Environment Canada Environnement Canada

Canada Water Act

Annual Report

for April 2008 to March 2009

Canada

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Foreword

The *Canada Water Act*, proclaimed on September 30, 1970, provides the framework for co-operation with provinces and territories in the conservation, development and use of Canada's water resources. Section 38 requires that a report on the operations under the Act be laid before Parliament after the end of each fiscal year. This 36th annual report covers progress on these activities from April 1, 2008, to March 31, 2009.

The report describes a wide range of federal activities conducted under the authority of the Act, including participation on 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:

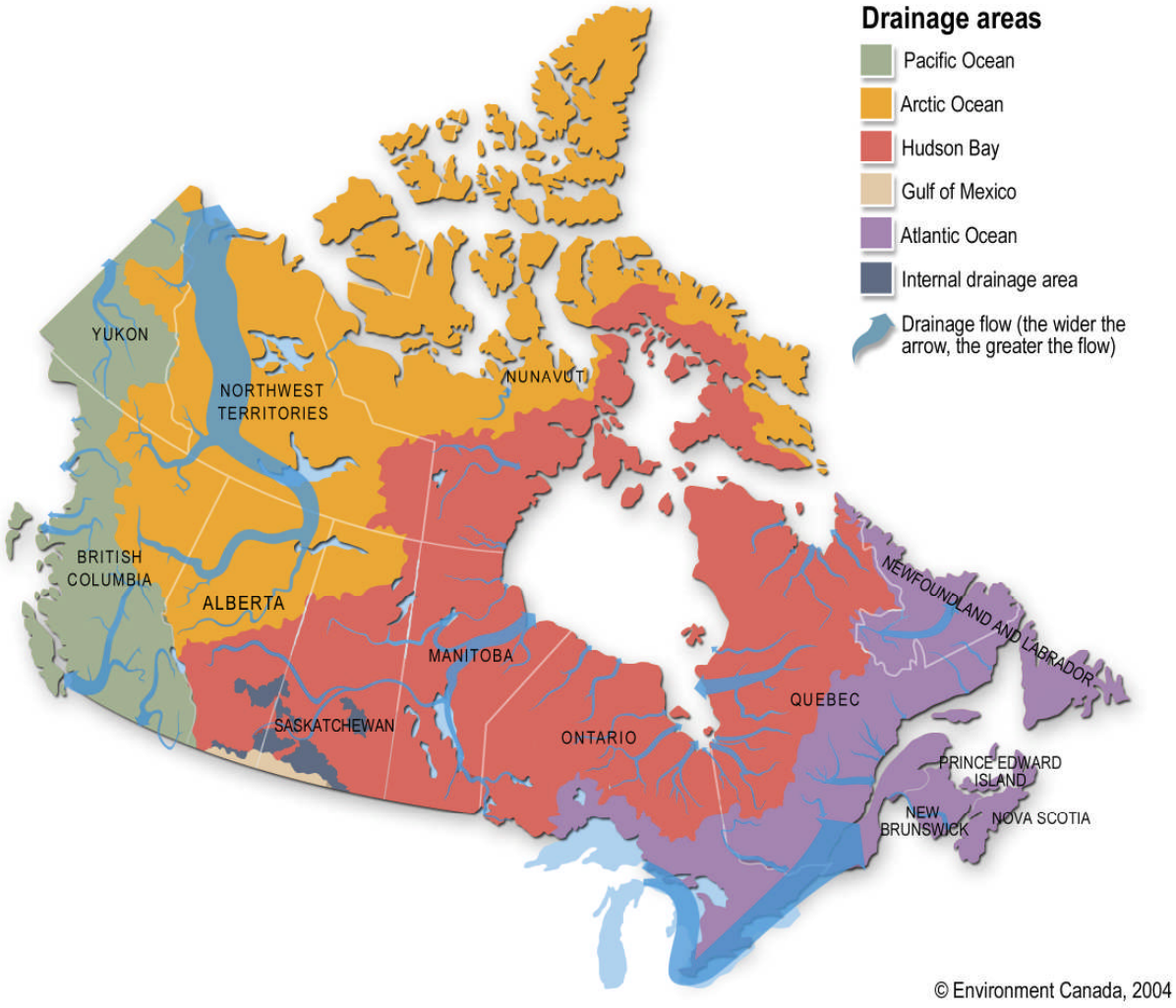
Part I, section 4, provides for the establishment of federal–provincial arrangements for water resource matters. **Sections 5, 6 and 8** provide the vehicle for co-operative agreements with the provinces to develop and implement plans for the management of water resources. **Section 7** enables the Minister, either directly or in co-operation 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 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 co-operative 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III, which provided for regulating the concentration of nutrients in cleaning agents and water conditioners, has been repealed.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/CEPARegistry/gene_info.)

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 co-operation 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

This 36th annual report on the *Canada Water Act* highlights activities under the Act from April 1, 2008, to March 31, 2009.

Hydrometric agreements have been administered as co-operative endeavours between most provincial/territorial governments and the federal government since 1975. These agreements provide for the collection, analysis, interpretation and dissemination of water quantity data to meet a wide range of needs in the hydrology community. During 2008, the Water Survey of Canada, the federal partner in the National Hydrometric Program, celebrated its first 100 years (1908–2008) of hydrometric service to Canadians. In 2008–2009, Environment Canada worked with provinces and territories to modernize the agreements, while continuing to co-operatively collect and manage water quantity data. There were no significant changes to the size of the hydrometric network in 2008–2009. Work continued on outreach, assistance during flood events, technology development, training and International Organization for Standardization (ISO) certification.

Partnerships in Ontario and the Okanagan Basin continued to monitor and evaluate water use, availability and demand, including characterizing ecosystems and monitoring the potential impacts of climate change. While some form of collaboration is likely to continue, the Ontario Water Use and Supply Project in its present form was completed during the reporting period.

Environment Canada collaborates on water quality monitoring under individual agreements with British Columbia, Manitoba, New Brunswick, Newfoundland and Labrador, and Prince Edward Island. Co-operative water quality monitoring in Quebec is conducted through the St. Lawrence Plan, an ecosystem initiative. In 2008–2009, measurements at numerous water quality monitoring stations for groundwater, inland freshwater and transboundary waters were used to assess and report on status and trends, and evaluate the progress of protection and remediation programs. Benthic and aquatic habitat monitoring was also undertaken as part of the Canadian Aquatic Biomonitoring Network, which provides a nationally standardized protocol for the collection, identification and reporting of data.

Federal–provincial/territorial water quality data, as well as data from numerous other federal sites, contributed to the development of Canadian Environmental Sustainability Indicators. The 2008 Canadian Environmental Sustainability Indicators report was released in March 2009, based on data collected from 2004 to 2006. Among other highlights, freshwater quality measured at 379 monitoring sites across southern Canada was rated as "good" or "excellent" at 48 percent of sites, "fair" at 30 percent, and "marginal" or "poor" at 22 percent. For the 32 monitoring sites in northern Canada, freshwater quality was rated as "good" at 66 percent of sites, "fair" at 28 percent, and "marginal" at 6 percent.

This report contains the 2008–2009 activities of three inter-jurisdictional water boards: the Ottawa River Regulation Planning Board, the Prairie Provinces Water Board and the Mackenzie River Basin Board. Activities and discussions were tailored to the needs in each region, such as integrated management of reservoirs, flood protection, transboundary apportionment, water quality and development activities.

Ecosystem initiatives respond to the unique problems of targeted areas and communities, and address environmental, economic and social concerns.

The Georgia Basin Action Plan, which was active from 2003 to 2008, was a multi-partner initiative to improve the state of the environment in the Georgia Basin. With its completion in 2008, the Georgia Basin Action Plan has left a legacy of more integrated partnerships to better manage environmental, social and economic activities in the basin. Funding continued in 2008–2009 for ongoing water quality projects. The Plan's results were summarized in a five-year program update.

The Canadian Federal 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 (Parks Canada Agency). It provides the framework for working toward Canada's commitments under the *Canada–United States Great Lakes Water Quality Agreement*, which is the key mechanism for protecting water quality and the health of the aquatic ecosystem in the Great Lakes. The Great Lakes Program also provides the federal focal point for co-operation with the Province of Ontario. Canada's activities are integrated with those of Ontario through the Canada–Ontario Agreement Respecting the Great Lakes Basin Ecosystem, which outlines how the two governments will co-operate and coordinate their efforts to restore, protect and conserve the Great Lakes Basin ecosystem. The Canada–Ontario Agreement plays a significant role in meeting Canada's obligations under the Canada–United States Agreement. Highlights of actions in 2008–2009 include a wide range of science, monitoring and restoration projects in Great Lakes Areas of Concern, and other projects through the Great Lakes Action Plan and the Great Lakes and Regional Environmental Quality Monitoring and Surveillance program; projects to reduce the amount of nutrients, solids and bacteria entering watercourses, and to restore aquatic and terrestrial habitat through the Great Lakes Sustainability Fund; and research in support of Lakewide Management Plans.

Environment Canada is carrying out its work under the federal government's Action Plan for Clean Water, through $96 million in cleanup funding to restore Lake Simcoe, Lake Winnipeg and contaminated sediments in Areas of Concern in the Great Lakes. In 2008–2009, the Government announced funding of $9.5 million for restoration projects for Lake Superior, Lake Simcoe and the Niagara River.

The St. Lawrence Plan, initiated in 1988, is a Canada–Quebec ecosystem initiative to protect, conserve and restore the St. Lawrence River ecosystem. In 2008–2009, in collaboration with community and industry partners, this extensive initiative undertook numerous programs, such as benthic and shore erosion monitoring, habitat restoration, youth outreach, and education and awareness.

Launched in 1991, the Atlantic Coastal Action Plan family is currently made up of 16 organizations in the Atlantic provinces. In 2008–2009, 32 projects (representing almost 50 percent of all projects) dealt with water issues.

In 2008–2009, numerous research projects were carried out by Environment Canada scientists on various current and emerging issues, such as testing methodologies, treatment technologies, pharmaceuticals and personal care products, pathogens, pesticides and agricultural and roadway runoff, nanoparticles and nutrients. Other research included hydro-meteorological modelling and prediction, the State of the Strait Conference and the National Agri-Environmental Standards Initiative.

Environment Canada continued to provide water-related public information and water awareness activities through its water website (www.ec.gc.ca/eau-water), RésEau website (www.ec.gc.ca/reseau), and Biosphère Environment Museum website (www.biosphere.ec.gc.ca).

COMPREHENSIVE WATER RESOURCE MANAGEMENT

(Part I of the *Canada Water Act*)

1 Federal–provincial/ territorial programs

This section describes federal, provincial and territorial collaboration in the following areas:

- data collection and use
- inter-jurisdictional water boards
- ecosystem initiatives

1.1 Water monitoring

1.1.1 Water quantity

Background

Formal bilateral hydrometric agreements between most provincial/territorial governments and the federal government have been administered co-operatively since 1975. These agreements provide for the collection, analysis, interpretation and dissemination of water quantity data to meet a wide range of needs in the hydrology community.

During 2008, the Water Survey of Canada, the federal partner in the National Hydrometric Program, celebrated its first 100 years (1908–2008) of hydrometric service to Canadians. A four-day Centennial Workshop in Penticton, British Columbia, brought together more than 240 present and former staff, partners and clients from across Canada and the United States to review the history of the program, receive technical and scientific training, and discuss the future human challenges facing the hydrometric monitoring program. In particular, the clients and partners of the federal–provincial/territorial hydrometric agreements shared their thoughts on the current value of the Water Survey of Canada's data products and services to their respective programs, and on what data products and services the programs will need in the future.

Under the Partnership Renewal Process initiative, government partners have been reviewing, updating and revising the 1975 bilateral agreements. Bilateral agreements were signed in 2008 between Canada and four provinces: Manitoba, Alberta, Quebec and Ontario. Negotiations continued with the remaining provinces and territories throughout 2008–2009. On June 6, 2008, the Government of Canada signed a Memorandum of Understanding on environmental co-operation with Newfoundland and Labrador, Nova Scotia, New Brunswick and Prince Edward Island. The Memorandum strengthens the ability of the federal and provincial governments to work together to achieve shared environmental objectives, and will help create multilateral or bilateral agreements. In 2008–2009, work began on a Water Annex, which will identify the roles of the federal and provincial governments on a number of issues surrounding water and will continue the renewal process for the 1975 hydrometric agreements for Atlantic Canada.

As part of their commitment to the principle of co-management under the National Hydrometric Program, both the National Administrators Table and the National Hydrometric Program Coordinators' Committee continued to meet regularly to discuss program issues throughout 2008–2009. At the face-to-face meeting in October 2008, the National Administrators Table undertook the development of a strategic framework, whose vision statement contemplates "leadership across Canada in timely service delivery of relevant, quality, responsive, integrated and standardized hydro-meteorological information and analysis that meets client and government needs."

Progress to March 31, 2009

The Network

There were no significant changes to network size in 2008–2009. Changes to the hydrometric network in 2008–2009 included an expansion in Newfoundland and Labrador, where five new provincial stations were added in the Churchill Basin in Labrador, related to the Lower Churchill

hydro development. In British Columbia, there was a net increase of one station: three stations were added and two stations were discontinued.

During 2008–2009, the shared network remained steady, with no changes in the stations operated in the Northwest Territories and Nunavut. However, five non-shared stations were added. These are stations operated by Environment Canada for other clients on a cost-recovery basis.

Outreach

A hydrometric display was coordinated for the Canadian Water Resources Association conference in Gimli, Manitoba, in June 2008, to showcase the Manitoba hydrometric agreement and to bring awareness to the products available. The overall feedback indicated that the information was well received, and interest in the program and its products was increased.

