

Manitoba Water  
Stewardship

Terms of Reference for Assessment of Water  
System Infrastructure and Water Supply Sources  
for Public Water Systems

Prepared for  
Office of Drinking Water  
Prepared by  
Cochrane Engineering Ltd.

Date: April, 2004



Office of Drinking Water

## **TERMS OF REFERENCE**

**FOR**

## **ASSESSMENT OF WATER SYSTEM INFRASTRUCTURE AND WATER SUPPLY SOURCES**

**For Public Water Systems**

**Date: April 2004**

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**TERMS OF REFERENCE  
FOR  
ASSESSMENT OF WATER SYSTEM INFRASTRUCTURE AND  
WATER SUPPLY SOURCES - FOR PUBLIC WATER SYSTEMS**

**April 2004**

**1.0 DEFINITIONS**

The following definitions apply throughout this document:

**AWWA** – means the “American Water Works Association” and its associated Standards, Manuals, White Papers and Policies.

**Domestic Purposes** – means the use of water for personal hygiene, drinking, preparing food or washing dishes or other items that come into contact with food, or other purposes prescribed by regulation.

**DWS Act** – means the “Drinking Water Safety Act” assented to August 9, 2002 and as amended from time to time.

**Engineer** – means a Professional Engineer as defined in the *Engineering and Geoscientific Professions Act* and who;

(a) is competent by virtue of training, and experience in engineering relating to drinking water supplies, to engage in practices that fulfil the requirements of these Terms of Reference, and

(b) is not an employee of the Owner of the Water System being reviewed, and

(c) has been contracted by the Owner of the Water System to prepare a System Assessment Report to determine whether the Water System is capable of achieving current quality and environmental standards in accordance with these Terms of Reference.

**GCDWQ** – means the latest version of the “Guidelines for Canadian Drinking Water Quality”, and as amended from time to time.

**ODW** – means the “Office of Drinking Water”.

**Owner** – means that person who is responsible for the ongoing operation of the Water System, or in charge of managing that operation, and if the Water System, or part of it, is owned by more than one person or is jointly owned, includes all of those Owners.

**Private Water System** – means a Water System that supplies water only to one private residence; or despite supplying water to commercial premises or to more than one private residence, is designated under clause 2(a) under the DWS Act as a Private Water System.

**Provincial Standards** – means the health related parameters as described in the Drinking Water Quality Standards Regulation in force under the Drinking Water Safety Act.

**Public Water System** – means a Water System that has 15 or more service connections; or has fewer than 15 service connections, but is designated under clause 2(b) under the DWS Act as a Public Water System.

**System Assessment Report or Report** – means the “Assessment of Water System Infrastructure and Water Supply Sources” referenced in Section 9 of the DWS Act and the deliverable product of these Terms of Reference.

**Semi-Public Water System** – means a Water System that is not a Public Water System or a Private Water System.

**SWTR** – means “Long Term 1 Enhanced Surface Water Treatment Rule” promulgated in January 2002 by the US Environmental Protection Agency, and as amended from time to time.

**Ten State Standards** – means the latest version of the “Recommended Standards for Water Works” as issued by the ‘Great Lakes-Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers’, and as amended from time to time.

**Water System** – means a well, or a device or structure or an assemblage of devices and structures, used or intended to be used for the production, treatment, storage and/or delivery of potable water for Domestic Purposes.

## **2.0 OBJECTIVES**

These Terms of Reference have been prepared in support of Section 9, ASSESSMENTS OF WATER SYSTEM INFRASTRUCTURE AND WATER SUPPLY SOURCES, of the DWS Act. The System Assessment Reports are to be completed by a Professional Engineer, licensed to practice and consult in the Province of Manitoba, with applicable experience relating to drinking water supplies.

The objective of the Report is to carry out an onsite evaluation to identify, analyse and mitigate any potential adverse health risks and environmental impacts associated with the Water System in a “source to tap” methodology. It is also to determine whether the Water System’s source, facilities, equipment and operations are effective in producing safe drinking water, and meet the regulations in force under the Public Health Act and the DWS Act. The level of effort and depth of the Report should reflect the Water System size, complexity and risks.

For regional systems where a supply, treatment and transmission water system may supply several separate storage and distribution system(s) owned by others, a System Assessment Report is required from each Owner of these system(s). The Owner of a system receiving water from another system need not include an assessment of that other system, as the Owner of the other system will be responsible for that assessment. Similarly, the Owner of a regional supply system is not responsible for assessing the distribution systems owned by others.

## **3.0 GENERAL REQUIREMENTS**

The Engineer preparing the Report is required to carry out an onsite evaluation and to establish contact with the regional Drinking Water Officer. The Report is to identify any risks to public health and shall make recommendations as necessary for operational and physical improvements that should be implemented to mitigate against these risks.

