Water License Annual Report 2008
Whale Cove Water Use and Waste Disposal
Hamlet of Whale Cove
Water License NWB3WHA0207

Prepared by

Nuna Burnside Engineering and Environmental Ltd.
Box 175 Rankin Inlet NU X0C 0G0 Canada
15 Townline Orangeville ON L9W 3R4 Canada

December 2008

File No: N-O 14851

Hamlet of Whale Cove Water License Annual Report 2008
Whale Cove Water Use and Waste Disposal
Hamlet of Whale Cove, Water License NWB3WHA0207

December 2008

Table of Contents

Figures

Appendices

1.0 Introduction

At the request of the Hamlet of Whale Cove, Nuna Burnside Engineering and Environmental Ltd. (Nuna Burnside) has prepared the Nunavut Water Board (NWB) Annual Report for 2008, as required by Water License NWB3WHA0207, which expired in 2007 (Appendix A). The Annual Report demonstrates the Hamlet of Whale Cove's efforts to achieve due diligence with respect to NWB license requirements. An application for replacement of the expired license is in progress.

A copy of the NWB Annual Report Form is included in Appendix B and the details are included in this report.

2.0 Project Background

The Hamlet of Whale Cove is located within the Kivalliq Region, Nunavut, at general latitude 62°11'N and general longitude 92°35'W (Figure 1). The Community is located approximately 80 km south of Rankin Inlet.

The Hamlet of Whale Cove, Water and Waste Disposal license NWB3WHA0207 (Appendix A) includes activities for municipal water intake, sewage disposal and waste disposal activities. As part of these activities the following facilities are operated:

- Whale Cove Water Supply Facility consisting of the Fish Lake Pumphouse and Truck Fill Station
- Whale Cove Sewage Treatment Facility (Sewage Lagoon and Wetland Treatment Area)
- Whale Cove Solid Waste Management Facility (Landfill, Bulky Metals Storage Area, and Landfarm).

Locations of these facilities are displayed in Figure 2.

A landfarm facility (for the treatment of hydrocarbon impacted soil), located in the Solid Waste Management Facility, is operated under a separate Water License (3BM-WCL0712), issued September 27, 2007. This Annual Report includes some of the monitoring requirements contained in that license that relates to the operation of the Solid Waste Management Facility.

A copy of the NWB Annual Report form is included in Appendix B.

3.0 Summary of Water and Waste Disposal Activities

3.1 Water Use

The Hamlet of Whale Cove obtains its potable water from Fish Lake, located approximately 3.5 km north of the community (Figure 2). The intake is a single vertically mounted drum screen and inclined shaft casing installed at a depth of 6 m. A submersible pump is mounted on a skid and located inside the casing about 15 m from the intake. Water is supplied to the water trucks by means of an overhead truck-fill arm. The intake and pump house are in good condition. Photographs are included in Appendix C.

The operation of the water taking activities is documented in the Hamlet of Whale Cove Water Supply Facility Operation and Maintenance (O&M) Plan.

The community currently takes approximately 40,000 L per day, 7 days a week. This amounts up to an annual water consumption of approximately 14,427 m^3. This does not exceed the allowable amount of 30,000 m^3 per year, as stated in the license (Appendix A).

The O&M Plan indicates the annual recharge to the lake is approximately 300,000 m^3/year. The licensed withdrawal rate is approximately 10 percent of the recharge, and current withdrawal is approximately 50 percent of the licensed amount. The water withdrawals are unlikely to have any significant impact on the lake.

4.0 Sewage Collection and Disposal

Sewage collection is provided by the Hamlet. Each building has a sewage holding tank that is pumped out by the Hamlet's sewage pump out truck as needed. Pumped out sewage is treated at the Sewage Treatment Facility located approximately 1 km from the Hamlet (Figure 2). The Sewage Treatment Facility consists of a Lagoon and a Wetland Treatment Area. Details are outlined in the Hamlet of Whale Cove Sewage Treatment Facility Operation and Maintenance (O&M) Plan. The lagoon is approximately 200 metres long and 110 metres wide. A berm of sand and gravel is constructed on the southwest side. Sewage from the lagoon slowly exfiltrates through the berm into a 600 m long designated Wetland Treatment Area down gradient and towards Hudson Bay. Photographs are included in Appendix C.

