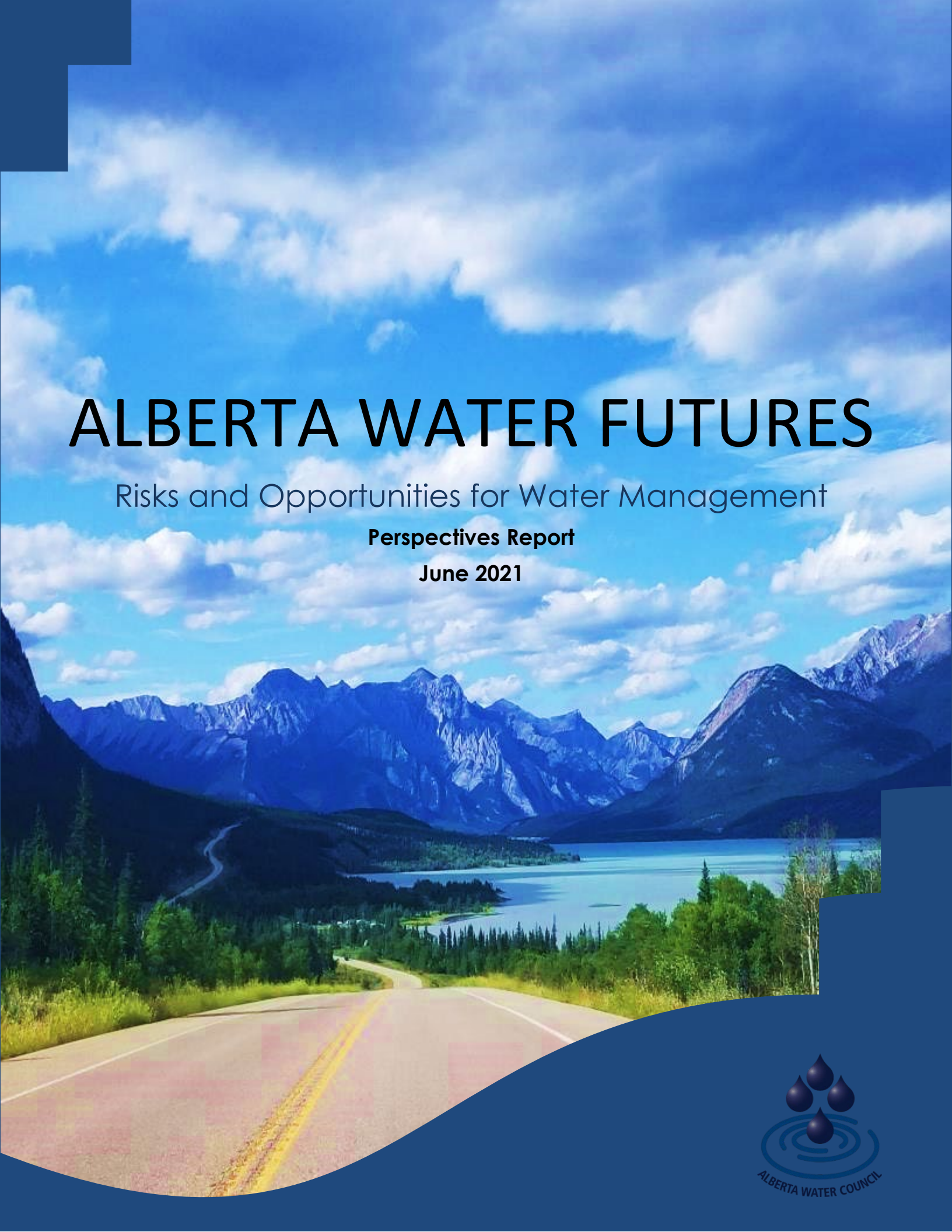
ALBERTA WATER FUTURES

Risks and Opportunities for Water Management

Perspectives Report

June 2021



ALBERTA WATER COUNCIL

About the Alberta Water Council

The Alberta Water Council (AWC) is a collaborative partnership that provides leadership, expertise, and sector knowledge and perspectives to help governments, Indigenous peoples, industry, and non-governmental organizations to advance the outcomes of *Water for Life*.

The AWC is one of three partnerships established under the *Water for Life* strategy: the others are Watershed Planning and Advisory Councils and Watershed Stewardship Groups.

The AWC regularly reviews the implementation progress of the *Water for Life* strategy and champions the achievement of the strategy's goals. The AWC may advise on government policy and legislation in some instances. However, the Government of Alberta (GoA) remains accountable for implementing *Water for Life* and continues to administer water and watershed management activities throughout the province.

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Acronyms

AIS	Aquatic invasive species
AWC	Alberta Water Council
GoA	Government of Alberta
TEK	Traditional ecological knowledge

Glossary

The following are several key terms used in this report:

- **Water management** – collective action of partners involved in planning, regulating, and using water resources. This project focused on water strategy and policy; supporting tools of legislation, regulation, governance and data; and regional and watershed delivery.
- **Adaptable and resilient** – the system can cope with changes resulting from unforeseen conditions that adversely affect how water resources are managed.
- **Governance** –the structures and processes designed to ensure accountability, transparency, responsiveness, rule of law, stability, equity and inclusiveness, empowerment, and broad-based participation. It is the culture and institutional environment where citizens and stakeholders interact with each other and participate in public matters.
- **Inclusive and collaborative** –the system provides equitable opportunities for Albertans to access and contribute to managing water.
- **Risk** – the possibility that an event could negatively influence how water is managed or the ability of management to respond to the event or circumstance.

The Alberta Water Futures Project: At-a-Glance Summary

The AWC decided to investigate the main risks and opportunities for water management in the province through the Alberta Water Futures project. This important task is rooted in *Water for Life* goals of safe, secure drinking water, healthy aquatic ecosystems, and reliable, quality water supplies for a sustainable economy. Additionally, the *Water for Life* strategy, *Our water, our future: a plan for action*, and other pertinent water initiatives have explored risks to water management and proposed opportunities to address them.

The AWC used a strategic lens to uncover the biggest drivers that currently and will continue, to stress the water management system over the next several years. The AWC also examined how critical parts of the system were responding to these drivers. Figure 1 illustrates the main risks that were identified:

1. **Climate** – fluctuating water resources and hydrology due to climate change.
2. **Growth** – increasing demand for water because of population and economic growth.
3. **Governance and Trust** – governance is not dynamic enough to adapt to changing conditions and to maintain trust in decision making.
4. **Knowledge** – understanding of environmental, social, and economic conditions is not robust enough to make well-informed decisions.

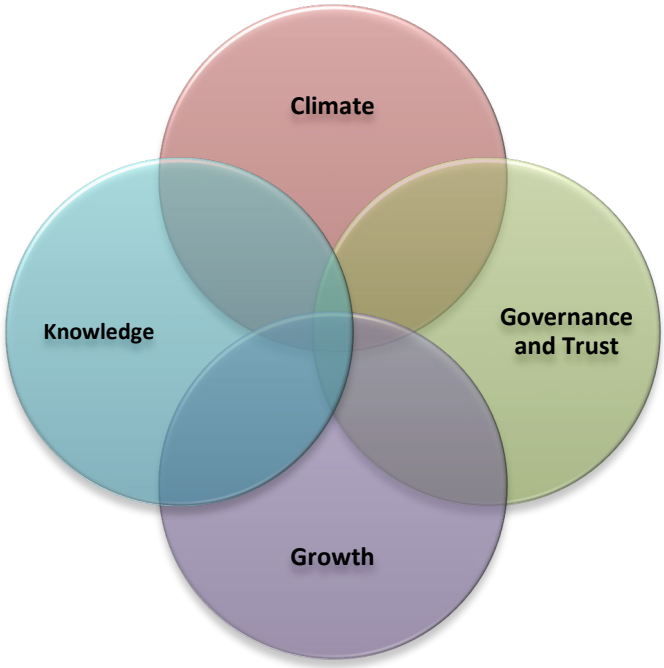

Figure 1: Main Risks to Alberta's Water management System

> The greatest threat is that risks occur simultaneously and thereby intensifying potential impacts on the water management system.

