ALBERTA WATER COUNCIL



Recommendations to Improve Lake Watershed Management in Alberta

About the Alberta Water Council

The Alberta Water Council (AWC) is a multi-stakeholder partnership with members from governments, industry and non-government organizations. All members have a stake in water. The AWC is one of three types of 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 also advises the Government of Alberta, stakeholders and the public on effective water management practices, solutions to water issues and priorities for water research. However, the Government of Alberta remains accountable for the implementation of the *Water for Life* strategy and continues to administer water and watershed management activities throughout the province.

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Sylvan Lake. Credit Anuja Ramgoolam, Alberta Water Council
Jackson Lake. Credit Marie-Claire St-Jacques, Alberta Water Council

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Acronyms

AAF	Alberta Agriculture and Forestry
AAMDC	Alberta Association of Municipal Districts and Counties
ABMP	Agricultural beneficial management practice
AEP	Alberta Environment and Parks
ALMS	Alberta Lake Management Society
ALSA	Alberta Land Stewardship Act
ALUS	Alternative Land Use Services
ASVA	Association of Summer Villages of Alberta
AUMA	Alberta Urban Municipalities Association
AWC	Alberta Water Council
BMP	Best or beneficial management practice
GIS	Geographic information system
GoA	Government of Alberta
IDP	Inter-municipal Development Plan
LUB	Land Use Bylaw
MDP	Municipal Development Plan
MGA	Municipal Government Act
NGO	Non-government organization
NRCB	Natural Resources Conservation Board
TEK	Traditional ecological knowledge
WID	Western Irrigation District
WPAC	Watershed Planning and Advisory Council
WSG	Watershed Stewardship Group

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Executive Summary and Recommendations

The Alberta Water Council established the Lake Management Project Team to provide recommendations for improved lake management in Alberta in support of *Water for Life* goals. This project also aligned with the 2013 Water Conversation outcomes and the Government of Alberta's subsequent commitment to develop a provincial lake policy.

Recognizing that lakes cannot be managed in isolation of the land uses around them, the work focused on the **lake watershed** as a management unit rather than the lake alone. The project documented the current state of four components of lake watershed management: science and knowledge; lake watershed governance; lake watershed management planning; and education, stewardship and tools. A stakeholder workshop held in September 2015 validated preliminary findings and explored potential solutions with representatives from provincial and local governments, Watershed Planning and Advisory Councils, Watershed Stewardship Groups, non-government organizations, and research and monitoring groups.

This report presents 12 recommendations for a coordinated approach to lake watershed management in Alberta. Section 4 provides background information and context necessary to understand the intent behind each recommendation. In many cases, this section identifies existing work and specific partners that implementers should consider in their efforts to address a given recommendation. When implemented, these recommendations will support the Government of Alberta's development of a provincial lake policy, foster greater provincial coordination of the stakeholders involved and contribute to improved lake watershed management.

Strategic Direction for a Provincial Lake Policy

Recommendation 1

The Government of Alberta, in setting strategic directions and developing a provincial lake policy:

a. adopt an aspirational vision for sustainable lake watershed management;

b. identify goals and objectives to improve the provincial, federal and local coordination of lake watershed management;

c. adopt a comprehensive watershed approach that supports all three goals of *Water for Life;*

d. define clear roles and responsibilities of all major groups (e.g., the Government of Alberta, municipalities, Watershed Planning and Advisory Councils, Watershed Stewardship Groups and other groups) involved in lake watershed management; and

e. define provincial processes for:

- setting provincial lake watershed monitoring and research priorities
- prioritizing lake watershed management needs and resources
- integrating lake watershed management planning into regional, sub-regional and municipal planning and decision-making.

Substantial progress on this provincial policy should be made by 2018 and the policy should be completed by 2020.

Science and Knowledge

Recommendation 2

In collaboration with partners, the Government of Alberta coordinate the development of a GIS-based, publicly available data layer of lakes in Alberta and their watersheds by 2019.

Recommendation 3

In collaboration with partners, the Alberta Lake Management Society continue developing a comprehensive knowledge portal that provides one-window access to information and products available for each lake in Alberta, and an ongoing process to populate it.

Recommendation 4

The Government of Alberta, in collaboration with partners:

a. identify provincial criteria and indicators of lake watershed health by 2018, to be informed by existing work;

b. use these criteria to conduct a preliminary assessment of lake watershed health and information gaps by 2019; and

c. identify provincial lake watershed research and monitoring gaps and needs to inform lake watershed management actions at provincial and local scales, based on the identified criteria and subsequent assessment.

Substantial progress should be made by 2020.

Lake Watershed Management Planning

Recommendation 5:

The Government of Alberta identify a process by 2020 for all levels of government to engage in and support multi-stakeholder lake watershed planning initiatives where appropriate, and to incorporate lake watershed management plans and/or objectives into land use planning and decision-making. This process should be reflective of the scale and urgency of issues facing the lake and outline how existing lake watershed management plans and/or objectives are to be considered in statutory planning and decision-making.

Recommendation 6

The Government of Alberta work with partners to develop an iterative process, using environmental, social and economic criteria, to prioritize lake watershed planning, management and implementation actions, by 2020.

Recommendation 7

By 2020, the Government of Alberta develop a process to designate a local lead to facilitate the collaborative development and implementation of lake watershed management plans and/or objectives where identified as a priority management action. The designated local lead could be a single entity or a group, and must be approved by municipalities in the lake watershed.

Regulatory and Voluntary Tools for Managing the Uplands

Recommendation 8

The Government of Alberta, through its periodic review of key legislation relevant to lake watershed management:

a. seek alignment with the goals and outcomes of *Water for Life* and the new provincial lake policy, when completed; and

b. strengthen legislative tools to enable consistent land-use practices to maintain or improve lake watershed health.

Recommendation 9

Alberta Urban Municipalities Association, Alberta Association of Municipal Districts and Counties and Association of Summer Villages of Alberta support greater collaboration and consistency in municipal planning around lakes by:

a. working with the Government of Alberta and other relevant partners to identify existing gaps in tools and information and to assist in developing resources to fill these gaps; and

b. continuing to promote information, tools and guidance documents related to lake watershed management planning.

Substantial progress should be made by 2019.

Recommendation 10

By 2019, the Government of Alberta work with all levels of government to identify regulatory or operational gaps relative to land development and other activities on and surrounding lakes, and develop and implement strategies to address such gaps.

Recommendation 11

The Government of Alberta work with municipalities and partners to align and enhance beneficial management practices incentive programs in lake watersheds where non-point source priority management actions have been identified for lake watersheds. An ongoing process to achieve this should be initiated by 2019.

Improving Access to Tools and Education

Recommendation 12

The Government of Alberta continue to work with partners to coordinate lake education and outreach through the Respect our Lakes program. This includes identifying target audiences, developing consistent messaging and ensuring access to educational information, tools and resources for lake watershed management by 2018.

"Alberta lakes are healthy, reflecting natural conditions, functions and variability, and are resilient to impacts over time. Lake watershed management is well-coordinated, resourced and efficient at maintaining aquatic health or restoring health where degradation has occurred."

— Lake Watershed Management Project Team's vision for sustainable lake watershed management

1.0 Introduction

Albertans use and enjoy lakes for a wide variety of activities. Over the past several decades, population growth and a strong economy have contributed to increasing recreational demand on Alberta lakes, greater urbanization of lakeshores and changing land uses in the uplands (e.g., intensification of agriculture, increase in industrial development). More recently, an increase in the availability of scientific data and anecdotal evidence from lake communities has raised awareness about lake issues, such as fluctuating water levels, changes in water quality, harmful algal blooms and fish kills. This has led to an improved understanding of the connection between growth and development in the uplands and potential changes to lake and watershed health. Emerging issues such as invasive species and climate change are also bringing attention to the longer-term condition of lakes and watersheds.

What do we mean by lake health?

In this report, the term "lake health" refers to the Alberta Water Council's definition of aquatic ecosystem health: *A healthy aquatic ecosystem is an aquatic environment that sustains its ecological structure, processes, functions and resilience within its range of natural variability.*[1]

1 Alberta Water Council. 2008. Healthy Aquatic Ecosystems-- A Working Definition. Available online http://www.awchome.ca/LinkClick.aspx?fileticket=dO4RIIJ9sSQ%3d&tabid=108. Accessed June 2017.

In response to these concerns, many groups have spearheaded management initiatives to better understand the changes to individual lakes and their potential management solutions. Provincial and local governments, Watershed Stewardship Groups (WSGs), Watershed Planning and Advisory Councils (WPACs) and many other stakeholders have become involved in lake watershed management, taking on various roles in assessing, planning, monitoring and education.

In 2013, the province-wide Water Conversation undertaken by the Government of Alberta (GoA) brought the topic of healthy lakes to the forefront. Throughout this consultation process, participants expressed confusion about the roles of those involved in lake management, the need for more coordinated and consistent policy regarding activities on and development around lakes, and the need for a better foundation of information about lake watersheds to inform policy and management decisions. Following the Water Conversation, the GoA made a long-term commitment to "advance a provincial lake policy that supports an integrated approach to healthy lakes in support of economic, environmental and social interests."[2]

Around the same time, the Alberta Lake Management Society (ALMS) brought forward a Statement of Opportunity to the Alberta Water Council (AWC) that emphasized two major challenges to effective lake management: ensuring sufficient information is available on the ecological characteristics of any given lake to inform management, and defining clear management roles and responsibilities. In October 2014, the AWC approved Terms of Reference (Appendix A) for a project team to recommend ways to improve lake management in Alberta to support *Water for Life* goals. Specifically, the project's objectives were to:

1. Document and assess the current state of lake management planning and governance (e.g., roles and responsibilities) in Alberta.

2 Government of Alberta. 2014. *Our Water, Our Future: A Plan for Action*. p.20. Available online: http://aep.alberta.ca/water/water-conversation/documents/WaterFuture-PlanAction-Nov2014A.pdf. Accessed August 2016.

2. Identify gaps, redundancies and opportunities for improvements in lake management.
3. Develop recommendations toward effective lake management in Alberta, including roles and responsibilities.

Representatives from governments, non-government organizations (NGOs) and industry participated in this project.[3] The AWC acknowledges that Indigenous communities are important participants in lake watershed management and need to be involved in further work to advance a provincial lake policy and implement the recommendations presented in this report. Accordingly, Indigenous communities are included when referring to "partners" or "stakeholders" throughout the report and recommendations.[4] However, Indigenous communities did not participate in this project or on the AWC while it was underway.

This report documents the AWC's findings beginning with terminology and methodology used to develop the report and recommendations. Section 2 provides an overview of Alberta lakes, the ecosystem services they provide and the key pressures they face today. Section 3 outlines the findings on the current state of lake watershed management in Alberta, along with gaps and opportunities for improvement. Finally, Section 4 presents the recommendations for improved lake watershed management in Alberta.

3 See Appendix B for a full list of team members.

4 See the glossary for descriptions of the words "partners" and "stakeholders" as used in this report.

The Alberta Lake Management Society (ALMS)

Formally established in 1991, ALMS works to promote the understanding and comprehensive management of lakes and reservoirs and their watersheds. Since 1996, ALMS' LakeWatch program has supported volunteer-based water quality monitoring on selected lakes across the province, using this data to educate lake users, foster a sense of stewardship for Alberta lakes, and guide water restoration and management efforts. ALMS also organizes an annual workshop held at a different lake community every year, providing a forum to discuss water quality issues, technical aspects of lake and watershed management, and practical solutions to local problems. For more information about ALMS and its programs, see their website at http://alms.ca/.

1.1 Terminology

Much of the terminology associated with lake watershed management has yet to be officially defined in Alberta. For this project, the following descriptions were used to establish a common understanding of key terms and to delineate project scope.

1.1.1 Lake

Only a few policies or statutory documents in Alberta define a "lake" and there is no consistent provincial definition. Instead, the term "water body" is often used. For example, the *Water for Life* strategy defines a water body as "any location where water flows or is present, whether or not the flow or the presence of water is continuous, intermittent, or occurs only during a flood. This includes, but is not limited to, wetlands and aquifers." [5] Where lakes are mentioned, the focus is often on "fish-bearing lakes," which tend to be described from a fisheries management perspective.

5 Government of Alberta. 2003. *Water for Life*: Alberta's Strategy for Sustainability, p.30. Available online: http://aep.alberta.ca/water/programs-and-services/water-for-life/strategy/documents/WaterForLife-Strategy-Nov2003.pdf. Accessed August 2016.

In this report, a lake is described as **an inland water body where the water usually is deep enough to not freeze to the bottom over the winter**. This includes permanent lakes and reservoirs with fresh or saline waters, but does not include other man-made structures (tailings ponds or other temporary holding ponds, end-pit lakes, dugouts, fish ponds, stormwater ponds, etc.) that are managed under specific regulations and authorization processes. The focus was on named lakes and reservoirs as they generally fit the above description, while unnamed lakes tend to be smaller and shallower. However, the distinction between small lakes and other water bodies such as wetlands is not always clear. The management of unnamed lakes should also be examined, and further work is required to formally define a lake.

Although reservoirs were included, they typically require different management than naturally-occurring lakes. For example, most reservoirs are managed for irrigation, hydropower and/or water supply; specific operational rules (called rule curves[6]) are used to guide operators in determining how much water is held and released throughout the year. Recognizing that reservoirs were created for specific purposes, their priority uses and functions will differ from those of natural lakes. Legislation related to reservoir management is further described in Section 2.

Lake level changes

All lakes have natural variability and lake levels fluctuate from year to year. In particular, shallow prairie lakes (such as Beaverhill Lake or Pakowki Lake) can be very shallow or dry in drought years but deeper in wet years.

6 See glossary for a description.

1.1.2 Lake Watershed

Lakes exist within a larger ecosystem and cannot be managed in isolation of the land-use activities occurring around them. This report focuses on the **lake watershed** as a management unit, which includes all the surrounding public and private lands and waters that drain into a lake and affect lake water quality and quantity. This is also consistent with the watershed approach promoted in *Water for Life*. Broadening the scope of management to the lake watershed is essential for a holistic approach. However, it also adds to the complexity of the issue, as several jurisdictions with legislated authority and private ownership are responsible for managing the lake watershed. This complexity is even greater in the case of on-stream reservoirs (i.e., dams built across a river channel), where the watershed includes the entire river basin upstream of the reservoir.

1.1.3 Lake Watershed Health

A healthy lake is "an aquatic environment that sustains its ecological structure, processes, functions and resilience within its range of natural variability."[7] At the same time, Alberta lakes are valued and managed for multiple uses, including aquatic life (e.g., fisheries and biodiversity), drinking water supply, recreation and industry (e.g., irrigation, hydropower). Man-made lakes, including major reservoirs, ought not to be expected to maintain the same ecosystem functions as natural lakes.

1.2 Methodology

Many information sources were used to document the current state of lake watershed management in Alberta. Lists of key stakeholders involved in lake watershed management, legislation and policies, tools and resources and completed or ongoing lake planning initiatives were also compiled (see Appendices C to F). Subject matter experts added further insights on a variety

7 Alberta Water Council. 2008. Healthy Aquatic Ecosystems – A Working Definition. p.1. Available online: http://www.awchome.ca/LinkClick.aspx?fileticket=dO4RIIJ9sSQ%3d&tabid=108. Accessed August 2016.

of topics, including legal aspects, policy issues and tools, approaches to lake watershed management planning, and education and outreach challenges. This information was used to document and assess the state of four components of lake watershed management in Alberta: science and knowledge; governance; planning; and education, stewardship and tools. Case studies and best practices from Alberta and other jurisdictions were considered where relevant.

In partnership with ALMS, a stakeholder workshop was held in September 2015 to validate preliminary findings and explore potential solutions to key challenges. The workshop engaged approximately 120 people from diverse sectors, including provincial and local governments, WPACs, WSGs, other NGOs and research and monitoring organizations.

Building on findings and input from the workshop, key components were identified that would inform a new approach to lake watershed management in Alberta. Recommendations were then developed to support the implementation of those components while aligning with the current provincial context, including the Land-use Framework regional plans and the GoA's Water Conversation commitment to develop a provincial lake policy.