The volume of sewage waste water roughly correspond to the annual water use of the Hamlet. Therefore approximately 14,427 m^3 of sewage is estimated to have been discharged into the sewage lagoon in 2008. There have been no issues with the sewage lagoon or wetland treatment area in 2008.

Studies on the efficiency of wetland treatment in several northern communities are being completed as part of the International Polar Year project by Fleming College. Sampling was conducted during the summer of 2008 on the Whale Cove Wetland Treatment Area. The results are not yet available but may be for the 2009 Annual Report.

5.0 Solid Waste Management Facility

Solid waste in the community is collected by a garbage compactor truck and deposited at Solid Waste Management Facility located 1.2 km southeast of the community (Figure 2). Photographs are included in Appendix C.

The Solid Waste Management Facility consists of a landfill and Bulky Metals Storage Area. There is currently no Hazardous Waste Storage Area.

The facility operates as described in the Hamlet of Whale Cove Solid Waste Management Facility Operations and Maintenance (O&M) Plan.

The Solid Waste Management Facility has several issues that should be noted. These include the following:

- Presently the entry point to solid waste site is from lower part of the site. To dispose of waste, the garbage truck must go down the hill to the entry gate and dump waste into landfill by moving as far uphill into site as possible. Due to the grade of the site and loose material, much waste is dumped at the entry to the site. This will become an increasing problem when the current waste is covered and the level of site is further raised

- To address these concerns a project has been proposed that will provide another approach road for the entry of garbage trucks from upper side of the landfill. The road would have an approximate length of 174 m. and width of 6 m. A proposed route for the new access road is shown in Figure 3

- Another issue with the landfill is the broken fence on the north side of the landfill site. Many of the concrete barrels holding the fence posts is holding the fence up have been heaved out of the ground. The weight of snow drifts have also pushed the fence down. Since this issue is less important than the access road, the Hamlet has chosen to put all available funds towards the access road construction before fixing the fence. Fence repairs are prepared for 2009. The damaged fence is not creating an environmental impact as there is a rock outcrop which acts as a barrier just beyond the fence

- Ponded water was noted in the landfill area, and flowing out of the fill area. This water was sampled in September 2008 (sample ID LF-1). The site should be re-graded to reduce the amounts of water ponding inside the landfill and to reduce the flow of water leaving the landfill area

- The Facility lacks a Hazardous Waste Storage Area.

A detailed description of all out of compliance issues at the landfill and recommendations to address these issues will be included in a Solid Waste Management Facility Rehabilitation Plan report to be completed in early 2009. This report will outline the proposed upgrades to enhance operations and maximize environmental protection.

Upgrades to the facility will be dependent on funding.

6.0 Monitoring Program

The monitoring program outlined in the Water License (Appendix A) includes specific requirements regarding sampling locations, sampling frequency, parameters to be analyzed and effluent quality. The requirements are summarized below:

Surveillance Network Program for Water License NWB3WHA0207

Station	Description	Frequency	Analysis Requirements
WHA-1	Raw Water Supply Intake at the Fish Lake prior to treatment	Monthly and annual	Measure and record in cubic metres of water pumped from station.
WHA-2	Runoff from the Solid Waste Disposal Facility	Monthly from May to August, Inclusive	• BOD • Fecal Coliforms • pH • Conductivity • Total Suspended Solids • Ammonia Nitrogen • Nitrate-Nitrite • Oil and Grease (visual) • Total Phenols • Sulphate • Sodium • Potassium Magnesium • Calcium • Total Arsenic • Total Cadmium • Total Copper • Total Chromium • Total Iron • Total Lead • Total Mercury • Total Nickel • Total Zinc • Chloride • Total Hardness.
WHA-3	Effluent Discharge from the Sewage Disposal Facilities	Monthly from May to August, Inclusive	Same as WHA-2

An Environmental Monitoring Program and Quality Assurance/Quality Control Plan for the Hamlet of Whale Cove has recently been developed as required by the Water License.

