A STUDY OF GOVERNANCE:

THE SASKATOON SOUTH EAST WATER SUPPLY SYSTEM

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ABSTRACT

The concept of water security increasingly frames global discussion of water issues. In 2012, water security became the local frame for water discussions in Saskatchewan when the Saskatchewan Watershed Authority was renamed the Saskatchewan Water Security Agency and the *25 Year Water Security Plan* was rolled out. This research uses a qualitative approach to understand if the adoption of "water security" language by the Saskatchewan Water Security Agency is a signal of governance change and as a result was matched with changes to water planning and management in the Saskatoon South East Water Supply region. The analysis looked for factors of anticipatory governance as an approach supportive of the water security framework in three data sources: the Water Security Agency's 25 Year Saskatchewan Water Security Plan, interviews with stakeholders from a subsection of the South Saskatchewan River Basin, and a social network map. Results from the study suggest that pockets of change in planning and management activities have occurred, specifically an increase in support of participatory decision making strategies. However, outside of this the majority of activities remain reflective of traditional water governance approaches in the Saskatoon South East Water Supply region. Therefore, it is likely additional work towards governance change will be needed to fully embrace an approach capable of supporting the water security framework and in turn enhance water security in Saskatchewan.

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CHAPTER 1
INTRODUCTION

1.1 Water Security

Water is generally considered to be one of the most important resources. It is a key requirement for human health and maintaining ecosystems. It is also often critical to economic and industrial development. These different requirements are often in conflict. Water security – defined as access to water that is safe for consumption, reliable in provision, and able to facilitate economic opportunities while sustaining the natural environment and its inhabitants – has emerged as the term to describe how these various requirements are balanced (Global Water Partnership, 2000; United Nations Water, 2013).

Issues threatening water security have emerged in virtually every part of the world. In the Middle East water security is threatened by frequent supply disruption and contamination as a result of ongoing war (Rossetti, 2015). In the Philippines water security as it relates to human health is often at risk if a family or region's income levels are low. The poorest areas of the country have the highest rates of waterborne illness (United States Agency for International Development, 2013). In Australia water security is endangered by those seeking water for economic benefit. Strong lobby groups for agriculture and mining industries support continued development of water supply-focused infrastructure projects despite the reality that 26% of surface water areas are rated "overused" when compared to sustainable flow requirements (Mercer, Christesen, & Buxton, 2007).

California's water security is endangered as a fourth consecutive year of drought since 2012 causes severe reductions in available surface water. Lower water availability reduces the number of planted acres in the Central Valley region and significantly decreases rates of profit (North American Space Administration, 2015; United States Geological Survey, 2015). Additionally, warmer river temperatures and reduced spawning habitat throughout northern California are occurring due to reduced surface water. These effects are combining to elevate the extinction risk for many native fish populations, the repercussions of which are unknown (Hanak *et al*., 2015; Moyle, Quiñones, Katz & Weaver, 2015).

Canada is not immune to water security challenges, despite having the largest supply of renewable freshwater in the world (Environment Canada, 2012). Brandes and Kriwoken (2006)

examined water management in the Okanagan Basin in British Columbia and describe perceptions of water as:

> Vital to Canada's long-term prosperity…Yet despite its critical importance, water is undervalued and often wasted. Perceived as an abundant and virtually limitless resource, the myth of abundance is entrenched even in water-stressed regions where conflicts among water users are common and drinking water supplies are at risk such as the Okanagan (2006, p.75).

Balancing increasing municipal, industrial, and agricultural water demands with environmental needs in a changing climate are fundamental elements of the water security discussion. The City of Montreal created controversy in balancing off water security challenges when it released 4.9 billion litres of untreated wastewater into the St. Lawrence River in November 2015. The sewage release allowed maintenance and repair work to be done on an aging treatment facility (Canadian Broadcasting Corporation, 2015b).

In Saskatchewan, First Nations, rural, and urban communities experience different levels of water security in relation to one another. Numerous First Nations communities are currently under drinking water advisories, some of which have been in effect for over ten years (Health Canada, 2015). Water and wastewater infrastructure is aging past its useful life across the province. Upgrade costs since 2010 for the Saskatoon South East Water Supply, a single multi-use water system, have reached $20 million CND alone (Piller, 2014; Boyle, 2014). Climate change is likely to cause progressively frequent and severe weather events such as drought and flooding (Pomeroy *et al*., 2010). Increases in extreme events often result in escalating provincial disaster relief costs.

Addressing these complex challenges to water security requires a new governance approach (Sarewitz, Pielke, Jr., & Byerly, Jr., 2000; Pahl-Wostl, 2009; Ostrom, 2010; Quay, 2010; Norman *et al*., 2010). Governance approaches appropriate under the water security framework must be capable of balancing water-related needs and facilitating informed trade-off decisions within social, environmental, and economic water requirements. Traditional water governance approaches are not meeting these needs (Folke, Hahn, Olsson, & Norberg, 2005; Mercer *et al*., 2007; Farrelly & Brown, 2011).

Saskatchewan's water governance organization, the Water Security Agency, has recognized this need. In 2012, the organization adopted water security language when it renamed itself the "Saskatchewan Water Security Agency" from the "Saskatchewan Watershed

Authority". At the same time, a formal long-term plan, the *25 Year Saskatchewan Water Security Plan (25 Year Water Security Plan),* was released to guide the province into the future with attention to needs, interests and concerns of the Saskatchewan people, and the protection and sustainable development of the resource (Saskatchewan Water Security Agency, 2012, p. 2)

1.2 Governance for Water Security

Improved governance is central to virtually all discussions of achieving water security. Governance is predominantly, "who gets to decide what?" (Fulton, Pohler, & Fairbairn, 2015, p. 4). Governance improvement focuses on changes to "who" has the power to decide and "what" are decision priorities as well as how decisions are made and to what degree they are collaborative. Changes to these elements create changes to governance outcomes. For water governance this equates to changes to water planning and management decisions.

In traditional water governance approaches, single organizations held the majority of decision-making power. Experts, such as water engineers, comprised the major employee group in these organizations (Chi, 2008; Brulle, 2010). This approach often focuses on major water infrastructure projects to ease or alleviate water-related challenges. As an example, the Hoover Dam, completed in 1935, protects southern states from damage and hardship due to extreme climate events and generates power for Los Angeles (United States Department of the Interior, 2015). The Gardiner Dam and the Qu'Appelle Dam, completed in 1967, control water flow on the South Saskatchewan River to create Lake Diefenbaker and in turn provide domestic water to approximately 60% of Saskatchewan's population (Saskatchewan Water Security Agency, 2016). In Ashkelon, Israel a recently built desalinization plant converts 330,000 cubic meters of sea water to safe potable water for human and industrial use a day. This amount equals 13% of the country's domestic consumer demand annually through advances in water infrastructure (Water-Technology.net, 2015).

Today, acceptance of traditional water governance approaches has waned (Huitema & Meijerink, 2010). Evidence of the desire for new water governance approaches comes in the following forms. Top-down decision-making structures are being challenged to become more inclusive of perspectives from those outside expert circles (United Nations Water, 2013; Patrick, 2013). Hesitation and resistance to the continued reliance on developing new large-scale infrastructure projects to solve water problems builds due to the high economic and

environmental costs associated with past projects (Gleick, 2002). Even stationarity, a once widely accepted assumption driving many water management decisions, has been recently rejected (Milly, Betancourt, Falkenmark, Lettenmaier, & Stouffer, 2008).[1]

Governance approaches must be altered in order to accommodate and balance water security requirements in a manner that is complementary to today's water sector and their stakeholders (Norman & Bakker, 2009). Participatory decision-making, proactive planning, flexibility, and adaptation are elements of governance approaches that fit this need. Participatory decision-making ensures those potentially affected by outcomes can be heard in the decision-making process (United Nations Water, 2013). Shifting from reactionary to proactive planning through increased data collection and monitoring of potential challenges aims to lessen or avoid waste (Fuerth, 2009).[2] Flexibility and adaptation allows for small changes as new information is available, crucial to success for decision-making under uncertain conditions (Lindblom, 1959). Focusing on fresh water as a finite resource and on the purpose of its uses spurs creativity such as using recycled water rather than potable water for yard maintenance (Gleick, 2002; Brooks, 2005). Anticipatory governance is an approach incorporating these elements (Fuerth, 2009; Quay, 2010; Davies & Selin, 2012; Fuerth & Faber, 2013; Boyd, Nykvist, Borgström, & Stacewicz, 2015).

1.3 Study Purpose and Contribution

Given its recent name change, the Saskatchewan Water Security Agency has formally recognized the need to address water security. The purpose of this thesis is to determine if the adoption of water security language by the Water Security Agency has been accompanied by a change in governance and in water planning and management that reflects the participatory, proactive and adaptive approaches found in anticipatory governance and that are believed necessary for the achievement of water security. To answer this question, the research compared the water planning and management activities described in the Water Security Agency's *25 Year*

[1] Stationarity assumes that the water cycle varies within predictable margins. The framework used historical information to plan for the future needs.

[2] Waste refers the act of carelessly expending something. Resources and money are examples of wastes that proactive planning and monitoring trends may help to reduce through preparation where possible.

Water Security Plan, the configuration of the social network operating in the Saskatoon South East Water Supply system, and the views of the participants in the system against the elements that are believed necessary for anticipatory governance. The factors that are considered evidence of anticipatory governance include foresight (which relates to proactive planning), participatory decision-making, flexibility, and continued monitoring (which relates to the ability to adapt to changing conditions as information becomes available) (Paul-Wostl, 2007; Fuerth, 2009; Quay, 2010; Boyd *et al*., 2015).

The Saskatoon South East Water Supply (SSEWS) system was chosen as the study site for this research because: (1) the site serves a diverse set of water users, (2) the system has imminent water delivery capacity issues, and (3) it is easily accessible from Saskatoon, Saskatchewan. First, SSEWS serves potash, recreation, agriculture, conservation, and municipal customers throughout its 110 km expanse. The breadth of customers served by the man-made canal mimics that of the larger South Saskatchewan River Watershed, allowing for the possibility of applying lessons learned here on a larger scale regionally and possibly beyond. Second, a large customer base results in high water demands. Demand has currently outstripped the delivery capacity of SSEWS infrastructure. This reality creates the potential for change in the system's governance, as the current state is no longer viable due to delivery capacity issues unlike many other regions in the province (Huitema & Meijerink, 2010). Last, the locations of major centres within the SSEWS are easily accessible from Saskatoon, Saskatchewan, the author's home city. The combination of these factors made the SSEWS an attractive research site.

Results from the study suggest elements of anticipatory governance are present in the Saskatchewan Water Security Agency's *25 Year Water Security Plan*. However, data from interviews and a social network map indicate water planning and management activities on the ground in SSEWS remain largely reflective of traditional water governance approaches. Therefore, despite the adoption of water security language into the Water Security Agency's title and long-term plan it is likely that further governance transformation is necessary if the Water Security Agency is to embrace a governance approach that is able to enhance water security in Saskatchewan.

This thesis contributes to water governance literature in three ways. First, a comparison of water planning and management activities against the elements required for anticipatory

governance in order to gauge the degree of governance change is novel and has not been done before. Second, the results from the thesis add to limited research on the use of anticipatory governance in real world settings. In the water sector, this type of research is particularly limited only one other study could be found, Boyd *et al*. (2015) during data analysis in late 2015. Third, the thesis gathers information on how water stakeholders in SSEWS understand the concept of governance and its relationship to water management and planning activities. Inquiry here is important, as similar stakeholder groups from the South Saskatchewan River Watershed ranked 'governance' second on a list of pressing water concerns for the region (Gober *et al*., 2015).

1.4 The Paper's Structure

The introductory chapter is followed by a review of the relevant literature related to water security and governance in chapter 2. Chapter 3 explains the study's research design and examines the methods and procedures used. Chapter 4 provides general geographic and social information about the SSEWS region, as well as the context for water governance and decision-making in Saskatchewan. Chapter 5 outlines the results of the data analyses. Chapter 6 begins by summarizing the study. Following the summary, documented challenges to governance transformation are presented with special attention to the relationship between urgency and policy change. To close the thesis, potential future research directions are outlined and the limitations of the study design and data analysis are discussed.

CHAPTER 2
LITERATURE REVIEW

2.1 Overview

This chapter examines three areas of literature relevant to this research. The first section outlines the concept of water security and its key factors, followed by a description of the shift from supply-side to demand-side water resource management in North America. The section closes with a discussion of elements that often impede transitions to water security. The second section outlines recent research on defining governance and water governance. The third section describes the concept of governance, followed by a discussion of anticipatory governance as an approach capable of leading to water security.

2.2 Water Security

The term water security has gained popularity in recent years, with water insecurity being increasingly used to describe the conflict that arises between and among the social, environmental, and economic uses of water. While a universal definition of water security does not exist, the Global Water Partnership and the United Nations Water definitions of water security are often quoted and will be used in this thesis.

The Global Water Partnership defines water security as:

> Every person having access to enough safe water at an affordable cost to lead a healthy and productive life, while also mitigating water-related risks, addressing conflicts over shared water resources, and ensuring the natural environment is protected and enhanced (Global Water Partnership, 2000).

A 2013 United Nations Water report defines water security as:

> The capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protections against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability (p.1).

Social justice, sustainability, foresight, and stability are key factors within these definitions. Social justice speaks to seeking equality in water access and use for all people, not only those that can afford to secure it. Sustainability is the assurance that the natural environment and future generations are counted as having water requirements and current use does not limit

their ability to use water into the future (World Commission on Environment and Development, 1987). Foresight and stability relate to the ability of those making decisions for an area to create safety and opportunities for prosperity for society while limiting instances that upset this balance. These factors highlight the relationship between human security and water (United Nations Water, 2013).[3] Decisions are necessary to balance these factors. As a result, governance, the processes by which decisions are made, is central to water security.

2.3 The Road to the Water Security Framework

2.3.1 The Supply-side Paradigm

Water security became the leading paradigm over time after changes in public perceptions of acceptable water management practices. Post-war water management focused on two goals: (1) finding new sources, and (2) developing new infrastructure projects (Brandes & Brooks, 2005; Gleick, 2002; 2003). The thinking around solving these two problems is known as the supply-side paradigm. This approach has produced many benefits through water management infrastructure. For example, reservoirs can provide flood control and drought mitigation capability for communities with variable climates (Glieck, 2003; Ludwig, Kabat, Van Shaik, & Van der Valk, 2009).

The integrated water resource management strategy gained popularity under the supply-side paradigm. Integrated water resource management is defined as,

> A process that promotes the coordinated development and management of water, land, and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital eco-systems (Global Water Partnership, 2008).

This management strategy focused on systems-based thinking and decision-making. Systems-based thinking ensures links and relationships between items are considered when decisions are being made. For instance, integrated water resource management considers the potential water quality and quantity impacts of locating concentrated livestock operations near open water

[3] Human security relates to the broad definition of security going beyond conflict management and military risk. Development can provide human security in this sense (United Nations Development Programme, 1994; Leb & Wouters, 2013).

sources. Zietoun (2011) uses systems-based thinking to consider how water availability affects food and energy production and cost, and in turn how these factors affect political stability.

Critics called integrated water resource management "a utopian notion." This scrutiny is linked to the capacity necessary to implement the strategy as designed (Pahl-Wostl, Lebel, Knieper & Nikitina, 2012). For instance, the capacity necessary to define all systematic effects while also ensuring maximum benefit under all three pillars of sustainability (i.e., social, environmental, economic) is often unrealistic in real world settings (Molle, 2008; Pahl-Wostl *et al*., 2012). Capacity refers to the ability or power to do, experience or understand something (Ananda & Proctor, 2013). Capacity, as it is used above, encompasses multiple dimensions including: financial, technical, legal, and human/social capacity (Ananda & Proctor, 2013). Additionally, Bakker (2012) argues that defining integrated water resource management as a process removes an obvious completion point leaving those involved frustrated, without a clear resolution point. Critiques such as these and added public pressure to move away from large scale supply-focused infrastructure projects, common under supply-side approaches, created an opportunity for a paradigm shift in theory and in practice.

