REVIEW
of COMMUNITY WATER MANAGEMENT *and* WATER SYSTEM INFRASTRUCTURE

Sachs Harbour, NT

A Project towards Providing Safer Drinking Water in the NWT Communities

Safe Water

Northwest Territories

Reviewed by:

Public Works and Services
Municipal and Community Affairs
Health and Social Services

April 2003

REVIEW
of COMMUNITY WATER MANAGEMENT *and* WATER SYSTEM INFRASTRUCTURE

Sachs Harbour, NT

Safe Water

Prepared by:

Water & Sanitation
Asset Management Division
Department of Public Works and Services

Northwest Territories

April 2003

Project Team

REVIEW
of COMMUNITY WATER MANAGEMENT *and* WATER SYSTEM INFRASTRUCTURE

Sachs Harbour, NT

Report Completion Dates	
Report Phase	Date
Field Work	August 12-16, 2002
Report Issue	April 2003

Field Inspection/Review Staff		
Technical Staff	Title/Organization	Telephone Number
Kim Philip	Sr. Engineer, PW&S	(867) 920-3489
Vincent Tam	Sr. Engineer, PW&S	(867) 873-7834
Loretta Ransom (Team Leader)	Intern Engineer, PW&S	(867) 873-7713

Questions about this report may be directed to the Field Inspection/Review Staff or to Water & Sanitation at (867) 873-7834 or (867) 920-3489

Water & Sanitation
Asset Management Division
Department of Public Works and Services
Third Floor - Stuart M. Hodgson Building
P.O.Box 1320, Yellowknife, NT X1A 2L9
Telephone: (867) 920-8088
Fax: (867) 873-0226

ACKNOWLEDGMENTS

PW&S Technical Services Section would like to acknowledge the local community staff who gave of their time to assist with this evaluation, including Philip Moon Ho Son, SAO, Floyd Lennie, Works Foreman and Joseph Carpenter, Water Truck Driver. Also, Margaret Carpenter, the Clerk at the Sachs Harbour Health Center, and John Bulmer of PWS, Chris Beveridge, EHO (H&SS), and Ron Rusnell of MACA, all of whom provided valuable information.

Much of the information contained in this report is based on discussions with the local staff mentioned above. Apologies are made in advance for any errors, omissions or misinterpretations.

Water & Sanitation
Asset Management Division
Department of Public Works and Services
Third Floor - Stuart M. Hodgson Building
P.O.Box 1320, Yellowknife, NT X1A 2L9
Telephone: (867) 920-8088
Fax: (867) 873-0226

DISCLAIMER OF LIABILITY

The information contained in this Review of Community Water Management and Water System Infrastructure ("Review") has been prepared and compiled in accordance with the principles and practices established by the Government of the Northwest Territories (GNWT) Department of Public Works and Services for the evaluation of community water supply systems. It constitutes a technical and operational "snapshot" of the of the water supply system at a specific point in time based in part on a limited inspection of the facility and limited discussions with community and government staff (both federal and territorial). Neither the GNWT, nor any other person, including, without limitation, employees, agents, or independent contractors of the GNWT involved in the Review:

a) make any representation of warranty whatsoever that the information contained in the report is complete or accurate; or

b) shall under any circumstances be under any liability whatsoever to any person for any loss, damage or expenses of whatever nature or kind arising or resulting directly or indirectly, whether in contract or tort, from reliance on the accuracy or completeness of the information contained in the Review report.

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

As part of the overall GNWT "Workplan towards Providing Safer Drinking Water in NWT Communities", the Departments of Public Works and Services (PW&S), Municipal and Community Affairs (MACA), and Health and Social Services (H&SS) have commenced joint reviews of community water supply systems. The aim is to ensure the safety and adequacy of all public water supply systems in non-taxed-based communities across the Northwest Territories. The scope of the review includes an assessment of existing infrastructure; roles and responsibilities; system operations, maintenance and management; and water sampling, testing and reporting. The goal is to identify potential problems and provide recommendations to improve the overall efficiency of the system. Technical Support Services, Asset Management Division, Public Works and Services, conducted a review of the Sachs Harbour water supply system infrastructure from August 12-16, 2002.

The community water supply system consists of a single intake, truckfill station and water delivery truck. The truckfill station is a single room Bally freezer building. The truckfill is connected to a single intake containing a submersible pump with a floating intake. When the disinfection system is connected raw water is drawn into the intake via the pump, into the truckfill facility and chlorinated as it is delivered to the water truck. When the chlorination system is not connected or not working raw water is delivered through the truckfill and is batch chlorinated in the water truck. The water truck and truckfill station is the responsibility of the Hamlet. This should include day-to-day operations such as mixing chlorine, testing chlorine residuals, adjusting the rate of chlorine injection, and minor maintenance, general housekeeping, trucked water delivery and maintenance of water truck. The local H&SS Community Health Representative assists with water quality sampling. Since the time of the review, the Regional EHO has requested that water operators take samples rather than CHR.

The community currently has a water licence, expiring June 30, 2009, which allows them to draw their raw water from Water Lake. Total residual chlorine, free residual chlorine, and total and faecal coliform are tested, although not routinely (this is currently under change). Water quality data, covering 1996 to 2002, are well within acceptable limits determined by the *Guidelines for Canadian Drinking Water Quality* (GCDWQ).

The current small system water treatment facility is truck fill only. The original system was installed in 1978. The water treatment system in Sachs Harbour has quite a varied history. Originally the system consisted of a single intake, pumphouse (which is now the current truckfill facility), a circulating water supply line to a water treatment truckfill facility, and an underground water supply line to various buildings (AES (Atmospheric Environmental Station)) within close proximity to the truckfill building. In 1986 the water supply line from the pumphouse to the truckfill froze. The costs to reactivate the line were estimated to be very high. It is also believed that things were further complicated by the fact that the truckfill was located on private property and the owner may have make demands about having access to water from the facility. It is believed that the truckfill was eventually declared surplus. It would have been at this time that the pumphouse was modified and began acting as a much more simplified truckfill station for community water supply. Therefore, the truckfill was no longer connected to any underground water supply lines. The old truckfill facility is still located, abandoned, not far from its original location and remnants of the supply line from the pumphouse to the truckfill are still evident.

In 1989 a passenger plane landing at Sachs Harbour crashed into Water Lake. This obviously created much concern in the community. Many community members felt that their drinking water would now be contaminated from fuels, etc. and some also felt that they did not want to drink the water out of the respect for those who died in the incident. After time and testing the community eventually went back to using Water Lake as its source. During that time it had also been suggested that Picnic Lake, a possible

alternative source, be investigated. Although, it still remains a possible alternative nothing further has come of that possibility. The water quality of Water Lake is very good, therefore, an alternative source is not currently necessary.

To add to the history of the Sachs Harbour water supply system, there are records that a Capital Upgrading Project for the truckfill facility began in the early 1990s (around 1992), which include the installation of a backup generator. This project, however, was never completed. The exact reasons have not been documented.

In 1997 duties for the operation and maintenance of the water treatment facility was turned over to the Hamlet of Sachs Harbour from the Department of Public Works and Services (Inuvik). A few upgrades were completed before the transfer, which included new Calcium Hypochlorate tanks (mixing and solution tank) plus a mixer, and a newly calibrated Hack 2000 for testing free and total residual chlorine. Training was also provided for pulling the intake line and on the intake/heat trace.

In December 2001 pump failure occurred in the truckfill facility intake. A contracting company that was currently completing a separate project in the community was hired to install a new pump. The project was completed but the heat trace line was not taped onto the discharge pipe. The contractor attempted to remove the pump again for heat trace line hook-up, but the pull cable broke resulting in the cables becoming jammed in the intake line. The incident eventually lead to freeze up of the intake pipe. Dowland Contracting Ltd, hired to come in from Inuvik, eventually thawed the intake line by steaming. The discharge pipe, intake screen, pump, and heat trace cable were all replaced. The pump is now fully functional.