Samples from the landfill, sewage lagoon and landfarm were collected on September 12, 2008 by Nuna Burnside. The samples were collected and shipped to an accredited Canadian Association of Environmental Analytical Laboratories (CAEAL) lab, AGAT Laboratories in Mississauga, Ontario within the required holding times. A description of the sample locations and the Water License station represented by the sample is given in Table 2. The locations of the samples are shown in Figure 3 and photographs of the sample locations are included in Appendix C.

The following table outlines the sample locations:

Sample Locations

Sample ID	NWB License Station	Sample Location	Description
SL-1		Sewage Lagoon	Edge of lagoon, beside sewage truck flute
SL-2		Sewage Lagoon	Flow 460 m from sewage lagoon within wetlands treatment area
SL-3	WHA-3	Sewage Lagoon	Flow 570 m from lagoon at end of wetlands, discharging towards ocean
LF-1		Landfill	Leachate ponding outside of landfill area
LF-2	WHA-2	Landfill	Water discharging from landfill towards Hudson Bay approximately 50 m away
LFRM-1		Landfarm	North-east side, taken at 0.5 m depth from hole dug
LFRM-2		Landfarm	West corner, taken at 0.5 m depth
LFRM-3		Landfarm	West corner, same hole as LFRM-2, 0.2 m depth
Observed	WHA-1	Fish Lake	Raw water supply withdrawal volumes

The raw water station WHA-1 is not required to be sampled. It is identified for the purposes of collecting water withdrawal data. Sampling results from previous INAC inspection reports were reviewed and compared to the 2008 results. The sampling results are presented in Tables 1 through 4. Laboratory Certificates of Analysis for all of the 2008 sampling results are included in Appendix D.

7.0 Monitoring Results

7.1 Water Supply Facility

The Fish Lake pumphouse is not currently equipped with a flow meter to monitor the water taken from the lake (Station WHA-1). To measure the amount of water used, the Hamlet records the amount of trucks they fill in a day. This is approximately 14,600 m^3 per year. Based on information from Hamlet staff, the community uses 40,000 L of water per day. It is recommended that the Hamlet install a flow meter in order to more effectively comply with the Water License requirements the next time the pumphouse is upgraded.

Water sampling of the raw water intake is not required in the NWB licence. Water samples were taken from the lake in 2001, 2002, and 2003 as part of the INAC Inspection Reports. The 2008 INAC Inspection Report is included in Appendix E. The results from this sampling are included in Table 5 and showed that there were no issues with water quality from the water intake.

Fish Lake has an area of approximately 110,000 m^2 and an estimated average depth of 8 m. Lake volume is estimated at approximately 88,000 m^2.

The withdrawal of water from Fish Lake, in amounts approximately 50 percent of the license withdrawal rate (30,000 m^3), is having no significant impact on the lake.

7.2 Sewage Treatment Facility

Samples were taken from the Sewage Treatment Facility at three locations. The results indicated that there were some exceedances at stations SL-1 and SL-2 however all standards were met at SL-3. At SL-1 (taken from water in the sewage lagoon) exceedances in aluminium (0.426 mg/L vs. 0.1 mg/L), copper (0.018 mg/L vs. 0.002 mg/L) and zinc (0.046 mg/L vs. 0.03 mg/L) were reported. At SL-2, (taken within the Wetlands Treatment Area) there was an exceedance in iron (0.346 mg/L vs. 0.300 mg/L). Since the raw sewage in the lagoon did not display an exceedance of iron, the results at SL-2 may be a result of natural conditions. All requirements for WHA-3 (SL-3) listed in the NWB licence were met. These requirements are as follows:

Sewage Effluent Quality Standards for WHA-3

Parameter	Maximum Average Concentration	Results (Sept 12, 2008)
Faecal Coliforms (CFU/dl)	100,000 CFU/dl	300
BOD_5 (mg/L)	120	<5
Total Suspended Solids (mg/L)	180	<10
Oil and Grease	No visible sheen	No visible sheen
pH	Between 6 and 9	8.4

The results indicate the Sewage Treatment Facility is meeting the requirements of the license and there is no evidence of a significant environmental impact.