2.3.2 The Demand-side Paradigm

The demand-side paradigm focuses on the end goal of water use. Within this approach, supply challenges are met with attempts to change how water is used and thought about instead of continually developing new sources (Gleick, 2002; Brooks, 2005). To illustrate, consider the increase in property value and neighborhood appeal that a luscious green lawn creates. Lawn watering allows homeowners to meet their "curb appeal" goal in this example. The demand-side paradigm asks water users to think about how their goals can be achieved with less water or lower quality water. Xeriscaping has become a popular landscaping method in regions with water supply challenges. This method reduces water use while still achieving the "curb appeal" goal.[4]

Within the demand-side paradigm, the water soft path, envisioned by Peter Gleick in 2002, has gained popularity in regions with water supply gaps. The water soft path focuses on

[4] Xeriscaping is a landscaping method that uses water-conservation techniques and drought tolerant plants to reduce watering requirements (University of Nevada, 2015).

resolving supply-demand gaps by looking at end goal water use and quality matching. Quality matching suggests that not all water uses, like lawn watering, require potable fresh water. Therefore quality matching ensures potable water, the highest quality water, will only be used when truly required (i.e., human consumption) (Gleick, 2002). This approach is applauded for its focus on changing how people think about water in water scarce regions.

The water soft path has had limited application outside supply challenged regions. This result may link to the necessity of urgency, or its perception, to spur policy and behaviour change (Dunn, 2006; Inskeep & Attari, 2014). For example, the water soft path has had little uptake in Canada, a region where a perception of water abundance exists (Brooks, 2005). Brandes and Kriwoken (2006) note that perceptions of water abundance often limit the use of alternative water use strategies in practice. As a result the water soft path may not be easily applied in regions without current water supply issues. This highlights a drawback of the approach, since in practice, much of its success occurs because it is a reactionary measure.

Adaptive management has also gathered attention under the demand-side paradigm. Adaptive management uses small changes and feedback to facilitate decision-making under uncertain conditions (Williams & Brown, 2012). The approach is rooted in adaptive decision-making concepts, first discussed by Beverton and Holt (1957) and made popular by Holling (1978). Interventions are treated like experiments, testing each in real world settings and learning from the results. Corrections and adjustments occur on the basis of results and newly available information (Lempert & Groves, 2010). Intervention editing of this nature gives those using adaptive management a way forward without perfect "problem and solution" type thinking.

Intervention editing, within adaptive management, has also been a source of criticism for the approach. Critiques suggest that those claiming to have successfully implemented an adaptive approach have often not fully quantified the costs or benefits related to interventions prior to implementation (Rist, Campbell, & Frost, 2013). As a result of this lack of quantification, critics suggest feedback is often missed rendering the "test" invalid and undermining the method's positive aspects (Williams & Brown, 2012). Despite this critique, the incremental change and learning aspects of this approach have intrigued many and are often incorporated in other management styles.

2.3.3 Moving Forward with the Water Security Framework

The water security framework rose to the forefront of water management by: (1) addressing critiques from past paradigms, and (2) building on elements that worked well in past paradigms. For example, systems-thinking and elements of the water soft path are integral parts of water security discussions aiming to balance the needs of economic, environmental and social sectors. Feedback loops, designed prior to implementation, also play a crucial role in the framework informing adaptive change. Additionally, the security focus creates an end point that is easily understood in goal-oriented societies (Cook & Bakker, 2012). Water security combines these elements to bridge the gap between supply-side and demand-side paradigms allowing for more balanced solutions to complex issues.

2.4 Achieving Water Security is Difficult in Practice

Achieving water security is difficult in practice. This difficulty frequently begins in the realm of public policy. For example, policy making can be slowed or blocked by a number of factors. In the past, policy supporting water security has been blocked due to a lack of perceived urgency to change from the current state, and by those with vested interest in the current state. Policy change is only one piece in the creation of water security, but an important one, as government continues to play an important role in public decision processes (Pierre & Peters, 2000; Huitema & Meijerink, 2010).

Grey and Sadoff (2007) detail how aspects of a region's hydrologic environment can also affect a region's ability to achieve water security.[5] Results from their study demonstrate that a region's hydrologic environment can influence investment decision-making regarding water infrastructure. However, as the main research question of this study relates to change in water management and planning activities based on the *25 Year Water Security Plan* analyses will focus on instances that block policy change.

[5] A region's hydrologic environment contains three factors: (1) the absolute level of water availability, (2) the variability of water availability throughout a single year and year-to-year, and (3) the geographic distribution of water supplies (Grey & Sadoff, 2007).

2.4.1 Urgency

Research depicting the need for or perception of urgency to fuel policy change is abundant (i.e., Solecki & Micheals, 1994; Burmil, Daniel, & Hetherington, 1999; Dunn, 2006; Daniell, 2012; Larson, Wiek, & Keeler, 2013). Within this body of research external "shock events," such as hurricanes or earthquakes, act as focusing events to create urgency by highlighting the ineffectiveness of the current policy (Huitema & Meijerink, 2010). As a result, external shocks can increase the possibility for policy change. Downs' (1972) issue-attention cycle theory as well as Kingdon and Thurber's (1984) work on policy windows demonstrate this phenomenon.

Downs' (1972) issue-attention cycle describes the manner in which the general public becomes aware and "interested" and subsequently "disinterested" in domestic and international issues. Downs describes the theory as having five stages: (1) the pre-problem stage, (2) alarmed discovery and euphoric enthusiasm, (3) realizing the cost of significant progress, (4) gradual decline of public interest, and (5) the post-problem stage. The second stage highlights the important role the external shock events play in focusing public attention on a problem and creating a collective desire for a solution. Downs references the ghetto riots in 1965 as a focusing event for conditions of racism and poverty in the United States.

Policy windows are defined as, "brief opportunities during which the probability of adopting new policy or legislative proposals is greater than usual" (Kingdon & Thurber, 1984; Solecki & Michaels, 1994). Policy windows do not require shock events to open but are more successful in urging new policy if an event or a combination of factors can create the perception of need (Kingdon & Thurber, 1984). Additionally, a policy window does not create certainty around new policy adoption or policy change as a number of factors can rapidly close a policy window (Berke & Beatley, 1992; Solecki & Michaels, 1994). Factors influencing policy window closure include but are not limited to: (1) participants feel the problem has been addressed (even if incompletely), (2) participants fail to get significant results to address the problem, (3) the crisis is short, (4) new personnel enter the problem space and decide to close the problem, and (5) if no available solution exists and as a result the prominence of the issue fades (Kingdon & Thurber, 1984; Solecki & Michaels, 1994).

Huitema and Meijerink (2010) state change is often only possible in water management after the existing paradigm is tested and fails, for example through devastating flooding or

drought. Brandes and Kriwoken (2006) present evidence of the importance of perceived urgency from the Okanagan Basin in British Columbia. The region is facing dwindling water supplies for all uses, but the perception of water abundance stalls the majority of efforts to promote water conservation. This example demonstrates the role that urgency (or a lack of) can play in fueling change in water management. However, gaining focused public attention on an issue that challenges widely held norms of the society is only one hurdle for those attempting policy change (Coyne, 2011). Challenging existing policy networks to move away from the status quo presents another significant hurdle.[6]

2.4.2 Vested Interests

Vested interests reduce the likelihood of movement away from the status quo. A vested interest refers to a stake in maintaining or influencing a condition, arrangement, or action to create personal benefit (Lehman & Crano, 2002). Examples of vested interest blocking policy change are present around the world.

Menahem (1998) describes the evolution of water policy in Israel from 1948-1997. The author outlines two water policy paradigms for the region during this timeframe.[7] The first supports expanding water resources and agricultural production as part of a nation building process, between 1948 and 1967. The second highlights legislation that prioritizes agricultural expansion over water conservation despite increasing water insecurity, between 1968 and 1997. During the latter time frame two widespread drought events occurred in Israel, 1979 and 1985 respectively. Despite these shock events, policy did not evolve to protect or conserve water resources as a "water is for agriculture" ideology was entrenched in the national identity of many in governing positions (Menahem, 1998). As a result, vested interests that supported agriculture's primacy over water resources in the current state contributed to the lack of adoption (or discussion) of water conservation policy.

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[6] Policy networks are those settings where actors from government and nongovernment interact, define problems, and create solutions that support established public and private interests (Menahem, 1998).

[7] Policy paradigms refer to the system of ideas and standards that specify the goals of a policy, the kind of instruments that can be used to attain them, and the very nature of problems they are meant to address (Hall, 1993, p. 279).

Mercer *et al.* (2007) suggest the "best of times" discourse, promoted by conservative government and corporations, limits discussion of the direction of society and the environment in general. The best of times discourse refers to the mainstream media's prominent discussion of: the abundance of resources in Australia and the widespread benefit that harvesting these resources yield to the population (Mercer et al., 2007). Within this discourse environmental issues are reported in a superficial manner as "anomalies" that do not require public concern. Here those with vested interests in processing Australia's fossil fuels, soils, forest and water supplies seek to delegitimize discussion that supports movement away from the current state (Mercer *et al*., 2007).

Brandes and Kriwoken (2006) suggest agricultural groups in the Okanagan Basin perceive "ownership" over water resources. Frequently conflicts occur among water users in the Basin as water supplies for human consumption, economic use, and ecological health are threatened by overuse. However, water management strategies to promote conservation and manage demand are largely rejected as described earlier. Perceptions of ownership over water resources in agricultural users groups has led to expectations of continued low water prices, even with supply limitations. Outside agricultural users, the public perception of water pricing strategies is negative. Water pricing strategies are seen as "just another government tax." These perceptions create vested interests in the current state for both groups, since increasing the costs of water use will result in a monetary or production loss. As a result, water pricing strategies have been rejected in the region (Brandes & Kriwoken, 2006).

2.4.3. Negativity Bias

Both vested interests and a lack of perceived urgency foster a negativity bias in decision makers. Hood (2010) and Howlett (2014) describe negativity bias as the tendency of decision makers to avoid action of any kind if it may result in adverse consequences, such as public criticism or an attribution of failure. Water policy, like many other environmentally based policies, can create real or perceived future loss for groups. If these groups have power to voice concern they often do so by publically criticizing officials who propose these changes. Mercer *et al*. (2007) describe how mining and agricultural lobby groups have contributed to Australia's natural resource policy.

To avoid action and the potential for adverse consequences, decision makers justify support for the status quo (Howlett, 2014). Often this justification behaviour takes the shape of: (1) denying a problem exists, and (2) attacking opponents (Howlett, 2014). As a result, vested interests can be powerful mechanisms to block policy (and other) changes that would result in movement away from the status quo.

2.5 Governance

2.5.1 Overview

This section briefly introduces the concepts of governance and water governance. Following these introductory discussions, the concept of anticipatory governance is described using the relevant literature. Next the key activities of anticipatory governance are outlined and related to the key activities of traditional water governance approaches. This relationship forms the analytical framework for the research. Last the concept of anticipatory governance is discussed as a governance approach capable of facilitating water security.

2.5.2 What is Governance?

Usage of the term "governance" has risen in recent years. The Treasury Board of Canada defines governance as "the processes and structures through which decision-making authority is exercised" (2012). The Institute on Governance defines governance as "who has power, who makes decisions, how other players make their voice heard and how account is rendered" (2016). As stated in Chapter 1, Fulton et al. (2015) succinctly define governance as "who gets to decide what." All of these definitions focus on three key factors of governance: decision-making, accountability, and authority (Institute on Governance, 2016).

Decision-making is a primary function of the groups governing organizations. These groups are often made up of a subset of people from the organization as a whole, for efficiency purposes. Therefore decision-making positions have inherent authority, because they are: (1) limited, and (2) direct the future of organizations (Institute on Governance, 2016). Accountability is a crucial factor of governance, as the outcomes of decisions often result in the creation or reduction of potential future prosperity for those affected (Institute on Governance, 2016). As a result, members of an organization who feel their interests have not been considered

or well represented in decisions hold those parties to the decision responsible and may seek to have their decision-making authority revoked (Institute on Governance, 2016).

2.5.3 What is Water Governance?

The Global Water Partnership describes water governance as "the range of political, social, economic, and administrative systems that are in place to develop and manage water resources, and delivery of water services at different levels of society" (Rogers & Hall, 2003). Under the "who gets to decide what" definition water management and planning decisions are the "what" (outcomes) of the "who" (various organizational systems) acting to govern water resources. Complexity increases as more outcomes and organizational systems are added to discussions. The rise of the term water governance speaks of to the reality that governing water has morphed into a multi-level and multi-actor game played by both government and non-government actors (Huitema & Merijerink, 2010).

Traditional water governance approaches are not able to change "who gets to decide what." Changes to this structure fundamentally change the way decisions are made in these approaches removing "traditional aspects" from the approaches. For example in this approach, the power to make decisions rests with technical experts and water engineers working with government employees (Pahl-Wostl, 2007; Uhlendahl, Salian, Casarotto, & Doetsch, 2011; Biggs, Duncan, Atkinson, & Dash, 2013). Extending decision-making power to individuals outside these groups removes a fundamental element of traditional water governance approaches. Other activities of traditional water governance approaches include: (1) information gathered centrally and transferred in a top-down format, (2) demand and supply questions are answered by forecasting past trends onto a predictable system, and (3) information from predictions guides investment and infrastructure development to achieve desired goals, such as accommodating future population and industrial growth (Pahl-Wostl, 2007; Chi, 2008; Huitema & Meijerink, 2010; Boyd *et al*., 2015).

Modern water governance leaves behind many traditional water governance traits by engaging multiple stakeholders and outside expert groups, focusing on proactive and flexible planning, and allowing for both supply-side and demand-side solutions to challenges. Transitioning from traditional to modern water governance will require a change in "who gets to decide what." Governance improvement of this nature is crucial to accommodate key factors of

the water security framework (Pahl-Wostl, 2007; Grey & Sadoff, 2007; Huitema & Meijerink, 2010; Dilling & Lemos, 2011; Cook & Bakker, 2012). Anticipatory governance is an approach able to meet this need.

2.5.4 Anticipatory Governance

Anticipatory governance has been suggested as a mechanism that can accommodate uncertainty, complexity, and problems that involve difficult trade-offs (Fuerth, 2009; Quay, 2010; Boyd *et al*. 2015). Anticipatory governance seeks to enhance the ability of decision makers to imagine and prepare for a variety of emerging futures based on trends (Barben, Fisher, Selin, & Guston, 2008). This new approach has taken on a number of forms: adaptive governance (Folke *et al*., 2005; Camacho, 2009; Brunner, 2010), anticipatory governance (Fuerth, 2009; Quay, 2010; Fuerth & Faber, 2013), robust decision-making (Lempert *et al*. 2003), robust adaptation (Wilby & Dessai, 2009), and transition management (Huitema & Meijerink, 2010). Common to all forms of the approach are the goals of social learning focused on building resilience and heavy reliance on the participation of individuals and groups not traditionally part of decision-making processes (Pahl-Wostl *et al.*, 2012; Davies & Selin, 2012; Boyd *et al*., 2015).[8]

Guston (2014) notes two distinct threads in the concept of anticipatory governance. The first thread is associated with public administration and management studies (i.e., Bächler, 2001), influenced by Lindblom (1959). This thread sees anticipatory governance as an undesirable approach as it equates anticipation with prediction, a concept incrementalists consider impossible (Guston, 2014). The second thread is based in environmental and policy studies (i.e., Sarewitz *et al.*, 2000; Boyd *et al*., 2015). Within this thread a distinction is drawn between prediction and anticipation, and as a result anticipatory governance is viewed more favorably (Guston, 2014).

This research follows the second thread in its distinction between prediction and anticipation. Sarewitz and Pielke Jr. (1999) state:

> Prediction is a test of scientific understanding where the answer to a hypothesis is the difference between what is predicted to happen based on theory and what

[8] Resilience is the ability of a system and its components to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely manner (IPCC, 2012).

