

Keewaytinook Okimakanak Tribal Council (KOTC)

First Nation Report Phase II

1.0 Introduction

1.1 Background

Following the outbreak of E. Coli in the Town of Walkerton, Ontario, in May 2000, and other incidents of Cryptosporidium and Giardia in other communities, the Ontario First Nations Technical Services Corporation (OFNTSC) expressed concerns as to potential health and safety risks facing First Nation communities resulting from water supplies, treatment and storage. It was decided to retain a consultant to carry out a study of existing water facilities in First Nation communities and to assess the ability of these facilities to meet the risk challenges.

In November 2000 the OFNTSC issued a Request for Proposal (RFP) for an Assessment Study of Water Supply/Treatment/Storage at Ontario First Nations Communities. The Ontario Clean Water Agency (OCWA) responded to the RFP and in January 2001 was awarded the assignment by the OFNTSC.

The objective of the study, as outlined in the RFP, was to provide an overall general assessment of the water supply/treatment/storage in First Nation communities to determine the magnitude and scope of existing and potential problems in terms of health and safety risks. Data was to be collected and analyzed on the facilities through observation and discussion and recommendations made on such issues as optimization, maintenance, training and the immediate need for the purchase of equipment. Estimates or details were not required.

Mr. Ross Holden, P.Eng. of Ross Holden Engineering Services was appointed as the Study Coordinator to manage the study on behalf of the OFNTSC.

To monitor the progress of the study and to provide direction, a Technical Steering Committee was formed with representatives from the OFNTSC, Ross Holden Engineering Services, Indian and Northern Affairs Canada (INAC), Public Works and Government Services Canada (PWGSC), Health Canada (HC) and OCWA. Meetings were held at OCWA's offices on January 9, 2001, February 6, 2001 and March 19, 2001. At these meetings it was agreed to expand the Terms of Reference for the study to include sewage facilities. Sewage treatment plants, sewage lagoons and pumping stations, together with water storage tanks, were to be included in the study. Sewage collection systems, other than lift stations, and water distribution systems were not to be included in the study. Individual water and sewage systems were not to be included in the report except where water from communal treatment facilities is provided to individual holding tanks.

The RFP included a questionnaire to be completed for water facilities at each of the First Nation communities included in the study. Through the Technical Steering Committee the questionnaire was revised and expanded to include the new scope of work. In addition, a second questionnaire was developed for sewage facilities. The completed summary for the Keewaytinook Okimakanak Tribal Council community is included in the Appendix "A" attached to this report.

Under the Terms of Reference for the study, OCWA representatives would travel to the communities, meet with the First Nation operators, and having enlisted their cooperation, complete the questionnaires by means of questions and discussions. A tour of the treatment facilities would be undertaken at the time

of the visit. Any concerns expressed by the operator would be recorded, together with observations made by the reporter. Reports were then to be prepared on the findings for each of the communities, documenting the potential health and safety risks that were apparent at the time of the visit. Reports for each Tribal Council and/or Large First Nation were then to be prepared to summarize the findings for all of the constituent communities.

Other information provided to OCWA by the Technical Committee included:

- Akwesasne to Wunnumin Lake
Profiles of Aboriginal Communities in Ontario
Ontario Native Affairs Secretariat and Ministry of Citizenship
January 1992
- First Nation Community Profile
Ontario Region
OFNTSC
- Capital Asset Inventory System (CAIS)

OCWA met with the Tribal Council Technical Services Advisors (TCTSA) and OFNTSC representatives on January 16, 2001 in Sault Ste. Marie to brief the TCTSA on the study and to ask for their assistance in contacting the various First Nation communities and, if possible, travel to the communities with the OCWA representative. The Tribal Council representatives were very cooperative in assisting with this study and their participation is a major reason for the very high community participation rate in the study.

Visits to the communities by OCWA and the TCTSA were made in February, March, April, May, June, and July 2001.

Draft Tribal Council and/or Large First Nations reports (22 reports in total) were produced in July 2001. These reports were circulated to OFNTSC and Ross Holden Engineering Services for review and comment. Final Tribal Council and/or Large First Nations reports were issued in October 2001 incorporating the comments received by OCWA. In October 2001, a draft Overview Report was also issued, summarizing the 22 Tribal Council and/or Large First Nation reports. The OFNTSC circulated the October 2001 final Tribal Council and/or Large First Nations reports to the various Tribal Councils and/or Large First Nation for comments in December 2001. The Keewaytinook Okimakanak Tribal Council marked up the draft report and returned the report to OFNTSC in January 2002. The Phase I report was finalized in March 2002 based upon the comments received.

1.2 Background - Phase II Reports

Representatives from INAC were members of the Technical Steering Committee and attended the Technical Steering Committee meetings. With INAC's involvement in the initial study in Ontario, INAC have seen the value of undertaking similar studies in the rest of Canada. INAC has taken and used the Terms of Reference prepared by OFNTSC in the initial Ontario study, have modified and expanded the Terms of Reference and the Questionnaire, and in early summer 2001 taken the study Nation wide. The new Terms of Reference developed by INAC are referred to as the "National Site Assessment" study. With the National Site Assessment study expanded Terms of Reference for the rest of Canada, the Ontario study is now less detailed and lacking information is compared with the rest of Canada studies. Therefore INAC at a meeting on August 30th, 2001, through OFNTSC, asked OCWA to submit a proposal expanding the initial Terms of Reference to the National level of detail. By July 2001, OCWA had visited all of the First Nation communities. To properly complete all the requirements of the expanded Terms of Reference, a revisit to the community would be required. INAC stated a revisit was not financially viable and therefore it was agreed some of the requirements of the expanded Terms of

Reference could not be met. OCWA submitted their proposal dated September 7th, 2001 based on the use of information gathered in the initial visits to the First Nation communities from February 2001 to July 2001 and any additional information gathered through Health Canada and discussions with the community.