7.3 Solid Waste Management Facility

The sampling results were compared to the CCME Water Quality Guidelines for Protection of Aquatic Life in freshwater systems (Appendix F). At LF-1, (taken from inside the Solid Waste Management Facility of ponding water outside of the fill area) results indicate exceedances in arsenic (0.006 mg/L vs. 0.005 mg/L), iron (2.01 mg/L vs. 0.3 mg/L) and toluene (1.2 µg/L vs. 0.8 µg/L). At LF-2, (taken from water discharging through wetlands outside of the landfill area towards the ocean) the only minor exceedance was in iron (0.311 mg/L vs. 0.300 mg/L).

A review of previous sampling results shows that there have been regular exceedances of iron and copper at WHA-2. Other contaminants such as aluminium and arsenic were detected at concentrations exceeding CCME guidelines in 2003. The following compares the 2008 samples with sample results from 2001 and 2003:

Sample Results for Parameters in Exceedance at WHA-2

Parameter	CCME standard	2001*	2003**	2008***
Iron (mg/L)	0.300	**0.349**	**7.4**	**0.311**
Copper (mg/L)	0.004	**0.005**	**0.022**	<0.300
Arsenic (mg/L)	0.005	0.0014	**0.006**	0.003
Aluminum (mg/L)	0.1	N/A	**4.6**	0.008

*Sampling results from INAC report August 30, 2001

** Sampling results from INAC report August 14, 2003

*** Sampling conducted by Nuna Burnside Sept 12, 2008

Samples taken from the Landfarm are included in this report as the Landfarm is part of the Solid Waste Management Facility area, however it operates under a separate Water

License 3BM-WCL-0712. The samples have been compared to Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health for industrial land uses (Appendix F). The results are displayed on Table 4. The samples taken from the landfarm met all of the CCME guidelines for soils for industrial land uses. This suggests the soil may be sufficiently remediated to use as cover material on the landfill.

8.0 INAC Inspection Reports

The most recent inspection report from INAC was dated July 31, 2008. The report identified several concerns for which the activities were out of compliance. A copy of the report is included in Appendix E. To address the concerns outlined in the inspection, the Hamlet of Whale Cove retained Nuna Burnside to make a submission for a new water license and provide the following documents as required by the recently expired license (Appendix A):

- Environmental Monitoring Program and Quality Assurance/Quality Control Plan
- Solid Waste Management Facility Operation and Maintenance Plan
- Sewage Treatment Facility Operation and Maintenance Plan
- Environmental Emergency Contingency Plan
- Water Supply Facility Operation and Maintenance Plan.

9.0 Summary

The results of the 2008 NWB Annual Report indicate the Hamlet of Whale Cove is in compliance with the majority of the requirements of the recently expired NWB License. A license renewal submission is in progress.

The monitoring data indicates no significant environmental impacts from the operation of the following:

- Sewage Treatment Facility
- Solid Waste Management Facility
- Water Supply Facility.

The Annual Monitoring did however, identify the need for upgrades to the landfill site to improve operations and maximize environmental protection.

Respectfully submitted,

Nuna Burnside Engineering and Environmental Ltd.

Stephanie Charity, B.Sc.	Jim Walls, P.Geol.
December 7, 2008	December 7, 2008
Date	Date

10.0 References

Canadian Council of Ministers of the Environment (CCME), 2007. *Canadian soil quality guidelines for the protection of environmental and human health: Summary tables.* Updated September, 2007. In: Canadian environmental quality guidelines, 1999, Canadian Council of the Environment, Winnipeg.

Canadian Council of Ministers of the Environment (CCME), 2007. *Canadian Water Quality Guidelines for the Protection of Aquatic Life: Summary table.* Updated September, 2007. In: Canadian environmental quality guidelines, 1999, Canadian Council of the Environment, Winnipeg.

Indian and Northern Affairs Canada, Inspection Report, Whale Cove, July 31, 2008.

Indian and Northern Affairs Canada, Nunavut District Office. November 14, 2003 Municipal Water Use Inspection – Report.

Indian and Northern Affairs Canada, Nunavut District Office. August 30, 2003 Municipal Water Use Inspection – Report.