The pace, magnitude, and variability of climate and regional economic growth are intensifying the need for agile, adaptive, and localized water management. Unfortunately, however, our ability to understand, forecast, plan for, and communicate system changes is not keeping pace with evolving conditions. The existing processes often minimize important local and cultural perspectives from being included in decision making. Moreover, water management challenges can rapidly outpace the response of the system which is not designed for swift and dynamic responses.

It is time for a new conversation about Alberta's water management future—one that examines how to strengthen the system's abilities to:

- be responsive and collaborative
- be place-based and inclusive
- understand and provide access to information
- effectively forecast and support decision making

The AWC was not tasked with making policy recommendations for prospective solutions. Rather, their scope of work focused areas that can be considered by the GoA in future water management initiatives.

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1.0 Introduction

In Alberta, our quality of life—and life itself—depends on a healthy and sustainable water supply for the environment, for our communities and for our economic well-being.[1] The foundation for this timeless and universal premise is a resilient water management system.[2] Over the decades, we Albertans have made progress in several areas of our complex, multifaceted water management system through the *Water for Life* strategy and other notable initiatives. Now, further work is warranted. We need to look ahead, plan, and to take action to shift from being a predominantly reactive water management system to one that is more proactive, thereby ultimately increasing the resilience of the system to future risks.

1.1. Background

At the June 2020 AWC board meeting, the GoA signaled that understanding potential risks to the water management system would be important in the coming years. This valuable information could strategically advise the GoA and other partners on priority areas for action. In response, the AWC established an ad hoc group to determine if a project idea existed. Upon further discussion, the group determined that there was a project idea, and with board approval this concept evolved into a working group and subsequently a project team.

1.2. Purpose and Outcomes

The AWC approved terms of reference (ToR) (Appendix A) for a project team to identify future risks that may affect Alberta's water management system and assess the readiness of the system to respond to those risks and potential opportunities. Given the short timeframe for this work, the ToR allowed the AWC to pilot an expedited project team process. The project's objectives were as follows:

- Current state assessment – undertake a strategic-level assessment of strengths and shortcomings of the current water management system.

[1]Government of Alberta, 2003. *Water for Life: Alberta's Strategy for Sustainability*. Available: https://open.alberta.ca/dataset/77189444-7456-47f7-944c-085272b1a79c/resource/17c41dc3-1692-4cf9-b931-2892c57a62b1/download/2003-water-life-albertas-strategy-sustainability-november-2003.pdf. Accessed February 2021.

[2]The "water management system" consists of many elements. The scope of this project was intentionally focused on water strategy and policy, the specific supporting tools of legislation, regulation, governance, data, and regional and watershed delivery.

- Identify main risks – describe the main social, environmental, and economic risks to the future of Alberta's water management in the short and longer term (10-year horizon) that may prevent the water management system from responding appropriately.
- Cross-sector perspectives – gather cross-sector perspectives on the readiness of the water management system to adapt or respond to the identified risks.

1.3. Methodology

Over the course of the project, a project team met virtually 20 times for approximately 487 person-hours. There was also in-kind support (i.e., co-chair time, sub-group meetings, and in-between meeting work) of approximately 420 hours.

The project team discussed and reviewed the current water management system (focusing on water strategy and policy); their supporting tools of legislation, regulation, governance, and data; and regional or watershed delivery. Based on these discussions and reviews, the team then carried out a SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats). A visual platform called MIRO was used to support team brainstorming and other activities.

To gather feedback, the project team surveyed AWC members, Indigenous partners, and organizations in the province. Responses were accepted from December 9, 2020 to January 15, 2021. Ninety-six responses were collected from several groups as illustrated by Table 1. The survey provided a snapshot of perspectives and is not a rigorous quantitative analysis.

Table 1:Survey Participants

Category	Group
Indigenous	Samson Cree Nation
Municipal Government	Rural
	Small Urban
	Large Urban
Government of Alberta	Agriculture and Forestry
	Environment and Parks
	Health
Industry	Cropping
	Irrigation
	Livestock
	Mining

	Oil and Gas
Non-Government Organization	Environmental
	Fish Habitat Conservation
	Watershed Planning and Advisory Councils
	Wetland Conservation
	Water Stewardship Group
Other	Academia
	Environmental Consulting
	Individual

These strategies helped the AWC identify the main risks and opportunities facing water management and inform the results presented in this report.

2.0 Water Management in Alberta

For the purposes of this project, the AWC developed a description about what is generally considered when the term "water management system" is used in this report. This description also provided a basis for the AWC when exploring risks and opportunities for future water management.

Water Management System Defined

The water management system in Alberta allocates and supplies water to maximize the value of this resources to Albertans, while managing the impacts of our human activities on aquatic ecosystems. The system manages water that naturally arises in Alberta from precipitation and glaciers across watersheds over time. The system is empowered and governed by provincial laws and public policies that aim to foster the wise stewardship of aquatic ecosystems and optimize water use to support the province's water needs. Within the system, collaborative planning is intended to consider emerging social, economic, and environmental pressures so that shared, desired, and balanced water management outcomes can be developed. The system operates water management infrastructure to distribute and supply water to achieve our desired outcomes. The system strives to build knowledge and information metrics for reporting trends and successes in set outcomes so that the public can be assured their interests are being achieved.

3.0 Indigenous Perspectives

The worldviews and perspectives of Indigenous peoples, and their constitutional matters, must be considered when assessing Alberta's water management system. It is also important to acknowledge the cultural and traditional relationships between Indigenous peoples and water and the treaty relationships and reconciliation between Indigenous and non-Indigenous Albertans. The AWC benefited from having a few Indigenous partners participate in this work. However, it should be noted that these partners cannot and should not represent the broader group of Indigenous Nations and settlements of Alberta. A deeper dialogue and improved working relationship with Indigenous peoples on water management is necessary.

The biggest challenges facing how water and activities that affect water are regulated concern historical issues about jurisdiction and responsibility towards water and the environment. These challenges stem from treaty relationships, and Indigenous peoples' rights and responsibilities in managing their relationships with water.

Indigenous communities have been left as by-standers in the management of natural resources during any discussions concerning water regulation. Beginning conversations about water regulation without addressing the fundamentally different perspectives on issues like water ownership, stewardship, and rights shared by Indigenous communities does not set the stage to start on equal footing.

The overlapping responsibilities of three governing bodies—the Government of Canada, the Government of Alberta, and Samson Cree Nation—plus other stakeholders further complicate our ability to practice self-determination. Jurisdictional issues will be further complicated by a changing climate that already disproportionately affects Indigenous and vulnerable communities in an increasingly water stressed region.

There is tremendous opportunity to include Indigenous communities in a deep and respectful way so that future challenges can be approached in collaborative partnership. Indigenous communities should be front and centre in issues like water regulation from the outset. There are many opportunities to create long lasting partnerships, but we must be included in determining the scope and parameters of involvement. We would love to see a world where Albertans are educated about water issues and Indigenous issues so that they can approach these concerns in a respectful and reciprocal manner.

Excerpt from the survey response, Nipi Committee, Samson Cree Nation, Treaty 6

4.0 Potential Risks

The AWC identified four broad areas of potential future risk with the potential to negatively affect Alberta's water management system in the future.