1.3 Phase II – Terms of Reference, Proposal, and Meetings

The Terms of Reference given to OCWA on August 30, 2001 were generic Terms of Reference developed by INAC Headquarters, and were meant to be modified for the Region involved. OCWA has taken the liberty with the Terms of Reference to make assumptions where blanks existed in the Terms of Reference. As was noted earlier, INAC instructed OCWA to use existing information and any additional information that could be gathered, without revisiting the community.

Terms of Reference has been included in Appendix “B” of this report.

OCWA submitted the proposal on September 7th, 2001 now referred to as the “Phase II” of the study. Meetings were held on September 12th, 2001, September 17th, 2001, September 24th, 2001, and October 1st, 2001 to clarify the proposal requirements. The negotiated activities for the Phase II study included:

- Preparing estimated costs of (Class D Level) capital works identified in the Phase I reports
- Inputting Phase I and Phase II information data into a computerized database developed by PWGSC
- Gathering Health Canada sampling and boil water advisories data
- Classifying the water and sewage facilities based upon Terms of Reference definitions
- Preparing updated Phase II reports.

The Technical Steering Committee had representation from OFNTSC, INAC, PWGSC, Ross Holden Engineering Services and OCWA. Steering Committee meetings were held on October 18th, 2001, November 9th, 2001, November 27th, 2001, December 17th, 2001 January 17th, 2002, and March 27, 2002. Teleconference calls were also held on January 23rd, 2002 and February 21st, 2002. Ross Holden Engineering Services was not involved in the meetings of February 21 and March 27, 2002.

OCWA received comments on the Phase I Keewaytinook Okimakanak Tribal Council report on January 25, 2002.

OCWA has also received Health Canada sampling data on the Keewaytinook Okimakanak Tribal Council communal water and sewage facilities in February 2002. This Phase II report includes the Phase I report information, along with the additional information gathered from Health Canada and discussions with Keewaytinook Okimakanak Tribal Council representatives.

2.0 Community Water and Sewage Facilities Assessed

2.1 Communities

The Keewaytinook Okimakanak Tribal Council is comprised of six communities, of which four are located 120 to 175 km north of Red Lake. These include: North Spirit Lake, McDowell Lake, Poplar Hill and Deer Lake, which has special access by air and by ice access road in the winter. One community, Fort Severn, is located 850 km north of Thunder Bay, and one, Keewaywin, is located approximately 225 km northeast of Red Lake.

From information obtained from CAIS and INAC reports, the on-reserve community population, number of houses, and services are tabulated below:

Table 1(a) - Community Statistics

Community	Pop.	Houses	Water Systems				Totals
			Communal	Wells	Holding Tanks	Other	
McDowell Lake	9	no info	N/A	N/A	N/A	N/A	N/A
North Spirit Lake	389	56	5	0	51	0	56
Deer Lake	812	155	20	0	135	0	155
Fort Severn	434	102	69	0	33	0	102
Poplar Hill	369	114	25	0	89	0	114
Keewaywin	425	56	56	0	0	0	56
Totals	2,438	483	175	0	308	0	483

Table 1(b) - Community Statistics

Community	Pop.	Houses	Sewage Systems				Totals
			Communal	Septic Tanks	Holding Tanks	Other	
McDowell Lake	9	no info	N/A	N/A	N/A	N/A	N/A
North Spirit Lake	389	56	5	0	30	21	56
Deer Lake	812	155	20	0	26	109	155
Fort Severn	434	102	0	0	96	6	102
Poplar Hill	369	114	25	0	25	64	114
Keewaywin	425	56	56	0	0	0	56
Totals	2,438	483	106	0	177	200	483

From the above tables the following observations can be made:

- of the 483 houses in the KOTC communities, 175 houses (36%) are serviced by communal water systems, and 106 houses (22%) are serviced by communal sewage systems;
- the McDowell community has no communal systems and therefore was not visited;
- 308 houses (64%) are serviced by water trucks delivering communal water to individual holding tanks, and 177 houses (37%) are serviced by individual sewage holding tanks;
- 200 houses (41%) are shown as having other sewage services; and
- it is recommended that the CAIS and INAC reports be updated and reconciled.

2.2 Community Visits

Cam McIvor, the OCWA representative, and Barry Strachan, the Operation and Maintenance Technologist, visited five of the six communities of KOTC in March 2001. No visit was made to the McDowell community since no communal systems exist there. No visit was made to the sewage treatment plant at Fort Severn because of the bad weather and lack of transportation. However, the inspector reviewed the facility with the operator. Operators in attendance at the time of the visits included Jackie Kakegamick and Elmer Ombash at North Spirit Lake, Nick Meekis at Deer lake, David Matthews at Fort Severn, Alvin Owen, Ennis Strang and Danny Owen at Poplar Hill and Luke Monias at Keewaywin.

Cam and Barry met with various band members at each of the five communities visited. They also met with the Councillor and Financial Administrator at Fort Severn.

The community facilities visited were as follows:

Table 2 - Community Visits

Community	Facilities Visited
McDowell Lake	N/A - no visit
North Spirit Lake	Water and sewage facilities
Deer Lake	Water and sewage facilities
Fort Severn	Water facilities
Poplar Hill	Water and sewage facilities
Keewaywin	Water and sewage facilities

Information contained within this report is based on discussions with the plant operators (as noted above), a quick walkthrough, and visual inspection of the facilities.

The findings presented by OCWA are based on provincial legislation pertaining to drinking water and sewage treatment requirements and on practices adopted by OCWA in the operation of facilities. Specifically the requirements of the Ontario Drinking Water Protection Regulation (O. Reg. 459/00) have been incorporated into the analysis - these requirements being more stringent than the guidelines included under the Guidelines for Canadian Drinking Water Quality - Sixth Edition.

The study only includes the assessment of communal systems. **No detailed review was conducted by OCWA.**

Individual systems, such as septic tanks and holding tanks, were not assessed.