Visitors were surveyed to obtain a sense of the types of users as well as the types of data being used and for what purposes, and to inquire about interest in a stakeholder workshop. An estimated 60–70 percent of the visitors to the display completed the survey. Results of the survey showed that many respondents were aware of the products, although some were not aware that they reflected all parties (Water Survey, Water Stewardship and Manitoba Hydro). Most of the respondents use both the real-time and historical data, with the main purpose being research. The majority of respondents expressed interest in attending a stakeholder workshop.

The Quebec Region hosted a large-scale, multi-agency discharge-measurement event in the Montréal archipelago during 2008–2009. It involved the participation of Environment Canada, Hydro–Québec, individual municipalities, and the United States Geological Survey. The intent was to reduce the uncertainty surrounding the flow balance in the Montréal archipelago through measuring the water coming into and going out of the archipelago, with all boats from the parties in the water at the same time.

Floods

Record-high snowfall conditions, combined with periods of high precipitation, produced flood conditions for the St. John River and its tributaries in late April and early May of 2008. Hydrometric managers and technologists maintained close contact with, and supplied support to, the New Brunswick River Watch Centre during the flood period. Field crews were assigned to target flow measurements in the flooding areas, and were prepared to respond to service calls for the real-time hydrometric network, should key stations stop functioning properly. Upgrades to a few key stations made earlier in the year likely contributed to a real-time network that functioned without significant problems during the flood period.

The Lower Fraser Valley experienced significant flooding in January 2009, resulting from a warm/wet Pineapple Express event occurring when snow depth was one-third to one-half metre. The Chilliwack River main stem did not flood, but there were reports of flooding and landslides in tributary basins, and widespread flooding on a number of small valley-floor creeks and streams in the Chilliwack area, resulting in flooding in residential areas (which led to declaration of a local state of emergency). In addition, the Nooksack River in Washington reached a high flood level, and overflow into British Columbia occurred at Sumas. Hydrometric personnel were on standby to support provincial partners when and where they were needed.

Technology

Progress continued toward the operationalization of the Hydrometric Work Station, a tool that will manage the hydrometric program's entire data production process. The software procurement and bid-evaluation process was conducted during 2008–2009, and the contract was awarded at the beginning of March 2009.

The hydrometric program continued to expand its installation, testing and operationalization of new field technologies. In particular, the program continued to certify field staff in the correct use of acoustic equipment, and used this equipment for field measurements in most regions. In addition, remote boats have been installed in certain regions for field testing. Subject to satisfactory field trials, these remote boats will replace manned boats resulting in lower risks of accident and injury to field personnel.

Human resources

There were a significant number of new recruits to the hydrometric program in 2008–2009. Twenty-four people underwent winter training at Water Survey of Canada headquarters in Ottawa in January 2008, followed by open water training in Chilliwack, British Columbia, in March 2009. Of these 24 recruits, 2 were employees of the Saskatchewan Water Authority.

ISO 9000 certification

The federal hydrometric program continued its pursuit of ISO certification during 2008–2009. During the fall of 2008, internal audits were performed in Calgary, Ottawa, Winnipeg and Yellowknife, followed by external audits at the same locations. Certification was obtained in October 2008.

1.1.2 Water use and supply

1.1.2.1 Canada–Ontario Water Use and Supply Project

Background

In the fall of 2000, the federal government and the government of Ontario initiated a joint federal–provincial water use and supply project for the Great Lakes Basin, which was supposed to run for five years. The primary objectives were to

- gain baseline information at the sub-basin level on water supply, use and demand;
- identify the system's ecological sensitivities to water resources; and
- make projections of future supply and use that take into account the potential impacts of climate change.

Environment Canada and the Ontario Ministry of Natural Resources co-led the project. The project management team included members from these two agencies, along with the Ontario Ministry of the Environment, the Ontario Ministry of Agriculture, Food and Rural Affairs, Conservation Ontario, and Fisheries and Oceans Canada. Three technical working groups (water use, water supply and ecological requirements) conducted the work.

Over the years, the project has been successful in gathering various watershed characterization data sets and developing them into a geographic information system. The intent was to use general data sets to compare watersheds throughout the basin. As well, the Water Use and Supply Project has served as a forum for discussing the integration of the various map data layers and the representation of overall water availability in study-area watersheds on a sub-watershed basis. The project team has documented its work and made it available to partner agencies.

Progress to March 31, 2009

Efforts continued on a work-share basis to assess water supply, water use and ecological water requirements on a watershed basis in the Great Lakes Basin. The Water Supply Working Group contributed to studies that looked at temperature conditions in streams as they relate to groundwater conditions. The work supported understanding of the ecological implications of changing groundwater resources. In addition, the project's methodologies for estimating groundwater resources using base-flow conditions were applied outside the basin to support other studies looking at the potential impacts of climate change on groundwater resources.

The Water Use and Supply Project was completed during the year. The project had already extended well beyond its planned five-year existence. The Project Management Team focused on reviewing and reporting results: it prepared summary material to update the project website. It also worked with partner agencies to determine appropriate next steps: project partners considered options for continued collaborative efforts on understanding water quantity in the Great Lakes Basin, and some form of collaboration is likely to continue.

1.1.2.2 Okanagan Basin Water Supply and Demand Project

Background

This project is a partnership between the Government of British Columbia and the Okanagan Basin Water Board. The British Columbia Ministry of Environment is the lead agency, operating in collaboration with the Board, the provincial Ministry of Agriculture and Lands, and the Ministry of Community and Rural Development. Federal agencies involved in the project include Environment Canada, Agriculture and Agri-Food Canada, and Fisheries and Oceans Canada.

Contributions to the project have also been received from the Okanagan Nation Alliance, the University of British Columbia (Okanagan), Simon Fraser University, the British Columbia Agriculture Council, the Water Supply Association of British Columbia, and the Planning Association of British Columbia.

Initiated in 2006, the Okanagan Basin Water Supply and Demand Project estimates present and future water needs and availability, in order to inform water management and planning decisions in the rapidly developing, dry (semi-arid), Okanagan Basin of British Columbia. This assessment uses available data on hydrology, climate, land use, water use, water diversion, groundwater, population trends and other relevant factors. Assessment of scenarios of potential climate change impacts on water use and availability, and on in-stream flow needs, is also considered.

Progress to March 31, 2009

The first phase of this project focused on identifying data sources and gathering data, including Environment Canada climate data and hydrological data from stations located in the Okanagan Basin. These and other data have been stored in a customized project database (OkWater database). After 2006, the project moved into a second phase that focused on estimating the overall water (including groundwater) budget for the Okanagan Basin. To do this, the balance of inflows and extraction/losses were assessed.

In 2008–2009, Environment Canada completed a report on estimation of evaporation for the main Okanagan lakes, as part of the water balance study for the Okanagan Basin. Environment Canada also provided technical support to a basin-wide groundwater balance assessment. The overall water balance report is scheduled for completion by the end of 2009. Access to information provided by the Okanagan Basin Water Supply and Demand Study will be facilitated through an interactive website hosted by the Okanagan Basin Water Board.

1.1.3 Water quality

Background

Beginning in the early 1980s, agreements were negotiated between the federal government and several provinces, including Quebec (1983), British Columbia (1985), Manitoba (1988), New Brunswick (1988), Newfoundland (1986) and Prince Edward Island (1989).

The agreement with New Brunswick was revised in 1995 when the provincial government undertook to collect, analyze and manage the data for the water quality monitoring program. The agreement with Prince Edward Island was incorporated into the Canada–Prince Edward Island Water Annex in 1996, which expired in 1999 and was replaced with the Canada–Prince Edward Island Memorandum of Agreement on Water, signed in May 2001. Water quality monitoring continued under this new agreement.

The agreement with Quebec was terminated in 1995, because activities were similar to those in the St. Lawrence Action Plan. In the context of the 2005–2010 Canada–Quebec agreement, the St. Lawrence Plan included a specific Annex for State of the St. Lawrence River Monitoring.

The biological health of freshwater in Canada is monitored through the Canadian Aquatic Biomonitoring Network (http://cabin.cciw.ca). It establishes a network of reference sites available to all users interested in assessing the biological health of freshwater in Canada. The Canadian Aquatic Biomonitoring Network achieves consistent, comparable and scientifically defensible data by providing a nationally standardized protocol for the collection and identification of benthic macro-invertebrates as well as associated water quality and aquatic habitat information; a national training program for interested partners; and shared online data management, quality assurance, and control and reporting systems.

Progress to March 31, 2009

National

In 2008, Environment Canada's Canadian Aquatic Biomonitoring Network, in partnership with the Canadian Rivers Institute of the University of New Brunswick, launched a new online program to train partners to implement the Network's standardized protocol and to share resulting data within the national network. Additionally, the International Polar Year initiative provided an

opportunity to expand training in Canada's northern regions.

British Columbia

Under the Canada–British Columbia Water Quality Monitoring Agreement, Environment Canada and the provincial Ministry of Environment jointly conducted water quality monitoring at 42 stream and river sites in British Columbia. Approximately half of these sites were transboundary, on significant tributaries to transboundary waterways, or of other federal interest (e.g., sites on Canadian Heritage Rivers, sites monitored for 2010 Olympic impacts or for Canadian Environmental Sustainability Indicators reporting). Data from 29 of these sites were included in the Canadian Environmental Sustainability Indicators report. British Columbia also produced more in-depth water quality assessment reports for five of the sites. A website (www.waterquality.ec.gc.ca/EN/home.htm) includes real-time water quality, flow and meteorological data from the Fraser River estuary site, which is part of the Network. The agreement also captures biological sampling conducted through the Canadian Aquatic Biomonitoring Network at water quality sites in the province.

Environment Canada also monitored an additional 7 sites in British Columbia and 10 sites in the Yukon Territory, many of these in co-operation with the Parks Canada Agency or the Yukon Government.

Co-operative federal–provincial arrangements to test groundwater quality continued at several locations where groundwater monitoring wells have been installed through cost-sharing with the provincial government. A total of 12 monitoring wells are sampled on an annual basis, with 6 of these wells sampled on a monthly basis. This co-operative groundwater monitoring forms part of a larger Environment Canada groundwater monitoring network in the transboundary Abbotsford–Sumas aquifer (see Section 1.3.1 Georgia Basin Action Plan), and also supports specific groundwater research projects investigating the potential occurrence and persistence of bacterial pathogens, pesticides, and pharmaceutical compounds in groundwater. Additional co-operative groundwater monitoring is conducted on a semi-annual basis in the transboundary Osoyoos aquifer (southern Okanagan), where a combination of provincial and Environment Canada monitoring wells form the basis of the Environment Canada groundwater monitoring network for this transboundary area.

Manitoba

Water quality sampling continued at nine sites identified as part of the Canada–Manitoba Water Quality Monitoring Agreement. Monitoring at interprovincial sites that are identified in this agreement is also discussed through the Prairie Provinces Water Board. The water quality station on the Red River at Emerson, which is located on the international boundary with the United States, supports the International Red River Basin Board. This water quality station was upgraded to accommodate the installation of state-of-the-art auto-monitoring equipment. Upgrades included improved access to—and doubling the size of—the building, which will allow for the future upgrade of valves and pumps. The new structure continued to house the Water Survey of Canada's water-level monitoring equipment and data logger.

The Province of Manitoba and Environment Canada finalized a plan to conduct joint sampling on the Red River at Selkirk. Further to the announcement of the Lake Winnipeg Basin Initiative on November 7, 2007 (part of the federal government's Action Plan on Clean Water), discussions are under way with the Province of Manitoba on a Canada–Manitoba Agreement with respect to Lake Winnipeg. The existing Canada–Manitoba Water Quality Agreement will need to be reviewed to assess its compatibility and consistency with any new agreement with Manitoba.

Quebec

An amendment to the Canada–Quebec Agreement (which gave rise to the St. Lawrence Plan) allowed the ministère du Développement durable, de l'Environnement et des Parcs du Québec to participate in the collection of water quality data, and in the calculation and interpretation of the Water Quality Index in support of Canadian Environmental Sustainability Indicators. Quebec water quality monitoring sites, including 119 provincial and 2 federal sites, represent nearly one quarter of the sites used to produce the Canada-wide Water Quality Index.

In addition, water quality monitoring studies were initiated at the mouths of three major rivers in

northern Quebec: Grande Rivière, Grande rivière de la Baleine and Koksoak River. These rivers account for more than 50 percent of the flow in northern and mid-northern Quebec. The sampling was conducted by local observers under contract with Environment Canada. Monitoring focused on contaminants, such as nutrients and metals, and interpretation parameters, such as suspended solids, major ions and chlorophyll. Additionally, pursuant to the signing of a Memorandum of Understanding for professional services between the Parks Canada Agency and Environment Canada, and the completion of an environmental impact assessment on the installation of a water quality station, water quality sampling has begun at the La Mauricie National Park monitoring station. This reference station at the mouth of the watershed will make it possible to measure natural contaminant levels (e.g., heavy metals) and monitor interpretation parameters (e.g., conductivity, organic carbon, suspended solids and nutrients), which will be analyzed on a monthly basis. This water quality monitoring site is also used by the Canadian Aquatic Biomonitoring Network for a benthos monitoring project.

An agreement with the Canadian Space Agency resulted in the implementation of a joint remote water quality and cyanobacteria monitoring project. An initial transfer of expertise between the research team and the monitoring team has been completed. The Université de Sherbrooke also participated in an initial field sampling (spectral information) at Lake Memphrémagog and Missisquoi Bay. Preliminary results from remote sensing imagery point to the strong potential of these images to be used for water quality monitoring applications involving medium- and large-sized lakes. Preliminary mapping data were also prepared and tested for future watershed analyses.

