Environment Canada Environnement Canada

Canada Water Act

Annual Report

for April 2013 to March 2014

Canada

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Foreword

The *Canada Water Act*, proclaimed on September 30, 1970, provides the framework for cooperation with the provinces and territories in the conservation, development and use of Canada's water resources. Section 38 of the Act requires that a report on operations under the Act be laid before Parliament after the end of each fiscal year. This annual report covers progress on these activities from April 1, 2013, to March 31, 2014.

The report describes a wide range of federal activities conducted under the authority of the Act, including participation in federal-provincial/territorial agreements and undertakings, significant water research, and public information programs. A map depicting Canada's major drainage areas and drainage flows is provided in Figure 1.

Provisions of the *Canada Water Act*

The following is a summary of the major provisions of the Act:

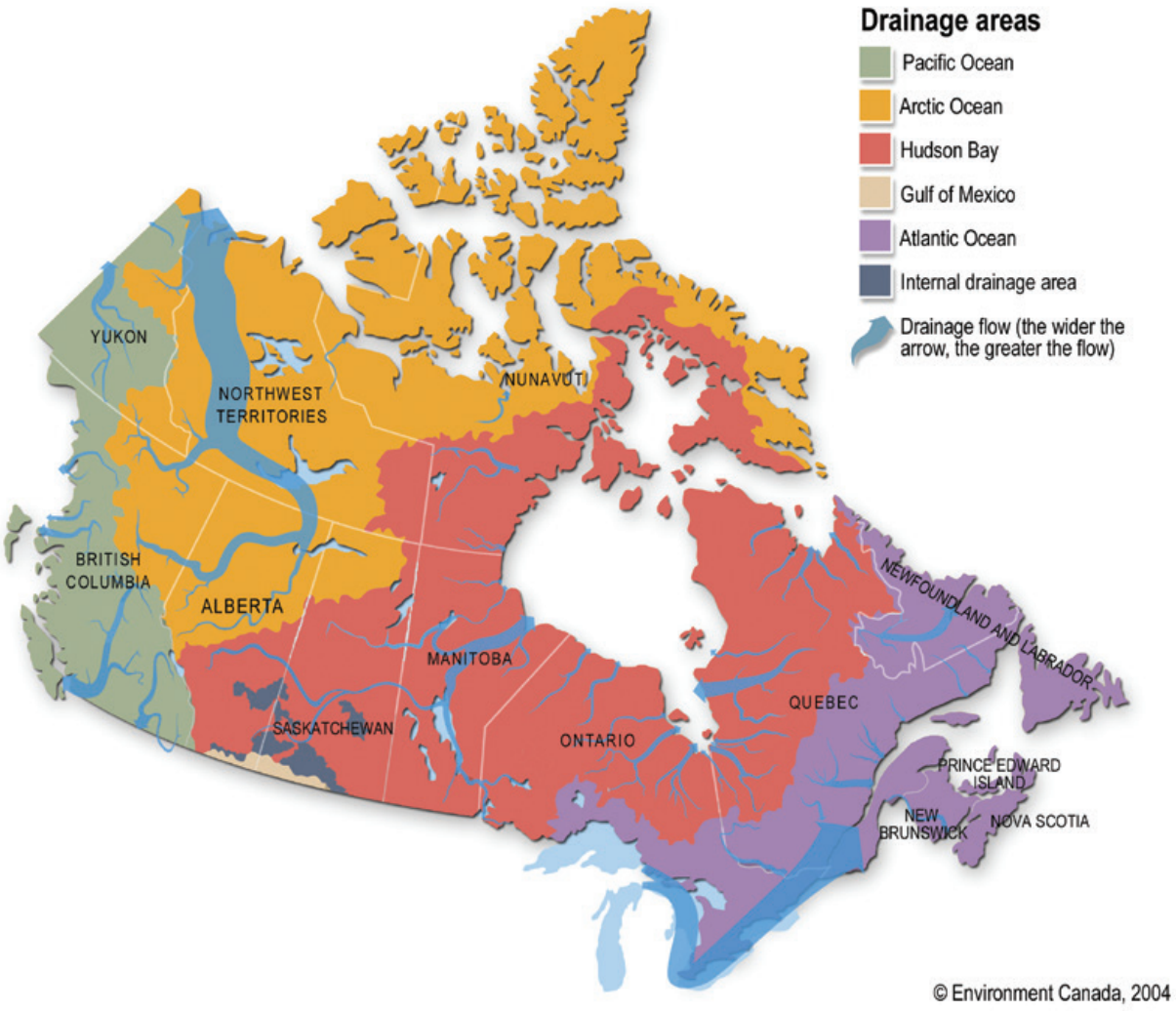
Part I, section 4, provides for the establishment of federal-provincial/territorial arrangements for water resource matters. **Sections 5, 6 and 8** provide the vehicle for cooperative agreements with the provinces to develop and implement plans for the management of water resources. **Section 7** enables the Minister, either directly or in cooperation with any provincial government, institution or person, to conduct research, collect data and establish inventories associated with water resources.

Part II provides for federal-provincial/territorial management agreements where water quality has become a matter of urgent national concern. It permits the joint establishment and use of federal or provincial incorporated agencies to plan and implement approved water quality management programs. The application of alternative cooperative approaches and programs has resulted in **Part II** never having been used.

Part III, which provided for regulating the concentration of nutrients in cleaning agents and water conditioners, was repealed. It was incorporated into the *Canadian Environmental Protection Act* in 1988 and later into sections 116–119 (Part VII, Division I) of the *Canadian Environmental Protection Act, 1999*, which came into force on March 31, 2000. (See the *Canadian Environmental Protection Act, 1999* annual reports to Parliament, available at www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=64AAFDF1-1.)

Part IV contains provisions for the general administration of the Act, including annual reporting to Parliament. In addition, **Part IV** provides for inspection and enforcement, allows the Minister to establish advisory committees, and permits the Minister, either directly or in cooperation with any government, institution or person, to undertake public information programs.

Figure 1: Major drainage areas and drainage flows in Canada



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Executive summary

The *Canada Water Act* provides an enabling framework for collaboration among the federal and provincial/territorial governments in matters relating to water resources. This annual report highlights Environment Canada's activities under the Act from April 1, 2013, to March 31, 2014.

During 2013–2014, Environment Canada's Water Survey of Canada, the federal partner in the National Hydrometric Program, continued to operate over 2100 hydrometric stations in Canada, measuring water flow and quantity. About 1000 of these are federal stations; the remaining stations are operated on behalf of provincial and territorial partners and third parties. Work also continued on outreach, technology development and maintaining the program's International Organization for Standardization certification.

The Water Quantity in Canadian Rivers Indicator was published in January 2014 as one of the Canadian Environmental Sustainability Indicators (CESI). This indicator shows that over the decade of 2002–2011, Canada's rivers typically contained a "normal quantity" of water.[1]

Similarly, the Water Quality Index provides an overview of water quality in Canadian waters in support of the CESI program, and an overview of the data is provided in this report. Analysts from all levels of government used measurements from numerous water quality monitoring stations for groundwater, inland freshwater and transboundary waters to assess and report on water quality status and trends, and to evaluate the progress of protection and remediation programs.

Work under the Joint Canada–Alberta Implementation Plan for Oil Sands Monitoring is progressing, with expansion of monitoring activities that has resulted in improved ability to detect changes. Canada and Alberta signed a co-management agreement in May 2013 that detailed the approach and established the two government co-leads.

Four inter-jurisdictional water boards (the Ottawa River Regulation Planning Board, the Prairie Provinces Water Board, the Mackenzie River Basin Board and the Lake of the Woods Control Board) addressed issues such as the integrated management of reservoirs, flood protection, transboundary apportionment, water quality, relations among adjoining jurisdictions and development activities.

Work continued under three partnership-based ecosystem approaches (Great Lakes Program, St. Lawrence Action Plan and Atlantic Ecosystem Initiatives) to ensure that Canadians have access to clean, safe and healthy water, and that the country's water resources are used wisely, both economically and ecologically.

Work under the Canada–Ontario Agreement Respecting the Great Lakes Basin Ecosystem continued in 2013–2014, while negotiations to develop a new Canada–Ontario Agreement continued.

Implementation of the Canada–Quebec Agreement on the St. Lawrence (2011–2026) continued, delivering 48 projects from its joint action program, along with activities under the Monitoring the State of the St. Lawrence River Program and the Numerical Environmental Prediction Program for the St. Lawrence.

In 2013–2014, the Atlantic Ecosystem Initiatives included 22 projects that dealt with water issues relating to water quality, biodiversity and climate change, including restoration, enhancement and improvement of water quality and watersheds through activities such as environmental education and outreach, water quality monitoring and research, and data collection.

1 The water quantity in Canadian rivers indicator summarizes annual trends in the hydrometric data at the national scale. Water quantity at a station is judged by comparing daily water flow or level data to the amount of water observed at water quantity monitoring stations from 1981–2010. Daily data are rolled up to annual patterns for a station, which are summarized by drainage regions.

Environment Canada also continued work in priority ecosystems where neither formal agreements nor ecosystem initiatives exist. In the Pacific and Yukon Region, Environment Canada works with the Okanagan Basin Water Board, a water governance body tasked with identifying and resolving critical water issues at the scale of the Okanagan watershed. The productive association with the Fraser Basin Council to manage sustainability issues in the Fraser River Basin also continued.

Environment Canada also continued work under the Lake Winnipeg Basin Initiative to address excess nutrients in Lake Winnipeg and its basin.

In 2013–2014, Environment Canada scientists carried out research projects on various current and emerging issues that support the various partnership-based ecosystem initiatives. Important areas of research included improving the understanding of nutrient loads and harmful algal blooms outbreaks, measuring the status and trends of priority pollutants in sediment and water, quantifying and predicting local, regional and national sensitivities of aquatic ecosystems to climate variability and change, and conducting hydro-meteorological modelling and prediction.

Environment Canada continued to provide water-related public information and water awareness activities through its Water website (www.ec.gc.ca/eau-water).

COMPREHENSIVE WATER RESOURCE MANAGEMENT

(Part I of the *Canada Water Act*)

In Canada, each level of government has different roles related to the management of water resources. As well, there are many areas of shared jurisdiction.

Canadian provinces and Yukon have the primary jurisdiction over most areas of water management and protection. Most of these governments delegate some authority to municipalities, in particular drinking water treatment and distribution, and waste-water treatment operations in urban areas. Some also delegate some water resource management functions to local authorities that are responsible for a particular area or river basin.

The federal government has responsibilities for managing water on federal lands (e.g., national parks), federal facilities (e.g., office buildings, laboratories, penitentiaries, military bases), First Nations reserves, and in Nunavut and the Northwest Territories.

The *Canada Water Act* provides an enabling framework for collaboration among the federal, provincial and territorial governments in matters relating to water resources. Joint projects involve the regulation, apportionment, monitoring or surveying of water resources, and the planning and implementation of programs relating to the conservation, development and utilization of water resources.

Agreements for specific water programs require participating governments to contribute funding, information and expertise in agreed ratios. For ongoing activities such as the water quantity survey agreements with each province, cost-sharing is in accordance with each party's need for the data. For study and planning agreements, generally the federal government and the specific provincial government each assume half of the costs. The planning studies encompass interprovincial, international or other water basins where federal interests are important. Implementation of planning recommendations also occurs on a federal, provincial and federal-provincial basis. Cost-sharing for the construction of works often includes a contribution from local governments.

The following *Canada Water Act* agreements were ongoing during 2013–2014.

Apportionment and monitoring programs

- Agreements on water quantity surveys with all provinces, and with Aboriginal Affairs and Northern Development Canada for the territories
- Master Agreement on Apportionment in the Prairie Provinces (Prairie Provinces Water Board)
- Water quality monitoring agreements with British Columbia, Newfoundland and Labrador, New Brunswick, Manitoba, and Quebec
- Canada–Prince Edward Island Memorandum of Agreement on Water
- Agreement Respecting Ottawa River Basin Regulation

Water management programs

- Mackenzie River Basin Transboundary Waters Master Agreement
- Canada–Manitoba Memorandum of Understanding Respecting Lake Winnipeg and the Lake Winnipeg Basin

Two other related agreements also address apportionment and monitoring programs: the 2007 Canada–Ontario Agreement Respecting the Great Lakes Basin Ecosystem was made pursuant to the *Canadian Environmental Protection Act, 1999*, and the Canada–Quebec Agreement on the St. Lawrence (2011–2026) was made pursuant to the *Department of the Environment Act* and the *Department of Fisheries and Oceans Act*.