2.3 Communal Systems

The communal water systems in the communities are shown below:

Table 3 - Communal Water Systems

Community	Water Supply Systems
McDowell Lake	N/A - no visit
North Spirit Lake	Surface water source - Water Treatment Plant (WTP) with in-ground pressure distribution system and distribution by tanker trucks
Deer Lake	Surface water source - WTP with in-ground pressure distribution system
Fort Severn	Surface water source - WTP with in-ground pressure distribution system and distribution by tanker trucks
Poplar Hill	Surface water source - WTP with in-ground pressure distribution system and distribution by tanker trucks
Keewaywin	Ground water source - WTP with in-ground distribution system

The KOTC community communal water systems consists of four communities with surface water intakes – one water system uses a groundwater source; Severn uses pressure filters; North Spirit Lake uses slow sand filtration; Deer Lake uses an ion exchange unit followed by multi-media sand and activated carbon filters; Poplar Hill has a Zenon plant with ZeeWeed micro filtration; and Keewaywin is a very basic system with a water softening system.

All the systems use chlorination. Three of the six systems have water reservoirs on site at the plant. Two systems have no reservoirs identified.

The communal sewage systems in the communities are shown below.

Table 4 - Communal Sewage Systems

Community	Sewage Treatment Systems
McDowell Lake	N/A - no visit
North Spirit Lake	Collection system and RBC system and holding tanks with trucked sewage
Deer Lake	Collection system and RBC system and holding tanks with trucked sewage
Fort Severn	Holding tanks with trucked sewage and lagoon
Poplar Hill	Collection system and RBC system and holding tanks with trucked sewage
Keewaywin	Low pressure sewage system and lagoon

In the six communities, there are four communal sewage systems. The systems at North Spirit Lake and Deer Lake are comprised of a collection system, pumping station, RBC unit, and chlorination. At Fort Severn trucks haul sewage to the lagoon. Poplar Hill has a sewage collection system and RBC system. Four of the communities have holding tanks with trucked sewage. At Keewaywin a low pressure sewage system feeds into a lagoon.

2.4 Classification of Facilities

The water and sewage facility classifications are based on classification guidelines developed by Public Works and Government Services Canada, Appendix I of the Terms of Reference for this study and with discussions with the Ontario Ministry of the Environment, Human Resources Branch, Certification Section. These guidelines are similar to the Ontario Guidelines as specified in Regulation 435/93.

However, the sludge/backwash water disposal criterion was omitted in the Terms of Reference guidelines, but was included for the purpose of this study.

The classifications of water and sewage facilities for the Keewaytinook Okimakanak Tribal Council communities are summarized below.

Table 5 – Classification of Facilities

Community	Water Treatment Facility	Sewage Treatment Facility
McDowell Lake	No communal services	No communal services
North Spirit Lake	Class II	Class I
Deer Lake	Class III	Class II
Fort Severn	Class II	No communal services
Poplar Hill	Class III	Class II
Keewaywin	Class I	Class I

3.0 Potential Health and Safety Risks to Communities

3.1 Definition of Risk

In the area of risk assessment, the concept of the frequency of occurrence, probability, and impact of risk situations are fundamental because they are used to assess the risk itself. When an impact assessment of water and wastewater systems is required, before any corrective measure can be implemented, the type and magnitude of impacts on the residents of a community must be identified.

The risk in relation to public health should be viewed as the product of such factors as: the frequency of occurrence of the event, the probability of the occurrence of negative effects and the seriousness of effects. All these factors were considered while surveying each system. The definition of Risk has been changed from the Phase I report. Risk in the Phase II assessment will focus on drinking water health protection using a simplified method under four categories. For more detailed descriptions of the categories entitled "Risk Assessment Model" are included herein under Appendix "B," Terms of Reference Appendix "E".

Low Risk (Ranking Scale 1-4)

Systems operating without major problems and are able to produce the drinking water that meet the Guidelines for Canadian Drinking Water Quality.

Medium Risk (Ranking Scale 5-7)

Systems with deficiencies that would require repairs and upgrades, should be identified. Some remedial action may be required to: construct a new facility, upgrade existing facilities, improve operation and maintenance practices.

Also, water systems that do not meet the Aesthetic Objectives (AO) parameters, indicated in the Guidelines for Canadian Drinking Water Quality are included in this category as are wastewater systems that do not meet MOE's Guidelines for Effluent Quality and Wastewater Treatment at Federal Establishments (GEQWTFE). The operation of water and wastewater facilities should not create a health risk to the public. In the case of water facilities, the quality of produced water may include a minimal excess of iron, manganese and sodium. Similarly, wastewater treatment facilities that may be experiencing operational problems, but will not create immediate health and safety risks.

High Risk (Ranking Scale 8-10)

Systems with potential health and safety concerns such as the repetitive water boiling advisories, not meeting the Maximum Acceptable Concentration (MAC) parameters specified in the Guidelines for Canadian Drinking Water Quality, and other issues of a similar nature. Deficiencies identified under this category may pose an immediate health risk for residents of a surveyed community.

Not Enough Information to Assess (Ranking Scale 0)

To properly assess the various categories for Water Source, Design, Operation, Reporting and Operators, OCWA would have to revisit the facility being evaluated. OCWA was requested to evaluate the facilities based upon the existing information gathered without a revisit to the facility. This category was created by OCWA if there was insignificant information to assess the facility.

3.2 Methodology for Risk Assessment

The methodology for the risk assessment consists of ranking each category, water source, design, operations, reporting, operators, individual wells and overall ranking as low, medium or high risk. This ranking is based on the "Risk Assessment Model" in the Terms of Reference and as discussed in Section 3.1. This methodology was approved at the January 17, 2002 meeting and January 23, 2002 teleconference meeting by the Steering Committee. Except in certain cases where Health Canada data was available, individual wells were not evaluated, as they were not part of the Terms of Reference.

