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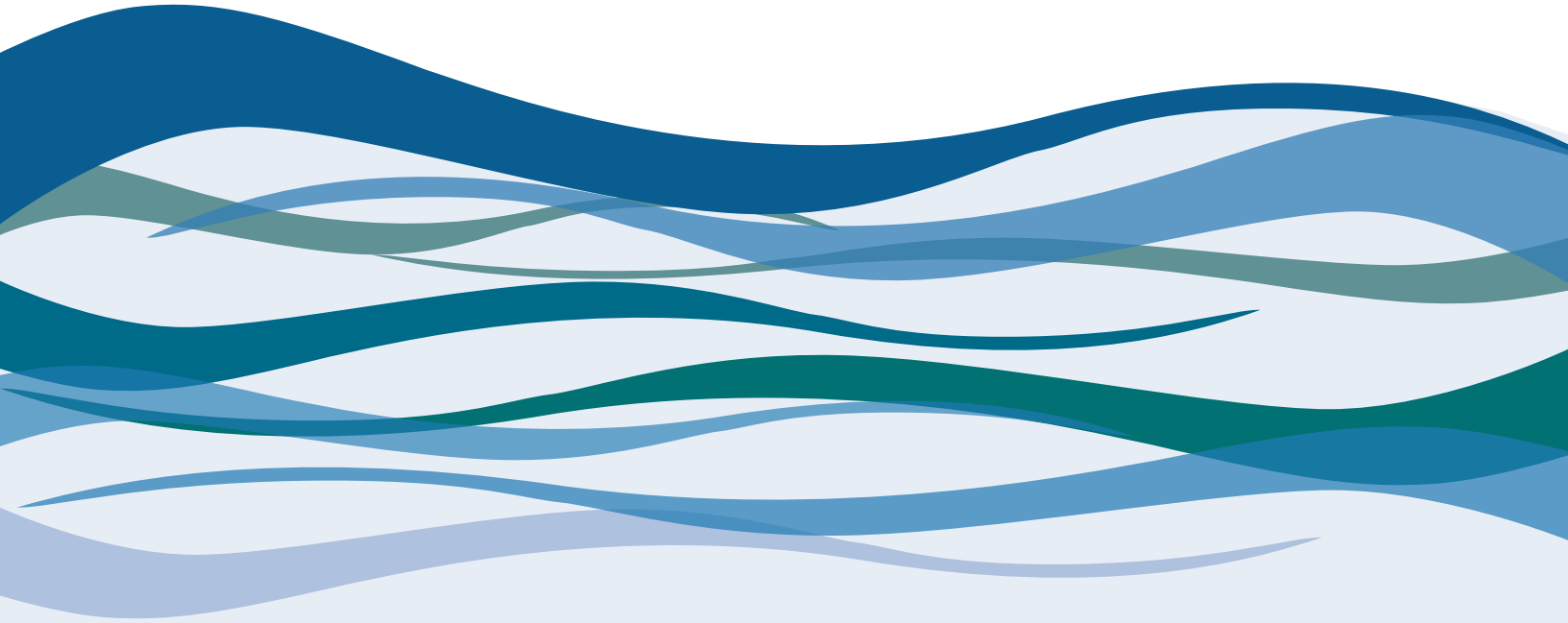
Guidelines for the Review of Water and Wastewater Project Proposals in First Nations Communities South of 60°

First Nations and Inuit Health Branch



Canada

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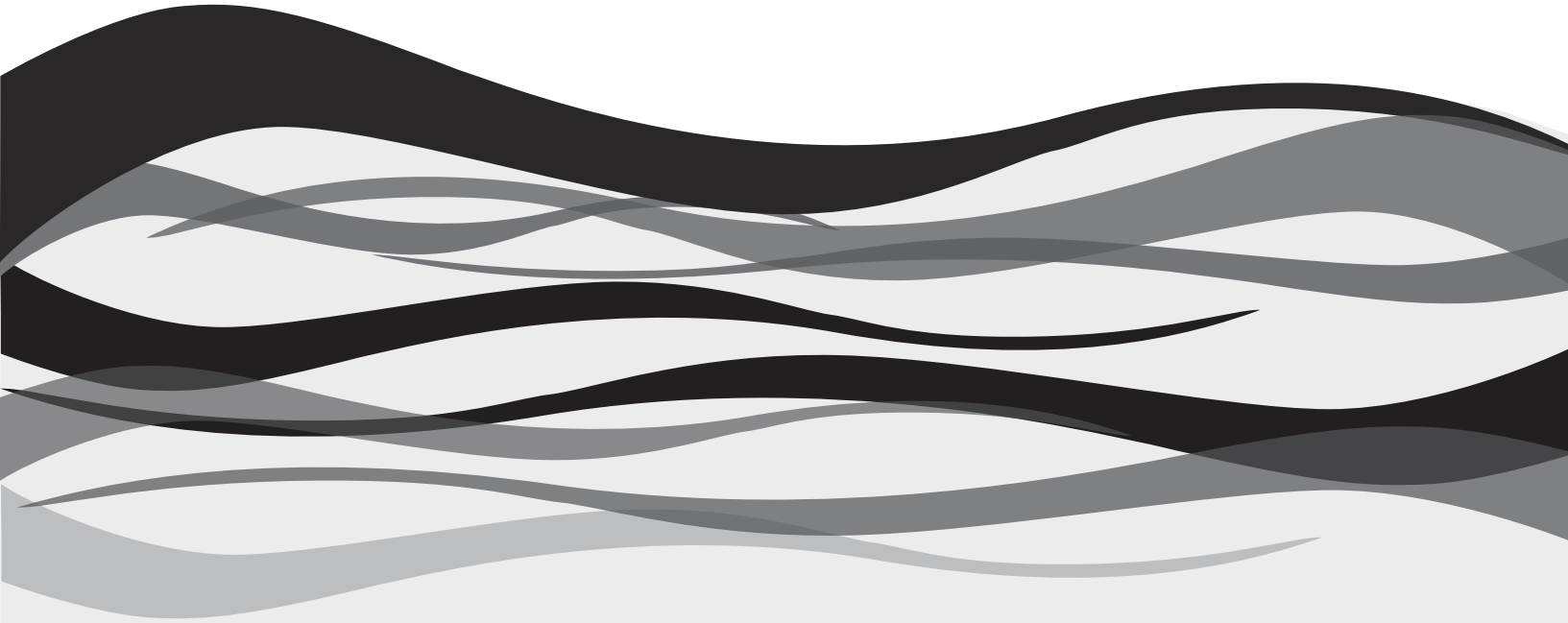

