

*Drinking Water Safety
in
Newfoundland and Labrador*

*Annual Report 2008
“Small Town Solutions”*




Newfoundland
Labrador

**Drinking Water Safety
in
Newfoundland and Labrador**

**Annual Report 2008
"Small Town Solutions"**

For additional copies, please contact:

Water Resources Management Division
Department of Environment and Conservation
Government of Newfoundland and Labrador
P.O. Box 8700
St. John's NL A1B 4J6
Telephone: (709)729-2563
Fax: (709) 729-0320

This document is also available electronically at:
<http://www.gov.nl.ca/env/water>

Printed on recycled paper

Cover: Community of Nain, Labrador
Cover Credit: Christa Ramsay, Department of Environment and Conservation

Message from the Minister



As the Minister of Environment and Conservation, I am pleased to introduce the 2008 annual report on Drinking Water Safety in Newfoundland and Labrador. The theme of this year's annual report is Small Town Solutions.

The annual report informs the public about drinking-water quality and government's commitment to ensuring the safety of drinking-water in the province. Some of the highlights include the Department's progress and accomplishments in protecting source-water, treating and distributing drinking-water, monitoring drinking-water quality, data management, operator education, training and certification, and corrective measures.

The province of Newfoundland and Labrador has one of the most widely adopted and well-established source-water protection programs in the country. A Multi-Barrier Strategic Action Plan is in place which is considered by many authorities to be the most effective and safe way to managing drinking-water systems.

I extend a sincere appreciation to the Water Resources Management staff for their dedication to drinking-water safety. I also appreciate the commitment from the Drinking-Water-Technical Working Group. The Working Group consists of representatives from the departments of Environment and Conservation, Health and Community Services, Government Services, Municipal Affairs and the Public Health Laboratory. The commitment from all four departments and the province's regional Health Authorities ensures the continued success of implementing the Multi-Barrier Strategic Action Plan, and its effort to safeguard drinking-water quality in the province for future generations.

Charlene Johnson
MINISTER

Executive Summary

This seventh annual report on drinking-water safety in Newfoundland and Labrador outlines the accomplishments and activities of the Multi-Barrier Strategic Action Plan (MBSAP) for the fiscal year 2007-08. Its theme, “Small-Town Solutions”, was taken from the theme of the Annual Safe and Clean Drinking Water Workshop, which was held in Gander on March 11 to 13, 2008. Throughout the report, attention is drawn to the particular challenges, as well as the success stories, of rural communities across the Province.

Part 1 of the report focuses on the first level of the MBSAP. This level includes the management of drinking water sources, water treatment systems, and water distribution systems in the Province. Source protection is the primary component of this level of the MBSAP. There are currently 314 protected public water supply areas designated under the *Water Resources Act, 2002*. In addition to 434 chlorination systems, 12 full scale water treatment plants, and many other systems with filtration or other treatments, are in operation across the Province.

Part 2 of the report focuses on the second level of the MBSAP. This level includes the monitoring of the Province’s drinking-water quality through chemical, physical and bacteriological sampling. In 2007-08 2,570 tap water samples and 277 source water samples were taken for analysis of chemical and physical parameters. In the case of tap samples, THMs and HAAs were also measured. There were 19,757 bacteriological samples taken during the fiscal year. As of March 31, 2008 there were 229 Boil Water Advisories in the Province. As always, efforts continue to reduce this number through such actions as chlorine demand management. Infrastructure improvement and the Operator Education, Training and Certification program are also part of this level of the MBSAP. For the first time in 2007-08, the award of Operator of the Year was introduced as recognition of the important role trained and certified operators play in drinking-water safety.

Part 3 of the report focuses on the third level of the MBSAP. This level deals with legislative and policy frameworks that govern all levels of the MBSAP. The Departments of Environment and Conservation, Government Services, Health and Community Services, and Municipal Affairs work collaboratively to enact the MBSAP, and to enforce regulations and guidelines regarding drinking-water safety. Level 3 of the MBSAP also includes public involvement and awareness, and all data continues to be made available to the public via community reporting as well as through posting on the Department of Environment and Conservation’s website. Through the Research and Development component of Level 3, Government remains committed to the ongoing refinement and advancement of its programs using new technology and management tools to better ensure the safety of the Province’s drinking-water.

The Government of Newfoundland and Labrador remains committed to ensuring the safety of the Province’s drinking water through enacting all levels of the MBSAP. Each Department involved in the MBSAP contributes uniquely to the safety of drinking-water across the Province. Implementation of the Rural Drinking-Water Safety Initiative for Newfoundland and Labrador will be a priority for 2008-09.

Table of Contents

Letter from the Minister	i
Executive Summary	iii
List of Tables	vii
List of Figures	vii
Overview	1
Part 1: Level 1 of the MBSAP	4
Step 1: Source-water Protection	4
Managing Watersheds	8
Step 2: Drinking-water Treatment	10
Disinfection	10
Water Treatment Plants in Newfoundland and Labrador	12
Part 2: Level 2 of the MBSAP	16
Monitoring	16
Sample Collection	17
Chemical and Physical Water Quality	17
Bacteriological Water Quality	19
Sample Analysis	20
Water quality Analysis: Chemical and Physical Parameters	20
Water quality Monitoring Results: Chemical and Physical Parameters	20
Results: Aesthetics	20
Results: Contaminants	24
Water quality Analysis: Bacteriological Parameters	27
Results: Bacteriological Parameters	27
Inspection and Enforcement	31
Permits	31
A Highlight on Permits to Operate	32
Inspection	32
Enforcement	33
Data Management and Reporting	35
Data Management	35
Reporting	38
Operator Education, Training, and Certification (OETC)	41
Operator Education	41
Operator Training	44
Operator Certification	44
The Annual Clean and Safe Drinking Water Workshop	49
Corrective Measures	50

Part 3: Level 3 of the MBSAP	56
Legislative and Policy Frameworks	56
Inter-departmental Cooperation	56
Public Involvement and Awareness	57
Guidelines, Standards, and Objectives	59
Research and Development	60
Summary 2007-08	62
The Path Forward	63
Government Action Plans for 2008–09	63
Department of Environment and Conservation	63
Department of Municipal Affairs	64
Department of Government Services	65
Department of Health and Community Services	66

List of Tables

Table 1:	Classification of Water Distribution Systems , 2007-08	15
Table 2:	Water Quality Monitoring Responsibilities by Department	16
Table 3:	Overview of Chemical/Physical Sampling Activity, 2007-08	18
Table 4:	Bacteriological Sampling Frequency	19
Table 5:	Aesthetic Parameter Exceedances, 2007-08	21
Table 6:	Contaminant Parameter Exceedances, 2007-08	24
Table 7:	Bacteriological Test Results from Public Water Supplies, 2007-08	28
Table 8:	Breakdown of Community Reporting, 2007-08	39
Table 9:	Participants in the 2007-08 Water Distribution Seminars	43
Table 10:	Certification Exam Numbers, 2007-08	46
Table 11:	Participants in Operator Training, 2007-08	47

List of Figures

Figure 1:	The Multi-Barrier Strategic Action Plan	3
Figure 2a:	Diversity of Public Water-Supply Systems in Newfoundland	5
Figure 2b:	Diversity of Public Water-Supply Systems in Labrador	6
Figure 3:	Community Water-Supplies in Newfoundland and Labrador, 2007-08	8

Overview

This is the seventh annual report that Newfoundland and Labrador's Department of Environment and Conservation has prepared to inform the public about how it is ensuring the safety of drinking-water in the province. It covers Government initiatives, activities, and accomplishments made in this area during the 2007–08 fiscal year (April 1, 2007, to March 31, 2008), and is part of the Department's ongoing efforts to keep the public informed about drinking-water quality.

The Government of Newfoundland and Labrador is committed to providing the public with safe, clean drinking-water. It uses a Multi-Barrier Strategic Action Plan (MBSAP) to meet this goal. Considered by many authorities to be the most effective way to managing drinking-water systems, a multi-barrier approach combines and integrates two important responsibilities: improving public health and protecting the watershed:

The levels and components in the province's MBSAP are illustrated in Figure 1. They include:

Level 1

- ◆ Source-water protection
- ◆ Drinking-water treatment
- ◆ Drinking-water distribution

Level 2

- ◆ Monitoring
- ◆ Inspection and enforcement
- ◆ Data management and reporting
- ◆ Operator education, training, and certification
- ◆ Corrective measures

Level 3

- ◆ Legislative and policy frameworks
- ◆ Public involvement and awareness
- ◆ Guidelines, standards, and objectives
- ◆ Research and development

This report is organized to reflect the levels of the MBSAP:

Part 1 describes progress and accomplishments in protecting source-water, and in treating and distributing drinking-water.

Part 2 describes progress and accomplishments related to monitoring drinking-water quality, including inspection and

enforcement, data management and reporting, operator education, training, and certification, and corrective measures.

Part 3 describes progress and accomplishments in the areas of legislative and policy frameworks, public involvement and awareness, research and development, and guidelines, standards, and objectives.

Summary of 2007–08 gives an overview of progress and accomplishments at all levels of the MBSAP.

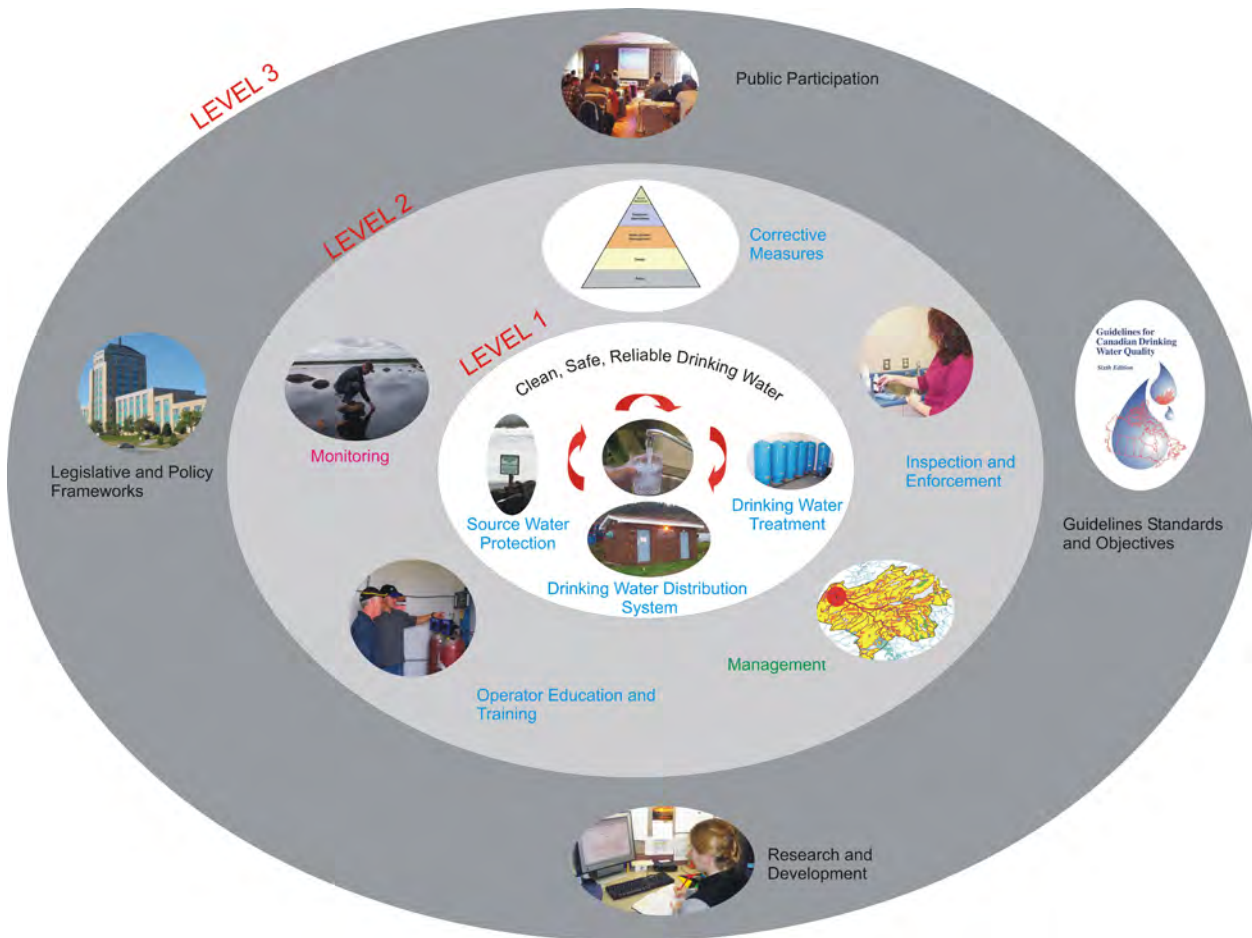
The Path Forward outlines proposed activities for the 2008–09 fiscal year that will ensure clean, safe, and secure drinking-water in the province.

The theme of this report is “Small Town Solutions.” New “Highlights” sections, added this year, summarize the key challenges and accomplishments that occurred during 2007–08.

Government’s efforts to ensure the safety of the province’s drinking-water requires the involvement of four departments. The Departments of Environment and Conservation (acting as the lead agency), Health and Community Services, Government Services, and Municipal Affairs all have responsibilities for one or more components of the MBSAP. Their efforts are coordinated by an inter-departmental committee of Deputy Ministers chaired by the Deputy Minister of the Department of Environment and Conservation.

The committee’s work is supported by the inter-departmental Safe Drinking-water–Technical Working Group, also chaired by the Department of Environment and Conservation. Its members include representatives from each of the four departments as well as the Public Health Laboratory. The Medical Officers of Health from each of the province’s regional Health Authorities are also members of this working group. This cooperative approach ensures the continued success of implementing the Multi-Barrier Strategic Action Plan, and of efforts to safeguard drinking-water quality in the province.

Figure 1 - The Multi-Barrier Strategic Action Plan



PARTICIPATING AGENCIES

Agencies in four provincial government departments oversee the implementation of the MBSAP. Their participation in the various components is denoted by the following colour coding:

Department of Environment and Conservation

Departments of Environment and Conservation / Health and Community Services / Government Services / Municipal Affairs / Federal Government

Departments of Environment and Conservation / Government Services

Departments of Environment and Conservation /Municipal Affairs

Part 1: Level 1 of the MBSAP

The three components of the first level of the Multi-barrier Strategic Action Plan are:

- ◆ source-water protection
- ◆ drinking-water treatment
- ◆ drinking-water distribution

This chapter outlines what is involved in each of these components.

Step 1: Source-water Protection

Protecting drinking water must start at the source

Drinking-water sources can be either surface water (rivers, brooks, lakes, ponds, and reservoirs) or groundwater (both dug and drilled wells). Whichever type a community uses, protecting source water has two important functions: it helps safeguard public health and it reduces the challenges and costs involved in water treatment. Dealing with a water-contamination event is much more expensive than running a source-protection program.

Protected Public Water Supplies in Newfoundland and Labrador, 2007-08

The province of Newfoundland and Labrador has one of the most widely adopted and well-established source-water protection programs in the country. Government uses the *Water Resources Act, 2002* to designate and protect public drinking-water sources as either “Protected Public Water-Supply Areas” (surface-water supplies) or “Protected Wellheads” (groundwater supplies). The source-water protection program is considered highly successful because most of the major water-supply areas in Newfoundland and Labrador have been designated as Protected Public Water-Supply or Wellhead Areas. At the close of fiscal year 2007–08, there were 314 protected public water supplies in the province (see Figures 2a and 2b). About ninety-one per cent of the people in the province whose drinking water came from a public water-supply received it from a protected water-supply.

