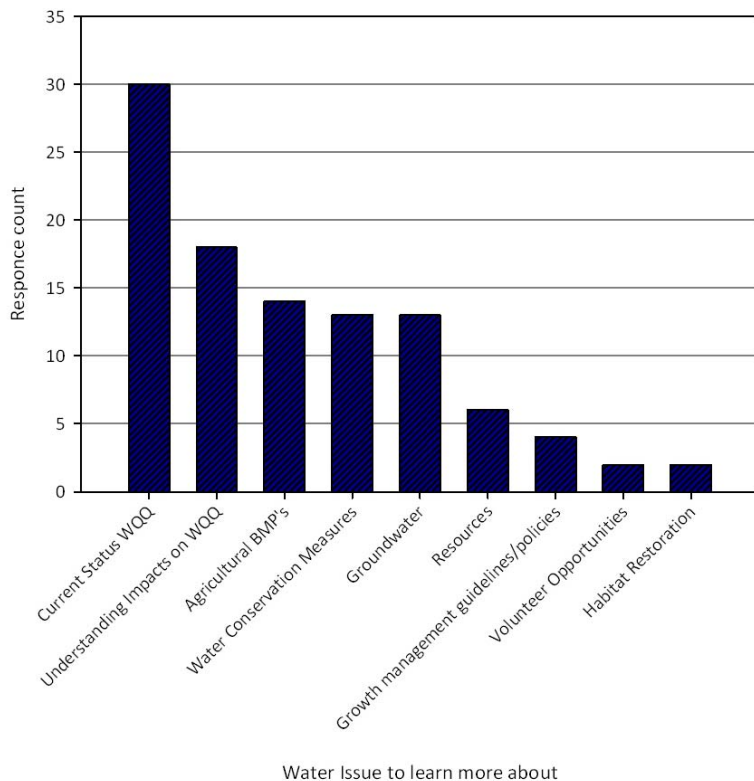


Figure 25: Water issues respondents want to learn about in Wheatland County.

Participants of the survey were asked to rank their preferred methods for learning about water best management practices. The top three methods were: demonstration sites, educational courses and newsletters (Figure 26). When asked to identify water conservation activities they had participated in, 62% of the respondents had not participated in any of the activities on the list provided. Of the 21% that had participated in some of the activities, over half of the respondents were actively involved in a watershed group or had visited the WOW demonstration site (Figure 27). The preferred media outlet for learning about water issues was weekly newspaper (70%) followed by the internet (69%) (Figure 28).

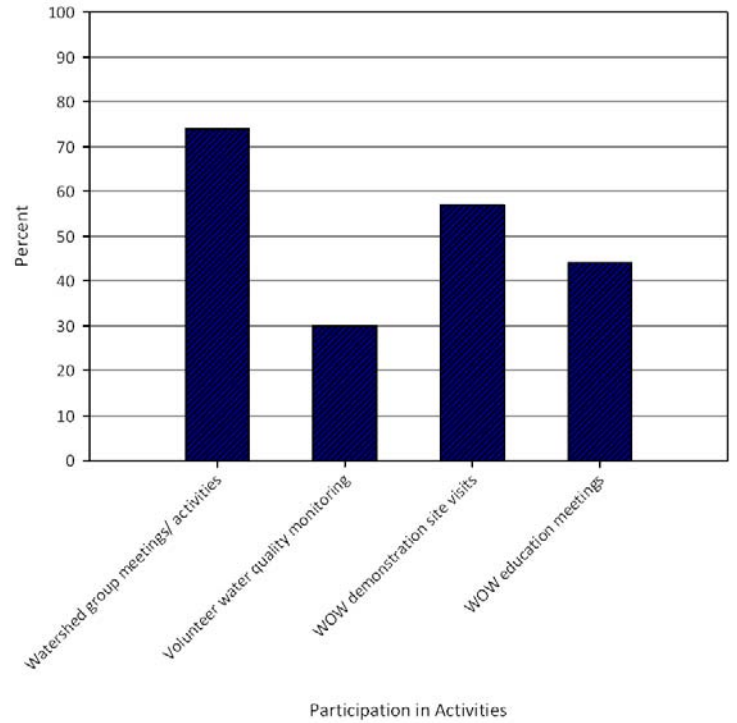
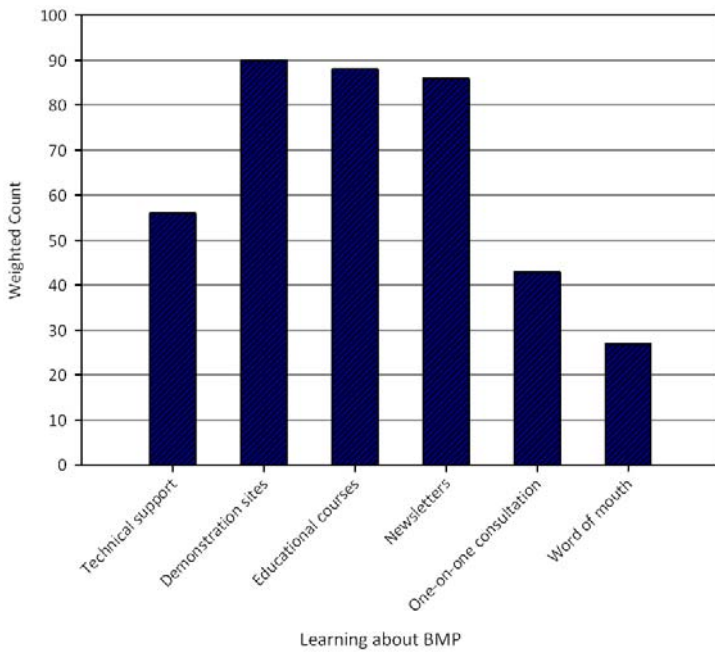