Health Canada is the federal department responsible for helping Canadians maintain and improve their health. We assess the safety of drugs and many consumer products, help improve the safety of food, and provide information to Canadians to help them make healthy decisions. We provide health services to First Nations people and to Inuit communities. We work with the provinces to ensure our health care system serves the needs of Canadians.

Published by authority of the Minister of Health.

Guidelines for the Review of Water and Wastewater Project Proposals in First Nations Communities South of 60°

Également disponible en français sous le titre :
Lignes directrices relatives à l'examen des projets d'alimentation en eau et d'assainissement dans les collectivités des Premières nations au sud du 60e parrallèle

This publication can be made available on request on
diskette, large print, audio-cassette and braille.

For further information or to obtain additional copies, please contact:
Publications
Health Canada
Ottawa, Ontario K1A 0K9
Tel.: (613) 954-5995
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E-Mail: info@hc-sc.gc.ca

HC Pub.: 3456
Cat.: H34-169/2007
ISBN: 978-0-662-49949-7

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Acknowledgements

The publication and distribution of Health Canada's First Nations and Inuit Health Branch *Guidelines for the Review of Water and Wastewater Project Proposals in First Nations Communities South of 60°* are possible because of the commitment and dedicated work of:

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In addition, the authors extend special thanks to Dr. Dan Smith of the University of Alberta and to David Atkins, P. Eng., of Indian and Northern Affairs Canada for providing input during the development of this document.

Executive Summary

The *Guidelines for the Review of Water and Wastewater Project Proposals in First Nations Communities South of 60°* (the Guidelines) were developed by representatives of Health Canada's First Nations and Inuit Health (FNIH) from the Alberta and Atlantic regions as well as from Environmental Health Division, Headquarters.

This document was created following the development of the *National Framework for the Review Process of Water and Wastewater Systems in First Nations Communities* to assist FNIH regional offices in their review of project proposals.

The Guidelines are a step-by-step guide for Environmental Health Officers (EHOs) and Public Health Engineers (PHEs) to review project proposals from a public health perspective. They provide elements to be considered in the review process, procedures for carrying out the review, essential documentation to be provided at each stage of the review, and the roles and responsibilities of EHOs and PHEs, including the coordination of the review process.

The Guidelines are a living document and will be updated as necessary.

1.0 Framework Agreement

The *National Framework for the Review Process of Water and Wastewater Systems in First Nations Communities* (the Framework) was created in March 2005 in response to the First Nations Water Management Strategy. The Framework is a joint effort of Indian and Northern Affairs Canada (INAC), Environment Canada (EC), and Health Canada (HC). It outlines an integrated review process for drinking water and wastewater infrastructure projects, along with the roles and responsibilities of the three departments.

The main objective of the integrated review process is to ensure that all project proposals are reviewed in a coordinated fashion by all involved departments at the various stages of their development to help First Nations meet relevant standards and guidelines. The Framework is intended to complement existing review processes in use in regions, by clarifying communications between departments and proponents.

Appendix 3 of the Framework lists examples of elements for review for consideration by each involved department. The INAC list of review elements is comprehensive and ensures that the project proposals meet appropriate engineering standards, guidelines, and policies, including Level of Service Standards and industry acceptable standards; that the estimated costs are reasonable; and that the proposed system can meet the project objectives within an acceptable time period. Environment Canada's role is to review proposals for potential environmental impacts; as such, examples of elements for review are included.

The *Guidelines for the Review of Water and Wastewater Project Proposals in First Nations Communities South of 60°* (the Guidelines) address Health Canada's mandate and review elements.

2.0 Purpose of Guidelines

The purpose of the Guidelines is to provide a step-by-step guide to help HC First Nations and Inuit Health Branch (FNIHB) regional reviewers, both Environmental Health Officers (EHOs) and Public Health Engineers (PHEs), review projects from a public health perspective. This document outlines elements to be considered for the review process, procedures for carrying out the review, essential documentation to be provided at each stage of the review, and the roles and responsibilities of the EHOs and PHEs, including coordination of the review process.

3.0 Health Canada Mandate

Health Canada's general mandate, as defined in the *Department of Health Act*, 1996, includes coordinating efforts to preserve and improve public health. The scope of the HC review will therefore be defined by those elements associated with protecting public health.