4.1. Potential Future Risks

Figure 2 outlines the main risks that were identified with supporting rationale:

1. **Climate -** fluctuating water resources and hydrology due to climate change.
2. **Growth** - increasing demand for water because of population and economic growth.
3. **Governance and Trust** - governance is not dynamic enough to adapt to changing conditions and to maintain trust in decision-making.
4. **Knowledge** – understanding of environmental, social, and economic conditions is not robust enough to make well-informed decisions.

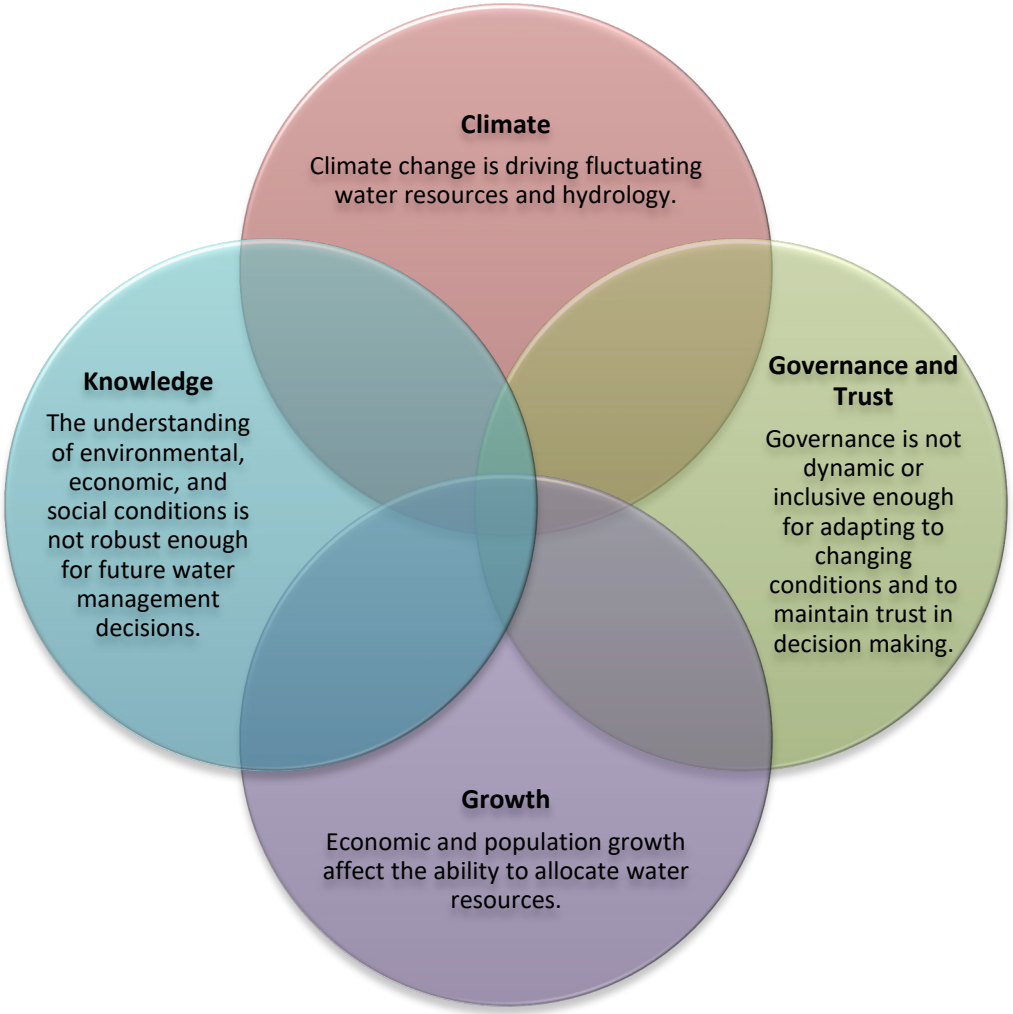


Figure 2: Main Risks to Alberta's Water Management System and Rationale

4.1.1 Climate

Climate change is driving fluctuating water resources and hydrology because of increasing or shifting ranges of variability and extreme climate events.

Geographic and seasonal differences in the rates of climate change are leading to unequal impacts and regional vulnerabilities.

Description

Climate change poses one of the greatest risks to Alberta's water management system. It can impact the supply and quality of freshwater and extreme climatic and hydrologic events (e.g., droughts, floods, hailstorms, wildfires). Variable supply, timing of supply, quality of water, and existing level of impairment coupled with increasing frequency and magnitude of extreme events, pose risks to the water management system. Additionally, regional climate conditions vary across the province. Climate extremes can be radically different (e.g., drought versus flood). Therefore, water management and water users must address the possibility of climate extremes happening at the same time in different parts of the province. Some of the opportunities arising from climate change need to be considered. For example, longer seasons will allow multiple crops to be grown each year, which will in turn, increase demand for irrigation water. In this example, the timing of water availability between an earlier spring freshet and irrigation could be challenging.

> Uncertainty in changes to our water system (i.e., how climate changes will impact our water systems including changes happening in the headwaters, wildfire impacts). Population growth expected in large urban areas. Changes in our economy and corresponding impacts on water.
> *Excerpt from survey response, Large Urban*

Rationale

Climate risks were among the biggest concerns expressed during the project. Alberta's climate and hydrologic conditions are naturally variable. However, climate change is driving additional changes in water availability and quality and influencing specific regions of the province differently. Greater variances in water quantity and quality pose a risk to the water management system because it must adapt to conditions and the needs of water users who must also adapt. When paired with variability across the province and seasons, the

type and level of response required for effective water management becomes regionally and sector specific.

4.1.2 Growth

Economic and population growth affect the system's ability to manage water resources because of changing water supply and increasing water demand.

This could result in declining water quality, aquatic ecosystem health, and inability of the system to support economic and social growth.

Description

Shifting population and economic growth across the province, and the imbalance of water supply and demand (i.e., between the northern and southern areas) influence the demand and use of finite water resources. Periods of positive growth add pressure on an already strained system to provide water resources for sustainable growth, built infrastructure, and aquatic environments. When there is no growth, the risk switches to restoring the aquatic environment while maintaining the water management system. Regional and local variability in population and economic conditions can trigger growth and decline scenarios to occur simultaneously across the province.

> Integrate more vertically and laterally so that local authorities and basin-scale groups are more involved in decisions by the province. Building capacity to educate and engaging more stakeholders are critical. Ensuring user-friendly tools to understand water management (e.g., online dashboards) would be a first step.
> *Excerpt from survey response, Oil and Gas*

Rationale

Population and economic variability require the system to react to changing local populations, economic activity, and naturally variable environmental conditions. Moreover, the system must consider downstream ecosystems, water users, and the impact of local water demands on water quality.

4.1.3 Governance and Trust

Water management governance is not dynamic or inclusive enough for adapting to changing conditions and to maintain trust in decision making.

Description

There is a risk of diminishing trust in governance and decision making when conflicting perspectives and values are not considered or not considered equitably. Trust is eroded when governance cannot keep pace with changing circumstances and expectations and becomes more reactive than proactive.

> Implementing *Water for Life* has been compromised to a considerable degree by not being as inclusive and collaborative is it needs to be and as it was intended. *Excerpt from survey response, Watershed Stewardship Group*

Governing the water management system is a complex process. Decisions often sit at the juncture of public and water user expectations, environmental conditions, regional-specific[3] characteristics as well as historical and cultural connections to water. The degree to which governments can incorporate these variables in decision making, is a pivotal contributor to building trust in the governance. Another facet of the governance risk is integrating land use and water management. Planning and decision making for water and land often occur in silos because of the various decision makers and mechanisms. Plans vary in their degree of authority; some are advisory and voluntary while others have statutory authority. This report suggests that the challenge of integrating land use and water management is a significant risk to governance and achieving desired outcomes through adaptive water and watershed management.

