

AN EXAMINATION OF
GOVERNANCE, EXISTING
DATA, POTENTIAL
INDICATORS AND VALUES IN

THE OTTAWA RIVER WATERSHED



Environment and
Climate Change Canada

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Changement climatique Canada

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It should be noted that the report summarizes “what we heard” from Indigenous organizations and the public and stakeholder engagement process. The opinions expressed were not validated based on data analyses. The Government of Québec provided comments of a factual nature on the draft report and does not condone nor is it bound by the findings in this report.

MESSAGE FROM THE MINISTER

I am pleased to present to Canadians our report entitled *An Examination of Governance, Existing Data, Potential Indicators and Values in the Ottawa River Watershed*. I am proud of the comprehensive and inclusive approach Environment and Climate Change Canada took to engage the diverse voices in the Ottawa River watershed to bring you this report, which is a culmination of what the Department heard is important to Canadians that live in or near the watershed.

The Ottawa River is an important part of our collective past, present and future and it is our collective responsibility. Home to more than 2 million people, the Ottawa River watershed is one of Canada's largest watersheds. The watershed holds spiritual significance for many Indigenous communities, and the river has played a key role throughout the history of Canada. Today, the Ottawa River continues to play an important role in the lives of Canadians by supporting important ecological, recreational and industrial roles.



As a former competitive swimmer, my connection with water, and with the Ottawa River, runs deep. I live near the river, I swim in it, I paddle on it, and I bike and play along the river with my family. In fact, nothing reminds me more strongly of just how important the river and watershed is, and the critical role of many different governments and stakeholders to keep it clean and safe, than the four kilometer swim along the Ottawa River that I participate in every year.

The Ottawa River Watershed Study has involved significant and sustained engagement and work by the Government of Canada since Motion M-104 passed in May 2017, tabled by the Honourable David McGuinty. The resulting report examines how the watershed is managed, identifies where gaps exist, and explores current and potential indicators to assess its health. It also examines the economic, cultural, heritage and natural values related to the watershed.

The report built on existing knowledge about the Ottawa River watershed, and promoted a broad engagement process with those implicated within the watershed, including Indigenous communities and organizations, all levels of government, industry, non-governmental organizations, and other interested parties and individuals. Such a multi-faceted study required using innovative approaches to ensure effective, broad and timely engagement. At every stage of our public engagement process, Environment and Climate Change Canada worked to reflect key engagement principles including transparency, openness, inclusiveness, responsiveness and flexibility.

On behalf of Environment and Climate Change Canada, I would like to thank all of the individuals, organizations and communities that took the time to provide input. Thank you for your participation, passion, and ongoing efforts to protect the Ottawa River watershed. The feedback Environment and Climate Change Canada received shows just how much Canadians care about not only the Ottawa River watershed, but also the importance of water resources to our identity, environment and economy.

I am confident that this foundational document, and the enthusiasm generated through the Ottawa River Watershed Study process, will contribute to future dialogues about how to support the long-term sustainability of the watershed. I encourage you all to read the report and work together to continue to support action within the Ottawa River watershed, and as your Minister of Environment and Climate Change, I will continue to promote the importance of working together to protect Canada's water resources for current and future generations.

EXECUTIVE SUMMARY

The Ottawa River watershed, home to over two million people, has long been cherished for its natural, economic, cultural, and heritage values. However, much like other watersheds across Canada and around the world, those values are subject to a number of stressors, including pressures arising from population growth, industrial development and climate change.

The Ottawa River watershed has been home to Indigenous peoples for countless generations. This area has been inhabited by different Algonquin communities, as well as Métis communities. In addition, Indigenous Nations known under the umbrella of the Haudenosaunee Confederacy (also known as the Iroquois Confederacy), have likewise utilized the watershed throughout time. The Ottawa River also acted as an important historical travel and trade route for transporting resources to major trading posts.

In 2016, the heritage significance of the Ottawa River was celebrated through recognition of the Ontario portion of the river as a Canadian Heritage River, followed by recognition of the Québec portion of the river as a historical site by the Government of Québec in 2017. These designations were the result of considerable efforts to raise awareness about the Ottawa River watershed, and efforts to broaden the public's understanding of its importance continue.

Recognizing that protecting the Ottawa River watershed requires collaboration amongst many organizations that span two provinces, the Government of Canada adopted Private Member's Motion M-104 in May 2017, which was tabled by the Honourable David McGuinty, Member of Parliament for Ottawa South. M-104 directed the Government to undertake a study on the Ottawa River watershed. Consistent with the Motion, the purpose of this study was to: 1) identify barriers to effective management of the Ottawa River watershed, as well as opportunities to enhance watershed collaboration moving forward; 2) explore existing and potential indicators for assessing the health of the Ottawa River watershed; 3) examine the economic, cultural, heritage and natural values associated with the Ottawa River watershed, including possible threats to those values.

Under the leadership of Environment and Climate Change Canada (ECCC), the Ottawa River Watershed Study (ORWS) was initiated. This involved a broad engagement process that included, among other activities, self-directed Indigenous consultation, an online engagement platform, Town Hall events, workshops, webinars, and the soliciting of submissions by email and mail. Input was provided by many, including, but not limited to, Indigenous organizations and communities (Algonquin Anishinabeg Nation Tribal Council, Algonquin Nation Secretariat, Algonquins of Ontario, Mohawk Council of Kahnawà:ke, Mohawk community of Kanesatake,

and Métis Nation of Ontario), the provinces of Québec and Ontario, federal Departments and agencies, municipalities, Conservation Authorities (CAs), Organismes de bassins versants (OBVs), non-governmental organizations (NGOs), businesses, stakeholder associations, youth, and individual citizens. To complement engagement, ECCC reviewed existing literature pertaining to the watershed and best practices for watershed management across Canada and internationally.

Global and domestic watershed management approaches vary considerably, and there is general consensus that approaches must be tailored to local conditions. There are, however, commonalities in the challenges faced, and groups around the world have worked towards the development of guiding principles for watershed management. Today, the concepts of Integrated Water Resources Management (IWRM) and Integrated Watershed Management (IWM) are generally considered to be the ideal approaches to watershed management. At the national scale, the federal-provincial-territorial Canadian Council of Ministers of the Environment (CCME) has identified eleven Principles of IWM to encourage its adoption.

Through the ORWS process, a number of existing approaches to watershed management, both domestic and international, were explored, with the objective of informing collaboration in the Ottawa River watershed. Examples of approaches examined included the Waikato River Authority in New Zealand, the European Union Water Framework Directive, the Mackenzie River Basin Board and Regional Round Tables in Québec. ECCC found that both international and Canadian watershed management bodies differ in many ways, including in their membership, structure, mandate, and the activities that they carry out. In addition, governance arrangements may take many forms, such as Round Tables, Councils, umbrella organizations, partnerships, or even a combination of many of these structures.

Models and best practices were also identified by Indigenous organizations and communities through the ORWS, including aspects of the holistic, relationship-based management system applied by the Algonquin nation; nation-to-nation relationships between Indigenous groups and various levels of government; and sharing and incorporation of Indigenous Knowledge into best practices. In describing gaps in current governance, most Indigenous organizations emphasized that consultation processes undertaken by governments and the private sector are not always consistent with the protection of Aboriginal rights and title recognized and affirmed by section 35 of the *Constitution Act*.

Views regarding governance in the Ottawa River watershed were gathered throughout the ORWS engagement process. While the range of views expressed varied considerably, it was found that the majority of respondents were in favour of the creation of a new collaborative body, as long as that body was mandated and structured in a way that it remained politically neutral and did not infringe on the existing authorities of its members. In addition, many respondents agreed that if a new collaborative body were to be established, its activities should focus on: improving trust, coordination and information sharing amongst its members; identifying priority issues in the watershed; and supporting local watershed stewardship initiatives. Several

respondents strongly cautioned against adding any new layers of bureaucracy or regulation. While Indigenous organizations also expressed the need for greater collaboration in the Ottawa River watershed, and generally supported the creation of a new collaborative body, most felt that its membership, structure, and mandate must be established in a way that strongly reflects Indigenous rights and interests, as well as Government commitments towards a renewed nation-to-nation relationship with Indigenous peoples.

Additionally, ECCC explored existing and potential indicators for assessing the health of the Ottawa River watershed, including those related to water quality, biodiversity and shoreline integrity. A number of potential indicators were identified under those three themes, including the examination of habitat cover, physical-chemical conditions of surface water, as well as changes to water flow regimes over time. In addition to the preliminary identification of indicators, surveys of existing monitoring and data collection activities, and of past assessments of watershed health, were completed. Existing data collection programs are being undertaken by various groups, including governments, non-governmental organization, and citizen scientists. While commonalities exist amongst monitoring activities and health assessments, the general public and stakeholders indicated that methods are not all standardized, and a number of datasets are incomplete and/or out of date. Indigenous organizations engaged for the ORWS also emphasized that current efforts to understand the watershed do not sufficiently incorporate Indigenous Knowledge. It was indicated by Indigenous organizations that, for centuries, these communities have relied on their lands and waterways, and they have had the ability to exercise rights under their own system of customary law and governance.

Throughout the ORWS process it was evident that the Ottawa River watershed is valued by many, and the natural, economic, cultural, and heritage values associated with the watershed are highly interconnected. The safeguarding of these values is largely dependent on the health of the watershed to enable the delivery of ecosystem services. Those ecosystem services include clean drinking water, food, timber and medicinal plants; climate change mitigation and adaptation, through carbon storage and erosion control; as well as cultural services, such as recreation, tourism and spiritual enrichment.

There are many economic activities throughout the Ottawa River watershed, including industries such as forestry, agriculture, hydroelectric power generation, mining, and tourism. Through the ORWS, it was found that social and cultural considerations shape the way individuals perceive the watershed, which influences conservation and stewardship activities. Overall, it is clear the Ottawa River watershed provides a number of benefits that contribute to a high quality of life and a sense of identity for those that live within the area. There was also recognition throughout the ORWS engagement process about the importance of natural values associated with the watershed, such as the importance of water quality and quantity to ecosystem health, as well as species diversity and habitat conservation.

Through the broader ORWS public engagement process, concerns regarding water quality featured prominently in feedback received. Many respondents suggested that industrial effluent and wastewater disposal are significant threats to the Ottawa River watershed. Indigenous organizations and communities noted that industrial development has led to an overall decline in the health of watershed.

By examining emerging trends and signals of change through a process called Foresight Analysis, ECCC identified potential future challenges and opportunities that could impact the Ottawa River watershed. Examples of these changes include the emergence of disruptive technologies, such as artificial intelligence and blockchain technology, as well as shifts in thinking, such as the growing recognition of the value of ecosystem services.

Gaps and opportunities were raised by participants during the ORWS engagement process and are presented throughout this report. Notably, respondents expressed an opportunity to enhance collaboration and communication among governments, Indigenous peoples, stakeholders and other knowledge holders within the Ottawa River watershed, including the need to improve collaboration with Indigenous peoples in areas such as monitoring and stewardship. In addition, some Indigenous organizations and stakeholders recognized the opportunity to develop a strategic plan and common vision for management of the Ottawa River watershed, with the support of guiding principles and an operational framework. Furthermore, ORWS respondents identified opportunities to build on existing Indigenous, scientific and socio-economic knowledge in the watershed by undertaking comprehensive baseline assessments, improved information sharing and accessibility, and through standardized monitoring and data collection efforts.

Given the shared responsibilities and the significant number of Indigenous communities and stakeholders within the Ottawa River watershed, enhancing collaboration within the watershed necessitates working together toward common goals and solutions. ECCC will continue to work with partners to make progress on key departmental water priorities, including activities and engagement that will benefit the Ottawa River watershed.

The Government of Canada will continue to take action in support of the health and protection of freshwater throughout the country, including the Ottawa River watershed. The Government is committed to the incorporation of Indigenous Knowledge, improving data collection and monitoring methods, protecting water resources through climate change adaptation and emergency management programming, as well as supporting healthy water ecosystems through investments in protecting biodiversity and nature.

The federal government is active in protecting the quality and quantity of water resources through its policies, programs, and regulations. This includes initiatives such as the Fresh Water Quality Monitoring and Surveillance program. Through the CCME, the Government of Canada works with provinces and territories to provide tools, guidance and approaches to support sustainable water management in Canada, and to adapt to future challenges, such as climate change. The Government also promotes watershed-based initiatives in major basins across the country, such as the Great Lakes.

The Government employs a number of stewardship tools and partnerships to stimulate biodiversity, habitat and ecosystem conservation actions on the ground, including the Habitat Stewardship Program for Species at Risk. Through the Indigenous Guardians Pilot Program, which provides Indigenous peoples with an opportunity to exercise responsibility in stewardship of their traditional lands, waters and ice, the Government is funding the Kitchissippi Watershed Lake Trout Monitoring Project within the Ottawa River watershed. This project draws on Indigenous Knowledge from Algonquin Elders and land-users to explore environmental changes observed over time.

In addition, ECCC provided funding to Ottawa Riverkeeper in 2018 to supplement the ORWS through the development of indicators to monitor and assess the health of the Ottawa River watershed. Their resulting report includes the identification of indicators pertinent to the mainstem of the Ottawa River, with a focus on indicators best suited to surface water systems. Supporting further work on watershed health, ECCC will provide additional funding for ongoing collaborative work on the next phase of watershed health assessment, including gathering data for indicators, selecting sampling sites, and supporting community-based monitoring efforts.

ECCC hopes that this report will contribute to the knowledge base about the Ottawa River watershed, that it will support dialogue on how to promote the watershed's long-term sustainability, and that it will also add to the discourse about watershed management and collaboration across Canada.

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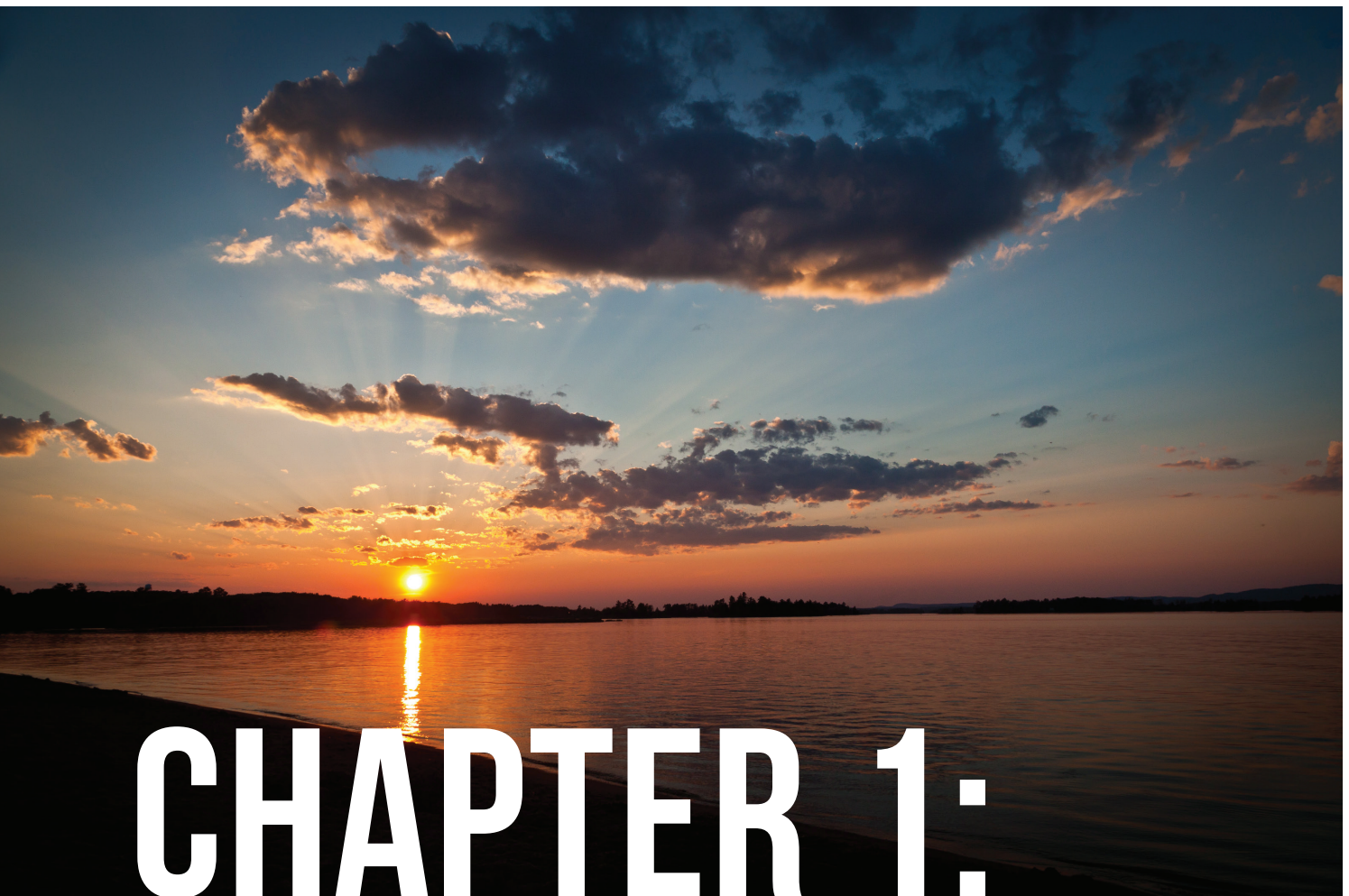
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LIST OF ACRONYMS

AAFC	AGRICULTURE AND AGRI-FOOD CANADA
ABRINORD	ORGANISME DE BASSIN VERSANT DE LA RIVIÈRE DU NORD
ABV 7	AGENCE DE BASSIN VERSANT DES 7
AI	ARTIFICIAL INTELLIGENCE
CA	CONSERVATION AUTHORITY
CABIN	CANADIAN AQUATIC BIOMONITORING NETWORK
CCME	CANADIAN COUNCIL OF MINISTERS OF THE ENVIRONMENT
CEPI	BRAS D'OR COLLABORATIVE ENVIRONMENTAL PLANNING INITIATIVE
CESI	CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS
CHRS	CANADIAN HERITAGE RIVER STATUS
CIPA	COUNTRY POLICY AND INSTITUTIONAL ASSESSMENT
CNL	CANADIAN NUCLEAR LABORATORIES
CNSC	CANADIAN NUCLEAR SAFETY COMMISSION
COBALI	COMITÉ DU BASSIN VERSANT DE LA RIVIÈRE DU LIÈVRE
COBAMIL	CONSEIL DES BASSINS VERSANTS DES MILLES-ÎLES
COBAVER-VS	CONSEIL DU BASSIN VERSANT DE LA RÉGION DE VAUDREUIL-SOULANGES
CREDDO	CONSEIL RÉGIONAL DE L'ENVIRONNEMENT ET DU DÉVELOPPEMENT DURABLE
ECCC	ENVIRONMENT AND CLIMATE CHANGE CANADA
EU	EUROPEAN UNION
EDNA	ENVIRONMENTAL DNA
G3E	WATER EDUCATION AND MONITORING GROUP
GBA+	GENDER-BASED ANALYSIS PLUS
GHG	GREENHOUSE GAS
GWP	GLOBAL WATER PARTNERSHIP
IJC	INTERNATIONAL JOINT COMMISSION
IPCC	INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE
IWM	INTEGRATED WATERSHED MANAGEMENT
IWRM	INTEGRATED WATER RESOURCES MANAGEMENT
MDDELCC	(FORMER) MINISTÈRE DU DÉVELOPPEMENT DURABLE DE L'ENVIRONNEMENT ET DE LA LUTTE CONTRE LES CHANGEMENTS CLIMATIQUES

MELCC	MINISTÈRE DE L'ENVIRONNEMENT ET DE LA LUTTE CONTRE LES CHANGEMENTS CLIMATIQUES
MNRF	MINISTRY OF NATURAL RESOURCES AND FORESTRY
MOECP	MINISTRY OF ENVIRONMENT, CONSERVATION AND PARKS
MP	MEMBER OF PARLIAMENT
MRBB	MACKENZIE RIVER BASIN BOARD
MRC	MUNICIPALITÉ RÉGIONALE DE COMTÉ
MVCA	MISSISSIPPI VALLEY CONSERVATION AUTHORITY
NBMCA	NORTH BAY-MATTAWA CONSERVATION AUTHORITY
NCC	NATIONAL CAPITAL COMMISSION
NCR	NATIONAL CAPITAL REGION
NGO	NON-GOVERNMENTAL ORGANIZATION
NPRI	NATIONAL POLLUTANT RELEASE INVENTORY
NRCAN	NATURAL RESOURCES CANADA
OBV	ORGANISME DE BASSIN VERSANT
OBV RPNS	ORGANISME DE BASSINS VERSANTS DES RIVIÈRES ROUGE, PETITE NATION ET SAUMON
OBVT	ORGANISME DE BASSIN VERSANT DU TÉMISCAMINGUE
OECD	ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT
ORHDC	OTTAWA RIVER HERITAGE DESIGNATION COMMITTEE
ORRPB	OTTAWA RIVER REGULATION PLANNING BOARD
ORWS	OTTAWA RIVER WATERSHED STUDY
PACES	GROUNDWATER KNOWLEDGE ACQUISITION PROGRAM
ROBVQ	REGROUPEMENT DES ORGANISMES DE BASSINS VERSANTS
RRCA	RAISIN REGION CONSERVATION AUTHORITY
RVCA	RIDEAU VALLEY CONSERVATION AUTHORITY
SDG	SUSTAINABLE DEVELOPMENT GOAL
SLAP	ST. LAWRENCE ACTION PLAN
SNCA	SOUTH NATION CONSERVATION AUTHORITY
UN	UNITED NATIONS
UNCED	UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT
U.S.	UNITED STATES
WEF	WORLD ECONOMIC FORUM
WWF	WORLD WILDLIFE FUND
WWF-CANADA	WORLD WILDLIFE FUND CANADA



CHAPTER 1:

INTRODUCTION & CONTEXT

The intent of the Ottawa River Watershed Study (ORWS) has been, above all, to examine the significance of the Ottawa River watershed to the diverse groups who rely on it, as well as to explore opportunities to enhance collaboration. It is hoped that the Government of Canada's ORWS process, and this resulting report, will add to the knowledge base about the Ottawa River watershed.

While undertaking this Study, it has been important to acknowledge and build upon past and current efforts within the Ottawa River watershed. Of particular note, the provinces of Québec and Ontario, and the watershed authorities within each province, have prioritized watershed management and have made significant contributions to knowledge about the Ottawa River watershed. In addition, there are a number of non-governmental organizations (NGOs) that are active within the watershed. For example, in 2015, under the leadership of Ottawa Riverkeeper, representatives of various sectors of society co-created and signed the Gatineau Declaration (see Appendix A), which among other important considerations and recommendations, highlighted that the protection of the Ottawa River watershed is a shared responsibility. In the years that followed, there has been continued momentum to recognize the importance of the Ottawa River watershed, which culminated in attribution of official heritage status to the Ottawa River by the governments of Canada and Québec. There have also been continued efforts to build on the Gatineau Declaration, led by Ottawa Riverkeeper.

Throughout this report, input received from Indigenous organizations, stakeholder and public engagement has been included as applicable. The following chapters of the report provide context on: how and why the ORWS was initiated by the Government of Canada; the roles and responsibilities of diverse groups working within the watershed; international and domestic governance trends; as well as a review of existing watershed bodies. This is followed by an overview of monitoring and data collection activities and existing assessments of the health of the watershed. Subsequently, there is a chapter that describes important economic, cultural, heritage, and natural values attributed to the Ottawa River watershed. Lastly, the report contains a chapter that identifies potential future challenges, and describes next steps.

1.1. MOTION M-104 AND THE OTTAWA RIVER WATERSHED STUDY

This section describes Private Member's Motion M-104 and how the ORWS originated.

1.1.1. ORIGINS OF THE MOTION

The decision to conduct a study on the Ottawa River watershed was initiated by the Honourable David McGuinty, Member of Parliament (MP) for Ottawa South, who introduced Private Member's Motion M-104 in the House of Commons on December 2, 2016. During his speech, he emphasized the significance of the Ottawa River, which he described as “the jewel in the crown of the national capital region”. He also explained that the Motion represents an opportunity to identify management gaps in the Ottawa River watershed, and improve current management practices. The Honourable David McGuinty identified Integrated Watershed Management (IWM) as an approach that could improve how watersheds are managed across Canada.

When describing the purpose of the Motion, the Honourable David McGuinty described how the Ottawa River defines much of the border between Ontario and Québec, making it an interjurisdictional waterway. According to the Honourable David McGuinty, a comprehensive study could help ensure that multiple levels of governments, Indigenous peoples, and all stakeholders work together to coordinate their activities and decisions, to better support the protection of the Ottawa River watershed into the future (House of Commons, 2017a).

Following the debates in the House of Commons, the Motion was approved on May 3, 2017 as follows:

“That, in the opinion of the House, the government should undertake a detailed study with regard to the creation of an Ottawa River Watershed Council, which would bring a comprehensive, inclusive, co-management approach to the Ottawa River Watershed, in order to foster ecological integrity, sustainable economic opportunities, and quality of life; in its study, the government should examine (i) the council membership, which would include, but would not be limited to, federal, provincial, regional, and municipal governments, First Nations, industry groups, non-governmental organizations, and academic institutions, (ii) important indicators such as water quality, biodiversity, and shoreline integrity, in order to assist with the creation of a co-management plan and conservation strategy, (iii) the economic, cultural, heritage, and natural values within the Ottawa River Watershed.”

1.1.2. PURPOSE OF THE STUDY

The ORWS was led by ECCC, on behalf of the Government of Canada. To respond to Motion M-104, the purpose of the Study was to 1) identify barriers to effective management of the Ottawa River watershed, as well as opportunities to enhance watershed collaboration moving forward; 2) explore existing and potential indicators for assessing the health of the Ottawa River watershed; 3) examine the economic, cultural, heritage and natural values associated with the Ottawa River watershed, including possible threats to those values.

1.1.3. PUBLIC STATEMENTS

On May 31, 2017, the Minister of Environment and Climate Change, Catherine McKenna, delivered a speech at the 4th Annual Ottawa Riverkeeper Gala, describing the launch of the ORWS. A public statement was subsequently posted, in July 2017, on ECCC’s website, specifying the Government of Canada’s Response to Private Member’s Motion M-104 (ECCC, 2017e). On January 25, 2018, a news release announced the launch of public consultations on the ORWS, which occurred from January 25, 2018 to April 27, 2018 (Government of Canada, 2018a; Water Canada, 2018).

1.1.4. GEOGRAPHIC SCOPE

For the purposes of this Study, the Ottawa River watershed includes the Ottawa River from its headwaters in Québec’s Laurentian Mountains, to its junction with the St. Lawrence River at the Lake of Two Mountains, as well as streams, rivers and lakes that are connected to the Ottawa River (ECCC, 2017e). The Ottawa River is connected to a number of rivers along its length, such as the Gatineau, du Lièvre, Madawaska, Coulonge, Petawawa, Rouge, South Nation, Bonnechere, and Dumoine Rivers (Ottawa River Institute, n.d.). As the Ottawa River flows into, and mixes with, the waters of the St. Lawrence River, groups and communities located downstream of Lake of Two Mountains were also engaged. Figure 1.1-1 is a map of the Ottawa River watershed, and associated population centres.



FIGURE 1.1-1. MAP OF THE OTTAWA RIVER WATERSHED AND ASSOCIATED POPULATION CENTRES

1.2. DESCRIPTION OF THE OTTAWA RIVER WATERSHED

1.2.1. DEFINITION OF A WATERSHED

Wang et al. (2016) defines a watershed as “a topographically delineated area that is drained by a stream system—it is the total area above some point on a stream or river that drains past that point”. In other words, a watershed, also referred to as a catchment or drainage basin, is an area of land where all surface water and precipitation (e.g., rain or snow) drain into the same place – be it a creek, a stream, a river, or an ocean. There are two types of watersheds, open and closed. An open watershed is one that, ultimately, drains into an ocean, while a closed watershed is one in which water only leaves through evaporation, withdrawal and use, or seepage into groundwater aquifers. An aquifer is a geological formation of permeable rock or material, such as sand or gravel, capable of holding significant quantities of water (Statistics Canada, 2017c). By this definition, the Ottawa River watershed is an open watershed as it drains into the St. Lawrence watershed and, eventually, into the Atlantic Ocean.

Watersheds and sub-watersheds have been characterized by Statistics Canada. The Department identified 974 sub-sub-drainage areas representing all Canadian land and interior freshwater bodies into 25 drainage regions. Figure 1.2-1 displays the 25 drainage basins, with the Ottawa River drainage basin listed as number 20.

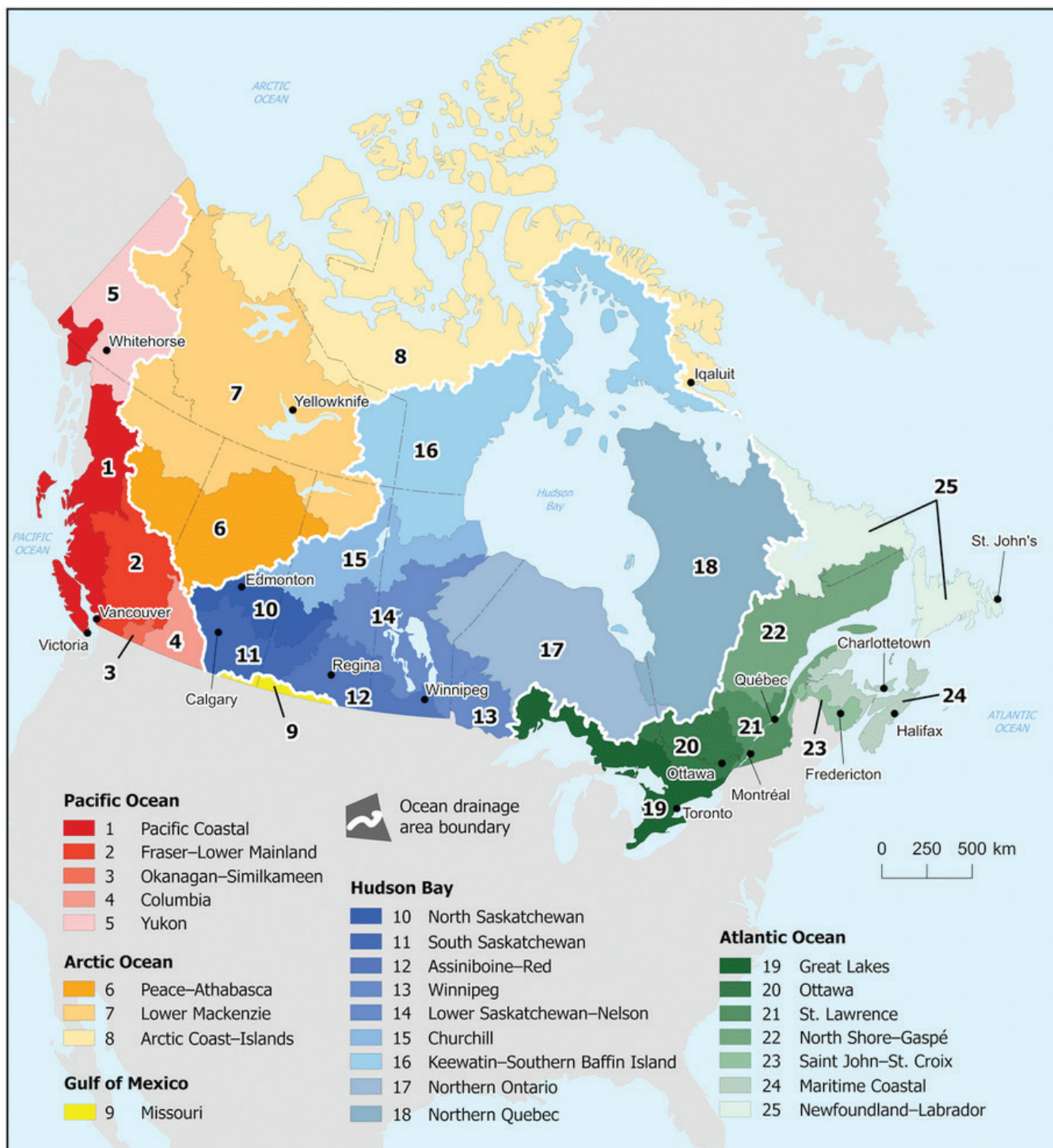


FIGURE 1.2-1. DRAINAGE REGIONS OF CANADA. (STATISTICS CANADA, 2017C)

1.2.2. PHYSICAL DESCRIPTION OF THE WATERSHED

The Ottawa River watershed covers over 140,000 square kilometers; 65% of which is located within Québec, and the other 35% in Ontario (MDDELCC, 2015). The stem of the Ottawa River has a length of more than 1,130 kilometers, and makes up the majority of the Québec-Ontario border (Ottawa River Institute, n.d.). According to the Ottawa River Heritage Designation Committee (ORHDC), the Ottawa River is Canada's 12th longest river, and ranks 8th in the country in terms of discharge volume (ORHDC, 2005).

The Ottawa River watershed contains more than 90,000 lakes, and 30 reservoirs (MDDELCC, 2015). Its flow is considered to be highly regulated due to the presence of hydroelectric dams and reservoirs in the watershed. However, because 50% of the storage capacity is within the upper reaches of the watershed, it can be challenging to manage water levels downstream (MDDELCC, 2015).

Within the watershed, the majority of the land is dominated by forests (approximately 73% forest cover on the Québec side). In the middle to southern regions of the watershed, forest cover is a combination of mixed and deciduous forests, representing 85% of all the forest cover. The remaining 15% is boreal forest, and primarily located in the northern portion of the watershed (MDDELCC, 2015).

The watershed is located within the Canadian Shield, a landform region that contains some of the oldest rocks in North America: more than 2.5 billion years old (ORHDC, 2005). The landscape of the watershed is largely a result of glacial activity from the last ice age (Pleistocene epoch, 2.6 Million years ago – 11.7 thousand years ago) (ORHDC, 2005). The Ottawa River is also the only Canadian River to cross four major geological subdivisions of the Canadian Shield, all of which have unique physical and geologic features: the Superior Province, Cobalt Plate, Grenville Province, and St. Lawrence Lowlands (ORHDC, 2005).

1.2.3. HISTORY AND PRESENT DEMOGRAPHICS

The Ottawa River watershed has a rich history. Through archaeological findings there is evidence that hunter gatherer communities occupied the area between 8,000 and 10,000 years ago. Evidence of humans from about 6,000 years ago is far more common, and while historians are apprehensive about speculating on the ethnic lineage, recorded practices and oral history suggest that certain areas display elements that are characteristic of the Algonquin people, while in other areas, such as the southeast side of the watershed, historical descriptions are more consistent with Iroquois peoples. There is substantial archaeological evidence that Indigenous peoples have travelled, traded and settled in and around the Ottawa River watershed for thousands of years. Below, the histories of three distinct Indigenous groups with present or historical ties to the watershed have been described: Algonquins, Mohawk, and Métis.

1.2.3.1. ALGONQUINS

Distinct Algonquin groups have lived throughout the Ottawa River watershed over time. According to the Algonquin worldview, the Ottawa River or “Kitchissippi” (big river in Algonquian), has been the lifeblood of the Algonquin people since time immemorial. In addition, for countless generations prior to European contact, Algonquins were considered to be the primary stewards, managers and guardians of the Kitchissippi watershed. The waterways forming the Ottawa River watershed were typically used by Algonquin communities to determine the boundaries of different family, band and tribal territories, and that those rivers and lakes linked communities together into a larger Algonquin confederacy (Morrison, 2005). Those communities are believed to have included the Ouaouechkarini (or Weskarini), along the Lièvre, Petite Nation, and Rouge Rivers; the Kichesipirini on Morisson Island and Allumette Island; the Kotakoutouemi along the Coulogne and Dumoine Rivers; the Kinouchepirini (or Quenongebin) between the Petawawa and Bonnechere Rivers; the Matouachkarini (or Matouweskarini) along Madawaska River; and the Ountchatarounounga (or Onontchataronon) along the Mississippi, Rideau, and South Nation Rivers (Lawrence, 2013).

Algonquin communities have experienced over four hundred years of colonialism in the Ottawa River watershed—including contact with missionaries, explorers, fur traders, lumbermen, settlers, miners, as well as energy developers—and the nature of their presence within the watershed has changed drastically (Morrison, 2005). Algonquin communities were considerably affected by European diseases, notably smallpox, as well as by ongoing conflict with the Haudenosaunee Confederacy. At present, there are ten Algonquin communities located within the watershed that are federally recognized as “bands” (First Nations) under the *Indian Act*. As of 2005, the ten communities had a total estimated population size of 8,000 to 10,000 people. Nine of the communities are located in Québec and one is in Ontario. The nine communities located in Québec are the Abitibiwinni (Pikogan), Timiskaming, Kebaowek (Eagle Village), Wolf Lake, Winneway, Kitcisakik, Lac-Simon, Barriere Lake (Rapid Lake) and Kitigan Zibi First Nations.

The Algonquins of Ontario are also located within the Ottawa River watershed. Algonquins of Ontario are comprised of the Algonquins of Pikwakanagan, Antoine, Kijicho Manito Madaouskarini (Bancroft), Bonnechere, Greater Golden Lake, Mattawa/North Bay, Ottawa, Shabot Obaadjiwan (Sharbot Lake), Snimikobi (Ardoch), and Whitney and Area. Algonquins of Pikwakanagan is the only Algonquin First Nation in the Ontario portion of the watershed with federal recognition under the *Indian Act*. These Algonquins of Ontario communities are working together to provide a unified approach to negotiate a modern-day Treaty. On October 18, 2016, the Algonquins of Ontario and the Governments of Ontario and Canada reached a major milestone in their journey toward reconciliation with the signing of the Agreement-in-Principle. The signing of the Agreement-in-Principle is a key step toward a Final Agreement, and a modern-day Treaty, which would clarify the rights of all concerned.

1.2.3.2. MOHAWKS

The Mohawks are one of the Six Nations of the Iroquois Confederacy. Significant archaeological evidence points to the presence of Iroquoian communities in the watershed, especially in the southeast areas. From the mouth of the Ottawa River in Kanesatake, to Luskville, west of Ottawa, Iroquoian artifacts demonstrate the presence of Haudenosaunee Confederacy peoples and communities throughout prehistoric and historic times. Of note, additional archeological research is necessary to better understand the extent and nature of the archeological artifacts within the Ottawa River watershed and the use of the territory by Algonquin and Iroquois Nations throughout time. During pre-contact times, these Nations achieved a notable milestone, through the development of a Confederacy and through devising a system of governance termed the Great Law of Peace. For the Mohawk people, the founding of the Confederacy demonstrates the value of working together in a respectful and peaceful manner, while the Great Law provides a democratic model for governance. In addition, the Creation Story, Ohen:ton Karihwahtekwen (the Thanks Giving address), the concept of the Seventh Generation, and the Two Row Wampum Treaty, form the basis of beliefs, values, traditions and philosophies, as well as a unique world view. The Creation Story explains how Mohawks came to be on the earth, and what their duties are as human beings; the Two Row Wampum Treaty instructs on how to interrelate with other governments and nations; and the concept of the Seventh Generation is a reminder to be respectful of future generations.

From Long-Sault and through the Riviere-Rouge, the Mohawks had access to Doncaster in the Laurentians, a territory they used for hunting and fishing purposes. Both Mohawks of Kanesatake and Kahnawà:ke now share jurisdiction over the Doncaster Reserve 17, known as Tioweró:ton (Thwaites, 2006).

Although little is known regarding the prehistoric political relationship between the Algonquin and Haudenosaunee Confederacies, early historic accounts refer to a time of ongoing conflict between the two confederacies from the time of contact with Europeans to the Great Peace of Montreal in 1701.

1.2.3.3. MÉTIS

The Métis are people with mixed Indigenous and European ancestry who developed their own distinct customs and way of life separate from their forbearers. These customs and traditions included, and often still include, harvesting of fish, blueberries, maple sugaring and trapping, participating in the fur trade and timber industry and music and dance practices, which included the jig and the fiddle. Michif, a mixture of old European and First Nation languages, is still spoken today by some in the Métis community; however, Michif speakers are in decline.

Throughout Ontario, Métis settlements were part of larger regional communities that were interconnected by kinship, collective identity, the mobile lifestyle of the Métis people, and the fur trade network (Métis Nation of Ontario, n.d.). During the fur trade in the 18th century, Métis settlements emerged throughout the Ottawa River watershed, with many Métis people and families employed by the North West Company in Mattawa and Fort Timiskaming. The distribution of the Métis population spans the Ottawa River, from Lac des Allumettes (Pembroke) to Timiskaming, with Métis communities continuing to live in and use the Ottawa River watershed today. Immediately downstream of the watershed in the Laurentides and Montérégie regions, Québec Métis are represented by Nation Métis Québec, which was founded in 1993 (Nation Métis Québec, n.d.). Significant Métis populations also live throughout western Canada and the Prairies (Métis Nation of Ontario, 2017).

1.2.3.4. POST-COLONIAL HISTORY

Regarded as a key component of the nation's history, the Ottawa River was a vital route in early European exploration. During the 17th century, the French established a thriving community, called New France. French missionaries were sent throughout the region in order to convert Indigenous populations to the Catholic Church, influencing Indigenous customs, traditions and language (MacGregor, 2017; ORHDC, 2005). While Indigenous communities had already established an extensive trade network throughout the region, the 17th century saw the beginning of a widespread European fur trade. For the next several years, France's booming fur trade was largely uninterrupted by other Europeans until 1670, when Britain's Hudson's Bay Company was established. Shortly after, the British founded the North West Company, spurring an increase in British exploration. By the late 18th century, fur traders began forming permanent settlements along the Ottawa River. In the early 1800s, timber demand from North America skyrocketed, with an estimated 80 million logs taken from the Ottawa River valley. This demand created jobs, and spurred emigration; Irish, Scottish and French Canadians began travelling to the area in hopes of earning wages in forestry, farming and other pursuits (ORHDC, 2005).

Both farming and forestry vastly changed the landscape of the Ottawa River watershed region, displacing Indigenous peoples and stimulating regional development for Europeans. Contributing to the changing landscape, as well as the availability of jobs, was the construction of the Rideau Canal, a navigable waterway between Lake Ontario and the Ottawa River. From 1826 to 1832, thousands worked on the 202 km long canal. Once completed, the canal was a valuable trading route, and contributed to the establishment and growth of Bytown. In 1855, Bytown was renamed Ottawa (Rideau Info, 2018). In 1857, Ottawa was declared the capital of the United Province of Canada, which resulted in further migration to the area. Influxes of people moved from Toronto, Kingston, Montreal and Québec City, joining large numbers of Irish, Scottish and French, along with smaller numbers of Belgians, Swiss, Italians, Germans, and Poles. The majority of immigrants were Irish, who brought distinct food, songs, stories and dance to the region. During the 1880s, an Ottawa Valley culture began to emerge, created by a melding of Irish, French Canadian and other settler cultures.

Over the next century, industries began to diversify, with mining operations, forest products processing, hydroelectric power and nuclear energy research becoming prominent (ORHDC, 2005; MacGregor, 2017). Remnants of the Ottawa River watershed's post-colonial history is still abundant today, with decades old hydroelectric dams still in operation, and the Rideau Canal weaving its way through the capital region's historic homes.



Today, the Ottawa River watershed is home to more than 2 million people; however, the population of the watershed is not evenly distributed. The highest concentration of the population is along the main stem of the Ottawa River and within the National Capital Region (NCR) of Ottawa-Gatineau (MDDELCC, 2015). See ECCC's map in section 1.1 (Figure 1.1-1), which depicts the population centers in and around the Ottawa River watershed. The most common origins were identified by Statistics Canada's 2016 Census, as North American, British Isles, French, Western European and Asian; approximately 132,000 individuals identified as being of North American Indigenous origin.

The average age of the population in the Ottawa River watershed is 41.5 years old, and the average household size is 2.4 people. Over 150 languages are spoken in homes across the watershed. However, in terms of languages spoken most at home, approximately 53% of the population speak English, 37% speak French, and 6% speak other languages. Roughly 0.03% of the population speak an Indigenous language in their home, with the majority of these languages coming from Algonquian roots. Approximately 4% of the population speak more than one language at home.

The following infographic (Figure 1.2-2), presents a summary of additional demographic information for the Ottawa River watershed from Statistics Canada's 2016 Census (Statistics Canada, 2017d)¹. The full analysis of the census data can be found in Appendix B.

¹ The demographics presented in this section are adapted from Statistics Canada, Semi-custom Profile, Census 2016. This does not constitute an endorsement by Statistics Canada of this product (Statistics Canada, 2017d). Demographics come from both the long-form and short-form census. It should be noted that in semi-custom profiles, Statistics Canada will use area suppression, as needed, in order to remove all characteristic data for geographic areas whose population size is below a certain threshold. This is done to ensure confidentiality.

SUMMARY DEMOGRAPHICS OF THE OTTAWA RIVER WATERSHED

ETHNIC ORIGINS

Approximately 73% of respondents identified their ethnic origin as one or more of the following:



89% of the population have a high school diploma or higher

Top field of study is business, management, and public administration

Top labour force occupations are:

- Sales and service
- Business, finance and administration
- Education, law and social, community and government services



Average household income:

- One-person household \$47,542
- Two-or-more person household \$108,924



The Top 3 industries in the Ottawa River watershed are:

- Retail trade
- Health care and social assistance
- Public administration



- 70% of the population identified themselves as "third generation or more"
- 14% as "second generation"
- 16% "first generation" Canadian



Approximately 69% of respondents are home owners, and 31% are renters

7.2%

The unemployment rate

41.5

Average age of the population

250+

More than 250 languages are spoken in homes across the watershed
Roughly 0.03% speak an Indigenous language at home

132,000

Approximate number of respondents that identified as being of North American Indigenous origin

FIGURE 1.2-2. SUMMARY OF THE DEMOGRAPHICS IN THE OTTAWA RIVER WATERSHED

1.3. ROLES, RESPONSIBILITIES AND ORGANIZATIONS IN THE WATERSHED

Many groups have important roles and responsibilities within the Ottawa River watershed, including the governments of Québec and Ontario, the federal government, municipalities, Indigenous peoples, local watershed management agencies, industry, and others, such as non-governmental organizations, academia, and the general public (Government of Canada, 2017b).

Responsibilities, within the context of watersheds, can be defined as the statutory requirements of an authority to take all necessary measures to protect and conserve water resources. Roles, on the other hand, may be defined as the functions that are expected of an authority or a stakeholder. Roles may not necessarily be driven by legal requirements, but rather by the desire to meet an objective, which would be aligned with that stakeholder's mission. This section provides an overview of those roles and responsibilities within the context of the Ottawa River watershed.

1.3.1. GOVERNMENTAL RESPONSIBILITIES

There are three main levels of government that share responsibilities in the Ottawa River watershed: the governments of Québec and Ontario, the federal government and municipalities. Water-related jurisdiction for the federal government and the provinces are largely determined by sections 91, 92 and 109 of the *Constitution Act, 1867*. Specifically, section 91 applies to federal oversight of fresh water, and sections 92 and 109 allocate provinces legislative powers regarding the management and ownership of Crown lands, including water. However, unlike responsibilities for resources such as timber and fisheries, heads of power regarding water resources or overall water management are not specifically described. This section clarifies the responsibilities of the different authorities in the Ottawa River watershed. It should not be interpreted as reflecting the official position of governments on this matter.

1.3.1.1. PROVINCIAL JURISDICTION

Provincial governments are responsible for water resources within their boundaries. The governments of Québec and Ontario have considerable responsibilities and play a crucial role in management and monitoring of the Ottawa River watershed. Provinces are responsible for the management of provincial crown land, which includes the protection of freshwater resources, monitoring and pollution control, agriculture, health, municipal affairs and land planning, natural resources management and environmental protection (Government of Canada, 2017b).

The governments of Ontario and Québec have passed legislation and policies on water. Within Québec, applicable legislation and policies include the *Québec Water Policy* (2002), the *Act to Affirm the Collective Nature of Water Resources and to Promote Better Governance of Water and Associated Environments (Québec Water Act, 2009)*, the *Environment Quality Act* (2018) and the *Québec Water Strategy* (2018). Within the province of Ontario, key water-related legislation and policies include the *Conservation Authorities Act*, *Nutrient Management Act, 2002*, and the *Clean Water Act, 2006*. Additionally, the provinces are responsible for the issuance of water use permits. Ontario and Québec also have important roles in supporting organizations that facilitate collaboration at the sub-watershed level, such as the Conservation Authorities (CAs) and the Organismes de bassin versant (OBVs), which are discussed further in section 1.3.4 Roles of Local Watershed Management Agencies.

THE GOVERNMENT OF QUÉBEC

Québec's *Water Policy* and the *Québec Water Act* affirm water as an important part of the province's collective heritage, with a goal to protect its quality and its ecosystems (MDDEP, 2009). The province implements a watershed-based management strategy using a sustainable development approach (MDDEP, 2009). This approach has been reinforced with the *Québec Water Strategy* in 2018. In the province, the governance of watersheds is partly delegated to watershed management agencies (OBVs), Regional Stakeholder Tables on the St. Lawrence (TCR) and Regional County Municipalities. The term "watershed management" is discussed in section 3.1: Watershed Management Approaches.

Under Québec's *Environment Quality Act* and *Wetland Conservation Act*, the Government of Québec is responsible for the protection of aquatic habitats (lakes, watercourses, banks, shorelines and floodplains), including plants and animal species. The *Environment Quality Act* also enabled the government to create new regulation regarding drinking water, municipal wastewater treatment systems, water withdrawals and transfers of water out of the St. Lawrence River Basin. The *Wetland Conservation Act* provides a regime for conserving and restoring wetlands as well as their waters (MELCC, 2018b). The *Watercourses Act* monitors and regulates the usage of watercourses in terms of development and construction works. Additionally, the *Pesticides Act* requires the government to supervise and control pesticide use on agricultural lands that could have an adverse effect on aquatic environments (Government of Québec, 2018).

THE GOVERNMENT OF ONTARIO

The province of Ontario also promotes the importance of freshwater protection through the implementation of legislation, such as the *Nutrient Management Act, 2002*, which is designed to manage nutrients derived from farmlands ensuring sustainable agriculture practices and the protection of the environment. The *Fish and Wildlife Conservation Act, 1997* and the *Clean Water Act, 2006*, mandate the protection of plant and animal species and all sources of drinking water, within the province. Both pieces of legislation work in tandem with the *Conservation Authorities Act*, which mandates the Government to establish a network of organizations to deliver programs and services that further the conservation, restoration, development and management of natural resources within local watersheds (Government of Ontario, 2017a).

Under the *Water Resources Act*, the province of Ontario provides for the conservation and protection of water resources; licensing and issuing of water permits to users and suppliers; and the efficient management and sustainable use of Ontario's water resources for the promotion of a long-term environmental, social and economic well-being (Government of Ontario, 2016b). Through the *Pesticides Act*, the province also has the responsibility to monitor and control pesticide releases that can be detrimental to water resources. Moreover, the *Lakes and Rivers Improvement Act*, the *Forestry Act* and the *Municipal Act*, require the Government of Ontario to protect and secure shorelines from erosion and flooding.

1.3.1.2. FEDERAL JURISDICTION

The main federal responsibilities with implications on the Ottawa River watershed include Aboriginal rights and title, the regulation of fisheries, shipping, navigation, and the management of federal lands. Section 35 of the *Constitution Act, 1982* protects Aboriginal rights and title and section 91 of the *Constitution Act, 1867* also grants the federal Parliament broad legislative powers for "Peace, Order and Good Government" and "Criminal Law", which can be exercised for matters of national importance, such as protecting fresh water, even if that matter is normally under provincial jurisdiction. The Government of Canada also undertakes water quantity and quality monitoring in collaboration with provinces, and administers programs that provide funding to provinces towards water and wastewater infrastructure. Federal legislation, such as the *Canada Water Act*, *Canadian Environmental Protection Act, 1999*, *International Boundary Waters Treaty Act*, and the *Fisheries Act*, provide for the management and protection of freshwater resources and the activities that depend upon it as it relates to areas of federal jurisdiction, such as fisheries and fish habitat, navigation, bulk water exports, nuclear safety, federal lands and transboundary waters.

The main federal statutes that enable the Government of Canada to manage water, or participate in watershed management, include:

- *Canada Water Act*;
- *Fisheries Act* (currently under review);
- *Canadian Environmental Protection Act, 1999*;
- *Canadian Environmental Assessment Act, 2012*;
- *Arctic Waters Pollution Prevention Act*;
- *Canada Shipping Act, 2001*;
- *Dominion Water Power Act*;
- *Nuclear Safety and Control Act*;
- *International Boundary Waters Treaty Act*;
- *International River Improvements Act*;
- *Navigation Protection Act*;
- *Northwest Territories Act*;
- *Nunavut Waters and Nunavut Surface Rights Tribunal Act*;
- *Migratory Birds Convention Act, 1994*;
- *Species at Risk Act*;
- *An Act respecting certain Works on the Ottawa River*².

The *Department of the Environment Act* identifies ECCC as the lead Department on water issues within the federal government, in areas not under the responsibility of other federal Departments. ECCC also has mandated responsibilities under specific pieces of legislation, such as pollution prevention and enforcement of general prohibitions on pollution and quality standards for effluents (i.e., under the *Migratory Birds Convention Act, 1994*, and the *Fisheries Act*). ECCC also undertakes monitoring of freshwater quality and quantity, pursuant to agreements with the provinces enabled under the *Canada Water Act*.

About 20 other federal Departments and agencies are involved in addressing water issues in some respect in the Ottawa River watershed. Key Departments include:

- Fisheries and Oceans Canada (DFO) (e.g., aquatic science research, fish habitat protection)
- Canadian Coast Guard, a special Operating Agency under DFO (e.g., aids in ensuring safe and accessible waterways)
- Agriculture and Agri-Food Canada (AAFC) (e.g., sustainable on-farm water management practices, drought monitoring)
- Indigenous Services Canada and Crown-Indigenous Relations and Northern Affairs (e.g., Indigenous drinking water and wastewater capacity)
- Health Canada (e.g., Drinking Water Quality Guidelines, water quality and health research)
- Natural Resources Canada (NRCan) (e.g., groundwater aquifer assessment and characterization, National Hydrographic Network, remote sensing and mapping to respond to floods)
- Transport Canada (e.g., navigable waters)
- Infrastructure Canada (e.g., funding support for water and wastewater systems)

² This Act is still in force but no longer has legal application as Transport Canada's *Navigation Protection Act* now effectively addresses what was covered by the 1870 Act. Of note, the Ottawa River is listed as item 52 in the *Navigation Protection Act's* Schedule.

- Canadian Nuclear Safety Commission (CNSC), an independent federal government agency, which regulates nuclear activities throughout Canada, including activities of the Canadian Nuclear Laboratories in Chalk River and Rolphton (Nuclear Power Demonstration)
- Public Safety Canada (e.g., emergency management for flooding, disaster mitigation)
- Public Services and Procurement Canada (e.g., operates water control dams on the Ottawa River)
- National Capital Commission (NCC) (federal Crown Corporation; planning, and partnering in the development, conservation and improvement of federal lands in Canada's National Capital Region (NCR))

The *Canada Water Act* provides an enabling framework for collaboration among the federal, provincial and territorial governments in matters relating to watershed management. The Act enables the Minister of Environment and Climate Change to enter into agreements and joint programs with provinces and territories regarding regulation, apportionment, monitoring or surveying of water resources, as well as planning and implementation of watershed protection. The *Canada Water Act* requires the Minister to prepare an annual report to Parliament on operations under the Act, which outlines activities undertaken in support of joint agreements and programs. ECCC has entered into such agreements with the two provincial governments in the Ottawa River watershed, the Governments of Ontario and Québec (i.e., to establish the Ottawa River Regulation Planning Board). Additionally, given the presence of the Rideau Canal within the watershed, the *Department of Transport Act* is also leveraged to manage water regulations within the canal.

1.3.1.3. MUNICIPAL JURISDICTION

There are about 200 municipalities in the Ottawa River watershed the most populous of which include the cities of Ottawa, Gatineau, Petawawa, Pembroke, and Rigaud. Municipal governments are generally responsible for drinking water and wastewater treatment services. Municipalities also undertake watershed protection initiatives within their respective areas of jurisdiction. In 2003, the municipalities of Ottawa and Gatineau partnered with the NCC to release the Ottawa River Integrated Development Plan, including recommended projects to be implemented over the long term. One such recommendation was that an Ottawa River Summit be held. An Implementation Guide for the Ottawa River Integrated Development Plan was released in 2009, and Ottawa Riverkeeper led the first Ottawa River Summit in 2010, with the support of the NCC, the City of Ottawa, and the City of Gatineau (NCC, n.d.-b). Also in 2010, the City of Ottawa released an Ottawa River Action Plan, a collection of 17 planned projects to improve the health of the watershed. Ottawa's Combined Sewage Storage Tunnel project, for example, is a \$232.3 million investment to reduce combined sewer overflows to the Ottawa River, with funding support from the governments of Canada and Ontario. The project is expected to be operational by 2020 (City of Ottawa, n.d.).

Local regional governments, such as counties, may also be responsible for wetland conservation, waste management, and the protection of shorelines and floodplains from encroaching development within their regional boundaries (Government of Canada, 2017b). In both the provinces of Ontario and Québec, the municipalities and regional government authorities have been delegated some managerial functions in terms of watershed protection. For example, in Ontario, under the *Environmental Protection Act*, the *Ontario Water Resources Act* and the *Planning Act*, the province of Ontario has the responsibility in partnership with the municipality to protect potable water sources, construct, operate and manage water supply and sewage services, as well as provide adequate remedial measures in situations of infrastructure default (Government of Ontario, 2016b). In Québec, the *Conservation of wetlands and bodies of water Act* reaffirms the government's partnership with the municipal sector, in particular by specifying the role of Regional County Municipalities in urban planning, development of plans related to banks, shorelines and flood plains, wetland mapping, and the management of restoration programs. Municipalities also often analyze the vulnerability of drinking water sources and develop source water protection plans (MELCC, 2018q).

1.3.2. INDIGENOUS PEOPLES

There are several Indigenous organizations that represent the interests and views of multiple communities. At the regional level, the Assembly of First Nations Québec-Labrador and the Chiefs of Ontario play a secretariat and political forum role for collective decision-making, action and advocacy for First Nations communities in Québec and Ontario, respectively. At the national level, the Assembly of First Nations is an advocacy organization representing First Nations with federal recognition under the *Indian Act*, which includes over 900,000 people living in 634 First Nation communities, as well as cities and towns across the country. The Congress of Aboriginal Peoples represents off-reserve status and non-status Indigenous peoples at the national level. Within the watershed, four organizations and two communities were consulted, in order to obtain perspectives, information and Indigenous Knowledge. Indigenous Knowledge can be found in a wide variety of contexts, including: agricultural, scientific, technical, ecological and medicinal knowledge, as well as biodiversity-related knowledge (WIPO, 2010). Throughout this report, the term Indigenous Knowledge will be used, with the exception of direct quotes.

1.3.2.1. ABORIGINAL RIGHTS

Section 35 of the *Constitution Act, 1982* recognizes and affirms Aboriginal rights. These rights have been interpreted to include a range of social, political and economic rights, which include right to land, as well as to fish, to hunt, to practice one's own culture, and to establish treaties (Tester, 1985). Relevant wording of the Act is included below:

1. The existing aboriginal and treaty rights of the aboriginal peoples of Canada are hereby recognized and affirmed.
2. In this Act, “aboriginal peoples of Canada” includes the Indian, Inuit and Métis peoples of Canada.
3. For greater certainty, in subsection (1) “treaty rights” includes rights that now exist by way of land claims agreements or may be so acquired.

1.3.2.2. ALGONQUINS

A number of Algonquin organizations were formed in order to represent the collective voices of multiple Algonquin communities. Algonquin Anishinabeg Nation Tribal Council was formed by of six First Nations in Québec – Kitigan Zibi, Kebaowek (Eagle Village), Winneway, Lac-Simon, Kitcisakik, and Abitibiwinini (Pikogan) First Nations – as well as one First Nation in Ontario, Wahgoshig First Nation. Similarly, the Algonquin Nation Secretariat is comprised of three other Algonquin communities in Québec: Timiskaming, Wolf Lake, and Barriere Lake First Nations. In the Ontario portion of the watershed, Algonquins of Ontario is comprised of Pikwakanagan First Nation, as well as nine Algonquin collectivities throughout communities in eastern Ontario without federal recognition as “status” First Nations under the *Indian Act*. Those nine communities are the Antoine, Bonnechere, Greater Golden Lake, Kijicho Manito Madaouskarini (Bancroft), Mattawa/North Bay, Ottawa, Shabot Obaadjiwan (Sharbot Lake), Snimikobi, and Whitney and Area Algonquin collectivities.

The Algonquins of Golden Lake (now the Algonquins of Pikwakanagan) began negotiating a comprehensive land claim with Ontario in 1991; Canada joined the negotiations in 1992. However, due to actions from other Algonquin groups seeking involvement at the negotiation table, it was recognized that the Algonquins of Pikwakanagan did not represent all Algonquins in Ontario. In 2005, negotiations expanded to include nine Algonquin collectivities that make up Algonquins of Ontario. There are a number of other Algonquin communities located within the watershed, which do not have federal recognition as “bands” (First Nations) under the *Indian Act*, and are not participating in the Algonquins of Ontario land claim negotiation process, despite attempts by negotiators for Canada and Ontario to include them in the process. Scholars have found that the majority of Algonquin peoples in Ontario do not currently have federal recognition, largely because they were not assigned reserves during the colonization process, or lost federal recognition as a result of marriage to “non-status” persons (*Indian Act* was amended in 1985 so that the loss of status through marriage to “non-status” persons could be prevented and reversed). This is inconsistent with national

Census data, which states 81% of First Nations peoples have federal recognition under the *Indian Act* and 19% do not (Hedican, 2017). Networks of “non-status” Algonquin families are located in places such as Ardoch, Baptiste Lake, Mattawa, Sharbot Lake, Whitney, Allumette Island, and Pembroke (Lawrence, 2013).

Throughout the course of the ORWS, ECCC was made aware that there are differing opinions within and between Algonquin communities as a result of colonial history and the Crown’s policies. Some Indigenous organizations indicated that this had caused some Indigenous peoples to not flourish in recent history. Some Algonquin groups are opposed to the Algonquins of Ontario land claim negotiation process, and expressed the view that Algonquins of Ontario is not sufficiently representative of all Algonquins (Munson, 2016). Specifically, the Algonquin Nation Secretariat stated that their participation in the ORWS process should not be construed as endorsing or supporting the current Algonquins of Ontario Agreement-in-Principle or an anticipated Algonquins of Ontario Treaty. In addition to the land claim negotiation process, division and tension has been exacerbated by the fact that some Algonquin communities are recognized as bands under the *Indian Act* while others are not. Ardoch Algonquin First Nation and Allies, for example, is an Algonquin community located along the Madawaska, Mississippi and Rideau Rivers, which does not have federal recognition under the *Indian Act* and is opposed to the Algonquins of Ontario land claim negotiation process. Algonquin First Nations located in Québec, with federal recognition under the *Indian Act*, have also expressed opposition to the Algonquins of Ontario land claim negotiation process, asserting that they continue to have Aboriginal rights and title to land in Ontario, as the provincial border separating Ontario and Québec did not exist prior to colonization by Europeans (Melnitzer, 2017). Over the years, Québec Algonquin communities have also submitted a number of land claim assertions and declarations to the Government of Canada. Most of these assertions have included territory on both the Ontario and Québec sides of the Ottawa River watershed.

1.3.2.3. MOHAWKS

The Mohawks are one of the Six Nations of the Iroquois Confederacy. In December 2005, a statement of solidarity was made between the Elected Councils of Kahnawà:ke, Kanesatake, Akwesasne, Tyendinaga, Wahta, Six Nations of Grand River and Oneida Nation of the Thames. The statement identifies common responsibilities and systems of governance. In March 2006, a declaration of “the members of the Iroquoian Caucus³” was made to the Special General Assembly of the Assembly of First Nations acknowledging the efforts and work of the Assembly of First Nations Renewal Commission, but emphasizing that “we must continue on our own path... we will continue to speak and represent ourselves and therefore cannot support any change or process that may effectively diminish our voice.” The Mission of the Iroquois Caucus is to “present a unified voice on common issues to protect and enhance the rights, language, culture, lands, environment and resources for the benefit of our People,” and the vision is “with the foundation of our Haudenosaunee culture, we work together to strengthening our Nations through the protection and maintenance of our rights and jurisdiction”. In this manner the Iroquois Caucus is comprised of delegates from each of the seven Iroquois Communities. The Iroquois Caucus Declaration of Principles states that “the Iroquois People have consistently and historically declared exclusive jurisdiction over all matters in their territories; have continued to exercise the right and responsibility to govern their affairs without interference; have continued to exercise these responsibilities using their own form of political, legislative and administrative processes; agreed to promote and protect the Iroquois languages, culture, and autonomy; and agreed to respect and recognize the unique responsibilities, authority and jurisdiction inherent within their respective communities” (Iroquois Caucus, 2014).

Kahnawà:ke is one of the communities that made up the Mohawk (Kanien;keha’ka) Nation with historical, political and cultural ties based on Honor, Trust and Respect to the Oneida, Seneca, Onondaga, Cayuga and Tuscarora Nations located in the Northeastern part of North America, including the Ottawa River watershed. The contemporary community of Kahnawà:ke has sustained itself and is built on its rich cultural background. The Kanesatake Mohawk Nation is located just upstream of the

³ The Iroquois Caucus is the elective band council system that the Federal and Provincial governments of Canada “recognize” as their representative governments within our lands. The Iroquois Caucus is not to be confused with the traditional “Iroquois” Confederacy that pre-existed prior to European contact.

junction of the Ottawa River and the St. Lawrence River. The Kahnawà:ke Mohawk Nation is located on the St. Lawrence River (Lac-St-Louis) downstream of its confluence with the Ottawa River. Kanesatake shares historical aspects with other communities; however, each community has their own unique history tied to place. Kanesatake and other Kanien'kehá:ka territories and communities still have citizens of the traditional Five Nations (later known as Six Nations) Confederacy who adhere to the ancestral laws and teachings of The Great Binding Law of Peace. In accordance with their Great Law, people are married, children are named and the dead are buried in accordance with these ancient rites, actions that give life and spiritual meaning to the often appropriated words and symbols (Bisson & Mohawk community of Kanesatake, 2018).

1.3.2.4. MÉTIS

Métis peoples and communities located in Ontario are represented by the Métis Nation of Ontario. In Supreme Court *R v. Powley*, the Supreme Court of Canada held that Métis rights are protected by section 35 of the *Constitution Act, 1982*. The case also helped to establish a framework for recognition of Métis rights. In order for Métis communities to possess section 35 rights, it must have its roots in an identifiable historic Métis community that emerged prior to the time when Europeans established political and legal control in the area.

In Ontario, the rights, interests and aspirations of the Métis people are represented by the Métis Nation of Ontario. The Métis Nation of Ontario has a democratic governance structure, which involves provincial and regional elections every four years. To represent the rights and interests of specific communities, Métis Nation of Ontario Community Councils have been established throughout the province, including in the Ottawa River watershed area, each with a mandate to support local governance (Métis Nation of Ontario, n.d.). In Québec, many Métis communities are represented by Nation Métis Québec.

1.3.2.5. NATIONAL AND REGIONAL ORGANIZATIONS

Many Indigenous communities were contacted about participating in the consultation process for the ORWS, although not all participated (detailed in Appendix D). Indigenous communities frequently do not have the capacity to participate in consultation processes. One or more communities are often represented by broader organizations, which provide a range of services. For example, organizations can provide a collective voice, administrative, operation and/or technical services, support to member communities, and protection and advancement of the rights of their respective community or communities (IIGR, n.d.). Throughout this report, the term “Indigenous organization” will be used to refer to these broader organizations, while “Indigenous communities” will be used to refer to individual communities.

There are varying scales of Indigenous Representative Bodies, many of which operate at a national or provincial scale. These organizations include the Assembly of First Nations, Congress of Aboriginal Peoples, Métis National Council and Native Women's Association. They serve a variety of purposes including presenting or representing the views of member groups on issues such as environment, economic development, and treaty rights, and the representation of specific Indigenous intersections, such as women. There are also several regional Indigenous Representative bodies, including Algonquin Anishinabeg Nation, Algonquin Nation Secretariat, Algonquins of Ontario, Chiefs of Ontario and Institut de développement durable des Premières nations du Québec et du Labrador (IIGR, n.d.).

1.3.3. OTHER COLLABORATIVE INITIATIVES

Due to shared jurisdiction related to water resources, water management is often undertaken collaboratively by multiple levels of government. Examples of joint initiatives undertaken in the Ottawa River watershed include the Ottawa River Regulation Planning Board (ORRPB) and the Joint Directors Committee on Water Management.

1.3.3.1. OTTAWA RIVER REGULATION PLANNING BOARD

The ORRPB was established through the *Canada Water Act* by the governments of Canada, Québec, and Ontario in 1983 to ensure integrated management of the principal reservoirs of the Ottawa River watershed. This integrated management of flow aims to minimize flood and drought damage along the Ottawa River, with particular attention to the Montreal region, while maintaining beneficial water uses such as hydro-electric power production and preserving statutory or environmental levels and discharges in respect of other interests (ORRPB, 2017). In the 1983 context, the term “integrated management” meant integrating the decision-making processes of respective dam operators into one process that provides a common information and decision-support system. The Board is composed of seven members who represent the federal government (3 members), the governments of Québec (1 member) and Ontario (1 member), Hydro-Québec (1 member) and Ontario Power Generation (1 member). At the federal level, ECCC, Public Services and Procurement Canada and the Canadian Coast Guard are involved in the ORRPB. ECCC staff provide scientific, engineering and management expertise; Public Services and Procurement Canada staff are involved as the Department owns the dam on the Lake Timiskaming reservoir; and the Canadian Coast Guard undertakes operational roles related to the *Navigation Protection Act*, while ensuring safe and accessible waterways for Canadians. The ORRPB does not have legal authority over the decisions of the operators of the reservoirs, and each operator is responsible for the operational strategies and decisions for respective facilities. The Board members work together to establish and implement general principles, priorities and overall regulation policies for integrated management of the reservoirs. Decisions are made by voting of all seven members, and unanimous consensus is required for a motion to pass. The authority of the Board is defined by the *Agreement Respecting Ottawa River Basin Regulation*. The ORRPB also ensures that relevant information (e.g., forecasts of river flows and levels along the Ottawa River) is made available to the public and government organizations, especially provincial agencies, given that the preparation and issuance of flood messages along the Ottawa River are a provincial responsibility (ORRPB, 2017).