For water servicing projects, these elements include an assessment of the following aspects:

- Drinking water quality meets the Guidelines for Canadian Drinking Water Quality (GCDWQ) and provincial standards, as applicable.
- Quantity of drinking water sufficient to meet present and future community needs.
- Reliable and continuous supply of safe drinking water.

For wastewater servicing projects, the review focus includes an assessment of aspects such as the location of both the outfall and sludge disposal facilities and proximity to other uses, as well as site security as it affects public health and safety.

4.0 Roles of Environmental Health Officer and Public Health Engineer

The roles of the EHO and the PHE, when engaged, are outlined in three parts:

- *Part 1:* Determine if the process used by the system designer identified the main health-related risk factors to be addressed in relation to:
    - Source water protection area
    - Potential threats to water source
    - Water monitoring protocols
    - Quality and location of wastewater effluent discharge
- *Part 2:* Based on experience with similar installations and in the context of the available raw water source, can the proposed system realistically meet the designer's performance claims by delivering safe drinking water continuously and reliably in a First Nations environment?

In addition, if there were risk factors identified by the designer in Part 1, what pre-design work (e.g. literature reviews, bench-scale testing, pilot plant testing) was completed to ensure that the design assumptions adopted to address all identified risk factors were correct?

Part 3: Do the performance claims for the proposed drinking water system meet or exceed HC's requirements for drinking water quality?

4.1 Environmental Health Officer

The EHO is responsible for the coordination of the review process on behalf of HC-FNIHB. The EHO brings on-the-ground experience to the review process, as well as familiarity with the site, local conditions, and community. If required, the EHO will engage a PHE to review specific aspects of a project from a public health perspective, as proposed in Appendix D.

4.2 Public Health Engineer

At the request of an EHO, the PHE will undertake the technical review of specific aspects of a given project from a public health perspective, in accordance with the three-part approach outlined above.

5.0 Review Process

As summarized in the Framework, reviews may take place during each of the following three stages of the development of a proposed project:

- Feasibility
- Pre-design
- Design

Indian and Nothern Affairs Canada serves as the single point of contact for First Nations submitting proposals. Health Canada and other stakeholders will receive projects for review from INAC. The EHO is responsible for the coordination of the review process on behalf of HC.

A list of minimum essential documentation to be provided by project proponents at each stage of the review process is presented in Appendix A of this report.

6.0 Elements for Review

The review process will proceed on a step-by-step basis through interrelated sub-components that together comprise the overall proposed water or wastewater servicing project. These sub-components are called Elements for Review. Each element focuses on the assessment of a specific aspect of the project.

The number of elements in a given project submission will vary depending on the scope and intent of the development initiative. Not all project submissions will require a review of each of the elements listed below. The types of elements vary between water servicing and wastewater servicing projects, with only minor overlap.

For each development initiative, the following required information should be listed and deemed applicable as a minimum in the review process:

- Individual responsible for review
- Applicable provincial/federal standard/regulation/guideline or alternative (e.g. Ten States Standards, best practices), as provided in Appendix B
- Confirmation of use of standards in design
- List of exceptions to the implementation of the standards

Form A of Appendix C provides an organizational tool for the EHO to establish the submission review process and document its progress.

Form B of Appendix C is a tool for the HC reviewers to document their findings in the review process.

The details associated with each element pertaining to either water servicing or wastewater servicing projects are outlined in Appendices D and E, respectively. An overview of the issues associated with the Elements for Review is listed below.

6.1 Water Servicing Projects

The overall objective is to protect public health by ensuring that the proposed system is sufficient to provide an adequate, safe, and reliable water supply that meets the GCDWQ (latest edition) and provincial water quality guidelines/standards, as applicable.

Although it is expected that project reviews at all stages will address these areas, greater emphasis ought to be placed on source, supply, and treatment processes, including a detailed assessment of all viable alternatives considered by the project proponent, during the feasibility stage.

At the design stage, project reviews generally will include greater emphasis on details regarding treatment processes, including disinfection practices, monitoring and alarm systems, integrity and security, and proposed filter backwash practices.

6.1.1 Drinking Water Source

The areas to be examined as part of the Drinking Water Source element assessment include:

- Source water protection area
- Potential threats to water source

The step-by-step procedures associated with carrying out the Drinking Water Source element review are presented in Appendix D, under the title “Water Servicing Project Elements for Review.”

6.1.2 Water Treatment

The areas to be examined as part of the Water Treatment element assessment include:

- Suitability of various types of treatment technologies:
  - Need for pilot project

  - Selection of various treatment processes
  - Assess the claim for reduction of water contaminants to meet GCDWQ
- Suitability of proposed treatment technology
- Management of backwash water

The step-by-step procedures associated with carrying out the Water Treatment processes and systems element review are presented in Appendix D, under the title "Water Servicing Project Elements for Review."

6.1.3 Disinfection

The areas to be examined as part of the Disinfection element review are indicated in the following points:

- Disinfection design
- Disinfection by-products (DBPs)
- Disinfection protocol
- The CT disinfection concept

6.1.4 Water Monitoring Systems

The areas to be examined as part of the Water Monitoring Systems element include:

- Water monitoring protocols
  - Automatic on-line monitoring systems
    - Turbidity levels and particle counts
    - pH levels
    - Residual chlorine levels
  - Sampling points for raw and treated water, access and protocols
- Alarms
  - Alarm supervision systems, protocols and settings

6.1.5 Integrity and Security of Water Systems

The areas to be examined as part of Integrity and Security of Water Systems include:

- Cross-connection control in the water treatment facility
- Cross-connection control in the distribution system
  - Dead-ends and stagnation potential
    - Flush points
  - Bulk water hauling — truck fill station designs
- Disinfection, flushing, and cleaning practices
  - Distribution boosting systems
- Security of water treatment facilities

6.2 Wastewater Servicing Projects

The overall objective is to protect public health by ensuring that proposed wastewater servicing systems minimize adverse impacts on all water use practices, including drinking water and recreational development.