Rationale

The landscape of water management decision-making is evolving—the drive to become more inclusive and proactive is a priority for water users, investors, and governments. Historically, cross-scale, multi-sector relationships[4] set the foundation for shared water management in Alberta. A key risk is fragmenting the effectiveness of these partnerships that drive water management outcomes.

[3] Characteristics here refer to the unique social and economic conditions that vary regionally and locally.

[4] For more information about *Water for Life* partnerships, see here: https://open.alberta.ca/publications/0778542424

Risks can manifest vertically through government hierarchies (i.e., federal, Indigenous, provincial, municipal) as relationships shift in response to emerging challenges and opportunities. Additionally, risks can manifest horizontally across a spectrum of participants, affecting how they contribute and their ability to collaborate across sectors, and foster shared approaches to support water management.

Most survey responses centered on aspects of governance and trust[5]. Diverse perspectives from water users and other partners are important in order to strengthen decisions, drive change, and adapt to environmental variability and water user needs. Place-based perspectives and values should also be considered in decision making because they vary geographically. I Indigenous peoples are particularly vulnerable because their rights, responsibilities, and cultural connections to water are often disregarded in decision making. Therefore, their ability to practise self-determination with respect to water can be restricted.

Inflexible governance relies on established processes that cannot keep up with evolving conditions and demands for inclusive decision making. This inflexibility can result in water management that is more reactive than proactive and is unable to mitigate impacts and adapt to changing needs.

4.1.4 Knowledge

Environmental knowledge

The understanding of environmental, economic, and social conditions is not robust enough for future water management decisions.

Description

Inadequate understanding of environmental conditions (e.g., climate, water quantity and quality) can lead to poor decision making and inadequate public understanding of water management issues and opportunities. Monitoring, evaluating, and reporting environmental conditions are all critical for managing water and restoring ecosystems. But monitoring programs must be paired with equally strong interpretation, evaluation, and reporting functions for maximum value. Emphasis, however, is often placed on monitoring efforts with insufficient evaluation and reporting. This can lead to deficiencies in understanding and

[5] Section 6 shares details on the survey responses collected.

communicating the information to water users and the public. There is an opportunity to weave environmental knowledge into Western science and Indigenous traditional ecological knowledge (TEK) to improve understanding of environmental conditions.

In general, there is a lack of available information for volunteer groups and the public to use. Government resources are often inaccessible, in terms of finding relevant resources and interpreting them for general use.

Social and economic knowledge

Societal and economic conditions are not monitored, tracked, or sufficiently understood to support water management decisions.

Description

Insufficient knowledge about evolving social and economic conditions can lead to poor water management decisions (e.g., demand shifts, use and allocation, efficiency and conservation). Effective water management demands a diversity of perspectives (e.g., cultural values about water, treated water as a commodity) and insights from social and behavioural sciences. Adequate monitoring and collection of data related to social and economic conditions are essential for decision making that balances diverse needs.

A holistic and accessible approach to knowledge

A robust, adaptable, and resilient water management system requires the integration of a broad range of knowledge from diverse knowledge holders, including an understanding of water supply (metering, environmental monitoring, evaluation, and reporting), and water demand (collection and analyses of social and economic trends and pressures).

> Improved modelling and forecasting offer an opportunity to predict when and where water surplus or shortages may have the greatest impact, and how we can manage the resources accordingly.
> *Excerpt from survey response, Wetland Conservation*

Furthermore, relevant, high-quality knowledge needs to be accessible to support water users across the system so that they can collectively make decisions. Misunderstanding and misinformation can lead to polarized viewpoints on key issues.

Rationale

The risks identified and our ability to make wise water management decisions are underpinned by a solid understanding of environmental, social, and economic conditions. Moreover, we must ensure that information is available to decision-makers, water users, and others.

Monitoring efforts are often uncoordinated and support for adequate and synchronized monitoring, evaluation, and reporting is missing or eroding. TEK is not considered equal to Western science in water management decision making. Economic and social considerations are rarely combined with environmental information. A holistic understanding of the system should be communicated to decision makers, water users, and the public.

The importance of comprehensive and accessible information is intensified by factors such as climate change, and growth pressures that stimulate uncertainty (e.g., droughts and floods). Public apathy toward water management issues that arise from misinformation or misunderstanding present further barriers to improving the system.

4.2. Interactions Among Risks

The main four risks identified by the AWC could significantly impact the future of Alberta's water management system and the decisions made. Furthermore, the most substantial threat exists when these risks occur together, as they do now.

Risks to the water management system are not independent of each other.

The greatest threat arises when multiple risk factors occur concurrently and their interactions intensify potential impacts.

The system and the risks it faces are intricate and interconnected as illustrated in Figure 3. Four elements emerged as key components to understanding the interactions among the risks to water management in Alberta. With increasing complex interactions and rates of changes, along with a water management system that is increasingly interdependent, the likelihood of one being resolved with the solution decreases. Understanding the interconnectedness and feedbacks among risks categories is critical to mitigating them. Water management decisions aimed at addressing one risk category may have cascading impacts on the others and inaction can impact all categories.

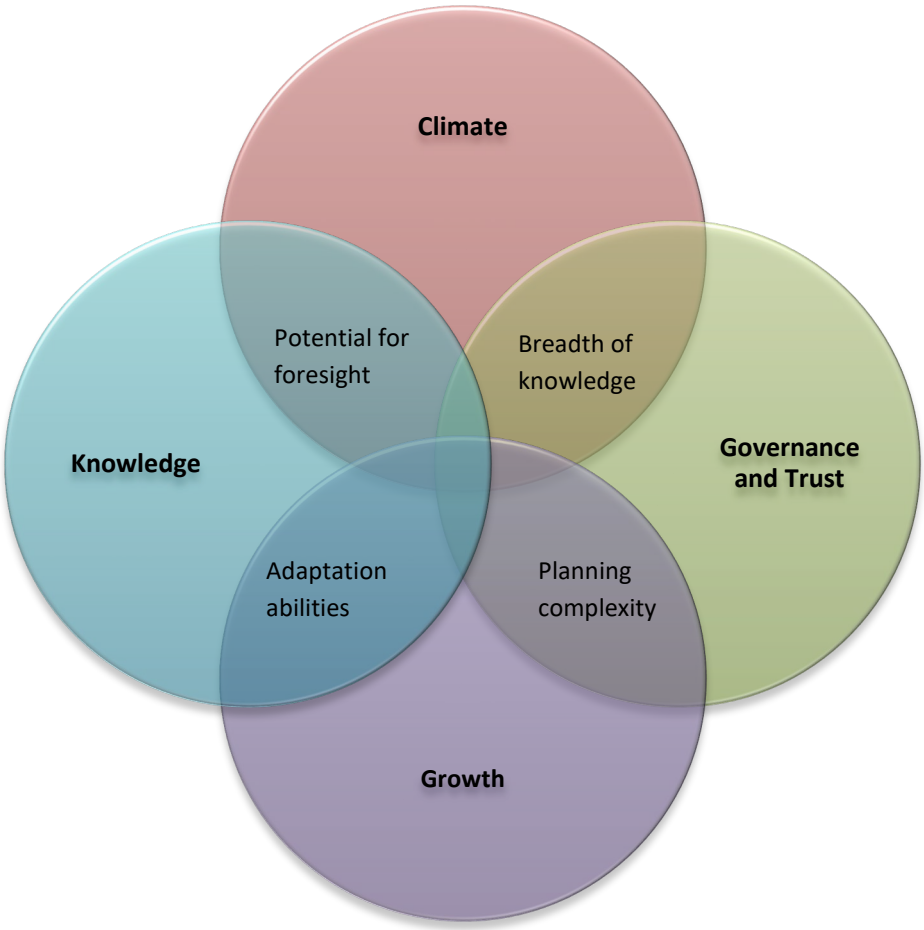


Figure 3: Interaction among Main Risks to Alberta's Water management System

4.2.1 Ability to adapt

When water management is prescriptive and difficult to change, the system is unable to respond with new solutions to emerging conditions. In times of rapid and potentially extreme change, or when opposite conditions can occur simultaneously (e.g., growth and decline), for novel and locally created solutions are called for. These solutions are often needed at a pace that exceeds the ability of the current system to provide them.