The current facility is old, running past its life expectancy. During the review a number of deficiencies were noted, which will be discussed further in this report. The major recommendation being given is that a new water treatment facility is needed and a planning study should be initiated as soon as possible to evaluate the feasibility of a new facility.

There were a number of O&M issues identified during the review, which are discussed throughout this report. Also, some community representatives expressed concern that there was a lack of general government support for the community.

2. WATER SUPPLY SYSTEM

The Sachs Harbour water supply system, consisting of a truckfill and intake system, was completed in 1978. The system draws water from Water Lake (also referred to as DOT Lake, MOT Lake and Water Supply Lake). The floating intake is 115.82 meters of 200 mm HDPE insulated piping extending outward into the lake from the pumphouse. The intake end floats at about 6-7 meters below the surface. A heat trace is located in the intake for freeze protection. A submersible pump is located in the intake line. Water is drawn into the intake, through truckfill facility to the trucfill arm into the water truck for filling. The water truck driver first turns on the chlorine injection pump in the facility and turns on the submersible pump by a switch outside on the truckfill arm. When not using the chlorine injection pump, the water truck is batch chlorinated. The community is using powdered chlorine or liquid chlorine bleach for disinfection (depending on the situation at the time; discussed further in report).

The community has two water delivery trucks, but only one is currently in use. This is an F Series truck with a 1000 imperial gallon tank, purchased in 1997. The other truck, purchased in 1990, is an F700 Ford with a 1000 imperial gallon tank. The truck had the tank removed for servicing during the review.

Truckfill Building

Water Delivery Truck

Chlorine System

Chlorine Mixing Tank

3. SYSTEM LAYOUT

Figure 1. Panorama of Water Lake and Truckfill (white building in picture left).

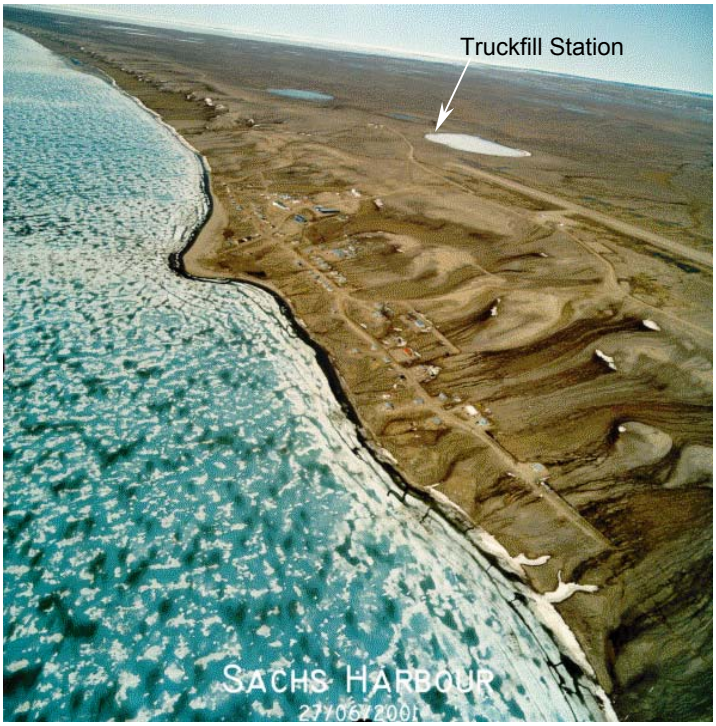

Figure 2. Aerial view of community and truckfill station location.

4. ROLES AND RESPONSIBILITIES

Table 1 lists the community and government departments, boards, agencies and organisations that have responsibilities associated with the Sachs Harbour community water supply system.

Agency or Department	Function
Hamlet of Sachs Harbour	1. Responsible for water delivery and minor maintenance of the water truck (such as cleaning). Water truck drivers do not enter the truckfill station itself, nor do they have any involvement in water treatment or water quality sampling. 2. Responsible for day to day operations including chlorine testing, maintaining proper chlorine dosage, water quality sampling and housekeeping. 3. Responsible for maintenance of the infrastructure including generation of work orders for local staff, purchase of chemicals, PM inspections, and repairs.
Public Works and Services (PW&S)	1. Region & HQ provided project management and technical support, respectively, for infrastructure design and construction. 2. Region & HQ continue to provide training and technical support for troubleshooting and optimization.
Municipal and Community Affairs (MACA)	1. Holds ownership of the assets (truckfill, intake and water truck). 2. Subsidizes the Community water delivery program through the Water and Sewer Subsidy Program (WSSP). 3. Provided program management for water supply system planning and funding for infrastructure construction.
Health and Social Services (H&SS)	1. As the main regulatory agency, H&SS administers the *NWT Public Health Act*, *General Sanitation* and *Public Water Supply Regulations* to ensure safe drinking water and adherence to the *Guidelines for Canadian Drinking Water Quality (GCDWQ).* 2. Local Community Health Representative takes monthly bacteriological samples and may assist with other sampling. (Since the time of the review sampling is being done at Hamlet level, rather than CHR). 3. All test results are sent to the Regional Environmental Health Officer (EHO) for review and action. 4. Discussion needed to allow each community to use independent labs for water testing.
NWT Housing Corporation (HC)	1. Responsible for the cleaning of house water tanks in houses owned by the Housing Authority. (Private householders are responsible for cleaning their own tanks).
NWT Water Board (NWTWB), Indian and Northern Affairs Canada (INAC - Federal), Department of Fisheries and Ocean (DFO-Federal), Resources Wildlife & Economic Development (RWED)	1. All play a role in environmental management of the watershed. • NWTWB is responsible for issuing water licenses. • INAC Regional staff inspect the water treatment facility annually for compliance with the water license and take raw water quality samples. • DFO is responsible for fish habitat under the *Fisheries Act*. • RWED monitors contaminant spills.

Table 1 Water System Roles and Responsibilities

5. WATER SUPPLY SYSTEM COMPONENTS – DESCRIPTION

The Sachs Harbour water supply system consists of a 115 meter single insulated intake with a submersible pump and a truckfill facility with a chlorination system for disinfection. The intake and facility were built in 1978. It is one of the simplest, oldest systems running in the Northwest Territories.

5.1 Raw Water Source

Sachs Harbour is located on Banks Island. The raw water source for the community comes from Water Lake, located just northwest of the community.

5.2 Water Intake

The 116 meter permanent intake to the truckfill station consists of 200 mm insulated HDPE piping. The intake is a floating intake with a weight at the end of the piping, before the intake screen elbow, and a buoy to help keep it afloat. The buoy is red and can be seen in the water on a calm day. The intake end floats at about 6-7 m feet below the surface. The intake pipe has a heat trace cable for pipe freeze protection. There are no temperature controllers for the heat trace, just on/off. The intake screen at the end of the intake, preventing debris from entering the intake pipe, is a 200 mm Johnson Stainless Steel Screen with a 90° elbow at the end. The intake screen, pump, and discharge pipe are new, being installed in March 2002.

5.3 Truckfill Station

The truckfill station itself is a single room Bally freezer, with plywood flooring. In the original water supply system, this building was a pump access building. It was upgraded to a truckfill station when the original truckfill station was dismantled. The building foundation is below ground surface. Within the past year a plywood entrance-way has been built on the front of the building for added protection from the elements for workers. The plywood entrance is insulated with rigid board insulation.

5.3.1. Truckfill Sub-Systems

There is no flow switch, flow sensor or flow meter installed in the truckfill.