Figure 26: Learning about best management practices.

Figure 27: Activities to address water conservation

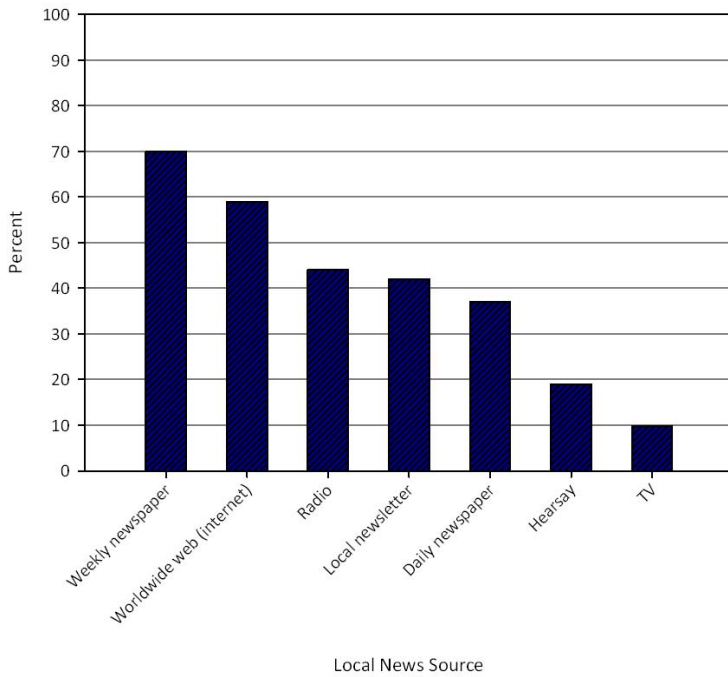


Figure 28: Local news sources for learning about water issues.

DISCUSSION AND CONCLUSION

Survey response rate was low, with 78 completed surveys representing 0.40% of Wheatland County residents. The survey results provide a starting point for understanding the broad public perceptions and attitudes toward water within Wheatland County. However the low sample size prevents a comparative analysis between urban and rural perceptions, attitudes and understanding of water conservation measures. Other research suggests there are normally differences in public perceptions of water health depending on where people live (Heartland Regional Water Coordination Initiative 2007). This may be important in designing and targeting education programs about water in the region. Residents from Strathmore were not well represented in the survey results relative to their population size in the region with only 15 respondents (0.15 percent of population represented). Future surveys would benefit from a higher response rate to increase the ability of WOW to understand the perceptions and attitudes about water in Wheatland County and therefore target resources and program development.

The overall perception of respondents towards water health, including ground and surface water quality and quantity, is that water is in adequate health within the County. Information from technical reports on the current health of surface water quality indicates that water quality is currently considered marginal, and so the survey results indicate that residents are slightly more positive regarding water quality than current data shows. Technical reports indicate water quality to be deteriorating over time within the county highlighting the importance of understanding activities that adversely impact water health within the region. A number of respondents recognized Bow River, Eagle Lake, Serviceberry Creek, Rosebud Creek, Crowfoot Creek and the western Irrigation canals as water bodies of concern. The three creeks are currently monitored through various initiatives and technical reports suggest deteriorating overall surface water quality, ranging from poor to marginal. Respondents' concerns were mainly associated with agricultural practices, with concern for the Bow River focused on upstream urban waste and run-off. Technical reports for the Bow River identify waste water from Calgary as a primary source of pollution; although the report noted on-going improvements to the waste water system, the increasing population of Calgary may reduce their overall impact in reducing pollution. Non-point sources of pollution from agriculture practices were noted as sources of contamination in the creeks and technical report recommendations focused on improving riparian habitat and implementing best management practices. Results indicate respondents perceptions are aligned with the technical report findings on the current water quality health of these water bodies and the activities adversely impacting water quality. Interestingly, the Red Deer River was not mentioned as a water body of concern, although the creeks that drain into the Red Deer River are of concern.