In support of Canadian Environmental Sustainability Indicators, a study of water quality and soil use provided a general overview and modelling of the linkages between the two indicators. In addition, a literature review was performed on approaches to and methods of categorizing and classifying lakes, to help in the selection of water bodies for study as part of the water quality index.

Atlantic provinces

Bilateral annual meetings were held by representatives for the Canada–New Brunswick, Canada–Prince Edward Island, and Canada–Newfoundland and Labrador water quality agreements, to discuss and review the previous year's accomplishments and to plan and prioritize workloads for cost-shared and work-shared projects. Most monitoring sites were used to report on water quality on federal lands or to report on freshwater quality in Canadian Environmental Sustainability Indicators reports.

In New Brunswick, 10 long-term federally designated and 47 provincially designated surface-water-quality stations continued to be monitored under the federal–provincial agreement. In 2008, 44 of these stations were used to report on freshwater quality in the Environmental Sustainability Indicators report. Four real-time water quality stations were operated on international rivers: two on the St. Croix River (at Milltown and Forest City), and two on the tributaries of the Saint John River (at Tracy Mills on the Big Presqu'ile River, and Aroostook River, although this was inoperable as of June 2008). Also, biological monitoring, using an approach similar to the Canadian Aquatic Biomonitoring Network standards, was undertaken at 20 sites in New Brunswick. Two new federal, automated water-quality monitoring stations were added on the Nerepis and Otnabog rivers in Canadian Forces Base Gagetown in partnership with Fisheries and Oceans Canada and National Defence.

In Newfoundland and Labrador, 85 water quality sites continued to be sampled four or six times per year under the federal–provincial agreement. In 2008, 28 of these stations were used to report on freshwater quality in the Canadian Environmental Sustainability Indicators report. Nineteen real-time water quality stations were active in a federal–provincial–private partnership, 13 of which were funded through a partnership with private industry.

In Nova Scotia, although no official water quality agreement exists between the federal and provincial governments, a network of 24 water quality monitoring stations continued to be operated by Environment Canada throughout the province after the Canadian Environmental Sustainability Indicators 2007 report identified gaps within the province. In 2008, four lake stations from the Acid Rain Program and two lake stations sampled by the

Parks Canada Agency were used to report on freshwater quality in the Canadian Environmental Sustainability Indicators report. Two real-time water quality stations, one on the Little Sackville River and another on the upper reaches of the Annapolis River, continued to operate. In addition, benthic sampling occurred at eight sites in Nova Scotia.

In Prince Edward Island, 32 water quality monitoring sites were sampled, including 8 at groundwater stations, 10 at marine or estuarine stations, and 14 at freshwater stream stations (www.gov.pe.ca/envengfor/index.php3?number=77980&lang-E). In 2008, data from 11 stream stations were used to report on freshwater quality in the Canadian Environmental Sustainability Indicators report. Water quality monitoring results were made available to the public through the provincial and RésEau websites. As well, three real-time water quality stations were active under a federal–provincial partnership, and seven stations were monitored using the Canadian Aquatic Biomonitoring Network standards.

1.1.4 Canadian Environmental Sustainability Indicators

Background

Since 2005, the Government of Canada has published a Canadian Environmental Sustainability Indicators annual report (www.ec.gc.ca/indicateurs-indicators/Default.asp?lang=En&n=A073189E-1), which provides indicators on the state of air and water quality, as well as greenhouse gas emissions. Its freshwater quality indicator uses the Water Quality Index, endorsed by the Canadian Council of Ministers of the Environment, to summarize the status of surface freshwater quality in Canada. Quality is assessed by examining the extent to which Canadian Water Quality Guidelines for the Protection of Aquatic Life (plants, invertebrates and fish) are being met at selected lake and river monitoring sites throughout Canada.

Progress to March 31, 2009

The 2008 Canadian Environmental Sustainability Indicators report was released in March 2009, based on data collected from 2004 to 2006. Freshwater quality measured at 379 monitoring sites across southern Canada was rated as "good" or "excellent" at 48 percent of sites, "fair" at 30 percent, and "marginal" or "poor" at 22 percent. For the 32 monitoring sites in northern Canada, freshwater quality was rated as "good" at 66 percent of the sites, "fair" at 28 percent and "marginal" at 6 percent. Freshwater quality was assessed using the Canadian Council of Ministers of the Environment's Water Quality Index. Table 1 provides details on the interpretation of Water Quality Index ratings.

Table 1. Interpretation of Water Quality Index

Rating	Interpretation
Excellent (95.0 to 100.0)	Water quality measurements **never** or **very rarely** exceed water quality guidelines.*
Good (80.0 to 94.9)	Measurements **rarely** exceed water quality guidelines, and if they do, it is usually by a narrow margin.
Fair (65.0 to 79.9)	Measurements **sometimes** exceed water quality guidelines and, possibly, by a wide margin.
Marginal (45.0 to 64.9)	Measurements **often** exceed water quality guidelines and/or by a considerable margin.
Poor (0 to 44.9)	Measurements **usually** exceed water quality guidelines and/or by a considerable margin.

*The water quality guidelines used in the calculations are those defined for the protection of aquatic life. They include national guidelines developed by the Canadian Council of Ministers of the Environment, as well as provincial and site-specific guidelines developed by federal, provincial and territorial partners. If a guideline value is exceeded at a given site, there is an increased probability of an adverse effect on aquatic life at that site.

The St. Lawrence River drainage basin, which includes the Great Lakes, had the highest percentage of sites where water quality was rated as "poor" or "marginal" (28 percent). Most of the stations in this basin are located in the Windsor–Québec corridor, a heavily populated, farmed and industrialized region. In this basin, phosphorus was the largest driver of index ratings, with 40 percent of sites experiencing frequent exceedances of this nutrient. The Maritime drainage basin and the Arctic drainage basin, which contain only seven sites each, had the highest percentage of sites with "good" or "excellent" freshwater quality (71 percent).

No long-term trends are yet available for the freshwater quality index. However, a comparison of the Water Quality Index results from the 2006, 2007 and 2008 Canadian Environmental Sustainability Indicators reports for similar sites revealed only minor changes during this period. The largest changes were in the 2007 report (covering 2003 to 2005 data), which showed nine fewer sites

rated as "good." These sites were rated as either "fair" or "excellent" in the 2006 and 2008 reports.

The analysis of nutrient data from 1990 to 2006 at 77 long-term monitoring sites revealed that 30 percent of sites showed decreases in phosphorus levels, 20 percent showed increases, and 50 percent showed no significant change.

1.2 Inter-jurisdictional water boards

1.2.1 Ottawa River Regulation Planning Board

Background

In 1983, Canada, Quebec and Ontario concluded an 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 a Secretariat, the Ottawa River Regulation Planning Board endeavoured to ensure that the integrated management of the reservoirs provided protection against flooding along the Ottawa River and its tributaries, and along its channels in the Montréal region.

Progress to March 31, 2009

The winter of 2008 was exceptional in terms of snowfall and accumulation. The amount of water in the snowpack was above average for the basin; particularly in the southwest where it was up to three times average values. This amount of snow accumulation led to the exceedance of flooding thresholds in the lower section of the river from Chats Lake to Lac des Deux Montagnes, Fortunately, a lack of rain during the snowmelt period limited the severity of flooding. The wet weather extended into the summer of 2008, during which above-average rainfall was also recorded.

The Board supports 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 French and English, which provide information on water levels and flows at various locations in the basin. Since the water levels were such a concern during 2008, there were an unusually large number of visits to the website (more than 87 000), and more than 3000 calls to the toll-free numbers. Secretariat personnel also participated in a number of radio, newspaper and television interviews.

The Board met on three occasions in locations in Ontario and Quebec. The agenda items and business considered by Board members were customary issues, such as current and planned projects along the Ottawa River, operation of the Regulating Committee and its annual report, Secretariat operations, and correspondence and communications from organizations and the public. There were no issues that warranted reference to government departments or Ministers.

1.2.2 Prairie Provinces Water Board

Background

In 1969, the governments of Canada, Alberta, Saskatchewan and Manitoba signed the Master Agreement on Apportionment to facilitate the equitable apportionment and protection of quantities and quality of eastward-flowing interprovincial rivers and streams, and groundwater. The agreement also fosters the co-operation of the Parties in interprovincial water management.

Schedules A and B to the Master Agreement provide mechanisms to apportion water, foster co-operation and resolve potential disputes between Alberta and Saskatchewan, and Saskatchewan and Manitoba, respectively. Schedule C establishes the Prairie Provinces Water Board to administer the provisions of the Master Agreement. Schedule E specifies water quality objectives in 11 river reaches along the Alberta–Saskatchewan and Saskatchewan–Manitoba boundaries and further defines the water quality mandate of the Board.

Progress to March 31, 2009

Accomplishments in 2008–2009 included the following:

- Apportionment requirements were met on all eastward-flowing prairie streams that fall under the agreement, with the exception of a small deficit on Middle Creek.

- In addition to approving the hydrometric and meteorological monitoring stations list for 2009–2010, work continued to modernize the natural (apportionable) flow computation software programs.
- Work continued on the development of a groundwater schedule to the agreement. No groundwater concerns were identified in 2008–2009.
- The Board approved the 2009 water quality monitoring program and the 2007 Water Quality Excursion Report. Percent adherence to water quality objectives was very high for all rivers, such that water quality continues to be protected.
- A four-step process was initiated to review all water quality objectives for each of the 11 rivers, with a priority on nutrient objectives.
- The Board continued to exchange information on issues of common interest, including water quality issues related to Lake Winnipeg, Manitoba–Saskatchewan drainage issues, and the St. Mary and Milk Rivers Water Management Initiative. A prairie hydrology study continued to model wetland drainage and effects of land uses.
- The Board and each of its three standing committees on hydrology, water quality and groundwater held at least one meeting and additional conference calls. Special meetings and conference calls were organized to develop a costed five-year work plan.
- Member agencies were informed about Board activities through distribution of minutes, quarterly reports and an annual report.
- A joint meeting of the Board and responsible Ministers was held on June 16, 2008, in Winnipeg.

1.2.3 Mackenzie River Basin Board

Background

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 (www.mrbb.ca) administers the provisions of the Master Agreement, representing all Parties to the Agreement. Federal members include representatives from Environment Canada, Indian and Northern Affairs Canada, and Health Canada. There are five Aboriginal Board members nominated by Aboriginal organizations in each of the jurisdictions.

Under the Master Agreement, Environment Canada is responsible for managing the expenditures of the Board, which are cost-shared equally by the Parties. Sharable costs include the staffing and operation of a secretariat office in Fort Smith, Northwest Territories (which is near the centre of the Mackenzie River Basin) to support the Board at the working level. An Executive Director of the secretariat, hired from within Environment Canada's Prairie and Northern Region, planned, directed and managed Board operations.

Progress to March 31, 2009

Accomplishments in 2008–2009 included the following:

- A joint meeting of the Board and responsible Ministers was held on July 3, 2008, in Edmonton, Alberta. Ministers provided direction on short-term operations of the Board and secretariat, and on the development, monitoring and reporting of bilateral water management agreements.
- The Board made progress on the Ministers' directions, including the preparation of an operational plan and background work on the development of bilateral water management agreements.
- The Board met November 25–26, 2008, in Saskatoon, Saskatchewan. At this meeting, a Steering Committee on Traditional Knowledge and Strengthening the Partnership with Aboriginal Peoples was established.
- Member jurisdictions continued to exchange information through agency reports.

- Work continued on the development of a hydrology model for the Mackenzie River Basin.
- A work plan and budget for the 2009 State of the Aquatic Ecosystem Report were developed.

Progress on bilateral/multilateral water management agreements included the following:

- The Board established a Bilateral Agreements Working Group to evaluate options and define a process to guide further bilateral negotiations. Topics being considered include principles and mechanisms for negotiations, third-party consultations, follow-up compliance monitoring and a schedule for completing the remaining bilateral agreements. Members agreed that some form of multilateral review process is required, based on British Columbia–Alberta and Alberta–Northwest Territories bilateral discussions. The goal is to complete negotiations of the remaining six bilateral agreements by 2013–2014.
- British Columbia and Alberta completed a joint background document in April 2008. Discussions were scheduled to resume once the Ministers approved a Board Bilateral Agreements Guidance Document.
- Alberta and the Northwest Territories continued meeting to collect and discuss background information to support bilateral water management negotiations. The Northwest Territories held a series of seven workshops from 2008 through early 2009 to continue development of a Northwest Territories water resource management strategy, which will provide guidance to the Northwest Territories during negotiations. Completion of the water strategy was expected to take place in late 2009.
- The Northwest Territories and Yukon met in February 2009 in Fort McPherson, informed each other of activities in the Peel Basin, and continued implementing bilateral consultation provisions through activities of the Peel River Watershed Planning Commission and other fora.

1.3 Ecosystem initiatives: watershed and water-related activities

Through the application of an ecosystem approach, the objective of Environment Canada's ecosystem initiatives is to attain the highest level of environmental quality within targeted ecosystems as a means of enhancing the health and safety of Canadians, preserving and enhancing natural resources, and optimizing economic competitiveness.

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 information and experiences, and informed decision making.

1.3.1 Georgia Basin Action Plan

Background

The Georgia Basin Action Plan, which was active from 2003 to 2008, was a multi-partner initiative to improve the state of the environment in the Georgia Basin. The Action Plan built on work undertaken by its predecessor, the Georgia Basin Ecosystem Initiative (1998–2003), and was based upon the guiding principles of accountability, ecosystem approach, pollution prevention, science-based decision making, and sustainability.