The process for protection is a cooperative process that is initiated by the communities, as specified in the *Water Resources Act, 2002*. The Department of Environment and Conservation continues to encourage all communities that have not already done so to initiate the protection process.

Figure 2a - Diversity of Public Water-Supply Systems in Newfoundland

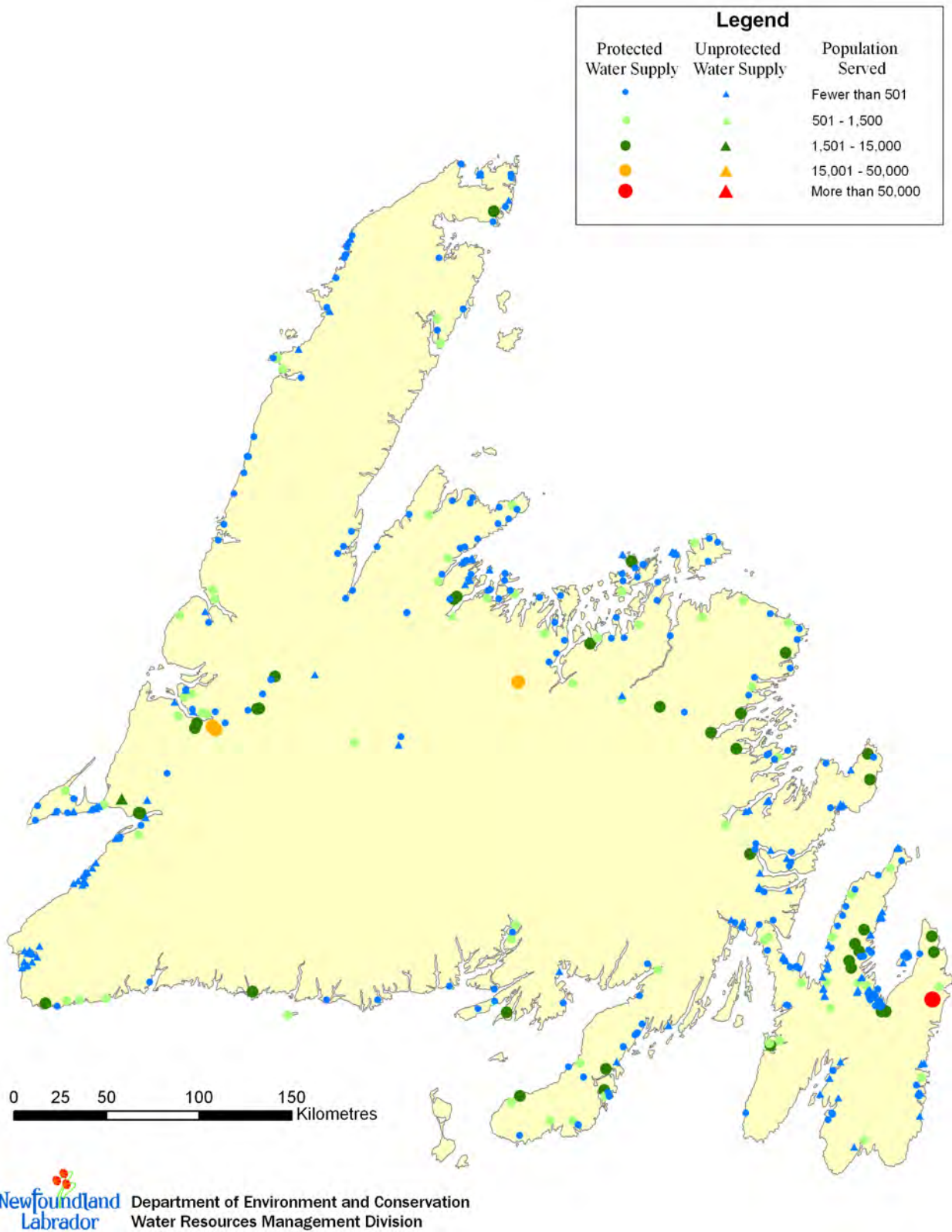
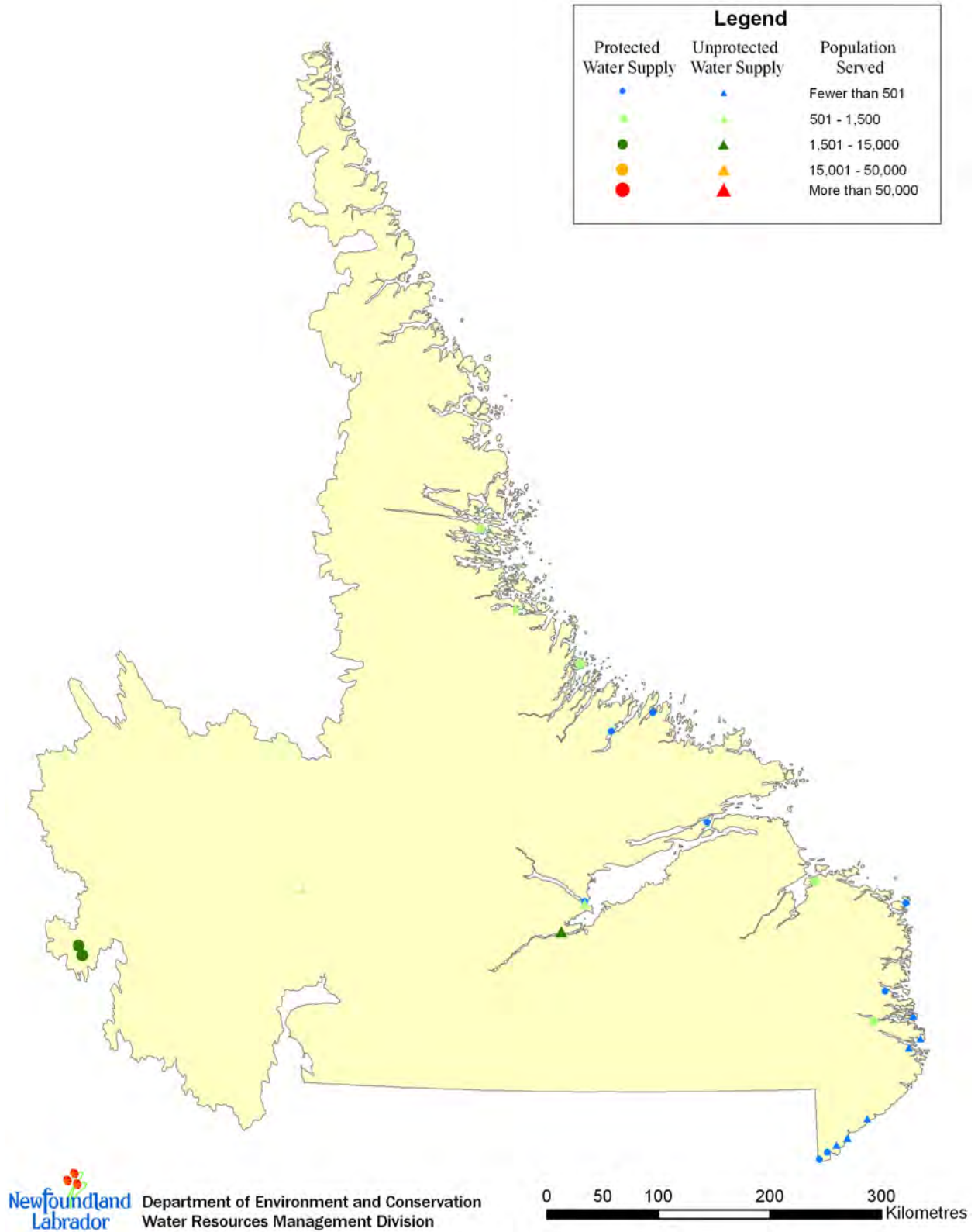


Figure 2b- Diversity of Public Water-Supply Systems in Labrador



Obtaining “protected” designation for a water-supply source includes these steps :

1. The town submits an application for designation
2. Water Resources Management Division staff gather information about land ownership, drainage patterns, the natural boundaries of the watershed area, nearby land-use activities, and surrounding topography
3. The watershed boundary is delineated and entered into the Department of Environment and Conservation’s GIS database
4. A map indicating the area to be designated as the Protected Public Water-Supply Area is submitted to the Interdepartmental Land Use Committee (ILUC)
5. ILUC reviews the proposed Protected Public Water-Supply Area to determine if any land-use conflicts exist and determines how to resolve them
6. Government designates the water-supply a Protected Public Water-Supply Area
7. A legal description of the protected boundary is posted in the Newfoundland Gazette.

Following designation, all activities inside the protected area are controlled and high-risk activities that could impair water quality are restricted using a permitting process. The controlling agency is the Department of Environment and Conservation, Water Resources Management Division, which issues regulatory permits under Section 39 of the *Water Resources Act, 2002*.

During fiscal year 2007–08, three water supplies in the province gained protected status, two protected areas were amended, and one protected designation was repealed:

- ◆ St. Jude’s (Uncle Arthur’s Brook) - New
- ◆ St. Jude’s (Chute Brook) - New
- ◆ Trinity (Indian Pond) - New
- ◆ Rushoon (Big Brook Pond) - Ammendment
- ◆ Springdale (Sullivan’s Pond) - Ammendment
- ◆ Gander Bay South (The Reservoir) - Repeal

The process of amending or protecting a water-supply took, on average, about four months. A list of all Protected Public Water-Supply Areas is available at:

http://www.env.gov.nl.ca/env/Env/waterres/Policies/PWS_List.asp

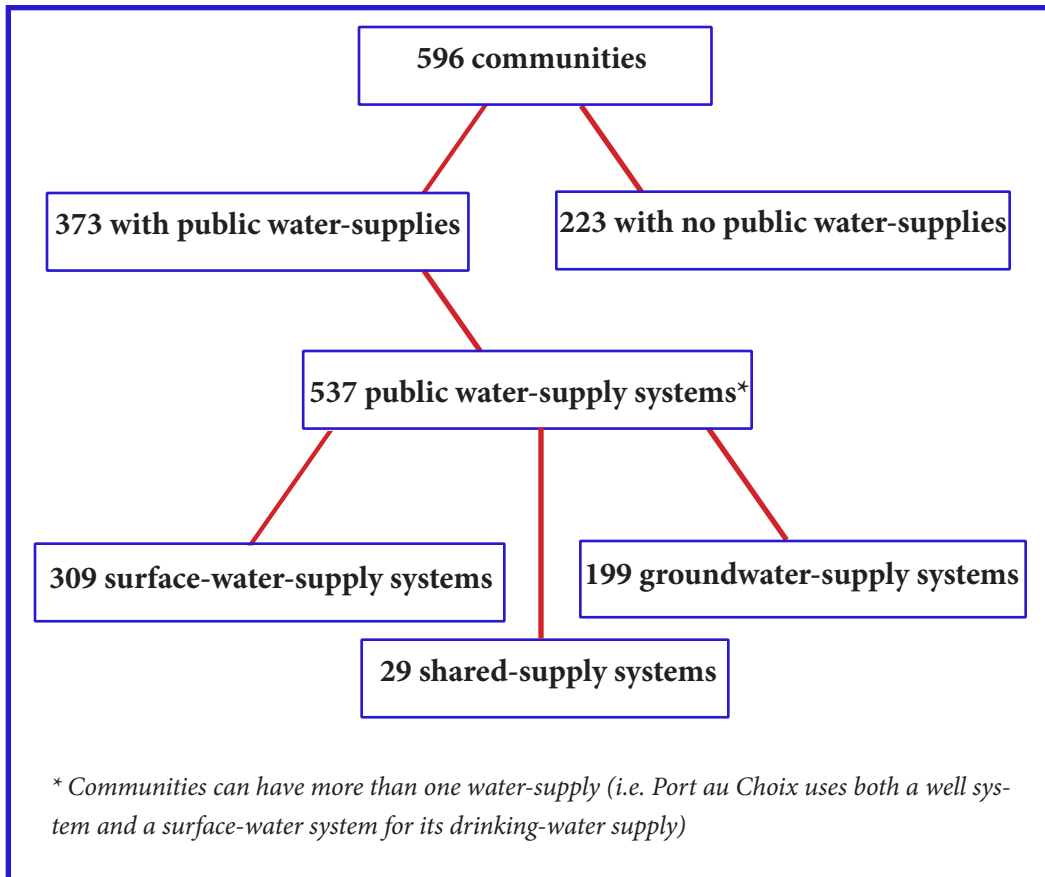
Designating a water supply as protected - what’s involved



Protected Public Water Supply Area Sign

Updates to Protected Water Supply Areas, 2007-08

Figure 3 - Community Water-Supplies in Newfoundland and Labrador, 2007-08



At the end of March 31, 2008, there were 596 communities in the province's public water-supply database. Figure 3 shows their water-supply sources and infrastructure characteristics.

Managing Watersheds

Once a water-supply is protected, a Watershed Management Committee can be formed to oversee the watershed, to resolve conflict over land-management and development issues and activity inside its boundaries. The main stakeholders on a Watershed Management Committee typically include town council members, town residents, representatives from industry involved in development activities, Department of Environment and Conservation staff, members of environmental groups, and other concerned parties. The five Watershed Management Committees currently active in the province are located in:

Active Watershed Management Committees, 2007-08

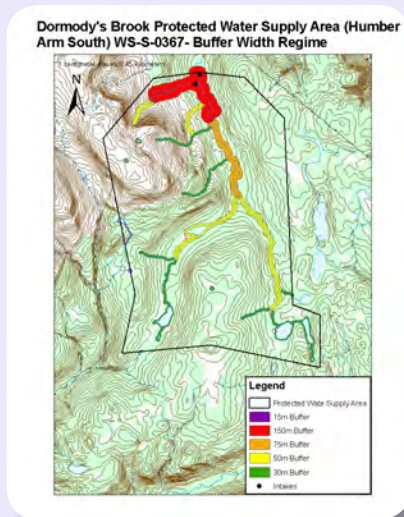
- ◆ Clarenville
- ◆ Steady Brook

GIS and Watershed Management and Planning

Geographic Information Systems (GIS) are computer systems (hardware and software) that are capable of storing, managing, mapping, and analyzing data in reference to location and geographical features. GIS technology is an increasingly valuable tool for watershed planning and management in the province.

Managing a watershed is a complex task because any and all activities that take place inside its boundaries can affect water quality. GIS gives the Water Resources Management Division a common framework—location—on which to layer data obtained from a wide range of sources. The Division’s staff can use GIS to visualize, integrate, analyze, and distribute recorded data about any human and natural phenomena that can be linked to location, including roads, commercial activities, rainfall amounts, and so on. New information can be added as it arises. Using GIS, the Department can use the most up-to-date spatial information in its decision-making about protecting the province’s drinking-water supplies.

The Department of Environment and Conservation shares and distributes its GIS data so that other government departments and development proponents can access accurate information on the location of drinking-water infrastructure. This helps mitigate potential land-use conflicts, as stakeholders can become aware of necessary restrictions related to the protection of drinking-water (and adapt their plans accordingly) early in their planning process.