1.3.3.2. QUÉBEC-ONTARIO WATER MANAGEMENT JOINT DIRECTORS COMMITTEE

The interprovincial Québec - Ontario Water Management Joint Directors Committee was created in 2015 and was then reaffirmed under the 2016 Environmental Cooperation Agreement between Ontario and Québec. Through this Agreement, the governments of Ontario and Québec committed to the strengthening of existing bilateral cooperation; information exchange on shared watersheds and ecosystems; to work mutually to address environmental issues; and to prevent and mitigate adverse transboundary impacts (Government of Ontario, 2015; Government of Ontario, 2016a). The joint committee provides a platform for Québec and Ontario to discuss water management issues, including management of the Ottawa River watershed.

1.3.3.3. CANADIAN COUNCIL OF MINISTERS OF THE ENVIRONMENT

The Government of Canada has a long history of collaborating with provinces and territories through the Canadian Council of Ministers of the Environment (CCME). CCME works cross-jurisdictionally to provide guidance and Canada-wide tools for water management (e.g., Canadian water quality guidelines development, advice to inform surface and groundwater decision-making).

1.3.3.4. EASTERN HABITAT JOINT VENTURE

Since 1989, the provincial and federal governments and NGOs, such as Ducks Unlimited Canada and the Nature Conservancy of Canada, have been working together to create the Eastern Habitat Joint Venture. These partners have been delivering wetland-habitat conservation projects in Eastern Canada, as part of the continental North American Waterfowl Management Plan – an international partnership with Canada, the United States and Mexico, to conserve wetland and associated upland habitats for the benefit of waterfowl and other migratory birds. Eastern Habitat Joint Venture partners in both Ontario and Québec work together to undertake habitat conservation and restoration projects for wetlands within the areas of the Ottawa River watershed that have been identified as priority areas for conservation work (Eastern Habitat Joint Venture, 2018).

1.3.4. ROLES OF SUB-WATERSHED MANAGEMENT AGENCIES

This section provides a brief description of sub-watershed management agencies that are active in the Ottawa River watershed. More information on their contributions to monitoring activities, data collection and research can be found in chapter 4: Data, Monitoring, and Potential Indicators.

1.3.4.1. ORGANISMES DE BASSINS VERSANTS

With the adoption of the *Québec Water Policy* in 2002, a network of 33 local watershed management agencies, called Organismes de bassins versants (OBVs), were established to ensure the conservation of water resources, and associated environments throughout Québec. The OBVs within the watershed are displayed in Figure 1.3-1, along with Conservation Authorities (described in this section). In 2009, the distribution of OBVs was modified to increase coverage of the province, which brought the total number of OBVs to 40 (COBAMIL, 2010). Of note, the northern part of Québec does not yet have any OBVs or other forms of integrated water resource management in place. The primary function of OBVs is to act as a consultative body, geared toward bringing together stakeholders from all sectors, in order to ensure participatory governance of a watershed. Membership differs, depending on local contexts, but typically includes representatives from municipalities, regional county governments (municipalités régionales de comté or MRC), local non-governmental organizations (NGOs), the general public, economic sectors, and Indigenous communities. All OBVs are brought together by the non-profit umbrella coalition called Regroupement des organismes de bassins versants du Québec (ROBVQ), which supports its members through offering training, tools, programs and services to OBVs (MELCC, 2018b, ROBVQ, 2018). Under section 14 of the *Québec Water Act*, each OBV is required to develop and put a Watershed Master Plan (Plan directeur de l'eau) in place for its Integrated Management Area, and subsequently promote, update and monitor its implementation. Additionally, it is required that the plan and its implementation ensure a balanced representation of users and various interested parties, including government, Indigenous peoples, municipalities, economic sectors, environmental organizations, agriculture representatives and community members within respective basin organizations (MDDELCC, 2015).

The Québec portion of the Ottawa River watershed was subdivided into seven integrated water management zones (see Figure 1.3-1). Within these zones, water management initiatives are carried out by seven OBVs (ROBVQ, 2018): Conseil du bassin versant de la région de Vaudreuil-Soulanges (COBAVER-VS); Conseil des bassins versants des Mille-Îles (COBAMIL); Comité du bassin versant de la rivière du Lièvre (COBALI); Organisme de bassin versant du Témiscamingue (OBVT); Organisme de bassins versants des rivières Rouge, Petite Nation et Saumon (OBV RPNS); Organisme de bassin versant de la rivière du Nord (ABRINORD); and Agence de bassin versant des 7 (ABV 7).

A CLOSER LOOK: A PARTICIPATORY, BOTTOM-UP GOVERNANCE APPROACH

Québec's IWM model is based on a participatory, bottom-up governance approach. OBVs prioritize stakeholder trust and engagement by bringing together various water users through a variety of participatory mechanisms to discuss priorities and to develop actions. These mechanisms include technical committees and round tables, which allows Indigenous organizations, economic sectors, community members, municipalities and many other groups to better coordinate on water-use issues. This model is gaining international and academic attention and has allowed OBVs to collaborate with other countries and regions, such as France, Mexico and Martinique.

1.3.4.2. REGIONAL ROUND TABLES AND ZONE D'INTERVENTION PRIORITAIRE COMMITTEES IN QUÉBEC

Integrated management has long been a priority in the St. Lawrence River, and today is implemented through Regional Round Tables. There are 12 Regional Round Tables being implemented, of which six are already active. Of note, the other six are scheduled to be planned and coordinated over the next five years, under the Québec Water Strategy. Regional Round Tables are independent, permanent, multi-stakeholder entities responsible for individual geographical areas covering the length of the St. Lawrence River. The primary purpose of Regional Round Tables is to promote collaboration amongst stakeholders in their respective sections of the St. Lawrence River basin, and harmonize their actions in order to ensure integrated management of the basin. Each Regional Round Table is responsible for the development and implementation of an Integrated Resource Management Plan (SLAP 2011-2026, 2012). These plans are developed to assist Regional Round Tables in accomplishing their mission. Additional committees exist in Areas of Prime Concern, known as zones d'intervention prioritaire, or areas of prime concern, committees, and represent important partners, among others, in supporting the work of Regional Round Tables. Zones d'intervention prioritaire Committees were established previously, in 1993, in a joint initiative led by the governments of Québec and Canada. There are now 12 zones d'intervention prioritaire Committees in total, including in areas without Regional Round Tables, which are responsible for coordinating the development of Regional Integrated Management Plans.

1.3.4.3. REGIONAL COUNTY MUNICIPALITIES

Regional County Municipalities are political entities which are responsible for land management. Regional County Municipalities develop regional plans for wetlands and water resources within their domain and they often collaborate with relevant OBVs, Regional Round Tables and other watershed municipalities.



FIGURE 1.3-1. MAP OF THE WATERSHED MANAGEMENT AGENCIES IN THE OTTAWA RIVER WATERSHED

1.3.4.4. CONSERVATION AUTHORITIES

Established under the *Conservation Authorities Act, 1946*, there are currently 36 Conservation Authorities (CAs) throughout Ontario. Conservation Ontario is a non-profit association established to represent the network of 36 CAs. The mandate of CAs is to oversee, at the watershed level, the conservation, restoration and responsible management of aquatic habitats, lands and natural resources, while balancing environmental, economic and human needs (Conservation Ontario, 2018b). Five CAs operate within the Ottawa River watershed. They are the: Mississippi Valley Conservation Authority (MVCA); Rideau Valley Conservation Authority (RVCA); South Nation Conservation Authority (SNCA); Raisin Region Conservation Authority (RRCA); and North Bay-Mattawa Conservation Authority (NBMCA), and are displayed above in Figure 1.3-1, along with OBVs. While 90% of Ontario's population lives in a watershed managed by a CA, CAs are primarily located in southern Ontario, and do not provide full coverage of the Ontario portion of the Ottawa River watershed. Notably, the region around the county of Renfrew and Algonquin Park are not managed by a CA. Watershed programs and services managed by CAs include (Government of Ontario, 2017a):

- Watershed planning and management, and the protection of watercourses, wetlands and hazardous lands subjected to flooding and erosion;
- Monitoring and advice on fish habitat protection, watercourse condition and sub-watershed ecosystem health;
- Advice to municipalities on land use planning and development of wetlands, river and stream valleys, woodlands, fish habitat, hazard lands, and hydrogeology;
- Provide emergency planning and response, including flood forecasting and warnings, and low water responses;
- Evaluate climate change impacts, develop mitigation and adaptation resilience strategies;
- Engage landowners and residents on waterway clean-ups, tree planting, shoreline protection, erosion control and water quality protection through education; and
- Develop measures to reduce water pollution, mitigate or prevent natural hazards (flood, drought, erosion), protect or restore wildlife habitat and restore shorelines.

A CLOSER LOOK: CREDIT VALLEY CONSERVATION AUTHORITY

Although CAs have been established across Ontario, the organizational structure of individual CAs vary. The Credit Valley Conservation Authority, located outside of the Ottawa River watershed (near Mississauga), is unique as it has been organized into five divisions based on IWM principles. Of their five divisions, three focus on the watershed scale, while the other two focus on corporate services and development. Within each division, there are four to five branches that focus on specific issues. Watershed related divisions include:

- Watershed knowledge - develops and provides scientific solutions to support decision making
- Watershed management - responsible for synthesizing the long term vision for the watershed into processes, management and strategic planning
- Watershed transformation - coordinates and delivers stewardship programs, and provides technical advice through outreach and education tools and techniques

1.3.5. ROLES OF KEY STAKEHOLDERS

When examining the wide array of responsibilities and initiatives highlighted in this section, it becomes clear that the protection of the Ottawa River watershed involves a number of important players, some of which do not have direct responsibilities within the watershed. Ensuring the success of policies and programs at the watershed level requires the participation and commitment of key stakeholders, who are often well placed to address watershed issues at the local scale (Cook, 2011).

1.3.5.1. PRIVATE SECTOR AND INDUSTRY

As users of the watershed, the private sector has an important role to play, not only with regard to their socio-economic value, but also in fostering innovation, developing corporate social responsibility plans, and by ensuring their activities and practices are sustainable (e.g., they ensure that their activities do not directly or indirectly affect the environment by adhering to environmental regulations and industry standards). Domtar Corporation and Cascade Inc. are both major pulp and paper producers operating within the watershed. Other significant industries in the watershed include the Canadian Nuclear Laboratories, Hydro-Québec and Ontario Power Generation. More information on industry in the Ottawa River watershed can be found in section 5.1.

1.3.5.2. NON-GOVERNMENTAL ORGANIZATIONS

There are many environmental NGOs currently active within the Ottawa River watershed. Some of them are presented below.

OTTAWA RIVERKEEPER

Formed in 2001, Ottawa Riverkeeper is a charity organization whose mandate is to protect the river and its watershed. Ottawa Riverkeeper is a member of the Waterkeeper Alliance, which currently has over 300 organizations and affiliates around the world with nine representatives in Canada. They have assumed an important role by conducting non-profit research, facilitating stakeholder collaboration through conferences and events, conducting water monitoring and encouraging environmental stewardship within the Ottawa River watershed (Ottawa Riverkeeper, 2015). Ottawa Riverkeeper advocates for the responsible and sustainable use of the Ottawa River in the context of several issues of interest to the public, including the storage of nuclear waste and sewage overflows by municipalities. They also lead various public education, community building and awareness programs, such as the Riverwatcher network and the River Patrol, which is described further in section 4.2.7.

As previously mentioned, in 2015, Ottawa Riverkeeper spearheaded the Gatineau Declaration, which highlighted the shared responsibility to preserve biodiversity, water quality and the well-being of communities in the Ottawa River watershed, and outlined shared actions to be taken by signatories moving forward. Following the release of the Gatineau Declaration, Ottawa Riverkeeper initiated a Watershed Health Committee, which is further described in section 4.3.1, and has been promoting the creation of an Ottawa River Watershed Council. Ottawa Riverkeeper released a discussion paper on Ottawa River Watershed Governance in May 2017, including a proposed structure for the Steering Committee of an Ottawa River Watershed Council (Ottawa Riverkeeper, 2017).

DE GASPÉ BEAUBIEN FOUNDATION

The De Gaspé Beaubien Foundation is a family run charity that organizes meetings and mobilizes champions in addressing community challenges, such as water conservation. They held a summit (AquaHacking) with a focus on the Ottawa River watershed in 2015, where the event brought together experts, decision-makers and passionate individuals to find innovative and technological solutions to promote the sustainable use and conservation of Canada's fresh waters (Aquahacking, 2015a). During the summit, which was organized in partnership with Ottawa Riverkeeper and Blue Legacy, the River Mission project was created with the goal to raise community awareness on preservation of the Ottawa River (Aquahacking, 2015b).

WATER RANGERS

Water Rangers is a registered non-profit organization that was founded out of the Aquahacking summit held in 2015. The organization is composed of citizens, web designers and developers who use their skills to help protect water resources. They partner with municipalities, schools, Indigenous communities, CAs and other NGOs to raise awareness and find solutions to water related issues (Water Rangers, 2018a). More specifically, their mission is to create the tools needed by citizens and scientists to record and analyze water-related data in order to understand the issues, share their discoveries and engage with their neighbours. In alignment to their mission, they have designed test kits adapted to experienced or inexperienced individuals who want to monitor water quality. Water Rangers also host a free platform for citizen scientists who wish to record their observations on water. The organization is described in further detail in section 4.2.7. Their interactive map is available online or through a smart phone application (Water Rangers, 2018a).

DUCKS UNLIMITED CANADA

Ducks Unlimited Canada is a non-governmental organization and registered charity. Established in 1938, their mission is to “conserve, restore and manage wetlands and associated habitats for North America’s waterfowl” (Ducks Unlimited Canada, 2018a). As a leader in Canadian habitat conservation, Ducks Unlimited Canada has completed more than 9,720 projects across Canada working in areas such as wetlands, grasslands, water, waterfowl, wildlife and Canada’s Boreal ecosystem. As part of their mandate, they conduct scientific research, work with all levels of government to help shape policy, and provide educational programs to inspire, empower, and deliver real-world results (Ducks Unlimited Canada, 2017). Ducks Unlimited Canada has a large presence in the Ottawa River watershed. They are working with many different organizations and levels of government, to focus conservation efforts on priority wetlands, such as mapping areas along the Ottawa River (Ducks Unlimited Canada, 2017). Their work is described further in section 4.2.7.

NATURE CONSERVANCY OF CANADA

Nature Conservancy of Canada is an NGO that specializes in land conservation. Through donation, purchase, conservation agreement and the relinquishment of other legal interests in land, they secure properties and manage them for the long term (Nature Conservancy of Canada, 2018a). This NGO has been active in the Ottawa Valley since 2002, and has designated the region as one of its Priority Natural Areas; approximately 8,000 hectares have been protected in the Ottawa Valley by the Nature Conservancy of Canada. Notable initiatives have been conservation efforts in the Clarendon and Bristol Grand Marsh areas, which have led to the protection of 2,400 hectares of wetlands, forests and shorelines, as well as protection of the Gervais Caves property, a 75-acre shoreline parcel (Nature Conservancy of Canada, 2018b).

WORLD WILDLIFE FUND CANADA

World Wildlife Fund Canada (WWF-Canada) is actively engaged in the protection of Canada’s fresh water, as well as the protection of species at risk, including those found in the Ottawa River watershed. Its main focus, across Canada, is centered on building resilient communities, promoting the use of scientific data in decision-making, and creating water conservation awareness and stewardship by working with all levels of government, Indigenous communities, researchers and civil society (WWF-Canada, n.d). Specific monitoring and research is described further in section 4.2.7.

REGIONAL ENVIRONMENTAL COUNCILS IN QUÉBEC

There are 16 regional environmental councils throughout Québec. These councils are non-profit organizations run by a board of directors elected from among their members. Within the watershed, two regional environmental councils are prominent, including the Conseil régional de l'environnement et du développement durable de l'Outaouais (CREDDO), which was created in 1990, and the Conseil régional de l'environnement des Laurentides (CRE-Laurentides), which was founded in 1995. Both have memberships that include businesses, individuals and local government representatives interested in environment and sustainable development of their respective regions. Of note, CREDDO sits on multiple committees and also participates in consultations led by different groups, such as municipalities and Hydro-Québec, while CRE-Laurentides undertakes several projects in lakes within the watershed (CREDDO, 2018; CRE-Laurentides, 2013).

1.3.5.3. ACADEMICS AND RESEARCH INSTITUTES

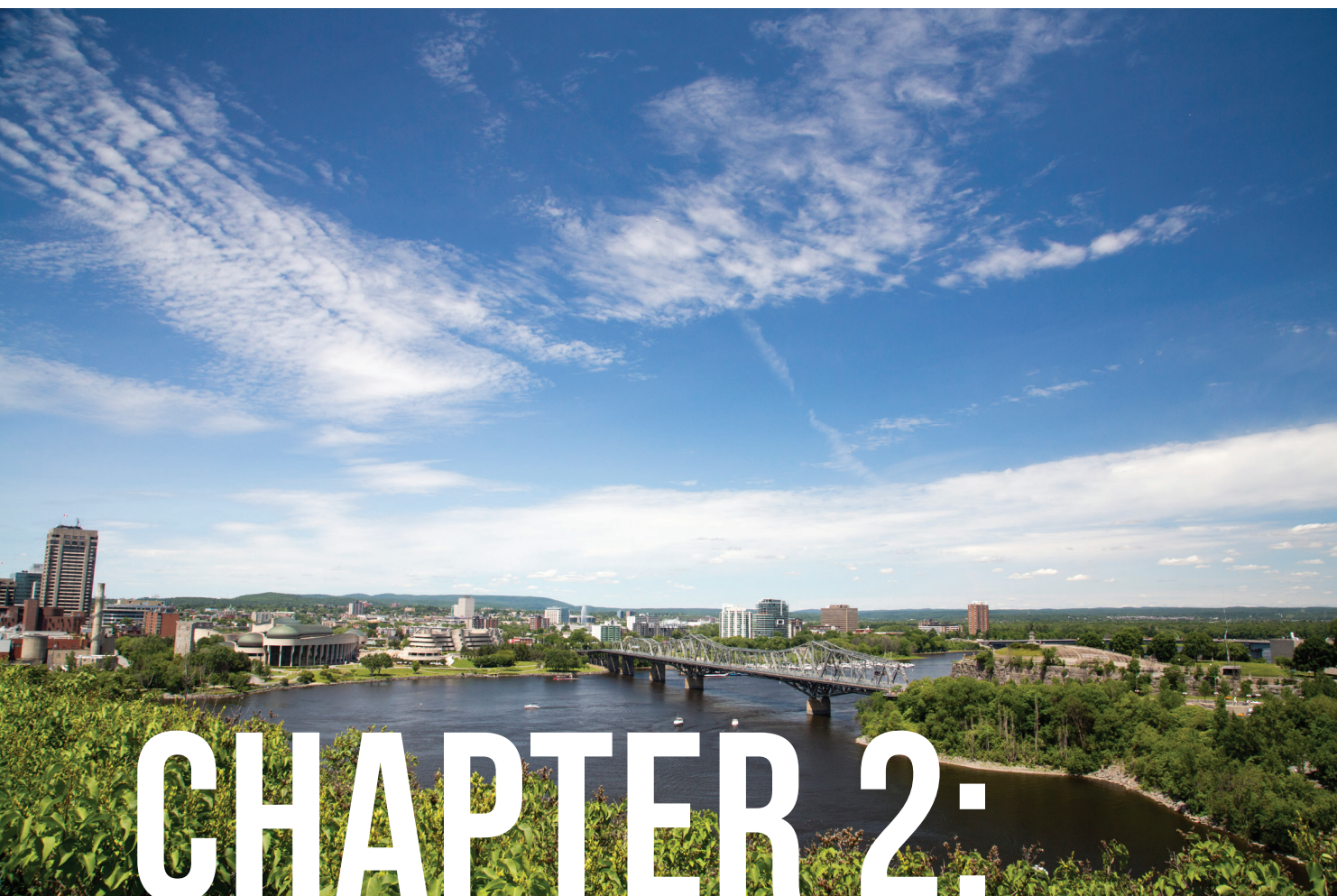
Academics and scientists play a crucial role in understanding the Ottawa River watershed. Academic institutions, research institutes and governmental science-based Departments are all home to renowned scientists and experts. They provide peer-reviewed scientific knowledge and technical data, develop innovative theory and practices, and support informed decision-making (MELCC, 2018b).

Within the Ottawa River watershed, academic institutions have been active in promoting research geared toward improving the health of the Ottawa River. Carleton University, for example, spearheaded the Watts Creek restoration project through the Great Lakes Guardian Community Fund to protect water quality and promote community involvement (Carleton University, 2013). Université du Québec en Outaouais also conducts a variety of work in the watershed, and their ISFORT institute focuses on forest ecosystems and their role in the Ottawa River watershed. Refer to chapter 4 for more information on research and monitoring being conducted within the Ottawa River watershed.

1.3.5.4. GENERAL PUBLIC

The general public plays an important role in the management of the watershed by: actively participating in organizations that promote the wellbeing of the watershed, like environmental NGOs; participating in community outreach and awareness programs hosted by OBVs and CAs; voicing public opinion at municipal hearings; and through communication with federal Departments and provincial ministries. The public has the potential to influence decision-making, which ultimately impacts watershed management. More information on public values and the sense of purpose the public derives from participating in watershed-scale efforts is included in section 5.3.

Specific features of the watershed are also of importance to the general public. For example, Réseau ZECs (controlled harvesting zones), provincial parks, such as Plaisance National Park, and Outfitter Associations within the watershed are popular ways to access nature in order to pursue different activities, such as camping, hunting, and fishing (Québec Outfitters, 2018). As users of the Ottawa River watershed, the collective interests of the public play a significant role in the sustainable use and protection of the watershed.



STUDY METHODOLOGY

The Ottawa River watershed has an engaged public, multiple government bodies, and diverse ecosystems found within its boundaries. In order to effectively engage the diverse groups who live and/or have an interest in protection of the Ottawa River watershed, ECCC sought to undertake a broad, comprehensive and multi-pronged engagement process. In addition, the region, the watershed, and the Ottawa River have been the focus of past publications and reports, which were analyzed as part of the ORWS.

In May 2017, an ECCC task force was established, bringing together experts from across the Department. Task force sub-groups were also formed to allow collaboration between ECCC staff with expertise on specific components of the Study. Task Force and sub-group members shared knowledge, compiled and assessed resources, and created and implemented the engagement approach. Overall, the Study methodology involved the steps outlined in Figure 2.1-1 below.

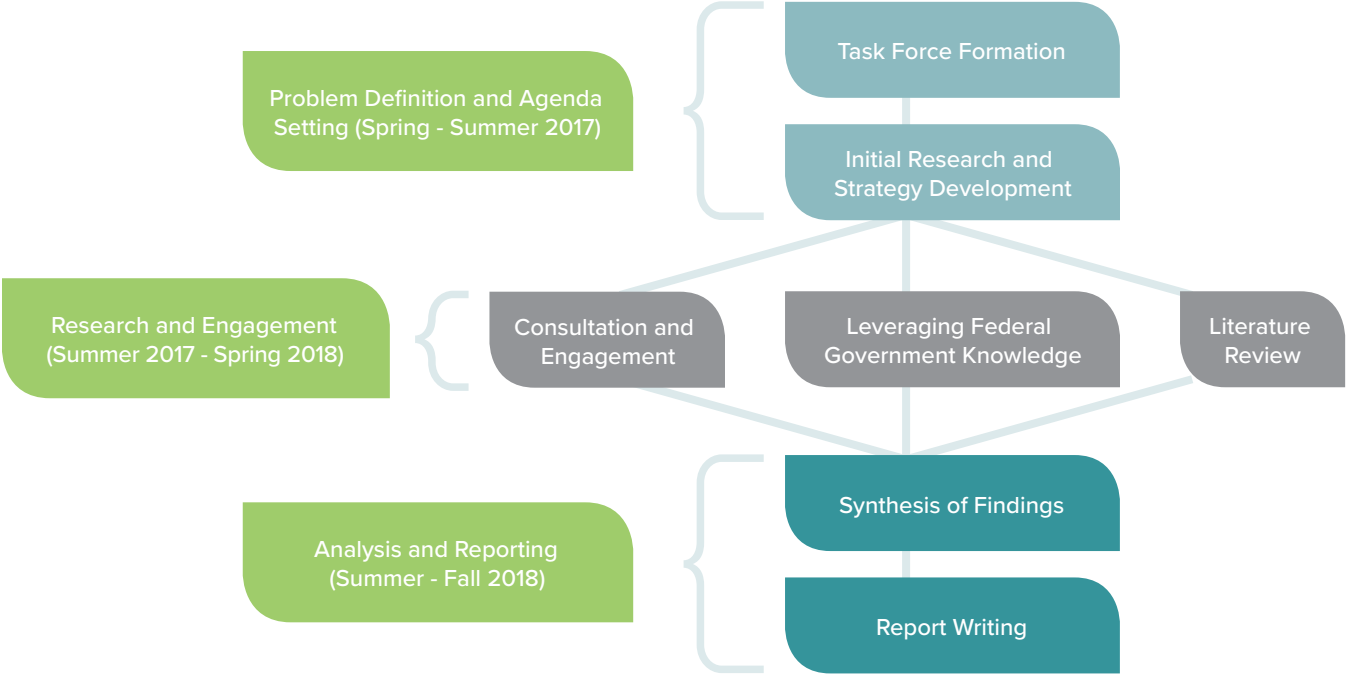


FIGURE 2.1-1. ORWS METHODOLOGY

2.1. ENGAGEMENT

ECCC strived to ensure that the engagement approach reached a broad range of groups and was comprehensive, transparent and meaningful. Engagement included:

- Informal initial meetings with Indigenous organizations and support for Indigenous organizations to run their own consultations and reporting processes within communities;
- Meetings and written submissions from all levels of government;
- Development of a list of potential stakeholder groups and email outreach;
- Public open-door meetings;
- Submissions and questions to dedicated ORWS email account;
- Workshops, presentations and webinars with specific stakeholders; and
- The use of an online public engagement platform called PlaceSpeak.

Figure 2.1-2 below summarizes the various groups that were proactively engaged throughout the course of the Study (see Appendix C for list of organizations that participated in the engagement process).

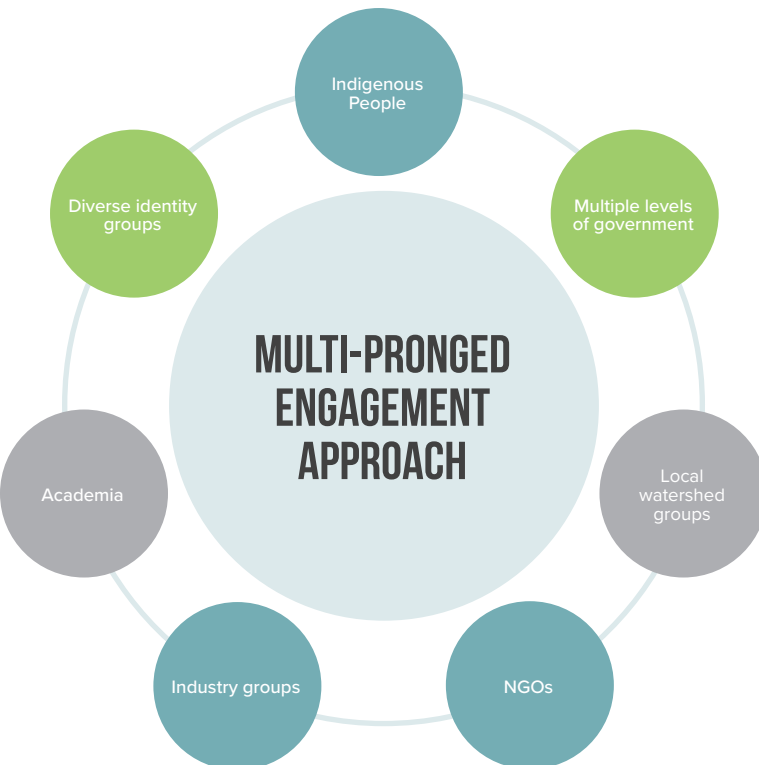


FIGURE 2.1-2. ORWS MULTI-PRONGED ENGAGEMENT APPROACH

ENGAGEMENT WITH GOVERNMENT BY THE NUMBERS

34	Attendees at two workshops with federal representatives
60	Federal officials that received engagement guides
2	Trilateral, executive-level meetings with ON and QC
2	Provinces received engagement guides for distribution to relevant ministries
1	Presentation to Ottawa River Regulation Planning Board and tailored engagement guide
91	Municipal councils and municipalities within the watershed received engagement guides
3	Municipalities downstream of watershed engaged
14	CAs and OBVs received engagement guides

2.1.1. SELF-DIRECTED INDIGENOUS CONSULTATIONS

ECCC committed, at the outset of the ORWS, to meaningfully consult Indigenous communities. A study about the Ottawa River watershed could not be successful if the rights and related interests of Indigenous peoples in the region were not duly considered. This commitment is in line with the ten Principles respecting the Government of Canada's Relationship with Indigenous Peoples, released in February 2018. The Principles guide the federal government's commitment to a renewed, nation-to-nation, government-to-government relationship based on recognition of rights, respect, co-operation, and partnership. The Principles are rooted in section 35 of the *Constitution Act, 1982*, and are guided by the United Nations (UN) Declaration on the Rights of Indigenous Peoples. They are also informed by the Report of the Royal Commission on Aboriginal Peoples and the Truth and Reconciliation Commission's Calls to Action (Department of Justice, 2018).

The Government of Canada follows the Principles as a starting point to support efforts to end the denial of Indigenous rights, which led to disempowerment and assimilationist policies and practices. They seek to advance fundamental change whereby Indigenous peoples increasingly live in strong and healthy communities with thriving cultures. To achieve this change, it is recognized that Indigenous nations are self-determining, self-governing, increasingly self-sufficient, and rightfully aspire to no longer be marginalized, regulated, and administered under the *Indian Act* and similar instruments. It should be noted, however, that the understandings and applications of these Principles in relationships with First Nations, Métis, and Inuit are diverse, and their use is contextual.

In the early planning stages of the ORWS, ECCC developed an overarching Indigenous Consultation Strategy to guide its approach throughout the duration of the study (see Appendix D). The strategy outlined how ECCC intended to consult with Indigenous nations and representative organizations in Québec and Ontario. The Strategy was updated over time to adapt to new information as it became available.

The next step was to identify and contact over 20 Indigenous communities and organizations, both within and outside of the watershed, with potential ties to it. These communities are represented by broader organizations which include: Algonquin Anishinabeg Nation Tribal Council, the Algonquin Nation Secretariat, Algonquins of Ontario, as well as Métis Nation of Ontario, and the Mohawk Councils of Kanesatake and Kahnawà:ke. In keeping with the spirit of the Indigenous Consultation Strategy, ECCC's initial contact letters introduced the study, expressed ECCC's interest in consultation, and asked communities to indicate whether and how they would like to be involved moving forward. Informative letters were also sent to national Indigenous organizations to welcome their involvement and to notify them about the ORWS, including the Assembly of First Nations and the Congress of Aboriginal Peoples.

A number of initial meetings with Indigenous organizations and representatives were held. Following these interactions, proposals were submitted and discussed with ECCC.

Six separate contracts were negotiated and signed with the Algonquins of Ontario, Algonquin Anishinabeg Nation Tribal Council, the Algonquin Nation Secretariat, the Métis Nation of Ontario, the Mohawk community of Kanesatake and the Mohawk Council of Kahnawà:ke, to allow these organizations to direct the gathering, reflection and formulation of their own input for the ORWS. Self-directed consultation processes varied. Approaches included: regional workshops involving various Indigenous representatives; community based research methods; establishment of community liaisons; development of online platforms to connect workshop participants; semi-structured interviews; community meetings; written input and review by representatives of Indigenous organizations; and extensive literature review. ECCC also attended a portion of some of the consultations to give a presentation about the ORWS and to answer questions.

2.1.2. ENGAGEMENT WITH GOVERNMENT BODIES

ECCC engaged all levels of government with authorities or responsibilities relating to the management of the Ottawa River watershed (see section 1.3 for a description of the roles and responsibilities).

Two federal workshops were held in August 2017, the first within ECCC, and the second with other pertinent federal Departments and agencies. The goal of the workshops was to engage federal Departments and agencies on the Study early in the process. ECCC then designed an engagement guide, which was sent to these Departments and agencies, to facilitate gathering their input.

Engagement with provincial governments was initiated by a letter from the Deputy Minister of ECCC to counterparts in Ontario and Québec's environmental ministries, followed by a Deputy Minister level meeting to discuss the ORWS. This meeting was followed by regular discussions among officials at the working level, including a presentation by ECCC to the Québec-Ontario Water Management Joint Directors Committee. A customized engagement guide was sent to both provinces, to gather information from the different provincial ministries about initiatives that implicate the Ottawa River watershed.

Following initial discussions with executives at the provincial level, ECCC developed a plan to engage directly with municipalities and with CAs in Ontario and OBVs in Québec. Customized engagement guides were sent to each of those groups. Of note, 14 municipalities submitted engagement guides, as well as four CAs and five OBVs. In addition, ECCC gave a formal presentation about the Study to the ORRPB, which was also sent a custom engagement guide to help them structure their input.

All engagement guides were tailored based on the roles and responsibilities of respective groups.

2.1.3. PUBLIC AND STAKEHOLDER ENGAGEMENT AND GENDER-BASED ANALYSIS PLUS

ECCC designed the public and stakeholder engagement process based on broad and meaningful engagement.

PUBLIC AND STAKEHOLDER ENGAGEMENT PLANNING BY THE NUMBERS

- 3 Bilingual maps created
- 1 Socio-economic analysis commissioned (Statistics Canada)
- 1 Online citizen engagement site created and managed
- 2 Bilingual webpages about the Study created on Canada.ca
- 1 Dedicated Study email inbox created and managed

2.1.3.1. APPLYING A GENDER-BASED ANALYSIS PLUS LENS

The Study and its associated engagement process are in line with government-wide commitments, such as the integration of Gender-Based Analysis Plus (GBA+). GBA+ is an analytical tool used to assess how diverse groups of people may experience policies, programs and initiatives, while also considering identity factors, such as gender, race, ethnicity, religion, age, and mental or physical disability. The approach is undertaken to mitigate potential adverse impacts on different segments of the population.

ECCC developed a GBA+ strategy to frame the research and engagement process of the ORWS. The strategy was used to help understand how diverse groups of people experience the

Ottawa River watershed, how they might be potentially impacted by governance mechanisms, and how to mitigate or eliminate any differential impacts. To encourage input from a broad diversity of voices, ECCC developed a large stakeholder outreach list encompassing about 300 groups. These groups represented: industry and business, NGOs, researchers and academics, community-based organizations, cultural, ethnic and faith-based organizations, persons with disabilities, and youth. For more information on the GBA+ approach, the strategy can be found in Appendix E.

2.1.3.2. STAKEHOLDER ENGAGEMENT

Identified stakeholder organizations received initial emails introducing them to the study and alerting them that they would receive occasional emails throughout the engagement process. Five subsequent email updates were sent to this stakeholder list while the online engagement site was live, encouraging participation and asking for help in promoting the study. Each email gave recipients the ability to opt-out from further updates. ECCC also informed stakeholders that submissions could be sent to the ORWS e-mail account or to ECCC by mail.

In addition to the email updates, customized engagement guides were sent to key industry and business associations. The purpose of the guides was to provide an opportunity for stakeholders to describe their industry's presence within the watershed, contributions to the natural, social and economic well-being of the region, to identify monitoring programs and available data on indicators relating to the health of the watershed, and to get their perspective on watershed governance. Academics and research institutes were also contacted related to indicators and data collection, specifically to post information about their research on the online public engagement site.

As indicated in section 1.3, Ottawa Riverkeeper has been active in the Ottawa River watershed for many years. Ottawa Riverkeeper initiated a process to create an Ottawa River Watershed Council. Early on in the ORWS process, ECCC approached Ottawa Riverkeeper regarding planning a workshop to gather further information about their process to establish an Ottawa River Watershed Council. A workshop was co-created by ECCC and Ottawa Riverkeeper with support from the Innovation, Science and Economic Development Canada (ISED) Innovation Lab, and was held in November 2017. When the online public engagement began, Ottawa Riverkeeper helped promote the study among its network and through social media outreach. A custom engagement guide was also prepared and sent to Ottawa Riverkeeper.

STAKEHOLDER ENGAGEMENT BY THE NUMBERS

300+	Stakeholders identified and informed about Study
5	Email updates sent to stakeholders during online public engagement
42	Attendees at joint, multi-stakeholder workshop co-created with Ottawa Riverkeeper with support from ISED Innovation Lab
60	Business and industry representatives sent custom engagement guides
2	Webinars with water-related networks
2	Articles in water-related e-publications
1	Guest lecture to a university class
3	Sessions with middle school and high school youth

PUBLIC ENGAGEMENT - BY THE NUMBERS

1,063	Visits to Study web pages on Canada.ca
3,800+	Views of video of Minister promoting the Study
13	Social Media postings about the study by other organizations
141,193	Social media account holders reached with "ads"
160,776	Distinct views of video used in public information notice "ad"
15,239	Click-throughs from social media "ads" to Study's online engagement site PlaceSpeak

In addition, ECCC actively sought input from youth, as they have unique perspectives and insights. ECCC facilitated lessons and activities with youth at the middle school and high school level (Blue Sky School and St. Lawrence Academy in Ottawa), presented at a science communication class at Carleton University, and actively reached out to other colleges and universities. In addition, ECCC promoted the ORWS through: submitting an online article to the Partnership for Water Sustainability in British Columbia; writing an online article for Water Canada magazine; and delivering a webinar to water professionals through the Canadian Water Network's Student and Young Professionals Committee.

ONLINE ENGAGEMENT ON PLACESPEAK BY THE NUMBERS

97	Days to provide input through the online public engagement site
71	Distinct documents, images, links posted as Resources
7	Distinct postings on Overview page
8	Distinct discussion questions posted
2	Distinct poll questions fielded
2	Distinct calls to action on Place-it map
4	Emails sent to connected participants
41K+	Page views during the online engagement period
387	Citizens registered
41	Comments on Noticeboard
333	Votes cast in two separate snapshot polls
27	Postings on Place-it map

2.1.3.3. ONLINE PUBLIC ENGAGEMENT – PLACESPEAK

PlaceSpeak was selected to host public engagement for the ORWS. Of note, ECCC was the first federal Department to use this platform. Governments and local watershed management agencies in British Columbia had shown that PlaceSpeak was an effective approach to gathering public input. ECCC benefited greatly from their past experiences, best practices and lessons learned when planning the online public engagement.

PlaceSpeak is designed for how Canadians behave in a digital age. Individuals are in the driver's seat, deciding how they want to participate, on what topics, and how often they wish to be notified about opportunities to provide input. It was felt that PlaceSpeak was well suited to host the online public engagement for the Ottawa River watershed due to a few unique features that met the needs of the Study. By linking digital identity to geo-location, ECCC was able to know whether participants in the online engagement lived within the watershed or not. By sub-dividing the watershed by census areas, ECCC was able to track and analyze whether comments differed across the watershed.

By registering on this platform, participants were able to connect with each other and were able to stay connected after the public engagement closed for the ORWS. The PlaceSpeak platform allowed ECCC to share a variety of resources and gather input in a number of formats. ECCC posted information on the "Resources" page, such as maps, external reports and studies, as well as storyboards and "what we heard" summaries. ECCC posted eight different discussion questions to the "Discussion Board" and fielded two different questions to the "Snapshot Poll". Individuals could also post documents, videos and photos on the "Noticeboard". Another unique feature

used on the PlaceSpeak site was "Placelt", where citizens could pinpoint an area on a map of the watershed and post a comment on issues or concerns in the watershed. The "Placelt" feature was also used for citizens to indicate where they collect data within the watershed.

These PlaceSpeak features gave ECCC the ability to adapt and change the engagement conversation as the Study evolved. For example, two discussion questions were posted to start the conversation about the Study, asking people how they are connected to the watershed and the issues of concern to them. ECCC then added new content related to watershed collaboration – a new snapshot poll, and three discussion questions. Questions were then added about indicators of watershed health, and citizen science. Finally, before the online engagement closed, ECCC posted summary storyboards that reflected on what was heard from participants on PlaceSpeak, so that any gaps could be addressed. These storyboards were then posted in the Resources section as the "what we heard" summaries for the public engagement portion of the Study. It should be noted that this report details "what we heard" from the ORWS engagement process. The opinions expressed were not validated based on data analyses.

2.1.4. COMMUNICATIONS AND OUTREACH

ECCC developed a number of communications products to support online public engagement and to ensure broad awareness throughout the Ottawa River watershed about the Study.

Two public meetings in the NCR (one in Ottawa, the other in Gatineau) were hosted to provide people with the opportunity to engage with ECCC, to consult maps and other resources about the Ottawa River watershed, and to learn more about the Study and the online public engagement.

As the watershed is quite large, special attention was focused on reaching communities outside of the NCR. ECCC developed a social media public notice campaign through Facebook and Instagram specifically targeting the sixteen most populated cities and towns within the watershed outside of the NCR. Use of this approach significantly boosted page views on PlaceSpeak. The list of cities and towns targeted includes:

- Hawkesbury, ON
- Embrun, ON
- Kirkland Lake, ON
- Petawawa, ON
- Pembroke, ON
- Renfrew, ON
- Arnprior, ON
- Smiths Falls, ON
- Perth, ON
- Barry's Bay, ON
- Bancroft, ON
- Sainte-Agathe-des-Monts, QC
- Mont Laurier, QC
- Maniwaki, QC
- Rouyn-Noranda, QC
- Shawville, QC

ONLINE ENGAGEMENT ON PLACESPEAK BY THE NUMBERS

2	Bilingual videos produced, one featuring the Minister
1	News release to launch the public engagement process
6	Bilingual storyboards produced
5	Bilingual infobytes produced for social media platforms
27	Bilingual tweets from ECCC or Minister's Twitter accounts
7	Bilingual posts on Environment and Natural Resources in Canada Facebook page
2	Open-door public meetings
63	Days of public information notices on social media sites
2	Media interviews

That success led ECCC to expand the public notice campaign to include residents of Ottawa and Gatineau. These notices continued until the end of April 2018, and greatly expanded the reach of the engagement process.

2.1.4.1. OTHER ENGAGEMENT ACTIVITIES

To support research regarding watershed governance, watershed management bodies and experts from across Canada were engaged. Summaries of watershed management bodies were produced and provided for feedback to respective organizations. This was followed by a webinar hosted by ECCC with the intent to gather information on experiences, best practices and feedback on the eleven CCME Integrated Watershed Management (IWM) principles. As a follow-up to the webinar, a customized engagement document was distributed to 24 interested water management bodies (see Appendixes J and K for governance body summary tables).

2.2. LEVERAGING GOVERNMENT OF CANADA EXPERTISE

ECCC collaborated with other Government of Canada Departments, in addition to the ISED Innovation Lab. These Departments included Policy Horizons and Statistics Canada.

ECCC worked with Policy Horizons Canada to develop a Foresight workshop used to develop and write the Foresight Analysis chapter.

ECCC also collaborated with Statistics Canada to better understand natural, economic and demographic features of the Ottawa River watershed. For example, information was drawn from Census 2016 data, as well as Statistics Canada's 2016 Human Activity and the Environment publication.

2.3. LITERATURE REVIEW

Significant background research was necessary to develop foundational knowledge and provide context to various components of the Study. Research was required to discern characteristics of effective watershed governance and to identify various methods and council structures used elsewhere in Canada and internationally. In addition, ECCC gathered information on the existing governance framework within the Ottawa River watershed. Regarding watershed health, literature was relied upon to develop an understanding of the variety of biological, geological and aquatic systems found throughout the watershed. Reports and datasets were also examined to understand existing information relevant to watershed health, along with an assessment of potential gaps in scientific data and monitoring efforts throughout the watershed. Lastly, ECCC researched and analysed the historical, economic, cultural and natural context of the watershed, through the use of historical summaries, academic literature and reports produced by various institutions.

2.3.1. ANALYSIS AND REPORTING

ECCC received input from multiple sources and in a variety of formats, depending on the target group. Submissions were analyzed, with individual comments tagged by keyword and entered into a database. Based on keywords, comments were qualitatively analyzed and grouped into broad themes.

2.3.2. FORESIGHT ANALYSIS

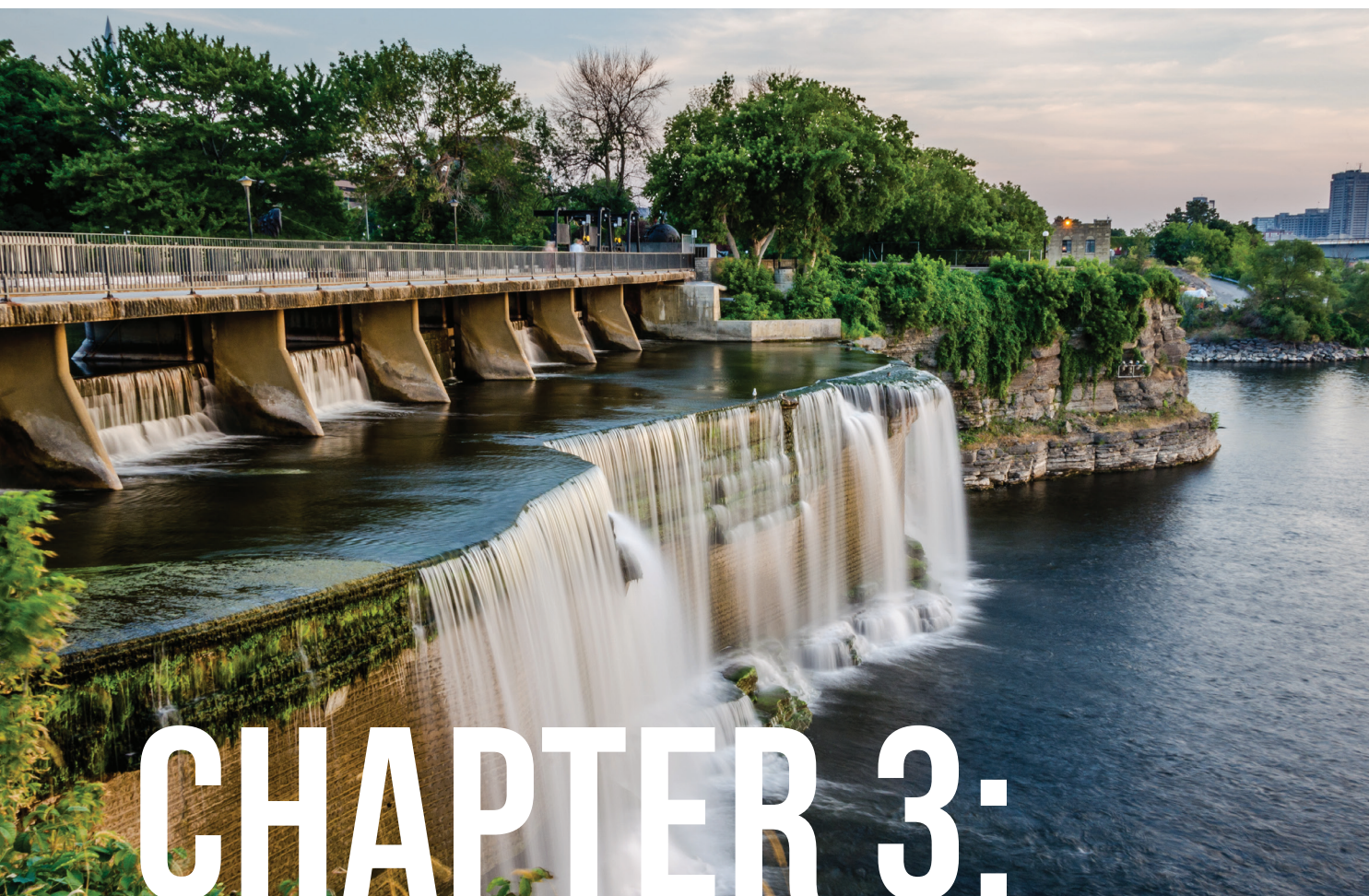
Foresight Analysis is the practice of identifying potential policy problems on an approximately 15 year time horizon, by researching and identifying indicators of change (weak signals) that may disrupt existing policies should they become more mainstream in the future. Foresight has helped ECCC understand what influences the Ottawa River watershed, how it may evolve, and what challenges or opportunities may arise in the future. The forward-thinking nature of foresight provides a powerful context to develop more resilient and adaptable policy in the face of change (Policy Horizons Canada, 2016).

To identify emerging policy challenges and opportunities, ECCC followed the Policy Horizons Canada Foresight Method (Horizons method) (Policy Horizons Canada, 2016). ECCC began the foresight analysis by framing the problems at hand, and identifying commonly held assumptions that were either embedded in Motion M-104, or currently influencing policy makers. To help frame the problem, and understand the interactions of various system elements, ECCC created a system map based on fundamental elements that rely on, or influence the Ottawa River watershed, including governance, natural values, economic values, and social/cultural/heritage values (see Appendix F for System Map).

The Policy Horizons method cites insightful scanning for weak signals as the foundation for effective foresight analysis (Policy Horizons Canada, 2016). ECCC identified weak signals by scanning domestic and international media, industry reports, and academic journals amongst other sources of information. Workshops were held to identify how these emerging signals may affect the Ottawa River watershed system should they become more prevalent in the future, and those that notably disrupted at least one of the system elements were selected as change drivers.

At this point in the Policy Horizons method, scenarios could be built to explore plausible futures for the system of study. The foresight analysis conducted by ECCC did not include an extensive scenario-building component. Instead, ECCC drew insights from the change drivers to develop plausible future circumstances for the watershed, which were then used to brainstorm first-, second-, and third-order impacts that may be caused by the realization of each circumstance.

The final step in the Policy Horizons method was to test the strength and validity of the previously defined assumptions against the defined change drivers, to help identify potential policy challenges or opportunities. The results of the foresight analysis are provided in section 6.1.



CHAPTER 3:

WATERSHED MANAGEMENT APPROACHES

As per the text of Private Member's Motion M-104, the first component of the study is to examine the potential creation of a new collaborative body, such as an Ottawa River Watershed Council. Typically, existing watershed councils or collaborative bodies are based on principles or processes of integrated water resources management (IWRM) or integrated watershed management (IWM). ECCC conducted research on IWRM and IWM theory, principles and practices. Additionally, benefits and challenges associated with implementation of IWRM or IWM approaches were reviewed, along with case studies of existing collaborative watershed governance models.

3.1. WATERSHED MANAGEMENT

Water is complex to manage—its dynamic nature does not coincide with institutional, social and political boundaries (Biswas, 2004). Over the last half century, IWRM has emerged as a guiding conceptual framework to address increasingly pressing water issues. A variety of definitions have been presented to explain the concept. The most commonly used definition comes from the Global Water Partnership, as follows:

“IWRM is a process which promotes the coordinated development and management of water, land and related resources, in order to maximize resultant economic and social welfare in an equitable manner without compromising the sustainability of vital eco-systems.”

(GWP, 2011)

3.1.1. IMPLEMENTATION OF WATERSHED APPROACHES

There is no universal recipe for success when implementing IWRM approaches, however, some success factors have been identified (Davenport, 2003; Gangbazo, 2004):

- Focus collaboration and coordination efforts at the watershed-level in order to effectively address cross-jurisdictional boundary issues, as well as impacts that result from conflicting uses;
- Promote a participatory approach and develop a strong communication plan. This will help raise awareness on important issues, as well as gain public support. Knowledge and information sharing is also important between practitioners and the public;
- Integrate science and use reliable data. This will assist in setting measurable targets and improve the understanding of the health of the watershed. Consequently, conservation priorities will be easier to identify and restoration actions will be more effective when implemented; and
- Promote collaboration that involves government(s) in order to better influence decision-making and leverage sustainable funding.

The first success factor—that naturally occurring watersheds should be used as the boundary for integrated planning—is perhaps the most frequently mentioned precursor to effective implementation of IWRM. As a result, many scholars and institutions use the terminology IWM (Wang et al. 2016, Heathcote, 1998; Qui, 2017; Ramin, 2004; Genskow & Born, 2006; Barham, 2001; CCME, 2016).

Watersheds have been referred to as logical geographical management units, given the ability to consider the causes and effects that impact water quality; the ability to link upstream and downstream issues; capacity to consider water allocation based on the full watershed; and it has also proven to be a useful boundary for educating and involving the public (Qui, 2017). Blomquist and Schlager (2005) stated that, ideally, IWM would be implemented through cooperation and coordination of existing agencies or through some form of watershed authority. Qui (2017) further expanded on this by developing four integral components to be applied to the IWM framework:

- A collaborative institutional structure: This should be established among leading organizations that participate in watershed management within a specific watershed. This could include scientists, governments, technology, and local communities;
- A watershed alliance: To be formed and operated with broad public participation;
- A decision support system: this involves the development of a watershed alliance, and evaluation and implementation of best management practices and watershed management plans; and
- A multi-tier extension outreach education and research program: This component is based on the success of the three other components, which then contribute to outreach, education and research programs.

Various IWM approaches have been adopted internationally, as collaboration at the watershed scale has gained traction; countries and regions include: Australia, New Zealand, the European Union (EU), the U.S., and basins coving multiple countries, such as those in southeast Asia and southern Africa (see section 3.2.1). Additionally, several Canadian regions, provinces and territories have incorporated this approach into watershed management, through grassroots approaches, law and policy (see section 3.2.2). In 2016, the federal-provincial-territorial CCME released a summary report of IWM approaches in Canada, designed to “enhance the capacity of jurisdictions to apply integrated watershed management principles and to develop policies and programs consistent with the principles” (CCME, 2016). As part of the analysis, CCME developed a list of 11 Principles of IWM (see Table 3.1-1). These eleven principles were used as the primary criteria to consider water/watershed management within the Ottawa River watershed, as well as for selecting domestic and international case studies.

TABLE 3.1-1. PRINCIPLES OF INTEGRATED WATERSHED MANAGEMENT

1	Geographical Scale: The watershed should be the planning boundary for IWM, and should be at an appropriate scale to address the issues under consideration in a way that recognises its connectedness to upstream and downstream watersheds.
2	Ecosystem Approach: An interconnected process should be considered that uses best available knowledge, considers cumulative impacts, and promotes watershed and sub-watershed approaches.
3	Adaptive Management: Flexible and continuous improvement and adaptation of approaches, policies and management should be undertaken by incorporating new knowledge and innovative design, practices and technology.
4	Integrated Approach: Land, water and infrastructure planning, investment and management should consider the direct, indirect or potential impacts and their interdependencies.
5	Cumulative Impacts: IWM planning should consider cumulative effects on the environment and the interdependency of air, land, water and living organisms.
6	Precautionary Principle and No Regrets Actions: Caution should be exercised to protect the environment when there is uncertainty about environmental risks.
7	Proactive Approach: Environmental degradation should be prevented. It is better for the environment and more cost-effective to prevent degradation of the environment than to clean it up after the fact.
8	Shared Responsibility: The responsibility for policy and program development and implementation should be shared within the mandate of all actors at the appropriate scale.
9	Engaging Communities and Aboriginal Peoples: IWM processes should recognize and duly support the identity, culture and interests of local communities and Aboriginal peoples. IWM processes should enable meaningful participation by local communities and Aboriginal peoples who have a vital role in IWM because of their knowledge and traditional practices.
10	Sustainable Development: The right to development should be fulfilled to equitably meet economic and societal needs while not compromising the environment for present and future generations.
11	Natural Capital: Natural capital should be protected and managed to reduce short- and long-term negative financial impacts. Natural systems provide goods and services of environmental, economic, social, cultural and spiritual value.

3.1.2. BENEFITS AND CHALLENGES OF INTEGRATED WATERSHED MANAGEMENT

The implementation of IWM approaches may result in numerous benefits. Indeed, it can allow for a broad array of interconnected issues to be addressed more effectively, with plans that are developed in a coordinated way (Conservation Ontario, 2018d). The benefits can be financial, social, environmental, or administrative. Perhaps most notably, IWM provides an opportunity to strengthen relationships and collaboration amongst authorities and stakeholders. Collaboration, in turn, allows for resources to be used sustainably. Similarly, increased communication between collaborating parties can lead to more consistent and coherent initiatives (Browner, 1996). For example, the involvement of researchers and academics can improve integration of science into decision-making, as well as foster innovative ideas. In addition, greater public participation can promote a sense of belonging and of collective responsibility (Gangbazo, 2004). Benefits of improved scientific integration could positively impact watershed health. Potential outcomes include: improved water quality and erosion control; more resilient biodiversity and habitats; economic activities and recreation opportunities that are more sustainable; and a greater ability for communities to adapt to climate change. Such outcomes ultimately lead to an improved quality of life for people living in the watershed (Conservation Ontario, 2012).

Challenges associated with advancing IWM can vary significantly from one watershed to another and so does the extent to which such challenges are addressed. Below are some common challenges experienced when implementing IWM in Canada and globally; it should be noted that they are generally interrelated (Heaney, 1993; Gangbazo, 2004; CCME, 2016).

- **SCOPE:** Watershed boundaries do not typically align with political boundaries, which can create challenges in identifying the appropriate decision-making authorities.
- **FUNDING:** When many people benefit from IWM actions, it can be difficult to identify who should fund stewardship initiatives, and the extent to which individual initiatives should be funded.
- **COMPLEXITY:** Problems can be specific to a certain area of a watershed; it can be difficult to appropriately reflect such localized issues in larger watershed planning processes.
- **ROBUST SCIENCE:** Knowledge and data gaps can lead to management decisions that do not adequately account for the watershed's reality.
- **CONFLICTING INTERESTS:** It can be difficult to have diverse groups with diverging or even opposite interests agree to common objectives for watershed management.
- **ADMINISTRATIVE BURDEN:** It can be challenging to establish an effective, efficient and equitable governance structure that would not duplicate efforts conducted by others, and that would not exacerbate any existing administrative burden.
- **TIME:** Planning processes can be time-consuming and take longer than expected.

International and Canadian case studies of IWM implementation will be further explored in sections 3.2.1 and 3.2.2.

3.2. WATERSHED MANAGEMENT CASE STUDIES

Consideration of international and domestic examples of watershed management approaches offers valuable lessons and insights on how other regions are incorporating principles for watershed management, such as the CCME IWM principles described in section 3.1. Examples were chosen based on the ways in which the experiences may inform efforts to improve collaboration in the Ottawa River watershed, and/or in which their membership, structure, mandate, and other characteristics have aligned with the CCME IWM principles or enabled the successful implementation of integrated watershed governance. Of note, achieving integration in water management is an iterative process, and there is often not a prescribed end goal. It is possible that none of these examples fully implements all principles of IWRM or the CCME's 11 IWM principles. In all cases, approaches are tailored to local conditions and are reflective of jurisdictional structures, stakeholder views and/or environmental conditions. Lessons learned in watershed management, specific to the Ottawa River watershed, were also communicated by Indigenous organizations through the consultation process associated with the ORWS. Those views are also provided in this chapter.

3.2.1. INTERNATIONAL CASE STUDIES

Water is connected to multiple sectors, places and people, as well as across geographic and temporal scales (OECD, 2015). Watershed management, therefore, often requires multiple levels of government to collaborate on watershed specific approaches (Wang, 2016). With the acknowledgement that “water crises are often primarily governance crises” (OECD, 2015), many intergovernmental organizations, forums, and institutions have established goals, best practices and frameworks for effective watershed management. On the international stage, there has been considerable work by international multilateral organizations, such as the UN, Organisation for Economic Co-operation and Development (OECD), GWP, and others, to develop a consensus on optimal watershed management principles, and encourage their adoption. Global guiding principles and international case studies for watershed management are discussed further in Appendix I.

Brandes et al., (2014) notes that consideration of successful international examples of watershed management, especially those that detail mandate, scope of power, and clear sets of roles and responsibilities, are integral to building local support and legitimacy. Examples are especially useful as they provide a tangible focal point for reference, which in turn helps to leverage financial commitment and capacity. The same paper states that “one of the best ways for practitioners in new organizations to learn is through the experiences of others in similar situations, as it helps organizers learn more about the successes and challenges that similar organizations or models have faced” (Brandes et al., 2014). The following international case studies highlight unique international approaches that incorporate the principles of IWM. A more extensive list of existing international watershed management approaches is provided in Appendix J.

3.2.1.1. THE EUROPEAN UNION AND WATER FRAMEWORK DIRECTIVE

In 2000, European Parliament and Council adopted new legislation to better harmonize water management in the EU. Titled the Water Framework Directive (WFD), the policy details a uniform set of guidelines, while allowing regions to tailor approaches to local conditions. Notably, the framework requires that the entire EU be divided based on physical boundaries of naturally occurring river basins. Furthermore, it states that leadership and regulatory powers regarding water be disseminated to a river basin scale, and that river basin authorities be formally recognized. Structures of these authorities vary throughout river basins; however, all authorities are required to have some aspect of public participation and citizen engagement, to ensure transparency, and citizen empowerment. At the time of implementation, individual countries had varying levels of river basin management structures in place. France and Poland had decentralized river basin approaches already in place, while nations such as Germany, Norway and Sweden had largely centralized water management approaches, and were required to make significant changes in their approach to water management (Jager et al., 2016).

Overall, the WFD strives to ensure that the quality of Europe’s surface and groundwater is protected. Specifically, the framework states that all river basins must achieve “good ecological status” by a series of set deadlines. Good ecological status involves using reference conditions to set water quality objectives, as well as the assurance that surface waters receive both ecological and chemical protection, while also ensuring that levels of groundwater are quantified (Jager et al., 2016; European Commission, 2016). Additionally, planning for public consultation, water pricing policies and risk management were also noted in deadlines for implementing the WFD (European Commission, 2016). Overall, the EU WFD demonstrates what can be developed at a large multi-jurisdictional scale, using a combination of top-down guidelines that require shared responsibility for river basins, and bottom-up strategies, to support decentralized, locally appropriate methods for watershed governance.

3.2.1.2. OKAVANGO RIVER BASIN WATER COMMISSION



In 1994, with the support of various development agencies, the governments of Angola, Namibia and Botswana signed an agreement to establish the Okavango River Basin Water Commission (OKACOM). The shared basin starts in Angola, flows through Namibia and eventually into Botswana, where it feeds into the second largest inland delta in the world. The watershed is largely undeveloped due to past civil conflicts in Angola, and recognition and protection of biodiversity in Botswana’s Okavango delta. In 2007, the agreement evolved to include three separate branches: the Commission, the Steering Committee, and the Secretariat. The Commission has a membership of nine, three from each participating country, and is tasked with setting and supervising policy objectives. The Steering Committee, made up of science-driven task forces, provides technical advice through three main groups: biodiversity, hydrological systems, and institutional structures. Lastly, the Secretariat addresses administrative and financial matters. At the watershed scale, OKACOM, and its related committees, strive to ensure good water governance at the basin scale through incorporation of various principles and practices.

Primary concerns within the watershed are variations in hydrological flow, changes in sediment dynamics, changes in water quality, and changes in biota, all of which are driven by a combination of population dynamics, land use changes, poverty, and climate change (OKACOM, 2012). The mandate and structure of the agreement requires proactive planning and the designation of responsible authorities to respond to any extreme event; shared responsibility for joint monitoring; information exchange amongst the three countries; and a dispute resolution mechanism that aims to achieve conflict prevention and consensus. Local programs are used to build capacity and knowledge of watershed issues within communities, and act as an avenue to obtain public feedback (Green, 2013). The Commission is supported through budgetary commitments by the three countries involved, as well as by international donors. While funding comes primarily from member states, the Swedish International Development Agency pledged \$2.2 million over 3 years to help establish the secretariat (OKACOM, 2019).

3.2.1.3. COLORADO WATER CONSERVATION BOARD BASIN ROUND TABLES

Driven by a significant drought in 2005, the State of Colorado began working on a new approach to manage water. To assist in development of a new policy, stakeholders from eight sub-watersheds within the state of Colorado, as well as stakeholders from the Denver Metropolitan area, were brought together in a series of round tables (Koebele, 2015). Round tables are vehicles for stakeholder groups to come together to share perspectives, values and strategies, and are characterized by their balanced format, which facilitate equal participation and contribution by multi-stakeholder groups. They provide the opportunity for peer learning, strategic collaboration, and if desired produce recommendations, or make decisions on pre-established issues. Round tables can be formed as a standalone structure, or to facilitate collaborations for a council or a board (Koebele, 2015; Fraser Basin Council, 2015). In this case, round tables were developed through a “grassroots” process that allowed for stakeholders and citizens to discuss their water consumption, environmental and recreational needs related to water. Group sizes were based on population of the given region.

Each round table was tasked with assessing sub-watershed scale needs, and to develop consensus-based recommendations to deal with future challenges, such as population growth and climate change. Each round table was advisory in nature and met either monthly or bi-monthly to discuss issues and goals within their watershed. Notably, each round table was provided funds from the state’s government, in order to finance operations and water related projects linked to respective goals. Identification and initiation of specific projects that sub-watersheds required were noted as one of the biggest successes of the round table process, as funding allowed for region specific infrastructure upgrades and increases in water-related community education. Other notable outcomes were the production of policy briefs and tools, and increased collaboration among stakeholder groups. To further encourage collaboration and communication amongst the nine round tables, a separate collaborative group, the Interbasin Compact Committee, was also formed. The recommendations and knowledge shared by these nine sub-watersheds was eventually used to inform Colorado’s first statewide water plan (Koebele, 2015). Released in 2015, the *Colorado Water Plan* establishes state wide priority areas, critical actions and measurable objectives to guide implementation of the plan (Colorado Water Conservation Board, 2015).

3.2.1.4. MEMORANDUM OF AGREEMENT BETWEEN NEW YORK CITY AND STAKEHOLDERS FROM THE CATSKILLS AND DELAWARE WATERSHEDS

Upon the introduction of Motion M-104, the Honourable David McGuinty acknowledged New York City’s Memorandum of Agreement (MOA) as an opportune way to manage water resources. Signed in 1997, the MOA is an institutional framework involving New York City and stakeholders from the Catskills and Delaware counties. Dozens of stakeholder groups were involved in the agreement process: community members, farmers, various levels of government, and industry. Historically, New York City was recognized for having among “the best urban water supply system in the world in terms of quality, reliability, and innovative management”. Regardless of this, new laws from the U.S. Environmental Protection Agency required that the city treat and filter their water to ensure a certain level of quality (National Research Council, 2000, p.45).

The majority of New York's municipal water supply comes from watersheds northwest of the city. Faced with a shortage of new water supply and the potentially large and on-going cost of increased water treatment and filtration, the city opted to use a different approach to ensure high water quality: collaboration with upstream users in the Catskills and Delaware counties, where 90% of water came from. Policy and regulation enforcement for the MOA are overseen by the New York City Department of Environmental Protection and other state and local government agencies, while different programs, such as the Watershed Agriculture Program, and the Catskill Watershed Cooperation, work on activities such as source water protection and stakeholder coordination, respectively (OECD, 2016).

Through the MOA, an economic value was assigned to ecosystem services and their role in maintaining water quality. New York City redirected funds that would have gone toward building new water treatment infrastructure into the rural communities within the Catskills and Delaware watershed, and towards acquisition of watershed lands. In turn, these communities curbed agricultural run-off, water intensive industry processes and other development to ensure the protection of the ecosystem, including clean water. Through implementation of best management practices, 350 farms have reduced pollution loads, such as coliform bacteria and phosphorus by 50%. Additionally, the MOA has funded a suite of new economic, education, and infrastructural projects in the upstream communities as a payment for deferred growth in the region. The MOA is celebrated as a successful case of payment for ecosystem services, in addition to its recognition of the interconnections between ecosystem health and water quality, prioritization of upstream protection, and ecosystem services. Additionally, the agreement has resulted in equity, power sharing, economic growth, and community development (Hanlon, 2017).

3.2.1.5. WHANGANUI RIVER CLAIMS SETTLEMENT

In March of 2017, the Whanganui River (New Zealand) was formally recognized as having the legal rights of a human. Upon colonization in 1840, the Māori (the Indigenous peoples of New Zealand) lost numerous rights to their familial lands, and since 1874 the Whanganui people have been fighting to regain ancestral claims to the land and their sacred river (Bliss, 2017). After eight years of formal negotiations with the Māori in the region, the Parliament of New Zealand passed the Whanganui River Claims Settlement resolving historical claims with seven different Whanganui Iwi, while setting a historical precedent by giving a river human status. Previously, the river was controlled by multiple freshwater management jurisdictions and the federal government, and the water within it was treated as a public good. Under this new system, the river is no longer valued anthropocentrically, but rather valued intrinsically, recognized as its own being (Talbot – Jones, 2017). Under the new legislation, a diverse set of groups will assist in caring for the river, while two legal guardians were appointed by the courts to ensure the voice of the river is effectively represented. One guardian was elected from Māori Iwi stakeholders, and one elected from the Crown. Additionally, a River Strategy Group was formed to ensure that stakeholders adhere to the legislation. To guarantee that financial resources are available to ensure protection and effective management of the river, \$1 million was set aside to develop a legal framework for the river, \$80 million is available for financial redress, and another \$30 million is available for restoration to a “pristine state” (Zimmer, 2017).

Of note, in December of 2017, during an Assembly of First Nations special chiefs assembly, Algonquin Chiefs Harry St. Denis of Wolf Lake First Nation and Chief Lance Haymond of Kebaowek First Nation, introduced a mandate to seek legal recognition for Kitchisibi, or the Ottawa River. This effort was agreed upon in consensus by all Algonquin leadership present at the Assembly of First Nations, and is modeled after international Indigenous efforts to provide robust legal protection to water bodies in accordance with Indigenous laws and knowledge. Specifically, the decision was influenced by this case in New Zealand (Kitchisibi Ikiidowin Anishinabe, 2018, Assembly of First Nations, 2017).

3.2.2. CANADIAN CASE STUDIES



In 2009, the CCME endorsed a Canada-wide strategic vision for water, outlining goals to help ensure that “Canadians have access to clean, safe and sufficient water to meet their needs in ways that also maintain the integrity of ecosystems” (CCME, n.d.). As mentioned in section 3.1, the CCME’s 2016 summary report of IWM practices in Canada, also presented a number of IWM Principles.

Much like international examples explored in section 3.2.1, Canadian watershed management bodies differ in many ways, including in membership, structure, mandate, and the activities that they carry out. For example, in terms of membership, some bodies have federal government representation, like the Fraser Basin Council and the Bras d’Or Lakes Collaborative Environmental Planning Initiative, while others do not, like CAs and the Regional Round Table for the Upper St. Lawrence and Greater Montréal. In other cases, such bodies are exclusively intergovernmental in nature, like the Mackenzie River Basin Board. Governance bodies also differ in the involvement of Indigenous peoples and stakeholder groups. For example, some governance bodies include Indigenous representatives as members; others engage Indigenous organizations or communities through events or fora.

