

LOCAL CAPACITY TO IMPLEMENT A SOURCE WATER PROTECTION PLAN  
IN THE SOUTH SASKATCHEWAN RIVER WATERSHED

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By

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## **ABSTRACT**

Following a number of waterborne disease outbreaks in Canada, the water resource management literature draws attention to source water protection (SWP). Source water protection is a drinking water management approach that attempts to improve drinking water quality by preventing contamination of untreated water at the source. The literature has identified methods for SWP planning; however, rates of implementation of SWP plans are variable and dependent on local capacity factors. Through key informant interviews, this study identifies factors that facilitate and constrain local capacity for implementation of a source water protection plan in the South Saskatchewan River watershed. Results are discussed according to four capacity areas for SWP: technical, institutional, financial, and social capacity. The results of this study show that capacity areas in need of improvement include access to data, training and educational opportunities for non-governmental organizations, greater enforcement of government legislation and regulations, financial security, community awareness and greater linkages and networks between organizations with similar objectives. Respondents identified adequate stakeholder involvement in the planning process, access to funding, and reliable information as examples of existing capacity. The results of this research contribute to the understanding of SWP plan implementation at the watershed scale in Canada and beyond.

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## **LIST OF ABBREVIATIONS**

CCME	Canadian Council of Ministers of the Environment
FSIN	Federation of Saskatchewan Indian Nations
IA	Institutional Arrangement
INAC	Indian and Northern Affairs Canada
MBA	Multi-Barrier Approach
MOE	Ministry of Environment
NGO	Non-Governmental Organization
PCAB	Provincial Council of Agriculture Development & Diversification Boards
REDA	Regional Economic Development Authority
SAW	Saskatchewan Association of Watersheds
SES	Saskatchewan Environmental Society
SNOWS	Saskatchewan Network of Watersheds
SSRWS	South Saskatchewan River Watershed Stewards Incorporated
SSWA	Saskatchewan Water and Wastewater Association
SWA	Saskatchewan Watershed Authority
SWP	Source Water Protection
WAC	Watershed Advisory Committee

## 1.0 INTRODUCTION

Communities depend on a healthy and sustainable water supply. To help achieve this, the literature supports the multi-barrier approach, which includes source water protection, drinking water treatment, drinking water distribution, management, and monitoring (CCME, 2002). Municipalities have typically focussed on treatment and distribution; however, after a number of communities experienced waterborne disease contamination outbreaks in Canada including Walkerton, Ontario and North Battleford, Saskatchewan, attention was drawn to the importance of the first barrier: source water protection (Laing, 2002; O'Connor, 2002b).

Source water protection (SWP) involves protecting a surface or groundwater source from sources of contamination. SWP identifies possible sources of contamination as well as any pathway where contaminated water may enter the supply of drinking water (Goss and Richards, 2008). A SWP plan can be established to try to prevent the potential for contamination. For example, SWP can be as simple as using a fence to keep cattle away from a river (Bender, 2005). SWP combines land use management with water management in order to prevent contamination of source water. SWP is often cheaper than water treatment and aims to ensure healthy water and a healthy ecosystem (Timmer, 2007; Parkes *et al*, 2010).

Moving SWP plans into action and implementation can be problematic, but research has identified the importance of local capacity requirements to the management of safe drinking water (de Loë and Kreutzwiser, 2005; Ivey, 2006a). Local capacity refers to the ability of municipalities to manage water quality to effectively prevent source water contamination (de Loë and Kreutzwiser, 2005). Little research has been done on capacity to implement SWP plans in Saskatchewan. This research will add to the body of knowledge on capacity to implement SWP plans and will address the gap of research looking at the prairies and agricultural regions in Canada. Regional differences may affect capacity needs for implementing plans, and so there is a need to determine what capacities are needed in the prairies in order to apply what is learned to other prairie conditions. This research divides local capacity to implement SWP plans into four main categories: institutional, technical, financial, and social capacity.

The Saskatchewan Government, through the Saskatchewan Watershed Authority (SWA), began meeting with community members and stakeholders in a variety of watersheds across the province, starting in 2002, in order to create watershed-based SWP plans. Although the initiative came from the provincial government, the intent was that local stakeholders would be



responsible for implementing key actions from the plan. The South Saskatchewan River Watershed Advisory Committee completed their plan in 2007 and shortly after created the South Saskatchewan River Watershed Stewards Incorporated (SSRWS). The SSRWS consists of a board of local landowners and two permanent staff members. A number of different groups and organizations are also directly involved in protecting source water in Saskatchewan, including the Saskatchewan Watershed Authority, the Saskatchewan Environmental Society, and local landowners. Today, no review of the implementation of this plan has occurred. One rationale for this research will be to serve as an initial review stage of the implementation process of the SWP plan in this watershed. Another will be to add to the broader academic literature on capacity for SWP implementation and in particular, establish whether the criteria for capacity that exists in the prairies are similar or different than those found in other regions of Canada.

### *1.1 Research goals and objectives*

The goal of this thesis is to identify and analyze factors that facilitate and constrain the capacity of local communities in the South Saskatchewan Watershed to implement SWP. To achieve this goal, the following objectives will be met:

- i. To determine capacity needs for source water protection implementation in the South Saskatchewan River watershed
- ii. To recommend capacity building measures for source water protection implementation in the South Saskatchewan River watershed
- iii. To derive lessons learned for source water protection implementation generally

In fulfilling this goal, this research will also identify opportunities for capacity enhancement for SWP implementation in rural Saskatchewan. Other topics that will be explored by investigating this research goal include: SWP, local capacity building, capacity needs in Saskatchewan for SWP, and existing institutional arrangements for land use planning and water management in Saskatchewan. Given the infancy of SWP in the province of Saskatchewan and the provincial government's current process of creating a new provincial water strategy (May, 2011), this research is timely and will be useful for improving water management in the future of the province.

Most SWP literature in Canada has been done in Ontario (de Loë *et al*, 2002; Carter *et al*, 2005; de Loë and Kreutzwiser, 2005; Ivey *et al*, 2006a; Ferreyra *et al*, 2008; Plummer *et al*, 2010;

Kreutzwiser *et al*, 2011) or British Columbia (Litke and Day, 1998; Patrick *et al*, 2008; Patrick, 2009), creating a distinct lack of SWP research in the Canadian prairies and in particular, in Saskatchewan. Patrick (2011a) recently made a case for conducting a water soft path study in Saskatchewan, but the focus was mostly on a need to assess quantity of water used; whereas, this research addresses the need to evaluate water quality in Saskatchewan. There is a gap in the literature on SWP implementation barriers in the Canadian prairies. Regional differences in SWP implementation may be likely across Canada and this research will help determine whether those differences exist.

While there are limited examples of literature exploring water management issues in an agricultural context, there is an absence in the academic literature of research looking at local capacity to implement SWP plans in agricultural communities. Rural areas face increasing challenges for source water protection as agricultural intensification threatens water quality. As farms concentrate, specialize, and become more intense as demand for animal-derived foods increases, this results in greater waste runoff and therefore a greater risk to human health. Hence, there is a need to examine SWP implementation in agricultural communities. Poirier and de Loë (2011) identified factors that influence attempts to protect and restore aquatic ecosystems in the Oldman River basin, yet SWP is concerned with drinking water sources and does not specifically address aquatic ecosystem health. Kreutzwiser *et al*. (2011) analysed factors that affect private well stewardship, but again, this research was done in Ontario and not explicitly for agricultural areas. Goss and Richards (2008) developed a risk-based index to assess the potential for water contamination on farms, but they did not look at mitigation of those potential contamination sources nor did they examine the capacity of local authorities to implement plans at a larger scale to protect source water from agricultural runoff. This research will address what these other agricultural water management studies have not touched on—implementation of SWP plans in an agricultural watershed.

Only two studies have looked at SWP in areas with agriculture in Canada; they were in Alberta (Ivey *et al*, 2006b) and Nova Scotia (Timmer *et al*., 2007) and their research was done before Saskatchewan had even released its first SWP plan. These studies will help determine whether the results from this study are regionally specific or common to other agricultural communities.

Arguably, watershed-based governance structure have been found to be less effective when trying to minimize agricultural water pollution threats and management scales are more meaningful when they are flexible and link to existing social and political boundaries in agricultural areas (Ferreira *et al*, 2008). The current SWP planning model in Saskatchewan follows the conventional watershed scale. This research will test Ferreira *et al* (2008) and determine if this is still an effective scale in the South Saskatchewan River Watershed, which is a predominantly agricultural community.

Morton (2008) found that financial incentives and regulations are not sufficient to prevent non-point sources of agricultural pollution. Morton argues that farmers have deeply-held internal belief systems and are generally resistant to change, but that social pressure from other farmers is the most effective way to create change and ultimately, to implement SWP plans. Morton's research is based on an American case study. This research will address a gap in the literature for Canadian research that critically assesses the local uptake of SWP in an agricultural context.

Small, rural communities also tend to have fewer resources at their disposal and so have a limited capacity to protect source water. Six small communities in Nova Scotia were shown to have limited institutional, financial, and technical capacities (Timmer *et al*, 2007). Therefore, there is a need to identify methods for capacity enhancement for small communities; this research will address that need.

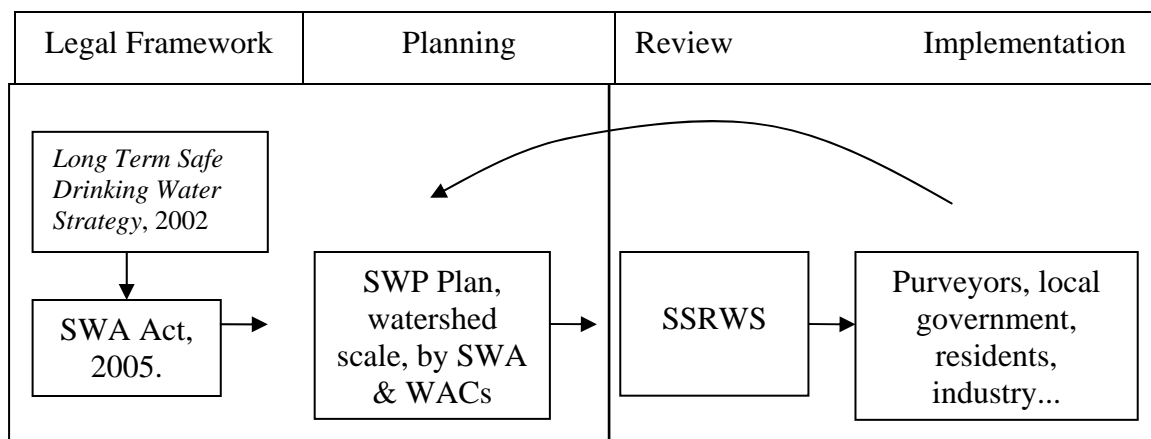
## 1.2 *Water governance in Saskatchewan*

Jurisdiction over water is complicated. In Canada, provincial governments are generally responsible for ensuring communities have reliable potable water supplies. Provinces are responsible for property and civil rights, municipal institutions, non-renewable resources, and hydroelectric power needs. The federal government is responsible for water issues that fall under its direct jurisdiction such as international and interprovincial transportation and shipping, federal lands and installations, and Indian Reserves (Environment Canada, 1987). SWP often uses local land use management to achieve its goals, which falls under municipal jurisdiction. Land use planning is a municipal responsibility, although provinces define the powers and responsibilities of municipalities and therefore oversee their planning systems. Land use planning and watershed management are therefore addressed by different authorities and occur somewhat separately in Saskatchewan. The literature argues that governance structures that

integrate water management and land use planning are necessary for successful protection of drinking water sources (Plummer *et al*, 2011).

The Government of Saskatchewan's response to drinking water safety following the Walkerton tragedy was to create the *Safe Drinking Water Strategy*(SWA, 2002), which involved Saskatchewan Environment, Saskatchewan Health, Regional Health Authorities, Saskatchewan Watershed Authority, Saskatchewan Government Relations, SaskWater and Saskatchewan Agriculture and Food. The goals of the *Safe Drinking Water Strategy* were to protect source waters, to improve water treatment, to provide safe, clean, and sustainable drinking water, to develop a clear and effective water regulatory system, and to ensure that consumers trust and value drinking water and the operations which produce it (SWA, 2002).

In 2002, the Government of Saskatchewan developed a *Long Term Safe Drinking Water Strategy* to protect source water quality by combining its resource management and stewardship functions. This led to the key piece of water legislation in Saskatchewan, the *Saskatchewan Watershed Authority Act* in 2005. The new agency that resulted, the Saskatchewan Watershed Authority (SWA), combined the watershed management responsibilities of SaskWater, Saskatchewan Environment, and Saskatchewan Wetland Conservation Corporation (Government of Saskatchewan, 2005). At this time, SaskWater also received a new mandate to provide water and wastewater services, and was no longer responsible for watershed management, well testing or source water protection (Government of Saskatchewan, 2002). However, the president of SWA still reports to the SWA Board Chair (who is also the President of SaskWater) and to the Minister of Environment. The SWP framework for Saskatchewan is shown in Figure 1.1 below.



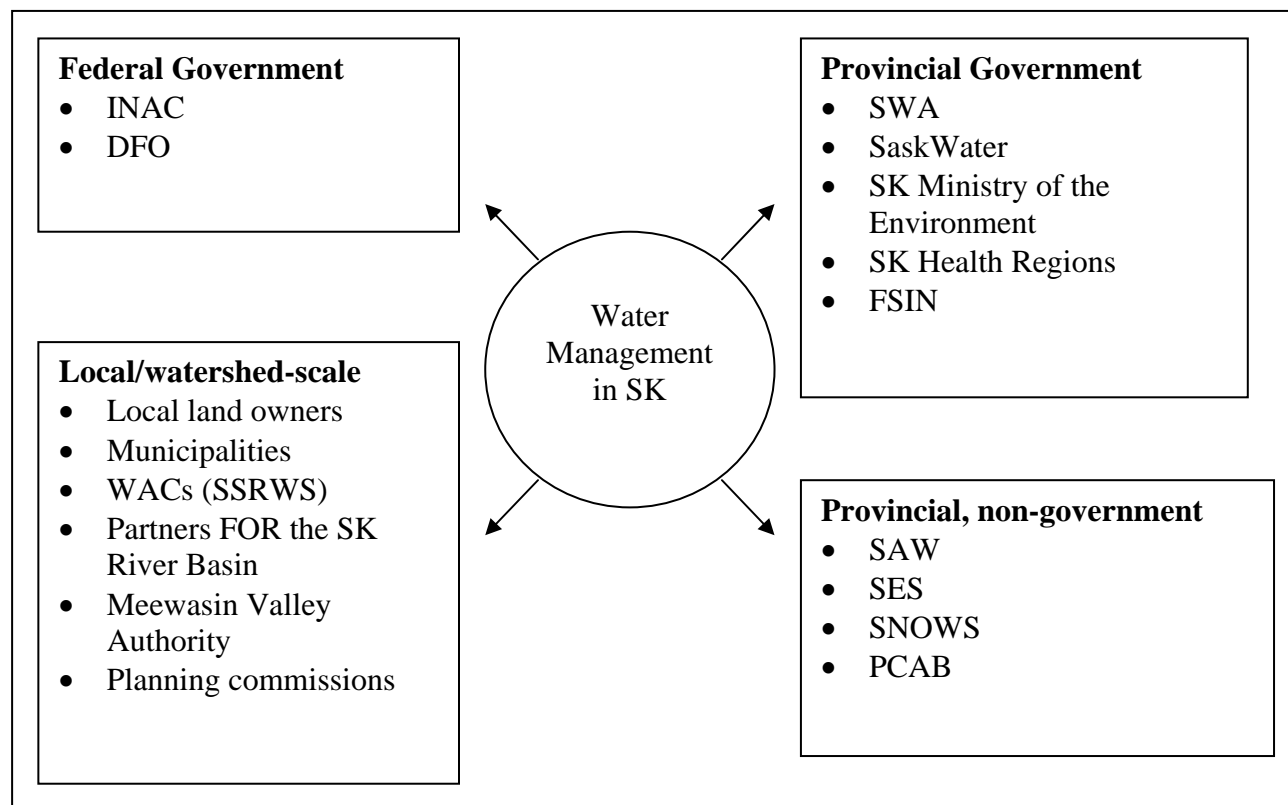
**Figure 1.1** SWP framework for Saskatchewan

According to its mandate, SWA "leads management of the province's water resources to ensure safe drinking water sources and reliable water supplies for economic, environmental and social benefits for Saskatchewan people" (SWA, 2010b). More specifically, SWA has legal jurisdiction to implement its mandate, which can be found in Appendix A. SWA is leading a SWP planning process for each of the watersheds in the province. Each plan typically takes three or four years to complete and is facilitated by SWA planning staff, but led by stakeholders. Following integrated watershed management practices, each planning group consists of a watershed advisory committee (WAC) and a technical committee. The WAC group members are stakeholders from diverse backgrounds such as representatives from municipalities, First Nations, industry, non-governmental organizations, and provincial and federal government. The technical committees consist of experts from government, universities, and non-governmental organizations who provide information to the WAC members in order to make more informed decisions. Once the available information is shared, stressors relevant to the watershed are evaluated and ultimately used to create a prioritized list of key actions. Corresponding departments responsible for carrying out those key actions are also identified.