Progress to March 31, 2009

With its completion in 2008, the Georgia Basin Action Plan has left a legacy of more integrated partnerships to better manage environmental, social and economic activities in the basin. Limited funding continued in 2008–2009 for certain legacy projects. The Plan's results are summarized in a five-year program update (www.pyr.ec.gc.ca/georgiabasin/reports/5_Year_Public_Update_2008/COM568_en_GBAP_Update_01.pdf).

Environment Canada expanded water quality monitoring to include an additional seven stations in the Georgia Basin under the Canada–British Columbia Water Quality Monitoring Agreement (www.waterquality.ec.gc.ca/EN/Home/GBAP/GBAP_monitoring.htm). Sites were chosen to assess impacts on water quality from a variety of human activities, including forestry, urbanization and the 2010 Winter Olympics. Data collected from these stations is summarized and reported on as part of the National Water Quality Index, and used in national Canadian Environmental Sustainability Indicators

reports. Georgia Basin stations were assessed as follows for the 2009 Canadian Environmental Sustainability Indicators report (based on data from 2005–2007): five sites as "good," six sites as "fair," and two sites as "marginal."

The Canadian Aquatic Biomonitoring Network approach continued to be implemented for stream-condition assessment at 67 sites that were sampled in the Georgia Basin, and in the Fraser, Okanagan and Columbia watersheds, including 18 federal–provincial monitoring stations. Two training workshops were conducted on the Network's standards and protocols. Sampling was also conducted at 26 sites in the Yukon Basin, as part of the Yukon Survey for the International Polar Year. In 2009, Environment Canada produced a report comparing results from the Network indicators with the Water Quality Index, which showed that 70 percent of the sites assessed gave similar water quality assessments using the biological as well as physical and chemical indicators, while 30 percent gave differing assessments. These results indicate that the use of one indicator alone did not always provide sufficient information about the stream condition, relative to effects on aquatic organisms.

Environmental levels of polychlorinated biphenyls (PCBs) and polybrominated diphenyl ethers (flame retardants) in the Strait of Georgia have been increasing over the past decades, and are now at high concentrations in regional marine mammals (e.g., whales and seals). Studies were carried out on the relative contributions of suspected sources, as well as the transport and fate of contaminants. In 2008–2009, study sampling and analytical results were being finalized, and for collaborative studies, manuscripts and presentations were under way or completed. Collaborators included Simon Fraser University, Metro Vancouver and Capital Regional District, Fisheries and Oceans Canada, and the British Columbia Ministry of Environment.

In order to monitor groundwater quality, and determine the extent of and trend in nitrate contamination, Environment Canada operates and maintains a network of monitoring wells in the transboundary Abbotsford–Sumas aquifer (www.ecoinfo.ec.gc.ca/env_ind/region/nitrate/nitrate_e.cfm). Monthly groundwater samples were taken from 30 of these monitoring wells and annual samples from 60 monitoring wells for analysis of a range of water quality parameters, including nitrate. This represents a slight increase in samples over previous years, as a result of the installation of several new monitoring wells. Nitrate levels in large parts of this aquifer were above Canadian Drinking Water Quality Guideline levels and were attributed to non-point agricultural sources.

Environment Canada continued to work with other agencies and stakeholders to mitigate nitrate contamination of the aquifer and promote aquifer protection. Environment Canada organized a conference session on internationally coordinated management of the Abbotsford–Sumas Aquifer at the 2009 Puget Sound Georgia Basin Ecosystem Conference in Seattle, in February 2009. Multi-agency members of the Abbotsford–Sumas Aquifer International Task Force and other stakeholders provided presentations and formed a discussion panel on a range of relevant topics.

Following on the successful Abbotsford–Sumas Aquifer Science Forum in April 2007, Environment Canada continued collaborative field research with Agriculture and Agri-Food Canada and academic research groups supported by the Canadian Water Network, to address key knowledge gaps related to the nitrate contamination.

Environment Canada also supports stakeholder engagement and outreach to help protect the Abbotsford–Sumas Aquifer. Environment Canada played a key role in organizing the Abbotsford Groundwater Forum in February 2009, to raise awareness of groundwater quantity and quality issues with stakeholders, communicating outcomes of the 2009 science forum, and engaging stakeholders in dialogue on aquifer protection.

The Burrard Inlet Environmental Action Program and the Fraser River Estuary Management Program are intergovernmental partnerships that coordinate the sustainable environmental management of the two most significant aquatic ecosystems in the Lower Mainland: the Burrard Inlet and the Fraser River estuary. Environment Canada supported various management committees, which monitor key ecosystem indicators, track cumulative effects and implement Consolidated Environmental Management Plans.

The Fraser Basin Council is a non-governmental, not-for-profit, non-partisan organization that implements sustainability-based projects in the Fraser Basin. Environment Canada is a member of the Board of Directors. Environment Canada supported the Fraser Basin Council to develop and produce the fourth sustainability snapshot report for the Fraser Basin, and to undertake collaborative water and watershed governance.

The Coast Salish First Nations are committed to the preservation, restoration and protection of the Salish Sea (Georgia Basin and Puget Sound). Their Coast Salish Action Plan allows for sharing information and taking action on environmental concerns with policy makers. With support from the Georgia Basin Action Plan, the Coast Salish have increased capacity to implement their action plan, developed the Tribal Canoe Journeys water quality project, which received the United States Department of Interior's Partners in Conservation Award in 2009, and strengthened their capacity to engage in environmental management, including environmental assessment.

The 2009 Puget Sound Georgia Basin Ecosystem Conference, The Future of the Salish Sea: A Call to Action, was held on February 8–11, 2009, in Seattle, Washington, and was attended by nearly 1200 people. This biennial ecosystem research and policy conference is co-chaired by Environment Canada and the Puget Sound Partnership, a Washington State Agency. One of the four conference sub-themes was marine and freshwater resources, and there were numerous concurrent sessions, presentations and posters on this topic. Arising from the conference was the document *A Call to Action for the Salish Sea*, which contains a series of commitments for participant implementation. Commitments included the development of meaningful Salish Sea ecosystem health indicators, formation of a science panel to create a research agenda, and establishment of an information portal to identify and collaborate on projects.

1.3.2 Great Lakes Program

Background

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 (Parks Canada Agency), whose goals are a healthy environment, healthy citizens and sustainable communities. This coordinated federal program significantly bolsters Canada's efforts to protect and restore the Great Lakes Basin ecosystem.

Federal partner departments' activities were integrated with those of Ontario through the Canada–Ontario Agreement Respecting the Great Lakes Basin Ecosystem. The Agreement outlines how the two governments will co-operate and coordinate their efforts to restore, protect and conserve the Great Lakes Basin ecosystem. It builds on the actions taken through previous agreements and focuses priorities for future actions. It also contributes to meeting Canada's obligations under the Canada–United States Great Lakes Water Quality Agreement.

Federal signatories to the Canada–Ontario Agreement include Agriculture and Agri-Food Canada, Environment Canada, Fisheries and Oceans Canada, Health Canada, Infrastructure Canada, Natural Resources Canada, Parks Canada Agency, and Transport Canada. Provincial signatories include the Ontario Ministries of Environment, Natural Resources, and Agriculture, Food and Rural Affairs.

Progress to March 31, 2009

Science monitoring and ecosystem restoration projects undertaken in the Great Lakes Areas of Concern included the following:

- The levels of several contaminants, including nutrients, metals, methyl mercury, PCBs, polycyclic aromatic hydrocarbons, brominated diphenyl ethers and *Escherichia coli* (E. coli), were assessed at a number of Areas of Concern (Jackfish Bay, Hamilton Harbour and St. Clair River).
- A benthic assessment using the Canadian Aquatic Biomonitoring Network protocol was conducted in the St. Clair River and sections of the Jackfish Bay Area of Concern. Some preliminary results from these studies indicate that PCB contamination in both the dissolved and particulate water phase in Spanish

Harbour is low, supporting the Area in Recovery designation. In contrast, monitoring suggests a previously unidentified potential PCB source in Hamilton Harbour. Work to track down the source will continue in 2009–2010.

- Work to characterize aquatic substrates, ecosystem status and fish habitat continued in Thunder Bay, Jackfish Bay and Nipigon Bay Areas of Concern.
- Work was also undertaken to coordinate research and monitoring activities on contaminated sediments in Areas of Concern, and review and advise on the management plans and strategies in the Jackfish Bay, Spanish Harbour, Hamilton Harbour and Detroit River Areas of Concern.
- Chemical, physical and biological assessments contributing to the benthic assessment of sediment toxicity study were undertaken in the St. Marys River and Jackfish Bay Areas of Concern in support of contaminated management plans and remediation activities. Toxicity and bioaccumulation studies were conducted to establish cause and effect linkages of sediment contamination and delisting criteria in the Detroit River Area of Concern.
- Water quality and metal loading data were collected in Spanish Harbour in the spring of 2008.
- A source identification study was conducted by Environment Canada in conjunction with the Sugar Island Monitoring Work Group to investigate the source of human sewage pollution (if it exists) in the St. Marys River near Sugar Island and the cities of Sault Ste. Marie, Michigan, and Sault Ste. Marie, Ontario. The study applied a microbial source identification approach to investigate the nature of bacterial contamination.
- Effects of effluent on fish health were investigated through research and monitoring in the St. Marys River and Niagara River Areas of Concern.
- Analysis of sediments in the Thunder Bay Harbour and at Peninsula Harbour on the north shore of Lake Superior was conducted to delineate the most contaminated areas of the harbours, in support of Environment Canada's sediment remediation program.
- Statistical analysis was used to reveal relationships between chemical contaminants and the health of fish from the Wheatley Harbour Area of Concern. An assessment of the thyroid status of fish in the St. Clair Area of Concern was presented at the Aquatic Toxicity Workshop and the Society of Environmental Toxicology and Chemistry annual meeting. Wild fish were sampled at the Niagara River Area of Concern at three zones: upstream, impact and downstream. Juvenile Rainbow Trout (*Oncorhynchus mykiss*) were caged in each zone for 21 days to test for exposure to environmental estrogens.

In 2008–2009, the Great Lakes Sustainability Fund, a component of the Great Lakes Action Plan ($40 million over 2005–2010, focused on the restoration of Areas of Concern), was used by various agencies and proponents to restore beneficial uses in Canadian Areas of Concern. Projects in Areas of Concern included reducing the amount of nutrients (phosphorus and nitrogen), solids and bacteria entering watercourses from both rural and urban sources; restoring aquatic and terrestrial habitats toward improving water quality; and assessing contaminated sediments and various sediment management options.

Under the Great Lakes Sustainability Fund's municipal wastewater program, studies focused on the reduction of phosphorus associated with solids from stormwater runoff in the Toronto Area of Concern. These studies included the Caledon Headwaters Rehabilitation Initiative and the Rural Clean Water Program to reduce nutrient loadings and improve water quality in streams flowing into Toronto's Lake Ontario waterfront. In the Bay of Quinte Area of Concern, the Fund supported the development of an integrated pollution prevention and control plan for all Bay of Quinte–bordering municipalities, stormwater management plans for new developments, and effective implementation of these plans. In the Hamilton Harbour Area of Concern, the Great Lakes Sustainability Fund supported the Hamilton Harbour Watershed Stewardship Project to create/enhance and protect upland forest and wetland habitat, and provide education/outreach to landowners to reduce bacterial, nutrient and sediment loadings to the creeks that flow into Hamilton Harbour.

Through the Great Lakes Sustainability Fund, program agencies worked in the Niagara River, St. Lawrence River (Cornwall), Hamilton, Toronto, St. Clair River, Detroit River, and Wheatley Harbour Areas of Concern to develop stewardship initiatives and to deliver programs to reduce nutrient inputs to watercourses from urban and rural non-point sources. Under these programs, outreach and education programs were directed to rural farming and non-farming landowners to encourage the adoption of rural best management practices, such as upgrading manure, milkhouse wash water or domestic septic systems; restricting livestock access to watercourses; adopting conservation tillage practices; reducing soil erosion; and establishing windbreaks, wooded areas and riparian buffer strips.

The Great Lakes Sustainability Fund supported a number of projects to restore habitat in Areas of Concern, including a binational project to restore sturgeon spawning habitat at Fighting Island in the Detroit River, and projects to restore wetlands in Cootes Paradise and Grindstone Creek in the Hamilton Harbour Area of Concern, wetlands in the Niagara River Area of Concern, and shorelines in the St. Clair River Area of Concern.

Activities undertaken to support the management of contaminated sediments in Great Lakes Areas of Concern to reduce risk to human health and environment included the following:

- completion of an ecological risk assessment of mercury-contaminated sediment in the St. Clair River Area of Concern, which identified three priority areas for sediment management based on the potential for biomagnification risk to some species of sport fish;
- assessment of various sediment management options for the mercury- and PCB-contaminated sediments in the Peninsula Harbour Area of Concern, in order to select the preferred management option; and
- development of the detailed engineering design of the engineered containment facility for the management of contaminated sediments in Randle Reef in the Hamilton Area of Concern.

The development of recommendations related to phosphorus removal (which are supported under the Remedial Action Plan program), and to other municipal issues such as land development, are proceeding in municipalities in the Detroit River, St. Clair River and Niagara River Areas of Concern.

Environment Canada continued to conduct monitoring programs throughout the Great Lakes in response to Annex 2 of the Canada–Ontario Agreement Respecting the Great Lakes Basin Ecosystem (the Great Lakes Open Lakes Surveillance Program), which provides status and trends information for water quality, reports on compliance with established guidelines, and serves to identify new and emerging issues. These monitoring programs include the following:

- Great Lakes Fish Contaminants Surveillance program, which measures and reports on trends in legacy and emerging contaminants in top predator and forage fish species;
- Connecting Channels Monitoring Programs in the St. Clair, Detroit, Niagara and St. Lawrence rivers, to measure and report on trends in inputs/outputs from the connecting channels to the lakes, and to measure the success of remedial measures in these Areas of Concern; and
- Integrated Atmospheric Deposition Network, a binational program with the United States Environmental Protection Agency to report on spatial and temporal trends in concentrations and loadings of priority toxic chemicals in the Great Lakes.