A watershed buffer-zone map using GIS layers



A watershed delineation map using satellite imagery

- ◆ Corner Brook
- ◆ Gander
- ◆ Grand Falls-Windsor

Step 2: Drinking-Water Treatment

After source-water protection, the next step in ensuring drinking-water safety is water treatment. This involves all the processes, techniques, and systems used to clean, disinfect, and protect water before it is distributed to homes and businesses.

When source-water quality problems are identified, the Department of Environment and Conservation (in consultation with the Department of Municipal Affairs) assesses the water treatment needs of the affected communities. It reviews water quality data, the extent and nature of the water quality problems, and the economic viability of various treatment options, then makes recommendations about the type of treatment plant required to address the problems and the funding required.

Disinfection

Chlorination is the most common disinfection method used in Newfoundland and Labrador. In fiscal year 2007–08, there were 434 chlorine disinfection systems in use in the province:

- ◆ 296 liquid-chlorine systems
- ◆ 129 chlorine-gas systems
- ◆ 9 chlorine-powder systems

Chlorine in any form (solid, liquid, or gas) can both disinfect drinking water and minimize microbial growth in the water distribution system. In addition to being an effective disinfectant, however, its presence can also create disinfection by-products (DBPs) in the distribution system. To ensure safe drinking water, it is essential that chlorine levels be high enough for disinfection to occur but low enough to prevent DBP formation.

Optimal levels of chlorine for disinfection can be obtained by using a “chlorine demand management” protocol. This useful management tool allows the water treatment system to detect and address the conditions that favour the formation of DBPs. Because this management method only adds chlorine as it is needed (and then only in the amounts required), it can also reduce the costs of operating a community chlorination system.

Alternatives to chlorine disinfection currently used in the province are:

Types of chlorination systems in the province 2007-08



Chlorination Building -
Spaniard's Bay

- ◆ ultraviolet radiation (UV)
- ◆ ozonation
- ◆ mixed oxidants (MIOX)

In the UV disinfection process, water passes through an ultraviolet irradiation chamber and the ultraviolet rays de-activate any microbial agents in the water. This process can be used as a primary disinfectant; it is most effective in treating water with low turbidity and colour. Because the UV process leaves no residual disinfection in the water, a secondary disinfectant such as chlorine must also be added to protect the water as it travels through the water distribution system.

Alternatives to chlorination

SMALL TOWN SPOTLIGHT 2007-08

UV Disinfection at the Deer Lake Water Treatment Plant

UV disinfection has been used for many years worldwide to disinfect drinking water and wastewater. Prior to 2001, Deer Lake was under a long-term Boil Water Advisory. The main reason was the presence of giardia cysts in the town's water. In 2001, a second filter was installed at the town's water treatment plant to provide continuous filtration of drinking water, but the problem continued.

In 2003, a UV system was installed to augment chlorination. At the same time, the intake was relocated to provide additional chlorine contact time, and a Watershed Management Committee was established. The use of the UV system helped manage the problem, without having to resort to the cost of installing a full-scale water treatment plant. This multi-barrier approach was seen as the best and most economical solution to Deer Lake's water quality problems.



UV Disinfection Chamber - Deer Lake

Ozone (O₃) is a powerful oxidant—that is, ozone molecules can easily lose one of their oxygen atoms, which can then react with other molecular substances to form oxides. The ozone disinfection process creates ozone by passing dry clean air between two high-voltage electrodes in an ozone generator. The ozone is then injected into the water, where it deactivates microbial agents including giardia and cryptosporidium. Using ozone as a drinking-water disinfectant also removes colour, taste, and odour from the water. As with UV, ozone treatment does not leave any residual disinfection, so secondary disinfection is required in the water distribution system.

The **mixed-oxidant process (MIOX)** uses salt, water, and electricity to produce a concentrated solution of oxidants that disinfects source water and generally improves the taste and odour of drinking water.

Water Treatment Plants in Newfoundland and Labrador

Twelve full-scale water treatment plants are currently in operation in Newfoundland and Labrador. They use a range of treatment processes in addition to disinfection. Eight of these plants are conventional water treatment plants, which use coagulation, flocculation, sedimentation, and filtration—or a combination of these processes—to improve the quality of raw source water. Site-specific water quality problems may require additional treatment. High colour, as well as the presence of iron, manganese, or arsenic, can all be managed using infiltration galleries and filtration units, for example.

In 2006, the Guidelines for Canadian Drinking Water Quality reduced the amount of arsenic considered acceptable, indicating that this substance is becoming a more serious concern. In response to this, communities with values above the current guideline in this province have begun to install arsenic removal systems.

In fiscal year 2007–08, several communities evaluated, installed, or commissioned new water treatment plants. Several have also upgraded their existing chlorination equipment.

One solution for small communities with persistent water quality issues (where conventional water treatment plants are not feasible) is Potable Water Dispensing Units (PWDUs). The Province is planning to provide these small-scale treatment units as part of its new Rural Drinking-Water Safety Initiative. The Province will be setting up PWDUs at centralized locations in communities with ongoing water quality problems. In 2007–08, two new PWDUs were installed (in St. Lawrence and in Howley).



Water Treatment Plant - Gander

The Bay Bulls Big Pond Water Treatment Plant

Built over a period of several years between 1975 and 1979, this plant now services the majority of the population of the City of St. John's, the City of Mount Pearl, and the municipalities of Paradise, Conception Bay South, and Portugal Cove–St. Phillip's. The water treatment process at the facility includes ozonation, direct filtration, pH adjustment, gas chlorination, and ammonization (which allows chloramines to be used for secondary disinfection instead of free chlorine).

In a recent major upgrade (2004), the plant installed a new gas chlorination system, a new ammonia system, and a new lime system. Each of these installations included all related equipment, piping, and controls. In addition, new filter-monitoring equipment was installed, which included flow meters, turbidimeters, clearwell level monitors, and a SCADA system. In 2005 the ozonation system was upgraded.

To investigate how to alleviate algae-blooms that were causing taste and odour problems, a pilot study using dissolved air flotation (DAF) was carried out in 2007. Deemed successful, the study has led the City of St. John's to move forward with installing a permanent DAF system.



*Bay Bulls-Big Pond Water Treatment Plant
(Photo Credit: Lynnann Stapleton)*

*An update on
Potable Water
Dispensing Units,
2007-08*



*The PWDU in Black
Tickle-Domino*

*Challenges faced
by small towns*

To date, Potable Water Dispensing Units have been recommended for 154 public drinking water systems in the province, 120 of these for rural communities with populations of fewer than 501 people. The first PWDUs are scheduled to be commissioned in 2008.

Step 3: The Drinking-Water Distribution System

The water distribution system is the final physical component in water treatment, and the last component in Level 1 of the MBSAP. The water distribution network is also the largest component of a water-supply's physical infrastructure. It includes all the pipes, valves, service lines, pumping stations, fire hydrants, and storage facilities that work together to deliver drinking water to homes, businesses, and industries.

The Atlantic Canada Waterworks Voluntary Certification Board categorizes water distribution systems according to the size of the population they service (Table 1). In Newfoundland and Labrador, “very small” distribution systems are the most common type. Very small systems face two major challenges: successful ongoing operation and maintenance—which includes employing and retaining qualified and trained operators—and administration. Many communities with small systems also serve relatively few people who are spread over a large geographical area, which makes both providing safe drinking water and maintaining the water-supply system demanding tasks. Consequently, Government continues to encourage the concept of regional water systems and regional water operators.

The infrastructure of water distribution systems is inherently subject to leaks and breaks, which can reduce hydraulic capacity and degrade water quality. Proper infrastructure maintenance and repair depend on operators knowing and following best-management practices and operational procedures. (Government addresses this educational need through its Operator Education, Training, and Certification program, see details on page 41) The financial cost of repairing and replacing infrastructure is substantial. In 2007–08, the Department of Municipal Affairs spent \$25.49 million on water-supply infrastructure.

Table 1 - Classification of Water distribution Systems - Fiscal Year 2007-08

Water Distribution System Classification	Population Size	Number of Systems
Systems with an unknown serviced population	n/a	20
Very small systems	500 or less	392
Small systems	501 to 1,500	82
Medium systems	1,501 to 15,000	41
Large systems	15,001 to 50,000	2
Very large systems	More than 50,000	1
Total Number of Systems		538

LEVEL 1 MBSAP

Highlights of 2007-08

- ★ **314** protected water supply areas in the province
- ★ The Department of Environment and Conservation continues to encourage communities to get their water supplies designated as protected
- ★ **Three** new protected public water supply areas designated
- ★ **Five** active watershed management committees
- ★ **434** chlorine disinfection systems in use
- ★ Alternative forms of disinfection are being used across the province
- ★ There are **twelve** water treatment plants operating in the province
- ★ **Eight** of these plants are conventional water treatment plants
- ★ **154** public drinking water systems recommended for PWDUs

*Departmental
sampling
responsibilities*

Part 2: Level 2 of the MBSAP

The five main components of the second level of the Multi-Barrier Strategic Action Plan are:

- ◆ monitoring
- ◆ inspection and enforcement
- ◆ data management and reporting
- ◆ operator education, training, and certification
- ◆ corrective measures

This chapter outlines what is involved in each of these components.

Monitoring

The Departments of Environment and Conservation and Government Services work together to monitor the drinking-water quality of all public water supplies in Newfoundland and Labrador.

Table 2 - Water Quality Monitoring Responsibilities by Department

Department of Environment and Conservation	Department of Government Services
Monitors source water (surface-water and groundwater) and tap-water for chemical and physical parameters	Monitors tap-water for bacteria and residual chlorine concentrations

Some communities in the province monitor water quality parameters themselves. Some also monitor their water for specific parameters for operational purposes necessary in water treatment plants.

“Monitoring” water quality involves collecting samples in a regular and consistent fashion so that they can be analyzed and compared to the Guidelines for Canadian Drinking Water Quality. In addition to the samples it collects to be tested for chemical, physical, and biological parameters, the Department of Environment and Conservation’s Water Resources Management Division also designs special monitoring programs to address site-specific characteristics and/or emerging issues.

The Province’s Standards for Chemical and Physical Monitoring of Drinking Water outlines the minimum number of parameters that should be monitored at all sites as part of the province’s drinking-water

quality program. These standards also outline the required frequency of sampling and the locations at which samples are taken. They are available online at:

www.env.gov.nl.ca/env/Env/waterres/Policies/WQ-Standard-PhysicalChemical.asp

Monitoring water over months and years can indicate water quality trends (and also stability) and show if the quality of a community's water is improving or deteriorating. This long-term data allows Government to note changes and determine if source protection needs to be reviewed or corrective measures introduced or revised.

Sample Collection

To ensure that water quality data is reliable, the Division's staff must follow a standard protocol or method when they collect samples. This protocol is outlined in the *Drinking-Water Quality Monitoring Manual: Physical and Chemical Parameters*, which is available online at:

www.env.gov.nl.ca/Env/Env/waterres/Surfacewater/DWQ%20Manual/DWQMonitoringManual.asp

Chemical and Physical Water Quality

Below are the chemical and physical parameters that the samples collected in the province are analyzed for:

- ◆ inorganics (metals, nutrients, physical parameters and major ions)
- ◆ trihalomethanes (THMs)
- ◆ haloacetic acids (HAAs)
- ◆ emerging or special parameters

Issue analysis of historical sampling results guides how the Department of Environment and Conservation designs its annual drinking-water quality sampling schedule for most chemical and physical parameters. Trihalomethanes and haloacetic acids samples are collected quarterly because the Guidelines for Canadian Drinking Water Safety are based on annual running averages for these parameters. Samples for inorganic parameters are collected twice a year (quarterly, in some circumstances) for tap-water. For source-water, the Department rotates which sources get sampled from year to year - on average most communities have their sources sampled every two years. During the year the sources are sampled, inorganic samples are collected twice a year.

Drinking Water Quality Monitoring Manual



Inorganic Sample Bottles



THM and HAA Sample Bottles

Samples taken in 2007-08

The Department's 2007-08 sampling schedule called for 2,847 samples to be collected:

- ◆ 277 inorganic from source water
- ◆ 1,044 inorganic from tap-water
- ◆ 1,148 trihalomethane (THMs)
- ◆ 378 haloacetic acids (HAAs)

Table 3 gives a breakdown of the samples taken in 2007-08. In fact, about 400 fewer samples than scheduled were actually collected during the year. The reasons for the difference between scheduled and actual numbers of samples taken included: site inaccessibility, lack of chlorination, sample spoilage, and staff vacancies.

Table 3 - Overview of Chemical/Physical Sampling Activity, 2007-08

Parameter	Number of Source Samples			Number of Tap Samples		
	Surface	Ground	Total*	Surface	Ground	Total*
Inorganic Parameters	137	130	267	576	289	865
THMs	THMs are a result of chlorination, thus are not found in source water samples			930	27	957
HAAs	HAAs are a result of chlorination, thus are not found in source water samples			303	13	316
Special Samples*	0	0	0	0	0	0

*Note - This refers to samples for parameters which are not included in the standard sampling program (i.e. radiological parameters). It does not include four special source water samples, 10 special tap samples, eight special THM samples and six special HAA samples which were also taken, but are not shown in this table.



Tap-water Quality Sampling

In the coming fiscal year (2008–09), significantly more samples (4,300) are scheduled because of the new guideline and sampling protocol for HAAs (see box on page 26). Sampling for HAAs must now be done quarterly in all communities.

Additional HAA sampling for 2008-09

Bacteriological Water Quality

Under the direction of the Department of Government Services, Environmental Health Officers collect samples from public drinking-water supplies for analysis of bacteriological parameters. The frequency of this sampling is related to the size of the population that the water-supply services (as outlined in Table 4). During the 2007–08 fiscal year, 19,757 bacteriological samples were collected from public drinking-water supplies.

Table 4 - Bacteriological Sampling Frequency

Population Served (number of people)	Sampling Frequency (per month)
Fewer than 101 or no distribution system	One sample
Fewer than 5,001	Four samples
5,001 to 90,000	One sample per 1,000 population
More than 90,000	90 samples plus one sample per additional 10,000 population

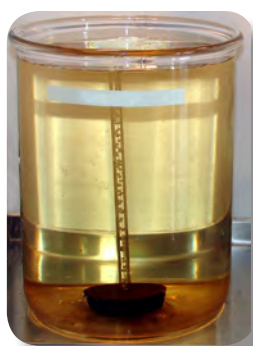
Sample Analysis

In 2001, the province of Newfoundland and Labrador adopted the chemical and physical guidelines for safe drinking water that are outlined in the Guidelines for Canadian Drinking Water Quality, published by Health Canada. The guidelines are updated as necessary; a summary is posted online at:

www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/water-eau/doc-sup-appui/sum_guide-res_recom/summary-sommaire_e.pdf

Guidelines for Canadian Drinking Water Quality

*Analytical lab
used for sample
analysis, 2007-08*



Highly Coloured Water

Drinking-water samples collected in the province are analyzed as outlined below, and the results are compared to the safe levels outlined in the Health Canada guidelines.

Water Quality Analysis: Chemical and Physical Parameters

The Department of Environment and Conservation submits all the water samples it collects to external laboratories for analysis. The laboratories must be accredited, a designation that ensures they are competent to perform sample analysis.

The tender for water quality sample analysis for chemical and physical parameters in the 2007–08 fiscal year was awarded to MAXXAM Analytics, Inc.

<http://www.maxxam.ca/index1.asp>

Water quality Monitoring Results: Chemical and Physical Parameters

Water quality parameters that exceeded guideline values in tap-water quality samples during the 2007–08 fiscal year are noted in Tables 5 and 6, and are discussed below.