In a 2015 investigation of the potential factors to support successful collaborative watershed governance arrangements, the Fraser Basin Council found that “no one size or shape fits all” (Fraser Basin Council, 2015), and that collaborative watershed governance arrangements are shaped by local environmental, socio-economic, and political characteristics. As part of its analysis, Fraser Basin Council produced an overview of structures for watershed governance, illustrating that governance arrangements may take many forms (Fraser Basin Council, 2015). Below is an adapted version of that overview.

TABLE 3.2-1. OVERVIEW OF STRUCTURES FOR WATERSHED MANAGEMENT

GOVERNANCE STRUCTURES	TYPICAL CHARACTERISTICS
Umbrella	Helps coordinate groups with related goals
Partnership	Limited number of entities working together towards shared objective(s) with joint investment of resources
Round table	Multi-interest, oriented around a geographic area/community
Society	Often has charitable status, can consist of diverse interests
Council	Includes government representatives and may be legislated
Combination	A combination of two or more of the above structures (e.g., sometimes a collaborative watershed governance structure will have a partner Society to leverage financial resources)
Evolution from one structure to another	Expects transition from a start-up structure to another structure at a later point

Despite the diversity of watershed management approaches in Canada, lessons learned may be drawn from many. Below are case studies from across the country. A more comprehensive overview of existing Canadian watershed management bodies is provided in Appendix K.

3.2.2.1. FRASER BASIN COUNCIL

Established in 1997, the Fraser Basin Council is a non-profit organization composed of 38 directors, including three representing the federal government, three representing the province of B.C., one representative from each of the eight regional districts overlapping with the watershed, as well as one representative from each of the eight Indigenous language groups in the area. Sixteen of the 38 directors are appointed by the aforementioned representatives, and include two from each of five geographic areas of the basin, three basin-wide directors focused on economic, social and environmental sustainability, one director representing youth, one director with experience in the finance sector, as well as one impartial chairperson. The Council is also composed of sub-committees which focus on specific regions and/or issues, including at the sub-watershed level. The Fraser Basin Council is guided by the Charter for Sustainability, a good-faith agreement among Fraser Basin residents, organizations, governments, and Indigenous peoples. The Charter includes four directions: understanding sustainability; caring for ecosystems; strengthening communities; and improving decision-making. Its main focus is to advance “sustainability in B.C., with a core focus on the Fraser River Basin; and support leaders in government, business and community organizations in finding collaborative solutions” (Fraser Basin Council, 2018).

The Fraser Basin Council is a neutral body, with government representation, that makes decisions based on consensus. As a result, it is able to provide direct feedback to government on policy issues, as well as facilitate cooperation, build trust, and enable information exchange amongst groups whose interests and perceptions may diverge from one another. The Council’s sub-committee structure supports smaller-scale community/collaborative watershed governance and planning, and allows the allocation of funding towards specific stewardship and sustainability projects at the local scale. The Fraser Basin Council’s Charter for Sustainability resembles Ottawa Riverkeeper’s 2015 Gatineau Declaration (see Annex A for full declaration).

3.2.2.2. MACKENZIE RIVER BASIN TRANSBOUNDARY WATERS MASTER AGREEMENT

The Mackenzie River basin is interprovincial/territorial and overlaps with the traditional Indigenous territories of a number of groups, much like the interjurisdictional nature of the Ottawa River watershed. In order to move towards more integrated management of the Mackenzie River basin, in 1972, the governments of Canada, Yukon, Northwest Territories, British Columbia, Alberta, and Saskatchewan created the Mackenzie River Basin Intergovernmental Liaison Committee, followed by the Mackenzie River Basin Committee in 1977 and, ultimately, the Mackenzie River Basin Board (MRBB) in 1997 (The Forum for Leadership on Water, 2016). The MRBB was established through the Mackenzie River Basin Transboundary Waters Master Agreement, a non-binding agreement that sets out principles for shared management of interprovincial and territorial waters. Membership of the MRBB consists of three federal representatives and two representatives from each of the five provincial/territorial jurisdictions within the basin. In addition, one representative from each jurisdiction must be of Indigenous ancestry. The main functions of the MRBB are to (1) provide a forum for communication, coordination, information exchange, and incorporation of traditional knowledge; (2) recommend objectives or guidelines for quality and quantity; (3) encourage consistent monitoring; and (4) report on the state of the aquatic ecosystem every five years. Each of the governments involved in the Board fund the MRBB's annual operational budget of \$280,000 (Government of Canada, et al, 1997). The MRBB and the associated Agreement may be described as important models for successfully integrating Indigenous interests in decision-making processes, which is very much aligned with CCME IWM Principle 9 on Community and Indigenous Engagement. A guiding principle for the inclusion of Indigenous interests—which is increasingly applied within the context of the Mackenzie River Basin Transboundary Waters Master Agreement, and supported by leading experts in watershed co-management—is that of collaborative consent. The term “collaborative consent” was initially coined to describe decision-making processes followed by territorial and Indigenous governments in the Northwest Territories to establish water-related agreements and legislation. The seven hallmarks of collaborative consent are as follows (Phare et al., 2017):

- Collaborative consent is based on respect, trust and the art of diplomacy between governments;
- All governments recognize each other as legitimate authorities;
- Collaborative consent tables are decision-making tables, which means that representatives must have the authority to participate fully and make decisions at the table;
- The scope of issues considered through the process can be extensive and ultimately must be satisfactory to all parties;
- Collaborative consent starts at the front-end and all governments commit to remaining at the table for the “long haul”;
- Each government's interests must be dealt with in a satisfactory manner from their own point of view; and
- The process generates real outcomes.

Collaborative consent is not exclusive to the MRBB, and has emerged as a guiding principle used in various processes, including the development of the bilateral agreements between the Northwest Territories and Alberta, and the Northwest Territories and British Columbia, in 2015 (Phare et al., 2017). As part of those agreements, a Memorandum of Understanding was signed between the Government of the Northwest Territories and Indigenous governments, establishing the roles and responsibilities of Indigenous peoples under agreements, and to ensure the process would be carried out in good faith. Through collaborative consent, Indigenous and non-Indigenous governments commit to collaborating over the long term, with a goal of obtaining each other's consent on decisions, policies and plans moving forward.

3.2.2.3. CONSERVATION AUTHORITIES IN ONTARIO

Ontario's CAs were established by the provincial government and a number of municipalities in the 1940s, in response to flooding and erosion occurring across the province. Under Ontario's *Conservation Authorities Act*, passed in 1946, provincial government watershed management authorities were delegated to these new, independent watershed-scale organizations. Over time, CAs became involved in a wider range of activities and responsibilities, and today, CAs have formally adopted an IWM approach (Conservation Ontario, n.d.). With the passage of Ontario's Bill 139 in December 2017 (*Building Better Communities and Conserving Watersheds Act*), the role of CAs in watershed management may expand. Among the roles and responsibilities of CAs is the requirement to develop and implement source water protection plans in designated areas. Source water protection plans are developed by multi-stakeholder Source Protection Committees which generally include Indigenous, municipal, and non-governmental members. Source water protection plans are also developed in consultation with the general public and, ultimately, approved by the provincial government.

While CAs receive funding from diverse sources, they are funded primarily by municipal levies and self-generated funds (i.e., fees for services). CAs manage relatively large amounts of funds relative to other watershed management agencies in Canada. In 2013, for example, Ontario's 36 CAs delivered programs and services totaling approximately \$290 million, with more than 3,600 staff (Conservation Ontario, 2017). Of note, the Grand River CA and the Lake Simcoe Region CA are the only Canadian watershed governance models to have received the Thiess International Riverprize, in 2000 and 2009, respectively. The Riverprize is awarded to watershed management agencies by the International River Foundation to "recognise exemplary initiatives in protection, restoration and sustainable management of the world's rivers" (International River Foundation, n.d.).

Ontario's CAs successfully implement many of the CCME IWM Principles. In a 2014 analysis by Mitchell et al., CAs were found to be particularly good models for watershed management, largely because they obtain significant funding from a variety of sources, have clearly defined roles and responsibilities in relation to other levels of government, and prioritize stakeholder engagement (Mitchell et al., 2014). The capacity of CAs to acquire sizable funding from a variety of sources empowers them to strive towards IWM Principles 1, 2, 3, 4, and 5, that is, to take relatively ambitious, ecosystem-wide, and integrated actions that consider cumulative impacts. In addition, the fact that CAs have clearly defined roles and responsibilities, and have been delegated provincial authorities through legislation, supports IWM Principle 8, on shared responsibility. Mitchell et al. also viewed the establishment of source water protection plans as particularly successful and innovative. Protecting the surface or groundwater that supplies municipal drinking water systems reduces the risk of drinking water contamination and associated threats to human health. It is a proactive approach, as per IWM Principle 7.

3.2.2.4. UPPER ST. LAWRENCE AND GREATER MONTRÉAL ROUND TABLE

The Regional Round Table for the Upper St. Lawrence and Greater Montréal—which, of all Regional Round Tables, is responsible for the largest population centre—provides another model of governance. Through the ORWS, OBVs, in particular, highlighted the effectiveness of the Regional Round Table’s structure in ensuring a collaborative process that is not biased towards the desires or motivations of one group. Launched in September 2015, the Regional Round Table is coordinated by local zones d’intervention prioritaire (ZIP) committees that were already well established and well connected to key stakeholders (Port de Montréal, 2015). The ZIP committees oversee three separate entities within the larger Regional Round Table structure: a Regional Forum, a Strategic Advisory Council, and Concertation Sub-Committees. Membership in the Regional Round Table is open to all, and the Regional Forum is an annual event that is open to all Regional Round Table members. It provides an opportunity for: broad engagement of all interest groups in the region; seeking input on the priorities of the Regional Round Table; and feedback on membership of the Strategic Advisory Committee. As a result, and as per CCME Principle 9, the Regional Forum could be deemed as supporting meaningful participation of local communities.

Membership on the Strategic Advisory Committee is limited to a number of key groups, as identified by the ZIP committees. There are currently 35 organizations on the Committee, which represent First Nations, the municipal sector, the community sector, the IWM sector, and the economic sector. Those representing the economic sector include the Port of Montreal, Hydro-Québec, and Québec’s professional farmers’ union (Table de Concertation Régionale Haut St. Laurent – Grand Montréal, n.d.). The participation of such private sector actors supports CCME IWM Principle 10, on Sustainable Development, to meet economic and societal needs without compromising the environment.

3.2.2.5. BRAS D’OR LAKES COLLABORATIVE ENVIRONMENTAL PLANNING INITIATIVE

The Bras d’Or Lakes Collaborative Environmental Planning Initiative (CEPI) is a collaborative effort to protect the Bras d’Or lake system in Nova Scotia. It was established in 2003 at the initiative of five Mi’kmaq First Nations who called for the development and implementation of an overall environmental management plan for the lake system. Similar to the Fraser Basin Council’s Charter for Sustainability, all the Mi’kmaq communities, municipal, provincial, and federal agencies, and citizens with an interest in the Bras d’Or watershed signed the Bras d’Or Charter, committing them to the new Bras d’Or Lakes CEPI. CEPI’s vision is to lead a unique collaboration of partners that incorporate both traditional and western perspectives in order to foster a healthy and productive Bras d’Or Lakes watershed ecosystem. CEPI is also guided by a Terms of Reference which outlines its vision, guiding principles, objectives and governance structure. Objectives are a balance of environmental, social, cultural and institutional priorities to ensure the health and sustainable use of the watershed ecosystem.

CEPI’s Senior Council consists of the five Mi’kmaq First Nation Chiefs, federal Regional Directors General, provincial Deputy Ministers, Mayors, and Wardens. It meets semi-annually to review and endorse CEPI’s activities and overall direction. CEPI is also supported by a Management Committee, consisting of one representative from each of the government partners and four ex-officio members, including the CEPI Secretariat. The Committee, which meets monthly, is responsible for oversight and management of activities. An Elders Council and a Youth Council provide unique guidance to the Senior Council and the Management Committee, and Task Teams are created by the Management Committee to implement specific aspects of the overall work plan. Since the signing of the Bras d’Or Charter in 2005, a number of notable accomplishments were made, including State of the Environment reports, an ecosystem overview report, as well as the establishment of an Organizations of the Bras d’Or network—a collaborative body consisting solely of non-governmental partners. From 2012 to 2014, CEPI also undertook a comprehensive analysis of monitoring gaps in the watershed, with support from ECCC’s Atlantic Ecosystem Initiative program (Bras d’Or CEPI, 2018).



Through the engagement process of the ORWS, CEPI indicated that the relatively high number of committees within its overall structure may create an administrative burden (CEPI, 2018); however, that burden may be outweighed by the associated benefit of having high accountability within the organization. CEPI has also indicated that the leadership role undertaken by Mi'kmaq, alongside representatives of other governments, not only reflects a nation-to-nation approach, but also allows for Indigenous Knowledge and spirituality to be integrated within CEPI's structure and activities. Of note, CEPI supports the guiding principle of Two-Eyed Seeing which, according to Elder Albert Marshall of the Mi'kmaq Nation, is when you "learn to see from one eye with the best in Indigenous knowledges and ways of knowing, and from the other eye with the best in Western (or mainstream) knowledges and ways of knowing ... and learn to use both these eyes together for the benefit of all" (Marshall & Bartlett, 2017).

3.2.3. INDIGENOUS LESSONS LEARNED IN WATERSHED MANAGEMENT

A number of governance best practices were communicated by the Algonquins of Ontario, the Algonquin Anishinabeg Nation Tribal Council, the Algonquin Nation Secretariat, the Mohawk Council of Kahnawà:ke, the Mohawk community of Kanesatake, and Métis Nation of Ontario for the ORWS. Below is a summary of those views. Indigenous input that is more specific to the potential creation of a new collaborative body is included in section 3.3 of the report.

Prior to European contact and settlement, the Ottawa River watershed was managed by Indigenous peoples in a way that recognized its status as sacred. The management system applied by Algonquins, for example, is fundamentally holistic and relationship-based, not transactional and anthropocentric. The Algonquin Anishinabeg Nation Tribal Council explained that for Algonquin peoples, the idea of looking at individual elements of an ecosystem, in and of themselves, falls outside of the Anishinabe belief system. Rather, achieving balance between all components of an ecosystem and physical environment is prioritized. The focus of ecosystem and environment protection is not solely on the water, but also includes the ecosystem around it—the forests, the animals, and the actions of the people. For example, moose feed from the river, and fish live in the river; studying these two animal populations may give an indication as to the state of their immediate environment (Algonquin Anishinabeg Nation Tribal Council, 2018). Similarly, the Algonquin Nation Secretariat expressed that all aspects of the watershed must be considered—“trees, roots, animals, medicines, air”—as a reflection of the understanding that every life form is integrated and tied to the wellness of another (Kitchisibi Ikidowin Anishinabe, 2018). Such practices are consistent with IWM Principles 1, 2, 4, and 5, which involve taking an ecosystem and integrated approach that recognizes the “interdependency of air, land, water and living organisms” (CCME, 2016). In addition, the Mohawk community of Kanesatake expressed that it is uniquely positioned to inform integrated management of the Ottawa River watershed because it is “at the confluence of the Ottawa and St. Lawrence rivers”, reflecting the fact that the health of the Ottawa River watershed has implications on the health of other watersheds downstream (Bisson & Mohawk community of Kanesatake, 2018).

The Algonquins of Ontario provided ECCC with additional information on the spiritual significance of the Ottawa River. According to the Algonquins of Ontario, Algonquin peoples believe, as original stewards of the Kitchissippi (Ottawa River), that the management of the watershed would greatly benefit from an infusion of Anishinabe values and teachings. Algonquins of Ontario explained that the Algonquins are guided by the spirit and intent of the Teachings of the Seven Grandfathers. These teachings, listed below, have been passed down from generation to generation, and continue to be practiced today. Recognizing such practices applies to CCME IWM Principle 9—that IWM should “duly support the identity, culture and interests of local communities and Aboriginal Peoples” (CCME, 2016). The teachings are as follows:

- “Honesty (Gwayakwaadiziwin): Honesty in facing a situation is to be brave
- Humility (Dabaadendiziwin): Humility is to know yourself as a sacred part of Creation
- Respect (Minaadendamowin): To honour all Creation is to have Respect
- Bravery (Aakode’ewin): Bravery is to face the foe with integrity
- Wisdom (Nibwaakaawin): To cherish knowledge is to know Wisdom
- Love (Zaagi’idiwin): To know Love is to know peace
- Truth (Debwewin): Truth is to know all of these things” (Richardson, 2018)

Additionally, Dr. Sue Roark-Calnek, an Algonquin researcher, indicated that “mutuality, respect and consultation are integral to Algonquin social and political organization on a number of levels: family-to-family, band-to-band, and nation-to-nation.” The Algonquin Nation Secretariat expressed that such principles should be harmonized into watershed governance (Kitchisibi Ikidowin Anishinabe, 2018).

3.3. WHAT WE HEARD: VIEWS ON WATERSHED MANAGEMENT APPROACHES

As per the text of Private Member's Motion M-104, one purpose of the study is to examine the potential creation of a new collaborative body, such as an Ottawa River Watershed Council. Participants in the engagement process for the ORWS were encouraged to share their views regarding challenges associated with the implementation of IWM in the Ottawa River watershed, and if a Council would be an appropriate means of addressing those challenges. Furthermore, participants were asked to provide input on what the potential structure, mandate, and membership of a Council could be, and who should provide funding if a Council were to be established. The governments of Québec and Ontario did not provide an official position on the potential creation of a collaborative body or the use of IWM principles.

3.3.1. VIEWS ON BARRIERS TO INTEGRATED WATERSHED MANAGEMENT IN THE OTTAWA RIVER WATERSHED

Through the engagement process for the ORWS, Indigenous organizations, provincial governments, municipalities, CAs, OBVs, and other key stakeholders were asked whether they supported IWM as an appropriate approach to watershed management, and whether they experienced challenges in implementing aspects of the CCME IWM Principles (see section 3.1 Watershed Management). While the general consensus was that IWM is the ideal approach to watershed management, a number of challenges in the implementation of the principles were raised, notably with regards to capacity, collection and integration of data, engagement of communities and Indigenous peoples, and consensus building.

Capacity can be defined as the appropriate mix of financial, material and human resources, which also encompass expertise and water infrastructure (Cervoni, Biro, & Beazley, 2008; Treasury Board Secretariat, n.d.). Respondents to the ORWS generally expressed that a lack of capacity often represents barriers to effective implementation of IWM (Public and Stakeholder consultations, 2018; Kitchisibi Ikidowin Anishinabe, 2018; Algonquin Anishinabeg Nation Tribal Council, 2018; Richardson, 2018). Algonquins of Ontario, Algonquin Anishinabeg Nation Tribal Council, and Algonquin Nation Secretariat identified capacity constraints as being an important barrier, and expressed an interest in building local expertise and understanding through funding and other knowledge building opportunities (Public and Stakeholder consultations, 2018). Local watershed management groups, such as CAs and OBVs, expressed that they lacked vital resources, notably staff, time and funding, which has limited their ability to monitor the watershed (Public and Stakeholder consultations, 2018). Environmentally-focused organizations, such as local Lake Associations echoed the same sentiment. In some cases, a lack of resources has required groups to prioritize actions, and has limited the implementation of an integrated, ecosystem approach (IWM Principle 2) that takes cumulative impacts into account (IWM Principle 5).

Groups also expressed that collecting and integrating data into decision-making, at the watershed level, can be challenging, particularly because research projects are often focused on smaller-scale issues (Public and Stakeholder consultations, 2018). If data is not accurately integrated into decision-making and not communicated to the public, a lack of public understanding and awareness of watershed issues may result. This, in turn, can lead to less public demand for, and funding towards watershed stewardship initiatives. A barrier to the implementation of IWM Principle 2, “adopting an ecosystem approach”, as well as Principle 9, “engaging communities and Indigenous groups”, includes the lack of proper science awareness integration with communities.

The meaningful engagement of local communities and Indigenous peoples is another challenge expressed during the ORWS. The Algonquin Nation Secretariat, for example, expressed that current consultation practices involved in watershed management are flawed, and that the rights and interests of Indigenous peoples are not taken into account when developers notify

communities about a process that is already underway (Kitchisibi Ikidowin Anishinabe, 2018). Métis Nation of Ontario voiced similar views, calling for rights-based consultation in areas where Métis Nation of Ontario communities assert rights (Odonaterra Community Environmental Strategies, 2018). Furthermore, the Mohawk Council of Kahnawà:ke stated that an assessment of monitoring activities and data gaps in the Ottawa River watershed is required, and that such an assessment needs to be driven by both science and Indigenous Knowledge, in order to “limit the possibility for bias” (Mohawk Council of Kahnawà:ke, 2018).

While some OBVs have reserved seats for Indigenous representatives on their administrative boards and board of directors, Indigenous organizations may not have the capacity or the desire to participate (Public and Stakeholder consultations, 2018). Inconsistencies in Indigenous engagement have sometimes resulted in uncertainty regarding the concerns and desires of local communities, and the inability to effectively and collectively address them. Furthermore, Algonquin Nation Secretariat and Algonquins of Ontario expressed that without greater decision-making authority, and the capacity to develop and enforce policies or regulations, concerns that have been identified are all the more difficult to address. In other words, it has been difficult to “share the responsibility for policy and program development and implementation within the mandate of all actors” or IWM Principle 8 (CCME, 2016).

Of those stakeholders or communities who are more successfully implementing IWM, groups have expressed that it is difficult to build consensus on priority issues, and identify a course of action. The Ottawa River watershed has several bodies involved in its management, resulting in fragmented jurisdictional responsibilities (see section 1.3 Roles and Responsibilities in the Ottawa River Watershed). This fragmentation can result in overlaps or gaps in mandated roles and responsibilities. Respondents also expressed concerns that fragmentation hindered the ability to gather knowledge about the watershed, share information, monitor, and collect data. Diverging priorities can also impede the development of strong partnerships between groups. In addition, because the benefits of IWM implementation are often only visible in the long-term, it is difficult to maintain momentum and collective action towards a common goal. These trends may impede implementation of IWM Principles 6, 10, and 11, in particular, which relate to the application of the precautionary principle, ensuring sustainable development in the watershed, and protecting its natural capital.

Given the views discussed above, the two overarching challenges expressed throughout the ORWS are a lack of capacity and jurisdictional complexity. These barriers are further exacerbated by the interprovincial nature of the Ottawa River watershed, and the unique language requirements that exist within it (i.e., the use of French and English languages as primary working languages).

3.3.2. VIEWS ON THE POTENTIAL CREATION OF AN OTTAWA RIVER WATERSHED COUNCIL

Feedback on the potential creation of an Ottawa River Watershed Council was collected throughout the engagement process associated with the ORWS, including through self-directed Indigenous consultations, public comments made on the online citizen engagement platform PlaceSpeak, individual email submissions to the Study email account, and engagement guides submitted by various interest groups. The views expressed are summarized below.

3.3.2.1. COUNCIL SUPPORT

Nearly all views expressed by stakeholders and individuals supported increased collaboration in the Ottawa River watershed. Many stated that a current lack of collaboration was one of the greatest challenges facing the watershed, particularly due its interprovincial nature. Many respondents expressed interest in establishing a Council to: coordinate watershed management across borders; develop common goals and objectives; support IWM approaches; address issues; and set priorities for action (PlaceSpeak consultations, 2018; Public and Stakeholder consultations, 2018). The need to convene diverse interest groups from across the watershed to share information and help identify concerns was widely recognized as a gap missing from current management practices.

"I fully support the formation of an Ottawa River Watershed Council to address the multiple issues, concerns, risks and complexities faced by a diverse set of interests involving multiple, even competing jurisdictions."

(PlaceSpeak consultations, 2018)

The majority of those supporting improved collaboration believed that a coordinating body was an effective strategy. The Algonquins of Ontario, the Algonquin Anishinabeg Nation Tribal Council, the Algonquin Nation Secretariat, the Mohawk Council of Kahnawà:ke, Mohawk community of Kanesatake, and Métis Nation of Ontario were supportive of the formation of a new watershed-based collaborative body, on the condition that their rights and related interests would be strongly reflected within its mandate, structure and membership. (Algonquin Anishinabeg Nation Tribal Council, 2018; Bisson & Mohawk community of Kanesatake, 2018; Kitchisibi Ikidowin Anishinabe, 2018;

Mohawk Council of Kahnawà:ke, 2018; Odonaterra Community Environmental Strategies, 2018; Richardson, 2018). Specifically, the Algonquin Nation Secretariat highlighted the importance of recognizing rights of First Nations as a starting point for improving governance in the Ottawa River watershed.

Those that opposed the establishment of a Council did so for a number of reasons, including concerns relating to costs, the duplication of efforts, or the belief that a Council would lead to over-regulation of the watershed. A small minority of respondents cited opposition to a Council based on a belief that there were no gaps in governance or knowledge of watershed health. Indigenous organizations consulted generally viewed the establishment of a new collaborative body as a positive path forward.

3.3.2.2. COUNCIL MANDATE

There was widespread agreement from nearly all respondents that the mandate of any new Council should be to: facilitate the sharing of data and information; identify knowledge gaps; foster cooperation and engagement; and in general, focus on non-regulatory work (PlaceSpeak consultations, 2018; Public and Stakeholder consultations, 2018). A number of respondents highlighted the importance of creating a space to coordinate efforts amongst groups that already collect information about the health of the watershed. For example, some suggested that the monitoring and reporting activities of governments, CAs and OBVs could be better aligned. Other respondents highlighted the importance of monitoring and data collection to better predict flood and drought events and to ensure risk management strategies were in place. In addition, to facilitate public engagement, education, and awareness, many respondents recognized data transparency and public accessibility as important components of a Council's mandate.

The Algonquins of Ontario, the Algonquin Anishinabeg Nation Tribal Council, the Algonquin Nation Secretariat, the Mohawk Council of Kahnawà:ke, Mohawk community of Kanesatake, and Métis Nation of Ontario were generally of the view that a Council should be empowered to better ensure recognition of rights, meaningful consultation of, and collaboration with Indigenous peoples, while furthering watershed protection. Multiple Indigenous organizations and community members expressed a need to better understand the baseline health and the ecological threats to the watershed, and a need to improve integration of Indigenous Knowledge. The Mohawk Council of Kahnawà:ke, for example, proposed the completion of a Regional Impact Assessment as a first activity to be carried out by a new Council. Similarly, Algonquin Anishinabeg Nation Tribal Council stressed the need for a baseline health assessment of the watershed, followed by the development and implementation of a plan to improve watershed health. However, Algonquins of Ontario cautioned against "reinventing the wheel", and that a new Council should strive to draw on existing skills, expertise and knowledge held by Indigenous communities, relevant government agencies and other stakeholder groups (Mohawk Council of Kahnawà:ke, 2018; Richardson, 2018).

Algonquins of Ontario suggested that a study on existing Indigenous Knowledge should be carried out and be "incorporated into the governance framework and decision-making processes regarding watershed governance, stewardship, and protection." As was also discussed in section 3.2.3, many Indigenous organizations stressed the importance of drawing on existing Indigenous Knowledge, with Algonquin Anishinabeg Nation Tribal Council highlighting the value of gathering and incorporating Indigenous Knowledge, into management (Algonquin Anishinabeg Nation Tribal Council, 2018). In addition, the Algonquin Nation



In terms of the role of governments, from a regulatory perspective, many respondents indicated that governments have adequate legislation in place to protect the Ottawa River watershed (Public and Stakeholder consultations, 2018); however, some expressed concern that governments may not have the capacity to properly enforce existing legislation (PlaceSpeak consultations, 2018). Other respondents stated that regulations are not well integrated between provinces and between orders of government, leaving gaps in environmental protection (e.g., protection of species at risk). On the other hand, some believed that no further regulatory action was needed (Public and Stakeholder consultations, 2018).

Regarding federal involvement specifically, a number of respondents indicated that the federal government has the unique ability to bring together groups from across the watershed and, therefore, should participate in the operations of any new collaborative body. Similarly, all Indigenous organizations consulted indicated that the federal government should be involved in watershed management. Many discussed the federal government's commitment to reconciliation and a renewed, nation-to-nation relationship, as important drivers for ensuring that Indigenous rights and interests are represented and respected. In fact, some argued that the federal government should have a strong presence; according to the Mohawk Council of Kahnawà:ke, "a federally coordinated process is likely to be more effective to ensure that the appropriate partners and resources are at the table to undertake concrete actions" (Mohawk Council of Kahnawà:ke, 2018). While the Algonquin Nation Secretariat acknowledged the importance of collaborative governance and nation-to-nation agreements, they also expressed concern regarding government involvement, noting there are potential risks to Anishinabe people in participating in federal and other non-indigenous governance initiatives" (Kitchisibi Ikidowin Anishinabe, 2018). According to the Algonquin Anishinabeg Nation Tribal Council, the main focus of the federal government should be to support the implementation of watershed management initiatives led by Indigenous peoples (Algonquin Anishinabeg Nation Tribal Council, 2018).

The following quotes, taken from engagement guides received by ECCC and from public comments made on PlaceSpeak, capture the views held by many respondents in regards to the mandate of a collaborative body:

"(A coordinating body should) work with all organizations within the Ottawa River watershed to collect, analyse and report on environmental data and conditions, and facilitate the identification of priority actions based on an IWM approach."

(Public and Stakeholder consultations, 2018)

"(The ideal role of a Council would be to) provide a central portal/location for information and guidance with respect to watershed protection and community development/education."

(Public and Stakeholder consultations, 2018)

In addition to the views expressed by respondents about what they believed should be included in a Council's mandate, there were a similar number of suggestions about what a Council should not do. Some individuals strongly expressed that a Council should not be granted authority to regulate or govern the watershed in any capacity, and suggested that the Council must work within existing regulatory frameworks (Public and Stakeholder consultations, 2018). Should a Council make recommendations concerning the management of the watershed, many respondents felt that such recommendations should be non-regulatory in nature and non-binding (Public and Stakeholder consultations, 2018). Respondents largely believe that no new level of regulatory protection is required, and that a Council would not be the appropriate group to introduce such regulations. There was also notable concern that a Council should not duplicate the efforts of OBVs, CAs, or other existing bodies in the watershed, such as the ORRPB.

3.3.2.3. COUNCIL MEMBERSHIP AND STRUCTURE

ORWS respondents also provided feedback on the structure and membership of a potential Council. The Algonquins of Ontario, the Algonquin Anishinabeg Nation Tribal Council, the Algonquin Nation Secretariat, the Mohawk Council of Kahnawà:ke, the Mohawk community of Kanesatake, and the Métis Nation of Ontario had varied opinions about structure and membership of a potential Council. These organizations expressed a strong desire for watershed management to involve Indigenous peoples in a way that is meaningful and inclusive, and for Indigenous peoples to be recognized as rights holders whose knowledge can make valid and important contributions to understanding the watershed. In order to better recognize Indigenous rights and interests, the Algonquin Anishinabeg Nation Tribal Council called for Algonquin Peoples to have a “strong—and at the very least equal—voice” within any new governance arrangement (Algonquin Anishinabeg Nation Tribal Council, 2018). Similarly, the Mohawk community of Kanesatake called for equal representation for all Indigenous and non-Indigenous communities (Bisson & Mohawk community of Kanesatake, 2018). Most Indigenous organizations also highlighted the importance of involving women, elders and youth: women are the traditional keepers and guardians of water, elders hold a wealth of knowledge, and youth have motivation and a vested interest in the future of water and the watershed.

During public engagement, many respondents shared views about membership on a Council. Suggestions included municipal, provincial, and federal governments, Indigenous peoples, CAs and OBVs, industry representatives, and Ottawa Riverkeeper. A few respondents suggested that Ottawa Riverkeeper should play a coordinating role and act as the secretariat for the Council. In addition to these groups, there were also suggestions that other environmental NGOs (e.g., Ducks Unlimited, WWF-Canada), the ORRPB, academics, land associations, and youth also be included.

Two notable rationales behind the membership suggestions were funding and accountability. For example, it was suggested that having elected municipal representatives on the Council was very important, as they are directly accountable to taxpayers (Public and Stakeholder consultation, 2018). However, some respondents expressed concern regarding the financial obligations that may come with membership on a Council, suggesting that the financial constraints of certain interest groups could be an important barrier that may need to be considered if a Council were to be established (Public and Stakeholder consultation, 2018).

Views regarding structure of the Council varied. Most organizations called for structures through which authority over the management of the watershed would be shared equally among Indigenous organizations and government institutions. For example, the Algonquins of Ontario, the Algonquin Nation Secretariat and the Mohawk community of Kanesatake all advocated for a “co-governance” structure which, according to the Algonquins of Ontario, refers to “two or more self-governing entities coming together to share authority and decision-making over a jurisdiction” (Richardson, 2018). Algonquins of Ontario listed four elements as common amongst successful watershed governance arrangements: (1) indigenous co-leadership, including “full partnership of Indigenous organizations in developing the governance structures and participating at the top levels of decision-making”; (2) recognizing sovereignty and jurisdictional rights, as in “recognizing conflicting views of sovereignty and jurisdiction while also finding a way to move forward in decision-making”; (3) consensus, as an essential element for ensuring that governance structures remain equitable; and (4) whole-of-watershed thinking, much like IWM Principle 1 which promotes the use of watershed boundaries for scoping management activities (Richardson, 2018).

Additionally, the Algonquin Nation Secretariat suggested that the next step should be developing a co-governance method to overcome some of the issues cited above. However, because needs, assets and objectives are unique to each Algonquin individual and community, there is no definitive co-production blueprint yet. Rather, certain guiding principles should be considered; for example, consulting in-depth with all communities to identify Algonquin people's existing concerns, capabilities, as well as strengths. The Algonquin Nation Secretariat also suggested that a pragmatic perspective must be used in determining the design and delivery of a co-governance model for the Ottawa River watershed (Kitchisibi Ikidowin Anishinabe, 2018).

The Algonquins of Ontario proposed that Memoranda of Understanding be negotiated between the Algonquins of Ontario and Crown regulatory bodies, clarifying "shared roles, responsibilities, authorities, and jurisdiction regarding matters that could impact the Ottawa River watershed" (Richardson, 2018). The Algonquin Anishinabeg Nation Tribal Council stated that Indigenous representation must be proportionate to other governments, and not limited to one or two token seats within a Council (Algonquin Anishinabeg Nation Tribal Council, 2018). The Algonquin Nation Secretariat highlighted a desire to be closely involved in the design of a new Council in a way that does not "dilute or compromise their long-held values, rights and title towards customary lands or their independence as a sovereign people" (Kitchisibi Ikidowin Anishinabe, 2018). The Mohawk community of Kanesatake added that all representatives of a new Council should have the appropriate expertise, education and commitment to protect the watershed, independent of any personal or economic gain (Bisson & Mohawk community of Kanesatake, 2018). Similarly, Gehl (2018) expressed that it is important that a council "rely on and include Indigenous people who are trained in Indigenous science and philosophy in real and collaborative ways". In addition, Métis Nation of Ontario suggested a structure involving the formation of an independent Métis Nation of Ontario Ottawa River Watershed Committee, as well as a broader Ottawa River Watershed Management and Policy Table. They specified that a new Management and Policy Table should be required to be consulted and be advised by the Métis Nation of Ontario Ottawa River Watershed Committee (Odonaterra Community Environmental Strategies, 2018).

Of note, some Indigenous organizations stated that if a watershed council was formed, any Indigenous organizations that hold Aboriginal rights within the watershed would require consultation under Section 35 of the *Constitution Act, 1982*. Moreover, the Algonquin Anishinabeg Nation and Algonquin Nation Secretariat suggest further deep, meaningful consultation on the future structure of the council with their communities and are proposing the idea an 11 community Algonquin Nation Watershed Council as part of the present Nation building exercise amongst Algonquin communities recognized under the *Indian Act*. For example, the National Capital Commission currently facilitates two separate Algonquin working tables in the NCR, one with the Algonquins of Ontario and one with the Algonquin Nation communities (Kitchisibi Ikidowin



Photo credit: Kitchisibi Ikidowin Anishinabe, 2018.

Anishinabe, 2018).

Many respondents during public engagement indicated that they would prefer if a Council was structured as a round table, where the views of all members are considered equally (Public and Stakeholder consultation, 2018). This was suggested as a means by which members can share ideas and information on an equitable level. A few respondents proposed that a Council be structured as a board of directors with various sub-committees. One respondent suggested a tiered Council, with each sub-watershed responsible for providing a representative to a larger watershed-wide Council (PlaceSpeak consultation, 2018). A top-down approach was criticized by one organization that cited that such a structure discourages the sharing of information (Public and Stakeholder consultation, 2018).

3.3.2.4. FUNDING OF A COUNCIL

Many participants in the study recognized that in order for a Council to fulfill its mandate, sustained resources would be required.

None of the Indigenous organizations consulted explicitly shared their views on who should fund a Council. However, all groups did suggest that establishing and operationalizing a Council, including Indigenous participation, would require financial support. The Algonquins of Ontario highlighted funding structures already used by existing watershed management bodies. For example, trusts used by the Waikato River Authority in New Zealand were favoured by the Algonquins of Ontario as they allow for “consistency and year-to-year security that allows for long-term planning.” Taxation authorities and shared funding schemes were also highlighted by the same group, given their successful use in some existing watershed boards in Canada (Richardson, 2018).

“(Funding) should be distributed and can come from a percentage from each municipality / stakeholder into a collective pot.”

(Public and Stakeholder consultations, 2018)

As demonstrated by the views expressed by certain interest groups in the previous sections, external funding may be required to ensure that all stakeholders have an equitable opportunity to participate on a Council. Respondents largely viewed two groups, government and Council members, as being best positioned to provide the funding required to operate a Council.

Those in favour of a government-supported Council felt that the federal government would be best positioned to provide the financial and technical support for the long-term success of the Council. However, mandating funding from all levels of government may place pressure on some smaller townships, as some indicated that they would be unable to pay the municipalities’ share of a Council (Public and Stakeholder consultation, 2018). Some respondents, who specified that funding for a Council should be distributed between all members, suggested that funds could be redistributed to implement actions within the watershed based on priority. Defining priorities could be a point of contention should a Council be established; however, one group suggested that funding should be allocated as follows: “Funding should be provided to the organizations that have the capacity to collect, analyse and report on indicators. Incentive should be provided to areas within the watershed that currently are not covered by an existing watershed organization” (Public and Stakeholder consultations, 2018).



CHAPTER 4:

DATA, MONITORING AND POTENTIAL INDICATORS

Private Member's Motion M-104 states that, as part of its study on the Ottawa River watershed, the Government of Canada should examine important watershed health indicators, such as water quality, biodiversity, and shoreline integrity. This chapter does not include an assessment of watershed health; rather, through engagement on the ORWS, as well as research into existing watershed health assessments and ongoing monitoring in the watershed, ECCC developed a list of potential watershed health indicators for consideration. In addition to health indicators, this chapter also examines responsibilities for monitoring activities, existing health assessments, available data, and discusses gaps related to data and information sharing.

4.1. INDICATOR THEMES AS IDENTIFIED BY MOTION M-104

An indicator is a quantifiable metric that is used to provide information about, describe, or evaluate, the state of the environment or area of consideration (OECD, 2003). While indicators are used for various purposes, there are several overarching criteria that are recommended for selecting appropriate indicators. For example, according to the OECD's Environmental Directorate, indicators should be (OECD, 2003):

- Easy to understand and communicate;
- Timely and relevant to the current policy context, and spatially and temporally representative of environmental conditions/pressures;
- Measureable through the incorporation of readily available, or well documented, data;
- Adaptable to changing information or conditions; and
- Founded in best practices and sound science.

"The Rio Conference on Environment and Development in 1992, and other similar environmental milestone activities and happenings, recognized the need for better and more knowledge and information about environmental conditions, trends, and impacts. To achieve this, it was not only necessary to collect new and better data; new thinking and research with regard to indicator frameworks, methodologies, and actual indicators were also needed".

(Segnestam, 2002, p. 1)

If appropriate indicators are selected, they can be an essential tool for tracking and measuring environmental performance, and supporting policy evaluation and management decisions. Indicators are also used to communicate findings, and can help identify early warnings for changes to a system. In some cases, if there is lack of baseline data for an element of the environment, certain indicators can be used as "proxies" to help track system changes. In addition to environmental performance, indicators may also be used to examine impacts to the socio-economic values of a system (e.g., tourism, community health and wellbeing).

Indicators for consideration can be found from a wide variety of sources. Potential indicators examined in this Study were mainly derived from the following:

- Existing indicator programs, such as the Canadian Environmental Sustainability Indicators (CESI) Program (see text box below) and Agri-Environmental Indicators;
- Existing monitoring programs or health assessments (e.g., CA watershed health report cards); and
- Recommendations from Indigenous, public and stakeholder engagement, through the online engagement platform PlaceSpeak and through the engagement guides (PlaceSpeak consultations, 2018; Public and Stakeholder consultations, 2018).

CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS PROGRAM (ECCC, 2016B)

The CESI program provides data and information to track Canada's performance on key environmental sustainability issues, including climate change, air quality, water quality and availability, and protecting nature. The indicators are prepared by ECCC with the support of other federal government Departments, such as Health Canada, Statistics Canada, NRCan, AAFC, as well as provincial and territorial government Departments. Designed to be relevant to Government of Canada policy, the indicators are built on rigorous methodology and high quality, regularly available data from surveys and monitoring networks.

Below are examples of indicators identified and used by the CESI program to monitor trends related to wildlife and habitat:

- Species at risk population trends
- Population status of Canada's migratory birds
- Ecological integrity of national parks
- Extent of Canada's wetlands
- Sustainability of timber harvest

CESI indicators are updated regularly on the Government of Canada's website. The website provides access to national, regional, local and international trends through the use of graphics, explanatory text, interactive maps and downloadable data. Indicator results are linked to their key social and economic drivers and information is provided on how the issues are influenced by consumers, businesses and governments. Each indicator is accompanied by a technical explanation of its calculation. There is CESI data available for the Ottawa River watershed.

Using the best available knowledge, developing indicators can help understand the health, or state, of a watershed. As mentioned previously, the text of Motion M-104 identifies three broad indicators for consideration: water quality, biodiversity, and shoreline integrity. More specific and measurable indicators could be identified under each of these indicator themes, along with others that don't fall under the theme areas. The following infographic (Figure 4.1-1), provides a brief snapshot of the watershed using some of the available data that falls under the three indicator themes.

SNAPSHOT PROFILE OF THE OTTAWA RIVER WATERSHED



Here is a summary about some of the key pieces of available information on the health of the watershed

WATER QUALITY



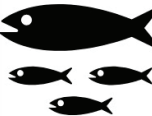
Freshwater quality index for the Ottawa River watershed from ECCC's CESI program indicates that the water quality ranges from marginal to excellent. According to ECCC's Risk-based Basin Analysis, in different segments of the watershed, there are medium and high risks from human activities to water quality.

TERRESTRIAL SPECIES AT RISK



According to ECCC data, 49 different terrestrial species at risk can be found in the Ottawa River watershed. The status of these species ranges from Special Concern to Endangered. Species include: Monarch butterfly, Least bittern, Eastern wolf, Blanding's turtle, and American ginseng.

AQUATIC SPECIES AT RISK



Six aquatic species at risk can be found in the Ottawa River watershed according to Fisheries and Oceans Canada's Aquatic species at risk maps. The status of these species ranges from Special Concern to Threatened. These species are: Bridle shiner, Grass pickerel, Deepwater sculpin, Channel darter, Northern brook lamprey, and River redhorse.

INDUSTRIAL RELEASES



According to ECCC's NPRI data, 18 different facilities reported substance releases to waterbodies in the Ottawa River watershed in 2016. Industries include pulp, paper and paperboard mills, metal ore mining, and sewage treatment facilities. Substances monitored include metals (e.g., lead and zinc), phosphorus, among others.

WATER QUANTITY



Water quantity conditions are difficult to apply at the regional/sub-regional level. According to ECCC's CESI indicators, there have been years of low and high water conditions within the watershed.

4.2. MONITORING AND DATA COLLECTION

Who is conducting monitoring in the Ottawa River watershed? Insufficient communication or understanding concerning monitoring activities in the watershed was a common concern raised by many throughout ECCC's engagement process. Some stakeholder groups indicated that coordination among monitoring groups is vital in reducing duplicated efforts, ensuring sufficient spatial coverage, and making sure that the broad variety of indicators used by different groups is compatible (Public and Stakeholder consultations, 2018). This section will highlight some of the key monitoring and data collection programs that are relevant to the Ottawa River watershed, in order to gain a better understanding about gaps in baseline knowledge. A list of some of these programs and organizations that are undertaking data collection and monitoring can be found in Appendix H.

"Data collection is the means by which [data] are acquired for multiple uses...Monitoring is data collection with the more targeted purpose of detecting and drawing attention to changes in selected measures, particularly extreme changes."

(National Research Council, 2004, p. 179)

ECCC has developed a list of more than 75 different organizations or programs that are undertaking monitoring and/or data collection activities in the Ottawa River watershed. The programs are being run by various jurisdictions and groups, and are categorized in this section as follows:

- Indigenous peoples;
- Federal government;
- Provincial governments;
- Municipal governments;
- Local watershed management agencies (OBVs, CAs);
- Academics, NGOs, citizen science, and community-based monitoring; and
- Industry.

It should be noted that this is not a comprehensive list; therefore some information may be missing regarding monitoring and data collection initiatives.

FIGURE 4.1-1. SNAPSHOT PROFILE OF THE OTTAWA RIVER WATERSHED

4.2.1. SUMMARY OF MONITORING AND DATA THEMES

The word cloud below (Figure 4.2-1), provides a summary of key monitoring and data collection activities in the Ottawa River watershed. The size of the word corresponds to the frequency with which the theme emerged from the activities list. “Surface water quality” is the most common type of data that is being collected in the watershed. This theme includes physical-chemical data (e.g., pH, temperature, clarity, etc.), as well as data related to nutrients (e.g., total phosphorus content in the water), and microbial content of the water (e.g., bacterial *E. coli* levels). The next most common type of data being collected is related to groundwater quality, the monitoring of releases of harmful substances (e.g., sewage effluent, industry releases to water, etc.), and toxic substances (e.g., metals, pesticides, radioactivity, etc.).

Other monitoring and data collection activities include the examination of invasive species, aquatic invertebrates, species at risk, wetland cover, as well as socio-economic data, such as tourism information and demographics. The following subsections will discuss some of these monitoring and data collection methods in more detail.

There are also ongoing collaborative monitoring efforts within the watershed. For water quality and quantity monitoring, there are agreements in place between the federal and provincial governments. There is also collaboration between provinces and municipalities, for example, through the monitoring of municipal wastewater and sewage effluent. Provinces and OBVs also collaborate on a number of monitoring efforts, such as surface and/or groundwater quality. Some of these collaborations will be highlighted in the following subsections.



FIGURE 4.2-1. WORD CLOUD REPRESENTING THE TYPES OF DATA BEING COLLECTED IN THE OTTAWA RIVER WATERSHED

4.2.2. INDIGENOUS PEOPLES

As previously discussed in section 1.3, Indigenous peoples of the Ottawa River watershed have a vast and rich history. For generations, Indigenous peoples have been making significant contributions to the understanding of the health of the Ottawa River watershed and some Indigenous organizations and communities have participated in partnership programs to monitor resources in traditional territories. For example, the Mohawks of Kahnawà:ke, in partnership with OBV Abrinord, participate in a water quality monitoring program that targets two river locations within Tioweró:ton, a hunting area within their territory (Mohawk Council of Kahnawà:ke, 2018). This community has also completed other studies in the territory, including conducting wetland inventories, and conducting an evaluation of the status of a rare freshwater mussel.

A CLOSER LOOK: INDIGENOUS GUARDIANS PILOT PROGRAM

At a local level, various programs exist to empower Indigenous communities, such as the Indigenous Guardians Pilot Program. Modelled after Australia's "Working on Country Initiative", the Pilot Program is gaining prominence in Canada, as a way to support Indigenous land management and stewardship (Government of Australia, 2013; Government of Canada, 2018b). The model aims to employ Indigenous guardians as "eyes and boots on the ground" in Indigenous territories. Guardians monitor ecological health, maintain cultural sites and protect sensitive areas and species, in addition to playing a role in creating land-use and marine-use plans (ILI, n.d.). Parks Canada has piloted this system in three parks, while through Budget 2017 ECCC was given a funding initiative of \$25 million over four years to support Indigenous communities, Nations, governments, and representative organizations (Parks Canada, 2018; Government of Canada, 2018b). In early 2018, the Department formerly known as Indigenous and Northern Affairs Canada launched a similar program, which has \$31.4 million in funds to allocate to community driven initiatives focused on monitoring effects of climate change on traditional land (INAC, 2018a).

Today, Indigenous communities continue to have a unique perspective on how the watershed has changed over time. The following quotes describe how Indigenous Knowledge contributes to the monitoring of, and to a greater understanding of, the health of the Ottawa River watershed.

"...members continue to occupy, manage, safeguard and intensively use the watershed as they carry out our traditional and contemporary activities. These activities are based on self-determination and a history of Algonquin traditional knowledge, eco-logical sustainability and land governance."

– Algonquin Nation Secretariat (Kitchisibi Ikidowin Anishinabe, 2018)



Photo credit: Kitchisibi Ikidowin Anishinabe, 2018.



Photo credit: Kitchisibi Ikiidowin Anishinabe, 2018.

“Their survival on this land for thousands of years has required them to apply their teachings to ensure the protection of the lands and waters that they rely on. [...] There were consequences that occurred when they strayed from their natural teachings, instructions and laws. They were constantly monitoring the environment, and if changes occurred, they would adapt.”

(Public and Stakeholder consultations, 2018)

“The practice of activities in headwaters and outlet areas of the watershed (as well as areas in between) provide the Mohawks of Kahnawà:ke a unique perspective on the overall health of the watershed.”

(Mohawk Council of Kahnawà:ke, 2018)

4.2.3. FEDERAL GOVERNMENT

There are several areas where the federal government undertakes monitoring and data collection activities in the Ottawa River watershed (see Figure 4.2-2). These include:

- Tracking of industrial releases to the environment, and the impacts of toxic substances/contaminants;
- Biodiversity and ecosystem monitoring (e.g., bird population trends, benthic invertebrates, protected areas, and species at risk);
- Greenhouse gases (GHGs) and air pollutant emissions;
- Surface water quality and quantity;
- Groundwater quantity and quality; and
- Meteorology (e.g., rainfall, air temperature).

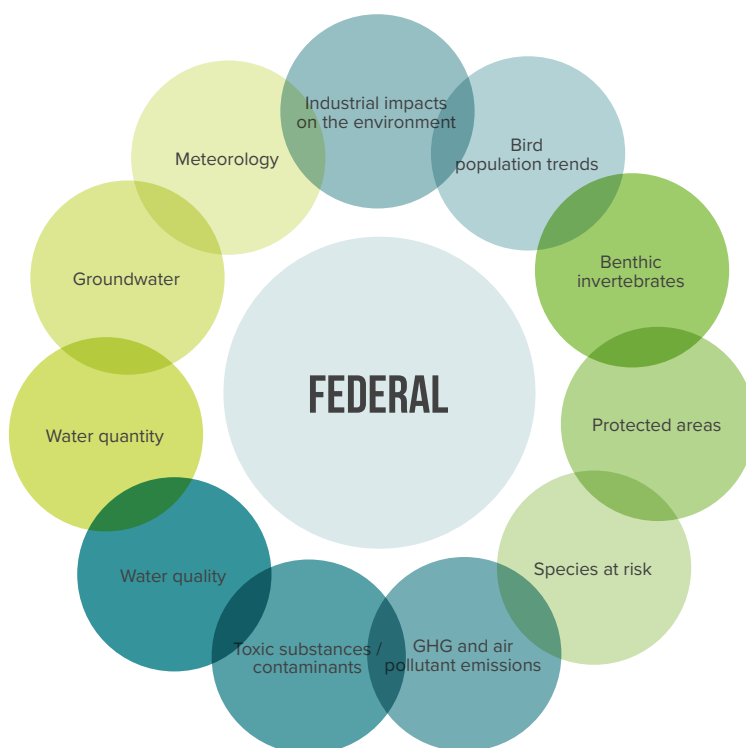


FIGURE 4.2-2. SUMMARY OF KEY PARAMETERS MONITORED/COLLECTED BY THE FEDERAL GOVERNMENT

The federal government addresses water quality issues under various statutes, including the *Fisheries Act*, and the *Canadian Environmental Protection Act, 1999*. Federal activities include monitoring, scientific research, and leadership on the development of guidelines for water quality. ECCC, for example, undertakes monitoring of freshwater quality and quantity, pursuant to agreements with the provinces enabled under the *Canada Water Act*. ECCC's Freshwater Quality Monitoring and Surveillance program implements a risk-based adaptive management framework for examining freshwater quality and aquatic ecosystems to better target monitoring activities to the risks of contaminants and human activities in Canadian watersheds (ECCC, 2017d). Activities under this program include long-term physical-chemical water quality monitoring, the Canadian Aquatic Biomonitoring Network (CABIN), automated water quality monitoring, site or issue-specific surveillance programs, and the use of the risk-based basin analysis tool (RBBA). RBBA is a flexible tool that allows for a more comparative analysis within sub-basins. RBBA methodology, supporting data, and results are very useful and reflect workflows supported and used in many federal Departments and NGOs, nationally and internationally (Public and Stakeholder consultations, 2018). Because of agreements with the provincial governments, provincial water quality monitoring site information is shared with ECCC through the Freshwater Quality Monitoring and Surveillance program.

CABIN involves the collection of information on benthic invertebrates, and a database in which partners of the program have access to tools for storing and managing their data and studies (ECCC, 2018e). Benthic invertebrates are organisms that live in/on sediments at the bottom of rivers, streams, and lakes, and they act as important indicators of the health of water bodies. CABIN's training program also provides the knowledge and skills required to conduct this type of biomonitoring.

ECCC's Water Survey of Canada is responsible for the collection, interpretation and dissemination of standardized water resource data and information in Canada (ECCC, 2018f). This program is also conducted in partnership with the provinces and territories enabled by the *Canada Water Act* (ECCC, 2018b). The Hydrometric Network, operated by the Water Survey of Canada, provides real-time water quantity data for approximately 2200 stations across Canada (ECCC, 2018f). All stations in the Ottawa River watershed (approximately 18 long-term stations) collect water levels and stream flow data, while some also collect information related to air and water temperatures. It should be noted that in Québec, the Ministère de l'Environnement et de la Lutte contre les changements climatiques (MELCC), formally the Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC), is the main operator of the water quantity monitoring network, and ECCC provides funding through the cost share agreement with the province for the operation of stations of federal interest in the watershed.

The National Pollutant Release Inventory (NPRI) is Canada's legislated and publicly accessible national inventory of pollutant releases (to air, water and land), disposals, and transfers for recycling (ECCC, 2017c). Pollution prevention data submitted to the NPRI is analyzed and outlined in the NPRI annual summary report. Pollution prevention activity data submitted by facilities is also summarized in ECCC's Pollution Prevention in Practice fact sheets. Public access to NPRI data is provided through the annual summary report, an online data search tool.

In 2002, a partnership was established between ECCC, the Canadian Space Agency, Ducks Unlimited, and the North American Wetlands Conservation Council (Canada), to create the Canadian Wetland Inventory: a national approach to establish a consistent framework to map wetlands, in order to build Canada's capacity to respond to local, regional, national and international drivers on wetlands. The vision of the program is to (Ducks Unlimited Canada, 2018b):

- Focus conservation, restoration and wetland monitoring programs;
- Assess changes in wetland abundance and classification in relation to climate change concerns;
- Assist industry, governments and conservation groups to develop land use policies and protocols; and
- Measure performance of those policies and protocols against landscape sustainability objectives.

By using aerial photography and satellite images, wetlands in the Ottawa River watershed are being identified and monitored. The online progress map displays wetland areas across Canada, and is being used to assess future wetland loss, degradation and restoration (Ducks Unlimited Canada, 2018c).

The information from the programs identified above is provided to the CESI program, which tracks Canada's performance on key environmental sustainability issues (previously described in section 4.1). The indicators developed from the data are used to monitor trends. Indicator themes tracked in the Ottawa River watershed include GHGs and air pollutant emissions, harmful substances, water quality, water quantity, and protected areas. Federal monitoring and data collection programs, as well as data collected from the provincial governments through data collection agreements is used to support this program.

Similar to ECCC's CESI program, AAFC has, since 1993, been compiling and analyzing data, and reporting on agri-environmental indicators, in order to measure key environmental conditions, risks and changes resulting from agriculture, and to track the practices used to mitigate risks of the management practices (AAFC, 2016). Indicators monitored by this program include soil health, water quality, wildlife habitat, nutrients, microbial conditions, and pesticides.

NRCan, through the Geological Survey of Canada, is responsible for the Groundwater Geoscience Program that conducts mapping and assessment activities of key Canadian aquifers. The data, made available through the Groundwater Information Network, provides baseline information and scientific knowledge to inform water management and protection. Groundwater assessment includes geological mapping, regional hydrogeological assessments to monitor movement and distribution, and modelling (NRCan, 2017; NRCan, 2018a). Through the Canada Centre for Mapping and Earth Observation, NRCan also uses satellite sensors to retrieve hydrology-related parameters of vegetation and soils for the Groundwater Geoscience Program, and provides Emergency Geomatics Service in support of Public Safety Canada's emergency management efforts to monitor and map flood extent in near real-time (NRCan, 2017; NRCan, 2018b).

The Canadian Nuclear Safety Commission (CNSC) collects environmental samples from the Ottawa River watershed as part of their Independent Environmental Monitoring Program. A wide range of sample media (e.g., air, water, sediment) are analyzed for a range of hazardous and nuclear substances with the results posted and downloadable from the CNSC website. However, these activities are localized in nature, generally focusing on the Ottawa River between Deep River and Pembroke and associated sub-watersheds (CNSC, 2018a).

AAFC - AGRI-ENVIRONMENTAL INDICATORS <ul style="list-style-type: none"> • Compiling, analyzing and reporting on indicators since 1993 • Assess impacts of agriculture on water quality • Indicators monitored include: <ul style="list-style-type: none"> • Soil health • Water quality • Wildlife habitat • Nutrients • Microbial conditions • Pesticides 	ECCC - CESI <ul style="list-style-type: none"> • Track Canada's performance on key environmental sustainability issues and monitor trends • Indicator themes monitored include: <ul style="list-style-type: none"> • GHGs and air pollutant emissions • Harmful substances • Water quality • Water quantity • Protected areas 	ECCC - CANADIAN AQUATIC BIOMONITORING NETWORK (CABIN) <ul style="list-style-type: none"> • Collects information on benthic invertebrates • Database provides partners with tools to store and manage their data and studies • An important part of water monitoring
COLLABORATION - CANADIAN WETLAND INVENTORY <ul style="list-style-type: none"> • ECCC, Canadian Space Agency, Ducks Unlimited and North American Wetland Conservation Council • Conservation, restoration, and wetland monitoring • Monitor changes in wetland abundance and classification • Used to develop land-use policies and protocols 	ECCC - FRESHWATER QUALITY MONITORING AND SURVEILLANCE PROGRAM <ul style="list-style-type: none"> • Activities include: <ul style="list-style-type: none"> • Long-term physical-chemical water quality monitoring • CABIN • Automated water quality monitoring • Site or issue-specific surveillance programs • Risk-based basin analysis (RBBA) tool to quantify risk to water quality 	ECCC - WATER SURVEY OF CANADA HYDROMETRIC NETWORK <ul style="list-style-type: none"> • "Real-time" water quantity data from over 2,200 stations across Canada • Parameters include: <ul style="list-style-type: none"> • Water level and stream flow • Some stations also collect information such as air and water temperature
ECCC - NATIONAL POLLUTANT RELEASE INVENTORY (NPRI) <ul style="list-style-type: none"> • Tool for Identifying and monitoring pollution sources in Canada • Parameters include: <ul style="list-style-type: none"> • Direct releases to air • Direct releases to surface water • Direct releases to land • Disposals and transfers of toxic substances • Disposal of tailings and waste rock • Off-site transfers for recycling 	NRCAN - GROUNDWATER GEOSCIENCE PROGRAM <ul style="list-style-type: none"> • Assess Canada's key aquifer systems • Methods for assessment: <ul style="list-style-type: none"> • Geological mapping • Regional hydrogeological assessments • Groundwater modelling • Satellite mapping of vegetation and soil hydrological parameters 	CNSC - INDEPENDANT ENVIROMENTAL MONITORING PROGRAM <ul style="list-style-type: none"> • Collects environmental samples from the Ottawa River watershed <ul style="list-style-type: none"> • Generally localized between Deep River and Pembroke, and associated sub-watersheds • Wide range of samples (e.g., air, water, sediment) are analyzed for range of hazardous and nuclear substances • Results posted and downloadable from the CNSC website

FIGURE 4.2-3. SUMMARY OF GOVERNMENT OF CANADA MONITORING AND DATA COLLECTION PROGRAMS

4.2.4. PROVINCIAL GOVERNMENTS

As identified in section 1.3, provinces have key roles and responsibilities related to the protection of freshwater resources, implemented through legislation and through a variety of programs. Figure 4.2-4 summarizes the key parameters monitored and collected in the Ottawa River watershed by the provinces of Ontario and Québec. These include the monitoring of surface and groundwater quality and quantity, toxic substances, and the status of species and habitats. Of note, both Ontario and Québec share the raw data that they collect through online portals, making it accessible and downloadable to interested citizens, scientists and organizations.

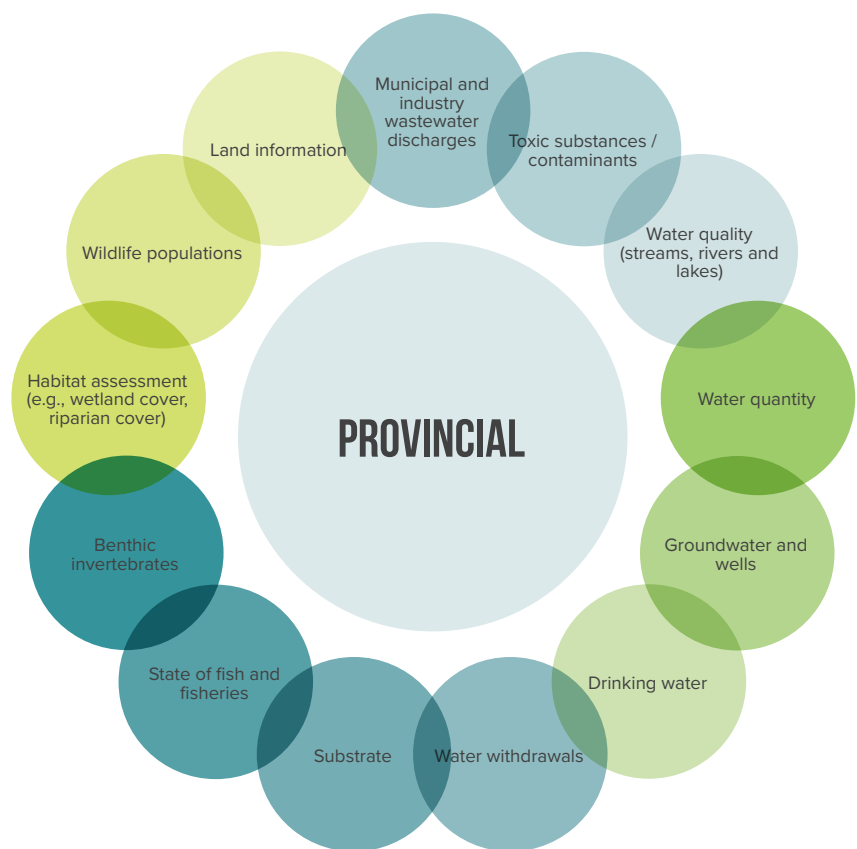


FIGURE 4.2-4. SUMMARY OF KEY PARAMETERS MONITORED/COLLECTED BY THE PROVINCES OF ONTARIO AND QUÉBEC

4.2.4.1. ONTARIO

The Ontario government undertakes many monitoring programs. The following are a few examples of those implemented by the Ontario provincial government that are undertaken in the Ottawa River watershed (see Appendix H for more information).

The Provincial Water Quality Monitoring Network is a collaborative program between the Ministry of the Environment, Conservation and Parks (MOECP) and CAs, municipalities, and provincial parks. The program provides stream water quality monitoring for a number of parameters, including chlorophyll a (used for tracking algae growth), nutrients, and metals (Government of Ontario, 2018b). MOECP's Provincial Groundwater Monitoring Network provides long-term regional groundwater monitoring in order to track potential changes in physical-chemical conditions (e.g., temperature, pH, water clarity) and water level conditions (MOECP, 2018b). MOECP also has a volunteer-based Lake Partner Program that collects water-quality data to monitor trends in about 800 Ontario inland lakes (MOECP, 2018c). The program, conducted in partnership with the Federation of Ontario Cottagers' Associations, collects information related to nutrients, and other physical-chemical conditions of the lakes. The Ontario Benthos Biomonitoring Network is also a collaborative program that monitors the ecological condition of lakes, streams and wetlands (Government of Ontario, 2013a). Data collected for this network include benthic invertebrate species counts, habitat conditions, and the physical-chemical conditions of the water.

Ontario's Ministry of Natural Resources and Forestry (MNRF) operates the Broad-scale Monitoring Program to collect information on lake fisheries for each of the fisheries management zones, as part of the province's obligations under the Ecological Framework for Fisheries Management (MNRF, 2018a). Every five years, information is collected for a representative number of lakes per fisheries management zone. Information collected includes distribution of fishes, amount and diversity of fishes in the lakes, physical-chemical conditions of the water, nutrient levels, some metals (e.g., iron), zooplankton, contaminant sampling, and fishing activities.

MNRF is also responsible for the Provincial Wildlife Population Monitoring Program as required under the environmental assessment requirements for forest management on Crown lands. This monitoring program collects long-term trend data to support the evaluation of forest management practices in maintaining wildlife (MNRF, 2018c). A variety of wildlife species are monitored including species such as moose, marten, pileated woodpecker, and white-tailed deer. Methods of assessment will also vary depending on the monitoring objectives of the region under assessment; however, some methods may include the use of breeding bird surveys, migration monitoring and nocturnal owl surveys. For a summary of monitoring and data collection programs raised in this section, see Figure 4.2-5.

MOECP - LAKE PARTNER PROGRAM	MNR - BROAD-SCALE MONITORING PROGRAM	MNR - PROVINCIAL WILDLIFE POPULATION MONITORING PROGRAM
<ul style="list-style-type: none"> • Volunteer-based program, in partnership with the Federation of Ontario Cottagers' Associations • Monitors water quality in about 800 of Ontario's inland lakes • Parameters include: <ul style="list-style-type: none"> • Nutrients • Physical-chemical conditions 	<ul style="list-style-type: none"> • Information collected every 5 years • Parameters monitored include: <ul style="list-style-type: none"> • Distribution, amount and diversity of fishes • Angling activities • Physical-chemical conditions • Nutrients • Some metals (e.g., Iron) • Zooplankton • Contaminant sampling 	<ul style="list-style-type: none"> • Supports evaluation of forest management practices in Ontario Crown lands • Variety of wildlife species monitored (terrestrial and riparian) • Methods include: <ul style="list-style-type: none"> • Breeding bird surveys • Migration monitoring • Nocturnal owl surveys
MOECP - PROVINCIAL WATER QUALITY MONITORING NETWORK	MOECP - PROVINCIAL GROUNDWATER MONITORING NETWORK	MOECP - ONTARIO BENTHOS BIOMONITORING NETWORK
<ul style="list-style-type: none"> • In partnership with CAs, municipalities and provincial parks • Provides stream water quality monitoring data for a number of parameters including: <ul style="list-style-type: none"> • Nutrients • Metals • Chlorophyll 	<ul style="list-style-type: none"> • Long-term regional groundwater monitoring to identify potential changes • Parameters include physical-chemical (water quality) and water levels 	<ul style="list-style-type: none"> • Multi-sector biomonitoring collaboration • Monitor ecological condition of lakes, streams and wetlands • Parameters collected include: <ul style="list-style-type: none"> • Benthic invertebrate taxa counts • Habitat • Physical-chemical conditions

FIGURE 4.2-5. SUMMARY OF KEY GOVERNMENT OF ONTARIO MONITORING AND DATA COLLECTION PROGRAMS

4.2.4.2. QUÉBEC

The Government of Québec is responsible for a variety of monitoring programs. This section will highlight a few examples of some of the programs implemented in the Ottawa River watershed. Additional information on the monitoring programs described below, as well as many others, can be found in Appendix H.

MELCC's river water quality monitoring program, Réseau-Rivières, is one of the province's primary methods for collecting information on surface water quality. The objective of the network is to collect data on, and monitor trends of water quality, in order to implement mitigation methods to improve the health of the aquatic environment (MELCC, 2018h). The parameters of assessment include physical-chemical conditions (e.g., pH, turbidity, suspended solids, dissolved organic carbon, conductivity, temperature, metals), chlorophyll a (i.e., used to monitor algae growth), microbial content (e.g., bacterial *E. coli* levels), and nutrient levels (e.g., total phosphorus, total nitrogen).

MELCC's Réseau de surveillance volontaire des lacs (voluntary lake monitoring network) focuses on understanding trophic levels of a large number of lakes in order to track their evolution over time. This network helps to determine and track lakes that are showing signs of eutrophication and degradation. Parameters for assessment include physical-chemical conditions, nutrients, detection of invasive aquatic plants, characterization of riparian buffers, and tracking blue-green algae blooms (MELCC, 2018e).

The purpose of MELCC's Suivi de la santé du benthos (monitoring of benthic community health), is to assess the health status of shallow habitats and streams (MELCC, 2018g). Parameters for monitoring include identification of benthic invertebrates, state of their habitat, as well as water quality parameters, such as physical-chemical conditions, microbial content, and the presence of toxic substances. MELCC indicated that this type of monitoring is important for the assessment of the integrity of the aquatic ecosystem, to monitor the evolution of biodiversity over time, to evaluate and verify effects of known sources of pollution on the health of the ecosystem, and to evaluate the effects of aquatic restoration activities (MELCC, 2018g).

MELCC also monitors groundwater levels and quality (MELCC, 2018d), the presence of pesticides in surface and groundwater (MELCC, 2018l; MELCC, 2018m), the presence of cyanobacteria in lakes (MELCC, 2018j; Public and Stakeholder consultations, 2018), and the state of fish communities (MELCC, 2018k; Public and Stakeholder consultations, 2018). These programs collect information on parameters such as physical-chemical conditions of the environment under assessment, as well as nutrient levels, and microbial content.