There is one pump located in the intake pipe. The new pump installed in early 2002 is a Franklin Electric (Crown), S6-150 2 stage submersible turbine pump c/w 5 HP 4" 230/1/60 submersible motor, motor 01L18-30-2420. The community has a spare pump (the same make) with motor number 01L18-30-0335, in storage near the community garage. Both pumps came with power cables and splice as well as 5 HP 230/1/60 Franklin control boxes. There is no means for backwashing the intake. However, the fire truck can be used for backwashing if necessary.

The truckfill arm is not a typical truckfill arm (though it will be called a truckfill arm for the purposes of this report). The Sachs Harbour truckfill has a hose attached to the end of the pipe bringing water out of the building. The operator must manoeuvre the hose into the water truck fill hole. The truckfill arm is not heat traced or insulated.

5.3.2. Mechanical and Electrical Systems

The electrical system generally consists of the main power supply, pump switch for the submersible truckfill pump and distribution panel. The main breaker is Panel D (600 volts) with on/off switch. It is an Amalgamated Electric power switch, max. amps. 30.

The pump switch is a single phase magnetic starter, Furnas Seris A, Volts 115/230, Max. Amps. 35, 600 VAC, size 1P, contact kit 75EF14, 1 Ph 35. The pump is a Franklin Electric, Model 2821138110, HP 5, Volts 230, HZ 60, PH 1, RPM 3450, Amp 23, S.F 1.15, S.F. max. amp. 27.5, Code F, Continuous Duty, Date 01E19.

The distribution Panel B is 120/240 volts, system 3W SN, Type ANLB, Amps. 225, Panelboard # 169940. The transformer inside of the truckfill building is by Polygon Industries Ltd., Style 6H1-10C-1, Serial 17949-7 Phase 1, Class H, Rated KVA 10, H.V. 600, L.V. 240/120.

Building heat is provided by a baseboard heater approximately 1.5 feet above floor base.

The pumphouse interior lighting is a single bulb. There is an exterior light next to the truckfill side of the building, which is likely photocell controlled.

One eyewash station is installed inside the truckfill.

5.3.3. Alarms

An auto dialer alarm used to be connected to the original truckfill station building, and was probably disconnected when the intake pumphouse was converted into the current truckfill station. There are currently alarms operating in the truckfill building.

5.4 Water Treatment

Water treatment consists of chlorine disinfection alone. The community, up until December 2001, was using powdered calcium hypochlorite. Due to operational problems the powdered calcium hypochlorite system was shut down and the community turned to batch clorination as their source of water disinfection. Batch chlorination was the process being used during the time of the review. After the review, however, the previous chlorination system was hooked back up. This disinfection system consists of a chlorine mixing tank, electric mixer, solution tank, and chlorine injection pump. There was also an electric mixer on the solution tank.

Both the chlorine mixing and solution tanks are 200L (45 imperial gallon) white plastic tanks, marked in 20L intervals (5 imperial gallon) with a white (painted) plywood tops. The mixers (agitators) on both tanks are by JL Wingert. The mixer on the mixing tank is Model, P-31 Code 1297 and mixer of the solution tank is P-11 Coce 0296. The metering pump (chlorine injection pump) is by Chempulse Electronic, Model 45-050K/KIM, Max GPH 5, Volts 115, S/N Au04655, Max Psi – 100 , and Amps 2.3. There is no spare metering pump. Chlorine solution is gravity fed from the mixing tank to the solution tank.

5.5 Water Distribution

Water distribution is accomplished via truck delivery. The community has two water trucks. The oldest truck an F700 Ford with a 1000 imperial gallon tank, purchased in 1990, is currently not in use, the tank has been removed for servicing. The newer truck, an F Series with a 1000 imperial

gallon tank, purchased in 1997, is currently being used for water delivery in the community. Water truck delivery in Sachs Harbour is the responsibility of the Hamlet.

5.6 Household Water Tanks

There are about 120-130 people in Sachs Harbour, and about 37 residential houses in the community. About 20 of these homes belong to the Housing Corporation, leaving approximately 15 as private homes. The majority of the home water tanks are 325 imperial gallon upright white plastic tanks. The Co-op and a few homes have low profile tanks under the building in the crawlspace area. Some public buildings may have larger tanks, particularly the school and the Nursing Station. Schools generally require enough water for drinking and operation of the sprinkler fire protection system.

6. WATER SYSTEM REVIEW – INFRASTRUCTURE

6.1 Water Intake and Truckfill Station

- In March of 2002 the discharge pipe, intake screen and water pump were replaced after a pump break down episode as well as a building freeze up episode. The repair work ended up costing approximately $90,000 for a water treatment facility that is over 20 years old. This was however, the only option at the time for getting the water treatment plant back on line. Although this facility is old and there are a number of items that are below standard there is no immediate public health risk. **However, recommend a planning study and conceptual design project be initiated for the next 20 year life cycle**.
- The access road to the truckfill is in reasonably good shape. The water truck, however, must back into position at the facility for filling, increasing the risk of hitting the building or backing into the lake. It would be more convenient to have a turnaround that allows the water truck to drive in and drive out when filling is complete. The current condition is likely due to the fact that the building was originally just a pumphouse, not a truckfill station. **Recommend a proper turnaround be built for the new truckfill.**
- The truckfill building is generally tidy. But it was poorly lit, cramped and the work station was not large enough to allow for proper testing or to wash the chlorine testing equipment. There was also no storage space for chemicals and supplies. The building is also poorly ventilated **Recommend establishing a designated area for storage and testing, such as the Hamlet Garage.**
- The truckfill building has been damaged in a number of places, as there are no bollards protecting the building from being hit. Also, the building is below ground surface and down gradient and floods up to a foot or more every spring. **Recommend installing bollards in the new facility (when built in the future) and immediately redirecting drainage around building using berms or ditching.**
- There is no fencing around the facility and there is no sign on the building labelling it as the water treatment facility. **Recommend attaching a sign to the new building written in English and the local language.**

6.1.1. Truckfill Sub-systems

- A new pump was installed in March 2002. Everything was connected properly but the pull cable was not attached for future removal of the pump. In order to remove the pump in the future the crew will have to pull on the discharge pipe (the pump screws into the discharge pipe). This may damage the discharge pipe, which would then have to be replaced again. **Recommend the pull cable be attached when the pump is next removed.**
- There is a new spare pump (same make as the current pump in use), with a power cord attached, in storage near the Hamlet maintenance garage.
- Some of the major sub-system problems are the lack of alarms, controls and backup power supplies to prevent freezing or alert operators to freezing conditions. Recommend these problems be addressed when a new project is undertaken. Details of some of the major concerns are listed below:
    - There are no thermistors (temperature sensors) on the intake line to regulate the intake heat trace cable or activate a low temperature alarm if the intake freezes. This means the intake heat trace is on all the time, which increases power costs.

  - There is no back up building heat and no low or high building temperature alarms, nor any fire or smoke alarms.
  - There is no back-up power supply nor any battery back-up to take over in the event of power failure. There were two power outages last year, which is not too frequent but is enough to be of concern.
- The building foundation is below grade and floods every spring, up to 1.5 feet deep. This can become a hazard if the water level comes in contact with an electrical unit. For example, the baseboard heater is less than 2 feet above the floor of the building. **Recommend moving the baseboard heater up at least half a foot, if possible.**
- Flow rate for the truckfill is below the standard 1000 L/min of flow required for fire protection purposes.
- There is no flow meter or flow totalizer on the truckfill process piping. Having a flow meter allows the operator to do regular checks on flow rate to confirm the intake screen has not become partially blocked or frozen. The flow totalizer helps as a check on total volume of water used.
- The chlorine injection port is bent, and the ports are welded instead of tapped, which makes them more difficult to fix. There is no flow switch to activate the chlorine injection pump.
- There is no connection available to allow regular backwashing of the intake.
- There is no storage space in building.

