



# **Evaluation of the Water Quality and Aquatic Ecosystems Health Program**

**Final Report**

Audit and Evaluation Branch

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### List of Key Acronyms

ADM	Assistant Deputy Minister
CABIN	Canadian Aquatic Biomonitoring Network
CCME	Canadian Council of Ministers of the Environment
CESD	Commissioner of the Environment and Sustainable Development
CESI	Canadian Environmental Sustainability Indicators
CFIA	Canadian Food Inspection Agency
CSSP	Canadian Shellfish Sanitation Program
DFO	Department of Fisheries and Oceans
DG	Director General
DSDS	Departmental Sustainable Development Strategy
ECCC	Environment and Climate Change Canada
FSDS	Federal Sustainable Development Strategy
FWQM	Freshwater Water Quality Monitoring Program
G&Cs	Grants and Contributions
IJC	International Joint Commission
INAC	Indigenous and Northern Affairs Canada
JOSM	Joint Canada-Alberta Implementation Plan for Oil Sands Monitoring
MRBB	Mackenzie River Basin Board
NCP	Northern Contaminants Program
PAA	Program Alignment Architecture
PPWB	Prairie Provinces Water Board
RDG	Regional Director General
STB	Science and Technology Branch
VNR	Vote netted revenue
WQMSD	Water Quality Monitoring and Surveillance Division
WSTD	Water Science and Technology Directorate

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## EXECUTIVE SUMMARY

### Program Description

- The objective of the Water Quality and Aquatic Ecosystems Health Program is to provide information on and increase understanding of the impacts and risks posed by human activities on water quality and the health of aquatic ecosystems. The Program includes activities related to the following:
  - monitoring of freshwater, marine water, and the oil sands;
  - research into water quality and aquatic ecosystems health, including related grants and contributions and research under the Northern Contaminants Program; and
  - analytical, laboratory and research support.
- The program also has close links with several other programs in the Department involved in work related to water quality and other water issues, including programs addressing freshwater ecosystem initiatives (e.g., Great Lakes, Lake Winnipeg and the St. Lawrence River).
- The program is delivered by the Science and Technology Branch (STB) of Environment and Climate Change Canada (ECCC), in partnership with provinces and territories, in accordance with water quality monitoring agreements and as directed by water boards, and, in the case of marine water, in partnership with other government departments.
- Program expenditures, including laboratory facility costs were \$61.1M in 2015–2016.

### Evaluation Results

- Given the importance of freshwater as a resource, the known and emerging threats to water quality and their potential health impacts, as well as existing legislative obligations, there is a clear need to monitor, assess and report on Canada's water quality.
- The work of the Water Quality and Aquatic Ecosystems Health Program supports several priority government programs, and addresses commitments outlined in federal/provincial/international agreements related to water quality monitoring.
- The federal government has responsibilities related to water management and has jurisdiction over transboundary waters, although it shares responsibilities for freshwater quality management with the provinces. To ensure clarity, the Program administrators have implemented a series of agreements that define its roles with respect to inter-jurisdictional water quality monitoring.
- Research is being conducted in collaboration with other organizations, with a focus on priority areas such as the oil sands, the Arctic, and the Chemicals Management Plan.<sup>1</sup>
- Credible, science-based and relevant water quality and aquatic ecosystems health information supporting the Program's mandate and commitments is available to the public and to stakeholders through websites, data portals, and peer-reviewed publications. A range of internal and external stakeholders use water quality and biological indicator data from the program to inform policies, direct actions, assess impacts, and understand status and trends. Although the long-term monitoring data provided are highly valued by partners, there is a need to improve the access and timeliness of the water quality monitoring data and other scientific knowledge and data in order to better support decision-making by program partners and stakeholders.

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<sup>1</sup> For the Chemicals Management Plan, the Program provides water quality monitoring information to inform risk management.

- Key risks have been identified and assessed for the freshwater and marine monitoring programs and are being used to manage activities. A considerable amount of work has been undertaken to prioritize freshwater quality monitoring activities through the development of a risk-based approach (RBA). While there has been substantial progress, the approach has yet to be fully implemented. For marine water quality monitoring, the program makes use of pollution surveys and surveillance to target activities and minimize risks.
- In addition to the use of integrated watershed and risk-based approaches, the evaluation found that the program is employing other efficient operational processes, including taking measures to ensure that activities remain focused on key priorities and the use of a collaborative delivery model.
- Governance for the key program components, such as for freshwater and marine water quality and oil sands monitoring, was found to be clearly defined.
- The Program tracks its progress and reports in various legally required reports, generally at the activity/output level. However, it does not have a performance measurement strategy or approved logic model that clearly communicates the intended Program outcomes for the immediate and longer term, and identifies how progress towards the achievement of these outcomes will be measured.

### Evaluation Recommendations

<b>Recommendations</b>
<b>The following three recommendations are addressed to the ADM of STB.</b>
1. Review current processes and identify actions required to support publishing of freshwater quality monitoring data in a more timely manner.
2. Develop a plan to fully implement the risk-based approach for freshwater quality monitoring.
3. Within the context of the new Departmental Results Framework, improve performance measurement for the Program by developing an updated logic model with associated indicators and targets for each intended outcome.

The responsible ADMs agree with the recommendations and management responses have been developed that appropriately address each recommendation.

### About the Evaluation

- The evaluation was conducted by ECCC’s Audit and Evaluation Branch between January 2015 and December 2016.
- The following data collection methodologies were used to address the evaluation issues and questions: a document review; a bibliometric analysis of Program scientists’ publications during the 2010–2014 period; a file review of a sample of 17 of 40 grant and contribution projects funded during the 2010–2014 period; 41 key informant interviews conducted with program representatives, provincial and territorial partners and other external stakeholders; and two case studies.

## 1. INTRODUCTION

This report presents the results of the Evaluation of the Water Quality and Aquatic Ecosystems Health Program (sub-program 1.2.1 in the Department's program alignment architecture), which was conducted by the Audit and Evaluation Branch of Environment and Climate Change Canada (ECCC). The evaluation was identified in the 2014 Departmental Risk-Based Audit and Evaluation Plan. The evaluation was conducted in order to respond to the requirements of the *Financial Administration Act* and the 2009 Treasury Board of Canada Policy on Evaluation<sup>2</sup>, to evaluate all ongoing grants and contributions programs and direct program spending at least once every five years.

## 2. BACKGROUND

### 2.1. Program Profile

The objective of the Water Quality and Aquatic Ecosystems Health Program is to provide information on and increase understanding of the impacts and risks posed by human activities on water quality and the health of aquatic ecosystems. The Program is divided into three main activity areas: (i) water quality monitoring; (ii) research activities; and (iii) analytical, laboratory and research support. These activity areas are described in greater detail below.

#### I. Water Quality Monitoring

Water quality monitoring activities include three types of monitoring: freshwater quality monitoring, marine water quality monitoring, and oil sands monitoring.

##### Freshwater Quality Monitoring

The Freshwater Quality Monitoring Program has been delivered by ECCC since the early 1970s. The program monitors and reports on the status and trends of freshwater quality and aquatic ecosystems health on federal lands, in provincial/territorial and international boundary waters, and in other waters of significant federal or national interest.

Most of the monitoring data come from approximately 522<sup>3</sup> sites managed under cooperative agreements with the provinces and territories and inter-jurisdictional agreements, and some higher-risk sites are supplemented with automated monitoring. Additionally, biological samples are collected through the Canadian Aquatic Biomonitoring Network (CABIN).<sup>4</sup> Monitoring is carried out in collaboration with many partners: provinces and territories, universities, non-governmental organizations, and other federal departments, i.e., Parks Canada, Natural Resources Canada and Indigenous and Northern Affairs Canada (INAC).

Using the Canadian Environmental Sustainability Indicators (CESI) and the Canadian Council of

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<sup>2</sup> The 2009 Policy on Evaluation was replaced by the Policy on Results effective July 1, 2016.

<sup>3</sup> This is comprised of long term freshwater quality monitoring sites, CABIN sites and automated sites. Data on monitoring sites was extracted from the Science and Technology Branch Reporting documentation for 2014-2015.

<sup>4</sup> CABIN is an aquatic biomonitoring program for assessing the health of freshwater ecosystems in Canada. CABIN is based on the network of networks approach that promotes inter-agency collaboration and data-sharing to achieve consistent and comparable reporting on aquatic ecosystem conditions in Canada. The program is maintained by ECCC to support the collection, assessment, reporting and distribution of biological monitoring information. CABIN allows partners to take their observations and make a formalized scientific assessment using nationally comparable standards. A training program to certify CABIN participants in the standard national protocols is currently offered by the University of New Brunswick's Canadian Rivers Institute.

Ministers of the Environment (CCME) Water Quality Index, Program staff submit reports every year and disseminate information on Canada's water quality performance.