MELCC works with OBVs to guide Programme d'acquisition de connaissances sur les eaux souterraines (PACES), a groundwater knowledge acquisition program. The program conducted thirteen regional hydrological studies between 2009 and 2015, to ensure that data was available on groundwater, and to develop maps related to groundwater sources. In 2017, under the Québec Water Strategy, the government renewed the program, and it is estimated that by 2022, groundwater collection will be complete in almost all inhabited areas of Québec (MELCC, 2018c).

MELCC is the main operator of the water quantity monitoring network in Québec. It conducts flood monitoring in collaboration with municipal authorities and observers in the field (Sécurité Publique, 2016). Hydrometric data that is collected and analyzed by the MELCC is used to manage dams operated by the MELCC or by other owners, and to monitor rivers during floods and periods of low water (MELCC, 2015). For a summary of the monitoring and data collection programs described in this section see Figure 4.2-6.

MELCC - RIVER WATER QUALITY MONITORING (RÉSEAU-RIVIÈRES) <ul style="list-style-type: none"> • Characterize the water quality of rivers and monitor trends over time • Parameters include: <ul style="list-style-type: none"> • Physical-chemical conditions • Microbial • Nutrients • Chlorophyll a 	MELCC - MONITORING BENTHOS HEALTH (SUIVI DE LA SANTÉ DU BENTHOS) <ul style="list-style-type: none"> • Assess the health status of shallow substrate and streams • Parameters include: <ul style="list-style-type: none"> • Benthic invertebrate communities • State of the habitat • Physical-chemical conditions • Microbial • Toxic substances 	MELCC - RIVER AND GROUNDWATER PESTICIDE MONITORING (SUIVI DES PESTICIDES DANS LES RIVIÈRES / LES EAUX SOUTERRAINES) <ul style="list-style-type: none"> • Detect and monitor trends in presence of herbicides, insecticides and fungicides in surface water groundwater • Parameters include: <ul style="list-style-type: none"> • Target pesticides or family of pesticides (e.g., organophosphorous compounds, glyphosate) • Quantity of nitrites/nitrates
MELCC - VOLUNTEER LAKE MONITORING NETWORK (RÉSEAU DE SURVEILLANCE VOLONTAIRE DES LACS) <ul style="list-style-type: none"> • Volunteer program that focuses on understanding trophic levels of a large number of lakes, and track evolution over time • Network tracks lakes that are showing signs of eutrophication and degradation • Water sampling and field measurements/observations based on MELCC protocols • Parameters include: <ul style="list-style-type: none"> • Physical-chemical conditions • Nutrients • Detection of invasive aquatic plants • Characterizing riparian buffer • Tracking blue-green algae blooms 	MELCC - QUÉBEC GROUNDWATER MONITORING NETWORK (RÉSEAU DE SUIVI DES EAUX SOUTERRAINES DU QUÉBEC) <ul style="list-style-type: none"> • More than 250 monitoring stations located in all regions of QC, with some stations that have been active since 1969 • Collects data to assess the effects of climate change on groundwater • Accessible information may include water levels, water quality testing results, and well layouts 	MELCC - HYDROLOGIC MONITORING (SUIVI HYDROLOGIQUE DE DIFFÉRENTES STATIONS HYDROMÉTRIQUES) <ul style="list-style-type: none"> • Operated by the MELCC • Ongoing hydrometric monitoring in collaboration with municipal authorities and observers in the field <ul style="list-style-type: none"> • Network of approximately 230 hydrometric stations across the province, almost all of which use telemetry and transmit data on a continuous basis • Hydrometric stations provide stream flow and levels data • Is used to manage dams and to monitor rivers during floods and during periods of low water

FIGURE 4.2-6. SUMMARY OF KEY GOVERNMENT OF QUÉBEC MONITORING AND DATA COLLECTION PROGRAMS

4.2.5. MUNICIPAL GOVERNMENTS

There is a wide range of monitoring mandates across municipalities of Ontario and Québec. Figure 4.2-7 presents some of the key parameters that are monitored by municipalities in the Ottawa River watershed. As outlined in section 1.3, municipalities operate and manage water supply and sewage services, as well as provide some watershed protection. This role includes responsibilities for monitoring and reporting of municipal wastewater and storm water data to the provinces, as well as undertaking inventories of septic tanks, characterization of riparian strips, developing wetland management plans, developing lake management plans and monitoring the water quality of local beaches. Municipalities in Québec are also responsible for sharing groundwater samples in order to examine potential impacts to this resource. The impacts of residential development on the environment, and residential/industrial pressures to water use, are also tracked in some municipalities (Public and Stakeholder consultations, 2018). In many cases, partnerships are established between the municipalities and OBVs/CAs in order to collect various data to help characterize water quality and quantity in the region. This data is often used in municipal development plans (Public and Stakeholder consultations, 2018).

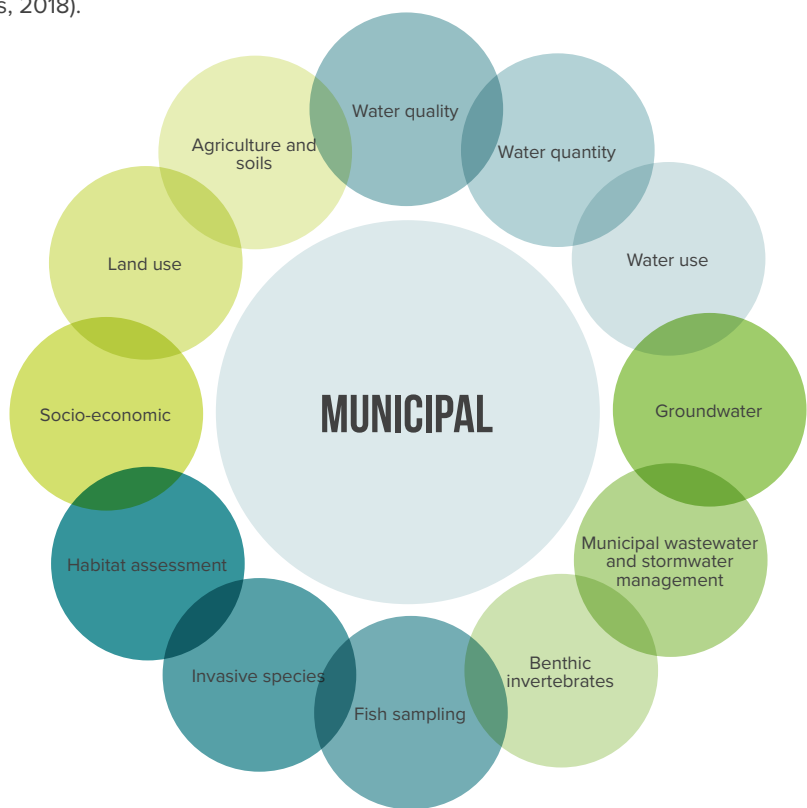


FIGURE 4.2-7. SUMMARY OF KEY PARAMETERS MONITORED/COLLECTED BY MUNICIPALITIES

There are many different monitoring and data collection programs undertaken by the hundreds of municipalities throughout the Ottawa River watershed. The following is an example of one program that has been implemented in the NCR. The City of Ottawa collects a variety of information including demographic data and projections; employment; land use; agriculture and soils data; water quality data in the main stem of the Ottawa River and tributaries; drinking water quality; flood risks; sewage discharges; and water quantity data. It is also responsible for the City Stream Watch Reports, which is a volunteer program involving partnerships with 10 different agencies (including CAs) to monitor streams within the city. The purpose of the program is to obtain, record, and manage the information of the physical and biological characteristics of city creeks and streams, while also ensuring that the natural features are valued (MVCA, 2018a; RVCA, 2018).

Parameters for assessment examined through these reports include:

- Stream and habitat assessments;
- Benthic invertebrate identification;
- Fish sampling;
- Stream temperatures;
- Identification and removal of invasive species;
- Stream rehabilitation and shoreline restoration projects; and
- Stream garbage clean-up.

See Appendix H for more information on municipal monitoring and data collection programs.

4.2.6. LOCAL WATERSHED MANAGEMENT AGENCIES

CAs and OBVs that work within the Ottawa River watershed play a vital role in the conservation, restoration and responsible protection and management of water resources, land and natural habitats. Figure 4.2-8 summarizes the key parameters monitored and collected in the Ottawa River watershed by these local watershed management agencies. These parameters include the monitoring of surface and groundwater quality and quantity, toxic substances, and the status of species and habitats.



FIGURE 4.2-8. SUMMARY OF KEY PARAMETERS MONITORED/COLLECTED BY WATERSHED MANAGEMENT AGENCIES

4.2.6.1. CONSERVATION AUTHORITIES

An important role that CAs play in the Ottawa River watershed is in the collection and monitoring of the health of the sub-watersheds. CAs partner with “municipal, provincial and federal governments, as well as landowners and other groups, to deliver community-based, practical solutions to a range of natural resource challenges” (Conservation Ontario, 2018a). Such partnerships include CA participation in the Provincial Water Quality Monitoring Network, Provincial Groundwater Monitoring Network, Hydrometric Network and others initiatives in the province of Ontario. They are also responsible for the CA Watershed Report Cards that provide an analysis of watershed health for their area of jurisdiction (these reports are discussed further in section 4.3).

As was mentioned in section 1.3, there are five CAs in the Ottawa River watershed: Mississippi Valley (MVCA), North Bay-Mattawa (NBMCA), Raisin Region (RRCA), Rideau Valley (RVCA), and South Nation (SNCA). The following illustrates the wide range of ongoing monitoring and data collection being done by CAs (see Appendix H for more information). MVCA monitors a number of environmental indicators for surface and groundwater, aquatic species, and benthic invertebrates (Public and Stakeholder consultations, 2018). It also maintains geo-spatial datasets that allow trends to be tracked and assessed over time. NBMCA participates in the collection of meteorological data (e.g., rainfall and snow accumulation), surface and groundwater quality and quantity, and aquatic species (including benthic invertebrates). NBMCA has indicated that the majority of this monitoring is done in partnership with federal and provincial governments (Public and Stakeholder consultations, 2018).

RRCA participates in precipitation, streamflow and water level monitoring. It also assists partner municipalities and MNRF with Flood Forecasting and Warning, and Low Water Response (RRCA, n.d.). RVCA collects data on key watershed characteristics and environmental indicators relating to hydrometrics, surface and groundwater, forest and wetland cover, aquatic species and benthic invertebrates. RVCA has indicated that 56 sites are monitored as part of its baseline monitoring program to assess the contribution of nutrients, bacteria, metals and other parameters from tributary streams of the Rideau River and upper watershed lakes (Public and Stakeholder consultations, 2018). RVCA is also responsible for the Watershed Watch Program which helps identify trends in water quality of 39 major lakes in its jurisdiction. Similar to MVCA, RVCA maintains geo-spatial datasets in order to track trends and changes over time.

SNCA collects data on surface and groundwater quality and quantity, species at risk, invasive species, stream morphology, and habitat cover. This CA also collects recreational related data by monitoring daily use of parks and trails, as well as the monitoring permits for its hunting and trapping program. In addition, SNCA has completed several partner projects with Indigenous communities. These projects were focused on identifying and protecting culturally and naturally significant species that are important to Indigenous communities (Public and Stakeholder consultations, 2018).

4.2.6.2. ORGANISMES DE BASSIN VERSANT

As identified in section 1.3, one of the main goals of the OBVs is to develop and monitor the implementation of their respective water master plans. In addition, OBVs in the Ottawa River watershed support the monitoring of environmental conditions within their respective jurisdictions. The OBVs in the watershed are COBALI, COBAMIL, COBAVER-VS, ABRINORD, OBVT, OBV RPNS, ABV des 7. OBV initiatives often involve partnerships with the Government of Québec and with local groups, which include collecting surface water quality data in partnership with MELCC’s Réseau-Rivières surface water quality program and volunteer lake monitoring program (Réseau de surveillance volontaire des lacs); working on the Network-River Sampling Campaign; identifying potential barriers to invasive species; and surveying activities related to flooding events (Public and Stakeholder consultations, 2018). The programs discussed below are examples of different types of monitoring and data collection being conducted by OBVs in the watershed. Additional information can be found in Appendix H.

COBALI has participated in the characterization of the Léopold-Leduc Creek Watershed and the evaluation of lakes in Chute-Saint-Philippe municipality, including through the monitoring of surface water quality of tributaries and lakes. Additionally, the OBV provides technical advice and support related to freshwater health to lake associations and municipalities. They also partnered with OBV RPNS, ABV des 7 and Ducks Unlimited Canada to map wetlands throughout the Ottawa River Lowlands. Lastly, COBALI participates in assessing risks associated with invasive species, notably Asian carps (COBALI, n.d.).

COBAMIL likewise collects surface water quality samples, the parameters of which include physical-chemical conditions (e.g., temperature, pH, conductivity), nutrient levels, microbial content (e.g., bacterial *E. coli* levels), and chlorophyll a (i.e., used to monitor algae growth) (COBAMIL, n.d.). They also conduct inventories of invasive aquatic plants.

COBAVER-VS indicated that they are responsible for the coordination of a monitoring program for invasive Asian carps, characterizing fish habitat, conducting fish inventories, and identifying riparian buffers (Public and Stakeholder consultations, 2018).

ABRINORD's program for monitoring water quality examines parameters, such as benthic invertebrates, microbial content, suspended matter, nutrients, and conductivity of the water. In addition, ABRINORD has been involved in mapping wetlands in partnership with Ducks Unlimited Canada, and mapping river courses in collaboration with MRC d'Argenteuil, to monitor flow dynamics (ABRINORD, n.d.). ABRINORD also supports MELCC's groundwater program, PACES.

OBVT indicated that they undertake a program to characterize physical-chemical conditions of water bodies, and conducts an inventory of benthic invertebrates, in collaboration with local schools (Adopt a Watercourse in collaboration with G3E, Water Education and Monitoring Group) (Public and Stakeholder consultations, 2018). OBVT also participates in the G3E SurVol Benthos program, by analyzing macroinvertebrate populations in two Témiscamingue streams. Additionally, OBVT is responsible for the establishment of a voluntary water quality testing programs for residential wells in collaboration with the Public Health Branch (Centre intégré de santé et de services sociaux de l'Abitibi-Témiscamingue), through the PACES program. OBVT also participates in the detection and monitoring of an invasive plant surveillance network in partnership with the MELCC, and is part of the regional committee on invasive species. Lastly, OBVT operates a harmonized database on the quality of surface water from the region (Public and Stakeholder consultations, 2018).

OBV RPNS partners with various other groups to conduct studies and assessments. Notably, they coordinate with various municipal partners to implement PACES groundwater assessments, and they collaborate with G3E to monitor benthic macroinvertebrates, mainly to assess the impact that climate change has on biodiversity. They have also partnered with Ducks Unlimited Canada to map wetlands in their area of jurisdiction, and partnered with Institut national de la recherche scientifique to monitor river flows, and to set new water level rules to reduce the risk of floods. This OBV has been involved in the characterization of tributaries, shorelines, and aquatic grass beds (OBV RPNS, 2018). Part of this characterization supports monitoring of invasive aquatic plant species.

ABV 7 is similarly involved in monitoring for invasive plant species, such as myriophyllum moss grass and Eurasian water-milfoil. ABV 7 also monitors for beach erosion, and has been responsible for the characterization of some riparian buffers and lake sediments in their area of jurisdiction (ABV 7, n.d.).

4.2.7. ACADEMIC / NON-GOVERNMENTAL ORGANIZATIONS / CITIZEN SCIENCE / COMMUNITY-BASED GROUPS

Many organizations and individuals contribute to the development of knowledge about the health of the Ottawa River watershed. This is being done through a variety of methods, and by examining parameters, such as water quality, toxic substances, as well as characterizing water bodies, invertebrates and vegetation, monitoring of wildlife, and conducting habitat assessments (see Figure 4.2-9).

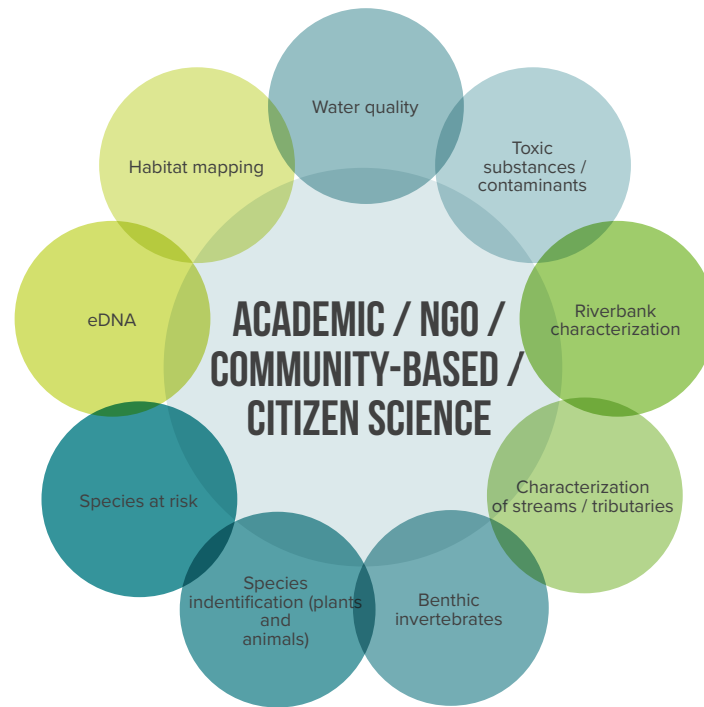


FIGURE 4.2-9. SUMMARY OF KEY PARAMETERS MONITORED/COLLECTED BY ACADEMICS, NGOS, COMMUNITY-BASED ORGANIZATIONS OR CITIZEN SCIENTISTS

The following examples of monitoring and data collection activities in the Ottawa River watershed were highlighted through ECCC's engagement process. These examples are also summarized in Figure 4.2-10, and additional information can be found in Appendix H.

4.2.7.1. ENVIRONMENTAL NON-GOVERNMENTAL ORGANIZATIONS

Various community groups and individuals are engaged in monitoring and data collection within the watershed.

CITIZEN SCIENCE

Citizen science is the active engagement of citizens in scientific activities and processes. Citizens volunteer to be contributors in research and can participate through different levels of commitment. A variety of organizations currently facilitate citizen science and research within the Ottawa River watershed (Kieslinger, Schäfer, Heigl, Dörler, Richter, A., & Bonn, 2017).

For example, the Water Rangers' website allows anyone to examine existing data, report issues, such as algae blooms, and record observations of water bodies (Water Rangers, 2018b). Water Rangers has collected over 18,000 observations from different sources, some of which were taken within the Ottawa River watershed. Water Rangers' water quality testing kits allow individuals to conduct tests for physical-chemical conditions, such as dissolved oxygen, water temperature, conductivity, pH, air temperature, water clarity, water depth, alkalinity and hardness. The kits also provide containers to collect samples of suspected pollutants (e.g., oil). In an interview with Ingenium Canada, Water Rangers co-founder Kat Kavanagh stated that the organization is "trying to give the average person access to water quality testing, either through viewing existing data, or by having the ability to add in their own observations and data" (Swanston, 2018).

"Citizen science is science that is accessible to everybody. It means that more people can participate. The purpose is not just to collect data, it's also to educate and engage the public. To me, it has to be an accessible format – you need to make sure the language and the tools are affordable, accessible, and easy to understand."

– Kat Kavanagh, co-founder of Water Rangers (Swanston, 2018)

A CLOSER LOOK: OTTAWA RIVERKEEPER'S RIVERWATCH PROGRAM

The Riverwatch program has more than 70 volunteers who, together with Ottawa Riverkeeper, work to find solutions to local issues (Ottawa Riverkeeper, 2018b). Since 2013, members of the Riverwatch program have been trained to participate in Ottawa Riverkeeper's citizen science water quality monitoring program. Parameters for monitoring include the detection of invasive species, turbidity, pH, temperature, and identifying issues such as algae blooms and shoreline development. The monitoring work done by Riverwatchers has contributed to Ottawa Riverkeepers campaign that focuses on combined sewer overflows, as well as a study to measure the presence of this microplastics and microfibres in the Ottawa River watershed. Past observations made by Riverwatchers has also led to the identification of toxic blue-green algae blooms in the Ottawa River watershed. To further develop the citizen science component of their programs, Ottawa Riverkeeper announced in August 2018 that they are developing a Citizen Science Hub. Through this Hub, volunteers can learn about the health of the river and participate in water quality testing.

"Citizen science is the best way to engage people and increase their awareness on the quality of the Ottawa River and its watershed."

(PlaceSpeak consultations, 2018)

The Water Education and Monitoring Group (G3E) is prevalent throughout Québec and coordinates citizen scientists through its Adopt-a-Stream and SurVol Benthos programs. The Adopt-a-Stream program focuses on connecting a variety of groups with streams, by giving groups the opportunity to study invertebrates, physical and chemical conditions of water as well as observe fish population. To support this program, G3E provides education materials and tools. The SurVol Benthos program is intended to increase the monitoring coverage of small streams in Québec. It is a voluntary monitoring program that

focuses on identifying benthic macroinvertebrates, and using them as bio-indicators. The program is in collaboration with the MELCC, and allows non specialists to contribute to scientific research (G3E, 2018).

iNaturalist is another example of a citizen science program. A joint venture with the California Academy of Sciences and the National Geographic Society, this program is a global "crowdsourced" species identification system and online occurrence recording tool (iNaturalist Canada, n.d.-a). With over 500,000 observations recorded in Canada, this application and website helps individuals identify plants and animals and share their observations broadly. Students of St. Laurent Academy in Ottawa participated in this program as part of their biology class (Public and Stakeholder consultations, 2018). Ontario Parks has also partnered with this organization, asking citizens to help identify species at risk in Ontario's provincial parks (iNaturalist Canada, n.d.-b).

A CLOSER LOOK: COMMUNITY-BASED LAKE ASSOCIATIONS

Throughout Ontario and Québec there are hundreds of community-based Lake Associations. In Québec, these associations are often a part of the MELCC Voluntary Lake Monitoring Network (RSVL), and in Ontario, these lake associations are often registered under surveillance networks. Such groups are often made up of concerned individuals passionate about the stewardship of their land and waters. Some lake associations form organically over time, through community-based efforts, while others are catalyzed to address pressing environmental concerns.

Throughout engagement, respondents to the ORWS shared that Lake Associations provide valuable citizen science, while building awareness in citizens and contributing to their fulfillment and sense of purpose.

An example of the specific work that lake associations undertake comes from interviews with the Saint Francois Xavier Lake Association. The group conducts water quality testing and assessments in order to increase community knowledge of the lake's environment and changes over time. Specifically, they take water samples to test for microbial conditions, nutrients levels, and other physical-chemical conditions, such as temperature and pH. Through this work, the group forms relationships, shares knowledge, and heightens awareness regarding human influence on lake quality.



4.2.7.2. COMMUNITY-BASED MONITORING

There are some community-based monitoring initiatives that are national in scope, with some monitoring being done within the Ottawa River watershed. In 2015, after the release of its Watershed Reports, WWF-Canada launched a National Community-based Freshwater Monitoring Program. Three sites were sampled in the Ottawa River watershed, in collaboration with ECCC. This program uses environmental DNA (eDNA) technology to compare genetic content collected via water samples in order to identify benthic invertebrates (WWF-Canada, 2017b). The genetic samples are compared to an existing global DNA barcode library. According to WWF-Canada, this technique is “easier, faster and more accurate than traditional manual analysis of benthic invertebrates, ensuring data gaps can be filled comparatively quickly and conclusions made about watershed health in a more timely and cost-effective manner” (WWF-Canada 2017b).

Some community-based monitoring organizations focus on monitoring certain parts of the Ottawa River watershed. For example, the Bonnechere River Watershed Project is a community-based volunteer organization that has been surveying the health of the Bonnechere River and its watershed since 1999 (PlaceSpeak consultations, 2018). Parameters that this organization has been monitoring over the years include benthic invertebrates, physical-chemical conditions of rivers, lakes and streams, nutrients in water bodies, and the effects of lake stratification on lake ecosystems (PlaceSpeak consultations, 2018).

Friends of the Gatineau River and H₂O Chelsea are also examples of organizations involved in community-based monitoring. Friends of the Gatineau River’s water quality monitoring program is supported by municipalities in the region (La Pêche, Cantley and Chelsea), as well as clubs and associations that use the river for recreational purposes (Friends of the Gatineau River, 2018). Water quality testing of the microbial content of the river takes place once a month during the summer months. Started in 2003, H₂O Chelsea is a volunteer program in the municipality of Chelsea whose purpose is to acquire knowledge of the water resources in the region (Municipality of Chelsea, 2012). This program uses volunteers, with local university support, to sample surface and groundwater quality. Parameters tested include physical-chemical conditions, microbial content, and presence of metals.

4.2.7.3. ACADEMIC AND OTHER ORGANIZATION STUDIES

The Algonquin Nation Secretariat shared that elders from Mitchikiniibikok, also termed Algonquins of Barriere Lake are working with University of Toronto Faculty of Forestry in an effort to conserve and promote Algonquin traditional ecological values. The objective of this work is to initiate new 'social contracts' and economies in co-existence within watershed forest management planning areas.

Fédération des lacs de Val-des-Monts is an organization that was created with the mission to protect and improve water quality in the Val-des-Monts region (Fédération des lacs de Val-des-Monts, 2015). The Federation has put forward the Val-des-Monts Integrated Watershed Management Project to study all the accessible and inhabited lakes of the Rivière Blanche watershed, through the collection of lake inventories. Parameters used in these inventories include the monitoring of physical-chemical conditions, riverbank characterizations, identification of species (including species at risk), indicators of beaver presence, and the characterization of tributaries, outfalls and major culverts. It is the intention of the Federation to use this information to help create a Water Master Plan (Fédération des lacs de Val-des-Monts, 2015).

In addition, the Kipawa Lake Preservation Society is a group of residents located in the area surrounding Kipawa Lake. Their goal is to lobby for the protection of the region from threats to ecosystems and nearby communities (Kipawa Lake Preservation Society, n.d.). This organization has been conducting surface water quality testing of the Kipawa watershed (PlaceSpeak consultations, 2018). Parameters monitored include metals and other pollutants, physical-chemical conditions, microbial content, and nutrients.

Lastly, some interesting academic research is being undertaken within the Ottawa River watershed. For example, Daniel Spitzer with A-MAPS Environmental Inc., Jesse Vermaire from Carleton University, and Michael Yee from RVCA conducted an aquatic environmental mapping project, in which the team developed and tested software mapping modules to help with water quality and vegetation mapping in Ontario lakes (PlaceSpeak consultations, 2018). They found that processed satellite images can be useful for:

- Estimating macrophyte biomass;
- Monitoring growth of aquatic vegetation;
- Mapping algae and suspended particulates;
- Surface temperature mapping;
- Monitoring snow and ice patterns; and
- Monitoring lake thawing processes.

WATER RANGERS <ul style="list-style-type: none"> • Citizens can register to add observations and report issues • Purchase or borrow testing kits to monitor water quality • Parameters include: <ul style="list-style-type: none"> • Physical-chemical conditions • Collect samples for suspected pollutants 	OTTAWA RIVERKEEPER - RIVERWATCH <ul style="list-style-type: none"> • Over 70 volunteers • Participate in citizen-science water quality testing program • Parameters include: <ul style="list-style-type: none"> • Invasive species • Species at risk • Algal blooms • Shoreline issues 	CITIZEN MONITORING LAC ST. FRANÇOIS-XAVIER <ul style="list-style-type: none"> • Collecting water quality data on the lake since 1970 • Wants to increase community knowledge, and bring together community to take action • Parameters include: <ul style="list-style-type: none"> • Microbial • Nutrients • Physical-chemical conditions 	FRIENDS OF THE GATINEAU RIVER - WATER QUALITY MONITORING PROGRAM <ul style="list-style-type: none"> • Conduct water quality monitoring of the Gatineau River once a month during the summer • Parameters include: <ul style="list-style-type: none"> • Microbial
KIPAWA LAKE PRESERVATION SOCIETY <ul style="list-style-type: none"> • Bring attention to the issues that are affecting the health of the Kipawa watershed • Conduct surface water quality testing in the watershed • Parameters include: <ul style="list-style-type: none"> • Metals and other pollutants • Physical-chemical conditions • Microbial • Nutrients 	CARLETON UNIVERSITY, A-MAPS ENVIRONMENTAL, RIDEAU VALLEY CA - AQUATIC ENVIRONMENT MAPPING PROJECT <ul style="list-style-type: none"> • Software mapping modules for water quality and vegetation mapping in lakes • Satellite images useful for: <ul style="list-style-type: none"> • Estimating macrophyte biomass • Monitoring growth of aquatic vegetation • Mapping algae and suspended particulates • Surface temperature mapping • Snow and ice patterns • Monitoring lake thawing process 	WWF-CANADA - NATIONAL COMMUNITY-BASED FRESHWATER MONITORING PROGRAM <ul style="list-style-type: none"> • Launched in September 2017 • Used eDNA technology to identify benthic invertebrates to better understand freshwater health <ul style="list-style-type: none"> • Easier, faster and more accurate than traditional methods of manual analysis 	iNATURALIST <ul style="list-style-type: none"> • Global “crowdsourced” species identification system and online occurrence recording tool • Individuals can identify plants and animals and share observations • >500,000 observations in Canada
H₂O CHELSEA <ul style="list-style-type: none"> • Acquire knowledge of surface and groundwater in territory • Volunteer-based • Parameters include: <ul style="list-style-type: none"> • Physical-chemical conditions • Microbial • Metals 	FEDERATION OF LAKES OF VAL-DES-MONTS - INTEGRATED WATERSHED MANAGEMENT PROJECT <ul style="list-style-type: none"> • Study accessible / inhabited lakes in the area • Parameters include: <ul style="list-style-type: none"> • Physical-chemical conditions • Riverbank characterization • Identification of species (including species at risk) • Indicators of beaver presence • Characterization of tributaries outfalls, and majors culverts linked to lakes 	BONNECHERE RIVER WATERSHED PROJECT <ul style="list-style-type: none"> • Community-based volunteer organization that has been surveying the health of the Bonnechere river and its watershed since 1999 • Parameters include <ul style="list-style-type: none"> • Nutrients • Physical-chemical conditions • Lake stratification • Benthic invertebrates 	WATER EDUCATION AND MONITORING GROUP (G3E - GROUPE D'ÉDUCATION ET D'ÉCOSURVEILLANCE DE L'EAU) <ul style="list-style-type: none"> • Coordinates citizen scientists through G3E programs, and provide education materials and tools • Adopt-a-Stream parameters include: <ul style="list-style-type: none"> • Invertebrates • Physical-chemical conditions • Fish observations • SurVol Benthos parameters include: <ul style="list-style-type: none"> • Identifying benthic macroinvertebrates

FIGURE 4.2-10. SUMMARY OF KEY ACADEMIC, NGO, COMMUNITY-BASED AND CITIZEN SCIENCE ACTIVITIES

4.2.8. INDUSTRY

There are several industries that operate in the Ottawa River watershed, including nuclear, forestry and hydroelectricity (see chapter 5). Each industry that participated in ECCC’s engagement process indicated that they, in one form or another, contribute to the data collection and monitoring of the water bodies in the Ottawa River watershed. Figure 4.2-11 describes some of the key parameters/data that is collected by industry. As indicated earlier in this report, through the NPRI, industries in the watershed are legislated to provide the federal government with an inventory of pollutant releases (to air, water and land), disposals, and transfers for recycling. This includes taking samples of surface and groundwater to test water quality using physical-chemical parameters, such as pH, temperature, conductivity, and toxic substances (Public and Stakeholder consultations, 2018). Some industries, such as hydroelectricity, also have biodiversity programs for tracking the status of species. Benthic invertebrates and species at risk are often the focus of biodiversity programs conducted by industry (Public and Stakeholder consultations, 2018). Water quantity monitoring (water levels and flows) is also a primary responsibility of hydroelectric companies, such as Ontario Power Generation and Hydro-Québec. Additionally, CNL’s Chalk River Laboratories monitors natural well-being, through monitoring of air, surface water, groundwater, food sources, effluent and biodiversity (Public and Stakeholder consultations, 2018).

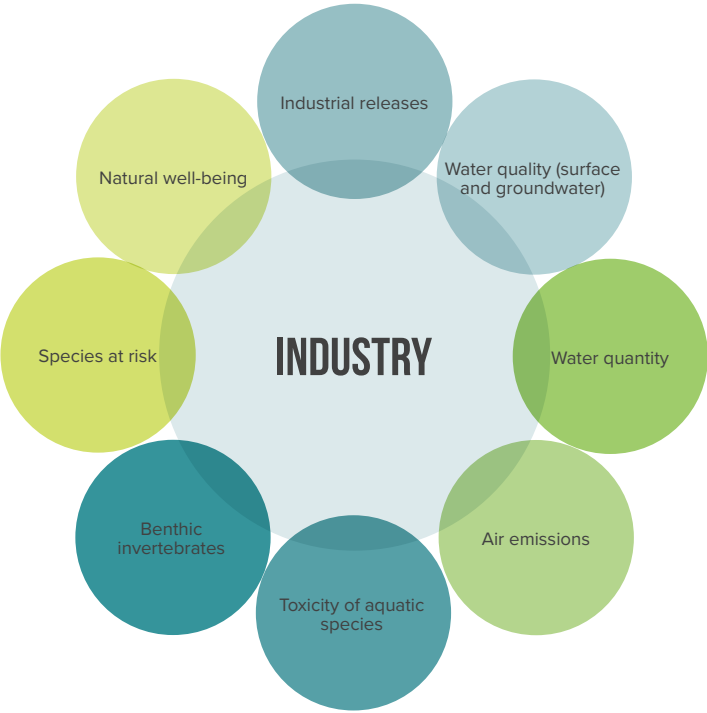


FIGURE 4.2-11. SUMMARY OF KEY PARAMETERS MONITORED/COLLECTED BY INDUSTRY

4.3. EXISTING ASSESSMENTS OF THE HEALTH OF THE WATERSHED

This section will provide a brief overview of some prevalent health assessments that have been conducted about the Ottawa River watershed, including an examination of the indicator themes assessed through this Study. This section will also discuss any trends or issues identified, as well as highlight some data gaps and opportunities presented through those assessments.

4.3.1. OVERVIEW OF EXISTING ASSESSMENTS ABOUT THE OTTAWA RIVER WATERSHED

4.3.1.1. GOVERNMENT OF QUÉBEC – “SUMMARY PROFILE OF THE OTTAWA RIVER WATERSHED”

In 2015, the government of Québec prepared a summary of the information available on the Ottawa River watershed, with a focus on the Québec portion of the watershed, which, as previously mentioned, represents approximately two thirds of the whole watershed. Conducted by the former MDDELCC, the profile describes watershed characteristics, including some of the physical, economic and social elements of the watershed. The profile was developed from existing data, some of which came from the province’s monitoring programs discussed in section 4.2, as well as from other data collection programs led by organizations such as the OBVs. Some of the key health indicator themes identified in the summary include water quality, groundwater, biodiversity, and protected areas. The summary also includes information regarding industries operating in the watershed and their interactions with the environment (MDDELCC, 2015).



4.3.1.2. CITY OF OTTAWA – “CHARACTERIZATION OF OTTAWA’S WATERSHEDS: AN ENVIRONMENTAL FOUNDATION DOCUMENT WITH SUPPORTING INFORMATION BASE”

This report focuses on the characterization of Ottawa’s watersheds (City of Ottawa, 2011), and aims to provide information on the health of the City of Ottawa’s watercourses to the residents and visitors of the Ottawa area. The report also features information to guide planning approaches undertaken by the City to protect local rivers and streams. The report includes a compilation of existing information on, and provides a characterization of, the City’s watershed and sub-watersheds, as well as identifies data sources and gaps. Indicator themes analyzed in the report include topography, climate, hydrology, water quality, groundwater, land use, and biodiversity.

4.3.1.3. ONTARIO CONSERVATION AUTHORITIES WATERSHED REPORT CARDS

As indicated in section 4.2, CAs deliver a variety of watershed management programs and services, including the monitoring of watershed conditions. In 2013, CAs began developing Watershed Report Cards, as a means of standardizing the examination of local environmental issues, tracking changes over time, and identifying priority action areas (Conservation Ontario, 2018c). Report cards are released every five years; they monitor for surface water quality, forest conditions, and wetland cover. Groundwater is also included in a few of the report cards. The 2018 report cards have been released for the MVCA (2018b), the NBMCA (2018), and the SNCA (2018), which operate within the Ottawa River watershed. The RVCA watershed report cards have been evaluated at the sub-watershed level, with one of the sub-watershed reports released annually since 2012 (includes Jock River Subwatershed Report, 2016; Kemptville Creek Subwatershed Report, 2013; Lower Rideau Subwatershed Report, 2012; Middle Rideau Subwatershed Report, 2015; Rideau Lakes Subwatershed Report, 2014; Tay River Subwatershed Report, 2017). RRCA last evaluated by water body region in 2017 (RRCA, 2017a, 2017b, 2017c, 2017d, 2017e, 2017f, 2017g, 2017h, 2017i).

4.3.1.4. ORGANISMES DE BASSIN VERSANT WATER MASTER PLANS

As was indicated in section 1.3 on roles and responsibilities, in the Ottawa River watershed, each OBV is required to develop a Water Master Plan. These documents are a planning and decision-making tool for water management, in order to promote best practices and identify local objectives and targets for the ecosystem and watershed communities (COBAVER-VS, 2018). Six overarching sections related to IWRM are required for each plan:

- Portrait of water resources – description of physical, economical, and social characteristics of the watershed;
- Establishment of a diagnostic of water resources;
- Definition of a long term vision of water resources;
- Determination of issues and medium term changes (over the next five years);
- Development of a five-year action plan; and
- Monitoring, evaluation and updating of the Water Master Plan.

While each OBV Water Master Plan contains the same sections, the content within the plans, as well as indicators used, vary between OBVs. Indicators often relate to quality, quantity, safety, accessibility, culture and ecosystems. Additionally, other indicators are often used to measure the achievement of actions set out in the Water Master Plan. These include examples such as water quality, biodiversity/ecosystems, hydrology, groundwater, land use and industry impacts, and topography.

The Water Master Plan diagnostic, and issues and trends sections from all OBVs within the Ottawa River watershed are examined in section 4.3.2 (i.e., ABV 7, 2014; Abrinord, 2015; COBALI, 2013; COBAMIL, 2011; Cyr, 2016; OBV RPNS, 2014; OBVT, 2013).

4.3.1.5. OTTAWA RIVERKEEPER 2006 RIVER REPORT

Published in 2006, Ottawa Riverkeeper's River Report was developed to inform broad audiences about the physical and biological conditions of the Ottawa River watershed (Ottawa Riverkeeper, 2006). This report provides an overview of watershed characteristics, including ecological values. The report was intended to be the first of a series of river reports in order to identify trends, as well as changes in impacts and pressures to the ecological integrity of the Ottawa River watershed. Though published in 2006, the information contributes to the understanding of the state of the watershed. Themes identified and explored in the report include hydrology, climate change, water quality, and biodiversity.

4.3.1.6. OTTAWA RIVERKEEPER WATERSHED HEALTH COMMITTEE PROCESS

In 2017, Ottawa Riverkeeper established the Watershed Health Committee, an advisory body made up of approximately 20 volunteer experts. The committee is intended to design and lead a health assessment of the Ottawa River watershed (Ottawa Riverkeeper, 2018c). The committee is working to examine available data, potential watershed health indicators, as well as monitoring protocols in effect across the watershed. Ottawa Riverkeeper has indicated that the results of this exercise will be presented online in the form of a report card, in order to strengthen data sharing networks, as well as inform both the public and decision-makers. A Watershed Health Committee workshop was held in March 2018 to discuss a framework for conducting the health assessment, existing data, integration of Indigenous Knowledge, and potential indicators. Indicator themes to be explored further include ecosystems (e.g., water quality, forest cover), human/ecosystem interactions (e.g., invasive species, land use), governance, science-policy interface (e.g., monitoring, data/information management, reporting), and Indigenous Knowledge.

ECCC provided financial support, along with others, to the Ottawa Riverkeeper for the development of a suite of indicators for the Ottawa River watershed. The Ottawa Riverkeeper employed an interdisciplinary, interprovincial and expert advisory Ottawa River Watershed Health Committee to help build consensus on a common set of watershed health indicators. The committee engaged representatives from governments, Indigenous peoples, watershed agencies, environmental groups, academia, and industry in this task. Indigenous Knowledge research and meetings with Indigenous communities was also undertaken to incorporate Indigenous Knowledge into the indicator development process. A final report was submitted to ECCC on May 2, 2019, which included an analysis of the recommended indicators, such as data availability, compatibility and credibility, as well as the effectiveness and relevance of the indicators to assess the health of the Ottawa River watershed.

4.3.1.7. WORLD WILDLIFE FUND CANADA WATERSHED REPORT

In 2013, WWF-Canada began a health and threats assessment of Canadian rivers, working to gather existing data in collaboration with community organizations, water agencies, Indigenous peoples, researchers, governments and industries (WWF-Canada, 2017a). The purpose of this assessment was to “help identify priority actions to ensure all waters in Canada are in good ecological condition by 2025” (WWF-Canada, 2017a, p. 4). WWF-Canada identified and assessed 25 major watersheds in Canada. A variety of tools and guidelines were used to assess water quality within the 25 watersheds, including the CCME's Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME, 2003). Results for the Ottawa River watershed were released in 2015 (WWF-Canada, 2015). Four metrics were chosen for the health assessment framework (hydrology, water quality, benthic macro-invertebrates, and fish) to represent key elements of the aquatic ecosystems. These metrics are commonly monitored in most Canadian jurisdictions (WWF-Canada, 2017a). Indicators were also developed for each metric.

4.3.2. OVERVIEW OF TRENDS, ISSUES AND GAPS IDENTIFIED IN THE HEALTH ASSESSMENTS

It should be noted that the methods used for the health assessments discussed in the previous section are not standardized, and vary across the different studies. Therefore, the purpose of this section is to provide some high-level comparisons and identification of common themes among the different studies.

4.3.2.1. SURFACE WATER QUALITY AND HYDROLOGY

Findings from the assessments discussed in the previous section indicate that there is a range in surface water quality across the Ottawa River watershed, varying from poor to excellent. There are several concerns related to the protection of water quality in the Ottawa River watershed, which can lead to the deterioration of water quality, and indirectly impact ecosystem health overall. Some of these issues include the following:

- **PHYSICAL-CHEMICAL CONDITIONS** (e.g., temperature, dissolved oxygen, pH, alkalinity) (ABV 7, 2014; City of Ottawa, 2011; MDDELCC, 2015; Ottawa Riverkeeper, 2006)
 - Some cases of low alkalinity were attributed to the geology of the area (noncarbonated bedrock or soils). Alkalinity is the buffering capacity of water; low alkalinity suggests that water is more susceptible to changes in pH
- **ELEVATED NUTRIENTS (PHOSPHORUS), CYANOBACTERIA, AND RELATED EUTROPHICATION** (Abrinord, 2015; ABV 7, 2014; City of Ottawa, 2011; COBALI, 2013; COBAMIL, 2011; OBVT, 2013; Cyr, 2016; Ottawa Riverkeeper, 2006; MDDELCC, 2015; RRCA, 2017a, 2017b, 2017c, 2017d, 2017e, 2017f, 2017g, 2017h, 2017i; RVCA, 2012; RVCA, 2013; RVCA, 2016; SNCA, 2018)
 - Found to be prevalent in areas with higher agricultural land use, and areas where there are more untreated municipal wastewater releases
- **HIGHER BACTERIAL COUNTS (*E. coli*)** (Abrinord, 2015; ABV 7, 2014; Cyr, 2016; City of Ottawa, 2011; OBV RPNS, 2014; RRCA, 2017a, 2017b, 2017c, 2017d, 2017g, 2017h, 2017i)
 - Found to be prevalent in areas with higher agricultural land use, and areas where there are more untreated municipal wastewater releases
- **PRESENCE OF HEAVY METALS AND TOXIC SUBSTANCES** (e.g., pesticides) (Abrinord, 2015; City of Ottawa, 2011; COBAMIL, 2011; Cyr, 2016; OBV RPNS, 2014; OBVT, 2013; Ottawa Riverkeeper, 2006; WWF-Canada, 2015)
 - Linked to industrial and agricultural activities
- **TURBIDITY AND AN INCREASE OF SUSPENDED MATTER** (Abrinord, 2015; ABV 7, 2014; COBAMIL, 2011; Cyr, 2016; OBV RPNS, 2014; SNCA, 2018)
 - Increased turbidity, greater sedimentation, and suspended matter linked to areas of lower forest cover, increased urbanization, and high levels of industrial activity

The City of Ottawa (2011), COBAMIL (2011), MDDELCC (2015), RVCA (2013), and WWF-Canada (2015) all indicated in their assessments an increasing trend of water quality deterioration, though the time period of assessment varied by study.

A number of the studies examined also raised issues regarding the hydrology of the watershed (i.e., water quantity and water dynamics). The majority of concerns raised were related to flooding in the region (COBALI, 2013; COBAMIL, 2011; Cyr, 2016; OBV RPNS, 2014). Potential causes identified for flooding exacerbation in the watershed include an increase in extreme precipitation events, land use changes, and an increase in beaver activity. In addition, large dams and reservoirs alter the natural flow regime, flooding cycles and magnitude of floods (WWF-Canada, 2015). The ORRPB estimated that flows during the flooding peak in 2017 were reduced downstream of the major reservoirs (e.g., by approximately 20% at the Carillon dam) (ORRPB, Feb 15, 2018 post on ORRPB website).

A couple of studies (Abrinord, 2015; WWF-Canada, 2015), also noted the impacts to biodiversity and ecosystems due to water-level fluctuations in the watershed. Future water use, and the effects on water levels in the watershed, were also cited as potential sources of future conflict (e.g., potential for overconsumption of clean drinking water) (COBALI, 2013; COBAMIL, 2011; ABV 7, 2014; OBV RPNS, 2014; Abrinord, 2015).

Knowledge gaps and opportunities identified in some of the reports included:

- Data insufficiency related to water quality, usage, and sources of pollution
- Identification of potential climate change impacts on water resources
- Improve knowledge concerning how the river system operates
- Improve data information sharing
- Work in partnerships to protect water sources

4.3.2.2. GROUNDWATER

According to MELCC (2018p), groundwater is the most economically accessible water supply source in Québec, due to its abundance, quality and proximity to consumers. From the studies that considered groundwater in their assessment, groundwater quality is generally considered to be good in both Ontario and Québec (ABV 7, 2014; NBMCA, 2018; SNCA, 2018). However, many assessments did not include groundwater, making it difficult to conclusively assess the overall quality. One of the main concerns that was raised in relation to groundwater, is the potential for natural or anthropogenic (i.e., human caused) activities to contribute to the deterioration of groundwater quality (e.g., from mining) (ABV 7, 2014; Cyr, 2016; OBVT, 2013).

Knowledge gaps and opportunities identified in the reports included:

- Data gaps on groundwater quality (e.g., limited information for private wells)
- Data gaps on groundwater quantity
- Identification of potential climate change impacts on water resources
- Improve ways to disseminate information

4.3.2.3. BIODIVERSITY/ECOSYSTEMS

Wetland cover and forest cover are the most common biodiversity indicators examined in existing health assessments. The forest and wetland cover indicator targets used in the majority of assessments were 30% and 10% coverage respectively. Wetland cover ranged across the watershed, but for the majority of assessments, the coverage exceeded the 10% target. Forest cover also varied across the watershed; however, forest cover often fell below the 30% target. As stated, Ducks Unlimited has partnered with various government agencies and organizations to classify wetland areas throughout Canada, for a project titled the Canadian Wetland Inventory. The project is in progress and currently provides data and classification for southern portions of wetlands in the watershed (Ducks Unlimited Canada, 2018c). In terms of identifiable trends, a number of assessments have observed declines in forest cover in their assessment areas, with greater losses of forest cover occurring in urban areas (NBMCA, 2018; RVCA, 2012; RVCA, 2013; RVCA, 2015; RVCA, 2016). In one study (SNCA, 2018), forest cover was also linked to trends in water quality. SNCA (2018) observed that “good” forest cover, especially in riparian areas, led to “good” stream health (and vice versa).

A number of the examined studies also identified several issues in relation to biodiversity and ecosystems:

- **LOSS OR DEGRADATION OF HABITAT** (e.g., terrestrial, wetland, riparian, spawning grounds) (Abrinord, 2015; ABV 7, 2014; COBALI, 2013; Cyr, 2016; OBV RPNS, 2014; OBVT, 2013; Ottawa Riverkeeper, 2006; MDDELCC, 2015; MVCA, 2018b; RRCA, 2017a, 2017b, 2017c, 2017d, 2017e, 2017f, 2017g, 2017h, 2017i; SNCA, 2018; WWF-Canada, 2015)
 - Industrial activities (e.g., deforestation, dams), general land use changes, and climate change were identified as potential causes for the loss or degradation of habitats in the watershed
- **DETERIORATION OR LOSS OF BIODIVERSITY** (e.g., species at risk, overexploitation of species) (Abrinord, 2015; ABV 7, 2014; COBALI, 2013; Cyr, 2016; MDDELCC, 2015; OBVT, 2013; Ottawa Riverkeeper, 2006)
 - Causes identified for changes in biodiversity include changes in land use, climate change, as well as impacts from pollution (e.g., bioaccumulation/biomagnification of toxic substances)
- **RAPID INCREASE IN THE NUMBER AND DISTRIBUTION OF INVASIVE SPECIES** (Abrinord, 2015; ABV 7, 2014; COBALI, 2013; Cyr, 2016; OBV RPNS, 2014; OBVT, 2013; Ottawa Riverkeeper, 2006; WWF-Canada, 2015)
 - Examples include the presence of Zebra Mussels, Eurasian Water-Milfoil, and the European Elm Bark Beetle
- **BARRIERS TO MOVEMENT OF VARIOUS SPECIES** (COBALI, 2013; Cyr, 2016; OBV RPNS, 2014; OBVT, 2013; Ottawa Riverkeeper, 2006; WWF-Canada, 2015)
 - A concern often raised in the context of fish migration, and the challenges for fish to migrate to spawning grounds through areas with hydroelectric operations
 - Habitat fragmentation caused by the building of roads and rail lines is also a concern for terrestrial species

Knowledge gaps and opportunities identified in the examined reports above included:

- Need for more vegetation mapping
- Sparse baseline data on benthic invertebrates
- Examination of tools for dealing with barriers to species movement
- Support reforestation efforts
- Improve knowledge of habitat functions

4.3.2.4. LAND USE/SHORELINE INTEGRITY

Many reports did not incorporate land use and shoreline integrity as indicators for monitoring health and trends; however, those that did, provided valuable insight into the influence that the indicators have on the health of the Ottawa River watershed. SNCA (2018), for example, observed that areas with lower scores of forest cover were prone to erosion and sedimentation, while the MDDELCC (2015), indicated that relicts of past forestry operations, including abandoned logging camps, piers and docks have contributed to increased shoreline degradation. Despite a lack of reporting across the watershed, erosion and sediment displacement in water bodies are concerns from industrial, economic and recreational activities in the watershed, which in turn can cause deterioration in water quality, aquatic habitats, and fish spawning sites (ABV 7, 2014; COBALI, 2013; COBAMIL, 2011; Cyr, 2016; OBV RPNS, 2014; OBVT, 2013; Ottawa Riverkeeper, 2006).

Knowledge gaps and opportunities identified in the examined reports above included:

- Need for improved understanding of physical structure and flow dynamics of streams
- Risk mapping of soils and slopes
- Focus on revitalizing shorelines with native trees and shrubs
- Create shoreline buffers for habitat and erosion control

4.4. WHAT WE HEARD: VIEWS ON WATERSHED HEALTH

The engagement process associated with the ORWS sought input from various groups to help identify knowledge, data, and information that could assist in furthering the understanding of watershed health. Views were collected from numerous sources, including from Indigenous communities and organizations, public comments on PlaceSpeak, submissions via email, and from engagement guides submitted by various interest groups. Types of watershed health information requested through the ORWS included the following:

- Issues or concerns related to the health of the Ottawa River watershed;
- Types of data collection/monitoring being conducted in the watershed (addressed in section 4.2);
- Themes or specific indicators that should be considered; and
- Information gaps, or where information is missing/hard to find, related to the health of the watershed.

Summarized in the sections below are the views expressed by stakeholders in the watershed.

4.4.1. VIEWS ON ISSUES OR CONCERNS RELATED TO WATERSHED HEALTH

Through various means of input, Indigenous organizations, the public, and stakeholders expressed many concerns in relation to the ecological health of the Ottawa River watershed (see Figure 4.4-1) (PlaceSpeak consultations, 2018; Public and Stakeholder consultations, 2018). The most common concern was related to water quality, and more specifically, the impacts that pollution or the release of harmful substances into the water will have on watershed ecosystem health. Other water quality concerns expressed include issues related to the physical-chemical conditions (e.g., increasing water temperatures, decreased oxygen availability in the water), cyanobacteria (i.e., blue-green algae), and the increase in algae blooms, potential climate change impacts, and sedimentation (i.e., the deposition of suspended particles in the water, which can bury critical aquatic habitats).

Threats to biodiversity were the second most common issue theme expressed. Specific issues related to biodiversity include the loss of critical habitat and the fragmentation of ecosystems. Fragmentation can severely affect migration of fish species, which in turn has cascading impacts to fish spawning. General health of species and concerns for population decline was another common issue identified (Public and Stakeholder consultations, 2018). This includes issues related to the increase in the number and distribution of invasive species, increase in the number of species at risk, impacts to benthic invertebrates, potential impacts of climate change, and overall ecosystem degradation.

Concerning issues of land use, respondents were most concerned about industrial and economic activity impacts to the water and ecosystems of the Ottawa River watershed (PlaceSpeak consultations, 2018; Public and Stakeholder consultations, 2018). This includes concerns about nutrient loading (i.e., increasing phosphorus levels in the water) from agricultural activities, and

“Please include means of regular, media friendly reports on the findings. When there are findings that show the river at risk, these should be made public in an active way...”

(PlaceSpeak consultations, 2018)

contaminant releases to the river system from the Chalk River nuclear facility. Other land use concerns include the removal of natural spaces, and degradation of shorelines. Hydrological concerns identified included potential climate change impacts on water flow and levels (e.g., extreme precipitation events), as well as the potential for loss of critical habitats, and the fragmentation of ecosystems from changes in flow regime. Though not as prevalent, a few respondents also expressed concerns about air quality in the watershed, specifically relating to GHG emissions and particulate matter (PlaceSpeak consultations, 2018; Public and Stakeholder consultations, 2018).

Finally, there were a few comments expressed on PlaceSpeak regarding transparency in relation to the health of the watershed. Individuals expressed concerns that there may be duplication of efforts related to data collection and monitoring due to a lack of transparency or information sharing of watershed health activities. Others took issue with a lack of transparency or communication about the state/health of the watershed, and expressed concerns regarding a lack of transparency or communication about pollution releases (PlaceSpeak consultations, 2018).

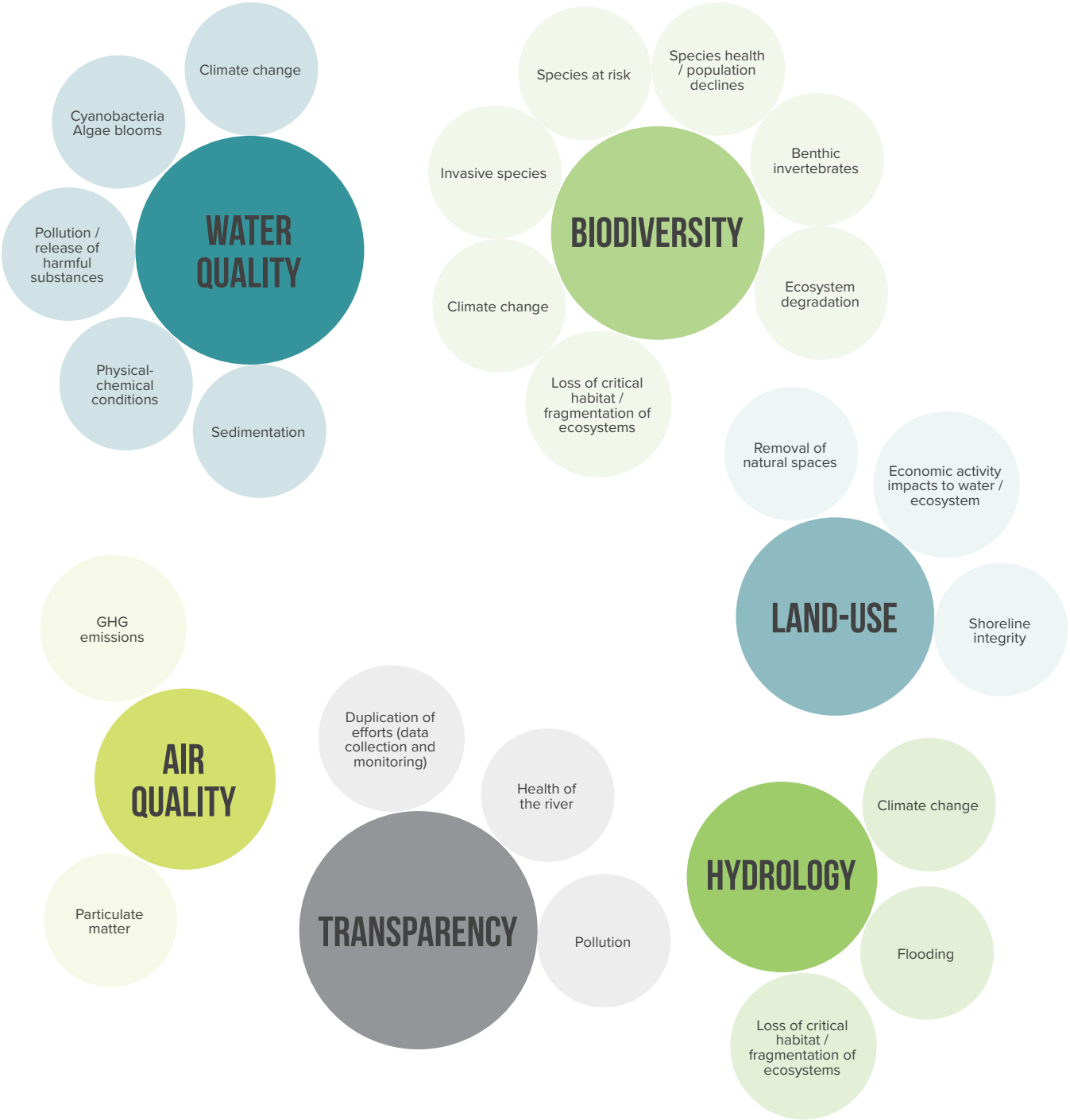


FIGURE 4.4-1. SUMMARY OF VIEWS ON ISSUES AND CONCERNS RELATED TO THE HEALTH OF THE OTTAWA RIVER WATERSHED

4.4.2. VIEWS ON POTENTIAL INDICATORS FOR CONSIDERATION

This section presents potential indicators that could be considered in future work on the health of the Ottawa River watershed. Sources of information for potential indicators came from online and other stakeholder engagement input, existing monitoring and data collection programs, as well as from the existing health assessments examined in section 4.3. From these sources, 58 potential indicators were identified for nine different indicator themes (see Table 4.4-1). While indicators are presented in this report, more work is needed to fully evaluate the indicators suitable for an assessment of the Ottawa River watershed.

The indicator themes of water quality and biodiversity were the most frequently proposed indicators for consideration. Many of the respondents indicated the importance of examining the following specific indicators for those themes:

- **WATER QUALITY:** physical-chemical conditions, point and non-point source pollution/industrial discharges, nutrients, and microbial conditions (e.g., *E. coli*); and
- **BIODIVERSITY:** Habitat cover (forest, wetland, riparian and protected areas cover), presence of benthic invertebrates, trends in terrestrial and aquatic species (e.g., fish, moose and bird populations), and invasive species.

Land use and hydrology were other commonly expressed indicator themes by respondents. Land use indicators include shoreline cover and development, water use, urban development, soil conditions (e.g., quality, moisture), industrial and economic activities in the watershed, and storm water and wastewater management. The hydrological indicators include water flows and fluvial dynamics (i.e., forces that act on the riverbed), water levels, depth, and substrate.

While not as prominent as the themes listed above, other important indicator themes that emerged through engagement included:

- **GROUNDWATER:** water levels, physical-chemical conditions, annual consumption and location of aquifers;
- **CLIMATE:** Trends in precipitation, seasonality, snow and ice patterns, temperature, and growing degree days;
- **GEOGRAPHY:** Geology, soil conditions (e.g., quality, moisture), topography, hydrography (i.e., physical features of the lakes and rivers);
- **SOCIO-ECONOMIC:** Demographic data and projections, human and community health, tourism data, and heritage or cultural sites; and
- **AIR QUALITY:** pollutant emissions.

“To really understand the ecosystem of a lake you must cover many diverse disciplines and topics. The list that is evolving based on my work understanding my lake includes: Geology, Biology/Limnology, Chemistry, Hydrology, History, Users/ Usage, Urban Planning, Development, Stakeholders/Interest groups, etc. A lake and its watershed is a living system and is very complex with many parts that are tightly interconnected.”

(PlaceSpeak consultations, 2018)

In addition to the identification of potential indicators, respondents made a number of recommendations in regards to how to develop and assess watershed health indicators. For example, several respondents specified the need for clear monitoring objectives to frame the development of indicators. Other respondents mentioned the idea of a “whole-of-watershed” approach to assessment in order to determine monitoring objectives and to identify which indicators to measure (PlaceSpeak consultations, 2018).

Respondents also identified citizen-science and community-based monitoring as effective means to monitor indicators and contribute to the development of baseline conditions.

However, several respondents indicated that monitoring and assessment of indicators requires a certain level of technical expertise, as well as standardized sampling protocols. For example, in terms of biodiversity, “acquiring the taxonomic expertise would be essential” (i.e., expertise in species identification) (PlaceSpeak consultations, 2018). Other stakeholders also expressed concerns that there may be some challenges involved in identifying healthy thresholds for some indicators, such as hydrology (i.e., water quantity) (ORRPB, 2017).

TABLE 4.4-1. SUMMARY TABLE OF POTENTIAL INDICATORS BY INDICATOR THEME

*The number in brackets beside the indicator is the number of times it was mentioned.

INDICATOR THEME	POTENTIAL INDICATORS
Water quality	Beach closures (2)
	Blue-green algae (cyanobacteria) (6)
	Fish consumption advisories (1)
	Microbial conditions (e.g., <i>E. coli</i>) (30)
	Nutrients (36)
	Physical-chemical conditions (e.g., temperature, pH, clarity) (48)
	Point and non-point source pollution/industrial discharges (19)
	Sediment quality (1)
	Toxic substances (e.g., metals, pesticides) (4)
	Visual observations (1)
Biodiversity	Barriers to migration (1)
	Benthic invertebrates (17)
	Environmental DNA (1)
	Habitat cover (forest, wetland, riparian and protected area cover) (44)
	Habitat trends (7)
	Invasive species (13)
	Limnology (1)
	System productivity (1)
	Species at risk (both wildlife and plants) (6)
	Terrestrial and aquatic species trends (e.g., fish, moose, and bird populations) (19)
	Terrestrial and aquatic plant biomass (3)
	Terrestrial and aquatic species distribution (1)
Hydrology	Fluvial dynamics (5)
	Substrate type (1)
	Water balance (3)
	Water depth (1)
	Water flow (17)
	Water levels (17)

INDICATOR THEME	POTENTIAL INDICATORS
Land use	Agriculture activities (7)
	Industry operations in the watershed (4)
	Land cover (9)
	Recreational/transportation use (5)
	Shoreline cover (7)
	Shoreline development (5)
	Storm water and wastewater management (5)
	Urban development (3)
	Water use (6)
Groundwater	Annual consumption (1)
	Location of aquifers (2)
	Water levels (2)
	Groundwater recharge (2)
	Physical-chemical conditions and toxic substances (e.g., temperature, pH, metals) (10)
Climate	Growing degree days (i.e., heat index that can be used to predict when a crop will reach maturity) (1)
	Precipitation trends (6)
	Seasonality trends (1)
	Snow and ice patterns (2)
	Temperature trends (5)
Geography	Ecological region (1)
	Geology (4)
	Hydrography (1)
	Shoreline stability (3)
	Soil conditions (e.g., quality, moisture) (7)
	Topography (2)
Socio-economic	Demographic data and projections (4)
	Heritage sites (1)
	Culturally important sites (1)
	Human/community health (2)
	Tourism information (2)
	Recreational data (e.g., seasonal fishing activity, boating, canoeing, hiking) (1)
Air quality	Pollutant emissions (3)



4.4.3. VIEWS ON KNOWLEDGE AND INFORMATION GAPS

Beyond seeking input on watershed indicators, views were sought on potential gaps in watershed knowledge. Gaps identified through the broad public engagement process included insufficient data to track trends in biodiversity, including invasive species, and a lack of understanding on the overall state of groundwater. Respondents also expressed concerns that many known and emerging contaminants are still poorly understood, including their potential impacts to an ecosystem and its elements (e.g., impacts of pesticides). Others expressed the need for increased mapping efforts for wetlands, land development, soil erosion, enhanced shoreline characterization, and for improved inventory of submerged heritage sites. Our analysis suggests that monitoring for water quality and quantity produces the most data of any indicator (as seen in section 4.2); however, several respondents indicated that data is missing or insufficient in this field (PlaceSpeak consultations, 2018; Public and Stakeholder consultations, 2018).

It is important to note that a lack of knowledge surrounding cumulative effects within the Ottawa River watershed was of particular concern to Indigenous organizations, such as the Algonquin Anishinabeg Nation Tribal Council, with the organization stating “As a Nation, little is known about the cumulative impact human activities have had or currently have on the river. It is recommended that Environment Canada conduct an in-depth analysis of the status of the water, the quantity of pollutants that the waterway is composed of, and the extent pollutants/human activities (e.g., operations of dams, municipal/industrial wastewater systems) have had an environmental impact on the water to provide a clear picture of the issue at hand” (Algonquin Anishinabeg Nation Tribal Council, 2018). The Mohawk Council of Kahnawà:ke shared a similar view, stating “the study must pay particular attention to sustainability and cumulative effects pertaining to Indigenous nations and activities” (Mohawk Council of Kahnawà:ke, 2018).

“...the growing recognition of the limits of Western science in solving environmental problems of increased complexity and magnitude has resulted in calls for the incorporation of Indigenous knowledge systems in resource management and development.”

(Public and Stakeholder consultations, 2018)

Other Indigenous organizations and community members highlighted the importance of incorporating Indigenous Knowledge, with the Mohawk community of Kanesatake stating “Management plans must include Indigenous Knowledge. Unfortunately, Indigenous Knowledge has been dismissed in the past in favor of more accepted scientific knowledge. The issue will also pose huge barriers for collaboration among Indigenous communities and industry/government” (Bisson & Mohawk Community of Kanesatake, 2018). The Algonquin Anishinabeg Nation Tribal Council also stated that “success of (an) initiative lies in a balanced alliance of both traditional knowledge and scientific knowledge” (Algonquin Anishinabeg Nation Tribal Council, 2018).

In addition, Indigenous organizations expressed the need for the incorporation of Indigenous Knowledge in watershed health assessments (i.e., the balance of Indigenous Knowledge and science), in order to support the development of baseline data. Notably it was recommended that the study process involve “an Indigenous Knowledge Study of the Ottawa River to document Algonquin knowledge of the watershed” and that a Regional Impact Assessment “must be driven by science and Indigenous Knowledge to limit the possibility for bias in the document” (Richardson, 2018; Mohawk Council of Kahnawà:ke, 2018).

A number of respondents indicated that one of the largest limitations to understanding the health of the watershed is an uncoordinated approach to data collection within the Ottawa River watershed. Respondents specified a lack of “whole of watershed” approach to assessments, and a lack of knowledge concerning data collection initiatives in the watershed and where the data is located (“information is scattered”) (PlaceSpeak consultations, 2018). In addition, others indicated that a number of datasets are incomplete or out-of-date, and that there is compatibility, comparability, and sometimes even credibility issues with previously collected data.

“Geo-spatial data sets such as land cover and other related features are important sources of information to assess watershed health. Many of these data sets have not been updated or are being updated by individual users.”

(Public and Stakeholder consultations, 2018)



CHAPTER 5:

SIGNIFICANCE OF THE WATERSHED

Watersheds are complex socio-ecological systems that involve various dimensions, including the environment, the economy, and society (Krievens, 2015). Such systems provide abundant services to humans that range from supplying raw goods, such as drinking water, to meeting more intangible needs, such as spiritual connections. In addition to providing value to humans, watersheds also hold intrinsic value by, for example, supporting rich biodiversity and unique habitats. Healthy watersheds represent an important part of Canada's historical fabric, as Indigenous peoples and, subsequently, settler populations have long relied on watersheds for their livelihoods, including for travel, food and drinking water (CCME 2016). The last component of Motion M-104 specifies the examination of the economic, cultural, heritage and natural values associated with the Ottawa River watershed. Below is a brief overview of literature and research related to values and threats within the watershed, followed by a summary of What We Heard (section 5.3), summing up the values and concerns of stakeholders.

5.1. VALUES

Values in this chapter are largely categorized based on the wording of Motion M-104, which directs the Government of Canada to consider “the economic, cultural, heritage, and natural values within the Ottawa River Watershed.” However, it is recognized that values are interconnected. The information in this chapter is based on a literature review, as well as input received through Indigenous, stakeholder and public engagement.

5.1.1. ECONOMIC VALUES

The term “economic value” can be interpreted as the economic contribution of goods or services that a watershed provides. Quantifying the value of those goods and services is regarded as beneficial, as it creates an understandable frame of reference for the public and decision-makers. It is a way to evaluate development and management decisions, and it assigns worth to resources that may otherwise be taken for granted or ignored (Costanza et al., 1997; Daily et al., 2009). However, determining the economic value of a watershed and the services it provides is difficult, as watersheds do not follow geo-political and administrative boundaries, which makes data collection, and thus comprehensive economic valuation a challenge. Below is a summary of the economic contributions of ecosystems, an examination of how fresh water contributes to the economy, as well as a description of economic sectors present in the Ottawa River watershed region.

5.1.1.1. NATURAL CAPITAL AND ECOSYSTEM SERVICES

As discussed in chapter 4, the quality and health of a watershed is influenced by a variety of factors, including changing climatic conditions, pollution from industry and agriculture, waste and sewage disposal, erosion and sedimentation, and degradation of wetlands (Henshaw, Bryan & ECCC et al., 2017). In turn, these factors alter physical, chemical, biological and microbiological characteristics of water bodies, such as nutrient levels, pH, turbidity, bacteria and fecal coliform levels (Chapman, 1996; Khan, Husain & Lumb, 2003).