3.3 Risk Assessment

For reference purposes, the Boil Water Advisories, issued over the last year that have been brought to OCWA's attention by the operators, are included herein. Health Canada compiled a list of active Boil Water Advisories dated November 2, 2001. It should be noted that there may have been other advisories issued of which OCWA is not aware. Requests to Health Canada, by Ross Holden, have not provided confirmation or any additional information to that included below:

Table 9 - Boil Water Advisories Issued in the Last Year

Community	Number of Boil Water Advisories
McDowell Lake	N/A - no visit
North Spirit Lake	One Boil Water Advisory reported
Deer Lake	No Boil Water Advisories reported
Fort Severn	One Boil Water Advisory reported
Poplar Hill	No Boil Water Advisories reported
Keewaywin	One Boil Water Advisory reported

Community water systems have been assessed high risk if there was a Boil Water Advisory in effect at the time of the OCWA visit, there is a history of repeated Boil Water Advisories, a Boil Water Advisory has been issued in the last 12 months, and, in the absence of any information, the reason and the corrective action taken to address the Boil Water Advisory.

North Spirit Lake had a Boil Water Advisory issued August 3, 2001 due to an electrical surge resulting in no chlorine injection.

Fort Severn has had a Boil Water Advisory issued within the last year. Fort Severn has a new water treatment plant system scheduled for completion in October 2002. Therefore, assuming the new facility is completed and operational in 2001, OCWA did not consider the Boil Water Advisory when establishing risk.

Keewaywin has had one Boil Water Advisory issued on May 24, 2001 because of a broken chlorinator. The problems was promptly fixed and the Boil Water Advisory was lifted on June 15, 2001.

The information collected by OCWA from on-site observations and interviews is summarized in the six Community Reports included herein under Appendix "A". These reports include a risk analysis according to a category rating system as developed by Ross Holden and OCWA. Descriptions of the categories entitled "Risk Categories and Risk Factors for Water" and "Risk Categories and Risk Factors for Sewage" are included herein under Appendix "B". One of the three categories (high, medium or low risk) has been assigned to each community system as shown below.

With the available information, OCWA has assessed the water treatment facilities using the above noted definition of risk:

Table 7 – Water Facilities Risk Categories

COMMUNITY	CATEGORY Water	SECTION RANKING Water	RISK Water
North Spirit Lake	A. Water Source	0	Not Evaluated
	B. Design	8	High Risk
	C. Operations	5	Medium Risk
	D. Reporting	3	Low Risk
	E. Operators	4	Low Risk
	F. Individual Wells	0	Not Evaluated
	G. Overall Ranking	5	Medium Risk
Deer Lake	A. Water Source	0	Not Evaluated
	B. Design	5	Medium Risk
	C. Operations	5	Medium Risk
	D. Reporting	2	Low Risk
	E. Operators	2	Low Risk
	F. Individual Wells	0	Not Evaluated
	G. Overall Ranking	4	Low Risk
Fort Severn	A. Water Source	5	Medium Risk
	B. Design	5	Medium Risk
	C. Operations	5	Medium Risk
	D. Reporting	6	Medium Risk
	E. Operators	2	Low Risk
	F. Individual Wells	0	Not Evaluated
	G. Overall Ranking	5	Medium Risk
Poplar Hill	A. Water Source	0	Not Evaluated
	B. Design	6	Medium Risk
	C. Operations	5	Medium Risk
	D. Reporting	3	Low Risk
	E. Operators	2	Low Risk
	F. Individual Wells	0	Not Evaluated
	G. Overall Ranking	5	Medium Risk
Keewaywin	A. Water Source	0	Not Evaluated
	B. Design	3	Low Risk
	C. Operations	5	Medium Risk
	D. Reporting	3	Low Risk
	E. Operators	5	Medium Risk
	F. Individual Wells	0	Not Evaluated
	G. Overall Ranking	4	Low Risk

The Fort Severn water system is expected to be ranked as low risk, once the new water treatment facility is complete in October 2002.

With available information, OCWA has assessed the sewage treatment facilities using the above noted categories:

Table 8 – Sewage Facilities Risk Categories

COMMUNITY	CATEGORY Sewage	SECTION RANKING Sewage	RISK Sewage
North Spirit Lake	A. Effluent Receiver	1	Low Risk
	B. Design	1	Low Risk
	C. Operations	1	Low Risk
	D. Reporting	8	High Risk
	E. Operators	4	Low Risk
	F. Individual Septic Tanks	0	Not Evaluated
	G. Overall Ranking	8	High Risk
Deer Lake	A. Effluent Receiver	0	Not Evaluated
	B. Design	1	Low Risk
	C. Operations	1	Low Risk
	D. Reporting	8	High Risk
	E. Operators	4	Low Risk
	F. Individual Septic Tanks	0	Not Evaluated
	G. Overall Ranking	8	High Risk
Poplar Hill	A. Effluent Receiver	1	Low Risk
	B. Design	1	Low Risk
	C. Operations	1	Low Risk
	D. Reporting	7	Medium Risk
	E. Operators	2	Low Risk
	F. Individual Septic Tanks	0	Not Evaluated
	G. Overall Ranking	7	Medium Risk
Keewaywin	A. Effluent Receiver	1	Low Risk
	B. Design	4	Low Risk
	C. Operations	1	Low Risk
	D. Reporting	7	Medium Risk
	E. Operators	5	Medium Risk
	F. Individual Septic Tanks	0	Not Evaluated
	G. Overall Ranking	4	Low Risk

The North Spirit Lake and Deer Lake sewage facilities are ranked high risk because the effluent is not tested.

4.0 Rationale for Assessment and Recommendations

4.1 Legislation and Guidelines

Following is a list of Provincial and Federal regulations and guidelines that pertain to the design and operation of water and sewage facilities:

- Ontario Water Resources Act;
- Ontario Drinking Water Protection Regulation (O.Reg. 459/00);
- Ontario Occupational Health and Safety Act;
- Guidelines for Canadian Drinking Water Quality - Sixth Edition (GCDWQ);
- Guidelines for Effluent Quality and Wastewater Treatment of Federal Establishments (GEQWTFE);
- Canada Labour Code - Part II; and
- Ontario Regulation 435/93.