The AWC process sets out clear guidelines to develop recommendations, and ultimately facilitate the commitment of all AWC sectors to their implementation. Of particular concern is the need to strike a balance between recommendations that are specific and results-oriented but do not constrain implementation options. All AWC recommendations:

- are based on consensus among the AWC membership;
- focus on **what** needs to be accomplished and **who** should do it, rather than **how** it should be done, which is left to the implementer of the recommendation; and
- include a clear timeline for implementation.

"Alberta is graced with a wonderful variety of lakes – perhaps as many different types as in any other region in the country. Within Alberta, clear lakes with sandy beaches decorate the Lakeland Region, warm green shallow lakes dot the prairie and parkland, brown water lakes occur throughout the Boreal forest, and pristine, cold, mountain lakes reflect spectacular scenery. We have added to this variety by creating new lakes, called reservoirs, in the southern half of the province. But particular kinds of lakes are not limited to one area. Lakes that are deep or shallow, green or clear, salty or fresh, may be found in many parts of the province."

—P. Mitchell and E. Prepas, Atlas of Alberta Lakes (1990)

2.0 Lakes in Alberta

Estimates of the number of lakes in Alberta vary depending on the source of information and the type of lake considered. According to the GoA Fisheries and Wildlife Management Information System, Alberta has 3,254 water bodies. Of those, Natural Resources Canada's Canadian Geographical Names Data Base lists 2,244 named lakes.[8] Alberta has approximately 800 native fish-bearing lakes and another 300 lakes are stocked annually.[9] The ten largest lakes make up almost 1% of the provincial land base, and total lake area is estimated to cover approximately 2.5% of the province.

Regional landscape assessments conducted in 2012 as part of forest management planning documented the number of permanent named lakes and reservoirs in six Land-use

The 10 largest lakes in Alberta are:

1.	Lake Athabasca	7,770 km^2
2.	Lake Claire	1,436 km^2
3.	Lesser Slave Lake	1,160 km^2
4.	Bistcho Lake	413 km^2
5.	Cold Lake	373 km^2
6.	Utikuma Lake	288 km^2
7.	Lac la Biche	234 km^2
8.	Beaverhill Lake	139 km^2
9.	Calling Lake	138 km^2
10.	Winefred Lake	123 km^2

8 Natural Resources Canada. The Canadian Geographical Names Data Base. Available online: www.nrcan.gc.ca/earth-sciences/geography/place-names/about-geographical-names-board-canada/9182. Accessed August 2016.

9 Government of Alberta. 2014. Fish Conservation and Management Strategy for Alberta. p.44. Available online: http://aep.alberta.ca/fish-wildlife/fisheries-management/documents/FishConservationManagementStrategyAlberta-Sep2014.pdf. Accessed August 2016.

Framework regions, based on available GIS data (see Figure 1).[10] However, the lack of a clear definition for lakes and the blurry boundary between permanent lakes, ephemeral lakes and wetlands are key challenges in this analysis. The numbers presented in Figure 1 remain a rough estimate that would benefit from more extensive work.

Most natural lakes are found in the boreal forest and parkland ecoregions of central and northern Alberta. In contrast, fewer natural lakes and more reservoirs are present in the more arid prairies. Accordingly, almost 60% of the lake area occurs in the Green Area, which includes most of northern Alberta, with a smaller percentage in the populated central and southern areas that make up the White Area (Figure 2).[11]

10 Government of Alberta. 2012. Regional Landscape Assessments – Forest Management. Available online: www.agric.gov.ab.ca/app21/forestrypage?cat1=Forest%20Management&cat2=Forest%20Management%20Planning&cat3=Regional%20Landscape%20Assessments. Accessed August 2016.

11 For a map of the Green and White Areas, see: http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/formain15744/$file/GeneralBoundary-CurrentFactsAndStatistics-2011.pdf?OpenElement.

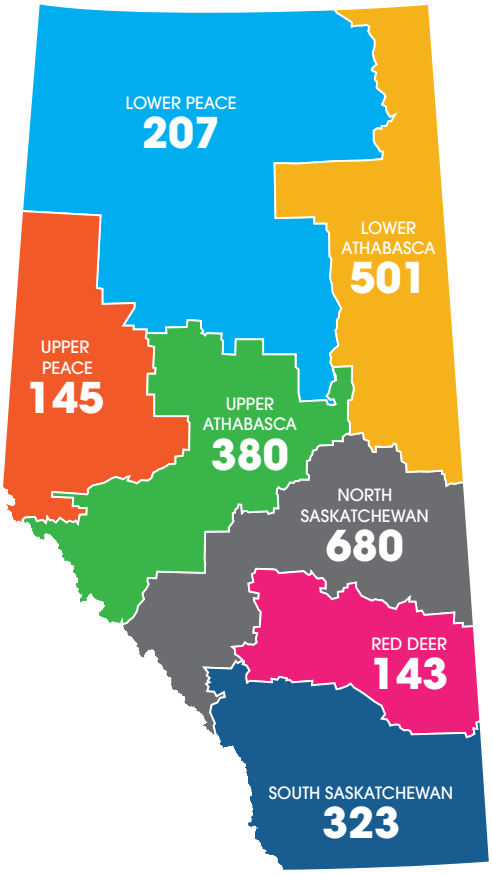


Figure 1: Approximate Number of Permanent Named Lakes and Reservoirs in each Land Use Region

2.1 Importance of Lakes in Alberta

Lakes have intrinsic value and contribute many natural functions within the larger ecosystem. They also provide ecological goods and services that benefit humans, such as water storage, flow attenuation and floodwater retention, water infiltration, groundwater recharge and discharge, aquatic and terrestrial biodiversity and nutrient cycling. Determining the monetary value of ecosystem services is useful to quantify the benefits provided by lakes. For example, a 2008 study on Ontario's Lake Simcoe estimated the services provided by the lake and its watershed at $975-million per year.12 Although no similar province-wide economic valuation for Alberta was found during this project, this report documents some of the reported social, economic and environmental benefits provided by our lakes.

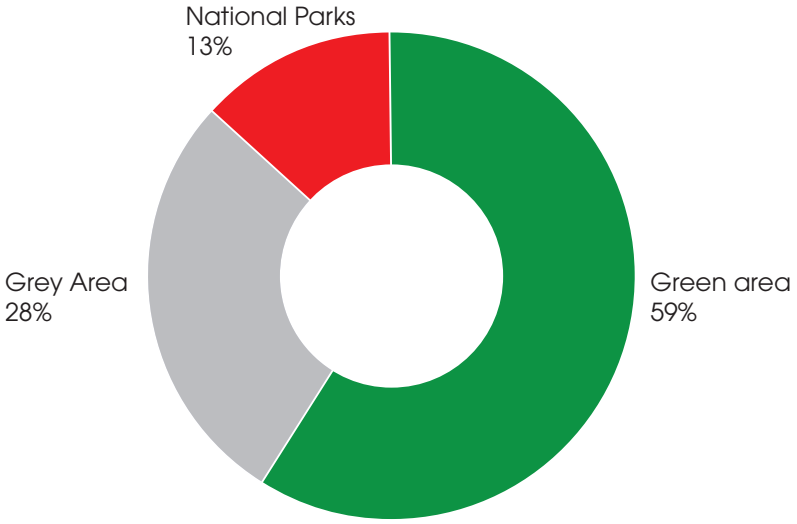


Figure 2: Distribution of Area Occupied by Named Lakes and Reservoirs in Alberta

12 Wilson, S.J. 2008. *Lake Simcoe Basin's Natural Capital: The Value of the Watershed's Ecosystem Services*. Friends of the Greenbelt Foundation Occasional Paper Series. p.35. Available online: http://www.davidsuzuki.org/publications/downloads/2011/Lake-Simcoe-GreenbeltNaturalCapitalJune%2020_2_.pdf. Accessed August 2016.

Case Study: Economic Assessment of Chestermere Lake's Ecosystem Services

Located only seven kilometres east of Calgary, Chestermere Lake is a small reservoir that covers an area of 2.65 km^2. Originally built to meet fluctuating water demands in the irrigation system around it, the reservoir is owned and managed by the Western Irrigation District (WID). It is now operated primarily for recreational purposes.

Since the implementation of a Water Management Agreement in 2005, the City of Chestermere pays an annual fee to the WID to manage water in the lake. This agreement ensures water levels are maintained during the summer for recreational activities and lowered during the winter to prevent ice movement from damaging docks. Due to its proximity to Calgary, Chestermere Lake is a popular destination for day users. A boat launch facility in John Peake Park provides access for non-resident boaters at the rate of $40 per day per boat.

A 2012 study estimated the total value of recreational ecosystem benefits provided by Chestermere Lake to non-resident day users at $794,000–$980,000 annually. This represents the total amount of time and money that people are willing to pay to enjoy the lake for recreational purposes.[13] A second study in 2013 found significant increases in both property values and property taxes for waterfront houses in Chestermere following the implementation of the 2005 Water Management Agreement. Interestingly, this suggests that fluctuations in property taxes may provide one way to capture the economic importance of water management and provide a vehicle for funding improvements in environmental quality.[14]

13 Bewer, R. 2012. *Recreational Value of Irrigation Infrastructure: a case study of Chestermere Lake, Alberta*. Master's Thesis, University of Lethbridge. Available online: https://www.uleth.ca/dspace/bitstream/handle/10133/3314/bewer,%20rob.pdf?sequence=1. Accessed August 2016.

14 Adamowicz, W., P. Boxall, H. Bjornlund and W. Xy. 2013 *Economic Assessment of Ecosystem Services*. Project Report, AI-EES, Water Resources.

Fisheries

With only about 800 natural fish-bearing lakes, Alberta is relatively lake poor compared to other provinces; For example, Ontario has 250,000 fish-bearing lakes and Saskatchewan has 94,000.[15] Lakes in Alberta were initially viewed from a fisheries management perspective with the first federal trout hatchery established at Banff in 1913. Through the 1940s and '50s, Alberta had a strong commercial fishery that saw the export of whitefish and other species. This fishery also provided a food source for a limited fur farm (i.e., mink and fox) industry. Later in the century, focus shifted to recreational fisheries. Today, with 300,000 anglers, the ratio of anglers per lake is roughly 300 to 1.[16] According to the Survey of Recreational Fishing in Canada[17], Alberta anglers caught over 12 million fish in 2010—primarily catch and release—and the total economic value of sport fishing was estimated at $488-million.

Source Drinking Water

Approximately 40 lakes and reservoirs (including on-stream reservoirs) are sources for treated drinking water facilities in Alberta. Treatment facilities are owned and/or operated by municipalities, private corporations and industry. These facilities are regulated by the GoA under the *Environmental Protection and Enhancement Act*. Other potable water treatment plants on First Nations reserves are regulated by the federal government. According to the First Nations Technical Services Advisory Group, 17 First Nations communities in Alberta use surface water as their source drinking water.

15 Regional Aquatics Monitoring Program. *Fisheries Resource in the Oil Sands* – an overview. Available online: http://www.ramp-alberta.org/resources/fisheries/distribution.aspx. Accessed August 2016.

16 Government of Alberta. 2014. *Fish Conservation and Management Strategy for Alberta*. p.44. Available online: http://aep.alberta.ca/fish-wildlife/fisheries-management/documents/FishConservationManagementStrategyAlberta-Sep2014.pdf. Accessed August 2016.

17 Fisheries and Oceans Canada. 2015. *Survey of Recreational Fishing in Canada*. Available online: http://www.dfo-mpo.gc.ca/stats/rec/canada-rec-eng.htm. Accessed August 2016.

Industry

Lakes also provide water for agriculture and other industrial uses. In Alberta, irrigation from natural lakes is very limited and mostly occurs through private systems. Southern Alberta's reservoirs store most of the water diverted under licence for irrigation purposes. Water withdrawals for industrial purposes are regulated under the *Water Act* and administered by the Alberta Energy Regulator and Alberta Environment and Parks (AEP).

Tourism and Recreational Uses

Water-based recreation and associated tourism activity is a substantial part of Alberta's regional economy. Since the 1950s, recreational opportunities have been expanded with the establishment of many provincial parks associated with lakes as well as the opening of several lake-lot sub-division developments. Alberta now has 165 recreational areas and provincial parks with access to a lake. In 2014, over two million person-visits were made to Alberta lakes to enjoy the beaches and go boating, canoeing, kayaking and fishing, resulting in expenditures of over $1-billion (Table 1).[18] Water-based recreation and tourism must be balanced with environmental sensitivity and the needs of other users to provide stable, long-term access to recreational water bodies.

Table 1: Visitation and Expenditures related to Selected Water-based Activities in Alberta (2014)

	Domestic Market		International Market		Total	
Activity	Expenditures (million $)	Person-visits (overnight)	Expenditures (million $)	Person-visits (overnight)	Expenditures (million $)	Person-visits (overnight)
Beach	239	730,000	159	188,000	399	918,000
Boating	156	483,000	196	158,000	352	641,000
Canoeing or kayaking	77	199,000	136	121,000	212	320,000
Fishing	132	551,000	24	33,000	156	584,000
TOTAL	**604**	**1,963,000**	**516**	**500,000**	**1,119**	**2,463,000**

18 Statistics Canada. 2014. *International Travel Survey, Travel Survey of Residents of Canada.*

Many lakes and reservoirs in Alberta are used for recreational activities such as swimming and other water sports where users are in direct contact with the water. Operators of recreational water sites (beaches) are required to meet recreational water quality standards to protect bathers from bacteriological risks and over 50 sites are actively monitored each summer.

Residential properties within the watershed boundary

Residential waterfront property can be purchased by the public. Landowners may occupy their property full-time or they may be present only for short periods. Lake properties can be found on public (leased) lands (e.g., Switzer Park, Beauvais Lake), or in municipalities (municipal districts, counties and summer villages). Summer villages alone contain 6,482 private dwellings; of those, 2,114 (33%) were occupied by permanent residents in 2011.[19]

Alberta's 51 summer villages are located on 20 lakes:

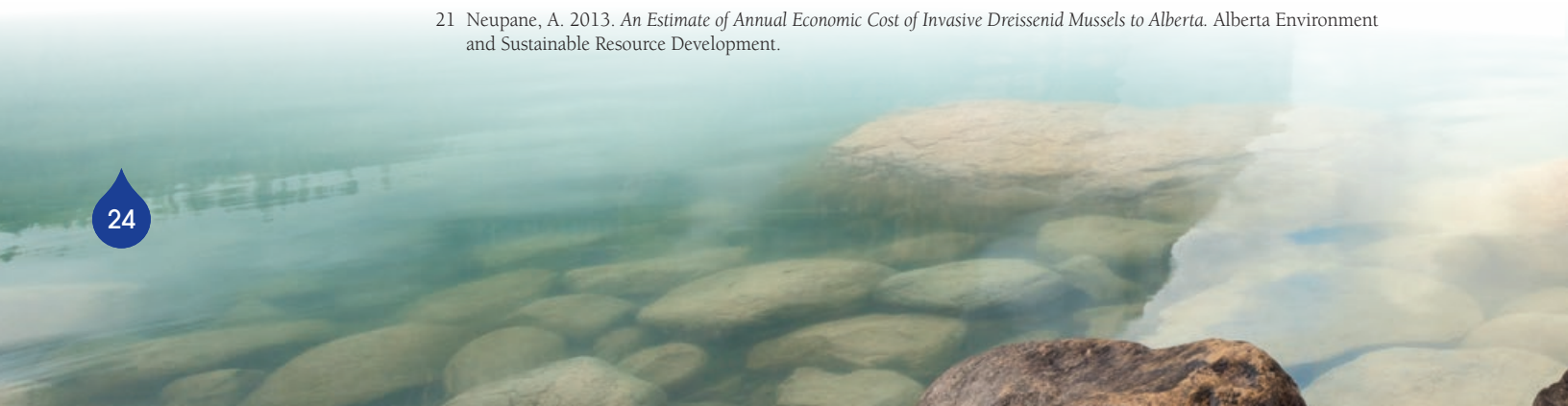
Amisk Lake	Lac Ste. Anne
Baptiste Lake	Long Island Lake
Burnstick Lake	Moose Lake
Buffalo Lake	Nakamun Lake
Ghost Lake	Pigeon Lake
Gull Lake	Sandy Lake
Island Lake	Skeleton Lake
Lake Isle	Sylvan Lake
Lac La Nonne	Vincent Lake
Lac La Biche	Wabamun Lake

In 2015, the total assessed value of residential properties in all summer villages was approximately $3-billion.[20] For seven of Alberta's most popular recreational lakes, the value of lakefront properties is estimated to be $2.8-billion.[21] According to the *ReMax 2014*

19 Statistics Canada. *Population and Dwelling Counts*, 2001 Census. Available online: http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/hlt-fst/pd-pl/Table-Tableau.cfm?LANG=Eng&T=302&SR=1&S=51&O=A&RPP=9999&PR=48&CMA=0. Accessed August 2016.