RESULTS: AESTHETICS

Aesthetic parameters pose no direct health or safety concerns. They may affect water's taste, colour, and odour, however, and as a result they can negatively affect consumers' opinions of drinking-water quality. Aesthetic parameters can also help determine the operational efficiency of a water system, and may highlight a need to make operational changes to the disinfection, treatment, or distribution systems.

During the 2007–08 sampling year, several aesthetic parameters exceeded the objectives outlined in the Guidelines for Canadian Drinking Water Quality (see below and Table 5 for details). They included pH, chloride, colour, copper, iron, manganese, total dissolved solids, sodium, and sulphate. Colour and pH exceedances were the most common and widespread in the province.

Table 5 - Aesthetic Parameter Exceedances, 2007-08

Aesthetic Parameter	GCDWQ Aesthetic Objective (AO)		Number of Exceedances (number of tap samples)
pH	6.5 to 8.5	< 6.5	223
		> 8.5	10
Chloride	> 250 mg/L		2
Colour	> 15 TCU		386
Copper	> 1.0 mg/L		5
Iron	> 0.3 mg/L		139
Manganese	> 0.05 mg/L		104
Sodium	> 200 mg/L		2
Sulfate	> 500 mg/L		4
TDS	> 500 mg/L		12

Aesthetic parameter exceedances, 2007-08

Note: pH levels do not have a unit measure; TCU refers to True Colour Units.

- pH** – (243 exceedances) The pH value measures the acidity of water. A low pH, which indicates higher acidity, accelerates the corrosion of pipes and fittings. A high pH encourages scaling in the distribution system. Low pH levels are common in many areas of the province, mostly where source water originates in watersheds with a large number of bogs. Water in a bog environment typically has a pH value of between three and four (a value of seven on the pH scale is neutral—neither base nor acid). There were fewer pH exceedances in 2007-08 than in the previous fiscal year.
- Chloride** – (2 exceedances) Chloride in drinking-water can come from salt used on highways to control ice and snow, effluents from chemical industries, oil-well operations, sewage, irrigation drainage, and landfill leachates. Natural causes include the dissolution of salt deposits, sea spray, and saltwater intrusion. Each of these sources can lead to local contamination of surface

Overall, there were fewer aesthetic exceedances in 2007-08 than in the previous year

water and groundwater. There was the same number of chloride exceedances in 2007-08 as there were in the previous fiscal year.

- ◆ **Colour** – (386 exceedances) Drinking water appears coloured usually because coloured organic substances (such as organic debris or leaves) or metals (such as iron, manganese, or copper) are present. Additional factors that can affect colour are activities in the water-supply's watershed and the watershed land-cover characteristics. For example, drinking-water supplies that are fed by water from bogs or peatlands may have a reddish-brown colour because of the humic acids, tannins, and lignins carried in from the wetlands. Elevated levels of colour in source water can be more than an aesthetic concern because some substances that cause colour can contribute to the formation of trihalomethanes (see chemical parameters, page 24). There were fewer colour exceedances in 2007-08 than in the previous fiscal year.
- ◆ **Copper** – (5 exceedances) Copper is usually found in drinking-water samples as a result of corrosion in copper piping systems. Elevated levels of this metal can stain fixtures a blue-green colour, and may give the water a bad taste. There were fewer copper exceedances in 2007-08 than in the previous fiscal year.
- ◆ **Iron** – (139 exceedances) A naturally occurring element, iron is often found in drinking-water source supplies in this province. Elevated iron levels can also be caused by the dissolution of iron piping in the distribution system. High iron levels can leave a brown stain on plumbing fixtures and other household items and adversely affect the taste of the water. There were slightly more iron exceedances in 2007-08 than in the previous fiscal year.
- ◆ **Manganese** – (103 exceedances) Manganese is another naturally occurring element common in both surface and groundwater in this province. Elevated levels of manganese can stain plumbing fixtures and other household items and adversely affect the taste of drinking water. There were slightly more manganese exceedances in 2007-08 than in the previous fiscal year.
- ◆ **Sodium** – (2 exceedances) When sodium concentrations are above the aesthetic objective outlined in the guidelines, the taste of the drinking water is generally considered offensive. In addition, despite the fact that sodium itself is not a toxic element—adults normally consume up to 5 grams of it each day—even small amounts can be a concern for people with health issues

who must follow a sodium-restricted diet. There were fewer sodium exceedances in 2007-08 than in the previous fiscal year.

- ◆ **Sulphate** – (4 exceedances) Sulphate is considered an aesthetic parameter because it affects taste. Discharged by industries that use sulphates and sulphuric acid, such as mining and smelting operations, sulphate makes its way into surface water mainly through atmospheric deposition. The presence of sulphate in surface water often correlates with the sulphur dioxide levels in emissions from industrial or other human sources. There was the same number of sulphate exceedances in 2007-08 as there were in the previous fiscal year.
- ◆ **Total Dissolved Solids (TDS)** – (12 exceedances) These are mainly inorganic substances that are dissolved in water. In addition to affecting the taste of drinking water, high levels of TDS can make the water excessively hard, which leads to mineral deposits and corrosion. There were fewer TDS exceedances in 2007-08 than in the previous fiscal year.

RESULTS: CONTAMINANTS

Contaminants are substances that are either known or suspected to cause adverse health effects when they are present in drinking water in amounts greater than the established maximum acceptable concentration set by the Guidelines for Canadian Drinking Water Quality. A description of the Department's exceedance reporting protocol can be found on page 39.

The 2007–08 contaminant exceedances in tap-water samples are outlined in Table 6. Exceedances were detected for arsenic, barium, bromodichloromethane (BDCM), chromium, fluoride, lead, mercury, turbidity, and trihalomethanes (THMs). The nature of these contaminants is described below.

Table 6 - Contaminant Parameter Exceedances, 2007-08

Contaminant Parameter	GCDWQ Health-based Guideline	Number of Exceedances (number of tap samples)
Arsenic	> 0.01 mg/L	13
Barium	> 1 mg/L	2
BDCM	> 16 µg/L	46
Chromium	> 0.05 mg/L	1
Fluoride	> 1.5 mg/L	1
Lead	> 0.01 mg/L	1
Mercury	> 0.001 mg/L	1
THMs*	> 100 µg/L	111
Turbidity	> 1 NTU	47

Contaminant Exceedances, 2007-08

* The THM guideline is based on quarterly averages for communities and not on individual samples.

- ◆ **Arsenic** – (13 exceedances) A natural element, arsenic is widely distributed in the Earth's crust. It can make its way naturally into groundwater through the erosion and weathering of soils, minerals, and ores. Because arsenic compounds are used to manufacture many products, arsenic can also enter drinking-water sources directly as a result of industrial effluents and indirectly through atmospheric deposition. There were fewer arsenic exceedances in 2007-08 than in the previous fiscal year.
- ◆ **Barium** – (2 exceedances) Barium is more often found in groundwater than surface water. A natural element, it is introduced to a water source through the erosion and weathering of soils, minerals, and ores. All of the barium exceedances in the province during 2007–08 were in groundwater-based water-supply systems that had a history of elevated barium levels—there were no new locations where this contaminant was detected.

There were two barium exceedances in 2007-08, while there were none in the previous fiscal year.

- ◆ **Bromodichloromethane (BDCM)** – (46 exceedances) This is one of the most commonly found trihalomethanes in drinking water. The Guidelines for Canadian Drinking Water Quality include BDCM in its concentration parameters for trihalomethanes, but a separate guideline for BDCM was also deemed necessary. There were slightly more BDCM exceedances in 2007-08 than in the previous fiscal year.
- ◆ **Chromium** – (1 exceedance) Chromium is another natural element that is widely distributed in Earth's crust. It is often introduced into groundwater through the erosion and weathering of soils, minerals, and ores. The single chromium exceedance detected in the province during 2007-08 was later determined to be a false reading. Re-sampling indicated that chromium levels in the affected water-supply were below the guideline limit.
- ◆ **Fluoride** – (1 exceedance) Fluoride in drinking water is often caused by the dissolution of naturally occurring ore. It comes from groundwater sources, which it enters through erosion and weathering of soils, minerals, and ores. The fluoride exceedances detected in the province during 2007-08 were found in groundwater-based water-supply systems that had a history of elevated fluoride levels.
- ◆ **Lead** – (1 exceedance) Corrosion of plumbing fixtures that contain lead (which can be used in pipes, solder, or service connections) usually is the reason behind elevated levels of lead in drinking water, though it can also be introduced from natural sources. There were slightly more lead exceedances in 2007-08 than in the previous fiscal year.
- ◆ **Mercury** – (1 exceedance) A heavy metal found naturally in Earth's crust, mercury is introduced into groundwater through the erosion and weathering of soils, minerals, and ores. One mercury exceedance was detected in the province during the 2007-08 sampling. It was determined to be a false reading; re-sampling established mercury levels in the affected water-supply were below the guideline.
- ◆ **Trihalomethanes (THMs)** – (111 exceedances) THMs are disinfection by-products that form when chlorine is added to water

Overall, there were fewer contaminant exceedances in 2007-08 than in the previous year

that contains elevated levels of natural organic matter. High THM levels are very common for surface-based public water supplies in Newfoundland and Labrador (see information box on page 30) because so many of them contain high levels of natural organic matter. Formation of disinfection by-products continues to be an issue in the province that is being addressed through chlorine demand management and exploration of treatment alternatives. There were fewer THM exceedances in 2007-08 than in the previous fiscal year.

A New Guideline - Haloacetic Acids

Haloacetic acids (HAAs), a type of disinfection by-product, are formed when naturally occurring organic matter reacts with the chlorine used to disinfect drinking water ("Organic matter" includes decaying leaves, branches, and other dead plant life).

The Department of Environment and Conservation began monitoring for haloacetic acids in 1999, in order to collect baseline information on HAA concentrations in the province. The data collected contributed to the development of a new national guideline, which was included in the Guidelines for Canadian Drinking Water Quality in January, 2008.

HAA levels are generally highest in fall and lowest in winter. The HAA guideline is based on an annual average of quarterly samples (at a minimum), which allowed seasonal variations to be taken into account. The new HAA guideline is 80 µg/L. The highest levels of HAAs are generally found in disinfected water that comes from surface sources such as rivers and lakes, which have high organic matter content. Groundwater sources usually have lower HAA levels. In an individual water supply, HAA levels can vary by season, due to source-water temperature, amount of natural organic matter in the water, pH, quantity of chlorine added, the point of chlorination, the time in the distribution system, and other factors such as the treatment processes used. Municipalities should make every effort to maintain HAA concentrations that are as low as can reasonably be achieved without compromising the effectiveness of chlorine disinfection.

- ◆ **Turbidity** – (47 exceedances) Turbidity is a measure of water’s inability to transmit light—it’s “cloudiness,” in other words. Turbidity in source waters is usually caused by suspended solids, natural substances such as clay or silt, or micro-organisms. In tap-water samples, turbidity can reflect either the characteristics of the source water or conditions in the distribution system. High turbidity alone is not considered harmful, but its presence can reduce the effectiveness of disinfection treatments. Elevated turbidity levels are common in surface-based public water supplies throughout the province. Improving source protection and introducing treatment alternatives can help reduce levels of this parameter. There were fewer turbidity exceedances in 2007-08 than in the previous fiscal year.

Water quality Analysis: Bacteriological Parameters

The provincial Public Health Laboratory performs sample analysis for bacteriological parameters. Samples are also tested at its affiliated regional testing sites. The Province compares the results to its own bacteriological standards (outlined in Standards for Bacteriological Quality of Drinking Water), which are based on the Guidelines for Canadian Drinking Water Quality. They can be found online at:

www.env.gov.nl.ca/Env/env/waterres/Policies/WQ-Standards-Microbiological.asp

In 2007–08, the bacteriological testing of water samples was directed to report on *E. coli* and total coliforms.

RESULTS: BACTERIOLOGICAL PARAMETERS

The Department of Government Services collected 19,757 bacteriological samples from public drinking-water systems throughout in the province during the fiscal year. Less than one per cent of them (133 samples) tested positive for the presence of *E. coli*, and approximately four per cent (747 samples) tested positive for the presence of total coliforms. Table 7 provides details about these samples.

Overall, there were fewer bacteriological exceedances in 2007-08 than in the previous year

Table 7 - Bacteriological Test Results from Public Water-Supplies, 2007-08

Samples	Department of Government Service Region					Totals
	Avalon	East	Central	West	Labrador	
Number of samples tested	6670	2145	4710	4609	1623	19757
Number of samples positive for total coliforms	103 (1.5%)	77 (3.5%)	274 (5.8%)	221 (4.8%)	72 (4.4%)	747 (3.78%)
Number of samples positive for <i>E. coli</i>	10 (0.15%)	16 (0.75%)	24 (0.5%)	45 (0.98%)	38 (2.3%)	133 (0.67%)

- ◆ ***Escherichia coli (E. coli)*** – *E. coli* is a bacterium that lives naturally in the lower intestines of humans and animals. The presence of *E. coli* in a water sample is a definite indicator of fecal contamination. If *E. coli* is present in a water sample, it means either that there was a deficiency in the water treatment process, or that post-treatment contamination was occurring. This situation must be investigated immediately. There were fewer *E. coli* exceedances in 2007-08 than in the previous fiscal year.
- ◆ **Total coliforms** – Coliform bacteria are generally found in the feces of warm-blooded animals, but they can also survive in aquatic environments, soil, and vegetation. They are widely used as an indicator organism in water sampling because the analysis required to detect them is relatively simple and it can be detected even in small amounts. If total coliforms are detected in concentrations greater than the guidelines, it can indicate that water treatment is inadequate or that bacteria are infiltrating or regrowing in the distribution system. The presence of coliform bacteria requires immediate investigation. There were fewer total coliform exceedances in 2007-08 than in the previous fiscal year.

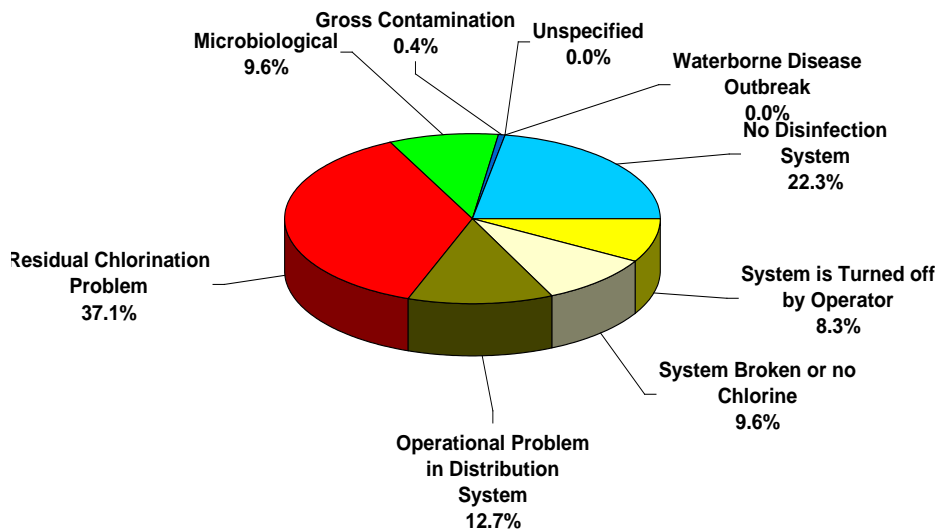
Boil Water Advisory Status 2007–08

The Department of Government Services issues a Boil Water Advisory (BWA) when it has is reason to suspect pathogen contamination of a community’s drinking water. BWAs are necessary to protect human health and are usually temporary. When a Boil Water Advisory is repeatedly issued to the same community, however, the community may have to make modifications to its drinking-water system and/or to related operation and maintenance activities.