4.2.2 Planning complexity

Coupled with the need for responsive decision making is the requirement to add certainty through responsive planning for future challenges. An understanding of local conditions and perspectives are imperative for effective and inclusive planning that considers local needs. At this point in time, there is uncertainty and complexity about the various plans and the roles and responsibilities of their creators.

4.2.3 Breadth of knowledge

As water management issues arise, it is valuable to monitor, evaluate, and report on environmental conditions[6], efficiency measures, and economic and social factors. Doing so will help us make the best use of limited water resources and ensures that they are aligned with the needs and desires of Albertans.

An inordinate focus on some areas of knowledge building above others (e.g., monitoring rather than evaluation) leads to insufficient understanding of water management issues. These issues can also be technical; a lack of expertise and capacity can impede progress. Providing decision makers with more access to educational resources would improve the understanding of these issues and consequently lead to better decisions and a more informed public.

4.2.4 Potential for foresight

A key component of the system's ability to respond to change is its capability to explore future scenarios for water management. If predictive capacity and tools are insufficient, we cannot understand, plan, and adapt. This challenge can manifest as either reduced capacity (e.g., expertise) and few tools (e.g., predictive models) or experts and tools that disagree or compete. In the former scenario, there are too few experts and tools, which can impede progress; in the latter, there are too many experts and tools, which can create uncertainty.

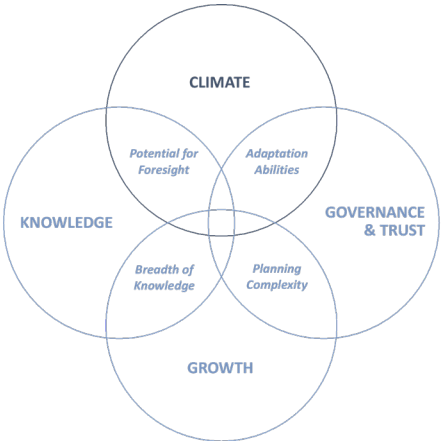
[6] These include water quality, water quantity, climate, and other indicators of aquatic ecosystem health.

Case Study: Interacting Risks and Aquatic Invasive Species

This example describes the risks and risk interactions outlined in this report. Other examples (e.g., treating municipal water, drought, managing wetlands) can be positioned in the identified areas to understand how risks interact.

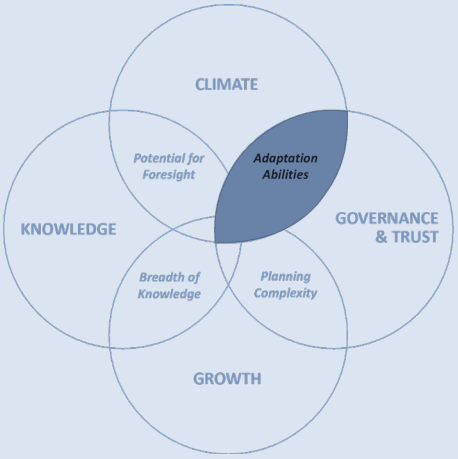
Climate

Climate-induced changes modify water quantity and quality parameters in Alberta's water bodies leading to an increase in the ability of existing species to spread and an increase in the opportunity for new invasive species to become established.



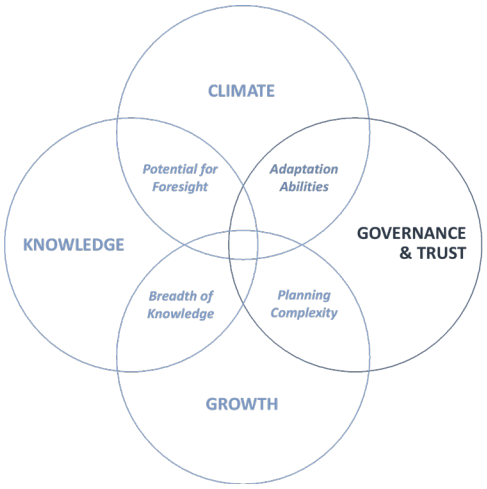
Ability to adapt

AIS establish and spread faster than the system can respond, requiring far-reaching management requirements in the future.



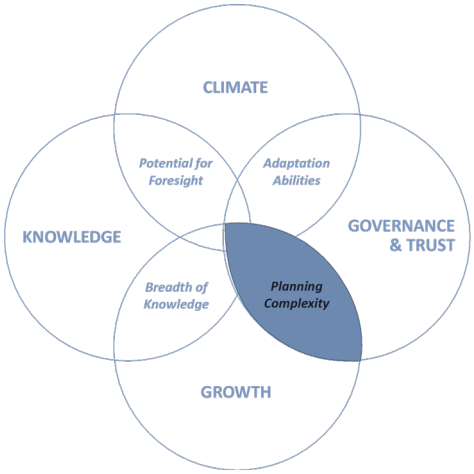
Governance and Trust

Prevention, inspection, enforcement, and monitoring activities are hampered or reduced because of shifting priorities. Stakeholders and the public become less confident that the establishment of AIS will be prevented and that the appropriate responses to AIS will be implemented.



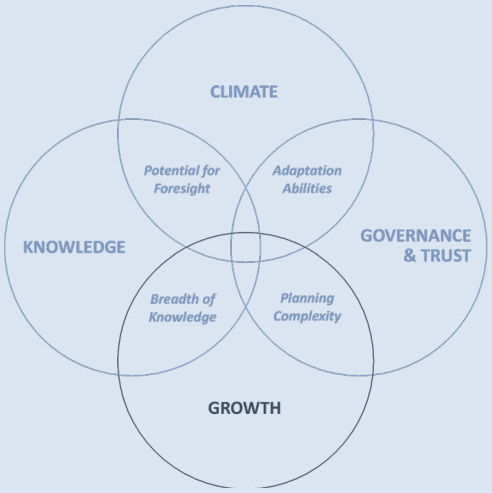
Planning complexity

Experience indicates that management actions become more reactive than proactive while public apathy increases. Greater pressure is exerted on preventing, inspecting, enforcing, and monitoring AIS activities.



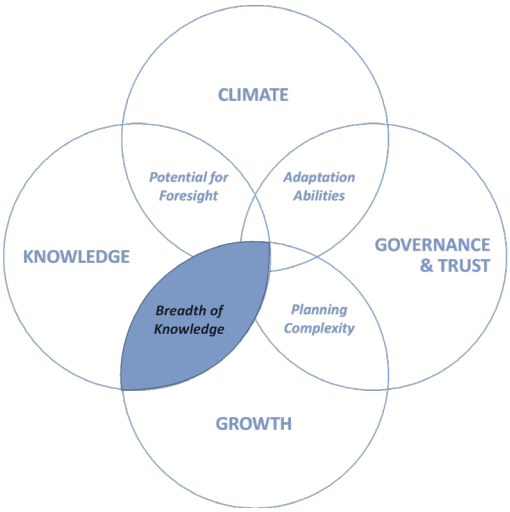
Growth

With population growth and shifts in societal activities associated with water, the risk of the introduction of AIS is heightened because of the increased use of water bodies and the emergence of new pathways of introduction.