> actually occurs. Alternatively anticipation is a guide to decision-making where people seek to know the future in the belief that the knowledge will enable beneficial proactive action in the present (p.122).

Toffler (1975) described this type of anticipation as building capacity for long-term planning by thinking about the future "we want to have." Given this understanding, processes within anticipatory governance build capacity to better prepare for a wide range of potential events, not a single expected instance. Guston (2014) likens this type of practice to a person lifting weights in a gym. He suggests the person is likely not preparing for an expected occurrence where physical strength will be needed, but building capacity for a range of potential instances where strength will be an asset.

Anticipatory governance has been applied in many research areas since gaining popularity in the early 2000s. Examples of previous research areas include those that: seek to understand climate change adaptation (Feltmate, 2013; Quay, 2010; Serro-Neumann, Harman, & Low Choy, 2013); gauge governance transformation (Osborne & Gaebler, 1993; Chi, 2008; Fuerth, 2009; Farooque, 2011); and document the development of nanotechnology (Camacho, 2009; Karinen & Guston, 2010; Barben *et al*., 2008; Davies & Selin, 2012; Guston, 2014). Using the anticipatory governance framework in water research is unique. Only one other study – Boyd *et al*. (2015) – has used this approach.

Boyd *et al.* (2015) investigated the application of anticipatory governance activities in multi-scale regional networks in an empirical case study of regional water governance in Mälaren, Sweden. The study showed evidence of: (1) collaboration and stakeholder integration in decision-making, (2) minor adaptive practices, and (3) long-term planning horizons. However, the authors conclude that transitioning to a fully anticipatory governance approach is inherently difficult. The conclusion relates to a lack of capacity to imagine and comprehend complex futures rather than ignorance of potential issues (Boyd *et al*., 2015). In other words, participants simply cannot imagine a future where it is not possible to mitigate years of consecutive drought through traditional measures such as "no lawn watering" conservative policy and reservoir draw down.

The difficulty in imaging complex futures is also evident in a case study from the Oldman River Basin in Alberta, Canada (it should be noted that this case did not examine anticipatory governance). Participants from the region's water governance agencies and irrigated agriculture sector engaged in a scenario-based game in order to understand adaptation processes

(Hadarits, Pittman, Corkal, Hill, & Bruce, 2015). In working through adaptation planning for a three-year consecutive drought scenario, the participants did not experience discomfort or display anxiety. Discussions focused on adaptations used during the 2001-2002 drought in Alberta. Participants employed enhanced water efficiency infrastructure, water markets, and cooperation between water users allowing their teams to "rise to the challenge" under this scenario (Hadarits *et al.*, 2015, p. 7). However, during rounds featuring two years of consecutive flooding followed by five years of consecutive drought, some participants experienced discomfort and visible agitation, as they were unable to draw on past experiences to inform adaptation decision-making.

Among researchers there is a general consensus that anticipatory governance is a cyclical approach made up of processes that occur in stages (see Figure 2-1 adapted from Serrao-Neumann *et al*., 2013). Barben *et al.* (2008) described the cyclical nature of anticipatory governance as an "ensemble" where each of the processes is needed to inform and evaluate the next, and in turn create the approach.

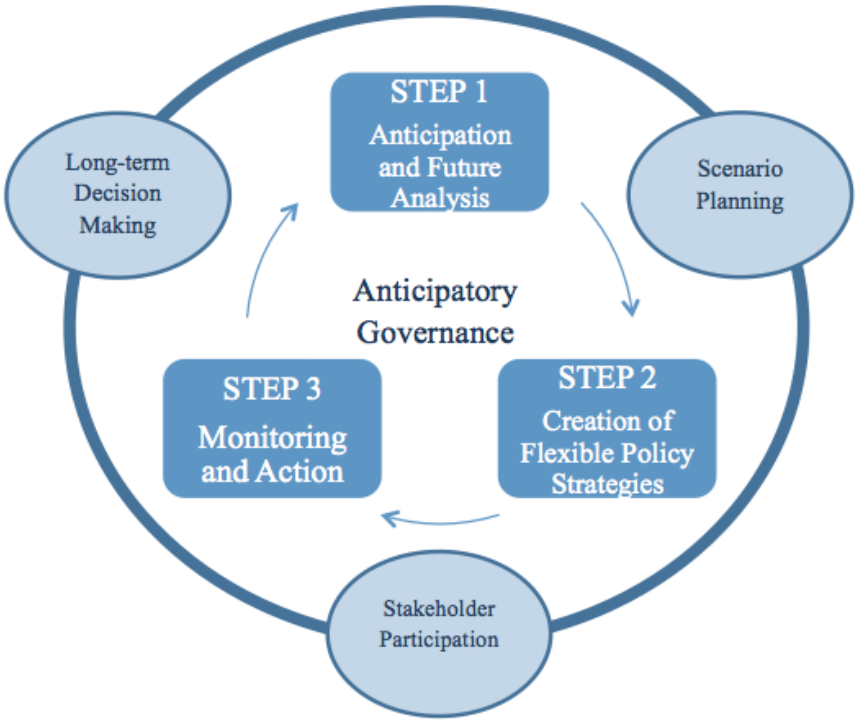

Figure 2-1. The Anticipatory Governance Process (Serrao-Neumann *et al*., 2013).

The three main processes of anticipatory governance are: foresight and engagement, creating flexible intervention strategies, and continued monitoring and change via feedback (Chi, 2008; Fuerth, 2009; Quay, 2010; Guston, 2008; Barben *et al*., 2008; Davies & Selin, 2012; Fuerth & Faber, 2013; Boyd *et al*., 2015). These processes and their activities are described below.

The foresight process moves beyond traditional single prediction based planning. Here multiple futures are imagined and analyzed in order to prepare for upcoming challenges and opportunities (Davies & Selin, 2012; Fuerth & Faber, 2013). Multiple futures are built through trend monitoring and collectively sourced information using methods such as participatory visioning and stakeholder engagement. This process focuses on including information from expert and non-expert stakeholder groups to incorporate local and traditional knowledge regarding potential opportunities and challenges (Gómez-Baggethun *et al.,* 2012; Valdivia *et al*., 2010). Mistrust between participants, differences in perceived power (the perception opinions are weighted differently) and time required can hinder foresight efforts through collective information gathering (Davies & Selin, 2012).

Information gathered in the foresight process is used to create scenarios. Scenarios allow for "pre-real life" testing of potential interventions as described under the adaptive management approach earlier in this chapter (Lempert *et al*., 2003; Foresight Horizon Scanning Center, 2009; Fuerth, 2009). Many computer programs exist to facilitate scenario planning. Feedback from these scenario planning tests guide intervention decision-making with the hope of building resilience to negative events and allowing for the seizure of new opportunities (Fuerth & Faber, 2013).

Policy, behavioral or infrastructure interventions that produce positive results in scenario planning tests become the chosen strategies for the implementation process (Fuerth, 2009; Quay, 2010). Strategies are considered positive when they preserve future options, allow for no-regrets scenarios, or work well over many different futures (robust strategies) (Quay, 2010). Strategies that preserve future options allow decisions to be made in the future when more information is available with limited risk of ending up in over-prepared or under-prepared states. To illustrate this, the City of Phoenix has purchased land where groundwater wells may be drilled if needed (Quay, 2010). In this instance, the municipal government is preparing for a future where current water supplies are supplemented through groundwater sources. Work to drill the wells will not begin until necessary. No-regrets scenarios prepare organizations for the worst "future."

Choosing a no-regrets strategy assumes all other futures will be prepared for as well if this type of strategy is used. Robust strategies are those that will perform well over the majority of futures (Wilby & Dessai, 2009).

Intervention implementation can be accomplished through all-or-nothing approaches or occur in staged modules. The module concept is often most common. It allows for precaution, with intervention modules implemented on an as needed basis (Guston, 2014). Here smaller actions can be taken without high levels of risk regarding wasted resources. Dupuy (2007) calls this a "prudential" approach to anticipatory governance. This type of implementation is common with strategies that preserve future options and robust strategies as they allow for social learning and adaptation.

The monitoring process in the anticipatory governance approach follows the implementation adaptive strategy. Since the problems addressed using anticipatory governance are complex, single "one-time" solutions are not possible (Fuerth & Faber, 2013). Monitoring intervention feedback is crucial as it enhances the ability for applied learning and creates opportunities for action to avoid complete intervention breakdown or policy deterioration (Lempert & Groves, 2010; Tschakert & Dietrich, 2010; Fuerth & Faber, 2013; Boyd *et al*., 2015). Monitoring processes have been criticized in the past for a lack of objectivity, as mentioned earlier in this chapter. To avoid missing signposts of intervention breakdown, detailed monitoring plans must be in place prior to implementation.[9] As a result small changes in intervention performance are not overlooked and opportunities for iterative change are not missed. The monitoring process is crucial if water governance systems are to move to proactive problem solving and away from traditional crisis management tactics.

Reaching the monitoring stages of the anticipatory governance approach takes time. Quay (2010) reported that planning organizations in Phoenix, Denver, and New York City were all actively engaging in anticipatory governance processes, including participatory decision-making and building adaptive climate change strategies. However, none of these organizations had moved beyond the implementation process to the monitoring stage.

[9] Signposts refer to as predetermined key occurrences or thresholds that once observed indicate a need for a change in the current policy or management strategy (Lempert & Groves, 2010).

2.5.5 The Relationship between Anticipatory Governance and Water Security

Water security requires a governance approach capable of addressing uncertain and complex challenges (Sarewitz, Pielke, Jr., & Byerly, Jr., 2000; Pahl-Wostl, 2009; Ostrom, 2010; Quay, 2010). Anticipatory governance is capable of addressing uncertain and complex problems. The framework does this through its process of processes: (1) imagining multiple futures, (2) testing each using scenario programming, (3) allowing various implementation strategies, and (4) focusing on monitoring to support adaptation as new information becomes available (Quay, 2010).

Water security requires a framework that allows for participation in decision-making activities from a wider group than is traditional. The anticipatory governance approach accepts that governance does not only involve the undertakings of government but rather includes planning and decision-making activities that involve a broad group of actors (Guston, 2014). Foresight processes within the anticipatory governance framework accommodates this need by including a wide range of actors to gather technical, social, ecological, and traditional information in order to build possible futures (Fuerth and Faber (2013).

Water security requires a long-term approach that maintains sustainability of people, the environment, and economic opportunity. Planning horizons in the anticipatory governance framework are longer than traditional cycles (Quay, 2010). Continuous monitoring allows intervention feedback to direct change to avoid complete breakdown over time (Lempert & Groves, 2010; Tschakert & Dietrich, 2010). Additionally, supporting adaptive change as information becomes available allows interventions to be implemented over longer time spans and on an as needed basis reducing wasted resources if potential futures do not come to fruition (Dupuy, 2007; Quay, 2010; Guston, 2014).

2.6 Analytical Framework

The analytical framework used in this research focuses on operationalizing the descriptions of traditional water governance and anticipatory governance approaches. Reactive thinking, traditional decision-making structures, rigidity, and fragmentation are considered factors exemplary of traditional water governance approaches. Table 2-1 outlines tangible activities attached to each factor of traditional water governance approaches.

Table 2-1. Factors of Traditional Water Governance Approaches.

Factors of Traditional Water Governance Approaches	Representative Activities
Reactive Thinking	Current issues gain the majority of focus
	Problems are acknowledged and/or addressed in a response-based manner
Traditional Decision-making	Decisions are made in a top down fashion mainly by water engineers
	Planning is done with short term horizons assuming stationarity
Rigidity	Hard-path or infrastructure based solutions
	Inflexible allocation systems
Fragmentation	Low levels of collaboration and communication between organizations involved
	Piecemeal planning in organizations

The following four factors are considered the elements of the process of anticipatory governance: foresight, participation, flexibility, and continued monitoring. Table 2-2 presents tangible activities associated with factors of anticipatory governance.

Table 2-2. Factors of Anticipatory Governance.

Factors of Anticipatory Governance	Representative Activities
Foresight	Planning using multiple scenarios
	Proactive thinking and/or problem acknowledgement
Participatory Decision-making	Stakeholder engagement
	Inter-agency coordination
	Bottom-up (shared) decision-making power
Flexibility	Planning using robust options or those that maintain options into the future state
	Soft-path solutions
Continued Monitoring	Feedback information is used for adaptive changes

Table 2-1 and Table 2-2 present factors of traditional water governance approaches and anticipatory governance in a simplified manner to ease research coding. This mutually exclusive listing allows differences between the governance approaches to be highlighted and quantified. However in practice the relationship between the traditional and anticipatory governance approaches could be considered a flexible continuum.

2.7 Summary

This chapter outlined the literature relevant to understanding the research undertaken in this thesis. Water security was defined and its key factors identified. Following this section, elements able to block water policy change were described. The concept of governance is introduced, followed by a discussion of traditional water and anticipatory governance approaches. The analytical framework of this research is outlined in Table 2-1 and Table 2-2. The tables outline the tangible key activities of both traditional water governance and anticipatory governance approaches. Finally, anticipatory governance is advanced as a governance approach that supports the needs of the water security approach.

CHAPTER 3
METHODOLOGY

3.1 Overview

This thesis is an exploratory study using a qualitative approach to examine if the adoption of water security language in the name and long-term planning document of the Saskatchewan Water Security Agency is associated with a change in the governance of the SSEWS and thus has affected water management and planning activities in this system. To accomplish this, the research uses three data sources: the *25 Year Water Security Plan*, a social network survey, and participant interviews coded for factors of traditional water governance and anticipatory governance using Table 2-1 and Table 2-2.[10] The research protocols were approved by the University of Saskatchewan Behavioral Research Ethics Board (BEH #13-408) on January 14, 2014.

3.2 Site Selection

The SSEWS system was chosen as the study site for this research because it serves a diverse set of water users whose membership mimics the user group compositions of larger watersheds, such as the South Saskatchewan River Watershed. Water users in SSEWS include potash and agriculture industries as well as recreation and municipal customers. The site is also home to conservation projects aimed at retaining wetlands for waterfowl nesting habitats (Ducks Unlimited Canada, 2016). In balancing these diverse and sometimes conflicting water demands, the SSEWS reflects the challenges of those making water security decisions on a larger scale. Therefore, lessons learned here regarding the impact of governance changes on water management and planning decisions have the potential to be applied elsewhere.

The SSEWS system is unique to Saskatchewan's portion of the South Saskatchewan River Watershed as demand is currently outstripping delivery capacity. "If everyone asked for their [allotted] water at the same time, the canal couldn't physically meet demand with the current infrastructure" (Participant G12). To date this challenge has been met with investment in infrastructure upgrade (Boyle, 2014) and water allocation reduction conversations (Participant

[10] Coding refers to the classification of data into themes and analytical constructs.

E13). However, the pressure this situation places on water managers and decision makers for SSEWS creates the potential for change in water management and planning decisions.

Additionally, SSEWS was an attractive study site due to its location. The majority of municipalities within the SSEWS are easily accessible from Saskatoon, Saskatchewan. Saskatoon is the author's home city and the relative closeness of interview sites limited interview-related costs.

3.3 Data Collection and Storage

Participant sampling was purposive. All participants must have been from organizations using water from the SSEWS region at the time of the interviews in order to be considered appropriate candidates.[11] Of course, other groups could have been focused on for participant selection. For example, employees from the Saskatchewan Water Security Agency may have been good candidates to measure changes in internal governance philosophy. However, because the study aims to gauge if the organizational title change and the roll out of the *25 Year Water Security Plan* have lead to changes outside the Saskatchewan Water Security Agency, a wider group of water stakeholders were selected as participants.

Potential participants were identified through conversations about water use in SSEWS with colleagues at the Global Institute for Water Security at the University of Saskatchewan. The participants were invited to participate in the study using a standardized invitation sent via e-mail. Of these contacts, 13 people (2 female; 11 male) agreed to take part in the research project. The total number of participants was two less than the original research goal set out in the thesis proposal defense. Snowball sampling to increase participant numbers was not allowed due to instruction from the University of Saskatchewan Research Ethics Board and as a result the study proceeded with 13 participants. The age and education distribution of the sample are shown in Table 3-1 and Table 3-2.