The GCDWQ and GEQWTFE guidelines were used as reference when evaluating facilities. Other relevant regulations (Ontario) may also have been referred to in performing assessments and evaluations of facilities.

4.2 Operators

Operator training is paramount to the successful operation of water and sewage systems and the mitigation of health and safety risks.

Consideration should be given to introducing a formal operator training and certification program for this community. The Circuit Rider Training Program is available and can provide valuable assistance in this respect.

Under provincial legislation, in addition to mandatory certification requirements, water and sewage plant operators are required to have a minimum of 40 hours per year of training.

Training should include the fundamentals of water and sewage treatment, collection and distribution system, the design and operating requirements of facilities, sampling and testing procedures, the importance of reporting protocols, emergency responses, and preventive maintenance. Health and safety should continue to be the focal point of training education.

4.3 Sampling and Reporting Procedures

Sampling, testing and reporting is a straightforward method of ensuring that facilities are properly operated and that health risks to the community are minimized. This is carried out by ensuring that the operators have proper monitoring equipment, on-site testing equipment and laboratories. In addition, off-site laboratory testing, feed back reporting and follow up is fundamental to ensuring operational excellence.

Sampling and testing of raw water, treated water and distribution systems should be undertaken on a regular basis, with all results being made available to the operators and other appropriate agencies.

Sampling and test results of sewage effluents should also be tabled with the operators and agencies. Non-compliance issues should be addressed at once.

Boil Water Advisories should be addressed immediately. These Boil Water Advisories indicate a breakdown in operating procedures, including equipment failure, and may have an adverse impact on

community health. A formalized reporting structure should be developed to address adverse sample results and Boil Water Advisories.

4.4 Water Sources

4.4.1 Surface Water

Surface water sources from lakes, or rivers, are susceptible to pollution problems and changing conditions in relation to both quantity and quality.

Changes to the raw water quality can occur at different times of the year, particularly at spring breakup, and after heavy rainfall events. Proper monitoring, including turbidity metering, can prepare the operators for changed conditions and adjustments can then be made at the water treatment plants. Raw water sampling should always be employed in order to optimize the treatment process.

Water intakes, particularly in lakes, with declining water levels can present major problems. These intakes should be inspected, modified and maintained accordingly. Shallow intakes are susceptible to winter ice damage, boat damage and poor water quality (turbidity, temperature, shore line pollution). In addition, intakes should be inspected regularly to ensure that zebra mussel infestation is not occurring.

All drinking water obtained from surface water sources must be treated by filtration or other approved processes, in addition to chlorination.

4.4.2 Groundwater

Groundwater sources, used for drinking water, should be monitored to ensure that no contamination is occurring from such sources as sewage effluent discharges, septic tanks, landfill sites or other sources of activity. In addition, naturally poor quality groundwater should be treated and monitored.

4.5 Sewage Effluent

Discharge of effluent from lagoons or sewage treatment plants, to receiving water, should be monitored to ensure compliance with discharge criteria in accordance with the facility design. Disinfection by chlorine or ultraviolet means should be maintained at all times. Discharges from overflows, by-passes, or other non-treatment situations can cause serious problems to drinking water sources as well as damaging the environment and should be minimized. Sewage effluent discharges should be located downstream from the community water intakes.

While not investigated under terms of this study, it is important to note that sludge disposal, from treatment facilities, should be monitored to ensure that cross contamination to drinking water sources does not occur.

4.6 Equipment Requirements

4.6.1 Safety Equipment

Appropriate safety equipment should be maintained on site at each facility for the safety of the operators. This includes protective clothing, where chemicals are being used, together with shower and eye wash stations in the event of spills occurring. Specialized equipment, together with procedures, should be in place where entry to confined spaces has to be undertaken by the operator.

4.6.2 Amenities

Treatment plants should include laboratory space for in-house testing. In the case of combined water and sewage plants there should be two separate laboratories.

Office facilities should provide for the storage of files and records.

It is recommended that facilities that do not have a self contained breathing apparatus (SCBA) should borrow this equipment from the Fire Department. This is a recommendation because the required maintenance for this equipment is difficult to perform due to the remote location of First Nations communities.

Work areas, for maintenance of equipment, should be clearly defined, organized and not impact on the operation of the facility.

All necessary tools should be made available to the operator to undertake emergency equipment repairs and to conduct routine maintenance. Proper organized storage areas for all tools and equipment should be available to the operator.

Separate chemical storage is required so that the chemicals are in one area and separate from the normal day to day activities of the operators.

Washrooms/showers areas should be provided to allow operators to maintain a high standard of hygiene.

4.6.3 Hazards

Access to all tankage, equipment and infrastructure should be protected to prevent injury to operator staff. Walkways and railings to tankage together with fall arrest systems should be in place.

Emergency lighting should be provided at all plants to prevent accidents occurring during power failures and to allow emergency operation to continue

Chemical storage areas should be constructed to provide containment of any spill and should also be properly ventilated. Fuel tanks should also be enclosed in containment areas. In both cases, the containment areas must prevent any leakage to either drinking water supplies or to the environment.

All plant facilities should maintain a housekeeping program to eliminate tripping hazards and to allow proper plant operation.

4.6.4 Chlorine Analyzers

Continuous chlorine residual analyzers should be installed at all water treatment facilities to monitor chlorine levels in the drinking water entering the distribution system. It is important to monitor disinfection as changing water source conditions can change the effectiveness of the treatment processes. Analyzers should be re-calibrated on a regular basis.

4.6.5 Turbidity Meters

Continuous turbidity meters should be installed at all surface water treatment plants to monitor the turbidity of the treated water. In addition operators should monitor the turbidity of the raw water because turbidity changes will affect the operation of the treatment processes. Turbidity meters should be re-calibrated on a regular basis.

4.6.6 Flow Meters

Flow meters should be installed at water and sewage facilities to monitor constant and changing flow conditions.

At water treatment plants, the recorded flow data provide historical information on community consumption and unusual demands caused by broken water mains or leakage. These data are used to coordinate chemical requirements, plant operation, and long term capacity planning.