Following the release of the official SWP plans, each WAC then becomes a legal entity, creating a watershed-based stewardship group responsible for implementing these plans across their local jurisdictions. The groups consist of volunteer board directors and staff, when funds are available. In the South Saskatchewan watershed, upon completion of the South Saskatchewan SWP plan in 2007, the WAC group formed the South Saskatchewan River Watershed Stewards Incorporated (SSRWS, 2007). In 2008, the WAC groups formed an independent umbrella organization--the Saskatchewan Association of Watersheds (SAW)—to identify common issues across watersheds and to act as a liaison or link between all the different WAC groups.

In order to understand the different roles for water management in Saskatchewan and to analyse the relationships between these groups, the following section describes the various organizations that deal with water management and water protection in Saskatchewan and their responsibilities (see Figure 1.2). The Saskatchewan Environmental Society (SES) has recently undertaken a Watershed Stewardship Capacity Building Project in 2010, which seeks to improve the organizational capacity of watershed groups to achieve their goals. This project has also taken up work previously done by the now inactive Saskatchewan Network of Watersheds (SNOWS). SNOWS was created as a partnership between provincial, federal and non-

governmental organizations and aimed to increase communication between stewardship groups and mostly worked with smaller lake stewardship groups, as opposed to the larger, watershed-based WAC groups. After a number of funding cuts, SNOWS has been suspended indefinitely.



**Figure 1.2** Water Governance in Saskatchewan

The Provincial Council of Agriculture Development and Diversification Boards (PCAB) is a producer-driven organizations that acts as a third party administrator of Agriculture Canada and the Saskatchewan Ministry of Agriculture funding for agri-environmental group farm plans and best management practices. The Partners FOR the Saskatchewan River Basin is a non-profit organization that creates resources and activities for educators across all three provinces in the basin to increase student awareness of watershed sustainability. They also publish a State of the Basin Report that gathers existing information on the basin. The Safe Drinking Water Foundation is a national organization with their head office in Saskatoon. They also provide teachers with a variety of educational, curriculum-based resources about keeping drinking water clean and safe. The Federation of Saskatchewan Indian Nations (FSIN)'s Lands and Resources Secretariat and Health Secretariat are working with Indian and Northern Affairs Canada (INAC)

to develop a safe drinking water framework for First Nations communities in Saskatchewan. Finally local stewardship groups, planning commissions, and landowners all play an active role in protecting water.

### *1.3 Research area: South Saskatchewan River watershed*

Three main Alberta tributaries feed the South Saskatchewan River—the Bow, Red Deer, and Oldman rivers—which originate in the Rocky Mountains. The portion of the South Saskatchewan River watershed that lies in Saskatchewan (see Chapter 3) drains an area of 35,000 square kilometres and the river flows 716 kilometres through this watershed (SWA, 2007). However, despite this large drainage area, most of the surface water flow for the river comes from Rocky Mountain snowmelt originating in the Rocky Mountains. This is due to a unique landscape feature of this watershed in Saskatchewan: non-contributing areas—land areas that do not produce surface runoff during a normal runoff event.

The river runs east into south western Saskatchewan and into Lake Diefenbaker, a reservoir lake filled in 1967 formed by the Gardiner Dam and the Qu'Appelle Dam. The river then flows north, through Saskatoon until reaching its confluence with the North Saskatchewan River just passed Prince Albert to form the Saskatchewan River that eventually drains into the Hudson Bay. Sixty-five percent of land cover in the basin is cropland, while another twenty four percent consists of native grassland (SWA, 2007). There are nineteen irrigation districts in the basin, covering a total of 672,000 acres. Economic activities in the region consist of a variety of agricultural activities including livestock and irrigated and dry land crops, as well as seven potash mines and oil and gas production particularly in the western portion of the watershed.

This watershed is the most heavily populated watershed in Saskatchewan with roughly 300,000 residents (SWA, 2007). Saskatoon's growth projections for 2055 are for a population of 400,000 in the city, which may have potential impacts on the river system. Most of the municipalities in the watershed get their drinking water from the river. However, most individual land owners in the watershed tap into aquifers through private wells. Nearly half of the province's population depends on the South Saskatchewan River for their source of drinking water (SWA, 2007).

This particular watershed was selected based on its official SWP plan release date; the South Saskatchewan River Source Water Protection plan was released by the Saskatchewan

Watershed Authority and the South Saskatchewan River Watershed Stewards Incorporated in 2007, which allowed sufficient time for implementation to occur. Site proximity and familiarity to the researcher also added to the rationale for conducting the research in the South Saskatchewan River watershed.

This study identifies capacity building requirements that are needed to improve SWP implementation within the South Saskatchewan River watershed. The results will hopefully enable those involved in SWP implementation to more effectively protect source water in Saskatchewan. The study results also contribute to the greater body of SWP literature in Canada in helping to identify local capacity needs to implement SWP.

#### *1.4 Organization of chapters*

Following the introductory chapter, chapter two presents the literature reviewed for this study. The third chapter covers the methodology used to gather research data. Chapter four presents the results of the research. The research findings are discussed in chapter five. The final chapter, chapter six, provides concluding remarks. The references cited and appendices follow these chapters.



## 2.0 LITERATURE REVIEW

Source water protection (SWP) has recently attracted considerable attention in the academic literature and the media following a number of health incidents in Canada caused by waterborne contaminants (Laing, 2002; O'Connor, 2002a). SWP aims to protect drinking water and is necessary to help promote ecosystem, economic, and human health. In order to better understand the context of the research question, this section will provide background literature on SWP, local capacity, and institutional arrangements for SWP. Origins of, key debates, influential authors, and approaches to implementing SWP plans topics will be discussed. This literature review will cover the following topics related to source water protection: capacity building, source water protection and the multi-barrier approach, and institutional arrangements for land use planning and water management in Saskatchewan and Canada.

### 2.1 *Context –a need for improved drinking water safety*

Although Canada enjoys abundant freshwater resources, a number of factors such as increased climate change, economic activity, population growth, and a higher standard of living are increasing pressure on those water resources. An increased water demand has implications on human health. Human health and well being have been shown to be linked on ecosystem and watershed services. In Parkes *et al* (2010) Watershed Governance Prism, they argue that watershed governance should explicitly consider health and well being, along with environmental and social concerns, in order to successfully achieve integrated watershed governance.

Protecting source-waters is necessary to ensure that communities have access to a healthy and sustainable water supply. Unfortunately, this need is often only recognized after major water crises, such as what occurred in the town of Walkerton, Ontario, in 2000. Seven people died and 2,300 more were made ill from drinking water contaminated with *Escherichia coli* from nearby farm runoff in Walkerton (Hrudey *et al.*, 2003). Justice Dennis R. O'Connor of the Ontario Appeals Court led an inquiry of the Walkerton events that resulted in recommendations for safe drinking water (O'Connor, 2002b). The town of Walkerton had a drinking water treatment facility, but this contamination event indicated a need to re-examine the current provincial water safety system in order to provide better water protection. Following the investigation into the Walkerton tragedy, 24 of the 93 recommendations of the Walkerton Inquiry to improve water

quality made specific reference to source water protection (O'Connor, 2002b). A similar inquiry took place after a contamination event in North Battleford in 2001.

These water outbreaks are not isolated cases. In 2008, more than 1,800 boil water advisories were in effect across Canada (Eggerston, 2008). One of the largest cases of water-borne contamination occurred in 1993 in Milwaukee, Wisconsin when *Cryptosporidium* made it through the treatment system, causing the death of approximately 100 people and illness in another 400,000 people (Olson, 2003). If SWP had been practiced in this area, the failure in the water treatment would not have resulted in such negative outcomes. SWP has been shown to be cheaper and sometimes more effective than cleaning contaminated water because not all contaminants can be removed by treatment (Leccese, 1998; Davies and Mazumder, 2003).

Following the Environmental Protection Agency's Surface Water Treatment Rule that required filtration of all unfiltered water supply systems, New York City decided to invest in rigorous watershed-control standards to avoid expensive treatment. In 1997, the New York City Watershed Memorandum of Agreement recognized the importance of protecting New York City's source watersheds by creating an integrated management plan for its source-water area, as well as adopting a substantial monitoring project of the area (Blaine *et al*, 2006).

The examples above demonstrate that there is a need for improved drinking water protection. Although the science and tools may exist to support water treatment, over-reliance on treatment technology has led to a system that is vulnerable to failure. This has raised the challenge to manage drinking water at every step, not just treatment, in order to prevent further tragedies from occurring (Hrudey *et al.*, 2003).

## 2.2 *Source Water Protection and the Multi-Barrier Approach*

Source water protection refers to protecting the quality and quantity of untreated surface water or groundwater that is a public drinking water supply (Pollution Probe, 2004). Recent literature has broadened the concept of SWP to beyond just drinking water protection—that clean and reliable supplies of water are also needed for agriculture, industry, commerce, ecosystem needs, and other needs (Simms *et al*, 2010). While these goals can often be achieved using similar techniques and will not be ignored, this research focuses on the need for SWP to ensure healthy drinking water supplies.

SWP is the first step of a multi-barrier approach (MBA) to water management. MBA is intended to protect drinking water from source to tap. The multi-barrier approach to drinking water includes: 1) source water protection 2) water treatment 3) distribution and delivery of water 4) monitoring programs throughout the whole system, including both the treatment plants and at the tap, and finally 5) responses to adverse conditions (O'Connor, 2002b). While reactive measures like upgrading water treatment facilities and water boil advisories can be effective responses to most emergencies, they are not considered long term strategies for safe drinking water; proactive strategies are needed as well. According to CCME (2002) safe drinking water requires a system of redundancies or barriers to protect human health.

Not long after the events of Walkerton, another drinking water event struck the city of North Battleford, Saskatchewan. The city's surface water treatment facility failed to properly remove suspended solids and caused an outbreak of *Cryptosporidium* that contaminated the city's drinking water supply (Jameson *et al*, 2008). This led to a provincial-wide investigation into more effective drinking water protection and changed the way the province regulated water (Laing, 2002). Using a multi-barrier approach to safe drinking water is an effective way to handle raw source water known for harbouring *Cryptosporidium*, such as areas with intensive agriculture (Jameson *et al*, 2008). The multi-barrier approach to safe drinking water is “an integrated system of procedures, processes and tools that collectively prevent or reduce the contamination of drinking water from source to tap in order to reduce risks to public health” (CCME, 2002).

Problems can occur even in properly operated water treatment facilities that may result in drinking water disease outbreaks. Poor source water can result in greater cases of contamination in instances of treatment plant failure. As a result, poor source water quality intrinsically has greater associated health risks (Davies and Mazumder, 2003). SWP is linked to public health as it involves risk management strategies, attempting to lower the risk of drinking water contamination. Microbiological, chemical, and hormonal contaminants can pollute water supplies from sources such as municipal and industrial wastewater, livestock, urban and agricultural storm water runoff, spills and floods (Bender, 2005). As made evident by the waterborne illness outbreaks already discussed, some pathogens that can cause gastrointestinal diseases, such as *Cryptosporidium*, can sometimes make it past treatment systems, again giving

rise to the need for SWP to reduce the risk of those contaminants reaching the drinking water supply.

There are many reasons to implement SWP and they include, but are not limited to protecting public health, safety and wellness, fiscal responsibility, environmental quality, and citizen awareness and involvement (de Loë and Kreutzwiser, 2005; Parkes *et al*, 2010; Plummer *et al*, 2010; Kreutzwiser *et al*, 2011). Protecting water sources to ensure safe and clean drinking water is not a new concept. Early settlements in North America were located near reliable water sources and societies have always ensured clean water for good health (Kundell and DeMeo, 2000).

Over-reliance on treatment technology has led to taking clean water for granted and forgetting about the importance of protecting water at its source. Greater SWP will not only alleviate the dependence on the other steps in the multi-barrier approach, but it also reduces public health risk, saves money spent on costly treatment clean-up after contamination, and increases ecosystem health (Ivey *et al*. 2006a; Timmer, 2007). SWP seeks to identify any possible source of contamination as well as the linking pathway from its source to the water (Goss and Richards, 2008). Once that relationship has been established, a SWP plan, which combines land use management with water management, can be established to mitigate the problem and prevent contamination of source water. SWP plans have six steps: delineate source waters, identify potential contamination source, assess susceptibility of water sources, provide results to public, manage contamination threats, create a contingency plan in case of contamination (Harrigan-Farrelly, 2002).

Historically, the approach for drinking water treatment has been “end-of-pipe” fixes that value technology over nature. Treatment alone as a method of water protection is insufficient. Not all contaminants can be filtered out of water. SWP may be the best method for ensuring safe drinking water. Water that is clean at its source is easier and cheaper to clean for drinking water, and it also requires fewer harmful disinfectants (Ivey *et al*. 2006a). Unfortunately, SWP is often a voluntary process, especially with regards to non-point source pollution, which is especially challenging for rural areas (Ivey *et al*. 2006b). It can also be very challenging to identify sources of ground water pollution and source waters that are not surface water, adding to the complexities of SWP (Kundell and DeMeo, 2000; de Loë and Kreutzwiser, 2005).

### 2.3 Institutional Arrangements

The absence of appropriate institutional arrangements (IAs) has been identified as a potential barrier to SWP implementation (Ivey *et al.*, 2006a). IAs refer to “the structures and processes of decision-making, and include legislation and regulations, policies and guidelines, administrative structures, economic and financial arrangements, and political structures and processes” (Ivey *et al.*, 2006b). However, following an analysis of five different case studies of integrated water resource management, Mitchell (2005) concluded that institutional arrangements could be designed to minimize cross-boundary problems with respect to implementing water management plans. For example, watershed councils are often comprised of governmental and nongovernmental stakeholders in order to collaboratively manage water across borders (Griffin, 1999). One province may have an effective SWP plan; however, if water policies vary drastically across borders, contamination may come from another upstream source, out of their jurisdiction. If an IA is in place to maintain some agreed upon standard water quality, SWP across the whole watershed can be much more successful.

Research and senior government support of SWP is widespread. For example, municipalities in the United States are required to create Water Master Plans, as part of the US Source Water Assessment Program, a 1996 amendment to the *Safe Drinking Water Act* (Kundell and DeMeo, 2000; Bender, 2005). Canadian provinces have been busy over the last decade developing water policies and plans, including SWP plans. Provincial governments are beginning to provide leadership and strategic direction on water policy. Some provincial SWP-enabling plans and policies include: British Columbia’s *Drinking Water Protection Act* (Government of British Columbia, 2001), Alberta’s *Water For Life Strategy* (Alberta Environment, 2003), Saskatchewan’s *Watershed Authority Act* (Government of Saskatchewan, 2005), Manitoba’s *Water Protection Act* (Government of Manitoba, 2005), and Ontario’s *Safe Drinking Water Act* (Ministry of the Environment, 2002). However, these policies and commitments often require adequate resources to enable tangible actions and outcomes.

Watersheds have often been adopted as the planning unit for water management, especially for integrated water resource management (O’Connor, 2002b; Timmer *et al.* 2007). However, this scale has sometimes been used without critical evaluation. For example, municipal boundaries often do not coincide with watershed boundaries, thus creating a great challenge for implementation and management, as water flows across boundaries (Timmer *et al.* 2007).

Planning along watershed boundaries is more effective if it is in response to an expressed demand for that style of management, because existing administrative divisions are more likely to lend their support (Global Water Partnership, 2000). Warner *et al.* (2008) also argue that because the decision to adopt a watershed management unit is a political decision, democratic debate is needed in order for this management style to be most successful.

Ferreira *et al.* (2008) analyzed water protection policies in Ontario from the last fifteen years and found that in most cases, watershed-scaled plans were meaningless. In contrast to the river basin management unit, they claim watersheds as management units create artificial communities and assumptions of success based on the pre-existing social, political, and institutional arrangements. As an alternative, they suggest more creative and flexible boundaries that incorporate existing social and political boundaries (Ferreira *et al.*, 2008). These social and political boundaries rarely coincide with ecological boundaries, but are much more meaningful for policy development and are more practical for implementation. This relates back to local capacity; in areas where agriculture is the prevailing industry, planning for SWP along agricultural boundaries may be more practical than simply the watershed scale. SWP plans should be tailored to the specific institutional arrangements, drainage patterns, and source of contamination for a region.