The sections below describe federal, provincial and territorial collaboration in the following areas:

- data collection and use (1);
- inter jurisdictional water boards (2); and
- partnership-based ecosystem approaches (3).

1 Data collection and use

1.1 The National Hydrometric Program

Formal bilateral hydrometric agreements between most provincial/territorial governments and the federal government have been administered cooperatively since 1975. These agreements provide for the collection, analysis, interpretation and dissemination of water quantity data, in order to meet a wide range of needs among researchers and decision makers.

Under the Partnership Renewal Process initiative, government partners have been reviewing, updating and revising the 1975 bilateral agreements. Canada has secured an Order in Council with three provinces (Newfoundland and Labrador, New Brunswick, and Nova Scotia) and is awaiting final signatures from both parties. The agreement with Aboriginal Affairs and Northern Development Canada for monitoring in the Northwest Territories terminated on March 31, 2014. With devolution starting on April 1, 2014, negotiations are under way to have a new agreement in place with the Northwest Territories. Until the new agreement is in place, program operations will continue as per letters exchanged between the Government of Canada and the Government of the Northwest Territories.

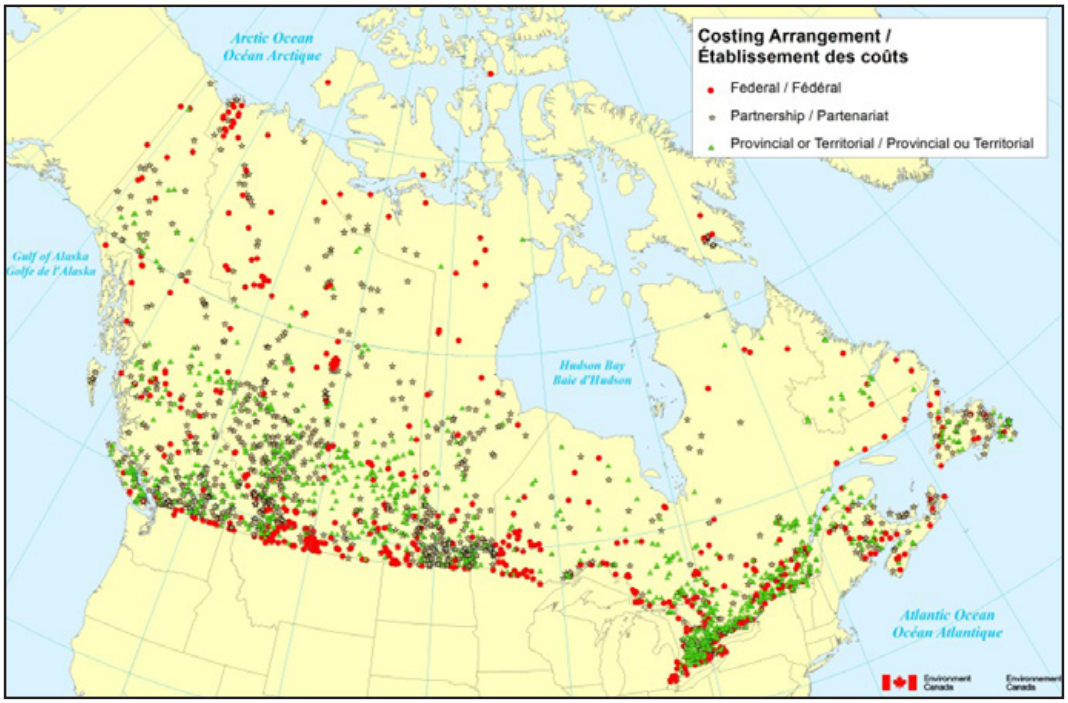
Governance

The National Hydrometric Program (NHP) is co-managed by the National Administrators Table and the National Hydrometric Program Coordinators' Committee, both of which met regularly throughout 2013–2014 to discuss program issues. The two groups met in October 2013 to discuss continuous data production issues and the use of Environment Canada products by provincial and territorial flood forecasting agencies.

The Network

The national monitoring network of the NHP consists of just under 2800 hydrometric monitoring stations (see Figure 2). During 2013–2014, Environment Canada's Water Survey of Canada (WSC), the federal partner in the NHP, operated over 2100 of these hydrometric stations. Approximately 1000 of the WSC-operated stations are federal stations; the remaining are operated by WSC on behalf of the provincial and territorial partners (see Table 1). For the province of Quebec, which is responsible for its own network, the ministère du Développement durable, de l'Environnement, de la Faune et des Parcs operated 222 hydrometric stations under the NHP.

Figure 2: National Hydrometric Monitoring Network



In 2013–2014, there were no significant changes to the size of the national hydrometric network, although the network did undergo some adjustments, including the following:

- In Yukon, two hydrometric stations were added to the network.
- In Northwest Territories, two new stations were installed and two stations were reactivated for third-party clients. In addition, three third-party stations were re-designated as territorial partner stations.
- In Nunavut, two federal stations were re-designated as federal-territorial.
- In British Columbia, five hydrometric stations were added to the network and five gauging stations removed from the network.
- In Alberta, eight hydrometric stations located in northern Alberta had their operational periods changed from seasonal to annual. One hydrometric station was re-designated from a seasonal water level to a seasonal discharge. Five network expansion hydrometric stations, originally built in 2007, were rendered active and operated in 2013.
- In June 2013, Alberta experienced an extreme precipitation event that caused major flooding in central and southern Alberta. The flood significantly affected the WSC infrastructure, damaging or destroying 32 stations and corresponding monitoring instrumentation and completely destroying 5 high-water measurement cableway structures. To date, all but 1 hydrometric station have been re-established. The cableways have not been rebuilt.
- The same event that brought flooding to Alberta in June 2013 impacted southeastern British Columbia. Fourteen sites were visited during the event, with highest measured flows being exceeded at four stations and near-record flows recorded at several more. Substantial damage to monitoring infrastructure occurred at four locations, including the destruction of the two cableways at St. Mary River and Fry Creek. These cableways will be repaired in 2014 and 2015 respectively.

- In Manitoba, one federal-provincial, continuous flow station was added to the network at was added to replace the original gauge, Assiniboine River near Russell, which will be discontinued in 2014–2015.
- In Saskatchewan, three provincial stations were White Lake, Saskatchewan River above the Forks, and Moose Mountain Creek below Alameda Reservoir. All three stations are continuous discharge stations.
- In Ontario, one new station was installed at Head River near Sebright, and two new northern stations and a personnel shelter were installed in the vicinity of the Ontario Ring of Fire area.
- In Quebec, four new provincial stations were added to the network, and one provincial station, situated in an area affected by backwater effects, makes use of hydro-acoustic technology and the index velocity method to calculate discharge. Water temperature sensors were added at some key hydrometric stations to provide useful information for water temperature modelling purposes.
- In New Brunswick, WSC operated 57 hydrometric stations and 9 ground water stations in partnership with the province.
- In Nova Scotia, the hydrometric network remained the same at 28 stations operated in partnership with the province and the Nova Scotia Power Corporation.
- In Newfoundland and Labrador, WSC operates 115 hydrometric stations in partnership with the province. In 2013–2014, there was an increase of 6 provincial stations.
- In Prince Edward Island, WSC operated seven hydrometric stations and one ground water station in partnership with the province and the City of Charlottetown.

Table 1: Stations within the National Hydrometric Monitoring Network

	WSC OPERATED			NON-WSC OPERATED	
PROVINCE/ TERRITORY	**FEDERAL**	**PARTNERSHIP**	**PROVINCE/ TERRITORY**	**VARIOUS COST ARRANGEMENTS**	**TOTAL BY PROVINCE OR TERRITORY**
Alta.	77	156	160	55	448
B.C.	59	181	212	8	460
Man.	28	91	113	95	327
N.B.	14	18	25	4	61
N.L.	17	32	66	3	118
N.S.	10	10	8	0	28
N.W.T.	40	43	9	0	92
Nun.	16	14	4	0	34
Ont.	133	74	324	44	575
P.E.I.	0	7	0	0	7
Que.	16	2	0	222	240
Sask.	95	52	8	126	281
Y.T.	9	23	19	4	55
Total	514	703	948	561	2726

Outreach

In addition to its contribution to Environment Canada's Canadian Environmental Sustainability Indicators program (see section 1.3, below), the WSC has integrated the water quantity indicator calculator into its HYDAT interface application, the Environment Canada Data Explorer, thereby making it publicly available in both official languages.

Technology

2013–2014 was the second year of operation for the new national Hydrometric Work Station, a computer system for managing the NHP's entire data production process. The system aims to provide water level and flow data in near real-time.

The NHP continued its investment in new field technologies (particularly hydro-acoustic equipment) in all regions of Canada in order to improve the measurement of stream velocity and the estimation of flow data.

Data dissemination

Environment Canada continued to work on the redesign of the National Wateroffice website (www.wateroffice.gc.ca) to improve its accessibility and usability. The transformation, as well as conversion of archived Web content, is intended to provide one integrated website for users to access both real-time and archived hydrometric information.

Work continued with the United States in creating a North American Water Watch, which will result in a fast, easy to use, cartographic and tabular user interface to compare historical and current stream flows.

ISO certification and audits

The NHP continued to maintain its ISO certification during 2013–2014, and one internal and two external audits were performed at various WSC offices throughout Canada as required under the ISO process. The results of the audits were positive and resulted in very few calls for corrective actions and/or opportunities for improvement within the program.

1.2 Water quality monitoring

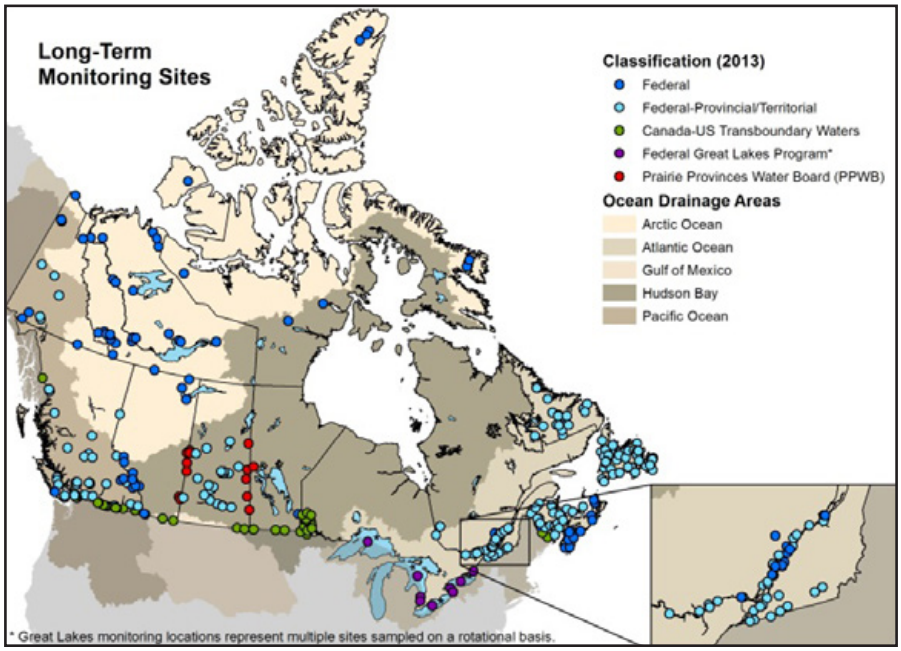
1.2.1 Freshwater Quality Monitoring Program

Freshwater quality monitoring has been a core program function of Environment Canada since the Department's inception in the early 1970s. The Department's monitoring and surveillance activities are critical for assessing and reporting on water quality status and trends, and for fulfilling many federal domestic and international commitments and legislative obligations. Much of the Department's monitoring is carried out through federal-provincial/territorial agreements, ensuring cost-effective and non-duplicative program delivery.

The objectives of the federal-provincial/territorial water quality monitoring agreements are to achieve a long-term commitment for the acquisition of water quality data; to obtain comparable, scientifically sound water quality data that are reliable for the purposes of water resource management; and to disseminate timely information on water quality to the public, government agencies, industry and the scientific community. Six federal-provincial water quality monitoring agreements are active. Other ongoing arrangements include the ecosystem-based Canada–U.S. Great Lakes Water Quality Agreement involving Ontario, and the Plan Saint-Laurent involving Quebec.

The long-term freshwater quality monitoring network consists of federal, federal-provincial and federal-territorial sampling sites across Canada (see Figure 3). Water quality samples are collected routinely at these sites for physical and chemical water quality parameters such as temperature, pH, alkalinity, turbidity, major ions, nutrients and metals. Pesticides and additional parameters of concern are also monitored where site-specific water quality issues exist.