A healthy watershed is integral to human health, economic development and habitat conservation. While watersheds contribute directly to various economic sectors through the provision of fresh water and other services, the monetary value of these services can often be difficult to quantify through commercial markets. By not assigning economic value to nature, there is concern that services and resources will be perceived as worthless or limitless, and not be efficiently allocated or managed. Recognition of ecosystem services is integral to ensuring that the most effective decisions are made, now and into the future (Kennedy & Wilson, 2009). To address this issue, there has been a move towards quantifying the goods and services nature provides.

Ecosystem services are the benefits that humans derive from ecosystems, and in the case of this study, watersheds. Valuation of ecosystem services can assist in providing comparisons of natural capital to physical capital to compare contributions to human welfare. These services can be broken down into four categories (Castro et al, 2018; Parkes et al., 2010):

- Provisioning services, which include goods directly obtained from the ecosystem;
- Regulating services, which include processes that maintain the environment;
- Cultural services, which are non-material benefits that humans obtain from ecosystems; and
- Supporting services, which refer to services not directly useful to humans, but integral to other supporting services.

ECOSYSTEM SERVICES

PROVISIONING SERVICES

Both forests and wetlands are integral to a clean water supply, as soil and small organisms filter pollutants out of the water. Food sources and timber are other examples of provisioning services found in the watershed, with fishing, hunting, agriculture and foraging all used to supply food to the population, while forests are harvested for timber and fiber (Molnar et al., 2012). In a study conducted by the Laboratory of Ecological Economics of the Université du Québec and Outaouais, on behalf of the NCC, it was found that urban forests, rural forests, and wetlands all contribute to the provisioning of fresh water, providing a value of over \$1,200 per hectare per year, within the NCR. The same study also valued the contribution of ecosystem services to agricultural production at over \$1,000 per hectare, per year (Dupras, J., L'Ecuyer-Sauvageau, C., Auclair, J & He, J. 2016).

REGULATING SERVICES

Most of the services provided by watersheds are less visible than the consistent supply of quality drinking water; however, regulating services, systems that help to maintain regular ecosystem functions, are important and plentiful. Services include carbon storage and sequestration, filtration of water resources, erosion control, air quality control, flood and storm protection, pollination and seed dispersal and climate regulation. Natural systems, notably forests and wetlands, act like a sponge, providing water regulation services that are costly and challenging to replicate using manmade infrastructure.

Wetlands are especially good at regulating water supplies, storing water when there are excess amounts, and providing valuable reserves during dry periods (Molnar et al., 2012). In the Rideau watershed, a sub-watershed within the Ottawa River watershed, the RVCA estimates that flood damage would be 10% higher without wetlands (RVCA, 2015). Wetlands are also key systems for filtering waste produced by humans. Physical, chemical and biological functions in wetland areas are especially efficient at removing phosphorus and nitrogen, thus providing free waste filtration, a service that is typically costly in urban settings. It is estimated that wetlands are capable of filtering 60% of metals, and 90% of sediment out of fresh water, while forest cover is correlated to lower water treatment costs. A study focused on the contribution of watershed ecosystem services in the Toronto area, found that if forests and wetlands declined from 30% to 10%, water treatment costs would rise from \$0.60 per cubic meter to \$0.94 per cubic meter (Molnar et al., 2012). A separate study on ecosystem services in Ontario's Credit River watershed found that the services wetlands provide, including flood reduction, water storage, waste treatment and carbon sequestration are valued at \$247 per person, annually, the highest value of any land cover type (Kennedy, 2009). Wetlands cover roughly 8% of the Québec portion of the watershed, while in the Ottawa region roughly 20% of land cover is represented by wetlands (MDDELCC, 2015; City of Ottawa, 2011).

Among other services, trees and forest ecosystems assist in ensuring a consistent quantity of water. A recent study found that forest restoration increased the amount of water being stored in soil, reduced flood intensity and frequency, and had a positive impact on water availability during the dry season (Filoso et al., 2017). A case study focused on Kenauk property within the Ottawa River watershed found that the 4,000 hectare forest stores half a million tons of carbon, and captures an additional 10,000 tons annually. The property also provides a vital wildlife corridor for mammals, habitat for threatened species, and water filtration for the nearby town of Montebello. Given these services, the forest was valued at \$20,000 per hectare annually (Becker et al., 2017). Dominated by eastern white pine, eastern hemlock, red oak, red pine, sugar maple and yellow birch, the Ottawa River watershed forests provide services such as carbon sequestration, wildlife habitat, and nutrient cycling. In 2009, a study commissioned by Ontario's MNRF estimated that rural forests provide services valued at \$4,442 per hectare, annually (Troy & Bagstad, 2009).

CULTURAL SERVICES

Cultural services include non-material benefits and services, such as spiritual enrichment, cognitive development, aesthetics, recreation and education. These services are often integral to an individual’s sense of identity, wellbeing, and motivation; people may treasure family trips to a lakeside cottage, canoe adventures with loved ones, or simply taking the time to sit in nature to reflect. However, the value of these experiences is often difficult to quantify or assign meaningful value.

In 2016, the NCC categorized aesthetics and recreational activities as cultural services, and found that within the Greenbelt and Gatineau Park, the aesthetics of crops, prairies and freshwater systems provided services valued at over \$400 thousand per year. Recreation was assigned a value of over \$3.7 million annually, as recreation services are provided by a variety of ecosystem types within the NCR (Dupras et al., 2016). A 2004 study considering tourist spending in Algonquin Provincial Park, within the watershed, found that visitors spent \$20 million annually within the park, contributing \$1.9 million to Ontario’s provincial GDP (Bowman & Eagles, 2004). A separate report, focused on the Credit River watershed (outside the watershed), found that recreational pursuits contribute \$6.9 million per year in value to the watershed, with \$1.2 million being attributed to recreational fisheries (Credit Valley Conservation, 2008; Kennedy, 2009). Notably, the Credit River watershed is an area of 94,885 ha and had a population of roughly 800,000 in 2006. The Ottawa River watershed, by comparison, is far larger at 14 million ha (140,000 km²), and has a population of around 2 million.

SUPPORTING ECOSYSTEM SERVICES

Supporting services are integral to processes described in the previous section. They include soil formation, photosynthesis, primary production and nutrient cycling. These services are less frequently studied and assigned economic value, however, all other services depend on them for regular functioning (see Figure 5.1-1) (MEA, 2005).

ECOSYSTEM SERVICES WITHIN THE OTTAWA RIVER WATERSHED		
Supporting Soil formation, nutrient cycling, photosynthesis, primary production, habitat		
Provisioning Drinking water, food sources, raw goods (timber and fiber), medicinal plants	Regulating Carbon storage and sequestration, flood and storm protection, erosion control, climate regulation, pollination	Cultural Recreation, tourism, aesthetics, education, spiritual enrichment

FIGURE 5.1-1. TYPES OF ECOSYSTEM SERVICES WITHIN THE OTTAWA RIVER WATERSHED

5.1.1.2. FRESH WATER AND THE ECONOMY

A healthy population and environment is needed to promote economic growth and development; accessible and clean fresh water are needed for both. Drinking water is vital to the livelihood and health of those in the watershed, and its price is kept low to ensure that the population can access the necessary resource and so that industries are not hindered by costs (Renzetti, 2009). As water utilities maintain low prices for services, and are subsidized, it does not directly contribute to GDP.

There are two main ways in which Canadians use water: through instream uses and withdrawal uses. Instream uses are those that allow water to remain in its natural setting, which aids in protecting wildlife habitat and ecosystems, as well as supports activities like transportation and fisheries. Hydroelectric power generation is also often considered an instream use; however, it impacts the quality and quantity of water through factors such as water flow, erosion and dilution. Withdrawal uses are those that remove water from its source for an amount of time, eventually returning all or some of it to its original source (e.g., household uses, industries, agriculture) (ECCC, 2013).

The Ottawa River watershed is dominated by service industries, with public administration, health care, social assistance, retail and education making up almost half of the workforce (Statistics Canada, 2017b). While often implied, water is required to support the health of the population, and thus the functioning of these sectors. The importance of a consistent and safe water supply can be illustrated through an example of when water quality was compromised. In 2000, Walkerton a small community southwest of Toronto, faced a water contamination crisis, in which the municipal water supply was contaminated with *E. coli*. Within the small community, six people died and over two thousand people suffered illness leading to severe disruption of the community and its wellbeing. Economic costs totalled \$64,527,194, and lost productivity costs were over \$1.2 million (Livernois, 2002). Overall, people rely on watersheds for a safe, accessible and affordable water supply to support health and productivity.

5.1.1.3. ECONOMIC SECTORS

Aside from the service sectors described previously, environmental health, water quality and water quantity are linked either directly or indirectly to all industry. Below, the economic contribution and significance of sectors is outlined. In section 5.2, the impacts of economic sectors have been examined further. For more information on specific sectors, please refer to Appendix G.

FORESTRY AND FOREST PRODUCTS MANUFACTURING

Today, the forestry sector is a key pillar of the Canadian economy. Canada's forests account for about 9% of forested land worldwide (Statistics Canada, 2018a). The Ottawa River watershed is dominated by forests, with approximately 85% of the watershed covered by deciduous or mixed forest cover. In the far north of the watershed, the forest is primarily boreal forest cover (DePratto & Kraus, 2017). Water and rivers are vital to the forestry industry as the resource is used in various levels of timber processing. Today, Canada is the world's fourth largest producer of pulp, paper and paperboard, and in 2016 accessible timber stocks were valued at \$215.4 billion, while the forestry and logging industry employed 205,660 people across Canada (Statistics Canada, 2018a). Of these jobs, 31% (approximately 63,755 jobs) were located in Québec and 21% (approximately 43,189 jobs) in Ontario.

In central and eastern Ontario, the local forestry industry generates \$573 million every year, while forestry industries in the central and eastern Ontario region employ over 6,000 people. In Québec, forestry and logging contributed \$337.6 million to the 2014 GDP, while pulp and paper mills contributed \$609.5 million in the same year (Statistics Canada, 2014). On the Québec side of the river, corporations such as Fortress Cellulose run plants in Hull, Masson-Angers and Thurso, with mills in the Outaouais region contributing to 12.7% of Québec's total pulp, paper and paperboard production, while the Abitibi-Témiscamingue and Nord-du-Québec regions contribute another 8.9% to the total production (ORHDC, 2005). Currently, nine pulp and paper mills are operating within the watershed (Ottawa Riverkeeper, 2018d). Natural resources, found throughout the watershed, are vital to this industry, and access to water is integral to producing paper, as it is used in almost all levels of processing, from cleaning to cooling, as well as for transport of both waste and completed products (Ottawa Riverkeeper, 2006). Pulp and paper processing is intensive; it uses the most water and creates the most effluent of any industry operating in the Outaouais region of the watershed (MDDELCC, 2015).

POWER GENERATION

Dam construction has dramatically transformed the Ottawa River, enabling hydroelectric power generation and flood control. In turn, this allowed for increased settlement along both the Ontario and Québec shores of the Ottawa River. Today, over 50 dams are dispersed throughout the watershed, 43 of which are used for hydro-electric power generation (ORRPB, 2011; ORHDC, 2005). These dams rely on large reservoirs that supply adequate flow for electricity production (see Table G-1, Appendix G). Ontario Power Generation and Hydro-Québec both operate several large dams within the Ottawa River watershed (see Table G-2, Appendix G). These dams produce electricity to the Canadian public and commercial industries, while supporting economic growth and reduce the risk of flood.

The dams developed for power production also provide various ancillary benefits to the Ottawa River. These include control of water flow, which in turn enhances opportunities for navigation, tourism, fisheries and the establishment of recreational properties on reservoirs. The economic and cultural benefits from these ancillary services are not currently quantified (ORRPB, 2017). Statistics Canada reported in 2008 that hydroelectricity represents 96.8% of Québec's electricity use; in Ontario, hydroelectricity represents 25% of the energy system (Statistics Canada, 2016). Hydro-Québec employs 19,786 people, while Ontario Power Generation employs over 10,000 people. Brookfield Renewable also operates hydroelectric dams in the region, specifically four hydroelectric stations along the La Lièvre River. Increasingly, energy markets are becoming more diversified; the watershed is home to solar projects and gas fired electricity (IESO, 2017). In Québec, the energy sector represented 3.88% of the provinces GDP in 2017, while in Ontario, energy made up 2% of the provinces GDP in 2017.

MINING AND RESOURCE EXTRACTION

The mining industry is dependent on water and natural resources for their activities, and uses water to flush out waste. As of 2012, the Québec side of the watershed had 16 active mining projects, eleven of these being in the Abitibi-Témiscamingue region (MERN Québec, 2017). Northwestern Ontario also has several active mines or mines in development. The Cobalt and Temiskaming region has the majority of mines, with 12 mines in operation and nine others in development, both within the boundary or near the boundary of the watershed (Ontario's Golden North, 2016). Of these mines, 17 extract, or plan to extract, gold (see Table G-3, Appendix G). Statistics Canada reports that roughly 6,800 people are employed in the mining, quarrying, and oil and gas extraction industry within the watershed (Statistics Canada, 2017d). There is no watershed specific data available on the mining, quarrying, and oil and gas extraction industry's contribution to GDP; however, in 2014, Statistics Canada reported that the sector contributed \$7.9 billion and \$4.5 billion to Ontario and Québec, respectively (Statistics Canada, 2014).

NUCLEAR ENERGY RESEARCH

The Chalk River Laboratories, located in Chalk River, are owned by Atomic Energy of Canada Limited (a federal Crown corporation) and operated by Canadian Nuclear Laboratories (CNL). The site has been used as nuclear laboratories for over 70 years and research activities conducted there have led to the development of the CANDU reactor technology and the production of medical isotopes, amongst many other scientific achievements. Today, activities at the site are focused on nuclear science and technology in support of the Government of Canada's priorities in the areas of health, safety, security, energy and emergency preparedness. Activities are underway to remediate areas of contamination at the site, including the decontamination and demolition of buildings, the remediation of contaminated lands, and the management of radioactive waste. CNL employs over 2,800 people at the site including many world-leading experts in a variety of scientific and technical disciplines. CNL is the second largest employer in the immediate area. The salaries of employees at Chalk River amount to approximately \$240 million annually, and in the past year, over 120 local contractors have been hired by CNL with contracts totalling over \$27 million.

RECREATION AND TOURISM

Recreation, cultural pursuits and tourism are significant within the watershed, both economically and for societal well-being. Thousands of tourists are drawn to both the wild and comparatively subdued rivers within the watershed for rafting and paddling opportunities. The Ottawa River contains a section of whitewater that is renowned as a world-class paddling and rafting destination (Ottawa Tourism, 2018). Other recreational activities, such as hiking, also draw in many tourists. A study conducted by the NCC in 2017 found that tourism in Gatineau park provided over 4,700 full time jobs, and brought direct expenditures of \$184 million during a one year period between 2015 and 2016 (Coulson, 2017). Additionally fishing for tourism and recreation is lucrative in the watershed. The total economic value for fishing on the Ottawa River, including expenditures and investments, was estimated at \$32.1 million in 2010 (ORHDC, 2005).

A number of provincial parks and wildlife reserves are located within the reaches of the watershed on both sides of the Ontario-Québec border. These parks include Algonquin Provincial Park, which was the first Canadian provincial park established to protect a natural environment. There is also a newly designated National Park, Opémican in Témiscamingue (Ballivy, 2018). Additionally, wilderness lodges, camps and retreats are found throughout the watershed. Winter time activities, such as sugar shacks and ski resorts also draw tourists to the region. For Canada 150 celebrations, tourism in the capital increased 8.8%, as over 11 million tourists visited the NCR. Total visitor spending in Ottawa was calculated at \$2.3 billion for 2017 (Ottawa Tourism, 2018).

AGRICULTURE

The agriculture industry is highly connected to the watershed, relying on freshwater resources for irrigation and food processing. Agriculture is the largest consumer of water in Canada, consuming 1,600 million cubic meters annually. Water used for irrigation and other purposes is absorbed into plants or transpired into the atmosphere (ECCC, 2016b). Both Ontario and Québec use little water compared to western provinces, with irrigation only occurring on 4% and 3% of each provinces farm land, respectively. In the Ottawa drainage basin, irrigation levels are the lowest in the country, with only 1,110 ha irrigated (Statistics Canada, 2010). Roughly 6,000 farms are estimated to be in the Ottawa River watershed region, with large areas of land used for agriculture purposes. For example, over 50% of land in the lower Mississippi, Castor, Ottawa East and Carp sub-watersheds have been allocated for agriculture use. Farm and crop types vary based on region; however, cattle ranching and livestock farming dominate farm types in the region, with large scale farming for vegetables, grains and other products far less common (Statistics Canada, 2016). Nutrient-rich silt and clay soils dominate the lower Ottawa River Valley, allowing for higher productivity where surface water drainage is adequate. In these areas, grain, food for cattle and alfalfa are often grown, and pastureland is common. In the northern and middle portions of the Ottawa River watershed, agriculture is limited, due to poor drainage (ORHDC, 2005).

PROPERTY VALUE

Property value and demographics are often influenced by the health of the Ottawa River watershed, and the proximity to scenic waterways and landscapes. Such properties can spur economic and population growth in smaller communities.

5.1.2. CULTURAL AND HERITAGE VALUES

As stated, watersheds are complex socio-economic systems, in which the environment, economy and society are deeply connected. Similar to the economic section above, society's value is largely extrinsic based on how humans benefit and interact with a given region. These values are important; they add another dimension, aside from economic value, that connects humans to the land they occupy. Social considerations shape the way individuals perceive the watershed, and influence the way they wish to conserve it. In the section below, the various ways that humans connect to the watershed will be described, through consideration of cultural and heritage values, as well as future considerations.



5.1.2.1. CULTURE

Culture accounts for social practices, customs and displays of human achievement and has a large influence on how societies or communities of individuals interact. Examples of culture include language, religions, music, sports, and arts. A defining attribute of culture is how people shape and are shaped by the environment, through use and interaction (Rapoport & El Sayegh, 2005). In preparation for the nomination of the Ottawa River as a Canadian Heritage River, the Ottawa River Heritage Designation Project documented the cultural heritage, natural heritage and recreational values extensively in their 2005 report (ORHDC, 2005). In order to avoid duplication with the 2005 ORHDC report, this sub-section includes an overview of the values, while section 5.3 provides an account of what respondents expressed as culturally significant through their input into the ORWS.

RECREATION

Recreation is highly regarded for its ability to help people build connection and concern for the natural environment. Those that participate in recreational activities, especially those that enjoy activities that involve appreciation of nature, often have stronger pro-environmental views (Jackson, 1986). It has also been found that recreation is connected to one's overall wellbeing and sense of fulfillment (Flanagan, 1978). Within the Ottawa River watershed, several recreational activities attract a variety of locals and visitors. These include water based sports, such as fishing, boating, paddling, swimming and kayaking, and other outdoor activities, such as camping, hiking and cycling. Winter activities, including skating, skiing, snowshoeing and ice fishing also connect locals to the watershed. Additionally, there are cultural recreational activities, such as Canada Day celebrations in the NCR, and recreational festivals such as Maniwaki's Upper Gatineau Whitewater Festival, the Jamboree de la Rivière Rouge in Grenville-sur-la Rouge and Petawawa's Hell or High Water paddle festival. Visiting museums within the watershed area is also popular (ORHDC, 2005). Many of these activities attract locals and visitors alike, contributing to the area's GDP (Ottawa Tourism, 2018).

ART

The Ottawa River has been the subject of poetry and photography, while Gatineau Park and Algonquin Park have often been the subject of paintings and various other mediums. The 3,000 year old Migizi Kiishkaabikaan (Oiseau Rock) is one of the first examples of artwork based on the Ottawa River. Balanced on a cliff alongside the Ottawa River, the rock features a pictograph that represents Algonquin's traditional understanding of the spiritual and physical landscape (ORHDC, 2005). In addition, various Algonquin stories and art were once inspired by the American eel (Algonquins of Ontario, 2014). The Group of Seven also painted extensively in the Ottawa River watershed throughout the 1920s (ORHDC, 2005).

SPIRITUALITY

The Ottawa River watershed holds a deep spiritual connection for Indigenous peoples, which is detailed in section 5.3.1. Indigenous peoples have long relied on the Ottawa River watershed which, in a spiritual and physical context, are "the veins of earth" and keep all life on earth alive. The importance of sacred sites, stories, and spiritual connection to species, such as the Lake Sturgeon and American eel, is often mentioned in research and historical accounts (Algonquins of Ontario, 2016; Morrison, 2005). As well, when tasked with developing a shared vision for the background study for nomination of the Ottawa River as a heritage river, members of the executive committee for the Ottawa River Heritage Designation Committee (ORHDC) indicated that the watershed was a spiritual entity, not a commodity (ORHDC, 2005). This process is described further in the heritage values section below.

5.1.2.2. HERITAGE VALUES

Indigenous peoples, including, but not limited to the participants of the ORWS, previously relied on the watershed for their livelihoods—including for sustenance, transportation, economic development and trade. Presently, due to colonialism, Indigenous use of watersheds has shifted and is primarily used for ceremonial purposes, recreation, sustenance and observing nature.

Spanning two distinct provinces, the watershed has a unique heritage. French and English are the languages most commonly spoken throughout the area. Additionally, many festivals, National and regional museums, interpretive centres, heritage trails and other activities celebrate the past and current culture of the region (ORHDC, 2005). The significance of the Ottawa River and other rivers in the watershed are increasingly being recognized. In 1998, the Mattawa River was granted heritage designation through the Canadian Heritage River System (CHRS), and in 2007, the Rideau Canal was granted UN Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site Status. In July 2016, the Ontario portion of the Ottawa River was also granted heritage designation through the CHRS, and the County of Renfrew was designated as the River Manager for this process. In August 2017, the Québec portion of the river received a similar designation of "Lieu Historique", when it was recognized as a historic site under Québec's *Cultural Heritage Act*. To support designation, the Ottawa River Heritage Designation Committee produced three documents that detail the region's history and heritage (ORHDC, 2005).

Heritage is displayed throughout the region, both in the visible sense, through Indigenous artifacts, old buildings and infrastructure, family heirlooms, and physical locations, and through less visible activities, such as practices and customs handed down through the generations. This often includes language, recipes, family traditions, stories, and songs (ORHDC, 2005).

5.1.3. NATURAL VALUES

The following section will consider the intrinsic value of nature independent of the value human assigns to it. Intrinsic value is defined as the value that an entity has in itself, for what it is. Often, intrinsic values assigned to the environment are based on complexity, beauty, diversity, wonder and wildness (Sandler, 2012).



5.1.3.1. BIODIVERSITY

Biodiversity refers to the variety of life forms in a given area. Typically, biodiversity measures the mix of genetics, species and ecosystems (UNEP, n.d).

While surface water covers only 2.3% of earth's surface, freshwater ecosystems are home to at least 9.5% of earth's wildlife species. These species are at risk; a recent WWF report found that freshwater species continue to decline at a faster rate than terrestrial or marine species, with freshwater species declining by 81%, relative to other index declines (WWF, 2016). A separate study by WWF observed that freshwater systems are the least well studied in Canada, with regards to biodiversity; the same report also stated that baseline data for Canadian freshwater ecosystems are too recent to clearly show the impacts of human activity (WWF, 2017c). Another recent study found that freshwater biodiversity is increasingly being threatened by a host of emerging issues, including climate change, invasive species, harmful algae blooms, microplastics, and expanding hydropower (Reid et al., 2018).

The Ottawa River watershed provides habitat to a variety of terrestrial and aquatic species, including dozens of species at risk. In a recent health assessment of the Ottawa River watershed, WWF-Canada reported that 85 fish species can be found in the Ottawa River, with the rare river herring and lake sturgeon found throughout the region at decreasing levels. In addition, the American eel are thought to be in decline, as habitat quality and fragmentation limits the range and abundance of the species (Richardson, 2018; Verreault, Dumont, & Mailhot, 2004). For more information on Species at Risk, refer to sections 4.1 and 4.2.

The watershed also provides important habitat and migration routes for roughly 300 bird species (ORHDC, 2005). Additionally, there are many mammals, amphibians and reptiles in the watershed, with mink, beaver, striped skunk, big brown bats, red foxes, woodchucks, eastern chipmunks, red squirrels, porcupines, white-tailed deer and raccoons frequently observed. Less commonly sighted, but abundant in specific areas, are wolves, lynx, moose, martens, black bears and wolverines (ORHDC, 2005).

5.2. CAUSES OF CHANGE

Given both ongoing local and global development, change is inevitable. Population growth and urbanization, development, and global scale issues have all led to changes within the watershed. While not all changes in the Ottawa River watershed are regarded as negative, changes alter pre-existing conditions in the region.

At times throughout history, economic development has been prioritized over environmental protection as many environmental issues were not yet well understood (Smith, 2009; Fraser Institute, 2008). Given this, historical development may have had larger environmental impacts than originally intended. Since European contact and the subsequent colonial settlement, there have been high levels of development in the Ottawa River watershed, which have been integral to the prosperity of the region. Notably, urban development (e.g., water utility infrastructure, roads, wastewater treatment, building construction), resource and related industry extraction (e.g., forestry, mining, cement processing), and electricity generation (e.g., hydroelectric power generation and nuclear research) were integral to the historical development and population growth of the region (see section 5.2). However, development caused some concerns; industrial growth in the form of mines, hydroelectric dams and nuclear developments, in particular, have affected the lands and waters upon which Indigenous peoples rely for food, drinking water, recreation, and transportation. Hydroelectric projects, for example, largely built between the 1880s and 1960s, caused the flooding of Indigenous villages and sacred sites. They also created physical barriers that prevented access to the Ottawa River watershed, and disrupted the ability of Indigenous communities to rely on the watershed for food and transportation (ORHDC, 2005).

Today, industrial and urban development are key drivers in environmental change (ECCC, 2017b). The region's growing population, coupled with the patterns in which people settle, alter the way that the land is used, increasing housing demands, and exerting pressures on municipal utilities, such as drinking water, and septic and sewer systems (Natural Resources Canada, 2013). Additionally, infrastructure built to support populations, such as hydroelectric dams and underground water and wastewater pipes, alter the supply and flow of water (Federation of Canadian Municipalities, 2016).

As stated, a suite of different industries contribute to the Ottawa River watershed's economic development, providing jobs to thousands, and stimulating and diversifying economic growth. Extractive industries, such as mining and forestry are regulated through legislation, such as the *Canadian Environmental Assessment Act, 2012*, and through agencies, such as the National Energy Board. Industries that process natural resources, such as pulp and paper and cement, impact the natural environment through production of effluent and GHG emissions. Agricultural run-off and municipal wastewater and sewage systems can further add to environmental change, through the introduction of effluents into waterways and ecosystems (Mateo-Sagasta et al., 2012). Management of past development also has implications. For example, CNL is proposing the decommissioning of the Nuclear Power Demonstration Waste Facility in Rolphton, ON, as well as a new waste storage site for Chalk River Laboratories (CNSC, 2018a; CNSC, 2018b). Decommissioning of other infrastructure, such as dams and mining sites, may also lead to unintended consequences, such as changes in hydrological flow regimes and water quality contamination (Bednarek, 2001).

It is recognized that humans have had a significant impact throughout the world, including in the Ottawa River watershed. Release of GHG emissions have been linked to changes in climatic conditions, with the Intergovernmental Panel on Climate Change (IPCC) projecting that current climatic patterns will continue to shift across the globe. Notably, the recent report projected that freshwater ecosystems will be among the most threatened systems on earth (IPCC, 2018). Canada's Annual Climate Trends and Variations Bulletin notes that temperatures have been increasing across Canada at twice the global rate, with the nation seeing an average temperature increase of 1.7 degrees Celsius (°C) since 1948. Precipitation patterns have changed in Canada over the past century, and projections indicate that climate change will cause more frequent heavy precipitation events and floods (Lemmen & Lacroix, 2014). This is likely to have impacts on the Ottawa River watershed, notably through flooding events and shifts in average temperatures.



Water quality varies throughout the watershed (see chapter 4), and is exposed to various pressures, including point source and non-point source pollution. Point source pollution (i.e., a single identifiable source of pollution), and non-source pollution (i.e., pollution resulting from many potential sources), stem from a variety of municipal practices, agriculture, natural processes, and industries (ECCC, 2017f). In 2011, because of several factors, including sewage overflows, beaches in Ottawa were closed for 24 days of the 57 day beach season (Goodwin et al., 2017; Herbert, 2016). Additionally, a recent study of water samples from the Ottawa River, found that all open water samples contained microplastics, most commonly as microfibers (Vermaire et al., 2017).

Pressures from population growth also lead to changes in species composition. The spread of invasive species is largely attributed to transportation and navigation, as new species can be introduced via ships, planes and other modes of transport (Fisheries and Oceans Canada, 2018). The migration of invasive species is also linked to climate change and ecosystem dynamics (Crowl et al., 2008). Additionally, extreme weather events allow some species to spread into previously uninhabited waterways, which was expected to be the cause of the spread of Asian carps (Koel et al., 2000). Once in a new ecosystem, many invasive species easily reproduce and thrive, due to the lack of natural predators, or the capabilities to out-compete naturally occurring species (Crowl, Crist, Parmenter, Belovsky & Lugo, 2008). Specifically, in southeast Ontario, the presence of zebra mussels, Asian carps, emerald ash borer and Eurasian milfoil have the potential to hinder the sport fishing industry, and access to lakes and other water bodies for recreational boating (FOCA, 2017). Human pressures also lead to encroachment on wildlife habitat and loss of various ecosystem types, especially wetlands and forests. In southern Ontario (not exclusively in the Ottawa River watershed), 68% of the original wetlands have been converted from their natural state to support alternative uses, such as agriculture and housing. Wetlands are critical to reducing impacts of climate change, purifying water and providing habitat for wildlife (ECCC, 2016). When key ecosystems are degraded, or removed entirely to make space for development, habitats become fragmented (Haddad et al., 2015). This happens both on land, and in water bodies.

Notably, WWF-Canada stated that the Ottawa River is one of the ten most threatened rivers in Canada; within their Watershed Reports, it states that “the Ottawa River is one of the most regulated river systems in Canada. Its natural flow regimes have been dramatically altered, compromising habitat and the diversity and distribution of the river’s fish and shoreline vegetation” (WWF-Canada, 2015; 2017a). Flow of water, both in unmanaged rivers and rivers with dams, are increasingly being altered by climate change, at relatively equal amounts (Ficklin, Abatzoglou, Robeson, Null & Knouft, 2018). The flow of the Ottawa River and its tributaries largely impacts biodiversity, hydroelectric generation potential, shoreline integrity and other ecological processes. Removal of vegetation along shorelines increases rates of erosion and sedimentation, which then impacts species composition and flow of the river (Poff et al., 1997).

Overall, changes within and outside the watershed have varying levels of impacts, which in turn impact economic, social and natural values within the watershed. For more information on the ecological health of the watershed, refer to chapter 4.

5.3. WHAT WE HEARD: VALUES AND THREATS

5.3.1. WHAT WE HEARD: VALUES

Aside from the report produced by the ORHDC in 2005, there is limited literature focused on what people feel is significant about the Ottawa River watershed. Through self-directed consultation with six Indigenous communities and organizations and through public and stakeholder engagement, several themes related to values were identified. Several questions posed during the ORWS engagement process were used to gain feedback on the population's experiences, values and understanding of the Ottawa River watershed. Questions included:

- Tell us how, when and where you use the Ottawa River watershed. What do you value most about it?
- Do you have any specific concerns about this watershed? Is there anything in particular that you think we should consider, or be aware of in the context of this study?
- Is your organization aware of any significant economic, cultural, heritage and natural values that are central to overall ecosystem health and the wellbeing of communities in the region? For example these may include facts and trends on species diversity, species at risk, or local tourism among others.

Responses were diverse; given this, values were organized into general themes, and not categorized as economic, cultural, heritage or natural values. Themes include: human and ecological health, fishing and aquatic diversity, clean water, sustenance, biodiversity, traditions and sacred sites, physical structures and other examples of human heritage, spirituality, settlement and economic development of the watershed, travel and transportation, recreational opportunities, access, aesthetics, economic prosperity, and future generations.

HUMAN AND ECOLOGICAL HEALTH: A few respondents and various municipal bodies recognized the watershed for its contributions to human health. Notably, quality of drinking water, and access to fresh water for drinking and agriculture were mentioned many times. Additionally, many expressed the importance of services that the watershed provides, including the value of forests for providing clean air and other regulating services, as well as the flow of the river for carrying away potentially dangerous wastes, both of which were shared as contributing to overall health of the public (Public and Stakeholder consultations, 2018).

FISHING AND AQUATIC DIVERSITY: Multiple groups shared that they valued a diversity of consumable fish, such as sturgeon, rainbow trout, pickerel, whitefish, and speckled trout. A member of the Algonquin Nation Secretariat stated that they valued the subsistence that the watershed provides to their family. The Mohawk community of Kanesatake largely valued “fishing for consumption of the fish” and ice fishing, notably because the water quality is “best in the winter season and the fish caught harbored less parasites.” Throughout public engagement, many respondents expressed enjoying fishing in various parts of the watershed (Public and Stakeholder consultations, 2018; PlaceSpeak consultations, 2018). The Métis Nation of Ontario valued the diversity of fish in the region, as well as the economic contributions of a “commercial caviar fishing [that] took place at La Page during the 1970s.” Additionally, Lake Sturgeon was identified by multiple Indigenous communities and stakeholders as being valuable to ones connection to nature, and the broader environment; Algonquins of Ontario stated that the fish species was an important food source, while other parts of the fish were used as a source of paint and carrying pouches (Richardson, 2018). Overall, all Indigenous organizations and other respondents appreciated fishing and aquatic diversity for sustenance, traditional practices and recreation.



Photo credit: Kitchisibi Ikidowin Anishinabe, 2018.

CLEAN WATER: Many ORWS respondents identified the importance of clean water, for both human and ecological health. Drinking water from surface and ground sources were identified as one of the most common services that healthy watersheds provide (Public and Stakeholder consultations, 2018). A respondent from the Algonquin Nation Secretariat said “I’m happy that we have water. Water is life”, while another community member from the same organization shared that everything grows from water, and that “we grow from it”. The ability to drink from, and swim in a watershed that is free of contaminants was desired by many Indigenous organizations and communities. Notably respondents from the Métis Nation of Ontario expressed their enjoyment of swimming in the river. Indigenous youth engaged by the Algonquin Nation Secretariat stressed that having access to clean waterways is important for the purpose of strengthening or reinvigorating their ancestral way of life, and ensuring the intergenerational transfer of culture (Kitchisibi Ikidowin Anishinabe, 2018).

SUSTENANCE: Several Indigenous organizations shared their appreciation of sourcing food through hunting and harvesting within the Ottawa River watershed. Respondents from the Métis Nation of Ontario expressed that they enjoyed harvesting blueberries, wild leeks and mushrooms, as well as hunting mammals within the watershed. Community members from the Algonquin Nation Secretariat shared valuing the subsistence the watershed provides, notably through fishing, which was described above, and hunting. Algonquins of Ontario stated that they have relied on the watershed for food and drinking water, and that harvesting in certain areas is valued by many. Additionally, the Mohawk community of Kanesatake expressed that they value the Ottawa River for hunting, fishing and harvesting, and linked the watershed’s health to food security within the community (Bisson & Mohawk community of Kanesatake, 2018).

BIODIVERSITY: All Indigenous organizations recognized plant species, wildlife, and/or biodiversity as valuable. Many public respondents valued biodiversity and the services that a healthy environment provides. A few respondents noted that wetlands were vital to flood protection and water purification. Input shared with the ORWS also expressed the value of species at risk and other species, such as the Blanding’s turtle and the American eel. One respondent valued the experience of viewing red phalarope, harlequin duck, Barrow’s goldeneye and ravens in nature, while another told of the return of bald eagles in the watershed. Another individual stated “we are landowners on the riverfront and are very fond of the natural beauty of the Ottawa River, the migrating birds and numerous species of birds” (PlaceSpeak consultations, 2018). PlaceSpeak respondents expressed that it is important that these species within the watershed are recognized and protected (PlaceSpeak consultations, 2018). During the public engagement process, many shared the importance of biodiversity, and their interest and enjoyment in documenting levels of biodiversity through bioblitz activities, online platforms, such as iNaturalist, and regional level biological databases that act as libraries for scientific information.

TRADITIONS AND SACRED SITES: Memories, stories and sacred sites that have been passed down or used by multiple generations are appreciated by Indigenous organizations and individual respondents throughout the watershed. Respondents from the Algonquin Nation Secretariat conveyed that good memories came from stories about the watershed told by elders and parents. Other groups value the capability to congregate at sacred sites located across the Ottawa River watershed. A respondent reiterated that water is a sacred element, and that honouring the sacred is an important cultural value of the Anishinaabeg (Gehl, 2018). The respondent then explained how beliefs have a significant influence in shaping one’s behaviour, which can ultimately impact society globally. It was stated in the ORWS feedback that “human beings need to value that what is sacred is more than living in close view of a river, it is more than having fun swimming in a river, and it is more than having fun boating on a river. By trivializing and denying the cultural value of honouring the sacred, human beings are destroying and polluting the river” (Gehl, 2018).

Other respondents shared stories of growing up or visiting the watershed decades ago. Some indicated that based on their own upbringing and family connection to the area, the watershed was an ideal location to raise a family. One person expressed fondness of such memories, by stating “when I was growing up, although we lived elsewhere, the Ottawa Valley was a magic place in our family—my parents came from the Pontiac in western Québec and told us many tales of doings around the river.” Others touched on experiences they had enjoyed in the past, such as camping, fishing and ice fishing (PlaceSpeak consultations, 2018).

PHYSICAL STRUCTURES AND OTHER EXAMPLES OF HUMAN HERITAGE: Today, numerous historic buildings and structures are still accessible throughout the watershed, allowing residents and visitors alike to view and celebrate the history of the region. Dating back to pre-colonial times, various structures and sites created by Indigenous peoples can still be recognized. Algonquins of Ontario shared that burial sites, historic trails and routes, petroglyphs, processing sites, pictographs and other carvings and images are found throughout the region. Specifically, these include, but are not limited to: pictographs in Algonquin Park, rock carvings within the Teaching Rocks of the Peterborough Petroglyphs, and the Serpent Mounds [Burials] on Rice Lake (Richardson, 2018; Algonquins of Ontario, 2014). Notable structures from post-colonial periods include Rideau Hall, the Abbey Ruins at Mackenzie King Estate, the Log Farm in the Greenbelt, the House of Parliament, Maplelawn and surrounding gardens, the Central Chambers National Historic Site, and multiple residences throughout Ottawa and Gatineau (NCC, n.d.-a).

Also notable, are the historic artifacts that are believed to be submerged throughout the watershed. Heritage researchers, such as academics and those at the Research Institute in Maritime History and Underwater Archeology, note that, given the region's rich history, it is likely that heritage wrecks, remains of dams, mills and bridges, and traces of historic dwellings are covered by water throughout the watershed area, and especially prominent in reservoirs. A few ORWS respondents expressed gratitude and interest in these historic structures (Public and Stakeholder consultations, 2018).

SPIRITUALITY: The Ottawa River watershed is of unique spiritual value to the Algonquins of Ontario, the Algonquin Anishinabeg Nation Tribal Council, the Algonquin Nation Secretariat, the Mohawk Council of Kahnawà:ke, the Mohawk community of Kanesatake, the Métis Nation of Ontario, as well as non-status communities, stakeholder groups and members of the public. The Algonquin Anishinabeg Nation Tribal Council shared through their input that there is a tendency to place too much focus on technical and political elements of water, while spiritual considerations are often ignored. Specifically they commented that “there has always been a spiritual connection with NIBi (water).” They went on to state that water is “the lifeblood for all living things on the planet. The lakes and rivers were used by ancestors and therefore there is a spiritual connection to the water” (Algonquin Anishinabeg Nation Tribal Council, 2018).

As explained by the Algonquin Nation Secretariat, Algonquin creation stories support the assertion that their time on this land reaches far into the past. The story of the giant beaver, for example, involves a species believed to have lived in North America during the Pleistocene epoch over 11,000 years ago (Kitchisibi Ikidowin Anishinabe, 2018). Another story of importance to Algonquin peoples, raised by the Algonquins of Ontario, is the Seven Fires prophecy, which concerns eight prophets who appeared to Algonquin peoples, on seven occasions, before crucial periods in their history. The prophet of the Sixth Fire, for example, warned that colonialism would reduce the Algonquin nation to the lowest point in their history, while the prophet of the Seventh Fire spoke of an opportunity for Algonquin peoples and Rainbow People—all other people who share the land—to determine if the environment, and people who depend on it, will survive or perish (Richardson, 2018). The Algonquin Nation Secretariat stressed that such stories, or dibaajimowinan, are “not simply 'folk tales' or for entertainment purposes, nor are they to be dismissed as knowledge that is primitive or irrelevant to the modern day”, instead the organization emphasized that these stories should be treated as living records from which to “draw life teachings and reverence” (Kitchisibi Ikidowin Anishinabe, 2018).

Additionally, the Algonquins of Ontario shared the importance of wildlife in traditional practices and celebrations. They stated “these age-old communal Algonquin sites are adjacent to traditional lake sturgeon spawning grounds, some of which lake sturgeon still use to this day. The presence and annual abundance of lake sturgeon at their spawning grounds was a celebrated ritual event for the Algonquins.” Anishinàbè peoples (of which the Algonquins are one of) are known to have held large festivals at lake sturgeon spawning grounds. These gatherings involved ceremonies, dances, and feasts all fed by sturgeon (Richardson, 2018).

Through public engagement for the ORWS, several stakeholders highlighted their spiritual connection to the watershed, with one respondent sharing that they appreciate the Ottawa River for “spiritual and intellectual stimulation”, while others enjoyed the tranquility and soothing peacefulness brought by pristine areas. Others appreciated connecting with untamed sections of the watershed, particularly in regions without hydroelectric dams and development (PlaceSpeak consultations, 2018).

SETTLEMENT AND ECONOMIC DEVELOPMENT OF THE WATERSHED: Recognition of the history of the Ottawa River watershed and surrounding landscapes was important to many respondents of the ORWS. Several celebrated the importance of the watershed for its role in pre-history and post-European contact history, including settlement of the Ottawa Valley, and the eventual designation of Ottawa as Canada's capital. Sentiments were articulated through statements such as "the (Ottawa) river and everything connected to it...is a reminder of the past and the critical lifeline that the river system played in the creation of the National Capital Region." More specifically, some expressed their views on the importance of initial economic growth and development of the region. The fur trade, forestry, farming, and hydroelectric generation were all mentioned as an integral part of the areas heritage (Public and Stakeholder consultations, 2018).



TRAVEL AND TRANSPORTATION: The ability to travel freely (prior to construction of dams) along the many waterways that make up the watershed was appreciated by many groups. As noted in section 1.2.3 of this report, prior to, and following the arrival of Europeans, the Ottawa River was an important component of travel and trade networks, linking the St. Lawrence River, the Hudson Bay, the Ungava Bay, as well as the Great Lakes. As stated by the Algonquin Nation Secretariat, the birchbark canoe, or wigwas ciman, illustrates the important role historically played by Algonquin communities in travel and trade, as it was perfected by Algonquin communities, and traded with others, in order to allow for travel across the Ottawa River watershed's powerful currents (Kitchisibi Iikidowin Anishinabe, 2018). Similarly, the Mohawks of Kahnawà:ke also stressed the importance of the Ottawa River watershed as a trade and travel route for Mohawk Nation (Mohawk Council of Kahnawà:ke, 2018), while the Mohawk community of Kanesatake expressed their use of the watershed for travel.

RECREATIONAL OPPORTUNITIES: The Ottawa River watershed provides recreational value to the Algonquins of Ontario, the Algonquin Anishinabeg Nation Tribal Council, the Algonquin Nation Secretariat, the Mohawk Council of Kahnawà:ke, Mohawk community of Kanesatake, Métis Nation of Ontario, and non-status communities. For example, members of the Métis Nation of Ontario stated that they enjoyed whitewater rafting, camping and canoeing, while members of Algonquin Nation Secretariat shared memories of camping and portaging. Through consultation of the Mohawk community of Kanesatake, 19% of members engaged on the ORWS said that they valued the watershed for opportunities to observe nature, while 8% of the community valued recreational opportunities, such as camping.

Recreational pursuits were the most commonly mentioned value throughout the public engagement process. During open door meetings, individuals spoke passionately about activities such as fishing in remote tributaries throughout the watershed, paddling wild rivers and surfing standing waves on the Ottawa River (Public and Stakeholder consultations, 2018). In dozens of comments through online feedback, respondents expressed a passion for activities, such as photography, painting, swimming, cycling, hiking, paddling, fishing, sailing and camping, among many others (PlaceSpeak consultations, 2018).

Many also appreciated recreation in winter months, such as ice fishing, skating, snowshoeing, and cross country skiing. One respondent shared that they enjoy swimming and paddling, and stated that “the more time I spend in nature, the better I feel and the more productive I am in life and in work” (PlaceSpeak consultations, 2018). Others enjoyed participating in activities that connected them with others; a few respondents stated they enjoyed kayaking and camping with friends and family or taking lessons for activities such as sailing or paddling (PlaceSpeak consultations, 2018). Another respondent stated “the more that (people) interact with it (Ottawa River watershed) the more they will love it and champion its safety” (PlaceSpeak consultations, 2018).

A CLOSER LOOK: WHITewater RECREATION

The Ottawa River watershed features the mighty Ottawa River, which from its headwaters declines 370 meters until its confluence. Given the change in height, the velocity of the river is fast paced and strong. Adding to the power and volume of the river are both major and minor tributaries, such as the Madawaska, Petawawa, Dumoine, Coulonge, Black, Gatineau, Lievre, Bonnechere, Rideau and South Nation. Paddlers are often drawn to the watershed for adventure, as well as to connect with nature, experience spiritual fulfillment and retrace historical voyages (ORHDC, 2005). While paddling and other types of recreation occur on all of these rivers, two are renowned for their whitewater paddling opportunities and were often mentioned in stakeholder engagement: the Dumoine and the Pettawawa. The Dumoine River is celebrated for its whitewater paddling. From Lac Dumoine to the Ottawa River, the river travels through thirty nine waterfalls and rapids, seven of which have mandatory portages. Beginning in Algonquin Park, the Pettawawa flows first by white pines and granite cliffs, before continuing through the town of Pettawawa and eventually into the Ottawa River. The 187 kilometer long river is favored by numerous paddlers, including former Prime Minister, Pierre Trudeau, due to its accessibility and natural beauty. Given this, the River is a major draw for both local and international paddlers (MacGregor, 2017).



ACCESS: Connected to recreational pursuits is the ease of access to the watershed. Many respondents appreciated the fact that the ability to access nature and shorelines had not been limited by private ownership and development. In contrast, many shared that public access had been limited in some situations and feared that private owners would begin profiting from the watershed (PlaceSpeak consultations, 2018). Many went on to state that public access to shorelines is essential, especially if recreation is to be maintained. Additionally, some industries and municipalities recognized the importance of access to nature, notably water bodies, and built accessible and safe boat launches (Public and Stakeholder consultations, 2018). In somewhat of a contrast, excerpts from Roy MacGregor’s book, *Original Highways: Travelling the Great Rivers of Canada* (2017), celebrated the inaccessibility of certain areas, such as the undeveloped Dumoine River.

AESTHETICS: The region’s aesthetics and complex ecosystems were mentioned numerous times by respondents during engagement. Much of the Ottawa River watershed is valued for its natural beauty and contrasting seasons – snow-capped rolling hills, wild rivers, deciduous forests in the summer and fall, and the calmness of lakes and other water bodies. Many expressed similar views of enjoying the natural beauty throughout the watershed, with one respondent noting that they “enjoy its beauty, size, cleanliness, and its many moods”. Many celebrated the value of nature for personal enjoyment, and expressed that viewing, listening to and experiencing nature brought about personal fulfillment and connection to natural spaces. One respondent summed up the sentiment of many when stating “life is more enjoyable with these bodies of water close by.” Another respondent touched on the dynamic nature of the river by stating “the Ottawa River is a long, majestic, varied body of fresh water. Each twist and turn provides a different vista and experience; it is like multiple river personalities in one”. In contrast, others felt that pristine areas of the watershed no longer exist, and that it is important that users be made aware of these less pristine areas, in order to bring about eventual change (PlaceSpeak consultations, 2018; Public and Stakeholder consultations, 2018).

ECONOMIC PROSPERITY: Throughout public engagement, respondents indicated that economic growth and industries were important to their quality of life, due to jobs, economic stimulation and identity of the region. Additionally, numerous respondents shared that ensuring healthy ecosystems, clean water and preserving the integrity of natural spaces within the Ottawa River watershed were vital for its economic prosperity, as industries and individuals rely upon its natural resources. A handful of industries within the Ottawa River watershed, both in the services and goods realm, expressed in their input the importance of water and the watershed to their processes and/or staff. Others identified the value of specific sectors with several respondents noting the importance of rivers in the watershed for power generation, and others linking the strength of the tourism industry to the plentiful rivers and aesthetic quality of the environment.

Businesses rely on the natural environment within the Ottawa River watershed, with one wilderness resort owner stating “my livelihood and that of my employees depend on the pristine nature of the watershed” (PlaceSpeak consultations, 2018). Others shared that clientele are often drawn to secluded wilderness lodges for their remoteness, pristine nature and wildlife. In addition to nature focused pursuits, ORWS respondents indicated that the tourism activities in the City of Ottawa, such as museums, historical sites, and festivals throughout the region, draw in millions of visitors annually (PlaceSpeak consultations, 2018).

FUTURE CONSIDERATIONS: Through the ORWS, ensuring that the watershed is protected for the future was a value commonly stated (PlaceSpeak consultations, 2018; Public and Stakeholder consultations, 2018). Respondents expressed gratitude and appreciation for the experiences they and their families have had in the watershed, and a desire to see similar experiences continued into the future. Others shared their appreciation for access to outdoor classrooms, such as the St-Laurent Academy’s living classroom in Macoun Marsh, and the Carp River Living Classroom in west Ottawa that is under development (PlaceSpeak consultations, 2018). All Indigenous organizations expressed a desire to see land conserved for future generations. Specifically, the Mohawk community of Kanesatake gathered and compared the views of Mohawk elders and Mohawk children, and observed that the community’s relationship to the Ottawa River changed significantly within the past two to three generations.

A CLOSER LOOK: YOUTH

Youth have a large stake in environmental management, and often have fresh perspectives on how natural areas should be managed. During three sessions led by ECCC with middle and high schools, students were taught about the concept of a watershed, and how the health of the watershed is linked to various services used by students, such as drinking water, recreational pursuits, biodiversity and habitat. Although these sessions were limited, and not necessarily reflective of all youth opinion, sessions were valuable in providing a snapshot of what aspects of the watershed youth found important.

Interconnections within the watershed: Students expressed interest, concern and value for how water connects to almost all aspects of a watershed, and to daily life.

Continued access: Access to natural areas was important to students, as it allowed them to easily go out and connect with the outdoors.

Recreation: Students valued outdoor experiences that better connected them to nature.

Wildlife: Wolves, bears, eagles, fish and other wildlife were of large interest to students, with many expressing a motivation to conserve the environment based on the desire to better protect various species.

Governance: Students had varying perspectives on which stakeholders and how many should collaborate to ensure the watershed was better conserved. Indigenous peoples, scientists, academics and environmental groups were recommended as being important to the collaboration process. Industry, media, teachers and government were also advocated for.

5.3.2. WHAT WE HEARD: THREATS TO VALUES

Indigenous, public and stakeholder feedback was analyzed to generate a list of risks that may currently threaten the values described in section 5.1 and 5.3. Below, various drivers of change and specific threats are grouped into themes and described. Specific concerns related to the health of the watershed were discussed in chapter 4.

Examples of engagement questions used to determine what stakeholders consider to be threats include:

- Is your organization aware of any significant economic, cultural, heritage and natural values that are central to overall ecosystem health and the wellbeing of communities in the region? Can you describe some of the past, present and potential future threats to those values?
- Do you have any specific concerns about this watershed? Is there anything in particular that you think we should consider, or be aware of in the context of this Study?

Respondents typically answered questions in one of two ways: some identified what activities they viewed as causing issues in the watershed (e.g., climate change, resource extraction, increasing development), while others identified outcomes of these changes, such as water pollution, reduced access to the watershed, and invasive species, which are further detailed in section 4.4. Threats identified by respondents often applied to multiple values. For example, decline in water quality may have negative impacts on recreational opportunities, health of the population, ecosystem processes, and the agricultural industry. Given these interconnections, the threats identified by respondents have been grouped into either drivers or issues. Of note, the drivers and issues identified do not represent a comprehensive or scientifically supported list of threats; instead they summarize the input received through the ORWS engagement process.

5.3.2.1. CAUSES OF CHANGE

Many Indigenous communities and organizations, individuals and stakeholder groups expressed their views regarding causes of change in the Ottawa River watershed, with many expanding on why they felt drivers of change were of concern.

CLIMATE CHANGE: Throughout the engagement process, many stakeholders expressed that climate change is a significant concern, noting that it has, and will continue to have an impact on all aspects of the environment. Many identified specific issues that result from climate change, such as flooding and ecosystem loss, as a threat to what is valued within in the watershed region (Public and Stakeholder consultations, 2018; PlaceSpeak consultations, 2018). In contrast, a few stakeholder groups identified the potential regional opportunities that climate change may present, such as longer summers, allowing for increased recreation.

HISTORICAL DEVELOPMENT: Throughout the ORWS, many respondents shared their concerns about aging infrastructure, nuclear-related research, and the decommissioning of past development and nuclear waste facilities. One of the most commonly mentioned concerns was nuclear waste disposal. Many respondents were extremely concerned about the impacts that storing waste from decommissioned nuclear facilities may cause to the watershed. Currently, CNL is proposing significant work at two of its facilities: the disposal of waste from Chalk River Laboratories and the decommissioning of the Nuclear Power Demonstration Waste Facility in Rolphton, ON (CNSC, 2018a; CNSC, 2018b). Concerns raised during the ORWS engagement process were largely due to general uncertainty regarding the risks associated with nuclear waste storage, proximity of proposed waste storage sites to water courses, and what some people believed were flawed public engagement and subsequent approvals processes (PlaceSpeak consultations, 2018).



Through the ORWS engagement process, one respondent stated that “old municipal wastewater infrastructure requir(es) updating”, while others added that leaks or breaches in wastewater infrastructure concerned them (Public and Stakeholder consultations, 2018; PlaceSpeak consultations, 2018). Furthermore, Indigenous organizations highlighted previous lack of Indigenous consultation, with a member of the Algonquin Nation Secretariat sharing that they felt there was no consultation for projects such as “dams cutting travel routes for fishing.” The Algonquins of Ontario identified industrial development in the watershed as a cause of reduced water quality, biodiversity loss, changes in water levels, and an overall decline in the health of the aquatic ecosystem (Richardson, 2018).

INDUSTRIAL DEVELOPMENT AND GROWTH: Although the economic contribution of industries was shared by multiple respondents, others expressed concern with a variety of projects, especially those that involved resource extraction, discharge of effluents and pollutants, and the release of emissions into the atmosphere. Elders from - Mitchikinibikok - Algonquins of Barriere Lake expressed that commercial forest operations continue to have significant negative impact on the watershed. For example, drainage from forestry activities continue to affect fish spawning habitat and health of adult fish (Kitchisibi Ikidowin Anishinabe, 2018). One respondent expressed their concern with a new proposed rare earth mine, and it’s potential to contaminate water, stating “we greatly depend on the waterway for our traditional way of life.” Another individual viewed mines as a threat to the region’s cultural and economic security, noting the various tourism outfitters in their respective region, and stated that “mining in the area would negatively impact the environment and current use of the lake and local economy.” Pollution, land use changes and erosion were also shared as potential negative impacts resulting from industrial practices (Public and Stakeholder consultations, 2018; PlaceSpeak consultations, 2018).

URBANIZATION AND LAND USE CHANGE: Throughout the ORWS engagement process, many shared concerns regarding the impacts that increased urbanization and subsequent development could have on the watershed. Some were concerned with the impacts that upstream development could have on downstream users. Many others were worried about how regulation and private land ownership may reduce or limit access of the watershed for recreational opportunities. Additionally, others were concerned with potential issues caused by landowners developing their land in an unsustainable way (Public and Stakeholder consultations, 2018).

5.3.2.2. SPECIFIC THREATS

While some respondents to the ORWS expressed their views regarding the main drivers or causes of issues within the Ottawa River watershed, the majority identified specific conditions or problems that impact values associated with the watershed.

WATER QUALITY: There is a perception amongst some stakeholders and the public that water quality has declined in the Ottawa River watershed. Decline in water quality is linked to almost all watershed values. Feedback received highlighted the fact that water quality degradation could potentially impact several aspects of the watershed, notably, the quality of life of citizens, economic losses to businesses and industry, and the maintenance of ecological processes (Public and Stakeholder consultations, 2018; PlaceSpeak consultations, 2018). Of note, point source and non-point source pollutants coming from nuclear waste disposal, raw sewage outflows, and emerging contaminants, such as microplastics, were all viewed as potential threats to water quality throughout the Ottawa River watershed.

While all Indigenous organizations and communities consulted expressed their value of clean water, many indicated that diminishing water quality was of concern, with one group noting that the younger generations have resigned themselves to a “dirty” river while their grandparents used to swim and fish in the Ottawa River (Bisson & Mohawk community of Kanesatake, 2018). Other Indigenous organizations had concerns regarding mercury, acid levels and high volumes of pollen within water bodies. The Mohawk community of Kanesatake stated that swimming was enjoyed as a “past activity,” as water quality has declined; 27% of the community members interviewed felt that water quality was the biggest concern. Specifically, two elders mentioned they “would never take their grandchildren to swim in the river despite the fact that it was something they enjoyed as children themselves”, while others expressed sadness at having lost the accessibility of the river to swim.

NUCLEAR WASTE: Many respondents expressed concern about how long term, *in-situ*, nuclear waste storage in close proximity to the Ottawa River and decommissioning of research laboratories may impact water quality (previously described in this chapter). One respondent expressed concerns about nuclear power generators potentially changing the temperature of the river by using water to cool the nuclear reactors (Gehl, 2018). Other respondents were concerned with how radioactive particles may cause negative ripple effects further downstream. Another shared their view that nuclear substances are less of a risk, especially when compared to the risks of other substances, such as those that “arise from non-point source releases, such as agricultural inputs and point sources from sewage and pulp mill releases” (Public and Stakeholder consultations, 2018; PlaceSpeak consultations, 2018).

RAW SEWAGE: Many respondents expressed their concern with the release of raw sewage into the Ottawa River, notably the lack of awareness about timing of raw sewage releases, as well as concern related to how flooding events impact ability to treat and manage raw sewage. One Indigenous community shared that “all life forms are in danger because of the unchecked pollutants flowing into the river from upstream, such as the sewage overflows from the city of Ottawa” (Bisson & Mohawk community of Kanesatake).

MICRO-PLASTICS: Microplastics, largely driven by individual consumption habits and municipal waste management processes, were also identified as an issue that can severely degrade water quality. Respondents stated that they rely on a certain level of water quality for drinking (both in the watershed and downstream), recreational pursuits, irrigation, and several other activities. Others indicated that fish and other wildlife species require high water quality for their continued survival (Public and Stakeholder consultations, 2018; PlaceSpeak consultations, 2018).

CHANGE IN HYDROLOGY AND FLOW: Flow regimes account for the amount of water flow at a given time, how quickly flow changes, and the regularity of consistent flows, among various other factors. Throughout the ORWS engagement process, many groups and individuals shared their stories of the impacts of the May 2017 floods throughout the watershed, which had significant economic repercussions, posed health and safety risks, and caused ecological damage (Public and Stakeholder consultations, 2018; PlaceSpeak consultations, 2018). Other groups noted the prevalence of annual floods that damaged or altered landscapes each year. One respondent shared that the issues associated with climate change will “fundamentally alter the hydrologic

characteristics under which local economic interests and natural heritage systems have developed, resulting in significant stress and disruption to these systems” (Public and Stakeholder consultations, 2018). Several others were concerned by the barriers that limited the wildness or accessibility of rivers. The Métis Nation of Ontario pointed out that access to fishing areas was often reduced due to water fluctuations caused by up-stream dams; they also expressed concern regarding the impacts water fluctuations had on fish habitat (Odonaterra Community Environmental Strategies, 2018). Stakeholders expressed concerns that several dams and structures crossing the Ottawa River and its tributaries reduced the beauty and value of culturally important sites, such as Chaudière Falls (Public and Stakeholder consultations, 2018; PlaceSpeak consultations, 2018).

REDUCED ABUNDANCE OF WILDLIFE AND LOSS OF BIODIVERSITY: Many respondents expressed concern regarding declining levels of biodiversity and reduced abundance of important species throughout the watershed. The Métis Nation of Ontario pointed to rising water temperatures as a cause of fish species decline. They also shared various concerns regarding the “significant decline in the quantity and size of fish over the years”. Some stated that they “used to see sturgeon in the past that were 40-50 pounds larger than they are today.” The Algonquin Anishinabeg Nation Tribal Council expressed their concern for fish and wildlife species, and stated that “as living creatures, they deserve to live in an environment not only to survive but to thrive” (Odonaterra Community Environmental Strategies, 2018). The Algonquins of Ontario indicated the American eel and Lake Sturgeon, which are of significant practical and cultural importance to their people, are in decline throughout the watershed (MacGregor et al., 2015). Indigenous peoples were especially concerned about the linkages between water quality and declining fish populations. The Mohawk community of Kanesatake also reported decreases in fish numbers and size. Certain species, such as the Blue Walleye, have disappeared entirely since the 1970s (Bisson & Mohawk community of Kanesatake, 2018).

INVASIVE SPECIES: Several respondents during the ORWS engagement process expressed concern that invasive species may impact water quality, aesthetics, and recreational opportunities (Public and Stakeholder consultations, 2018; PlaceSpeak consultations, 2018). Many respondents also expressed concern that invasive species would impact the ecosystems and wildlife populations in the region (Public and Stakeholder consultations, 2018; PlaceSpeak consultations, 2018).

WETLAND AND FOREST LOSS: As was noted in section 5.1, wetlands provide significant services to the entire watershed. Water filtration, water storage, habitat, flood control and carbon sequestration are just a few of the services that wetlands provide to humans. Throughout the ORWS engagement process, many respondents shared their concerns related to wetland loss. One respondent indicated that wetlands will be more susceptible to drying out, as temperatures and evapotranspiration increase as a result of climate change. Others pointed to urban and industrial development as being an additional driver in wetland loss. One stakeholder group shared that “as urban expansion continues and associated land conversion continues, it is expected that (forest and wetland loss) will show further deterioration and reach critical thresholds” (Public and Stakeholder consultations, 2018).

Overall, many felt the loss of wetlands and forests threaten economic, societal and natural values. Notably, if there is a loss of ecosystem services, a reduction in the aesthetic quality and recreational opportunities in the Ottawa River watershed could occur.

HABITAT LOSS AND LANDSCAPE FRAGMENTATION: The Algonquins of Ontario shared the connection between landscape fragmentation and loss of biodiversity stating that American eel are thought to be in decline, as habitat quality and fragmentation limits the range and abundance of the species (Richardson, 2018; Verreault, Dumont, & Mailhot, 2004). Many respondents also expressed the importance of an individual’s connection with nature through natural spaces; many expressed their concern that natural spaces were being lost. Consequently, many shared concerns regarding a decline in natural spaces as potentially causing a decline in well-being and quality of life.



SHORELINE DEGRADATION AND REDUCTION OF ACCESS: Access to, and degradation of shorelines was shared as an issue within the watershed. Indigenous organizations expressed concern regarding limitations in fishing, hunting and gathering rights in the Ottawa River watershed; however, they are generally confined to harvesting in specific locations, and find that increased competition has resulted in their resources becoming increasingly depleted, as well as reduced the ability of Indigenous groups to profit economically from these activities (Bisson & Mohawk Council of Kanesatake, 2018). The Métis Nation of Ontario expressed concerns that they were unable to fish freely in the Québec portion of the watershed due to licensing and harvesting rights (Odonaterra Community Environmental Strategies, 2018). The Algonquins of Ontario also shared that restricted access around Chalk River Laboratories prevents Algonquins of Ontario from practicing their Constitutionally protected rights outlined in section 35 of the *Constitution Act, 1982* (Richardson, 2018).

Other respondents expressed concerns regarding the effect that human interventions have on flow, which impact habitat and ecosystems, while other groups shared that changes in water levels limited access or visibility of specific sites, such as heritage resources submerged below the surface of reservoirs (Public and Stakeholder consultations, 2018).

Some were concerned with private land ownership and development; notably, many respondents felt that private land reduced their access to the watershed. One respondent stated “universal public access to the shoreline is essential” but added the caveat that “sensitive areas should still stay protected.”

5.3.2.3. RELEVANCE

Although this section has highlighted risks to values within the Ottawa River watershed that were shared through Indigenous, public and stakeholder input rather than proven scientifically, it is important to be aware of the concerns within the watershed, as well as to take into consideration the historical accounts from Indigenous organizations and communities that have observed changes to the watershed over time.



CHAPTER 6:

FUTURE CHALLENGES AND OPPORTUNITIES

The perspectives shared with ECCC through consultation and engagement assist in understanding the present health of the Ottawa River watershed, and the interests, values and concerns of those who occupy it. When considering the next steps for the watershed, it is important to examine not only the present interests and concerns, but also the potential future challenges and opportunities that the watershed may encounter. The following sections explore potential future challenges and opportunities for the Ottawa River watershed, by identifying emerging trends, and their potential impacts through a foresight analysis. This process was undertaken to proactively assess potential societal, technological, and environmental changes that may alter public policy and decision-making within the next approximately 15 years.

6.1. FORESIGHT ANALYSIS

Foresight analysis, as described in chapter 2, has been included in this Study to help ECCC understand what influences the Ottawa River watershed, how it may evolve, and what challenges or opportunities may arise in the future. This chapter is not intended to provide predictions about the future, and the information provided in this chapter does not constitute recommendations for what should be done in the future.

ECCC convened a series of internal sessions that focused on identifying current assumptions, building mental models of the system, and discussing emerging trends (change drivers) that relate to watershed governance. These included disruptive technologies, shifting ideologies, and new economic interests. The identified change drivers contributed to the development of insights into the future of the Ottawa River watershed as a means of identifying potential implications for watershed governance. Relationships between change drivers (defined in section 6.1.2) and commonly held assumptions were also identified, to determine their validity under plausible future circumstances. The forward-thinking nature of foresight analysis provides a powerful context to identify potential future challenges and opportunities in watershed governance, develop more robust and resilient policy, and ultimately improve the protection of the watershed.

6.1.1. SYSTEM ASSUMPTIONS

At the outset of the foresight analysis process, 84 commonly held assumptions were identified by ECCC that were either embedded in the Study, or that are currently influencing policy makers. The assumptions that were identified covered themes such as motivation for change in watershed governance, the roles of various authorities (including government), and how watershed health is assessed, amongst others. Examples of assumptions include:

- Collaboration within the Ottawa River watershed needs to be improved;
- A healthy environment enhances the quality of life for all;
- Sustainable economic development requires a healthy environment;
- The public desires openness and transparency in the sharing of data; and
- Sufficient baseline data is available to diagnose watershed health.

Assumptions shape perceptions and influence decisions, and are therefore one of the fundamental building blocks of creating mental models of the system of study. Defining, and eventually testing assumptions, is a strategic point of intervention in foresight analysis to gain a better understanding of the system of study, and to identify where policy weaknesses may exist (Policy Horizons Canada, 2016). In section 6.1.4, the validity of ten commonly held assumptions identified by ECCC, are tested.

6.1.2. CHANGE DRIVERS

Change drivers are weak signals that could disrupt at least one of the system elements of the Ottawa River watershed in the next 15 years. ECCC scanned domestic and international media, industry reports, and academic journals, amongst other sources of information, to identify seven change drivers across the three sub-themes: disruptive technologies, shifting ideologies, and new economic interests.

6.1.2.1. DISRUPTIVE TECHNOLOGIES

WIRELESS WATER MONITORING SENSORS AND SATELLITE COMMUNICATION

ECCC undertakes a number of initiatives to address environmental issues in Canada, one of which is to conduct science-based research to facilitate policy and regulatory development (Government of Canada, 2017a). Access to current and reliable data is central to science-based decision-making, which requires extensive monitoring and reporting. Data acquired from water monitoring, for example, is one of the many sources of information that contributes to decision-making in the Ottawa River watershed. Conventional water monitoring processes are labour and time intensive, relying on manual sample collection followed by laboratory testing and analysis, which limits timely or proactive responses to concerns in the watershed (Pule, Yahya, & Chuma, 2017). To overcome the limitations of conventional water monitoring, substantial investments are being made to develop wireless sensor technologies that offer remote, real-time data collection with minimal human intervention.

BCC Research anticipates that the global market for water quality sensors will reach USD \$4.6 billion by 2022 (approximately \$6.1 billion Canadian (CDN)), with groundwater and surface water monitoring making up the largest section of the market (Kumar, 2018). Recent advances in water monitoring technology offer continuous, multi-parameter *in-situ* measurements of water quality indicators, such as nitrate, turbidity, and suspended solids. Real-time results can be communicated through a range of interfaces, enabling early identification and response to threats.

Similar to the market for water quality monitoring technology, the market for satellite communications technology is also growing globally. BCC Research anticipates that the global market for satellite communication technology should reach USD \$7.5 billion (approximately CDN \$9.9 billion) by 2022 (Guarev, 2018). Growth in the field of satellite communications technology has many implications for environmental monitoring, including improved communication with remote areas that have an absence of wired networks, real-time data transfer and information sharing, and monitoring of fixed or changing features.

Widespread adoption of sensor and satellite technologies to replace conventional water and environmental monitoring strategies is limited by affordability, large energy requirements to run automated sensors, and security concerns, amongst others. The projected growth of sensor and satellite industries could help alleviate these concerns in the future, introducing new opportunities and challenges that may disrupt conventional water and environmental monitoring in the Ottawa River watershed, and across Canada.

BLOCKCHAIN

Blockchain technology is a digital platform that authorizes and stores records or online transactions without the need for a central authority (Public Safety Canada, 2018). Blockchain can provide services, such as issuing licences, creating smart contracts, or processing payments for services upon completion. The traceability and authenticity of data stored in blockchain reduces the risk of fraud and compromise, as no one party can modify, delete or attach any records without all parties reaching consensus (Public Safety Canada, 2018). While initially designed for the cryptocurrency Bitcoin, the application of blockchain has proven much more versatile, with the potential to reach all fields, including the areas of water and environmental governance (Chapron, 2017).