Research and monitoring were carried out to detect the possible presence of antibiotics and household personal care products in sewage sludge and effluents. This work will lead to a greater understanding of the extent to which these substances are entering the Great Lakes from municipal water treatment facilities. As understanding of the sources and extent of the problem deepens, different approaches, such as increased awareness through education, can be developed to address this issue. As a pilot project in the Lake Superior area, posters and flyers with information on how to properly dispose of pharmaceuticals and personal care products were distributed to medical and dental clinics, hospitals, seniors' centres, retirement homes and the Thunder Bay District Health Unit network, as well as to 11 Aboriginal communities. In addition,

presentations were made to community organizations, and a series of public information sessions were held to help prevent these products from entering our waterways, including the Great Lakes.

Work toward eliminating persistent toxic substances in the Great Lakes continued under the Great Lakes Binational Toxics Strategy. The Integration Working Group, the Legacy Substances Working Groups, and the Public Stakeholder Forum continued to meet to ensure progress toward reductions of "legacy substances" (substances no longer in use but still present in the natural environment). The new Substance and Sector Working Groups have been identifying priorities to reduce toxic "emerging contaminants" (substances in use for which concern is growing) in the Great Lakes Basin, consistent with Canada's Chemicals Management Plan.

Environment Canada, in collaboration with the United States Environmental Protection Agency, hosted the 8th biennial State of the Lakes Ecosystem Conference on October 22–23, 2008 (http://binational.net/solec/intro_e.html). A set of draft environmental indicator reports prepared for and presented at the conference provided an overview of current Great Lakes monitoring and research findings, and highlighted the significant current threats to Great Lakes water quality and ecosystem health.

Environment Canada co-chairs binational Lakewide Management Plans under the Canada–United States Great Lakes Water Quality Agreement with the United States Environmental Protection Agency. The management plans identify binational ecological objectives and management strategies, including science priorities for data collection to fill knowledge gaps in ecosystem status and trends. Updates to the Lakewide Management Plans were released in April 2008 for lakes Superior, Huron, Erie and Ontario. The following are highlights of research conducted in support of Lakewide Management Plans in 2008–2009:

- Models linking non-point source pollution from agricultural sources to stream and nearshore lake models have been developed for selected watersheds in the Great Lakes Basin and other regions. The research included the integration of lake models with terrestrial watershed models, particularly for the Lake Ontario Drinking Water Protection Project under the Canada–Ontario Agreement. An integrated assessment using model results was conducted, combining requirements from land and lake-water-quality objectives. A model has also been developed to simulate *Cladophora* growth, detachment and transport in selected nearshore areas in Lake Erie and Lake Ontario. The modelling approach involved lakewide simulations scaled down to the nearshore zone.
- Research was conducted on aquatic substrates, and equipment and procedures for mapping and monitoring contaminated sediments were developed and applied. For example, comprehensive monitoring and assessment activities, involving several Canadian and United States jurisdictions, were carried out in support of Remedial Action Plan and Lakewide Management Plan programs. Site-specific studies to address information requirements for the development of sediment management decisions for Peninsula Harbour and Wheatley Harbour were completed. Studies in the Bay of Quinte, Jackfish Bay, and St. Clair and St. Marys rivers continued. Another study of aquatic substrates deployed a deep-water video system to investigate the use of offshore reefs as fish habitat, and the impacts of zebra mussels and other exotic species in Lake Huron. A collaborative project on Lake Erie was initiated to identify potential fish habitat regions using geospatial analysis.

The following are highlights of the Great Lakes and Regional Environmental Quality Monitoring and Surveillance Program in 2008–2009:

- Ambient-environment-quality monitoring programs were carried out for lakes Superior, Huron, Erie and Ontario, as well as the St. Clair/Detroit corridor, and the Niagara and St. Lawrence rivers. Organic contaminants, including emerging contaminants, and trace metals were measured in water, whole fish (top predators) and sediment, to assess progress toward specific goals in environmental improvement, identify problems and emerging issues, and support planning and decision making. While long-term trends indicate

declining concentrations of most contaminants, some chemicals continued to exceed water and sediment quality guidelines, and guidelines for the protection of piscivorous (fish-eating) wildlife. Fish consumption advisories continued throughout the Great Lakes. Reports on legacy pollutants, current-use pesticides and sediment quality in Areas of Concern were completed.

- In 2003, the Great Lakes Binational Executive Committee endorsed the Cooperative Monitoring Initiative to improve the coordination of monitoring in the Great Lakes. A five-year rotational cycle was adopted to focus on one lake per year, with Lake Ontario selected for 2008. Monitoring focused on the nearshore zones in support of decision making for remediation and delisting in four Areas of Concern and one Area in Recovery. Co-operative monitoring efforts also included multimedia (atmospheric, water, sediment, fish and lower food web) measurements of critical pollutants, atrazine and emerging chemicals; nearshore and offshore lower trophic level monitoring; screening of Canadian and United States tributaries for toxic contaminants; and a multi-agency inter-comparison study for contaminants in fish. These efforts pulled together federal, state and provincial agencies in a unique way that allowed for building on existing programs.
- The concentrations of eight contaminants in Herring Gull (Larus argentatus) eggs were calculated for 15 Great Lakes sites for the five-year period from 2003 to 2007. The sites were ranked according to the concentrations of seven compounds relative to fish flesh criteria for the protection of piscivorous wildlife, and a single overall rank was calculated for each site. Eggs from three sites (Saginaw Bay, Detroit River and western Lake Erie) had the highest levels of contaminants, and three sites from eastern Lake Superior, the North Channel and southern Lake Huron ranked as the least contaminated. Monitoring of Herring Gull eggs for legacy and emerging contaminants continues on an annual basis.

1.3.3 Action Plan for Clean Water

Background

The Action Plan for Clean Water includes the Oceans Action Plan, which coordinates and implements oceans activities, the Plan of Action for Drinking Water in First Nations Communities for the provision of safe drinking water to First Nations on reserves, and Building Canada: the Plan, a blueprint for building a modern public infrastructure.

Environment Canada is carrying out its work under the Action Plan for Clean Water through $96 million in cleanup funding to restore Lake Simcoe, Lake Winnipeg and Areas of Concern in the Great Lakes.

The Action Plan for Clean Water also provides additional resources for efforts in targeted areas under other existing programs (e.g., the Great Lakes Program).

Progress to March 31, 2009

In April 2008, the Government announced an investment of up to $2.9 million to clean up the contaminated sediment in a tributary of the Niagara River, Lyons Creek East. By August 2008, management options had been evaluated against 10 criteria, such as compliance with legislation and policy, protection of ecological integrity, and community support. Monitored natural recovery was selected as the preferred option, mainly because of the desire to protect the provincially significant wetlands. A public open house was planned to present this recommendation, which is supported by all levels of government. Funds will be used to develop an administrative controls protocol, develop a long-term monitoring plan, and conduct sediment and PCB fate and transport studies.

In April 2008, Environment Canada funding of $200,000 was provided to clean up PCB-contaminated sediment and bank soil in Turkey Creek, a tributary of the Detroit River. A total of 975 cubic metres, containing a PCB mass of 8 kg, was excavated and transported to an approved landfill site in November 2008. Evaluation of project effectiveness will be undertaken by the City of Windsor, Essex Region Conservation Authority and the Ontario Ministry of the Environment.

An additional $200,000 is being provided by Environment Canada over four years for monitoring in the Trent River, which flows into the Bay of Quinte. Monitored natural recovery was selected as the preferred sediment management option by the

Trent River Mouth Investigation Steering Committee because risk to humans and wildlife was found to be minimal. The upstream source of the dioxin and furan contamination of the sediment is still present but is being brought under control through co-operation between industry and the province.

In 2008, Environment Canada launched the Lake Simcoe Clean-Up Fund initiative, designed to protect and conserve Lake Simcoe by helping to decrease phosphorus inputs to the lake, rehabilitating habitats and improving scientific understanding of the lake ecosystem. The program was launched with a call for proposals for Round 1, issued on February 25, 2008. A federal–provincial technical review committee was formed and project review criteria were established. Thirty-six projects received a total of $1.9 million in the first round of projects approved under the Lake Simcoe Clean-Up Fund.

The call for proposals for Round 2 of the Lake Simcoe Clean-up Fund was issued in September 2008. On February 27, 2009, the Minister of the Environment announced that 26 projects were to receive a total of $4.7 million in funding. The projects contribute to meeting the Government of Canada's Lake Simcoe Clean-up Fund objectives of reducing rural and urban non-point sources of pollution, rehabilitating priority habitats to restore the health of the aquatic ecosystem and coldwater fishery in Lake Simcoe, and improving monitoring data and other information for decision makers.

In collaboration with key stakeholders, a number of projects were initiated in 2008 to improve scientific understanding of Lake Simcoe to assist in sound decision-making:

- A phosphorus-source-tracking project was initiated to further the understanding of phosphorus cycling and phosphorus sources in Lake Simcoe.
- A project was initiated to determine targets for phosphorus and nitrogen in streams that would maintain ecological integrity in the Lake Simcoe watershed.
- A bathymetric survey of Lake Simcoe began in 2008 to update the 1957 coarse bathymetric maps of the lake. Preliminary results from these studies have been made available to partners.

In 2008, Environment Canada launched the $18-million Lake Winnipeg Basin Initiative to help restore the ecological integrity of Canada's sixth-largest lake. The initiative includes three key activities: science (research, monitoring and information management), facilitating watershed governance and establishing a Lake Winnipeg Basin Stewardship Fund.

A science plan for the Lake Winnipeg Basin was developed and activities initiated on Lake Winnipeg and major sub-basins, including the Red–Assiniboine and Winnipeg rivers, and Lake of the Woods. The science plan also encompasses a monitoring program to determine how Lake Winnipeg and its watershed are responding to nutrient management decisions within the basin. The goal of the science program is to understand the gaps related to ecology and nutrient cycling, the sources and transport mechanisms for nutrients to develop nutrient objectives for the lake, and performance indicators to assess the health of the lake and watershed.

Environment Canada initiated work with stakeholders in 2008 to develop an all-inclusive information portal to compile and promote data sharing with key partners and ensure consistent, relevant and reliable access to information and products concerning the Lake Winnipeg Basin.

Environment Canada and the Province of Manitoba began discussions to establish a Canada–Manitoba agreement to provide for a long-term collaborative and coordinated approach between the two governments to ensure the sustainability and health of the Lake Winnipeg Basin.

In September 2008, Environment Canada launched the $3.65-million Lake Winnipeg Basin Stewardship Fund to support projects or activities having concrete, demonstrable results to reduce pollutants and, in particular, nutrient loadings entering Lake Winnipeg. A federal–provincial technical review committee was formed and project review criteria were established. Fourteen projects were approved for a total of $1.1 million in the first round of funding.

1.3.4 St. Lawrence Plan

Background

Launched in 1988, the St. Lawrence Plan (www.planstlaurent.qc.ca) is a Canada–Quebec ecosystem initiative to protect, conserve and restore the St. Lawrence River ecosystem. The program has been renewed three times since 1988. Concrete results have been achieved through the concerted actions of federal and provincial departments, in collaboration with the private sector, universities, research centres, ZIP committees (zone d'intervention prioritaire [priority intervention zone]), non-governmental organizations and riverside communities. The program focuses on the St. Lawrence River and its main tributaries, from Saint-François Lake at the Quebec–Ontario border to the eastern tip of the Gulf of St. Lawrence.

The 2005–2010 agreement was signed in November 2005. This fourth phase of the St. Lawrence Plan continues the collaborative implementation of several measures designed not only to conserve, protect and restore the ecosystem but also to recover its uses. It also marks the development of a new governance mechanism to achieve integrated management of the St. Lawrence.

Progress to March 31, 2009

Integrated management of the St. Lawrence

In 2008–2009, working groups focussed on finalizing Integrated Management of the St. Lawrence implementation procedures to obtain the government authorizations required to proceed with implementation and involve non-government partners.

Community involvement and awareness component

The 14 ZIP and St. Lawrence Strategy committees continued to act at the local level. One of the highlights of 2008–2009 was the "Des collectivités actives tournées vers le Saint-Laurent" (active communities caring for the St. Lawrence) forum held in March 2009 and attended by approximately 150 participants. Environment Canada continued to support the 14 ZIP and St. Lawrence Strategy committees, with contributions totalling $1.1 million annually.

The St. Lawrence Global Observatory established a scientific advisory committee that held its first meeting in February 2009, as well as a virtual network of experts that met in March 2009. The partners have selected and prepared the first 10 databases for online publication, such as databases on seabirds, waterfowl, biodiversity, wetlands, and the geomorphology and restoration of the St. Lawrence River's shores.

The Community Interaction Funding and Technical Assistance Program underwent a comprehensive review to enhance its performance. In 2008–2009, 17 projects were implemented as part of regular programming. An example is the Pointe aux Pins improvement project, which is designed to limit the impact of visitors (e.g., hikers, motorcyclists, mountain bikers and snowmobilers), as well as motor vehicles, to protect the site's ecological integrity. Fifteen other projects were approved in 2008–2009 for implementation in the following year. This was the result of an effort to attract a greater level of interest and broaden the scope of community actions by increasing the focus on the St. Lawrence Plan's priorities. Examples include the île à Napoléon and île à Tambault shoreline stabilization and protection project, and community management of shellfish harvesting at Bonaventure and Saint-Siméon.