Figure 3: Long-term water quality monitoring sites



The Freshwater Quality Monitoring Program is aligned with Canada's major watersheds (Pacific, Arctic, Hudson Bay and Atlantic). This organization promotes robust water resource management across Canada.

The Program worked on finalizing the Risk-Based Basin Analysis (RBBA), a geospatial approach to identifying relative risks and priorities in basins (sub-drainage areas) across Canada. Key stressor variables were identified, stressor intensities calculated, and compilation of relevant geospatial layers continued. The RBBA will enable calculation of an aggregate measure of risks to water quality and aquatic ecosystems at a sub-drainage scale across Canada.

Other improvements included finalization of statistical tools for status and trend monitoring to ensure scientifically defensible methods and robust statistical analysis for network design. These tools will assist with sampling frequency evaluation and optimization, and ensure that important trends at all monitoring sites are identified. A Quality Assurance Framework was further documented to assure that water quality data disseminated by the Department meets common quality standards across Canada and is fit for its intended uses. These tools will continue to be implemented in the upcoming fiscal year.

Pacific Ocean Watershed

In the Pacific Ocean Watershed (British Columbia and Yukon), monitoring is conducted under the Canada–British Columbia Water Quality Monitoring Agreement and the draft Canada–Yukon Water Quality and Aquatic Ecosystem Monitoring and Reporting Memorandum of Agreement. Under the B.C. agreement, originally signed in 1985, Environment Canada conducts joint monitoring with the provincial Ministry of Environment at 38 river sites (including 3 automated sites) in B.C.

One of the automated stations is a buoy located in Osoyoos Lake that monitors water quality in this transboundary area. In addition to providing data for Environment Canada requirements, the buoy is also used by an operational team comprised of Fisheries and Oceans Canada, BC Water Stewardship, and the Okanagan Nation Alliance for adaptive management of the lake. The team monitors real-time dissolved oxygen and temperature from the buoy, and makes recommendations to BC Water Stewardship regarding the need for in-season fish (i.e., juvenile and adult sockeye salmon) and water management when water temperatures become too high and dissolved oxygen too low.

In Yukon, six sites (including one automated site) were monitored on Yukon rivers in collaboration with Environment Yukon. The final draft of the Canada–Yukon Water Quality and Aquatic Ecosystem Monitoring and Reporting Memorandum of Agreement has been completed and is awaiting signature. This agreement will formalize a Canada–Yukon monitoring partnership that has been in effect for eight years.

In 2013–2014, the Department operated six long-term water quality monitoring sites in national parks, in partnership with the Parks Canada Agency (four in British Columbia and two in Yukon). The sites are relatively pristine and provide important reference information for comparison with sites influenced by human activities. Many of these sites are also located in important areas for assessing climate change.

Hudson Bay Watershed

In the Hudson Bay Watershed, Environment Canada conducts water quality monitoring at key interprovincial and international transboundary sites as well as in certain national parks.

In support of the Prairie Provinces Water Board Master Agreement on Apportionment, Environment Canada monitors 11 sites along the key rivers crossing between the Alberta, Saskatchewan and Manitoba provincial boundaries, as well as Cold River at the outlet of Cold Lake in Alberta. This work supports annual reporting on water quality objectives for nutrient, metal, major ion and pesticide parameters established by Canada, Alberta, Saskatchewan and Manitoba. The water quality data and information obtained is also used to support the Lake Winnipeg Basin Initiative. Water quality data are routinely shared with partners involved in the Lake Winnipeg Research Consortium, including the province of Manitoba, federal departments, universities and institutes working on Lake Winnipeg.

Other key transboundary monitoring sites are located on the Red, Pembina, Winnipeg and Souris rivers and on the Milk River–St. Mary River system. The Red and Souris rivers, in particular, have encountered many water quality issues over time (nutrients, metals, pesticides, salinity). Water quality and water quantity issues on these rivers are addressed formally through the International Red River Board and International Souris River Board under the International Joint Commission (IJC). Regular monitoring updates were provided to these boards and to a number of institutional partners in 2013–2014.

All of the transboundary rivers are monitored regularly (8 to 12 times per year). During the 2013–2014 open water season, the Red River was monitored more intensively (biweekly to weekly) to address concerns related to increased water releases from Devils Lake (North Dakota) crossing the Canadian border, and to improve the nutrient loading estimates for Lake Winnipeg. Additionally, Environment Canada operates an automated station on the Red River at Emerson, Manitoba, as an alert system in the context of transboundary flooding and water quality monitoring. Real-time data were used to assess water quality changes due to increased Devils Lake water releases.

As an international and interprovincial transboundary waterway, Lake of the Woods is relatively unique in the number of jurisdictions and international organizations, such as the IJC, that have a role to play for successful environmental management. Local and national concerns with noxious and potentially toxic cyanobacteria (blue-green algae) blooms and declining water quality in Lake of the Woods prompted the formation of Environment Canada's Lake of the Woods Science Initiative as part of a larger program to assess and remediate deteriorating water quality in Lake Winnipeg. Research activities included development of remote sensing and whole-lake models, collection and evaluation of water quality samples to determine the frequency, severity and spatial-temporal patterns of the blooms and their toxicity, and examination of different elements of the lower aquatic food web to help gauge their responses to physical and chemical characteristics of their environment.

Environment Canada continued to work with Manitoba Conservation and Water Stewardship under the Lake Winnipeg and Lake Winnipeg Basin Science Subsidiary Arrangement. The agreement, signed in 2012, supports the development of science-related data, indicators and nutrient targets. In 2013–2014, a scientific workshop was held to further the development and improvement of environmental indicators used for reporting on the health of the lake and its watershed. Fact sheets on key nutrient indicators are in development.

Atlantic Watershed

In the Atlantic Watershed, federal-provincial water quality monitoring is supported through the Great Lakes Water Quality Agreement, Canada–Quebec Water Quality Agreement, Canada–New Brunswick Water Quality Monitoring Agreement, Canada–Prince Edward Island Memorandum of Agreement on Water and the Canada–Newfoundland and Labrador Water Quality Monitoring Agreement.

As mandated by the 2012 Protocol to the Canada–United States Great Lakes Water Quality Agreement (see section 3.1, below), monitoring and surveillance of water quality is undertaken in the Great Lakes to provide information for measuring local and whole-lake responses to control measures and to assess the effectiveness of management decisions. Activities are also undertaken to determine the presence of new environmental problems in the Great Lakes Basin. Monitoring is conducted to determine the extent to which the General Objectives, Lake Ecosystem Objectives and Substance Objectives, as set forth in the Protocol, are being achieved.

In 2013–2014, a broad range of monitoring activities were undertaken in the Great Lakes on water, sediment and fish. Monitoring activities focused on the status and trends of toxics and metals, in-use pesticides, compounds of emerging concern (perfluorinated compounds, bisphenol A and triclosan), phosphorus, nitrogen, organics, nutrients, major ions, dioxins, polybrominated diphenyl ethers (PBDEs), legacy organochlorine pesticides and polychlorinated biphenyls (PCBs), and perfluoroalkyl contaminants (PFCs).

Environment Canada reports on spatial distributions and temporal trends in surface water, sediment and fish indicated that the status of all lakes was "fair," with the exception of Lake Huron, which was assessed as "good."

Measurements of total phosphorus by the Canadian and U.S. federal governments were compiled and analyzed to describe the nutrient status in each of the Great Lakes. In lakes Michigan, Huron and Ontario, offshore total phosphorus concentrations were below targets and may be too low, negatively impacting lake productivity. In Lake Erie, phosphorus targets were frequently exceeded, and conditions were deteriorating. Only in Lake Superior were offshore targets being met and conditions acceptable during the reporting period.

The Canada–Quebec Water Quality Monitoring Agreement signed at the end of 2012–2013 comprises 39 sites in the transboundary St. Lawrence River watershed. In addition to the sites covered by this agreement, Environment Canada operated 10 additional federal sites (including 6 automated) in the St. Lawrence River Basin. The sites were sampled monthly in 2013–2014 for physicals, nutrients, metals and pesticides. Together, these sites are important for tracking the effectiveness of actions taken under the St. Lawrence Action Plan.

The Canada–New Brunswick Water Quality Agreement was signed in 1988 and updated in 1995. During 2013–2014, 10 federal-provincial sites were monitored under the Agreement. The sites are located on transboundary rivers or their tributaries. In addition, two real-time (automated) sites were maintained by Environment Canada at the borders of the Big Presquile and Meduxnekeag transboundary rivers.

The International St. Croix River Watershed Board, under the IJC, plays an important role in managing water levels, water quality and fisheries between Maine and New Brunswick. The Board works collaboratively with stakeholders within the watershed by preventing and resolving disputes. Environment Canada monitored water levels at seven stations in the watershed and real-time (automated) water quality at two stations and provided input to the Board's 2013 Annual Report to the IJC.

The Canada–Prince Edward Island Memorandum of Agreement on Water was originally signed in 1989 and renewed in 2001. Eleven sites were monitored under the agreement in 2013–2014. One real-time (automated) site was operated on the Wilmot River. The sites are distributed across the province, with data available on the Government of Prince Edward Island's website.

Environment Canada managed 13 federal sites (including 2 automated sites) in Nova Scotia in support of the Canadian Environmental Sustainability Indicators in 2013–2014. Nova Scotia Environment provided support on data collection. The sites are

located across the province and cover major watersheds within the Maritime Major Drainage Area, including those flowing into the Bay of Fundy.

Pesticide monitoring during rain events was added to the routine monitoring at three sites in Atlantic Canada based on the ongoing risk-based assessment of monitoring sites. The pesticide sampling was added at higher-risk agricultural sites in Nova Scotia (Cornwallis River), New Brunswick (Big Presquile) and Prince Edward Island (Wilmot River) to assess potential impacts from surface runoff during rain events.

In Newfoundland and Labrador, 79 sites across the major drainage areas were sampled 4–8 times per year. Data and station information from the sites is available on the Department's website, as well as on the Newfoundland and Labrador Water Resources website.

Arctic Watershed

Environment Canada undertakes monitoring at over 40 sites within the Arctic Watershed and across the North. A majority of these sites are operated in cooperation with Parks Canada, with sites located in 8 national parks. Many of the High Arctic sites are considered relatively pristine, and over time provide an important baseline and reference for comparison with respect to long-range transport of atmospheric pollutants to high-latitude areas as well as for any potential future influences from human activities in the North. Environment Canada also operates water quality stations on major rivers in the North, some of which are associated with transboundary basins (e.g., Mackenzie River, Slave River, Liard River) or are significant northern watersheds (e.g., Coppermine River, Thelon River, Great Bear Lake/River). Additional northern rivers are also monitored in Yukon (see Pacific Ocean Watershed section, above). In addition, Environment Canada is working with Alberta for the implementation of the Joint Oil Sands Monitoring Plan (see section 1.2.2, below).

For more information, please consult the Department's Fresh Water Quality Monitoring and Surveillance website (www.ec.gc.ca/eaudouce-freshwater/Default.asp?lang=En&n=6F77A064-1).

CABIN

In addition to the water quality monitoring explained above, Environment Canada also undertakes monitoring of biological components (i.e., fish, benthic macroinvertebrates and algae) to assess the health of aquatic ecosystems.