It is expected that the review of projects in all stages of an initiative's development will address the objectives of reducing the negative impact on water use practices.

At the design stage, project reviews will include greater emphasis on details regarding effluent quality and location, cross-connection control in the plant, and security measures.

6.2.1 Sewage Collection Systems

The areas to be examined as part of the Sewage Collection Systems element include:

- Physical layout and infrastructure routing:
  - Horizontal and vertical separation between sewer and water pipes
  - Overflow/outfall discharge routes
  - Alarm mechanisms to control the collection system
  - Overflow mechanisms and related discharge protocol

6.2.2 Effluent Discharge

The areas to be examined as part of the Effluent Discharge element include:

- Potential impact on other water uses:
  - Location of discharge, frequency of discharge, and appropriate effluent discharge criteria relative to public recreational facilities / water intakes
  - Receiving water body:
    - Water levels
    - Flow data
    - Assimilative capacity

6.2.3 Physical Integrity and Access Restriction

The areas to be examined as part of the Physical Integrity and Access Restriction element include:

- Prevention of cross-contamination:
  - Fencing of lagoons and open tankage
  - Appropriate signage

Appendix A:

List of Minimum Essential Review Package Submission Documents

Minimum Essential Review Package Submission Documents

Water Servicing Projects

Feasibility Stage

- Feasibility Study Report:
  - Development of contemplated design criteria
  - Evaluation of all available alternatives:
    - For each source option:
      - Delineation of watershed area
      - Evaluation of vulnerability to contamination
      - Evaluation of adequacy of quantity of supply
      - Raw water quality data
    - For each treatment option:
      - Matched to water source characteristics
  - Distribution

Pre-design Stage

- Pre-design Report/Design Brief:
  - Detailed development of recommended option, including:
    - Evaluation of adequacy of quantity of supply
    - Detailed evaluation of treatment option, including:
      - Results of a pilot project
      - Design guidelines to be followed
      - Design discussions, including disinfection methods
    - Detailed raw water quality data:
      - Physical, chemical, radiological, and microbiological
      - Seasonal data
- Environmental Screening Report

Design Stage

- Drawings and specifications for review by PHE
- Monitoring plan
- Information on system integrity
- Treatment processes, method of disinfection and type of disinfectant, other chemical additives, determination to ensure adequate CT for log reduction of Cryptosporidium, Giardia, and viruses, etc.

Wastewater Servicing Projects

Feasibility Stage

- Review of proposed locations of facilities
- Review of surrounding land use
- Information on the effluent quality

Pre-design Stage

- Location of proposed discharge
- Detailed land use mapping
- Proposed effluent discharge criteria
- Proposed set-back criteria
- Proposed method of sludge disposal

Design Stage

- Detailed drawings and specifications for review by PHE
- Discharge location, frequency of discharge, and effluent discharge criteria
- Proposed method of sludge disposal
- Set-back distances
- Fencing and other security measures

Appendix B:

List of Relevant Guidelines and Standards

List of Relevant Guidelines and Standards

1. Health Canada's *Guidelines for Canadian Drinking Water Quality* (latest version)
   http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/doc_sup-appui/sum_guide-res_recom/index_e.html

2. Health Canada's *Guidelines for Canadian Recreational Water Quality* (latest version)
   http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/guide_water-1992-guide_eau_e.html

3. *Protocol for Safe Drinking Water in First Nations Communities, published by Indian* and Northern Affairs Canada (INAC), March 2006
   http://www.ainc-inac.gc.ca/H2O/sdw/index_e.html

4. Health Canada's *Procedure Manual for Safe Drinking Water in Canada's First Nations Communities South of 60°*, available at Health Canada's First Nations and Inuit Health Branch regional offices

5. Environment Canada's *Guidelines for Effluent Quality and Wastewater Treatment at Federal Establishments*, 1976
   http://www.ec.gc.ca/etad/default.asp?lang=En&n=023194F5-1

6. Indian and Northern Affairs Canada's Corporate Manuals System
   Volume 1 – Capital Facilities and Maintenance, Water and Sewage Systems
   http://www.ainc-inac.gc.ca/ps/hsg/cih/dl/wat_e.pdf

7. Indian and Northern Affairs Canada's *Technical Information Document – Community Water Systems*
   http://www.pwgsc.gc.ca/si/inac/content/docs_technical_water_part2-e.html

8. Applicable Provincial Regulations/Standards – Links to provincial websites:

   Alberta
   http://www.gov.ab.ca/home/index.cfm?page=5

   British Columbia
   http://www.gov.bc.ca/bvprd/bc/home.do

   Manitoba
   http://www.gov.mb.ca/departments.html

New Brunswick
http://app.infoaa.7700.gnb.ca/gnb/pub/search1.asp

Newfoundland and Labrador
http://www.health.gov.nl.ca/health/divisions/medical/diseasecontrol.htm