The Report must include:

- 3.1 A compilation of existing Certificate(s) of Approval, Permits and Licences for the Water System.
- 3.2 A review of previous applicable studies and reports relating to the Water System.
- 3.3 A characterization of the raw water supply source(s), and a description of any source water protection measures being implemented.
- 3.4 A description of the Water System and operations.

- 3.5 A characterization of the treated water.
- 3.6 An assessment of the potential for microbiological, chemical and physical contamination.
- 3.7 An assessment of the physical works associated with the Water System.

#### **4.0 COMPILATION OF CERTIFICATES, PERMITS AND LICENCES**

- 4.1 The Engineer shall compile Certificate(s) of Approval, Permit(s) and Licence(s) for the Water System from the Owner, and include a copy of these as an Appendix to the Report.
- 4.2 The Engineer shall prepare a listing of available Certificates, Permits and Licences in chronological order summarizing the certificate number, a brief description of the works approved for each Certificate, Permit and Licence, and a summary of terms and conditions.

#### **5.0 CHARACTERIZATION OF THE RAW WATER SUPPLY SOURCE(S).**

- 5.1 The Engineer shall characterize the raw water of each individual source of the Water System's raw water supply, including any back-up supplies. The Engineer shall utilize the source raw water sampling and analysis records available from the Owner and the ODW, and any additional sampling and analysis that may need to be undertaken for a characterization appropriate to the source. A copy of these records is to be included as an Appendix to the Report.
- 5.2 The Engineer shall, if applicable, provide a preliminary determination of whether a groundwater supply is under the direct influence of surface water based on available evidence, and indicate the need for additional studies if required.
- 5.3 Based on the raw water characterization, the Engineer shall:
  - Determine raw water quality conformance to the GCDWQ and the Provincial Standards, whichever is the most stringent, and any parameters listed in the Operating Licence (where a licence has been issued).
  - Identify parameters that may impact treatment of the water, and influence operation of the system.
  - Evaluate trihalomethanes (THMs) formation potential from the raw water; a THM formation potential test shall be conducted if no actual THM results are available.
  - Determine the potential for formation of other disinfection by-products (DBPs).
  - Identify any emerging issues that may impact the water source.
  - Identify treatment options that may be necessary to assure conformance to the Provincial Standards, and any parameters listed in the Operating Licence.
  - The characterization shall also include an evaluation of any source water protection measures being carried out.

## **6.0 DESCRIPTION OF THE WATER SYSTEM AND OPERATIONS**

- 6.1 The Engineer shall prepare a description of the Water System, including works for the collection, production, treatment, storage and/or delivery of potable water.
- 6.2 This description shall be in sufficient detail to permit the ODW to utilize this description for an Operating Licence for the Water System.
- 6.3 The description of works shall also include a schematic process flow diagram of the Water System with process units and equipment identified, as well as points of connection to the distribution system.
- 6.4 This description shall include the types, number and sizes of all process units and equipment including waste stream treatment and disposal facilities, and shall include critical process design parameters, such as, but not limited to: intake velocity, mixing rates in rapid mix and flocculation tanks, surface settling rates and retention times in settling tanks, filtration and backwash rates in filters, chemical feed rates and disinfection concentration/time (CT) factors.  
  
Particular attention is required in describing the complete disinfection system. CT calculations must be included for worst case conditions between the application point and the first user. Disinfection profiling shall be based on the methodology and tables from the GCDWQ, or the SWTR where not covered in the GDCWQ.
- 6.5 The Engineer shall also include a summary of the Water System's log reductions for pathogen removal based on the GCDWQ, or the SWTR where not covered in the GDCWQ. All Water Systems that are supplied by surface water, or groundwater under the direct influence (GUDI) of surface water, shall ensure the following minimum reduction in pathogen levels: Minimum 2-log reduction in *cryptosporidium*; minimum 3-log reduction in *giardia*; and minimum 4-log reduction in *viruses*. Higher source water contamination levels may require greater log reductions.
- 6.6 The assessment of the physical works shall include a review of all on-line instrumentation in regards to their installation and operation.
- 6.7 The Report shall include an evaluation of the Water System's long term sustainability, reliability of operation, consistency of quality, remaining service life and short- and -long-term upgrading needs.
- 6.8 The Engineer shall provide a brief review of operations, including documenting number of employees, level of certification of employees and the number of hours on average each employee spends on operating the Water System.
- 6.9 The Report shall include a summary of water production and consumption quantities for a minimum three-year period.