Respondents considered themselves less knowledgeable about ground water quality, as indicated by the higher number of 'don't know' responses. The hydrological consultants report on groundwater suggests current monitoring is inadequate to enable a full groundwater budget and to understand comprehensively the current health of ground water in the region. The report provides a number of recommendations to improve the monitoring of ground water in Wheatland County. The results of this survey suggest a general level of support for these recommendations, as the notion of monitoring surface and ground water quality and quantity were rated as important by respondents.

Although respondents' understanding of the water quality and quantity in Wheatland County were in general agreement with technical reports, it was one of the main topics that respondents wanted to learn more about, indicating a desire for access to more information on water health in Wheatland County.

Respondents identified activities they perceived as having a negative impact on water health in the region. Three broad areas of concern included agricultural impacts (including confined livestock operations, pesticide and fertilizer application and livestock access to water bodies); oil and gas activity and urban waste water. These results are consistent with the 2001 agriculture survey of Crowfoot Creek Watershed.

Half of the respondents felt climate change would result in a reduction of water availability, but there were a number of respondents who were unsure of the impacts of climate change. The impact of climate change on the local environment is complex, but extremely important for long term planning of water resources in the region. However, we are not aware of any predictive models or reports for either Wheatland County specifically or that could inform water planning in Wheatland

County. Understanding the range of potential implications of climate change to changes in the amount and timing of water availability on a regional basis is an important consideration in planning for water resources in the future.

Respondents indicated concern about water in the region. Specifically the top three concerns were water quality, water quantity and water sustainability. Respondents expressed the highest level of concern for water quality in the region, specifically including impacts of urban run-off and sewage effluent on water quality and the quality of drinking water. Other areas of concern include ecosystem health concerns such as habitat loss (wetlands and riparian areas) and unhealthy wildlife populations. Loss of wetland habitat was identified as a concern in the Rosebud Watershed assessment in the Red Deer State of Watershed Report (*Aquality* Environmental Consulting Limited 2009). In addition, a number of respondents were concerned about current water restrictions, including either license restrictions or water bans, and their impact on the agricultural sector.

Respondents tended to show more confidence in local entities managing water: Municipal government, watershed groups and the irrigation district were viewed as managing water well, while the Provincial and Federal governments and individual citizens were seen as poor managers of water.

Most respondents felt riparian areas were important, although the state of riparian habitat was not identified strongly as an area of concern by respondents. Technical reports identify the maintenance of riparian habitat as a top priority for improving water quality (*Aquality* Environmental Consulting Limited 2009, Cross 2006). In addition, management of riparian areas was mentioned as a topic that respondents wanted to learn more about (under the category `agricultural best management practices`) and should be considered in educational initiatives.

The majority of respondents felt their drinking water was of acceptable quality, although 60% of respondents either filter their tap water or drink bottled water.

Survey results identified actions taken by respondents to reduce their quantity of water use and impacts on water quality. Over 89% of respondents have implemented at least one water conservation measure and water quality improvement measure. The key barriers to implementing water conservation and water quality improvement measures include: costs, lack of incentives and lack of knowledge. The order differed for the identified barriers in the 2001 Standard village survey where time, knowledge and then costs were the major barriers. Both these surveys experienced low sample size and likely all are barriers to implementing water conservation measures in the region. Identifying and exploring effective mechanisms to reduce the identified barriers may result in increased implementation of water conservation measures in the region.

The majority (63%) of agricultural producer respondents felt their hay or crop operations did not have a negative effect on water quality in the region. In contradiction, technical reports suggest agricultural practices have adversely impacted water quality in the region and water quality has been deteriorating over time. Given the possible disconnect between technical reports (deteriorating water quality trend) and the results of the farm component of the survey, education in this area should be considered. However, half of the respondents reported implementing best management practices, such as maintaining riparian corridors or spray avoidance times. Likely individuals implementing best management practices are having less impact on water health and therefore concluded their own practices are not adversely affecting water quality. However, overall, agricultural practices may be having an adverse effect on water quality. The best management practices less likely to be implemented included manure management plans, alteration of livestock distribution and run-off diversion and settling areas, representing priority areas for education. In addition, best management practices for agriculture were one of the top three areas respondents identified that they wanted to learn more about. The barriers to implementing agricultural best management practices were identified as costs, lack of resources and lack of knowledge. These results are consistent with the 2001 survey of 100 agricultural producers in Crowfoot Creek Watershed.