20 Government of Alberta. *Provincial 2015 Equalized Assessment Report*. Available online: http://www.municipalaffairs.alberta.ca/documents/as/2015ProvEqRpt.pdf. Accessed August 2016.

21 Neupane, A. 2013. *An Estimate of Annual Economic Cost of Invasive Dreissenid Mussels to Alberta.* Alberta Environment and Sustainable Resource Development.



Recreational Property Report, a typical cottage on Sylvan Lake is valued at approximately $750,000 for an 1,800 square foot home.[22] ReMax also reports that buyers' demographics are changing, with more buyers in their 30s and 40s entering the market and the size of cabins and cottages increasing.

Cultural and Spiritual Values

Since time immemorial, Indigenous peoples have used lakes for all manner of life-supporting and life-affirming purposes, including for travel and as basic sources of food, drinking water and medicinal plants. Lakes are also important areas of cultural, spiritual and aesthetic significance for Indigenous communities. Many Indigenous people believe the Creator gave instructions to respect water, air and the land by keeping it pure, and these original instructions are reflected in many Indigenous beliefs, values and traditions to this day.

2.2 Lake Diversity, Pressures and Concerns

Widely diverse freshwater lakes are found across the six major natural regions in Alberta.[23] These include shallow, nutrient-rich (eutrophic) lakes in the boreal and parkland natural regions and some deep and large lakes throughout the province. Nutrient-poor (oligotrophic) lakes predominate at higher elevations in the Rocky Mountains and foothills. More saline lakes, rich in minerals, tend to occur in the dry grasslands region.

Many Alberta lakes are eutrophic due to the geology and extensive glacial till in their surrounding watersheds. Paleolimnological studies reveal that eutrophic conditions and multiple algal blooms have occurred in Alberta lakes since before European settlement. However, since the early 1800s, settlement, land clearing and other human activities have enhanced nutrient inputs to individual lakes.

22 ReMax. *Recreational Property Report 2014 – Alberta*. Available online: http://www.remaxoa.com/14/PR/RecReport/Alberta.pdf. Accessed August 2016.

23 For more information on the six major natural regions of Alberta, see http://eae.alberta.ca/englishexpress/articles/pdf/ra11_09_l3.pdf.

The fate and cycling of nutrients is strongly influenced on an annual basis by seasonal differences, especially during the open-water period when algal growth and blooms can be dominant. Over the longer term, climate variability and changes or trends will be important factors in understanding the underlying drivers of change in water quantity (including lake level), water quality and resident biota.

In summary, the stresses on lakes and watersheds include a combination of environmental and human influences. These individually affect lake ecosystems, but understanding their cumulative effects is especially relevant to lake watershed management. Human pressures include:

- lake-side use, such as increasing property and tourism development at lakes (e.g., residential, summer use, resorts and recreational development)
- need for improved waste management and sewage infrastructure
- increased swimming, boating, fishing, hiking and other outdoor activities
- changing levels of land-use activities and management within the watershed
- introduction of invasive species to the lake and riparian habitats
- climate change and its influence on water quantity and quality and water temperature

Although issues are lake-specific, common concerns have been identified through existing lake watershed management and monitoring initiatives. Examples, in no particular order, include:

- changes in lake level and water quality conditions and trends
- changes to the lake fishery (e.g., fish kills and fish consumption advisories)
- harmful algal blooms and associated advisories for human, pet and livestock use
- vegetation growth and abundance related to swimming and boating activities

- aesthetic concerns, such as accumulation and odour associated with rotting aquatic vegetation and algal blooms
- modification of shorelands and habitat removal including riparian and littoral vegetation
- aquatic invasive species
- boating capacity and speed, other human use conflicts and public access

Lake users and watershed residents are concerned about these pressures and observed changes. However, at any particular lake and watershed, it is important to collect, compile and evaluate relevant information and data before developing a plan or management solutions. For example, identifying and mitigating or controlling the major sources of nutrients within a lake watershed are key to reducing or avoiding subsequent problems due to nutrients in lake sediments and the water column. To set realistic management expectations and priorities, it is also important to distinguish between issues that may be part of the natural Alberta landscape and those that are likely a result of human influence. Alberta's naturally shallow and nutrient-rich lakes will never offer the same experience as deep, clear, cold water lakes. Public perceptions and expectations of a certain "lake experience" may not always be realistic given the physical, chemical and biological characteristics of lakes in Alberta.

3.0 Current State of Lake Watershed Management in Alberta

Four high-level components of lake watershed management were part of the assessment of the current state in Alberta: science and knowledge; lake watershed governance; lake watershed management planning; and stewardship, education and tools. This section summarizes the current state and the key findings for each component.

List of lakes where State of the Watershed reports are complete or in progress:

Baptiste Lake
Jackfish Lake
Island Lake
Lac La Biche
Lac La Nonne
Lac St. Cyr
Lac Ste. Anne
Lake Isle
Lesser Slave Lake
Mayatan Lake
Moose Lake
Pigeon Lake
Skeleton Lake
Sylvan Lake
Wabamun Lake
Wizard Lake

3.1 Science and Knowledge

A wide range of information is needed to inform lake watershed management. While assessing the state of lake health across the province was beyond the scope of this project, this section presents an overview of work related to assessments of Alberta lakes and their watersheds, and identifies key knowledge gaps.

Many agencies and sources of information have contributed to the evolution of lake science and knowledge in Alberta. These include:

- *Atlas of Alberta Lakes.* The GoA and the University of Alberta jointly compiled knowledge on 100 lakes and reservoirs. Released in 1990, the Atlas includes information on the physical, chemical and biological characteristics of the lakes and other related background and history on their surrounding watersheds.[24]
- *State of the Watershed reports.* These comprehensive reports have been completed or are in progress for 16 lakes. They usually provide a snapshot of water quality, water quantity and to some degree, aquatic ecosystem health (often reflected as fisheries or riparian health). They may also feature an assessment of the lake watershed, including land cover, land uses and

24 Mitchell, P. and E. Prepas. 1990. *Atlas of Alberta Lakes*. The University of Alberta Press.

human footprint. These reports are typically produced as a first step in the development of lake watershed management plans (see Section 3.3).

- *Government of Alberta.* AEP has produced more than 100 reports on water quality conditions in Alberta lakes. More than 800 lakes and reservoirs have been sampled for water quality since the 1960s, approximately 70 of which have long-term records spanning 10 to 30 years.[25]
- *Alberta Lake Management Society.* Since 1996, ALMS has collected water quality data through its LakeWatch program, a citizen-science program offered to Albertans who are interested in collecting information about their local lake or reservoir. This includes physical data such as water temperature and clarity, water chemistry parameters and data on invasive species. To date, the program has monitored 116 lakes across Alberta, many over multiple years. A Lakewatch report, summarizing the data collected, is produced every year for each lake monitored.
- *Academia.* University researchers have produced numerous studies and reports on water quantity and quality and the conditions in various Alberta lakes.

Traditional ecological knowledge (TEK) is increasingly being considered as part of environmental monitoring activities. The Alberta Environmental Monitoring, Evaluation and Reporting Agency (now the Environmental Monitoring and Science Division of AEP) established the Indigenous Wisdom Advisory Panel to explore how TEK can be incorporated in the monitoring, evaluation and reporting system. Considering that many lakes are used by Indigenous peoples, the incorporation of TEK is relevant to the context of lake watershed management.

25 More information on lake water quality data and reports is available online at http://aep.alberta.ca/water/reports-data/surface-water-quality-data/default.aspx.

Despite the resources identified above, gaps remain in lake watershed knowledge and research. This need for better information on Alberta's lakes and reservoirs was emphasized in the 2013 Water Conversation, and in *Our Water, Our Future: A Plan for Action* (2014). While many organizations actively monitor several Alberta lakes, focus has mostly been on recreational lakes or reservoirs in central and southern Alberta and therefore may not adequately represent other lake types across all areas of the province. Most existing programs focus on water quality and rarely include monitoring of non-fish biota (e.g., benthic invertebrates, aquatic vegetation and riparian vegetation), bottom sediment or shoreland condition as indicators of lake watershed health. Indicators used in monitoring programs vary from lake to lake and may not inform provincial-scale issues. Finally, despite monitoring lake conditions, the impacts of land use in creating these conditions is not always well understood. Without a better understanding of the "natural state" of our lakes and the issues affecting them, including the range of natural variability, it is challenging to provide comprehensive assessments of lake health throughout Alberta.[26]

26 Government of Alberta. 2007. *Summary Report on the Initial Assessment of Ecological Health of Aquatic Ecosystems in Alberta: Water Quality, Sediment Quality and Non-Fish Biota.* Available online: http://esrd.alberta.ca/water/programs-and-services/surface-water-quality-program/documents/EcologicalHealthAquaticEcosystems-Oct2007.pdf. Accessed August 2016.

3.2 Lake Watershed Governance

Governance refers to "the dual process of decision-making and holding those that make decisions to account."[27] Others suggest that those accountable include "the people and organizations who are involved in making those decisions, the roles they play, and the structures and processes through which they make decisions."[28] Lake watershed governance in Alberta is complex, involving a number of entities with a variety of statutory and non-statutory tools and processes to support decision making about lakes and land uses around them. While governments play a major role through their legislated mandates (Table 2), partnerships such as WPACs and WSGs are also important stakeholders in Alberta's collaborative water governance framework. Treaty rights confer an important role to Indigenous communities in making decisions about water and watersheds. For a list of key stakeholders, legislation and policy relevant to lake watershed management in Alberta, refer to Appendices C and D.[29]

27 Brandes, O.M. and J. O'Riordan. 2014. *A Blueprint for Watershed Governance in British Columbia*. POLIS Project of Ecological Governance, University of Victoria. Available online: http://poliswaterproject.org/sites/default/files/POLIS-Blueprint-web.pdf. Accessed August 2016.

28 Melnychuk, N., D. Murray and R. de Loë. 2012. *Water Governance Challenges and Opportunities: Lake Windermere, British Columbia*. Available online: http://www.wpgg.ca/sites/default/files/Melnychuk%20et%20al%202012.pdf. Accessed August 2016.

29 Appendices C, D and others can be found here http://awchome.ca/Projects/LakeManagement/tabid/204/Default.aspx

Table 2: A Sample of Agencies with a Legislated Mandate in Lake Watershed Management

Agency	Legislation
Government of Canada	*Fisheries Act* *Canadian Environmental Assessment Act* *Navigation Protection Act* *Species at Risk Act*
Indigenous communities (federal lands)	*Safe Drinking Water for First Nations Act*
GoA – Environment and Parks	*Alberta Land Stewardship Act* *Environmental Protection and Enhancement Act* *Fisheries (Alberta) Act* *Provincial Parks Act* *Public Lands Act* *Water Act* *Wildlife Act*
GoA – Agriculture and Forestry	*Forests Act*
GoA – Natural Resources Conservation Board (NRCB)	*Agricultural Operation Practices Act* *Natural Resources Conservation Board Act*
GoA – Municipal Affairs, Alberta Emergency Management Agency and Municipal Government Board	*Emergency Management Act* *Municipal Government Act* *Safety Codes Act*
GoA – other departments and industry regulators, including Alberta Energy Regulator and NRCB	Multiple acts, regulations, policies, codes of practice and best management practices (BMPs) associated with public health, drinking water and wastewater infrastructure, oil and gas regulations, consultation and more.
Municipal governments including summer villages and regional service commissions	*Municipal Government Act* Land Use Bylaws, Municipal Development Plans and Inter-municipal Development Plans
Irrigation districts	*Irrigation Districts Act*

Figure 3 provides an overview of the key stakeholders involved in lake watershed management in Alberta and their associated jurisdictions and roles.[30] Planning mechanisms relevant to lake watershed management are also illustrated. The next sections provide more details on each of the stakeholders and their respective roles as illustrated in Figure 3.

3.2.1 Federal Government

The federal government administers the *Fisheries Act*, which requires that development projects do not harm commercial, recreational and Aboriginal fisheries, and prohibits depositing deleterious substances into waters frequented by fish. The *Navigation Protection Act* protects the public right of navigation and regulates structures that interfere with navigation, and the *Species at Risk Act* protects endangered or threatened species and manages species of special concern.

3.2.2 Indigenous Communities

First Nation and Métis communities have constitutionally protected rights to water, land and subsistence activities. The GoA has a legal duty to consult when its decisions may adversely affect the continued exercise of these rights. The Province also recognizes that First Nations and Métis Settlements members engage in customs or practices that are not existing Treaty rights under the Constitution, but are traditional uses important to Indigenous peoples. Various government ministries are involved in Indigenous consultation and engagement processes, with appropriate levels of support from Alberta Indigenous Relations. Much of the consultation with Indigenous communities on watershed-level plans occurs at the regional scale.

30 Figure 3 is adapted from Haekel, G. 2002. *The Law and the Lake: Navigating Alberta's Regulatory Framework.* Available online: http://healthyshorelines.com/media/The_Law_and_the_Lake.pdf. Accessed August 2016.

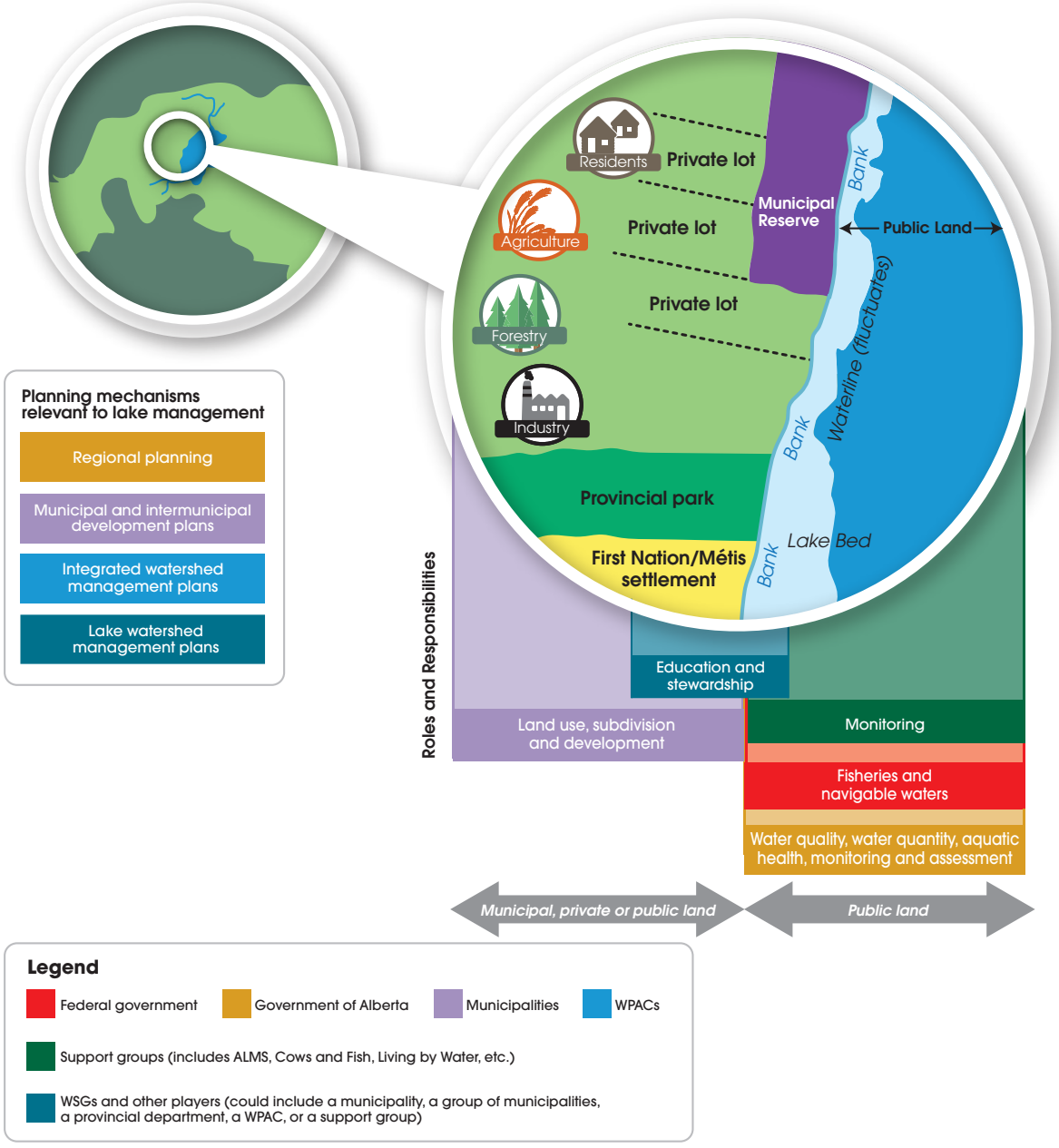


Figure 3: Key Stakeholders in Lake Watershed Management in Alberta and Associated Roles and Responsibilities

3.2.3 Government of Alberta

The GoA (AEP) is responsible for managing the bed and shore of any permanent water body under the *Public Lands Act*. This includes the management of shoreline alterations and their occupation, aquatic vegetation removal, water quantity, water quality and, to some degree, aquatic health, via the *Water Act* and *Environmental Protection and Enhancement Act*. AEP is also responsible for regional planning through the *Alberta Land Stewardship Act* (ALSA) and for managing wildlife under the *Wildlife Act* and *Fisheries (Alberta) Act*.