Nova Scotia
http://www.gov.ns.ca/gov_index.asp

Ontario
http://www.infogo.gov.on.ca/infogo/mainPage.do

Prince Edward Island
http://www.gov.pe.ca/phone/index.php3

Quebec
http://www.gouv.qc.ca/portail/quebec/pgs?lang=en

Saskatchewan
http://www.gov.sk.ca/departments-agencies/

9. Ten States Standards
Recommended Standards for Water Works (latest edition)
http://www.dutchessny.gov/countygov/Departments/Health/Reports/HD10StatePreface.pdf

10. National Sanitation Foundation (NSF)
NSF Standard 60 – Drinking Water Treatment Chemicals, Health Effects
NSF Standard 61 – Drinking Water System Components, Health Effects
http://www.nsf.org/consumer/drinking_water/index.asp?program=WaterTre

Appendix C:

Submission Review Process Tracking Forms

Form A: Review Process — Assignment of Responsibility

First Nation Band Name: _____

First Nation Community: _____

Project: _____

Stage: _____

Date Submitted: _____

Environmental Health Officer: _____

Water Servicing Projects				
Element of Review	Responsibility	Assigned Reviewer	Date Commenced	Date Completed
Drinking water source				
Water treatment				
Disinfection				
Water monitoring protocol				
Integrity and security of water systems				

Wastewater Servicing Projects				
Element of Review	Responsibility	Assigned Reviewer	Date Commenced	Date Completed
Wastewater collection system				
Effluent discharge				
Physical integrity and access restriction				

Form B: Review Process — Element Assessment Results

First Nation Band Name: _____

Date Submitted: _____

Project: _____

Stage: _____

Environmental Health Officer: _____

Element for Review: _____

Standards/Guidelines Applied: _____

Exceptions:

Form B (continued)

Comments:

Resolution:

Appendix D:

Water Servicing Project Elements for Review

WATER SERVICING PROJECT

Element: Drinking Water Source

Project Stage: Feasibility stage

Aim of Review: Assess the vulnerability and security of the proposed drinking water source and highlight concerns that will need to be addressed during subsequent stages of a project's development.

Reviewer: Environmental Health Officer (EHO)

Review Focus and Issues Identification:

Source Water Protection Area

For the proposed drinking water source, has the area of source water been delineated by the proponent within the feasibility study submission? Items to consider in making such assessments include the following:

a) The first step in protecting a drinking water source is to identify the watershed area that provides water from either a surface water or a groundwater source. In all cases, the initial source of water is precipitation. After rain falls on the Earth's surface, water either runs off as surface water or infiltrates the ground to become groundwater. Surface-related activities have impacts on both surface water and groundwater.

b) The key question when assessing the area of a surface watershed is: "If a drop of water falls on an area, where will it go and what will it carry along on the surface?" For large watersheds, judgement is required to determine the area of significant impact. Is the proposal's judgement in such cases considered satisfactory?

Has consideration been given to development of a source protection plan?

For the proposed drinking water source, has the area of source water been delineated by the proponent within the feasibility study submission? Items to consider in making such assessments include the following:

a) For groundwater, the area that contributes water to the well is known as the capture zone. Typically, capture zones are delineated based on the amount of time water takes to travel to a well. For example, typically 50-day, 2-year, 5-year, 10-year, and 25-year capture zones are delineated. Does the feasibility study submission acknowledge such zones?

b) Although the surface watershed or groundwater capture zone may not be mapped in detail at the feasibility stage, some consideration should be given to delineation, in order to evaluate the suitability of the source based on potential threats and vulnerability to contamination.

Potential Threats to Water Source

With regard to the EHO's first-hand knowledge of the community, determine whether both known and suspected conditions of source water contamination have been addressed in the feasibility study.

a) Has a watershed evaluation been conducted for potential contamination from industrial, agricultural, and municipal sources that could affect required treatment for drinking water treatment facilities?

Within the delineation of the source area presented by the feasibility study submission, identify high-risk activities and land uses and identify whether each has been addressed in the study. These may include:

a) Local and neighbouring landfill sites: hazardous waste, municipal waste, and private disposal
b) Known locations of groundwater contamination with industrial by-products
c) Existing or abandoned commercial or industrial sites
d) Intensive agricultural operations
e) Storage and land application of biosolids, septage, and manure
f) Direct industrial and municipal waste discharge to surface waters
g) Locations of storm water discharges
h) Locations of subsurface infiltration lagoons/ponds
i) Septic fields and cemeteries
j) Fuel storage
k) Bulk liquid chemical storage
l) Salt piles and snow dumps
m) Airport operations
n) Major highways

Element: Water Treatment

Project Stage: Feasibility stage

Aim of Review: Assess the selection of treatment technologies and their suitability for processing the proposed water source.

Reviewer: Public Health Engineer (PHE)

Review Focus and Issues Identification:

Suitability of various types of treatment technologies

Has the selection of the proposed treatment technology been clearly substantiated?

a) Were adequate water quality parameters sampled and tested?
   - Was the sampling conducted during all seasons?

b) Review the assessed treatment technologies for their abilities to meet required treatment criteria.
   - Does the claim for the total reduction of contamination across all treatment processes meet the defined treatment criteria?

c) Was consideration given to undertaking an on-site pilot study to test applicable treatment technologies?

d) The need for pilot testing generally arises where site conditions are difficult to simulate at the bench-scale level, where significant operating experience is not available for the proposed treatment technology, or where the raw water source indicates unusual water contaminants.

e) Assess the appropriateness of the recommended treatment processes. Can all raw water contaminants be removed using the proposed treatment processes?

f) Are there unusual, locally driven raw water quality issues exhibited by the proposed source that the treatment processes must address? Do the proposed treatment processes address these issues?

