

Six Nations of the Grand River (Band No. 121)

Date of Visit: March 20, 2001

By Mike Newland (OCWA)

Site Address: P.O. Box 5000

Ohsweken, ON N0A 1M0

Phone No.: 519-445-2201

Fax No.: 519-445-4208

Tribal Council Affiliation: Unaffiliated First Nations (South)

Operators: Jason Martin and Steve Lickers

Location: The Six Nations of the Grand River community is located approximately 20 km southwest of Hamilton off Hwy. 6

Population: 10,876 people in the community (November 2000 - INAC)

No. of Units: 2,700 housing units (CAIS)

1.0 Description of Community Water Supply

Based on the CAIS report, water to the houses in the Six Nations of the Grand River community is treated as follows:

- 1,476 people use piped water;
- 2,200 people use individual holding tanks with trucked water; and
- 7,200 people are serviced by individual wells.

- 444 houses and commercial establishments are serviced by a communal water supply system;
- 522 houses have individual water holding tanks with trucked water (cisterns); and
- 1,734 houses are serviced by individual wells.

2.0 Description of Community Sewage Facilities

Based upon the CAIS report and information supplied to OCWA, sewage from the houses in the Six Nations of the Grand River community is treated as follows:

- 1,300 people use piped sewage; and
- 9,576 people use septic tanks with tile beds or holding tanks.

- 408 houses and commercial establishments are serviced by a communal sewage treatment system; and
- 2,294 houses are serviced by septic tanks with tile beds or holding tanks.

3.0 Overall Assessment for Communal Water Treatment Supply

The questionnaire developed by PWGSC required OCWA to undertake a risk assessment of the Water Source, Design, Operation, Reporting, and Operators. To properly assess these areas, a revisit to the water treatment facilities would be required.

OCWA was requested to undertake the evaluation without a visit to the site. With the available information, OCWA has undertaken the requested assessment of the facilities.

The ranking system used is as follows:

- 0 = Not Enough Information to Assess
- 1-4 = Low Risk
- 5-7 = Medium Risk
- 8-10 = High Risk

For more detailed information on the Risk Assessment used see Appendix "B" of this report, Terms of Reference, Appendix E.

SECTION Water	SECTION RANKING Water	RISK Water
A. Water Source		
Biological	0	No Evaluated
Chemical	8	Aluminum, sodium, turbidity
Physical	7	Colour, total dissolved solids, dissolved organic carbon, hardness
Overall Ranking for Water Source	8	High
B. Design		
Biological	2	Six exceedances
Chemical	8	Iron, aluminum, sodium THMs in dead end of distribution system
Physical	6	Colour, hardness, total dissolved solids, capacity
Risk to Public Health	8	THMs in dead end
Condition of Laboratory Equipment	0	Not inspected
Overall Ranking for Design	8	High
C. Operations		
Reservoir Cleanliness	0	Not inspected
Emergency Plan	10	No written contingency plan
Overall Ranking for Operations	6	Medium
D. Reporting		
Ranking for Laboratories and Testing	1	Weekly basis

SECTION Water	SECTION RANKING Water	RISK Water
Ranking for Boil Water Advisories	2	One boil advisory with explanation
Overall Ranking for Reporting	2	Low
E. Operators		
Overall Ranking for Operators	2	Class I Operators Low
F. Statistical Data		
Overall Ranking for Individual Wells	0	Not Evaluated
G. Overall Ranking for the System	8	High

In discussions between Dayle Bomberry, Director of Public Works, Six Nation Council and Robert Dormer of OCWA, OCWA understands the water treatment facility is reaching its maximum capacity and needs to be expanded. This need of expansion is resulting in difficulties of the facility meeting the GCDWQ guidelines and therefore the resultant High Risk designation.

4.0 Overall Assessment for Communal Sewage Treatment Facilities

The questionnaire developed by PWGSC required OCWA to undertake a risk assessment of the Effluent Receiver, Design, Operation, Reporting, and Operators. To properly assess these areas, a revisit to the sewage treatment facility would be required.