The Natural Resources Conservation Board (NRCB) administers the *Agricultural Operation Practices Act*, based on standards and licensing to manage manure and farm run-off. This is primarily targeted at large confined feeding operations and may not necessarily address other producers that are adjacent to and that affect Alberta lake shorelines.

Alberta Municipal Affairs administers the *Municipal Government Act* (MGA), which sets out the legislative framework under which all municipalities operate. In particular, Section 60 of the MGA gives responsibility to municipalities for land use planning and managing water bodies within their boundaries. The MGA requires that municipal planning be consistent with regional planning under ALSA. Alberta Municipal Affairs is also a partner with the Safety Codes Council in developing codes for plumbing and sewage.

Under the *Alberta Land Stewardship Act*, the Land Use Secretariat oversees the preparation of regional plans. Regional planning provides the policy integration, direction and clarity needed to help the GoA make decisions that collectively reflect and support the needs and values of Albertans. The Secretariat works with cross-ministry teams to develop, implement and monitor regional plans in Alberta. These plans identify strategic directions and outcomes for their respective regions and once a plan is in force, land use partners and decision makers must then demonstrate alignment to regional outcomes identified in the plans.

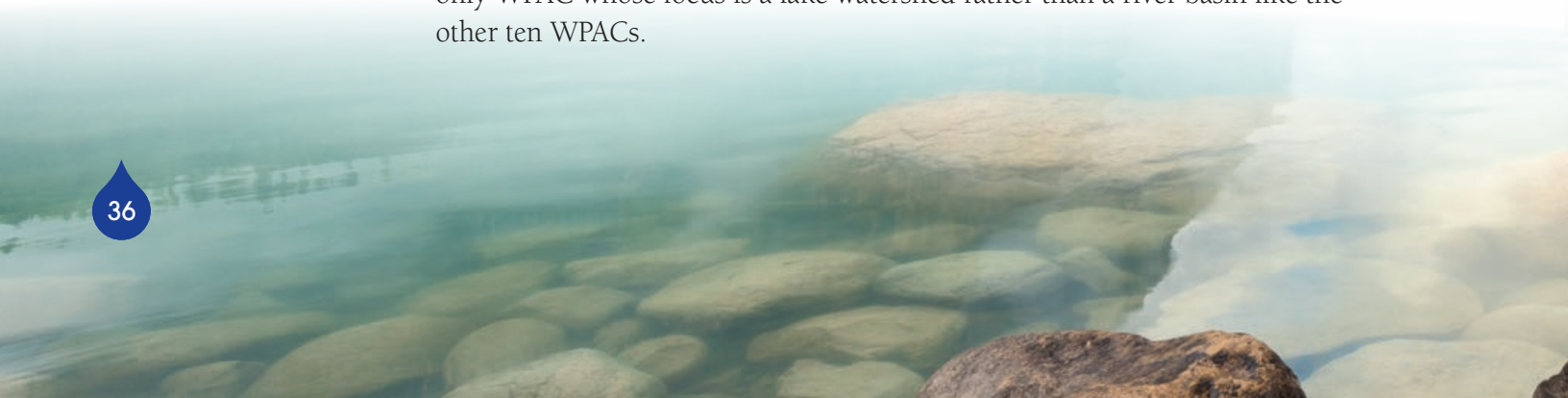
Other provincial authorities also play an important role in setting standards and regulating land use activities that can affect lake watersheds such as agriculture, forestry, mining, oil and gas, water management projects and recreation. For example, in the case of forestry, assessing the effects of harvest on both water quality and quantity in a watershed is already a mandatory component of Forest Management Plans.

3.2.4 Municipalities

In Alberta, municipalities include cities, towns, municipal districts and counties, villages and summer villages. The MGA provides legislative powers to municipalities for regulating land use development. Municipalities thus have jurisdiction over much of the land surrounding many of Alberta's lakes, excluding the bed and shore of any naturally occurring or permanent water bodies, which is owned by the Province as noted under the *Public Lands Act*. Among the statutory planning instruments available to guide land use, Municipal Development Plans (MDPs) establish policies for land use in the entire municipality, and all municipalities with a population of 3,500 of more are required to adopt a MDP. Inter-municipal Development Plans (IDPs) may be adopted by multiple municipalities around shared features such as lakes. A mandatory Land Use Bylaw (LUB) provides the means to regulate the use and development of parcels of land in all municipalities, regardless of size.

3.2.5 Watershed Planning and Advisory Councils

Designated under *Water for Life*, WPACs are regional, multi-stakeholder organizations responsible for reporting on the health of Alberta's major watersheds, leading collaborative assessment and planning, and facilitating education and stewardship activities. Through the development of state of the watershed reports and integrated watershed management plans, WPACs provide advice on watershed management issues to residents, landowners, businesses, industry, community, environmental organizations and those with decision-making authority. The Lesser Slave Watershed Council is unique as the only WPAC whose focus is a lake watershed rather than a river basin like the other ten WPACs.



While they work primarily at the river basin scale, some WPACs also lead sub-basin and lake-level planning. For example, the North Saskatchewan Watershed Alliance is supporting planning initiatives for Wabamun and Mayatan lakes. Similarly, the Battle River Watershed Alliance is involved with plan development for Pigeon Lake, and the Beaver River Watershed Alliance has supported planning at Moose Lake.

3.2.6 Watershed Stewardship Groups

Watershed Stewardship Groups (WSGs) are a key partnership identified in the *Water for Life* strategy. Approximately 25 WSGs are engaged in lake stewardship activities in Alberta (see Figure 4 and refer to Appendix F[31] for a list of lakes and WSGs). Groups tend to form where lake and/or watershed conditions have, or are perceived to have, deteriorated, where a local champion is present and where a variety of stakeholders can bring resources to support the process.

WSGs are mainly involved in assessment, planning, monitoring and education activities. They identify and bring attention to lake issues and play a key role in linking local lake watershed management interests and initiatives to municipal and provincial decision makers. While governments and other decision makers may participate in these groups, WSGs are similar to WPACs in that they are voluntary and advisory only.

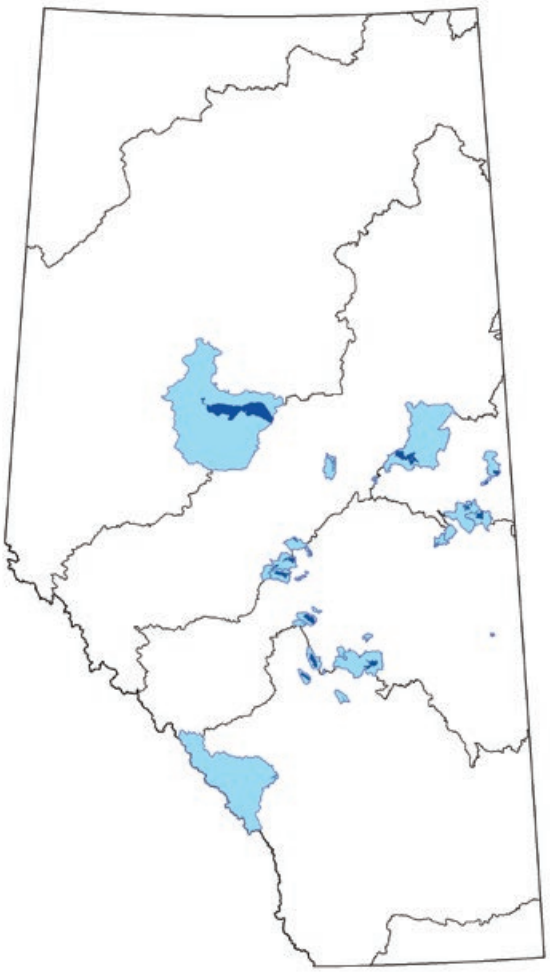


Figure 4: Lakes, Reservoirs and Watershed Boundaries where Lake Stewardship Groups are Active (AEP, 2016)

31 Appendix F and other appendices can be found here http://awchome.ca/Projects/LakeManagement/tabid/204/Default.aspx

Irrigation Districts and Reservoir Management

Alberta's 13 irrigation districts own and operate 38 reservoirs in Alberta; another 11 irrigation-related reservoirs are owned and operated by AEP.[32] A reservoir includes not only the inundated area but also the inlets, outlets and the adjacent lands owned under title. The main purpose of the irrigation district reservoirs is to store and release water to district water users primarily for crop production. Within their individual water licence(s), irrigation districts also convey water for communities, businesses, farm households and farmsteads, livestock operations, management of fish and wildlife, recreation and habitat creation; overall, 2.7% of district licensed water is set aside for purposes other than irrigation.[33] Districts allow recreational activities on their reservoirs and manage the land they own adjacent to the reservoir for various purposes. Some districts even construct campsites and boat facilities to enhance recreational opportunities in rural areas. There are more than 20 constructed recreational day use areas and campsites on the 49 irrigation-related reservoirs owned by the GoA or irrigation districts.

Legislatively, irrigation districts operate within the *Irrigation Districts Act*. The main purpose of irrigation districts, as defined in the *Act*, is "to convey and deliver water through the irrigation works of the district in accordance with this *Act*." Districts operate their reservoir(s) and manage their lands in the best interest of their water users according to their policies and board direction, each district being governed by an elected board of directors. In dry years, the board may decide to lower the reservoir to a set minimum level to ensure delivery of available water to its users. In wetter years, the drawdown of the reservoir may be hardly noticeable. Large reservoirs are operated based on "rule curves" that give target fill and withdrawal levels at

32 Irrigation Water Management Study Committee. 2002. *South Saskatchewan River Basin: Irrigation in the 21st Century. Volume 1: Summary Report.* Alberta Irrigation Projects Association. Lethbridge, Alberta. Available online: http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/irr4421. Accessed August 2016.

33 Government of Alberta. 2014. *Alberta Irrigation Information* 2014. p. 16. Available online: http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/irr7401/$FILE/altairriginfo2014.pdf. Accessed August 2016.

specified times of the year, often with modifiers based on whether it is a wet year or a dry year.

An irrigation district is somewhat similar to a municipal government with powers of expropriation, seizure of land for non-payment of fees, and control of any deleterious material entering its works, including reservoirs (with power to charge costs to an offender where work is required by the district to prevent or eliminate drifting soil or other deleterious materials from entering its works).

3.3 Lake Watershed Management Planning

Lake watershed management planning refers to the strategic process of developing and implementing actions to maintain or improve lake health, including the management of activities in the uplands.[34] The ALMS *Workbook for Developing Lake Watershed Management Plans* provides comprehensive guidance on this planning process, which involves:

- the identification of willing partners and how they will work together
- agreement on a defined iterative and adaptive process
- setting clear outcomes, objectives and indicators
- shared resourcing of the process
- assessing the condition of the lake and its watershed and identifying issues related to water quality, water quantity, aquatic ecosystem health and land uses in the uplands
- plan development, including stakeholder engagement
- plan implementation
- ongoing monitoring, evaluation and reporting
- education and outreach to support increased awareness of lake issues and encourage behaviour change where needed[35]

34 ALMS. 2013. *Workbook for Developing Lake Watershed Management Plans*. Available online: http://alms.ca/wp-content/uploads/2014/02/ALMS_WMPWorkbook.pdf. Accessed August 2016.

35 The ALMS Workbook aligns with the 16 steps for watershed management planning recommended by the GoA in its *Guide to Watershed Management Planning in Alberta*.

Alberta lakes where lake watershed management plans are completed or in progress:

Baptiste Lake*
Battle Lake*
Big Lake
Buffalo Lake
Burnstick Lake
Chain Lake
Cold Lake-Beaver River
Lac La Biche
Lesser Slave Lake*
Mayatan Lake
Moose Lake
Pigeon Lake*
Pine Lake
Skeleton Lake
Sylvan Lake
Wabamun Lake*

**plan is in progress*

Eleven lake watershed management plans were completed between 1996 and 2016, and at least another five are in progress.[36] Various stakeholders were engaged in developing all of these plans, but the content and scope of the plans vary. For example, the *Buffalo Lake Integrated Shoreland Management Plan* focuses on the shore lands around the lake rather than the entire lake watershed. In contrast, the *Chain Lakes Watershed Management Plan* was initiated specifically to address municipal land use issues and contains recommendations that apply to the local county only. Leadership for developing these plans has also been diverse, ranging from the GoA to local stewardship groups (Table 3). For a full list of existing plans and their lead organizations, see Appendix F.

Table 3: Number of Completed or Ongoing Lake Watershed Management Plans

Plan lead	# of plans
WSG	6
Municipality	5
GoA	4
WPAC	1

Most lake watershed management plans address issues related to water quality, water quantity, aquatic ecosystem health, and safety and aesthetics. They are generally guided by the following principles: an ecosystem-based approach, adaptive management, sound science, inclusiveness and engagement of all stakeholders, consensus-based process and integration with other planning and decision-making processes.

36 Land use and municipal plans, though not lake watershed plans *per se*, may include goals and objectives for lake watershed management. For example, the County of Newell MDP has a number of policies to protect the "supply and water quality" of Lake Newell (see http://www.countyofnewell.ab.ca/images/council/bylaws/1705-10.pdf).

Table 4: Examples of Issues and Corresponding Actions that may be included in a Lake Watershed Management Plan

Issue	Potential Cause(s)	Actions
Water Quality	Agricultural and cosmetic fertilizer run-off is enriching the lake and causing algal blooms	Local municipal bylaws may prohibit use of fertilizers for cosmetic purposes; programs like Cows and Fish and Environmental Farm Plans might be used to increase awareness of agricultural producers
	The cumulative impact of wetland drainage, docks, moorings, boat launches and other hard structures affect lakeshore health and ability to filter surface run-off	Shoreline restoration, education programs about healthy shorelines
	Septic fields and leaking septic tanks are contributing to lake eutrophication	Municipalities may incent property owners to change from septic fields to contained holding tanks with pump outs. A septic system standard of practice was released in 2015 and is now being implemented on new and re-developed sites
	Sediment and nutrient run-off from agricultural lands, forestry, construction and linear development are contributing to lake eutrophication	Sector-specific BMPs may be included in approvals, followed by compliance monitoring
	Growth pressures from residential and recreational development affect riparian zones and water quality	Set policies, targets or standards oriented toward sustainable development in local statutory plans and LUBs (e.g., use low-impact construction methods; promote Leadership in Energy and Environmental Design certified building; plan for more ecologically sensitive green spaces, stormwater management and hard surface design elements and materials; prioritize preservation of natural landscapes)

Issue	Potential Cause(s)	Actions
Water Quantity	Surface water or connected groundwater withdrawals by municipalities, industry and others draw down lake levels affecting aquatic ecosystems, recreation and infrastructure like docks and water intakes	AEP may limit licences or institute a water quantity management framework. Homeowners may need to move or upgrade infrastructure
Aquatic Ecosystem Health	An endangered aquatic species is present	Recovery plan actions
	Fishing conditions are poor	Fish management actions like harvest limits might be implemented by the GoA
Safety and aesthetic issues	Boating intensity and speed are too high Loud music on watercrafts is disruptive	Bylaws and other restrictions

3.3.1 Plan Implementation

Most existing lake watershed management plans are advisory, building on the participation of the right stakeholders at the table to ensure buy-in and implementation of recommendations. Due to their advisory nature, implementation and integration of lake watershed management plans within the formal land use planning system (i.e., regional plans and MDPs) is a key challenge.