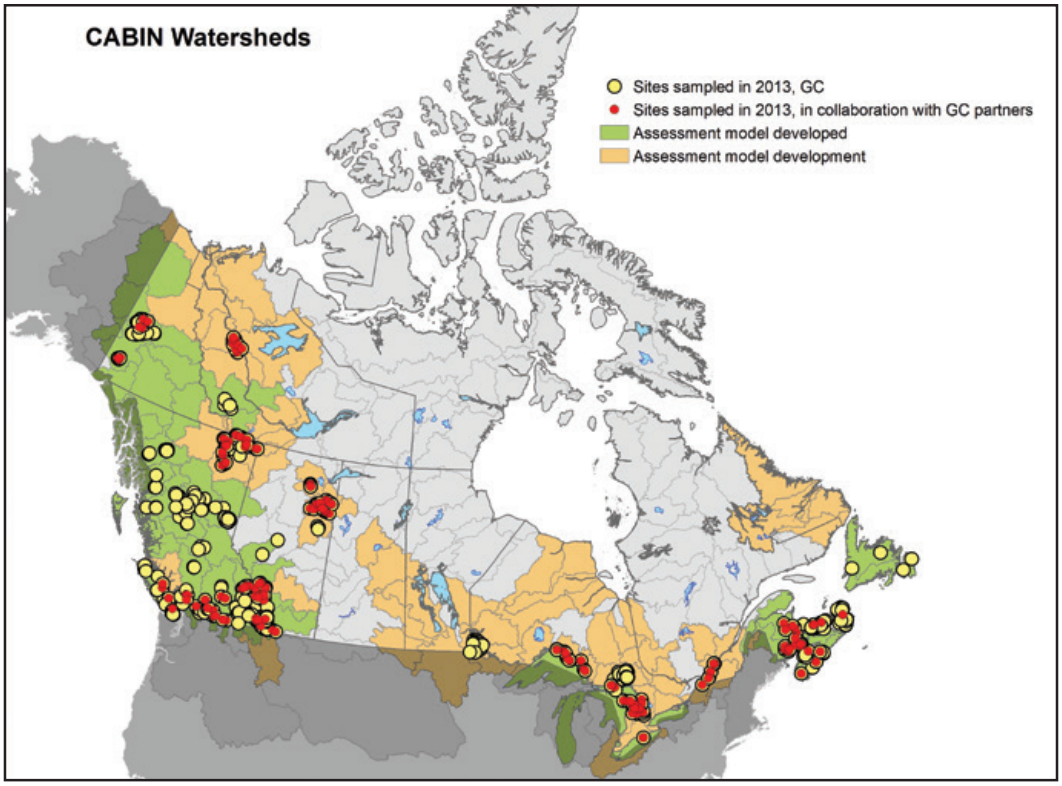
The Canadian Aquatic Biomonitoring Network (CABIN) is a water monitoring program for assessing the biological condition of freshwater ecosystems in Canada using standardized data collection and analysis methods (www.ec.gc.ca/rcba-cabin). This monitoring program, based on decades of research and development in many countries, has been adopted by multiple agencies and organizations across Canada. The success of CABIN results from interagency collaboration and data sharing. The program is led by Environment Canada's National CABIN Team, which provides online data management, assessment tools and models, field and laboratory analysis protocols, certification and training, and ecological research and development. Network partners share their observations within the national database. CABIN partners include federal, provincial and territorial government departments, industry, academia, First Nations, and non-governmental organizations such as community watershed groups. A CABIN Science Team consisting of Environment Canada and external scientists with expertise in large-scale ecological monitoring provides science advice and recommendations for the CABIN program.

Currently, there are 11 reference models available to assess the biological health of freshwater bodies in Yukon, British Columbia, Nahanni National Park, Rocky Mountains national parks, the Atlantic provinces and the Great Lakes (2 of these models are undergoing final testing). Additional reference models are in development for streams in the Boreal ecoregion of central Canada and the St. Lawrence River. The CABIN program is also working towards the development of sampling and analysis protocols for other freshwater habitats such as large rivers and wetlands.

Since the early development of the CABIN monitoring strategy in the 1980s, data have been collected in over 8070 locations across the country. In 2013–2014, data were collected at 878 sites in several sub-basins across the country by Environment Canada and its partners (Figure 4). The development of a national

training program in 2008, in partnership with the Canadian Rivers Institute of the University of New Brunswick, provided a means of promoting the use of national protocols and expanding data collection and knowledge of biological condition across the country. In 2013, participation in the online modules included 229 participants. As the number of CABIN-trained participants increases, the ability to generate new data across the country and assess water quality improves for Environment Canada and all network partners.

Figure 4: CABIN monitoring sites



Pacific Watershed

In British Columbia, CABIN monitoring is jointly conducted under the Canada–British Columbia Water Quality Monitoring Agreement. Under this agreement, Environment Canada and the provincial Ministry of Environment collaborate on data collection for reference model maintenance and development and site assessment. Nine reference models are available to all CABIN users to conduct biological assessments in watersheds in British Columbia and Yukon that were developed collaboratively by federal, provincial and territorial agencies (i.e., Department of Fisheries and Oceans, Parks Canada, BC Ministry of Environment, and Government of Yukon). Models are available for the Yukon River Basin, Fraser River/ Georgia Basin, Skagit River Basin, Columbia/ Okanagan Basin, B.C. Coastal, Skeena Region and Rocky Mountains national parks models. In 2013, Environment Canada collected CABIN data from 51 stream and river sites, 34 sites for reference model maintenance and development, and 17 sites for assessment of biological condition co-located at long-term physical-chemical monitoring sites.

Arctic Watershed

CABIN activity in the Arctic Watershed has been focused in the Athabasca Basin. Under the Joint Canada–Alberta Implementation Plan for the Oil Sands, CABIN protocols have been applied in the tributaries of the Athabasca River as per recommendations in Phase 2 of the integrated Monitoring Plan, with a total of 52 sites visited in fall 2013. The program also included biomonitoring sampling in the mainstem of the Athabasca River, with 11 monitoring reaches along the Athabasca River and multiple stations within each reach

representing 110 sampling sites. The sampling sites range from sites extending from within the active oil sands development region to sites outside of the development area as well as beyond any natural exposures of the bituminous geologic formations in the region. In addition, comparative assessments were collected in 2013 to develop comprehensive and compatible datasets that can be used to assess long-term cumulative effects on aquatic ecosystems. Further details can be found below (see section 1.2.2, below) and on the Canada–Alberta Oil Sands Environmental Information Portal (www.jointoilsandsmonitoring.ca/pages/home.aspx?lang=en).

Hudson Bay Watershed

CABIN sampling has been focused on Lake of the Woods, conducted as part of the Lake of the Woods Science Initiative. A preliminary reference model for the lake has been developed and will continue to be revised and updated as additional sites are sampled. Located at the corner of Ontario, Manitoba and Minnesota, Lake of the Woods is the largest lake in the drainage basin upstream of Lake Winnipeg, contributing ~6% of the total phosphorus load to Lake Winnipeg via the Winnipeg River.

Atlantic Watershed

In the Atlantic Watershed, 150 stream and river sites were monitored in 2013 (115 in the Atlantic provinces, 15 in Quebec and 20 in Ontario), using CABIN protocols by Environment Canada and partners to support federal-provincial water quality monitoring agreements with Newfoundland and Labrador and Prince Edward Island, Canadian Environmental Sustainability Indicators, and to conduct assessments in transboundary watersheds (Saint John River, St. Lawrence River) and federal lands (i.e., national parks, First Nations, CFB Valcartier and CFB Gagetown). CABIN sampling using lake protocols was also conducted in the Great Lakes.

1.2.2 Oil sands monitoring

Working together, Canada and Alberta have made progress since the February 2012 announcement of the Joint Canada–Alberta Implementation Plan for Oil Sands Monitoring. Scientist and technical experts are implementing major enhancements to air, water and biodiversity monitoring that were described in the Joint Plan.

The Joint Plan has increased the geographic coverage of monitoring efforts, almost doubling the number of sites (water, air, biodiversity) monitored; increasing the frequency of sampling (typically from once a year to once a month); sampling for more compounds, with more sensitive detection methods; and integrating results from air, water and biodiversity. This has resulted in a significantly improved ability to detect changes and any cumulative impacts.

Canada and Alberta signed a co-management agreement in May 2013 that details the approach and establishes the two government co-leads. The federal representative from Environment Canada is the Assistant Deputy Minister of the Science and Technology Branch.

In the Joint Plan, the two governments committed to ensuring that data will be transparent, supported by the necessary quality assurance, and will be made publicly available to allow independent scientific assessments and evaluations. On April 22, 2013, the governments launched the Canada–Alberta Oil Sands Environmental Monitoring Information Portal (www.jointoilsandsmonitoring.ca). The Portal provides access to information related to the Joint Plan, including maps of the monitoring region, details of the monitoring sites, the most up-to-date data collected by scientists, and scientific analysis and interpretation of the data and results. As more data becomes available over the coming months, the Portal will evolve with new updates and features and become more comprehensive.

The *Joint Canada/Alberta Implementation Plan for Oil Sands Monitoring First Annual Report: 2012–2013* highlights progress made during the first year of the Plan, including a brief summary of initial findings. Results of environmental monitoring to date show low levels of oil sands development–related contaminants present in air, water and biota. In almost all water and air samples, levels of oil sands development–related contaminants are below relevant environmental guidelines, and levels decrease with increasing distance from oil sands development. The report is available on the Portal at www.jointoilsandsmonitoring.ca/default.asp?lang=En&n=074F3CAC-1.

1.2.3 Agricultural and industrial runoff

A four-year research effort between Environment Canada and Agriculture and Agri-Food Canada that was initiated in 2009 in collaboration with academic research partners from the University of Calgary and University of Waterloo has been extended for an additional three years, through 2016. The main focus is collaborative research towards the mitigation of agricultural impacts on groundwater quality in the transboundary Abbotsford–Sumas aquifer (the study area is located on the Canadian side of the aquifer, in British Columbia's Lower Fraser Valley). Environment Canada provided an update on groundwater quality conditions at a meeting of the Abbotsford–Sumas International Task Force in June 2013. The aquifer straddles the Canada–U.S. border (approximately 50% on each side) and is a valuable source of freshwater for communities on both sides of the border. Environment Canada manages a network of monitoring wells on the Canadian side of the aquifer, focused on the agricultural area where high nitrate levels have been observed in groundwater. Continuous groundwater monitoring in this portion of the aquifer has shown 72% exceedance of the Canadian Drinking Water Quality Guidelines since 1992 (10 mg/L Nitrate-N). The average nitrate concentration in the area of study is about 15 mg/L Nitrate-N, representing a concern for groundwater users on both sides of the international border. The current research effort is aimed at informing both non-regulatory and regulatory approaches towards mitigation of nitrate contamination from agricultural activities.

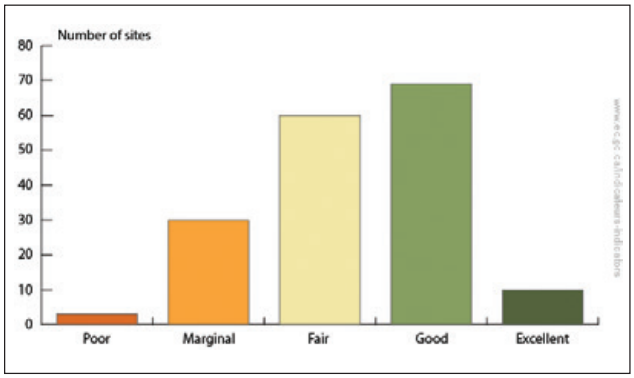
1.3 Canadian Environmental Sustainability Indicators

The Canadian Environmental Sustainability Indicators program reports on the status and trends of key environmental issues (www.ec.gc.ca/indicateurs-indicators/default.asp). Indicators cover air quality, greenhouse gas emissions, water quality and quantity, and protecting nature. The program's freshwater quality indicator provides an overall measure of the ability of freshwater bodies to support aquatic life (plants, invertebrates and fish) at selected monitoring sites across Canada. The freshwater quality indicator is calculated using the water quality index, endorsed by the Canadian Council of Ministers of the Environment, to summarize the status of surface freshwater quality in Canada. This indicator reflects the extent to which water quality guidelines for the protection of aquatic life are being met at selected river monitoring sites throughout Canada. Water quality at a monitoring station is considered excellent when ambient water quality does not exceed guidelines at any time for any selected parameter. When water quality is rated poor, water quality measurements usually exceed the guideline, and the exceedances may be large.

The latest freshwater quality indicator is based on data collected from 2009–2011 at 334 water quality stations across Canada and reflecting the diversity of watersheds in the country. The data were assembled from 23 federal, provincial, territorial and joint water quality monitoring programs. The national water quality indicator was calculated using a core national network of 172 river sites, selected to be representative of surface freshwater quality across Canada and the human pressure exerted on it (Figure 5).

Freshwater quality measured at these 172 river sites across Canada was rated excellent for the protection of aquatic life at 10 stations, good at 69 stations, fair at 60 stations, marginal at 30 stations, and poor at 3 stations. Overall, there has been little change in the national freshwater quality indicator between 2003–2005 and 2009–2011 at the 101 stations for which there are data for that entire period. During this period, no change was detected in the freshwater quality indicator rankings for 84 stations, while the ranking has significantly improved for 13 stations and declined for 4 stations (Figure 6).