Indian and Northern Affairs Canada, Nunavut District Office. 2001 Municipal Water Use Inspection – Report.

Indian and Northern Affairs Canada, Nunavut District Office. July 12, 2002 Municipal Water Use Inspection – Report.

Indian and Northern Affairs Canada, Nunavut District Office. August, 14, 2003 Municipal Water Use Inspection – Report.

Nuna Burnside Engineering and Environmental Ltd., Environmental Monitoring Program and Quality Assurance/Quality Control Plan, October 2008.

Nuna Burnside Engineering and Environmental Ltd., Solid Waste Management Facility Operation and Maintenance Plan, October 2008.

Nuna Burnside Engineering and Environmental Ltd., Sewage Treatment Facility Operation and Maintenance Plan, October 2008.

Nuna Burnside Engineering and Environmental Ltd., Environmental Emergency Contingency Plan, October 2008.

Nuna Burnside Engineering and Environmental Ltd., Water Supply Facility Operation and Maintenance Plan, October 2008.

2008 Annual Report.doc 2008-12-10 1:58 PM

Tables

Table 1: Whale Cove Water Quality Samples - General Chemistry September 12, 2008

Parameter	Unit	RDL	CCME Standards (Fresh water)	NWB License Standards	Sewage Lagoon			Landfill	
					SL - 1	SL - 2	SL - 3	LF - 1	LF - 2
Microbiology									
Fecal Coliform	CFU/100ml	1		100000	12000	7	300	30	1
General Chemistry									
Electrical Conductivity	uS/cm	2			690	659	552	1200	1200
pH	N/A	N/A		6 to 9	7.86	8.24	8.4	8.07	8.37
Saturation pH					7.65	7.46	7.6	7.13	7.1
Langelier Index	N/A				0.21	0.78	0.8	0.94	1.27
Total Dissolved Solids	mg/L	20			402	372	324	702	672
Total Suspended Solids	mg/L	10		180	<10	<10	<10	<10	26
Total Hardness (as CaCO3)	mg/L	10			97	134	124	278	281
Alkalinity (as CaCO3)	mg/L	5			166	187	145	207	220
% Difference/ Ion Balance		0.1			4.3	1.3	0.4	2	2.5
Bicarbonate (as CaCO3)	mg/L	5			166	187	142	207	216
Carbonate (as CaCO3)	mg/L	5			<5	<5	<5	<5	<5
Hydroxide (as CaCO3)	mg/L	5			<5	<5	<5	<5	<5
Fluoride	mg/L	0.05			<0.05	<0.05	0.06	0.12	0.14
Chloride	mg/L	0.10			91.6	94.2	85.8	227	234
Bromide	mg/L	0.05			0.23	0.21	0.09	0.79	0.82
Nitrate as N	mg/L	0.05			0.36	1	<0.05	<0.05	0.27
Nitrite as N	mg/L	0.05			<0.05	<0.05	<0.05	<0.05	<0.05
Sulphate	mg/L	0.10			29.3	5.62	9.17	72.2	57.6
Orthophosphate as P	mg/L	0.10			3.08	1.1	<0.10	<0.10	<0.10
Total Phosphorus	mg/L	0.05			4.1	1.36	< 0.05	0.14	0.09
Ammonia as N	mg/L	0.02			18.6	1.83	<0.02	0.65	0.08
Total Organic Carbon	mg/L	0.5			35	14.7	10.3	8.5	8.7
Reactive Silica	mg/L	0.05			9.33	7.53	0.15	5.43	2.84
Colour	TCU	5			140	50	37	27	28
Turbidity	NTU	0.5			15	1.6	0.6	16	1.3
Calcium	mg/L	0.05			27.7	42.1	37	77.7	74.9
Magnesium	mg/L	0.05			6.76	7.07	7.73	20.4	22.9
Sodium	mg/L	0.05			79.4	75.2	64.5	132	131
Potassium	mg/L	0.05			16	13	7.2	9.27	11.7
Aluminum	mg/L	0.004	0.100		**0.426**	0.013	0.005	0.009	0.008
Arsenic	mg/L	0.003	0.005		<0.003	0.007	<0.003	**0.006**	0.003
Barium	mg/L	0.002			0.006	0.009	0.012	0.036	0.019
Boron	mg/L	0.010			0.099	0.078	0.059	0.212	0.248
Cadmium	mg/L	0.002	0.000017		<0.002	<0.002	<0.002	<0.002	<0.002
Chromium	mg/L	0.003			0.003	0.003	<0.003	0.008	0.005
Copper	mg/L	0.003	0.002-0.004[1]		**0.018**	<0.003	<0.003	<0.003	<0.003
Iron	mg/L	0.010	0.300		0.296	**0.346**	0.076	**2.01**	**0.311**
Lead	mg/L	0.002	0.001-0.007[1]		<0.002	<0.002	<0.002	<0.002	<0.002
Manganese	mg/L	0.002			0.083	0.074	0.006	0.292	0.065
Mercury	mg/L	0.0001	0.000026		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	mg/L	0.002	0.073		<0.002	<0.002	0.002	0.057	0.033
Nickel	mg/L	0.003	0.025-0.150[1]		0.003	0.003	<0.003	0.004	0.004
Selenium	mg/L	0.004	0.001		<0.004	<0.004	<0.004	<0.004	<0.004
Silver	mg/L	0.002	0.0001		<0.002	<0.002	<0.002	<0.002	<0.002
Strontium	mg/L	0.005			0.109	0.203	0.214	0.503	0.562
Thallium	mg/L	0.006	0.0008		<0.006	<0.006	<0.006	<0.006	<0.006
Titanium	mg/L	0.002			0.007	<0.002	<0.002	<0.002	<0.002
Uranium	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002
Vanadium	mg/L	0.002			<0.002	<0.002	<0.002	0.002	0.002
Zinc	mg/L	0.005	0.03		**0.046**	0.012	0.013	0.023	0.014
Phenols	mg/L	0.001			0.003	0.002	<0.001	0.008	0.001
BOD (5)	mg/L	5		120	<5	<5	<5	<5	<5