Project Stage: Pre-design stage

Aim of Review: Assess the rationale for the selected treatment technology and its suitability for the selected source water.

Reviewer: Public Health Engineer (PHE)

Review Focus and Issues Identification:

Suitability of Proposed Treatment Technology

Has the selection of the adopted treatment technology been substantiated?

a) If pilot testing was conducted, were the methods, time, and duration of the pilot project satisfactory?

b) Is it substantiated that the finished water produced by the treatment processes will comply with drinking water quality guidelines and standards?

c) Are there any concerns about the finished water quality resulting from the application of the proposed chemical dosages used in the recommended treatment processes (e.g. coagulation and flocculation)?

Is there a risk of interruptions to the water supply (e.g. filter cleaning)?

Is fluoridation being considered by the First Nation or Health Canada for application as a post-treatment conditioning process? If so, are appropriate equipment and training planned?

Management of Backwash Water

Have collection, treatment, and disposal of the generated wastewater (filter backwash water) been addressed?

a) Is the approach acceptable?

b) Is the chemical composition of the backwash water a concern?

c) Is the proposed management of backwash water considered acceptable?

Element: Disinfection

Project Stage: Pre-design stage

Aim of Review: Assess the adequacy of the proposed disinfection process to satisfy drinking water disinfection standards and requirements.

Reviewer: Public Health Engineer (PHE)

Review Focus and Issues Identification:

Disinfection Design

All communal drinking water systems should provide disinfection to ensure an adequate level of removal or inactivation of pathogenic organisms that may be present in the raw water, in order to prevent recontamination of drinking water within the distribution system, and to maintain adequate drinking water quality throughout the distribution system.

Disinfection must therefore provide initial treatment at the plant or source (primary disinfection) and residual treatment in the distribution system (secondary disinfection). Although some form of chlorination is typical for primary disinfection, ozonation or UV light may also be used. Some form of chlorination, however, will be required for secondary disinfection and maintenance of a residual in the distribution system.

a) Have the criteria and rationale for the disinfection protocol been presented in the design?

b) Does the design clearly indicate to the operator the required disinfectant residual to be maintained during primary disinfection?

c) Are the disinfectant dosage points that are provided within the design adequate in both quantity and location within the treatment process, based on the source and type of treatment?
   - Is the type of disinfection — or, in some cases, oxidation — chemical appropriate for the application at hand?

d) Is there adequate provision for secondary disinfection and maintenance of a residual in the distribution system?
   - Are the proposed disinfectant dosages satisfactory?

Disinfection By-products

A key component in the selection and design of an appropriate disinfection system is control of the formation of disinfection by-products (DBPs). DBPs are undesirable organic by-products caused primarily by the reaction of chlorine with natural organic matter in water.

Laboratory testing can be completed to determine the potential for the formation of DBPs, including trihalomethanes, such as chloroform, and haloacetic acids. The concentrations of dissolved organic carbon (DOC), turbidity, and colour in the source water are initial indicators of DBP formation potential. The higher the DOC, turbidity, or colour level, the greater the propensity for by-product formation.

a) Does the design incorporate adequate measures to reduce or avoid the potential of formation of DBPs?

Disinfection Protocol

The disinfection system design also involves the location of dosage points. For systems with groundwater sources that include a water reservoir and the distribution system, the minimum dosage points include locations both before the reservoir and immediately before the distribution system. For systems involving filtration, disinfection dosage points should be provided before treatment, following filtration but before the reservoir, and immediately before the distribution system.

a) Are the criteria upon which the proponent's disinfection protocol is based considered adequate?

The CT Disinfection Concept

The CT disinfection concept combines a disinfectant residual concentration and the effective disinfectant contact time to ensure the effectiveness of pathogen inactivation as part of the water treatment process.

This contact time should be calculated at worst-case operating conditions — highest anticipated flow rate, lowest water level in the reservoir (if applicable), lowest anticipated

disinfection concentration, and highest anticipated water temperature. If no reservoir is present, then contact time is calculated using the volume of water contained in the distribution pipe on the way to the first user.

The required concentration and contact time are calculated based on CT tables. Typical CT tables can be found in documents such as *Procedure for Disinfection of Drinking Water in Ontario*[1], U.S. Environmental Protection Agency guidelines, and Guidelines for Canadian Water Quality: Supporting Documentation — *Protozoa: Giardia and Cryptosporidium*[2], *Escherichia coli*[3] and *Total coliforms*[4]. These tables indicate the combination of disinfectant residual and contact time required to achieve various levels of pathogenic removal, stated in terms of log removal. Typically, groundwater not under the direct influence of surface water, with no other treatment, requires a combination of concentration and contact time to achieve a 2-log (99%) removal or inactivation of pathogenic organisms. Surface water or groundwater under the direct influence of surface water typically requires a 2-log (99%) removal or inactivation of *Cryptosporidium* oocysts, a 3-log (99.9%) removal or inactivation of *Giardia* cysts, and a 4-log (99.99%) removal or inactivation of viruses. Credit is provided towards these requirements depending on the treatment provided.