OCWA was requested to undertake the evaluation without a visit to the site. With the available information, OCWA has undertaken the requested assessment of the facilities.

The ranking system used is as follows:

- 0 = Not Enough Information to Assess
- 1-4 = Low Risk
- 5-7 = Medium Risk
- 8-10 = High Risk

For more detailed information on the Risk Assessment used see Appendix "B" of this report, Terms of Reference, Appendix E.

SECTION Sewage	SECTION RANKING Sewage	RISK Sewage
A. Effluent Receiver		
Overall Ranking for Effluent Receiver	0	Not Evaluated
B. Design		
Quality of Treated Effluent	1	Good effluent quality
Ranking of Design of Sewage Plant	0	Not Evaluated
Ranking of Concerns and Hazards within the Plant	8	No back up power causing effluent bypassing
Condition of Laboratory Equipment	0	Not Evaluated
Overall Ranking for Design	8	High
C. Operations		
Ranking for Emergency Plan	0	Not Evaluated
Overall Ranking for Operations	7	Service disruptions Medium
D. Reporting		
Overall Ranking for Reporting	2	Low
E. Operators		
Overall Ranking for Operators	2	Class I Low
F. Statistical Data		
Overall Ranking for Individual Septic Tanks	0	Not Evaluated
G. Overall Ranking for the System	8	High

The sewage collection is High Risk because of effluent bypassing, in filtration problems, lack of backup power and service disruptions.

5.0 Communal Water Treatment Plant (444 houses)

5.1 Water Source

The raw water source is the Grand River.

The following table summarizes the raw water data supplied by Health Canada in February 2002.

Date	Location	Exceedances	Result	Health Limit / Aesthetic Objective / Operational Guideline
Aug. 16, 1999	Raw Tap	Aluminum	0.513 mg/L	0.10 mg/L (OG)
		Iron	0.956 mg/L	0.30 mg/L (AO)
		Sodium	68.8 mg/L	20 mg/L (AO)
		Hardness	272 mg/L	80 to 100 mg/L (OG)
		Colour	17.2 TCU	15 TCU (AO)
		Total Dissolved Solids	636 mg/L	500 mg/L (AO)
		Turbidity	30.7 NTU	1 NTU
Oct. 4, 1999	Raw tap	Iron	0.606 mg/L	0.3 mg/L (AO)
		Aluminum	0.263 mg/L	0.10 mg/L (OG)
		Sodium	51.4 mg/L	20 mg/L (AO)
		Hardness	257 mg/L	80 to 100 mg/L (OG)
		Color	15.4 TCU	15 TCU (AO)
		Turbidity	25.8 NTU	1 NTU
Dec. 13, 1999	Raw tap	Aluminum	0.228 mg/L	0.10 mg/L (OG)
		Sodium	29.2 mg/L	20 mg/L (AO)
		Hardness	305 mg/L	80 to 100 mg/L (OG)
		Colour	26.2 TCU	15 TCU (AO)
		Turbidity	8.94 NTU	1.0 NTU
		Dissolved Organic Carbon	7.5 mg/L	5.0 mg/L (AO)
Mar. 8, 2000	Raw tap	Iron	0.433 mg/L	0.30 mg/L (AO)
		Aluminum	13.5 mg/L	0.10 mg/L (OG)
		Total Dissolved Solids	516 mg/L	500 mg/L (AO)
		Sodium	42.4 mg/L	20 mg/L (AO)
		Hardness	347 mg/L	80 to 100 mg/L (OG)
		Turbidity	13.9 NTU	1.0 NTU
		Colour	18.6 TCU	15 TCU (AO)
May 24, 2000	Raw tap	Aluminum	8.81 mg/L	0.10 mg/L (OG)
		Sodium	25.2 mg/L	20 mg/L (AO)
		Hardness	302 mg/L	80 to 100 mg/L (OG)
		Turbidity	7.49 NTU	1.0 NTU
Feb. 20, 2001	Raw tap	Aluminum	2.66 mg/L	0.10 mg/L (OG)
		Sodium	30 mg/L	20 mg/L (AO)
		Hardness	297 mg/L	80 to 100 mg/L (OG)
		Turbidity	15 NTU	1.0 NTU