Sewage flow meters should be installed at pumping stations and/or at sewage treatment plants. Such data will identify unusual occurrences such as high inflow/infiltration into the collection system. Also, the data can be used to optimize sewage treatment and are necessary for long term planning.

Flow meters should be re-calibrated on a regular basis.

4.6.7 Alarms

Alarm systems should be installed in all water and sewage treatment plants, and all sewage pumping stations. These alarms monitor and report on changing treatment process conditions, equipment failure, power failure and unauthorized intrusion. The alarms can register either at the facility and/or remotely, by dial out, to an emergency number.

Each facility should be reviewed and appropriate alarms installed accordingly, in order to minimize potential risks to the services being provided.

4.6.8 Spare Parts and Tools

Sufficient spare parts should be catalogued and stocked at all treatment facilities to allow for repairs to essential equipment and for the ongoing maintenance of all equipment. A recommended spare parts list should be developed for each plant.

Essential equipment, such as chemical feed systems, should be duplicated to allow switch over when one system fails and thereby allow treatment to continue. The original systems should then be repaired as soon as possible.

The necessary tools should be made available to the operator to make repairs to equipment. Without the appropriate tools, it makes repairs difficult for the operator.

4.6.9 Backup Power

Backup power should be considered for each facility in order to maintain treatment functionality during power outages.

4.6.10 Filtration

All drinking water supplied from surface water sources should be filtered or treated in addition to chlorination or other methods of disinfection. This requirement is to ensure the removal of turbidity, which affects the disinfection process. In addition, parasites such as *Giardia* and *Cryptosporidium* are removed.

4.6.11 As-Built Drawings and Maintenance Manuals

All facilities, including treatment plants, pumping stations, storage tanks, and collection and distribution systems, should have as-built drawings made available to the operators.

In the case of plants and pumping stations, Operations and Maintenance Manuals should be available on site.

These documents allow the operators to understand the systems and to respond and react to emergency issues including process failure and equipment failure. These documents also permit scheduled maintenance to be undertaken and future planning to be carried out.

4.7 Maintenance Programs

4.7.1 Preventative Maintenance

All facilities should have a preventative maintenance program prepared and implemented. This ongoing routine management plan ensures that all equipment is kept in a fully functional condition. This practice reduces down time, helps to minimize non-compliance situations, extends equipment life, and reduces risk. Equipment duplication of critical systems also assists in maintaining compliance. Damaged or broken equipment should be repaired immediately and, in the case of backups or duplicated equipment, not left until both systems are in states of disrepair.

4.7.2 Scheduled Maintenance

Routine maintenance of other system components should be carried out on a scheduled basis. Such items as watermain swabbing and flushing, sewer flushing, hydrant draining prior to winter, and other routine items should be planned and implemented. The benefits of these programs is to monitor excessive water losses from water distribution systems and excessive inflow and infiltration into sewage collection systems. In both cases properly maintained systems are less costly to operate and the capacity, as designed, can be maintained thus delaying future capital expansion.

4.8 Contingency Planning

Each facility, community or group of communities should develop a contingency plan. This document should contain all contacts, names, addresses and telephone numbers in order to allow effective responses to all potential emergency and unusual circumstances. Such a plan could include the procedures to be followed for such occurrences as operator absence, changes to water source quality, flooding or fire events, chemical spills, bypassing of sewage, power failures and major equipment failures. With such plans in place, the response to an unusual event can be handled in a timely and effective manner.

Boil Water Advisories should also be addressed in the plan. When a Boil Water Advisory is issued, a process should be in place to work towards having the Boil Water Advisory lifted at the earliest possible time.

4.9 Record Keeping

A separate log book for each facility should be maintained by the operator(s) to record important operational issues, changes to the operation of the facilities, and the completion of the maintenance.

4.10 Individual Systems

Individual systems, including septic tanks and wells, can be susceptible to major problems that pose health and safety risks to community residents.

Septic tanks that are not properly constructed and maintained can cause serious problems by polluting groundwater supplies and hence drinking water supplies that depend on groundwater. In addition, poorly functioning systems can result in breakthrough of untreated or partially treated sewage to the ground surface.

Wells that are poorly installed or maintained can be serious health risks, should the groundwater become contaminated from septic tanks or other polluting sources. Surface water infiltration into poorly sealed well casings can also introduce pollutants into the water.

Where individual holding tanks are located at residences for the storage of bulk water deliveries from communal treatment facilities, procedures should be established for the monitoring of these tanks, together with the delivery tankers. This process will ensure that risks associated with the delivery of drinking water to community residents is minimized.

Beyond the scope of this study, it is advisable to consider undertaking a review of individual systems where water testing results indicate potential problems.

5.0 Recommended Action Items

Based on the three classifications developed under Section 3.0, the findings, as recorded in the Community Reports included under Appendix "A", are now tabulated below for each communal water and sewage facility in each community.

5.1 Immediate Action Issues

Immediate action issues may include high risk items such as broken or malfunctioning equipment, unfiltered surface water, Boil Water Advisories, and noncompliance issues such as exceedances of health related parameters stipulated in GCDWQ, or sewage discharge to the environment.

5.1.1 Water

Immediate action items that are recommended, in relation to communal water supplies in the communities, are as follows:

Table 9 - Immediate Action - Water

Community	Action Required
McDowell Lake	<ul style="list-style-type: none"> • N/A - no visit
North Spirit Lake	<ul style="list-style-type: none"> • Repair continuous on-line chlorine analyzer at plant • Implement bacteriological sampling protocol • Use new colilert unit • Improve record keeping • Purchase and maintain spare parts and tools at plant • Investigate reasons for THM exceedance in 2001 sample
Deer Lake	<ul style="list-style-type: none"> • Add continuous on-line chlorine analyzer at plant
Fort Severn	<ul style="list-style-type: none"> • New water treatment plant to be completed in October 2002. • Ensure all test results are returned to the operator and kept on site • Purchase safety equipment
Poplar Hill	<ul style="list-style-type: none"> • Repair pump that is a reoccurring issue • Establish a protocol for taking samples • Train operators to use colilert unit and ensure bacteriological testing is conducted regularly • Monitor THM and aluminum levels to ensure they do not exceed GCDWQ
Keewaywin	<ul style="list-style-type: none"> • Investigate well running dry in the fall • Add a continuous on-line chlorine analyzer at plant • Address safety issues with the water pump being located in a 200 foot deep well • Provide and maintain spare parts and tools at plant • Add flow meter at plant • Add alarm systems at plant

The above comments have been extracted from the Community Reports enclosed herein under Appendix "A".