6.1.2. Mechanical and Electrical Systems

- Some of the electrical components are old and eventually will need to be replaced. However, they will likely suffice until a new truckfill is established.
- There is also some concern about pump power cable not being covered/protected (a potential danger).
- There is potential danger if spring run-off floods the building above some of the electrical components, such as the baseboard heater.

6.1.3. Alarms

- There is no alarm system in the truckfill at present. **Recommend a complrehansive alarm system be installed when a project is undertaken to replace the truckfill. In the mean time consideration should be given to installation of a simple alarm system.**

6.2 Water Treatment

- At the time of the review the operators were batch chlorinating, as their form of disinfecting, the water being delivered by the water truck. They had been batch chlorinating since the pump broke down in December. Since the review, however, the calcium hypochlorite disinfection system inside the truckfill building has been connected and is now being used.
- Expected revisions to the GCDWQ turbidity guidelines will likely require filtration for all surface water sources. This will have a significant impact on NWT water supply infrastructure in general, including that in Sachs Harbour. H&SS is working with the *Federal-Provincial-Territorial Committee on Drinking Water Quality Guidelines* on this issue, and with PW&S (through the *NWT Drinking Water Committee*), on a pilot plant study to test the viability of cartridge filtration for meeting the new requirement. Cartridge filtration systems are less expensive than traditional filtration systems, and simpler to operate and maintain. **Recommend continued co-operation between PW&S and H&SS on the pilot study project, along with**

continued monitoring of the status of any guidelines changes, and further investigation of options for addressing the new requirements.

- If a decision is eventually made to build a new water treatment plant, consideration should be given to some type of filtration system. More comprehensive seasonal raw water quality data is required before treatment options can be properly identified and evaluated. **Recommend planning work include sampling of raw water quality for physical, chemical and microbiological parameters (PW&S and H&SS to advise on sampling requirements). A minimum of three sample sets should be collected over the course of a year, one during spring runoff, one in the fall and one in the winter.**

7. WATER SUPPLY REVIEW – OPERATIONS AND MAINTENANCE

7.1 Watershed and Raw Water Quality

- The Hamlet of Sachs Harbour has a Type "B" water license as required under the *NWT Waters Act*. This license allows them to withdraw 4,400 m^3 of water per year. The license does not require raw water quality monitoring though Indian and Northern Affairs (INAC) completes an annual inspection in the fall of each year, which includes raw water quality testing. The current water license expires on June 30,2009. During the review the Hamlet still had not filled out the required annual report. **Recommend completing this report as required**.
- There are currently no noted concerns with the drinking water quality, in the community. As in various other communities, many members use ice from the lake or sea ice as sources of water, mainly for making tea. There was concern when approximately 7 years ago a plane when down into the lake. Community members were concerned about possible pollutants from the plane fuel, and they did not want to drink the water out of respect for those who passed away in the accident. However, since then the community has resumed using Water Lake (DOT Lake) as their drinking water source.
- Water samples collected from Water Lake during the time of the review, as well as previous water quality data, indicate that the quality of Water Lake is very good and there are currently no concerns with the quality. We do, however, recommend continuous sampling of water from Water Lake, following the sampling guidelines set out by the Department of Health and Social Services. **Recommend contacting the Regional Environmental Health Officer for clarification on sampling frequency and procedures.**

7.2 Water Intake

- The community has not had a problem with raw water supply but have over the past year had problems with pump failure and intake freeze-up (see Executive Summary for discussion). A major factor in this freeze up was the lack of alarm systems and proper training for pump removal and installation. During turn over of the facility to the Hamlet from Public Works and Services (in 1997) training was provided on pump removal and installation. That was many years ago, however, and information is easily forgotten after such a period of time. **Recommend the Hamlet request a member of Public Works and Services to come into the community for a hands-on training update for the current system, including the chlorination system. The Works Foreman has recently completed a small systems course, held in Inuvik (November 2002), for operators and completed the course with ease, which is a great start to training upgrading. Ideally it is beneficial to have at least two people in a community trained for small system operations.**

7.3 Truckfill Station

- An erosion channel has developed down gradient between the truckfill facility and the lake. **Recommend the channel be filled in with a course granular to help drainage and minimize further erosion. Also a splash pad and drainage channel or culvert at the base of the truckfill under the spot where the truckfill arm drains should be installed. Further, the culvert that goes under the access road near the truckfill station should be cleared and the end pried open to allow run-off from the ditch to drain away from the truckfill.**

- The water truck must back into position at the building in order to complete its fill. There is a potential for the truck to back into the lake. **Recommend placing a log or similar truck stop on the ground behind the truckfill arm to reduce the possibility of backing into the lake.**
- During the review spare parts were found resting on the floor. It was noted that the facility usually floods every spring; which could potentially damage any spare parts stored on the building floor. It also appeared that the baseboard heater could be within flooding limits of the building (although it was reported that the water in the building had never gotten as high as the heater). **Recommend moving the spare parts off the floor, to another building, if necessary. The baseboard heater could also be raised a few inches to provide extra protection from flood damage.**

7.3.1. Truckfill Sub-systems

- The truckfill station logbook (daily checklist) has columns for daily recording of free available chlorine, total available chlorine, date, time, operator. **Recommend adding columns to the checklist for recording changes to chlorine injection pump settings, dates of mixing chlorine solutions, water quality changes, such as visual or measured changes in color or tubidity and weather.**

7.3.2. Mechanical and Electrical Systems

- There is potential danger from spring flooding of the truckfill building. **Recommend establishing a berm or diversion channel around the building, to reduce flooding. Recommend keeping spare parts off the floor of the building and raising any electrical components higher up inside the building if possible.**

7.3.3. Alarms

- There used to be an autodialer system installed in the original truckfill station, which is no longer connected. **Recommend consideration be given to installing some sort of alarm system, to alert local staff to critical problems while still being simple to maintain, which might include (in addition to the current low building temperature alarm) low intake casing temperature. Cost and benefits of installing a more comprehensive system must be evaluated, however, considering the age of the building and the fact that a planning study may be initiated in the near future.**

7.4 Water Treatment

- The community uses calcium hypochlorite granules (65% available chlorine). At the time of the review there were approximately ten 2 kilogram bags of the powdered chlorine in storage at the Hamlet Garage. When they are using the calcium hypochlorite disinfection system they usually mix up a solution once a month. 2/3 of a cup of powder are added to make up a 45 gallon solution of chlorine (which lasts about one month). **Recommend mixing smaller batches of chlorine solution (approximately once every two weeks) in order to maintain chlorine solution strength, since the amount of chlorine in the solution slowly dissipates over time. Recommend posting updated instructions.**
- The NWT Public Health Act requires you to have a spare chlorine injection pump. **Recommend purchasing a spare chlorine injection pump.**
- An agitator (mixer) is located on each of the tanks (both the mixing and solution tanks). **Recommend removing the mixer for the solution tank and trying the system without it. A**

mixer is needed on the mixing tank, but not generally on the solution tank. It is best if the binding agent in the powdered chlorine stays settled out on the bottom of the solution tank so it doesn't clog the foot valve on the chlorine injection pump.

- The tubing leading from the chlorine injection pump to the truckfill piping was black. **Recommend switching to clear tubing so that the operator can visually check that the chlorine solution is pumping onto the system.**

7.5 Water Quality Testing and Reporting

- Table 2 shows the frequency of water quality sampling being done, along with the sample location. Table 3 shows who takes the samples, who tests them, who sees the results.