#### 2.4 Capacity Literature

Local capacity is needed to support existing institutional arrangements that facilitate SWP by municipalities (Ivey *et al.*, 2006a). For this research, local capacity refers to the ability of municipalities to create and implement SWP plans with the intent to manage water quality to effectively prevent source water contamination. This research project is concerned with evaluating the process of implementing SWP plans, and not with the resulting performance effects. “A fundamental goal of capacity building is to enhance the ability to evaluate and address the crucial questions related to policy choices and modes of implementation among development options, based on an understanding of environment potentials and limits and of needs perceived by the people of the country (or municipality) concerned” (UNCED, 1992: 37.1).

Provincial agencies and local organizations require adequate resources such as funding, training, and authority from institutional arrangements for effective implementation of SWP

plans (Ivey *et al.*, 2006b; Timmer *et al.*, 2007). Municipalities play a key role in protecting water at its source since they are responsible for land use planning, wastewater treatment, and water supply. Also, no federal source water protection legislation currently exists in Canada. Most SWP plans are legislated at the provincial level, but created and implemented at the watershed or local level.

SWP plans have not always been effectively implemented at the ground level; therefore, the current SWP literature has responded by trying to identify what factors might be constraining or facilitating implementation (Ivey *et al.*, 2006a; Timmer *et al.*, 2007; Patrick *et al.*, 2008). This literature addresses capacity of local governments to develop, agree upon, and implement a SWP plan, which in turn contribute to protecting source water. Factors constraining source water protection have been identified to include institutional barriers that reduce local capacity to properly implement source water protection plans (Carter *et al.*, 2005; Patrick *et al.*, 2008; Patrick, 2009). Some studies have attempted to over-simplify capacity building by attributing it to a single factor, such as local stewardship (Litke and Day, 1998).

Using the Oldman River basin as a case study, Ivey *et al.* (2006a) identified existing institutional arrangements as being one of the greatest constraining factors to SWP. A similar result was found in the Okanogan Valley, British Columbia; however, the political ecology and the ensuing power relationships between local water purveyors and provincial bodies were also constraining factors for SWP (Patrick *et al.*, 2008). Reduced capacity for SWP in Ontario has been associated with inadequate funding, unskilled staff, a lack of leadership, weak standards and ineffective or non-existent plans and policies (de Loë and Kreutzwiser, 2005). Smaller communities in rural areas demonstrate limited capacity to protect source water compared to larger municipalities with greater access to resources (de Loë and Kreutzwiser, 2005; Timmer *et al.*, 2007).

In order to identify and evaluate local capacity for SWP, this study will focus on technical, financial, institutional, and social factors. *Technical capacity* refers to the technical knowledge, abilities, and skills of governments and organizations. It describes the availability of data on delineation, quality, and quantity of surface and ground water sources and the ability of employees to access, interpret and use that information. It also includes the ability to identify and respond to source water contaminants.

*Institutional capacity* describes the institutional arrangements that exist that influence the actions of actors involved with SWP. These primarily define the legal authority of local and provincial actors through regulations, by-laws, policies, and plans (Timmer *et al*, 2007). Local governments should have the authority to influence land use planning and to acquire land in order to protect sensitive areas (Ivey *et al*. 2006a).

*Financial capacity* refers to the ability to access adequate funding to properly manage water supplies. Adequate funding has been cited as the most important factor for successful watershed management, and that inadequate funding greatly limits the capacity for planning (Litke and Day, 1998).

*Social or public capacity* refers to the extent to which the public is involved. Support from a wide variety of stakeholders, including citizens, landowners, government, industry, and commerce is necessary for successful watershed management (de Loë *et al*, 2002). This is achieved by raising public awareness of watershed problems and solutions through education and communication and by actively involving all stakeholders in decision-making and implementation of management plans. If stakeholders and those who live within the watershed are not involved in the planning and implementation stages, they often resist these changes (Timmer *et al*, 2007).

## 2.5 *Summary*

The SWP literature is missing critical assessment of local uptake of SWP planning and management, including actual case studies illustrating how it is practiced on the ground. There is a need to identify the relationships between and within watersheds, multiple users, stakeholders, and IAs. In Canada, the call for greater protection of water at its source came following a number of water contamination events. These events point out the weakness of the current system—over-reliance on expensive water treatment—and the need for a multi barrier approach to safe drinking water. As more and more SWP plans and policies emerge in Canada, researchers have begun to investigate what barriers to implementation exist and what can be done to mitigate those problems, although little research has identified which capacity limitations apply to the Canadian Prairies. This research will add to the growing literature on capacity building for SWP. In particular, this research will identify which capacity limitations are relevant to SWP implementation in Saskatchewan.



### 3.0 METHODS

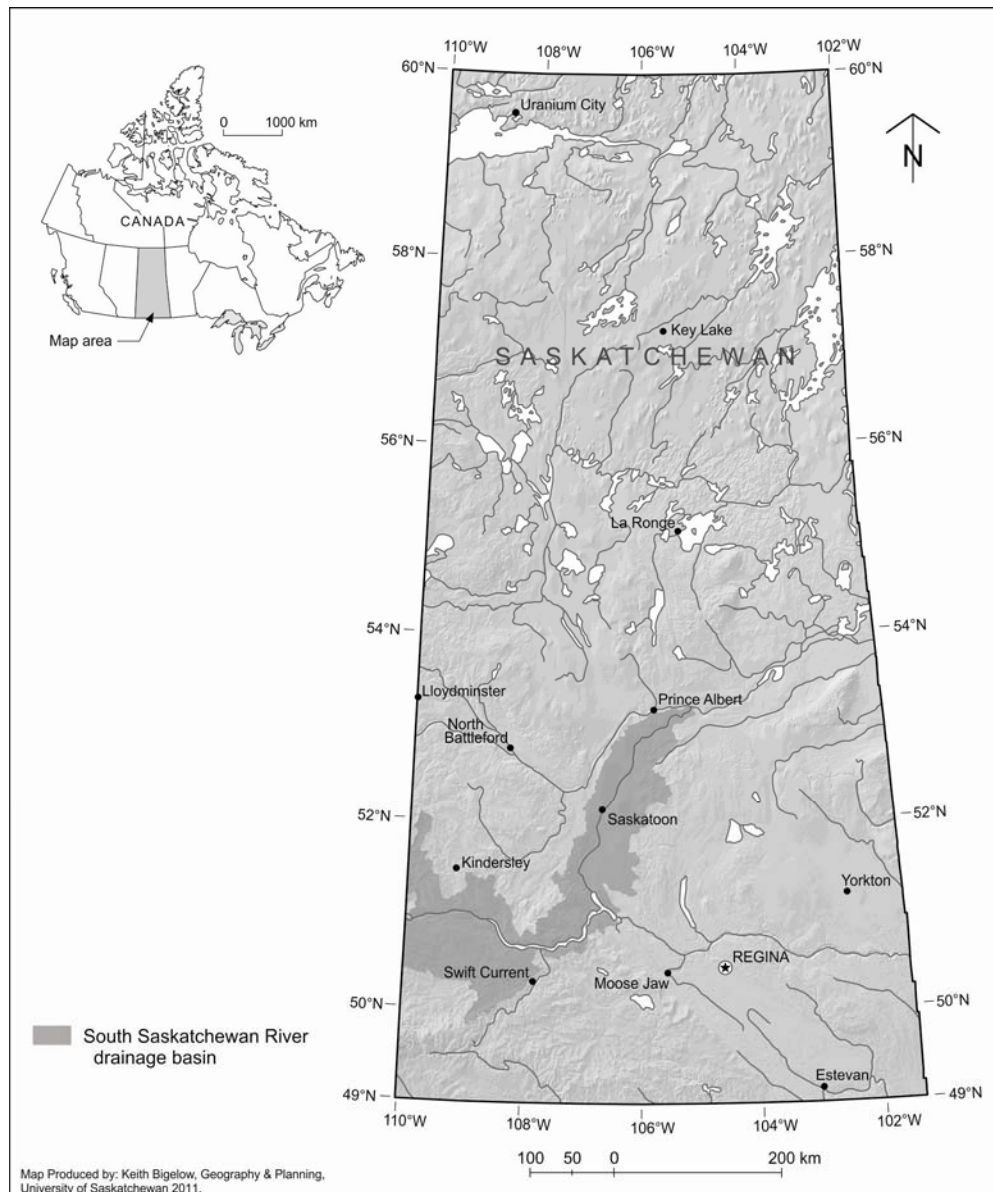
The goal of this research is to identify and analyze factors that facilitate and constrain the capacity of local communities in the South Saskatchewan Watershed to implement SWP and to identify opportunities for capacity enhancement for SWP implementation in rural Saskatchewan. The experiences and perspectives of individuals involved with source water protection were explored through region-wide interviews with twenty-five key informants. The South Saskatchewan River Basin was selected because of the opportunity to assess implementation of a four-year-old plan, the *South Saskatchewan River Watershed Source Water Protection Plan*. The study area includes the portion of the South Saskatchewan River watershed located within the Province of Saskatchewan, Canada (see Figure 3.1). It is an important study area because more than half of Saskatchewan's population depends on water from the South Saskatchewan River for their drinking water (SSRWS, 2007).

A mixed methods approach was used for data collection and analysis. The research design is primarily qualitative, but quantitative strategies are also used to help illuminate the qualitative results and to help add validity to the research (Morse, 2005). The decision to use qualitative research was chosen mainly for the nature of the research question. In order to identify factors that facilitate and constrain local capacity to implement a source water protection plan, individual experiences within social structures were examined.

Methods of data collection included semi-structured interviews and document review. Two methods of data collection were chosen so that data could converge in a triangulating manner, again adding validity to the research findings (Yin, 2003). Data was gathered for this study through interviews with employees and residents involved with, and knowledgeable in, SWP in the South Saskatchewan River Watershed. The interviewees were either employees of a municipal or provincial government or were land owners, non-governmental workers, or otherwise involved in SWP plan implementation in Saskatchewan.

A review of the capacity literature relating to source protection facilitated development of an interview guide with an ordered list of questions (see Table 3.2); however, specific questions were tailored to each individual participant's knowledge and expertise (see Appendix B for full interview guide). A Certificate of Approval for conducting key informant interviews was issued July 18, 2009 by the University of Saskatchewan research Ethics office. Interviews were

conducted in person, from June to November 2009. Documents were collected at the time of the interviews and website searches.



**Figure 3.1** Map of study area, the Saskatchewan portion of the South Saskatchewan River watershed. Source: Keith Bigelow, Geography & Planning, University of Saskatchewan 2011.

### 3.1 Semi-Structured Key-Informant Interviews

A total of twenty-five key informant semi-structured interviews were conducted in person, from June to November 2009. For a list of organizations from which interviewees were from, see Table 3.1. Interviewing was selected as a method of data collection in order to capture many different views from the participants, including their varying opinions, experiences, and meanings (Stake, 2005). A semi-structured interview format was chosen in order to gain

consistent information from the key informants, but also to allow for additional information to be gathered as it arose.

Table 3.1: Case Study Interviewees (South Saskatchewan River Watershed)

<b>GOV/ NGOV</b>	<b>Position</b>	<b>Organization</b>
GOV	Senior Agrologist	Saskatchewan Watershed Authority
GOV	Councillor; WAC member	RM of Corman Park; South Saskatchewan River SWP planning watershed advisory committee
GOV	Manager for crown lands management and watershed planning	Saskatchewan Watershed Authority
GOV	Project coordinator	Saskatchewan Watershed Authority
GOV	Agrologist, projects & partnerships division	Saskatchewan Watershed Authority
GOV	Environmental Protection Officer, Saskatoon	Ministry of the Environment
GOV	Mayor	Resort Village of Mistusinne
GOV	Policy Manager, Strategic Services Branch; Board Member	City of Saskatoon; South Saskatchewan River Watershed Stewards
GOV	Manager of Planning Coordination	
GOV	Manager of Approvals, Standards & Compliance Unit; Manager of the provincial water & wastewater program	Ministry of the Environment;
GOV	Councillor	Town of Outlook
GOV	President	Saskatchewan Watershed Authority
NGOV	Water Issues Coordinator	Saskatchewan Environmental Society
NGOV	CEO	SSRWS
NGOV	Resource planning manager	Meewasin Valley Authority
NGOV	Board president	SSRWS
NGOV	Manager	Partners FOR the SK basin
NGOV	Landscape architect & community planning	Crosby Hanna
NGOV	Board member	North Sask River Watershed Stewards; Saskatchewan Association of Watersheds
NGOV	Board member	North Sask River Watershed Stewards; Student at the University of Saskatchewan
NGOV	Watershed Coordinator	SSRWS
NGOV	Project manager	WaterWolf
NGOV	Executive director	SNOWS
NGOV	Watershed Awareness Coordinator	PCAB
NGOV	Farm stewardship advisor/ watershed awareness initiative advisor	PCAB

GOV = Government participant; NGOV = Non-government participant

Dunn (2005) recognizes flexibility and the ability for a researcher to adapt to the way an informant addresses a question as two of the strengths of semi-structured interviews and is the main reason for employing this method in this research. Each informant has a different familiarity with planning and implementing SWP plans and by following a semi-structured interview style, questions with which the participant was more familiar were explored more fully in the interview. Alternatively, topics that participants were less familiar with were given less time and attention. The interviews were based on predetermined questions, with additional questions arising from the discussion around one particular answer or altering questions as more information was revealed. This semi-structured format allowed for more freedom to fully explore each participant's own experiences (Dicicco-Bloom and Crabtree, 2006). All interviewees were assumed to have a basic working level of knowledge of SWP because the individuals were selected particularly because of their relationship to either the planning of implementing processes. For example, all interviewees were assumed to understand the meaning of source water protection.

Interviews were recorded using a digital voice recorder and transcribed verbatim into Word document text. The researcher did all transcriptions to enable an initial phase of analysis. The transcripts were analysed according to themes falling under the four areas of capacity: technical, institutional, financial, and social. Where applicable, responses were tallied to provide a quantitative comparison between the government and non-government responses. Interviews ranged from about 30-75 minutes in length, with most lasting about 45 minutes. Key informants were initially contacted by telephone and asked if they would volunteer to be interviewed as part of the research project. Prior to commencement of each interview, the researcher presented a research consent form for review and signature by the key informant.

Purposeful sampling was used to select initial interviewees based on their familiarity with water management and source water protection. Government and organization websites were used to obtain contact information of potential participants. Later participants were identified using a snowballing technique through referrals from initial participants in order to expand the list of potential key informants. The researcher observed a repetition of themes in transcripts and participant names at interviews, which suggests that sufficient interviewees had been identified (Morse, 2005).

As mentioned above, the researcher transcribed all interviews as the first step of data analysis. A naturalized transcription practice was used, which includes as much detail from the interview as possible in the transcription such as pauses, pronunciations and involuntary vocalizations. This method was chosen because the more natural the conversation in the transcription, the more the interviewee is allowed to speak for themselves, even after the interview (Oliver *et al*, 2005). Because the researcher did the interviews, transcriptions, and data analysis, there was no concern about misrepresenting the data, as the same researcher was present at each step (Oliver *et al*, 2005).

**Table 3.2.** Indicator questions used to identify facilitating or constraining capacity areas to implement source water protection.

Capacity Area	Indicator Question
Technical	<ul style="list-style-type: none"> <li>• Is there data available to delineate drinking water sources, watersheds and aquifers, and groundwater recharge areas?</li> <li>• Have potential contaminations sources and their threats to the water sources been identified?</li> </ul>
Institutional	<ul style="list-style-type: none"> <li>• Do training and educational opportunities exist for staff members involved in SWP?</li> <li>• To what extent can existing and future land use activities be controlled or managed by your organization in sensitive or vulnerable areas (municipal well fields, recharge and watershed supply areas)?</li> <li>• Do provincial legislation and policies provide adequate guidance for drinking water protection at the local level?</li> </ul>
Financial	<ul style="list-style-type: none"> <li>• Are you able to access funding for SWP projects?</li> <li>• Do water rates for customers reflect the full cost of protecting and providing municipal drinking water?</li> </ul>
Social	<ul style="list-style-type: none"> <li>• To what extent, and how, have stakeholders participated in the selection and development of SWP tools?</li> <li>• Has community awareness and support for watershed protection been developed? How has this happened?</li> <li>• Are there active relationships between municipal and provincial agencies?</li> <li>• Are there active relationships among organizations that share SWP as a common goal?</li> </ul>

Key informants were selected from a broad scope of individuals consisting of two main groups: government and non-government. Individuals from government included elected officials (rural, town, resort village), employees of the City of Saskatoon, and provincial government workers from the Ministry of Environment (MOE) as well as the Saskatchewan Watershed Authority (SWA). A number of non-government groups and organizations were also interviewed. Individuals from non-government included the South Saskatchewan River Watershed Stewards Inc. (SSRWS), Saskatchewan Environmental Society (SES), Meewasin Valley Authority, Partners FOR the Saskatchewan River Basin, Saskatchewan Association of Watersheds (SAW), North Saskatchewan River Watershed Stewards (NSRWS), WaterWolf Planning Commission, private landscape architect & community planner, Saskatchewan Network of Watersheds (SNOWS), Provincial Council of Agriculture Development and Diversification Boards (PCAB), and the MidSask Regional Economic Development Authority (REDA).