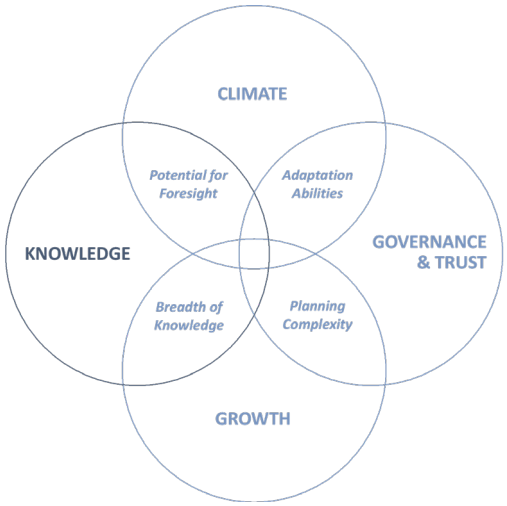
Breadth of knowledge

Knowledge of the introduction, spread, impacts, and management of potential AIS is not adequate and well communicated, resulting in a decrease in monitoring activities concurrent with an increase in the use of water bodies.



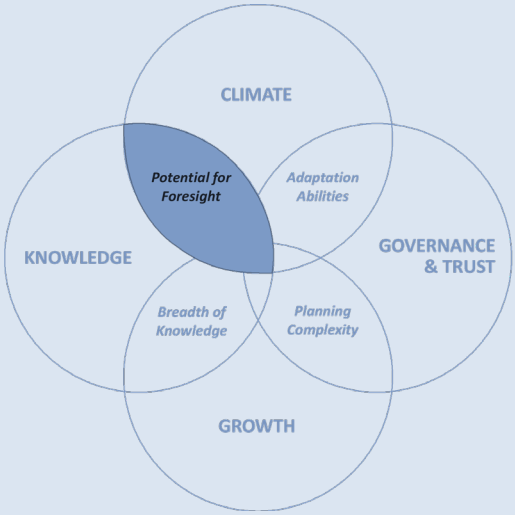
Knowledge

Decreasing, non-inclusive, and uncoordinated monitoring activities lead to reduced detection and lack of understanding of new pathways of introduction for AIS.



Potential for foresight

A poor understanding of the establishment of potential AIS because of changing conditions, along with the lack of baseline data, reduces proactive planning adaptation and management response.



5.0 Opportunities to Improve Readiness

Historically, the projects, programs, and policies of Alberta's water management system have adapted to changing conditions, and myriad reports and recommendations intended to address challenges facing the system have been written. This perspectives report was an opportunity to examine the broader management system from the standpoint of AWC's sectors and other key partners.

The goal of this project was to examine potential risks confronting water management and explore Alberta's readiness in the face of these risks. Based on discussions with key partners and the results of a survey, the AWC's conclusion is simple: the landscape of water management in Alberta is changing, and we must do more now to prepare. Together, intersecting risks related to climate, knowledge, governance and trust, and growth are poised to influence water management in the 21st century.

Our ability to proactively respond to these challenges will shape our readiness to respond. While we must acknowledge both the tremendous positive legacy and the shortcomings of the water management system, the path ahead is different. We face four substantive risks and their interactions with one another indicate that the status quo or inaction is not an option if we are committed to the goals of *Water for Life*.

> It is time for a new conversation about water management.

It is time for a new conversation about water management—one that aligns with the ethos of *Water for Life* and its culture of shared responsibility. The AWC revealed that its members and other key partners were eager to build on *Water for Life's* positive legacy and partnerships to ensure a proactive and coordinated approach to tackling these key risks.

This report outlines four core areas and key questions that intends to spark discussion and exploration among *Water for Life* partners on the potential next steps. These questions are not prescriptions or formal recommendations; they are a starting point towards a renewed dialogue about the system, the leadership, and the cross-sector input. The questions focus on the intersections of the four risk areas identified by the project. However, there is room to address

the significant individual risk of climate, growth, governance and trust, and knowledge.

1. Adaptation

How might we renew our water management system so that it can adapt quickly to changing conditions and enhance the abilities of *Water for Life* partnerships to collaborate for achieving *Water for Life* goals?

This question acknowledges the value of involving institutions and partnerships that propel the system and the leadership required to navigate intersecting risks in the 21st century. Improving our readiness in the face of mounting risks will require strong leadership, clear roles and accountabilities, and coordination across partners. This is a critical area requiring attention.

Points to consider:

- the contrast between a system designed to support growth and one designed to support sustainability
- the possibility of new regulatory approaches that may better achieve outcomes and support collaboration
- examples from other jurisdictions or countries from which Alberta might draw examples of comprehensive and effective water management practices

2. Planning

How might we improve our understanding of place-based conditions and be broadly inclusive of *Water for Life* perspectives in effective planning?

By focusing on the need to be inclusive of diverse views in planning at a more localized scale, this question highlights discussions about the role of different worldviews in water management, existing *Water for Life* partnerships, and the scale at which new planning is most effective.

Points to consider:

- the importance for good working relationships with Indigenous peoples that considers their values, knowledge, and worldviews as equal to Western science perspectives

- the potential for *Water for Life* partnerships to assume different roles in water management and address identified risks and their interactions

3. Knowledge

How might we optimize our ability to monitor, evaluate, and report on environmental, social, and economic conditions, and improve accessibility to this information?

This question points to the fundamental need to balance monitoring, evaluation, and reporting efforts and make knowledge widely available to support decisions across the water management system. Doing so would ensure we gain the best value from the information we collect.

Points to consider:

- the capacity to monitor, evaluate, report, and forecast across environmental, social, and economic pillars
- the need to work with Indigenous peoples so that their values, knowledge, and worldviews are considered equally with western science perspectives
- the role of citizen science and other broadly inclusive methods in water management monitoring, evaluation, and reporting

4. Foresight

How might we develop our forecasting abilities and improve how foresight supports decision-making across *Water for Life* partners?

This question recognizes that our abilities to understand future scenarios must be developed with partners across the water management system, thus supporting how partners make water management decisions.

Points to consider:

- the scope of information required about climate, growth, environment, social, and economics to support new models of decision making
- integrating social, environmental, and economic information in a transparent and defensible manner

6.0 Perspectives on Alberta Water Management

The information in this section reflects the diverse opinions of the survey respondents and is not based on scientific facts or evidence. The findings are not intended to be statements of consensus or representative of the AWC. The following tables summarize the responses provided by survey respondents to questions.

6.1 Risks

Over the next 5 to 50 years, what are some of the potentially biggest challenges facing how we regulate water and activities affecting water?

Table 2: Potential Challenges to Water Management in the Next 5 to 50 years

Category	Potential Risk
Climate change	• Polarized viewpoints and inaction because of them. • Increasing number and uncertainty of extreme events (e.g., drought, flood). • Insufficient water to meet the needs of the economy, communities, and the environment. • Lack of climate and water variability planning (e.g., more flood-focused than drought-focused).
Data, information, and knowledge	• Inconsistency when reporting actual water use. • Decision making processes are not informed by relevant information and data, it is not available, accessible, or of sufficient quality. • Diverse water values are not considered equitably in decision making.
Environmental protection	• Relying on future technology to solve contamination. • Inability to manage impacts on aquatic ecosystems by climate variability added to natural variability. • Managing impacts to water quality with climate variability, complex contamination, natural environmental variability, and growth pressures (e.g., increased contamination, runoff). • Increased spread of aquatic invasive species because of climate change impacts in aquatic ecosystems.
Governance	• Changing political priorities. • Not considering jurisdictional perspectives in decision making. • Failure to consider Indigenous and other key partner perspectives in decision making. • Lack of, or delayed response to some challenges and opportunities. • Reactive water management system rather than a

	proactive one.
Growth pressure and conflicting uses	• Not including transboundary agreements in water management decisions. • Insufficient water to meet the needs of people and economic growth, while having enough for the ecosystem • Managing impacts to water quality with climate variability, complex contamination, natural environmental variability, and growth pressures.
Indigenous	• Disproportionate and increasing vulnerability of Indigenous people and water management issues. • Ability of Indigenous peoples to practice self-determination. • Not acknowledging the cultural connections of Indigenous people and water.
Partnerships	• Apathy about water issues is a barrier to improving water management. • Ineffective partnerships because of a lack of resources, access to knowledge, and authority to act. • Exclusive partnerships result in important perspectives being missed.
Social perspectives	• Lack of trust in the regulatory system. • Competing and discounted values regarding water. • Misunderstood and misrepresented challenges and opportunities.
System tools	• Local issues and perspectives are not considered. • Insufficient water to meet the needs of the economy, communities, and the environment. • Reactive water management system rather than a proactive one.