Date	Location	Exceedances	Result	Health Limit / Aesthetic Objective / Operational Guideline
Apr. 25, 2001	Raw tap	Aluminum	3.98 mg/L	0.10 mg/L (OG)
		Sodium	38 mg/L	20 mg/L (AO)
		Hardness	317 mg/L	80 to 100 mg/L (OG)
		Turbidity	18.4 NTU	1.0 NTU
June 26, 2001	Raw tap	Aluminum	0.316 mg/L	0.10 mg/L (OG)
		Iron	0.305 mg/L	0.30 mg/L (AO)
		Total Dissolved Solids	556 mg/L	500 mg/L (AO)
		Sodium	57 mg/L	20 mg/L (AO)
		Hardness	281 mg/L	80 to 100 mg/L (OG)
		Colour	19.6 TCU	15 TCU (AO)
		Turbidity	33.1 NTU	1.0 NTU

AO - aesthetic objective; OG - operational guideline

Health Canada undertakes a chemical analysis on a sample of raw water every 2-3 months. The raw water source is known for quick changes in flow and quality of water depending on local weather conditions.

5.2 Design

A Class III water treatment plant constructed in 1989 services the community. The raw water source is the Grand River. The operators report that the capacity of the treatment plant is 17.2L/s. The water treatment plant has two parallel Ecodyne Mono Valve Reactivator Package Plants. The two tanks consist of a rapid mixing reactivator tank with tube settlers and two filter compartments (300 mm of sand and 300mm of anthracite).

The following table summarizes the exceedances in treated water data supplied by Health Canada in February 2002:

Date	Location	Exceedances	Result	Health Limit / Aesthetic Objective / Operational Guideline
Aug. 16, 1999	Treated Tap	Aluminum	0.189 mg/L	0.10 mg/L (OG)
		Iron	0.314 mg/L	0.30 mg/L (AO)
		Sodium	71.2 mg/L	20 mg/L (AO)
		Hardness	273 mg/L	80 to 100 mg/L (OG)
		Total Dissolved Solids	660 mg/L	500 mg/L (AO)
Aug. 16, 1999	Public Works	Aluminum	0.139 mg/L	0.10 mg/L (OG)
		Iron	0.305 mg/L	0.30 mg/L (AO)
Oct. 4, 1999	Treated Tap	Aluminum	0.219 mg/L	0.10 mg/L (OG)
		Sodium	57.4 mg/L	20 mg/L (AO)
		Hardness	255 mg/L	80 to 100 mg/L (OG)
Oct. 4, 1999	Public Works	Aluminum	0.216 mg/L	0.10 mg/L (OG)