State of the St. Lawrence Monitoring Program

A total of nine water quality stations were sampled in the St. Lawrence through the State of the St. Lawrence Monitoring Program, covering the river's main water bodies. Sampling frequency varied from weekly to monthly, based on the variability of contaminant levels. Contaminants measured included nutrients, metals, pesticides, polycyclic aromatic hydrocarbons, polybrominated diphenyl ethers and pharmaceutical products.

A new 10-year surface sediment sample collection project (65 samples) was initiated at Lake Saint-François. The chemical analyses for mercury and PCBs performed on approximately 30 samples will make it possible to determine sediment contamination levels and provide data on long-term trends through comparisons with earlier campaigns (1979, 1989 and 1999). Other substances sampled under the study include polybrominated diphenyl ethers, dioxins and furans.

Approximately 50 sediment samples were collected from Lac des Deux Montagnes, which is fed by the Ottawa River, as an initial gauge of contamination levels in this sector. The majority of the samples were analyzed for metals and polycyclic aromatic hydrocarbons (the substances of primary concern in these environments). Dozens of analyses of PCBs, planar PCBs, dioxins, furans and tributyltins were conducted as part of the monitoring activities in the Îles de la Paix and Îles de Contrecœur sectors to assess toxic substance levels in sediment.

Monitoring of shore erosion continued at approximately 100 stations scattered between Lake Saint-Louis and Saint-Pierre-les-Becquets. Three ZIP Committees are involved in this project: Deux Rives, Lake Saint-Pierre and Jacques-Cartier. Results point to significant inter-annual variations. For instance, the freeze-thaw cycle from 2006 and 2008 was severe, with 70 percent of the erosion occurring between November and April. Erosion from 2005 to 2006 occurred throughout the year as a result of relatively high water levels in the summer. Water levels often impact other shore-erosion factors. These activities have shed some light on the variety of natural events that contribute to the erosion of the St. Lawrence's shores, such as fluctuating water levels, the freeze-thaw cycle and the drying out of clay. Human activities that may have potential impacts in the area include commercial navigation, forest harvesting and agriculture.

Monitoring of benthic communities in the St. Lawrence continued with the addition of some 30 stations, located mainly in Lake Saint-Louis, and the Varennes and Contrecœur archipelagos. Sampling of the river's natural shores between Beauharnois and Nicolet was performed based on the Canadian Aquatic Biomonitoring Network's protocol. The main environmental factors impacting benthic communities include river water levels, habitat parameters (such as station depth), dominant plant species in the habitat, sediment type and landscape.

Wetland monitoring activities included the completion of an analysis report on changes over the last three decades. Work continued on a proposal for national monitoring of ecological functions related to water quality. In addition, a proposal was prepared for a pilot project to test a method of estimating ecological functions in the St. Lawrence River.

The inventory of the eight species (Eurasian watermilfoil, water chestnut, purple loosestrife, reed canarygrass, European frog-bit, flowering rush, common reed, and Japanese knotweed) targeted by the invasive plant monitoring project continued. This work was done by six riverside community organizations. A workshop was held to discuss and improve the data collection protocol with these groups. Four training sessions were also held to help organizations understand the proposed methodological changes. A shore-raking campaign was carried out at Lac des Deux Montagnes in response to reports of water chestnut sightings in the Ottawa River upstream of the Carillon dam. This campaign led to the discovery of the first water chestnut in Lac des Deux Montagnes, highlighting the need to monitor this water body, which flows into the St. Lawrence River.

Land use monitoring activities provided updated change analysis data thanks to a new watershed boundary model.

Initiatives to improve community participation in the State of the St. Lawrence Monitoring Program remain on course. The tool developed and enhanced by Nature Quebec to document recreational use and view the resulting data is of particular interest. In addition, monitoring of the recreational usage of Lake Saint-Pierre continued through the summer, with the work being accomplished by the Lake Saint-Pierre ZIP Committee.

The interpretation and awareness activities of the program continued in 2008–2009. Program partners all significantly contributed to the *Overview of the State of the St. Lawrence River 2008*. This publication makes a diagnosis based on environmental monitoring activities, including monitoring of water, sediments, shores, biological resources and uses. This second edition included backgrounders on environmental indicators of the state of the St. Lawrence. Two backgrounders have been published (one on invasive plants and one on sediment contamination due to toxic substances in Lake Saint-Louis) and three others are under development. A scientific article on the environmental factors that influence benthic

communities in Lake Saint-Pierre was also published. The development and consolidation of the water quality database continued. Database access was also improved to make it easier to use and to facilitate data production, particularly regarding the state of the St. Lawrence.

Seven posters designed by scientists were unveiled during the Secrets of the St. Lawrence conference, commemorating the 20th anniversary of the St. Lawrence Plan, which also included a presentation on the contamination of the St. Lawrence. A series of informative banners on the state of the St. Lawrence was circulated during 19 events held throughout the year, reaching more than 2500 people.

Scientific liaison with St. Lawrence communities led to the signing of environmental monitoring contracts in the following areas: erosion, invasive exotic species and uses of the St. Lawrence. Scientific and technical support helped respond to approximately 12 community requests for more information on these topics.

The network of government and non-government partners and collaborators remained active and productive in terms of reporting on the state of the St. Lawrence through a number of activities, including chairing the State of the St. Lawrence Monitoring Advisory Committee, regular participation in the Management Committee of the Canada–Quebec Agreement on the St. Lawrence River, and maintaining close ties with other advisory committees active in the fields of ecological integrity, community involvement and awareness, shore access, and navigation.

Ecological integrity

Working with private conservation organizations, Coordinating Committee partners focused on assessing and improving the current network of protected areas along the St. Lawrence. The Conservation Plan for the St. Lawrence Valley and Lake Champlain, developed by the Nature Conservancy of Canada (Quebec Region), targets 1653 priority sites for biodiversity conservation. Analysis of these priority sites suggests that the contribution of the current network of protected areas is significant, yet insufficient. In addition, work continued on the modelling of specific habitats and the hydrodynamics of the Trois-Rivières–Québec freshwater reach.

Research projects on the composition, fate and toxicity of contaminants in urban wastewater effluents have led to improvements at water treatment plants in Montréal and other municipalities. The results of these projects, including at least 12 scientific articles, have been published in internationally recognized journals.

Navigation

Revised criteria for the assessment of sediment quality were made public in a document entitled *Criteria for the Assessment of Sediment Quality in Quebec and Application Frameworks: Prevention, Dredging and Remediation*. An online registry of dredging activities was developed and work continued on the second part of the study on adapting marine transportation to climate change, which delves deeper into the environmental impact of certain adaptation strategies.

Agriculture

Monitoring of pesticide levels at the mouths of the St. Lawrence's major tributaries continued through the National Agri-Environmental Standards Initiative. Work also continued on the study of the volume of sediments, nutrients and contaminants from agricultural activities in Lavallière Bay, and their impact on fish and bullfrog populations.

Shore access

Eight shore-access improvement projects were completed in riverside communities along the St. Lawrence, such as dredging of marine access channels, and development of access ramps, observation towers and walking trails. Several rebuilding projects of federal government marine infrastructures were also completed. A comprehensive cartographic inventory of St. Lawrence access routes was developed based on data from various sources.

1.3.5 Atlantic ecosystem initiatives

Background

The Atlantic Coastal Action Plan is a collaborative community watershed-based program that has built partnerships, increased capacity and achieved

environmental results through an ecosystem-based management approach since 1991. This approach is centred on community-based leadership and delivery, to address environmental and sustainable development issues in ecosystems that include watersheds and coastal areas throughout Atlantic Canada. There are currently 16 Atlantic Coastal Action Program organizations and three other ecosystem initiatives in the Atlantic provinces. Environment Canada contributes 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, atmospheric depositions, toxics and natural habitat.

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In 2008–2009, 32 projects (representing almost 50 percent of all projects under the Atlantic Coastal Action Plan) dealt with water issues.

In partnership with the New Brunswick Department of Environment, the Miramichi River Environmental Assessment Committee launched the process of Water Classification on the Miramichi, in northeastern New Brunswick. This project partners with a University of New Brunswick Ph.D. research project. The Assessment Committee prepared a strategic plan to classify the 13 major tributaries of the Miramichi River system over a five-year period. The Committee was also engaged in an extensive biomonitoring project that allowed opportunities for fieldwork and data collection on adult-stage insects (caddisfly, mayfly, dragonfly and damselfly) as part of the Canadian Aquatic Biomonitoring Network.

The Bay of Fundy Ecosystem Partnership, a "Virtual Institute" dedicated to fostering the well-being of the Bay of Fundy ecosystem, relies on working groups to achieve its goal. This year, the Eutrophication/Nutrients Working Group collected water samples near salmon aquaculture sites and control sites in the outer Bay of Fundy. The samples were sent for analyses of nitrates, nitrites, silica, ammonia and phosphates. This work is part of a continuing monitoring study of nutrients in the vicinity of salmon pens that are discharging significant amounts of salmon feed and fecal material into local waters on a continuous basis.

In southwestern New Brunswick, the Quoddy Future Foundation (formerly St. Croix Estuary Project) continued its long-running annual monitoring. This year, the monitoring activities resulted in the identification of a new problem site at the St. Andrews wharf where sewage was discharged through storm drains.

In Prince Edward Island, the Southeast Environmental Association launched the second stage in the development of a draft watershed management plan for the Montague/Valleyfield River systems. A Montague/Valleyfield Watershed Management Planning Advisory Group developed a draft watershed management plan to present to the public for community support. The management plan included 7 goals, 14 objectives and 43 management strategies. Public meetings were held to present the draft to the community. Achieving a fully community-supported watershed management plan is an ongoing process and is the main focus of the Planning Advisory Group.

In Newfoundland and Labrador, the Northeast Avalon organization worked on increasing local students' understanding and appreciation of the local coastal and marine environment. The Humber Arm Environmental Association studied the Bay of Islands shoreline. These groups hope to foster greater collaboration among relevant government departments on shoreline planning and protection measures.

2 Water research

This section describes research activities conducted by Environment Canada's Water Science and Technology Directorate in support of *Canada Water Act* activities.

2.1 Methodologies

The extent of groundwater contamination discharging to surface water was studied in three urban streams in order to test a new sampling method involving direct sampling below the stream bed. The sites were located in Angus, Ontario; Amherst, Nova Scotia; and the Halifax Regional Municipality, Nova Scotia. All three locations had a known plume of groundwater containing chlorinated solvents heading to the streams, which allowed for testing of the screening methodology. At each location, the known

chlorinated solvent plume was detected and roughly delineated. Previously unknown contaminants were also identified, including indications of fuel-associated groundwater plumes, possibly leaking sewer/stormwater lines and/or lawn-applied fertilizer (including minor chlorinated solvent co-contamination), and road salt.

As part of ongoing studies on pharmaceuticals in Canadian surface waters, a method was developed for determination of fluoroquinolones, a class of synthetic broad-spectrum antibiotics/antimicrobials commonly prescribed to humans for the treatment of infections. The methodology was applied to samples collected from 13 sewage treatment plants located in southern Ontario over a one-year period. All three fluoroquinolones were detected in the sludge samples at parts per billion concentrations. The results confirmed that sewage sludge is a source of these substances in the environment, and that they are not readily biodegradable or easily removed by conventional sewage treatment processes.

Methods were developed to determine the occurrence of polybrominated-chlorinated biphenyls in fish. These chemicals can be formed during the combustion of brominated flame retardants in the presence of chlorine, and also during municipal waste incineration. Analysis of samples of Lake Ontario fish showed several polybrominated-chlorinated biphenyls were present at part per trillion levels. These substances have not been reported previously in North American samples. Follow-up studies are planned because the effects of these chemicals may be similar to those of PCBs, and chlorinated dioxins and furans.

Scientists continued to develop and apply new tests, bioassays and methods, including genomics techniques, for fish, invertebrates and complex algal/bacterial/microbial microcosms. This research examined methods to make bioassays more applicable to the Canadian environment, and to allow data extrapolations for risk assessments to be more accurate as well as more meaningful to Canadian regulatory programs. Several new articles were published demonstrating enhanced capacity to predict the effects of toxic substances using complete life-cycle exposure and embryological/larval studies.

Research collaboration between Environment Canada and the United States Environmental Protection Agency led to the discovery of unique DNA sequences from bacteria found only in the gut of gulls and Canada geese. These DNA sequences are now being used as new microbial-source tracking tools to detect the presence of gull or goose fecal contamination in water from beaches and other aquatic ecosystems.

Research collaboration between Environment Canada, the United States Geological Survey, the Southern California Coastal Water Research Project and university partners led to the development of a new method for enumerating fecal indicator bacteria in beach sand. This method will be a valuable tool to investigate the role of beach sand as a reservoir of fecal indicator bacteria like E. coli, and to understand the sand contribution to E. coli re-suspension and beach closures.

Research was conducted on the potential for examining the impact of humans on freshwater ecosystems by studying biological traits of a species, rather than measuring a species' population levels. Linking how an organism's traits respond to human impacts on ecosystems promises to expand biomonitoring approaches beyond traditional assessments that identify the existence of an ecological effect, to assessments that provide explanations for effects. Traits-based information may have several advantages over methods based on population measurements. These include providing an understanding of the mechanisms that link biotic responses to the condition of an environment; consistent systems of measurement across broad spatial scales; and more seasonal stability than traditional assessments. Also, traits-based assessments can be seamlessly integrated into assessment programs. Initial research evaluated the use of biological traits to assess the condition of a river ecosystem, where the flow characteristics had been changed by humans.