6.2 Opportunities

What opportunities might arise for managing water in the future (next 5 to 50 years)?

Table 3: Potential Opportunities for Water Management in the Next 5 to 50 years

Category	Potential Opportunity
Clarity and certainty	• Clarify the roles and responsibilities of the AWC, Watershed Planning an Advisory Councils (WPACs), and Watershed Stewardship Groups (WSGs) in the system. • Improve transparency and access to data use on water quantity and quality.
Data, information, and knowledge	• Coordinate science, research, modelling, and community-led monitoring. • Investigate and pilot new technologies for water management.

Environmental protection	• Protect aquatic ecosystems (e.g., riparian, headwaters) using tools (e.g., offsets). • Manage land use impacts (e.g., watershed-level water quality).
Governance	• Refocus decision making to ensure operational decisions are in the hands of operators and producers. • Develop standard approaches (e.g., water sharing agreements) to anticipate re-assignment of senior licenses to others in times of need (e.g., drought). • Integrate land and water management to include watershed-level representation in decision making. • Reimagine resourcing model for water management (e.g., with tools and programs such as conservation offsets).
Growth pressure and conflicting use	• Evaluate existing water allocations based on actual use.
Indigenous	• Include TEK in decision making; treat as TEK equivalent to Western science. • Engage Indigenous peoples in water management decisions.
Partnerships	• Clarify the roles and responsibilities of the AWC, WPACs, and WSGs in the system. • Coordinate science, research, modelling, and community-led monitoring.
Social perspectives	• Encourage public dialogue on water management challenges and opportunities to drive political will and change. • Enhance sustainable planning for future generations.
System tools	• Diversify sustainable practices (e.g., specialty crops). • Improve water conservation, efficiency, and productivity practices across sectors. • Enhance water storage to mitigate drought and flood. • Employ green and grey infrastructure to support ecosystem services. • Adopt new technologies and natural systems for greater efficiency and environmental protection. • Use surface and deep, saline groundwater in a coordinated way for industrial activities. • Improve education, awareness, and stewardship about the regulatory system.
Climate changes	• Create a regulatory system that is flexible with variable hydrologic conditions occurring synchronously.

6.3 Roles of Watershed Groups

What role should our voluntary watershed partnership groups have in addressing the challenge you identified?

Table 4: Potential Roles of Watershed Groups

Category	Potential Roles of Watershed Groups
Decision making	• Advocate for change so it can be backed by policy action. • Inform decision-making processes—bring local and Indigenous perspectives to the table. • Support capacity and relationship building at local levels. • Clarify roles and responsibilities in regional land-use planning.
Education	• Educate the public on priority issues (e.g., AIS, wetlands, water use, regulatory system). • Focus awareness efforts on Indigenous-led education initiatives.
Engagement	• Organize partners and the public by building local capacity. • Advance, science, planning, technology, and education across sectors. • Facilitate conversations among partners and the public on water management challenges and opportunities.
Indigenous	• Cultivate meaningful relationships with Indigenous peoples based on shared responsibility, respect, and understanding of their rights, history, and issues.
Investment	• Coordinate investing in water infrastructure or conservation areas.

6.4 Information and Knowledge Needs

How will our information and knowledge need to change to effectively address the challenges and opportunities you identified?

Table 5: Information and Knowledge Needs Required to Address Opportunities

Category	Information and Knowledge Needs:
Access	• Clarify the roles and responsibilities to foster more partnerships to avoid duplicated efforts and more collaboration. • Central hub for information so it can be accessed and used by partners. • Systems to track water availability, allocation, use, and actual stream flows at various geographic scales.
Aquatic ecosystem	• Understanding of aquatic ecosystem value and health

	status. • Knowledge about water quality trends, point and non-point source pollution and loadings.
Climate information	• Science-based information about climate change impacts. • Information and modeling that can predict floods and droughts.
Cumulative effects	• Cumulative impacts of growth and change.
Decisions	• Science-based resources that can inform adaptive decisions and drive regulatory and legislative changes. • Link the cost of protection with the cost of savings (e.g., headwater protection and downstream water treatment).
Education	• Demonstration projects to illustrate beneficial management practices. • Communicate the results of modelling to decision makers, partners, and Albertans. • Understand how farmers and industry are managing water for various uses (e.g., drainage, wetlands, stewardship). • Educate industry, landowners, and other target groups about why water should be protected and how.
Engagement	• Involve youth in water management (e.g., youth service clubs, 4-H Alberta Program, Scouts).
Groundwater	• Information about groundwater and potential aquifer storage.
Indigenous knowledge	• Include Indigenous peoples perspectives on water management issues. • Promote awareness about Indigenous approaches to water regulation.
Local knowledge	• Local information on social and environmental contexts to consider rules and perspectives.
Monitoring	• Capture water data (e.g., quantity, quality, use, allocation, ecosystem health) to support holistic reporting. • Predictive capabilities (e.g., modelling, forecasting).
Reporting and compliance	• Public reporting on key parameters (e.g., status of water resources, impacts, and benefits).
Social	• Human dimensions, such as values and perceptions of water and governance, are often overlooked as drivers of system behaviour and performance.
New technology	• Knowledge along with new technology could support investments across sectors. • Consider the food-energy-water nexus and how it affects the system.

Appendix A- Terms of Reference

Alberta Water Futures: Challenges and opportunities for Alberta's Water Management System

Approved by the Alberta Water Council (AWC) in November 2020.

Context

The Alberta Water Council (AWC) approved forming an ad hoc discussion and subsequent working group to explore potential future challenges and opportunities facing Alberta's water management system. The project team will operate in a manner that is consistent with the rules, policies and procedures adopted by the AWC, including the use of consensus to make decisions in a multi-stakeholder process.

Strategic intent (goal)

The purpose of the Alberta Water Futures project is to identify the main future risks that may affect Alberta's water management system[7] and then assess the readiness[8] of the system to respond to those emerging challenges and potential opportunities.

The project will focus on water strategy and policy aspects of the water management system, and accompanying legislative, regulatory, governance, data, and regional/watershed delivery tools.

Objectives

The Water Futures project would achieve the following three objectives:

1. **Current state assessment:** Conduct a strategic-level assessment of strengths and shortcomings of the current water management system.
2. **Identify main risks**[9]: Describe a select few main social, environmental, and economic risks to Alberta's water management future in the short and

[7] The working group noted that the 'water management system' is comprised of many elements. The scope of this project was intentionally focused on water strategy and policy, and the specific supporting tools of legislation, regulation, governance, data, and regional/watershed delivery.

[8] Readiness is broadly described by the working group as the system's ability to be resilient, adaptable, inclusive, and collaborative.