### *3.2 Document Review*

At each interview attempts were made to collect documents relating to source protection. A broad range of documents were reviewed including source water protection plans, municipal plans, state of the basin reports, notes from the technical planning committee, third-party financial incentive programs like the Canada-Saskatchewan Farm Stewardship Program Cost-Shared Incentives for Beneficial Management Practices, Saskatchewan government policy documents, The Saskatchewan Watershed Awareness Initiative, policy review documents such as the Prairie Water Directive, well field exploration data, and municipal by-laws. Document review was used to corroborate information gathered through the interview process as well as add to the technical component of this research.

### *3.3 Data Analysis*

The process of transcription allowed the researcher to revisit the interviews again, which allowed for the initial phase of analysis (Dicicco-Bloom and Crabtree, 2006; Dunn, 2005). Latent content analysis, a method of analyzing interview data by searching through the transcripts for reoccurring themes, was used for this research analysis (Dunn, 2005). The decision to use this method of analysis was to identify overall capacity areas that are either facilitating or

constraining the implementation process for SWP plans. Dicicco-Bloom and Crabtree (2006) refer to this as a 'template approach', where categories are first identified through the literature and then later applied to the data. In other words, text segments are tagged then sorted into categories in order to identify major themes.

The decision to separate the interviewees into two categories—GOV versus NGOV—was made after the interviews had been conducted. During the transcription process, this initial stage of analyse revealed a difference in responses between the two groups of interviewees. It was then decided to explore any potential differences that may exist in fuller detail by dividing the interviewees into these two categories. Other group factors (for example land ownership or level of education) that may have revealed differences in responses between groups were not explored in this study due to scope and the relatively small sample size.

In this research, all transcriptions were coded according to the four areas of capacity previously identified: technical, financial, institutional, and social. For example, any time a participant spoke about financial issues, that section of the interview was highlighted and tagged as "Financial Capacity." Then, sub-categories for each question were coded and a tally was recorded of the number of times a specific category was discussed by each participant. For example, a tally was kept for every time participants discussed data availability, as well as identifying what types of data were or were not available. For each sub-category, it was also recorded whether the participant thought that the capacity area was a facilitating or limiting factor for SWP implementation. These themes were compiled, arranged according to individual questions and by capacity areas, then were tallied and compared across participant groups (government versus non-government). Once all the themes were identified and transcripts were coded, it was possible to view all references to one capacity area, such as all references to funding in order to ascertain varying opinions or trends for that area.

Documents were reviewed primarily to corroborate interview findings and to help validate certain findings. Document review allowed for the researcher to evaluate the participants' experiences and allowed for an analysis of the respondent's understanding of an idea or a term. In some cases, for example, a participant may claim not to have access to data or training needed in order to implement SWP properly. However, that opinion may be more a result of the participant's ability to find the data rather than the actual data availability. In that example, presence or absence of data available to participants was determined through document

review. In many cases, manifest content analysis (i.e. searching a document for the presence or absence of certain terms) was used to achieve this goal (Dunn, 2005). For example, the researcher searched for the term “groundwater” in a number of the documents listed above to determine whether groundwater information was present in that document and to what extent was that information useful for SWP in that area.



## 4.0 RESULTS

This chapter is organized in five sections; the first four sections report the results for each of the capacity areas identified above. Individual research questions are explored for each capacity area and results are further explained and corroborated using quotations from the interview transcriptions. The final section provides a synthesis of the capacity areas in greatest need, as identified by the participants. Interviewees who claimed to have insufficient knowledge on a particular question were omitted from analysis; therefore, the number of respondents for each question may vary.

Interviewees were given the opportunity to talk about different ways in which they practice source water protection. This showed their level of understanding of what they believe source water protection to be as well as what they are doing to implement it. All of the respondents exhibited some knowledge of source water protection and provided practical examples of how they were practicing source water protection. Some of the current efforts mentioned include well-decommissioning, workshops and conferences promoting SWP, municipal bylaws preventing development on sensitive land, best management practices on farms and agri-environmental group plans, new lagoons for municipalities, educational material such as the Water Watchdog school program, Click on Climate, and Roofer's Amazing Journey, just to name a few. The responses from key informants indicated that they possess the appropriate knowledge on how to protect source waters, yet they also stated that they were unable to protect source waters in certain instances. When probed about this situation certain areas of capacity limitation were identified. These limiting capacity areas are explored further in this chapter.

### *4.1 Technical Capacity*

Technical capacity can be defined as the physical and operational ability of an organization to perform SWP adequately. In other words, it describes whether there is sufficient data available and accessible and whether qualified, skilled, and dedicated staff is available, or training opportunities exist to have the ability to carry out SWP. Three questions were asked and analysed relating directly to technical capacity to support SWP implementation. These questions address data availability for watershed mapping, identification of water contamination sources,

and training and educational opportunities (see Appendix B for list of interview questions). Many of the interviewees did not know whether they had access to personnel with water management expertise and so those results are incomplete and the question is not reported in this section. The results of the first three questions are reported in Table 4.1 below.

Table 4.1 Technical Capacity Results

<b>Technical capacity</b>	<b>GOV</b>	<b>NGOV</b>
Data on water sources, aquifers, and groundwater recharge zones is accessible.	89%	27%
Information on contamination sources is available.	75%	12.5%
Training opportunities are available	91%	50%

GOV = government; NGOV = non-government

#### 4.1.1 Data Availability

More government respondents said that they had access to data needed for implementing SWP than did the NGOV group (89% versus 27%). It should be noted that the researcher was interested in whether the participants were aware of or had access to data, such as water or contamination sources. This question was not intended to determine whether that data exists, which is objective—it either does or does not exist—but rather, identified the perceived availability of information to the individual being interviewed.

When asked if the respondents had access to data that delineates drinking water sources, watersheds and aquifers, and groundwater recharge areas, only three of 11 non-government respondents stated that information is available compared to 8 out of 9 government employees. Most of the government employees who said that information for SWP was available also clarified that information on groundwater was limited or lacking. Many of the non-government group also pointed out groundwater information as being limited, but several also focused on other data limitations such as water quality and baseline information. Others noted that they did not know what information was available or where to look for the information.

The provincial government is responsible for much of the water quality and water licensing in the province and as a result, they are often the body collecting data and information on water. Therefore, it is logical that more government respondents claimed to have access to information, perhaps simply because they are part of the information gathering process and are

aware that it exists. Some NGOV respondents seemed to indicate that they would not even know where to look to find certain data sets.

The overall sentiment among respondents was that more data collection could always help for better SWP implementation, but that other capacity areas including staff time, funding, or a lack of training restricted the ability to collect more information. The Government of Saskatchewan is currently in the process of conducting a four-year water availability study aimed at filling possible data gaps and adding to current knowledge around water availability.

When asked specifically about data regarding contamination sources, six of eight government employees said that data was available, compared to only one of eight non-government respondents. GOV respondents pointed out that contamination risks were identified as part of the SWP planning process and therefore information is available to anyone who has access to the plan. Many participants also specified that many point sources such as intensive livestock operations or urban wastewater effluent are known and monitored, but that non-point sources are very difficult if not impossible to track accurately.

Some of the water monitoring and assessment programs that SWA currently operates include: the Rural Water Quality Advisory Program, which is a service to assess samples from private water supplies and provide advice to improve the water source if relevant; the Erosion Control Assistance Program which encourages monitoring and remediation of sites prone to erosion; and biological assessments which evaluate piping plover habitat, the effect of increasing salinity on lake ecosystems, and the effects of total dissolved solids on fish and fish habitat (SWA, 2011a). The SWA has also taken on a few more in-depth water quality monitoring programs such as the *Water Quality and Usage Survey for the Village of Hepburn, Saskatchewan: A Risk Assessment* (SWA, 2009) and the *Water Quality and Usage Survey for the District of Katepwa, Saskatchewan: A Risk Assessment* (SWA, 2010b) and continue to maintain a number of hydrological monitoring stations in partnership with Environment Canada and several ground water observation wells to an on-going record of aquifer water levels (SWA, 2010a). The Saskatchewan Watershed Authority also requires some industrial and municipal users to record and report their water use each month; however this information, especially for industrial water use is limited. The Saskatchewan Ministry of Environment has a surface water-monitoring program that samples bacteria, pesticides, and metals along the South Saskatchewan River.

Despite these efforts for gathering water information, many groups have identified gaps in the information currently available. A representative from the SSRWS expresses: “there is a lack of strategic design in the water quality monitoring programs in our province. Gaps exist in the number of monitoring stations, the frequency at which sampling takes place, and in where those monitoring stations are located” (SSWRS, 2011).

Some of the respondents pointed to a lack of information sharing as the reason for not having access to data, rather than the data not actually existing. In many cases, information on a water source, or contamination source, or other relevant data might have once been collected, but over time the data was either lost due to inefficient organization systems or it was proprietary to only one group and so not widely available. This lack of sharing of information came up more than once between both groups, as did the costs of obtaining certain types of information, such as GIS shape files, which can sometimes be prohibitive. This quote from a NGO participant gives a sense of the lack of data sharing: “you push them (the provincial government) and they say, well we do have something somewhere, but they couldn't give us any data.” Another says this: “In Canada, we've got this attitude that everybody who wants to do GIS work has to pay for data and pay, pay, pay, pay. It's a pay system.”

There are some avenues available for sharing and accessing information. For example, the Government of Saskatchewan developed an informational website called SaskH2O in 2008 to provide water information to residents across the province (SaskH2O, 2008). The University of Saskatchewan is also working on a number of different water research projects, which will hopefully add to this knowledge gap. Some of the programs include THREATS—The Healthy Rivers Ecosystem Assessment System—and the Global Institute for Water Security.

A number of respondents stated that the necessary data simply does not exist. “I think there's an assumption in public that we have all this data in some computer somewhere and we can just flip a switch” says one government respondent. For example, a consistent comment among most respondents was that groundwater and aquifer mapping in the province is insufficient and incomplete.

A municipal planner interviewed also pointed out that planners do not have any maps pointing out sensitive areas or groundwater recharge areas. As a result, municipal planners do not address SWP planning in the same way that they do in other areas of planning, such as zoning and land use. If certain developments are more or less of a risk to source water quality based on

location, those areas must be identified and made available for planners and land owners—the ones who are deciding how land is managed, because land use management is intricately related to water quality management. The planner interviewed said that if we want to encourage land use planning that positively affects SWP, then the planners need the geographical information on what areas are most sensitive to development. He states that currently, planners do not have access to that information. As a result of this lack of information, some of the NGOV participants said that they did not trust the information out there because it was "sketchy" and others noted, "some councillors make anecdotal decision because they do not have access to good data."

#### 4.1.2 Training & Educational Opportunities

Government respondents claimed to have more access to training to help with SWP implementation than their non-government counterparts. Ten of eleven of the GOV respondents said that they had access to training or educational opportunities to learn more about SWP including conferences and workshops, compared to only half (5 out of 10) of the NGOV respondents. This difference between the two groups may be due to a lack of funding or other resources such as staff time, which can be common in non-governmental organizations. Training opportunities mentioned by interviewees include professional development courses, participating in committees that work on SWP, collaboration with academic institutions, and attending workshops, conferences, and seminars offered by the American Water Works Association (AWWA), Prairie Conservation Action Plan, Canadian Water Resources Association, Saskatchewan Water and Wastewater Association (SSWA), Saskatchewan Association of Watersheds (SAW) and SWA.

The one GOV respondent who claimed to not have access to these opportunities came from a very small resort village and so the claim may be a result of lack of communication rather than a lack of opportunity. One NGOV respondent said that formal training did not exist: "No, I'd say there's not a lot of training opportunities, instead it's kind of an after-the-fact, professional development, learn as you go, learn from others, who can you replicate, whose examples do you want to avoid." This sentiment was quite common, especially among the non-governmental organizations and organizations who had a large reliance on volunteer work such as the watershed advisory committee, whose board of directors are all volunteers. Others felt that

they did not necessarily have training for SWP specifically but more that "the training we have had...it's more about here's what some of the resources are and here are some of the go-to places to get it and here's some of the things you should get."

There was also a strong sentiment that training was not needed in terms of technical skills, but that rather, in organizational and management training. Many of the organizations working with water were relatively new and suggested that they could use help building their organizational structure and with human resources and management. This interviewee explains: "we don't need it (training) in the aspect of technical skills, we probably need it in more human resources and management."

Overall, the results indicate that there was a need for more training for those tasked with implementing the SWP plan, in particular among the NGOV interviewees. More organizational training, more technical expertise to gather baseline data, and more training on how to effectively communicate a message to many people were all mentioned as skills that participants would value but did not currently possess.

#### *4.2 Institutional Capacity*

Institutional capacity refers to the policies, regulations, legislation, protocols, and the delineation of responsibility to provide safe drinking water protection. In this subsection, two questions were asked, each relating to institutional capacity. These questions address the extent to which interviewees or their organizations could control existing and future land use activities in sensitive or vulnerable areas, as well as whether the participants thought provincial legislation and policies provide adequate guidelines for providing safe drinking water protection at the local level. The results from these questions are shown in the following table (Table 4.2).

Table 4.2 Institutional Capacity Results

<b>Institutional capacity</b>	<b>GOV</b>	<b>NGOV</b>
They have control over land use activities in sensitive or vulnerable areas.	45%	33%
Provincial legislation and policies provide adequate guidance for drinking water protection at the local level.	82%	20%

GOV = government; NGOV = non-government

#### 4.2.1 Land Use

Even though most participants from both groups responded that they did not have control over land use activities on sensitive or vulnerable land areas, the majority of all respondents said that they did not see that as necessary for their role in SWP. If those interviewed currently do not have authority to influence land use, they said that they do not want that power nor do they see it as their responsibility. Most of the respondents viewed land management as a duty that was up to individual landowners and municipalities to decide. They would rather educate and inform land owners about how to improve their land use practices and then help them to make the necessary steps to adopt those better land use management practices.

It was clear among all the respondents that they did not want to force land owners to manage their land a particular way, and equally, land owners wanted the freedom to decide how to best manage their own land. SWA employees especially stressed that the "government can't just strong-arm" landowners into certain land practices. This SWA agrologist explains: "I would like to say that there is no control, that it's up to the land owner himself to, or herself to manage that land as they see fit. So the biggest role we can play is to try and provide that information so that they can manage to improve or maintain the health of their surrounding land."

The only people who were interviewed as a part of this research who had control of land use were individual land owners, municipalities (an RM or a city could limit future development within their municipality, for example), Meewasin Valley Authority (they have authority over all new developments in the river valley within the jurisdictional boundaries of the City of Saskatoon and Warman Park RM), and WaterWolf. WaterWolf is a joint planning commission of several municipalities south of Saskatoon, toward Outlook. Its goal is to create a Master Plan for the area, encouraging sustainable development in the area such as limiting development in sensitive areas. Municipalities wanted to combine their development goals in order to ensure safe drinking water for the entire area.

#### 4.2.2 Legislation

Based on the results of this research, the control of land use was consistently viewed as a right of the individual land owner and not a responsibility of the government; however, participants' views on legislation seemed to be contradictory, because many also thought that

water legislation should be more strict and more rigorously enforced. When asked whether provincial legislation and policies provided adequate guidance for drinking water protection at the local level, there was a clear divide between the GOV respondents and the NGOV group. 82% of the GOV participants thought that policies and legislation were adequate, whereas only 20 percent of the NGOV responded that they thought the current legislation was enough to ensure safe drinking water.