Parameter	Frequency of Testing		No. of Samples	Location	Comments
	Raw	Treated			
Bacteriological		Monthly	Three	Two public buildings (random), water truck, and private homes upon request	Treated water should be tested 4 times each month as per GCDWQ. Ideally, water should be tested once each week to allow for the required 4 tests per month. Test should be carried out from water obtained from water trucks by the Hamlet, as that is the municipal system.
Chemical	Annually				Incorporate into regular routine.
THMs and TOCs					THM and TOC should be tested for every six months by the Hamlet.
Water License	Annually		One	Truckfill station	
Free Available Chlorine		Daily (since review)	One	Water truck or truckfill arm	EHO would like to see tests three times a day.
Total Chlorine		Daily (since review)	One	Water truck or truckfill arm	EHO would like to see tests three times a day.

Table 2 Sampling and Testing Procedures

Sampling/ Testing	Sampled by	Tested by	Distribution of Results	Comments
Bacteriological	Health Center Clerk or Local H&SS Representative (Since review has changed to Water treatement operator each week).	Inuvik Hospital	H&SS Rep. (Health Center) when necessary	EHO to report findings on a quarterly basis as a minimum.
Chemical	INAC Region – Scott Gallupe	Taiga Labs	INAC Region and SAO	Raw water sampling done in August 2002.
THMs and TOC				THM and TOC to be sampled by Hamlet/PWS and tested by an independent lab. Results to be forwarded to EHO.
Water License	INAC Region – Scott Gallupe	Taiga Labs	INAC Region and SAO	(Scott Gallupe is no longer with INAC – Replacement is unknown).
Free Available Chlorine	Works Foreman	Works Foreman	Truckfill log-book	
Total Chlorine	Works Foreman	Works Foreman	Truckfill log-book	Recommenced after review.

Table 3 Communication and Reporting

7.5.1. Chlorine Testing

- The truckfill station has one Hach Pocket Colorimete (tests free and total chlorine), which was purchased after the review. There is also a Hach Colour Disk, which was used prior to the purchase of the Hach Pocket Colorimeter, which had only one 10 ml vial to use for testing. **Recommended buying (if not already done) extra 10 ml testing vials, brushes for cleaning the vials, Free Available Chlorine testing reagent, rubber gloves and a container for washing. Vials can be cleaned with a mixture of vinegar and water.**
- **When testing, recommend wiping test vial free of all excess moisture on outside, fill sample so bottom of meniscus is level with 10 ml line on vial, and hold the vial by the top so fingerprints do not interfere with the Colorimeter reading.**
- **Recommend three chlorine tests per day. Samples should be collected from the water truck, as water collected from the truckfill arm is not fully mixed and test results will not be accurate. The following tests are recommended:**

1. **The truckload that sits overnight for fire protection purposes should be tested first thing in the morning to ensure adequate free available chlorine level prior to delivery, and batch chlorinated to increase the free available chlorine if required. Additional test(s) may be required to confirm the batch chlorination results.**
2. **The first truckload filled in the morning should be tested, for free available chlorine and total available chlorine, 20 minutes after filling. This test ensures the chlorine injection pump is set properly for the day. Additional test(s) may be required to confirm FAC results due to pump adjustments.**
3. **A truckload in the afternoon, testing for free available chlorine only, to ensure that there is a minimum of 0.2 mg/L after 20 minutes.**

- **Remember to wait 20 minutes after the chlorine has been added to the water before testing for chlorine. This gives the chlorine sufficient time to react with (kill) the bacteria in the tank and leave available free chlorine.**
- **Recommend inserting extra columns into daily data log sheet in order to have room for the increased number of free and total chlorine readings.**
- Currently in the truckfill station there is no good place for the operator to do the chlorine tests and clean the test equipment after use. The building is cramped and poorly lit with no place to rinse the equipment off, and the addition (built on to the main building) would be too cold in the winter. **Recommend either buying a small tub or wash pail for the truckfill station, or allow the operator to do the tests somewhere else where there are better facilities for washing.**

7.5.2. Bacteriological Testing

- Bacteriological sampling is done by the Health Centre Clerk or the local Community Health (H&SS) Representative. **Ultimately the collection of water samples is the responsibility of the operator. However, in many communities it has become the responsibility of the CHR, though it is not part of their job description. EHO has recently, since the review, designated water operator for sampling. Recommend ensuring this change.**
- The Community Health Representative takes about three samples each month. Generally, two are collected randomly from public buildings, one from the water truck. Samples are collected from a private home upon request. **Bacteriological testing is done free of charge at the Inuvik Hospital and additional samples are recommended whenever there is a concern. EHO suggests the Hamlet be given the choice of labs to use.**
- The *Guidelines for Canadian Drinking Water Quality (GCDWQ)* recommend four bacteriological samples per month for populations up to 5,000 people. All EHO's across the NWT recently adopted this standard and informed the communities of the change. (The NWT Public Health Act requires only two bacteria samples per month for communities of 501 to 2,500 people.) The Inuvik Region EHO has requested that communities take one sample per week, for a total of four per month. This helps level out time requirements for analysis of all regional samples and ensures more frequent monitoring of all community water supply systems. **Recommend community staff (operator) take four bacteria samples per month (one per week). Samples should be collected from the public water system, including the water truck (2 or 3 per month) and public buildings (1 or 2 per month). Testing should focus on the water trucks. Samples should not be obtained from private homes when assessing public systems. month).**
- **MACA Region should work with the EHO to develop a Standard Operating Procedure (SOP) for bacteria sampling, and incorporate this into an SOPs binder for the truckfill station.**

- Samples are normally taken from the kitchen or bathroom sink. **Recommend the tap be sterilized with a lighter and the water run until temperature stabilizes before taking a sample.**
- Test results are forwarded from the hospital lab to the EHO automatically. The EHO calls the Community Health Representative immediately if there is a problem. **Recommend bacteriological test results be forwarded automatically from the EHO to the local water treatment plant operator, Community Health Representative, SAO, and PW&S HQ.**

7.5.3. Chemical Sampling

- The community is not regularly testing their drinking water or raw source water for THMs (Trihalomethanes) and TOC/DOC (total and dissolved organic carbon). The Water Resources Officer (INAC) does water sample collection for chemical analysis during some of his visits to Northern communities. However, any water quality testing results obtained by PW&S for this review do not show any THM or TOC/DOC analyses. THMs are part of the set of disinfection by-products – compounds formed by the interaction of chlorine with organic material naturally present in the raw water supply (such as decaying leaves). As such, THM samples are generally collected after chlorination, usually from the water truck or the tap of a public building. **Recommend developing routine sampling procedures for THMs and TOC/DOC and that samples be collected biannually**.
- **Recommend MACA work with the Community and Regional EHO to clarify operator responsibilities with respect to sampling and help the community integrate sampling into their regular routine.**
- As sampling for chemical and physical parameters had not yet become routine, there was no protocol for distribution of sample results. **Recommend the Regional EHO ensure sample test results and/or deficiencies in sample collection are forwarded to the local Operator, SAO and Council. Test results should come complete with Guidelines for Canadian Drinking Water Quality (GCDWQ) maximum acceptable concentration (MAC), interim maximum acceptable concentration (IMAC), or Aesthetic Objectives (AO) values for comparison and/or a brief interpretive letter explaining the significance of the results.**
- **Recommend MACA clarify sampling requirements with the EHO and incorporate them into the regular operational routine. In general, H&SS requires sampling of treated water for chemical parameters once a year at spring freshet and sampling for THMs twice a year in spring and fall. Additional sampling for TOCs is recommended to coincide with THM sampling. Recommend MACA Region work with Taiga Environmental Laboratory and the Regional EHO to develop a set of standard operating procedures (SOPs) for annual sampling of chemical and physical parameters and biannual sampling of THMs, and incorporate the procedures into a SOPs binder for the truckfill.**
- **Sampling should be co-ordinated between MACA, the Community, the EHO and INAC to minimize costs, and ensure all parameters are covered and samples are collected properly.**

7.5.4. Sampling and Testing for Water License

- Even though the current water license does not require raw water quality testing, INAC does an annual inspection complete with raw water quality sampling at the truckfill intake for a number of physical, chemical and biological parameters. The annual INAC inspection report complete with sampling results is sent to the SAO and other government departments as

requested. H&SS has been relying on this data for the last three years, even though it has been collected in the fall and not under worst-case conditions. Currently there is no Water Resources Officer at INAC in Inuvik (previously Scott Gallupe). **Recommend sampling be co-ordinated with H&SS and done at spring freshet and that all necessary parameters are covered.**

7.5.5. Reporting - General

- The operator never sees the results of any testing except the chlorine testing he does himself. **Recommend H&SS forward all sample results to PW&S HQ for entry into the new Water Quality Database (which can be found at the GNWT Public Works and Services website).**
- The public does not receive any information on their drinking water. **An attempt should be made to educate the public on water quality issues. This could take the form of a poster in the Hamlet Office describing the water quality system, summarizing water quality test results and providing a contact number for concerns.**

7.6 Community Operations

- Table 4 lists community and GNWT staff with operational responsibilities relating to the water supply system.