The Department of Environment and Conservation maintains an inventory of current BWAs on its website:

<http://www.env.gov.nl.ca/Env/env/waterres/CWWS/Microbiological/BoilWaterAdvisories.asp>

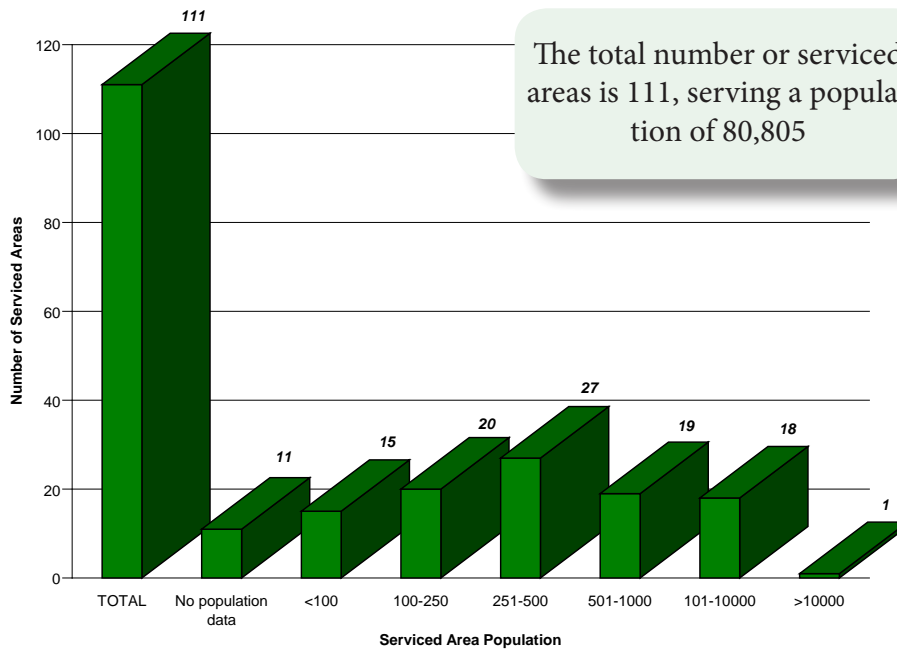
Reasons for Boil Water Advisories



Trihalomethanes (THMs) in Newfoundland and Labrador, 2007-08

Trihalomethanes (THMs) are disinfection by-products that are found in tap-water samples of supplies that use chlorination to disinfect their water. When chlorine comes in contact with high levels of organic matter in the water, THMs are formed. The majority of water-supplies in Newfoundland and Labrador use surface-water sources, which often have elevated levels of organic matter. The graph below summarizes the population that experiences high levels of THMs (above the current Guideline for Canadian Drinking-Water Safety - 100 µg/L) in the Province. THM formation can be minimized through the use of chlorine demand management, as well as through treatment to remove the precursors to THM formation from the water.

Population Exposed to THM Levels Above the Guideline (100 µg/L)



Inspection and Enforcement

Permits

Every public drinking-water system in the province must be issued a Permit to Operate by the Department of Environment and Conservation, according to the *Water Resources Act, 2002*. Permits establish minimum operating standards that will ensure that clean and safe drinking water is delivered to consumers.

During the 2007–08 fiscal year, 381 permits were issued that dealt with various components of water-supply and sewer systems (such as construction and operation).

The Department of Environment and Conservation issued 45 additional permits that regulated how activities in Protected Public Water-Supply Areas should be conducted in order to ensure the integrity of drinking-water sources. They covered a variety of activities, including cabin use, forestry (domestic, commercial harvesting, silviculture), installing utility lines, operating quarries, and the use or construction of roads and trails.

Water-supply and sewer system permits, 2007-08

Protected water supply area permits, 2007-08

Why Is Complying with a Permit Important?

Compliance with the terms of a Permit to Operate is advantageous for communities because:

- ◆ proactive and timely maintenance means a more efficiently operated water system
- ◆ the water that efficient and well-maintained systems deliver to residential taps is consistently of high quality
- ◆ proactive operation and maintenance programs extend the useful life of municipal infrastructure. Municipal water systems have an infrastructure that is expensive to install and replace

This is why government departments that are requested to fund infrastructure upgrades or replacement first ask whether municipalities have been compliant with their Permits to Operate. When provincial financial resources are requested, priority is given to those who operate and maintain their systems in a proactive and effective manner, according to their Permits to Operate, and to the established best practices of the industry.



Investigation at Lourdes with a town council official from the community - see information box on page 35

Permits are also required to drill or dig a non-domestic well, and must be obtained before construction begins. No non-domestic well permits were issued during the 2007–08 fiscal year.

A Highlight on Permits to Operate

The Province has invested considerable time and resources to the Permits to Operate component of the MBSAP. The permit to operate program was designed to focus municipal government leaders (and operators) on the basic activities necessary to develop and practise proactive operation and maintenance programs. Specifically, the permits highlight the importance of:

- ◆ regular, timely monitoring and inspection activities
- ◆ performing maintenance tasks in accordance with recommended manufacturer's instructions
- ◆ operator education, training, and certification
- ◆ regularly recording data and thorough record-keeping

The Permits to Operate were designed to be used as tools. Over time, however, the Department of Environment and Conservation has realized that some communities simply filed them away, instead of copying them to operators or using them as a reference for complying with regulations. It became clear that a follow-up inspection program that would compel municipal councils and committees to refocus on the content of their permits was required. The Department has limited staff and resources to devote to this task, however, so it chooses to use compliance-assurance reporting forms. Consequently, operators or municipal leaders are required to review these forms at a town council (or committee) meeting, to answer questions related to their Permits to Operate, and to sign an affidavit that confirms their review. Departmental staff provide assistance to municipalities that request help in understanding and complying with the terms of their permits.

With this new reporting regime, the Department hopes to achieve significant improvements in operation and maintenance awareness across the province, as well as associated improvements in system management and enhanced consumer confidence.

Inspection

The Department of Environment and Conservation requires that all public waterworks be maintained and operated sustainably, as prescribed by the *Water Resources Act, 2002*. The first step to ensure that this happens is informal inspections (site visits) of a facility. If problems are reported or

observed on a site visit, the Department follows up with a formal inspection. In the 2007–08 fiscal year, there were 135 water- and sewer-related inspections of public waterworks.

The *Water Resources Act, 2002*, also governs the construction and maintenance of public groundwater wells, and inspections are carried out to ensure that communities comply with permit specifications. In the 2007–08 fiscal year, the Department conducted 133 inspections of public groundwater supplies. Eleven inspections were made of protected public surface-water supplies.

Enforcement

The *Water Resources Act, 2002*, regulates:

- ◆ changes to public water-supply and sewer systems
- ◆ development activities within watersheds
- ◆ the licensing of water-well drillers

Water Resources Management Division staff conduct regular inspections of water-supply systems to ensure that they comply with the terms and conditions of their permits. When proponents do not comply with the conditions of their permits, the Department acts to enforce the regulations of the *Water Resources Act, 2002* as needed.

Enforcement initiatives are always difficult to design and implement, and punitive actions are seldom productive in achieving desired results. The Department would rather work with municipalities to identify their weaknesses (and their strengths) and focus attention on areas needing improvement. Its goal is to achieve clean and safe drinking water, in a sustainable and efficient manner.

Water and sewer-system related inspections, 2007-08

SMALL TOWN SPOTLIGHT 2007-08: Incident and Response in a Protected Public Water Supply Area, Black Tickle–Domino

At about noon on a stormy November 20, 2006, the power went off in Black Tickle-Domino. Newfoundland and Labrador Hydro personnel investigating the outage discovered that freezing rain and high winds had downed a transformer structure located about 150 metres from the edge of Martin's Pond, the community's water supply. Three transformers were on the ground, and two of them—severely damaged—were leaking oil.

The on-site investigators immediately reported the oil spill to the relevant government agencies and the town council, then returned to the site to begin their oil-spill response efforts. First, absorbent materials were used to recover as much oil as possible (it was estimated that about 175 litres of NON-PCB transformer oil had leaked). All contaminated snow and ice in the immediate area of the spill was recovered in salvage drums. These actions recovered between 75 and 100 litres of the oil.

Twelve soil samples were taken in the spill area and analyzed for their oil contamination concentrations. The results indicated that only some of the soil in the immediate area of the spill was contaminated: the initial response had contained the accident's potential impact to a localized area at the base of the structure. Because the ground cover was frozen and covered by snow and ice, however, no contaminated soil was removed from the spill area in 2006.



Downed and leaking transformers

On September 27, 2007, a permit for “development activity” in a Protected Public Water Supply Area was issued to Newfoundland and Labrador Hydro, who then cleaned up the remnants of the spill. They sampled and removed contaminated soil, removed old poles and anchor boxes, and replaced the downed structure with untreated poles.

SMALL TOWN SPOTLIGHT 2007-08: Investigating Turbidity in the Lourdes Protected Water Supply Area

On October 22, 2006, the Department of Environment and Conservation received a complaint from the Town Clerk of Lourdes about turbidity in Victor's Brook, the drinking water source for the community (population 650).

There was concern that the turbidity could cause problems with the town's new multi-million dollar water treatment facility. These problems could include increased chlorine consumption, maintenance issues, and low chlorine residuals that could lead to Boil Water Advisories, along with the associated health risks for citizens sensitive to such changes.

Investigation of the situation determined that mineral exploration in the Protected Public Water Supply Area, together with extremely wet conditions, had caused the event. The exploration company was immediately ordered to stop its activities in the area and to rehabilitate affected locations.



Lourdes after rehabilitation

Data Management and Reporting

Data Management

The Department of Environment and Conservation's drinking-water quality database and reporting system is a critical component in the management and reporting of drinking-water data. This comprehensive database stores the results from all chemical analyses of source-water, and tap-water samples taken in the provincial chemical and physical water quality monitoring program. It also stores other essential information used to manage the program.

Before each quarterly sampling period begins, the drinking-water quality sampling schedule is reviewed and updated to reflect the latest changes in the public water-supply list. Customized bottle labels, field sheets, and the new schedule are then printed and sent to field staff. A month after the end of each season, the laboratory supplies the Department with sample analysis reports in both electronic and printed formats. This data,

*Development
of web-based
applications*

along with information reported by staff on the field sheets, is added to the drinking-water quality database.

The new data then goes through a comprehensive Quality Assurance/Quality Control (QA/QC) procedure, which usually takes about six weeks depending on the number of issues that arise and the size of the dataset. When the QA/QC procedure is complete, individual reports are printed and mailed to each community. Summary reports are posted on the Department's website:

<http://www.env.gov.nl.ca/env/env/waterres/Surfacewater/Drinking/DrinkingWater.asp>

A critical software tool used in managing, analyzing, and organizing drinking-water quality data is the enterprise-level Oracle database-management system. With this system, data can be used in both tabular and geographic information system (GIS) formats, and shared more effectively amongst software applications. It also allows links to be created between spatial data (such as public water-supply boundaries) and tabular-attribute data (such as water quality sampling results).

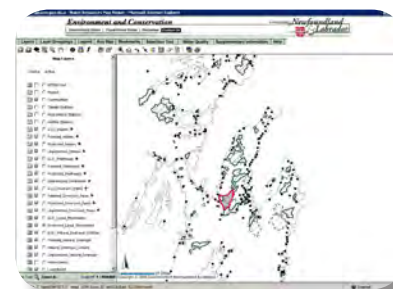
To further improve data sharing and program delivery, the Department of Environment and Conservation has continued to migrate to new web-based applications that are linked into the enterprise-level Oracle database system. During the 2007–08 fiscal year, the continuing work to develop these internal web applications included these tasks and accomplishments:

- ◆ Phase 2 of an enhanced version of the “Drinking-Water Quality Sampling Schedule Application” was completed. This application reconciles scheduled sampling against the work that staff actually completed during the field program. Summary information is created seasonally or annually, and comments can be added to explain missed samples.
- ◆ Preparation for the 2008–09 implementation of the new HAA guideline. This work included:
 - implementing and testing database structures and relations
 - designing an application that could perform the required calculations and write the values to the database, which included integrating the new guideline into the Drinking Water Quality Index.
- ◆ Work on the web application for the Newfoundland and Labrador Canadian Water Quality Index (CWQI) calculator neared completion. The application is almost through its testing phase; it is anticipated that development will be completed early in the 2008–09 fiscal year.

- ◆ The internal drinking-water quality web-based GIS application was successfully updated and the new application is now in use by staff.
- ◆ The screen appearance of the Drinking-water Quality Search Engine was revamped using a new toolset. This toolset will be used in the future to give all internal web applications a common “look and feel.” The application is near the end of the testing phase; it is anticipated that development will be completed early in the 2008–09 fiscal year. Highlights of the redesigned search engine include:
 - a multi-tab interface that retrieves all data types (such as source water, tap-water, THMs) in one action, and can also export search results to Excel
 - detailed data-summary functions that can be tailored to season, fiscal year, or parameter
- ◆ Development of a web application for a water treatment plant inventory began. The work accomplished to date includes:
 - implementing and testing database structures and relations
 - preliminary design of a web application that will allow users to view and edit information about water treatment plants

The Department of Environment and Conservation continues to use the drinking-water quality web-based GIS application it developed and deployed (for internal use) in the 2003–04 fiscal year. This application allows water quality records and the spatial aspects of water supplies to be analyzed. In 2007–08, the Department received funding through the federal government’s GeoConnections program to make the application accessible to the public. The project will also update the application so it can use new GIS server technology, and create web services that are compatible with the Canadian Geospatial Data Infrastructure, so they can be accessed and used by other web applications. This work should be completed before the end of the next fiscal year.

In 2002, in order to make it easier for government departments to share water-supply and water quality information, the Municipal Information Management System (MIMS) was created. Managed by the Department of Municipal Affairs, MIMS is a database with several modules that hold basic information on the province’s municipalities, including their waste-management facilities, capital works, financial details, municipal profiles, and water supplies. MIMS continues to be enhanced when needed improvements are identified.



A screen-shot of the GIS Web Application

A new public web portal, funded by GeoConnections

The Municipal Information Management System

Data-management services are essential to the designation of Protected Public Water-Supply Areas. The data-management staff prepares much of the documentation for the Interdepartmental Land Use Committee (ILUC) process, including creating the initial boundary map for the watershed or wellhead, the legal description of the area, and a digital file of the new boundary.

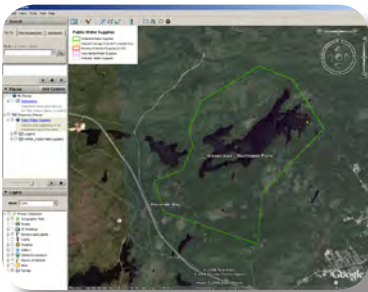
The ILUC review process sometimes results in changes to a protected watershed or wellhead boundary. After the protected-area designation process is completed, a notice is published in the Newfoundland Gazette and the digital file of the final boundary is moved from the ILUC GIS layer to the Protected Supplies GIS layer, which makes it available to all departments and agencies on the internal government network. These boundaries can be viewed by the public in Google Earth. In addition, stand-alone shape files that show the boundaries of Protected Water-Supply Areas are made available to the public and updated regularly on the web page:

www.env.gov.nl.ca/Env/env/waterres/GIS/PWS/PWSLayer.asp

Reporting

The Department began the practice of sending annual and quarterly reports on drinking-water quality to the communities where water samples have been taken in 2001. Depending on the type of sampling performed, these reports contain results of source, tap, THM, and HAA analysis, and the summary tools used—the Water Quality Index (WQI) and the Langelier Index.