Little information is available about the implementation success of lake watershed management plans in Alberta and plans have different approaches to accountability for implementation. Table 5 outlines examples of successfully implemented management actions in jurisdictions that have appointed a body responsible for implementation. Nevertheless, participants in the stakeholder workshop highlighted a number of reasons why implementation challenges remain:

- a lack of accountability and commitment for plan implementation, particularly in the case of advisory plans developed by WPACs and WSGs
- a lack of coordination of short-term decision making at the municipal or provincial levels and long-term planning efforts
- competing pressures and priorities
- a lack of understanding and/or interest among politicians and the public
- changing political leadership
- a lack of provincial and municipal legislated tools to implement plans and the poor use of existing tools (i.e., advisory plan actions are not automatically integrated into statutory plans such as MDPs)
- limited financial and human capacity and volunteer burnout, especially in WSGs

Table 5: Examples of Implementation Successes and Mechanisms for Accountability in Lake Watershed Management Plans

Lake	Examples of Implementation and Accountability
Buffalo Lake	An operational plan guides land use and natural resource management on publicly owned shoreland. AEP is accountable for implementation, and the five municipalities surrounding Buffalo Lake have developed an Inter-municipal Development Plan.
Lac La Biche	A Watershed Advisory Committee developed the plan and oversees its implementation. Lac La Biche County is expected to review planning documents to incorporate recommendations into its LUB. For example, the County incorporated plan provisions for riparian protection into its MDP, Lakeshore Policy and Environmental Reserve Policy.
Moose Lake	In 2007, the municipal district of Bonnyville created a Municipal Lands Bylaw, which includes protection of Environmental Reserves around Moose Lake, and a Private Sewage Disposal System Bylaw.
Sylvan Lake	The Sylvan Lake Management Committee was established to facilitate coordinated land use decision making among the eight municipalities in the Sylvan Lake watershed. Released in 2015, the Cumulative Effects Management System Plan Phase 2 outlines actions to achieve objectives identified in Phase 1.
Skeleton Lake	Skeleton Lake Stewardship Association is responsible for providing annual progress reports. Plan implementation occurs by seeking endorsement, support and enforcement by the county, summer villages and GoA.

Beyond lake watershed management plans, a number of existing land use planning mechanisms already provide opportunities to incorporate lake watershed management objectives. For example, Forest Management Plans and Integrated Resource Management Plans, used in the Green Area, include setbacks and other requirements when operations occur near lakes; federal and provincial park management plans include lake watershed management activities; and Environmental Farm Plans can inform watershed protection on agricultural landscapes. Regional planning may also present opportunities for integrating land and water planning. The development of the *North Saskatchewan Regional Plan*—the first plan to include a component on lake management in its terms of reference[37]—may provide a model for setting regional lake watershed management strategies and objectives. Water quality, water quantity or biodiversity management frameworks developed under regional planning initiatives may also offer an opportunity to integrate lake watershed management objectives into legislated regional plans.

3.3.2 Capacity Issues

Participants at the multi-stakeholder workshop highlighted both human and financial capacity as challenges in developing and implementing lake watershed management plans. The level of capacity and expertise to make informed decisions and implement management actions varies among municipalities. In addition, volunteer-based organizations such as WSGs experience high turnover due to burnout and may struggle to carry on long-term planning initiatives with uncertainties in year-to-year funding.

In a jurisdictional review of watershed planning conducted in 2010, the Environmental Law Centre identified sustained and sufficient funding as a

37 Government of Alberta. 2014. *Terms of Reference for Developing the North Saskatchewan Regional Plan*. Available online: https://landuse.alberta.ca/LandUse%20Documents/Terms%20of%20Reference%20for%20Developing%20the%20North%20Saskatchewan%20Region%20-%202014-05.pdf. Accessed August 2016.

challenge in all jurisdictions reviewed.[38] In Alberta, groups undertaking lake watershed management planning have relied on a variety of funding sources. As one of the *Water for Life* partnerships, WSGs receive funding through the Watershed Stewardship Grant Program from 2006. In 2016, the GoA approved a multi-year grant to the Land Stewardship Centre to help protect water resources in Alberta.[39] Funded by AEP, this grant program has supported the development of WSG-led lake watershed management plans. Other examples of successful resourcing include the Pigeon Lake Watershed Management Plan, which is funded primarily from the RBC Blue Water Project[40] and Leduc County. The municipality-led Sylvan Lake Management Committee obtains funding from the eight municipalities around Sylvan Lake. More recently, the Wabamun Lake Subwatershed Land Use Plan, an ongoing planning initiative led by Parkland County, secured funding through a regional collaboration grant from the provincial government.

Investigating Alternative Funding Models for Watershed Governance

A discussion paper prepared by the Fraser Basin Council in British Columbia (BC) explored a wide range of innovative financial mechanisms and models to support collaborative approaches to watershed governance in BC. These included property and parcel taxes, grants, water pricing, utility fees and recreational fees, and payments for downstream benefits or ecosystem services.[41] A number of recommendations are included in the discussion paper to support collaborative funding models.

38 Unger, J. 2010. *Consistency and Accountability in Implementing Watershed Plans in Alberta: A jurisdictional review and recommendations for reform.* Environmental Law Centre. Available online: http://elc.ab.ca/Content_Files/Files/ELCWtshdPlnImpReviewRecommendations.pdf. Accessed August 2016.

39 Government of Alberta. 2016. *Grant will help protect Alberta's water resources.* Available online: https://www.alberta.ca/release.cfm?xID=450425A8B5E81-A581-8AC9-B8D1A21501359303. Accessed March 2017.

40 See http://www.rbc.com/community-sustainability/environment/rbc-blue-water/index.html

41 Fraser Basin Council. 2015. *Financial Mechanisms and Models for Collaborative Watershed Governance in BC.* Discussion Paper. Available online: http://www.fraserbasin.bc.ca/_Library/Water_BCWF/Financial_Mechanisms_and_Models_for_Watershed_Governance-May1-2015_web.pdf. Accessed August 2016.

3.4 Education, Stewardship and Tools

Several tools and educational materials are available to guide land and water managers, stewardship groups and individuals in their lake watershed management efforts.[42] These include:

- documentation on best management practices
- education and outreach programs
- grants and financial incentive programs
- modelling tools
- monitoring programs, reports and data
- planning tools

Although these resources have helped some individuals and groups implement new practices, private property owners, local councillors and land use planners, agricultural producers, industry workers and recreational users still may lack understanding of the connection between their actions and lake health or have the motivation to act. In its *Lake Stewardship Reference Guide*, the Association of Summer Villages of Alberta (ASVA) documents several issues commonly encountered in summer villages across the province:

- removal of aquatic vegetation by residents
- development of private beaches (sand placement)
- contamination from fertilizers, run-off from septic fields
- inappropriate placement of docks and other mooring structures
- clearing of vegetation from environmental or municipal reserves by adjacent property owners
- shoreline modification and erosion control[43]

42 For a list of tools, see Appendix E here http://awchome.ca/Projects/LakeManagement/tabid/204/Default.aspx Also, see the GoA's Watershed Support Material and Publications webpage (www.waterforlife.alberta.ca/02645.html) for a number of helpful documents for developing indicators, state of the watershed reports, and watershed management plans and the ALMS website (www.alms.ca) for a list of resources.

43 Association of Summer Villages of Alberta. 2006. *Lake Stewardship Reference Guide*. Available online http://www.asva.ca/lake-stewardship-guide.html. Accessed August 2016.

Both voluntary and regulatory tools exist to support improved management of the uplands surrounding lakes and to address several of the issues listed above. The next sections provide some examples of these tools.

3.4.1 Voluntary Tools

Stewardship is defined as the "recognition of a collective responsibility to retain the quality and abundance of land, air, water and biodiversity, and to manage this natural capital in a way that conserves all of its environmental, economic, social and cultural values."[44] In other words, stewardship is about people voluntarily taking action, both individually and collectively, to safeguard their lakes.

Voluntary stewardship approaches to improve watershed health are particularly popular with agricultural producers. These approaches typically involve implementing agricultural beneficial management practices (ABMPs) to help address issues such as non-point source pollution. Because ABMP implementation can be costly, incentive programs have been introduced to encourage their adoption by agricultural producers. Examples include county-led programs such as Alternative Land Use Services (ALUS) and Green Acreages, which support environmental stewardship on private lands through projects such as conservation agreements, riparian fencing and other ABMPs. Similarly, Growing Forward 2 (GF2) is a federal-provincial partnership that provides grants for various on-farm stewardship projects. Of particular relevance to lake watershed management, the Agricultural Watershed Enhancement Program of GF2 funds extension programs and the implementation of wetland and riparian health ABMPs in defined watersheds, prioritizing projects in areas with a high risk of water quality impairment. Alberta Agriculture and Forestry (AAF) also works with Cows and Fish (formally known as the Alberta Riparian Habitat Management Society) to promote an understanding of the values of riparian areas and how ABMPs

44 Alberta Stewardship Network. Available online: http://www.landstewardship.org/ASN/. Accessed August 2016.

can improve riparian health. Finally, the Agricultural Research and Extension Council of Alberta, with support from AAF and other partners, directs the Environmental Farm Plan Program, which is delivered through agents in municipalities and other organizations. This process is voluntary and involves a whole-farm assessment of environmental risks followed by the development of a plan to mitigate these risks.

At the residential level, ASVA is a good source of lake watershed management materials, and Nature Alberta's Living by Water program also provides guidance to lakeshore property owners who wish to maintain shoreline and lake health. AEP leads two programs that address common issues and concerns related to lake health: Respect our Lakes[45] and the Central Alberta Recreational Lakes Initiative.[46] Finally, education and outreach are central components of programs led by the many municipalities, WPACs, WSGs and other NGOs working around lakes.

3.4.2 Regulatory Tools

Voluntary stewardship is a first step towards the adoption of new behaviours and practices but regulatory approaches are often needed to prompt more widespread changes. At the municipal level, various regulatory and statutory planning tools can support improved lake watershed management. Examples include incorporating lake watershed management objectives into MDPs and LUBs; establishing setbacks, buffers and reserves around water bodies; and using IDPs and joint Area Structure Plans to ensure consistency among municipalities around a shared lake.

Though a municipality is not required to undertake any project referenced in a statutory plan, these planning tools are land-use policy and design instruments that reflect the aspirational outcomes of a municipality; they establish the basis for a course forward over long- and short-range timeframes. Should an ALSA

45 For more information, see: http://aep.alberta.ca/water/programs-and-services/respect-our-lakes/default.aspx.

46 For more information, see: https://exts2.aep.alberta.ca/CR-RecLakes/default.aspx.

regional plan or agencies listed in Section 619 of the MGA (Natural Resources Conservation Board, Alberta Energy Regulator, Alberta Utilities Commission) address lake watershed management planning either generally or specifically, the affected municipality's statutory plan or LUB must conform to it.

A municipality may also develop other types of non-statutory plans, standards or guidance documents, adopt them by bylaw to enforce their provisions and commit to implement them. Examples include a guideline or plan about open spaces, parks, recreational trails, natural buffers and reserve lands, or a master drainage plan.

In 2014, the Pigeon Lake Watershed Association released its Model Land Use Bylaw to help municipalities around the watershed incorporate new environmental provisions into their bylaws to support lake health. The County of Wetaskiwin's *Pigeon Lake Watershed Area Concept Plan* (see case study) provides another example of provisions that can be incorporated to address lake health.

Case Study: County of Wetaskiwin's Pigeon Lake Watershed Area Concept Plan

Approved in February 2014, the County of Wetaskiwin's *Pigeon Lake Watershed Area Concept Plan* addresses new development and redevelopment in the Pigeon Lake Watershed.[47] The vision is "a healthy natural environment supporting sustainable development coexisting with the recreational value of the lake" (5.1).

Lands within 500 metres of the lakeshore and within specific distances from creeks, wetlands and riparian regions are subject to special development provisions. Wherever possible, new development would be restricted to cleared land. Environmental and municipal reserves are

47 County of Wetaskiwin. *Pigeon Lake Watershed Area Concept Plan*. Available online: https://www.county.wetaskiwin.ab.ca/DocumentCenter/View/478. Accessed August 2016.

required for development adjacent to the lake and land adjacent to creeks (running and dry). Reserves also protect forested and natural areas in upland development. Regulations requiring sewage collection systems or connection to a sewer system are in place. Low impact development principles will be used to ensure run-off from new development does not contaminate watercourses or the lake.

The plan supports best management practices for agricultural producers, specifically fencing riparian regions and rehabilitating damaged lands.

3.5 Summary of Key Issues and Gaps

The following key findings emerged from the assessment of the state of lake watershed management in Alberta.

Science and Knowledge

- Baseline data on water chemistry and biota appear to exist for many Alberta lakes but the impacts of land use on lake health are not always well understood. Data appear to be lacking for stream inflows and lake watersheds.
- No criteria to assess lake watershed health exist to guide research and monitoring at the provincial scale
- A broader baseline assessment of lake watershed health across the province is needed to prioritize management actions.

Lake Watershed Governance

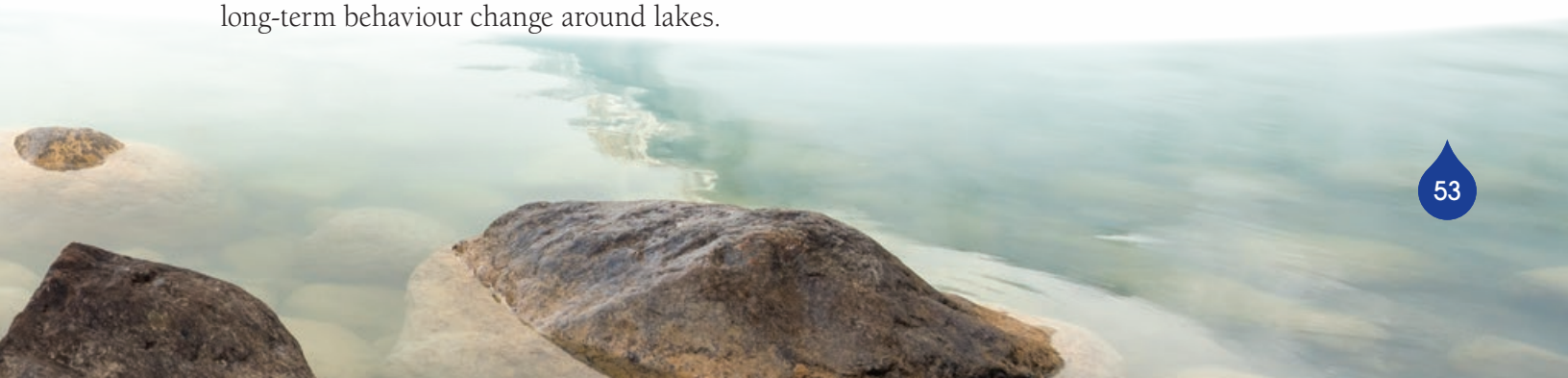
- Although several key pieces of legislation exist and many jurisdictions are involved in lake watershed management, it is not clear who is ultimately accountable for leading this process in Alberta. For example, the *Water Act* and *Public Lands Act* are powerful pieces of legislation but do not necessarily protect lakes because they are not always used in an integrated fashion for combined land and water management.
- This lack of clarity is magnified with a shift in focus from the lake to the lake watershed, which includes a number of additional jurisdictions responsible for regulating and carrying out land-use activities that can affect lake health.
- No single body has a specific mandate or dedicated resources to undertake a provincial leadership role in assessing needs and setting management priorities to ensure the lake resource is maintained in Alberta.
- Land-use decisions around lakes appear to vary greatly among municipalities and there is a need for greater consistency. The current MGA review offers an opportunity to strengthen overarching standards for development around lakes.
- All three levels of government—federal, provincial and municipal—have responsibilities related to approvals, compliance and enforcement activities. However, these activities often occur in silos and greater coordination is required.