Name	Level of Certification	Years of Experience	Education Requirement	Reports To	Comments (hr./day on site)
Floyd Lennie (Works Foreman)	Small Systems (re-certified after Review)	16	Met	SAO	10 min/day testing chlorine levels and a couple of hours every month for mixing chlorine.
Joseph Carpenter	Trained – Not certified	3	Met	Works Foreman	1-2 hours/3 days – water truck driver
Tim Bettger	Mechanic			Works Foreman	Maintenance on water trucks
Margaret Lennie	Trained – Not Certified			Works Foreman	Sewage truck driver

Table 4 Community Water System Operational Staff and Related Training

- The Community Works Foreman, Floyd Lennie, is responsible for day-to-day truckfill station operations including chlorine testing, adjusting the chlorine injection rate, and general

housekeeping. During the Review, however, Joseph Cerpenter was performing much of the day-to-day operations (at that time the chlorine system was not hooked up and there was no testing being performed).

- Joseph Carpenter, the water truck driver, is interested in the day-to-day operations in the truckfill station and had attended a small systems course in January/February of 2002. Margaret Lennie the sewage truck driver also attended the course. **It is important that there be at least two trained workers; one or more for backup if the regular operator(s) is not available. Recommend further training.**
- There was no O&M Manual at the truckfill station. **MACA Region should confirm whether there is an O&M manual in the community and have a copy remain in the truckfill station or at the maintenance garage so it can be referred to when necessary.**
- **Recommend MACA Region work with the operators and the Regional EHO to prepare a simple set of standard operating procedures (SOPs) (or consider having SOPs as part of the O&M manual for the future truckfill station), for items such as (but not limited to):**
  - **chlorine test procedures;**
  - **process control (adjusting the chlorine injection pump and batch chlorinating);**
  - **summary of sampling requirements for regulatory compliance and water tanks;**
  - **sampling procedures for bacteria, THMs, TOCs and chemical parameters; and**
  - **a summary of roles of various agencies/departments with respect to water supply along with contact names and numbers.**

7.7 Training Requirements

- **Recommend MACA organize continued practical, "hands-on" field training for all operations staff.**

7.8 Workplace Safety

- **Material Safety Data Sheets (MSDS) should be clearly displayed for all chemicals used in the truckfill station and included in the SOPs.**
- The truckfill station has some of the required safety equipment including goggles, eyewash station, first aid kit and first aid booklet. Gloves and dust masks are stored at the maintenance garage. Most of the staff has WHMIS. **Recommend purchasing appropriate gloves and aprons to be used when mixing chlorine solution.**
- **Recommend spare eyewash bottles be provided.**

7.9 Maintenance Management Systems

- The community does not refer to the Operations and Maintenance (O&M) Manual. There was no O&M Manual in the truckfill station. **Recommend MACA Region assist the community with preparation of regular (daily, weekly, monthly, and annual) PM checklists with specific action triggers and responses. An old copy of the Water Pumphouse Maintenance Schedule (developed by PWS) can be found at the Sachs Harbour Hamlet Office, which can be used as a basis for the development of an up to date and suitable checklist. It is also strongly recommended that operator(s)' responsibilities are clarified so that each worker knows what role they play with respect to truckfill operations. There appears, in past records, to be some confusion about operators' roles and responsibilities.**

- The Works Foreman does not use the MMOS system. **Recommend training on the MMOS system.**

7.10 Inventory/Spares

- **Spare parts should include (but not be limited to) a chlorine injection pump, two or three pump repair kits, flexible tubing, a foot valve, powdered chlorine and chlorine test reagent.**

7.11 Water Distribution

- The Bureau of Statistics estimates there were 153 people living in Sachs Harbour in the year 2000, and 40 occupied dwellings with an average of 3.3 people per dwelling in 1996. Population is expected to grow to 169 in 2009 and 185 in 2019. Local staff estimated there are about 20 public houses and approximately 15 residential units in the community.
- The water license allows the Community to draw a maximum of 4,400 m^3 from Water Lake each year.
- The water truck driver delivers water to all buildings three times a week (Monday, Wednesday, and Friday). Monday and Friday are the busiest days. Local staff estimated the water truck delivers approximately 10 loads of water per day. The water truck generally works 9 to 5 on delivery days.
- **Recommend establishing cleaning the water truck with a chlorine bleach solution at least once a year or as recommended by the Environmental Health Officer, and incorporate into the water delivery contract.**
- The nozzle on the water truck hose does not have a trigger, camlock or other means for shutting off the flow of water. Therefore water is spilled on the stairway or driveway creating icey conditions in the winter-time. Also the reel, to reel up the hose on the new water truck, does not work. **Recommend replacing the nozzle with a trigger nozzle (like used for pumping gas at a gas station. (Note: This may have already been done since time of review). Also recommend fixing hose reel.**
- The reverse option on the water truck did not work during the time of the review. In order to back up the truck had to be driven to a high point and allowed to roll back wards. **Recommend water truck be serviced and repaired as soon as possible.**

7.12 Household Water Tanks

- The Housing Corporation cleans its managed residential units once a year. A notice is also put up in the community during that time to notify/remind homeowners that water tank cleaning should be done. Private homeowners are responsible for cleaning their own tanks. **Recommend the Community discuss public education with the Regional EHO and MACA to encourage local residents to clean their water tanks regularly. The Band should consider organizing a regular (annual) community wide household water tank cleaning program, building upon what is already done annually in the community.**
- Although only a few homes have crawl space water tanks and it was not mentioned whether people had to enter the water tanks for cleaning it is a common occurrence in communities. **However, no one should be entering water tanks (or any other confined space) without proper equipment. Recommend the EHO provide the band with updated instructions for cleaning water tanks (and possibly some training) and ensure they are posted at the Band Office and Health Centre. Recommend H&SS take the lead in discussions with the Housing Corporation to develop a preferred method (including equipment specifications if**

necessary) for cleaning of household water tanks, and an improved water tank design that facilitates easy identification of dirty tanks and cleaning.

8. GAP ANALYSIS

The gap analysis shown in Table 5 highlights some of the deficiencies in the existing water supply system. It is the intention of the GNWT to review and update the gap analysis annually.

COMPONENT	ANALYSIS
Roles and Responsibilities	• Works Foreman responsibilities relating to preventative maintenance inspections and sampling should be clarified. • H&SS and Clinic staff relied on the majority of the time to do bacteriological sampling.