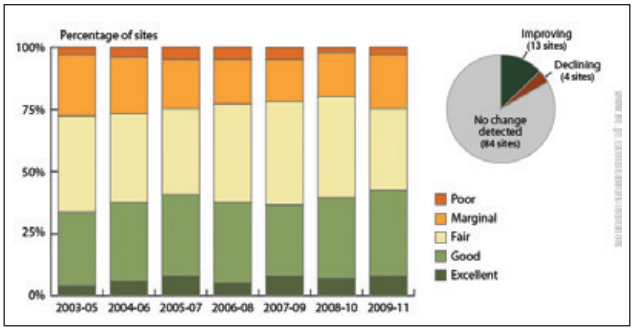
Figure 5: National freshwater quality indicator for 2009–2011, Canada



Note: Freshwater quality was assessed at 172 stations throughout Canada's 16 drainage regions where human activity is most intensive, using the Canadian Council of Ministers of the Environment Water Quality Index.

Source: Data assembled by Environment Canada from federal, provincial, territorial and joint water quality monitoring programs.

Figure 6: National freshwater quality indicator change between 2003–2005 and 2009–2011, Canada



Note: Change in the indicator between the 2003–2005 and 2009–2011 periods was assessed at 101 stations in 16 drainage regions across Canada where historical data were available. For each station, change in the indicator was assessed using a consistent set of water quality guidelines and parameters through time.

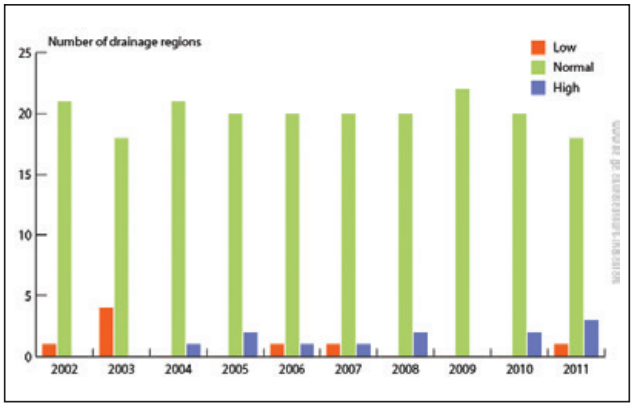
Source: Data assembled by Environment Canada from federal, provincial, territorial and joint water quality monitoring programs

The water quantity in Canadian rivers indicator summarizes annual trends in the hydrometric data at the national scale. Water quantity at a station is judged by comparing daily water flow or level data to the amount of water observed at water quantity monitoring stations from 1981–2010. Daily data are rolled up to annual patterns for a station, which are summarized by drainage regions.

The latest water quantity in Canadian rivers indicator was released in January 2014 and uses 2011 data at 2796 hydrometric stations across Canada rolled up to the drainage region scale.

In 2011, 18 drainage regions were classified as having normal water quantity; 3 had higher-than-normal water quantity; and 1 had lower-than-normal water quantity. Over the past decade (2002–2011), Canada's rivers typically contained a normal quantity of water. The year with the most drainage regions with higher-than-normal water quantity was 2011, a particularly wet year in the south-central Prairies. Four drainage regions had lower-than-normal water quantity in 2003, a year with lower-than-usual rainfall and snowfall in central Canada.

Figure 7: Water quantity in Canada's drainage regions, 2002–2011



Note: Normal water quantity is based on the amount of water observed at water quantity monitoring stations from 1981–2010 for Canada's 25 drainage regions. There are not enough data to describe water quantity for 3 drainage regions. Normal water quantities are specific to each region and do not refer to the same amount of water in each drainage region (e.g., normal water quantity on the Prairies is different from normal water quantity in the Maritimes).

Source: Water Survey of Canada, Environment Canada (2013) HYDAT Database. Retrieved on 19 July 2013.

Other water indicators can be found online at www.ec.gc.ca/indicateurs-indicators.

1.4 Hydro-meteorological modelling and prediction

For several years, researchers and scientists at Environment Canada and many partner organizations have used atmospheric and weather data as input for day-to-day operational forecasting models, and hydrologic data collected under the hydrometric

agreements as input for hydrologic models. These models demonstrate how regional hydro-meteorological modelling can help improve water resources management.

In 2013–2014, Environment Canada, in collaboration with the Global Water Institute at the University of Saskatchewan, completed involvement in hydro-meteorological model development programs, including support for the Changing Cold Regions Network. Work focused on land-surface hydrological prediction systems and Environment Canada operational modelling platforms.

Environment Canada also invested in further development and automation of the Green Kenue application, a pre- and post-processing application for hydrologic modellers and the engineering community. The advancements enable better use of hydrometric data.

Throughout 2013–2014, Environment Canada contributed internationally through its leadership as the Canadian hydrological advisor to the World Meteorological Organization's Commission for Hydrology (CHy). This entails providing input and advice to the CHy on all matters related to hydrometric monitoring and hydro-meteorology. Specifically, the Department continued to contribute expertise toward the development of techniques for uncertainty analysis in hydrometric measurements and on basic systems. The Department continues to lead the Arctic Hydrological Cycle Observing System initiative, which focuses on freshwater assessment into the Arctic Ocean. Hydrological services in all Arctic Council nations have a work plan this year to ensure data on freshwater fluxes to the Arctic Ocean is made available in a timely fashion.

Great Lakes

In 2013–2014, Environment Canada continued to improve methods for coupled hydro-meteorological modelling and prediction under an expanded environmental prediction framework. The model enables an improved understanding of interactions between the atmosphere and land surface, and supports improved water management in the region. Environment Canada is partnering with the U.S. Army Corps of Engineers, the National Oceanographic and Atmospheric Administration in the U.S., and the U.S. Geological Survey to operationalize various modelling systems for historical analysis of the water balance in the upper Great Lakes. Products developed in this modelling system are being analyzed and used to assist in understanding recent and future changes in water levels in the Great Lakes.

Prairies

Ongoing studies have focused on improved understanding of water availability in Canada through the development of new methods for modelling the hydrological cycle at a variety of scales, from small basins to large rivers. Research continued on developing models for large-scale simulation of the Saskatchewan River Basin with the Global Institute for Water Security at the University of Saskatchewan. Recent progress includes developing a basin model that links hydrologic land surface and atmospheric models at a 10-km resolution. Initiatives focused on lateral flow of water through prairie landscapes including dealing with no-contributing areas, frozen soils and blowing snow.

St. Lawrence River

Activities under the St. Lawrence Action Plan's numerical environmental predictions working group progressed well in 2013–2014. The main activities of the group are:

- modelling and assimilation of surface data covering the watersheds of St. Lawrence River tributaries;
- hydrological modelling and routing of waters entering via the watersheds of St. Lawrence tributaries;
- 2D hydrodynamic modelling of the St. Lawrence River, Lac des Deux-Montagnes, Lac Saint-Louis, the LaPrairie Basin, Rivière des Mille-Îles, Rivière des Prairies, and the Sainte-Anne and Vaudreuil channels;
- modelling of the dynamics of the major St. Lawrence River ecosystems; and
- modelling of ocean ice in the St. Lawrence Estuary and the Gulf of St. Lawrence.

These activities are done through the collaboration of federal and provincial partners under the St. Lawrence Action Plan, and they support the main priorities of the plan (biodiversity, water quality and uses).

The hydrodynamic model of the St. Lawrence River between the Port of Montréal and Trois-Rivières has been operating in "experimental mode" at the Canadian Meteorological Centre for more than a year. At present, one simulation per day (nowcasting) is produced automatically, and the results are made available online (http://collaboration.cmc.ec.gc.ca/cmc/cmoi/SHOP) and will eventually be published on Environment Canada's Wateroffice website. The performance of the system has been assessed, and work is under way to extend the modelling domain upstream in the Montréal Archipelago and downstream for the sector from Trois-Rivières to Québec.

Other activities

Environment Canada has been involved with numerous other partners in the development of the plan of study for the Lake Champlain–Richelieu River watershed that was published by the IJC in July 2013. The Lake Champlain–Richelieu River basin is located in New York and Vermont on the U.S. side (lake portion) and in southern Quebec (south/southeast of Montréal) for the river portion.

Environment Canada has also provided support to the IJC for the development of hydrodynamic and ecohydraulic models in the Namakan–Rainy Lakes basin located in northwestern Ontario.

2 Inter-jurisdictional water boards

Inter-jurisdictional water boards have been established to focus on specific water issues that have implications for more than one province or territory.

2.1 Ottawa River Regulation Planning Board

In 1983, Canada, Quebec and Ontario concluded the Agreement Respecting Ottawa River Basin Regulation. Under its terms, a board was constituted to plan and recommend regulation criteria for the 13 principal reservoirs of the basin, taking into account flood protection, hydroelectric power production and other interests. Supported by a regulating committee and secretariat, the Ottawa River Regulation Planning Board endeavours to ensure that the integrated management of the reservoirs provides protection against flooding along the Ottawa River and its tributaries, and along its channels in the Montréal region.

At the beginning of the freshet period, given the snowpack conditions, the freshet volume was expected to be about 10% above normal. Following a cold and snowy March and delayed freshet period, a significant rainfall in mid-April 2013 set off the melt for the majority of the basin at the same time. After the peak, the very large amounts of precipitation in April and May had an impact by keeping the inflows very strong during an abnormally long period and by therefore gradually increasing the volumes. The volumes, in particular in the northern half of the Ottawa River basin, were among the largest volumes in the last 60 years.

The Board supported a number of public information initiatives through the Ottawa River Regulation Secretariat. The Secretariat, which is housed at Environment Canada, maintains a website and a recorded message on toll-free telephone services in English and French, both of which provide information about water levels and flows at various locations in the basin. In 2013–2014, the Secretariat recorded 109 165 hits on its website during the freshet period (March–June 2013), 83 048 more than the previous year. This increase is primarily due to the large volume of the 2013 freshet.

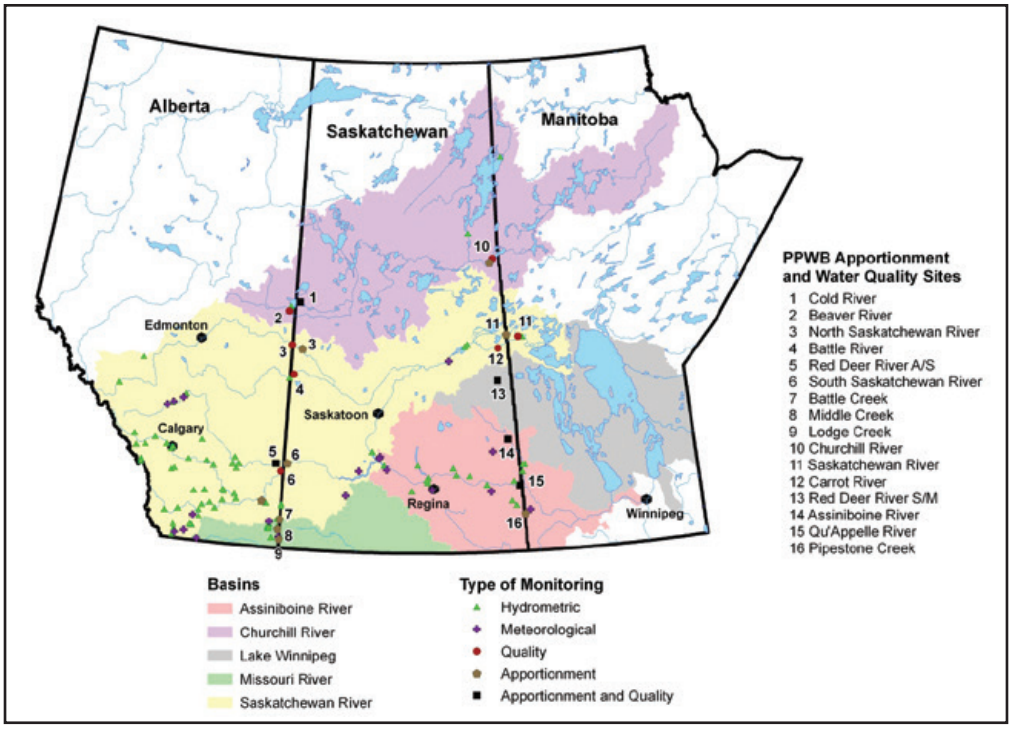
2.2 Prairie Provinces Water Board

Recognizing that water use within one province may affect another province, and because federal and provincial governments have shared responsibility for water, the governments of Canada, Alberta, Saskatchewan and Manitoba signed the Master Agreement on Apportionment (MAA) in October 1969. The purpose of this agreement is to apportion water between the provinces of Alberta, Saskatchewan and Manitoba, and to protect surface water quality and transboundary aquifers. The MAA also provides for cooperation between governments with respect to transboundary water management, and for the establishment of the Prairie Provinces Water Board (PPWB) to administer the MAA (see www.ppwb.ca).