[9] The identification of potential responses to main risks is out-of-scope for the Alberta Water Futures project.

long term (10-year horizon) that may prevent the water management system from responding appropriately.

3. **Cross-sector perspectives**: Characterize cross-sector perspectives on the readiness of the water management system to adapt or respond to the identified main risks.

Key tasks

1. **Current state assessment**
    - Conduct a strategic-level SWOT analysis of the existing system and describe key findings with rationale.
2. **Identify select main risks**
    - Gather feedback and input from sectors and select experts, maximizing cross-sector collaboration where possible, to create a listing of potential social, environmental, and economic risks.
    - Synthesize input and prioritize the list of risks to identify the main risks overall.
    - Describe these main risks with their rationale for selection.
3. **Cross-sector perspectives**
    - Maximizing cross-sector collaboration where possible, collect input and feedback from sectors regarding the readiness of the water management system to adapt or respond to each main risk.
    - Characterize system readiness, identifying differences or similarities across sectors.
    - Describe, if possible, opportunities for collaboration to improve readiness across AWC sectors.
4. **Reporting**
    - Assemble the draft report progressively through the project and present to AWC for feedback.
    - Incorporate feedback and present the final multi-sector report to AWC.

TIMELINES and DELIVERABLES

The project team will provide the following deliverables to the AWC:

- **Approval of the Alberta Water Futures Project terms of reference……Nov 2020**
  Transition of existing working group into project team
- **Current State Assessment…… …Nov 2020 – Dec 2020**
  Planning and delivery

- **Email update to Council……..Dec 2020**
  Project update and results to date presented electronically
- **Identify Select Main Risks……..Nov 2020 – Jan 2021**
  Engage sectors, synthesize feedback, identify risks
- **Email update to Council……..Jan 2021**
  Project update and results to date presented electronically
- **Cross-sector perspectives……Jan 2021 – Mar 2021**
  Engage sectors, synthesize feedback, describe system readiness
- **Update to Council……Feb 2021**
  Project update and results to date presented at the AWC Board meeting
- **Final Report……Mar 2021**
  Final report, incorporating comments or changes coming from an AWC Board discussion of the draft assessment report.

Membership

The project team is expected to encompass membership from the Industry, Non-Government Organizations, other Governments, and the Government of Alberta and Provincial Authorities. The working group membership is expected to transition into the project team membership, allowing for additional members to join if interested.

Budget

The working group anticipates that the Alberta Water Futures project can be completed using an estimated $18,000 of AWC core funds identified to support project teamwork. No additional project-specific funding is required.

Type	Amount
Stakeholder support	$ 8,000
Hosting (i.e., meetings and workshop support)	$ 2,000
Communications (design, layout, printing)	$ 8,000
Total	**$ 18,000**

Appendix B- Acknowledgements

The AWC acknowledges the contributions of ad hoc group participants, working group, project team members, and their organizations who volunteered their time, resources, and expertise to this project.

Members	Representing
Brandi Newton	Alberta Environment and Parks
Brian Deheer	Environmental
Cheri Funke	Small Urban
Che-Wei Chung	Small Urban
Dan Moore	Alberta Forest Products Association
Danielle Koleyak	Large Urban
Dave Trew*	Lake Environment Conservation
Deanna Cottrell	Oil and Gas
Fiona Briody	Cropping
Harpreet Sandhu	Large Urban
James Guthrie	Mining
John Taggart (co-chair)	Alberta Environment and Parks
Josée Methot	Watershed Planning and Advisory Councils
Margo Jarvis Redelback (co-chair)	Irrigation
Mario Swampy	Nipi Committee, Samson Cree Nation, Treaty 6
Maureen Bell	Environmental
Pat Currie	Assembly of First Nations Alberta
Rawnald Axelson	Livestock
Sharlene Browne	Rural
Shelley Woods	Alberta Agriculture and Forestry
Steve Wallace*	Alberta Environment and Parks
Zahidul Islam	Alberta Environment and Parks

Project managers: Scott Millar and Anuja Hoddinott
*Indicates participants of the ad hoc and working group phases only.

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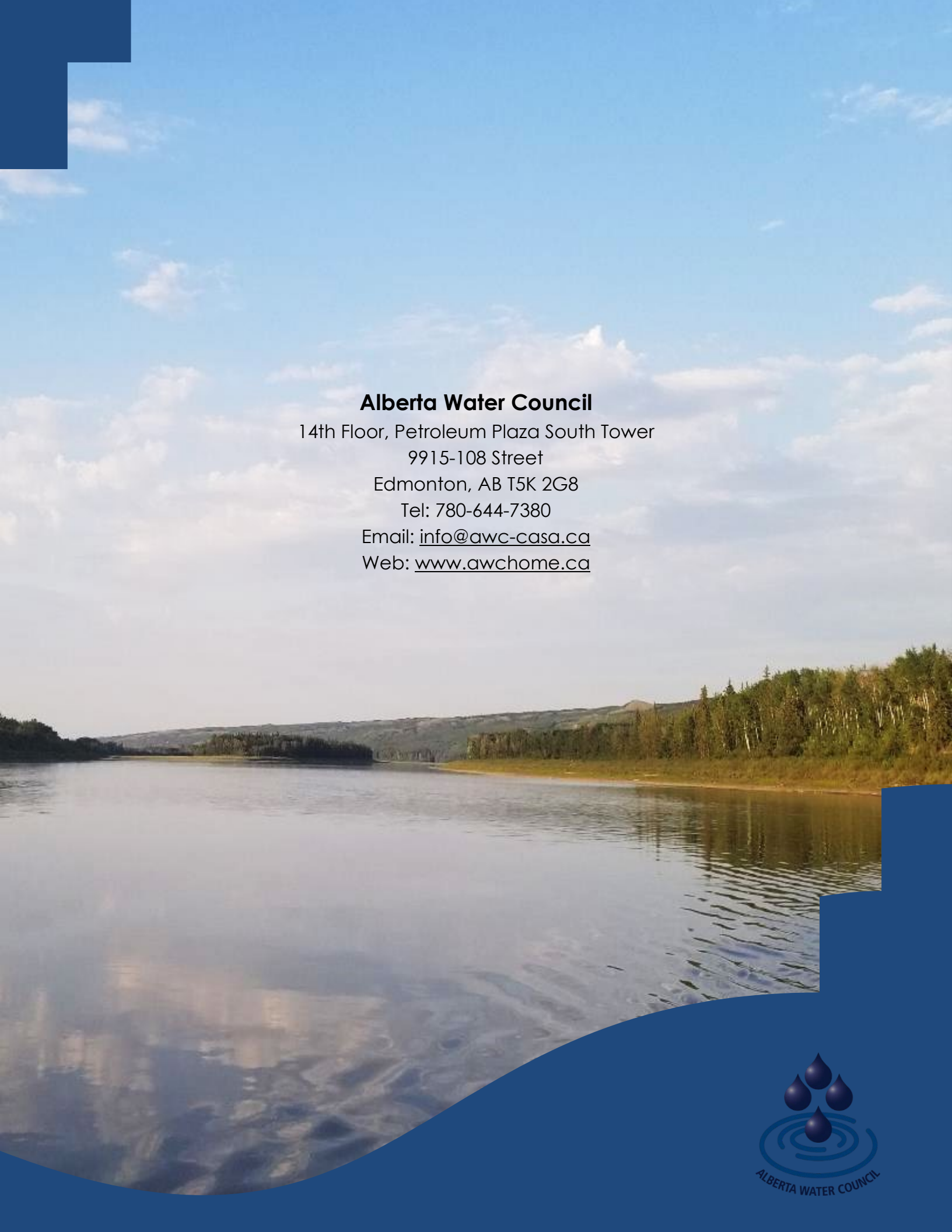

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