[11] Purposive sampling refers to building a participant pool based on the research objectives. "Stakeholder" sampling is a type of purposive sampling where all major stakeholders involved in designing, giving, receiving, or administering the program or service being evaluated are identified as potential participants (Palys, 2008, p.697).

Table 3-1. Sample Age Distribution.

Age	*n*
60 and above	1
51-60	4
41-50	1
31-40	2
21-30	1

Table 3-2. Sample Education Distribution.

Education Level	*n*
High School Diploma	1
Technical Certificate or Diploma	2
Bachelor's Degree	2
Master's Degree	3

Four people abstained from giving age and education information. As a result only nine participants are listed in Table 3-1 and Table 3-2. However, thirteen participants took part in the study.

Participant organizational affiliation was diverse and representative of the region in order to gather a wide set of perspectives. Participants from provincial and municipal government, crown corporations, agriculture and potash industries, conservation organizations, and consulting companies were included in the study. Representation from the recreation and tourism sector was sought but unfortunately the targeted individuals declined to participate.

Interviews were completed from March 2014 to May 2014. Interviews were semi-structured, loosely followed an interview guide (Appendix E). Interviews ranged from 30 to 70 minutes and took place in private settings such as offices and boardrooms to ensure participant confidentiality. Interview questions contained some language participants found confusing. Terms such as "governance", "water governance", "water situation/context", and "futures planning" often required explanations from the author. The presence of jargon may have affected the results of the study, as explanations of these terms may have inadvertently primed participant responses.

All interviews were tape recorded with consent. Recordings were stopped at the request of participants at any time. Two participants requested tape stoppages for only short explanatory

conversations outside the scope of the research. Interview recordings were fully transcribed by the author and imported into NVivo 10 for Mac (QSR International, 2014) software to aid coding following the suggested method of Crowley, Harré and Tagg, (2002). Alphanumeric codes were used on all participant transcription files to ensure confidentiality.

Following the interviews, participants were given an eight-question social network survey. The survey asked participants to list the names and the corresponding organizations of up to ten people they communicate with about water and their work, and/or water governance. Three participants listed more than ten contacts (11, 11, and 12 respectively). The average number of contacts listed was 7.2. The survey also gathered information on the type of interactions participants experienced with those they listed. Of the 13 interview participants, three opted not to complete the survey. The remaining 10 social network surveys were filled in to varying degrees. Unclear instructions and confusion with terminology may have contributed to this completion rate issue.

All people listed as contacts of participants were given the same alphanumeric code as the participant that listed them plus one number. For example, if participant E04 listed three contacts they would be recorded as E041, E042, and E043. The code sheet is kept in a locked file separate from the data itself.

All data sources are maintained on the double secured student file system within PAWS at the University of Saskatchewan. All thesis materials will remain in this secure location for five years as per the University of Saskatchewan Research Behavioral Ethics Board stipulations (University Council, 2013).

3.4 Data Analysis

Table 2-1 and Table 2-2 presented factors of traditional water governance and anticipatory governance as well as tangible activities associated with each factor. This information guided data coding and analysis. Two methods of data analysis were used in this research: directed content analysis and social network analysis. Results demonstrating a higher a number of instances of anticipatory governance in all three data sources would be considered evidence of a governance change on paper and on the ground. Additionally, this result would suggest that the inclusion of water security language in the Saskatchewan Water Security Agency's title and its long-term plan moves beyond linguistics.

3.4.1 Directed Content Analysis

Content analysis can be performed on a wide range of raw text sources including newspapers, radio broadcasts, interview transcriptions, and social media posts (Hsieh & Shannon, 2005). The current research uses two raw text sources: (1) the *25 Year Water Security Plan*, and (2) interview transcriptions. Content analysis is used to gain an understanding of text that is deeper than counting words and phrases with the goal of making inferences, revealing trends, and differences within sources after data aggregation (Kripendorff, 1989; Hsieh & Shannon, 2005).

Directed content analysis is different than conventional content analysis in that the coding is guided by a set of pre-selected themes of interest to the researcher (Hsieh & Shannon, 2005). As mentioned above, the pre-selected themes, called factors in this study, are outlined in chapter 2, Table 2-1 and 2-2. Directed content analysis is used when theory exists on the topic of study and this theory can help hone the research question and develop predictions about relationships between variables (Mayring, 2000). The goal of directed content analysis is to extend, support, or refute existing theory (Hsieh & Shannon, 2005). In this research, the theory of anticipatory governance as a cyclical approach made up of processes that could accommodate the water security framework using elements of foresight, participatory decision-making, adaptive strategies, and continued monitoring is examined.

A potential weakness of the directed content analysis method is confirmation bias on the part of the investigator (Lincoln & Guba, 1985; Hsieh & Shannon, 2005). Confirmation bias occurs when a researcher knowingly or unknowingly codes data in support of the hypothesis or predicted result. The risk of confirmation bias is lowered if multiple coders are used and results are collapsed to create a master-coding list. Multiple coders were not used in this research due to budgetary constraints. However, full coding lists for traditional water governance approaches and anticipatory governance are available for review in Appendices A and B to ensure data transparency.

3.4.2 Social Network Analysis

Social network analysis assumes that social life is created through relations and patterns (Marin & Wellman, 2010). Simply put, a social network is a set of actors, individuals or social entities and their relationships or ties with each other (Koehly & Shivy, 1998). Social

relationships or ties commonly studied by network analysts include common distinctions like kinship, friend, student, and coworker; affective ties based on network members' feelings towards one another; or cognitive awareness (i.e., "knowing someone"). Four basic assumptions underlie the network perspective:

1. Actors and their actions are viewed as interdependent;
2. Relational ties between actors serve as channels for social resources, such as information, material or nonmaterial support, or friendship;
3. The structure of a network can limit as well as foster individual action; and,
4. Network maps model patterns of relations among actors (Galaskiewicz & Wasserman, 1994).

Social network analysis allows researchers to examine relationships among groups of social actors within specific social contexts (Koehly & Shivy, 1998). This ability has led to a large uptake in social network analysis as a method of visualizing personal networks (Hogan, Carrasco, & Wellman, 2007), understanding emergency service networks (Eisenman *et al*., 2009) and business links (Lewrick, Peisl, & Raeside, 2007), counseling (Koehly & Shivy, 1998), nursing (Pow, Gayen, Elliott, & Raeside, 2012), and enhancing collaboration between organizations (David, 2013).

This research uses a social network analysis to map communication and connectivity patterns between those interviewed. An analysis of the patterns will allow an assessment of who holds the power in the network. Anticipatory governance assumes that power is distributed across a wider set of actors than in traditional water governance approaches. A network map that shows connections distributed throughout sectors suggests those on the ground collaborate, communicate, and share power in water management and planning decisions, all of which are important elements of anticipatory governance. A network map that shows the opposite of this, connections focused within individual sectors, indicates the continuation of traditional water governance approaches.

The social network survey used in this research was modeled after a survey developed by Graham-Durant Law and Trish Milne from the University of Canberra. The survey was altered to include questions relevant to this research. Survey responses were collected and a sociogram (social network map) was created using this information in UCINET 6 for Windows (Borgatti, Everett, & Freeman, 2002). The UCINET software license is maintained by the Social Sciences Research Laboratory at the University of Saskatchewan.

3.5 Summary

A qualitative approach was used to assess if the adoption of water security language by the Saskatchewan Water Security Agency has been accompanied by a change in governance and has had an impact on water management and planning activities in SSEWS. Three data sources were coded using the factors of anticipatory and traditional water governance outlined in Table 2-1 and Table 2-2. Results from the directed content and social network analyses are presented in Chapter 5.

Chapter 4 presents information on the study site, the SSEWS. Information about the SSEWS's geographic locale and history are outlined first. Following this, the history of water management in the SSEWS is summarized.

CHAPTER 4
THE SASKATOON SOUTH EAST WATER SUPPLY SYSTEM

4.1 Overview

This study uses the Saskatoon South East Water Supply (SSEWS) system as its geographic setting. The SSEWS system spans a small region, but the diversity of water users and current challenges, such as aging infrastructure and rapidly growing demand, mimic that of larger systems in Saskatchewan and Western Canada. All persons interviewed for the research use water from the SSEWS region in their work or home life. As a result it is assumed the participants have an interest in how the water in SSEWS is governed and are appropriate interview candidates for this research.

The SSEWS is contained within the South Saskatchewan River Watershed in Saskatchewan, Canada. The system delivers water to multiple users from Lake Diefenbaker via the East Side Pump Station and M1 Canal (Figure 4-1). Gravity feeds the majority of the man-made system as it stretches 110 km from Broderick Reservoir to Dellwood Reservoir (Dury, Ylioja, & Green, 2012).

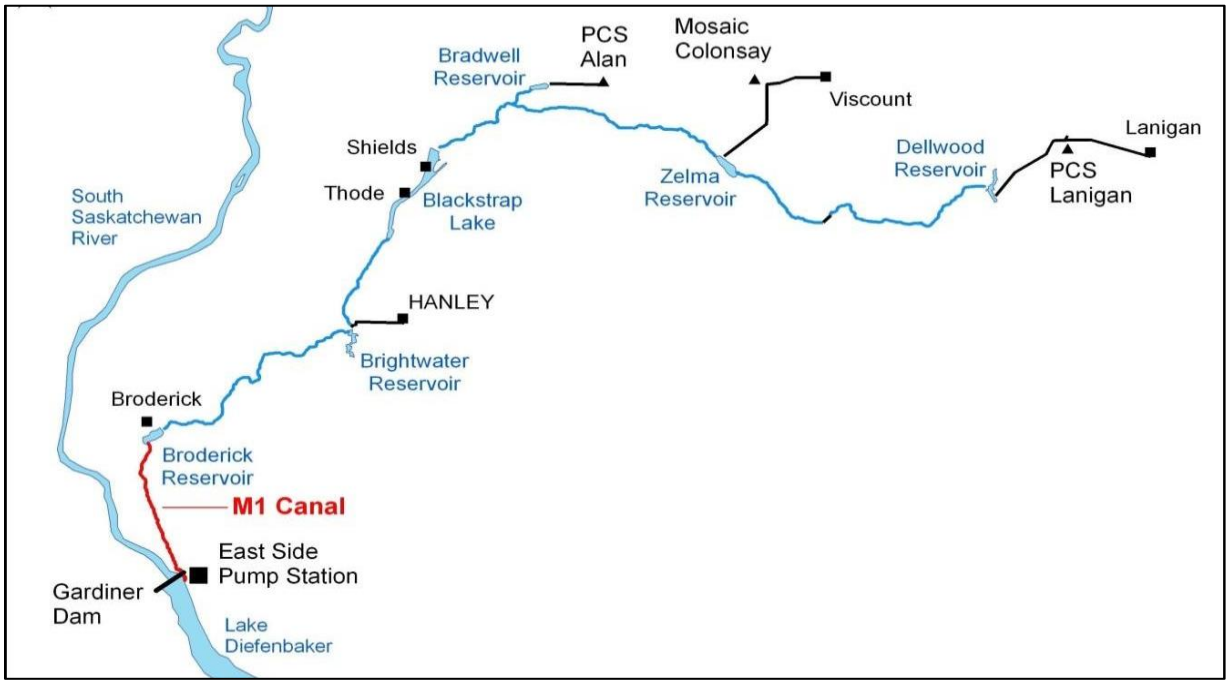

Figure 4-1. The Saskatoon South East Water Supply System (Dury *et al*., 2012).

Through its expanse, SSEWS provides non-potable water supplies for eight small towns and communities, three potash mines, 13 wetlands projects, and 57,000 acres of irrigated agriculture.[12] Communities drawing water from SSEWS for human consumptive uses are responsible for water treatment to standards set by the Saskatchewan Water Security Agency.

The region's population is growing slowly. In the 2006 Census, 3,436 residents listed the municipalities of Viscount, Hanley, Lanigan, Guernsey, Dundurn, Colonsay and the resort villages of Thode and Shields as their primary residence (Statistics Canada, 2012). In 2011, this group of municipalities had grown to 3,600 residents (Statistics Canada, 2012). The majority of the population in the region is employed in the agriculture, tourism, or potash industries.

4.2 The Saskatoon South East Water Supply's Geographic Locale

4.2.1 The Saskatchewan River Basin

SSEWS is a subsection of the South Saskatchewan River Watershed located within the Saskatchewan River Basin. The Saskatchewan River Basin is one of the world's largest river systems covering 336,000 km^2 of Western Canada. Runoff from spring snow melt in the Rocky Mountains provides 80% of the flow in the Saskatchewan River Basin (Pomeroy *et al*., 2010). The basin consists of two major east flowing river systems: (1) the South Saskatchewan River, and (2) the North Saskatchewan River. The South Saskatchewan River runs through diverse agricultural lands in the Canadian Prairies. The North Saskatchewan River drains prairie and forested areas. The two rivers join to pass through the Cumberland Delta and enter Lake Winnipeg, see Figure 4.2 (Gober & Wheater, 2014).

[12] 8,000 acres of irrigated agriculture are supported directly through the SSEWS system and 39,000 are supported through the M1 canal (Boyle, 2014).

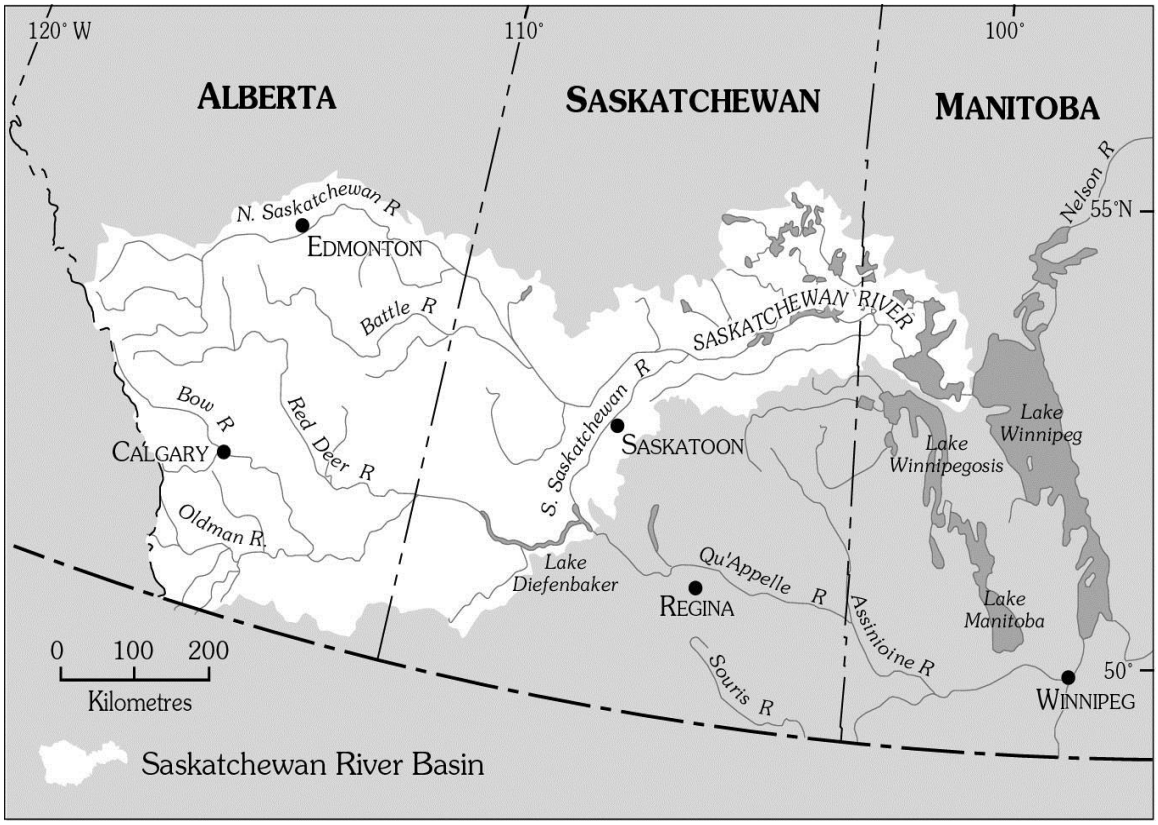

Figure 4-2. The Saskatchewan River Basin (Banff Centre, 2014).