### **Marine Water Quality Monitoring**

The primary role of the Marine Water Quality Monitoring Program is to support ECCC's mandate under the Canadian Shellfish Sanitation Program (CSSP). The CSSP is overseen by the Canadian Food Inspection Agency (CFIA) in collaboration with ECCC and Fisheries and Oceans Canada (DFO). These three partners work together to:

1. Protect the public from health risks associated with the consumption of contaminated bivalve molluscan shellfish (e.g., mussels, oysters and clams); and
2. Fulfill Canada's commitments to meet exporting countries' requirements.

ECCC's primary responsibilities include conducting sanitary and marine water quality monitoring surveys, and assessing pollution sources in order to make recommendations on the appropriate classification for shellfish growing areas. ECCC's water quality sampling and analysis covers approximately 15,000 km<sup>2</sup> of marine waters along Canada's Atlantic and Pacific coastlines, encompassing close to 1,000 shellfish harvesting areas.

### **Oil Sands Monitoring**

The Joint Canada-Alberta Implementation Plan for Oil Sands Monitoring (JOSM), announced in February 2012, committed the Governments of Canada and Alberta to carrying out scientifically rigorous, comprehensive, integrated and transparent environmental monitoring of the oil sands region to ensure responsible resource development. The Water Quality and Aquatic Ecosystems Health Program supports the JOSM through the implementation of several activities, including collecting and analyzing environmental monitoring data in selected areas facing increased resource development; developing models and other tools to understand and predict the impacts of resource extraction on the environment; and reporting on results.

## **II. Research Activities**

The Program's research activities address three main areas, as described below:

### **Northern Contaminants Program**

The Northern Contaminants Program (NCP) is a multi-disciplinary initiative led by Indigenous and Northern Affairs Canada (INAC) to co-ordinate Canada's action on contaminants of concern in the North, including persistent organic pollutants and mercury. The overall objective is to reduce, and where possible eliminate, contaminants in the Arctic environment, while providing information to residents of the North about contaminants in traditional food sources.

Each year, NCP staff publish a call for proposals intended for scientists. ECCC scientists participate in the NCP by monitoring and providing their research findings relative to long-range contaminants in the Arctic.

### **Grants and Contributions (G&Cs)**

From 2010–2011 to 2014–2015, ECCC funded a total of 40 G&C projects with a total value of approximately \$14M in order to support core research activities related to water quality.<sup>5</sup> These

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<sup>5</sup> Funded projects are mainly related to the acquisition of new scientific knowledge on a range of water quality-related issues, including water quality and watershed modelling, identification and quantification of contaminants, and the effects of oil sands development. Other agreements support training in watershed and biomonitoring as well as international obligations and priorities.

projects are managed under the authority of ECCC’s umbrella terms and conditions in “Contributions in support of Water Resources and Freshwater Programs.”

### **Climate Change Adaptation**

Program staff also conduct research to provide foundational knowledge aimed at understanding and predicting the effects of climate change in order to support decision-making related to climate change adaptation.

## **III. Analytical, Research and Laboratory Support**

ECCC’s operational laboratories provide analytical and technical services that support the Program’s scientific research and water quality monitoring activities, including its work related to the JOSM. The Program’s activities in this area also contribute to other ECCC programs by providing, for example, services to support enforcement investigations and environmental emergencies. Expertise from seven locations<sup>6</sup> nationwide is used to provide ISO 17025<sup>7</sup> accredited products and services to clients in Canada and abroad, including analysis of samples, broader analyses of datasets, data modelling, legal-grade certified sample handling and processing methods, and support for emergency situations.

### **2.2. Governance and Management**

Overall accountability for the Water Quality and Aquatic Ecosystems Health Program rests with the Assistant Deputy Minister (ADM), Science and Technology Branch (STB). The Program is managed by the Director General (DG) of the Water Science and Technology Directorate (WSTD), along with his management team. Within the WSTD, four divisions help to implement this Program:

- i. Water Quality Monitoring and Surveillance Division;
- ii. Watershed Hydrology and Ecology Research Division;
- iii. Aquatic Contaminants Research Division; and
- iv. Emergencies, Operational Analytical Laboratories and Research Support Division.

In addition to the WSTD management team, there are advisory and working-level committees within the Water Quality Monitoring and Surveillance Division that address science and program delivery issues (e.g., the Quality Data Management Task Group).

The Water Quality and Aquatic Ecosystems Health Program has close links with several other ECCC programs, including the Water Resource Management and Use Program, for which it provides information on water quality for use by the inter-jurisdictional water management boards; the Hydrometric Services Program, which is responsible for monitoring water quantity; and the various freshwater ecosystem initiatives (e.g., Great Lakes Program, Lake Winnipeg Program and St. Lawrence Program). Scientific research in support of the ecosystem initiatives had previously been conducted as part of this Program, but starting in 2015–2016, these activities and resources were realigned with the individual initiatives they supported.

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<sup>6</sup> Pacific Environmental Science Centre (Vancouver, BC), National Hydrology Research Centre (Saskatoon, SK), Canada Centre for Inland Waters (Burlington, ON), Centre St-Laurent (Montreal, QC), Atlantic Environmental Science Centre (Moncton, NB), Bedford Institute of Oceanography (Dartmouth, NS), and Marine Water Quality Monitoring Microbiology Laboratory (Grand Falls, NL).

<sup>7</sup> ISO 17025 is an ISO certification for laboratory competencies and management system requirements that is intended to ensure that test results and calibrations are consistently accurate.  
<http://local.imsi.com/ontario/iso-17025/?qclid=CN7kkcDbpc0CFQkq0wodnFMPBA>



## External Governance

Externally, there are multi-stakeholder committees that coordinate the activities of several initiatives in the Water Quality and Aquatic Ecosystems Health Program, including the following:

- CSSP – The Interdepartmental Shellfish Committee includes the CFIA, the DFO and ECCC, and the Regional Interdepartmental Shellfish Committees and Regional Shellfish Area Classification Committees also include the provincial governments.
- JOSM - Co-chaired by the ADM, STB at ECCC and the ADM, Science and Monitoring, Alberta Environment and Water, and includes the Component Advisory Committees (CACs) with joint membership by representatives of both the federal and provincial governments.
- NCP - Committee chaired by INAC and also including representatives of Health Canada, ECCC, the DFO, the territorial governments and Northern Indigenous organizations.

## Partners and Stakeholders

ECCC works with a variety of partners to deliver components of the Program. Partnerships are usually governed by formal agreements that define roles and responsibilities (e.g., Master Apportionment Agreements for water management boards, Memorandum of Understanding for the CSSP, and federal-provincial-territorial agreements on water quality monitoring). Examples of these partnerships include the following:

- Prairie Provinces Water Board (PPWB) – includes representatives of Agriculture and Agri-Food Canada, and the governments of Alberta, Saskatchewan and Manitoba;
- Mackenzie River Basin Board (MRBB) – includes representatives of INAC, Health Canada and the governments of British Columbia, Yukon, Alberta, Northwest Territories and Saskatchewan; and
- Five federal-provincial water quality monitoring agreements.<sup>8</sup>

## 2.3. Resources

Table 1 summarizes the Program's expenditures for the period from 2010–2011 to 2015–2016. About one third of the Program's expenses are for real estate costs related to the laboratories (e.g., facilities and lease management) which account for a significant portion of the Program expenditures that other comparable scientific research programs generally do not incur. As previously noted, scientific activities in support of the Great Lakes, Lake Winnipeg and St. Lawrence Programs were part of this program until 2015–2016, when the coding for these activities was transferred to those respective programs. Additionally, ECCC's hosting and support of the United Nations Environmental Programme's Global Environmental Monitoring Systems (UNEP GEMS) was previously part of this program, but this activity terminated at the end of 2013–2014.

Vote netted revenue (VNR) represents the expenditures for which the Program has cost recovery. These mainly consist of funding received from the Government of Alberta for the JOSM, which was introduced in 2012–2013.

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<sup>8</sup> Federal-provincial water quality monitoring agreements are active with British Columbia (1985), Manitoba (1988), New Brunswick (1988), Newfoundland (1986), and Prince Edward Island (1989).

**Table 1: Program Expenditures, 2010–2011 to 2015–2016 (\$000,000s)**

	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16
<b>Science and Technology Branch (STB)</b>						
Salary	\$36.9	\$33.7	\$33.2	\$32.8	\$26.9	\$27.2
O&M	\$17.2	\$14.7	\$12.9	\$10.6	\$8.8	\$7.0
Capital	\$4.0	\$3.2	\$5.7	\$3.5	\$2.0	\$3.1
G&Cs	\$1.3	\$0.9	\$1.0	\$1.0	\$0.9	\$0.7
VNR Salary	\$1.1	\$0.6	\$3.2	\$3.1	\$2.5	\$2.2
VNR O&M	\$0.7	\$0.8	\$4.7	\$8.7	\$8.4	\$5.1
<b>STB Total</b>	<b>\$61.2</b>	<b>\$54.0</b>	<b>\$60.4</b>	<b>\$59.8</b>	<b>\$49.5</b>	<b>\$45.2</b>
<b>Other Branches* (primarily represents laboratory lease and facility management expenditures)</b>						
<b>Total</b>	<b>\$21.6</b>	<b>\$18.5</b>	<b>\$17.6</b>	<b>\$17.1</b>	<b>\$17.4</b>	<b>\$15.9</b>
<b>All Branches</b>						
<b>Grand Total</b>	<b>\$82.8</b>	<b>\$72.5</b>	<b>\$78.0</b>	<b>\$76.9</b>	<b>\$66.9</b>	<b>\$61.1</b>

Source: Information was extracted from ECCC's financial system and validated with the ECCC Finance Branch. Numbers may not add up due to rounding.