During the 2007–08 fiscal year, 1,229 reports were generated and mailed. The breakdown is shown in Table 8. These reports include sampling data for their respective seasons for all inorganic parameters, THMs and HAAs. The reports also include a calculated Langlier Index and Drinking Water Quality Index to help communities better understand what the data means to them as consumers.



View of a Protected Public Water Supply Area boundary in Google Earth

Table 8 - Breakdown of Community Reporting, 2007-08

2007-08 Reports	
Timing of Distribution	Number and type of reports
Spring 2007	237 quarterly reports
Summer 2007	249 quarterly reports
Fall 2007	429 quarterly/annual reports
Winter 2008	314 quarterly reports

Annual and quarterly reports to communities, 2007-08

The contaminant exceedance reporting protocol implemented in 2001 continues to be successful in ensuring prompt communication with communities and relevant government agencies and departments when exceedances above maximum acceptable concentrations are detected in drinking water samples. When the Department receives an exceedance notification from the lab, a confirmation of receipt is faxed back immediately. A letter explaining the exceedance and whether or not a resample is required is then sent via facsimile, email or mail to the town and to members of the Department of Government Services, Municipal Affairs, and Health and Community Services. In cases where it is a new exceedance for a particular parameter, a resample is taken as soon as possible, to confirm that the initial sample was accurate.

Contaminant exceedance reporting

In the 2007–08 fiscal year, the contaminant exceedance reporting protocol was used to report eighty exceedances to the affected communities, as outlined below:

- ◆ Spring 2007: 20 sample exceedances (3 source, 17 tap)
- ◆ Summer 2007: 18 sample exceedances (3 source, 15 tap)
- ◆ Fall 2007: 24 sample exceedances (0 source, 24 tap)
- ◆ Winter 2008: 18 sample exceedances (10 source, 8 tap)

Contaminant exceedance reports, 2007-08

The Department of Environment and Conservation’s website is also an important tool for communicating with the public. It is updated regularly with new information on drinking-water quality and related topics. Information posted throughout the 2007–08 fiscal year included:

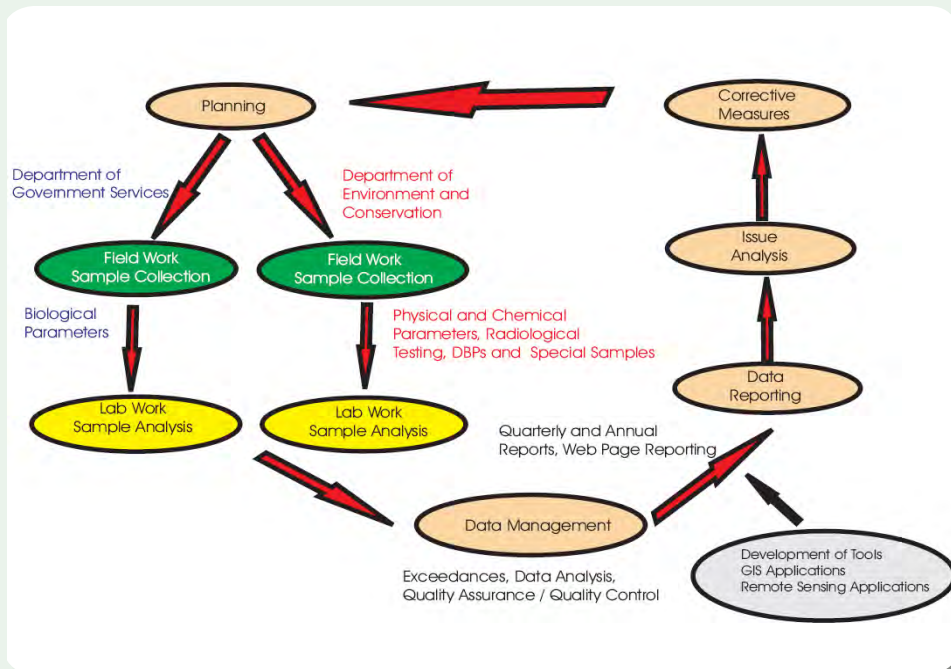
- ◆ quarterly drinking-water quality reports for source and tap-water, THMs, HAAs (including the Drinking Water Quality and Langelier indices):

Updates to the Department's website, 2007-08

- Winter 2007, posted May 22, 2007
- Spring 2007, posted October 9, 2007
- Summer 2007, posted December 21, 2007
- Fall 2007, posted February 29, 2008
- ◆ the 2006–07 Chemical Drinking Water Quality Monitoring Schedule (April 1, 2006 to March 31, 2007) (posted May 3, 2007)
- ◆ an inventory list of water and wastewater treatment plants (posted November 29, 2007)
- ◆ the Municipal Guide to Developing a Watershed Management Plan. This step-by-step guide for communities explains the process of developing a drinking water source protection plan. It was developed in partnership with the Western Newfoundland Model Forest (posted November 2, 2007)
- ◆ the Water Quality of Dug Wells Lined With Galvanized Steel Culverts report (posted October 12, 2007)
- ◆ an article on the process of developing the Forestry Water quality Index Calculator 1.0 (posted April 30, 2007)

The Drinking Water Information Management System

The steps involved in the Department's management system are represented graphically below:



Operator Education, Training, and Certification (OETC)

The Department of Environment and Conservation has developed a long-term strategic plan for educating and training the province's water-system operators. Its unique approach provides operators with both education and hands-on training opportunities focussed on four key areas:

- ◆ job competency
- ◆ drinking-water safety
- ◆ environmental protection
- ◆ infrastructure sustainability

The Operator Education, Training, and Certification (OETC) program, the first of its kind in Canada, was developed specifically for small rural communities. It is offered to all municipalities in the province, regardless of their size or fiscal capability.

Operator Education

The education component of the OETC program takes place in a classroom-type setting. It gives municipal water-system operators the theory and knowledge they need to successfully operate their drinking-water systems and to pass certification exams. Seminars are offered free of charge to participants, and locations for seminars are chosen to minimize travel time and costs for the participants. High operator participation levels (and exam success) since the program's inception speak to its value.

To further enhance the OETC program's education component, the focus is on developing and delivering seminars for municipal operators in the water distribution and water treatment sectors. As a result, OETC staff continued to deliver its Water Distribution seminars during the 2007–08 fiscal year. Throughout the province there is a great need for these repeat seminars, because retirement and other issues are causing a high turnover of municipal operators.

The Water Distribution curriculum includes three day-long seminars:

- ◆ Water Distribution Basics
- ◆ Water-system Hydraulics
- ◆ Water quality Issues.

In the 2008–09 fiscal year, the Water Distribution seminars will be revised and updated to provide more streamlined information delivery. The OETC Section anticipates that the need for the Water Distribution

Seminars are offered free of charge to participants



Operator Training Seminar in Labrador West

*New water
treatment
curriculum
developed and
delivered*



*Mobile Training Unit used in the
OETC program*

seminars will continue to be strong, as more municipal operators near retirement age.

During 2007-08, 275 operators attended 20 seminars across the province. Table 9 indicates the locations, topics, and attendance.

During the 2007-08 fiscal year, the OETC Section developed a Water Treatment Level I and Level II curriculum. This three-day classroom seminar combines a variety of audio-visual teaching components and presentations. Topics covered include coagulation/flocculation, sedimentation, filtration, disinfection, corrosion control, taste and odour control, iron and manganese removal, membrane processes, sludge handling and disposal, laboratory procedures, math preparation, and more.

The first Water Treatment Level I and Level II courses were delivered by the OETC Section in November, 2007, in St. John's. Eighteen municipal water treatment plant operators from across the province attended. Future sessions on water treatment will be scheduled on an as-needed basis.

The Operator Education component of the OETC program will be further expanded in the near future. The Department of Environment and Conservation will develop seminars to target emerging-technology topics such as Potable Water Dispensing Units. This course will be developed specifically for communities that are considering installing (or have already installed) one of these water treatment systems. A seminar will also be developed for municipal staff and operators to help them interpret and understand the data presented in community drinking-water quality reports, and ensure they understand the revisions and additions of recent years.

Table 9 - Participants in the 2007-08 Water Distribution Seminars

Communities	Water Distribution Basics	Water-systems Hydraulics	Water quality Issues
Carbonear		28	28
Clarenville		6	
Corner Brook	23	11 and 24	23
Cow Head		11	
Gander		10	
Grand Falls-Windsor		16	
Happy Valley-Goose Bay		17	
Labrador City			10
L'Anse aux Clair	5		
Marystown		9	
Placentia			9
Port aux Basques		2	
Port Hope-Simpson		3	
Springdale	Cancelled due to weather conditions		
Stephenville	11		
St. Anthony		6	
St. John's		23	
TOTALS: 17 communities	39	166	70

The importance of hands-on training



Operators Darrin Hicks (left) and Kirk Way receive hands on training in the MTU in Bonavista

Phasing in mandatory certification

Operator Training

The hands-on training component of the OETC program continues to be a widely accepted and well-received way for operators of municipal water-system facilities to improve operations and maintenance skills. Although many operators retired or left their positions during the 2007–08 fiscal year, it is encouraging to note that the number of municipal water system operators nevertheless appears to be increasing. In 2007–08, 54 operators either retired or left their positions, but 79 new operators were hired. Fifty-six operators attended on-site training for the first time.

The Department's three Operator Trainers delivered 188 training sessions throughout the province in 2007–08 (see Table 11), using mobile training units (MTUs). Of these, 68 were repeat sessions, and 120 were first-time training sessions. The repeat visits were made to instruct either newly hired operators, or operators and municipal representatives who had not participated in the program before.

During the year, the Operator Trainers also developed new courses and obtained training equipment for Pipe Tapping and Distribution System Flushing, two new programs added in the 2007–08 fiscal year.

Operator Certification

At the close of the 2007–08 fiscal year, mandatory operator certification for water-system operators in Newfoundland and Labrador was still in the phase-in stage. Most municipalities are in agreement with the principle of mandatory certification, and recognize the value of having certified operators.

Current certification levels in Newfoundland and Labrador include:

- ◆ Water Distribution Operators Class I, II, and III
- ◆ Water Treatment Operators Class I, II, III, and IV
- ◆ Wastewater Collection Operators Class I and II
- ◆ Wastewater Treatment Operators Class I and II

Table 10 indicates the certificates that operators in the province acquired during the 2007–08 fiscal year.

SMALL TOWN SPOTLIGHT 2007-08: Training Solves Ongoing Issue in Burlington

Before its operators received hands-on training in the operation and maintenance of Burlington's water distribution's systems control valves (including the pressure-reducing valves, pressure -sustaining valves, and others), the community on the Baie Verte peninsula had never been able to achieve fire-flow pressure. Whenever it was time to flush the water distribution system or use the fire hydrants, almost all water flow in the community was lost.

During a Control Valve Maintenance on-site training session, the operators expressed their suspicion that the pressure-reducing valves (PRVs) were not set up correctly. Investigating the situation, the Operator Trainer discovered that all of the community's water flow was directed through a three-inch flow meter. Normally such a meter would have a "swing check valve" that would open on demand when additional flow was required for fire fighting. In Burlington's system, there was only a gate valve on the six-inch main line, which was closed.

The operators opened the gate valve, then checked and reset the PRV station settings. Although the PRVs had been set correctly, a three-inch line cannot supply enough water to maintain pressure needed for fire flow. With the six-inch valve opened and the PRVs reset, the operators tried out a fire hydrant in the community—a dramatic increase in flow and pressure was immediately recognized.

Until Burlington can install a swing check valve to automatically provide fire flow on demand, the six-inch valve will have to be opened manually in the event of a fire. However, the operators can now flush the town's water system more effectively, and the fire chief is pleased with the increased flow available for fighting fires.

Table 10 - Certification Exam Numbers, 2007-08

Certification Exam	Written	Passed	Pass Percent
Water Distribution Class I	18	14	78%
Water distribution Class II	12	9	75%
Water Treatment Class I	11	9	82%
Water Treatment Class II	15	10	67%
Water Treatment Class III	2	2	100%
Water Treatment Class IV	2	2	100%
TOTALS:	60	46	77%

Certified operators in Newfoundland and Labrador, 2007-08

At the close of the 2007–08 fiscal year, there were 260 certified water and/or wastewater operators in Newfoundland and Labrador, who held a total of 413 operator certificates. A closer look at the operator certification statistics reveals that:

- ◆ 115 municipalities were employing 237 certified operators
- ◆ two First Nations communities were employing five certified operators
- ◆ National Defence and the Canadian Forces (through SERCO in Happy Valley-Goose Bay) were employing five certified operators
- ◆ the three federal parks were employing eight certified operators
- ◆ two industrial/commercial systems were employing five certified operators

As the Department pursues the goal of mandatory operator certification, the OETC Section will continue to provide no-cost education and hands-on training support to the province's water-system operators. These

sessions, combined with their own experience and self-study, will assist operators in the challenge of writing and passing a certification exam.

Table 11 - Participants in Operator Training, 2007-08

Training Session Topic	Number of Sessions	Operators Attending	Communities Represented
Disinfection/ Chlorination	75	101	54
Hydrant maintenance	28	77	32
Control valves	16	67	20
Leak detection	33	64	36
Pipe tapping	34	100	34
Distribution-system flushing	2	2	2
TOTALS:	188	411	178

Training Participation, 2007-08



Operators writing their Certification Exams

New in 2008: The Operator of the Year Award

To recognize the importance of the province's public water system operators, and to honour their outstanding dedication, the Department of Environment and Conservation has initiated an "Operator of the Year" award. The award was presented for the first time at the 2008 Clean and Safe Drinking Water Workshop in Gander.

Communities across the province were invited to nominate an operator they felt had made an outstanding contribution, with details about why he or she was worthy of the award. The Department received two-dozen outstanding nominations by the deadline.

Winston Lethbridge was chosen the 2008 Operator of the Year award based on a glowing nomination submitted by the Town of Clarenville. Mr. Lethbridge has worked with the town for thirty-three years and over that period has consistently demonstrated his dedication to providing the community with clean and safe drinking water. He has sacrificed vacation and personal time to deal with issues at the town's water treatment plant, and provided support and leadership to his staff that was above and beyond all expectations. He has also shared his knowledge and expertise in the water treatment field internationally. Mr. Lethbridge continues to work for the town; his reliability, dedication, efficiency, and technical skill make him a worthy recipient of the inaugural Operator of the Year award.

As a result of the success of this year's nomination process, the award ceremony will be expanded in 2009 to two awards—Operator of the Year and Volunteer Operator of the Year.



*Left: Some of the many outstanding nominees with Minister Johnson
Right: Winston Lethbridge with his award at the Clarenville water treatment plant*

The Annual Clean and Safe Drinking Water Workshop

The purpose of the annual Clean and Safe Drinking Water Workshop program is to bring together municipal water-system operators from across the province for training and knowledge-building. Each year, experts in the field of water distribution and treatment from across the country are invited to give presentations and to share their experiences and knowledge with attendees. The workshops also provide an opportunity for operators to network and learn from each other.