The Saskatchewan River Basin faces a complex set of challenges. Rapid population growth and economic development increasingly threaten already fully allocated water resources in some areas (Hecker, Khim, Giesy, Li, & Ryu, 2012). Climate change is expected to create increasingly frequent extreme events such as flooding and drought (Sauchyn *et al*., 2008; Pomeroy *et al*., 2010; Marshall *et al*., 2011). The severity of the 2013 Bow River flood killed five people and caused an estimated $6 billion CND in damage as it moved through southern Alberta (Canadian Broadcasting Corporation, 2014). Temporal changes to the hydrologic cycle add new demand pressures to areas with heavy irrigation as irrigators strive to ensure high crop yields through appropriate watering schedules (Marshall *et al*., 2011; Schindler & Donahue, 2006). These challenges are further complicated as those who make water management and planning decisions reside across national and international boarders in fragmented and overlapping governance structures (Hurlbert, 2009; Gober & Wheater, 2014).

4.2.2 The South Saskatchewan River Watershed

The South Saskatchewan River Watershed is contained within the Saskatchewan River Basin. The watershed is home to more than three million people, heavy agricultural development, and diverse industrial ventures (Piersol, 2010). The region crosses the southeast corner of Alberta and moves north to central Saskatchewan then on to Manitoba. See the light blue section in Figure 4-3 below.

Figure 4-3. The South Saskatchewan River Watershed (Burke, 2011).

The region measures 146,100 km² and drains an area of 405,864 km² (Partners for the Saskatchewan River Basin, 2009). Saskatchewan's portion of the watershed features a semi-arid climate with pronounced seasonal variability and a mixed landscape (Pomeroy, *et al.*, 2010; Tanzeeba & Gan, 2012; Gober & Wheater, 2014).

Water demand throughout the watershed is large, varied, and increasing. Industrial demands come from power generation, natural resource extraction and transport for oil, natural

gas, and potash (Kulshreshtha, Nagy, Bogdan, 2012; Gober & Wheater, 2014). Pressure for increasing irrigated agriculture to foster the development of valued-added processing facilities in Saskatchewan adds to the competition for future water resources in the region.

4.3 Building the Saskatoon South East Water Supply System

After the crippling drought of the 1930s the Prairie Farm Rehabilitation Administration envisioned a large reservoir to create drought protection for communities and the agriculture industry in Saskatchewan (Saskatchewan Irrigation Projects Association, 2008).[13] Lake Diefenbaker and the SSEWS system are some of the results of this vision. Both structures were purpose-built to ensure local residents had a constant source of water for their many uses (Saskatchewan Water Supply Board, 1968).

The Government of Saskatchewan began consultation work with potential users of the SSEWS in the early 1960s. Increasing industrialization, urban expansion, and a need for water-based recreation outlets and irrigation supply were cited as indications of the need for the system (Saskatchewan Water Supply Board, 1968). Following public consultations, feasibility studies were conducted for the gravity fed system (Saskatchewan Water Supply Board, 1968). Construction of the SSEWS system began in 1966 shortly before Lake Diefenbaker was originally filled.

The SSEWS project was guided and designed by the Saskatchewan Water Supply Board, a newly formed Crown corporation, known today as SaskWater. By August of 1968 the system was fully operational. SSEWS was the first multi-purpose water supply system to take water out of Lake Diefenbaker. Two billion gallons were removed in the first year (SaskWater, 2015). Many of the original uses envisioned for the region have been fulfilled today including irrigation, industry support, and recreation development. SSEWS was based on a cost recovery model where the $25 billion CND price tag was to be recovered through user fees (Saskatchewan Water Supply Board, 1968). It is unclear if this goal was fulfilled.

[13] The Prairie Farm Rehabilitation Administration (PFRA) was a branch of the Agriculture and Agri-food Canada. This branch of Agriculture and Agri-food Canada no longer exists. In Agriculture and Agri-food Canada's new organizational structure PFRA and its services has been subsumed by Agri-Environment Services Branch (Agriculture and Agri-food Canada, 2011).

Lake Diefenbaker was filled in 1967. Gardiner Dam (north) and Qu'Appelle Dam (south) create the 225 km long man-made lake. The lake has a total storage capacity of approximately eight million dam^3 (Kulshreshtha *et al*., 2012).

The lake has reached much of its potential providing drought protection and flooding control opportunities for the province for over 50 years (Saskatchewan Water Security Agency, 2015a). However, unlike SSEWS, Lake Diefenbaker has not reached its design potential for irrigation support. The lake has seen economic, recreational, and residential activities development, but irrigation has not reached the critical mass of 500,000 acres required to support value-added processing (Saskatchewan Irrigation Projects Association, 2008). As a result, many irrigation supporters attempt to influence water and agricultural governance authorities to make decisions that will foster further irrigation development, much like is present in southern Alberta.

4.4 Managing the Saskatoon South East Water Supply System

Hurlbert (2009) describes water governance in Saskatchewan as occurring largely at the provincial level. This description remains relevant today. The Saskatchewan Water Security Agency and SaskWater are jointly responsible for water management, under the direction of the elected Minister of Environment (Hulbert, 2009).

The Saskatchewan Water Security Agency is responsible for water management and planning decisions. The organization is responsible for creating a holistic water policy, like the *25 Year Water Security Plan*, to be implemented province wide. Discretionary water licensing and drainage complaints are also addressed by this organization (Saskatchewan Water Security Agency, 2012). SaskWater is Saskatchewan's water utility. The organization is responsible for implementing water management planning on the ground on behalf of the Water Security Agency. Essentially, SaskWater is the organization distributing water to customers through infrastructure for a fee.

The relationship within these two organizations is fragmented and decentralized. Organizational decentralization stems from splitting people working who work for these organizations throughout Regina, Moose Jaw, and Saskatoon. This set up limits communication to videoconferencing, email, and telephone most often. Fragmentation comes from the split of water related responsibilities into categories that are not mutually exclusive. For instance, ownership and operational responsibilities are split by type of infrastructure. The Saskatchewan

Water Security Agency owns all dams. SaskWater owns water transport works. Division of responsibility in this manner increases the need for communication between organizations which is limited by decentralization, and hence could contribute to governance gaps as described in Cook and Bakker (2012).

In SSEWS, the Saskatchewan Water Security Agency acquired ownership of the East Side Pump Station and the M1 canal from the Ministry of Agriculture in March of 2013. However, SaskWater retains ownership of all transport works and manages the day-to-day activities throughout the system. As a result, SaskWater operates the East Side Pump Station, M1 canal, and all dams on the Saskatchewan Water Security Agency's behalf demonstrating the current division of responsibilities may not work in practice.

4.5 Summary

This chapter described the SSEWS as an aging man-made canal system stretching 110 km across southcentral Saskatchewan serving a diverse set of water users, and located within the Saskatchewan River Basin. The Saskatchewan River Basin is home to more than three million people, heavy agricultural development, many industrial ventures, and increasingly frequent and severe climate events. Water challenges facing the region as a whole were then outlined. The pressures that are especially poignant for SSEWS include: (1) rapidly growing water demand in a system that is aging beyond its useable life, and (2) governance through a fragmented and decentralized system.

CHAPTER 5
RESULTS

5.1 Overview

This study aims to understand if the adoption of water security language into the Saskatchewan Water Security Agency's name and long-term plan corresponds with real change in water management and planning activities in SSEWS and as a result indicates a shift in governance towards an anticipatory approach that may enhance water security in Saskatchewan. Results from the analysis of the *25 Year Water Security Plan* are outlined first in this chapter. Results from the social network survey and participant interviews are presented following this. An interpretation and discussion of study results closes the chapter.

5.2 Document Analysis

The directed content analysis of the Saskatchewan Water Security Agency's *25 Year Water Security Plan* looked for factors of both traditional water governance approaches and anticipatory governance, as outlined in Table 2-1 and Table 2-2, within the text of the *Plan's* "Action Areas." Action areas identify areas of focus the Saskatchewan Water Security Agency sees as necessary for achieving larger plan goals (Saskatchewan Water Security Agency, 2012). Coding only the *Plan's* Action Areas reduced the chance of coding single initiatives multiple times and increased focus on actual actions being taken by the organization. The results from coding are presented in Table 5-1 and Table 5-2.

Table 5-1. Factors of Anticipatory Governance and Number of Coded Instances.

Factors of Anticipatory Governance	Representative Activities	Number of Coded Instances
Foresight	Planning using multiple scenarios	1
	Proactive thinking and/or problem acknowledgement	16
Participatory Decision-making	Stakeholder engagement	16
	Inter-agency coordination	9
	Bottom-up (shared) decision-making power	1
Flexibility	Planning using robust options or those that maintain options into the future state	9
	Soft-path solutions	0
Continued Monitoring	Feedback information is used for adaptive changes	1
Total		53

Table 5-2. Factor of Traditional Water Governance Approaches and Number of Coded Instances.

Factors of Traditional Water Governance Approaches	Representative Activities	Number of Coded Instances
Reactive Thinking	Current issues gain the majority of focus	1
	Problems are acknowledged and/or addressed in a response-based manner	13
Traditional Decision-making	Decisions are made in a top down fashion mainly by water engineers	0
	Planning is done with short term horizons assuming stationarity	0
Rigidity	Hard-path or infrastructure based solutions	0
	Inflexible allocation systems	0
Fragmentation	Low levels of collaboration and communication between organizations involved	0
	Piecemeal planning in organizations	1
Total		15

The results presented in Table 5-1 and Table 5-2 indicate the Saskatchewan Water Security Agency's *25 Year Water Security Plan* contains more references to activities akin to anticipatory governance compared to traditional water governance approaches. This information suggests the adoption of water security language by the Saskatchewan Water Security Agency is accompanied by movement toward a governance approach that supports the water security framework as defined by the Global Water Partnership and the United Nations Water organization.

5.2.1 Coding Results for Factors of Anticipatory Governance

Within coding, the Participatory Decision-making factor was the most common with 26 instances. Examples of instances coded under this factor are provided below.

"Develop improved models for engagement with First Nations and Métis to better understand their perspectives on water and water management and facilitate effective working relationships" (p. 37)

"Work with partners to promote research and development of innovative technology that improves the efficient use of water" (p. 6)

"Continue to work with research partners on climate change impacts to identify possibilities for adaptation" (p. 11)

High commitment to participatory decision-making and its supporting activities is not surprising. The Saskatchewan Water Supply Board reports public consultation before designing and building the SSEWS in the early 1960s. The Saskatchewan Water Security Agency also undertook extensive public consultation throughout 2010 and 2011 in creating the *25 Year Water Security Plan*. Therefore, continued commitment to consultation is expected. However, relationship-building activities were coded under the Participatory Decision-making factor as they extend to agencies and groups not traditionally a part of water governance activities such as First Nations and Métis groups (Quay, 2010; Davies & Selin, 2012; Boyd *et al*., 2015). See Appendix A for a full presentation of the coded anticipatory governance factors.

The Foresight factor was the second most frequently coded under the anticipatory governance. Seventeen instances of this factor were recorded including the following:

"Examine projected water demand by sector within major basins to the year 2060" (p. 12)

"Investigate pricing strategies as a means of promoting conservation" (p. 6)

"Establish legislative requirements for dam safety for both public and private dams and identify long-term strategies for compliance" (p. 25)

"Establish site-specific objectives for environmental flows in priority surface water system" (p.22)

These Action Areas showcase information gathering, proactive problem acknowledgment, and scenario planning aspects of Foresight activities as described in the literature by Quay (2010) and Fuerth and Faber (2013). Projected water demand allows allocation and management decisions to be made in a manner that does not limit future options in

the region. Chapter 2 highlighted similar actions undertaken by a planning organization in Phoenix where land for water wells was purchased but will not be used until needed (Quay, 2010). Investigating pricing strategies to promote conservation, as well as establishing legislative requirements for dam safety, and site-specific environmental flows allow potential problems related to an uncertain water system to be mitigated prior to actual occurrence without over spending.

Nine actions were coded under the Flexibility factor. Examples of these instances are highlighted below.

"Develop a modern system of water allocation including a new allocation policy and regulations" (p. 11)

"Develop new regulations for water allocation to help manage water shortages during droughts" (p. 30)

All instances under the Flexibility factor were coded as representing the "planning that maintains options in the future state" activity. Here, creating modern water allocation policy and regulations for drought and non-drought scenarios increases the flexibility that decisions-makers have prior to the scenarios coming true. For example, moving towards percentage based water allocations eases decision-making when resources are constrained as allocations are naturally reduced with resource availability.

A single action was coded as representing the Continued Monitoring factor.

"Assess and renew the approach to implementing source water protection plans to ensure that threats to source water are mitigated into the future" (p. 23)

This action represented the "feedback information drives adaptive and incremental changes" activity under the factor. Minimal instances of continued monitoring type activities was not surprising as the *25 Year Water Security Plan* is in its infancy and mainly focused on information gathering and future planning. Increases in this factor would be expected as an organization worked through the first three processes of anticipatory governance.

5.2.2 Coding Results for Factors of Traditional Water Governance Approaches

The Reactive Thinking factor was the most commonly coded factor under traditional water governance approaches with 14 instances. Examples of Action Areas coded under this factor are outlined below.

"Implement an effective education and information strategy to raise awareness of drinking water safety issues, including information on proper well management, system operation and maintenance, water quality testing, and identification of and solutions for groundwater quality problems" (p. 16)

"Prepare a new provincial wetland policy that includes an assessment of the status of wetlands in the province and identification of conservation priorities, including a strategy to retain and restore wetlands" (p. 21)

"Investigate alternative measures to increase the delivery of water from Lake Diefenbaker to Buffalo Pound Lake, including evaluation of the feasibility of the Qu'Appelle South irrigation project" (p. 7)

See Appendix B for a full presentation of Action Areas coded under factors of traditional governance approaches.

These Action Areas are all positive moves towards water security in Saskatchewan, however, they are likely response-based problem solving. These initiatives link with known issues, some of which are longstanding in the province. As a result of this circumstance they were coded under Reactive Thinking. For example, a renewed focus on effective education and information strategies around drinking water safety relates to the high profile outbreak of cryptosporidium in North Battleford in 2001 (Saskatchewan Water Security Agency, 2012). Additionally, the need for a new wetland policy is apparent as the current policy has had limited success to curb illegal drainage. The failure of this policy has resulted in the loss of 350,000 hectares of wetland area in the last 40 - 50 years (Badiou, 2013). Investigating alternative measures to increase water delivery from Lake Diefenbaker to Buffalo Pound Lake is a supply-side infrastructure-focused response to growing water demand in the Buffalo Pound Lake region from growth in population and industrial usage, a classic example of traditional water governance.

A single action was coded under the Fragmentation factor.

"Develop new criteria for allocation licensing based on best practices and new technologies to sustainability support irrigation" (p.10)

This action represented “piecemeal planning in organizations” as it focuses solely on serving one purpose, serving irrigation. Seven action areas are devoted to supporting irrigation within the *25 Year Water Security Plan* suggesting irrigation groups hold some power over water planning and use in Saskatchewan. No action areas were coded under the Traditional Decision-making and Rigidity factors.

5.3 The Saskatoon South East Water Supply’s Social Network

Communication patterns and connectivity among water users interviewed in SSEWS was investigated to understand decision-making power distribution in the network. Under the anticipatory governance approach decision-making power is participatory and shared outside traditional holders such as water engineers and government officials. The study’s social network survey followed the initial in-person interview. Ten participants (2 female, 8 male) out of 13 agreed to fill in the social network survey.