Lake Watershed Management Planning

- Lake watershed management planning is occurring mostly at the local scale through initiatives led by WSGs, WPACs and municipalities. However, no entity is responsible and accountable for leading the development of lake watershed management plans and tracking their implementation.
- Guidance is already available on the development of lake watershed management plans, but plan implementation remains the key challenge for advisory plans developed by WSGs and WPACs. Although some examples exist where advisory watershed planning objectives have been incorporated into provincial and municipal statutory plans and legislative tools, there is no provincially-consistent process to integrate advisory lake watershed management plans in legislated land-use planning.
- Planning initiatives are occurring on an ad hoc basis, where champions lead the process. Without a process to identify provincial management priorities, it is hard to know whether planning is occurring where it is most needed.
- All stakeholders report that insufficient staff, expertise and funding are limiting factors for plan development and implementation.

Education, Stewardship and Tools

- Many tools and resources are available to support lake watershed management, but they are housed by the agencies that develop them. A single portal providing easy access to tools, resources and existing data is needed.
- Many initiatives already exist to support greater public awareness and local stewardship. Future efforts should target high priority areas across Alberta's lake watersheds.
- Tools are available for municipalities to incorporate lake watershed management objectives into their statutory plans and bylaws. Improving awareness of these tools among municipalities and encouraging their broader application provides an opportunity to enhance consistency in municipal planning around lakes.
- A combination of voluntary and regulatory approaches is necessary to foster long-term behaviour change around lakes.



4.0 A New Approach to Lake Watershed Management in Alberta

The purpose of this project was to recommend ways to improve lake watershed management in Alberta to support the goals of *Water for Life*. Different building blocks for a comprehensive approach to lake watershed management were considered; the building blocks and associated recommendations are shown in Figure 5. The recommendations are strongly interconnected and must be implemented as a whole if the proposed approach is to be effective.

The recommendations are intended for lakes and reservoirs, recognizing that the main purpose of reservoirs may be to supply water for irrigation, hydropower, recreation or drinking water.

Provincial Lake Policy (1)

Science and Knowledge (2, 3, 4)

Lake Watershed Management Planning (5,6 7)

Regulatory and Voluntary Tools for Managing the Uplands (8, 9, 10, 11)

Tools and Education (12)

Figure 5: Building Blocks for a Comprehensive Approach to Lake Watershed Management (recommendations relevant to each section are indicated in brackets)

4.1 Strategic Direction for a Provincial Lake Policy

A key challenge is coordinating the many stakeholders involved in lake watershed management as well as the multiple planning and decision-making processes that can influence the ecological health of a lake and its watershed. A holistic lake watershed management approach is essential. Although it is part of *Water for Life*, such an approach is not always integrated into all legislation, planning and decision-making processes that involve lake watershed management. The GoA's commitment to developing a provincial lake policy provides an opportunity to address this coordination challenge.

The AWC offers the following vision for sustainable lake watershed management, drawing on elements from *Water for Life* and the ALMS vision for healthy lakes:

Vision for Healthy Lakes

"Alberta lakes are healthy, reflecting natural conditions, functions and variability, and are resilient to impacts over time. Lake watershed management is well-coordinated, resourced and efficient at maintaining aquatic health or restoring health where degradation has occurred."

Recommendation 1 provides strategic level advice to support this vision through the development of a provincial lake policy. The recommendation is not meant to include all potential elements of a provincial lake policy; rather, it provides an overarching umbrella for subsequent recommendations, many of which expand on elements from Recommendation 1 and their implementation. In particular, many of the later recommendations provide more detailed guidance in relation to specific roles and responsibilities of key stakeholders in lake watershed management.

Recommendation 1: The Government of Alberta, in setting strategic directions and developing a provincial lake policy:

a. adopt an aspirational vision for sustainable lake watershed management;

b. identify goals and objectives to improve the provincial, federal and local coordination of lake watershed management;

c. adopt a comprehensive watershed approach that supports all three goals of *Water for Life;*

d. define clear roles and responsibilities of all major groups (e.g., the Government of Alberta, municipalities, Watershed Planning and Advisory Councils, Watershed Stewardship Groups and other groups) involved in lake watershed management; and

e. define provincial processes for:

- setting provincial lake watershed monitoring and research priorities
- prioritizing lake watershed management needs and resources
- integrating lake watershed management planning into regional, sub-regional and municipal planning and decision-making.

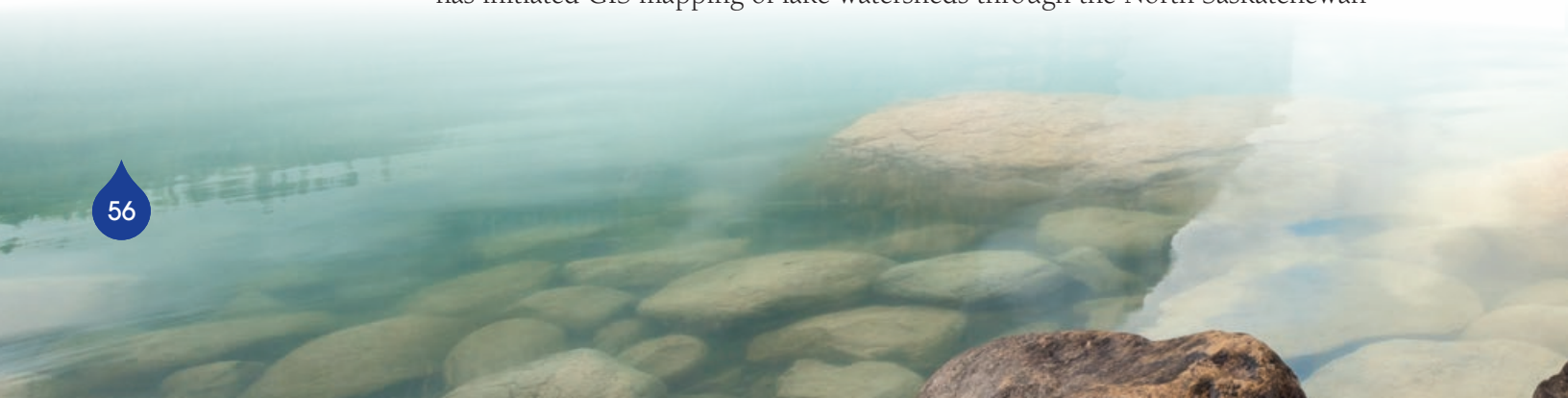
Substantial progress on this provincial policy should be made by 2018 and the policy should be completed by 2020.

4.2 Science and Knowledge

Lake watershed management relies on sound science and knowledge about lakes and their watersheds. Many stakeholders have been involved in collecting data and expanding the collective knowledge of Alberta lakes. Building on this work, the AWC presents recommendations in two areas related to science and knowledge to improve provincial coordination, fill information gaps and provide a solid foundation to inform lake watershed management.

4.2.1 Consolidating Information on Alberta Lake Watersheds

Lake watershed management begins with understanding lake watersheds at a provincial scale, including their social, economic and environmental values. The *Atlas of Alberta Lakes* (1990) presents information on 100 lakes, making it the most comprehensive lake inventory in Alberta to date. However, no similar inventory exists for the other (~2,000) lakes in the province. The GoA has initiated GIS mapping of lake watersheds through the North Saskatchewan



regional planning process, but the mapping exercise is particularly challenging due to the difficulty in distinguishing lakes from other water features such as wetlands. Ultimately, GIS mapping of Alberta lakes could provide a clear delineation of lake watershed boundaries for named and unnamed lakes.[48] It could also serve as a starting point for the development of further mapping and inventory products for lake watersheds.

Lake health is becoming a growing concern for many Albertans, and organizations like ALMS see increasing public demand for information about lakes. Much information is already available, but there is a clear need to better consolidate the vast and growing amount of knowledge. In response, ALMS has been developing a publicly available knowledge portal on lakes and watersheds in the form of a website with digital resources and links to other information sources. Based on priorities and needs, the portal could bring together information on:

- the physical characteristics of lakes and their watersheds
- important social, economic and environmental benefits provided by various lakes, including source drinking water, key fisheries, industrial water allocations or recreational value
- existing sources of data and information for individual lakes, such as individual WSG websites

Both GIS mapping and a comprehensive knowledge portal will require continued ALMS operational funding and collaboration among the organizations involved in generating information about Alberta lakes. In addition to the GoA and ALMS, WPACs and WSGs have produced many GIS products, enhancing knowledge at the local scale, and they should be key partners in this work. The knowledge portal could also incorporate traditional ecological knowledge from Indigenous communities and knowledge from academia and NGOs working on lake watersheds across Alberta.

48 This work may be done through existing efforts to inventory and map Alberta's wetlands.

Recommendation 2: In collaboration with partners, the Government of Alberta coordinate the development of a GIS-based, publicly available data layer of lakes in Alberta and their watersheds by 2019.

Recommendation 3: In collaboration with partners, the Alberta Lake Management Society continue developing a comprehensive knowledge portal that provides one-window access to information and products available for each lake in Alberta, and an ongoing process to populate it.

4.2.2 Establishing Provincial-scale Criteria for Determining Lake and Watershed Health

Baseline data are already available on water chemistry and biota for many lakes in Alberta. We have technical information on the impacts of land use or cover and in-lake activities on lake health through the 14 existing State of the Watershed reports. Many stakeholders, including the GoA, academia, municipalities, WPACs and WSGs, conduct lake watershed health assessments. We also have technical information on many other lakes and streams gathered over the past several decades. Yet no provincial guidance exists on criteria for determining lake and lake watershed health. Management decisions, including the development and implementation of lake watershed management plans, depend on reliable information from research, monitoring, evaluation and modelling. A clearly defined process is needed to identify research and monitoring needs at the provincial level and inform resource allocation accordingly.

Previous work could inform the development of provincial criteria for assessing lake and watershed health. In 2009, an AWC report identified seven ecological criteria for healthy aquatic ecosystems in Alberta.[49] Revised criteria and associated indicators were subsequently used to map Environmentally Significant Areas.[50] At the watershed level, the GoA released in 2012 its *Guide to*

49 Alberta Water Council. 2009. *Provincial Ecological Criteria for Healthy Aquatic Ecosystems: Recommendations from the Alberta Water Council*. Available online: http://www.awchome.ca/LinkClick.aspx?fileticket=1LxcW7__lqQ%3d&tabid=117. Accessed August 2016.

50 Fiera (Fiera Biological Consulting Ltd.). 2014. *Environmentally Significant Areas in Alberta: 2014 Update*. Report prepared for the Government of Alberta, Edmonton, Alberta.

Reporting on Common Indicators Used in State of the Watershed Reports.[51] Written primarily for WSGs and WPACs, the guide identified a suite of indicators from which to build a comprehensive assessment of the overall health of a watershed. Recommended indicators were later adapted to the specific context of lakes in the ALMS *Workbook for Developing Lake Watershed Management Plans*.[52]

Key partners in funding and developing provincial criteria and indicators for lake watershed health include WPACs, WSGs, municipalities, academia and Indigenous communities. Although meant to be applied to lake watersheds across the province, criteria and indicators should be tailored to the different types of lakes, including reservoirs. Lake-specific targets and thresholds should also be identified to support the application of criteria and indicators at the local scale.[53] While such a process is needed for improved provincial coordination, it should not delay immediate local management actions or initiatives where supporting knowledge is already available.

Recommendation 4: The Government of Alberta, in collaboration with partners:

a. identify provincial criteria and indicators of lake watershed health by 2018, to be informed by existing work;

b. use these criteria to conduct a preliminary assessment of lake watershed health and information gaps by 2019; and

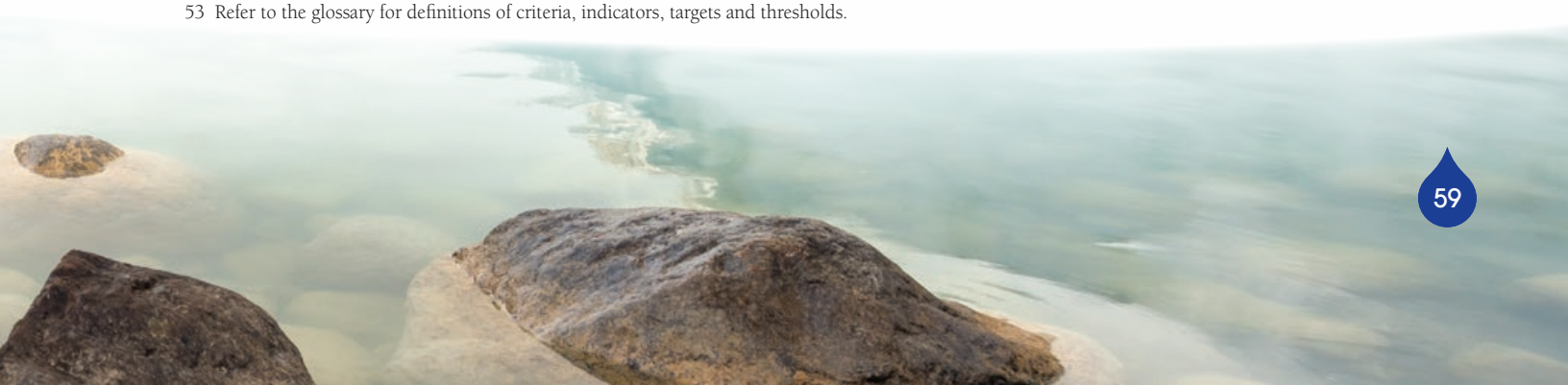
c. identify provincial lake watershed research and monitoring gaps and needs to inform lake watershed management actions at provincial and local scales, based on the identified criteria and subsequent assessment.

Substantial progress should be made by 2020.

51 Government of Alberta. 2012. *Guide to Reporting on Common Indicators Used in State of the Watershed Reports*. Available online: http://aep.alberta.ca/water/programs-and-services/water-for-life/partnerships/documents/8713.pdf. Accessed August 2016.

52 ALMS. 2013. *Workbook for Developing Lake Watershed Management Plans*. Available online: http://alms.ca/wp-content/uploads/2014/02/ALMS_WMPWorkbook.pdf. Accessed August 2016.

53 Refer to the glossary for definitions of criteria, indicators, targets and thresholds.



4.3 Lake Watershed Management Planning

Addressing challenges surrounding the development and implementation of lake watershed management plans—as defined in Section 3.3—were an important focus of this work. Three recommendations related to planning reflect key findings: identifying a process for all levels of government to engage in multi-stakeholder lake watershed management planning initiatives; prioritizing lake watershed planning, management and implementation actions; and developing a process to identify a lead agency to facilitate the collaborative development and implementation of lake watershed management plans. These are discussed in more detail in the following sections.

4.3.1 Integrating Lake Watershed Management Plans in Land-use Decision Making

Lake watershed management planning is not occurring concurrently with formal land-use planning and decision-making processes such as regional plans, MDPs and IDPs. Without a provincial process to formally incorporate lake watershed management plans into provincial and municipal decision making, land-use decisions do not always consider lake specific health objectives and cumulative effects of development around lakes.