\*Approximately 96% of expenditures in other branches represent laboratory real estate costs that are coded to the Corporate Services and Finance Branch and the Regional Director's Office. Other ECCC branches with small levels of expenditures coded to this Program include the Environmental Protection Branch, the Meteorological Service of Canada and the Strategic Policy Branch.

## 2.4. Intended Outcomes

Since there was no formally approved logic model associated with this Program, the evaluation team, together with Program representatives, developed a draft logic model for the purposes of the evaluation. The draft logic model was endorsed by the ADM, STB during the evaluation's planning phase, and can be found in Appendix 1.

The expected outcomes from the draft logic model, which were used for the assessment of performance, are presented below.

### Immediate Outcomes

- Research capacity is maintained in areas that align with ECCC and federal government priorities;
- High-quality knowledge, science-based information and data are made available to address Canada's legislated mandates and commitments related to water quality and aquatic ecosystems health;
- Risk-based mechanisms are in place to support water quality monitoring, using cooperative and integrated approaches within ECCC, with other levels of governments (federal, provincial and territorial) and other stakeholders for sustainable water resource management.

### Intermediate Outcomes

- Water resource managers use timely and relevant science-based information and data to support decisions on policies, programs and regulations related to water quality and ecosystems within the federal mandate;
- Key risks associated with water quality and aquatic ecosystems health are identified, assessed and managed.

## Final Outcome

- Canada's water resource policies and programs are informed by water quality and aquatic ecosystems health data and information from ongoing research and monitoring of waters under federal jurisdiction or responsibility.

Through the achievement of the immediate and intermediate outcomes, the Program is expected over the long-term to help mitigate threats to Canada's water resources and aquatic ecosystems, and maintain their sustainability, thus improving the overall well-being of Canadians.

## **3. EVALUATION DESIGN**

### **3.1. Purpose and Scope**

The evaluation was conducted in order to meet the requirements of the *Financial Administration Act* and the 2009 Treasury Board of Canada Policy on Evaluation, which state that all ongoing grants and contributions programs and direct program spending must be evaluated at least once every five years.

The evaluation initially addressed the five-year time frame from 2010–2011 to 2014–2015, but was updated with recent information available from 2015–2016 and 2016–2017. The scope of the evaluation covers ECCC activities related to water quality monitoring, research activities and laboratory support, including activities supported through G&Cs. The following activities have been removed from the scope of the evaluation:

- Activities related to the research framework for climate change adaptation, because this work is being evaluated within the context of the Evaluation of the Clean Air Agenda Adaptation Theme;
- ECCC's hosting and support of UNEP GEMS, because this activity has ended and there was no requirement identified by management for a "lessons learned" assessment of this work; and
- Activities that were transferred out of sub-program 1.2.1 in 2015–2016 and which are the focus of other specific evaluations (e.g., Great Lakes Program; Lake Winnipeg Program and St. Lawrence Program).

Additionally, activities related to oil sands monitoring were given limited focus in the evaluation, as these activities have been recently reviewed by the Commissioner of the Environment and Sustainable Development (CESD)<sup>9</sup> and the Expert Panel on Assessing the Scientific Integrity of the Canada-Alberta Joint Oil Monitoring.<sup>10</sup>

### **3.2. Evaluation Approach and Methodology**

The following methodologies were used to collect evidence for the evaluation.

**Document Review.** Relevant documentation on the management, delivery and results of core activities related to water quality and aquatic ecosystems health was reviewed and key points related to the evaluation questions were identified and summarized. This included foundational documents, previous evaluations and audits of program components, partner agreements, policy documents, strategies, work plans, performance reports and other strategic documents.

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<sup>9</sup> CESD. 2014. 2014 Fall Report of the CESD, Chapter 2 – Environmental Monitoring of Oil Sands. [http://www.oag-bvg.gc.ca/internet/English/parl\\_cesd\\_201410\\_02\\_e\\_39849.html](http://www.oag-bvg.gc.ca/internet/English/parl_cesd_201410_02_e_39849.html)

<sup>10</sup> JOSM. 2015. Assessing the Scientific integrity of the Canada-Alberta Joint Oil Sands Monitoring (2012–2015).

**Bibliometric Analysis.** An analysis of the Program’s publications related to water quality and aquatic ecosystems health was conducted in order to assess productivity and alignment with core activities covered by the Program. Given that scientists within the WSTD are active members of the wider scientific community, collaborations and linkages at the national and international level were also assessed as an indicator of impact. The bibliometric analysis included unique publications from 2010 to 2014, and provided an analysis of the raw data by year, number of authors, number of unique journals, diversity of institutions, and external collaborations.

**G&C Project File Review.**<sup>11</sup> A sample of 17 files from the 40 G&C projects that were funded between 2010 and 2014 was reviewed. The sample included: single-year and multi-year agreements; a range of research categories; a variety of Canadian universities and research institute recipients across all regions; and a range of funding amounts. This data collection method addressed the evaluation questions related to expected outcomes, appropriateness of design, efficiency, and performance information.

**Key Informant Interviews.** A total of 41 interviews were conducted with program representatives, provincial and territorial partners and other external stakeholders, in order to obtain a cross-section of views. The distribution of interviews by respondent category is shown in Table 2.

**Table 2: Key Informant Interviews Conducted by Category**

Stakeholder Category	Interviews Conducted
ECCC program managers and scientists in national and regional offices	17
Program partners representing provincial and territorial agreements, and international and domestic water boards	14
Key external data users of ECCC water quality monitoring data	7
G&C project funding recipients	3
<b>TOTAL</b>	<b>41</b>

**Case Studies.** Two case studies were conducted to provide additional insight for the evaluation. The following were the two case studies:

- **Pilot project implementing the risk-based approach (RBA) tool (power analysis) for the PPWB’s water quality data.** This case study examined the 2011–2012 pilot project, which studied the ability of current sampling strategies in the watershed to detect long-term trends and contribute to optimized monitoring strategies.
- **CABIN’s “network of networks” approach for inter-agency collaboration and data-sharing.** This case study examined the use of CABIN for collaboration and data-sharing among stakeholders.

The method used in the case studies included targeted interviews with five ECCC representatives and three external stakeholders, and a review of relevant documentation.

### 3.3. Challenges and Limitations

Challenges that arose during the evaluation, as well as the related limitations and strategies used to mitigate their impact, are outlined below:

<sup>11</sup> These G&Cs were also considered within the context of an evaluation of ECCC’s Umbrella Terms and Conditions.

- The Program went through a significant transition during the evaluation time frame, which posed a challenge in terms of assessing its performance over time.<sup>12</sup> To address this challenge, interviewers were trained to seek clarity regarding the time frame applicable to interviewees' comments. Additionally, findings are presented in such a way as to acknowledge the changes that took place, and focus on the most recent Program activities and results.
- This Program is highly interconnected and plays a supportive role for many other programs, making it difficult to attribute impacts solely to the Program. The evaluators recognized the interdependencies between the various programs and tried to clearly delineate findings and relevant links, where possible. Emphasis was placed on examining the Program's contribution to, rather than attributing the Program's impact on, achievement of the intended outcomes.

## 4. FINDINGS

This section sets out the findings of this evaluation, broken down by evaluation issue (relevance and performance) and by related evaluation questions. For each evaluation question, a rating is provided based on an assessment of the evaluation findings. The rating statements and their significance are outlined below in Table 3. A summary of ratings for the evaluation questions is provided in Appendix B.

**Table 3: Definitions of Standard Rating Statements**

Statement	Definition
Acceptable	The Program has demonstrated that it has met the expectations with respect to the issue area.
Opportunity for Improvement	The Program has demonstrated that it has made adequate progress to meet the expectations with respect to the issue area, but continued improvement can still be made.
Attention Required	The Program has not demonstrated that it has made adequate progress to meet the expectations with respect to the issue area, and attention is needed on a priority basis.
Not Applicable	There is no expectation that the Program will address the evaluation issue
Unable to Assess	Insufficient evidence is available to support a rating.