The 2008 Clean and Safe Drinking Water Workshop was held from March 11 to 13 in Gander. Its theme was “**Small Town Solutions**” and most presenters were from Newfoundland and Labrador. The intent was to ensure that the topics discussed were relevant to situations faced by small municipalities in the province, such as filtration for small systems, using a Regional Operator, aging infrastructure, and Potable Water Dispensing Units. Copies of all presentations are available online at:

www.env.gov.nl.ca/env/Env/waterres/OETC/Operator/Workshop2008/Clean&Safe.asp.

The 2008 workshop included a trade show exhibit in its program. The seventeen companies that participated in this aspect of the event showcased a variety of technologies and equipment related to water distribution and treatment. The response of municipal operators to the trade show was overwhelmingly positive.

Attendance at the 2008 workshop was high: 288 delegates from across the province. Attendees included municipal operators, municipal officials and staff, aboriginal community members, government employees, students, and consultants. Once again, the Department of Municipal Affairs provided assistance to municipalities to alleviate travel costs associated with attending the workshop. Communities from the Island portion of the province were reimbursed up to \$300; communities from Labrador were reimbursed up to \$600.

The 2009 Clean and Safe Drinking Water Workshop is scheduled for March 24 to 26 at Hotel Gander. It will incorporate an informal brainstorming session with the municipal operators—the Department wants input and feedback from operators about the Operator Education, Training, and Certification program and its path forward. The workshop will continue to integrate information and presentations relevant to small communities.

The continued success of the Annual Clean and Safe Drinking Water Workshop



The Annual Clean and Safe Drinking Water Workshop, Gander 2008

Corrective Measures

The Department of Environment and Conservation prepared a comprehensive report, Sustainable Options for the Management of Drinking Water Quality in Small Water Systems, in 2008. As outlined in the box on page 51, it highlighted “corrective measures” as an important new component of the MBSAP.

The MBSAP outlines eleven key areas of action:

- ◆ source-water protection
- ◆ drinking-water treatment
- ◆ operation and management of the drinking-water distribution system
- ◆ monitoring
- ◆ inspection and enforcement
- ◆ data management and reporting
- ◆ operator education and training
- ◆ legislative measures and policy framework
- ◆ public involvement and awareness
- ◆ developing guidelines, standards, and objectives
- ◆ research and development

Since the province adopted the MBSAP, substantial progress has been made in all eleven areas of endeavour. Following a recent evaluation of the plan, a twelfth element was added to further improve the MBSAP framework: corrective measures.

Just as in the saying “where there’s smoke, there’s fire,” where a drinking-water quality issue exists there is always an associated cause. Corrective measures are taken to address and nullify that cause (or causes). They can include structural, non-structural, or operational techniques and other best-management practices, including these broad measures:

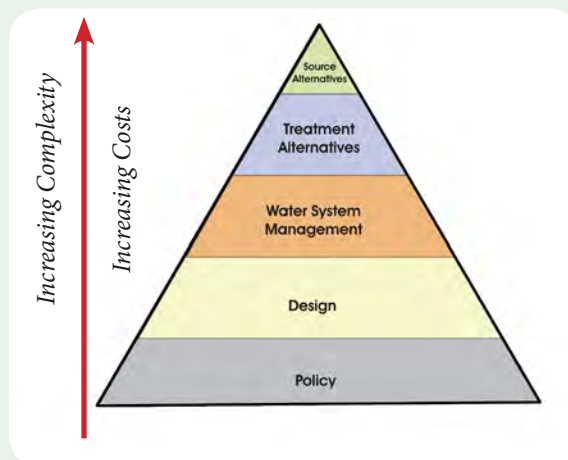
- ◆ policy changes or additions
- ◆ source-based control measures
- ◆ improving or adding chlorine demand management (CDM)
- ◆ improving or adding retention time management (RTM)
- ◆ improving or adding water demand management (WDM)
- ◆ water distribution system operational and infrastructural measures
- ◆ introducing alternative disinfectants
- ◆ improving or adding source-water treatment
- ◆ introducing point-of-use/point-of-entry measures
- ◆ improving operator education and training
- ◆ water-system design measures

Examples of Corrective Measures

A Closer Look at Corrective Measures

The new component of the MBSAP, Corrective Measures, is shown as a triangular graphic in the MBSAP diagram (see the Figure below). Each layer of the triangle represents a category of corrective measures. From the bottom of the triangle to the top, the complexity of the measures category increases, as does the cost of the action required. The categories are described below:

- ◆ Policy: the foundation of the Corrective Measures triangle, policy is the easiest category to enact and involves little cost (i.e. policy to chlorinate)
- ◆ Design: the second level of the triangle includes the use of models, and incorporation of modern design using the latest knowledge and understanding in planning (i.e. for water distribution systems)
- ◆ Water System Management: the third level of the triangle deals with the actual operational work of the treatment facilities and distribution systems (i.e. maintenance of distribution systems)
- ◆ Treatment Alternatives: the fourth level of the triangle includes such measures as the use of additional treatment (i.e. using UV for disinfection as well as chlorine), installation of water treatment plants, etc.
- ◆ Source Alternatives: the top level of the triangle is the most complex and costly category of all, and involves choosing and developing a new source for drinking water (i.e. a new pond or well). This level requires a significant investment for planning, consultation, and construction.



Corrective Measures as shown in the MBSAP diagram

Before taking any of these steps, the probable impact and effectiveness of a potential corrective measure must be evaluated as rigorously as possible. Methods used to determine the potential effectiveness of a proposed corrective measure include gathering information from other jurisdictions, conducting scientific studies, performing computer modelling, and comparing the situation and solution to similar previous experiences.

Finally, after the preferred corrective measure(s) has been implemented, monitoring and review must be conducted to ensure that the action has successfully dealt with the original water quality problem.

As part of the Sustainable Options report (see information box on page 53), each community in the province experiencing drinking water quality issues was identified. Possible corrective measures to address these issues were also identified. In 2008, the Minister of the Department of Environment and Conservation announced the Drinking-Water Safety Initiative for Newfoundland and Labrador. This is a proactive plan to implement corrective measures in rural communities facing drinking-water quality issues. The success and accomplishments achieved under this initiative will in future be reported under the Corrective Measures section.

SMALL TOWN SPOTLIGHT 2007-08: A New Drinking-Water Quality Management Framework

In 2008, after a number of years of planning and research, the Department of Environment and Conservation completed a detailed report aimed at rectifying drinking-water quality problems in Newfoundland and Labrador's smaller communities. **Sustainable Options for the Management of Drinking-water Quality in Small Water Systems** is both a thorough assessment of the state of drinking-water quality in the province, and an action plan that identifies sustainable options for managing it better, community by community, in the future. The report addresses three main questions:

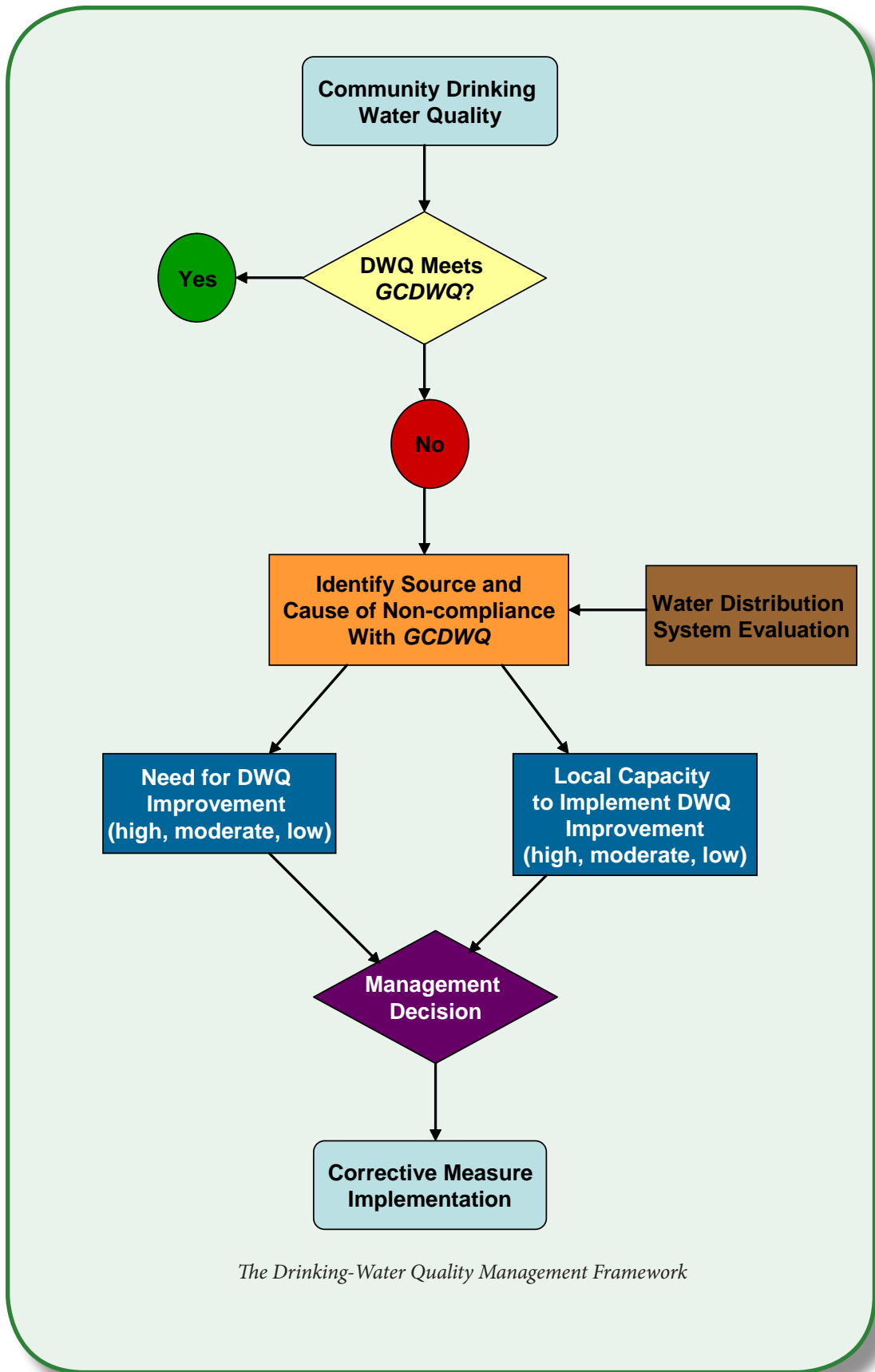
- ◆ What drinking-water quality problems exist at the community water-system level in the province?
- ◆ What options could mitigate or correct these problems?
- ◆ What action plan could best address these problems?

The report identifies 447 public water-supply systems or service areas in the province with some kind of drinking-water quality issue—which it defined as “any exceedance of the Guidelines for Canadian Drinking Water Quality”. These issues include Boil Water Advisories and water with either high levels of disinfection by-products or high contaminant and aesthetic-parameter levels. Significantly, the report also includes a full assessment of these public water-supply systems.

Every drinking-water quality issue has a corresponding array of potential options to mitigate it. The report presents the Rural Drinking-Water Quality Management Framework as a tool (see the Figure below for a graphical representation of the Framework) to help government departments choose the best corrective measure(s) for each situation. The framework takes into account:

- ◆ the level of risk associated with each drinking-water quality parameter that exceeds national guidelines
- ◆ the ability of community-level resources to deal with the issue
- ◆ the specific attributes of the individual water distribution system

In addition, the report outlines a management strategy to streamline government resources, so that the most pressing drinking-water quality issues can be tackled first. It is anticipated that implementing the report's recommendations will fulfill Government's vision and commitment to provide safe drinking water to the citizens of the province.



The Drinking-Water Quality Management Framework

LEVEL 2 - MBSAP

Highlights of 2007-08

- ★ 2,847 chemical/physical water quality samples taken
- ★ 19,757 bacteriological water quality samples taken
- ★ Tender for chemical/physical water quality sample analysis awarded to MAXXAM Analytics, Inc.
- ★ Overall there were fewer chemical/physical and bacteriological exceedances in 2007-08 than there were in the previous fiscal year
- ★ 381 permits dealing with various components of water supply and sewer systems were issued
- ★ 45 permits regulating activity within Protected Water Supply Areas were issued
- ★ 275 operators attended 19 OETC seminars across the province
- ★ The new curriculum for Water Treatment Levels I and II were developed and delivered
- ★ 260 certified water and/or wastewater operators in the province
- ★ 79 new operators were hired
- ★ A new component was added to the MBSAP - Corrective Measures

Legislation governing drinking water safety



Confederation Building

Part 3: Level 3 of the MBSAP

The four main components of the third level of the Multi-Barrier Strategic Action Plan are:

- ◆ legislative and policy frameworks
- ◆ public involvement and awareness
- ◆ guidelines, standards and objectives
- ◆ research and development

This chapter outlines what is involved in each of these components.

Legislative and Policy Frameworks

The *Water Resources Act, 2002*, the *Municipal Affairs Act, 1995*, and the *Municipalities Act, 1999*, all have sections that relate to drinking-water safety. Different government departments are responsible for enforcing different parts of the each piece of legislation. For example:

- ◆ the Department of Environment and Conservation enforces the well-drilling regulations of the *Water Resources Act, 2002*, its environmental control water and sewage regulations, and compliance with permit conditions
- ◆ the Department of Municipal Affairs enforces the sections of the *Municipal Affairs Act* and the *Municipalities Act* that relate to municipal infrastructure funding and the administration of drinking-water infrastructure

Inter-departmental Cooperation

In June, 2000 the Safe Drinking Water-Technical Working Group was formed. This inter-departmental committee's mandate is to ensure that the participating departments are made aware of all current events pertaining to drinking-water safety. This way, departments can work together to deal efficiently and proactively with emerging drinking water safety issues. Representatives from the departments of Environment and Conservation, Health and Community Services, Municipal Affairs, and Government Services make up the Working Group. In addition to these departments, the Medical Officers of Health are members of the Working Group, as are representatives from the Public Health Laboratory.

The Working Group met seven times in 2007-08. All activities of the Working Group are reported to the chair of the Steering Committee of Senior Government Officials. The following accomplishments and tasks were achieved or completed in the past year:

- ◆ coordinating upgrades to the Municipal Information Management System (MIMS) in the area of data entry for water test results, recording of Boil Water Advisories and maintaining a current record of water related infrastructure in the province as well as keeping the data current and up-to-date
- ◆ prepare and review the Drinking Water Safety in Newfoundland and Labrador Annual Report 2007
- ◆ reviewing proposed standards for drinking-water safety for semi-public water supplies and develop a draft implementation plan
- ◆ review provincial Boil Water Advisories and discuss ways to help communities deal with the issues that bring about those advisories, and coordinate with regional water committees
- ◆ informing committee members about the activities of the Federal-Provincial- Territorial Committee on Drinking Water and solicit comments on revised drinking water guidelines
- ◆ apprising committee members of the use of non-certified chlorine for water-supply disinfection
- ◆ discussing revised Health Canada Guidelines for benzene, corrosion control, chloral hydrate, potassium and HAAs
- ◆ discussing and developing a communication plan for blue-green algae
- ◆ reviewing primary disinfection in terms of ultraviolet (UV) treatment
- ◆ reviewing and developing a strategy for safe drinking water in rural communities in Newfoundland and Labrador

The ongoing work of the Safe Drinking Water - Technical Working Group

Public Involvement and Awareness

Public involvement and awareness are integral to the Multi-Barrier Strategic Action Plan, which is why the Department of Environment and Conservation is committed to providing easily accessible and timely drinking-water quality information to the public. All drinking-water quality data is available on the Department's website, for example, and exceedance reporting, quarterly reports, and annual reports are also publicly available.