Coordinating planning efforts to reflect the objectives of lake watershed management advisory plans in formal land-use planning could improve decision making around lakes. One option to address this challenge is having the Province and all affected municipal governments endorse the advisory plans developed by WPACs and WSGs such that the plans are incorporated into local statutory and non-statutory planning and decision making. Through ALSA, the GoA has the legislative power to require the implementation of a lake watershed management plan at the regional, sub-regional and municipal levels. As the first regional plan to include a lake watershed management component, the *North Saskatchewan Regional Plan* may provide an opportunity to integrate lake and land use planning at the regional and sub-regional scale.

Integrating lake watershed management plans through ALSA would be an effective way to support the implementation of lake watershed management objectives. However, there are some limitations in that the process is lengthy and complex. In practice, a multi-scale process may be more appropriate to facilitate the implementation of management actions based on the scale of a given issue and the level of risk it represents for the lake watershed. Table 6 outlines what such a multi-scale process could look like, where different issues within a lake watershed management plan may be implemented through different statutory and planning tools. The issues, assessment of potential risk and associated implementation tools will vary for individual lakes.

Table 6: Example of a Multi-scale Risk-based Approach to Incorporate Lake Watershed Management Actions into Provincial and Municipal Planning and Decision Making

Issue (lake-specific)	Scale	Potential Risk			Planning Body or Authority	Statutory Tool
		Low	**Med**	**High**		
Boating density	Lake				Municipality	Municipal bylaw
Unauthorized shoreline vegetation removal	Shoreline				GoA (*Public Lands Act*)	Compliance and enforcement
Shoreline development	Shoreline and near shoreline				Local municipality (MGA)	MDP, IDP and other planning documents
Phosphorus loading from the uplands	Lake watershed				GoA (ALSA) or WPACs	Regional, sub-regional or watershed plans

Developing and implementing lake watershed management plans requires funding, expertise and human capacity. In this project, the various organizations involved in planning efforts reported different capacity challenges specific to their sector:

- The GoA does not have the capacity to participate on every lake watershed management initiative.
- The availability of human capacity and the level of expertise required to make informed decisions vary among municipalities, including summer villages.
- WSGs experience volunteer burnout and high turnover.
- Funding for WSGs, WPACs and other NGOs is a challenge when carrying out long-term initiatives in lake watershed management planning.
- WSGs are not established in some priority lake watershed management areas across the province.
- Many Indigenous communities lack capacity to participate in all of the policy and other development-related engagements to which they are invited, including lake watershed management planning.

Current planning initiatives rely on funding and expertise from multiple sources. It is important to continue to support groups that wish to undertake a plan or who have already initiated one.

Recommendation 5: The Government of Alberta identify a process by 2020 for all levels of government to engage in and support multi-stakeholder lake watershed planning initiatives where appropriate, and to incorporate lake watershed management plans and/or objectives into land use planning and decision-making. This process should be reflective of the scale and urgency of issues facing the lake and outline how existing lake watershed management plans and/or objectives are to be considered in statutory planning and decision-making.

4.3.2 Prioritizing Management Needs

Lake watershed management planning is occurring on an *ad hoc* basis, often triggered by strong local interests, particularly around recreational lakes in central Alberta. In the absence of a provincial assessment of management needs and priorities, it is difficult to ascertain whether activities are happening where they are needed most. Given that limited resources are available to support planning across the province, a prioritization process could help to efficiently allocate resources to planning and implementation. However, a provincial-scale prioritization system should not preclude volunteer groups from undertaking local activities that support the goals and objectives of the provincial lake policy; rather, it should support and more closely monitor management actions where they are most pressing. To remain flexible and able to respond to change over time, a prioritization process should also be iterative (e.g., conducted every five years) and should allow submissions for consideration during the intervening period.

Prioritization programs already exist in other jurisdictions. India's National Lake Conservation Plan recognizes the necessity to prioritize lakes and their catchments for conservation efforts, in view of the limited resources available.[54] The program is based on three types of criteria:

- hydrological criteria, including whether the lake is permanent and meets certain physical parameters such as size and depth
- scientific criteria, including "designated best use criteria" which correspond to uses such as drinking water source, fisheries, irrigation or industrial cooling
- administrative criteria, which consider important uses of the lake and take into account public demand and a stakeholder commitment to bear 10% of the State's share in the project cost

54 Government of India. 2008. *Guidelines for National Lake Conservation Plan*. Available online: http://www.moef.nic.in/sites/default/files/nlcp/NLCP_guideline.pdf. Accessed August 2016.

A similar prioritization program was explored in Missouri as part of the development of regional watershed strategies.[55] Possible selection criteria included a mix of biological criteria for biodiversity objectives; social criteria for recreational objectives; and economic criteria such as potential partners for funding, planning and projects.

In Alberta, regional planning under the Land-use Framework provides a process where prioritization could occur. The review of regional plans on a five-year cycle could also allow for regular reassessment of lake watershed management priorities. Table 7 presents examples of conditions and pressures that could be used to prioritize management needs. Prioritization will vary based on regional context and should incorporate local perspectives, but should allow for the classification of both preventive and remediation actions. For example, preventive management actions may be needed to preserve the natural state of a given lake, while remediation actions would apply to lakes that show serious negative impacts.

55 Missouri Department of Conservation. 2010. Strategies for Watershed Management. Available online: http://mdc.mo.gov/sites/default/files/resources/2010/10/watershedmanagementstrategy_2010-10-07.pdf. Accessed August 2016.

Table 7: Examples of Potential Conditions and Pressures to Prioritize Lake Watershed Management Needs

	Conditions	Pressures
Social	■ Drinking water source ■ Traditional use values or source of local food, medicinal plants, etc. ■ Recreation	■ Increasing property and tourism development ■ Increased boating and speed ■ Swimming, fishing and other outdoor activities ■ Urban development
Environmental	■ Habitat for a species at risk ■ Changes in lake level (beyond the normal range of variability) ■ Changes in water quality conditions and trends ■ Research or benchmarking opportunities	■ Introduction of aquatic invasive species ■ Modification of shoreland and habitat removal ■ Land use activities and management within the watershed (contributing to point and non-point pollution) ■ Water withdrawals to support industrial development ■ Urban development
Economic	■ Water source for agriculture and industry ■ Presence of recreational fisheries, guiding and outfitting and other economic activities	■ Land use activities and management within the watershed (contributing to point and non-point pollution) ■ Urban development

Recommendation 4 provides a starting point to establish environmental criteria by calling for the identification of criteria for lake watershed health. This work could then be expanded to develop social and economic criteria as part of the prioritization process, as proposed in Recommendation 6.

> **Recommendation 6:** The Government of Alberta work with partners to develop an iterative process, using environmental, social and economic criteria, to prioritize lake watershed planning, management and implementation actions, by 2020.

4.3.3 Local Lead for Developing and Implementing Individual Lake Watershed Management Plans

Lake watershed management planning generally relies on the local leadership of WPACs, WSGs or municipalities. No single organization is responsible and accountable for leading the development of lake watershed management plans and tracking their implementation. While much guidance is already available on how to develop a lake watershed management plan, implementation remains a key challenge.

Municipalities have statutory authority for land-use planning and the management of water bodies within their boundaries in accordance with the MGA. WPACs and WSGs often have the local knowledge required to develop effective lake watershed management plans, but they do not have the legislated authority to lead the development of land-use plans. Ownership of lake watershed management plans by municipalities surrounding a lake is therefore essential for successful implementation.

As priority management needs are identified for lake watershed management, a local designated lead should be made accountable for the development and implementation of lake watershed management objectives. In some cases, a lead may already exist at the local level and plan development and implementation may be underway. In cases where planning has not been initiated, a process to designate a lead may be needed. Appropriate checks and balances should be included in the process to ensure that planning is knowledge-based and reflects shared socio-economic and environmental objectives.

Recommendation 7: By 2020, the Government of Alberta develop a process to designate a local lead to facilitate the collaborative development and implementation of lake watershed management plans and/or objectives where identified as a priority management action. The designated local lead could be a single entity or a group, and must be approved by municipalities in the lake watershed.

4.4 Regulatory and Voluntary Tools for Managing the Uplands

This project emphasized the need to acknowledge the connection between land uses and lake health. Both voluntary and regulatory approaches can improve management of the uplands, and successful examples of both approaches are already evident in Alberta. Recommendations in three areas will build on these success stories and foster greater collaboration and consistency in managing the uplands; improve the coordination of regulation, compliance and enforcement activities; and target efforts to high priority areas.

4.4.1 Improving Collaboration and Consistency in Land-use Decisions around Lakes

Lake watershed governance relies on several pieces of federal and provincial legislation. Given that the review of the MGA was happening concurrently with this work, it is used as an example to examine how the periodic review of legislation could support improved lake watershed management. Both the MGA review and future reviews of key policy and legislation (e.g., wastewater regulations, riparian and wetland policies, regional land use plans) are opportunities to ensure that a) provincial legislation is consistent with principles for improved lake watershed management, and b) all relevant policies and legislation work in an integrated fashion to improve management of land and water.

Municipalities are responsible for land-use decisions around many lakes in Alberta. Although it is the main legislation guiding those decisions, the MGA does not compel municipalities to follow consistent planning guidelines around lakes, which leads to considerable variation in land-use decisions by local governments. The MGA review is an opportunity to improve both statutory and non-statutory tools for lake watershed management. Tools could include:

- overarching standards for development around lakes and guidelines for bylaws and enforcement (e.g., erosion control, riparian setbacks, environmental reserves, docks and other shore infrastructure, low impact lakeshore development and cumulative effects management)
- an oversight mechanism to hold municipalities accountable for development decisions that have negative impacts on lake watershed health
- requirements for IDPs and consistent LUBs across municipalities around a lake
- appropriate mechanisms for engaging with Indigenous communities that are situated around lakes or that pursue traditional land uses on or around lakes

Some municipalities have already integrated lake watershed management objectives in their statutory plans and bylaws, and groups of municipalities are working together for greater consistency in decision making around lakes. Building on these efforts, the Alberta Urban Municipalities Association (AUMA), Alberta Association of Municipal Districts and Counties (AAMDC) and Association of Summer Villages of Alberta (ASVA) can play a critical role in promoting tools and mechanisms to support municipal planning around lakes. In particular, municipalities may need more technical, human and financial support in:

- using existing tools such as the ALMS Workbook for Developing Lake Watershed Management Plans or the GoA guide Stepping Back from the Water
- implementing lake watershed management objectives via MDP, LUBs, IDPs and sustainability plans

- setting and enforcing setbacks, riparian buffers and reserves to maintain healthy lake watersheds
- offering incentive programs for the implementation of BMPs around lakes

Supporting Municipal Planning around Lakes: Additional Resources and Considerations

Additional resources to support municipal planning around lakes include the Alberta Professional Planners Institute and Alberta Development Officers Association, both of which represent planning and development practitioners. These organizations have expertise through the membership community and a framework to leverage professional expertise and resource tools for sustainable planning and development around lakes. Many municipalities employ these qualified professionals or have access to necessary expertise on an as-needed basis. Planning in irrigation districts requires additional consideration due to the extensive open channel networks throughout the planning area, and the hydrological and water quality impacts on operations. Irrigation districts are essential stakeholders in these areas.

Recommendation 8: The Government of Alberta, through its periodic review of key legislation relevant to lake watershed management:

a. seek alignment with the goals and outcomes of *Water for Life* and the new provincial lake policy, when completed; and
b. strengthen legislative tools to enable consistent land-use practices to maintain or improve lake watershed health.

Recommendation 9: Alberta Urban Municipalities Association, Alberta Association of Municipal Districts and Counties and Association of Summer Villages of Alberta support greater collaboration and consistency in municipal planning around lakes by:

a. working with the Government of Alberta and other relevant partners to identify existing gaps in tools and information and to assist in developing resources to fill these gaps; and

b. continuing to promote information, tools and guidance documents related to lake watershed management planning.

Substantial progress should be made by 2019.

4.4.2 Improving Coordination of Regulation, Compliance and Enforcement

Many provincial and municipal regulations exist for managing activities around a lake (see Table 2). However, provincial and municipal approvals, compliance and enforcement occur largely in silos in Alberta. In a system where federal, provincial, municipal and Indigenous jurisdictions co-exist within a lake watershed, all levels of government have responsibilities in relation to compliance and enforcement issues. With little coordination among them however, some issues can easily slip through the regulatory net.

While there is anecdotal evidence of compliance and enforcement gaps due to the lack of federal-provincial-municipal coordination, other regulatory gaps have not been explored as part of this work. A review of existing regulations as they apply at the federal, provincial and municipal levels would be necessary to identify potential regulatory gaps.

Both the GoA and municipalities have indicated a desire to take on more active education about and enforcement of existing regulations and bylaws, but capacity is often a limiting factor. Greater collaboration between them may offer a potential solution to capacity issues. Building on the need to define clear roles and responsibilities for lake watershed management as identified in Recommendation 1, the following recommendation provides advice specific to

the definition of roles and processes for improved coordination of regulation, compliance and enforcement activities. Given the multi-jurisdictional nature of lake watershed management, this work will need to occur in collaboration with all levels of governments, notably Fisheries and Oceans Canada, Indigenous communities and municipal associations.

Recommendation 10: By 2019, the Government of Alberta work with all levels of government to identify regulatory or operational gaps relative to land development and other activities on and surrounding lakes, and develop and implement strategies to address such gaps.

4.4.3 Targeting Incentives for Stewardship

Given the complexity of the relationship between land uses and lake health, the impact on lake health of implementing BMPs is difficult to assess. Nonetheless, managing activities in the uplands is an integral part of taking a watershed approach to lake management. BMP tools used to conserve riparian areas allow management to move beyond the lake and extend into its surrounding watershed. Such tools include applying generous vegetative buffers and environmental reserves; conserving upland woodlots and wetlands; and using appropriate development setbacks, sediment and erosion controls and sustainable stormwater techniques.

ABMPs and Water Quality

The science and effectiveness of Agricultural Beneficial Management Practices (ABMPs) on water quality is not clear-cut. A recently completed six-year study by AAF showed that ABMPs improved water quality by lowering concentrations of nitrogen, phosphorus, total suspended solids and *Escherichia coli* at field edges.[56] However, as expected, improved water quality was not observed at the downstream end of the watershed. This was likely because the ABMPs only covered a small portion of the study

56 Paterson Earth & Water Consulting Ltd. and Alberta Agriculture and Rural Development. 2014. N*utrient Beneficial Management Practices Evaluation Project. Volume 1—Summary and Recommendations.* Available online: http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/epw11955/$FILE/summary_and_recommendations.pdf. Accessed August 2016.

watersheds. Results from a modelling component of the study indicated that watershed-scale improvements in water quality might only occur if ABMPs are implemented on a much larger scale. To enhance the outcome of having a positive effect on water quality, the study noted that critical sources of nutrients should be identified and ABMPs targeted to those areas. Future work by AAF will look at cumulative effects of multiple ABMPs targeted at such critical source areas within a watershed.

Adopting BMPs can lead to water quality improvements beyond what can be achieved by regulatory tools. Financial incentives are effective at driving the adoption of BMPs on private land. Examples include incentive programs such as ALUS, Green Acreages, Alberta Conservation Association Riparian Conservation Program and Growing Forward 2, as well as tools like the Alberta Environmental Farm Plan (see Appendix E[57] for more details). Targeting the voluntary adoption of BMPs to high-priority areas and aligning, coordinating and enhancing BMP programs could maximize their impact at the provincial scale. Similar approaches also exist to encourage stewardship by cottage owners and industries. Financial incentives for stewardship are one of many options to improve management of the uplands.

The ALMS Workbook stresses the importance of identifying sources of point and non-point source pollution as part of a lake watershed management plan. The 2013 AWC report Recommendations to Improve Non-Point Source Pollution Management[58] in Alberta extensively documented the challenges associated with non-point source pollution management in the province. As lake-specific management efforts identify key areas of point and non-point source pollution, incentive programs for BMP implementation can be better targeted according to priority management needs.

57 Appendix E and other appendices can be found here http://awchome.ca/Projects/LakeManagement/tabid/204/Default.aspx

58 Alberta Water Council. 2013. *Recommendations to Improve Non-Point Source Pollution Management in Alberta*. Available online: http://www.awchome.ca/LinkClick.aspx?fileticket=ff90UcqhD_o%3d&tabid=134 . Accessed August 2016.