Figure 5-1 depicts the social network map created from the survey data. See Appendix C for a larger version of the figure. The three digit alphanumeric codes (i.e., A03, E13) indicate study participant locations on the map. In the map, shapes denote the sex of the person represented. Diamond shapes represent females (n = 9) and circles represent males (n = 63; N = 72). People listed as contacts of more than one study participant in the social network surveys are highlighted as connections in Figure 5-1. Connections are marked with four digit alphanumeric codes (i.e.X001, X002) from 1 to 9.

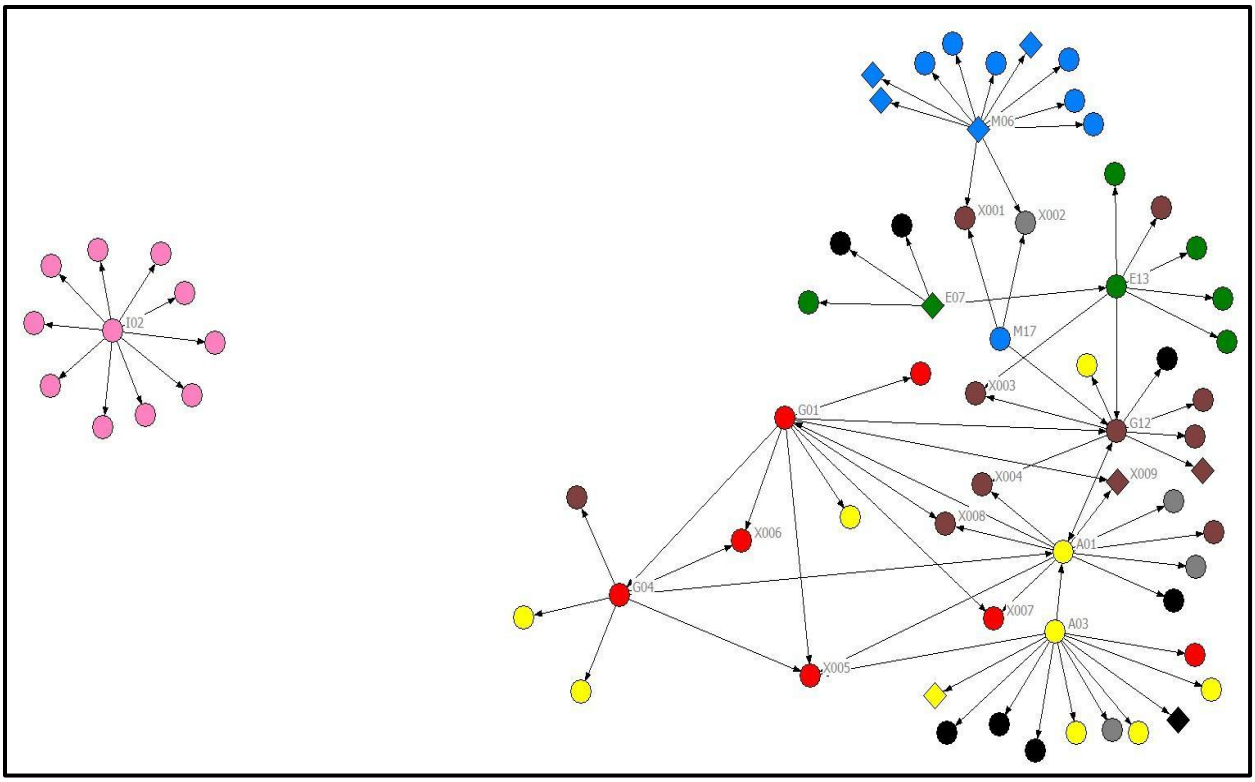

Figure 5-1 .The Participant Social Network Map.

The color of the node signifies the type of organization a node belongs too. Table 5-2 explains the organization color scheme.

Table 5-3. Color and Organization Type Represented.

Color	Organization Type Represented
Blue	Municipal Administration
Red	Provincial Government
Green	Conservation Groups
Pink	Potash Industry
Yellow	Agriculture Industry
Brown	Crown Corporations
Grey	Consulting Firms
Black	Other

Within Table 5-3 the ‘other’ category included four retired professionals from the Universities of Saskatchewan and Regina and three people listed as “friend” with no organizational information.

5.3.1 Communication Flow

The directions of arrows in a social network map are used to signify communication flows (Wasserman & Faust, 1994). Communication can be unidirectional, a single arrow head, or bidirectional, an arrow head at both ends of a connection line. However, in Figure 5-1arrow directions are a reflection of the design of the social network survey, not communication flow.

The social network survey asked participants to list those they communicate with regarding water. As a result all arrows, except one, are unidirectional moving outward from participants to their listed contacts. A single bidirectional arrow links participants A01 and G12 because they both listed each other as contacts. Future research aiming to understand communication flows must ensure survey questions are designed to inform valid flow patterns. Additionally, following up with contacts listed by participants for a second (and third) round of social network surveys would likely create a more accurate picture of communication patterns and flow in the region.

5.3.2 Connectivity within the Network

In the social network map, connectivity is a rough translation of social power or relative importance within the network. Power is gained as nodes are able to control access to other nodes (Wasserman & Faust, 1994; Spizzirri, 2011). For example, if nodes “X” and “Q” can communicate or share information with nodes “T”, “Z” and “J” but only through node “F”; “F” likely has the most power in the network.

Social power within a network map can be quantified using computer programs and measures of centrality. UCINET 6 for Windows, the social network mapping program used within this research, has the capability of calculating social power in a network using the eigenvector centrality measure (Borgatti *et al*., 2002). Based on graph theory, eigenvector centrality moves beyond other measures of centrality, like degree centrality, by incorporating a node’s ability to control access to other nodes (and as a result information) (Gould, 1967;

Spizzirri, 2011). [14] Eigenvector centrality was not calculated is this study, since the matrix data used to create the social network map was deemed likely incompatible for this calculation (J. Langstaff [Social Science Research Lab Acting Director], personal communication, July 6, 2015).

In this network map G12 is likely to hold the most social power. Evidence of this includes the number of connections G12 has as well as the type of connections these are. For example, G12 is the most highly connected node with four connections to other participants and two to participant listed connections. Furthermore, a small cluster of municipal administration contacts depend on G12 to link with the larger network structure.

Additionally, participant G12 is the most diversely connected node, as four other participants (M17, E13, G01, and A01) listed G12 as a main contact in the SSEWS area. Participants A01 and G01 follow G12 in connectivity with three and one participants listing them as contacts, respectively. In the absence of an eigenvector centrality measure, these factors taken together suggest that G12 is likely the node with the most social power in the network as this node can control the flow of information throughout the network.

5.3.3 Communication Flow and Connectivity Results Interpretation

Both connectivity and communication patterns suggest the maintenance of traditional water governance approaches on the ground in SSEWS. The communication patterns shown are often sector specific with minimal cross sector communication. This suggests inter-agency collaboration is occurring less frequently on the ground as compared to Action Area descriptions in the *25 Water Security Plan.* Connectivity describes G12 as the individual with the most power. This person is a water management professional with SaskWater, suggesting that decision-making power and information control likely remains within traditional hands.

[14] Degree centrality considers the number of ties (connections) a node has to be its defining characteristic. This measure ignores relative placement of a node in a graph and as such disregards a nodes potential to control access to information and other nodes in the network (Spizzirri, 2011). For example, degree centrality ranks the participant I02 (0.14) higher than participant G12 (0.11). However viewing the map in Figure 5-1 suggests the G12 is more important to the network than I02. See Appendix D for degree centrality equation.

5.4 Interviews

Thirteen in-person interviews were conducted to gather participant perceptions of the water context and water governance in SSEWS. This data allowed comparisons to be made between governance on the ground and on paper in the *25 Water Security Plan.* All interviews loosely followed an interview guide (see Appendix E). Overall, interviewees saw the SSEWS region's water context as secure, given the storage capacity in Lake Diefenbaker. Descriptions of water governance were largely reflective of the Reactive Thinking and Fragmentation factors of traditional water governance.

5.4.1 The Water Context in the Saskatoon South East Water Supply

Information regarding the water context in SSEWS was gathered through questions about organizational interactions with and personal thoughts about water use. The majority of participants perceived SSEWS as water secure, often referencing the capacity for water storage and flood protection that Lake Diefenbaker provides as supporting evidence. This outlook is highlighted in the following participant statements:

"Someone would really have to pull the plug out for it [Lake Diefenbaker] to drain down and I don't see this as something that could or will happen."

"Well quite frankly I think uncertainty is far overrated insofar as the water supply in Saskatchewan goes."

"I think with Lake Diefenbaker we are water secure. Quantity and quality are important but we can clean the water, right? Like relative to Lake Winnipeg, we are doing pretty well."

"Well a lot of people don't realize how much water is there [Lake Diefenbaker]. So when they come out and look at the Lake they are assured we will never run out of water."

"Because I am an irrigation farmer, quantity is my number one concern. Quality is a concern as well, but I don't think it is an imperative right now."

"If you get a dry year, you can see the Lake [Diefenbaker] is pretty low. But in wet years, like the last few, you can see the spillway going hard and you know we are doing OK."

This type of commentary suggests that the "water richness" perspective documented by Brandes and Kriwoken (2006) in the Okanagan Basin is also present within this region of Saskatchewan.

Participants with this view often suggested they would like to see further water use development in the region. Water export to the United States or a renegotiation of the Master

Apportionment Agreement to support Albert's growing irrigation and processing sectors were described as potential threats to water security, based on supply, in the region. To illustrate these discussions, a participant stated, "If we don't use it [the water] someone else will!" When asked about these perspectives, members from the Saskatchewan Water Security Agency stated they had heard, "Similar musings from the public but no official discussions of this nature were occurring in the organization."

A small number of participants directly challenged the "water secure" view. Participants regarded increasing power, potash, and irrigation related demands as direct threats to the region's water security context. Statements regarding the "short memories" and "complacency" of water users in the region often accompanied such statements. The rationale here related again to the visual nature of water storage in Lake Diefenbaker.

"I think we are very overconfident in our water system and that [Gardiner] Dam has gone some distance to fuel that view. The problem is especially bad in Saskatoon because they have the river staying the same every day."

Participant views on the water context in SSEWS varied in an expected manner, given organizational affiliation and assumed corresponding interests. Participants who suggested further development should occur around Lake Diefenbaker and in SSEWS would either directly benefit (i.e., irrigation and agriculture related groups) or indirectly benefit (i.e., job security for agriculture government organizations) from policy to this effect. Participants who stated a number of water security issues already exist came from groups whose mandate is supported through this type of perception (i.e., consulting and conservation groups).

5.4.2 Perceptions of Governance in the Saskatoon South East Water Supply

5.4.2.1 Defining governance

The second section of the interview asked participants to: (1) define governance, and (2) explain their perceptions of water governance in SSEWS. When asked to define 'governance', participants both laughed aloud and paused. Often following these reactions participants asked for question clarification. M06 remarked, "This is a really hard question." Another said it was hard to define such a "grey term." When asked what was meant by "grey term" the participant suggested, "It (governance) is always changing depending on who you ask and what they do, and then still definitions can change to support different functions."

Answers depicted two themes: (1) governance as decision-making for creating overarching regulations, rules, or policy, and (2) governance as decision-making for operations (i.e., the running of organizations day to day). Themes described here generally support the governance definitions cited in Chapter 2. However, participant governance descriptions did not mention the "who" of "who gets to decide what" (Fulton *et al*., 2015). Future investigations of stakeholder perceptions of governance should focus on gaining an understanding of perceptions of how decision-making power is allocated.

5.4.2.2 Perceptions of water governance in the Saskatoon South East Water Supply

Participant comments regarding water governance on the ground in the SSEWS focused on water management and planning activities. Descriptions of these activities reflected piecemeal planning and persistent reactionary decision-making. Both of these activities relate to factors of traditional water governance approaches.

5.4.2.2.1 Activities of traditional water governance approaches. Piecemeal planning activity was reflected in water user discussions regarding industrial and power generation water demands as driving decision-making for water management planning. The following excerpts outline these discussions.

"It's a problem of priorities. People say: I don't care about waterfowl nesting habitats. I care about cheap energy."

"My personal opinion is SaskWater has let us all down, without a doubt, they went to a system of making money and don't care or keep us [municipal users] informed on what they are doing. They don't care about the quality, I mean they do well around Saskatoon but in these little outreaches it just doesn't work"

"When BHP was putting together their proposal for the big Jansen mine, we were asked by SaskWater if we could reduce our water allotment."

"Irrigation is the adaptation [Lake Diefenbaker was built for], but all of the sudden you have SaskPower as the driver of decisions and if you look at dollars per power production versus irrigation the writing is on the wall."

Water users expressing these perspectives often felt that their organization's water needs were not considered adequately in the current management of Lake Diefenbaker. This is potentially contradictory to the high Participatory Decision-making score resulting from the *25 Year Water Security* document analysis. Management of Lake Diefenbaker's water levels directly affects

water users in the SSEWS system. Lower water levels increase the cost of delivery of water along the canal, contributing to the focus on Lake Diefenbaker throughout the discussions.

Persistent Reactive Thinking activities were linked with discussion around limited action to protect wetlands from illegal drainage and the timing of the rehabilitation of the canal system. Two participants described the ongoing nature of illegal drainage stating:

"On average 28 acres of wetlands are lost a day in Saskatchewan equalling approximately 10,000 acres annually."

"They keep saying they are doing something, but they don't seem to be doing anything at all. The problem is serious; we have even had occurrences of illegal drainage on our conservation land."

Frustration around the lack of action of this issue was apparent in discussions. Coding the development of a new wetland policy as Reactive Thinking is supported by these sentiments and the length of time this problem has been occurring in Saskatchewan, 40-50 years (Badiou, 2013). Furthermore, the capability of wetlands to provide ecological services like water management and treatment as well as carbon sink opportunities has recently been discussed more frequently by globally focused organizations (i.e. The Ramsar Convention on Wetlands). As a result, continuing to allow for wetland degradation in Saskatchewan, virtually unchecked, became unpalatable to decision makers and a "reaction" to this "current issue" was required.

Additionally, water delivery capacity issues in the SSEWS canal indicate Reactive Thinking. The majority of canal infrastructure will be fifty years old in 2018. Water systems degrade overtime, averaging a useable life of 50-55 years (American Society of Civil Engineers, 2011). The SSEWS's canal infrastructure entered the latter half of its usable life in approximately 1997. However, investment in the canal's rehabilitation did not begin until 2010 (Piller, 2014; Boyle, 2014).

The influx of funding coincides with the announcement of the BHP Billiton Jansen potash mine project, which moved from pre-feasibility to feasibility studies in late 2010 (BHP Billiton, 2010). The addition of water demands for the BHP Billiton Jansen project would have pushed SSEWS infrastructure beyond its delivery capacity in 2015.[15] Delivery capacity refers to

[15] On August 22, the Canadian Broadcasting Corporation reported that BHP Jansen project was expected to be fully operational and producing eight million tonnes of potash annually in 2015

the ability of the canal system to move the required amount of water from its intake at Lake Diefenbaker to its customers with current pump and gravity feeds. This situation created a looming capacity issue for SSEWS. This issue was addressed with infrastructure rehabilitation plans and funding but only after the problem was imminent. Once the delivery capacity was imminent a "response" to solve the issue must occur in order for decision makers to avoid negative feedback related to being "unprepared". An example of both the Reactive Thinking factor's representative activities: "current issues gain the majority of focus" and "problems are acknowledged and/or addressed in a response-based manner" and the propensity of the negativity bias in actions of decision makers.

This reactive decision-making behavior is not surprising. Canadian municipalities also routinely ignore looming water and wastewater infrastructure issues. The Canadian Water Network (2014) reported that municipalities face a collective $80 billion CND price tag in the next twenty years as water and wastewater infrastructure ages past its usable life. This price does not reflect upgrades required if regulatory changes occur or as population growth continues.

5.4.2.2.2 Activities of anticipatory governance. Praise for water governance activities related to communication and collaboration were heard from two participants. The first suggested SaskWater's inter-agency collaboration and communication efforts when running water were very accommodating and professional.[16] The second participant praised the Saskatchewan Water Security Agency's openness and responsiveness in water demand conservation. These comments support the Participatory Decision-making factor of anticipatory governance.