The application of DNA bar-coding as a means of identifying invertebrates was investigated with university partners. This molecular technique promises to greatly increase the capacity to rapidly monitor ecosystem conditions in freshwater ecosystems. To date, the technique has been able to rapidly identify freshwater invertebrates.

Researchers are exploring the possibility of integrating bar-coding into the Canadian Aquatic Biomonitoring Network protocol.

2.2 Treatment technologies

Analyses were completed to identify the effectiveness and potential toxicological impacts of promising biochemical treatment technologies for ballast water under variable temperature and salinity conditions. A second part of the project, describing the effects of cold conditions on treatment effectiveness, is in progress for publication. A monitoring technique for characteristics of the treated waters using ultraviolet (UV) visible spectrophotometry has been developed. This was the first study aiming at testing a bioreactive technology to treat ballast waters to eliminate unwanted invasive and exotic species.

The shield or shadow effect of large particles on bacteria undergoing irradiation by UV light in treated wastewater effluents reduces the effectiveness of UV disinfection. To address this issue, a novel method of applying a high-pressure water jet as a pre-treatment step in combination with UV irradiation was proposed to improve the efficiency of wastewater disinfection. This process breaks up large particles and reduces the shield (or shadow) effects. The E. coli and total coliform tests showed that pre-treatment by the high-pressure water jet enhanced the efficiency of UV disinfection by more than 1 log unit compared with the treatment by UV alone, when the UV dose was in the 20–30 mJ/cm^2 range. The E. coli test results indicated that the well-known "tailing region" of the typical UV dose-response curves was eliminated or decreased when the wastewater was pre-treated by high-pressure water jet. This step might also be beneficial in terms of cost-effectiveness.

Research continued into methods to remove antibiotics from wastewater. The research focused on the development of micellar enhanced ultrafiltration techniques. Partitioning the antibiotics into micelles increased hydrodynamic volume of the contaminant, which led to enhanced removal from wastewater streams.

Results on selected occurrence of pharmaceuticals and personal care products in Ontario wastewaters and their reductions during various conventional treatment processes were published. Monitoring for other high-priority trace contaminants, including brominated flame retardants, bisphenol A, and perfluorinated compounds, in Canada-wide municipal wastewater influents, effluents and sewage solids, has been initiated in support of Canada's Chemicals Management Plan. Future studies will include assessment and demonstration of the application of new technologies, such as advanced oxidation, adsorption, and the use of membranes and enzymes, for enhanced removal of pharmaceuticals, personal care products and other trace contaminants from municipal wastewater streams.

A research study to assess the performance of wastewater treatment systems in Canada's Arctic began in 2009 and will be continued over the next three years. Field research is being conducted to develop an inventory of wastewater system characteristics, as well as the current status of their treatment capabilities. Other components of the research include laboratory investigation of cold-temperature wastewater treatment kinetics, modelling of treatment systems to predict performance enhancement under optimized operating conditions, and reviewing standards for wastewater discharge in other circumpolar jurisdictions. Results from this study, coupled with associated risk assessment input, will be used to formulate discharge standards for the Arctic Component of the Canada-Wide Strategy for the Management of Municipal Wastewater Effluent, which, in turn, will be incorporated into regulations under the *Fisheries Act*.

Operation of the Town of Richmond Hill's Snow Storage Facility was investigated over two snowmelt seasons with respect to snowmelt flows, fluxes of chemicals contained in snowmelt, and direct effects on the receiving water. Study results indicate that the stormwater management system seemed to effectively remove metals and polycyclic aromatic hydrocarbons, but such systems are typically not designed to remove soluble contaminants such as road salts. Although only approximately 1 percent of the total chloride applied to streets as road salts was transported to the site, the concentrations of chloride in early-season snowmelt can be exceedingly high, and these high chloride levels

may be directly transported to receiving waters. The study results will help to develop guidance on designing snow disposal sites and identify best management practices for reducing road salt output into the environment.

2.3 Pharmaceuticals and personal care products

Studies were conducted on triclocarban, a widely used antimicrobial, to accurately determine its concentrations in wastewater and sludge samples. Municipal wastewater and sludge samples were collected from 10 sewage treatment plants located in southern Ontario. Triclocarban was detected in all influent and effluent samples with median concentrations ranging from 34 nanograms per litre (ng/L) (effluent) to 206 ng/L (influent). The results indicate that triclocarban is removed but is not readily biodegraded. It accumulates in sludge with median dry mass concentrations varying from 7.7 mg/kg (raw sludge) to 8.4 mg/kg (digested sludge).

The occurrence of the two most popular cholesterol-lowering drugs (atorvastatin and rosuvastatin) in sewage samples was investigated. Results have shown the ubiquity of these drugs in sewage samples, with rosuvastatin more abundant than atorvastatin in all cases, as well as surface water impacted by the discharge of municipal wastewaters.

The potential for transport of a veterinary antimicrobial (lincomycin) to surface waters through surface runoff and leaching to groundwater was assessed by monitoring manure-amended soil, simulated rainfall runoff, snowmelt runoff, and groundwater, over a two-year period in Saskatchewan after fall application of liquid swine manure to cropland. Lincomycin was detected in all samples at part per billion concentrations. The study demonstrates that the management practice of using livestock manure from animal feeding operations as a plant nutrient source on cropland may result in antimicrobial transport to surface and ground waters.

The bioavailability and bioaccumulation of pharmaceutical antidepressants were studied in municipal wastewater effluents and the receiving waters of the St. Lawrence River. A liquid chromatography–tandem mass spectrometry method has been developed for the determination of common antidepressants and their metabolites in biological tissues. An extraction procedure was successfully applied to the analysis of bioaccumulated antidepressants in Rainbow Trout (*Oncorhynchus mykiss*) previously exposed under microcosm conditions to dilute and treated effluents at the Montréal sewage treatment plant. Sertraline and its metabolite, desmethylsertraline, were the predominant substances observed in most biological tissues. Individual antidepressant concentrations ranged from 0.04 ng/g to 10 ng/g.

Life-cycle exposures of fish to municipal wastewater effluents show that the effluents can affect fish reproduction. Fathead Minnows (*Pimephales promelas*) grew normally and appeared healthy in 50–100 percent effluent mixtures, yet they produced 40 percent fewer eggs than reference fish. The municipal wastewater effluents contained a mixture of compounds, including ammonia, oils, metals, nutrients, and many pharmaceuticals and personal care products. Studies will next assess which treatment technologies can remove pharmaceuticals and personal care products.

Researchers documented the presence and potential environmental effects of N,N,-diethyl-m-toluamide (DEET) in prairie waterways. DEET is the active ingredient in most commercial insect repellents used around the world. It is used in more than 200 registered veterinary and human-use products, with production of up to 1.8 million kg/year in the United States. As a consequence of this extensive use, DEET has been detected in many water surveys, including surface water, groundwater, sewage effluent and drinking water. Studies on municipal wastewater effluents from the cities of Regina and Saskatoon, Saskatchewan, and their respective receiving environments (South Saskatchewan River and Wascana Creek) have confirmed that, although DEET is not detectable in municipal wastewater effluents, it is ubiquitous in these two rivers, at 10–20 ng/L and 100–450 ng/L, respectively. Application of a variety of micro-scale, molecular and conventional approaches to assess microbial community responses indicated that, at 500 ng/L, DEET can significantly alter microbial community structure and function.

2.4 Pathogens

Environment Canada and partners at the University of Alberta and the Institut national de recherche scientifique in Quebec began a research study to investigate the occurrence of waterborne pathogens, such as cryptosporidium, giardia, campylobacter and enteric viruses, at offshore Lake Ontario drinking water intakes. Lake Ontario currently serves as the source of drinking water for more than six million Canadians. The study is following up on the Province of Ontario's new source-water protection regime, and is being conducted in collaboration with several municipalities and the Collaborative Study to Protect Lake Ontario Drinking Water.

The seasonal changes of a benthic cyanobacterium (*Lyngbya wollei*) in Lake Saint-Louis, Quebec, were investigated in conjunction with physical and chemical water quality characteristics, to assess the extent of its colonization in the neighbourhood of the intakes of drinking water filtration plants. In Lake Saint-Louis, zones of highest algal density appear to coincide with areas of urban (storm and sewer) overflow in sheltered bays under the influence of turbid, nutrient-rich waters originating from the Ottawa River. Further studies will be performed to determine whether *Lyngbya* sp. abundance varies with environmental conditions.

Microbial source-tracking studies were conducted with the City of Toronto to identify beaches and stormwater outfalls contaminated by municipal sewage. Water samples were analyzed using a DNA-based assay to detect strains of Bacteroidetes bacteria unique to the human gut. The results are guiding efforts to find and remediate sources of sewage contamination, such as illegal stormwater cross-connections.

2.5 Pesticides and agricultural and roadway runoff

Research was conducted to assess the impacts of current-use pesticides on freshwater ecosystems within the Great Lakes Basin. The use of short-term *in situ* (caged) invertebrate exposures is being developed as a tool to predict long-term, population-level impacts of pesticides on ecosystem health. Significant impacts on *in situ* survival and biomarkers associated with pesticide exposure occurred during periods of peak pesticide application, indicating that pesticide use is negatively affecting some freshwater streams.

Monitoring of current-use pesticides in watercourses draining agricultural areas focused on the influence of runoff from precipitation as a transport mechanism. Results show that the highest concentrations of pesticides occur during rainfall events. However, those elevated concentrations are short-lived. Research was also conducted on ways to reduce this type of runoff through modified farming practices.

Research on pesticides in runoff from intensive potato operations in northern New Brunswick was completed. Through collaboration with researchers at the University of New Brunswick and Agriculture and Agri-Food Canada, it was determined that several compounds exceeded their limits under the relevant Canadian Council of Ministers of the Environment water quality guidelines during summer storms. Pesticides that exceeded the water quality guidelines included azinphos-methyl, linuron and imidacloprid.

Models linking non-point source pollution in runoff from agricultural sources to water quality in streams and near lakeshores were developed for selected watersheds in the Great Lakes Basin and other regions. The models used two different data sets and scenarios developed for land use and biodiversity management. The first set was developed under the National Agri-Environmental Standards Initiative; the second was developed for the Lake Ontario Drinking Water Protection Project under the 2007 Canada–Ontario Agreement Respecting the Great Lakes Basin Ecosystem. These new models allowed users to make integrated assessments of whether all water quality standards were being met and provided guidance on how to reduce loadings to Lake Ontario.

Studies measuring cumulative effects of parasites and pesticide residues indicate that their combined effects, as well as their interactions, result in a stressed river ecosystem. These studies show that the presence and abundance of parasites of certain groups can be used to monitor environmental conditions from a biological effects perspective. Results also showed that parasites

could be used to observe effects of pesticides and landscape development on local biodiversity of the wetlands as an indicator of ecosystem health.

Environment Canada researchers, in collaboration with several municipal departments, conducted a field study of street sweeping effectiveness in improving street runoff quality in Toronto. Study results indicated that sweeping did provide significant environmental benefits, but mostly in areas with high sediment accumulations. The planning of enhanced street sweeping requires cost-benefit analyses. This information and other research results were shared with Canadian researchers and practitioners in three knowledge-transfer workshops organized in Vancouver, Calgary and Toronto in collaboration with the Canadian Water Network.

Laboratory tests with invertebrates were conducted to determine the cause of toxicity at a stormwater management facility that receives inputs of multiple contaminants via runoff from Highway 401 and the surrounding residential area. No toxic effects were observed after exposure to samples collected in the fall. However, survival and growth were significantly impaired after exposure to samples collected in the spring. Polycyclic aromatic hydrocarbons and metals are of concern at these sites, but the primary cause of toxicity in these tests was determined to be chloride from road salt.

Research was conducted to assess the potential interactive effects of nutrients and insecticides. The use of mesocosm systems with communities of stream invertebrates is being developed as a tool to determine whether nutrient enrichment decreases the effect of sublethal exposure to the insecticide imidacloprid. Results suggest that this may be the case in some instances.

2.6 Nanoparticles

The expanding use of nanotechnology in manufacturing leads to an increasing release of nanoparticles into the environment. Environmental effects of nanoparticles are not well known and require further study. In response to a request from a journal, Environment Canada scientists prepared a review paper on the detection, characterization and activities of nanoparticles. Subsequently, papers were published on natural nanoparticles' fouling of membrane filters in a water treatment system, and on the genesis of metal-rich nanoparticles by natural organic nanoparticles acting as templates. A current focus, with one paper recently published, is on establishing the methods for minimizing the artifactual aggregation of manufactured nanoparticles in tests designed to count nanoparticles and to assess their toxicity in a non-aggregated state.

The fate of silver nanoparticles was investigated in natural waters. After mixing, most material was found in the larger aggregate form, with some (10–15 percent) found as nano-sized particles. Naturally occurring dissolved organic matter likely influences the fate of this nanomaterial in maintaining it in colloidal forms. This remains to be confirmed with further experiments with controlled conditions.

Progress was made on evaluating the toxicity of nine common metallic nanopowders (copper zinc iron oxide, nickel zinc iron oxide, yttrium iron oxide, titanium dioxide, strontium ferrite, indium tin oxide, samarium oxide, erbium oxide and holmium oxide) and two organic nanopowders (fullerene-C60 and single-walled carbon nanotube). These nanoparticles were assayed across several taxonomic groups, including decomposers (bacteria), primary producers (micro-algae), as well as primary and secondary consumers (micro-invertebrates and fish). Toxicity data revealed that toxicity responses spanned over three orders of magnitude. This initial investigation suggests that chemicals emerging from nanotechnology may pose a risk to aquatic life in the water column and in sediment. The Microbial Array for Risk Assessment procedure was also conducted on sediments to determine the toxic potential and fingerprint of four metallic nanopowders (copper zinc iron oxide, samarium (III) oxide, erbium (III) oxide and holmium (III) oxide). The endpoint value of the concentrations that were toxic to microbes showed a range of toxicity responses generated by and specific to individual strains. Bioassay data also indicated that metallic nanopowder toxicity can be influenced by sediment grain size, and that any adverse effects on aquatic biota will in part depend on sediment characteristics.