Public involvement is also encouraged through participation in Watershed Management Committees across the province. These committees are excellent forums for stakeholders to voice opinions and concerns about land-management and water quality issues in their watershed areas.

In addition to providing the Operator Education Training and Certification program, the Department encourages the involvement of

All drinking water quality data is available to the public online

SMALL TOWN SPOTLIGHT 2007-08: Steady Brook Watershed Report Card

In September of 2005, a Steady Brook Watershed Management Plan was developed by a group of partners: the Western Newfoundland Model Forest, the town of Steady Brook, and several provincial government departments. The comprehensive plan outlines an approach to help protect the ecological integrity of the Steady Brook basin, where the water-supply source for the community is located.

One of the plan's management strategies includes issuing an annual report—a "watershed report card." The report has become a useful tool for assessing the previous year's overall monitoring efforts, the permits issued, and other water quality information. It provides an easy way to compare progress in managing the watershed from year to year. The Steady Brook report card has three main sections:

- ◆ *Stressors*: this section covers anything that puts stress on the watershed. This could include the number of land- and water-use activities, the area of the watershed that is under development, the presence of beavers, and the number of unauthorized development activities.
- ◆ *Condition*: This section deals with the condition of the watershed and both source water and water after it is treated. It also includes information taken from the provincial drinking-water quality monitoring program, such as the number of samples collected during the previous year, the number of exceedances, and the average Drinking Water Quality Index score. In addition, information such as the number of Boil Water Advisories and any flood events are included here.
- ◆ *Response*: This section deals with any responses or actions that have been taken to improve water quality or increase watershed protection, such as how often the distribution system was flushed, the number of watershed committee meetings, the number and type of outreach or education initiatives that were implemented, and the watershed surveys completed.

The report also includes background information on the watershed itself, such as area of coverage and percentage of the watershed that is protected under the *Water Resources Act, 2002*. The report card's flexible format allows communities to focus on specific local issues. The report card can be a good way to draw attention to them and monitor progress. Report cards are also useful for summarizing information for municipalities and the public.

municipal operators and administrators through its annual Clean and Safe Drinking Water Workshop. This event brings together a diverse group of stakeholders to learn about drinking-water safety and exchange information and experiences. Those with a stake in providing clean and safe drinking water to the public can meet face-to-face with representatives of many levels of government and other groups. In particular, the annual workshop allows municipalities to learn from each other—they hear about issues other communities are facing and methods of dealing with them.

Employees of the Water Resources Management Division are also often asked to make presentations on a range of issues to technical working groups, conferences, post-secondary education classes, municipalities, and interest groups. These are opportunities to discuss topics that affect drinking water in the province with a wide range of people. Some of the presentations made in the 2007–08 fiscal year included:

- ◆ “QA/QC Practice for Real-time Water quality Monitoring in Newfoundland and Labrador,” at the Real-time Water quality Monitoring Workshop, St. John’s (June, 2007)
- ◆ “Water Issues in the 21st Century: Water Policy Implications for Science and Technology,” at the Canadian Water Resources Association’s 60th Annual Conference, Saskatoon (September, 2007)
- ◆ “The Effects of Forestry on Water Quality and Quantity in Newfoundland and Labrador,” at Corner Brook Pulp and Paper Limited’s Public Advisory Committee Meeting, Corner Brook (October, 2007)
- ◆ “The Drinking-water Quality Regulatory Framework and the Provincial Monitoring Program,” at the Marine Institute, St. John’s (February, 2008)
- ◆ “Potable Water Dispensing Units,” at the Clean and Safe Drinking Water Workshop, Gander (March, 2008)
- ◆ “Watershed Management Planning,” at the ninth Urban Watersheds Workshop, St. John’s (March, 2008)

*Presentations
given by Water
Resources
Management
Division Staff,
2007-08*

Guidelines, Standards, and Objectives

The Department regularly develops or revises its documents about drinking-water safety, guidelines, standards, and objectives to address the issues and challenges of ensuring public health and protecting the environment. During the 2007–08 fiscal year, the publications and guidelines that were revised or developed included:

- ◆ the Guidelines for Canadian Drinking Water Quality were amended to include a guideline for haloacetic acids (HAA) in

*New or revised
publications and
guidelines,
2007-08*

2008, with a maximum allowable concentration of 80 µg/L (see information box on page 26 for more information)

- ◆ the Guidelines for the Design, Construction, Operation, and Maintenance of Water and Sewer Works were revised. The updated guidelines are available at:
www.env.gov.nl.ca/env/Env/waterres/CWWS/Guidelines_Water_Sewerage/Report.asp
- ◆ the Operator Education, Training and Certification Section developed a Water Treatment Level I and Level II curriculum.
- ◆ the Operator Trainers developed new curricula for Pipe Tapping and for Distribution System Flushing.
- ◆ the report Sustainable Options for the Management of Drinking Water Quality in Small Water Systems was completed in 2008.
- ◆ the report Best Management Practices for the Control of Disinfection By-products in Drinking Water Systems in Newfoundland and Labrador was completed in 2008.

Research and Development

The Department of Environment and Conservation undertakes research to help in the development of new tools and methodologies related to drinking-water safety. The Water Resources Management Division, for example, performs research on an ongoing basis in a variety of areas.

The Department's Research and Development initiatives during the 2007–08 fiscal year included:

- ◆ developing an online Water Quality Index calculator
- ◆ developing best-management practices for managing disinfection by-products
- ◆ making improvements to the internal Drinking-water Quality Search Engine and GIS application
- ◆ applying real-time water quality monitoring to drinking-water programs
- ◆ emerging parameters such as radiological characteristics were studied for development of a sampling program for 2008-09
- ◆ study of the formation behaviour of disinfection by-products
- ◆ collaborating with the Office of the Chief Information Officer (OCIO) and the Department of Municipal Affairs to create a centralized GIS data warehouse (still under development)
- ◆ enhancing the graphic elements of the online Automated Data Retrieval System (which collects, processes, and distributes hydrometric, climate, and real-time water quality data)
- ◆ implementing a common “look and feel” for the Department's internal web application

Level 3 - MBSAP Highlights 2007-08

- ★ The Departments of Environment and Conservation and Municipal Affairs enforce legislation related to drinking water quality
- ★ The Safe Drinking Water-Technical Committee works to ensure all participating departments are made aware of all current events pertaining to drinking-water quality
- ★ Water Resources Management Division staff continue to educate and inform the public and stakeholders about water quality topics and issues
- ★ A new HAA guideline was announced
- ★ The Department of Environment and Conservation continues to encourage and support research and development initiatives in the area of drinking-water quality

Summary 2007-08

Government continues to rely on the Multi-Barrier Strategic Action Plan (MBSAP) to help strengthen its commitment to providing clean and safe drinking water in Newfoundland and Labrador. This report gives an overview of the activities undertaken as part of the MBSAP during the 2007–08 fiscal year, and highlights the progress made towards ensuring drinking-water safety in the province.

Source-water protection is an integral part of Level 1 of the MBSAP. During the 2007–08 fiscal year, the source-water protection program designated three new Protected Public Water-Supply Areas in the province. As a result, ninety-one per cent of the province's residents whose homes are supplied by public water systems are now receiving their water from a protected source.

The Operator Education, Training, and Certification program continues to be a significant part of Level 2 of the MBSAP. During the 2007–08 fiscal year, twenty one-day classroom seminars were held, which were attended by 275 operators. The first three-day seminar of a new Water Treatment Level I and Level II curriculum was also held, attended by eighteen operators from across the province. In addition, 188 hands-on training sessions across Newfoundland and Labrador were held using mobile training units (MTUs). The OETC program continues to contribute to a high success rate when operators in the province write their certification exams.

Another successful component of the OETC program is the annual Clean and Safe Drinking Water Workshop. Held in Gander (March 11–13, 2008), this year's event attracted 288 delegates from across the province.

Government supports its MBSAP Level 3 responsibilities by continuing its efforts to promote public involvement, development of guidelines, standards, and objectives, and perform new and necessary research and development. During the 2007–08 fiscal year, all drinking-water quality data was made available to the public on the Department of Environment and Conservation's website and through regular reporting to communities experiencing water quality issues. A new guideline for haloacetic acids (HAAs) was developed and implemented this year, as well, as per the Guidelines for Canadian Drinking Water Quality.

The Path Forward

Government Action Plans for 2008–09

DEPARTMENT OF ENVIRONMENT AND CONSERVATION

The Department will pursue its commitment to the continued development and strengthening of all levels and components of the Multi-Barrier Strategic Action Plan (MBSAP). It will continue its traditional activities and also continue its efforts in research and development to improve the Drinking Water Quality Monitoring program.

Because protecting water supplies is the foundation of the MBSAP, the Department will continue to educate and encourage communities to pursue the legal designation of their water-supply as a protected area, and assist them in the designation process.

Monitoring in the 2008–09 fiscal year will be increased to accommodate the new HAA guideline and sampling protocol. Approximately 4,300 source- and tap-water samples will be collected and analyzed as part of the drinking-water quality monitoring program. The plan is to collect:

- ◆ 490 source-water samples from water-supply sources, for analysis for inorganic chemical parameters
- ◆ 1,054 water tap-water samples, for analysis for inorganic chemical parameters
- ◆ 1,168 tap-water samples, for analysis for trihalomethanes (THMs)
- ◆ 1,588 tap-water samples, for analysis for haloacetic acids (HAAs)

Quality Assurance/Quality Control (QA/QC) sampling will continue as part of the monitoring program. Drinking-water quality issues of priority concern for 2008–09 are expected to be:

- ◆ the formation behaviour of disinfection by-products (THMs, HAAs) and chlorine demand management
- ◆ contaminant parameters (particularly arsenic, lead, barium, and turbidity)
- ◆ bacteriological parameters (E. coli and total coliforms)
- ◆ special sampling for radiological characteristics
- ◆ special sampling for emerging parameters

The Operator Education, Training, and Certification program will continue to deliver education and training throughout the province on drinking-water management topics, through both classroom seminars and on-site training using Mobile Training Units. The program's website

will be used to provide further educational information, as well as curriculum and seminar schedules.

The annual Clean and Safe Drinking Water Workshop is scheduled to take place in Gander on March 24 to 26, 2009. The event will again include a trade-show, so that attendees can see and discuss equipment and technology with industry representatives. It will also incorporate an informal brainstorming session with municipal operators to elicit feedback and comments about the Department's Operator Education, Training, and Certification program and path forward.

Implementation of the Drinking-Water Safety Initiative for Newfoundland and Labrador will be a priority for 2008-09. This initiative, announced in May, 2008, outlines several options to improve upon drinking water safety in the province. The Drinking-Water Quality Management Framework discussed in the Sustainable Options report is a component of the initiative, which includes the installation of Potable Water Dispensing Units (PWDUs) in rural communities across the Province. For the fiscal year 2008-09, \$1.025 million dollars has been allocated to the Department of Environment and Conservation, and \$6 million dollars has been allocated the Department of Municipal Affairs for infrastructure funding.

DEPARTMENT OF MUNICIPAL AFFAIRS

The Department of Municipal Affairs will continue to financially support requests from communities for the provision of water related infrastructure. Appropriate water treatment technology to enable communities to meet the Canadian Drinking Water Guidelines continues to be a priority for capital funding assistance. In this regard, the Department has allocated \$18 million over the next three years to fund requests under the Province's "Drinking Water Safety Initiative". This initiative outlines several options to improve drinking water safety based on a comprehensive evaluation of every public water supply in the Province. A significant component of this initiative includes the installation of Potable Water Dispensing Units. These units are small scale water treatment plants from which the residents of small communities are provided high quality drinking water which meets the Canadian Drinking Water Guidelines.

Cost effective approaches with regard to regionalization of operational and maintenance services will be encouraged in the way of both advisory and financial support. The Department will also continue to provide financial assistance to communities wishing to have representatives attend

training, workshop and certification courses relating to drinking water safety.

DEPARTMENT OF GOVERNMENT SERVICES

There were 19,757 public bacteriological water samples collected from 535 public water-supply systems in 2007-08. The continued high level of public water sample collection over the last few years is an indication of the commitment of this department to a satisfactory level of bacteriological water monitoring and compliance with the levels currently recommended in the Provincial Standards and the Guidelines for Canadian Drinking Water Quality.

Through its bacteriological water monitoring program, the Department of Government Services helps ensure that public drinking water is protected from waterborne diseases and is safe for consumption. A review of the current sampling program was undertaken as part of the department's workload analysis in the 2006-07 fiscal year with a view to determining whether additional improvements or efficiencies could be achieved. This review resulted in the Budget 2007 announcement of the creation of six new Environmental Health Technician positions which will be placed in GSC offices throughout the province in 2008-09. As part of their assigned duties, these personnel will assist the Department's Environmental Health Officers in the collection of water samples, further securing the safety of our public water supplies. The department is also interested in improving surveillance of drinking water that may be accessible to the public other than through municipal/public water supplies, such as semi-public and institutional supplies, and will continue discussions with the Department of Environment and Conservation on this issue.

As in the past, the Department of Government Services will also continue to partner with the Department of Health and Community Services and the Regional Health Authorities. It is recognized that in order to ensure that Environmental Health Officers are provided the highest standard of professional development in their field, particularly in bacteriological water monitoring, support for professional development in this area will continue, in cooperation with the Canadian Institute of Public Health Inspectors (NL Branch). The summer of 2008 will provide an opportunity for all Environmental Health Officers and Trainees throughout the province to participate in the Canadian Institute of Public Health Inspectors National Educational Conference, being held in St. John's in July. Beyond the educational opportunity afforded by their attendance at this national event, Government Services' environmental

health professionals will be provided with a one-day Water Workshop immediately following the conference. This department recognizes that continuous learning is necessary to build capabilities and to ensure that our environmental health personnel have the best possible tools and information at their disposal.

DEPARTMENT OF HEALTH AND COMMUNITY SERVICES

In 2007-2008, the Department of Health and Community Services continued to support and fund the bacteriological water quality monitoring and testing program. Through regional testing sites and the Provincial Public Health Laboratory, water samples from municipal and private supplies are tested for *E. coli* and total coliform bacteria.

In 2008-2009 the Department of Health and Community Services and the four Regional Health Authorities will continue with ongoing drinking-water safety initiatives by working collaboratively with provincial and municipal drinking water partners to enhance health protection efforts and disease prevention initiatives related to drinking water. In 2008-2009 the Department of Health and Community Services, and the Regional Health Authorities, will continue to:

- ◆ Provide policy and technical support to Environmental Health Officers who carry out bacteriological water quality monitoring and the interpretation of bacteriological water quality test results.
- ◆ Review and enhance, where necessary, drinking-water safety promotional material.
- ◆ Provide health related advice to municipal leaders and residents where public water-supplies are identified to have unsatisfactory water quality.
- ◆ Partner with the Department of Government Services and the Canadian Institute of Public Health Inspectors (Newfoundland and Labrador Branch) to provide drinking-water related continuing professional development to public health inspectors.
- ◆ Work at the national and inter-provincial levels on safe drinking-water initiatives (e.g., Federal Provincial Committee on Health and the Environment).