### 4.1. Relevance

#### 4.1.1. Continued need for Program

Evaluation Issue: Relevance	Rating
1. Is there a continuing need for the Program?	Acceptable

**Given the importance of freshwater as a resource, the known and emerging threats to water quality and their potential health impacts, as well as existing legislative obligations, there are clear societal, environmental and legislative needs to monitor, assess and report on Canada's water quality.**

<sup>12</sup> The transition involved moving from a regional to an integrated watershed-based approach and taking steps to introduce a more risk-based approach to monitoring,

- Canada contains roughly seven percent of the Earth’s renewable freshwater. Water quality degradation affects both aquatic life and human uses of water. For example, higher concentrations of nutrients may result in uncontrolled plant growth and reduce the amount of dissolved oxygen available for fish and other aquatic animals. They can also foster the growth of algae, some of which can cause health effects in humans and animals. Degraded water quality can also undermine economic activities such as fisheries, tourism and agriculture.<sup>13</sup>
- According to the CESD 2010 Fall Report, Canadians have historically regarded fresh water as the country’s most important natural resource, and fresh water is considered a critical factor to Canada’s future prosperity.<sup>14</sup> However, the quality and quantity of Canada’s water resources are under pressure from a variety of sources, including urban runoff and sewage, invasive species, agriculture, and industrial activities. Other long-term threats include population growth, economic development and climate change.<sup>15</sup>
- Adequate long-term trend information on water quality is important for the timely identification of current and emerging threats and preventative actions, and to help ensure that aquatic ecosystems are conserved and protected for the well-being of Canadians. As well, sufficient information on water quality and aquatic ecosystems health is needed to be able to restore or mitigate the impact of an industrial accident or spill on a watercourse.<sup>16</sup> There is expected to be a continuing need for water quality monitoring over time as the nature of environmental contamination changes (e.g., climate change, northern contaminants, invasive species and agricultural pesticides), as community and resource development takes place (e.g., Ring of Fire mine in Ontario)<sup>17</sup>, and as the nature of partnerships change (e.g., Indigenous peoples’ involvement in CSSP activities and the public’s increasing participation in monitoring).

#### 4.1.2. Alignment with federal government priorities

Evaluation Issue: Relevance	Rating
2. Is the Program aligned with federal government priorities?	Acceptable

**The work of the Water Quality and Aquatic Ecosystems Health Program supports several priority government programs, and addresses commitments outlined in federal/provincial/international agreements related to water quality monitoring.**

- Through the provision of water quality and aquatic ecosystems health data and information from ongoing research and monitoring, the Program supports a range of priority government programs, including the Federal Action Plan on Clean Water, the Clean Air Agenda Adaptation Theme, and the Chemicals Management Plan. Program activities also support the Federal Sustainable Development Strategy (FSDS).<sup>18</sup> As well,

<sup>13</sup> ECCE. 2015. “2015 Progress Report of the Federal Sustainable Development Strategy.” <https://www.canada.ca/en/services/environment/conservation/sustainability/federal-sustainable-development-strategy/2015-progress-report/water-quality-availability.html>

<sup>14</sup> Report of the Commissioner of the Environment and Sustainable Development, Chapter 2 – Monitoring Water Resources, Office of the Auditor General, 2010, p. 3.

<sup>15</sup> National Water Research Institute, Environment Canada, 2001. Threats to Sources of Drinking Water and Aquatic Ecosystem Health in Canada.

<sup>16</sup> CESD, 2010. Fall 2010 Report of the Commissioner of the Environment and Sustainable Development, Chapter 2 – Monitoring Water Resources. [http://www.oag-bvg.gc.ca/internet/English/parl\\_cesd\\_201012\\_e\\_34435.html](http://www.oag-bvg.gc.ca/internet/English/parl_cesd_201012_e_34435.html)

<sup>17</sup> The Ring of Fire is the name given to a massive planned chromite mining and smelting development project in the mineral-rich James Bay Lowlands of Northern Ontario.

<sup>18</sup> In particular, contributes to the theme: Maintaining Water Quality and Availability, from the 2010–13 and 2013–16 FSDS.

the Program fulfils federal environmental monitoring commitments under the bilateral agreement between ECCC and the Province of Alberta to implement the JOSM (three-year Memorandum of Understanding [MOU], 2011–2015). Research as part of the NCP meets federal commitments related to the Arctic Council’s Arctic Monitoring and Assessment Program.

#### 4.1.3 Alignment with federal duties and responsibilities

Evaluation Issue: Relevance	Rating
3. Is the program consistent with federal roles and responsibilities?	Acceptable

**The federal government has responsibilities related to water management, and has jurisdiction over transboundary waters, although it shares responsibilities for freshwater quality management with the provinces. To ensure clarity, the Program administrators have implemented a series of agreements that define the Program’s roles in inter-jurisdictional water quality monitoring.**

- The Program’s current focus is on activities related to water quality and aquatic ecosystems health monitoring and research that support legislated mandates and commitments, priority government initiatives (including regulatory activities) and reporting responsibilities, as noted below.
  - Under the *Canadian Environmental Protection Act, 1999* and the *Department of the Environment Act*, ECCC is mandated to conduct scientific research and environmental monitoring in order to provide robust scientific data, knowledge and evidence to support policy, regulations, enforcement, and decision-making. However, the federal and provincial governments share responsibility for overall freshwater management. The provinces have authority to legislate with respect to various aspects of water supply and use, pollution control, hydroelectric and non-nuclear power development, irrigation, and recreation within their borders.
  - Under the *Canada Water Act, 2014*, the federal government has jurisdiction over and responsibility for managing inter-jurisdictional waters,<sup>19</sup> water on federal lands (e.g., national parks), federal facilities (e.g., office buildings, labs, penitentiaries and military bases), First Nations reserves, and two of Canada’s three territories (Nunavut and the Northwest Territories). The Act also empowers the Minister of the Environment to enter into intergovernmental arrangements to establish and maintain an inventory of any waters where there is significant national interest, and to collect, process and provide data on the quality, quantity, distribution and use of those waters.
  - Under the *International Boundary Waters Treaty Act, 2001*, the Department has commitments relative to the use of boundary waters between Canada and the United States.
  - Under the *Fisheries Act*, ECCC, through the CSSP, is required to undertake sanitary and marine water quality monitoring surveys and assess pollution sources in order to classify shellfish growing areas as safe for harvesting. An MOU signed in 1990 describes the duties and responsibilities of the three participating departments or agencies. In addition, ECCC is responsible for administering and enforcing the

<sup>19</sup> The Act defines “inter-jurisdictional waters” as “any waters, whether international, boundary or otherwise, that, whether wholly situated in a province or not, significantly affect the quantity or quality of waters outside the province.”

pollution prevention provisions under the *Fisheries Act*, which prohibit the deposit of deleterious substances into fish habitat.

- Preserving the health of Canadian waters is a shared responsibility, and partners in program delivery related to freshwater quality monitoring include other government departments and provinces and territories. Federal-provincial water quality monitoring agreements with British Columbia (1985), Manitoba (1988), New Brunswick (1988), Newfoundland and Labrador (1986), Prince Edward Island (1989), the Prairies Provinces Water Board (1992) and the Mackenzie River Basin Transboundary Waters (1997) constitute a long-term commitment to acquire comparable water quality data across the country to support shared roles in water resource management.
- Interviewees noted that, in addition to supporting obligations, as outlined above, federal involvement was crucial for ensuring a nationwide approach to monitoring and providing an unbiased, credible, long-term and integrated understanding of aquatic ecosystem health. Data users noted that water quality monitoring data would be less comprehensive, more fragmented (e.g., focused on industrial activity or provincial compliance), less accessible and ultimately less useful without a nationwide approach. Provincial/territorial interviewees said that their governments did not have the financial resources or scientific expertise to sustain the water quality monitoring activities that are needed.
- Program partners also noted that ECCC has avoided the potential for overlap or duplication between federal and provincial/territorial activities related to water quality monitoring and aquatic ecosystems' health initiatives by streamlining and rationalizing its activities and ensuring consistent and frequent consultation with provincial/territorial partners.

#### 4.2. Performance – Effectiveness

Evaluation Issue: Performance – Effectiveness	Rating
<p>4. To what extent have intended outcomes been achieved as a result of the Program?</p> <p><u>Immediate Outcomes</u></p> <p>i. Research capacity is maintained and aligned with priority areas;</p> <p>ii. Science-based knowledge and data is available to address mandates and commitments</p> <p>iii. Risk-based mechanisms are in place to support water quality monitoring</p> <p><u>Intermediate Outcomes</u></p> <p>i. Timely science-based information and data is used to support decisions</p> <p>ii. Key risks are identified, assessed or managed</p> <p><u>Final Outcome</u></p> <p>Water resources policies and programs are informed by data and information.</p>	<p>Acceptable</p> <p>Acceptable</p> <p>Opportunity for improvement</p> <p>Opportunity for improvement</p> <p>Acceptable</p> <p>Acceptable</p>

**Immediate Outcome 1:** *Research capacity is maintained in areas that align with ECCC and federal government priority areas – Acceptable*

**Research is being conducted in collaboration with others, and addresses priority areas including the oil sands, the Arctic, and the Chemicals Management Plan.**