A number of respondents, 62% have not participated in a watershed group, nor attended WOW demonstration sites or educational meetings. The preferred method for learning stated by respondents was demonstration sites, educational courses and newsletters. This is consistent with the survey results of agricultural producers in Crowfoot Creek Watershed in 2001.

While the response rate was low, this survey provides WOW with a better understanding of public perceptions, attitudes and willingness to implement water conservation measures in Wheatland County. It also provides WOW with a better

understanding of knowledge gaps within the community, preferred methods of learning and barriers to implementing further conservation measures.

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APPENDIX 1: QUESTIONNAIRE

Waters of Wheatland Water Survey

1. Perceptions about water

The first section of the survey focuses on water QUALITY and QUANTITY – please read carefully

1. How would you rate the overall QUALITY of surface water (i.e. lakes, rivers, streams, creeks) in Wheatland County?

very poor poor adequate good excellent no opinion/don't know

2. How would you rate the overall QUANTITY of surface water (i.e. lakes, rivers, streams, creeks) in Wheatland County?

very poor poor adequate good excellent no opinion/don't know

3. How would you rate the overall QUALITY of ground water in Wheatland County?

very poor poor adequate good excellent no opinion/don't know

4. How would you rate the overall QUANTITY of ground water in Wheatland County?

very poor poor adequate good excellent no opinion/don't know

5. How would you rate the QUALITY of your drinking water?

very poor poor adequate good excellent no opinion/don't know

6. Please rank the top 3 (THREE) activities that you think have the greatest negative effect on water quality in Wheatland County? (Please choose only THREE and rank your choices by indicating a 1, 2 or 3 in the appropriate box, where 1 is the activity with the activity with the greatest negative effect on water quality)

Pesticide and fertilizer application,	<input type="text"/>
Confined livestock feeding (manure management)	<input type="text"/>
Industrial activity (non oil and gas)	<input type="text"/>
Septic systems	<input type="text"/>
Urban wastewater	<input type="text"/>
Storm water	<input type="text"/>
Livestock access to water bodies	<input type="text"/>
Improper chemical disposal	<input type="text"/>
Land fill site	<input type="text"/>
Irrigation practices	<input type="text"/>
Oil and gas activities	<input type="text"/>
Development (ie. residential, recreational)	<input type="text"/>
Other	<input type="text"/>

Waters of Wheatland Water Survey

7. Are there specific sites or water bodies (i.e. lakes, rivers, streams, creeks) where you are concerned about water quality? Please name the sites or water bodies and briefly explain why?

8. I believe that current predictions for climate change will result in the following:

- Less water availability
- Same water availability
- More water availability
- Greater difference in water availability between years
- Don't know

9. The month with the highest precipitation in Wheatland County is:

10. Most of the precipitation in Wheatland County comes from:

- Snow
- Rain
- Equal snow and rain
- Don't know

2. Attitudes about water

1. Please list your top three concerns about water in Wheatland County.

1	<input type="text"/>
2	<input type="text"/>
3	<input type="text"/>

Waters of Wheatland Water Survey

2. In your opinion who should be most responsible for ensuring water quality and quantity in Wheatland County?

- Federal government
- Provincial government
- Municipal government
- Irrigation district
- Industry
- First Nations Council
- Land Managers
- Watershed groups
- Citizens

3. How do you feel each of these groups perform in fulfilling their responsibility for protecting water quality and quantity in Wheatland County? (select one per row)

	Well	Don't Know	Poorly
Federal government	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Provincial government	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Municipal government	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Irrigation district	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Industry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
First Nations Council	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Land Managers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Watershed groups	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Citizens	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4. In your opinion how important are healthy riparian areas (the area directly adjacent to and influenced by a water body) to watershed health in Wheatland County?