When asked if the current regulations were adequate to maintain clean source water, an NGOV participant said: "Not at all. (It's) not enough. The regulatory framework is a bare minimum approach." Some participants mentioned that they did not like the current method of enforcement of water regulations, which is a complaint-based system. For example, a SWA agrologist stated that: "It's if they (landowner) have a complaint, they (SWA employees) have to follow up, they can't just say: don't worry about it. And another thing is if they (SWA employees) see something themselves that they don't think is right, until they get a complaint, they can't act on it." A PCAB employee stated the following in relation to enforcement of regulation:

The province really lacked in the ability to stand up. They feared that it was going to scare development off. There's lots that I, that us as a province, we're falling really short, really short on...just regulation, just absolute, specific requirements and regulating it. I don't get why we can't just require some of the most basic requirements: minimal disturbance, you know, non-stripping type methods that I said, that are quite acceptable. They're not out there, they're not going to halt development, they're not going to scare development away.

Municipalities are responsible for meeting provincial standards for wastewater and SWP through wastewater effluent. Accordingly, most of the municipal officials interviewed said they thought that there were high standards for wastewater effluent and that they are doing a good job of protecting water, as expressed by a town councillor: "Yes and we're very conscientious about making sure that all of the regulations are followed very carefully." A manager for the Ministry of Environment pointed out that the Canadian Council of Ministers of the Environment (CCME) recently created a Canada-wide strategy on wastewater effluent, which included stricter standards; however, he also stated that CCME has no jurisdiction in provincial or federal government.



The Saskatchewan Watershed Authority is the primary provincial government department responsible for water allocation and licenses in Saskatchewan. There is no limit set as a maximum eligible quantity that an individual or organization can apply for, so licenses could be for very large quantities. There is also not an established priority use system for water licences, so all water license applications are treated equally. Water allocation and water quantity in general was not mentioned as a concern among those interviewed for this research. This was surprising because essential services do not get priority for water use and there is no limit as to how much water can be requested.

#### 4.3 Financial Capacity

Financial capacity is the ability to acquire adequate funds to pay for the operation and maintenance of SWP processes. Two questions were asked relating directly to financial capacity to support SWP implementation. These questions address access to funding sources for SWP projects and whether the interviewees thought that water rates where they live reflect the full cost of protecting and providing safe drinking water. Results from these questions are found in Table 4.3.

Table 4.3 Financial Capacity Results

<b>Financial capacity area need</b>	<b>GOV</b>	<b>NGOV</b>
Participant <i>is</i> able to access funding for SWP projects.	90%	91%
Municipal water rates do not reflect full cost of protecting and providing safe drinking water	83%	100%

GOV = government; NGOV = non-government

The majority of people interviewed said that they had access to funding for SWP projects (9 out of 10 GOV participants and 10 out of 11 NGOV people interviewed). People from the provincial government departments said that they had a budget for SWP projects, while most of the representatives from municipalities did not have part of their budgets dedicated to SWP initiatives. Only two of the NGOV participants said that they dedicated budget money specifically for SWP; however the others said that it was indirectly funded through their overall water initiatives, such as water awareness campaigns, which would be considered SWP.

Although most of the organizations interviewed said that they had access to funding for SWP, it should be noted that many of these same groups were unsure of how long that funding would last since it was usually only confirmed annually. Many participants from non-

governmental agencies expressed their concern of not being able to rely on the funding for SWP year-to-year because of annual budget cycles. In relation to funding permanency, one participant was concerned about government restructuring, which might result in cancelling SWP funding programs.

SWA's annual contribution to each watershed association, such as the SSRWS, is \$92,500 each year (Government of Saskatchewan, 2011). Additional funding for the watershed advisory committees comes from their individual member fees. The SSRWS charge their members, which are predominantly municipalities, based on population size. Municipalities pay between \$100-1,000 depending on the size of the community. The City of Saskatoon is an exception, paying \$20,000 to the SSRWS for a membership fee (SSWRS, 2011). This amount does not leave a lot of extra money for project funding once full-time staff salaries have been paid.

There was concern among some of the NGOV participants interviewed about spending a significant amount of staff time applying for additional funding opportunities. "You spend so much of your time chasing after dollars and then doing the reporting on the dollars, that you don't have a lot of time to actually use the dollars and get things done." A lot of SWP funding currently goes toward supporting projects or infrastructure, rather than staff time. For example, farmers who undergo an environmental farm plan for their farm can then apply for funding to share costs for best management practices (BMPs) that they implement through the Canada-Saskatchewan Farm Stewardship Program.

Most respondents from both groups (10 out of 12 of the GOV participants and 13 out of 13 of the NGOV participants) thought that municipal water rates where they live do not reflect the full cost of protecting and providing safe drinking water. When asked to identify a capacity area that is limiting their effort to effectively implement the SWP plan, 34% of GOV and 21% of NGOV respondents identified financial capacity as one of the most limiting factors for their efforts to implement SWP plans. These results imply a need for greater funding opportunities and in particular, more long-term, consistent funding.

#### *4.4 Social capacity*

Social capacity can be thought of as the people-oriented capacity: public awareness, stakeholder involvement, leadership, partnerships, and communication. Four questions were

asked relating to social capacity needs. These questions addressed stakeholder participation in the planning and implementation stages, community awareness of SWP, and what types of relationships existed both vertically across different governmental levels and horizontally among different organizations involved with SWP.

Overall, the interviewees identified social capacity as an area needing more work, including increased networking opportunities to share resources and information, greater stakeholder involvement, and more community awareness about SWP and what community members can do to help. Table 4.4 below describes the results from the questions asked that address social capacity.

Table 4.4 Social Capacity Results

<b>Social capacity</b>	<b>GOV</b>	<b>NGOV</b>
Greater stakeholder involvement needed	18%	64%
Increased community awareness needed	54%	58%
More vertical linkages needed (connections across different levels of government and different organizations)	0%	36%
More horizontal linkages needed (connections across similar organizations and government departments at the same level)	36%	36%

GOV = government; NGOV = non-government

#### 4.4.1 Stakeholder Involvement

There was a difference of opinion between the two groups interviewed in terms of whether there has been sufficient stakeholder involvement in the SWP planning and implementation processes. Only 18% of the GOV group thought that greater stakeholder involvement was needed, as compared to 64% of the NGOV group. Most GOV respondents agreed that there was a lot of stakeholder involvement in SWP planning and implementation, that the whole process was 'stakeholder-driven' and stakeholders came from a diverse background: municipalities, technical committee members, farmers, ranchers, etc. Whereas roughly two thirds of the non-government respondents thought that there was not enough diversity among those involved in the planning process or that too few people were involved. They also felt that there was not as much involvement post-plan (implementation stage) and that stakeholders did not always understand the planning process or why they were invited to participate. This discrepancy in results between the two groups could be a potential barrier to capacity building; if GOV think

that there is enough stakeholder involvement already, they may not see the need to increase stakeholder involvement that the NGOV group sees.

The level of stakeholder involvement in SWP planning and implementation was reported high according to the GOV respondents. The minimal doubt is likely an anomaly from one municipal mayor that felt her concerns were not taken seriously or listened to: "they (the South SK watershed SWP planning committee and SWA) weren't really interested in hearing our ideas or in really sharing what was going on. They obviously had an agenda and having the annual general meeting was just a formality they had to go through."

The NGOV participants who thought that greater stakeholder involvement was needed usually explained this because they did not feel that their voices were heard, they did not think that enough groups were represented at the planning stage, or that involvement from different groups dropped significantly after the SWP plan was published. However, one NGOV coordinator said that she was very impressed that all the WAC members were able to contribute to the list of possible threats to water sources and to then prioritize those threats and that they were not simply given a list to work with—they created the list.

One watershed advisory committee member voiced his suspicion about how the SWP planning committees were first formed: "when it's government pushing an organization, you were sort of suspicious so, you go to these planning meetings, and not knowing what it's going to be about and you have somebody from government trying to push the agenda." This same individual liked that SWA turned over the control of implementing to local officials though: "when we actually took control, people felt more comfortable that it was a local person that was leading it instead of government. Government had a hard time letting go, because I'm sure that wasn't part of their agenda." However, other NGOV participants wanted more support from SWA for implementation as this WAC committee member comments on SWA's involvement in SWP: "we're done the planning stages and now you're into implementation stage and you're on your own type of thing." PCAB employees have heard the same sentiment from many farmers: "'it just seems they developed a plan and dropped it on our lap. What are we supposed to *do* with it?" This concern about poor post-plan involvement by government departments is expressed by this NGOV participant's disappointment:

SWA, they led this process, they said this is your plan, and then they kind of, like are trying to get, (laughs) I'm going to get shot for saying this, they're trying to just take the fault off themselves. They're trying to take the responsibility and pass it on.

Here's this plan. You know, like you've developed this plan, here you go! Well, ok, but you're the body that's in charge of water, so great, I'm glad you're wanting people to take charge of themselves, but now: hey, we've got all the SWP plans, we're what, not going to fund them, not going to help them meet their goals, anything that they've asked the SWA to do in their plans is not getting done or is getting done at like way on the bottom of the SWA's list...government, get off your butt and do what you're saying you're going to do.

#### 4.4.2 Community Awareness

Roughly half of both groups (54% of GOV and 58% of NGOV) interviewed thought that increased community awareness of SWP initiatives was necessary for successful SWP implementation. These participants thought that although community awareness is increasing, greater education is still needed. The SSRWS is tasked with implementing, and arguably promoting, the SWP plan principles and actions to residents and businesses within the South Saskatchewan watershed. According to their website, three of the six goals of the SSRWS involve raising awareness watershed stewardship or building an appreciation for protecting the water supply (SSRWS, 2011). In an effort to raise awareness within the watershed, the SSRWS hosts a number of different field days and attends tradeshow and workshops relating to water management. They have hosted a watershed stewardship multimedia competition for high school students to raise awareness about SWP (SSRWS, 2011).

In the interview, SSWRS claimed that they are not as effective in awareness building as they could be because funders place a higher priority on projects than on awareness initiatives: "what I find a little bit frustrating is that we, as such a new organization, we need to put energy and funds into our communications strategy but we're very much being pushed (by SWA) to implement projects immediately, without establishing a presence or anything." A number of other water groups also contribute to raising awareness about SWP, including SWA, SNOWS, individual municipalities, PCAB, and others. Some organizations that are not necessarily mandated to promote SWP have still done a lot of work on raising awareness on the importance of protecting our water sources; one such group is Duck Unlimited Canada, for example.

PCAB has a staff position called the watershed awareness advisor. These watershed awareness advisors raise general awareness about what a watershed *is* and what producers can do on their land to help protect their water source. The PCAB employees interviewed for this research also said that they thought that general awareness has been developed—specifically that

producers are aware what a riparian area is, where it is on their land, and the value of protecting that area in order to maintain water health. According to the PCAB employees, this awareness about riparian areas did not exist even six years ago. However, SSRWS directly contradicted this sentiment when interviewed, saying that most residents within the watershed do not know what the term watershed means. That interviewees also thought that the public does not think that water quality or quantity are threatened in Saskatchewan and as a result do not see the importance of taking extra measures to protect their water source.

#### 4.4.3 Networking – Horizontal Linkages

Networking opportunities and relationships between organizations working towards SWP were analysed in two ways: those relationships that exist across different levels of government, for example municipal governments working with different provincial departments of government (known as vertical linkages); and the cooperation of similar organizations, such as many municipalities sharing information or different environmental organizations working together (known as horizontal linkages), the results of which will be shown here. The majority of those interviewed, from both groups (seven out of eleven of both the GOV respondents and the NGO group), thought that there was communication and cooperation between groups with similar goals and organizational structure (horizontal linkages). A lot of the programs that exist to explicitly bring different groups together were mentioned as effective tools for bridging gaps. For example, producer cooperation was given as an example by a number of different interviewees, in particular through the agri-environmental group plans (AEGP). Town mayors pointed to regional municipality committees. Several of the individuals interviewed were members of the Watershed Advisory Committee (WAC) that formed to create the original SWP plan, and they pointed to this WAC group as a useful way to get to know others committed to protecting source water and building those networks. One respondent named SAW as a group that helps avoid duplication between groups because they speak for all the WACs across the province. WaterWolf is a planning commission made up of several municipalities and is a good example of a strong horizontal link between those municipalities involved.

The high number of GOV interviewees who indicated effective horizontal linkages could point to a well-established communication system between governmental departments. The government departments are aware of the mandates and directives of other governmental

departments, which facilitates cooperation. Interestingly, there was a difference between the reported sentiment of government employees and the perception from those outside the government; a few NGOV interviewees responded that they perceived the horizontal linkages between provincial governments to be ineffective and that government departments act as individual silos.

Of the individuals who thought that cooperation was currently ineffective on SWP efforts, they mentioned the need for more funding and the competitive nature of grants and financial opportunities as one of the reasons that some groups, in particular smaller municipalities and non-governmental organizations would not want to work together and share resources. This SWA employee observes, "I see some real inconsistencies and I see a lot of organizations out there trying to do similar things...it's a bit of scramble for funding." There might also be some cases where there is a lack of partnership or a relationship is unreported simply because there is a lack of awareness of the different groups that exist and that *could* be a potential ally. The water issues coordinator for the Saskatchewan Environmental Society says, "a real disconnect between...all levels, even between NGOs, you know, one NGO will go and do some work, and then some other groups will be doing the same work or similar work and you know they would have been doing it for a year and you'll say to them, oh have you talked to so and so at this group? And they're like no. And I'm like, ya, you should 'cause they could tell you all about it, really. I think that's a common problem across the country."

Other reasons mentioned for a lack of cooperation between groups included that Saskatchewan is just too spread out to facilitate cooperation on some of these issues and to share resources. Also it was mentioned that a mentality shift is needed to overcome capacity barriers. This mentality of "us versus them" is explained here: "we're still very much *me* focuses instead of *us* focussed. Until we can get to the *us* side, I think we're going to continue to struggle with this agenda (SWP)" (emphasis added).

#### 4.4.4 Networking – Vertical Linkages

All government respondents thought that there was good cross-communication across different levels of government and between the different groups involved with SWP and that those relationships were useful for SWP. A few NGOV participants (4 out of 11) were less content about their relationships with other levels of organizations or other levels of government

when it came to working on water issues. Those four identified the following reasons for a lack of vertical connections: RMs want to be too autonomous, data is not being shared, or that NGO respondents have lost their contact with SWA because a government liaison staff was laid off.

This lack of vertical linkages was also explained by an apparent distrust of authority positions held by some of the individuals or organizations interviewed. Even among some of the NGO respondents who answered yes to that question (that vertical linkages do exist), expressed this distrust of others, leading to a lack of partnerships. Some individuals expressed a distrust of the motives of scientist: “that's one of the reasons why I got involved is because I, we have a significant ranching company that our family owns and I began to question some of these so-called scientists who have blamed one sector of society over another and I'm not into that. I don't believe in doing that.” Other individuals expressed a distrust of government, presumably provincial government: “when we actually took control, people felt more comfortable that it was a local person that was leading it instead of government...pushing their agenda.”

Similar to the horizontal linkages that exist between organizations, many of the people interviewed referred to some of the existing groups that bring together different groups at different levels, such as the SSRWS Watershed Advisory Committee and the technical advisory committee for that group as well, which helped form vertical linkages. The SWP planning process aimed to include a variety of stakeholders and as a result, a variety of groups made connections at that stage of the SWP plan process and this was pointed out by a number of respondents. However, a number of others mentioned that there was little effort to keep those connections active, now that the SWP plan was published. Other groups like SAW, SNOWS, SUMA, and SARM, were also mentioned as agencies that acted as a vehicle for connections for different levels of organization.

The provincial government, led by the Ministry of Environment, is currently working on creating a new comprehensive water management strategy, which will redefine each government department's role for water management in the province. This is in its preliminary stages of consultation with stakeholders, but will likely act as a useful tool for bringing together different organizations who work on water and will hopefully aim to build those connections further. In general, more than half of all those interviewed thought that both horizontal and vertical connections existed between different organizations and government departments working on implementing SWP.



#### 4.5 Limiting and facilitating capacity areas

Following a series of indicator questions designed at addressing specific areas of capacity, three additional questions were asked of the participants to get their overall sense of capacity needs for SWP. These questions asked the interviewee to identify the greatest facilitating and limiting capacity area, what resources were lacking in order to implement SWP, and if they thought change was necessary to bring about SWP in Saskatchewan. Participants could list more than one limiting or facilitating capacity area.

##### 4.5.1 Facilitating capacity areas

Table 4.5 Capacity areas that facilitate SWP implementation, as identified by participants.

<b>Capacity area identified as facilitating</b>	<b>GOV</b>	<b>NGOV</b>
Technical Capacity	3/12 = 25%	1/13 = 8%
Institutional Capacity	5/12 = 42%	1/13 = 8%
Financial Capacity	1/12 = 8%	2/13 = 17%
Social Capacity	3/12 = 25%	0/13 = 0%
No capacity area is facilitating	4/12 = 33%	9/13 = 69%

GOV = government; NGOV = non-government

Five out of 12 GOV participants thought that institutional capacity needs were met and that it was a facilitating factor. Technical and social capacity were said to be facilitating by three GOV people each and one thought that current funding capacity facilitates SWP implementation (see Table 4.5). This supports the responses where GOV participants were asked to identify limiting factors in which the most capacity areas were listed in the inverse order (i.e. institutional capacity was most often labelled as limiting and financial and social capacities were listed least frequently as limiting capacity areas).