- In collaboration with others, ECCC scientists actively contribute to new knowledge related to water quality threats, and have developed new approaches for the assessment, conservation and remediation of aquatic ecosystems.<sup>20</sup>
- A Bibliometric Analysis conducted for the evaluation showed that over the 2010–2014 period, a total of 397 WSTD scientists contributed to 1,208 scientific publications (average of 242 publications per year). Eighty-eight percent of the articles published were co-authored by at least one WSTD researcher and one or more external authors. These WSTD publications included 2,637 unique external authors from 12 different categories of institutions and were published in 299 unique journals.
- G&C projects also contribute to research capacity. The file review revealed that most of the G&C projects sampled (13 out of 17) focused on producing “new knowledge for the conservation and restoration of water resources and aquatic ecosystems” and addressed a range of water quality-related issues including water quality and watershed modelling, identification and quantification of contaminants, and the effects of oil sands development.
- The Program’s research contributes to key priority areas by
  - Significantly improving the ability to track low-level contaminants and provide information about the impacts of oil sands activity through the provision of monitoring, research and analysis of water resources in the Lower Athabasca region;
  - Providing water quality surveillance information to inform risk assessment and risk management for the Chemicals Management Plan; and
  - Contributing new knowledge on long-range contaminants in the Canadian Arctic for the NCP.<sup>21</sup> Canadian Arctic Contaminants Assessment Reports state that progress has been made in understanding their trends and sources, while noting that the assessment of biological effects remains a challenge.<sup>22</sup>
- ECCC interviewees and program partners rated the achievement of this outcome as moderate, stating that, while the Program’s existing research capacity is very strong, retiring scientists and technicians are not being replaced and those who remain reported feeling “spread very thin.” Program representatives reported that the Program’s focus is on identified high-priority areas, with limited attention on other emerging issues, such as pharmaceuticals, nanoparticles and marine monitoring. Some interviewees expressed a desire to see more research on aquatic ecosystem health, noting that work in this area is primarily limited to activities under formal federal/provincial agreements for monitoring in the Great Lakes.

**Immediate Outcome 2:** *High quality science-based knowledge and data are made available to address Canada’s water quality and aquatic ecosystems health legislated mandates and commitments – Acceptable*

**Credible, science-based and relevant water quality and aquatic ecosystems health information is made available to stakeholders and the public through websites, data portals and peer-reviewed publications to support the Program’s mandate and commitments related to its component programs.**

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<sup>20</sup> ECCC. *Canada Water Act* annual reports.

<sup>21</sup> For example, WSTD funded five projects in 2016–2017 that primarily consist in measuring trends in organic contaminants, mercury and metals in the Arctic, areas that align with the NCP’s contaminants of concern.

<sup>22</sup> Note that the priorities for funding under the NCP are not defined by the WSTD but by an INAC-led multi-department committee.

- Consistent with its legislative responsibilities, the Program ensures that key information related to freshwater quality monitoring is made available to the public through ECCC's water website<sup>23</sup> and includes information on water quality guidelines and water quality monitoring. From this site, the public can view information on national, regional and local water quality conditions through the National Freshwater Quality Indicator (updated in June 2015 to cover the 2010–2012 period).<sup>24</sup> Freshwater quality is rated at a total of 336 long-term monitoring sites<sup>25</sup> across Canada, by determining whether chemicals in water and the physical properties of water are at levels that could harm aquatic plants and animals.
- As part of the Freshwater Quality Monitoring Program, aquatic ecosystem health data are provided from the CABIN data portal. As of 2016, the CABIN portal includes data for approximately 15,500 samples contributed from various parties.
- In addition to the freshwater quality monitoring data, other components of the Program make their data available to the public, for example:
  - Through the JOSM data portal, the public can access monitoring maps, site information and environmental monitoring data;
  - As part of the CSSP, marine water quality information is available through the CESI, and is provided to DFO and the CFIA, which provide information externally on the classification of shellfish harvest areas. The Shellfish Growing Area Quality Indicator indicates the percentage of growing areas approved or conditionally approved for harvesting for human consumption (updated in 2011; most recent data are for 2006–2010).
- The quality of water monitoring data is assured through ECCC's laboratories and analytical services, which provide credible (ISO-certified), legally defensible science. These services support the various water quality component programs, such as freshwater quality monitoring and surveillance, oil sands monitoring, the CSSP, and research initiatives such as the NCP. In addition, a Freshwater Quality Monitoring and Surveillance Quality Assurance Framework has been completed and is being implemented to provide national guidance for consistent quality assurance.
- The evaluation found no evidence to indicate that ECCC is not meeting its commitments related to the provision of scientific knowledge and data as required under legislation, water quality monitoring agreements and priority programs, as described in Sections 4.1.2 and 4.1.3.
- Both internal and external interviewees rated the achievement of this outcome as good, and noted the high quality and demand for WSTD science in order to inform policy, regulations and new methodologies. Promoting knowledge transfer with other scientists was another identified area of strength; for example, the relationship between water quality monitoring scientists and CABIN scientists and the newly installed National Laboratory Information Management System (LIMS). External interviewees expressed an

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<sup>23</sup>ECCC. "Water." [www.ec.gc.ca/eau-water/](http://www.ec.gc.ca/eau-water/)

<sup>24</sup>ECCC. "Water Quality, Nationally and Where I Live." [www.ec.gc.ca/eaudouce-freshwater/default.asp?lang=En&n=DE0A538F-1](http://www.ec.gc.ca/eaudouce-freshwater/default.asp?lang=En&n=DE0A538F-1)

<sup>25</sup> Including 172 core sites (chosen to represent how humans have influenced water quality in the most populated parts of Canada), and 164 local sites (which provide localized information, but are not used to assess national freshwater quality). The number of sites in the network varies slightly from year to year, as sites are adjusted according to a risk-based analysis. This indicator is a measure of the Program's performance in fulfilling its monitoring mandate under the *Canada Water Act*.

interest in increased timeliness of data, more data related to aquatic ecosystem health and greater flexibility in determining monitoring locations and detection levels.

**Immediate Outcome 3:** *Risk-based mechanisms are in place to support water quality monitoring using cooperative and integrated approaches with others – Opportunity for Improvement*

**A considerable amount of work has been done to prioritize freshwater quality monitoring activities through the development of a risk-based approach (RBA). While there has been substantial progress, the approach has yet to be fully implemented. For marine water quality monitoring, the Program makes use of pollution surveys and surveillance to minimize risks.**

- The Freshwater Quality Monitoring Program has been significantly transformed in the past few years, partially in response to a Commissioner of the Environment and Sustainable Development (CESD) 2010 audit.<sup>26</sup> In particular, the Program has developed and begun implementation of a RBA for its monitoring activities.
- The RBA is intended to focus available resources on monitoring the activities and substances that pose the greatest risks to water quality (i.e., determine the optimum number and location of water monitoring sites across Canada). The RBA was overseen by a Network Planning Team set up in 2011 and the approach was developed in several stages, as follows:
  - the scope of federal responsibilities for water quality monitoring was defined;
  - a risk-based assessment<sup>27</sup> of all long-term freshwater quality monitoring sites was conducted;
  - a geospatial risk-based basin analysis (RBBA)<sup>28</sup> was conducted to develop cumulative risk maps of threats to water quality at the sub-basin level; and
  - statistical power analytical tools were used to assess optimal sampling strategies.
- The approach combines risk-based components, specifically the likelihood, extent and severity of impact, in order to provide a summary of relative risk to water quality and the aquatic ecosystem. The analysis uses ECCC's scientific data, information and knowledge of the site and watershed (e.g., incorporating the status and trends, CABIN assessments, and surveillance data with available background science information).
- While a considerable amount of work has been done in this area, the RBA has not been fully implemented and program representatives are still developing the approach and working with key clients to determine how best to apply it in light of user needs and existing agreements. It was determined in a case study of the pilot study of the power analysis statistical tool that the tool was not useful for or applicable to the circumstances of the PPWB, since water quality monitoring requirements in the area were already agreed to and outlined in an inter-jurisdictional water quality agreement.<sup>29</sup> The annual CESI/CCME Workshop is leveraged as a forum to inform, collaborate with and receive feedback from other agencies and partners.

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<sup>26</sup> CESD, Fall 2010 Report of the CESD, Chapter 2 – Monitoring Water Resources. In response to this audit, the Department agreed to apply, enhance and document on a national basis, a risk-based approach based on the analysis of the scientific results of its surveillance programs, its Canadian Aquatic Biological Monitoring Program, and its aquatic ecosystem monitoring programs in order to improve its long-term water quality monitoring. No date was specified for completion.

<sup>27</sup> The RBA tool assigns a risk score to monitoring sites based on an assessment of various criteria related to sources of contamination, potential impact to water quality and aquatic ecosystems health, and vulnerability of the ecosystem.

<sup>28</sup> To calculate the RBBA simple sum index, key water basin stressor variables were identified (e.g., road salt and climate change), stressor intensities were calculated, and relevant geospatial layers were compiled.

<sup>29</sup> The PPWB Master Agreement on Apportionment.