There are four areas where blockchain may provide opportunities relating to water and environmental governance; ownership, traceability, incentives, and policymaking (Chapron, 2017). The technology can be used to certify and timestamp the existence of ownership of entities, such as land titles or data. The decentralized, open source and open access platform that blockchain runs on could be applicable to scenarios where data is being collected by multiple parties (Weisbord, 2018), as is currently the case for water quality monitoring in the Ottawa River watershed.

Joining blockchain technology with advances in sensor and satellite technologies may offer opportunities to improve on existing governance practices, such as tracking and reporting on energy or resource use, or could facilitate new strategies, such as offering incentives for sustainable behaviours (Chapron, 2017). Blockchain can help ensure that funds allocated for specific purposes, like conservation projects, are being used appropriately by tracking transactions, or establishing smart contracts that only release funds once project milestones are achieved (Chapron, 2017). The Canadian company GuildOne Inc., for example, is working to use blockchain technology to create smart contracts that would help build trust and strengthen relationships between Indigenous peoples and the energy sector. Another example is Atlantic DataStream, which was developed through a partnership between the Gordon Foundation, WWF-Canada, the Atlantic Water Network and Royal Bank of Canada. Using blockchain technology, the data platform brings together data from a variety of monitoring efforts across Atlantic Canada. Then, through use of decentralized networks, it authenticates and makes data more uniform, thus improving accessibility and transparency (Atlantic Data Network, 2018).

Blockchain technology offers a realm of possibilities to water and environmental governance; however, widespread adoption may be limited by a number of factors, including concerns of network influence (one party gaining more than 50% of control of the network), and the role of human error in data input. Solving these challenges may facilitate the widespread adoption of the technology, and if accomplished, could change water and environmental governance in Canada.

ARTIFICIAL INTELLIGENCE

Advancements in sensor and satellite technologies are generating more data than ever before, helping researchers, industries, and decision-makers assess the health and predict the behaviours of species and ecosystems (Palminteri, 2018). The Government of Canada's Open Information initiative and other similar initiatives, have improved public access to data, helping to drive innovation and new solutions to environmental problems. A new challenge, however, has emerged alongside recent progress in data availability: how to manage and interpret large amounts of information. Various tools are being developed to help resolve this issue, many of which involve the use of Artificial Intelligence (AI). AI is a subfield of computer science that uses programming to solve problems, by allowing computers to learn from prior experience, and interpret data and visual scenes (Public Safety Canada, 2018).

The application of AI to analyze large datasets and help solve water and environmental challenges has already begun. Programs have been written to address a number of environmental issues, such as classifying land use through satellite imagery (Zhang & Roy, 2017), using environmental input factors (e.g., ecology, precipitation, temperature) to predict the migration of vector-borne diseases (Hwang, Clarite, Elijorde, Gerardo, & Byun, 2016), and helping decision-makers respond to invasive species (Xiao, Greiner, & Lewis, 2018). In the latter example, researchers at the University of Alberta developed an algorithm that identified patterns from 143 documented attempts to eradicate invasive species, by assessing the environment, the type of invader, and the mitigation method used in each prior attempt. The program uses these patterns to predict an outcome of various eradication strategies on a given environment, to help decision-makers identify the best course of action (Xiao, Greiner, & Lewis, 2018).

The implementation of AI in water and environmental governance could change how decisions are made in the future. Although there has been progress in the field of AI, a number of limitations to widespread adoption remain. To identify patterns and make recommendations, many AI programs require access to substantial amounts of data. Data availability is improving; however, it remains a limitation to AI, particularly for remote areas. Another risk to AI is hidden biases from the data used to train the system (Brynjolfsson & McAfee, 2017). With the continued advancement of sensor, satellite, and blockchain technologies, it is conceivable that some of these limitations may be alleviated over the next 15 years, providing more opportunities for AI to contribute to water and environmental governance.

6.1.2.2. INSTITUTIONAL RECOGNITION



INCREASING RECOGNITION OF INDIGENOUS RIGHTS

The federal government has made it a priority to renew the relationship between the Government of Canada and Indigenous peoples. In doing so, the Government is making recognition and implementation of the rights of Indigenous peoples the basis for all relations between Indigenous peoples and the federal government (Government of Canada, 2018c). Chapter 2 outlines the actions and principles that guide the federal government's commitment to a renewed, nation-to-nation relationship.

In recognition of the importance of a renewed relationship with Indigenous peoples, various industries have started to prepare for how strengthened rights of Indigenous organizations may influence how their businesses operate. The Residential and Civil Construction Alliance of Ontario for example, suggested in their 2016 Megatrends report on the Impact of Infrastructure on Ontario's and Canada's Future, that growing legal recognition of the rights of Indigenous peoples in Canada will likely increase demand for infrastructure to serve remote communities (Fenn, 2016). The Megatrends report notes that the widened scope of Indigenous rights in connection with traditional lands will likely subject infrastructure projects to new conditions, particularly due to the enhanced need for consultation and/or community benefit agreements for projects affecting traditional Indigenous lands (Fenn, 2016).

Recognition of the value of incorporating Indigenous perspectives into environmental and water governance is not exclusive to Canada, as many other countries are working with Indigenous organizations to facilitate better management of the environment. As a means of shared governance and territorial management, the governments of Australia, Brazil, New Zealand, and Ecuador have granted Indigenous organizations control over how to conduct biodiversity conservation on their land through recognized Indigenous Protected Areas (IPAs) (Porta, Racine, & Vaughan, 2017). IPAs deliver environmental, cultural, social, health and well-being, and economic benefits to Indigenous peoples, while preserving heritage and providing training and education opportunities for Indigenous peoples in remote areas (Porta, Racine, & Vaughan, 2017).

RECOGNITION OF THE VALUE OF ECOSYSTEM SERVICES

As described in section 5.1.1, ecosystem services are outputs and attributes of ecosystems that in some way provide value to humans (Epanchin-Niell, et al., 2018). Systemic failure to recognize the value in maintaining healthy ecosystems to provide these services has contributed to a global decline in biodiversity (TEEB, 2008). As discussed in section 5.1.1, value has historically been assigned to ecosystems primarily based on the provisioning services they provide, such as the production of fish or timber, which is largely defined by market demand for the product (Federal, Provincial and Territorial Governments of Canada, 2010). More recently, however, the non-market value of ecosystem services is being realized, partially attributed to the recognised impacts of climate change, and the depletion of natural resources, on both humans and the environment.

Recognition of the non-market value of ecosystem services is emerging through numerous fields, which in some cases is leading to fundamental shifts in the way the environment is being protected. For example, a Finnish study found that countries that exhibit annual increases in forest growth tend to score higher on the UN's Human Development Index (Kauppi, Sandström, & Lipponen, 2018). In this instance, value is being created by conserving resources, rather than exploiting them, leading to improvements in human well-being. Recognition of the value of ecosystem services has also led to cases where rivers have been granted the same legal rights as humans, in an effort to curb pollution and preserve the resource (Safi, 2017), as was introduced in chapter 3 through the Whanganui River (New Zealand) case study. These types of actions promote the sustainable management of resources, and suggest a growing recognition for the intrinsic value in protecting ecosystems.

6.1.2.3. NEW ECONOMIC INTERESTS

INNOVATIVE INSURANCE POLICIES

The effects of climate change on property and critical infrastructure can be detrimental to individuals, business owners, and governments alike (Nottingham & Yeo, 2018). The costs of natural disasters in Canada, measured through Disaster Financial Assistance Arrangement payments and insurance claims, has increased in recent decades (IBC, 2015).

Since the 1900s, floods have accounted for 40% of natural disasters in Canada, which is more than twice as frequent as the next most-common disaster (Insurance Bureau of Canada, 2015). From 1983-2008, Canadian insurers faced annual claims on natural disaster relief ranging from CDN \$200-500 million; however, since 2009 annual claims have consistently exceeded CDN \$1 billion (Insurance Bureau of Canada, 2015). The number of flood disasters (floods with major impacts on people and assets) around the world nearly doubled in the decades before and after the year 2000, largely due to increased flood risk from urbanization, population increases, and development in flood hazard-prone areas (Keating, et al., 2014).

In response to the risks that climate change poses on property owners, new insurance policies are emerging to cover weather related threats that previously could not be covered. In May 2018, for example, Canada's first storm surge insurance plan was introduced to homeowners in British Columbia and Nova Scotia (Adriano, 2018). In addition to the recognition of the risk that climate change poses on human infrastructure, the growing recognition of the value of ecosystem services has also led to an emerging trend in insurance policies. In Mexico's state of Quintana Roo, for example, conservation funds collected by the tourism industry are partially being used to purchase an insurance policy to protect coral reefs in the Cancun and Puerto Morelos areas (The Nature Conservancy, 2018). Coral reefs can reduce wave energy by 97% before reaching the shore, protecting coastal communities and industries from the effects of severe storms (The Nature Conservancy, 2018). This innovative policy contributes to the protection of the region's USD \$10 billion tourism industry (approximately CDN \$13 billion), while conserving a valuable natural asset, and potentially signaling a shift in conservation strategies globally.

WATER AS A COMMODITY

Water prices in Canada largely reflect a perception that fresh water is abundant throughout the country, as on average Canadians are charged approximately one-quarter of European water prices, and about three-quarters of American domestic and industrial prices. Internationally, climate, geography, conflict, and instability, all play large roles in the distribution and access to water resources.

Many dimensions of the UN's Sustainable Development Goals, including health, food security, and poverty reduction, are contingent on access to fresh water in sufficient quality and quantity. However, in 2015, 844 million people lacked access to basic water services to provide fresh water, and 2.3 billion people lacked access to basic sanitation services (UN, 2018). Many countries that have water security concerns face further challenges from inadequate infrastructure leading to water loss through leakage, and water theft via illegal wells and pipelines that divert water for private sale (Felbab-Brown, 2017). For example, the cities of Karachi, Pakistan, and Delhi, India, lose 30 to 35% of water annually, due to inadequate infrastructure and theft (Felbab-Brown, 2017). The sale of illegally sourced, untreated water in India has created a black market for water worth millions of dollars, diverting funds from the government, and limiting their ability to respond to the threats that contribute to, and are associated with water shortages (Felbab-Brown, 2017).

It is important to note that water abundance does not necessarily negate the possibility of water theft. Brazil for example holds approximately 13% of the world's freshwater reserve, the most of any country in the world; however, 37% of water is lost annually, approximately half of which is to theft (Felbab-Brown, 2017). Although widespread cross-border water smuggling has not yet materialized, population growth, climate change, and unstable geopolitical relationships have contributed to the emergence of water theft and illegal trading in many areas around the world, which could be a signal of potential change in the future.

6.1.3. POTENTIAL IMPACTS ON THE WATERSHED

The purpose of identifying change drivers in foresight analysis is to uncover what impacts may come from the realization of those changes, and discern where a system may be vulnerable in the future. ECCC attempted to uncover these potential impacts by using the aforementioned change drivers to build insights about plausible futures for the Ottawa River watershed. Once insights were established, first, second and third order impacts were identified for each of the four key system elements (i.e., governance values, natural values, economic values, and social/cultural/heritage values). First order impacts are those that would immediately result from the realization of the insights identified, such as more data being generated from increased monitoring. Second order impacts are those that result from the realization of the first order impacts, for example, more data from monitoring would lead to better tracking of health indicators. Likewise, third order impacts are those resulting from the realization of second order impacts. Continuing with the previous example, this could be in the form of a better diagnosis of watershed health.

While it is difficult to discern with any certainty the likelihood or extent to which these change drivers may come to fruition, developing insights and identifying potential impacts is an important tool for policy development. Most policy research is focused on the expected future—that is, high probability, high impact developments that could disrupt operations (Policy Horizons Canada, 2016). The foresight method helps policy makers identify challenges and opportunities that are of low or unknown probability and potentially high impact, which are often discounted or unidentified (Policy Horizons Canada, 2016). Considering all plausible challenges and opportunities that could occur in the future, ultimately encourages more proactive policy development.

6.1.3.1. INSIGHT 1 – DISRUPTIVE TECHNOLOGIES

The introduction of new technologies into water governance has the potential to impact the Ottawa River watershed. Insights about the potential future of the watershed were developed based on the automation of water monitoring sensors, the introduction of blockchain technology in data sharing and collaboration, and the use of AI to help decision-makers organize data and prepare response plans to water-related concerns. Some of the potential opportunities identified from these insights include enhanced coordination and communication between stakeholders and jurisdictions; a better understanding of ecosystem services, water use, and anthropogenic impacts to the environment; and greater public awareness of environmental health. ECCC brainstormed that these changes could contribute to an improved ability to identify emerging concerns and protect resources in the watershed. As discussed in section 5.4.2.3, input from both stakeholders and Indigenous organizations in the watershed revealed that many respondents are concerned that invasive species may affect water quality, ecosystems, wildlife populations and recreational opportunities in the watershed. The use of AI to identify, and help respond to invasive species, could prove useful in mitigating this concern in the future. Alongside these benefits, however, also come a number of challenges to water governance, such as the need for additional resources to respond to issues identified through enhanced monitoring, and the introduction of cyber security threats through automated “smart” technologies. These potential challenges may require policy intervention in the future.

6.1.3.2. INSIGHT 2 – SHIFTING IDEOLOGIES

Greater recognition of the rights of Indigenous peoples in Canada and the value of ecosystem services each have the potential to change water governance in the Ottawa River watershed. The insights developed from these change drivers led to the identification of a number of potential opportunities, including the potential to increase the incorporation of Indigenous Knowledge into decision-making and the possibility to assign greater value to ecosystem services. Alongside these opportunities, ECCC brainstormed a number of potential challenges to water governance, such as an increasing need to negotiate data sharing arrangements, heightened public expectations of industries operating within the watershed, and conflict over views regarding best management practices between various authorities. Policy intervention may be required to respond to these challenges.

6.1.3.3. INSIGHT 3 – NEW ECONOMIC INTERESTS

The trends identified in this chapter contribute to numerous insights about plausible futures for the Ottawa River watershed. For example, the emergence of insurance policies to respond to the risks of climate change, particularly through concerns of overland flooding, could influence the lives of many Canadians, particularly those living in coastal, or flood prone areas. The Insurance Bureau of Canada estimated that damage caused by two extreme storms, and subsequent flooding events in eastern Ontario and western Québec in April and May of 2017 resulted in more than CDN \$223 million in insured damages (Insurance Bureau of Canada, 2017). The actual figure was likely much higher as most homeowners were not covered by overland flood insurance (Ottawa Business Journal, 2017). Emerging insurance policies may provide citizens with better protection from flood-related damages, could spur investment in climate resilient infrastructure, and could present challenges relating to insurance affordability and inequality in lower-income communities. Hence, increased availability of flood insurance in Canada will allow homeowners to transfer some portion of their flood risk to the financial markets.

Homeowners are not likely to be the only group affected by emerging insurance plans, as insurance plans that are implemented to protect ecosystem services could have substantial impacts on conservation and business strategies. The realization of a future where governments, watershed organizations, industries, or communities use insurance policies to protect various natural features may lead to a number of opportunities. ECCC brainstormed that these opportunities could include better ecosystem health and accountability for damages, an enhanced appreciation for the value of a healthy environment, and a strengthened relationship between the environment and the economy. One of the most notable challenges that ECCC discussed from this insight, relates to how value is assigned to ecosystem services.

The second change driver was the emergence of the threat of water theft and illegal trade, which presents a number of potential challenges to water governance in Canada. Scarcity and affordability are the two drivers of present water theft around the world. While ECCC does not anticipate that this will become a nation-wide concern in the near future, regional water scarcity induced by drought, over-exploitation of groundwater resources, or widespread infrastructure failures induced by natural disasters, could introduce localized water stress in the future. China, for example, has imposed restrictions on water consumption in certain geographic regions where water scarcity is a concern, which has led to requirements to import water from more water-rich regions (Xu, 2018). The challenges of regional water scarcity, and the threat of water theft or illegal trade, may justify global policy action in the future to introduce an emergency water network to re-distribute water to stressed areas, or increase monitoring and enforcement should illegal trade become prevalent.

6.1.4. TESTING ASSUMPTIONS

To respond to potential changes that may occur in the Ottawa River watershed, it is important to examine the fundamental assumptions that currently underlie water and environmental policies in Canada (Policy Horizons Canada, 2016). Figure 6.1-1 presents a sample of the potential relationships between change drivers, and commonly held assumptions that underlie current policy. Assumptions that remain valid in futures where change drivers are realized, are viewed as being credible and should guide planning in the future (Policy Horizons Canada, 2016). Those assumptions that remain uncertain may require further research to verify their validity, while those that are vulnerable should be reconsidered (Policy Horizons Canada, 2016). The degree to which any one driver may affirm, or refute the assumptions presented remains uncertain; however, identifying potential relationships and weaknesses is the first step to preparing for plausible futures.

One of the system assumptions that ECCC identified was that there is a lack of awareness regarding the value of ecosystem services. This assumption may need to be re-evaluated based on the role of emerging change drivers. The weak signals that contributed to the establishment of the change driver: innovative insurance policies, such as the Quintana Roo coral reef insurance plan, suggest that industries are beginning to recognize that the health of the environment is fundamental to the sustainable operation of their businesses.

The relationship between the change driver, monitoring technologies, and the system assumption that it will become increasingly expensive to manage the watershed, is a slightly more complicated example of an assumption that may need to be reconsidered in future policy design. Autonomous monitoring technologies are becoming increasingly affordable, and resilient to various weather conditions, suggesting that widespread adoption may be attainable in the relatively near future. Should an autonomous monitoring program be implemented in the Ottawa River watershed, it is reasonable to assume that the up-front cost could be substantial. Examples of the costs associated with such a program could include the installation and maintenance of new monitors, the establishment of a program to manage the data, and perhaps the creation of a team to respond to threats identified through enhanced monitoring. These costs initially suggest that the assumption is valid; however, it is also important to consider the costs of failing to improve monitoring in the watershed. The benefits of increased monitoring capacity through autonomous sensor technologies could help identify threats in the watershed that would otherwise go undetected. The availability of this data could lead to an increase of the frequency of pollution related fines, which could reduce environment-induced health-related costs.

Foresight Analysis is an effective tool to identify potential policy problems on an approximately 15 year time horizon. The change drivers and insights identified in this chapter are not intended to be predictive, but rather provide an evidence-based platform to begin thinking about future challenges and opportunities. By identifying change drivers and developing insights about plausible futures for the watershed, ECCC is better positioned to identify trends and potential threats. The foresight process has also helped ECCC to identify potential opportunities to enhance collaboration and the adoption of IWM principles in the watershed. These opportunities are discussed in section 6.2.

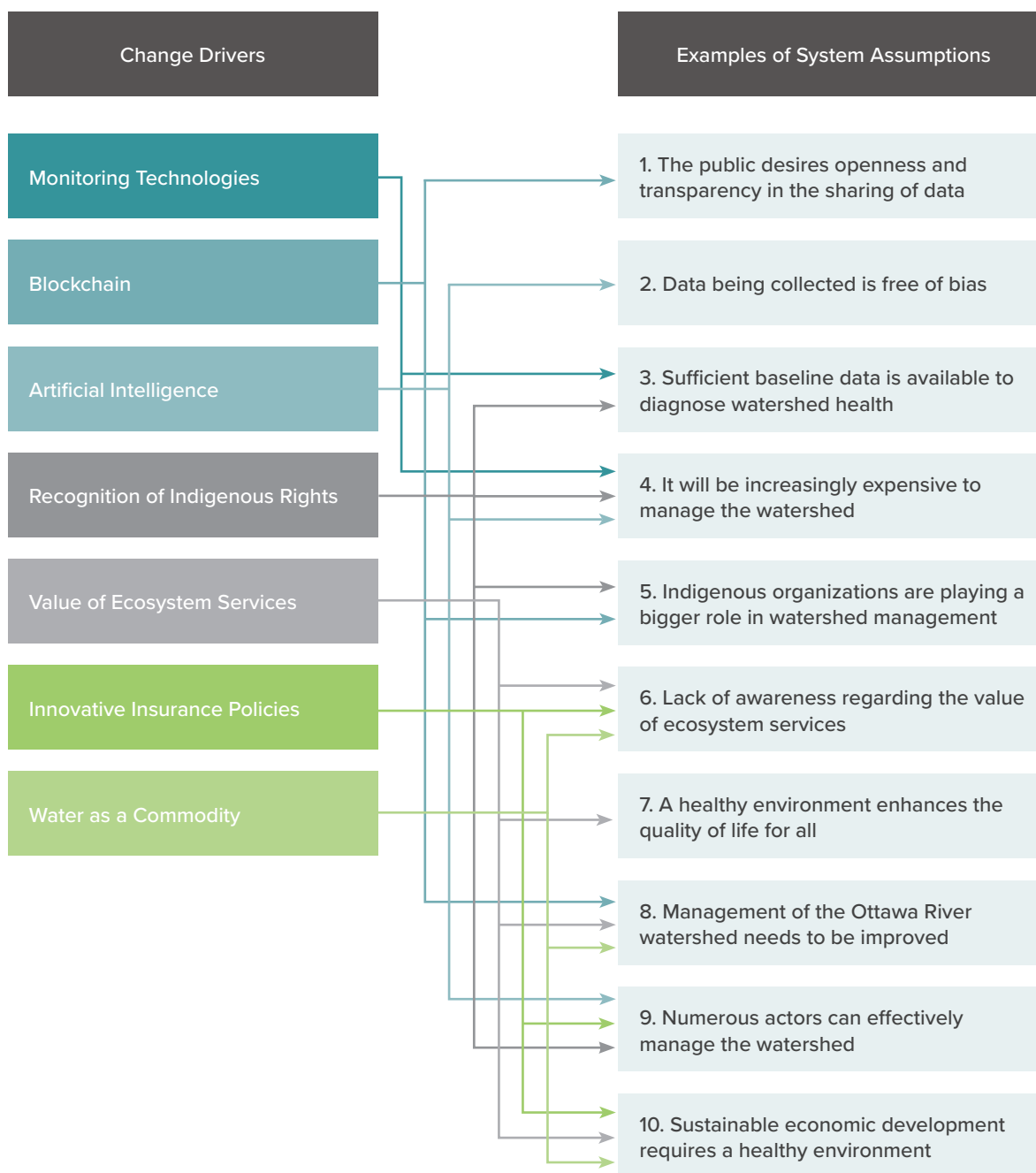


FIGURE 6.1-1. CHANGE DRIVERS THAT MAY DISRUPT COMMONLY HELD ASSUMPTIONS RELATED TO THE OTTAWA RIVER WATERSHED



6.2. OPPORTUNITIES WITHIN THE WATERSHED

As discussed previously, there are multiple challenges in achieving IWM and collaboration in the Ottawa River watershed (see section 3.3). These challenges limit the overall ability to ensure collaborative management and protect natural, economic, cultural, and heritage values. Indigenous consultation, stakeholder and public engagement, literature reviews and foresight analysis have helped ECCC to identify some current gaps, and articulate where opportunities may exist. Opportunities have been categorized into six themes: collaboration, the role of Indigenous Nations and collectives, strategic planning, information sharing and accessibility, monitoring and data, and watershed knowledge.

6.2.1. COLLABORATION

Feedback received throughout the ORWS highlighted challenges in coordinating across multiple jurisdictions and stakeholder groups within the watershed. Challenges associated with collaboration were often expressed as being due to the lack of a knowledge and information sharing platform, the absence of a central watershed-specific governance structure, and language barriers. Many respondents also expressed that there were gaps regarding strategies, incentives and/or opportunities to ensure more effective communication within and between orders of government, including with Indigenous peoples and stakeholder groups. Some groups stated that stakeholder groups and/or local communities were not sufficiently being engaged in existing collaborative efforts. In addition, the leveraging of local universities and others with specialized knowledge was shared as a gap. Respondents indicated that there are multiple universities in the region with expertise that could provide information on the watershed.

Overall, there was general consensus amongst respondents that there was a need, and an opportunity, to improve collaboration within the watershed. Various stakeholder and Indigenous organizations demonstrated an interest and willingness to be involved in new collaborative processes. Of note, many respondents expressed that funding may be necessary to support some groups and individuals, so that they are able to meaningfully participate. Many respondents agreed that opportunities to create a new collaborative body or Council should be explored further. Respondents generally suggested that a potential Council should have broad membership, remain politically neutral, and make decisions based on consensus. In addition, based on expressions of interest made during the engagement process of the ORWS, there may be an opportunity to include youth to a greater extent in collaborative initiatives concerning the Ottawa River watershed.

6.2.2. THE ROLE OF INDIGENOUS NATIONS AND COLLECTIVES

All of the Indigenous organizations consulted highlighted gaps in the involvement of Indigenous peoples in existing water-related decision-making, monitoring, and stewardship initiatives within the Ottawa River watershed. The Algonquin Anishinabeg Nation Tribal Council, for example, suggested that management activities related to groundwater and surface water are currently inadequate, and that Indigenous Knowledge should be valued more greatly. Many other Indigenous organizations echoed similar concerns regarding the inclusion of Indigenous Knowledge in management practices, such as research and assessments. Algonquin Anishinabeg Nation Tribal Council and Algonquin Nation Secretariat highlighted that current watershed management activities do not recognize the rights and related interests of Indigenous peoples, and that past consultations undertaken by the Crown and industry lacked legitimacy, as input was not taken into account (Algonquin Anishinabeg Nation Tribal Council, 2018; Kitchisibi Ikidowin Anishinabe, 2018).

All Indigenous organizations consulted felt there are also opportunities to include Indigenous Knowledge to a greater extent in Ottawa River watershed initiatives and decision-making processes. They all expressed that they hold and collect valuable Indigenous Knowledge, which has the potential to inform decision-making. Algonquins of Ontario recommended that an education endowment be established to support development of internal capacity, and Algonquin Nation Tribal Council recommended that “youth receive some type of educational awareness within schools. Youth need to be involved in solving the problem” (Algonquin Anishinabeg Nation Tribal Council, 2018). The provinces of Ontario and Québec, for example, have water, watershed and/or wetlands issues built into their secondary level curriculums (Ministry of Education, Ontario, 2017; Ministère de l’Éducation et de l’Enseignement supérieur, n.d.). Indigenous youth surveyed through one independent consultation demonstrated a concern and interest in water issues, while a separate Indigenous report stated that indigenous youth should be encouraged to pursue environment and/or scientific fields, as they would have the unique potential and capacity to conduct scientific testing, while coming from a background of rich Indigenous Knowledge.

There is a clear opportunity and desire from Indigenous organizations to collaborate with federal, provincial and municipal governments to better conserve the Ottawa River watershed on a nation-to-nation basis. Specifically, many Indigenous groups expressed that through potential changes in management of the Ottawa River watershed, there is the opportunity to demonstrate commitments made by the federal government to renew a nation-to-nation relationship with Indigenous peoples. A potential new collaborative body was viewed as an important opportunity to recognize Indigenous rights and related interests in the management of the Ottawa River watershed, perhaps most notably, a step towards meaningful consultation practices. All Indigenous organizations consulted proposed possible governance approaches, in varying detail (see section 3.3). Other unique opportunities for greater Indigenous involvement, identified during the foresight analysis for the ORWS, included the development of Indigenous Protected Areas (see section 6.1) and the granting of legal personhood to water bodies (identified by the Algonquin Nation Secretariat and detailed in section 3.2.3).

6.2.3. STRATEGIC PLANNING

There is a global consensus that effective watershed management requires some form of a strategic plan, framework, and/or guiding principles (Wang et al., 2016; CCME, 2016; ECCC, 2010; Brandes & O’Riordan, 2014). This report presented various best practices and guiding principles, notably the 11 CCME IWM principles (section 3.1). Additionally, success factors of existing watershed management bodies were described in chapter 3. Although the combined geographic scope of activities led by CAs and OBVs covers much of the extent of the Ottawa River watershed, they do not cover the watershed in its entirety. Further, members of the public and Indigenous organizations stressed the need for a comprehensive plan or strategy that is tailored to the Ottawa River watershed. Algonquin Nation Tribal Council (2018), for example, shared the need for a “comprehensive and solid action plan to ensure the preservation and protection of the ecological health of the Ottawa River and surrounding area, which would encompass both the surface water and the groundwater”.

There may be an opportunity to develop a strategic plan for the Ottawa River watershed, given the significant demand expressed by key stakeholder groups and Indigenous peoples. Many viewed strategic planning as an opportunity to strengthen collective responsibility in the watershed, better recognize pressing issues affecting the watershed, and or highlight natural, economic, cultural and heritage values associated with the watershed. Many Indigenous organizations stressed the desire for such plans to be co-developed with Indigenous organizations and/or communities, in order to ensure that their views are acknowledged and respected.

6.2.4. INFORMATION SHARING AND ACCESSIBILITY

As was discussed in chapter 4, one of the primary challenges identified through engagement on the ORWS is the absence of a central data-sharing mechanism, such as an online platform, to exchange information about the health of the watershed. Those who provided feedback frequently cited concerns regarding difficulty in finding information about the status and health of the watershed. One township indicated that there is a lot of data and information already being collected by various branches of government, and other organizations; however, not all parties are aware of the extent of data that others are already collecting (Public and Stakeholder consultations, 2018). Respondents on PlaceSpeak and in engagement guides also shared concerns regarding a lack of information on, and awareness of, how individual actions could potentially impact the watershed, with some respondents linking lack of awareness and education to irresponsible behaviors.

Addressing information sharing challenges presents a number of opportunities to improve collaboration and understanding about the health of the Ottawa River watershed. Many respondents viewed improving communication and transparency as an effective mechanism to improving the overall understanding of the health of the watershed (Public and Stakeholder consultations, 2018). Some respondents called for the creation of a place for information sharing, such as a data portal or central platform, to host information that is being collected in the watershed (Public and Stakeholder consultations, 2018).

6.2.5. MONITORING, DATA AND ESTABLISHING COMPREHENSIVE BASELINE WATERSHED KNOWLEDGE

In addition to challenges in data accessibility and the capacity to share data, engagement on the ORWS showed that many individuals perceive there to be gaps in current monitoring and data collection activities. Some respondents indicated that across the watershed monitoring is fragmented as differing types of indicators are being monitored, there are different protocols in place to assess indicators, and some data is out-of-date (Public and Stakeholder consultations, 2018). Many groups cited that gaps in monitoring were due to capacity and resource constraints, as well as a lack of communication.

Feedback received also suggests that the inconsistent monitoring and insufficient access to information are limiting the ability to assess the health and socio-economic conditions of the Ottawa River watershed. There is a perception that inadequate baseline data in many regions of the watershed has made tracking trends in watershed health difficult, a product of both insufficient monitoring, and lack of integration of Indigenous Knowledge (Algonquin Anishinabeg Nation Tribal Council, 2018; Kitchisibi Iikidowin Anishinabe, 2018; Richardson, 2018; PlaceSpeak consultations, 2018).

In addition, respondents suggested that there is a lack of socio-economic data being collected, leading to gaps in understanding the values associated with the watershed. As indicated in section 4.4, many respondents suggested that adopting a whole-of-watershed approach could improve our understanding of ecological functions, such as hydrologic connectivity. Several Indigenous organizations also highlighted other potential opportunities for further work in the watershed.

The Mohawk Council of Kahnawà:ke suggested that a Regional Impact Assessment could be conducted to assess the state of the watershed and the impacts of current activities on humans and wildlife, as well as to identify priority areas for improvements, and to determine the carrying capacity of the watershed for additional development (Mohawk Council of Kahnawà:ke, 2018). Similar input from the Algonquin Anishinabeg Nation suggested there is an opportunity to conduct a cumulative effects assessment to determine the extent of impacts that pollutants and human activities have had, and will have, on the environment (Algonquin Anishinabeg Nation Tribal Council, 2018).

Feedback received for the ORWS shows that respondents in the watershed are concerned about a lack of standardization across the Ottawa River watershed, which has led to concerns related to compatibility, comparability, and sometimes credibility of previously collected data. It was also suggested that the development of monitoring priorities, protocols, and indicators could help identify where there are additional gaps, duplication, or opportunities.

“The natural heritage features in the upper portions of the watershed support species diversity and water based tourism although values are not well documented”

(Public and Stakeholder consultations, 2018)



CONCLUSIONS AND NEXT STEPS

As home to Indigenous peoples for countless generations, as an important transportation route and commercial hub, as a focal point for recreational activities, as a source of abundant drinking water, and as an example of natural beauty that supports intangible needs, the Ottawa River watershed has earned a cherished and iconic place within Canada.

In responding to Motion M-104, the Department focused on better understanding these various facets of the watershed through the identification of existing and potential indicators for assessing its health, and through an examination of its economic, cultural, heritage and natural values. The Department also examined barriers and opportunities with respect to collaboration within the watershed. The ORWS process, as well as the resulting report, provide an important foundation of knowledge, which will not only benefit those in the Ottawa River watershed, but those involved in watershed management across the country.

Through the ORWS, the Department took an approach to engagement that was innovative, broad, inclusive and meaningful. It received input from Indigenous communities and organizations, the provinces of Québec and Ontario, municipalities, CAs, OBVs, NGOs, businesses, stakeholder associations, youth and interested individuals. This report recognizes and celebrates the important roles, responsibilities and ongoing work of these key players to further the sustainability of the Ottawa River watershed. Incorporating these diverse and wide-ranging views from across the watershed allowed for a comprehensive understanding of the key issues facing the watershed and assisted in the identification of potential opportunities for future collaboration.

KEY THEMES AND ACTIONS

Through this engagement, a number of key themes emerged. Firstly, a comprehensive assessment of the state of the watershed was seen as a necessary stepping-stone to identifying gaps, priorities and common goals for the watershed. Some of the ideas the Department heard included improving the coordination of monitoring, enhancing data collection and using scientific and socio-economic data to improve knowledge of the watershed, as well as the standardization of data and monitoring requirements. Stakeholders also proposed taking a “whole of watershed” approach, and suggested that improved information sharing could be facilitated through a central knowledge and data platform.

Secondly, the Department heard a strong desire for an enhanced role for Indigenous peoples in decision-making regarding the Ottawa River watershed, including ensuring meaningful consultation and improved incorporation of Indigenous views and input. Some Indigenous organizations and communities expressed a desire to have direct involvement in monitoring and information gathering, and to see greater incorporation of Indigenous Knowledge in the protection of the Ottawa River watershed.

Stakeholders also raised the possibility of a strategic plan for the Ottawa River watershed. It was suggested that such a strategy could include the Canadian Council of Ministers of the Environment’s IWM Principles, and could be informed by various strategies undertaken in support of domestic and international watershed bodies.

Finally, there were many expressions of interest through the ORWS for the creation of a collaborative body for the Ottawa River watershed. It was suggested that such a body include balanced representation from governments (regional, provincial, and federal), Indigenous organizations, industry, recreational organizations, NGOs, the public and academia.

These are themes that could help inform future work in the watershed, individually and collectively, by the various parties and orders of government working within it.

MOVING FORWARD – NEXT STEPS

The Government of Canada will continue to take action in support of the health and protection of freshwater throughout the country, including the Ottawa River watershed.

The federal government is active in protecting the quality and quantity of water resources through its policies, programs, and regulations. This includes initiatives such as the Fresh Water Quality Monitoring and Surveillance program, an ongoing initiative that implements a risk-based adaptive management framework for examining freshwater quality and aquatic ecosystems to better target monitoring activities, including in the Ottawa River watershed. Through the CCME, the Government of Canada works with provinces and territories to provide tools, guidance and approaches to support sustainable water management in Canada, and to adapt to future challenges, such as climate change. The Government also promotes watershed-based initiatives in major basins across the country, such as the Great Lakes, Lake Winnipeg, and the St. Lawrence River basin. These initiatives will contribute to a better understanding of IWM and best practices that would be applicable to the Ottawa River watershed and others in Canada.

The Government also employs a number of stewardship tools and partnerships to stimulate biodiversity, habitat and ecosystem conservation actions on the ground. These include the Habitat Stewardship Program for Species at Risk, and the North American Waterfowl Management Plan. Through the Indigenous Guardians Pilot Program, which provides Indigenous peoples with an opportunity to exercise responsibility in stewardship of their traditional lands, waters and ice, the Government is funding the Kitchissippi Watershed Lake Trout Monitoring Project within the Ottawa River watershed. This project draws on Indigenous Knowledge from Algonquin Elders and land-users to explore environmental changes observed over time. These are initiatives that will directly and indirectly serve the interests of the Ottawa River watershed.

In 2018, ECCC provided funding to Ottawa Riverkeeper to develop indicators to monitor and assess the health of the Ottawa River watershed. This first phase of work resulted in a report that includes the identification of indicators pertinent to the mainstem of the Ottawa River, with a focus on indicators best suited to surface water systems. To further support these efforts, ECCC will provide funding to support ongoing collaborative work on the next phase of the watershed health assessment, including gathering data for indicators, selecting sampling sites, and supporting community-based monitoring efforts.

CONCLUDING THOUGHTS

Watershed management is an adaptive process that requires ongoing collaboration and dialogue to succeed. The stewardship and protection of water is a vital mandate for ECCC and the Government of Canada, and one that ECCC will continue to support, for the benefit of all Canadians.

ECCC hopes that this report will contribute to the knowledge base about the Ottawa River watershed, that it will support discussions on how to promote the watershed's long-term sustainability, and that it will add to the discourse about watershed management and collaboration across Canada.

This report would not have been possible without input from Indigenous organizations and communities, the provinces of Québec and Ontario, municipalities, CAs, OBVs, NGOs, businesses, stakeholder associations, youth and individual citizens. Thank you for your contributions and for your genuine concern and passion regarding the protection of the Ottawa River watershed.

GLOSSARY

GLOSSARY

AQUIFER

Geological formation of permeable rock or material such as sand or gravel capable of holding significant quantities of water (Statistics Canada, 2017).

BIODIVERSITY

The variety of life forms in a given area. Typically, biodiversity measures the mix of genetics, species and ecosystems.

CHANGE DRIVER

Something that causes significant change in the system under study.

CHLOROPHYLL A

A commonly used measurement in water quality assessments for analyzing the presence and productivity of algae.

CITIZEN

A citizen is an individual Canadian who is neither a delegate nor a representative of any government, organization, association or interest group.

CITIZEN SCIENCE

Citizen science is the active engagement of citizens in scientific activities and processes. Citizens volunteer to be contributors in research and can participate through different levels of commitment.

COMMUNITY-BASED MONITORING

Community-based monitoring is a process where concerned citizens, government agencies, industry, academia, community groups and local institutions collaborate to monitor, track, and respond to issues of common community concern (ECCC, 2003).

CONSULTATION

Consultation refers to processes through which governments seek the views of individuals or groups on policies, programs, services or initiatives that affect them directly or in which they have a significant interest. Consultation is a two-way exchange that includes informing participants, listening to and acknowledging their concerns and aspirations, and providing feedback on how input was used.

CUMULATIVE EFFECTS

The accumulated spatial and temporal impacts to environmental and socioeconomic values from multiple projects and other activities.

DATA COLLECTION

The means by which data are acquired for multiple uses (National Research Council, 2004, p. 179).

DIALOGUE

To engage in a multi-party discussion to deepen a shared understanding of views, impacts and solutions, and deliberate, debate and shape decisions.

DIGITAL ENGAGEMENT

A range of digital online technologies used as part of an engagement activity to facilitate participation. This can include social media feeds, email distribution lists, websites and online public engagement platforms.

ECOSYSTEM SERVICES

The benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services, such as nutrient cycling that maintain the conditions for life on Earth.

ENGAGEMENT

This term refers to any process through which decision makers collaborate with external individuals or groups to encourage learning, interactive dialogue, in-depth deliberation on issues, and commit to consider their views in a decision. Engagement usually happens at the preliminary stages of policy or program design – often when the focus is more on finding common ground on the goals and underlying values and principles that will frame an issue, a policy, program, service, or initiative. Engagement requires two-way communication that is interactive.

FORESIGHT ANALYSIS

A tool to explore plausible, alternative futures, and identify the challenges and opportunities that may emerge.

GENDER-BASED ANALYSIS PLUS (GBA+)

GBA+ is a method for examining the intersection of sex and gender with other identity factors like race, ethnicity, religion, age, and mental or physical disability. Its purpose is to foster an understanding of how different individuals experience public policy and ensures that policies and programs have fair and intended results across the population. Analysis is conducted during the development, implementation, assessment, and monitoring of policies/programs/projects.

GROUNDWATER

Water located below ground between particles of soil and fractured rock in the saturated zone below the water table.

GROWING DEGREE DAY

A heat index that can be used to predict when a crop will reach maturity.

HYDROLOGY

Refers to the movement and distribution of water resources (i.e., water quantity and water dynamics).

INDICATOR

An indicator is a quantifiable metric that is used to provide information about, describe, or evaluate, the state of the environment or area of consideration (OECD Environmental Directorate, 2003).

INTEGRATED WATER RESOURCES MANAGEMENT (IWRM)

A process which promotes the coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems and the environment.

INTEGRATED WATERSHED MANAGEMENT (IWM)

A continuous and adaptive process of managing human activities in an ecosystem, within a defined watershed. IWM involves the integration of environmental, social and economic decisions and activities through an inclusive decision making process to manage the protection, conservation, restoration and enhancement of aquatic and terrestrial ecosystem features, functions and linkages.

INTRINSIC VALUE

The value that an entity has in itself, for what it is, or as an end.

MICROBIAL CONTENT

A commonly used measurement in water quality assessments for determining the amount of bacteria in the water (e.g. *E. coli*).

MONITORING

Monitoring is data collection with the more targeted purpose of detecting and drawing attention to changes in selected measures, particularly extreme changes (National Research Council, 2004, p. 179).

NON-POINT SOURCE POLLUTION

Pollution resulting from many wide spread sources.

PARTNER

Any individual, group or organization that participates in, or shares responsibility for, the implementation of policy or program decisions.

PHYSICAL-CHEMICAL CONDITIONS

Measurements to help determine water quality. These conditions include parameters such as water temperatures, oxygen availability, pH, etc.

POINT SOURCE POLLUTION

Pollution coming from a single identifiable source.

RESERVOIR

An artificial lake often created by the construction of dams along a natural lake or river.

STAKEHOLDER

A stakeholder is any individuals, groups or organizations external to all levels of government and Indigenous peoples, who have an interest in, have some influence on, or may be affected by a given policy or initiative. Stakeholders can be citizens, interest groups, associations, sector representatives, private companies, academics or others.

TRANSBOUNDARY WATERS

Water bodies, such as lakes, rivers and aquifers, which are shared by two or more jurisdictions, such as two provinces or two countries.

WATER GOVERNANCE

The set of rules, practices and decision- making processes followed to ensure the adequate management of water resources.

WATER MANAGEMENT

The operational approaches used to ensure the adequate allocation, stewardship and flow of water resources.

WATERSHED

Also referred to as a catchment or drainage basin, a watershed is an area of land where all surface water and precipitation (e.g., rain or snow) drain into the same place – be it a creek, as stream, a river, or an ocean.

WEAK SIGNAL

A sign that a significant change is starting or that it could be underway in a particular system. A development that is perceived to have unknown or low probability of occurring and a potentially high disruptive impact if it does occur.

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APPENDIX A: GATINEAU DECLARATION



PRESENTED BY



Fondation
de Gaspé Beaubien
Foundation

IN PARTNERSHIP WITH



ASSOCIATED PARTNER



Gatineau Declaration Towards an Integrated Approach to Sustainable Water Management within the Ottawa River Watershed

The undersigned participants of the Ottawa River Summit, Representing various sectors of society, including municipal governments, First Nations, businesses, provincial and federal agencies and not-for-profit organizations among others,

Having met in Gatineau, Quebec, on May 29, 2015,

Acknowledging that:

The Ottawa River watershed drains an area of 146,300 square kilometres, is the largest tributary of the St. Lawrence River, and has 17 major tributaries of its own,

Further acknowledging that for much of its length the Ottawa River forms a shared boundary for Quebec and Ontario and that the federal government as well as the provincial governments of Quebec and Ontario and many municipalities within the watershed have unique roles and responsibilities to protect ecosystem health within Ottawa River Watershed,

Further acknowledging that First Nations and Métis peoples have an important longstanding relationship with the Ottawa River Watershed,

Recognizing that water is an essential element that sustains and connects all life, has been instrumental in our past development and it is equally the key to our future prosperity,

Further recognizing that within our watershed we have unique and valued biodiversity as well as recreation, tourism and economic development opportunities that require us to manage our freshwater ecosystems effectively,

Further recognizing that the implementation of an integrated approach to watershed management is essential for setting priorities and taking actions to restore and protect the health of the Ottawa River Watershed,

Further recognizing that government, business and civil society all have a stewardship role to play in solving our water challenges and that raising the level of awareness and understanding of water protection issues is essential,

With the goal of developing collaborative, adaptive, and fair solutions to achieve improved water quality and ecosystem health that recognize environmental, social, and economic values,

Adopt the Gatineau Declaration on an Integrated Approach to Sustainable Water Management within the Ottawa River Watershed, which is annexed to this present resolution.



Annex - The Action Agenda

Gatineau Declaration Towards an Integrated Approach to Sustainable Water Management within the Ottawa River Watershed

We, stakeholders with a common interest in the health of the Ottawa River Watershed, assembled at the Ottawa River Summit in Gatineau, Quebec on May 29, 2015, affirm our commitment to work collectively for a healthy and sustainable future for the Ottawa River Watershed.

We acknowledge a shared responsibility to preserve the biodiversity, the quality of our water and the well-being of communities within the Ottawa River Watershed.

We propose to work with all relevant levels of government, business and industry, as well as civil society to:

1. Acknowledge and celebrate the cultural, heritage, and natural values within the Ottawa River Watershed;
2. Create new forums, or adapt existing ones, for integrating and sharing information, research and knowledge about the health of the Ottawa River Watershed, the challenges we face, and potential solutions or best management practices relevant to protecting freshwater ecosystems;
3. Agree on a set of indicators (such as water quality, biodiversity, shoreline integrity, etc.) to monitor and report on river health; and
4. Recognise people, businesses, organizations, and communities who are leading change in our watershed or are implementing projects that foster innovation and promote sustainable river management.

We aim to monitor, review, assess and publicly report on an annual basis on our progress towards the achievement of our action agenda.

We are in agreement that this must be an inclusive process, and will work to involve all governments, organizations and key stakeholders from around the Ottawa River Watershed.



APPENDIX B: POPULATION DEMOGRAPHICS

GENERATION, ETHNIC ORIGINS AND IMMIGRATION

The Ottawa River watershed is made up of diverse communities, and includes individuals who are first, second or third generation or more Canadian. Statistics Canada defines “first generation” as those individuals who were born outside of Canada, and who are now, or once were, immigrants to Canada” (Statistics Canada, 2016). “Second generation” includes persons who were born in Canada and had at least one parent born outside of Canada. “Third generation or more” refers to persons who were born in Canada with both parents also born in Canada. According to respondents of the long-form census, approximately 70% of the population in private households identified themselves as “third generation or more”, 14% identified as “second generation”, while the remaining 16% identified as “first generation” Canadian.

The long-form census questionnaire also collects information on ancestral origins, or what is often referred to as a person’s “roots” (Statistics Canada, 2018b). Statistics Canada notes that “ethnic origin responses are a reflection of each respondent’s perception of their ethnic ancestry. Awareness of family background or length of time since immigration can affect responses to the ethnic origin question as well” (2018b). It should also be noted that in responding, individuals could choose up to six ethnic origins, leading to a greater number of responses than population counts.

For the Ottawa River watershed, Figure B-1 illustrates some of the more frequent responses to the question related to ethnic origin. The majority of respondents identified themselves as North American, a category that includes origins such as Canadian, American, Québécois(es), Newfoundlander, Acadian, etc. The other prominent origins include British Isles, and/or French. Those that identified as North American Indigenous made up approximately 6.6% of the population. Of Indigenous populations, there is little census data distinguishing between community origins, however, 71% identify as First Nations, while 27% are Métis and 2% are Inuit, within the Ottawa River watershed.

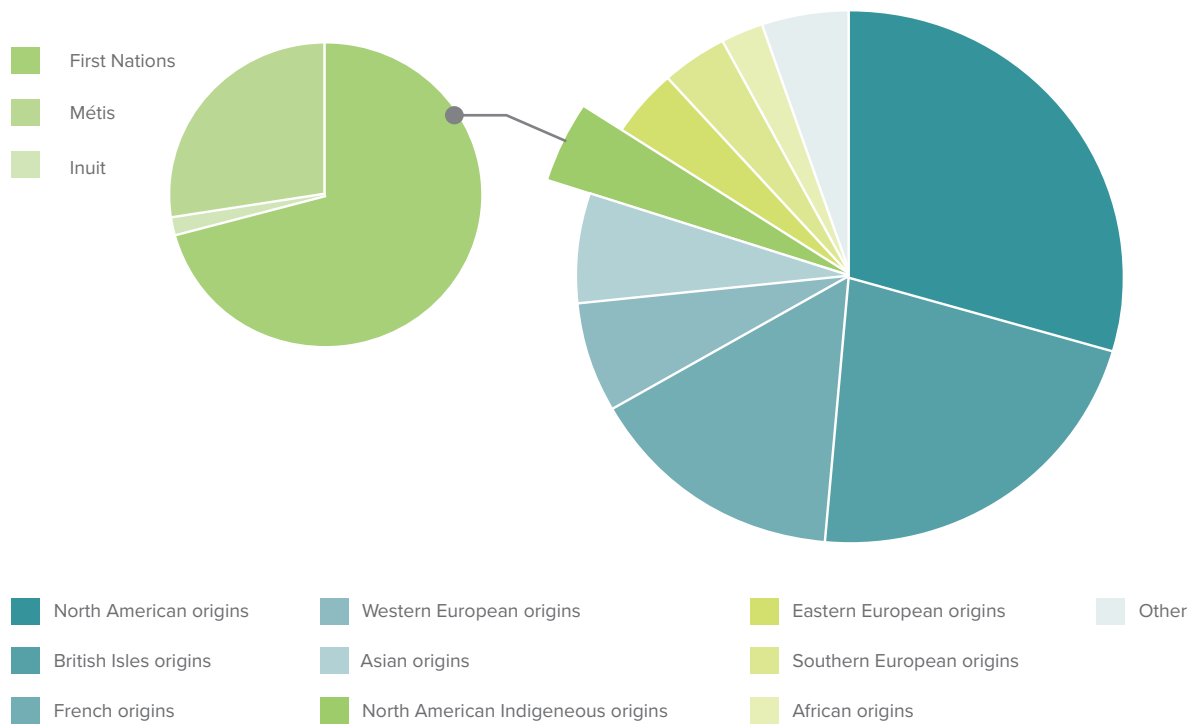


FIGURE B-1. PROPORTION OF CENSUS REPOSSES RELATED TO ETHNIC ORIGIN

The long-form census also asked private households questions related to immigration. Those who have recently arrived, permanent residents, and those that have obtained Canadian citizenship are part of this group (Statistics Canada, 2018b). Approximately 85% of persons located within the Ottawa River watershed that responded to the long-form census, identified as non-immigrants. The remaining 14% identified as immigrants and 1% as non-permanent residents. Of those that identified as immigrants, they were asked for the year in which they first obtained landed immigrant or permanent resident status (Statistics Canada, 2018b). According to the figure below, the majority of the respondents in the Ottawa River watershed arrived in Canada either before 1981 or between 2001 and 2010.

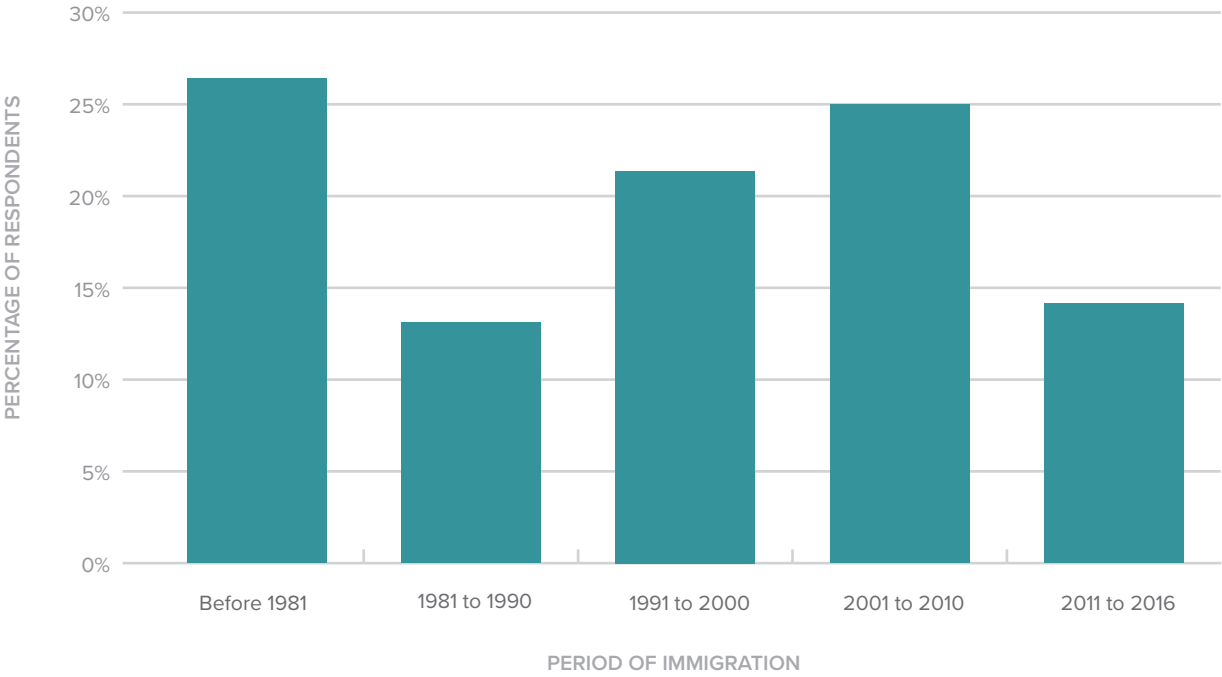


FIGURE B-2. PERIOD OF IMMIGRATION FOR THE POPULATION IN PRIVATE HOUSEHOLDS

Place of birth has been collected in every census since 1981, except for the 2011 Census (Statistics Canada, 2018b). The figure below refers to the place of birth for the immigrant population in private households. The figure is broken down by continent of birth; the blue bars show the total responses, while green represents the responses of “recent” immigrants. “Recent” immigrant refers to a person that immigrated to Canada between 2011 and 2016. The majority of immigration from Europe occurred prior to 2011, while we have seen a greater percentage of immigration from Africa and Asia in recent years. It should be noted that Asia includes Middle Eastern countries, including Syria which makes up 5% of “recent” immigrants.

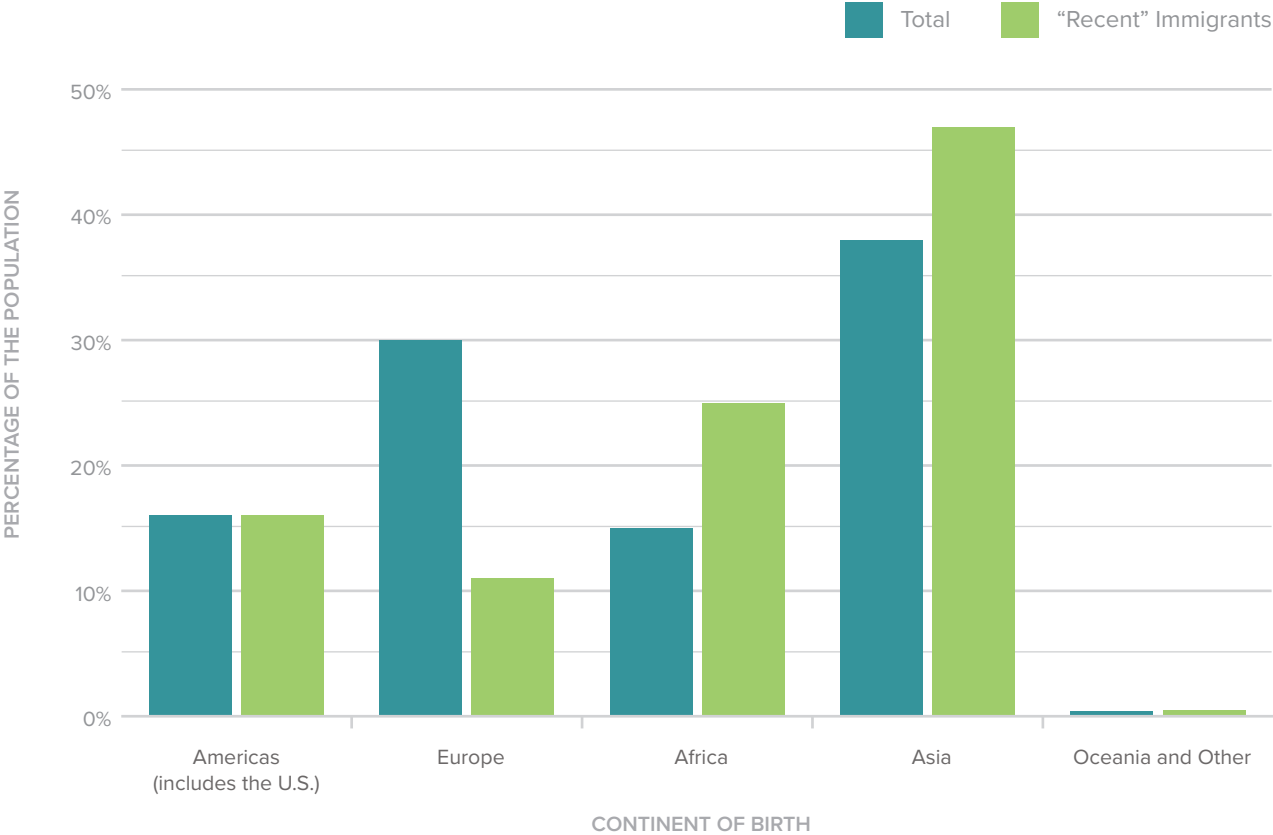


FIGURE B-3. SELECTED PLACES OF BIRTH FOR THE IMMIGRANT POPULATION IN PRIVATE HOUSEHOLDS

HOUSING AND INCOME

According to the housing questions of the long-form census, approximately 69% of respondents in the Ottawa River watershed are home owners and 31% are renters. There is also a very small percentage (0.02%) of respondents that indicated Band housing as their place of residence. The top three residence building types in the watershed include single-detached homes (55% of respondents), followed by apartments in a building that has fewer than five storeys (14%), and row houses (11%).

The average monthly shelter costs for non-farm, non-reserve private owned dwellings is \$1,269; while approximately 62% of owner households have a mortgage, with 14% of owner households spending 30% or more of its income on shelter costs. By comparison, the average monthly shelter costs for rented dwellings in non-farm, non-reserve private dwellings in the watershed is \$972, with 13% of tenant households responded that they are in subsidized housing, and approximately 40% are spending 30% or more of their income on shelter costs.

In 2015, the average total income of one-person private households was \$47,542 (\$39,221 after-tax). By comparison, the average total income in 2015 for two-or-more private households was \$108,924 (\$89,444 after tax).

Statistics Canada also categorizes income by “economic family”, which is a group of two or more persons who live in the same dwelling and are related to each other by blood, marriage, common-law union, adoption or a foster relationship (Statistics Canada, 2016). The figure below shows the average total economic statistics of income and average family size for economic families, economic families without children or other relatives, economic families with children, and lone-parent economic families. As you can see, in 2015, economic families with children have both the highest average total income (\$137,587) and highest average family size (4 people).

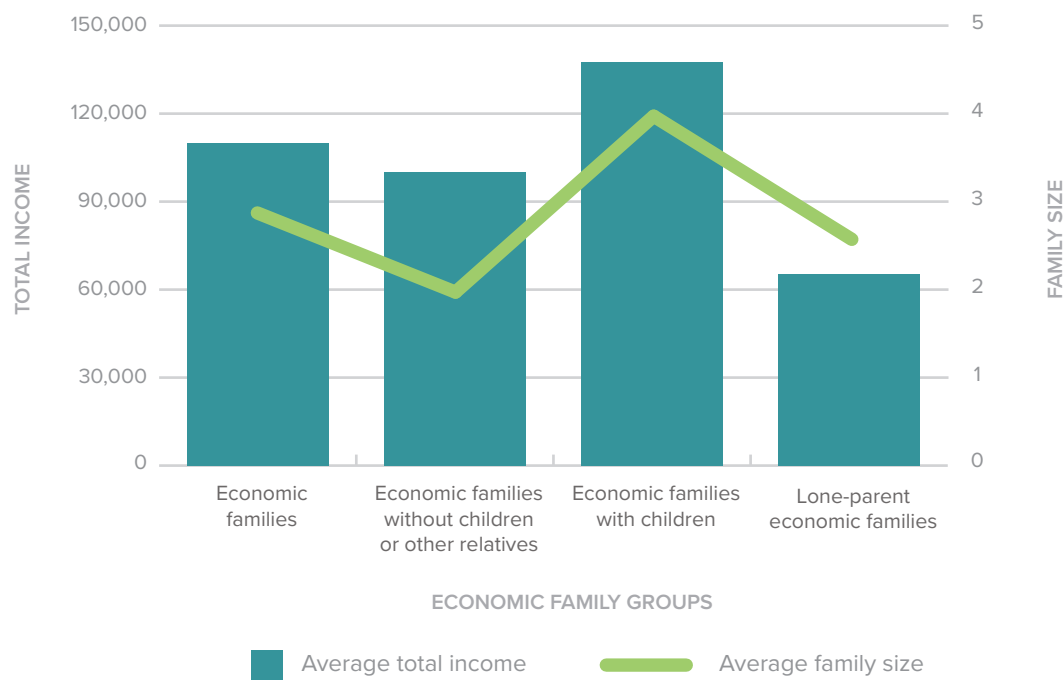


FIGURE B-4. 2015 ECONOMIC STATISTICS FOR ECONOMIC FAMILIES

When income is broken down by gender and income group, it was found that more female respondents are making less than \$10,000 to \$49,999 a year when compared to male respondents, while more male respondents are making from \$50,000 to over \$100,000 than female respondents. In particular, 60% of respondents earning between \$10,000 and \$19,999 are female and nearly 70% of respondents earning \$100,000 and over, are males.



FIGURE B-5. TOTAL INCOME GROUPS IN 2015 FOR THE POPULATION AGED 15 YEARS AND OVER

EDUCATION, EMPLOYMENT AND WORKFORCE

The graph below depicts the highest certificate, diploma or degree earned for the sample population, aged 25 to 64 years, in private households. Approximately 11% of the population in the Ottawa River watershed do not have a certificate, diploma or degree, 21% have a high school diploma or equivalent, while 68% of the population have a postsecondary certificate, diploma or degree of some kind. The highest number of respondents have a college or university certificate. According to the Census data, 61% of those with Apprenticeship or trades certificates are males, while the majority of respondents with College, CEGEP or other non-university certificates (56%), University certificates below a bachelor (59%), and University certificates/diplomas at a bachelor level or higher (55%) were earned by females in the watershed.

If you were to break down the university certificate/diploma/degree at a Bachelor’s degree or higher, the majority of degrees earned for the population in the watershed are Bachelor’s degrees and Master’s degrees. Approximately 57% of respondents with a bachelor’s degree are female, while 60% of those that have a doctorate are males.