Date	Location	Exceedances	Result	Health Limit / Aesthetic Objective / Operational Guideline
Dec. 13, 1999	Treated Tap	Aluminum	0.171 mg/L	0.10 mg/L (OG)
		Sodium	35.6 mg/L	20 mg/L (AO)
		Hardness	287 mg/L	80 to 100 mg/L (OG)
		Colour	15 TCU	15 TCU (AO)
		Dissolved Organic Carbon	6.1 mg/L	5.0 mg/L (AO)
Dec. 13, 1999	Public Works	THM	0.138 mg/L	0.1 mg/L
		Aluminum	0.122 mg/L	0.10 mg/L (OG)
Feb. 7, 2000	Treated Tap	NDMA	35 ng/L	9 ng/L
Mar. 1, 2000	Public Works	NDMA	66 ng/L	9 ng/L
Mar. 6, 2000	Public Works	NDMA	11 ng/L	9 ng/L
Mar. 8, 2000	Treated Tap	Aluminum	0.292 mg/L	0.10 mg/L (OG)
		Total Dissolved Solids	628 mg/L	500 mg/L (AO)
		Sodium	47 mg/L	20 mg/L (AO)
		Hardness	347 mg/L	80 to 100 mg/L (OG)
May 24, 2000	Treated Tap	Sodium	31.6 mg/L	20 mg/L (AO)
		Hardness	294 mg/L	80 to 100 mg/L (OG)
Feb. 20, 2001	Treated Tap	Sodium	38.8 mg/L	20 mg/L (AO)
		Hardness	291 mg/L	80 to 100 mg/L (OG)
Feb. 20, 2001	Water Tower	Total Dissolved Solids	506 mg/L	500 mg/L (AO)
		Sodium	53.4 mg/L	20 mg/L (AO)
		Hardness	304 mg/L	80 to 100 mg/L (OG)
Apr. 25, 2001	Treated Tap	Total Dissolved Solids	520 mg/L	500 mg/L (AO)
		Sodium	46 mg/L	20 mg/L (AO)
		Hardness	309 mg/L	80 to 100 mg/L (OG)
Apr. 25, 2001	Public Works	THM	0.114 mg/L	0.1 mg/L
		Sodium	42.8 mg/L	20 mg/L (AO)
		Hardness	301 mg/L	80 to 100 mg/L (OG)
June 26, 2001	Treated Tap	Aluminum	0.237 mg/L	0.10 mg/L (OG)
		Total Dissolved Solids	620 mg/L	500 mg/L (AO)
		Sodium	68 mg/L	20 mg/L (AO)
		Hardness	276 mg/L	80 to 100 mg/L (OG)
June 26, 2001	Public Works	Aluminum	0.124 mg/L	0.10 mg/L (OG)
		Total Dissolved Solids	624 mg/L	500 mg/L (AO)
		Sodium	66.8 mg/L	20 mg/L (AO)
		Hardness	286 mg/L	80 to 100 mg/L (OG)

AO - aesthetic objective; OG - operational guideline

Health Canada undertakes a chemical analysis on a sample of treated water every 2-3 months.

There is a combined laboratory and office area in the plant and there is a workshop with appropriate tools. Ventilation is insufficient for the chemical storage area. There is no backup power generator for fire protection. Safety equipment that is missing includes is the SCBA. Safety training for confined space entry and UV operation would be useful to the operators.

The community has a semi-annual hydrant-flushing program but no fire hydrant maintenance program and no annual main valve operating and maintenance program. The treatment plant lacks routine maintenance. Only breakdown maintenance is performed.

5.3 Operations

Sodium hypochlorite and UV is used for disinfection. The disinfection equipment is functional and there is a sufficient chlorine supply. The plant uses an on-line chlorine residual analyzer. The chlorine residual is also analyzed on a daily basis.

Operation and maintenance manuals for plant equipment are on-site, but there are no as-built drawings for the treatment plant. Most emergency spare parts are readily available on-site. There is a contact listing of technicians/trades people available with a response time of 24 to 48 hours.

High turbidity in the raw water causes re-occurring operational problems for the plant.

5.4 Reporting

The operators conduct bacteriological testing daily on the communal water system and take the samples to the Hamilton Health Laboratories. The operators conduct weekend testing with a colilert unit at the plant. The results are kept in the Public Works office.

The Six Nation Public Works has issued one boil water advisory in the past two years. Six Nations Public Works follow a protocol during a boil water advisory and work closely with Health Canada.

The following table summarizes the bacteriological data supplied by Health Canada in February 2002:

Period	Frequency	Regularity	Exceedances
99/08/03 to 2001/10/24	3 to 6 times per week	<ul style="list-style-type: none"> ▪ No months missing 	<ul style="list-style-type: none"> ▪ Total coliform exceedances in distribution system were recorded on 99/09/14, 99/10/21, 2000/05/30, and 2001/07/30. ▪ Total coliform exceedances at water treatment plant were recorded on 2001/07/13 and 2001/07/17. ▪ APC exceedances recorded several times per week throughout year.

The turbidity of the treated water is recorded on a daily basis. A chemical analysis of the treated water is conducted on a quarterly basis.

Sample data received from Health Canada confirm that sodium (on sodium restricted diets), aluminum, total dissolved solids and hardness exceeded the GCDWQ. The maximum allowable concentration (MAC) for THMs has been exceeded in the Public Works building, which is located in the dead end of the distribution system.