- unimportant
- of little importance
- moderately important
- important
- don't know

5. In your opinion how important do you think it is to monitor: (select one per row)

	unimportant	of little importance	moderately important	important	don't know
Ground water quality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Surface water quality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ground water quantity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Surface Water quantity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3. Water conservation

Waters of Wheatland Water Survey

1. Where does your household drinking water come from?

- Springs,
- Irrigation canal
- River and stream (individual system)
- Groundwater well
- Cistern
- Municipal water supplies
- I don't know

Other (please specify)

2. Do you have a groundwater well?

- Yes
- No

4. Water conservation

1. How often do you test the water quality of your ground water well?

- Annually
- 2-5 years
- Never

5. Water conservation

1. Which best reflects the water you drink

- I use bottled drinking water
- I use drinking water from the tap
- I filter tap drinking water

2. Do you practice any of the following water conservation measures in your home?
(check all that apply)

- Rain barrels,
- Water conservation devices (shower heads, low flush toilets),
- Household water metre
- Restricting lawn watering to early AM or PM
- Waste-round-up program

Other (please specify)

Waters of Wheatland Water Survey

3. Do you practice water quality improvement measures (check all that apply)

- Use of environmentally friendly cleaning products
- Safe use and disposal of herbicides
- Minimal use of garborators
- Use of carwash facilities

Other (please specify)

4. Please select the top 3(THREE) barriers to you implementing water conservation measures in your home. (Please choose only THREE and rank your choices by indicating a 1, 2 or 3 in the appropriate box, where 1 is the activity with the activity with the greatest negative effect on water quality)

- | | |
|---------------------------|----------------------|
| Lack of incentives | <input type="text"/> |
| Lack of knowledge | <input type="text"/> |
| Cost | <input type="text"/> |
| Time commitment | <input type="text"/> |
| Not personally interested | <input type="text"/> |
| No barriers | <input type="text"/> |

5. Do you have a farming operation on your property?

6. Farm management

1. What type of farming operation do you manage?

- Confined Feeding operation
- Cow/calf
- Irrigation farming
- Dryland farming
- Hayland
- Horse

Other (please specify)

2. How many acres do you manage?

- 1-10 Acres
- 10-320 Acres
- 320-2000 Acers
- Over 2000 Acers

Waters of Wheatland Water Survey

3. What best management practices have you introduced? (check all that apply)

- Maintenance or enhancement of riparian areas (implementing a buffer along creeks, rivers or lakes)
- Fencing or grazing practices
- Alternative water system (pumps)
- Alter livestock distribution (salting site, fencing, water systems)
- Run-off diversion and settling areas
- Manure management plan
- Soil tests prior to fertilizing to determine nutrient level
- Spray avoidance times (<10m from water body, winds over 20km/hr, before or after a rain, bare ground)
- Rotating crops to increase soil organic matter
- Apply N to meet crop requirements
- Maintained grass waterways
- Maintain buffer strips to trap sediments and chemicals

Other (please specify)

4. Runoff from your crop or hay operations has a negative impact on water quality in your area.

strongly disagree disagree undecided agree strongly agree

5. Please select the top 3 (THREE) barriers to implementing best management practices. (Please choose only THREE and rank your choices by indicating a 1, 2 or 3 in the appropriate box, where 1 is the activity with the greatest negative effect on water quality)

- | | |
|------------------------------------|----------------------|
| Some of the BMP's reduce land base | <input type="text"/> |
| Time constraints | <input type="text"/> |
| Lack of resources | <input type="text"/> |
| Lack of knowledge | <input type="text"/> |
| Costs | <input type="text"/> |
| Lack of incentives | <input type="text"/> |

7. Water conservation

Waters of Wheatland Water Survey

1. Please select the top 3 (THREE) ways you prefer to learn about water best management practices (BMP's). (Please choose only THREE and rank your choices by indicating a 1, 2 or 3 in the appropriate box, where 1 is the activity with the activity with the greatest negative effect on water quality)

- Technical support
- Demonstration sites
- Educational courses
- Newsletters
- One-on-one consultation
- Word of mouth (i.e. neighbour, friend)

2. Have you participated in any of the following activities: (check all that apply)

- Watershed group meetings/ activities
- Volunteer water quality monitoring
- Waters of Wheatland demonstration site visits
- Waters of Wheatland education meetings

Other (please specify)

3. Please list the top 2 water issues you personally would like to learn more about?

- 1
- 2

8. General information

1. What local sources of news do you tend to rely on (Check all that apply).

- Weekly newspaper
- Daily newspaper
- Worldwide web (internet)
- Local newsletter
- Radio
- Hearsay

Other (please specify)

Waters of Wheatland Water Survey

2. Where do you live?

Town of Strathmore

Village/Hamlet

Acreage

Farm or Ranch

Siksika Nation

Other (please specify)

3. What is your gender?

4. How long have you lived in Wheatland County?

0-5 years

6-10 years

11-20 years

> 20 years

5. What year were you born?

6. What is your occupation?