RDL - Reported Detection Limit

BOLD - indicates exceedence of CCME standards

Shading - indicates exceedance of the maximum allowable concentrations in Water License NWB3WHA0207

CCME - Canadian Council of Ministers of the Environment, Canadian Water Quality Guidelines for the Protection of Aquatic Life, Updated 2007

[1] Value depends on water hardness, see CCME Guidelines

Table 2: Whale Cove Water Quality Samples - VOCs, September 12, 2008

Parameter	Unit	RDL	CCME Standards (Fresh water)	Landfill	
				LF - 1	LF - 2
Chloromethane	µg/L	0.40		<0.40	<0.40
Vinyl Chloride	µg/L	0.17	0.5	<0.17	<0.17
Bromomethane	µg/L	0.20	0.9	<0.20	<0.20
Chloroethane	µg/L	0.20		<0.20	<0.20
Trichlorofluoromethane	µg/L	0.40		<0.40	<0.40
Acetone	µg/L	0.50		<0.50	<0.50
1,1 Dichloroethene	µg/L	0.30	0.66	<0.30	<0.30
Methylene Chloride	µg/L	0.30	50	<0.30	<0.30
trans- 1,2-dichloroethylene	µg/L	0.20	100	<0.20	<0.20
Methyl tert-butyl ether	µg/L	0.20	200	<0.20	<0.20
1,1-Dichloroethane	µg/L	0.30	70	<0.30	<0.30
Methyl Ethyl Ketone	µg/L	0.90	350	<0.90	<0.90
cis- 1,2-Dichloroethylene	µg/L	0.20	70	<0.20	<0.20
Chloroform	µg/L	0.20	0.5	<0.20	<0.20
1,2 - Dichloroethane	µg/L	0.20	5.0	<0.20	<0.20
1,1,1-Trichloroethane	µg/L	0.30	10	0.52	<0.30
Carbon Tetrachloride	µg/L	0.20	0.5	<0.20	<0.20
Benzene	µg/L	0.20	5.0	<0.20	<0.20
1,2-Dichloropropane	µg/L	0.20	0.7	<0.20	<0.20
Trichloroethylene	µg/L	0.20	20	<0.20	<0.20
Bromodichloromethane	µg/L	0.20	5.0	<0.20	<0.20
cis-1,3-Dichloropropene	ug/L	0.20		<0.20	<0.20
Methyl Isobutyl Ketone	µg/L	0.30		<0.30	<0.30
trans-1,3-Dichloropropene	µg/L	0.30		<0.30	<0.30
1,1,2-Trichloroethane	µg/L	0.20	5	<0.20	<0.20
Toluene	µg/L	0.20	0.8	**1.2**	<0.20
2-Hexanone	µg/L	0.30		<0.30	<0.30
Dibromochloromethane	µg/L	0.10	0.5	<0.10	<0.10
Ethylene Dibromide	µg/L	0.20	1.0	<0.20	<0.20
Tetrachloroethene	µg/L	0.10	5.0	<0.10	<0.10
1,1,1,2-Tetrachloroethane	µg/L	0.10	5.0	<0.10	<0.10