The overarching deliverable for the PPWB is to report on achievement of the terms of the MAA. The MAA provides for an equitable sharing of available waters for all eastward-flowing streams, including transboundary lakes, that cross provincial boundaries. The schedules to the MAA describe the role of the PPWB and stipulate the amount and quality of water that shall pass from Alberta to Saskatchewan and from Saskatchewan to Manitoba.

In support of the MAA, Environment Canada monitors stream flows, water quality and meteorological conditions on eastward-flowing streams on the provincial borders (see Figure 8). The PPWB computes apportionable flows based on the natural flow on a river if that river had never been affected by the activities of people. Excursions to the MAA water quality objectives are calculated annually.

Figure 8: PPWB water quantity and quality monitoring stations and basins for 2013



Activities and accomplishments in 2013–2014 included the following:

- Apportionment requirements were met in the calendar year of 2012 on all eastward-flowing prairie streams. Interim flows indicated that 2013 apportionment requirements were likely met on the South Saskatchewan River. It is anticipated that there will not be any problems with meeting apportionment for 2013 on any transboundary stream.
- The PPWB approved the hydrometric and meteorological monitoring station list for 2014–2015. On the Assiniboine River, the Russell hydrometric station was relocated as a result of sediment issues at that site. Two meteorological stations were changed and one new one was added on Lodge Creek, which will be operated by Alberta Agriculture and Rural Development.
- A project to review apportionment methods is continuing. The North Saskatchewan River basin was the first basin to undergo review. A priority ranking is being developed for the review of apportionment requirements for other basins.
- Work continued on the development of a schedule to the MAA related to transboundary aquifers. An agreement on groundwater was drafted and is under review.
- The PPWB approved the 2013 water quality monitoring program and the 2012 Water Quality Excursion Report. The overall adherence to interprovincial water quality objectives was very

high, with an average of 95% in 2012, such that water quality continues to be protected. In 2012–2013, work on the comprehensive review of the interprovincial water quality objectives was completed. Each member organization has started an internal review of the recommended changes.

- The PPWB continued to exchange information on issues of common interest, including water quality issues related to Lake Winnipeg, Saskatchewan–Manitoba drainage issues, Carrot River sediment issues and invasive species.
- The PPWB five-year work plan was renewed until fiscal year 2017–2018.

2.3 Mackenzie River Basin Board

The governments of Canada, British Columbia, Alberta, Saskatchewan, the Northwest Territories and Yukon signed the Mackenzie River Basin Transboundary Waters Master Agreement in July 1997. The Master Agreement endorses the principle of managing water resources for future generations such that the ecological integrity of the aquatic ecosystem is maintained. It provides for early and effective consultation on potential developments and activities in the basin that could affect the integrity of the aquatic ecosystem. It also contains provisions for seven sets of bilateral agreements between adjacent jurisdictions in the basin.

The 13-member Mackenzie River Basin Board (MRBB), which represents all parties to the Master Agreement, administers the provisions of the agreement. Federal members include representatives from Environment Canada, Aboriginal Affairs and Northern Development Canada, and Health Canada. The 3 provinces and 2 territories in the basin are represented by 10 members, including an appointee from provincial and territorial government water management agencies, and an Aboriginal board member nominated by Aboriginal organizations.

Under the Master Agreement, Environment Canada is responsible for managing the expenditures of the MRBB, which are cost-shared equally by the parties. Shareable costs include the staffing and operation of the secretariat office in Yellowknife, Northwest Territories, to provide working-level support for the board. The executive director of the secretariat, hired by Environment Canada's Prairie and Northern Region, plans, directs and manages board operations.

MRBB members met twice during the year, and activities and accomplishments in 2013–2014 included the following:

- The MRBB published the *Mackenzie River Basin Board Report to Ministers 2012–2013*. The report describes the activities of the board during this period and is available on the MRBB website (www.mrbb.ca).
- Member jurisdictions continued to exchange information through agency reports.
- The Traditional Knowledge and Strengthening Partnerships Steering Committee sponsored a Traditional Knowledge learning workshop for MRBB members.
- The State of the Aquatic Ecosystem Report Steering Committee sponsored a workshop to scope environmental and socio-cultural indicators for inclusion in the next *State of the Aquatic Ecosystem Report*.
- The MRBB tracked the progress of three bilateral water management negotiations between British Columbia and Alberta; Alberta and Saskatchewan; and the Northwest Territories and Alberta. Negotiations are ongoing.

2.4 Lake of the Woods Control Board

The Lake of the Woods Control Board (LWCB) does not fall under the *Canada Water Act*, but it is included in this report to provide a more complete picture of federal-provincial water management in Canada. The LWCB is a board consisting of four members, each with an alternate, who represent Canada (one member), Ontario (two members) and Manitoba (one member). Appointments are made by orders in council of the appropriate government, and each appointee must be a professional engineer.

The LWCB, established in 1919, is responsible for the regulation of levels in Lake of the Woods and Lac Seul, and flows in the Winnipeg and English rivers downstream from these lakes to their junction. In addition, when the level of Lac Seul exceeds certain specified levels, the LWCB controls the diversion of water from Lake St. Joseph (Albany system) into Lac Seul.

The LWCB's authority is defined by concurrent Canada–Ontario–Manitoba legislation (*Lake of the Woods Control Board Act*; 1921, 1922, 1958) and is further mandated by a Canada–U.S. treaty (Convention and Protocol for Regulating the Level of the Lake of the Woods, 1925), since Lake of the Woods is an international boundary body of water. This treaty also created a second board, the International Lake of the Woods Control Board (ILWCB). Although Lake of the Woods is normally regulated solely by the LWCB, the outflow from the lake is subject to the approval of the ILWCB whenever the level of the lake rises above or falls below certain levels specified in the treaty.

The LWCB maintains a full-time secretariat that monitors conditions in the basin, provides information and analysis, and recommends regulating strategies or specific outflows. It also implements the LWCB's operating strategy, conducts studies and maintains communications with basin users.

The spring of 2013 was a sharp contrast to that of 2012. Freshet in 2012 began in mid-March and subsided by mid-April, leading to record early ice-out for many of the major lakes. In 2013, however, the beginning of the snow melt was delayed until the last week of April, and ice-out was nearly the latest on record. The late freshet inflows across the basin combined with runoff from a significant rainfall event across the Winnipeg River basin in late May drove inflows above the 90th percentile for many lakes. Despite the high inflows, the management of flows out of Lac Seul and Lake of the Woods by the LWCB allowed the levels of these lakes to stay within the respective operating ranges defined in legislation and treaty.

From late summer until the end of the year, inflow to the major lakes was moderate to low, with no exceptional events. On an annual basis, total inflow to Lake of the Woods was median. For Lac Seul, 2013 was the 11th year since 2000 with above normal inflow, ranking 5th out of 97 years of record. In total, the LWCB directed 37 outflow increases from Lake of the Woods and 12 from Lac Seul in 2013. The ILWCB was not involved in Lake of the Woods regulation in 2013, as the lake level remained within the normal operating range.

The LWCB held three regulation meetings with resource advisors and special interest group representatives in Kenora in 2013. These meetings resulted in the adoption of seasonal operating strategies employed by the LWCB Secretariat in daily operations.

In addition to carrying out its regulation duties, the LWCB conducted public information activities during 2013. In June, it held a public open house in Kenora and toured the basin to meet with various stakeholders in the basins of Lac Seul, English River, Lake of the Woods and Winnipeg River in Ontario and Manitoba. The LWCB also held a technical information session on the LWCB and its operations in October with representatives of several Treaty No. 3 First Nations.

3 Ecosystem initiatives and ecosystem-based approaches

Federal and provincial governments have jointly developed and implemented basin-wide action plans in collaboration with communities and other stakeholders. These action plans are designed to help resolve complex environmental issues, particularly deteriorating water quality that threatens human and ecosystem health.

This section describes a number of key partnership-based ecosystem approaches through which Environment Canada works to ensure that Canadians have access to clean, safe and healthy water, and that the country's water resources are used wisely, both economically and ecologically.

Environment Canada's Ecosystem Initiatives are cooperative, place-based programs designed to deliver environmental results in targeted ecosystems. The objective of the Ecosystem Initiatives is to enhance or maintain ecosystem sustainability by addressing a range of local or regional environmental challenges through partnership-based work. Local activities are coordinated by Environment Canada and undertaken in collaboration with a range of local partners and stakeholders that may include other federal departments, provinces and territories, regional, municipal and local governments,

Aboriginal peoples, federal and state governments in the United States, businesses, non-governmental and community organizations, and colleges and universities.

Ecosystem Initiatives achieve their objectives by relying on measurable environmental results, aligned and coordinated efforts, collaborative governance mechanisms, integrated science and monitoring, community and stakeholder involvement, sharing of information and experiences, and informed decision making.

3.1 Great Lakes Program

The Great Lakes Program is a partnership of federal departments (Agriculture and Agri-Food Canada, Environment Canada, Fisheries and Oceans Canada, Health Canada, Natural Resources Canada, Public Works and Government Services Canada, Transport Canada, and Infrastructure Canada) and one federal agency (the Parks Canada Agency), whose goals are a healthy environment, healthy citizens and sustainable communities. This program significantly bolsters Canada's efforts to protect and restore the Great Lakes Basin ecosystem (www.ec.gc.ca/grandslacs-greatlakes).

The Great Lakes Program also coordinates actions towards meeting Canada's commitments under the Canada–U.S. Great Lakes Water Quality Agreement (www.ec.gc.ca/grandslacs-greatlakes/default.asp?lang=En&n=45B79BF9-1), which is the key mechanism for protecting water quality and the health of the aquatic ecosystem in the Great Lakes. An amended Great Lakes Water Quality Agreement was signed in 2012 (see Canada–U.S. cooperation in this section, below).

Work to coordinate Canada–Ontario Agreement actions to protect Great Lakes water quality continued in 2013–2014, while negotiations to develop a new Canada–Ontario Agreement on Great Lakes Water Quality and Ecosystem Health concluded.

Areas of Concern

Areas of Concern (AOC) are specific locations, such as harbours and embayments, where water quality and ecosystem health have been severely degraded by human activity at the local level. In 1987, Canada and the United States together designated 43 AOCs, 12 of which are in Canada, and 5 are shared between Canada and the United States. In 2013–2014, coordination of Remedial Action Plan (RAP) activities in Great Lakes AOCs continued, including assessing and reporting on the success of past actions and on the status of remaining actions. Some examples of these activities are as follows:

- All restoration actions identified in the St. Lawrence River (Cornwall) AOC RAP have been carried out. The evaluation of AOC status is continuing, and a decision is expected in 2014–2015 on whether to delist the AOC or recognize it as an Area of Concern in Recovery.
- The Bay of Quinte AOC RAP participants completed an assessment of the status of the "Degradation of Fish Populations," "Degradation of Benthos" and "Degradation of Fish and Wildlife Habitat" beneficial use impairments. These assessments confirmed that planned remedial actions have been implemented, and restoration targets and criteria have been met. Reports documenting these results are being prepared.
- The Toronto and Region RAP completed the public review of their evaluation of two beneficial use impairments, "Restrictions on Dredging Activities" and "Degradation of Benthos." The RAP team has recommended to Environment Canada and the Ontario Ministry of the Environment that these beneficial uses be considered "not impaired" in the AOC.
- In the Hamilton Harbour AOC, a major step in the process to restore Hamilton Harbour was achieved when the Government of Canada, along with the Ontario Ministry of the Environment, the City of Hamilton, the Hamilton Port Authority, U.S. Steel Canada and the City of Burlington, announced agreements to fund and implement the Randle Reef contaminated sediment remediation project. This project is being led by Environment Canada, with Public Works and Government Services Canada serving as the project manager.
- In the St. Clair River AOC, Environment Canada, in partnership with the Ontario Ministry of the Environment and the St. Clair Region Conservation Authority, completed public consultations regarding the evaluation of contaminated sediment management options, and identified a preferred management option for the three remaining contaminated sediment sites in the river.

- In the Detroit River AOC, the "Tainting of Fish and Wildlife Flavour" beneficial use impairment was binationally re-designated to "not impaired" status.
- In the St. Marys River AOC, a study was initiated to develop options to restore and expand fish and wildlife habitat in the river. The study is being undertaken in collaboration with the local First Nations communities.
- In the Thunder Bay AOC, an ecological health risk assessment and a human health risk assessment were completed, and an engineering study was initiated to evaluate the sediment management options and identify a preferred option for managing the contaminated sediments from past paper mill operations in Thunder Bay North Harbour.