Alternatively, the majority of the NGOV participants (9 out of 13) did not identify any capacity areas that they consider facilitate their efforts for SWP implementation, or in other words they did not think any capacity areas fully meet their needs. Two NGOV participants said that they were happy with the amount of money they had access to and so financial capacity was a facilitating factor for them. One person considered institutional capacity to be facilitating (good legal framework for SWP) and another identified technical capacity (the ability to access data if needed). The low number of interview respondents who answered this question supports

the other finding from the overall responses averaged from all of the questions asked—the NGOV group interviewed were far more likely to think that capacity needs were not being met in each of the questions addressing individual capacity needs than GOV respondents were.

These results were averaged and displayed as a pie chart below to give a visual representation of how many participants identified particular capacity needs as facilitating their efforts to protect source water (Figure 4.1).

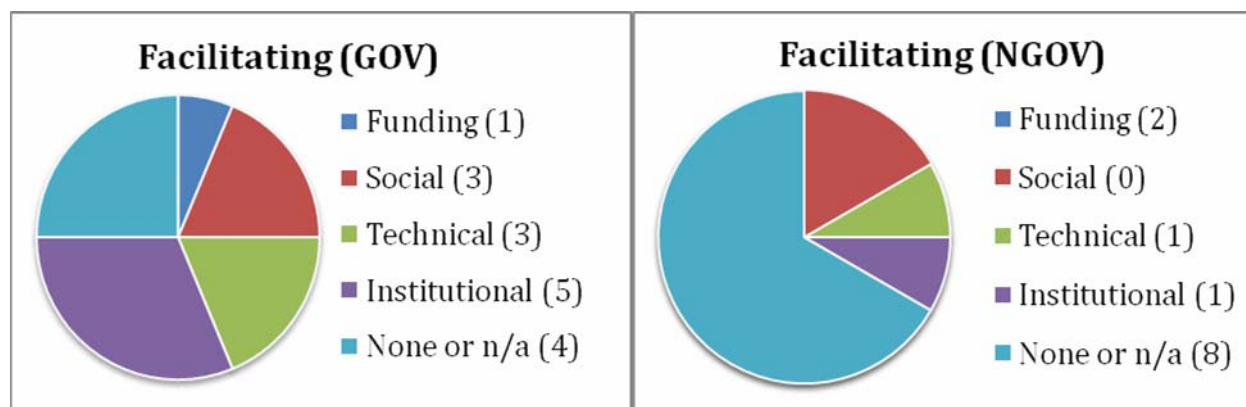


Figure 4.1 Facilitating capacity areas for implementing SWP, with number of respondents

#### 4.5.2 Limiting capacity areas

Both groups listed more limitations to implementing SWP plans than facilitating factors. According to the government participants, funding and social capacity were both the most limiting areas for SWP (with eight responses each). Technical capacity (five responses) was the third most limiting area and only two GOV participants thought institutional capacity was the most limiting capacity area (Table 4.6). Some of the main comments from this group included a need for more: money, education & awareness, participation, networking & communication.

Table 4.6 Capacity needs assessment identified by participants.

Capacity area identified as limiting	GOV	NGOV
Technical Capacity	5/12 = 42%	13/13 = 100%
Institutional Capacity	2/12 = 17%	6/13 = 46%
Financial Capacity	8/12 = 67%	6/13 = 46%
Social Capacity	8/12 = 67%	3/13 = 23%

Alternatively, 13 NGOV participants claimed that technical capacity was the greatest limiting factor. Six participants also thought that both funding and institutional capacity were

limiting and only 3 people said that social capacity needed improvement (Table 4.6). Some of the main comments from those interviewed from the NGOV category included a need for more: staff, leadership, info/data, and equipment to collect data, more relationship building, and better organizational structure. Money was usually only mentioned in reference to meeting a need from one of the other capacity areas. They also mentioned low turnout to the planning sessions, conflicting interests for land use, weak legislation, and poor provincial government involvement.

Similar to the previous section, these results were averaged and are displayed as a pie chart below to give a visual representation of which capacity areas were more commonly listed as limiting their efforts to implement SWP plans (see Figure 4.2).

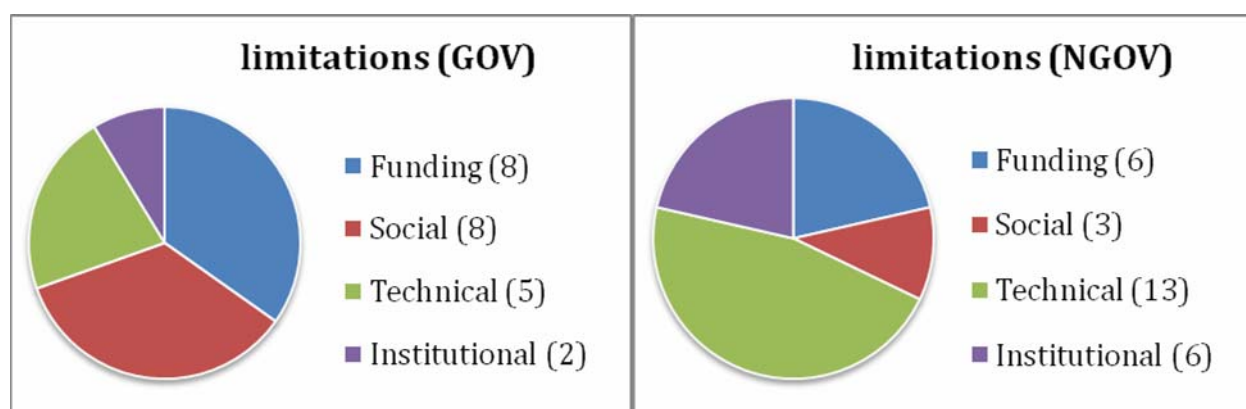


Figure 4.2 Limiting capacity areas for implementing SWP, with number of respondents. Based on results from Table 4.6.

The researcher also calculated limiting capacity areas by averaging the results from all the indicator questions from each capacity area. The results of those calculations are below (Table 4.7). These averages establish whether each capacity need is being met based on a number of questions. They are not explicitly chosen by the participant, but rather determined by the researcher based on the overall interview.

Table 4.7 Capacity needs calculated from the average of the indicator questions

Capacity area for which needs are <i>not</i> currently being met	GOV	NGOV
Technical Capacity	15%	70%
Institutional Capacity	36.5%	73.5%
Financial Capacity	46.5%	44.5%
Social Capacity	27%	48.5%

GOV = government; NGOV = non-government

The two respondent groups had different responses to the capacity questions asked: in each capacity area, over half of the GOV respondents thought that their capacity needs for SWP were being met; whereas, on average, fewer than half of the NGOV participants indicated that their needs were being fulfilled. The capacity areas that the NGOV respondents identified to be in greatest need of improvement were technical and institutional capacity needs. These results will be discussed further in the following chapter.

This method allows the researcher to identify the capacity area needs from an average of many other questions, whereas Table 4.6 displays the results from participants identifying their greatest capacity needs. By comparing these averages to the limiting capacity areas listed in Table 4.6, some slight differences are observed. The combined averages of GOV respondents who thought capacity needs were not being met in technical, social, institutional, and financial capacity areas were 15%, 25.5%, 36.5%, and 46.5% respectively. In other words, based on the indicator questions, GOV respondents identified financial capacity as the most limiting capacity area for implementing SWP plans, followed by institutional capacity and finally a tie between technical and social capacities. Averaging the NGOV groups responses from the indicator questions gave the following results: technical capacity 70%, institutional capacity 73.5%, financial capacity 44.5%, and social capacity 52%.

The results are displayed in pie charts below (Figure 4.3) for a visual comparison of the two methods of acquiring limiting capacity areas (when compared to Figure 4.2).

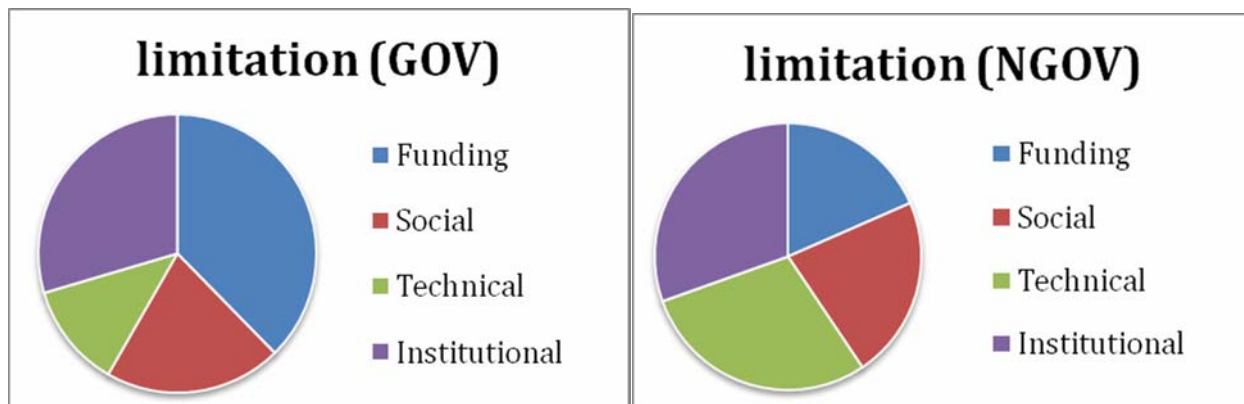


Figure 4.3 Limiting capacity areas for implementing SWP, calculated from averaged indicator questions responses. Based on results from Table 4.7.

The largest differences between the two ways of calculating capacity limitations for the GOV participants was in the perception of social and technical capacities. When GOV participants were asked to name a capacity area that limits effective SWP, social capacity was

identified most often, whereas when the responses from all the questions were combined, social capacity was mentioned the second least often as a capacity area in need of improvement. Similarly, technical capacity was named by 42% of the GOV participants when explicitly asked to identify a limiting capacity area, whereas when combining all the responses, it was raised as a limitation in only 15% of the limiting capacity area responses.

One of the most striking differences when comparing the averaged responses from both of the interview groups is that on average, the GOV group expressed that capacity needs were not being met in 30.9% of their responses to indicator questions (the average of all of the combined negative responses to all of the interview questions), whereas the NGOV group indicated that capacity areas needed improvement in 60.4% of their responses to the indicator questions. In other words, interviewees who work for the government have a more positive view of the current state of needs for local capacity to implement SWP than the interviewees who do not work for the government. Working to address this difference so that all those who work on improving water quality in the watershed have the same opinion of the resources that are available to them could improve SWP in the South Saskatchewan River.

The GOV group self-reported greater limitations for three of the four capacity areas (all excluding institutional capacity) as compared to their calculated averages; whereas, the NGOV group only self reported technical and financial capacities as being more limiting than when their responses were averaged. The only difference between the two groups reporting trends was for social capacity: NGOV reported social capacity to be limiting more often based on average indicator questions than when self-identifying limiting areas, compared to GOV self-reporting social capacity as more limiting when asked directly than based on the indicator questions.

#### 4.5.3 Is Change Needed?

When asked which resources are currently lacking but needed in order to implement SWP, GOV participants responded: data, money, communication, leadership, education, staff, and enforcement. Lacking resources listed by NGOV participants include money, staff, data, and equipment. The respondents did not elaborate on this question, possibly because they had already answered several questions relating to resource needs. Accordingly, the results from this question were not analysed further for this research.

The interviews concluded with one final question of the participants: is change needed to implement SWP in the South Saskatchewan River watershed? The responses were as follows: 8 out of 12 GOV participants and 9 out of 11 NGOV participants thought that change was necessary in order to bring about effective SWP in Saskatchewan. Among the GOV respondents, a few felt that a cultural shift was what was needed and two respondents thought more education was what we needed. The NGOV participants had a more broad range of suggestions including increasing follow-through post-plan (3 people), stricter water quality standards and better enforcement (2 people), more data and more relevant information (2 people), and finally, clearer roles for SWP and better communication between all of the groups involved (2 people). These results reflect previous results indicating that among those interviewed, the majority revealed that their capacity needs for SWP were not currently being met and in order to effectively implement the newly published SWP plan, changes would need to be made.

#### *4.6 Summary*

This chapter presented the results from interviews conducted with key informants to assess local capacity for SWP in the South Saskatchewan River watershed. The results followed four major capacity areas including technical capacity, institutional capacity, financial capacity, and social capacity for SWP. The interviewees were divided into two groups for analysis—those who work for government (GOV) and those who do not (NGOV). According to this research, the GOV participants had a much more positive outlook on the current state of local capacity to implement SWP than did the NGOV group. The GOV key informants were much more likely to indicate that capacity needs were being met. As well, they were also able to identify capacity areas that they considered to be limiting or facilitating their SWP efforts.

Included among the capacity needs that were mentioned that need improvement are: more secure, long-term funding sources, more information and increased access to that information (especially for the NGOV group), and increased communication between groups and raising public awareness about SWP. Some of the capacity needs that appear to be facilitating the SWP process include: information on water sources, training opportunities, provincial drinking water protection policies and legislations (according to the GOV group), access to some funding for

SWP, and cooperation between different government departments (again, according to the GOV participants).

The SWP plan for the South Saskatchewan River Watershed was published in 2007. Now, four years later, we are able to begin to evaluate the capacity of agencies within this watershed to implement that plan. The following chapter will discuss the implications of these research findings and make connections to the broader literature. Limitations of this research and suggestions for future research will also be explored.

## 5.0 Discussion

This chapter discusses the results of the data analysis presented in the previous chapter. The objective of this study was to identify and analyze factors that facilitate and constrain the capacity of local communities in the South Saskatchewan Watershed to implement SWP. The results between the two groups interviewed, NGOV and GOV, were different for each capacity area. The results also varied when individuals were asked outright to identify the capacity area that most limited their ability to implement SWP plans, versus when limitations were calculated based on the average of several indicator questions. Therefore, it is difficult to conclude that one capacity area stood out among the others as a limiting or facilitating factor in SWP plan implementation in the South Saskatchewan River Watershed. However, the subtleties in the difference between groups and between responses are meaningful and will be discussed here.

This research was the first of its kind in Saskatchewan. The results are mostly consistent with the other studies that have examined SWP in an agricultural region. Morton (2008) argues that due to their conservationist nature, farmers are naturally resistant to change. Strong social pressure that will shift internal beliefs and knowledge systems is needed to reduce non-point source pollution from agricultural run-off on a large scale. The best way to achieve that social pressure is by creating local farmer groups that are rural, place-based, grassroots, and encourage public dialogue (Morton, 2008). Those interviewed for this research felt strongly that land owners, many of whom are producers, should maintain authority over their own land management decisions. According to the results, many people felt that government authority should only be at an arm's length and that any imposed restrictions would be viewed as a personal attack on their rights. Even those working in provincial government departments echoed the sentiment that their role is to encourage sustainable land use practices through education and incentive programs, not to impose legislated restrictions on land use. This deeply rooted cultural belief about water use and land use was also found in a case study in the Old Man River Basin, another predominately agricultural region (Poirier and de Loë, 2011). The importance of who holds authority to make land use decisions was not mentioned in many of the studies of SWP in non-agricultural areas in Ontario, and so may indicate that the conditions for SWP are regionally specific.

The desire for minimal regulation of specific land use practices is related to the reported sense of distrust among many of the NGOV interviewees. According to the interview results,



some of the stakeholders called to the original SWP planning meetings were very sceptical when they had learned that it was a provincial government project. These same individuals then felt a sense of relief when they realized that the government was relinquishing authority and that local groups would be tasked with implementing the plans. This result is consistent with Morton's observations: that the local land owners were most willing to participate in the program when it was just them and their neighbours deciding how the SWP plan would be created and implemented (Morton, 2008). Based on these results, the need for bottom-up planning approaches as opposed to top-down approaches for planning and implementation is important to the success of SWP planning in small agricultural and rural communities.

This bottom-up approach to planning is not new to Saskatchewan. Planners for this SWP plan relied on some already established mechanisms and planning tools. If these existing mechanisms and instruments are not considered when creating a new policy, they can become redundant and add complexity to the new policy (Plummer *et al*, 2010). Most of those interviewed liked the SWP planning process and many mentioned that the new SWP plan was going to fit within some of the existing regulatory and governance framework. Simms *et al* (2010) from the Water Policy and Governance Group provided a survey of SWP approaches in Canada and acknowledge the difficulty of merging new initiatives with existing arrangements.