Baffling is installed in reservoirs or other holding vessels used to achieve contact time to enhance tank through-flow distances and to prevent short-circuiting between tank inlet and tank outlet. In effect, the CT time achieved by a given unbaffled storage tank can be increased by up to 10 times through the use of properly designed baffle wall systems.

a) For primary disinfection, has the CT concept been used to calculate the required disinfection dosage rates?
   - Are the criteria on which the CT calculations are based clearly presented?
   - Is the manner in which the CT concept has been applied considered appropriate?
   - If the CT concept has not been used, has another method been used? Is this other method considered adequate?
   - Are the CT or other calculations based on worst-case operating conditions? Have the worst-case operating conditions been clearly identified and justified?

b) Is adequate holding time provided?
   - Is baffling proposed?

Element: Water Monitoring Systems

Project Stage: Design stage

Aim of Review: Assess whether proposed monitoring of the quality of both raw and finished water is adequate.

Reviewer: Public Health Engineer (PHE)

1 http://www.ene.gov.on.ca/envision/env_reg/er/documents/2005/PA05E0008.pdf
2 http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/doc_sup-appui/protozoa/index_e.html
3 http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/doc_sup-appui/escherichia_coli/index_e.html
4 http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/doc_sup-appui/coliforms-coliformes/index_e.html

Review Focus and Issues Identification:

Water Monitoring Protocols

The monitoring systems and protocols apply to the water treatment facility and distribution systems.

Is the plan for water monitoring systems in the operation of the water treatment facility and distribution systems adequate?

Monitoring systems generally refer to the use of automatic electronically based devices designed to measure various water quality, process system, and/or building function parameters.

a) Water quality monitoring of both raw and finished water streams generally includes:
   - Turbidity level analyzers
   - Chlorine residual analyzers
   - pH level analyzers
   - Particle counters

b) Process system function monitoring devices generally include:
   - Pressure measurement
   - Flow meters

c) Building function monitoring devices generally include:
   - Air quality monitors
   - Temperature monitors

Monitoring protocols also include conducting regularly scheduled manual sampling and testing of water quality and system performance parameters by the operator. Monitoring by hand is required in the absence of automatic monitoring equipment and is also often used to augment automatic monitoring data.

Health-related reviews will focus primarily on the manner in which water quality monitoring devices are engaged within the scope of a project and include:

a) Identifying regional, provincial, or other guidelines specifying minimum levels of water quality monitoring (e.g. Health Canada's *Procedure Manual for Safe Drinking Water in First Nations Communities South of 60˚* and Indian and Northern Affairs Canada's *Protocol for Safe Drinking Water in First Nations Communities*):
   - Determine whether the Health Canada and Indian and Northern Affairs Canada monitoring requirements will be adopted for the project at hand.
   - If so, perform the review against these adopted criteria.
   - Does the design clearly present a list of parameters planned for monitoring within

the water treatment facility and distribution system?
Are there any monitoring gaps?

- With respect to the proposed monitoring requirements, what parameters will be monitored, and how frequently?

b) Is the system equipped to satisfy the regularly scheduled on-site manual water quality testing that will be carried out?
   - Are portable water quality measurement devices considered?

c) Does the design include information monitoring for water quality parameters appropriate to the water source, raw water quality, and type of treatment?
   - As a minimum, provision should be made for raw and treated water turbidity, chlorine residual at both the pre- and post-clearwell locations, and pH monitoring.
   - Continuous on-line monitoring is recommended for turbidity and chlorine residual.
   - Is there provision for automatic recording of data?

d) Is provision made for manual sampling points for both raw water and treated water before the reservoir, post-reservoir, and in the distribution system?

e) Does the design proposal include remotely situated components for which automatic monitoring could be considered (e.g. chlorine booster stations, wet wells)?

f) In the case of rural areas where water is transmitted through low-pressure water pipes into cisterns, is there provision for sampling points to ensure routine sampling? The water sample should be from the distribution line and from the cistern (when feasible).

Alarms

Suggested alarm notification conditions might include:

- High/low clearwell water levels (as required)
- High treated water turbidity
- High/low chlorine residual levels
- Adverse pH levels within the function of the treatment process

Element: Integrity and Security of Water Systems

Project Stage: Design stage

Aim of Review: Assess the potential for cross-contamination situations.

Reviewer: Public Health Engineer (PHE)

Review Focus and Issues Identification:

Cross-Connection Control in the Water Treatment Facility

Are all hatches providing access to reservoirs or storage tanks suitably equipped with sealed covers and raised edges?
Confirm that the specifications of any waterproofing agents scheduled for application to concrete or other surfaces within the treated water storage reservoirs or storage tanks are suitable for potable water environments.

a) Should conform to NSF Standard 60 and NSF Standard 61 as a minimum.

Are the piping penetrations of the operating floor through to the treated water reservoir fitted with suitable watertight seals and/or other water stoppage mechanisms?

If the water treatment facility is equipped with a washroom:

a) Is the sewer service pipe completely isolated from the treated water reservoir or water piping?

b) Is all other drain/waste/vent piping (i.e. floor drains, process wastewater drains, etc.) completely isolated from the treated water reservoir or water piping?

If the water treatment facility is equipped with on-site fuel storage capacity (i.e. for heating, standby generators, or diesel-driven pumps):

a) Is there proper containment for fuel storage facilities?

b) Is proper secondary containment for fuel storage provided? Are the secondary containment mechanisms adequate?

c) Is the manner in which the fuel tank units are equipped with level monitors and alarms to protect against overfilling considered adequate?

Are the containment and chemical storage and handling facilities that are designed to protect against treated water contamination in the case of a chemical spill considered adequate?