Recommendation 11: The Government of Alberta work with municipalities and partners to align and enhance beneficial management practices incentive programs in lake watersheds where non-point source priority management actions have been identified for lake watersheds. An ongoing process to achieve this should be initiated by 2019.

4.5 Improving Access to Tools and Education

Despite educational efforts around lake watershed management, many people still have a limited understanding of the connection between lake health and land uses. While much work is being done on lake watershed management in Alberta, accessibility is limited because there is no single point of access to the tools, resources, data and reports that have been produced. For example, there is no consolidated list of active WSGs and other lake watershed management planning initiatives or of the products they have developed.

Greater provincial coordination is needed to facilitate access to resources, but also to ensure that education efforts follow consistent messaging, address all components of lake watershed management and target all key audiences such as property owners, agricultural producers, local decision makers and stewardship

groups. Respect our Lakes, AEP's education and outreach initiative, provides a strong basis to enhance provincial coordination around education and access to information about lakes and their watersheds. This work should not replicate but should build on partnerships with organizations that are already actively involved in lake education and outreach, including ALMS, the Alberta Conservation Association, Land Stewardship Centre, Cows and Fish, Trout Unlimited Canada, WPACs, WSGs and municipalities.

Recommendation 12: The Government of Alberta continue to work with partners to coordinate lake education and outreach through the Respect our Lakes program. This includes identifying target audiences, developing consistent messaging and ensuring access to educational information, tools and resources for lake watershed management by 2018.

4.6 Timelines for Recommendations

Timelines for these recommendations balance the urgent need for action with realistic expectations of the time required to put new processes in place. Figure 6 illustrates the chronology of proposed timelines associated with each recommendation. Several broader processes will ultimately influence these timelines, including the development of a provincial lake policy, regional planning and the ongoing legislative review of the MGA. In many cases, the development of new processes identified in the recommendations may begin through regional or local initiatives, and later be modified to align with the provincial lake policy as it is developed.

Figure 6: Proposed Timelines for Implementing Recommendations

	2017	2018	2019	2020 and beyond (ongoing)
Recommendations	**Recommendation 1:** The Government of Alberta, in setting strategic directions and developing a provincial lake policy (as committed to under Our Water, Our Future: A Plan for Action): a. adopt an aspirational vision for sustainable lake watershed management; b. identify goals and objectives to improve the provincial, federal and local coordination of lake watershed management; c. adopt a comprehensive watershed approach that supports all three goals of *Water for Life*; d. define clear roles and responsibilities of all major groups (e.g., the Government of Alberta, municipalities, Watershed Planning and Advisory Councils, Watershed Stewardship Groups and other groups) involved in lake watershed management; and e. define provincial processes for: ■ setting provincial lake watershed monitoring and research priorities ■ prioritizing lake watershed management needs and resources ■ integrating lake watershed management planning into regional, sub-regional and municipal planning and decision-making. Substantial progress on this provincial policy should be made by 2018 and the policy should be completed by 2020.			
	Recommendation 2: In collaboration with partners, the Government of Alberta coordinate the development of a GIS-based, publicly available data layer of lakes in Alberta and their watersheds by 2019.			
	Recommendation 3: In collaboration with partners, the Alberta Lake Management Society continue developing a comprehensive knowledge portal that provides one-window access to information and products available for each lake in Alberta, and an ongoing process to populate it.			
	Recommendation 4: The Government of Alberta, in collaboration with partners: a. identify provincial criteria and indicators of lake watershed health by 2018, to be informed by existing work;			
		b. use these criteria to conduct a preliminary assessment of lake watershed health and information gaps by 2019; and		

Recommendations

2017	2018	2019	2020 and beyond (ongoing)
		c. identify provincial lake watershed research and monitoring gaps and needs to inform lake watershed management actions at provincial and local scales, based on the identified criteria and subsequent assessment. Substantial progress should be made by 2020.	
Recommendation 5: The Government of Alberta identify a process by 2020 for all levels of government to engage in and support multi-stakeholder lake watershed planning initiatives where appropriate, and to incorporate lake watershed management plans and/or objectives into land use planning and decision-making. This process should be reflective of the scale and urgency of issues facing the lake and outline how existing lake watershed management plans and/or objectives are to be considered in statutory planning and decision-making.			
			Recommendation 6: The Government of Alberta work with partners to develop an iterative process, using environmental, social and economic criteria, to prioritize lake watershed planning, management and implementation actions, by 2020.
Recommendation 7: By 2020, the Government of Alberta develop a process to designate a local lead to facilitate the collaborative development and implementation of lake watershed management plans and/or objectives where identified as a priority management action. The designated local lead could be a single entity or a group, and must be approved by municipalities in the lake watershed.			

	2017	2018	2019	2020 and beyond (ongoing)
Recommendations	**Recommendation 8:** The Government of Alberta, through its periodic review of key legislation relevant to lake watershed management: a. seek alignment with the goals and outcomes of *Water for Life* and the new provincial lake policy, when completed; and b. strengthen legislative tools to enable consistent land-use practices to maintain or improve lake watershed health.			
	Recommendation 9: Alberta Urban Municipalities Association, Alberta Association of Municipal Districts and Counties and Association of Summer Villages of Alberta support greater collaboration and consistency in municipal planning around lakes by: a. working with the Government of Alberta and other relevant partners to identify existing gaps in tools and information and to assist in developing resources to fill these gaps; and b. continuing to promote information, tools and guidance documents related to lake watershed management planning. Substantial progress should be made by 2019.			
	Recommendation 10: By 2019, the Government of Alberta work with all levels of government to identify regulatory or operational gaps relative to land development and other activities on and surrounding lakes, and develop and implement strategies to address such gaps.			
	Recommendation 11: The Government of Alberta work with municipalities and partners to align and enhance beneficial management practices incentive programs in lake watersheds where non-point source priority management actions have been identified for lake watersheds. An ongoing process to achieve this should be initiated by 2019.			
	Recommendation 12: The Government of Alberta continue to work with partners to coordinate lake education and outreach through the Respect our Lakes program. This includes identifying target audiences, developing consistent messaging and ensuring access to educational information, tools and resources for lake watershed management by 2018.			

5.0 Conclusion

Lake watershed management is a complex task, bringing together many stakeholders that are part of multiple planning and decision-making mechanisms. Individual volunteers, community lake groups, local municipal governments and many others have spurred the work happening at the watershed scale on Alberta lakes. As lake and watershed health issues become more prominent, increased provincial coordination will be needed to ensure that planning efforts lead to successful implementation of management decisions at all scales.

The recommendations in this report will support the GoA and its partners in developing an improved approach to lake watershed management. They build on opportunities to strengthen work that is already underway and to support a wider adoption of promising tools. When implemented, these recommendations will contribute to maintaining the many social, economic and environmental benefits provided by Alberta lakes.

Glossary

Criteria	The valued components or qualities in a system.
Indicator	A direct or indirect measurement of some valued component or quality in a system. For example, an indicator can be used to measure the current health of the watershed.[59]
Lake	An inland water body where the water usually is deep enough to keep it from freezing to the bottom over the winter.
Lake Health	A healthy lake is an aquatic environment that sustains its ecological structure, processes, functions and resilience within its range of natural variability.
Partner	An organization or government that is actively involved in achieving a common objective. In this report, partners may include different levels of government (i.e., federal, provincial, municipal governments and Indigenous communities), NGOs, WPACs, WSGs and industry.
Reservoir	A man-made water body created to collect, store and supply water for one or more specific uses (e.g., irrigation, power generation), with a possibility of management to achieve additional economic, environmental and/or social benefits.
Rule Curve	Defines the minimum water level required in a reservoir to meet specific needs for which the reservoir is designed.[60]
Stakeholder	An individual, organization, or government with a direct interest in a particular process or outcome.[61]
Target	A value that reflects a desirable outcome.[62]
Threshold	The value of an indicator that reflects a problem condition.[63]
Watershed	Area of land that catches precipitation and drains it to a common point such as a wetland, lake, river, stream or groundwater aquifer.[64]

59 Adapted from: Alberta Environment. 2008. *Glossary of Terms Related to Water and Watershed Management in Alberta*, 1st edition.

60 AMEC. 2009. *South Saskatchewan River Basin in Alberta: Water Supply Study*. Alberta Agriculture and Rural Development. Available online: http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/irr13053/$FILE/ssrb_main_report.pdf. Accessed August 2016.

61 Alberta Environment. 2008. *Glossary of Terms Related to Water and Watershed Management in Alberta*, 1st edition.

62 Ibid.

63 Ibid.

64 Alberta Water Council. 2008. *Recommendations for a Watershed Management Planning Framework for Alberta*. Available online: http://www.awchome.ca/LinkClick.aspx?fileticket=6xyO8NkXdtY%3d&tabid=101. Accessed August 2016.

Appendix A – Terms of Reference

Lake Management Project Team Terms of Reference

Approved by the Alberta Water Council on October 30, 2014.

CONTEXT:

- The lake management initiative originated from a Statement of Opportunity (SOO) brought forward to the Council by the Alberta Lake Management Society. The Council identified this initiative as a potential project at the October 2013 board meeting and established a working group to further define the scope of a potential project.
- Alberta's lakes exhibit natural variability in trophic status with some being nutrient rich and others nutrient poor and less productive. Lakes in the central region, where anthropogenic pressures are arguably higher and projected to increase, are generally naturally eutrophic and further nutrient inputs could exacerbate existing problems. Human influence on watershed land use and lake ecosystems in the last 100 years has altered the nature of some Albertan lakes, and is evident in scientific data and repeated anecdotally from those living near these lakes. Influences include control of water levels, diversion of water, changing the land cover and use in the lake's drainage basin, overfishing, urbanizing the lakeshore and climate change. Our finite lake resource is under pressure.
- As growth continues the public expectation of adequate protection of those attributes associated with the Canadian lake experience (good water quality, good sport fishing, safe contact recreation, pleasing aesthetic values, and healthy aquatic ecosystems) will also continue.
- There are two major challenges to effective lake management in Alberta: a) ensuring sufficient information on the ecological characteristics of any given lake to effectively inform management, and b) defining management roles and responsibilities. There is an opportunity for a proactive, coordinated approach to lake monitoring, evaluation, reporting and management. This comes with the understanding that a watershed approach to the development of lake management plans is an effective, supported and current approach in Alberta.
- The Council uses a multi-stakeholder consensus based process to provide recommendations to advance the three goals of the *Water for Life* Strategy. This project aligns with advancing the three goals by incorporating the Council's multi-stakeholder approach in the development of effective cross-sector solutions.

- The Project Team will operate in a manner that is consistent with the rules, policies and procedures adopted by the Alberta Water Council, including the use of consensus to make decisions in a multi-stakeholder process.

STRATEGIC INTENT (GOAL):

The purpose of this initiative is to provide recommendations for improved lake management in Alberta to support achievement of *Water for Life* goals.

OBJECTIVES:

Document and assess the current state of lake management planning and governance (e.g., roles and responsibilities) in Alberta.

Identify gaps, redundancies and opportunities for improvements in lake management.

Develop recommendations toward effective lake management in Alberta, including roles and responsibilities.

KEY TASKS:

- Develop a work plan of main steps and expected products or outcomes for each task.
- Develop a list of what lake management includes.
- Summarize the current state of lake management in Alberta, including: a) examples of management planning/plans; b) monitoring/research, evaluation and reporting; c) implementation of lake and watershed management plans and practices; and, d) education and awareness initiatives.
  - Engage key groups as needed
  - Consider current and evolving policy and legislation
  - Engage experts as needed (e.g., to address concerns regarding legal aspects of lake management)
- Identify the current roles and responsibilities of the main stakeholders in lake management activities or components.
- Consider current lake management approaches and practices from other jurisdictions (e.g., presentations from informed experts).
- Identify gaps and redundancies in the existing lake management system, and highlight opportunities for improving lake management in Alberta.

- Based on the information and evaluation above, develop a draft approach for lake management.
  - Some factors to consider in lake management include: the aquatic ecosystem; major land use types; activities in the watershed; potential influences (including cumulative impacts) on the health of lakes; the hydrology of the area surrounding the lake; lake water quality and quantity, including trends; uses of lakes and reservoirs; lake-specific objectives or desired outcomes; economic and governance requirements; alignment of lake and associated watershed planning with overlapping plans (e.g., Land Use Framework plans and municipal development plans); and the role of existing legislation, policy, guidelines (e.g., *Water Act, Environmental Protection and Enhancement Act, Alberta Land Stewardship Act, Agricultural Operation Practices Act, Municipal Government Act* and GoA policy on "Consultation with First Nations on Land and Natural Resource Management").
- Organize a facilitated workshop with key stakeholder representatives involved in lake management.
  - The workshop will be used as a forum to solicit feedback on the draft approach for lake management, to inform the team's development of final recommendations.
- Provide updates to the Alberta Water Council as needed.
- Provide recommendations to Council.

TIMELINES and DELIVERABLES:

- Present initial findings on the current state of lake management in Alberta. . . . . June 2015
- Hold a facilitated workshop bringing together stakeholders involved in lake management (consider opportunities to combine with related events) . . . . . Fall 2015
- Draft final report recommendations . . . . . March 2016
- Final report recommendations . . . . . March 2017

SUGGESTED MEMBERSHIP:

Industry:

- Irrigation
- Cropping
- Livestock
- Forestry
- Oil and Gas
- Tourism and Recreation

Non-Governmental Organizations:

- Environmental NGO
- Fish Habitat Conservation
- Lake Environment Conservation
- Watershed Planning and Advisory Councils

Government:

- Small Urban
- Rural
- First Nations
- Métis Settlements

Government of Alberta and Provincial Authorities:

- Aboriginal Relations
- Agriculture and Rural Development
- Alberta Innovates
- Environment and Sustainable Resource Development
- Municipal Affairs
- Alberta Health
- Culture and Tourism

BUDGET:

The Working Group estimates a total budget of $96,000 to complete the project, broken down as follows:

Core Funding Costs (covered by Alberta Water Council):

Project Team Support	$	70,000
Hosting	$	5,000
Communications Support	$	6,000

Project Funding Costs (covered by stakeholders):

A facilitated workshop bringing together lake management stakeholders	$	15,000

Appendix B — Acknowledgements

The Alberta Water Council acknowledges the contributions of the following working group and project team members who volunteered their time and expertise on this project, along with their member organizations for supporting their participation.

Peter Aku	Alberta Conservation Association
Beverly Anderson	Association of Summer Villages of Alberta
Tasha Blumenthal	Alberta Association of Municipal Districts and Counties
Richard Casey	Alberta Environment and Parks
Alf Durnie**	Alberta Municipal Affairs
Donna Hovsepian*	Alberta Aboriginal Relations
Glenn Isaac*	North Saskatchewan Riverkeeper
Mike Iwanyshyn	Natural Resources Conservation Board
Jennifer Kerr*	Alberta Agriculture and Forestry
Madison Kobryn	Alberta Agriculture and Forestry
Sharon McKinnon	Crop Sector Working Group
Ron McMullin	Alberta Irrigation Projects Association
Stephanie Neufeld	Alberta Lake Management Society
Robert Nygaard	Alberta Association of Municipal Districts and Counties
Meghan Payne	Lesser Slave Lake Watershed Council
Peter Pellatt	Alberta Urban Municipalities Association
Brett Purdy	Alberta Innovates
Hugh Sanders	Battle River Watershed Alliance
Jon Sweetman	Alberta Innovates
Dave Trew*	North Saskatchewan Watershed Alliance
Ron Zurawell	Alberta Environment and Parks

Project managers: Petra Rowell, Marie-Claire St-Jacques and Anuja Ramgoolam

*Indicates participants to the working group only.

**The AWC team would like to express condolences on the passing of Alf Durnie who was a valuable team member that brought municipal concerns to the project table.

The AWC would also like to thank the Alberta Lake Management Society for hosting the team's stakeholder engagement workshop as part of the ALMS Annual Workshop in September 2015, as well as all the workshop participants for providing valuable input. The Alberta Irrigation Projects Association generously provided financial support for the stakeholder engagement workshop.

Appendices C, D, E, F and G are published online

www.awchome.ca/Projects/WFLIR/tabid/102/Default.aspx

ALBERTA WATER COUNCIL

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