5.5 Discussion

The premise of this thesis is that water security in Saskatchewan will be enhanced if the Water Security Agency is able to adopt an anticipatory governance approach. Anticipatory governance is believed to support and enhance water security as a result of its ability to anticipate and accommodate uncertain and complex problems (Fuerth, 2009; Quay, 2010; Davies

(2012). Currently, the project is moving forward slowly with completion expected "sometime in the next decade" (Stringer, 2015).

[16] Running water refers to times when SaskWater is actively moving water through the SSEWS via pumps and canal infrastructure.

& Selin, 2012; Fuerth & Faber, 2013; Boyd *et al.*, 2015). The study used three data sources to compare the Water Security Agency's governance approach on paper (*25 Year Water Security Plan*) to water management and planning activities on the ground in the SSEWS region. The key purpose of this thesis is to determine if the adoption of water security language by the Water Security Agency has been accompanied by a change in governance and in water planning and management that reflects the participatory, proactive and adaptive approaches found in anticipatory governance.

The results present conflicting views of the Saskatchewan Water Security Agency's governance approach on paper versus on the ground. Analysis of the *25 Year Water Security Plan* indicates anticipatory governance activities outnumber those related to traditional water governance approaches, almost 4:1. Anticipatory governance activities included: long-term planning, diverse stakeholder engagement, high levels of proposed inter-agency coordination, and proactive problem acknowledgement. Activities suggesting the continuation of a largely traditional water governance approach included water management decision-making power remaining in the hands of a water engineer, as well as the continuation of piecemeal-type planning and persistent reactionary decision-making as highlighted in participant interviews.

5.5.1 Why Governance Transformation Stalls

It is generally accepted that water security requires a governance approach capable of addressing uncertain and complex challenges. Addressing these types of challenges means balancing off water needs for human and environmental health in a sustainable manner while also ensuring economic opportunities do not suffer (Global Water Partnership, 2000; United Nations Water, 2013). Anticipatory governance is presented in this research as a governance approach that can achieve this goal and as a result enhance water security.

Despite numerous calls to action, little water governance transformation appears to have been achieved in practice to date. Situations where there is a lack of perceived urgency around a problem or there are vested interests in the current state can make movement away from the status quo difficult (Kingdon & Thurber, 1984; Hood, 2010; Howlett, 2014). The following sections discuss how these factors may have been present in the case examined in this study and how they may have contributed to the discrepancy between governance results on paper versus on the ground.

5.5.2 A Lack of Urgency

Huitema and Meijerink (2010) state change is often only possible in water management after the existing paradigm is tested and fails, for example through devastating flooding or drought. Drought and flooding have occurred in Saskatchewan in the last two decades. However, the devastating effects of these potential "shock events" have mostly been site specific, likely creating only pockets of urgency. Additionally water events are often framed as "one in one hundred year events" or more when reported to the public (i.e., Canadian Broadcasting Corporation, 2015a). Reporting on extreme events using this type of frame may work to further limit the perceived urgency to move away from the status quo, as Mercer *et al.* (2007) describe the media-driven "best of times" discourse has done in Australia.

However, if recent extreme events and the highly reported water quality issue in North Battleford in 2001 combined to open a window for water policy reform it was likely quickly closed. Factors that can quickly close policy windows were described in chapter 2. Both the length of a crisis and the perception that the problem has been addressed were outlined in this description (Kingdon & Thurber, 1984; Berke & Beatley, 1992; Solecki & Michaels, 1994). Organizational changes at the Water Security Agency and the creation of the *25 Year Water Security Plan* may have satisfied the public desire for action around water in the province and created a "problem solved" mentality.

In SSEWS, water variability is controlled through the man-made delivery structures and buffered by storage capacity in Lake Diefenbaker. As a result, recent flood and drought events have not created substantial issues in the region. This situation may have contributed to the majority of participants perceiving the SSEWS region as water secure. A study participant said, "People have short memories," referring to the speed at which people resume normal water usage behaviors after drought or flooding events in the region. This highlights the prominence a lack of urgency has on limiting public desire for (or discussion of) change; when conditions creating urgency are short-lived they are quickly forgotten. In addition, in this study those that are satisfied with the current state, or benefit from it, outnumber those who desire change, thus contributing to a "change is unnecessary" mentality in the region.

5.5.3 Vested Interest in the Status Quo

Participant views on the water context in SSEWS varied in an expected manner. Chapter 5 outlined participant commentary on the water context in SSEWS; perceptions varied based on organizational interests. For instance, a participant belonging to a Saskatchewan irrigation advocacy group spoke about how "developing Lake Diefenbaker to support the necessary acres of irrigation to foster value-added processing would create economic benefit for the province and ensure others do not try to use the resource like Alberta or the United States." Additionally, a participant who works with a conservation group suggested continued development of Lake Diefenbaker's water resources should be avoided if it threatens waterfowl nesting habitats. Both statements support organizational vested interests in the current state. Agricultural groups have often been cited as powerful sources of vested interests in status quo water management approaches (Menahem, 1998; Brandes & Kriwoken, 2006; Mercer *et al*., 2007).

5.5.4 Negativity Bias in Government

Negativity bias exists when the political will to make a change is lowered in order to avoid potential negative public feedback (Hood, 2010; Howlett, 2014). Boyd *et al*. (2015) outlined "a lack of political will" as a contributing factor to the absence of a coordinated attention to climate change adaptation in the water governance approach of Malaren, Sweden. Quay (2010) reported that planning organizations working to design climate change adaptation strategies in Phoenix, New York and Denver are all slowly moving from selecting to implementing strategies in their respective regions. No single strategy has been implemented to the point where evaluation of its effectiveness could begin (Quay, 2010). Decision makers are risk averse; they will often choose no action over action that could result in adverse consequences (Howlett, 2014). As described in chapter 2, this is the negativity bias at work (Hood, 2010).

In the current study, negativity bias may be occurring within the Saskatchewan Water Security Agency and SaskWater organizations. Public perceptions of water security and groups with vested interests in the SSEWS as it is today may be encouraging this decision-making bias. For example, agricultural and other users in SSEWS benefit from low cost water today. Only "cost of delivery" charges are passed on to the users. As a result, changes to water management and planning by way of new pricing structures are likely to be met with criticism due to financial

loss from these groups. When asked how full-cost water pricing would be received in Saskatchewan, personnel from SaskWater and the Water Security Agency often winced and exchanged glances or laughter, “Oh that would be a big change.” This may point to negativity bias in these organizations where this option will not be entertained.

CHAPTER 6
CONCLUSION

6.1 Overview

This chapter closes the thesis with four sections. First, a summary of the paper is presented. Second, a list of recommendations to increase water security in Saskatchewan's future is offered. Third, future research directions are suggested given study results and recommendations. Fourth, the thesis closes with a discussion of limitations to the research design and data analysis methods.

6.2 Research Summary

The study used a qualitative approach to understand if the adoption of water security language by the Saskatchewan Water Security Agency was accompanied by a governance change and, in turn, a change in water management and planning activities on the ground in the SSEWS region. Data analysis included three methods: document analysis, social network analysis, and participant interview interpretation. The study's results presented conflicting views of the Saskatchewan Water Security Agency's governance approach on paper versus on the ground.

The document analysis of the *25 Year Water Security Plan* looked for the presence of activities related to anticipatory governance and traditional water governance approaches. Results from this analysis suggested that activities related to anticipatory governance outnumber those related to traditional water governance approaches by almost 4:1, with activities related to participatory decision-making strategies being the most commonly coded.

In contrast, the participant interview and social network data suggested the majority of water management and planning activities remain reflective of traditional water governance approaches. For instance, a water management professional was the central figure in the social network map, indicating that decision-making power likely remains in traditional hands. Additionally, participant interview transcripts highlighted frustration with persistent reactionary decision-making activities related to wetland drainage and infrastructure upgrading.

Together the interpretation of study results suggests the Saskatchewan Water Security Agency likely operates in much the same fashion as it did prior to its 2012 name change. Three factors were identified as probable contributors to the discrepancy between the "on paper" versus

"on the ground" results within the study. The factors included: 1) a lack of perceived urgency to move away from the status quo, 2) vested interests in the status quo, and 3) negativity bias in government organizations. Each of these factors has an ability to slow governance changes, potentially explaining the study results.

6.3 Recommendations

The Saskatchewan Water Security Agency is working to improve water security in Saskatchewan through the implementation of its *25 Year Water Security Plan*. The *Plan* calls for action on long-standing problems, such as illegal drainage and incomplete data capture. The *Plan* also focuses on waste water systems, source water protection plans and safe municipal drinking water (Saskatchewan Water Security Agency, 2012). The approaches to these problems are reflective of a traditional water governance style, with an emphasis on expert knowledge, centralized information data capture and analysis, the forecasting of past trends into the future, and a reliance on infrastructure development to address problems. Given the conditions currently in place in the water system in Saskatchewan, it is likely that this governance style can provide a high degree of water security. However, a different governance style may be required in the future as hydrologic and societal conditions change.

Although the future is not known, water researchers believe climate change and rising temperatures across Western Canada will affect Saskatchewan's hydrologic future. A warmer climate may reduce snow accumulation in the Rocky Mountains and in turn lower seasonal runoff currently feeding river systems across the Prairies. Extreme weather events are expected to become more intense and more frequent, thus increasing pressure on traditional disaster management tactics, infrastructure, and assistance funding (Pomeroy *et al*., 2010).

Changes to current hydrologic conditions such as these are likely to increase tensions between water users who have had co-operative relationships historically. For example, in California recent rains in the state's Northern region have resulted in large volumes of runoff flowing into the ocean to preserve endangered fish habitats in the Sacramento-San Joaquin Delta. Irrigation farmers in Central California, as well as some residents and decision-makers in Southern California, have voiced concerns about this decision as they continue to endure severe water restrictions due to the region's prolonged drought (Sabalow & Kasler, 2016). In Saskatchewan, some study participant comments alluded to tensions between water users

regarding water level management in Lake Diefenbaker – future change may increase the tensions in these relationships.

If a water crisis does occur, it is unlikely to lead to changes to fundamental water governance philosophy, at least in the short term. In crisis situations, decision-makers typically focus on "solving the crisis" – securing the required resources and undertaking a response, but only until the issue-attention cycle has run its course (Downs, 1972). Once attention on the crisis recedes, discussions of water governance planning and philosophy often take a backseat to other emergent issues.

In addition to changes in the physical system, there are changes to the social system. The public now has a much greater desire for participation in decision-making activities than has been the case. This greater desire is being fueled in part by a mistrust of elites such as politicians who people believe act in self-interested ways. The volume of information available to the public and their ability to rapidly access and spread it through the Internet and social media platforms may be another factor contributing to the change. Within this context, water management plans and policy created by elites, like water management engineers, may not receive public support, and proceeding without this support may create re-election challenges for those in power.

Anticipatory governance provides a way forward under the above conditions and other uncertainties. A systematic focus on foresight and proactive action allows "tough discussions" between water users regarding availability and hydrologic change to occur before the situations become reality. Participatory decision-making increases the number of actors involved in a decision, which works to balance existing vested interests and increase the likelihood that solutions will emerge with local public support and will use resources efficiently (Devas & Grant, 2003; Denters, van Heffen, Husiman & Klok, 2013). Finally, anticipatory governance uses information from real-life intervention performance to guide iterative change and adaptation (Fuerth, 2009).

However, anticipatory governance will not emerge on its own. A water crisis could create the perception of urgency and result in increased public attention to water governance, stimulating change toward anticipatory governance type thinking. However, the experience from other jurisdictions suggests that such attention is likely to exist only while the crisis is in effect. Real change requires a change in the public perception of water, and in particular a movement away from the idea that water is abundant.

Creating this type of large-scale worldview change is difficult but not impossible. In the short-term, training for water governance staff in participatory decision-making and foresight strategies may change the way internal water governance decisions are made. Additionally, implementing full-cost water strategies that account for both the energy to move the resource and the volume of the resource used may change water perceptions and usage behaviors of customers. Long-term change requires changes to K-12 education programming to include discussions of potential climate and hydrologic change and fresh water as a "non-renewable resource". These changes could alter the way future generations think about, interact with, and use water as well as create a public desire for water governance changes prior to a crisis.

However, the short and long-term suggestions presented above are unlikely to be implemented under Saskatchewan's current water governance structure. For example, attempts to increase public participation may be viewed as reducing the power of those currently in decision-making roles and would likely trigger resistance. Education programming that discusses potential hydrologic change would directly challenge the belief that "Saskatchewan is water secure and will remain so," a belief that is held by some participants in this study and likely many other residents in the province. Discussions of future conditions, such as lower water supply levels and full-cost water, are likely to create negative feedback from large and long-standing industrial users such as agriculture, power generation, and potash. An acceptance of climate change as "a real phenomenon" would also be required prior to creating a classroom curriculum for age appropriate audiences.

In addition to changes in the large-scale worldview, changes will also be required to the manner in which Saskatchewan's water system is administered. In particular, attention will have to be paid to the various power dynamics that exist. One of these power dynamics concerns who is viewed to have power and authority within the system – currently this power is seen to rest largely with engineers within the Saskatchewan Water Security Agency. Another of the power dynamics concerns the relationship between the Saskatchewan Water Security Agency and SaskWater, which is currently complicated and potentially unwieldy.

To better understand the conditions that may block or foster the emergence of anticipatory governance in Saskatchewan the following questions should be asked:

1. What is the relationship between the Saskatchewan Water Security Agency and SaskWater?
    - What should the relationship look like?

- What changes are required to achieve the desired relationship?
- What factors are hindering these changes?

2. What is the perception of water quality and availability in Saskatchewan?
   - What influences these perceptions?
   - How difficult is it to change these perceptions?
3. What groups have a vested interest in the status quo of water governance and management in Saskatchewan?
   - Which of these groups have the power to block movement away from the status quo?
4. Does public participation in Saskatchewan's water governance activities impact decision-making and policy development?

6.4 Future Research

Directions for building the next stages of this research focus on answering the questions outlined in section 6.3. First, the Saskatchewan Water Security Agency will have to find ways to integrate with SaskWater in order to ensure the relationship remains functional under current and future conditions. Reducing opportunities for fragmentation between the two organizations involved in water governance, management, and planning would ensure that decisions can be made without delay and would lower the risk that some aspects "will fall through the cracks." Second, research on how Saskatchewan residents and those with decision-making power perceive and use water would need to be undertaken. Research of this nature could be used to inform future water-related education programming and policy development aimed at changing perceptions and behavior if necessary. Third, efforts are required to understand where vested interests in the current state of water governance occur and if these groups have the power to block change. This understanding may allow for policy responses that reduce the likelihood that change efforts are stymied. Research of this nature, however, is likely to be difficult to undertake. Fourth, research regarding how information from public participation is used in decision-making and policy development may increase public trust in governing bodies, or enable recommendations for more meaningful participation that could increase public trust in governing bodies if implemented.

6.5 Limitations

A number of limitations were identified during the course of this study. The presence of limitations in a study can generate questions regarding the validity of results (Albert, Ratnasinghe, Tangrea, & Wacholder, 2001). Specific to this research the selection of

interviewees, relevance and wording of interview questions, timing of data collection, and confirmation bias are identified as potential limitations. The identified limits are outlined and discussed below.

6.5.1 Study Design

A limit to all survey and interview research is the generalizability of results. Purposive sampling a common method in survey and interview based research, does not always yield representative participant pools. In this study, the representatives from the recreation and tourism industries declined the invitation to participate. As a result, a key water perspective for the SSEWS region was not incorporated.

Interview questions contained jargon and were designed prior to gaining a full understanding of the concept of anticipatory governance. The presence of jargon in interview questions often led to participants asking for clarification prior to providing responses. In meeting explanation requests the author may have indirectly primed participant responses (Molden, 2014). Davies and Selin (2012) outlined a similar limitation after leading public workshops regarding energy nanotechnologies. Additionally, interview questions may not have been appropriately designed to gather evidence on the presence or absence of activities exemplary of anticipatory governance on the ground in SSEWS. Given this occurrence the contradictory result between document and interview data may have been exaggerated. In future research, piloting data collection materials such as interview questions and survey materials will reduce the likelihood of issues such as these and those described below regarding the social network survey.