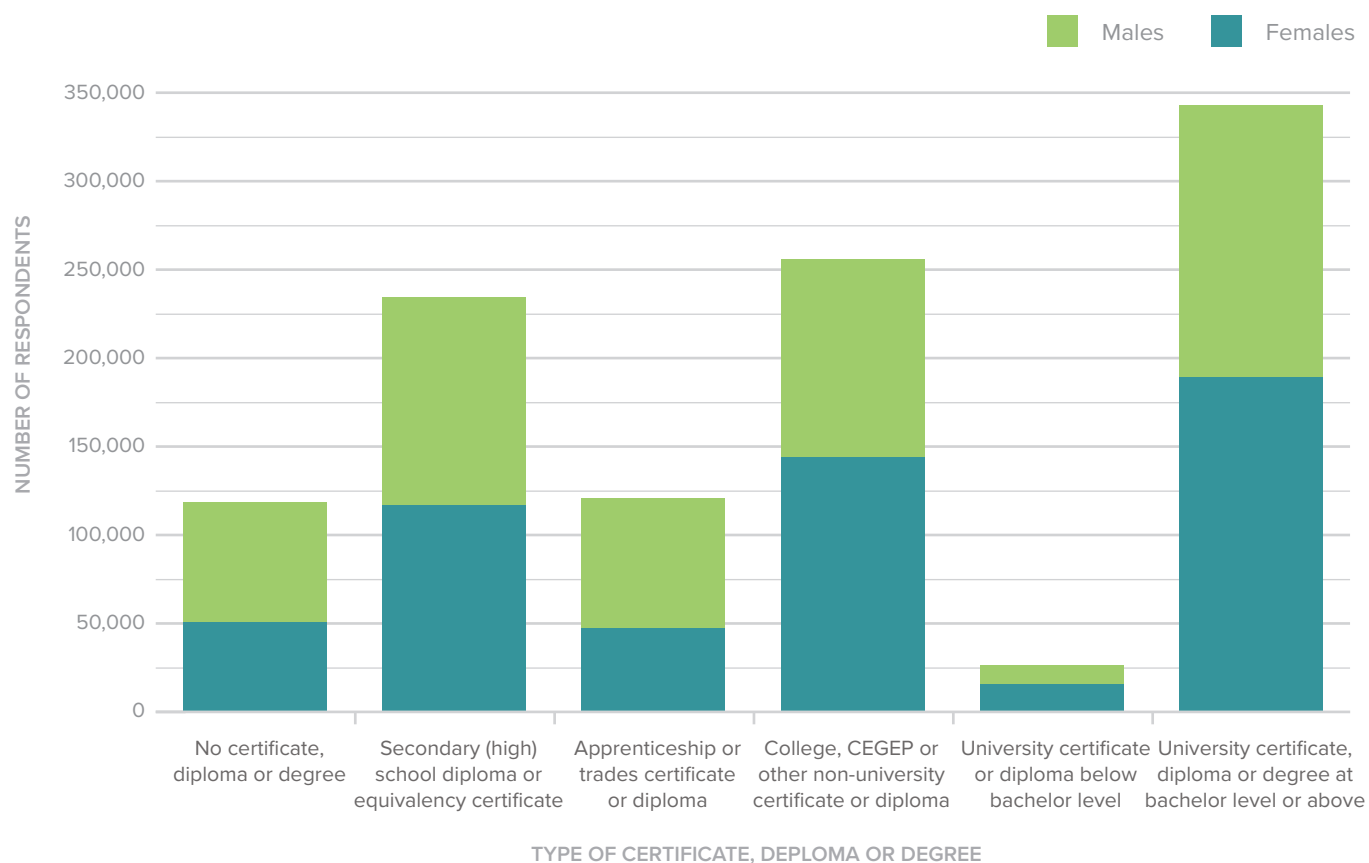


FIGURE B-6. HIGHEST CERTIFICATE, DIPLOMA OR DEGREE EARNED FOR THE POPULATION AGED 25 TO 64 YEARS IN PRIVATE HOUSEHOLDS

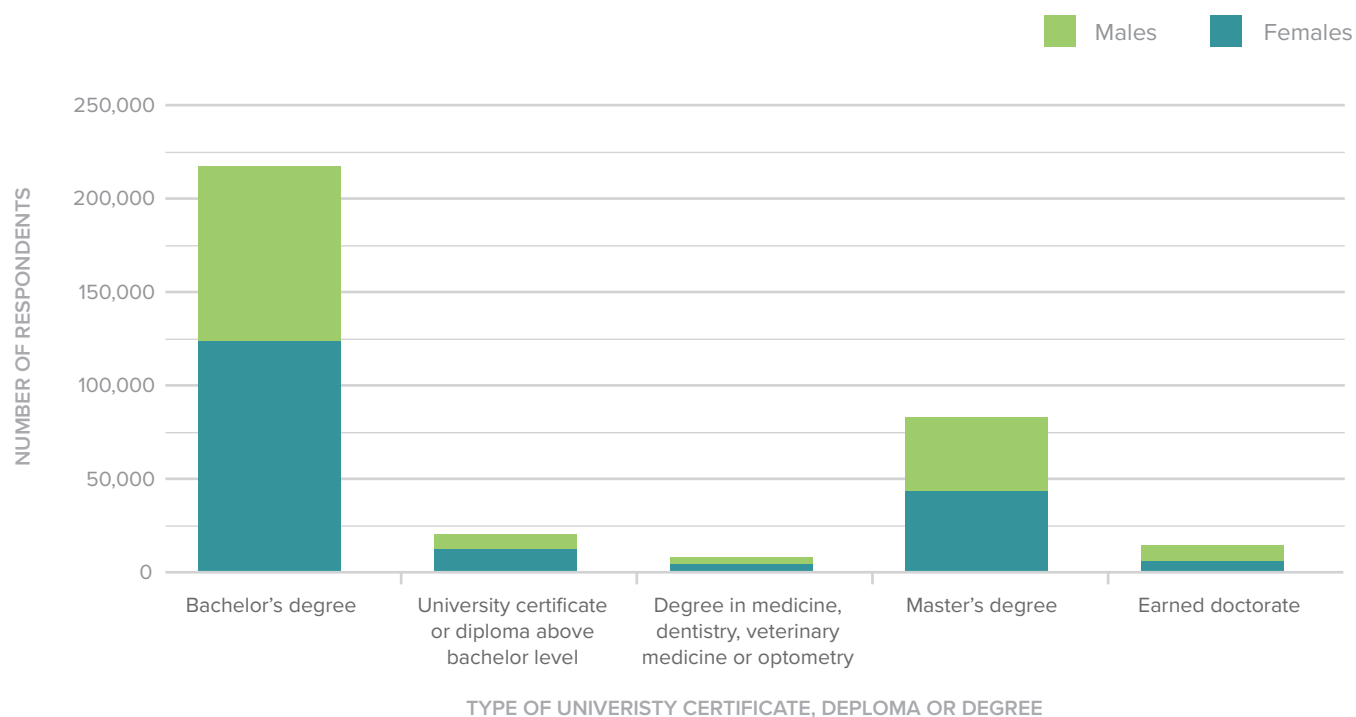


FIGURE B-7. HIGHEST UNIVERSITY CERTIFICATE, DIPLOMA OR DEGREE EARNED FOR THE POPULATION AGED 25 TO 64 YEARS IN PRIVATE HOUSEHOLDS

The top 5 fields of study (Figure B-8) for respondents in the watershed are: 1) business, management, and public administration; 2) architecture, engineering, and related technologies; 3) social and behavioural sciences and law; 4) health and related fields; and 5) personal, protective and transportation services. The information indicates that more females than males studied the following:

- Education
- Humanities
- Social and behavioural sciences and law
- Business, management and public administration
- Health and related fields

More male respondents, than female respondents, studied the following:

- Mathematics, computer and information sciences
- Architecture, engineering and related technologies
- Agriculture, natural resources and conservation

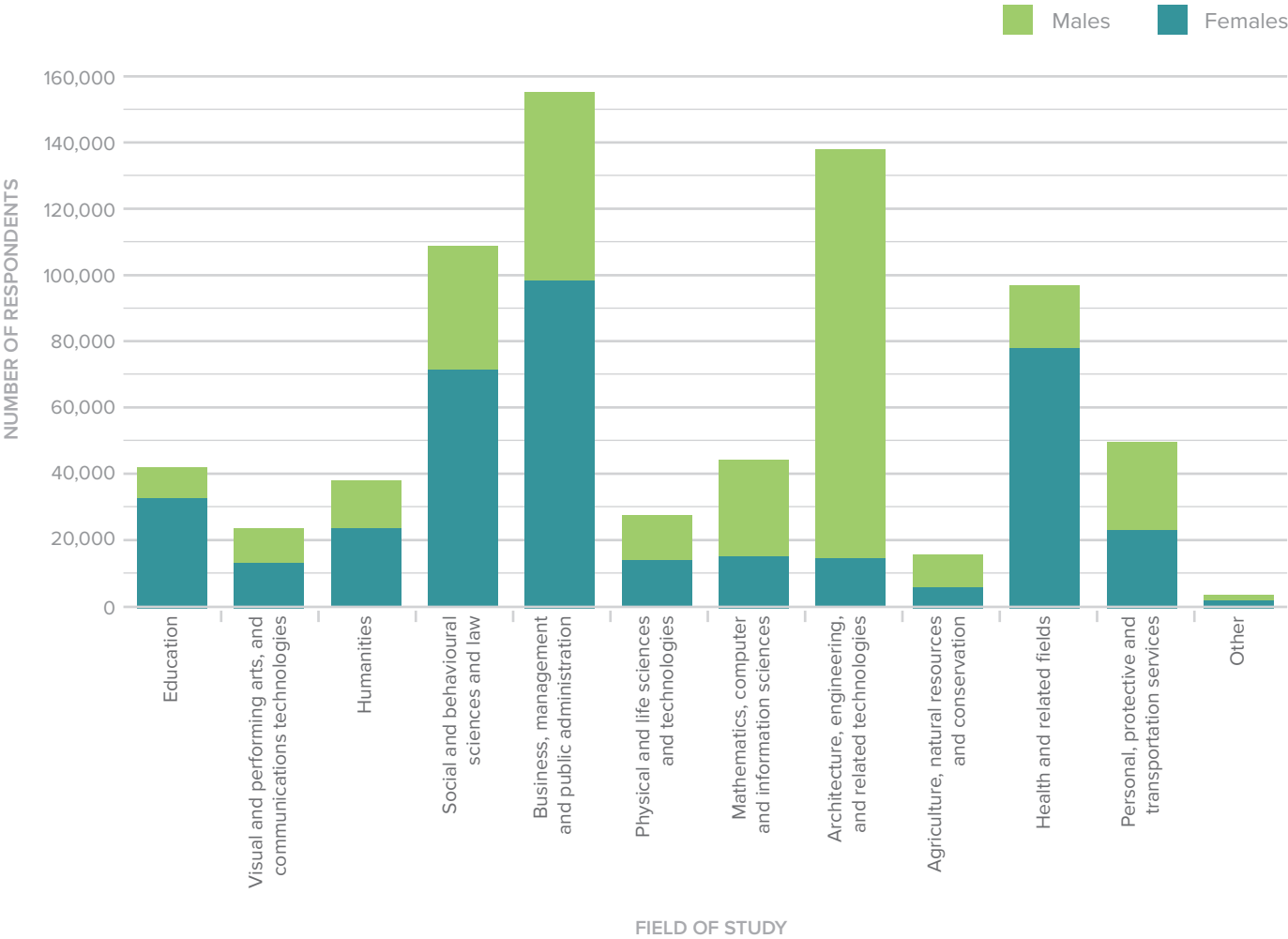


FIGURE B-8. FIELD OF STUDY FOR THE POPULATION AGED 25 TO 64 YEARS IN PRIVATE HOUSEHOLDS

The Statistics Canada data shows that the Ottawa River watershed has an unemployment rate of 7.2% (6.5% for females, and 7.9% for males in the population). The Census question related to the occupation of the labour force population aged 15 years and over, indicates that the top occupations for respondents are:

- Sales and service
- Business, finance and administration
- Education, law and social, community and government services

The bullets listed above are also the top occupations for females in the sample population. The top occupations for males are:

- Natural resources, agriculture and related production occupations
- Sales and service
- Management
- Natural and applied sciences and related occupations

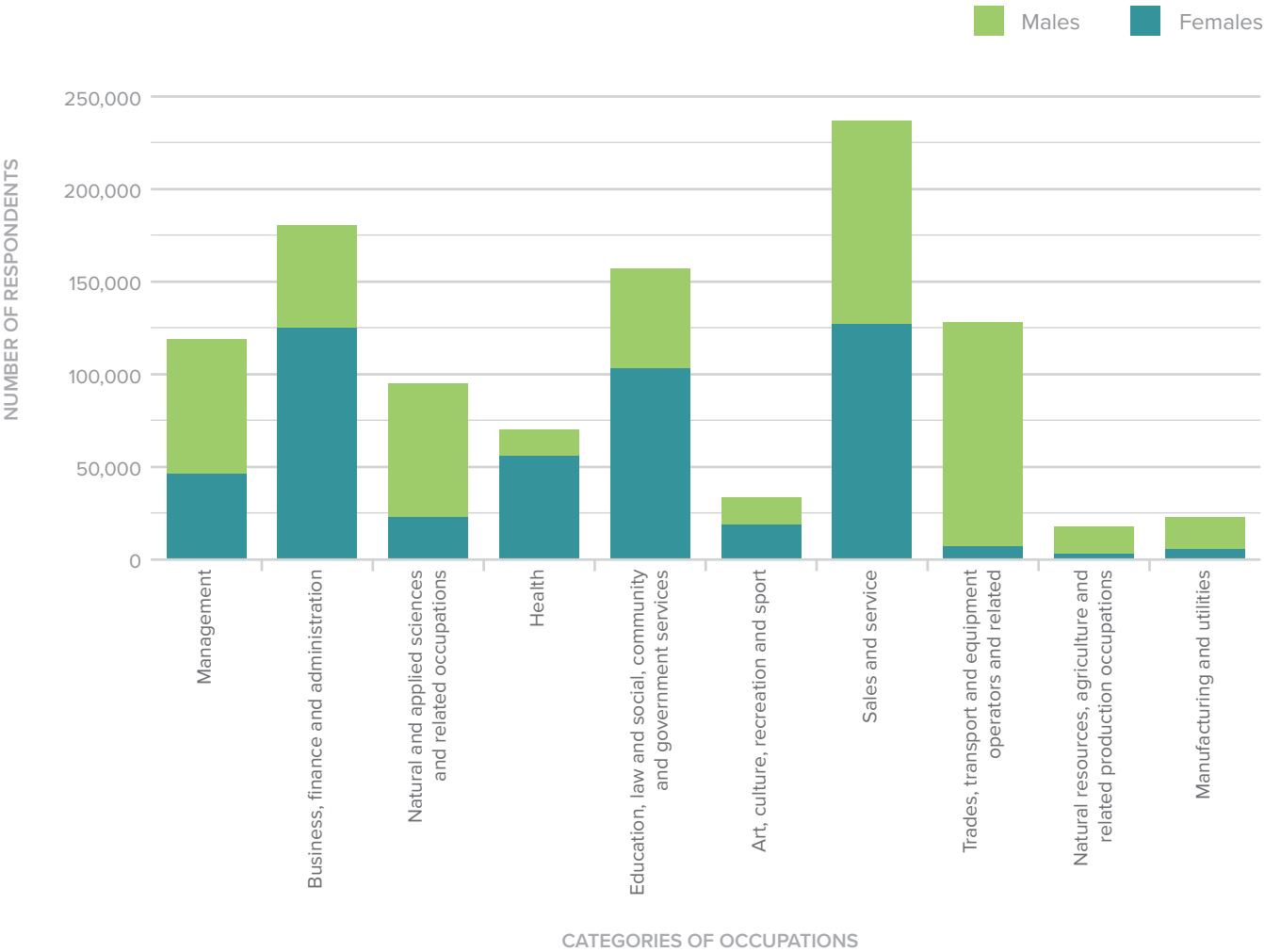


FIGURE B-9. LABOUR FORCE POPULATION AGED 15 YEARS AND OLDER, BY OCCUPATION

The long-form census also examined the labour force population, aged 15 years and over, by industry. Top three industries in the Ottawa River watershed, based on the sample population, are the retail trade, health care and social assistance, and public administration. There is a near 50/50 split in terms of males and females in the retail industry, as well as public administration. There are, however, a significantly higher amount of female respondents in the health care and social assistance field than males (approximately 82%).

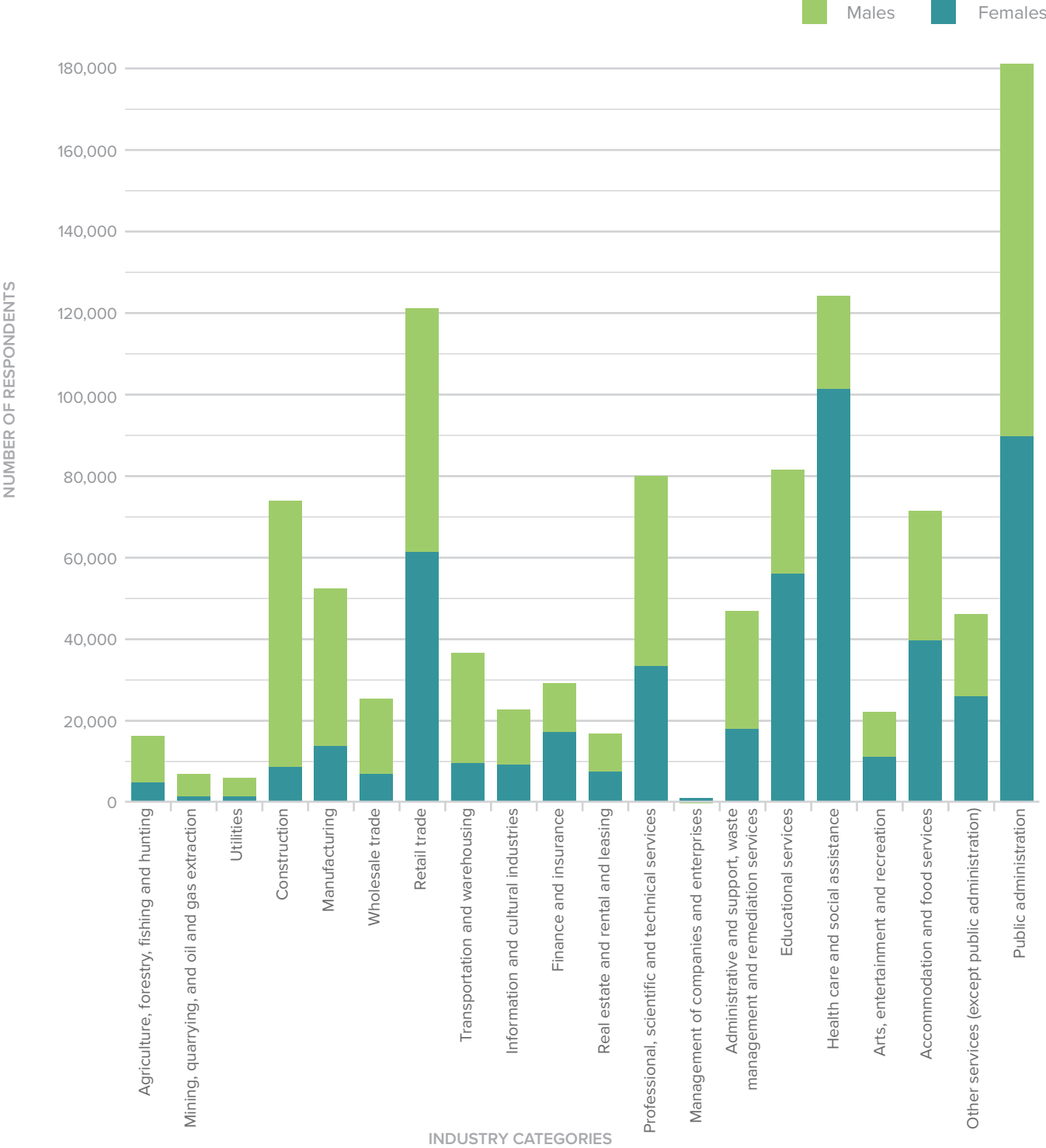


FIGURE B-10. LABOUR FORCE POPULATION AGED 15 YEARS AND OVER, BY INDUSTRY

APPENDIX C: ENGAGEMENT AND CONSULTATION

In order to reach as wide and diverse an audience as possible, ECCC developed a broad Indigenous, stakeholder and public engagement approach, encompassing approximately 400 diverse groups and affiliations, including Indigenous organizations, industry and business, non-governmental organizations, researchers and academics, community-based organizations, cultural, ethnic and faith-based organizations, persons with disabilities, youth, and Canadian watershed organizations. Key government departments and agencies were also targeted, including the provincial governments of Ontario and Québec, municipalities and counties, CAs, OBVs, and federal departments.

Not all of the approximately 400 groups and affiliations that were contacted provided input, and for privacy reasons, individuals that provided input through PlaceSpeak are not identified in the list below. Groups that provided input through emails submitted to the Study email account, engagement guides, reports, workshops, meetings, presentations and webinars are included in the list below.

INDIGENOUS ORGANIZATIONS (FORMALLY CONSULTED)	FEDERAL DEPARTMENTS AND AGENCIES
Algonquin Anishinabeg Nation	Agriculture and Agri-Food Canada
Algonquin Nation Secretariat	Canadian Nuclear Safety Commission
Algonquins of Ontario	Crown-Indigenous Relations and Northern Affairs Canada
Métis Nation of Ontario	Environment and Climate Change Canada
Mohawk Council of Kahnawá:ke	Fisheries and Oceans Canada
Mohawk Council of Kanesatake	Health Canada
	Infrastructure Canada
	Innovation, Science and Economic Development Innovation Lab
	Library and Archives Canada
	Natural Resources Canada
	National Capital Commission
	Parks Canada
	Policy Horizons Canada
	Public Services and Procurement Canada
	Statistics Canada
	Transport Canada
INDIGENOUS ORGANIZATIONS (INFORMAL MEETINGS)	
Ardoch Algonquin First Nations and Allies	
Dokis First Nation	

PROVINCIAL GOVERNMENTS

Province of Ontario
(MOECP coordinated with implicated Ministries)

Province of Québec
(MELCC coordinated with implicated Ministries)

INTERGOVERNMENTAL BOARD/COMMITTEE

Ottawa River Regulation Planning Board

Québec – Ontario Water Management
Joint Directors Committee

MUNICIPALITIES - ONTARIO

City of Ottawa

County of Renfrew

Laurentian Valley

Madawaska Valley

Petawawa

United Counties of Prescott-Russell

MUNICIPALITIES - QUÉBEC

MRC du Témiscamingue

MRC La Vallée-de-l'Or

MRC Les Collines-de-l'Outaouais

MRC les Pays-d'en-Haut

MRC Matawinie

MRC Vaudreuil-Soulanges

Municipalité d'Oka

Ville de La Tuque

Ville Mirabel

CONSERVATION AUTHORITIES (CAs)- ONTARIO

Mississippi Valley

North Bay-Mattawa

Rideau Valley

South Nation

ORGANISMES DE BASSINS VERSANTS (OBVs) - QUÉBEC

Comité du bassin versant de la rivière du Lièvre (COBALI)

Conseil des bassins versants des Mille-Îles (COBAMIL)

Conseil du bassin versant de la région de
Vaudreuil-Soulanges (COBAVER-VS)

Organisme de bassin versant du Témiscamingue (OBVT)

Organisme de bassins versants des rivières Rouge,
Petite Nation et Saumon (OBVRPNS)

INDUSTRY ASSOCIATIONS AND BUSINESSES

A-MAPS Environmental

Brookfield Energy

Canadian Nuclear Laboratories

Forest Products Association of Canada

Fortress Cellulose spécialisée

Hydro Québec

Ontario Power Generation

Résolu Produits Forestiers

NON-GOVERNMENTAL ORGANIZATIONS (NGOs)

Institute de Recherche en Histoire Maritime
et Archéologie subaquatique

Kipawa Lake Preservation Society

Lac Saint-François Xavier Association

Let's Talk Science

Nature Conservancy of Canada

Ottawa Riverkeeper

Vankleek Hill and District Nature Society

World Wildlife Fund-Canada

CANADIAN WATERSHED BODIES OUTSIDE OF OTTAWA RIVER WATERSHED

Bras d'Or Lakes Collaborative Environmental
Planning Initiative

Clean Annapolis River Project

Coquitlam River Watershed Roundtable

Fraser Basin Council

Mackenzie River Basin Board

Muskoka Watershed Council

Muskrat Watershed Council

Nashwaak Watershed Association Inc.

PEI Watershed Alliance

Prairie Provinces Water Board

PUBLIC ENGAGEMENT

Email Submissions

PlaceSpeak

UNIVERSITIES AND NETWORKS

Canadian Water Network

Carleton University

Queen's University

York University

YOUTH

Blue Sky Academy

St. Lawrence Academy

The Starfish Canada

APPENDIX D:

INDIGENOUS CONSULTATION STRATEGY

OBJECTIVE

The purpose of Indigenous consultation for the ORWS was to identify and reflect, in the study, the concerns and interests of Indigenous peoples regarding the Ottawa River watershed, as per Motion M-104. ECCC consulted with Indigenous organizations and communities in Québec and Ontario, and provided recommendations which reflect the rights and related interests of the Indigenous peoples in the region.

Indigenous consultation focused on the following goals:

1. Understand perspectives on the ecological significance of the Ottawa River watershed and existing measures to conserve and protect key ecosystems including, but not limited to, threats to water quality and quantity, as well as to species biodiversity and their habitats;
2. Understand historical, cultural, spiritual, and heritage significance of the Ottawa River watershed for Indigenous peoples;
3. Understand perspectives on existing governance structures for the management of the watershed;
4. Understand perspectives on whether an Ottawa River Watershed Council should be established, including the potential purpose, mandate, structure, and membership of such a Council; and
5. Seek the participation of Indigenous peoples in other engagement activities involving non-Indigenous organizations.

DUTY TO CONSULT

ECCC views the study on the Ottawa River Watershed as a standalone decision by Parliament which does not trigger the legal duty to consult due to the absence of adverse impacts on potential or established Aboriginal or treaty rights. When considered as part of a continuum of decisions that may ultimately result in restrictions regarding the uses or governance of the Ottawa River watershed, the study could be considered a “strategic, higher-level decision” which may give rise to a legal duty to consult.

Depending on its mandate and the authorities conferred to it, a Council could create future adverse impacts on potential or established Aboriginal or treaty rights. It was therefore recommended that ECCC consult meaningfully with the appropriate Indigenous communities and organizations at the outset of the study as a matter of good governance and policy.

CONSULTATION APPROACH AND DESIGN

ECCC was committed to carrying out a meaningful consultation process that respected the uniqueness of the Crown's relationship with Indigenous peoples and Canada's commitment to implementing the United Nations Declaration on the Rights of Indigenous Peoples. As a result, Indigenous consultation was distinct, meaningful, and robust.

More specifically, ECCC applied the following principles when consulting Indigenous peoples:

- **TIMELINESS, EFFICIENCY AND RESPONSIVENESS** – ECCC conducted consultation activities and shared all relevant information early and consistently to provide adequate time for Indigenous communities to understand the purpose of the study; ECCC adapted the consultation process when needed; and ECCC meaningfully integrated Indigenous peoples' perspectives in the study.
- **TRANSPARENCY AND PREDICTABILITY** – ECCC shared updates with Indigenous organizations about the progress of the study and incorporated their input in the resulting report. As well, ECCC invited Indigenous organizations and communities to participate in engagement activities with other stakeholders.
- **ACCESSIBILITY, REASONABLENESS, FLEXIBILITY AND FAIRNESS** – ECCC considered providing capacity support to Indigenous nations and communities on a case-by-case basis to facilitate a meaningful exchange of information. ECCC shared information related to the study in plain language, and in both English and French. ECCC's approach to consultation allowed for flexibility in timelines and the format of consultation activities.
- **GOOD FAITH, RESPECT AND RECIPROCAL RESPONSIBILITY** – ECCC undertook genuine efforts to understand, seriously consider, and reflect Indigenous peoples' interests and concerns in the study. Information gathered through consultation activities was used and shared in ways deemed appropriate by each Indigenous nation or community, as appropriate.
- **RESPECT FOR THE UNIQUENESS OF EACH COMMUNITY** – Recognizing that today's events are part of a long-lasting and ongoing nation-to-nation relationship between Indigenous peoples and the Crown, ECCC consulted with each Indigenous nation or community separately, unless otherwise requested, and adapted the consultation process according to their preferences.
- **ACCOMMODATION, WHERE APPROPRIATE** – ECCC undertook genuine efforts to ensure consultation with Indigenous peoples adequately addressed concerns raised by the communities.

ECCC relied on existing relationships and networks established between Indigenous organizations and the Québec and Ontario regional offices to initiate consultation. The consultation approach was flexible. Organizations and communities were asked how they wished to be consulted and ECCC tailored the process where possible to meet specific requests. In instances where Indigenous organizations had consultation policies, protocols, or agreements in place, ECCC followed them to the best of its ability, unless otherwise specified by each respective Indigenous organization.

Where relationships or mechanisms for consultation did exist between ECCC and Indigenous organizations, it was recommended that ECCC initiate consultation at the Nation or Council level, as appropriate, rather than at the community or reserve level. See A list of Indigenous organizations and communities that were contacted can be found later in this strategy.

Indigenous peoples were also invited to participate in engagement sessions that involved non-Indigenous organizations to encourage dialogue and collaboration across interest groups. As a complement to the consultation sessions, an online platform was available to anyone who wanted to provide comments on the study, including Indigenous peoples.

REQUESTS FOR SUPPORT

It was expected that Indigenous organizations and communities would request financial support to participate in the consultation process for the study. Although ECCC is operating under the assumption that this is not a legal duty to consult at this time, Canada's *Guidelines for Federal Officials to Fulfill the Legal Duty to Consult* provide the following reference list of potential capacity areas which financial support has been provided to Indigenous communities and organizations in the context of consultation:

- Information-sharing and awareness-raising;
- Participation at meetings including honorarium for elders and others;
- Travel costs;
- Preparation of scientific, technical, and legal reviews to provide advice in relation to the consultation;
- Analysis and reporting related to potential impacts on potential or established Aboriginal or treaty rights and related interests;
- Professional fees (for example, for facilitation, writing of documents, translation, and interpretation);
- Communications and printing;
- Research and development;
- Land use, traditional knowledge and use, or targeted resource planning, management, and implementation; and
- Administrative fees.

ECCC assessed whether financial support should be provided and the extent of that support on a case-by-case basis, as the need arose.

TIMELINE AND MILESTONES FOR CONSULTATION (AUGUST 2017-DECEMBER 2018)

ECCC, to the best of its ability, consulted early and often with Indigenous communities and organizations to allow for the maximum amount of time for their input to be formulated, shared, considered, and discussed with ECCC.

More detailed timelines were established for the Indigenous consultation process once initial discussions regarding design occurred with Indigenous organizations. The following milestones were instrumental to the process:

- Participation in the federal Interdepartmental Québec-Ontario Network on Aboriginal Consultation (May 2017)
- Initial notification letters requesting consultation (August 2017)
- Follow-up phone calls with groups that did not respond and discussion about how best to engage (September-November 2017)
- First in-person meetings (November 2017-May 2018)
- Workshop with Indigenous participation (November 2017)
- Follow-up meetings, including those with working level contacts (February 2018 -June 2018)
- Shared preliminary draft of the final report with the consulted organizations (August 2018)
- Integration of additional input and preparation of final report (August 2018 -December 2018)

INDIGENOUS ORGANIZATIONS CONTACTED

INDIGENOUS ORGANIZATIONS AND COMMUNITIES THAT RECEIVED CONSULTATION LETTERS:

IN ONTARIO:

- Algonquins of Ontario, which includes:
 - Pikwakanagan (Golden Lake)
 - Antoine
 - Snimikobi
 - Bonnechere
 - Greater Golden Lake
 - Kijicho Manito Madaouskarini (Bancroft)
 - Mattawa/North Bay First Nation
 - Ottawa
 - Shabot Obaadjiwan (Sharbot Lake)
 - Whitney and Area
- Matachewan
- Beaverhouse
- Dokis
- Nipissing
- Temagami
- Wahgoshig
- Wahnapiatae
- Métis Nation of Ontario

IN QUÉBEC:

- Algonquin Anishinabeg Nation
- Algonquin Nation Secretariat
- Kitcisakik
- Abitibiwinni (Pikogan)
- Wolf Lake
- Kitigan Zibi
- Winneway
- Barriere Lake (Rapid Lake)
- Lac-Simon
- Timiskaming
- Kebaowek (Eagle Village)
- Mohawk Council of Kahnawà:ke
- Kanesatake
- Akwesasne

INDIGENOUS ORGANIZATIONS THAT WERE SENT LETTERS OF INFORMATION ABOUT THE CONSULTATION:

- Chiefs of Ontario
- Assembly of First Nations
- Congress of Aboriginal Peoples
- Métis National Council
- Native Women's Association
- Institut de développement durable des Premières nations du Québec et du Labrador

APPENDIX E:

GENDER-BASED ANALYSIS PLUS STRATEGY

OVERVIEW AND BACKGROUND

Gender-Based Analysis Plus (GBA+) is a method for examining the intersection of sex and gender with other identity factors like race, ethnicity, religion, age, and mental or physical disability. GBA+ recognizes the complex nature of identity and status for women, men and gender-diverse people, and reassesses the notion that gender is the only form of discrimination. Its purpose aims to foster an understanding of how women, men and gender-diverse people experience public policy and ensures that policies and programs have fair and intended results across the population. Analysis is conducted during the development, implementation, assessment, and monitoring of policies/programs/projects. GBA+ requires that a diversity of the intersections of identities actively participate in the design and implementation of environmental initiatives. For more information, see Figure E-1 below.

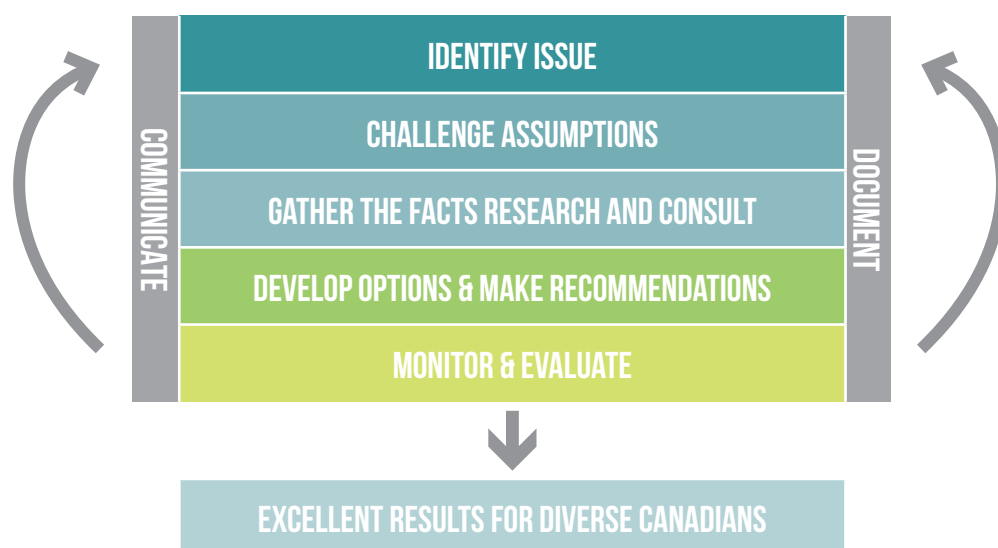


FIGURE E-1. GBA+ DEVELOPMENT AND ANALYSIS CYCLE

For the purpose of the ORWS, GBA+ helped ECCC understand how a diversity of Canadians experience the Ottawa River watershed. This included considering the impacts of potentially altering watershed management in the region, and approaches to mitigate or eliminate any differential impacts associated with related policy changes. In addition, where possible, intersecting identity factors were considered as these individuals may be more susceptible to negative impacts.

STUDY CONTEXT

Private Member's Motion M-104 brought forward by the Honourable David McGuinty proposed that a study be undertaken on the Ottawa River watershed. It was passed on May 3, 2017. See Chapter 1 for more information on the study background.

A summary of the population demographics can be found in sub-section 1.2 of the report, with a detailed summary found in Appendix B. Gathering of demographic data and sex disaggregated data is integral to the GBA+ process, as it provides information on the diverse people that rely on the watershed.

FACT GATHERING AND CONSULTATION: OTTAWA RIVER WATERSHED GBA+ STAKEHOLDERS (FALL 2017 – SPRING 2018)

Identification of diverse stakeholder groups was an iterative process. During the initial phase of stakeholder identification, various groups were selected based on review of existing research, news, reports and historical documents focused on the watershed. Stakeholder lists were updated frequently, and added upon, based on further research and recommendations by existing stakeholder groups. For information on the Indigenous consultation for this Study, please see Appendix D.

MULTIPLE LEVELS OF GOVERNMENT: Federal, provincial, and municipal governments all hold mandated jurisdiction over various aspects of management within the watershed. Additionally, other institutions such as Conservation Authorities, Organismes de Bassins Versants, and the Ottawa River Regulation Planning Board have roles to play (see section 1.3 for more information).

INDIVIDUALS: People experience, benefit from, value and use the watershed to varying degrees. Common uses include recreation, drinking water, and ecosystem services (see section 5.1 for more information). Recreationally, the public uses and benefits from the river's scenic views, forests, camping, boating, hiking skiing, ice fishing, paddling and swimming, among other activities (ORHDC, n.d.). Some rely on it for small scale consumption, others benefit from the employment opportunities it brings, and many live along the banks year round or seasonally (ORHDC, 2005).

COMMUNITY GROUPS: Such groups are integral to bringing together interested individuals to address and manage specific projects. For example, community groups campaigned to have formal recognition of the Ottawa River as a Canadian Heritage River (ORHDC, 2005). Community efforts also: foster sustainable communities in the watershed, as seen with food cooperatives and community associations; protect and serve the public through fire and emergency services; conduct research and analysis on the state of the river and its watershed; and encourage wide-ranging forms of tourism.

INDUSTRIES: Businesses and their associations see the Ottawa River as an important economic engine (see section 5.1.1 for more information on economic values). Energy (hydroelectricity and nuclear), agriculture, forestry and pulp and paper, mining, and peat moss are just some of the industries that are part of the watershed and benefit from and use the Ottawa River.

YOUTH: Future generations require a healthy environment to maintain a quality of life as at present time. Current climate change and population growth projections illustrate a rapidly changing environment. It is therefore important that the environment be stewarded in a way that does not compromise the watershed for future generations.

ACADEMIA: Several universities and research institutions are located within the watershed, many of which research aspects of the watershed (see Chapter 4 for more information on data and monitoring in the watershed). Scientific research and data collection assist in providing peer reviewed knowledge regarding the various components that make up the region.

PUBLIC ENGAGEMENT AND GBA+

A. BACKGROUND

Engaging women, men and gender-diverse people helped to determine how they experience, benefit from, value and use the Ottawa River watershed. This engagement also informed how to enhance collaboration in the Ottawa River watershed. Other identity-based, economic, and social interest groups also had relevant perspectives to share. Reasonable efforts were made to ensure that all views within the community were adequately canvassed.

B. THE OTTAWA RIVER WATERSHED STUDY'S ENGAGEMENT APPROACH

PURPOSE

The purpose of the Ottawa River Watershed Study was to examine: 1) identify barriers to effective management of the Ottawa River watershed, as well as opportunities to enhance watershed collaboration moving forward; 2) explore existing and potential indicators for assessing the health of the Ottawa River watershed; 3) examine the economic, cultural, heritage and natural values associated with the Ottawa River watershed, including possible threats to those values.

OBJECTIVES

- To raise awareness about the Ottawa River Watershed Study;
- To create opportunities for stakeholders to engage with and learn from each other;
- To allow for a comprehensive and meaningful process, in order to hear from a diverse set of voices;
- To gather existing information and data and highlight gaps, regarding the health of and threats to, the values of the Ottawa River watershed; and
- Gather information and perspectives related to watershed management.

EXPECTED OUTCOMES

- Accurate and up-to-date input provided on data, monitoring and potential watershed health indicators, including possible information gaps;
- Input provided on the values of the Ottawa River watershed;
- Evidence and input from key players and stakeholders to inform analysis of the need for a collaborative body, including its potential mandate, structure and membership; and
- ECCC included the perspectives and input of diverse groups throughout the study process.

C. ENGAGEMENT SCOPE

A wide diversity of user groups who benefit from, value and use the Ottawa River watershed were engaged. An effort was made to remove potential obstacles to participation to ensure full diversity of voices in the engagement process.

D. ENGAGEMENT APPROACH

A multi-pronged engagement approach was used to reach the diverse stakeholder groups within the Ottawa River watershed. This included, but was not be limited to:

1. **Engagement of individuals:** Through the use of the online, public engagement platform, PlaceSpeak.
 - The platform was advertised through multiple emails, as well as through social media, face to face meetings and other events.
 - Participants were encouraged to give feedback through discussion questions, polls, and a noticeboard from January 25 – April 27, 2018.
 - Individuals were sent to the Study's PlaceSpeak website through the Government of Canada's Consulting Canadians website.
2. **Target groups:** Through the use of workshops, open door events, university, high school and middle school visits, webinars, tailored engagement guides and email exchanges.

A more detailed summary of the public engagement and Indigenous consultation process can be found in Chapter 2 of the report and Appendix D.

E. TARGET GROUPS

The target groups for engagement included: Indigenous peoples; individuals; industry associations and businesses; non-government organizations; research institutes and academics; community associations and interest groups; cultural, ethnic, faith-based organizations; organizations for people with disabilities; youth organizations; municipalities and counties; watershed organizations, including Conservation Authorities in Ontario and Organismes de bassins versants in Québec; and provincial and federal government departments.

F. ENGAGEMENT METHOD

Engaging stakeholders on GBA+ took place in various ways, in order to enhance opportunities and access for participants. It included offering both in-person and online engagement opportunities during the information gathering and planning phase and following-up with these groups once an approach had been determined and implemented.

TARGET GROUP	METHOD	ACCESSIBILITY
Government Departments, Ministries and Agencies	<ul style="list-style-type: none"> Workshops Tailored engagement guides Presentations 	<ul style="list-style-type: none"> Tailored engagement guides and materials were provided in the desired official language. Roughly a month given to complete each guide. Presentations provided in both official languages
Individuals	<ul style="list-style-type: none"> PlaceSpeak Emails Mailing address Open door events Consulting Canadians website 	<ul style="list-style-type: none"> PlaceSpeak was available in both official languages. PlaceSpeak meets a conformance level of AA according to Web Content Accessibility Guidelines Users were encouraged to contact a purpose-built email account or the ECCC Study mailing address regarding concerns or information that they didn't want to post publically. All emails were answered in 3 business days. Open door events occurred in both official languages and in both Ontario and Québec. Meeting locations were central, and wheelchair accessible. Other accommodations, such as hearing impairment, were addressed as they arose.
Community Interests	<ul style="list-style-type: none"> Joint workshops PlaceSpeak Emails Mailing address Open door events Tailored engagement guides Consulting Canadians website 	<ul style="list-style-type: none"> A workshop was jointly organized to encourage participation by interested groups. PlaceSpeak was made available in both official languages. Users were encouraged to contact a purpose-built email account or the ECCC Study mailing address regarding concerns. All emails were answered in 3 business days. Open door events occur in both official languages and in both provinces. Meeting locations to be central, and wheelchair accessible Tailored engagement guides were provided in the desired official language. Roughly a month given to complete each guide.
Industry	<ul style="list-style-type: none"> Email exchanges Tailored engagement guides 	<ul style="list-style-type: none"> Tailored engagement guides were provided in the desired official language. Roughly a month given to complete each guide.
Youth	<ul style="list-style-type: none"> Classroom visits 	<ul style="list-style-type: none"> Classrooms were visited to engage directly with youth. Lessons and feedback were prepared to suit various learning styles. Depending on age, youth were encouraged to visit PlaceSpeak and take part in the discussions
Academia	<ul style="list-style-type: none"> PlaceSpeak Email exchanges 	<ul style="list-style-type: none"> PlaceSpeak available in both official languages. Personalized emails were sent to academics to encourage feedback.

G. ENGAGEMENT QUESTIONS

Engagement questions were based on the three main components of the study.

1. Collaboration and Governance within the watershed

- What is needed to assist those involved in managing the watershed to collaborate more effectively?
- Should a new collaborative body be created to manage the Ottawa River watershed? If No, please describe why not. If Yes, please consider the following questions in your response: How would the entity operate? Who would be involved? What projects/issues would this entity undertake?
- How should historical, cultural, natural and economic values be represented in watershed governance?

2. Watershed health indicators and related data

- Are you interested in engaging in citizen science projects to monitor the Ottawa River watershed? Are there existing citizen science initiatives we should be aware of? Please tell us about these existing projects and tell us what types of projects you would be interested in (e.g., water quality sampling, wildlife monitoring).
- Motion M-104 identifies the following themes for assessing and monitoring the health of the Ottawa River watershed: water quality, biodiversity and shoreline integrity. Do you agree with including these themes? Are there other themes or specific indicators that should be considered?
- Where are the information gaps, or where is information missing / hard to find, related to the health of the Ottawa River watershed? Do you know of good sources of information about the Ottawa River watershed? Do you have any suggestions for how to encourage information gathering and sharing?

3. Economic, cultural, heritage and natural values associated with the watershed

- Tell us how, when and where you use the Ottawa River watershed. What do you value most about it?
- Do you have any specific concerns about this watershed? Is there anything in particular that you think we should consider, or be aware of in the context of this study?

H. OTHER CONSIDERATIONS

The following services and options were offered whenever possible:

- Bilingual materials and facilitators;
- Accessible premises for people with disabilities; specific accommodations were considered upon request; and
- Various methods to contact ECCC.

Materials used for promoting and obtaining individual public feedback were developed and/or edited by ECCC communications to ensure that materials were accessible for a diversity of audiences.

COMMUNICATION

Once the study has concluded, GBA+ considerations were included in the communications strategy. For example, ensuring that the visual and verbal language is meaningful for women, men and gender-diverse people; using inclusive language; refraining from stereotypes or loaded words; and communicating using different approaches/methods.

APPENDIX F: OTTAWA RIVER WATERSHED SYSTEM MAP

OTTAWA RIVER WATERSHED SYSTEM MAP

Water Levels	Freshwater Habitat	Wetlands	Nuclear Power	Hydroelectric	Mining
Parks	Ecosystem Services	Species at Risk	Pharmaceuticals	Farms	Pulp And Paper
Flora/Fauna	NATURAL VALUES		ECONOMIC VALUES		Tourism
Shifting Biodiversity					Agriculture
Invasive Species					Upstream Industry
Wildlife					Forestry
IWRM	GOVERNANCE <i>*Intersects with all other sections</i>		SOCIAL, CULTURAL & HERITAGE VALUES		Winter Sports
Flood Planning					Hunting/Fishing
Townships					Hiking/Biking
OBVs/CAs					Tourist Activities
ORRPB	Water Monitoring & Treatment	Municipal, Provincial, Federal Gov.	Sacred Places	Historic Places	Kayakers/Boaters
National Capital Commission	NGOs	Indigenous Peoples	Birding	Spirituality	Healthy Communities

**This is not meant to be a comprehensive list, and was only used to facilitate the brainstorming sessions for the foresight process of the ORWS.*

APPENDIX G: HYDROELECTRIC AND MINING PROJECTS IN THE OTTAWA RIVER WATERSHED

TABLE G-1. PRINCIPAL RESERVOIRS IN THE OTTAWA RIVER WATERSHED

RIVER	RESERVOIR	CAPACITY (MILLIONS OF M ³)
Outaouais	Dozois (1)	1,863
	Rapid VII (2)	371
	Quinze (3)	1,308
	Timiskaming (4)	1,217
	des Joachims (5)	229
Montreal	Lady Evelyn (6)	308
Kipawa	Kipawa (7)	673
Madawaska	Bark Lake (8)	374
Gatineau	Cabonga (9)	1,565
	Baskatong (10)	3,049
Lievre	Mitchinamecus (11)	554
	Kiamika (12)	379
	Poisson Blanc (13)	625

TABLE 6-2. LIST OF POWER GENERATING STATIONS OPERATED BY ONTARIO POWER GENERATION AND HYDRO QUÉBEC

(Note: This list is not exhaustive, as other smaller scale power generation stations exist)

ONTARIO POWER GENERATION		HYDRO QUÉBEC	
Name	Mega watts	Name	Mega watts
Armprior Generating Station	82	Bryson (barrage Rocher Fendu)	56
Barrett Chute Generating Station	176	Carillon	753
Calabogie Generating Station	5	Chelsea	152
Chats Falls Generating Station	192	Chute Bell	10
Chute Generating Station	3	Chute-des-chats	92
Des Joachims Generating Station	429	Mercier (reservoir Baskatong)	55
Hound Chute Generating Station	9	Paugan	226
Lower Notch Generating Station	274	Première Chute	131
Matabitchuan Generating Station	10	Rapide-2	67
Mountain Chute Generating Station	170	Rapide-7 (reservoir Decelles)	67
Otto Holden Generating Station	243	Rapide-Farmer	104
Stewartville Generating Station	182	Rapides des îles	176
		Rapides des Quinze	109

TABLE 6-3. MINES OPERATING AND IN DEVELOPMENT IN OR NEAR THE OTTAWA RIVER WATERSHED

MINE NAME	STATUS	MINERALS
Francoeur, Québec	Development	Gold, silver
Westwood, Québec	Development	Gold
Akasaba Ouest Mines Agnico Eagle , Québec	Development	Gold, copper
Horne 5 Ressources Falco, Québec	Development	Gold, copper
Mouska, Québec	Active mine	Gold, silver, copper
LaRonde Mines Agnico Eagle, Québec	Active mine	Gold, silver, copper, lead, zinc
Othmer, Québec	Active mine	Feldspar
Lac des Îles, Québec	Active mine	Graphite
Saint-Canut, Québec	Active mine	Silica
Saint-Rémi-d'Amherst, Québec	Active mine	Silica, kaolinite

MINE NAME	STATUS	MINERALS
Belleterre, Québec	Pre-development	Gold
Joanna, Québec	Pre-development	Gold, silver
Lac Pelletier, Québec	Pre-development	Gold
Wasamac, Québec	Pre-development	Gold
Dumont Nickel, Québec	Pre-development	Nickel
Zeus, Québec	Pre-development	Rare earths, yttrium, zircon
Authier, Québec	Pre-development	Lithium ores
Niocan, Québec	Pre-development	Niobium
Young-Davidson, Ontario	Active mine	Gold
Detour Lake, Ontario	Active mine	Gold
Kidd Mine, Ontario	Active mine	Copper and zinc
Hollinger, Ontario	Active mine	Gold
Hoyle Pond, Ontario	Active mine	Gold
Dome, Ontario	Active mine	Gold
Penhorwood, Ontario	Active mine	Talcum
Macassa, Ontario	Active mine	Gold
Bell Creek, Ontario	Active mine	Gold
Timmins West, Ontario	Active mine	Gold
Black Fox, Ontario	Active mine	Gold
Holt-Holloway, Ontario	Active mine	Gold
Bradshaw, Ontario	Development	Gold
Taylor, Ontario	Development	Gold
Golden Highway, Ontario	Development	Gold
Garrison, Ontario	Development	Gold
Upper Beaver, Ontario	Development	Gold
McGarry, Ontario	Development	Gold
Cote Gold, Ontario	Development	Gold
Timmins, Ontario	Development	Magnesium and talcum
Whitney, Ontario	Development	Magnesium and talcum

APPENDIX H: EXAMPLES OF MONITORING AND DATA COLLECTION IN THE OTTAWA RIVER WATERSHED

Note: This is not a comprehensive list, and therefore some information may be missing regarding monitoring and data collection initiatives

FEDERAL

ORGANIZATION	MONITORING / DATA COLLECTION PROGRAM	SOURCE
Agriculture and Agri-food Canada (AAFC)	<p>Agri-environmental Indicators</p> <ul style="list-style-type: none"> • AAFC has been compiling and analyzing data, and reporting on agri-environmental indicators, in order to measure key environmental conditions, risks, and changes resulting from agriculture. Indicators include: <ul style="list-style-type: none"> • Nutrients (e.g., nitrogen, phosphorus) • Microbial conditions (e.g., coliforms) • Pesticides • Soil health • Wildlife health <p>In addition, AAFC publishes geospatial data on land cover and crop statistics</p>	AAFC, 2016; Public and Stakeholder consultations, 2018
Canadian Nuclear Safety Commission (CNSC)	<ul style="list-style-type: none"> • Industrial activities with licenses though the CNSC are required to monitor and report on releases to waterbodies, and monitor downstream aquatic environments • Also required to develop and maintain site-specific environmental risk assessment (to inform design of environmental monitoring programs) <p>CNSC Independent Environmental Monitoring Program (IEMP)</p> <ul style="list-style-type: none"> • Environmental sampling by CNSC staff and analyzed in CNSC laboratory. Results are posted on CNSC's Chalk River site-specific webpage 	Public and Stakeholder consultations, 2018
Environment and Climate Change Canada (ECCC)	<p>Canadian Aquatic Biomonitoring Network (CABIN)</p> <ul style="list-style-type: none"> • Collects information on benthic invertebrates and uses their counts as an indicator of the health of the water body • Measure freshwater ecosystem health with standardized methods • Database provides partners with tools to store and manage their data and studies • Training program provides the knowledge and skills required to conduct biomonitoring • Extensively used by scientists within federal, provincial and territorial governments; also used by Indigenous peoples, academia, industry, and NGOs 	ECCC, 2017d; ECCC, 2018e

ORGANIZATION	MONITORING / DATA COLLECTION PROGRAM	SOURCE
ECCC	<p>Canadian Environmental Sustainability Indicators (CESI)</p> <ul style="list-style-type: none"> Track Canada's performance on key environmental sustainability issues and monitor trends Data comes from federal monitoring and data collection programs, as well as through data collected from the provincial governments through data collection agreements Indicator themes monitored in the watershed include: <ul style="list-style-type: none"> GHGs and air pollutant emissions Air quality (e.g., fine particulate matter, ozone, etc.) Harmful substances (e.g., emissions to air, releases to water) Water quality Water quantity Protected areas Biodiversity (e.g., waterfowl) 	ECCC, 2016a; Public and Stakeholder consultations, 2018
ECCC	<p>Canadian Wetland Inventory</p> <ul style="list-style-type: none"> Partnership with the Canadian Space Agency, Ducks Unlimited, and the North American Wetlands Conservation Council Established in 2002 Purpose is to create the Canadian Wetland Inventory: a national approach to establish a consistent framework to map wetlands Vision of the program is to: <ul style="list-style-type: none"> Prioritize conservation, restoration and wetland monitoring programs Assess changes in wetland abundance and classification in relation to climate change concerns Assist industry, governments and conservation groups to develop land-use policies and protocols Measure performance of those policies and protocols towards landscape sustainability objectives Canadian Wetland Inventory Progress Map displays wetland areas across Canada <ul style="list-style-type: none"> The map has been compiled to make wetland information readily available for a broad range of users 	Ducks Unlimited Canada, 2018b; Ducks Unlimited Canada, 2018c
ECCC	<p>North American Breeding Bird Survey</p> <ul style="list-style-type: none"> Volunteer-based program; conducting roadside surveys since 1966 Primary source of long-term, large-scale population data for over 400 breeding bird species Coordinated in Canada by ECCC's Canadian Wildlife Service Data is freely available, and analyzed on a yearly basis Collected information includes: <ul style="list-style-type: none"> Bird population trends Relative abundance Species composition and richness at the local, regional and continental scale 	ECCC, 2018a

ORGANIZATION	MONITORING / DATA COLLECTION PROGRAM	SOURCE
ECCC	<p>Freshwater Quality Monitoring and Surveillance Program</p> <ul style="list-style-type: none"> • Risk-based adaptive management framework for examining freshwater quality and aquatic ecosystems to better target monitoring activities • Activities are accomplished in collaboration with provincial and territorial governments • Activities under this program include: <ul style="list-style-type: none"> • Long-term physical-chemical water quality monitoring sites • CABIN • Automated water quality monitoring sites • Site or issue-specific surveillance programs • Risk-based adaptive management framework 	ECCC, 2017d
ECCC	<p>Environmental Effects Monitoring Program</p> <ul style="list-style-type: none"> • Monitoring conducted by industries to identify potential effects caused by effluents • Regulatory monitoring of: <ul style="list-style-type: none"> • Biological monitoring such as fish and benthic invertebrates • Water quality • Effluent chemical characterization • Effluent toxicity testing 	Public and Stakeholder consultations, 2018
ECCC	<p>National Pollutant Release Inventory</p> <ul style="list-style-type: none"> • Legislated and publicly accessible national inventory of pollutant releases • Inventory collects information yearly on facility-based releases to air, water and land as well as disposals and transfers of over 300 substances and substance groups • Parameters include: <ul style="list-style-type: none"> • Direct releases to air • Direct releases to surface waters • Direct releases to land • Disposals and transfers of toxic substances • Disposal of tailings and waste rock • Off-site transfers for recycling 	ECCC, 2017c
ECCC	<p>Weather data</p> <ul style="list-style-type: none"> • Collects data related to: <ul style="list-style-type: none"> • Historical weather data, radar images, climate datasets • Climate cycles and trends • Short-term and long-term weather forecasts including seasonal forecasts, temperature and precipitation 	ECCC, 2018h; Public and Stakeholder consultations, 2018
ECCC	<p>Water Survey of Canada</p> <ul style="list-style-type: none"> • National agency responsible for the collection, interpretation and dissemination of standardized water resource data and information in Canada • Conducted in partnership with provinces and territories • Collect “real-time” water quantity data from approximately 2200 stations across Canada • Access to historical hydrometric data, such as archived historical daily means • Approximately 18 long-term stations in the Ottawa River watershed • In Québec, the MELCC is the main operator of the water quantity monitoring network, and ECCC provides funding through a cost shared agreement (explained in a later table) • Parameters monitored include: <ul style="list-style-type: none"> • Water level and stream flow • Some stations also collect information such as air and water temperature 	ECCC, 2018b; ECCC, 2018f; MELCC, 2015; Public and Stakeholder consultations, 2018

ORGANIZATION	MONITORING / DATA COLLECTION PROGRAM	SOURCE
Library and Archives Canada	<ul style="list-style-type: none"> • Maintains a rich collection of records that document the “management of water, water resources or resource use” in Canada • Maintains ECCC records that date from the 1870s and document the Atmospheric Environment Service (the predecessor to the Meteorological Service of Canada), including the earliest meteorological observations made in Canada 	Public and Stakeholder consultations, 2018
National Capital Commission (NCC)	<ul style="list-style-type: none"> • Collects data through environmental impact evaluation of projects, development of long-term plans, and via Corporate Natural Resources Stewardship Action Plan • Developed and launched a citizen science program in 2018 that aims to carry out studies to monitor the biodiversity of the NCR (in collaboration with the Friends of Gatineau Park) • Monitor a set of environmental indicators in order to help understand the state of health of Gatineau Park 	Public and Stakeholder consultations, 2018
Natural Resources Canada (NRCan)	<p>Groundwater Geoscience Program</p> <ul style="list-style-type: none"> • Conducts mapping and assessment activities of key Canadian aquifers and makes data available through the Groundwater Information Network in order to provide baseline information and scientific knowledge for better water management and protection • Methods for assessment include: <ul style="list-style-type: none"> • Geological mapping • Regional hydrogeological assessments • Groundwater modeling • Satellite mapping <p>Canada Centre for Mapping and Earth Observation</p> <ul style="list-style-type: none"> • Provides satellite mapping of vegetation and soil hydrological parameters for the Groundwater Geoscience Program • Provides Emergency Geomatics Services to Public Safety for mapping and monitoring flood extent using satellites • Manages the National Hydrographic Network which provides input to the ECCC Water Survey • Coordinates the Federal Geospatial platform which integrates economic, social, and environmental geospatial data from multiple departments and agencies 	NRCan, 2017; NRCan, 2018a
Public Services and Procurement Canada (PSPC)	<ul style="list-style-type: none"> • Tracks historic water level and water flow data around the dams that they are responsible for operating 	Public and Stakeholder consultations, 2018
Statistics Canada	<ul style="list-style-type: none"> • Population and socio-economic demographics through the census program • Land cover and land use for geographic areas • Water-related surveys such as: <ul style="list-style-type: none"> • Survey of drinking water plants • Household and environment microdata • Industrial water survey • Agriculture water survey • Water related data <ul style="list-style-type: none"> • Water yield statistics • Agriculture data <ul style="list-style-type: none"> • Canada land use product • AAFC crop inventory • Agriculture census 	Public and Stakeholder consultations, 2018

PROVINCIAL

ORGANIZATION	MONITORING / DATA COLLECTION PROGRAM	SOURCE
Government of Ontario	<p>Municipal treated wastewater effluent</p> <ul style="list-style-type: none"> • Data contains flows and effluent quality from municipal wastewater treatment plants in Ontario • Parameters include: <ul style="list-style-type: none"> • Biological oxygen demand • Total suspended solids • Total phosphorus • Total monthly flow 	Government of Ontario, 2017b; Public and Stakeholder consultations, 2018
Government of Ontario	<p>Southern Ontario Land Resource Information Systems (SOLRIS)</p> <ul style="list-style-type: none"> • Based on MNRF's Ecological Land Classification for Southern Ontario • A land use inventory that supports a number of key Provincial initiatives including: <ul style="list-style-type: none"> • Source water protection • Natural spaces • Biodiversity conservation • State of resources reporting 	Government of Ontario, 2016; Public and Stakeholder consultations, 2018
Ontario Ministry of the Environment, Conservation and Parks (MOECP)	<p>Provincial Water Quality Monitoring Network</p> <ul style="list-style-type: none"> • In partnership with CAs, municipalities and provincial parks • Measures water quality in rivers and streams across Ontario • Provides stream water quality monitoring data for a number of parameters, including: <ul style="list-style-type: none"> • Nutrients • Metals • Chlorophyll a 	Government of Ontario, 2018b; Public and Stakeholder consultations, 2018
Ontario MOECP	<p>Provincial Groundwater Monitoring Network</p> <ul style="list-style-type: none"> • Provides long-term regional groundwater monitoring in order to track potential changes in groundwater quality or levels • Parameters include: <ul style="list-style-type: none"> • Physical-chemical conditions • Water levels 	MOECP, 2018b; Public and Stakeholder consultations, 2018
Ontario MOECP	<p>Ontario Benthos Biomonitoring Network</p> <ul style="list-style-type: none"> • Collaborative monitoring program • Bottom-dwelling aquatic invertebrates are used to monitor the ecological condition of lakes, streams, and wetlands • Data collected includes: <ul style="list-style-type: none"> • Invertebrate species counts • Habitat conditions • Physical-chemical conditions of the water 	Government of Ontario, 2013a; Public and Stakeholder consultations, 2018
Ontario MOECP	<p>Lake Partner Program</p> <ul style="list-style-type: none"> • Volunteer-based, water-quality monitoring program • Conducted in partnership with the Federation of Ontario Cottagers' Associations • Collects water-quality data to monitor trends in about 800 Ontario inland lakes • Parameters include: <ul style="list-style-type: none"> • Nutrients • Physical-chemical conditions 	MOECP, 2018c; Public and Stakeholder consultations, 2018

ORGANIZATION	MONITORING / DATA COLLECTION PROGRAM	SOURCE
Ontario MOECP	<p>Well Records</p> <ul style="list-style-type: none"> • They are used to: <ul style="list-style-type: none"> • Learn about the groundwater and geology of an area to best locate new wells • Find existing wells • Provide original construction information about existing wells • The well record indicates: <ul style="list-style-type: none"> • How the well was constructed • Its location • Results of the pumping test • General information on groundwater quality 	MOECP, 2018d; Public and Stakeholder consultations, 2018
Ontario MOECP	<p>Drinking Water Surveillance Program</p> <ul style="list-style-type: none"> • Voluntary partnership with municipalities • Monitors water quality at selected municipal drinking water systems for scientific and research purposes • Parameters include: <ul style="list-style-type: none"> • Inorganic parameters • Organic parameters • Radiological parameters 	Government of Ontario, 2013b; Public and Stakeholder consultations, 2018
Ontario MOECP	<p>Guide to Eating Ontario Fish</p> <ul style="list-style-type: none"> • MOECP monitors and provides consumption advice for fish from lakes and rivers in Ontario, including in the Ottawa River and the entire watershed, to minimize public exposure to toxins • Interactive map allows individuals to identify the types and amounts of fish that are safe to eat from more than 2,400 fishing locations across Ontario 	MOECP, 2018e; Public and Stakeholder consultations, 2018
Ontario MOECP	<ul style="list-style-type: none"> • Government of Ontario issues permits for water takings • These permits are tracked, and individuals can access information on water-taking locations, source type, withdrawal limits/day, purpose and permit holder 	MOECP, 2018a; Public and Stakeholder consultations, 2018
Ontario MOECP	<p>Industrial wastewater discharges</p> <ul style="list-style-type: none"> • Data are submitted quarterly to MOECP, as required by the Effluent Monitoring and Effluent Limits Regulations 	Government of Ontario, 2016d; Public and Stakeholder consultations, 2018
Ontario MOECP	<p>Toxics Reduction Act – Reporting</p> <ul style="list-style-type: none"> • Provides the complete public data on toxics use and reduction plans data • Information submitted by facilities reporting under the Toxics Reduction Program 	Public and Stakeholder consultations, 2018
Ontario MOECP	<p>Ontario's Blue-Green Algae Information Forum</p> <ul style="list-style-type: none"> • This is a limited access site that was designed and built to facilitate collaboration and information sharing between MOECP and its partners on the subject of Microcystin and Blue-Green Algae 	Public and Stakeholder consultations, 2018
Ontario MOECP	<p>Environmental Compliance Reports</p> <ul style="list-style-type: none"> • Reports provide information about environmental activities in local communities • Annual summaries for all regions include: <ul style="list-style-type: none"> • Air • Industrial, municipal and private sewage works discharges 	Government of Ontario, 2016c

ORGANIZATION	MONITORING / DATA COLLECTION PROGRAM	SOURCE
Ontario Ministry of Natural Resources and Forestry (MNRF)	<p>Broad-scale Monitoring Program</p> <ul style="list-style-type: none"> Information collected once every 5 years Sampling is conducted by MNRF crews on the selected lakes during the summer each year of the Broad-scale Monitoring Program Program is designed to: <ul style="list-style-type: none"> Describe the distribution, amount, and diversity of fishes in Ontario Estimate the current state and changes over time of Ontario's fisheries Identify natural and human-caused stresses affecting fisheries Provide reports on the state of fisheries and aquatic environments in Ontario Parameters include: <ul style="list-style-type: none"> Distribution of fishes Amount and diversity of fishes in the lakes Physical-chemical conditions of the water Nutrient levels Some metals (e.g., iron) Zooplankton Contaminant sampling Fishing activities 	MNRF, 2018a
Ontario MNRF	<p>Land Information Ontario (LIO)</p> <ul style="list-style-type: none"> Helps individuals and organizations find, access and share geographic data Coordinates the collection of aerial photography Geographic information distributed by LIO includes information on: <ul style="list-style-type: none"> Roads, railways and trails Lakes, rivers, streams and wetlands Elevation Official names and boundaries Management and classification information Ontario Dam inventory Ecological land classification Areas of natural and scientific interest 	MNRF, 2018b; Public and Stakeholder consultations, 2018
Ontario MNRF	<p>Provincial Wildlife Population Monitoring Program</p> <ul style="list-style-type: none"> Required under the Environmental Assessment Requirements for forest management on Crown lands Collect long-term trend data to support evaluation of the effectiveness of forest management in maintaining wildlife on Crown land Monitoring a variety of species including terrestrial and riparian vertebrates Methods include: <ul style="list-style-type: none"> Breeding bird surveys Migration monitoring 	MNRF, 2018c
Québec Ministère de l'Environnement et de la Lutte contre les changements climatiques (MELCC)	<p>Hydrologic Monitoring</p> <ul style="list-style-type: none"> Operated by the MELCC Ongoing hydrometric monitoring in collaboration with municipal authorities and observers in the field <ul style="list-style-type: none"> Network of approximately 230 hydrometric stations across the province, almost all of which use telemetry and transmit data on a continuous basis Hydrometric stations provide stream flow and levels data Is used to manage dams and to monitor rivers during floods and during periods of low water 	MELCC, 2015; Sécurité Publique, 2016; Public and Stakeholder consultations, 2018

ORGANIZATION	MONITORING / DATA COLLECTION PROGRAM	SOURCE
Québec MELCC	<p>Québec Groundwater Monitoring Network</p> <ul style="list-style-type: none"> • More than 250 monitoring stations located in all regions of QC, with some stations that have been active since 1969 • Collects data to assess the effects of climate change on groundwater • Accessible information may include water levels, water quality testing results, and well layouts 	MELCC, 2018d
Québec MELCC	<p>Voluntary Lake Monitoring Network</p> <ul style="list-style-type: none"> • Volunteer program that focuses on understanding trophic levels of a large number of lakes, and track evolution over time • Network tracks lakes that are showing signs of eutrophication and degradation • Water sampling and field measurements/observations based on MELCC protocols • The network team coordinates, provides the protocols, interprets the data, and communicates the results • Parameters include: <ul style="list-style-type: none"> • Physical-chemical conditions • Nutrients • Detection of invasive aquatic plants • Characterizing riparian buffer • Tracking blue-green algae blooms 	MELCC, 2018e
Québec MELCC	<p>Monitoring River Water Quality</p> <ul style="list-style-type: none"> • Characterize the water quality of rivers and monitor trends over time • Parameters include: <ul style="list-style-type: none"> • Physical-chemical conditions • Microbial • Nutrients • Chlorophyll a 	MELCC, 2018h
Québec MELCC	<p>Monitoring Benthos Health</p> <ul style="list-style-type: none"> • Assess the health status of shallow substrate and streams by examining the composition of benthic invertebrate communities • Parameters include: <ul style="list-style-type: none"> • Benthic invertebrate communities • State of the habitat • Physical-chemical conditions • Microbial • Toxic substances 	MELCC, 2018g
Québec MELCC	<p>River Pesticide Monitoring and Groundwater Pesticide Monitoring</p> <ul style="list-style-type: none"> • Detect the presence of herbicides, insecticides and fungicides in surface water and groundwater, and monitor their evolution over time • Parameters include: <ul style="list-style-type: none"> • Targeted pesticides or family of pesticides (e.g., organophosphorous compounds, glyphosate) • Quantity of nitrites/nitrates 	MELCC, 2018i; MELCC, 2018m

ORGANIZATION	MONITORING / DATA COLLECTION PROGRAM	SOURCE
Québec MELCC	<p>Saint Lawrence River Network</p> <ul style="list-style-type: none"> • MELCC is monitoring 28 active stations in 2018 between Lac Saint-François and L'île • Parameters assessed include: <ul style="list-style-type: none"> • Physical-chemical conditions (pH, temperature, turbidity, silica) • Nutrients (total phosphorous, nitrogen, etc.) • Microbial substances • Chlorophyl a 	MELCC, 2018i; Public and Stakeholder consultations, 2018
Québec MELCC	<p>Two types of monitoring conducted by MELCC related to cyanobacteria</p> <ul style="list-style-type: none"> • Monitoring in eight lakes took place over the course of 2000 to 2016. Two of these lakes are located in the Ottawa River watershed (Lac Gauvreau and Lac Forgeron) <ul style="list-style-type: none"> • Parameters include: <ul style="list-style-type: none"> • Cyanobacteria • Cyanotoxins • Other biological and physical-chemical conditions • Management Plan for Cyanobacteria water flowers <ul style="list-style-type: none"> • Started in 2014 and data is available on an ad hoc basis • Cyanobacteria samples collected for all samples; cyanotoxin results available for most of those samples collected before 2014 • Most of the samples collected by citizens or organizations 	MELCC, 2018j; Public and Stakeholder consultations, 2018
Québec MELCC	<p>Toxic Contamination Of Fish</p> <ul style="list-style-type: none"> • Detect the presence of poisonous substances in fish meat • Used to understand the state of the environment and establish recommendations for human consumption • Parameters include the presence of toxic substances, such as: <ul style="list-style-type: none"> • Mercury • Organochlorines • Polybrominated diphenyl ethers • Arsenic • Cadmium • Lead • Selenium 	MELCC, 2018f
Québec MELCC	<p>Toxic Substances in Rivers and Lakes</p> <ul style="list-style-type: none"> • Detect the presence of toxic substances in surface waters • Used to determine if the concentrations of the toxic substances meet the water quality criteria for the protection of aquatic life, the protection of fish-eating terrestrial wildlife, and the prevention of contamination of water and aquatic organisms • Parameters vary, but may include: <ul style="list-style-type: none"> • Metals, organochlorine compounds • Polycyclic aromatic hydrocarbons • Surfactants • Flame retardants • Stain-resistant products • Drugs and hormones 	MELCC, 2018o

ORGANIZATION	MONITORING / DATA COLLECTION PROGRAM	SOURCE
Québec MELCC	<p>Status of Fish Communities</p> <ul style="list-style-type: none"> Results and data on fish communities are available in various reports including the biotic status monitoring reports (1989 to 2016) The following components of fish communities were considered: <ul style="list-style-type: none"> Biological integrity Taxonomic composition External anomalies 	MELCC, 2018k; Public and Stakeholder consultations, 2018
Québec MELCC	<p>(PACES) Groundwater Knowledge Acquisition Program</p> <ul style="list-style-type: none"> A series of projects that provide an understanding of the groundwater resources of the municipal territories of southern Québec Purpose of the program is to protect groundwater resources and ensure their sustainability Collaborative initiative with academic research institutions, OBVs, and others Groundwater collection is expected to be complete in almost all inhabited areas of Québec by 2022 	MELCC, 2018c
Québec MELCC	<p>(SOMAE) Monitoring of Municipal Wastewater Treatment Plants</p> <ul style="list-style-type: none"> Under provincial wastewater regulations, municipalities submit a monthly report which includes: <ul style="list-style-type: none"> Water quality analysis and test results Overflow measurements and overhauls carried out as part of the operation of its works 	MELCC, 2018n
Québec MELCC	<p>Tracking of Toxic Substances</p> <ul style="list-style-type: none"> Toxic substances in water have been tracked since the end of the 1980s for 200 sampling stations from a variety of different studies <ul style="list-style-type: none"> Parameters measured include the following: <ul style="list-style-type: none"> Trace metals Organochlorines Polycyclic aromatic hydrocarbons Rotational regional monitoring of emerging contaminants and fish communities since 2010 <ul style="list-style-type: none"> Approximately 15 sites per year in one region are examined Analysis conducted include the following: <ul style="list-style-type: none"> Persistent bioaccumulative contaminants in whole fish Emerging contaminants in water samples Status of fish communities 	MELCC, 2018r; Public and Stakeholder consultations, 2018
Québec MELCC	<p>Interactive Map of Québec Wetlands</p> <ul style="list-style-type: none"> Collaboration with Ducks Unlimited Canada A set of geomatic tools based on the detailed wetland mapping initiative for the settled areas of southern Québec This wetland inventory is intended to help all stakeholders understand wetland conservation issues and better meet current and future conservation challenges 	Ducks Unlimited Canada, 2018d

MUNICIPAL

ORGANIZATION	MONITORING / DATA COLLECTION PROGRAM	SOURCE
City of Ottawa	<p>Responsible for data related to:</p> <ul style="list-style-type: none"> • Demographic data and projections • Agriculture and soils • Water quality • Water quantity (i.e., flooding risks) • Sewage discharge • Land use and land cover <p>City Stream Watch reports</p> <ul style="list-style-type: none"> • 10 agencies that monitor City of Ottawa streams • Obtain, record, and manage valuable information on physical and biological characteristics • Parameters include: <ul style="list-style-type: none"> • Habitat assessments • Benthic invertebrates • Stream temperatures • Invasive species 	MVCA, 2018a; RVCA, 2018; Public and Stakeholder consultations, 2018
Laurentian Valley	<p>Data collected includes:</p> <ul style="list-style-type: none"> • Water quality related to pollution control and water treatment plants • Stormwater management reports/drainage plans and environmental impact studies 	Public and Stakeholder consultations, 2018
MRC des Collines-de l'Outaouais	Collects data related to residential development and water use pressures	Public and Stakeholder consultations, 2018
MRC des Pays-d'en-Haut	In collaboration with OBVs, collect data to characterize water quality and quantity in the MRC. Information is incorporated into development plans	Public and Stakeholder consultations, 2018
Oka	Water quality sampling is done daily at the Oka National Park in the jurisdiction	Public and Stakeholder consultations, 2018
Ville de Mirabel	Collaborate with OBVs to conduct stream sampling. Log their wastewater data to MELCC's SOMAE municipal wastewater monitoring program and share groundwater samples	Public and Stakeholder consultations, 2018