In 2013–2014, Environment Canada continued to fund multi-stakeholder projects to clean up and restore the Great Lakes AOCs through the Great Lakes Sustainability Fund, which is part of the Great Lakes Action Plan.

In partnership with local and provincial stakeholders, the Great Lakes Sustainability Fund provides funds for projects in three key areas: (1) improving point source and non-point source water quality; (2) rehabilitating and protecting fish habitat and wildlife habitat; and (3) characterizing contaminated sediment and developing contaminated sediment management plans in AOCs.

The fund continued to support work to improve point and non-point source water quality, in the Bay of Quinte, Niagara River, Hamilton Harbour, Toronto, St. Marys River, Nipigon Bay and Detroit River AOCs, to develop and implement stewardship initiatives and deliver programs that reduce nutrient inputs to watercourses from urban and rural non-point sources. Initiatives included outreach and education programs to encourage rural farming and non-farming landowners to adopt best management practices, and studies leading to improved water quality through improved management of municipal waste water.

In 2013–2014, the fund supported a number of projects to restore fish and wildlife habitat in AOCs, including projects to implement habitat management plans in the Bay of Quinte AOC; habitat restoration projects along the Detroit River, in the tributaries of the Niagara River, in George Creek in the Thunder Bay AOC, and six projects in the St. Clair River AOC; projects to monitor and assess fish populations in the Nipigon Bay AOC; and five projects to restore fish and wildlife habitat and populations in the Toronto and Region AOC.

In 2013–2014, work continued to advance the development of plans and strategies to remediate contaminated sediments. This included supporting management plans for mercury-contaminated sediments in the St. Clair River and in Thunder Bay North Harbour with projects in both AOCs aimed at identifying and evaluating sediment management options and carrying out public, stakeholder and First Nations consultation on the potential options.

Science and monitoring

Environment Canada undertakes science and monitoring projects to support decision making in the Great Lakes AOCs in Canada and in binational AOCs. In 2013–2014, projects focused on understanding the sources of *E. coli* contamination in the Toronto, Niagara and Bay of Quinte AOCs; evaluating the risk of planktonic harmful algal blooms; identifying factors that promote development and moderate impact of harmful algal blooms on inshore areas; analyzing water quality data from Hamilton Harbour; and assessing liver tumour and deformities in fish at the Thunder Bay AOC. Other research activities in AOCs focused on identifying sources of sewage contamination and supporting the measurement of aquatic ecosystem health status.

Canada–Ontario and Canada–U.S. cooperation

In 2013–2014, the Government of Canada made great progress towards the development of a new Canada–Ontario Agreement on Great Lakes Water Quality and Ecosystem Health (COA) to meet the commitments made in the 2012 Canada–U.S Great Lakes Water Quality Agreement. A draft COA is expected to be posted for public comment and finalized in 2014–2015, and full-scale implementation will begin. The draft agreement covers a broad range of issues vital to restoring and protecting water quality in the Great Lakes in the 21st century.

Excessive algae growth is a complex and significant issue in the Great Lakes, and great effort is being made to address it. Lake Erie is the most affected

by excessive algae and therefore getting urgent attention, but the other lakes are also experiencing algae problems on a more localized scale.

Work was undertaken in 2013–2014 towards determining how much phosphorus levels would need to be lowered to achieve a healthy and sustainable Lake Erie, and to work out strategies that could be implemented to achieve the desired outcomes. Through the Great Lakes Nutrient Initiative, research and monitoring were undertaken to determine current nutrient loadings from Canadian tributaries and enhance our knowledge of the factors that impact algae growth. Together with similar work being done by the U.S., this analysis will provide the scientific basis to establish binational phosphorus reduction targets for Canada and the U.S. to meet.

This work is being coordinated under the Canada–United States Great Lakes Water Quality Agreement, which requires the identification of new phosphorus targets for Lake Erie by 2016 and domestic action plans by 2018. Binational working groups have been formed with representatives from federal, provincial and municipal levels of government, and from the waste water sector and agriculture among others.

Lake Simcoe/south-eastern Georgian Bay

In 2013–2014, the Government of Canada committed $8.6 million, leveraging $15.4 million, to 26 community-based projects under the renewed and expanded Lake Simcoe/South-eastern Georgian Bay Clean-Up Fund. These projects included activities to reduce phosphorus inputs to the watersheds from urban and rural point and non-point sources, restore and create aquatic habitat, and support innovation and advance research into the water quality issues of south-eastern Georgian Bay and Lake Simcoe.

A workshop was held for stakeholders in south-eastern Georgian Bay to discuss current and emerging issues within the watershed and identify gaps in the current knowledge of issues within the geographic area. Findings were issued to validate the current science plan and help prioritize which projects are supported by the Fund.

Research and monitoring work undertaken during 2013–2014 in the Lake Simcoe/south-eastern Georgian Bay area focused on sediment characterization; nutrient source tracking; surface water quality and associated harmful algal blooms; and groundwater quality and its role in nutrient loading. In addition, a weather station has been installed in the study area, and moorings were deployed.

3.2 St. Lawrence Action Plan

The St. Lawrence Action Plan (http://planstlaurent.qc.ca/en/home.html) is a collaborative effort between the Canadian and Quebec governments to protect, conserve and enhance the St. Lawrence ecosystem. This multi-year program, which has been renewed four times since it was first signed in 1988, has helped produce concrete results through the cooperative efforts of the two governments. Their efforts have benefited from participation by the private sector, universities, research centres, Areas of Prime Concern committees (known as ZIP committees – zone d'intervention prioritaire), non-governmental organizations and riverside communities. The program focuses on all of the St. Lawrence River's ecosystems and on the mouths of its main tributaries, from Lake Saint-François, straddling the border between Quebec and Ontario, to the eastern reaches of the Gulf of St. Lawrence.

The Canada–Quebec Agreement on the St. Lawrence, also known as the St. Lawrence Action Plan 2011–2026, covers a span of 15 years with 5-year planning cycles.

In 2013–2014, various components of the Action Plan continued, including 48 projects from its joint action program, where a number of research activities were undertaken, including:

- A study of the impacts of climate change on water supplies;
- Improving knowledge of pathogenic micro-organisms from agricultural sources in the tributaries of Lake Saint-Pierre;
- A study in the Richelieu River where parasite species composition and richness in spottail shiners was affected by climatic conditions in the form of precipitation;
- Separate studies of the physiological effects and impact on the immune system for mussels fed with *Anabena flos-aquae* or exposed to the benthic algae *Lyngbya wollei*; and

- An evaluation of the effects of antibiotics on the endemic snail species *Lymnaea* sp. and comparison of the results with responses to effluent from Montréal.

Community involvement and awareness

The ZIP Program supports Stratégies Saint-Laurent and its members (the 13 Areas of Prime Concern committees) in their efforts to continue working with local communities to protect, conserve and develop the St. Lawrence ecosystem. In 2013–2014, activities included collaboration between communities to highlight local environmental issues related to the St. Lawrence; participation in community projects related to access to the Saguenay River, shoreline erosion and the sustainable development of coastal environments; and habitat conservation and the enhancement of natural environments. Furthermore, ZIP committees contributed significantly to the St. Lawrence integrated management approach at the local level, notably through the establishment of some regional issues round tables.

Under the St. Lawrence Action Plan 2011–2026, Environment Canada and Quebec's Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs are also implementing the Community Interaction Program (CIP), which supports non-governmental organizations that implement projects that benefit the St. Lawrence. During 2013–2014, Environment Canada funded 14 projects under this program, which were carried out throughout the program area extending up the south shore of the St. Lawrence from Cornwall to Gaspé, including the Magdalen Islands, and up the north shore from Carillon to Blanc-Sablon, including Anticosti and the Saguenay region. The projects involve key players from riverside communities, including municipalities, First Nations, academia, industry, agriculture, local communities and relevant provincial and federal departments. Projects in 2013–2014 included the restoration of the mouth of the Rivière Brochu in Sept-Îles, the creation and implementation of a conservation plan for the Northern Map Turtle in the Lac des Deux Montagnes area of the Montréal region, and the experimental restoration of an eelgrass bed in Baie de Mitis in Sainte-Flavie, in the Bas-Saint-Laurent. A total of 39 new project proposals were submitted under the CIP in 2013–2014 for activities that will be carried out beginning in spring 2014.

Finally, the third Forum on the St. Lawrence was held in Québec City in October 2013, focusing on access to the St. Lawrence. At the regional level, two round tables were established by the Quebec government and supported by the federal government through the ZIP Program.

The State of the St. Lawrence River Monitoring Program

A network of governmental and non-governmental partners and collaborators continued to conduct sampling campaigns required to obtain scientific data through the State of the St. Lawrence River Monitoring Program. Environment Canada collected data on water levels and flow rates; water and sediment quality; benthic communities at Lake Saint-Pierre; the area covered by wetlands; seabird populations, the Northern Gannet and the Great Blue Heron; and shellfish water quality.

During 2013–2014, Environment Canada published an online fact sheet on the contamination of sediments by polybrominated diphenyl ethers (PBDEs) and prepared six new fact sheets on environmental indicators used to monitor the state of the St. Lawrence. These include surface areas of freshwater wetlands, benthic macro-invertebrate communities in Lake Saint-Pierre, contaminant transport, changes in discharge and water levels, the Northern Gannet and seabirds. They are scheduled for publication during 2014–2015, along with the proceedings of Rendez-vous Saint-Laurent 2013, which will be available on the St. Lawrence Action Plan's website.

The Working Group on the State of the St. Lawrence River worked during 2013–2014 on the preparation of a major report on the Overview of the St. Lawrence River. The Overview addresses changes in the state of the St. Lawrence by looking at 19 environmental indicators on water, sediments and biological resources, general issues and the future outlook for this ecosystem. It is scheduled for publication in 2014–2015, and it is revised every 5 years.

Environment Canada used monitoring data to prepare a technical and scientific report on monitoring the Northern Gannet population and contamination in Quebec (1966–2009) as well as a fact sheet, prepared in collaboration with Quebec, on concentrations of medications, hormones and other contaminants of emerging concern in the St. Lawrence and three of its tributaries.

Numerical Environmental Prediction Program

The Working Group on Numerical Environmental Prediction for the St. Lawrence was formed under the St. Lawrence Action Plan with the goal of having a better understanding of the ecosystem in the St. Lawrence as a whole and to provide a tool for supporting decisions about its integrated management. In 2013–2014, the group's activities progressed well, notably through the three specific projects focused on the atmosphere–surface schema–hydrology coupling, integration of hydrodynamic modelling tools into the Montréal Archipelago, and hydrologic and hydraulic modelling of the Richelieu River watershed. The group also supported activities under the St. Lawrence Action Plan's three main issues, which are conservation of biodiversity, sustainability of uses and water quality improvement.

3.3 Atlantic Ecosystem Initiatives

The Atlantic Ecosystem Initiatives (AEI) implements an ecosystem-based approach to environmental management through internal engagement, external engagement with multi-stakeholder community organizations, regional coalitions and research organizations in the Atlantic provinces. The work of these partners has a positive impact on the health of watershed ecosystems across the region and on larger ecosystems in the Gulf of Maine, the southern Gulf of St. Lawrence and the Bay of Fundy. AEI-funded initiatives support the use of local and regional expertise, and support people who work in their own communities and regions, in order to help build a better environment for Canadians.

Environment Canada contributed funding, technical and scientific expertise, and direct staff support, with respect to four broad categories of projects relevant to the *Canada Water Act*: clean water, pollution sources, toxics and natural habitat.

In 2013–2014, 22 projects (representing 61% of all projects funded) addressed water issues related to water quality, biodiversity and climate change. Environment Canada committed over $800,000 for these projects. The bulk of project activities pursued enhancement and improvement of water quality and watersheds through initiatives such as identification and assessment of threats to water resources, water quality monitoring and research, and development of ecosystem management tools and management plans. The following examples demonstrate the type of projects that were carried out and supported by Environment Canada in 2013–2014.

In Nova Scotia, the Bluenose Coastal Action Foundation completed the first year of a three-year project to field test the catchment liming technique in the Gold River watershed of Lunenburg County, which continues to experience impacts of soil acidification after decades of acid rain. The three-year pilot project will develop a "recipe book" for watershed liming that can be used by other community groups and stakeholders throughout Atlantic Canada.

In Prince Edward Island, the Bedeque Bay Environmental Management Association collaborated with Saint Mary's University in Halifax on the CURA H2O project to launch and implement a province-wide community water quality monitoring program. As a result, 10 provincial community watershed groups received standardized water monitoring training and certification that enabled them to adopt and follow common scientific monitoring protocols for standardized water quality data collection and management.