Infrastructure Review	• Infrastructure is ageing past its expected design life. Planning for the next 20-year life cycle is required.
	• Some deficiencies noted during the Review include:
	  • No system alarms
	  • No back-up power
	  • Flow rate below GNWT standard
	  • Chlorine system not working (during review)
	  • No gauges, flow meters
	  • Inadequate chlorine testing space and no storage space
	  • No complete truckfill turnaround
	  • Poorly lit building
	  • No ventilation system

Operations and Maintenance Review	• No certified back-up staff (although there are trained staff). • Water quality sampling not done during worst case conditions. • Concerns identified relating to chlorine mixing, testing and process control. • Operations and Maintenance Manual not made available. • Missing some required laboratory and test equipment. • Responsible staff are not getting all water quality test information. • Residents are not getting any information on drinking water quality. • No simple standard operation procedures available for all activities. • No standard chemical and physical water sampling procedures. • No preventative maintenance checklists available for operator. • Material Safety Data sheets not readily available. • The operator is not alerted of an alarm situation automatically. • Lack of GNWT support.

Table 5 Gap Analysis

9. RECOMMENDED COMMUNITY ACTION PLAN

Table 6 suggests a recommended action plan for the community. Items are listed in priority order. Note that "time frame" is a general reference to the expected time to implementation, and not necessarily a reflection of priority. GNWT assistance maybe required in some cases, and a lead contact is specified where applicable.

#	RECOMMENDED COMMUNITY ACTION PLAN	PRIORITY	TIME FRAME	LEAD
1	Ensure a minimum free available chlorine (FAC) residual of 0.2 mg/L after 20 minutes contact time for all water delivered. Recommend a minimum of three FAC tests on each delivery day, one on the truck that sits full overnight for fire protection, one on the first truckload filled each morning, and one in the afternoon to confirm pump settings	High	Immediate and on-going	Hamlet
2	Recommend Community staff assist H&SS staff with bacteria sampling to ensure at least four samples are taken each month (one per week). At least one sample should be taken from the water truck and one or two from public buildings. Water should not be tested from private homes when assessing public systems. Complaints from private owners should contact EHO and discuss solutions/testing. Sampling requirements should be confirmed with the Regional EHO.	High	Short term and on-going	Hamlet H&SS
3	Recommend the Community ensure staff in charge of day-to-day operations have Small Systems Certification and maintain their certification status by providing regular opportunities to attend training events and conferences for continuing education credit. Recommend two people be trained (1 for back-up).	High	Short-term and on-going	Hamlet MACA
4	Recommend staff begin batch chlorinating the water truck if it does not have a minimum FAC residual of 0.2 mg/L after 20 minutes.	High	Immediate and on-going	Hamlet
5	Recommend chlorine solution be mixed every two weeks in order to maintain solution strength.	High	On-going	Hamlet
6	Recommend improving the workstation area in the building for testing, washing, etc. or establish a suitable area elsewhere for testing, record keeping and washing test equipment.	High	Medium term and on-going	Hamlet
7	Purchase a spare chlorine injection pump.	High	Short term and on-going	Hamlet
8	Remove agitator from solution tank.	High	Short term and on-going	Hamlet
9	Recommend Material Safety Data Sheets (MSDS) for all chemicals used be posted in the truckfill so they are readily available at all times for emergency response.	High	Short term and on-going	Hamlet
10	Appropriate safety equipment (including solution for the eyewash station, gloves and an apron) must be available at the truckfill station at all times.	High	Short term and on-going	Hamlet

11	Recommend annual water quality sampling for chemical parameters and THMs. Confirm sampling requirements with the Regional EHO.	High	Short term and on-going	Hamlet H&SS
12	Recommend the Community implement daily, weekly, monthly and annual operations and preventative maintenance checklists for the water supply system. MACA Region to take the lead in assisting with preparation of O&PM checklists. Improve daily chlorine checklist.	High	Medium term and on-going	Hamlet MACA
13	Recommend filling in the erosion channel on the lake side of the truckfill station with a course granular material to help drainage and minimize further erosion. It is also recommended to install a splash pad and drainage channel or culvert at the base of the truckfill under the spot where the truckfill drains and repair the culvert that is currently present under the access road near the truckfill station (which would only require clearing it out and straightening out the pipe).	High	Medium term and on-going	Hamlet
14	Complete annual report as required by water license.	High	Short term and on-going	Hamlet
15	Fix reverse on water truck.	High	Short term	Hamlet
16	Change tubing on chlorine injection line from black to clear	High/Medium	Short term and on-going	Hamlet
17	Recommend storing a fire extinguisher in the truckfill building and that it be checked monthly and serviced annually.	Medium	Medium term and on-going	Hamlet
18	Recommend installing a simple ventilation system or keep door open when mixing chlorine solution.	Medium	Short term and on-going	Hamlet
19	Recommend cleaning water truck once a year. Work with MACA or H&SS to develop a regular preventative maintenance program for water truck.	Medium	Short term and on-going	Hamlet MACA
20	Recommend continued discussions with the EHO on public education and appropriate cleaning methods for household water tanks. Ensure updated instruction for cleaning household tanks are posted at the Band Office and Health Centre. Consider a regular (annual) community based water tank cleaning program.	Medium	Medium term and on-going	Hamlet H&SS
21	Recommend formal reporting to Council to facilitate planning, budgeting and continual improvement. The SAO (in co-ordination with operating staff) should submit brief Annual Operating Reports and quarterly updates to the Community Council on the status of the water supply system. Operating Reports should include summaries of water quality test results, maintenance work, operating issues/concerns, expenses and training. Reports should be forwarded to MACA Region to assist MACA in identifying training, technical or financial support requirements. MACA Region will co-ordinate with Community staff, PW&S and the EHO to assist with preparation of the first Annual Operating Report in **2003**.	Medium	Medium term and on-going	Hamlet MACA

23	Recommend purchasing extra chlorine test vials, as well as a small tub and cleaning brushes to facilitate cleaning of laboratory equipment.	Medium	Medium term and on-going	Hamlet
24	Recommend placing a log or similar truck stop on the ground behind the truckfill arm to reduce the possibility of the water truck backing into the lake.	Medium	Medium term and on-going	Hamlet
25	Track inventory of chlorine test reagent to ensure sufficient supply at all times.	Medium	On-going	Hamlet
26	Move spare parts off the floor (store elsewhere if necessary). Recommend moving baseboard heater up in order to ensure protection from spring flooding.	Medium	Short term	Hamlet
27	Fix nozzle on water truck (prevent from leaking when water flow stops).	Medium/Low	Short term	Hamlet
28	Recommend Community work with PW&S and MACA to determine the feasibility installing an alarm system and determine whether it is worthwhile considering the age of the facility and the potential for new infrastructure planning.	Low	Medium term	Hamlet MACA PW&S
29	Recommend the back-up water truck be stored full every night if possible to assist with fire protection.	Low	Short term and on-going	Hamlet
30	Recommend advance preparation of mechanical and electrical deficiency lists prior to each annual inspection to facilitate faster repairs at minimal cost. MACA Region to assist as required.	Low	Medium term and on-going	Hamlet MACA

Table 6 Recommended Community Action Plan

10. RECOMMENDED GNWT ACTION PLAN

Table 7 suggests a recommended action plan for the GNWT to help improve the overall water supply system efficiency. Items are listed in priority order. "Time frame" is a general reference to the expected time to implementation, and not necessarily a reflection of priority.