Despite this expressed need for individual autonomy over land use decisions, most of the NGOV interviewees did not think that provincial legislation and policies provide adequate guidance for drinking water protection at the local level. Significantly, interviewees appeared to directly contradict themselves with their responses to the two questions; they want more authority over their own land and want land owners to maintain control of their land instead of being given government direction, but they also want stricter laws and enforcement to prevent contamination. Based on the interviews, it appeared that many people want regulations to prevent activities that would result in point source pollution, such as illegal dumping of hazardous waste, but did not make the connection to activities that would result in non-point sources of contamination. The legal division between land use planning and water management in governmental departments may explain this ambivalent attitude towards regulations. Land use planning and water management continue to be managed by separate provincial departments in Saskatchewan, which leads to a disconnect between the two disciplines and continues to be a limitation for SWP implementation (Ivey *et al*, 2006b). Clarity of actors' roles and jurisdictional

responsibilities are acknowledged as one of the most influential factors for protecting water sources (Poirier and de Loë, 2011).

Many people indicated that enforcement was very poor even where legislation exists that might be able to help with SWP. Implementing SWP actions in Saskatchewan is voluntary and is not legislated, which means that many municipalities have not created strategies to protect water supplies. Timmer *et al* (2007) found similar results in Nova Scotia: that the institutional capacity of small towns was limited by a lack of municipal strategies and by the costs involved with doing legal surveys of the watershed.

The concept of bringing neighbours together to work collectively on SWP plan implementation is beneficial for the value of its social pressure to create change as mentioned above and also for the value of stakeholder involvement. The results show that those interviewed see a need for greater stakeholder involvement, particularly for implementing the SWP plans. Once the base of a group is made up of local people the group's scientific, personal, and cultural experiences can be combined to come up with the best solution for SWP (Morton, 2008). If more people of diverse backgrounds are invited to participate in the SWP process, more experiences can be shared to improve SWP implementation. Without these local, place-based groups composed of many different individuals, people tasked with SWP may not be aware of the tools or programs available to help reduce their risk of contaminating source water. Stakeholders were involved in the SWP planning process in Saskatchewan through existing networks and connections, but this process was insufficient according to the research results.

Another study in the Old Man River Basin found that existing institutional arrangements constrained local capacity for SWP (Ivey *et al.*, 2006b). Specifically, the existing IAs did not allow for locally relevant technical information to be gathered because of existing power differentials between the local level and the provincial government. This supports our finding that the majority of GOV interviewees said that they had access to information on water sources and contamination sources whereas the majority of NGOV interviewees did not think that they have access to that same technical data. Poirier and de Loë (2011) also concluded that a lack of access to appropriate data was a limiting factor for protecting aquatic ecosystems.

This study identified a gap in groundwater information in Saskatchewan, more than any other data source relating to SWP. Knowledge about groundwater sources and a corresponding desire to protect it are shown to be motivating factors for SWP, but without these factors

stewardship behaviours are constrained (Kreutzwiser *et al*, 2011). There is a strong need for more comprehensive information on groundwater sources in Saskatchewan in order to improve SWP efforts. This capacity need relates to other capacity areas such as access to technically skilled staff and to funding sources to conduct new water studies.

Although some technical data does not exist and is still needed, in other instances the information exists but its availability is limited or individuals may not be aware of its existence or where to find it. There was a large difference between the number of GOV and NGOV participants who claimed that they had access to technical information to help with SWP, such as access to information on contamination and access to water sources or aquifer information. Very few NGOV participants had access, whereas most of the GOV interviewees had access to that information. The two groups interviewed varied the most in their responses to questions addressing technical capacity, more than any of the other capacity areas. The difference between the number of GOV and the number of NGOV interviewees who responded positively to each of the technical capacity indicator questions was greater than 40%. This observation suggests that government bodies need to communicate the sources of the data that they use to the NGOV organizations that are also working on SWP. Kreutzwiser *et al* (2011) argue that governments are responsible for a number of factors to encourage individual stewardship behaviours, including education, awareness, financial assistance, and regulations. The provincial and municipal governments in the South Saskatchewan River watershed need to increase their education and awareness of existing data sets in order to improve local capacity to implement SWP plans.

Technical information such as stream water quality is often gathered by government researchers or by independent researchers, but not often by the NGOV organizations responsible for the local implementation of SWP plans. A study of private water well stewardship behaviours found that a barrier to stewardship was complacency and ignorance (Kreutzwiser *et al*, 2011). If these NGOV organizations did not know about a particular study, they would assume that the information does not exist and would not be as well equipped to protect water quality.

The observation that the NGOV participants did not have access to or knowledge of the same data systems as the GOV participants is linked to other areas of capacity, such as awareness and linkages between organizations. Smaller and more rural organizations are more likely to lack access to data (de Loë and Kreutzwiser, 2005). Awareness in this study generally

refers to community awareness of SWP, but it can also refer to awareness of available data. An organized and easily accessible database of water information made available to all those working on SWP would address this capacity gap between the two groups interviewed. Data sharing between organizations is essential for effective SWP.

Data sharing may still need to be improved to promote SWP, but organizations are working together according to the research results. The majority of those interviewed identified both vertical and horizontal linkages that exist between their organization and others working on water management in Saskatchewan. This was also a strength noted in a case study of SWP in Nova Scotia; the social networks between six small communities were found to be the only supporting capacity areas and that other capacities were constrained, such as technical, financial, and institutional constraints (Timmer *et al*, 2007). This is an important capacity need that appears to be met. After completing a thorough review of different approaches to SWP from across Canada, Simms *et al* (2010) found that strong governance is rooted in power sharing, active stakeholder involvement, and non-traditional relationship building in order to adapt to new needs. The South Saskatchewan River Watershed has already built strong governance for addressing SWP needs.

Funding opportunities, especially long-term and consistent funding, were identified as a need for SWP in this study. All but two people interviewed said that they had access to funding specifically for their SWP efforts; however, when asked to identify a capacity area that they consider limit SWP, funding was named by 14 of 25 people interviewed. Many other studies have also found a lack of funding to be a barrier for stewardship (Timmer *et al*, 2007; Kreutzwiser *et al*, 2011; Poirier and de Loë, 2011). These results are inconsistent with a case study from Waterloo, Ontario that found funding to be a facilitating factor for SWP.

Smaller organizations and local groups often lack funding for SWP implementation (Kreutzwiser *et al*, 2011). However, based on the indicator question alone, SWP appears to be well funded in the watershed because almost all NGOV participants said that they had access to SWP funding. Of only four NGOV participants who identified a facilitating capacity area when asked, two of them said that they thought financial capacity was facilitating their efforts to implement SWP plans.

Part of the reason that the results show somewhat limited awareness of SWP is due to the fact that SWP plans in Saskatchewan are relatively new; the first official plan was released in

March 2006 and the South Saskatchewan River SWP plan was published in September 2007 (SWA, 2011b). It will take time for this new priority to take hold in land and water management decisions of government and residents across the province. A lack of sufficient funding and staff members was also mentioned by a number of respondents as a reason why awareness has not been raised as much as it could be. According to this research, it is unclear as to whether residents within the South Saskatchewan River watershed have increased awareness about water protection as a result of the SWP plans, but more than half of all those interviewed indicated that they thought that more SWP awareness is still needed. These results support the claim that ignorance has been shown to be a barrier to stewardship and better local initiatives and educational materials are needed to promote stewardship (Kreutzwiser *et al*, 2011). Stewardship is influenced by knowledge, both in terms of identifying a problem and knowing how to solve that problem, and so public awareness and education are critical for SWP.

The results from this study indicate that there is a need for more training opportunities especially among the NGOV interviewees. A study of municipalities in Ontario found that while some organizations had a high capacity for SWP, many small communities, particularly in rural areas did not have access to the skilled staff or data necessary for SWP (de Loë and Kreutzwiser, 2005). This was mostly because local authorities were given the responsibility of protecting source water without the appropriate support and training to be effective. This supports the research finding that very few GOV participants indicating a need for more training opportunities, but half of the NGOV participants desired more training. Although it is mostly groups from the NGOV interviewees that are largely responsible for SWP implementation, participants indicated that they still require more training to improve management, technical, and communication skills. This could be partially explained by the relative newness of many of these organizations; it may take time to develop these skills as the organization grows.

Differences are noticed when the two methods of determining limiting capacity areas are compared; direct question versus averaged indicated questions yielded different results. This difference can be explained by decision science, where the result of an interview is influenced and altered by the individual and that numerous realities may exist, depending on how the problem is formulated (Roy, 1993). While it is interesting to know what the participants might identify as the greatest limitation, the more accurate method is the one determined by averaging indicator questions because it involves more data points (Morais and de Almeida, 2012). This is

relevant because interviewees may spend more energy and resources on the overall capacity limitation areas that they identified, which may in fact be less meaningful or significant than the smaller initiatives.

The GOV participants were more critical of their capacity to implement SWP plans when asked to identify limiting capacity areas than they were when their responses from each question were averaged. GOV responded higher in three of the four categories when asked to identify limitations. Only one NGOV capacity area was reported as a higher concern when participants were asked to identify limitations versus the averaged responses.

The biggest difference between the two ways of determining limiting capacity areas was that of the GOV group's perception of social capacity. When asked to identify limiting capacity areas, 67% of GOV respondents said social capacity needed improvement. However, based on the indicator questions asked, only 26% of GOV responses indicated that social capacities were somehow limited. Also interesting is that three of the four capacity area weaknesses had a difference of equal or greater than 30% between the two methods. Therefore, the NGOV group gave a different impression of limiting factors in SWP plan implementation in the indicator questions than they did when asked to identify limiting capacity areas. This might mean that NGOV participants do not understand the meaning of these capacity areas as much as they do the individual questions. Institutional and social capacities were identified to need improvement more often in the indicator questions than when participants identified limiting capacity areas.

The differences in perception of limitations could impact the day-to-day operations of the organizations tasked with SWP implementation. For example, if someone identifies financial capacity as their most limiting factor for SWP, they will likely focus energy on procuring more funding, but they may have many more needs that must be addressed before financial capacity in order to increase their overall capacity.

As described more fully in Chapter 2, provincial and municipal governments are typically more responsible for technical and institutional capacity for SWP, whereas NGOV organizations are more directly linked to social capacity because they are tasked with raising awareness for these plans. Based on the indicator questions asked, many more GOV interviewees claimed to have high technical and institutional capacity for SWP than the NGOV participants. More NGOV interviewees indicated high social capacity compared to the GOV individuals. This indicates that overall, participants perceive higher capacity for SWP in the areas with which they

are more directly connected and for which they hold more responsibility(Kreutzwiser et al, 2011).

Overall, the research results were consistent with the results from several other studies on local capacity for SWP or water management. The overall combination of conditions required for SWP in the South Saskatchewan River Watershed are specific to the watershed; however, each area of capacity displayed similarities to other regions in Canada and the results are therefore transferable to other regions. The final chapter will conclude this research by summarizing the research findings, as well as suggesting implications and suggestions for future research.

## 6.0 CONCLUSION

This chapter reflects upon the significance of the research findings. This research will be placed in the greater context of its contributions to the academic literature. Finally, the limitations of the research will be discussed as well as suggestions to help guide future research.

### *6.1 Significance of Findings*

Interviews were conducted with twenty-five key informants to determine the local capacity to implement SWP in the South Saskatchewan River watershed. The participants were divided into two groups for analysis: those who work for the government and those who do not. The results were also analysed and discussed according to four capacity areas including technical, institutional, financial, and social capacities to implement SWP plans. According to the interview results, the GOV group reported that local capacity needs were being met in all four capacity areas. Fewer than half of the NGOV participants thought that the following capacity areas were being met: technical information such as sources of drinking water, aquifers, and contamination sites; training opportunities to improve water management skills; control over land use activities in sensitive or vulnerable areas; adequate provincial legislations and policies to protect drinking water sources; full-cost municipal water rate accounting; involvement of stakeholders, and community awareness about SWP. The only three capacity needs discussed which more than half of the NGOV group agreed were being met was that 91% of those interviewed had access to some kind of funding for SWP projects, and that 54% of those interviewed thought that good vertical and horizontal linkages existed between organizations and governmental departments. Of each of the capacity areas discussed, more than half of the GOV group thought that the capacity needs were currently being met except for the following areas: municipal water rates do not fully reflect the cost of protecting and providing clean drinking water, and more community awareness about SWP is needed.

### *6.2 Contributions to Academia*

The main implication of these results is that improvements are needed to have enough capacity to implement SWP plans in this watershed. There are a number of local capacity areas that need improvement, especially according to the non-government individuals involved in this study. The results of this study indicate that if an effort is not made to improve these weak



capacity areas, SWP may not be effectively achieved and source water in this watershed could be at risk of future contamination. The research findings also identified a clear disconnect between government and non-government perceptions of current capacity needs for SWP. This could mean either that resources are not available to non-government groups or that these groups are not aware of the resources at their disposal. Government initiatives need to be made more accessible and promoted more in order to balance the perception of resources available to those involved in SWP. In most cases, many of the non-government groups involved with this study are new organizations and so time may resolve some of this capacity-gap.

Several capacity needs were identified through this research. More data is needed to fully understand how to best protect water in this watershed, in particular information on aquifers and groundwater recharge zones. Greater training and educational opportunities for non-government groups are needed. Provincial legislation and policies should be stricter or more strongly enforced to ensure adequate protection of our drinking water sources. Funding needs to be more reliable for non-government groups working on protecting source water. The general community must be made more aware of SWP initiatives and how they can contribute. Another need identified by most respondents was for greater linkages across organizations and governmental levels including information and resource sharing, as well as more networking opportunities. Non-government participants thought that there should be greater follow through in the post-plan stage from the government and clearer roles and better communication between all groups involved with implementing SWP.

These findings suggest an opportunity for the SWA to re-evaluate the SWP planning and implementation processes in order to improve on the watersheds that already have plans and to ensure that new watershed plans can be as good as they can be. It is also a good time to not only evaluate how effective the process of implementation has been, but also whether the plans themselves were effective at protecting source water in each watershed.

As demonstrated in the discussion section, the research findings enhance our understanding of, and add to, a growing body of literature on local capacity to implement SWP. While other research has taken place on source protection in other regions of Canada, this study has enhanced our understanding of the prairie conditions for effective SWP planning and implementation. This research is based on a single watershed in the Canadian Prairies; however,

the results provide more general insight into plan implementation generally and how to increase local capacity of those tasked with plan implementation.

An important outcome of this research is the lesson learned about moving from plan making to plan implementation. Many respondents noted having more support during the plan making stage as opposed to the implementation stage. Planning research often lacks an evaluation of plan implementation after adoption (Laurian *et al*, 2004; Brody and Highfield, 2005). Plans that contain implementation policies have been found to have higher rates of implementation (Brody and Highfield, 2005).

Many resources were available during the SWP plan making phase, but as expressed by many of the NGOV responses, there is a need to continue that support from the provincial government for the plan implementation stage. A technical advisory group was established during the plan making stage that helped inform the key actions of the plan. The technical advisory group was discontinued after publication of the source water protection plan. This group would be a valuable resource for those responsible for plan implementation. It is the recommendation of this research that an evaluation of the plan implementation be incorporated in early stages of any future SWP plan development.

### *6.3 Limitations and Future Research*

More interviews would have provided a greater breadth of perspective and possibly more information on the current state of local capacity to implement SWP. The conclusions drawn are based solely on the perspectives of those interviewed. A suggestion for future research would be to adapt an online questionnaire to supplement the in-person interviews conducted. Given the limited amount of time that the researcher had to conduct the interviews and also the limited time of the key informants, it may have been possible to include more people, especially those living in more remote areas, with an online questionnaire. Using two watersheds would have provided a comparative study to help draw general conclusions from the results.

The source water protection policy reviewed in this research does not address protection of First Nations water. No members of First Nations communities were interviewed for this research and the condition of drinking water quality or source water protection on reservation lands within the South Saskatchewan River watershed was not discussed as part of this thesis. Governance of First Nations water is independent and different than that of the rest of the

province and it is suggested that future research on source water protection in Saskatchewan examine the First Nation governance structure specifically. First Nation communities could greatly benefit from an increased focus on SWP because water quality on First Nations communities has been found to be much poorer quality than that on non-First Nations communities (Patrick, 2011b). The need may be greater in these communities because they have 2.5 more frequent boil water advisories than non-First Nation communities, 30% have high risk water systems, and water-borne diseases are 26 times greater than the national average (Patrick, 2011b). It would also be interesting to compare First Nations SWP to the provincial watershed-based SWP planning model discussed in this research.