- For marine water quality monitoring, pollution surveys and surveillance activities are used to target monitoring activities for the CSSP in a way that minimizes the risks associated with shellfish consumption. As part of this activity, ECCC continues to update and maintain an extensive inventory of land-based sources of pollution impacting coastal environments, including approximately 350 wastewater systems discharging into shellfish harvesting areas. ECCC's outputs under the CSSP are measured annually in order to further develop and improve the Program, with the resources available.<sup>30</sup>
- ECCC representatives and program partners rated the achievement of this outcome as good, given the work undertaken since 2010 to review the Program's processes, roles and responsibilities and develop the tools for evaluating risks at monitoring sites. As described above, interviewees said that the risk-based mechanism is still in the development phase, and noted that 2016–2017 would be critical in determining how best to apply the mechanism.
- According to interviewees, other countries and jurisdictions consider some of ECCC's risk assessment and risk-based sampling methods to be best practices, and in some cases, have adopted a similar approach.<sup>31</sup>

**Intermediate Outcome 1:** *Water resource managers use timely and relevant science-based information and data to support decisions related to water quality – Opportunity for Improvement*

**A range of internal and external stakeholders use reliable scientific water quality and biological indicator data from the Program to inform policies, direct actions, assess impacts, and understand status and trends. While Program staff are taking steps to address concerns, there are still challenges related to providing timely access to freshwater quality monitoring data and other scientific knowledge in order to inform decision-making.**

- There are numerous examples of how the Program's science-based information and data are used to support policies, programs and regulations, including the following:
  - Monitoring measurements are used by various levels of government to assess and report on status and trends (e.g., "State of the Lake" reports, "State of Parks" reports) and evaluate progress made in protection and remediation programs (e.g., Chemicals Management Plan);
  - A JOSM-specific information portal provides monitoring results for an area covering some 140,000 km<sup>2</sup> and enables interested parties to conduct their own analyses of the impacts of oil sands development;
  - Results from the NCP continue to play a role in the assessment of future chemicals of interest and policies needed to protect the North. Program results are used for reporting purposes under the Global Monitoring Plan established under Article 16 of the Stockholm Convention;<sup>32</sup>

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<sup>30</sup> Measurements include the percentage of surveyed sectors meeting monitoring requirements, and the percentage of pollution sources evaluated. ECCC's performance was 68%–87% of the target in 2013–2014, and is generally improving over time.

<sup>31</sup> For example, CABIN's sample collection methodology has been adopted in some other Canadian jurisdictions (British Columbia, Yukon) and the methods for assessing risk in marine waters used in the CSSP are being considered for use in other countries (e.g., Australia).

<sup>32</sup> The Stockholm Convention, which came into force in 2004, is an international treaty to protect human health and the environment from persistent organic pollutants (POPs).

- CABIN-generated biological indicator information is used by a wide range of water resource managers across Canada to understand watershed health and inform management, policy and regulatory decisions. The number of CABIN users has grown from less than 100 in 2002 to 1,460 in 2016.
- The CESI National Freshwater Quality Indicator uses Program data to provide an overall measurement of the status of water quality to protect aquatic life across Canada. This can be used by the public to understand water quality and human impacts on water quality.
- The key issue identified by some Program partners and data users is the lack of timely access to freshwater quality monitoring data, which hinders its effective use for risk identification and mitigation. They said that currently, data is rarely received within less than a year; a time frame that does not meet their needs in order to develop appropriate policies and mitigation measures.
- Program representatives share these concerns, noting that, among other issues, timelines for the release of data are impacted by quality assurance/quality control (QA/QC), in particular, the time required for laboratory analysis and the need to wait until the end of the season to assess quality over the entire season. Data is usually available within 18 months, but can take up to two years or longer.
- Program staff are looking at a number of measures to increase the accessibility and timeliness of data, but progress has been slow and the work has yet to be completed. For example,
  - The Data Management Task Group, set up in 2013, developed a standard approach for publishing scientifically valid and comparable long-term water quality monitoring data through the GC Open Data Portal. At the time of writing of this report, Program staff were in the process of releasing the water quality monitoring data from the 2000–2015 period from the core monitoring sites in an openly accessible format. Over the longer term, Program staff will be working on setting up a data warehouse into which the five key water quality monitoring databases will be migrated to create a single open database system available to the public. This project was previously scheduled for completion by the end of 2017, but is now considerably delayed. It should be noted that the project is dependent on corporate and financial functions outside the Department's control.
  - Starting in 2016, Program staff were implementing a National Data Request and Data Release Protocol and a National Registry for documenting data requests. Under this Protocol, it is expected that all data will be made available to members of the public who clearly specify the stage of data verification/validation.
- In addition to issues related to timely access to water quality data, concerns were also expressed by both internal and external stakeholders regarding the public accessibility of scientific research and publications. This information is generally shared within the academic and scientific community; however, a lack of public dissemination of research studies to provide the tools and inform water management decision-making for stakeholders outside of the scientific community was identified.

**Intermediate Outcome 2:** *Key risks associated with water quality and aquatic ecosystems health are identified, assessed or managed – Acceptable*

**Key risks have been identified and assessed for the freshwater and marine water quality monitoring programs and are being used to manage activities.**

- Risks for both the Freshwater and Marine Water Quality Monitoring programs have been identified and assessed, as follows:
  - The Marine Water Quality Monitoring Program risks include point and non-point sources of pollution that could impact shellfish harvesting areas. These risks are assessed through comprehensive sanitary and bacteriological water quality surveys and identification of pollution sources. This information is used to recommend the classification of growing areas and their boundaries (e.g., approved or conditionally approved for harvesting or closed for harvesting). This process is fully implemented as part of the CSSP. The 2013 international program audit report indicated that the program is supporting food safety outcomes, and that risks are being managed through the use of existing measures and the introduction of continued program refinements.
  - The Freshwater Quality Monitoring Program risks, identified as part of the risk-based approach previously described, include: (1) human activities in the watershed; (2) impacts and risks to water quality and aquatic life; and, (3) health/vulnerability of the aquatic ecosystem. These risks are analyzed for all federal freshwater sites and used to help ECCC focus on priorities and performance deficiencies. Results may point to a need for increased monitoring activity and resources in areas where the risk of impairment is high, but they should also be used to balance the need for baseline data at reference locations, identify knowledge gaps and prioritize future monitoring activities. This analysis has been used to implement changes (e.g., the results of the power analysis were used to justify an increase in the frequency of sampling for pesticides at some sites),<sup>33</sup> although, as previously described, the RBA has not been fully implemented.

**Final Outcome:** *Canada's water resources policies and programs are informed by water quality and aquatic ecosystems health data and information from ongoing research and monitoring of waters under federal jurisdiction – Acceptable*

**Monitoring data and scientific research from the Program are used to inform water resource policies and programs across Canada.**

- As described above in the assessment of immediate and intermediate outcomes, data and information from the Program is being used to inform water resource policies and programs across Canada. Partners use and highly value the long-term monitoring data provided.
- ECCC interviewees rated the achievement of this outcome as reasonably good, although several areas for improvement and challenges were identified. Some interviewees noted that the Program provides information and knowledge that allows ECCC to identify, characterize and target threats to water quality and aquatic ecosystems health, indicating that the Program's real contribution is to enable the Department to identify what it needs to

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<sup>33</sup> Freshwater quality data has been used to help other programs identify risks. For example interviewees indicated that water quality data was used in the discovery of fire-retardant contamination as part of the Chemicals Management Plan.

do to address threats and ensure sustainability. As previously noted, the identified challenges were difficulty in providing timely access to data, lack of funding and support for research into emerging issues, and limited research into aquatic ecosystem health.

- Program partners were more positive and rated the achievement of this outcome as good, and nearly all of them provided examples of how policies and programs are or have been informed by program information (e.g., CCME national water quality policy on nutrients). In their view, it is of the utmost importance that ECCC maintain its long-term monitoring program.

### 4.3. Performance – Efficiency and Economy

#### 4.3.1. Program Delivery

Evaluation Issue: Performance – Efficiency and Economy	Rating
5. Is the program implemented efficiently and economically?	Acceptable

**Program staff are implementing measures to ensure efficient operations, including the use of integrated watershed and risk-based approaches, measures to ensure that activities remain focused on key priorities, and a collaborative delivery model.**

- According to the majority of internal interviewees and Program partners, Program staff carry out their activities efficiently, and they provided examples of efficient practices including the following: co-location of hydrometric and water quality monitoring staff to minimize sampling expenses; application of the risk-based approach to promote better decision-making relative to monitoring within financial constraints; the creation of Research Manager positions to ensure that all activities help to achieve key priorities; and the setting up of the National Laboratory Information Management System (NLIMS) at four out of eight departmental laboratories, with full implementation scheduled for 2016–2017.<sup>34</sup>
- The Program has also moved away from its previous regional perspective towards use of an integrated watershed-based approach across federal, provincial and territorial jurisdictions (Pacific, Arctic, Hudson Bay and Atlantic). Water monitoring and assessment water from this perspective is viewed as a more efficient and effective approach because it takes into account activities occurring in multiple jurisdictions and considers the impacts of upstream watersheds.
- The Program’s collaborative approach also contributes to program efficiencies. ECCC’s internal science capacity is significantly increased through extensive collaboration across Canada and internationally. There is a wide variation in the types of collaboration between the WSTD and its partners, and these were viewed favourably by interviewees.
- The CABIN’s network of networks approach and blended (online and field) training is another example of efficient collaboration with partners. The data gathered by the CABIN every year has grown from about 50 samples in the early 2000s, prior to the development of a training program, to an average of about 900 per year from 2003 to 2015. Across Canada, more than half of all CABIN data is now contributed by external agencies.