Table 7 Recommended GNWT Action Plan

#	RECOMMENDED GNWT ACTION PLAN	PRIORITY	TIME FRAME	LEAD
1	The Sachs Harbour truckfill is old and a number of repairs are required to bring it up to standard. Recommend a planning study be added to MACAs Capital Plan as soon as possible.	High	Long term	MACA
2	Increase operational assistance to the community to facilitate continual improvement. EHO will continue to visit community twice a year, and will review log book and chlorine levels/test procedures on each visit. PW&S HQ will work with EHO to provide regular practical hand-on operations training and troubleshooting assistance.	High	On-going	PW&S H&SS
3	PW&S HQ will continue to review truckfill station operations and maintenance annually. On each visit, PW&S will review the log-book and maintenance checklists, test chlorine levels in the water truck, and confirm accurate chlorine test and batch chlorination procedures, provide technical services and hands-on traning.	High	Short term and on-going	PW&S
4	Recommend MACA work with Community to install backup building heat and alarm system. However, the cost and benefits of installing these systems should first be evaluated against the long-term cost and benefits of a new system in the planning study.	High	Medium term	MACA
5	Improve community and interdepartmental reporting on water quality testing. As of **2003**, H&SS will forward all test results with GCDWQ values for comparison and/or a brief interpretative letter to the Band Manager and Council. H&SS will copy all test results and notices regarding sampling requirements to PW&S HQ for input into the water quality database.	High	Short term and on-going	H&SS
6	PW&S HQ will conduct a pilot study (in Colville Lake) to determine the feasibility of using cartridge filtration for truckfill stations typical of the NWT. Study to be completed in **FY 2003/04**.	Medium	Long term	PW&S
7	INAC Region and EHO Region to ensure all sample results are forwarded to PW&S HQ for input into Database as soon as possible.	Medium	Long term	INAC EHO

8	Recommend MACA Region work with the Community, PW&S, the Regional EHO, Taiga Environmental Laboratories, and INAC or the NWT Water Board, as required, to prepare a set of standard operating procedures (SOPs) for the Truckfill Station Operator. SOPs will be finalized by **mid 2003** and should be included in O&M manual for new truckfill station.	Medium	Medium term	MACA
9	Recommend MACA Region co-ordinate with Community staff, PW&S and the EHO to assist with preparation of Annual Community Operating Reports. MACA Region should forward Community Operating Reports to PW&S and the IHO to ensure all departments are aware of any deficiencies or concerns. First Operating Report to be prepared by **2004/2005 FY**.	Medium	Medium term and on-going	MACA
10	Recommend MACA Region take the lead in assisting the Community with budgeting for water supply system O&M at the Community's request. This would include clarification of funding sources, identification of annual operating requirements (sampling, training, etc.), and possibly an annual review to identify major maintenance requirements (inventory deficiencies, electrical/mechanical deficiencies, etc.). Planned for **2004**.	Medium	Long term and on-going	MACA Hamlet
11	Recommend H&SS HQ take the lead in discussions with the Housing Corporation (NWTHC) to improve water tank design and develop a preferred tank cleaning methodology. PW&S will provide technical support as required. Discussions to be initiated in **2003**.	Medium	Medium term	H&SS
12	Recommend MACA Region take the lead in working with the Community, Regional EHO and INAC or the Sahtu Land and Water Board, to co-ordinate annual sampling of chemical and physical parameters and THMs with annual sampling for water license requirements where possible and to arrange for sampling of chemical parameters including, turbidity, THMs and TOCs in raw and treated water every year during spring freshet starting in **May 2003**.	Medium	Medium term and on-going	MACA
13	Recommend H&SS take the lead on improving communications between federal and territorial departments on issues related to the water supply system. This would include establishing links to facilitate input on watershed development, planning studies and projects, and circulate information won water quality sampling, water license reporting, community O&M reporting and community concerns. H&SS to initiate discussions in **early 2003**.	Medium	Long term and on-going	H&SS
14	Establish a reporting structure to alert the GNWT to watershed issues that may affect raw water supply. H&SS HQ, through the Drinking Water Committee, will invite Federal and Territorial Departments responsible for watershed management to a round table discussion on reporting links.	Medium	Medium term	H&SS
15	Recommend H&SS develop a standard poster that can be customized for each community to educate/inform residents of their water supply system and water quality.	Medium	Medium term	H&SS

16	MACA to help community revise daily chlorine checklist	Medium/Low	Short term and on-going	MACA

Table 7 Recommended GNWT Action Plan (continued)

11. APPENDIX A (PHOTOGRAPHS)

11.1 Raw Water Source

Photo 1. Sachs Harbour truckfill station (white building in picture left), located on the shoreline of Water Lake.

11.2 Truckfill Station Building, Site and Water Truck

Photo 2. Sachs Harbour truckfill station.

Photo 3. Water truck pull-up area of truckfill station.

Photo 4. Water truck must back into position in order to fill with water.

Photo 5. Water truck driver initiating truck fill. Truck is being batch chlorinated.

Photo 6. Sachs Harbour water truck.

Photo 7. Water truck distribution hose.

11.3 Electrical, Mechanical, Process Piping, and Disinfection System

Photo 8. Transformer, uphill from truckfill station, which supplies power to the building.

Photo 9. Power is transferred from the transformer (Photo 8) to this pump house feed which used to supply power to the old village truckfill building. Power is relayed from this location to the current truckfill station.

Photo 10. Power from the pump house feed (Photo 9) enters the truckfill station into this power box at 600 volts.

Photo 11. Main Panel D is the buildings power on/off switch.

Photo 12. Power the power is then transformed in this transformer to lower voltage and is transferred to the distribution panel.

Photo 13. Distribution panel.

Photo 14. Pump on/off switch on left and control panel on right (not currently operating).

Photo 15. Pump power supply box. Note power cord (red, green, black, yellow) leading to pump.

Photo 16. Heat trace power supply box. Heat trace tapes are the grey lines coming out of the bottom of the box.

Photo 17. Electrical panels.

Photo 18. Left is where power enters building from underground power cable. Bottom right is where the water intake line enters building.

Photo 19. Raw water intake line into building.

Photo 20. Water distribution piping (white). The domestic water supply is the copper pipe leading from the white pipe to the chlorine solution mixing tank (out of picture). The chlorine injection point is located just below where the copper piping enters the distribution pipe. Note that, in this picture, the black tube (used to transfer chlorine solution to water) is not connected.

Photo 21. The hanging clipboard is where chlorine levels are recorded. Also observed are the eyewash station, the black tubing leading from the chlorine injector, and the copper tubing leading to the mixing tank.

Photo 22. Copper piping (the domestic water supply) leading to mixing tank. Mixer is located on the tank.

Photo 23. Chlorine solution mixing tank.

Photo 24. Connection between chlorine mixing tank (right) and chlorine solution tank (left); solution is gravity fed from the mixing tank to the solution tank via this connection.

Photo 25. Mixer (agitator) on chlorine solution tank.

Photo 26. There is a bend in the chlorine injection pipe (indicated by arrow).

Photo 27. Water is carried out of the building at this point (white pipe near ceiling) to the truckfill pipe.

Photo 28. A camlock hose is attached to the top of the piping (indicated by white arrow) in order to fill water truck.

Photo 29. Chlorine injection pump.

Photo 30. Baseboard heater. Only building heat source.

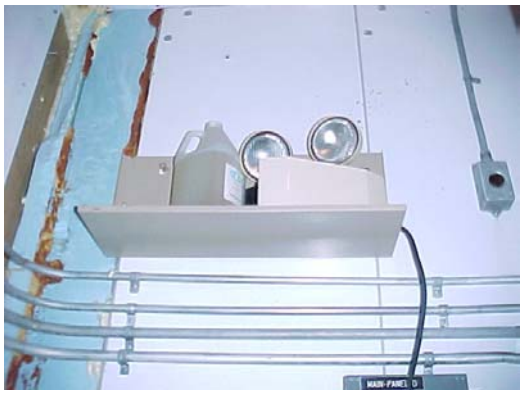

Photo 31. Emergency lighting and spare eyewash fluid.

Photo 32. Workstation in truckfill building (pumphouse).

Photo 33. Outside lighting on truck fill side of building. Note the javex used for batch chlorination.

Photo 34. Spare pump connected to power cord.


Safe Water