NDMA has exceeded the MAC, however, this has not reoccurred since March 2000.

Mr. Dayle Bomberry, Director of Public Works, Six Nations Council state that the Public Works Department has issued one boil water advisory on the water treatment plant in the last two years, due to ice forming in the water tower and dislodging, causing mixing of water in the water tower and colour and turbidity to increase.

5.5 Operators

Jason Martin and Steve Lickers are the operators of the treatment plants. The operators are certified (Level 1) to operate the water treatment plant. They are familiar with calibrating and maintaining the disinfection equipment. A comprehensive and ongoing training program is suggested for both operators for the water and sewage operations.

6.0 Deficiencies in the Communal Water Supply

1. The plant does not have a backup power generator.
2. Ventilation is insufficient for the chemical storage.
3. Safety training for confined space and UV operation would be useful for the operators.
4. As built drawings for the treatment plants are not available.
5. The community does not have an annual fire hydrant and main valve operating and maintenance program in place.
6. The treatment plant operators do not have a routine maintenance program and only perform breakdown maintenance.
7. High turbidity in the raw water source is an operational problem at this treatment plant.
8. Aluminum, iron, sodium (for sodium restricted diets) and total dissolved solids in the treated water have exceeded the Canadian Drinking Water Quality Guidelines.
9. THMs have exceeded the Canadian Drinking Water Quality Guidelines in the Public Works building, which is located in the dead end of the distribution system.
10. There is no written contingency plan available.
11. The operators are certified to Level I and operate a Class III water treatment plant. The operators need ongoing training.

7.0 Communal Sewage Treatment Facilities (408 houses)

7.1 Effluent Receiver

The lagoons are discharged to the Mackenzie Creek, which discharges into the Grand River.

7.2 Design

The Six Nations of the Grand River community communal sewage system consists of six pumping stations and a three newer cells and two older cell lagoon treatment system. The other pumping station a stand alone system with peatland treatment and collection system. The lagoons are tested by Health Canada and discharged semi-annually based on Health Canada's approval. Cells are rotated which results in one cell being discharged approximately once/year into the Mackenzie Creek, which discharges into the Grand River.

The main pumping station is the only part of the sewage system that has backup power. Confined space entry safety equipment is required on site. The plant has emergency spare parts readily available. There is a contact listing of technicians/trades people, with a response time of 24 hours. The pumping stations are cleaned on a yearly basis and the pumps are routinely maintained.

The plant has operation and maintenance manuals but no as-built drawings on-site.

7.3 Operations

There have been service disruptions with the treatment system caused by an electrical transformer breakdown that has caused sewage collection backups. The sewage collection system has an infiltration problem that causes two of the pumping stations to bypass approximately once/year during high flows.

The following table summarizes treated effluent data supplied by Health Canada in February 2002:

Date	Location	Exceedances	Ministry of Environment and Energy Effluent guidelines
Feb. 4/99	Lagoon #1	E. coli < 10 ³	Fecal Coliform = 400 per 100 mL
Feb. 4/99	Lagoon #3	E. coli < 10 ³	
Feb. 11/99	Lagoon #1	No exceedances	
Feb. 11/99	Lagoon #3	No exceedances	
Oct. 27/99	Lagoon #1	No exceedances	
Oct. 27/99	Lagoon #2	No exceedances	
Oct. 27/99	Old lagoon #1	No exceedances	
Mar. 16/00	Lagoon #2	No exceedances	
Mar. 16/00	Lagoon #3	No exceedances	
Oct. 3/00	Lagoon #1	No exceedances	
Oct. 3/00	Lagoon #2	No exceedances	
Oct. 3/00	Old lagoon #3	Total suspended solids = 29 mg/L	Total suspended solids = 25 mg/L
Oct. 3/00	Old lagoon #4	No exceedances	
May 23/01	Lagoon #1	No exceedances	
May 23/01	Lagoon #2	No exceedances	
May 23/01	Lagoon #3	No exceedances	
May 23/01	Lagoon #4	No exceedances	

The lagoons are not experiencing excessive reed growth and the berms are in good condition.