5.1.2 Sewage

Immediate action items that are recommended, in relation to sewage treatment in the communities, are as follows:

Table 10 - Immediate Action - Sewage

Community	Action Required
McDowell Lake	<ul style="list-style-type: none"> • N/A - no visit
North Spirit Lake	<ul style="list-style-type: none"> • Implement a regular sampling program • Ensure all sample test results are returned to the operator and kept on site • Improve record keeping
Deer Lake	<ul style="list-style-type: none"> • Repair hatch door on RBC unit • Implement a regular sampling program on effluent
Fort Severn	<ul style="list-style-type: none"> • No Action Required
Poplar Hill	<ul style="list-style-type: none"> • Establish a protocol for taking samples
Keewaywin	<ul style="list-style-type: none"> • Obtain spare parts and tools to remain on site

The above comments have been extracted from the Community Reports enclosed herein under Appendix "A".

5.2 Short Term Action Issues

Short term action issues may include medium risk items such as the undertaking of capital works and equipment together with operational review to bring the facilities up to approved standards. This classification also includes an assessment of the operator's knowledge, skill levels and abilities, and the necessity for further and ongoing training.

5.2.1 Water

Items that should be considered for implementation, as part of an ongoing plan of action, include the following:

Table 11 - Short Term Action - Water

Community	Action to be Undertaken
McDowell Lake	<ul style="list-style-type: none"> • N/A - no visit
North Spirit Lake	<ul style="list-style-type: none"> • No action required
Deer Lake	<ul style="list-style-type: none"> • No action required
Fort Severn	<ul style="list-style-type: none"> • No action required
Poplar Hill	<ul style="list-style-type: none"> • Train operators to use colilert unit • Install new railing on top of ZeeWeed platform
Keewaywin	<ul style="list-style-type: none"> • Obtain as-built drawings and operations and maintenance manuals • Provide emergency backup power

The above comments have been extracted from the Community Reports enclosed herein under Appendix "A".

5.2.2 Sewage

Items that should be considered for implementation, as part of an ongoing plan of action, include the following:

Table 12 - Short Term Action - Sewage

Community	Action to be Undertaken
McDowell Lake	<ul style="list-style-type: none"> • N/A - no visit
North Spirit Lake	<ul style="list-style-type: none"> • Ensure that cross-contamination does not occur in the WTP • Provide backup power
Deer Lake	<ul style="list-style-type: none"> • Initiate a groundwater monitoring program at sludge pit
Fort Severn	<ul style="list-style-type: none"> • Develop program to reduce vandalism and potential risks
Poplar Hill	<ul style="list-style-type: none"> • No action required
Keewaywin	<ul style="list-style-type: none"> • Obtain as-built drawings and operations and maintenance manuals • Provide emergency backup power

The above comments have been extracted from the Community Reports enclosed herein under Appendix "A".

5.3 Long Term Issues

Long term issues may include low risk items and the strategies needed to be put in place to ensure long term optimal operation of the facilities, which will minimize risk to the communities.

5.3.1 Water and Sewage Communal Systems

It is expected that the action items as described in Sections 5.1 and 5.2 will be undertaken to bring the facilities up to full operating standards. At the same time consideration should be given to planning the long term strategy necessary to maintain that level of operational excellence. This strategy will both minimize the long term health and safety risks to the communities, and at the same time maintain the capital investment value of the facilities.

To achieve this long term objective, a support structure should be developed that will provide assistance to the community administration on such issues as operator training and certification, testing and reporting, responding to non compliance issues including Boil Water Advisories, contingency planning, preventative maintenance and planning issues.

This study has focused on communal water and sewage facilities. In order to provide a comprehensive evaluation of the entire system, further assessment of the water distribution systems and sewage collection systems should be undertaken. Problems associated with leaking water systems and infiltrating sewage systems are previously discussed under Section 4.0.

Consideration should also be given to further studies of individual systems including water and sewage holding tanks, and other individual water and sewage services. These facilities were not required to be assessed as part of this report.

Items that should be considered for implementation, as part of a long term action plan, include the following:

Table 13 - Long Term Action - Water and Sewage Communal Systems

Community	Action to be Undertaken
All Communities	<ul style="list-style-type: none"> • Develop and implement a training program that will lead to certification of all operators
	<ul style="list-style-type: none"> • Develop and implement a system for obtaining water analyses of raw water, treated and distributed water
	<ul style="list-style-type: none"> • Develop and implement a system for obtaining influent and effluent analyses for all sewage treatment facilities
	<ul style="list-style-type: none"> • Ensure all non compliance results are reported to the appropriate authorities
	<ul style="list-style-type: none"> • Provide separate laboratory, office space, maintenance areas, washroom, and shower facilities at all plants
	<ul style="list-style-type: none"> • Develop and implement a comprehensive preventative maintenance program for all systems
	<ul style="list-style-type: none"> • Develop and implement a comprehensive contingency plan to address all potential emergencies and unusual circumstances for all systems

5.3.2 Water and Sewage Individual Systems

The investigation of individual septic tanks, water holding tanks, individual wells, and other individual water and sewage systems were outside the scope of this study. There is potential for individual systems to cause health and environmental problems. Items that should be considered for implementation, as part of the long term action plan, include the following:

Table 14 - Long Term Action - Water and Sewage Individual Systems

Community	Action to be Undertaken
All Communities	<ul style="list-style-type: none"> • Develop and implement a training program for truck haulers
	<ul style="list-style-type: none"> • Develop and implement a protocol for taking water samples and put in place an action plan to address non-acceptable sample results
	<ul style="list-style-type: none"> • Develop and implement a protocol for regular cleaning and disinfecting individual water holding tanks

6.0 Summary of Observations

The OCWA representative, together with the Tribal Council Operation and Maintenance Technologist, visited five of the six communities of KOTC in March 2001 and met with the various operators. McDowell Lake was not visited because the community has no communal systems. This report summarizes the information gathered, and observations made, at the time of the visits.