Cross-Connection Control in the Distribution System

Has the cross-connection control been considered in the design?

a) There is to be no connection between the distribution system (any pipes, pumps, hydrants, or tanks) and sewage or other contaminated areas whereby contaminated water or other contaminating materials may be discharged or drawn into the system.

Has the design of the piping network been done in such a way that dead-ends have been minimized? Is the potential for stagnant water in dead-ends minimized?

a) Are each of the dead-ends equipped with a means to provide adequate flushing operations as well as taking a water sample?

Is the water main positioned at least 3 m horizontally from any existing or proposed gravity sanitary sewer or septic system?

a) No water pipe is to pass through or come into contact with any part of a sewer manhole.

Are the inverts of water mains, branches, and house connections 450 mm above the obverts of sewer lines at any cross-over locations?

Are the truck fill stations adequately designed to be serviced?

a) Equipped with suitably sized and suitably specified backflow preventers?

b) Equipped with piping arrangements that prevent contaminants from being transferred from a hauling vessel to others using the station?

c) Equipped so that hoses are not contaminated by contact with the ground?

Disinfection, Flushing, and Cleaning Practices

Does the design exhibit an ability to maintain disinfectant residuals throughout the length of the distribution system? If not, should disinfectant booster stations be considered?

If equipped with disinfectant booster stations, is the design considered adequate?

In the case of rural areas where water is transmitted through low-pressure pipes into cisterns, are flushing points provided?

Security of Water Systems

With regards to fencing and building security:

a) Is there provision to secure the water treatment plant (i.e. properly locked)?

b) Does fencing surround the water reservoir and chemical storage facility?

With regards to the provision of standby power:

a) Is there a means of standby power proposed?

b) If so, is it appropriate for the size of the water treatment facility?

c) Is the generator provided with an automatic starter to ensure continuous power for the plant?

Appendix E:

Wastewater Servicing Project Elements for Review

Element: Wastewater Collection Systems

Project Stage: Feasibility stage and Pre-design stage

Aim of Review: Assess the integrity of the sewage collection system design and the adequacy of the measures to eliminate potential hazards that may contribute to undesirable exposure or cross-contamination of water supply.

Reviewer: Public Health Engineer (PHE)

Review Focus and Issues Identification:

Physical Layout Infrastructure Routing

Sewer mains and septic systems are to be positioned at least 3 m horizontally from any existing or proposed water service pipe. Is this stipulation satisfied, and shown to be satisfied, in the project submissions?

a) No water pipe is to pass through or come into contact with any part of a sewer manhole. Is this stipulation satisfied, and shown to be satisfied, in the project submissions?

Vertical separation between sewer and water main piping at pipe crossings is to be at least 450 mm. Is this stipulation satisfied, and shown to be satisfied, in the project submissions?

Is the collection system equipped with overflow and/or outfall mechanisms, emanating either directly from manholes or from pumping station wet wells?

a) Are the protocols governing the operation and function of such overflow/outfall mechanisms clearly described? Are the protocols acceptable?

b) Is the anticipated quality of effluent emanating from the project's overflows/outfalls assessed? Is the effluent quality considered acceptable within the system's operation and function?

c) Are the alignments, grades, and materials of construction of overflow/outfall discharge routes clearly delineated?

d) In what manner are any overflow/outfall routes protected from public access? Are these measures acceptable?

e) Are alarms or other notification mechanisms included in the design to signal whether overflow/outfall conditions are being experienced by the collection system? Are these mechanisms/systems considered adequate?

f) For lagoon systems (including liners), does the feasibility and design submissions show methods to protect groundwater?

Element: Effluent Discharge

Project Stage: Feasibility stage and Pre-design stage

Aim of Review: Assess the effluent discharge system and protection of water source.

Reviewer: Public Health Engineer (PHE)

Review Focus and Issues Identification:

Potential Impact on Other Water Uses

Have the receiving body and proposed location of wastewater discharge been identified?

a) Has the water quality of the receiving body been documented?

b) Does the documentation show the future location of treated effluent discharge into the receiving body upstream from, or in the vicinity of, a known water supply source or intake structure? Is enough information presented to assess these conditions?
   - Attention should be directed to the location of a water intake structure relative to the effluent outfall structure.

c) Is there recreational activity (i.e. beaches, swimming, diving, boating, etc.) in the location of the proposed wastewater effluent discharge?
   - Attention should be directed to the location of such water uses relative to the effluent outfall structure.
   - Have these concerns been addressed in the submission by the proponent?

d) Evaluate the results of treated wastewater discharge in close proximity to recreational facilities and drinking water intakes.

e) If the proximity of the effluent discharge poses potential public health risks, evaluate the quality of the effluent before it is discharged. The sample results should be assessed to determine if they comply with applicable standards.

Does any part of the wastewater system fall within a water source protection plan area?

a) Is the water source protection plan area identified and referenced within the proponent's submission package?

b) If so, are precautions to protect the water source identified?

Element: Physical Integrity and Access Restriction

Project Stage: Design stage

Aim of Review: Assess the design with respect to potential for cross-contamination.

Reviewer: Public Health Engineer (PHE)

Review Focus and Issues Identification:

Protection of Cross-Contamination

Is the wastewater treatment facility equipped with domestic water service?

a) Is the manner in which water service piping is completely isolated from any effluent streams, tankage, or any other drain/waste/vent piping (e.g. floor drains) systems considered adequate?

b) Is there a provision for fencing of lagoon and open tankage?

c) Is there appropriate signage indicating the possible danger associated with entering the lagoon system?