A suggestion for continued research related to this study would be to explore whether the initial key actions established in the SWP plan were adequate and effective. The advisory committee that selected the SWP key actions to better protect source water in the watershed may have missed a potential contaminant source. SWP only focuses on preventing anthropogenic causes of changes in water quality and so may not have a broad enough scope to mitigate impacts from climate change and natural land disturbances to ultimately protect water quality (Emelko *et al*, 2011). Future research could study the effectiveness of these plans by analysing the impact that implementing these key actions have had on the watershed and on overall water quality.

Another study could cross-examine several different studies that identify watershed-specific capacity limitations for SWP and then discern the similarities and differences that arise based on geographic location in different provincial jurisdictions. That research would identify capacity areas that are limited by politics and geography. Other researchers have determined that tools in one area may not work in another (Simms *et al*, 2010). Therefore it would be useful to study what SWP tools are effective and why are some more effective in different regions than others.

## LITERATURE CITED

- Alberta Environment. 2003. *Water for Life: Alberta's strategy for sustainability*. Edmonton: Government of Alberta.
- Bender, Michael. 2005. "Source water protection." *Western Canada Water*, 57(4): 32-35.
- Blaine, James, Bernard Sweeney, and David Arscott. 2006. "Enhanced source-water monitoring for New York City: historical framework, political context, and project design." *The North American Benthological Society*, 25(4): 851-866.
- Brody, Samuel D. and Wesley E. Highfield. 2005. "Does Planning Work?: Testing the Implementation of Local Environmental Planning in Florida." *Journal of the American Planning Association*, 71(2): 159-175.
- Carter, Nicole, Reid D. Kreutzwiser, and Rob C. de Loë. 2005. "Closing the circle: linking land use planning and water management at the local level." *Land Use Policy*, 22: 115-127.
- CCME—Canadian Council of Ministers of the Environment. 2002. *From Source to Tap: the multi-barrier approach to safe drinking water*. Winnipeg, MB: Canadian Council of Ministers of the Environment.
- Davies, J-M. and A. Mazumder. 2003. "Health and environmental policy issues in Canada: the role of watershed management in sustaining clean drinking water quality at surface sources." *Journal of Environmental Management* 68: 273-286.
- de Loë, Rob, S.E. Di Giantomasso, and Reid Kreutzwiser. 2002. "Local capacity for groundwater protection in Ontario." *Environmental Management*, 29 (2): 217-233.
- de Loë, Rob and Reid Kreutzwiser. 2005. "Closing the groundwater protection implementation gap." *Geoforum*, 36: 241-256.
- DiCicco-Bloom, Barbara and Benjamin F Crabtree. 2006. "The qualitative research interview." *Medical Education*, 40: 314-321.
- Dunn, Kevin. 2005. "Interviewing," in eds. Iain Hay. *Qualitative Research Methods in Human Geography*. Oxford: Oxford University Press.
- Eggerston, Laura. 2008. "Investigative Report: 1766 boil-water advisories now in place across Canada." *Canadian Medical Association Journal*, 178 (10): 1261-1263.
- Emelko, M. B., Uldis Silins, Kevin D. Bladon, and Michael Stone. 2011. "Implications of land disturbance on drinking water treatability in a changing climate: Demonstrating the need for "source water supply and protection" strategies." *Water Research*, 45(2): 461-472.

- Environment Canada. 1987. *Federal Water Policy*. Ottawa: Environment Canada. PDF format on the Web [[http://www.ec.gc.ca/water/en/info/pubs/fedpol/e\\_fedpol.pdf](http://www.ec.gc.ca/water/en/info/pubs/fedpol/e_fedpol.pdf)]. Accessed October 2008.
- Ferreira, C., R.C. de Loë, and R.D. Kreutzweiser. 2008. "Imagined communities, contested watersheds: Challenges to integrated water resources management in agricultural areas." *Journal of Rural Studies*, 24: 304-321.
- Global Water Partnership. 2000. *Integrated Water Resource Management: TAC Background Paper 4*. Stockholm: Global Water Partnership.
- Government of British Columbia. 2001. *Drinking Water Protection Act*. Victoria: Queen's Printer.
- Government of Manitoba. 2005. *The Water Protection Act*. Winnipeg: Government of Manitoba.
- Government of Saskatchewan. 2002. *S-35-01 - The Saskatchewan Water Corporation Act*. Regina: Queen's Printer.
- Government of Saskatchewan. 2005. *S-35-03 - Saskatchewan Watershed Authority Act*. Regina: Queen's Printer.
- Government of Saskatchewan, 2011. "\$100,000 in increased funding for source water protection." News Release, April 12, 2011. [<http://www.gov.sk.ca/news?newsId=3fc349dd-51aa-4246-9d7f-8b9fcb303159>] Accessed September 29, 2011.
- Goss, Michael and Charlene Richards. 2008. "Development of a risk-based index for source water protection planning, which supports the reduction of pathogens from agricultural activity entering water resources." *Journal of Environmental Management*, 87(4): 623-632.
- Griffin, C. B. 1999. "Watershed councils: an emerging form of public participation in natural resource management." *Journal of the American Water Resources Association*, 35: 505-518.
- Harrigan-Farrelly, Joan. 2002. "Status of Source Water Protection." *Ground Water Monitoring & Remediation*, 22(3): 50-51.
- Hrudey, S.E., P. Payment, P.M. Huck, R.W. Gillham, and E.J. Hrudey. 2003. "A fatal waterborne disease epidemic in Walkerton, Ontario: comparison with other waterborne outbreaks in the developed world." *Water Science and Technology*, 47 (3): 7-14.
- Ivey, J.L., R.C. de Loë, and R.D. Kreutzweiser. 2006a. "Planning for source water protection in Ontario." *Applied Geography*, 26: 192-209.

- Ivey, J.L., R.C. de Loë, R.D. Kreutzwiser, and C. Ferreyra. 2006b. "An institutional perspective on local capacity for source water protection." *Geoforum*, 37: 944-957.
- Jameson, P., YT Hung, C Kuo, and P Bosela. 2008. "Cryptosporidium Outbreak (Water Treatment Failure): North Battleford, Saskatchewan, Spring 2001" *J. Perf. Constr. Fac.*, 22 (5): 342-348.
- Kreutzwiser, R, R de Loë, K Imgrund, MJ Conboy, H Simpson, and R Plummer. 2011. "Understanding stewardship behaviour: Factors facilitating and constraining private water well stewardship." *Journal of Environmental Management*, 99: 1104-1114.
- Kundell, J.E., and T.A. DeMeo. 2000. *Source Water Protection: A Guidebook for Local Governments*. Georgia Water Management Campaign. The University of Georgia.
- Laing, Robert D. 2002. *The North Battleford Water Inquiry*. Regina: Queen's Printer.
- Laurian, Lucie, Maxine Day, Philip Berke, Neil Ericksen, Michael Backhurst, Jan Crawford & Jenny Dixon. 2004. "Evaluating Plan Implementation: A Conformance-Based Methodology." *Journal of the American Planning Association*, 70(4): 471-480.
- Leccese, M. 1998. "Saving the source: watershed-management plans in the San Francisco region aim at protecting the public water supply." *Landscape Architecture*, 88(12): 40-45.
- Litke, Stephen and J.C. Day. 1998. "Building local capacity for stewardship and sustainability: the role of community-based watershed management in Chilliwack, British Columbia." *Environment*, 25: 91-109.
- Ministry of the Environment, Ontario. 2008. *Safe Drinking Water Act*. Ottawa: Queen's Printer for Ontario.
- Mitchell, Bruce. 2005. "Integrated water resource management, institutional arrangements, and land-use planning." *Environment and Planning*, 37: 1335-1352.
- Morais, Danielle C. and Adiel Teixeira de Almeida. 2012. "Group decision making on water resources based on analysis of individual rankings." *Omega*, 40 (1): 42-52.
- Morse, Janice M. 2005. "Evolving Trends in Qualitative Research: Advances in Mixed-Method Design." *Qualitative Health Research*, 15(5): 583-585.
- O'Connor, D.R. 2002a. *Report of the Walkerton Inquiry: The Events of May 2000 and Related Issues. Part One*. Toronto, Ontario: Ontario Ministry of the Attorney General, Queen's Printer for Ontario.
- O'Connor, D.R. 2002b. *Report of the Walkerton Inquiry: Part Two, A Strategy for Safe Drinking Water*. Toronto, Ontario: Ontario Ministry of the Attorney General, Queen's Printer for Ontario.

- Oliver, Daniel G, Julianne M. Serovich, and Tina L. Mason. 2005. "Constraints and Opportunities with Interview Transcription: Towards Reflection in Qualitative Research." *Social Forces*, 85(2): 1273-1289.
- Olson, E. 2003. *What's on tap? Grading drinking water in US cities*. National Resources Defence Council, New York.
- Parkes, M., K. Morrison, M. Bunch, L. Hallstrom, R. Neudoerffer, H. Venema, and D. Waltner-Toews. 2010. "Towards integrated governance for water, health and social-ecological systems: The watershed governance prism." *Global Environmental Change*, 20: 693-704.
- Patrick, R., R. Kreutzwiser, and R. de Loë. 2008. "Factors Facilitating and Constraining Source Water Protection in the Okanogan Valley, British Columbia." *Canadian Water Resources Journal*, 33: 39-54.
- Patrick, R. J. 2009. "Source water protection in a landscape of 'New Era' deregulation." *Canadian Geographer*, 53: 208–221.
- Patrick, R. 2011a. "Enhancing water security in Saskatchewan, Canada: an opportunity for a water soft path." *Water International*, 36(6): 748-763.
- Patrick, R. 2011b. "Uneven access to safe drinking water for First Nations in Canada: Connecting health and place through source water protection." *Health and Place*, 17: 386-389.
- Plummer, R., J. Velaniškis, D. de Grosbois, et al. 2010. "The development of new environmental policies and processes in response to a crisis: the case of the multiple barrier approach for safe drinking water." *Environmental science & policy*, 13(6): 535 -548.
- Plummer, R., D. de Grosbois, R. de Loë, and J. Velaniškis. 2011. "Probing the integration of land use and watershed planning in a shifting governance regime." *Water Resource Research*, 47.
- Poirier, B. A. and R. C de Loë. 2011. "Protecting aquatic ecosystems in heavily allocated river systems: the case of the Oldman River Basin, Alberta." *Canadian Geographer*, 55: 243–261.
- Pollution Probe. 2004. *Source Water Protection Primer*. Toronto: Pollution Probe.
- Roy, Bernard. 1993. "Decision science or decision-aid science?" *European Journal of Operational Research*, 66 (2): 184-203.
- SaskH2O. 2008. *SaskH2O--About us*. Online [www.SaskH2O.ca] Accessed May 4, 2011.

- Simms, G., D. Lightman, and R. de Loë. 2010. *Tools and Approaches for Source Water Protection in Canada*. Governance for Source Water Protection in Canada, Report No. 1. Waterloo, ON: Water Policy and Governance Group.
- SSRWS. 2007. *South Saskatchewan River Watershed Source Water Protection Plan*. Saskatoon: Saskatchewan Watershed Authority.
- SSRWS. 2011. *South Saskatchewan River Watershed Stewards 2011 Newsletter*. Online [http://www.southsaskriverstewards.ca/PDFS/SSRWSI%20Newsletter%20Jan%202011%20FOR%20WEB.pdf] Accessed May 4, 2011
- Stake, Robert E. 1995. *The Art of Case Study Research*. USA: Sage Publishing.
- SWA. 2002. *Safe Drinking Water Strategy*. Online [http://www.publications.gov.sk.ca/details.cfm?p=11274] Accessed May 11, 2009.
- SWA, 2007. Background Report, South Saskatchewan River Watershed. Regina: Saskatchewan Watershed Authority.
- SWA, 2009. *Water Quality and Usage Survey for the Village of Hepburn, Saskatchewan: A Risk Assessment*. Survey Summary Report.
- SWA, 2010a. *What We Do--Mandate*. Saskatchewan Watershed Authority Website. Online [http://www.swa.ca/AboutUs/WhatWeDo.asp] Accessed June 4, 2010.
- SWA, 2010b. *Water Quality and Usage Survey for the District of Katepwa, Saskatchewan: A Risk Assessment*. Survey Summary Report.
- SWA, 2011a. *Monitoring and Assessment*. Online [http://www.swa.ca/Stewardship/AssessmentMonitoring/Default.asp] Accessed May 7, 2011
- SWA, 2011b. *Watershed and Aquifer Planning*. Online [http://www.swa.ca/Stewardship/WatershedPlanning/Default.asp?type=Map] Accessed May 4, 2011.
- Timmer, D.K., R.C. de Loë, and R.D. Kreutzwiser. 2007. "Source water protection in the Annapolis Valley, Nova Scotia: Lessons for building local capacity." *Land Use Policy*, 24: 187-198.
- UNCED. 1992. "Chapter 37: Capacity Building in Developing Countries." *Agenda 21: The Rio Declaration on Environment and Development*. Rio de Janeiro: The United Nations Conference on Environment and Development.
- Warner, Jeroen, Philippus Wester, and Alex Bolding. 2008. "Going with the flow: river basins as the natural units for water management?" *Water Policy*, 10(2): 121-138.



Yin, Robert K. 2003. *Case Study Research Design and Methods*. Third Edition. USA. Sage Publishing.

## **Appendix A: Saskatchewan Watershed Authority Mandate**

- (a) to manage, administer, develop, control and protect the water, watersheds and related land resources of Saskatchewan;
- (b) to promote the economical and efficient use, distribution and conservation of the water, watersheds and related land resources of Saskatchewan;
- (c) to maintain and enhance the quality and availability of the water, watersheds and related land resources of Saskatchewan for domestic, agricultural, industrial, recreational and other purposes;
- (d) to promote and co-ordinate the management, administration, development, conservation, protection and control of the water, watersheds and related land resources of Saskatchewan;
- (e) to promote, undertake and co-ordinate research, investigations, surveys, studies, programs and activities relating to the management, administration, development, conservation, protection and control of the water, watersheds and related land resources of Saskatchewan;
- (f) to promote, undertake and co-ordinate conservation programs in Saskatchewan.

SWA, 2005, c.S-35.03, s.5.

## **Appendix B. Interview Questions**

1. What are some of the ways SWP is practiced by your organization?
2. How important is source water protection to the quality of (your) delivered potable water? Very Important/Important/Medium Importance/Low Importance/Very Low Importance. Briefly explain your answer
3. What other means, other than SWP, are available to you to ensure safe drinking water? (gets at awareness of multi-barrier approach)

### **TECHNICAL**

4. Is there data available to delineate drinking water sources, watersheds and aquifers, and groundwater recharge areas?
5. Have potential contaminations sources and their threats to the water sources been identified?
6. Do training and educational opportunities exist for staff members involved in SWP?
7. Do you have access to or is there an individual in your organization that has expertise needed to undertake SWP and water management?

### **INSTITUTIONAL**

8. To what extent can existing and future land use activities be controlled (managed) by your organization in sensitive or vulnerable areas (municipal well fields, recharge and watershed supply areas)?
9. What mechanisms exist for targeting protection of sensitive water supply areas (eg. wellheads, recharge areas, riparian zones) and water supply areas physically located outside (your) the local jurisdictional boundaries?
10. How is source water quality protected from the impacts of historical, existing, and future urban and rural land use activities?
11. Do provincial legislation and policies provide guidance for drinking water protection at the local level?
12. Which organization (local, prov., federal) do you work most closely with to implement (promote, further, practice?) SWP?

### **FINANCIAL**

13. Are you able to access funding for SWP projects? (from where?)
14. Have you been successful in accessing external SWP funding? How much?
15. Do you have a specific budget identified annually for funding SWP activities?
16. Do water rates for customers reflect the full cost of protecting and providing municipal drinking water?

### **SOCIAL**

17. To what extent, and how, have stakeholders participated in the selection and development of SWP tools?
18. Who is providing leadership for water quality protection in your organization?
19. Has community awareness and support for watershed protection been developed? How has this happened? Why has it not happened?
20. Are there active relationships between municipal and provincial agencies (vertical linkage)?

21. Are there active relationships among watershed organizations & municipality and community organization (horizontal linkage)? and within your organization

#### OVERALL

22. Identify the greatest capacity limitation to your organization respecting SWP and rate 1(facilitating)-5(limiting factor): a) financial, b) technical knowledge c) legal, d) land and water integration, and e) social networks such as public involvement

23. Are sufficient resources (leadership, financial, human, and technical) available to conduct SWP planning and implementation?

24. Is change needed to bring about SWP in SASK? If so, what change and at what level? (Federal, provincial, municipal, water purveyor, industry, other?)