## **7.0 CHARACTERIZATION OF THE TREATED WATER**

- 7.1 The Engineer shall characterize the treated water at the treatment facility and in the distribution system. The Engineer shall utilize the treated water sampling and analysis records available from the Owner and the ODW, and any additional sampling and analysis that may need to be undertaken for a characterization of the treated water. A copy of these records is to be included as an Appendix to the Report.

- 7.2 Based on treated water characterization, the Engineer shall:
- Determine treated water quality conformance to the GCDWQ and the Provincial Standards, whichever is the most stringent, and any parameters listed in the Operating Licence (where a licence has been issued).
  - Evaluate trihalomethanes (THMs) formation potential in the treated water at the plant; a THM formation potential test shall be conducted if no actual THM results are available.
  - Determine the potential for formation of other disinfection by-products (DBPs).
  - Identify any emerging issues that may impact the treated water quality.

## **8.0 ASSESSMENT OF THE POTENTIAL FOR MICROBIOLOGICAL, CHEMICAL AND PHYSICAL CONTAMINATION**

- 8.1 The Engineer shall undertake a review of the complete Water System to assess the potential for contamination using the following:
- A review of the intake/well physical works, treatment works including storage facilities for the purpose of identifying potential sources and pathways of contamination to the physical works. Items to be reviewed include, but are not limited to: well head protection, watershed land uses, agricultural/economic/ industrial activities, waste treatment, potential developments, natural protective features and known threats.
  - A review of available records of treated water quality testing for parameters that exceeded the Provincial Standards over the last five years.
  - A review of any source water protection activities that are being implemented to assess whether they are sufficient to maintain consistent source water quality.
- 8.2 The Engineer shall undertake a review of the results of bacteriological and disinfection residual sampling and analyses taken from the distribution system for the purpose of identifying locations within the distribution system which may need further assessment as potential sources of bacterial contamination or respecting disinfection residual enhancements using the following:
- A review of available records of microbiological testing in the distribution system over the last five years.
  - A review of the distribution system details, including service connections. The review shall include a review of pipe materials, age of system, lead connections, known watermain breaks and suspected deficiencies.
- 8.3 The Engineer shall review cross connection control and backflow prevention programs, flushing/swabbing programs and any start-up and shutdown protocols, where applicable, and make recommendations for improvements that may be required to mitigate against the potential for microbiological, chemical and physical contamination of the drinking water.
- 8.4 The Engineer shall review the standard operating procedures and/or contingency plans for ensuring distribution system water quality during disruptions in system integrity. The Engineer shall also identify any emergency contingency plans that exist and if they are regularly reviewed and practiced by staff.



- 8.5 Should, at any time during the assessment, the Engineer discover direct sources of microbiological contamination, or malfunctioning disinfection equipment, or any system directly relating to microbiological contamination, the Engineer shall immediately notify the regional Drinking Water Officer, the ODW and the Owner.
- 8.6 Should, at any time during the assessment, the Engineer discover a situation where workplace safety is at risk, the Engineer shall immediately notify the Workplace Health and Safety Officer, the regional Drinking Water Officer, the ODW and the Owner.
- 8.7 The Engineer shall make recommendations as necessary for operational and physical improvements that should be implemented to mitigate against the potential for contamination.

## **9.0 ASSESSMENT OF PHYSICAL WORKS ASSOCIATED WITH THE WATER SYSTEM**

- 9.1 The Engineer shall review the existing Water System with particular attention to works necessary to ensure the robustness of the system utilising the multiple barrier concept. The review should consider documents such as AWWA and Ten State Standards as they pertain to water quality and safety.
- 9.2 The Engineer shall determine if the Water System, including disinfection procedures, is being operated in compliance with the Public Health Act, the DWS Act and all regulations in force under these Acts.
- 9.3 The Engineer shall review the existing building(s) (super- and sub-structure, reservoirs, water tower), mechanical, HVAC, electrical and control systems as to their general condition and potential to affect water quality or reliability of service.
- 9.4 The Engineer shall make recommendations as necessary for operational and physical improvements that should be implemented to achieve compliance with regulations.