LOCAL WATERSHED MANAGEMENT AGENCIES

ORGANIZATION	MONITORING / DATA COLLECTION PROGRAM	SOURCE
ALL OBVs	<p>Plan directeur de l'eau (PDE) - Water Master Plan</p> <ul style="list-style-type: none"> • These documents are a planning and decision-making tool for water management, in order to promote best practices and identify local objectives and targets for the ecosystem and watershed communities • Five overarching sections related to IWRM are required for each plan: <ul style="list-style-type: none"> • Portrait of water resources – description of physical, economical, and social characteristics of the watershed; • Establishment of a diagnostic of water resources; • Definition of a long term vision of water resources; • Determination of issues and medium term changes (over the next five years); • Development of a five-year action plan; and • Monitoring, evaluation and updating of the Water Master Plan 	COBAVER-VS, 2018
Organisme de bassin versant de la rivière du Nord (ABRINORD)	<p>Program for monitoring the quality of water courses</p> <ul style="list-style-type: none"> • Parameters include: <ul style="list-style-type: none"> • Microbial • Physical-chemical conditions (e.g., suspended matter, conductivity) • Nutrients • Aquatic invertebrates • Detailed mapping of wetlands, in partnership with Ducks Unlimited Canada • Mapping streams to understand how flow dynamics are threatening communities groundwater • Support the government of Québec's PACES (Groundwater knowledge acquisition program) 	ABRINORD, n.d.
Agence de bassin versant des 7 (ABV 7)	<p>Various monitoring projects including:</p> <ul style="list-style-type: none"> • Monitoring invasive species, such as zebra mussels, myriophyllous mossgrass, and Eurasian milfoil • Beach erosion • Physical-chemical analysis of lakes • Characterization of lake riparian strips and sediments <p>Supporting MELCC Réseau-Rivières program by conducting water sampling (physical-chemical conditions and microbial)</p> <ul style="list-style-type: none"> • Supporting Ministère des Forêts, de la Faune et des Parcs with water sampling in parks (physical-chemical conditions and microbial) 	ABV 7, n.d.
Comité du bassin versant de la rivière du Lièvre (COBALI)	<p>Various monitoring programs including:</p> <ul style="list-style-type: none"> • Characterization of sub-watersheds in management area (e.g., water quality) <p>Supporting MELCC's Réseau-Rivières and volunteer lake monitoring programs</p> <ul style="list-style-type: none"> • Provisioning of technical advice to lake associations and municipalities regarding freshwater health • Partnering with OBV RPNS, ABV 7 and Ducks Unlimited Canada to map wetlands throughout the Ottawa River lowlands 	COBALI, n.d.; Public and Stakeholder consultations, 2018

ORGANIZATION	MONITORING / DATA COLLECTION PROGRAM	SOURCE
Conseil des bassins versants des Mille-Îles (COBAMIL)	<p>Various monitoring programs including:</p> <ul style="list-style-type: none"> • Inventory of exotic aquatic plants • Surface water sampling in local waterways <p>Supporting MELCC Réseau-Rivières program by conducting water sampling</p> <ul style="list-style-type: none"> • Characterization and mapping of agricultural sector in sub-watersheds • Parameters include: <ul style="list-style-type: none"> • Nutrients • Microbial • Physical-chemical conditions 	COBAMIL, n.d.; Public and Stakeholder consultations, 2018
Conseil du bassin versant de la région de Vaudreuil-Soulanges (COBAVER – VS)	<p>Various monitoring programs including:</p> <ul style="list-style-type: none"> • Water quality sampling and monitoring of tributaries in management area. Data feeds into the MELCC Réseau-Rivières program • Parameters include: <ul style="list-style-type: none"> • Physical-chemical conditions • Nutrients • Microbial • Coordinating the monitoring of invasive Asian carps • Characterization of various tributaries in management area, this includes: <ul style="list-style-type: none"> • Determination of riparian buffer quality • Physical-chemical conditions • Characterizing fish habitat, this includes: <ul style="list-style-type: none"> • Documenting potential habitats • Targeting erosion issues • Identifying sites to be restored • Monitoring sources of contamination • Taking fish inventories 	Public and Stakeholder consultations, 2018
Mississippi Valley Conservation Authority (MVCA)	<ul style="list-style-type: none"> • Monitor a number of environmental indicators for surface and groundwater, aquatic species and benthic invertebrates • They also maintain geo-spatial datasets that allow trends to be tracked and assessed over time 	Public and Stakeholder consultations, 2018
North Bay-Mattawa Conservation Authority (NBMCA)	<ul style="list-style-type: none"> • Various monitoring programs in jurisdictional area, including: <ul style="list-style-type: none"> • Meteorology (rainfall and snow accumulation) • Ground and surface water quantity and quality • Aquatic biology (benthic invertebrates) • Many of the monitoring programs done in partnership with federal and provincial agencies 	Public and Stakeholder consultations, 2018
Organisme de bassin versant du Témiscamingue (OBVT)	<ul style="list-style-type: none"> • Surface water quality monitoring network <ul style="list-style-type: none"> • Use the water quality index via SurVol Benthos (G3E) • Several activities carried out with schools to characterize physical-chemical conditions and collect an inventory of aquatic invertebrates • Conduct water quality analyses of private wells • Collaborative network for monitoring invasive species, including a mobile washing station to remove invasive species • Support other networks, such as MELCC's Réseau-Rivières and volunteer lake network 	Public and Stakeholder consultations, 2018

ORGANIZATION	MONITORING / DATA COLLECTION PROGRAM	SOURCE
Organisme de bassins versants des rivières Rouge, Petite Nation et Saumon (OBV RPNS)	<p>Various monitoring programs in jurisdictional area, including:</p> <ul style="list-style-type: none"> • Water quality data collection • Shoreline integrity for some studied lakes • Collecting data on biodiversity, including invasive species, and mapping wetlands in collaboration with Ducks Unlimited Canada • Characterization of tributaries, agricultural area shorelines and aquatic grass beds • They hold various partnerships with different organizations, including: <ul style="list-style-type: none"> • With municipal partners to implement PACES assessments • With G3E to monitor benthic macroinvertebrates, to assess the impact that climate change has on biodiversity 	OBV RPNS, 2018
Rideau Valley Conservation Authority (RVCA)	<ul style="list-style-type: none"> • Collect a variety of data, including: <ul style="list-style-type: none"> • Key environmental indicators, such as hydrometrics, surface and groundwater, forest and wetland cover, aquatic species and benthic invertebrates • Information is maintained in geo-spatial data sets, which enables the RVCA to assess changes over time • Water sampling at 57 stream locations and approximately 39 lake locations for a total of 409 sampling sites throughout the Rideau watershed <ul style="list-style-type: none"> • Parameters include: <ul style="list-style-type: none"> • Physical-chemical conditions • Nutrients • 39 major lakes are monitored as part of RVCA's Watershed Watch Program <ul style="list-style-type: none"> • Helps to identify trends in water quality • Collects streamflow and water level data to monitor flood and drought events 	Public and Stakeholder consultations, 2018
South Nation Conservation Authority (SNCA)	<ul style="list-style-type: none"> • Collects data on fish and benthic species and stream morphology, tree species, species at risk and invasive species • Completed several partner projects with Indigenous communities focused on identifying and protecting species with natural/cultural heritage to the communities • Supports the Provincial Water Quality Monitoring Network and Ontario Benthic Biodiversity Network • Surface water quantity • Conducts testing on groundwater levels and annual groundwater quality testing • Collects visitor data on its day use parks and trails (e.g., car and trail counters) • Hunting and trapping program is monitored through permits 	Public and Stakeholder consultations, 2018

ACADEMIC / NGO / CITIZEN SCIENCE / COMMUNITY-BASED GROUPS

ORGANIZATION	MONITORING / DATA COLLECTION PROGRAM	SOURCE
Bonnechere River Watershed Project	<ul style="list-style-type: none"> Community-based volunteer organization that has been surveying the health of the Bonnechere river and its watershed since 1999 Parameters include: <ul style="list-style-type: none"> Nutrients Physical-chemical conditions Lake stratification Benthic invertebrates 	PlaceSpeak consultations, 2018
Carleton University, A-MAPS Environmental, and Rideau Valley Conservation Authority	<p>Aquatic environment mapping project</p> <ul style="list-style-type: none"> Software mapping modules for water quality and vegetation mapping in lakes Satellite images useful for: <ul style="list-style-type: none"> Estimating macrophyte biomass Monitoring growth of aquatic vegetation Mapping algae and suspended particulates Surface temperature mapping Snow and ice patterns Monitoring lake thawing processes 	PlaceSpeak consultations, 2018
Federation of Lakes of Val-des-Monts	<p>Integrated Watershed Management Project</p> <ul style="list-style-type: none"> Study all accessible/inhabited lakes in the area Parameters include: <ul style="list-style-type: none"> Physical-chemical conditions Riverbank characterization Identification of species (including species at risk) Indicators of beaver presence Characterization of tributaries, outfalls and major culverts linked to lakes 	Fédération des lacs de Val-des-Monts, 2015
Friends of the Gatineau River	<p>Water quality monitoring program</p> <ul style="list-style-type: none"> Conduct water quality monitoring of the Gatineau River once a month during the summer months Sampling conducted with support from the municipalities of La Pêche, Cantley and Chelsea and recreational clubs and associations Parameters include: <ul style="list-style-type: none"> Microbial 	Friends of the Gatineau River, 2018
H2O Chelsea	<ul style="list-style-type: none"> Acquire knowledge of surface and groundwater in territory Relies on volunteer citizens and university support Parameters include: <ul style="list-style-type: none"> Physical-chemical conditions Microbial Metals 	Municipality of Chelsea, 2012

ORGANIZATION	MONITORING / DATA COLLECTION PROGRAM	SOURCE
iNaturalist	<ul style="list-style-type: none"> • A joint initiative by the California Academy of Sciences and the National Geographic Society • Global “crowdsourced” species identification system and online occurrence recording tool • Individuals can identify plants and animals and share observations • >500,000 observations in Canada • Various organizations are using the online tool to help use “crowdsourced” identification to record species <ul style="list-style-type: none"> • e.g., Ontario Parks wants visitors to help identify species at risk in provincial parks 	iNaturalist Canada, n.d.-a; iNaturalist Canada, n.d.-b
Kipawa Lake Preservation Society	<ul style="list-style-type: none"> • Bring attention to the issues that are affecting the health of the Kipawa watershed • Conduct surface water quality testing in the watershed • Parameters include: <ul style="list-style-type: none"> • Metals and other pollutants • Physical-chemical conditions • Microbial • Nutrients 	Kipawa Lake Preservation Society, n.d.; PlaceSpeak consultations, 2018
Citizen Monitoring Lake St. Francois Xavier	<ul style="list-style-type: none"> • An Individual has been collecting water quality data on the lake since 1970 • Wants to increase community knowledge and bring together the community to take action • Parameters include: <ul style="list-style-type: none"> • Microbial • Nutrients • Physical-chemical conditions 	PlaceSpeak consultations, 2018
Ottawa Riverkeeper Riverwatch	<ul style="list-style-type: none"> • Over 70 volunteers • Participate in citizen-science water quality testing program • Parameters include: <ul style="list-style-type: none"> • Invasive species • Species at risk • Algal blooms • Shoreline issues 	Ottawa Riverkeeper, 2018b
Water Rangers	<ul style="list-style-type: none"> • Non-profit whose mission is to build the tools to help citizens and scientists easily record and analyze water data • More than 18,000 observations from different sources • Purchase or borrow testing kits to monitor water quality • Parameters include: <ul style="list-style-type: none"> • Physical-chemical conditions • Collect samples for suspected pollutants 	Water Rangers; 2018a; Water Rangers, 2018b; Swanston, 2018

ORGANIZATION	MONITORING / DATA COLLECTION PROGRAM	SOURCE
WWF-Canada	eDNA Citizen science project <ul style="list-style-type: none"> • Launched in September 2017 • National community-based freshwater monitoring program using eDNA technology to identify benthic invertebrates to better understand freshwater health <ul style="list-style-type: none"> • Easier, faster and more accurate than traditional methods of manual analysis • Three samples were collected in the Ottawa River watershed as part of this project 	WWF-Canada, 2017b

INDUSTRY

ORGANIZATION	MONITORING / DATA COLLECTION PROGRAM	SOURCE
Canadian Nuclear Laboratories (CNL)	<ul style="list-style-type: none"> • Variety of data collection, including: <ul style="list-style-type: none"> • Air quality, water quality, groundwater, effluent and biodiversity <ul style="list-style-type: none"> • emphasis on species at risk • Monitoring programs have been in place for over 6 decades • A summary of the monitoring performed is available on the CNL website (Annual Compliance Report) 	PlaceSpeak consultations, 2018
Fortress Cellulose spécialisée	<ul style="list-style-type: none"> • Sampling of effluent releases <ul style="list-style-type: none"> • Parameters include: <ul style="list-style-type: none"> • Physical-chemical conditions • Harmful substances • Nutrients • Conduct studies on groundwater quality and wildlife 	PlaceSpeak consultations, 2018
Hydro-Québec	<ul style="list-style-type: none"> • Variety of monitoring programs that collect data on species at risk and water quantity 	PlaceSpeak consultations, 2018
Ontario Power Generation	<ul style="list-style-type: none"> • Variety of monitoring programs that collect data on water quality, biodiversity and water quantity 	PlaceSpeak consultations, 2018
Résolu Produits Forestiers	<ul style="list-style-type: none"> • Collects data as required under effluent regulations 	PlaceSpeak consultations, 2018

APPENDIX I: GLOBAL GUIDING PRINCIPLES FOR WATERSHED MANAGEMENT

In 2015, the UN released the Sustainable Development Goals (SDGs), a set of goals aimed at addressing areas of critical global importance to promote sustainable development for humanity and the planet. Building on previous Millennium Development Goals, the 17 SDGs are further broken down by 169 targets, all of which include indicators and are intended to be addressed by 2030. Goal 6 promotes the availability and sustainable management of water and sanitation for all. Within goal 6, target 6.5 states that IWRM at all levels should be implemented by 2030. The goal recognizes that water resources are connected to various parts of diverse global societies, and as such, are complex to manage. While reaching this target is instrumental in addressing water issues, uptake has been slow, with the implementation of IWRM globally estimated at 48%; notably the least amount of progress has been made on gender issues and financing of IWRM. Many countries are challenged by the fact that there is no universal approach to delivery of integrated arrangements, as IWRM requires that each country or region develop its own structures based on respective political, social, environmental and economic circumstances. Additionally, lack of political will, fragmented institutional frameworks, poor data availability and lack of capacity and resources limit the achievement of IWRM globally (UN, 2017; UN, 2018).

Also in 2015, the OECD Ministerial Council released 12 principles on water governance that aim to ensure that water resources be managed in a sustainable, integrated and inclusive fashion (OECD, 2015). Beginning in 2013, over a hundred delegates from public, private and non-profit sectors joined together to discuss principles and frameworks developed through bottom-up approaches. Based on the three main goals of effectiveness, efficiency and ability to develop trust and engagement, and rooted in broader principles of good governance, such as legitimacy, transparency, accountability, human rights, rule of law and inclusiveness, the 12 principles strive to assist policymakers from a diversity of countries in identifying and addressing specific governance challenges (Akhmouch & Correia, 2016; OECD, 2015). The OECD (2015) further acknowledged the diverse nature of water resources, by noting that “there cannot be a single, uniform policy response to the water challenges worldwide, given the diversity of situations within and across countries in terms of legal and institutional frameworks, cultural practices, as well as climatic, geographic and economic conditions at the origin of diverse water challenges and policy responses.” To address the diverse range of situations, the OECD advocates for decentralization and bottom up approaches in order to best tailor policies to local realities.

While application of IWRM has brought varied results within and across countries, successes have been noted when local approaches raised both capacity and coordination, while empowering local community members to participate in the decision-making process. Beyond the 12 listed principles (see Figure I-1), the report stated further instructions for achieving desirable outcomes. Specifically, it was noted that pre-determined schedules should be established in setting goals and achieving various objectives, and that duties and responsibilities should be clearly assigned. Additionally, strategies that lay out specific operational frameworks for the short, medium and long term in a consistent and sustainable way are vital. The final step in the incorporation of the 12 principles and subsequent advice is to ensure that regular monitoring and evaluation is achieved (OECD, 2015). In 2018, the OECD surveyed stakeholders from several member countries to assess the value of the 12 principles. Of the 85 respondents, 80% noted that they used the principles to guide their activities either “often” or “sometimes”. For those that didn’t find them useful, it was due to reasons such as lack of capacity or lack of clarity on the intended meaning of the principles, and how to apply them. The majority of respondents also recommended that the principles should be better linked with global agendas, and to improve dissemination at water-related conferences and events.

THE 12 OECD WATER GOVERNANCE PRINCIPLES

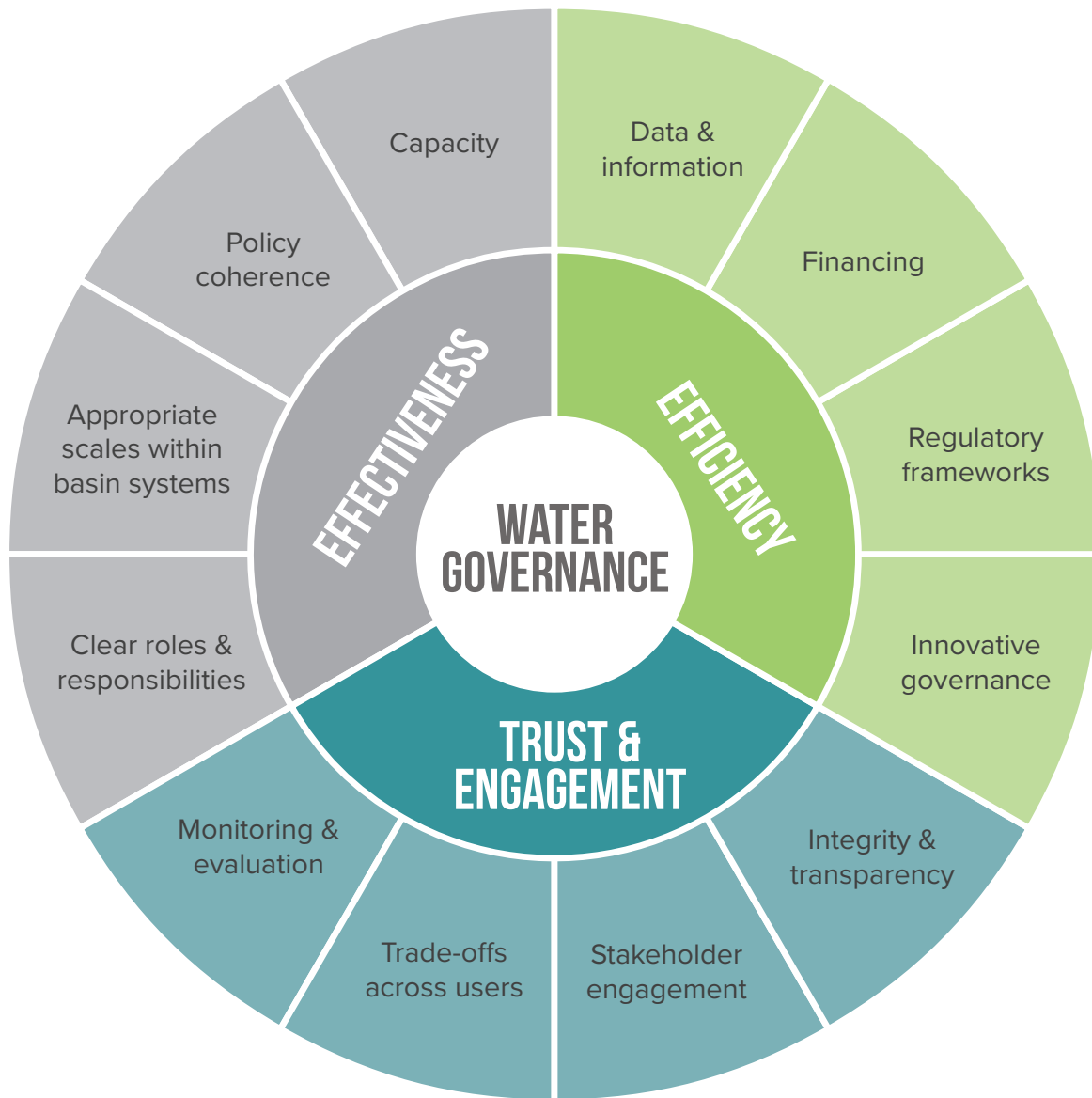


FIGURE I-1. OECD PRINCIPLES ON WATER GOVERNANCE

Other intergovernmental and globally focused organizations, such as Stockholm International Water Institute (SIWI), the Global Water Partnership (GWP), and universities such as IHE Delft also focus on developing global water governance approaches, strategies and research. For example, SIWI lists water governance as a “priority area” and acknowledges that the timing and access of water services is largely dependent on water governance, and the social relations and systems in place. Like the UN and the OECD, SIWI recognizes that multiple sectors and governance systems influence water services, but they also note that it is how stakeholders and the broader society interact with these sectors and governance systems that influence interaction and use of water resources (SIWI, n.d.).

In order to address the gaps in capacity recognized by the UN and OECD, the GWP strives to ensure that appropriate tools are provided to those wishing to learn about, and adopt better practices for water governance and management. They provide about 60 tools focusing on specific management instruments, institutional arrangements, policies, legislation, financing structures and investing strategies specific to the country; in addition, they provide helpful references and case studies where water governance strategies have been implemented (GWP, 2017). IHE Delft, the largest international graduate water education facility in the world, encourages further research into water governance and management, and recognizes that water governance is interdisciplinary, as it interacts with various academic fields and subjects. Importantly, they note that there are two broad approaches to the way we consider water governance. The first is that water governance is a tool that needs to be tailored to produce desired outcomes. This approach is often referred to as instrument-oriented and encourages government arrangements and processes that establish efficiency, equity and effectiveness. In contrast, the second approach, critically analyzes current governance processes and decisions, and how these systems influence equitable access to water resources and services for a range of stakeholder groups (IHE Delft, n.d.).

It is worth noting that the majority of international and intergovernmental literature focuses on water governance, not watershed governance more broadly; whereas the ORWS considers water governance and subsequent management at the watershed scale. Notably, watershed or basin level approaches are often recommended. The second OECD Water Governance Principle notes that water should be managed at the appropriate scale within basin systems, while the UN SDGs note that monitoring ecosystems at the basin scale is important (OECD, 2015; UN 2018). Additionally, several academics focus on water governance and management at the watershed scale (Parkes & Horwitz, 2009; Parkes et al., 2010). Parkes et al. (2010) for example, note that “watersheds (also known as catchments and river basins) provide an ideal context to design integrated governance that addresses health, environmental and socio-economic priorities”. Wang et al. (2016) echoes this, stating that watersheds are an appropriate scale for management given that water is interconnected with all aspects of a system. Through considering international examples to build knowledge on watershed scale management, Wang also details an ideal process for developing an effective watershed management strategy (Wang et al., 2016):

- Survey the status of the watershed and identify its situation, specifically indicators of ecosystem health to evaluate ecosystem function, such as physio-chemical (e.g., pH, water temperature, concentration of nutrients), biological (e.g., flora and fauna biodiversity, algal growth), habitat (e.g., riparian habitat species composition, degree of bank erosion), and water flow indicators (e.g., peak flow, base flow) should be surveyed;
- Identify stakeholders;
- Identify interests and objectives;
- Determine the target and plan;
- Implement the plan; and
- Evaluate management success and failures, reassess objectives, and adjust the plan to improve management success.

Furthermore, multiple Canadian institutions and academics have advocated for managing Canada’s water resources at the watershed scale, with the CCME encouraging this approach, and Ontario’s CAs, Québec’s OBVs, and multiple local and transboundary watersheds operating at the watershed scale (see section 3.1).

APPENDIX J: INTERNATIONAL WATERSHED MANAGEMENT BODIES

INTERNATIONAL WATERSHED BODIES	ORIGIN AND MAIN PARTNERS	MANDATE AND PRIMARY ACTIVITIES	ORGANIZATIONAL STRUCTURE	FUNDING SOURCES
<p>Australia National Water Commission</p> <p><i>*Abolished in 2014 and National Water Initiative</i></p>	<p>Australia</p> <p>The National Water Commission (NWC) was established in 2004, in the wake of a severe drought, in order to better assess Australia's progress on the National Water Initiative, which was established in the same year. The NWC released reports that assessed state and local government efforts to implement the new initiative.</p> <p>The NWC was abolished in 2014, as it was felt that, under budget constraints, enough progress had been made in water reform.</p>	<p>The Commission was a purely advisory body responsible for assessing, auditing and monitoring water reform in Australia. Assessments of Federal, state and local implementation of the NWI were the focus of triennial assessments developed by the commission.</p> <p>Set up to advise the Prime Minister on water spending and to audit, assess and monitor Federal Water Reform.</p> <p>The National Water Initiative, commits the states and territories to, among other things, include Indigenous representation in water planning, take account of Indigenous rights to water, incorporate Indigenous social, spiritual and customary objectives and strategies, and take into account water allocated to native title holders for traditional cultural purposes.</p>	<p>6 commissioners chaired by one federal appointee.</p> <p>In 2010, the triennial assessment found that it was rare for Indigenous peoples' requirements to be included in water plans and most jurisdictions were not adequately engaging Indigenous peoples in water planning processes. The First People's Water Engagement Council was developed to advise to the NWC on national water issues. Members of the Council are appointed by the Chair of the NWC and most were Indigenous peoples.</p>	<p>Was funded by the Australian Government, specifically through the Department of the Environment and Energy. Budget for the Commission was roughly \$5 million per year.</p>

INTERNATIONAL WATERSHED BODIES	ORIGIN AND MAIN PARTNERS	MANDATE AND PRIMARY ACTIVITIES	ORGANIZATIONAL STRUCTURE	FUNDING SOURCES
Murray Darling Basin Authority	Australia Established by the <i>Water Act 2007</i> .	The authority has 7 functions 1. Prepare, implement and review an integrated plan for the sustainable use of the Basin's water resources 2. Operate the Murray River system and efficiently deliver water to users 3. Measure, monitor and record the water quality and quantity 4. Support, encourage and conduct research about the Basin's water resources and dependent ecosystems 5. Advise the Australian Government Minister for Water Resources on the accreditation of state water resource plans 6. Provide water rights info to facilitate water trading 7. Engage and educate the Australian community about the Basin's water resources	Composed of: <ul style="list-style-type: none"> Commonwealth Minister responsible for water Six member Murray–Darling Basin Authority Ministerial Council Basin Officials Committee Basin Community Committee. A government-run authority, with roughly 300 staff, and various offices. Extremely broad reach and a diverse set of roles and responsibilities.	Funded by the Government of Australia. Spending was \$180 million in 2017.
Victoria Catchment Management Authorities	Australia Created in 1994, the State of Victoria has a statewide catchment management council and 10 catchment management authorities, that enables integrated catchment management in naturally occurring drainage basins.	Authorities are responsible for integrated planning and coordination of land, water and biodiversity in a designated "land protection region". Regional catchment strategies provide a framework to inform direction and management within each authority.	Authorities are structured to ensure community involvement. Board members: Develop strategic direction and provide management oversight. Implementation Committees: Engage communities and focus on specific details of programs. Staff: Support board and committee through implementation of plans, and form partnerships with catchment focused organizations.	Funding comes from Australian federal government.

INTERNATIONAL WATERSHED BODIES	ORIGIN AND MAIN PARTNERS	MANDATE AND PRIMARY ACTIVITIES	ORGANIZATIONAL STRUCTURE	FUNDING SOURCES
Catalan Water Agency	Spain State Government organization; legally defined as a public company.	Develops and implements policies based on the Water Framework Directive. Primarily in charge of the Catalan River Basin District, which has 11 basins within it. Its main goals include: <ul style="list-style-type: none"> • Execute the Water Framework Directive • Protect the aquatic environment and authorize river works • Plan and manage water supply and water treatment to the inland basins of Catalonia • Build and operate water treatment plants • Compose flooding studies • Conduct inspections and monitoring • Develop laws related to water resources 	The agency consists of 4 bodies, all with membership designated by the Agency Director: <ul style="list-style-type: none"> • The Administrative Council • The Council for Sustainable Use of Water • Council of Supply Network • Reservoir Withdrawal Commission 	Funded by the Spanish State Government.
European Union Water Framework Directive (WFD)	European Union (EU) Prior to the turn of the century, the water quality of many European rivers was declining, and surveys showed that nearly half of the EU public saw water issues as a primary environmental concern. At the time, water management was largely managed by individual EU countries, leading to inconsistencies, overlaps, and confusion regarding the many shared river basins on the sub-continent. Through a series of review and recommendation processes from member states and stakeholder groups, as well as a conference attended by 250 delegates, a new approach to water governance in the EU was agreed upon.	Strives to ensure cleanliness of Europe's waters and to ensure citizen involvement. The WFD required that all river basins achieve "good ecological status" by a series of set deadlines. Specifically, a first round of environmental objectives were to be met in 2015, and a second round are intended to be met by 2027. Good ecological status includes the objective that surface waters receive both ecological and chemical protection, and that the amount of groundwater is quantified. There are three criteria in the framework used to evaluate water policies: (1) water quality objectives must be set in relation to reference conditions; (2) actions to achieve the objectives must be compared in terms of cost and efficiency; and, (3) water quality data must be systematically collected and made public.	A combination of a top down and a bottom up approach, the EU provides frameworks and objectives, however allows individual watershed authorities to develop based on local conditions. Each river basin is required to establish a River Basin Authority, which would include public participation.	Funding comes from EU member states; however each River Basin Authority often has a diversity of groups making financial contributions.

INTERNATIONAL WATERSHED BODIES	ORIGIN AND MAIN PARTNERS	MANDATE AND PRIMARY ACTIVITIES	ORGANIZATIONAL STRUCTURE	FUNDING SOURCES
International Commission for the Protection of the Rhine and the Rhine Coordination Committee	<p>Switzerland, France, Germany, Luxembourg and the Netherlands</p> <p>Countries listed above, as well as the “European Community”.</p>	<p>Maintaining and improving the quality of the Rhine’s waters (including the quality of the suspended matter, sediments, and groundwater) through the prevention, reduction, or elimination of pollution caused by noxious substances, nutrients from point sources (such as industry and municipalities), diffuse sources (such as agriculture and traffic), and shipping.</p> <p>Ensuring the environmentally sound management of water resources.</p> <p>The Rhine Coordination Committee is responsible for coordinating the tasks of the International Commission for the Protection of the Rhine and decides on the establishment of various project groups, often to work on projects related to the EU WFD.</p>	<p>The presidency of the Commission alternates every three years. The Plenary Assembly is staged annually together with the Rhine Coordination Committee. Decisions are made in the Plenary Assembly. Technical questions are dealt with in working and expert groups with permanent or fixed-term mandates and passed on to the Strategy Group preparing the Plenary Assembly. A Strategy Group is responsible for: (a) preparing solutions for budget and staff issues; (b) coordinating, managing and overseeing the Commission’s work – for example, activities related to Rhine 2020, the WFD, and the European Community Flood Management Directive, as well as reports to the Plenary Assembly, Rhine Coordination Committee, and working groups; and (c) facilitating public relations and information exchange.</p>	<p>Switzerland’s share of the budget is 12% and the European Community’s share is 2.5%. The remaining 85.5% share is divided between Germany (32.5%), France (32.5%), Luxembourg (2.5%), and the Netherlands (32.5%).</p>

INTERNATIONAL WATERSHED BODIES	ORIGIN AND MAIN PARTNERS	MANDATE AND PRIMARY ACTIVITIES	ORGANIZATIONAL STRUCTURE	FUNDING SOURCES
UK Rivers Trust	UK and Ireland Independent, community-led charitable organization that began in 2001.	<p>The organization uses programs called the Blueprint for Water, the Wildlife and Countryside Link and the Catchment Based Approach to guide their direction. Each trust has its own structure; however all deliver education, water management advice and practical conservation work.</p> <p>Conservation work includes tree planting to prevent erosion and restore waterways, surveying and data collection in streams, flood risk management and removal of fish barriers. Additionally, the river trust team supports local trusts in gathering data, and in the production of maps and infographics to support governments, business and charities within local watersheds.</p>	Umbrella organization for over 60 local trusts. Most trusts are made up of local community members. The umbrella organization is made up of a president and eight trustees that oversee the direction and management of the charity.	Funded by community members and industry groups.
Oregon Watershed Councils	Oregon, U.S. Based on naturally occurring watersheds. Each council involves multiple stakeholders from each respective watershed.	<p>Community based, voluntary and non-regulatory group.</p> <p>Watershed Councils are made up of people from the local communities. They represent local knowledge and have ties to the existing community. Watershed Council's work across jurisdictional boundaries and across agency mandates to look at the watershed more holistically.</p> <p>The organizations are established by local governments, and guided based on two primary components of state legislature:</p> <ol style="list-style-type: none"> 1. The watersheds must be a voluntary, local group 2. The council represents a balance of interested and affected persons within the watershed 	<p>There are 90 local watershed councils in Oregon. Councils are designated by county governments and have broad and balanced representation and viewpoints.</p> <p>The overarching board is made up of members of various watershed council's and academics.</p>	Fifty-nine watershed councils receive capacity funding support through the state Oregon Watershed Enhancement Board (OWEB). OWEB provides grants for operating funds, restoration projects, and other programs to enable councils to carry out restoration, monitor the status of the watershed, and reach out to landowners and other community members.

INTERNATIONAL WATERSHED BODIES	ORIGIN AND MAIN PARTNERS	MANDATE AND PRIMARY ACTIVITIES	ORGANIZATIONAL STRUCTURE	FUNDING SOURCES
Colorado Water Conservation Board Basin Round Tables	<p>Colorado, U.S.</p> <p>State funded program, which was initiated to support the development of the Colorado Water Plan. Each round table is organized based on naturally occurring sub-watersheds.</p>	<p>Mandate to create a Basin Implementation Plan to examine individual needs. The existing Colorado Water Conservation Board prepared a nine chapter report to provide water related information, as well as goals and action items to each group. Round tables then assessed the specific needs and provided consensus-based recommendations for their respective watershed. Each round table delivered policy briefs, including operational and infrastructure requirements.</p>	<p>The nine individual round tables were made up of a range of stakeholder groups. Round table sizes were proportional to the size of the sub-watershed.</p> <p>A separate collaborative group, the Interbasin Compact Committee, was developed to encourage communication and collaboration among the nine groups throughout the process.</p>	<p>Funded by the Colorado State government.</p>
New York City (NYC) Memorandum of Agreement (MOA)	<p>U.S.</p> <p>Partnership between governments, nonprofits and interest groups.</p> <p>27 members from diverse stakeholder groups.</p> <p>Initiated due to the U.S. Environmental Protection Agency (EPA) requirement for NYC to filter their water using chemicals. Instead the City initiated the New York City Watershed MOA with the State of New York, local governments, the EPA and environmental groups.</p>	<p>To preserve the ecological integrity of the Catskills and Delaware watersheds in which NYC relies upon for drinking water. Activities include re-allocating funds to upstream inhabitants to encourage protection of water quality and quantity, often through limiting industrialization.</p>	<p>In the agreement, NYC bought land from the upstream watershed that was contributing to water degradation. Upstream residents are compensated to follow restrictions set by the MOA.</p> <p>The MOA also created a Council to ensure regions were engaged in the long term protection of NYC's drinking water, The Council also worked to ensure that economic growth was supported in the Catskills and Delaware counties.</p>	<p>Funded by the state and NYC.</p>

INTERNATIONAL WATERSHED BODIES	ORIGIN AND MAIN PARTNERS	MANDATE AND PRIMARY ACTIVITIES	ORGANIZATIONAL STRUCTURE	FUNDING SOURCES
Navajo Nation Department of Water Resources	<p>U.S.</p> <p>Not a council, a department within Navajo Nation which has an elected government that includes an executive office, a legislative house, and a judicial system. The Nation is within the U.S., therefore is influenced by U.S. regulations as well.</p>	<p>They aim to manage water resources for the benefit of present and future generations to sustain long term socio-economic development while protecting the nation's sovereignty over its water.</p> <p>Approximately 30% of the Navajo Nation does not have access to clean drinking water.</p>	<p>There are five branches within the department, which aim to combat drought, provide more accessible access to water, and to ensure the long term sustainable protection of water resources. The branches are the Water Code Section, the Technical and Construction Branch, the Operation and Maintenance Branch, Water Management Branch and the Safety of Dams Program.</p>	<p>Funding from local, state and federal agencies. The Water Management Branch coordinates many funding agreements for planning, design and construction of water projects.</p>
Permanent Okavango River Basin Water Commission (OKACOM)	<p>Angola, Botswana and Namibia</p> <p>Three member delegation from all three member countries, up to nine delegate's total. However, delegates can hire as many advisors as they wish.</p>	<p>The Commission's mandate emerges from the shared vision of the three States that envisages anticipating and reducing unintended, unacceptable and often unnecessary impacts to the resources of the Okavango basin system. The vision is supported by operational principles of:</p> <ul style="list-style-type: none"> • Equitable allocation • Sustainable utilization • Sound environmental management • Sharing of benefits 	<p>There are three entities within OKACOM—the Commission, the Okavango Basin Steering Committee (the "OBSC"), and the Secretariat (also referred to as "OKASEC"). The Commission serves as OKACOM's principal body and is responsible for guiding its policy and supervising its activities. The OBSC serves as the technical advisory body to the Commission. It is supported by three task forces – biodiversity, hydrology, and institutional.</p> <p>The Secretariat is an internal entity that provides administrative, financial and general services to support decisions.</p>	<p>Funding comes primarily from member states; however the Swedish International Development Agency has pledged \$2.2 million USD over three years to help establish the secretariat.</p>

INTERNATIONAL WATERSHED BODIES	ORIGIN AND MAIN PARTNERS	MANDATE AND PRIMARY ACTIVITIES	ORGANIZATIONAL STRUCTURE	FUNDING SOURCES
Waikato River Authority	<p>New Zealand</p> <p>In the 1860s, the colonial government confiscated the Waikato lands, causing many local Indigenous communities to lose their homes, livelihoods and sense of power. In 2009, a Deed of Settlement recognized the Waikato – Tainui's historical claims relating to the Waikato River. The Deed also created the Waikato River Authority; a single co-governance and co-management board.</p>	<p>Mandate: 1. Restoration and protection of the health and wellbeing of the Waikato river; 2. Promote an integrated, holistic and coordinated approach; and 3. Fund rehabilitation initiatives.</p>	<p>10 board members:</p> <p>Five appointed by the Crown, and one each from the five participating Māori Iwi communities. Decisions are reached via consensus and there are two co-chairs, one Crown and one Māori. In instances where the committee cannot agree upon a decision, recommendation is made by the Minister of the Environment and a nominated Māori individual, and this recommendation becomes binding if, after 20 days, a decision has still not been determined.</p> <p>The board advises a six person management team, who carries out various projects and plans.</p>	<p>Over \$100 million over 30 years committed by the Government of New Zealand. Specifically, the 2009 settlement created a single co-governance and co-management board with equal numbers of Indigenous and Crown representatives. Funding for this initiative came from the New Zealand Government and includes a NZ\$20 million endowment to a college trust, NZ\$50 million for initiatives to restore and protect the river, NZ\$1 million per year for 30 years to support Māori participation in the co-governance arrangement, and NZ\$7 million for 30 years to a clean-up fund for the river.</p>
Whanganui River Claims Settlement	<p>New Zealand</p> <p>In 2009, formal efforts to give the Whanganui River legal title began, and in March of 2017, the river was officially recognized as having the legal rights of a human. The Parliament of New Zealand passed the Whanganui River Claims Settlement resolving historical claims with seven different Whanganui Iwi, while setting a historical precedent by giving a river human status.</p>	<p>Not a council or management body.</p> <p>Relatively new concept, however non-human entities such as corporations and religious sites have been granted legal personhood in the past.</p> <p>Management structure is being developed.</p>	<p>The settlement appointed two legal guardians to the river, one from the Māori Iwi and another from the New Zealand Government.</p>	<p>Financial redress of \$80 million is included in the settlement as well as an additional \$1 million contribution towards establishing the legal framework for the river. The Crown will also contribute \$30 million towards a contestable fund to further the health and wellbeing of the Whanganui River.</p>

APPENDIX K: CANADIAN WATERSHED MANAGEMENT BODIES

WATERSHED BODIES	ORIGIN AND MAIN PARTNERS	MANDATE AND PRIMARY ACTIVITIES	ORGANIZATIONAL STRUCTURE	FUNDING SOURCES	FEDERAL INVOLVEMENT
Yukon River Inter-tribal Watershed Council	Established in 1997. Non-governmental organization composed of 73 First Nations and Tribes from Canada and the U.S.	Undertakes research, training, education, and awareness programs in collaboration with First Nations and Tribes. Priority issues include Brownfields, drinking water improvement, solid waste management, and setting of water quality standards to protect quality and flow.	There are two co-chairs, one from Alaska and one from Yukon, as well as 25 executive committee members, including elders.	Funding provided by the U.S. federal government, and obtained through, grants and donations.	Yukon First Nations have been recognized by Canadian law, and largely govern their own land, providing advice and meeting with other governments as necessary. In 2014, Health Canada provided funding of \$100,000 for the council to develop a climate change policy.
Mackenzie River Basin Board	Established in 1997 through the <i>Mackenzie River Basin Transboundary Waters Master Agreement</i> involving the governments of Canada, Saskatchewan, Alberta, British Columbia, Yukon and Northwest Territories.	Provides a forum for communication, coordination, information exchange and incorporation of traditional knowledge; recommends objectives or guidelines for water quality and quantity; encourages consistent monitoring; reports on the state of the aquatic ecosystem every five years. Mackenzie River Basin Transboundary Waters Master Agreement sets out principles for management of interprovincial and territorial waters.	There are three federal representatives and two representatives from each of the five provincial/territorial jurisdictions within the basin. One representative from each provincial/territorial jurisdiction must be of Indigenous ancestry.	The six governments fund the Board's annual operational budget of \$280,000.	Co-created and partially funded by the Government of Canada. Three federal representatives are on the 13 member board; one each from CIRNAC, ECCC and Health Canada. The ECCC member has chaired the Mackenzie River Basin Board since its inception. Under the Master Agreement, ECCC and CIRNAC contribute \$40,000 each, with provinces/territories paying the remainder. Interjurisdictional partnership reviewed annually under <i>Canada Water Act</i> .

WATERSHED BODIES	ORIGIN AND MAIN PARTNERS	MANDATE AND PRIMARY ACTIVITIES	ORGANIZATIONAL STRUCTURE	FUNDING SOURCES	FEDERAL INVOLVEMENT
Mackenzie Valley Land and Water Board	Established in 1998 under the federal <i>Mackenzie Valley Resource Management Act</i> , which enabled integrated co-management structures for lands and waters.	A regulatory body, with specific roles in the overall resource management regime, defined by legislation. Activities include: issuing land-use permits and water licenses in areas with unsettled land claims, and screening proposals which may trigger assessment by the Mackenzie Valley Environmental Impact Review Board. Also regulates deposits of waste.	All Board members are co-appointed by the First Nations, federal and provincial / territorial governments. The board consists of four groups with five members each. The four groups are: the overarching board of Mackenzie Valley Land and Water and the three regional boards of Gwich'in, Sahtu and Wek'eezhii.	Primarily funded by the federal government. Supplementary funding comes from the Government of the Northwest Territories.	Established through a federal Act. The board reports to parliament through CIRNAC and CIRNAC provides their budget (\$2.65 million annually). The Minister of CIRNAC appoints board members. A regulatory agency – not a collaborative board.
Fraser Basin Council	Established in 1997, the non-profit organization appoints board of directors and has representatives from all levels of government and non-governmental organizations. Sub-committees focus on each region and on specific issues, including watersheds and water resources.	Guided by the <i>Charter for Sustainability</i> , a good-faith agreement among Fraser Basin residents, organizations and governments. The Charter includes four directions: understanding sustainability; caring for ecosystems; strengthening communities; and improving decision-making. The Council makes decisions based on consensus.	Council consists of 38 directors, including: Three federal representatives, three provincial representatives, one representative from each of the eight regional districts, one representative from each of eight Indigenous language groups, and 16 appointed representatives. The 16 appointed representatives represent geographic regions, economic, social, environmental values, youth, as well as one impartial chairperson.	Base funds from each of the eight regional districts, cost-recovery services, and donors.	One federal representative each from DFO, NRCan and ECCC. The federal government has provided funding for various initiatives, for example the Fraser River Action Plan (DFO and ECCC); however, they are not responsible for regular funding. No legislative authority.

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Skeena Watershed Conservation Coalition	<p>Established in 2004 by community-based grassroots movement.</p> <p>Non-governmental organization aiming to protect the Nass, Skeena and Stikine Rivers in British Columbia.</p>	<p>Activities include:</p> <p>Informing proposed development plans that may compromise sustainability;</p> <p>Developing long-term stewardship plans;</p> <p>Organizing multi-jurisdictional and stakeholder meetings; contributing to baseline research on wildlife, water quality, and cultural heritage; as well as community engagement programs.</p>	Skeena Watershed Conservation Coalition has a board consisting of a chair and four directors. Other staff include community members, academics, Indigenous peoples and industry.	Mix of funding sources, including foundations, corporate, government and non-profit.	No direct involvement.
Coquitlam River Watershed Roundtable	<p>Established in 2011.</p> <p>Multi-stakeholder Roundtable that includes government members and provides advice based on consensus. Participation is open to anyone who supports the Roundtable's mission: Kwikwetlum First Nation, provincial government, DFO, industry and municipal governments have all participated.</p>	<p>Activities include coordinating monitoring efforts, participating in the preparation of a watershed plan, sponsoring educational events, or working towards consensus on issues that affect the watershed.</p>	A core committee of 18 members, which meets every two months, consists of municipal, provincial, federal, and Indigenous government representatives, representatives for industry and non-governmental organizations. Public roundtable meetings held annually.	Mix of funding, sources, including community, federal, municipal, industry.	<p>One federal government representative from DFO sits on their 16 member Core Committee. Governments and government agencies participate in the Roundtable, but it is an independent entity, and does not have jurisdictional or legislative capacity. DFO and the Government of Canada are listed as funders.</p>

WATERSHED BODIES	ORIGIN AND MAIN PARTNERS	MANDATE AND PRIMARY ACTIVITIES	ORGANIZATIONAL STRUCTURE	FUNDING SOURCES	FEDERAL INVOLVEMENT
Cowichan Watershed Board	<p>Established in 2010 as a result of the 2007 Cowichan Basin Water Management Plan.</p> <p>Partners include, municipal, provincial and federal governments, as well as community members. The Board prioritizes actions, and decides which party has legal authority and capacity to implement an action.</p>	<p>Mandate is to provide leadership for sustainable water management to protect and enhance environmental quality and the quality of life.</p> <p>Activities include outreach and education; implementation of Cowichan Basin Water Management Plan; providing specialized advice to Indigenous, federal, provincial and local governments; and monitoring the health of the watershed.</p>	<p>Board consists of two co-chairs, representing Cowichan Tribes and Cowichan Valley Regional District. There are also three appointees to represent geographic areas, two Councilors from Cowichan Tribes, as well as two federal appointees and two provincial appointees.</p> <p>There is also an advisory committee involving environmental groups, land owner associations, and others.</p>	<p>Funding provided by the Cowichan Tribes and the Cowichan Valley Regional District.</p> <p>Project-specific funding provided by government, non-government, industry, and other organizations.</p>	<p>Established based on a Management Plan developed by multiple partners including DFO.</p> <p>One representative from DFO sits on the board, while other members are selected with federal assistance.</p> <p>The federal government has provided specific project funding.</p> <p>The board has no legislative authority.</p>
Okanagan Basin Water Board and Okanagan Water Stewardship Council	<p>Board established in 1970, under <i>British Columbia's Municipalities Enabling and Validating Act</i>; the Council was established in 2006.</p> <p>It is a collaboration of the three Okanagan regional districts.</p> <p>Program Committees (long-term) and Task Forces (short-term) are formed to oversee work on specific issues.</p> <p>The Council is an advisory body and communication channel to communities throughout the Okanagan.</p>	<p>Led by the three Okanagan regional districts, to provide leadership on water issues and promote coordinated water management.</p> <p>Board activities include receiving input from private and public interests, defining problems and priorities, making recommendations to governments, and participating in surveys or projects.</p> <p>Council meets monthly to provide independent advice and policy recommendations to the Board.</p>	<p>Board consists of 12 members. Nine directors are elected officials from the valley's three regional districts; one director is appointed by the Okanagan Nation Alliance; one director represents the Water Supply Association of British Columbia; and one director represents the Okanagan Water Stewardship Council.</p> <p>Water Stewardship Council is made up of 28 technical experts and stakeholders.</p>	<p>Funding for the Board provided through levies from the three regional districts, as well as through their partnerships.</p> <p>Funding also provided through leveraging of external funds and in-kind contributions.</p>	<p>The Government of Canada has formally recognized and prioritized the importance and sensitivity of the Okanagan Basin ecosystem since the 1969 "Canada-British Columbia Okanagan Basin Agreement." In 1974, ECCC produced an "Okanagan Basin Study" and has collaborated with provincial and regional partners on the issue since.</p> <p>The federal government provides supplemental funding for various programs, for example provide roughly \$150,000 to combat invasive species.</p> <p>Council members include representatives from ECCC, DFO and AAFC.</p>

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Alberta Water Council	<p>Established in 2004 and incorporated as a not-for-profit society in 2007.</p> <p>A multi-stakeholder, consensus-based partnership.</p>	<p>Council's mission is to provide leadership, expertise and sector knowledge to engage industry, non-governmental organizations, and governments in the achievement of the provincial Water for Life strategy.</p> <p>Focused on ensuring that the strategy's three goals are met: (1) safe drinking water, (2) maintained and protected aquatic ecosystems, and (3) effectively managed water supplies for a sustainable economy.</p>	Council is composed of 24 members from provincial government, municipal governments, industry, and non-governmental organizations. An Executive Committee is comprised of one member from each of these categories.	<p>Funding provided by the Government of Alberta through multi-year grants.</p> <p>Funding also obtained from donations.</p>	Provincial organization
Alberta Watershed Planning and Advisory Councils	<p>Alberta has 11 Watershed Planning and Advisory Councils representing the major river basins.</p> <p>Independent, non-profit organizations that are designated by Alberta Environment and Parks.</p>	<p>Report watershed health, lead collaborative planning, and facilitate education and stewardship activities.</p> <p>Councils engage representatives of governments, Indigenous communities, industry, conservation groups, academia, and the public, and seek consensus on land and water resource management strategies that support shared goals.</p>	Of the 11 watershed councils, each has different structures and partners.	<p>Core funding for the 11 Councils provided by Government of Alberta through multi-year grants. Funding and support also provided by other governments, industry, organizations, and individuals.</p>	Provincial initiative

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Alberta Watershed Stewardship Groups	<p>Program established in 2011 and aims to fund a diverse range of watershed stewardship groups.</p> <p>There are over 140 watershed stewardship groups in Alberta. These groups include individuals, organizations, representatives from the agricultural and industry sectors, municipalities and other forms of local government.</p>	Groups actively engage in environmental stewardship of their watershed and take community-level action to safeguard Alberta's water sources.	Community and volunteer based partnerships.	Provincial government support through the Watershed Stewardship Grant Program.	Provincial initiative
Saskatchewan Water Security Agency	<p>Established in 2002 and renamed in 2013.</p> <p>The primary groups involved are SaskWater, the Saskatchewan Wetland Conservation Corporation, and Saskatchewan Environment.</p>	<p>Manages the province's water supply, protects water quality, owns and manages 69 dams and related water supply channels, reduces flood and drought damage, provides information about water, and represents Saskatchewan on transboundary water issues.</p> <p>In 2003, Protecting Our Water, a Watershed and Aquifer Planning Model for Saskatchewan resulted in 12 watershed and aquifer source water protection plans being established.</p>	<p>Made up of roughly 200 government staff.</p> <p>Brings together provincial agencies responsible for water supply and dam management, safe drinking water standards, and flood reduction management.</p>	<p>The agency provides grant funding annually to support basic operations.</p> <p>Additional revenue is generated from federal and provincial programs, and through municipal memberships and donations.</p>	<p>Provincial Crown corporation under the Minister of Environment's portfolio. Partners with federal and provincial counterparts for: Prairie Provinces Water Board, Mackenzie River Basin Board, Committee on Drinking Water, International Joint Commission and the CCME.</p> <p>ECCC and DFO have a protocol agreement with the Saskatchewan Water Security Agency to discuss urgent water issues as needed bilaterally.</p>

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Saskatchewan Association of Watersheds	The Saskatchewan Association of Watersheds is the umbrella organization representing 11 watershed groups' interests and concerns. The Association advocates to the provincial government on behalf of those groups.	The Association provides a unified voice to influence decision-making and policy development within the province and balances the economic, environmental and social aspects of the watershed members in order to ensure there will be a healthy source water supply of ground and surface water for future generations in Saskatchewan.	Composed of 13 members, including one board member from each of the 11 watershed groups plus "two members at large". Additionally there is a board of five administrative directors.	Funding obtained through membership fees from the watershed groups.	Provincial initiative
Manitoba Water Council	* Now dissolved Established in 2007 under the authority of the <i>Water Protection Act</i> . Senior advisory body to Manitoba's Minister of Sustainable Development.	The Council coordinated the work of all provincial advisory bodies on water protection, played an important role in province-wide water issues, and built consensus among Manitobans on sustainable solutions that will help protect and manage the province's water.	Members (of which there were at least five) were appointed by the Lieutenant Governor in Council, and represented diverse interests, including those of local governments, agricultural producers, and environmental non-governmental organizations.	Funding info not publically available.	Provincial initiative
Manitoba Climate and Green Plan Expert Advisory Council	The Made-in-Manitoba Climate and Green Plan Expert Advisory Council is a senior advisory body to the Minister of Sustainable Development and replaces the Manitoba Water Council. The Expert Advisory Council was established in 2018 under the authority of the <i>Water Protection Amendment Act</i> , one of the five separate acts of the <i>Climate and Green Plan Implementation Act</i> .	The Expert Advisory Council provides advice and recommendations to the Minister of Sustainable Development on programs, policies and measures for the Climate and Green Plan, including on GHG reduction; a carbon savings account; and counseling on water issues that were previously handled by the Manitoba Water Council.	The Expert Advisory Council consists of eight members and one technical advisor. Its membership represents diverse interests, including those of conservation, water management, recycling, biodiversity, climate change, resource development and local government.	Funding info not publically available.	Provincial initiative

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Manitoba Conservation Districts	<p>A non-profit organization representing 18 Conservation Districts within Manitoba.</p> <p>The <i>Water Protection Act</i> initiated these districts as it mandates watershed planning; additionally the <i>Conservation Districts Act</i> defines conservation districts.</p>	<p>Provides a leadership role and unified voice between Conservation Districts, the government of Manitoba, and their partners in watershed management.</p> <p>In Manitoba, the Conservation Districts usually lead development of an integrated watershed management plan. The districts are directed by these plans, which include identifying priority land and water-related issues, determining actions, policies and cooperative efforts to address the issues identified in their watershed.</p> <p>The passing of the <i>Sustainable Watersheds Act</i> in June 2018 will bring name, boundary, and mandate changes to the Manitoba Conservation Districts. Further details are pending in the regulations expected in the next 2-3 years.</p>	The Board of the Manitoba Conservation Districts Association includes 19 members with one representative from each of the 18 Conservation Districts (one of which sits as the Chair) and an Executive Director.	<p>Funded by the provincial government.</p> <p>Conservation Districts also apply for other funding, including federal government Grants and Contribution programs, such as Lake Winnipeg Basin Program Funding.</p>	Provincial initiative Conservation Districts are eligible to apply for federal Grants and Contribution funds provided through programs such as the Lake Winnipeg Basin Program.

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Prairie Provinces Water Board (PPWB)	<p>In 1969, Alberta, Saskatchewan, Manitoba, and Canada signed the Master Agreement on Apportionment (MAA) to equitably apportion eastward flowing streams that cross the provincial boundaries.</p> <p>The MAA was amended in 1992 to add an Agreement on Water Quality and to authorize the PPWB to address transboundary groundwater issues.</p> <p>The PPWB was established to administer the agreement and to facilitate cooperative water management.</p> <p>Board members report directly to provincial and federal government ministers.</p>	<p>Activities include: Analyzing streamflow data and reporting on the apportionment of water, reporting on the achievement of transboundary water quality objectives, identifying water-related problems or disputes and recommending appropriate management approaches, coordinating water quantity and quality objectives, and monitoring programs.</p>	<p>Five-member board composed of senior officials from the governments of Alberta, Saskatchewan, Manitoba, and Canada. The Board is supported by a secretariat and four permanent committees (hydrology, flow forecasting, water quality, and groundwater).</p>	<p>Funding formula is specified by the Master Agreement:</p> <p>Government of Canada pays for 1/2 and each province pays 1/3.</p> <p>Annual contributions currently total: \$690,000.</p>	<p>Voluntary Agreement, no related legislation.</p> <p>Federal government is a partner in Master Agreement, and they provide half of annual budget. Canada, via ECCC, is responsible for providing the surface water quantity and quality monitoring required to support the MAA. ECCC houses the Secretariat which comprises six employees funded through the PPWB budget. The PPWB reports directly to federal and provincial ministers.</p> <p>The Board is chaired by ECCC and an AAFC representative sits on the board.</p> <p>Interjurisdictional partnership reviewed annually under <i>Canada Water Act</i>.</p>

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Ontario Conservation Authorities	<p>Established in 1946 under the <i>Conservation Authorities Act</i>.</p> <p>Conservation Ontario is a non-profit association that represents a network of 36 Conservation Authorities (CAs).</p>	<p>CAs are community-based watershed management agencies dedicated to conserving, restoring and managing Ontario's natural resources on a watershed basis.</p> <p>The Ontario provincial government provides policy direction. <i>Conservation Authorities Act</i> (1946) delegates authorities to CAs, including developing natural resource management programs, land acquisition and alterations (including waterways), research, permitting, and community engagement.</p> <p>CAs also mandated to implement source water protection plans under the <i>Clean Water Act</i>.</p>	CAs are governed by a board of municipally appointed members, the majority of which are also elected municipal councilors.	CAs are, on average, funded mostly by municipalities (48%), self-generated revenues (40%), and by the provincial (10%) and federal governments (2%).	CAs are funded primarily through regional levies. Though it varies based on specific authority, the federal government provides roughly 3% of annual budget, through contracts and grants.
Ontario's Great Lakes Guardians' Council	The Great Lakes Guardians' Council, established under the Province of Ontario's <i>Great Lakes Protection Act</i> .	Council provides a forum to identify and find solutions to address Great Lakes challenges; increase science and consideration of Indigenous communities' traditional knowledge; share information and strengthen shared understanding of the Great Lakes.	<p>Members on the Great Lakes Guardians' Council include Great Lakes provincial Ministers, Municipal Representatives, First Nations and Métis representatives, and representatives from the farming community, conservation authorities, industry, environmental groups, the recreation and tourism sectors, and the science community.</p> <p>Generally the number of representatives from each municipality is proportional to their respective population sizes.</p>	Funding information not publically available.	<p>Provincial organization.</p> <p>They interact with American counterparts.</p>

WATERSHED BODIES	ORIGIN AND MAIN PARTNERS	MANDATE AND PRIMARY ACTIVITIES	ORGANIZATIONAL STRUCTURE	FUNDING SOURCES	FEDERAL INVOLVEMENT
Ottawa River Regulation Planning Board	The Ottawa River Regulation Planning Board was established in 1983 by the governments of Canada, Québec, and Ontario to ensure integrated management of the principal reservoirs of the Ottawa River Basin.	<p>The mandate of the Board is to ensure that the regulation of flow from the principal reservoirs of the Ottawa River Basin is carried out in a fashion that minimizes damage from extreme conditions (flood and drought) along the Ottawa River and in the Montreal region, while maintaining beneficial water uses within the watershed.</p> <p>In addition, the Planning Board ensures that relevant hydrological information, for example forecasts of river flows along the Ottawa River and its major tributaries, is made available to the public and government organizations. The governments also established two other entities that report to the Board, namely the Ottawa River Regulating Committee and the Ottawa River Regulation Secretariat, which act respectively as the operational arm and working arm of the Board. The role of the Planning Board is often misconstrued to be that of a 'control board'. In fact, the Planning Board does not have legal authority over the decisions of the operators of the principal reservoirs. Each operator is responsible for the operational.</p>	The Board consists of seven members, each with an alternate, who represent Canada (Three members), Ontario (Two members), and Québec (Two members).	<p>Each ministry and agency that is represented on the Planning Board and/or Regulating Committee pays for the salaries, travel and other expenses incurred by their representatives in performing duties assigned to them under the Agreement.</p> <p>Other costs are shared by three governments, on the following basis: Canada (50%), Québec (25%), Ontario (25%).</p> <p>Annual budget for 2016-2017: \$405,000.</p>	Federal-Provincial agreement, that is a legislative framework related to the operations of dams. The board has seven members, three of them representatives of the federal government, with one from each of ECCC, DFO and Public Services and Procurement Canada. ECCC represents the federal government on the official agreement and maintains the Ottawa River Regulation Secretariat, which provides information to the public on water levels and flows.

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Muskoka Watershed Council	<p>Established in 2001 by the Muskoka Heritage Foundation and the District Municipality of Muskoka.</p> <p>The Muskoka Watershed Council is a volunteer-based non-profit organization which provides a coordinated voice on issues affecting the environmental quality of their watersheds.</p>	<p>Sustain the watersheds of Muskoka through a cooperative, multi-stakeholder, watershed management approach (there is no conservation authority in Muskoka).</p> <p>The Council is not a regulatory or enforcement agency but provides information to decision-makers, managers and the general public on ways to protect and restore the resources of their watersheds.</p>	<p>The Council includes representatives from municipal, provincial and federal governments; lake and area ratepayer associations; local industry, tourism, real estate and other interests from across the watersheds.</p> <p>The Muskoka Watershed Council consists of the Council itself, three Committees (an Executive Committee, a Working Group, and a Communications Committee) and several sub-committees under the Working Group which focus on a specific topics or issues (watershed report card, algae, hydrology, endocrine disrupting compounds).</p>	<p>Office space, phones, computers, meeting space and salary for two employees at ~2/3 time is provided by the District of Muskoka.</p> <p>Funding for specific projects are sought as needed from foundations, provincial and federal government grants.</p>	Grass-roots initiative; federal government has provided grants for programs.
Muskrat Watershed Council	<p>Established in 2013 at the public Muskrat Lake Water Quality Symposium, due to interest in the formation of a local, community-led organization.</p> <p>It is composed of volunteer residents who share an interest in preserving, restoring and enhancing the watershed.</p>	<p>The Council works collectively on finding solutions to improve water quality for the Muskrat watershed, provides education for the need to maintain them, and advocates for regulations that will protect the watershed and improve its water quality.</p> <p>Partnerships with the municipal, provincial and federal government levels, with industry, non-governmental organizations, educational institutions, the science community, and with Algonquin First Nations are important to achieving the Council's goals.</p>	<p>The Council includes an elected Executive and appointed directors, representing various sectors (e.g., farmers, anglers and hunters, tourism and recreation, property owners), all have equal voting privileges.</p>	<p>The Council seeks or raises funding from any resources available.</p>	Grass-roots initiative; federal government has provided grants for programs.

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Organismes de Bassins Versants (OBVs) du Québec	<p>The OBVs were legally formed following the establishment of the 2009 Québec Water Law and its associated 2002 Water Policy, to implement integrated watershed management.</p> <p>The Regroupement des Organismes de Bassins Versants du Québec (ROBVQ) brings together and represents the 40 OBVs present throughout southern Québec.</p>	<p>The ROBVQ is recognized by the Québec government as its preferred method for implementation of integrated watershed management in the province.</p> <p>Each of the 40 watershed-specific OBVs operates according to a 5-year adaptive and integrated water management plan approved by the Québec government, and is mandated to: encourage dialogue between regional stakeholders concerned by water issues in their respective territories; inform, mobilize, consult and sensitize the population and promote integrated water management in their respective territories; and develop a water master plan that is representative of the concerns and vision of the environment.</p>	<p>The ROBVQ, which is governed by a board of directors made up of 10 OBV directors, develops and coordinates projects and programs, as well as offers a wide range of support services to OBVs.</p> <p>Each OBV Board has municipal, Indigenous, economic, and environmental and community representation, as well as government representation, but in an advisory capacity and not part of the decision-making process. Each OBV also includes representation from applicable St. Lawrence Regional Round Tables.</p>	<p>The MELCC financially supports the OBV and ROBVQ mandates. Other sources of funding for these organizations are from the provincial and federal government, academic, corporate and non-governmental organizations.</p>	<p>Provincial organization, primarily funded by provinces. Individual OBVs have received federal funding for activities such as participation in CEAA processes, while Canada's EcoAction fund has supported specific projects.</p>

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Tables de concertation régionales – Gestion intégrée du Saint-Laurent (Regional Round Tables – Integrated management of the St. Lawrence)	The Regional Round Tables were established in 2011 as part of the Canada-Québec Agreement on the St. Lawrence 2011-2026, in an effort to bring together key regional stakeholders whose concerns include the management and use of the St. Lawrence River.	<p>The Regional Round Tables promote the cooperation of regional stakeholders with commons concerns related to the integrated management of the St. Lawrence. They contribute to the implementation of regional integrated management plans.</p> <p>The Regional Round Tables have similar mandates as OBVs, detailed above.</p> <p>Notably, both organizations allow for diverse regional actors concerned with the management of water and other resources to collaborate with one another, in order to develop a common vision, and harmonize their actions.</p> <p>Both groups assist regional stakeholders by informing, mobilizing and raising awareness among the population, and assisting in the development of planning documents for IWRM in respective territories.</p>	Oversight of the Regional Round Tables was entrusted by the Québec government to existing organizations with regional integrated watershed management expertise. Round Table membership generally includes representatives from municipal government, industry, non-governmental organizations, and environmental groups among others. Currently six out of the 12 Regional Round Tables have been established. The remaining six should be established by March 31, 2021.	\$6.5 million in funding over five years was provided by the MELCC and confirmed through the Canada-Québec Agreement on the St. Lawrence 2011-2026, towards the establishment of the Round Tables.	<p>Enabled under the Canada-Québec Agreement on the St. Lawrence. The Canadian government allocated \$35.2 million for the period of 2016-2021.</p> <p>ECCC plays an official observer role in each of the Round Tables. In addition, ECCC or other federal departments or agencies may provide expert advice to the Regional Round Table when consulted.</p>

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Prince Edward Island Watershed Alliance	The Prince Edward Island Watershed Alliance (PEIWA) is a non-profit cooperative association of watershed management groups on Prince Edward Island. The group became incorporated in 2010. The PEIWA works collaboratively with watershed groups and the provincial government to ensure issues of environmental quality in watersheds are addressed.	The PEIWA serves as a representative voice for the 23 community-based watershed organizations on Prince Edward Island and often provides input on public policy and programs that support conservation, and protection and enhancement of watersheds.	A nine-member Board of Directors oversees and manages the PEIWA and includes three regional representatives for eastern, central and western Prince Edward Island.	The PEIWA receives funding support from Prince Edward Island's Watershed Management Fund (approx. \$25k/year). Individual watershed groups are also eligible to receive support from this fund.	Provincial initiative.

WATERSHED BODIES	ORIGIN AND MAIN PARTNERS	MANDATE AND PRIMARY ACTIVITIES	ORGANIZATIONAL STRUCTURE	FUNDING SOURCES	FEDERAL INVOLVEMENT
Bras d'Or Lakes Collaborative Environmental Planning Initiative	Established in 2003 in response to a request by Mi'kmaq Chiefs to develop an overall environmental management plan for the Bras d'Or lakes and watershed lands, and to facilitate its implementation.	<p>All the Mi'kmaq communities, municipal, provincial, and federal agencies, and citizens with an interest or responsibility in the Bras d'Or watershed signed the Bras d'Or Charter committing them to the Bras d'Or Lakes Collaborative Environmental Planning Initiative (CEPI).</p> <p>CEPI's objectives are to balance environmental, social, cultural and institutional priorities to ensure the health and sustainable use of the watershed ecosystem. Activities generally include monitoring, research on ecosystem health, as well as public education and information events presenting findings from both Western and traditional knowledge sources.</p>	<p>Senior Council consists of the five Mi'kmaq First Nation Chiefs, federal regional director generals, provincial deputy ministers, mayors and wardens. It meets semi-annually to review and endorse CEPI's activities and overall direction.</p> <p>CEPI also includes a Management Committee, a Steering Committee, as well as an Elders Council and a Youth Council.</p> <p>Task Teams are created by the Management Committee to address specific issues.</p>	<p>Funding provided by federal and provincial partners, and the Unama'ki Institute of Natural Resources.</p> <p>Requests for funding occasionally made to municipalities and five Unama'ki First Nation Communities.</p> <p>Project funding is applied through the task teams on projects that address specific objectives of the work plan.</p>	<p>No related legislation.</p> <p>Charter establishes agreement to collaborate.</p> <p>The main components of CEPI's governance structure include a Senior Council, Management Committee, Steering Committee, Elders Council, Task Teams and a Secretariat. The senior council typically has four federal representatives: two from DFO, one from CIRNAC and one from ECCC.</p>

WATERSHED BODIES	ORIGIN AND MAIN PARTNERS	MANDATE AND PRIMARY ACTIVITIES	ORGANIZATIONAL STRUCTURE	FUNDING SOURCES	FEDERAL INVOLVEMENT
International Joint Commission (IJC) Boards	<p>Binational agreement enabled by the Boundary Waters Treaty of 1909.</p> <p>Various partnerships between the U.S., Canada, Canadian provinces, U.S. states, as well as communities, researchers and industry representatives on both sides of the Canada-U.S. border.</p>	<p>The IJC undertakes research, engages stakeholders, and makes recommendations to the Canadian and U.S. governments that take into account the needs of a wide range of water uses, including drinking water, commercial shipping, hydroelectric power generation, agriculture, industry, fishing, recreational boating and shoreline property.</p> <p>Transboundary water bodies are geographically dispersed and have distinct circumstances; therefore issues are dealt with on a case by case basis, often through specific boards.</p> <p>Board are generally mandated to monitor and report on ecological health, assist the IJC in preventing and resolving disputes, as well as applying the best available science and knowledge in the provision of advice to governments.</p>	<p>Structure varies depending on the mandate of each board.</p> <p>Representation is balanced with American and Canadian membership. Location specific boards include:</p> <ul style="list-style-type: none"> • International Lake Osoyoos Board • International Souris River Board • International Red River Board • International Lake Superior Board • International Lake Ontario • St. Lawrence River Board <p>Boards with technical mandates include:</p> <ul style="list-style-type: none"> • International Kootenay Lake • International Columbia River • Accredited Officers of the St Mary Milk Rivers • International Lake of the Woods • International Niagara River <p>Boards are generally supported by advisory groups consisting of researchers and key stakeholders.</p>	<p>Funding provided by the U.S. and Canadian federal governments through the IJC.</p>	<p>Not a governmental organization – a binational organization.</p> <p>Global Affairs Canada is responsible for providing funding. However, IJC operations are independent of Global Affairs Canada.</p> <p>In 2015-16, the Canadian Section had three commissioners, supported by 33 federal staff in Ottawa and Windsor.</p> <p>The Canadian Section received approximately \$6.5 million in annual appropriations for operating and for programs, and \$486 thousand for contributions to employee benefit plans.</p>

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