In New Brunswick, unknown contaminant sources currently restrict areas of the Miramichi Inner Bay to direct shellfish harvesting. The Miramichi River Environmental Assessment Committee, in partnership with Environment Canada's Science and Technology Branch, used intensive water quality sampling and Microbial Source Tracking technology to analyze the DNA of fecal coliforms in order to better identify sources of contamination in the Inner Bay.

In Newfoundland and Labrador, Healthy Waters Labrador worked with the Town of Happy Valley–Goose Bay towards the protection and rehabilitation of Birch Island Creek, with the ultimate goal of creating a productive stream and riparian wetland habitat for wildlife. The group developed a Geographic

Information System and built a digital map database of all available scientific and Traditional Knowledge data available for the area. The end result is a management plan for the rehabilitation of the wetland, riparian and fish habitat on Birch Island.

Other AEI project activities included assessment of threats from sedimentation and nutrient transport, the development of data management tools for integrated watershed planning, assessing land-based threats to coastal wetlands and important aquatic habitats, flood-risk data gathering and mapping, and monitoring nearshore water pH (i.e., ocean acidification).

Memorandum of Understanding on Environmental Cooperation in Atlantic Canada

The Memorandum of Understanding (MOU) on Environmental Cooperation in Atlantic Canada is a federal-provincial collaborative effort to preserve, protect and enhance the environment in Atlantic Canada. Signed in 2008, the MOU expired in early 2013, and parties are now working towards an alternative arrangement.

3.4 Gulf of Maine

As part of the Government of Canada's Health of the Oceans Initiative, Environment Canada worked collaboratively with partners in the Gulf of Maine to implement an ecosystem-based approach for conserving and enabling responsible development in this transboundary ecosystem, which includes coastline in New Brunswick and Nova Scotia.

In collaboration with other federal departments, provincial governments, U.S. governments and community groups, a number of scientific research and planning needs were identified, and projects enabling action on these common interests were supported. Projects focused on strategic planning, science and monitoring, and development of decision-support tools on issues related to water quality, habitat, climate change and general ecosystem health. Projects included:

- Compiling information on monitoring activities throughout the Gulf of Maine (including water monitoring) and making the information accessible in an online searchable Web tool (www2.gulfofmaine.org/esip/reporting/gmap2.php?new=true);
- Mapping of impervious surfaces to support assessment of water quality impacts and ecosystem health, as well as flood mitigation and adaptation to extreme events;
- Enhancing a nearshore water temperature monitoring network to better understand climate impacts to coastal ecosystems and species;
- Development of habitat conservation strategies to help identify species and habitats of conservation priority;
- Assessing and summarizing municipal climate change adaptation measures and needs;
- Preparing a framework for identifying and developing best management practices for addressing issues (including water quality) affecting the health of the Gulf of Maine;
- Developing a conceptual model and framework for identifying and assessing threats to the Gulf of Maine ecosystem; and
- Producing and disseminating information on the state of, and trends in indicators of, ecosystem health (e.g., contaminants).

Environment Canada also continued to support the Canada–U.S. Gulf of Maine Council on the Marine Environment (GOMC) and implementation of its 2012–2017 Action Plan. The GOMC is a Canada–U.S. partnership of governmental and non-governmental organizations working together to maintain and enhance environmental quality in the Gulf of Maine and its watershed, allowing for sustainable resource use by existing and future generations.

3.5 Lake Winnipeg Basin Initiative

In August 2012, Phase II of the Lake Winnipeg Basin Initiative (LWBI) was launched with a five-year (2012–2017), $18-million investment that will focus on improving water quality in the region. The renewal of the Stewardship, Science and Transboundary Partnerships pillars of the LWBI builds on Phase I of the initiative. Environment Canada is responsible for the overall coordination of the LWBI and the delivery of its Stewardship, Science and Transboundary Partnerships pillars.

Phase II of the LWBI increases focus on community stewardship actions that measurably reduce nutrients and improve Lake Winnipeg's water quality, while continuing a strong foundation of science and environmental monitoring. Science efforts during Phase II focus on watershed and in-lake research and monitoring to help further target and measure actions on the land that will improve water quality in the lake.

Some key highlights from 2013–2014 include:

- The Ministerial-appointed, 6-member Public Advisory Committee provided funding recommendations for the Minister's approval of 16 Lake Winnipeg Basin Stewardship Fund (LWBSF) projects in funding Round 7;
- LWBSF projects from Phase I continue to reduce phosphorus loading by 6000 kg/year. Under Phase II, estimates indicate an additional phosphorus reduction of 10 800 kg/year will be achieved by March 31, 2017;
- Continued engagement of transboundary water management boards supported efforts to develop water quality objectives for nutrients in the Red River and Winnipeg River systems;
- Substantial progress was made towards the renewal of the Canada–Manitoba MOU Respecting Lake Winnipeg and the Lake Winnipeg Basin and delivery of its work plan;
- Environment Canada continued delivery of the Science Subsidiary Arrangement (2012) under the Canada–Manitoba Lake Winnipeg MOU. Part of this work focused on the development of a preliminary set of eutrophication-related indicators for the Lake Winnipeg basin; and
- Extensive collaborations were held by way of the Canada–Manitoba MOU on the formation and implementation of Manitoba's Lake Friendly Accord and Stewards Alliance. The Minister of the Environment signed the Lake Friendly Accord on behalf of the Government of Canada on March 21, 2014.

The Government of Canada also continued to provide support for community-based projects through the LWBSF with an increased funding envelope for Phase II. In 2013–2014, Environment Canada approved $916,900 for 16 LWBSF projects aimed at reducing nutrient loading in the Lake Winnipeg Basin. Since its inception in 2008, the LWBSF has provided over $5 million in federal funding for 59 community-based projects ranging from wetland restoration to innovative waste-water treatment, and beneficial agricultural practices to cutting-edge scientific research. For every dollar provided by the fund, approximately $2.42 in additional partner funds and in-kind contributions were generated. In total, community-based projects valued at over $17 million have benefitted the Lake Winnipeg Basin. These are funds that, without the LWBSF, may not otherwise have been available. Funding for Round 7 projects of the LWBSF was initiated in 2013–2014.

The LWBI continued to provide annual funding support to the Lake Winnipeg Research Consortium, which operates the MV Namao, the only research and monitoring vessel operating on Lake Winnipeg.

The LWBI emphasizes collaborative work with other governments (provincial, state, federal) and organizations within the Lake Winnipeg transboundary watershed. Domestic and international water management boards play a key role in managing nutrients in the Lake Winnipeg Basin. Environment Canada participates on a number of water science and water management boards to facilitate coordination of efforts across the watershed and to help address nutrient loading originating from outside of Manitoba's jurisdiction.

In September 2010, pursuant to section 4 of the *Canada Water Act*, Environment Canada signed the five-year Canada–Manitoba MOU Respecting Lake Winnipeg and the Lake Winnipeg Basin, providing for the establishment of a steering committee and a collaborative and coordinated approach between the two governments. The steering committee, with representatives from key federal and provincial departments, provides oversight for the MOU. A science subsidiary arrangement was finalized under the MOU and will assist to coordinate federal-provincial scientific monitoring and research.

Research and monitoring activities during 2013–2014 included the ongoing implementation of 13 research and monitoring projects in Lake Winnipeg and its watershed, with a focus on the identification of the sources and impacts of nutrient loadings to Lake Winnipeg. Work is well under way in a number of areas, including water quality

monitoring of core transboundary sites and related main rivers. Focus is also on assessing nutrient sources and transport in runoff from agricultural fields, specifically snowmelt and rainfall runoff; assessing the ecological condition of watersheds in southern Manitoba; fate and effect of nutrients; groundwater impact on streamflow; model development; nutrient management; algal blooms; and the bioavailability of nutrient inputs.

3.6 Pacific and Yukon Region/ Okanagan Basin Water Board

Environment Canada's regional offices coordinate the Department's interventions in identified priority ecosystems where a formal ecosystem initiative is not established. In the Pacific and Yukon Region, the Regional Director General's Office works with the Okanagan Basin Water Board, a water governance body tasked with identifying and resolving critical water issues at the scale of the Okanagan watershed. Funding was provided to the board to bring together existing wetlands information, identify gaps and synergies, and establish a plan of action for wetland protection in the Okanagan. Other funding was provided to improve hydrometric data in the Okanagan basin by re-establishing strategic hydrometric stations and long-term agreements with local governments for annual operating costs, all in support of water management modelling, research and decision-support tool development.

The regional office continued to support the planning of the 2014 Salish Sea Ecosystem Conference through the Fraser Basin Council, a charitable non-profit organization devoted to advancing sustainability in the Fraser Basin and across British Columbia. The conference serves to share the latest scientific research on the state of the Salish Sea and integrate the physical and social sciences to inform policy.

Okanagan Basin Water Supply and Demand Project

Initiated in 2006, the Okanagan Basin Water Supply and Demand Project estimates present and future water needs and availability, to inform water management and planning decisions in the Okanagan Basin of British Columbia. This assessment uses available data on a multitude of relevant factors, including hydrology, climate and land use. The project also considers potential effects of climate change, regional growth and water conservation measures on water use and availability under different scenarios.

The Okanagan Basin Water Board leads the project in collaboration with British Columbia's Ministry of Environment, Ministry of Forest, Lands and Natural Resource Operations, and Ministry of Agriculture. Environment Canada, Agriculture and Agri-Food Canada, and Fisheries and Oceans Canada also participate in the project, along with the University of British Columbia (Okanagan), the BC Agriculture Council, and several local and regional stakeholders.

Now in Phase 3, the Okanagan Water Supply and Demand Project is focusing on ensuring the best use of available information for planning, adaptation, education and water management in the Okanagan Basin.

To help achieve these objectives, the project has developed a public information Internet portal (Okanagan Water Supply and Demand Viewer) and a water-use reporting tool (www.obwb.ca).

Environment Canada also continued to work with the Okanagan Basin Water Board on the Okanagan Lake Evaporation Study, which will determine how much water is lost to evaporation and inform the impacts and drivers of lake evaporation so that the Okanagan will be in a better position to plan for these challenges, including drought.

4 Research on the impacts of climate change on aquatic systems

In 2013–2014, Environment Canada undertook a number of activities to quantify and predict local/regional and national sensitivities of aquatic ecosystems to climate variability and change, including:

- Identifying and accumulating freshwater biodiversity water sources across Canada's North;
- A study of the effects of permafrost thaw on tundra lakes, particularly the responses of benthic invertebrate communities;

- A study of effects of megaslumps on the physical and chemical characteristics of stream ecosystems;
- Two projects focused on quantifying and predicting vulnerability and sensitivity of high-latitude and -altitude cryospheric systems to climate variability and change: one focused on quantifying northern-hemisphere freshwater ice and the other looking at ecological and hydro-climatic impacts of river ice jams;
- Continued research related to extreme hydrologic events focused on changes in peak runoff events to the Arctic Ocean and on understanding and defining stream flow and water chemistry regimes in the subarctic Canadian Shield, with a focus on the Baker Creek Research Catchment, in order to define subarctic Canadian Shield stream flow and water chemistry regimes in support of responsible northern resource development;
- Hydro-climatic analysis and impact studies in western and northern Canada continued, to quantify and predict the impacts of both past climate trends and variability and future climate change on key watersheds within western and northern Canada; and
- Assessment of climate variability and change on prairie wetlands and hydrology.

Environment Canada also continued a number of projects to improve hydrologic modelling for application in the development of adaptation options for watershed management, including analysis and modelling watershed runoff in discontinuous drainage systems, with a focus on the Prairies and ungauged watersheds; and to improve understanding of relationships between ice, lake temperature and evaporation regimes on the Great Lakes.

PUBLIC INFORMATION PROGRAM

(Part IV of the *Canada Water Act*)

There are a number of ways in which Environment Canada and its partners engage Canadians to learn more about the country's water resources and provide information on its sustainable use and conservation at a national level. These activities are discussed throughout the annual report, including in the section on ecosystem initiatives.

Environment Canada's Water website

Environment Canada's Water website (www.ec.gc.ca/eau-water) continued to provide general information on a wide range of water-related topics, comprehensive educational materials (such as *A Primer on Fresh Water* and various fact sheets) and the full text of key water publications (such as the *Canada Water Act Annual Report*, the Federal Water Policy, and reports on municipal water use and pricing). In addition, the site provides content on Environment Canada's water-related activities and program areas.

www.**ec.gc.ca**

Additional information can be obtained at:

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