7.4 Reporting

Health Canada conducts regular effluent tests prior to the discharge of the lagoon. The effluent is tested two times per year prior to discharge. The results are kept in the Public Works Office.

7.5 Operators

Jason Martin and Steve Lickers are the operators of the treatment plants. The operators are certified (Level I) to operate the class III water treatment plant. They are familiar with calibrating and maintaining the disinfection equipment. A comprehensive and ongoing training program is suggested for both operators for the water and sewage operations.

8.0 Deficiencies in the Communal Sewage Treatment Facilities

1. Only one out of the seven pumping stations in the system has backup power.
2. There are no as-built drawings on-site.
3. Service disruptions have been experienced due to electrical hydro disruptions.
4. The collection system has a infiltration problem causing a 15%-20% increase in flows that causes two pumping stations to bypass on average once/year during high flow periods.
5. There are odour complaints one to two times per year in the springtime.

9.0 Action Taken Since OCWA Inspection in March 2001

On February 20th, 2002, Robert Dormer (OCWA) met with Dayle Bomberry, Director of Public Works for the Six Nations Council to review the comments made by Dayle in a letter dated January 3rd, 2002 concerning the Phase I OCWA study. At the same time, OCWA had an opportunity to undertake an update of the report. Since the OCWA visit on March 20, 2002, Public Works have undertaken the following to address the recommendations in the October 2001 OCWA report:

1. Jason Martin and Steve Lickers have obtained their Level I operators certificate.
2. Addressed the sewage pumping station bypassing by investigating alternative solutions to the problem by diverting sewage from the existing catchments area and pumping directly to the lagoon. Discussions are underway with INAC to address this issue.
3. Reactivating the existing alarm systems at various locations.
4. The water treatment plant is nearing its capacity and investigations and discussion with INAC are underway to expand the facilities.
5. Alternatives to increase the lagoon capacity, such as addition of aeration of the lagoon, are being investigated.

6. The Public Works Department has hired a chemical specialist to optimize the water treatment plant. In discussions with the operators, they state they are using less chlorine and more polymers to improve the operations of the treatment facilities. The operator also state they understand the operations of the facilities better.
7. The frequency of chemical analysis sampling has been increased to monthly.

10.0 Recommendations

- Consider backup power for the treatment plants and six pumping stations or implement alternatives to reduce pumping station bypasses.
- Purchase self contained breathing apparatus (SCBA) equipment.
- Continue to train the operators to the level of the facility (Water Class III, Sewage Class I).
- Implement a preventive maintenance program.
- Develop a comprehensive operations and maintenance program on the water distribution system to address valve and hydrant maintenance.
- Develop a written comprehensive contingency plan to address operational problems, breakdowns, vacations and illnesses, main breaks and boil water advisories.
- Monitor previous boil water advisories and chemical analyses exceeding GCDWQ (i.e. aluminum, iron, THMs, total dissolved solids, and sodium) to ensure the source of the contamination has been addressed adequately.
- Obtain as built for facilities
- Correct electrical transformer problem to reduce service disruptions.
- Address infiltration problem.

11.0 Plant Classification

Based upon the Terms of Reference – Appendix I – Plant Classification Guidelines developed by Public Works and Government Services Canada and with discussions with the Ontario Ministry of the Environment Classification Group, OCWA classified these plants as follows:

Water Treatment Facility - Class III
Sewage Treatment Facility - Class I

12.0 Overall Community Risk Assessment

Water Category – High Risk

High risk because of the following:

- Nearing capacity;
- Aluminum, iron, total dissolved solids, THMs exceeding CDWQG; and
- No written contingency plan.

Sewage Category - High Risk

High Risk because of the following:

- Pumping station bypassing;
- Infiltration problem;
- Lack of backup power at pumping stations; and
- Service disruptions because of transformer problems.

Note: Information within this report is based on discussions with the plant operators and a quick visual walkthrough of the facilities. No detailed review was undertaken by OCWA.