<sup>34</sup> NLIMS is a harmonized data system throughout the laboratory network that ensures efficient and secure centralized data management, facilitates sample transfers within the laboratory network, and allows for the generation of multi-laboratory reports for clients and/or management staff.

- The majority of internal and partner interviewees said that the current program delivery methods, with duties and responsibilities shared with provinces and territories and/or other departments, operate effectively and optimize the expertise and mandates of all concerned. However, a few partners had concerns regarding the following:
  - draft water agreements yet to be signed or requiring modification;
  - the split in responsibilities related to air- and surface-water versus groundwater monitoring between ECCC and Natural Resource Canada (i.e., if ECCC were responsible for all water monitoring, it might promote a more cohesive management of the water file); and
  - the potential impact of increased community-level participation in water monitoring tasks in the future on data quality.
- The use of G&Cs was also viewed as an effective mechanism to address research issues and make efficient use of university and government scientific investments. A review of G&C files revealed that about one quarter of total project resources came from funded partners, and that most projects (65%) would be sustained by other means in the future.
- A few interviewees noted that efficiencies may have been achieved at the expense of flexibility to address emerging issues and new research areas, and about half of the program partners noted in their answers that more direct, regular and structured communications by Program staff with provincial/territorial partners would make the Program even more efficient. To increase collaboration with the provinces and territories, a few program partners suggested that it would be beneficial to reinstate the former national annual conference on water quality monitoring. Currently, information is shared as specified in formal agreements and in specific watershed forums.

#### 4.3.2. Program Governance and Management

Evaluation Issue: Performance – Efficiency and Economy	Rating
6. To what extent is the governance structure clearly defined and appropriate for achieving expected results?	Acceptable

#### **Governance for the key components of the Program is clearly defined in formal agreements and/or through established committees.**

- The evaluation found that governance appears to be clearly defined and appropriate at the individual component level within the Water Quality and Aquatic Ecosystems Health Program (e.g., for freshwater quality monitoring, the CSSP, the JOSM and the NCP).
- Specific governance for these multi-stakeholder program components is defined either under formal water quality agreements, MOUs (e.g., the CSSP) or under committee structures (e.g., the CSSP, the JOSM and the NCP).
- For the most part, interviewees confirmed that the governance procedures for the Program components were clearly stated and appropriate, and included clearly defined priorities and accountabilities.



### 4.3.3. Performance Measurement

Evaluation Issue: Performance – Efficiency and Economy	Rating
7. Are performance data being collected and reported? If so, is this information being used to inform senior management and decision-makers?	Opportunity for improvement

**Program staff track progress made under the Program and submit various legally required reports, generally at the activity/output level. However, there is no performance measurement strategy or formally approved logic model that clearly states intended Program outcomes in the immediate and longer term, and identifies how progress toward these outcomes will be measured.**

- Program administrators report on performance in the Departmental Performance Report, in the Canada Water Act Annual Report and in the CESI. As well, the Marine Water Quality Monitoring component has specific performance indicators and the latter’s administrators report in the Fisheries Act Annual Report to Parliament.
  - The Departmental Performance Report provides information on indicators that track the percentage of sites within ECCC’s national core water quality monitoring network where water quality monitoring was carried out. In 2015–2016, additional performance indicators were introduced to assess client satisfaction and annual per capita peer-reviewed publications. This provides a better alignment of Program performance information with the broader Water Program (1.2) and ECCC’s Science Strategy.
  - The drafters of the Canada Water Act Annual Report use Program information to report on progress (activities, outputs) relative to water quality monitoring, water research, inter-jurisdictional water boards and ecosystem initiatives.
- A broader initiative entitled “Measuring Environment Canada’s Research and Development Performance” is currently under way and its objective is to measure and report on research and development across ECCC, including work related to water quality.
- Program administrators have developed a “Plan / Do / Check / Improve” framework to enhance program management. It is based on the scope of activities, client needs, key risks and program priorities, and incorporates a total quality management system and performance excellence model. This framework is intended to be used to monitor, adjust and continuously improve water quality monitoring, and, while not yet formally implemented, it is currently influencing work planning.
- While these activities contribute to performance reporting, as previously noted, the Program does not have a formally approved logic model that identifies its immediate, intermediate-term and longer-term intended outcomes, other than those developed for this evaluation, and there is no performance measurement strategy that clearly identifies the indicators to be used to monitor progress on performance in relation to these intended outcomes.

## 5. CONCLUSIONS

### Relevance

Overall, the activities carried out under the Water Quality and Aquatic Ecosystems Health Program continue to be relevant, given the ongoing need to assess water quality for various uses, identify water quality threats and trends over time, and determine the effectiveness of

environmental programs. The Program is aligned with federal legislation, such as the *Department of the Environment Act*, *Canada Water Act* and *Fisheries Act*, and supports priority programs. Because the responsibilities for water quality management in Canada are shared with the provinces, the Program administrators maintain consistency with federal responsibilities by developing and implementing inter-jurisdictional water quality monitoring agreements.

### **Performance – Effectiveness**

Water quality research is carried out in priority areas, including those related to the oil sands, the Arctic and the Chemicals Management Plan. Credible water quality and aquatic ecosystems health information is produced collaboratively and made available to the public and to stakeholders. This information is used by water resource managers across Canada to draft policies, supervise activities, assess impacts, and understand water quality status and trends. However, there are still areas in need of improvement related to public data access and timeliness of freshwater quality monitoring data to inform decision-making. Program staff are trying to address these issues by using new procedures, protocols and technologies, but progress has been delayed and more work is needed in these areas.

Key risks have been identified and assessed for the freshwater and marine monitoring programs and are being used to manage activities. For marine water quality monitoring, through the CSSP, Program staff use pollution surveys and surveillance to target activities and minimize risks associated with the consumption of shellfish. A considerable amount of work has been done to prioritize freshwater quality monitoring activities through the development of a risk-based approach (RBA) that includes a comprehensive assessment of freshwater quality monitoring sites. While substantial progress has been made, the approach has yet to be fully implemented, thereby limiting the full extent to which the benefits of the approach can be realized.

### **Performance – Efficiency and Economy**

Program staff are using efficient operational procedures, including moving from a regional to an integrated watershed-based approach and introducing a risk-based approach to monitoring. The Program also uses a collaborative delivery model to enhance efficiencies.

Overall, governance of the key Program components was found to be clearly defined. Specific governance for multi-stakeholder Program components is defined either in formal water quality agreements or MOUs, or by committees.

Performance information is collected and reported every year, primarily at the output level, and client satisfaction measurements have recently been implemented. The quality indicators for both freshwater and marine water (i.e., shellfish growing areas) are part of the Canadian Environmental Sustainability Indicators. However, the Program does not have a performance measurement strategy or formally approved logic model that clearly communicates its intended outcomes for the immediate and longer terms, or identifies how progress toward these outcomes will be measured.

## 6. RECOMMENDATIONS AND MANAGEMENT RESPONSES

The following three recommendations are addressed to the ADM of Science and Technology Branch as the senior departmental official responsible for the management of the Water Quality and Aquatic Ecosystem Health Program.

### **Recommendation 1: Review current processes and identify actions required to support the publishing of freshwater quality monitoring data in a more timely manner.**

A key issue identified in the evaluation related to data access and the timely delivery of freshwater quality monitoring data. Only recently has some of the historic freshwater quality monitoring data been made publicly and easily accessible as part of the open data approach. While steps have been taken to increase automation and reduce the time needed for quality assurance, further work is needed in this area to enhance timeliness to support decision-making and maximize its use. It is recommended that a plan be developed to support the publishing of freshwater quality monitoring data in a timely manner, with consideration given to expanding this approach to all water quality science and data.

### **Management Response to Recommendation 1**

The ADM of STB agrees with the recommendation.