2.7 Nutrients

Research investigated the impact of excess nutrients on the aquatic environment, specifically in Lake of the Woods—a large international water body shared by Ontario, Manitoba and Minnesota. Prior to 2007–2008, there had been concerns regarding water quality, including the presence of toxic cyanobacteria blooms in some parts of the lake. An initial Environment Canada assessment and modelling exercise identified key knowledge gaps in the Winnipeg Basin. As part of a larger initiative to assess and remediate water quality in the basin, Environment Canada, in partnership with provincial and state agencies, initiated a nutrient assessment plan addressing these data gaps, and implemented a three-year field study and detailed modelling of the lake.

The broader Hydrological and Aquatic Ecosystem Impacts Research Program is one of the primary mechanisms to identify the impacts of environmental stressors on the hydrology and ecology of freshwater ecosystems, including assessment of the productivity and community-structure impacts downstream of non-point and point sources of nutrients. For example, during the spring of 2009, new research was initiated under the Lake Winnipeg Basin Initiative to support the objectives of addressing and managing the following:

- non-point source contributions of nutrients in the Lake Winnipeg watershed and ultimately to the lake; and
- impacts of climate variability and change on the watershed's contribution of non-point source nutrients to the lake.

This integrated research program will provide broader understanding of risks related to water quality and water quantity management for agricultural watersheds in southern Manitoba, and an integrated water quality-quantity modelling framework that will allow testing of Beneficial Management Practices efficacy.

2.8 Wetlands

As part of continuing studies to quantify carbon cycling in wetland ecosystems, studies were conducted to determine the impacts of conventional farming practices on carbon and nitrogen cycling in riparian wetlands, and the role of climatic and hydrologic processes in controlling the distribution of nutrients and the exchange of greenhouse gases in riparian wetlands. In 2008–2009, this research, conducted in collaboration with university and other partners, focused on effects of nutrients and moisture supply on greenhouse gas emissions in cropped fields and adjacent stream riparian zones. The research will contribute to the development of farm or wetland management options that could maximize the sequestration of carbon or minimize the emissions of carbon dioxide, methane and nitrous oxide from riparian wetlands.

2.9 Hydro-meteorological modelling and prediction

Background

Applied science makes extensive use of models as tools for predictions about the physical world. For several years, researchers and scientists at Environment Canada and many partner agencies have made use of atmospheric and weather data as input for day-to-day operational forecasting models, and of hydrologic data collected under the hydrometric agreements as input for hydrologic models. Since 2006, concerted efforts have been made to couple atmospheric and hydrological models, and these models and eco-hydraulic modelling systems have been tested. These models demonstrate how regional hydrometeorological modelling and ensemble forecasting systems can help improve weather prediction and water resources management.

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Environment Canada's atmospheric researchers working on coupled hydro-meteorological modelling and prediction under an expanded environmental prediction framework achieved improved understanding of interactions between the atmosphere and the land surface. Their work supported improved water management using the "Modélisation environnementale – Surface et Hydrologie – MESH" system and also supported the International Hydrological Ensemble Prediction

Experiment. The prediction framework contributed directly towards an International Joint Commission program focused on assessing the contributions of ship traffic and climate to the recent low water levels in Lakes Michigan and Huron. Environment Canada used coupled regional climate and hydrology modelling to assess long-term climate change. The department used the numerical weather and hydrological modelling system to study uncertainty and water balance closure. This study included the hydrodynamic modelling of the St. Clair River, an initial draft report of the International Upper Great Lakes Study, as well as research on the dredging history. Also, the model of the St. Lawrence River upstream of Cornwall was fine-tuned. Development and operationalization of Environment Canada's eco-hydraulic modelling system for major portions of the St. Lawrence River continued.

The department continued to develop water supply indicators in support of a hydrological atlas project and contributed to ecosystem trends studies that focused on water resources. Other projects included an assessment of the impacts of climate change on the Port of Montreal in support of Canadian Coast Guard initiatives. The integrated flow simulation model for the Peace, Athabasca, Slave and Mackenzie river system with its user interface for operational use was completed. This was done in collaboration with the Canadian Hydraulics Centre and the University of Alberta. An Environment Canada scientist and regional hydrologist contributed significantly to programs funded by the Canadian Foundation for Climate and Atmospheric Sciences, such as a drought-research initiative, the Improved Process, Paramaterization and Prediction (IP3) program and the Western Canadian Cryospheric Network.

Studies considered the potential impact of the proposed Mackenzie Gas Pipeline on the hydrology and ecology of the Mackenzie Valley and Delta. Research considered the modelling of flows in streams crossing the pipeline right-of-way, the role of river ice in controlling peak water levels in the Mackenzie Delta, and the relative importance of factors controlling flooding of the Kendal Island Bird Sanctuary in the Mackenzie Delta with an emphasis on developing the knowledge needed to predict the impact of subsidence on future flooding of bird habitat.

Ongoing studies have focused on improving our 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. In 2008–2009, research focused on developing physically based models for predicting snow-cover development, melt and runoff, and improved techniques for predicting evaporation from lakes of various sizes.

Environment Canada scientists installed instruments on a lighthouse on a small reef in Lake Superior to provide the first direct estimate of evaporation rates from this lake.

Scientists continued detailed studies of wetlands in the central Prairies and southern boreal forest of Saskatchewan, with an emphasis on understanding prairie water sustainability.

2.10 The State of the Strait Conference

Background

The State of the Strait Conference is a Canada–United States event held approximately every two years that brings together government managers, researchers, students, members of environmental and conservation organizations, corporations, planning organizations, communities and concerned citizens, to assess ecosystem status and provide advice to improve research, monitoring and management programs for the Detroit River and western Lake Erie. The conference alternates locations between Canada and the United States, and a report is issued following the conference.

Progress to March 31, 2009

A comprehensive and integrative assessment of the 2006 conference was completed and the paper appeared in the November 2009 issue of *Environmental Assessment and Monitoring*.

The 2009 conference was scheduled for April, at the University of Windsor, Ontario. The theme of the 2009 conference is "Ecological Benefits of Habitat Modification."

2.11 National Agri-Environmental Standards Initiative

Background

The National Agri-Environmental Standards Initiative was a four-year program (2004–2008) led by Environment Canada in partnership with Agriculture and Agri-Food Canada under their Agricultural Policy Framework. The initiative develops two types of science-based agri-environmental performance standards:

- ideal performance standards, which specify the desired environmental state needed to maintain ecosystem health; and
- achievable performance standards, which specify environmental conditions that can realistically be achieved using currently available and recommended beneficial management practices.

These non-regulatory standards provide benchmarks of environmental quality, which can be used to develop and promote the adoption of beneficial agricultural management systems and practices that help reduce environmental risks. These benchmarks could also be used to measure progress toward identified environmental outcomes. The standards have been designed specifically for agriculture, with the understanding that they will be used in the context of a working landscape where zero risk is not the ultimate goal.

The development of voluntary agri-environmental performance standards was carried out under four themes (air, biodiversity, pesticides and water), and involves science-based assessments of environmental risk and the determination of desired environmental quality. Work relevant to the *Canada Water Act* was carried out under the pesticide and water themes.

Progress to March 31, 2009

The research and development component of the National Agri-Environmental Standards Initiative was completed on March 31, 2008. Activities in 2008–2009 were dedicated to reporting the outcomes to stakeholders and finalizing the publication of the synthesis reports.

In January 2009, Environment Canada hosted the final stakeholder workshop in Winnipeg, Manitoba, to present and clarify the draft standards, discuss limitations and gaps in the science, and identify opportunities that will ensure the standards are used to their potential in informing decision making in agriculture in Canada. Participants were a targeted group of stakeholders who included representatives of other federal departments (Agriculture and Agri-Food Canada, Health Canada, and Fisheries and Oceans Canada), as well as representatives from the provinces, industry and non-governmental organizations. This workshop was a follow-up to the first stakeholder workshop (March 2006) and fulfilled a Government commitment to report back to these stakeholders.

The final National Agri-Environmental Standards Initiative products include 15 technical synthesis reports outlining the draft standards and major research findings, as well as the approach used to develop the standards, potential uses and limitations of the standards, and recommendations for future research activities. Reports outlining standards pertaining to water included six from the water theme, covering standards for sedimentation, nutrient eutrophication, nutrient toxicity, pathogens, in-stream flow needs, and water availability, as well as five reports published under the pesticide theme outlining ideal and achievable performance standards, mixture and commodity-based standards, and risk-based standards. As a companion to the technical synthesis reports, an overarching report was also written highlighting the history of the program and the final standards, as well as providing recommendations for use of the standards and guidance on future activities. These 16 documents were made available to the public in March 2009.

PUBLIC INFORMATION PROGRAM

(Part IV of the *Canada Water Act*)

1 Environment Canada's Water website

The Environment Canada Water website (www.ec.gc.ca/eau-water), the former Freshwater website, continues to provide basic information on a wide range of water-related topics, comprehensive educational materials (e.g., *A Primer on Fresh Water*, the Water Fact Sheets, *Explore Water With Holly Heron*, and *Let's Not Take Water For Granted – A Resource Guide*), and the full text of key water publications (e.g., the *Federal Water Policy*, the *Canada Water Act Annual Report*, and reports on water use and pricing).

In 2008–2009, the site was heavily used, averaging more than 80 000 visits each month, and was often referenced on other websites and in print material produced by other agencies.

2 RésEau – Building Canadian Water Connections

RésEau is a Government of Canada online demonstration initiative that focuses on water information (www.ec.gc.ca/reseau). The RésEau prototype was launched in March 2006. Water data are now accessible online through one portal that includes a selection of federal government monitoring programs for water quality and quantity, as well as programs on groundwater availability, groundwater contamination, water use, and water and human health (disease outbreaks). In addition, data has been made available from a network of partner groups, including provinces, non-governmental organizations, community groups and high schools. In 2008–2009, the RésEau website continued to establish contributors and update water information for Canadians.

3 Water Survey of Canada website

The Water Survey of Canada (www.wsc.ec.gc.ca) of Environment Canada is the federal agency responsible for the collection, interpretation and dissemination of standardized water quantity data and information in Canada.

Each year, Environment Canada updates the national Hydroclimatological Data Retrieval Program (HYDAT) water quantity data archive with data from all 2650 active hydrometric monitoring stations. This includes streamflow, water level and sediment data (daily and monthly means, and instantaneous values). HYDAT contains historical data for an additional 5500 discontinued monitoring stations across Canada. Users can access data from the HYDAT archive using an online interactive query tool or download a copy of the HYDAT database from the website (www.wsc.ec.gc.ca/hydat/H2O).

Data from two thirds of the active hydrometric network are reported in near real-time on the website. Water level data for all stations and stream flow data for a growing number of stations are presented graphically within hours of their measurement on the website (http://scitech.pyr.ec.gc.ca/waterweb/formnav.asp?lang=0).

Work was initiated in 2008–2009 to integrate the Water Survey website into Environment Canada's Weather Office, with the new site scheduled for launch in 2010. In addition, the implementation of the new Hydrometric Work Station data management system in 2010 will enable the provision in real time of quality-checked water level and stream flow data for all real-time reporting stations.

4 Biosphère Environment Museum

As an environmental museum, Environment Canada's Biosphère (www.biosphere.ec.gc.ca) offers expositions, guided tours and animations to help visitors explore and better understand major environmental issues relating to water, while also touching on climate change, responsible use of resources, sustainable development and biodiversity. The goal is to help Canadians, particularly young Canadians, develop responsible consumer habits to help preserve the environment. In 2008–2009, more than 100 000 people visited these expositions or participated in educational activities.

In addition, more than 4000 young Canadians made a commitment to protect their water resources through the Adopt a River initiative, a hands-on project made possible by an expanded network of coordinators spanning five provinces. Other programs of note that continued in 2008–2009 include "On the Water Trail," which draws attention to the economic and social importance of the St. Lawrence River, as well as the "Moving Giant: The Great Lakes – St. Lawrence Ecosystem" and "Water Wonders" expositions. New activities further exploring water and biodiversity were introduced this year, including "Arctic: Walking on Thin Ice," an outdoor exhibit of giant photographs, and "Blue-Green Algae," presented in the Museum's indoor garden.

To mark the 20th anniversary of the St. Lawrence Plan, a video conference on the St. Lawrence was presented simultaneously to three student groups located in the Musée de la civilisation in Québec, the Maurice-Lamontagne Institute in Rimouski, and the Biosphère in Montréal.

The Biosphère also hosted the "Celebrating Lakes and Rivers" event May 7–8, 2008. This event, organized by the International Secretariat for Water, brought together a team of approximately 15 young people to develop a plan for the preservation of various watersheds.

Appendix A. Agreements

The following *Canada Water Act* Agreements[1] were ongoing during 2008–2009.

Apportionment and Monitoring Programs

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

Note that on behalf of the federal government, the 2007 Canada–Ontario Agreement Respecting the Great Lakes Basin was made pursuant to the *Canadian Environmental Protection Act, 1999* and the Canada–Quebec Agreement pertaining to the St. Lawrence (2005–2010) was made pursuant to the *Department of Environment Act* and the *Department of Fisheries and Oceans Act*.

Water Management Programs

- Mackenzie River Basin Transboundary Waters Master Agreement

[1] For which *Canada Water Act* authority exists (in most cases, by Order in Council).

www.ec.gc.ca

Additional information can be obtained at:

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