## **10.0 PREPARATION AND SUBMISSION OF A REPORT**

- 10.1 The Engineer shall prepare a written Report outlining the findings and recommendations that shall be relied upon by the ODW in support of further decisions to be made by the ODW. The completed Report shall be to the satisfaction of the ODW.
- 10.2 Five (5) bound copies of the Report shall be submitted to the Owner. The Report shall also be submitted electronically in PDF format on compact disk. All supporting documents are to be digitized/scanned, and included in the PDF file.
- 10.3 The Engineer shall complete Form ODW0001-2A and ODW0001-2B and attach a copy to each Report.
- 10.4 The Owner shall review the Report and forward three (3) copies to the ODW with the completed Form ODW0001-1.
- 10.5 Within one year of the completion of the Report, the Owner shall submit to the ODW an action plan detailing the tasks to be taken to address any deficiencies noted in the Report, and the schedule of implementation. **The Owner shall correct any critical issues identified in the Report as posing an immediate health risk within 30 days, or within a timeline approved by the ODW.**

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## NOTICE OF COMPLETION OF AN ASSESSMENT OF WATER SYSTEM INFRASTRUCTURE AND WATER SUPPLY SOURCES FOR A PUBLIC WATER SYSTEM

<b>TO BE COMPLETED BY THE OWNER:</b>		Date of Report: <i>(yyyy/mm/dd)</i>
Name of Water System:		Community Code:
Category of Water System:	Raw Water Source: (Surface/Groundwater/Combined)	
Location of Water System:		Population Served:
Water System Owner Name:	Telephone:	Fax:
Water System Owner Address:		
OPERATING LICENCE NUMBER AND DATE OF ISSUE (Where available) : As issued under the Drinking Water Safety Act		
<u>Operating Licence Number:</u>	<u>Date of Issue:</u> <i>(yyyy/mm/dd)</i>	
<p>I certify that:</p> <ol style="list-style-type: none"><li>1. The attached Report was prepared by a Professional Engineer who met the qualification requirements as stipulated in the "Terms of Reference for Assessment of Water System Infrastructure And Water Supply Sources - For Public Water Systems", and who is not an employee of the Water System Owner.</li><li>2. I have read the Report, and it is consistent with my understanding of the Water System.</li><li>3. I understand the Report to the best of my ability.</li><li>4. The information provided to the engineer, for the basis of this report, was accurate and complete to the best of my ability and knowledge.</li></ol> <p>The undersigned is the person, or the person designated by the Owner as being, responsible for the Water System:</p> <p>Signature of Owner: _____</p> <p>Name of Owner: _____</p> <p>Title: _____</p> <p>Date Signed: _____</p>		



<b>TO BE COMPLETED BY THE ENGINEER:</b>	Date of Report: (yyyy/mm/dd)
Name of Water System:	Community Code:

I certify that:

1. I prepared this System Assessment Report for this Water System.
2. I am a Professional Engineer registered in the Province of Manitoba with good standing.
3. I have relevant experience in sanitary engineering relating to drinking water supplies.
4. I have visited the Water System for the preparation of this Report.
5. This Report was prepared in accordance with the "Terms of Reference for Assessment of Water System Infrastructure And Water Supply Sources - For Public Water Systems".

**DECLARATION OF ENGINEER SIGNING AND SEALING REPORT**

"I, the undersigned, hereby declare that to the best of my knowledge, the information contained herein and the information in support of this submission is complete and accurate in accordance with my obligations under the *Engineering and Geoscientific Professions Act* and its regulations.


I further declare that this submission has been prepared in reasonable accordance with the published Terms of Reference for this submission, despite any qualifications in the agreement contracting me, and I acknowledge that the Office of Drinking Water and the Owner will be relying on the accuracy of this report."

Name of Engineer: \_\_\_\_\_

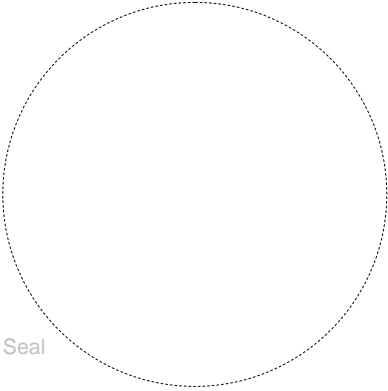
Signature of Engineer: \_\_\_\_\_

Date Signed: \_\_\_\_\_

Professional Engineer's seal and Certificate of Authorization to be affixed in the space below and signed by the Professional Engineer who prepared this Report.



Certificate of Authorization



Seal



<b>TO BE COMPLETED BY THE ENGINEER:</b>	Date of Report: (yyyy/mm/dd)
Name of Water System:	Community Code:
Name of Engineer: _____	
Name of Company: _____	
Full Address: _____	
_____	
_____	
Telephone: _____	
Fax: _____	
Email: _____	
Checklist for submission to the Owner:	
<input type="checkbox"/> Five (5) bound copies of the Report to the Owner.	
<input type="checkbox"/> One (1) copy of complete Report on compact disk in PDF format to the Owner.	
<input type="checkbox"/> Forms ODW0001-2A and ODW0001-2B signed and sealed and included in Report.	
<p style="text-align: center;"><i><b>This completed form is to be included with the Report submission to the Owner in both hard copy format and PDF version.</b></i></p>	