<b>Management Action</b>		
<p>A central issue of the evaluation relates to data access and the timely delivery of freshwater quality monitoring data. A key element of the proposed action plan is to improve internet accessibility of freshwater quality monitoring data, to include publishing datasets on Open Data and implementation of user-friendly interactive solutions to assist in the discovery and extraction of freshwater quality monitoring data by users.</p> <p>The Program has developed a three-pronged proposed plan to make data available from all freshwater quality monitoring activities. This would address key evaluation findings relating to determining current database capabilities and constraints, improving public accessibility of Program data, and moving towards an integrated and outward-facing data management approach.</p> <p>To this end, working within the spirit and intent of “Open by Default”, the Program commits to make all raw data available within 30 days of receipt, and verified data will be re-released within an appropriate period of time once quality assurance/quality control has been undertaken (90 days from receipt is the STB target). On digitizing Program legacy archival paper data, a corollary to the above commitment is to immediately undertake a review to develop an inventory of what STB has in its possession, with a view to assessing within 12 months what is likely most relevant for public disclosure.</p>		
<b>Timeline</b>	<b>Deliverable(s)</b>	<b>Responsible Party</b>
Immediate (May 2017)	Undertake a review of the Water Quality and Aquatic Ecosystems Health Program’s archived paper database	DG WSTD-STB and other implicated partners
By end Sept 2017	Make all raw data publically available within 30 days of receipt	DG WSTD-STB with Corporate Services and Finance Branch (CSFB), Shared Services Canada and

		other partners
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**Recommendation 2: Develop a plan to fully implement the risk-based approach for freshwater quality monitoring.**

The program has made significant progress toward implementing a comprehensive risk-based approach for all core freshwater quality monitoring sites. This approach can be used to focus available resources on monitoring the activities and substances that pose the greatest risks to water quality, determine the optimum number of water monitoring sites across Canada, identify gaps in existing coverage, and establish new monitoring sites where required. However, these benefits have not yet been realized as the approach has not been fully implemented. As such, it is recommended that a plan be developed that identifies key milestones and timelines to ensure the RBA is fully implemented.

**Management Response to Recommendation 2**

The ADM of STB agrees with the recommendation.

Management Action		
<p>The need to implement the Risk-based Adaptive Management Framework (RBAMF) in a nationally consistent, on-going manner using updated science, and input from partners and stakeholders (such as provinces/territories) is a key Evaluation finding.</p> <p>The Science and Technology Branch has convened an Expert Panel to undertake a review of existing approaches to environmental monitoring and to provide recommendations moving forward.</p> <p>Taking into consideration the recommendations from this Expert Panel, the Program will develop a risk-based implementation plan for freshwater quality monitoring within 90 days.</p>		
Timeline	Deliverable(s)	Responsible Party
August 2017	Develop an implementation plan for a risk-based approach to freshwater quality monitoring	DG WSTD-STB (with National Planning Team, National Coordinator and Watershed Managers)
By end Sept 2017	Presentation of implementation plan to EMC for approval	DG WSTD-STB

**Recommendation 3: Within the context of the new Departmental Results Framework, improve performance measurement for the program by developing an updated logic model with associated indicators and targets for each intended outcome.**

The program conducts some performance reporting through various legally-required reports, generally at the activity/output level. However, there is no performance measurement strategy or formally approved logic model in place that clearly communicates the program’s intended outcomes for the immediate and longer term, or identifies how progress toward these outcomes will be measured. Within the context of the new Departmental Results Framework, the program should develop a performance measurement strategy that clarifies linkages between indicators and program outcomes.

### Management Response to Recommendation 3

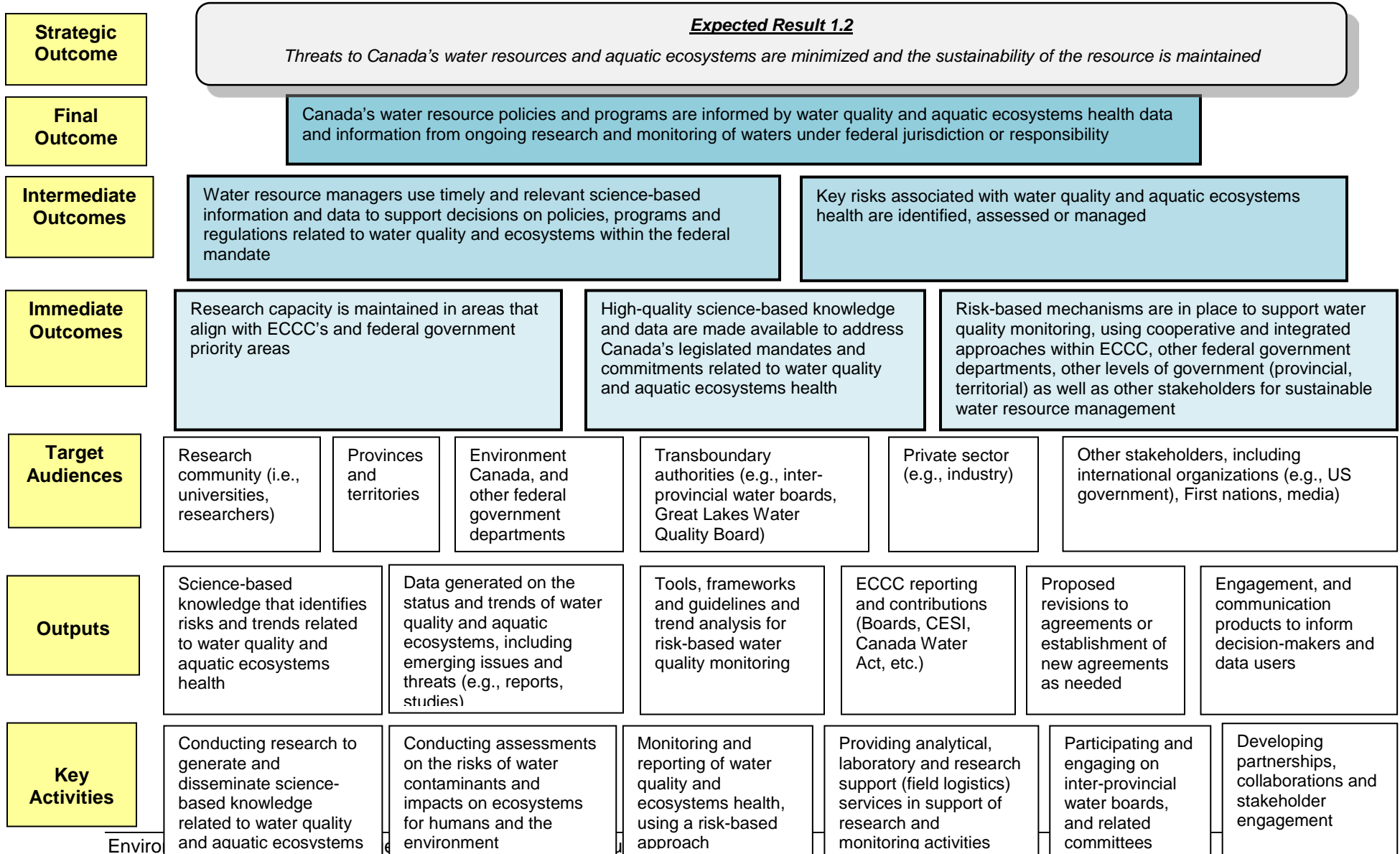
The ADM of STB agrees with the recommendation.

<b>Management Action</b>		
<p>The Program recognizes that while it conducts some performance reporting through various legally-required reports at the activity/output level, there is no approved performance measurement strategy or logic model in place that clearly communicates the Program's intended outcomes for the immediate and longer term, or identifies how progress toward these outcomes will be measured.</p> <p>The intent of this work will be to ensure Program activities are appropriately integrated in the logic model that is being developed for the Performance Information Profile (PIP) in conjunction with Corporate Management Directorate.</p>		
<b>Timeline</b>	<b>Deliverable(s)</b>	<b>Responsible Party</b>
August 2017	Develop an updated logic model to address the Evaluation findings	DG WSTD-STB/DG Corporate Management Directorate (CMD), CSFB
By end Sept 2017	Updated draft logic model provided to EMC for approval	DG WSTD-STB/DG CMD - CSFB

## ANNEX A – Draft Logic Model

### Draft Logic Model for Water Quality and Aquatic Ecosystems Health

Developed to support the Evaluation of Water Quality and Aquatic Ecosystems, 2014-15 – not approved for other purposes



## ANNEX B – Summary of Findings<sup>35</sup>

### Relevance

Evaluation Question	Acceptable	Opportunity for Improvement	Attention Required	Unable to Assess	Not Applicable
1. Continued need for the program	•				
2. Aligned to federal government priorities	•				
3. Program consistent with federal roles and responsibilities	•				

### Performance

Evaluation Question	Acceptable	Opportunity for Improvement	Attention Required	Unable to Assess	Not Applicable
4. Achievement of intended outcomes:					
Immediate Outcome 1: Research capacity is maintained in areas that align with ECCC's and federal government priority areas	•				
Immediate Outcome 2: High quality science-based knowledge and data are made available to address Canada's water quality and aquatic ecosystems health legislated mandates and commitments	•				
Immediate Outcome 3: Risk-based mechanisms are in place to support water quality monitoring using cooperative and integrated approaches with others		•			
Intermediate Outcome 1: Water resource managers use timely and relevant science-based information and data to support decisions related to water quality		•			
Intermediate Outcome 2: Key risks associated with water quality and aquatic ecosystems health are identified, assessed or managed	•				
Final Outcome: Canada's water resources policies and programs are informed by water quality and aquatic ecosystems health data and information from ongoing research and monitoring of waters under federal jurisdiction	•				
5. Program is implemented in an efficient and economical manner	•				
6. Governance clear, appropriate and efficient	•				
Other governance considerations		•			
7. Performance data collected and reported		•			

<sup>35</sup> The ratings symbols and their significance are outlined in Table 3 on Page 10.