The design of the social network survey was not effective in establishing communication flow directionality. As a result, the question design limited the social network map analysis in regards to the ability to speak to the presence of anticipatory governance activities, specifically Participatory Decision-making activities. Future research must pay close attention to the design of interview and survey questions to ensure they are capable of gathering information relevant to determining the presence or absence of activities of anticipatory governance. Evaluating research materials using a pilot method may be helpful here as suggested earlier.

The timing of data collection could also have impacted results. The *25 Year Water Security Plan* was released in October 2012. Data for this study was collected from March to

May 2014. The *Plan* was designed to be implemented in five-year segments and iteratively updated as progress is made. Many Action Areas outlined in the *Plan* relate to building relationships with those not traditionally involved in water governance and to gathering information on the current state of water in Saskatchewan. These activities are important precursors to change but may not translate quickly to water management and planning changes on the ground. Therefore, interview data presented in this research may be more reflective of the short time span between the roll out of the *25 Year Water Security Plan* and data collection rather than depicting true differences between governance on paper versus on the ground in SSEWS.

6.5.2 Data Analysis

Confirmation bias is a known issue with the directed content analysis method, as mentioned in chapter 3. Confirmation bias is a tendency for to search for information inadvertently (or advertently) that confirms preconceptions while denying evidence of the contrary (Nickerson, 1998). Study data was collected and analyzed solely by the author. As a result, confirmation bias is a potential limitation to this study. The use of multiple coders blind the research question would reduce the likelihood of this bias occurring in future research (Nickerson, 1998).

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APPENDIX A
INSTANCES OF FACTORS OF ANTICIPATORY GOVERNANCE

Theme: Foresight		**Subtotal 17**
Sub-theme: Planning using multiple scenarios		
	Examine projected water demand by sector within major basins to the year 2060	
Sub-theme: Proactive thinking and/or problem acknowledgement		
	Evaluate existing water supplies and future demands for the next 25 years and beyond	
	Investigate pricing strategies as a means of promoting conservation	
	Undertake a flood risk assessment of municipal drinking water and wastewater infrastructure	
	Implement the flood protection and prevention measures established in The Statements of Provincial Interest Regulations into local official community plans and zoning bylaws	
	Develop modern and comprehensive water legislation	
	Undertake comprehensive water management analyses for priority surface and groundwater systems	
	Implement new watershed modeling and data base management systems to allow efficient evaluation of new requests for water and ensure that cumulative effects are considered	
	By watershed, determine the existing use of water, level of protection of environmental flows, how much water is available for future allocation, and identify areas where water scarcity may be a factor	
	Establish legislative requirements for dam safety for both public and private dams and identify long-term strategies for compliance	
	Complete emergency preparedness plans for Water Security Agency major dams	
	Prepare an aquatic alien species strategy to identify and address significant threats to biodiversity and ecosystem health	
	Develop improved flood forecasting tools	
	Develop a strategy to ensure communities and the public have access to flood hazard information and are aware of potential flood risks	
	Promote adoption of best conservation and efficiency practices and technology through education, regulations, water license conditions and new programming	
	Evaluate the need to expand source water protection planning to additional watersheds or aquifers	
	Establish site-specific objectives for environmental flows in priority surface water systems	
Theme: Flexibility		**Subtotal 9**
Sub-theme: Planning that maintains options in the future state		
	Develop a modern system of water allocation including a new allocation policy and regulations	
	Examine alternative ways of instituting the concept of "user-pay" with respect to development of additional provincially owned multi-purpose water supply infrastructure	
	Develop a strategy to encourage the renewal of municipal wastewater treatment infrastructure to ensure protection of water quality in receiving water bodies	
	Develop coordinated policies to reduce risk of water contamination that may result from residential wastewater management in high density rural developments and cottage subdivisions	
	Implement the Water Security Agency's 10- year plan for infrastructure rehabilitation and dam safety	
	Develop a coordinated provincial drought response plan that includes monitoring, preparedness, response, and recovery approaches	
	Develop new regulations for water allocation to help manage water shortages during droughts	
	Provide information and encourage the implementation of beneficial land and water management practices to reduce non-point sources of nutrients and other contaminants to surface and ground water	
	Define a strategy to reduce the contamination risk posed to groundwater sources by abandoned water wells	
Theme: Continued Monitoring		**Subtotal 1**
Sub-theme: Feedback information drives adaptive and incremental changes		
	Assess and renew the approach to implementing source water protection plans to ensure that threats to source water are mitigated into the future	

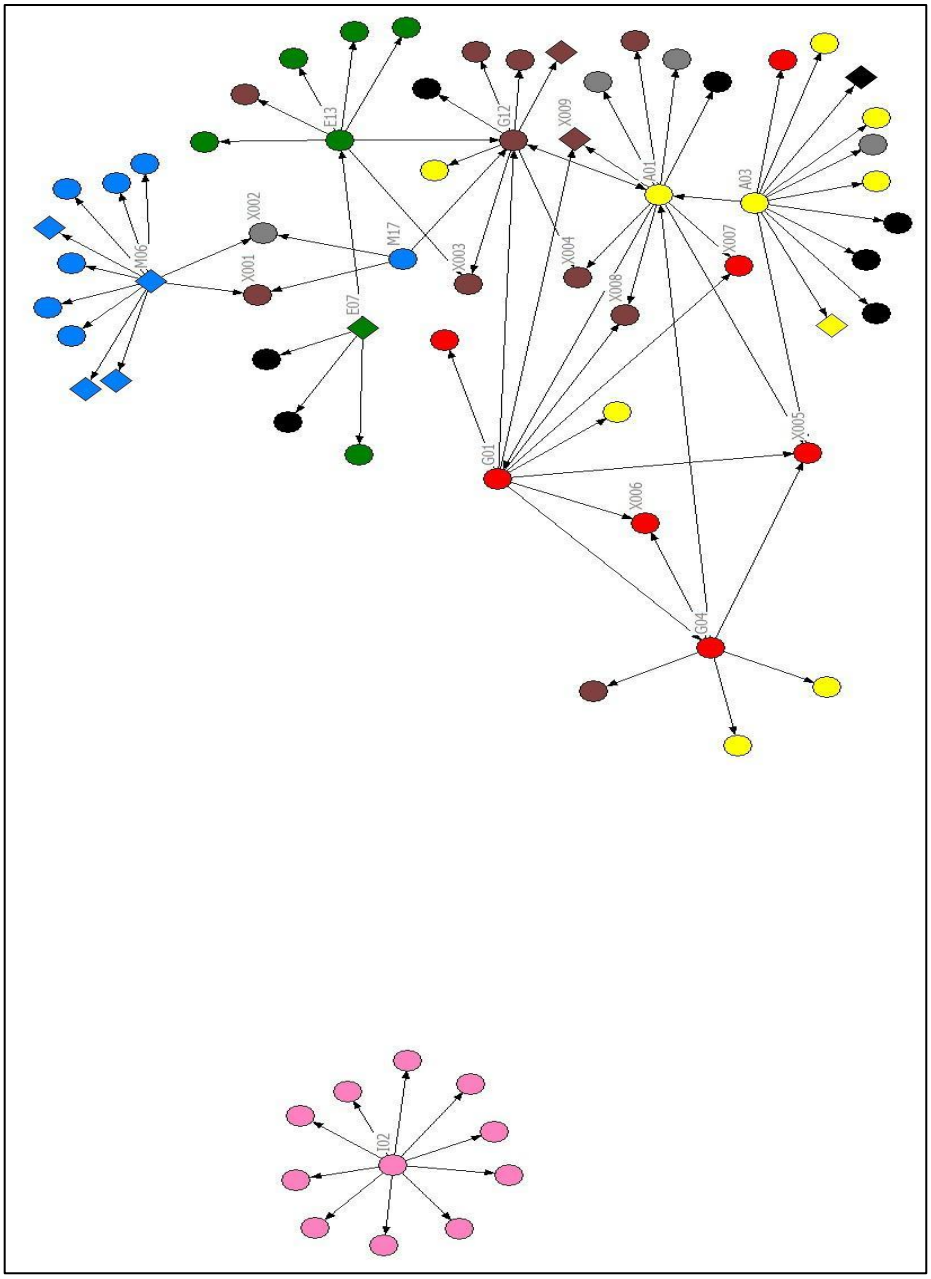
Theme: Participatory Decision-making	**Subtotal 26**
Sub-theme: Stakeholder engagement	
	Work with partners to promote research and development of innovative technology that improves the efficient use of water
	Support research on water treatment technologies for point-of-use water systems
	Work with Saskatchewan Association of Watersheds to more clearly identify the future roles and responsibilities of watershed and aquifer planning groups, including the renewal of source water protection plans
	Encourage municipalities to map flood risk areas associated with under-capacity of wastewater and storm sewer infrastructure as projected in the Insurance Bureau of Canada's report on impacts associated with climate change
	Consolidate precipitation data and information through the development of cooperative agreements and partnerships with government and non-government organizations
	Support the work of the Global Institute for Water Security at the University of Saskatchewan in their assessment of the water supply and quality issues in the South Saskatchewan River
	Identify opportunities to collaborate with external academic and research partners on defining and undertaking strategic research initiatives
	Develop improved models for engagement with First Nations and Métis to better understand their perspectives on water and water management and facilitate effective working relationships
	Where water management decisions may have an adverse impact on the exercise of treaty and aboriginal rights and pursuit of traditional uses, consult with First Nations and Métis in accordance with the First Nations and Métis Consultation Policy Framework and the legal duty to consult
	Establish the Provincial Water Council with sector-based representation
	Investigate new approaches to engage the public and local governments on water issues and decisions of importance to them
	Continue to work with the Prairie Provinces Water Board to evaluate the resiliency of the Master Agreement on Apportionment
	In support of the Mackenzie River Basin Board, negotiate bilateral agreements with Alberta and Northwest Territories
	Establish provincial Deputy Ministers' Water Committee
	Continue to work with the International Souris River Board of the International Joint Commission to establish an enhanced operating plan for Rafferty and Alameda reservoirs
	Continue to support the work of the Council of the Federation Water Stewardship Council to use information and experience from other jurisdictions across Canada to address water problems in Saskatchewan
Sub-theme: Inter-agency coordination	
	Work with Canada to continue to asses and seek funding support for further irrigation opportunities
	Work with Canada to transfer ownership of federal irrigation projects to local patrons
	Assess, with federal and First Nations governments, opportunities for the province to provide the infrastructure, including connections to regional water systems, and technical and inspection services on reserves on a cost-recovery basis
	Develop an agreement with Environment Canada for coordinated implementation of the Canadian Council of Ministers of the Environment Municipal Waste Water Effluent Canada-Wide Strategy and the Federal Wastewater System Effluent Regulations
	Negotiate with Canada a new commitment to continue the Environmental Farm Plan Program, with a focus on nutrient management and protection of water supplies
	Develop protocols with the Department of Fisheries and Oceans to ensure the ongoing protection of fish habitat under the new federal Fisheries Act
	Continue to work with the Canadian Council of Ministers of the Environment to address emerging water issues common to all jurisdictions
	Pursue negotiations with Canada to develop and implement a new long-term federal- provincial program for flood mitigation as part of an all hazards program
	Work with Canada to identify opportunities to improve regulatory and program coordination and collaboration
Sub-theme: Bottom-up (or shared) decision-making power	
	Continue to work with research partners on climate change impacts to identify possibilities for adaptation

TOTAL SCORE 53

APPENDIX B
INSTANCES OF FACTORS OF TRADITIONAL WATER GOVERNANCE APPROACHES

Theme: Reactive Thinking	**Subtotal 14**
Sub-theme: Current issues gain the majority of focus	
	Investigate alternative measures to increase the delivery of water from Lake Diefenbaker to Buffalo Pound Lake, including evaluation of the feasibility of the Qu'Appelle South irrigation project
Sub-theme: Problems acknowledged and/or addressed in a response-based manner	
	Evaluate existing water supplies and future demands for the next 25 years and beyond "to determine the need for new infrastructure across the province"
	Review and update the province's approach to safe drinking water, including consideration of the 2002 Laing Report and the 2002 Safe Drinking Water Strategy
	Review and rationalize the regulatory regime applying to semi-public systems
	Implement an effective education and information strategy to raise awareness of drinking water safety issues, including information on proper well management, system operation and maintenance, water quality testing, and identification of and solutions for groundwater quality problems
	Encourage testing of private water supplies, including testing for heavy metals
	Provide water testing and treatment advice in at-risk locations during emergency events such as flooding that pose a high risk of drinking water contamination
	Prepare a new provincial wetland policy that includes an assessment of the status of wetlands in the province and identification of conservation priorities, including a strategy to retain and restore wetlands
	Assess the range of alternatives and implement strategic actions to manage drainage
	Develop a results-based drainage works approval process and associated enforcement strategy, including the potential use of financial penalties
	Develop new strategies to effectively address excessive moisture concerns on agricultural lands, including provision of information and advice on proper drainage design and management and consideration of the benefits of wetland retention and restoration
	Establish protocols for informing the public during emergencies related to flood, drought, infrastructure failure, and water quality and drinking water concerns
	Define water quality objectives, including nutrient-related objectives, for surface water bodies and watercourses in the province, beginning with the highest priority systems and including work on key transboundary sites
	Implement a recreational lake water quality monitoring program for swimming areas at lakes across the province
Theme: Traditional Decision-making	**Subtotal 0**
Theme: Rigidity	**Subtotal 0**
Theme: Fragmentation	**Subtotal 1**
Sub-theme: Piecemeal planning in organizations	
	Develop new criteria for allocation licensing based on best practices and new technologies to sustainably support irrigation
TOTAL SCORE 15	

APPENDIX C
PARTICIPANT SOCIOGRAM



APPENDIX D
DEGREE CENTRALITY EQUATION

Measure	Formula	Explanation
Degree Centrality	$C_D(v) = \frac{deg(v)n - 1}$	Here $C_D(v)$ is the degree centrality of node *v*, *n* is the totoal number of nodes in the graph and *deg*(*v*) is the number of ties or connections from *v* to other nodes.
Degree Centrality (I02)	$C_D(I02) = \frac{10}{72 - 1}$	$C_D(I02) = 0.14$
Degree Centrality (G12)	$C_D(G12) = \frac{8}{72 - 1}$	$C_D(G12) = 0.11$

APPENDIX E
INTERVIEW GUIDE

Individual Interview Guide

1. **Opening**
    a. Are you familiar with the Saskatoon South East Water Supply system?
    b. Where do you work?
    c. What is your position?
    d. How long have you been working in your current position?
    e. Could you briefly explain to me what your current position entails?
2. **Governance**
    a. Can you define governance?
    b. Can you define water governance?
    c. What can you tell me about the water governance in Saskatchewan? In SSEWS?
3. **Water**
    a. Can you explain how your organization uses or interacts with water in/from SSEWS?
    b. Can you define water security?
        i. How do you see the water situation in SSEWS?
            1. Prompts: Threats to water security or reasons the area is water secure.
        ii. Has your organization ever been affected by flood?
            1. Do you plan for the possibility of future floods in your organization?
        iii. How would your organization be affected by a drought?
            1. Do you plan for the possibility of future drought in your organization?
4. **Policy**
    a. Are you familiar with the Saskatchewan Water Security Agency?
    b. <u>IF YES:</u>
        i. Can you tell me what you know about their *25 Water Security Plan*?
        ii. Did you know in this plan the WSA expresses a commitment to irrigation infill and expansion around Lake Diefenbaker of up to 500 thousand acres?
        iii. Are there policy measure you would support to help make this project a reality?
        iv. Do you think there would be policy "winners" and "losers" if this project becomes a reality?
    c. <u>IN NO:</u> Give general blurb about the Water Security Agency and the *25 Year Water Security Plan* and then begin questions.