KOTC is made up of six communities – four are located 120 to 175 km north of Red Lake. These include North Spirit Lake, McDowell Lake, Poplar Hill and Deer Lake, which has special access by air and by ice access road in the winter. Fort Severn is located 850 km north of Thunder Bay, and Keewaywin is located approximately 225 km northeast of Red Lake. Based on the information obtained from the INAC and CAIS reports, there are 2,438 people occupying 483 houses within the communities.

The Deer Lake community water treatment plant is a U.S. Filter Package plant. It uses ion exchange with flocculation and coagulation. The chemicals used are sternpac, polymer, caustic soda, and granular hypochlorite. There is a small filter with mixed sand and activated carbon. The sewage treatment plant is an RBC plant with a primary digester, and an effluent contact chamber.

The North Spirit Lake community water treatment plant is a slow filtration plant with chlorination. The sewage treatment plant is an RBC plant without aeration, and with chlorination. The community has three lift stations with a sewage collection all leading to the sewage treatment plant. There are approximately eleven hydrants on the distribution system. The band also has two water trucks and a vacuum truck. Water is trucked to those who need it. There are small reservoirs for the people who are not hooked up to the water system. Some homes also have sewage holdings tanks that are pumped out by a vacuum truck.

The Keewaywin community water supply is from a well. There is a backup well, which will supply water to the main well if there is a shortage of water. The water treatment plant has a water softening system and a chlorination system. The sewage system is a low pressure system with a lagoon. There are two-stage septic tank systems in each home with a pump to the collection system. The effluent is pumped to the lagoon.

The Fort Severn community water treatment plant consists of a pressure filter system that will be replaced by October 2002. There is a raw water reservoir, which is filled three to four times a year. A 30 hp pump on a barge in the middle of the river pumps the raw water into the reservoir. The water treatment plant is gravity fed from the reservoir. The water is chlorinated and sent to the distribution system. The sewage system is an exfiltration lagoon, which does not need to be discharged as the liquid percolates into the ground. The lagoon was not visited by the OCWA representative due to bad weather conditions.

The Poplar Hill community water treatment plant is a ZeeWeed micro filtration plant, manufactured by Zenon. The filtered water is chlorinated and distributed to the community. Only part of the community is on the distribution system. The rest of the homes have the water hauled by tanker trucks. These homes have holding tanks, which are cleaned regularly. Only part of the community is on the sewage collection system. The operators also have a vacuum truck which they use to transport the raw sewage from the homes to a sewage collection system, which is all gravity fed to the sewage treatment plant.

In the KOTC communities, the water supply systems consist of 175 houses (36%) with communal service and 308 houses (64%) with water holding tanks and trucked water.

In the KOTC communities, sewage systems consist of 106 houses (22%) with communal service, 177 houses (37%) are serviced by truck hauling sewage from individual holding tanks, and 200 houses (41%) have other sewage disposal systems.

Operators informed OCWA that there had been one Boil Water Advisory placed on the North Spirit Lake, Fort Severn and Keewaywin communities.

The report has identified potential high risk issues at the North Spirit and Deer Lake sewage facilities because effluent testing is not conducted.

The high risk items identified in the Community Reports, and summarized in Tables 9 and 10, should be acted on immediately. These items may include repairs to critical components of the treatment processes that, if not addressed, could lead to contamination of water supplies or contamination of the environment by sewage. Also included are those items that monitor the facilities to ensure the treatment process is operating properly.

The following communities are medium risk because of potential high THMs in the treated water (North Spirit Lake and Poplar Hill) and due to low chlorine residual and turbidity problems (Fort Severn), and incomplete effluent testing (Poplar Hill –sewage).

- North Spirit Lake - communal water and sewage systems;
- Fort Severn - communal water system; and
- Poplar Hill - communal water and sewage systems.

These communities are medium risk because of a the minimal regular sampling undertaken on these communal systems and no samples are sent off site.

Short term action items have also been identified and summarized under Tables 11 and 12. These items deal with operator health and safety issues, which improve the response time of the operator to correct alarm situations. Capital and operational improvements required, to bring performance of the facilities up to standard, are included. A vital component of this short term planning requires that operator assessment and training be thoroughly addressed.

Finally, the long term recommendations listed under Tables 13 and 14, are to maintain or improve the operational excellence of the facility, minimize the long term health and safety risks to the community, and maintain the value of the capital assets.

Overall observations would indicate that operator training is the main area that requires a long term strategy to be developed to ensure that health and safety risks to the communities are minimized. In addition, occupational health and safety issues should also become part of the operating requirements.

Sampling and testing, together with reporting and remedial actions, are essential to the proper operation of water and sewage facilities. From OCWA's experience in operating facilities across the province, it becomes readily apparent that operational excellence can only be achieved through compliance with all of the provincial regulations. These regulations cover all aspects of treatment, including compliance issues, training and certification, testing and reporting, documentation, and contingency planning. By meeting these regulatory recommendations, the health and safety risks to the operators, the community residents, and the environment are mitigated.

Although not included in the Terms of Reference of this study, it is recommended that further in-depth studies be considered for the facilities, including the distribution and collection systems, to review design, compliance and capacity issues.

A continuing review and monitoring program should be undertaken of individual systems, including water holding tanks and septic systems, to ensure the integrity of those systems and to mitigate any health risks.