Chlorobenzene	µg/L	0.10	15	<0.10	<0.10
Ethylbenzene	µg/L	0.10	2.4	0.16	<0.10
m & p-Xylene	µg/L	0.20		0.38	<0.20
Bromoform	µg/L	0.10	5.0	<0.10	<0.10
Styrene	µg/L	0.10	4.0	<0.10	<0.10
1,1,2,2-Tetrachloroethane	µg/L	0.10	1.0	<0.10	<0.10
o-Xylene	µg/L	0.10		0.23	<0.10
1,3-Dichlorobenzene	µg/L	0.10	2.5	<0.10	<0.10
1,4-Dichlorobenzene	µg/L	0.10	1.0	<0.10	<0.10
1,2-Dichlorobenzene	µg/L	0.10	2.5	<0.10	<0.10
1,2,4-Trichlorobenzene	µg/L	0.30	0.5	<0.30	<0.30
1,3-Dichloropropene (Cis + Trans)	µg/L	0.30	1.4	<0.30	<0.30
Xylenes (Total)	µg/L	0.20	72	0.61	<0.20

RDL - Reported Detection Limit

BOLD - indicates exceedance of CCME standards

CCME - Canadian Council of Ministers of the Environment, Canadian Water Quality Guidelines for the Protection of Aquatic Life, Updated 2007

Table 3: Whale Cove Water Quality Samples - Hydrocarbons, September 12, 2008

Parameter	Unit	RDL	O.Reg 154 Table 2 Potable Groundwater	Sewage Lagoon	Landfill
				SL - 1	LF - 1
Hydrocarbons					
C6 - C10 (F1)	µg/L	100		<100	<100
C6 - C10 (F1 minus BTEX)	µg/L	100		<100	<100
C>10 - C16 (F2)	µg/L	100		<100	<100
C6 - C16 (F1 + F2)	µg/L	100	1000	<100	<100
C>16 - C34 (F3)	µg/L	500		<500	<500
C>34 - C50 (F4)	µg/L	500		<500	<500
C>16 - C50 (F3 + F4)	µg/L	500	1000	<500	<500
Gravimetric Heavy Hydrocarbons	µg/L	500		NA	NA
C6 - C10 (F1)	µg/L	100		<100	
C6 - C10 (F1 minus BTEX)	µg/L	100		<100	
C6 - C10 (F1)	µg/L	100		<100	
C6 - C10 (F1 minus BTEX)	µg/L	100		<100	
Oil and Grease (visual)				none	none

RDL - Reported Detection Limit

BOLD - indicates exceedence in the license requirements or CCME standards which are assumed to be similar to O.Reg 153/04, Table 2, Potable Ground Water

Table 4: Whale Cove Landfarm Soil Samples, September 12, 2008

Parameter	Unit	RDL	CCME Guideline (Industrial Use)*	Landfarm		
				LFRM-1	LFRM-2	LFRM-3
Hydrocarbons						
Benzene	µg/g	0.10	0.03	<0.10	<0.10	<0.10
Toluene	µg/g	0.08	0.37	<0.08	<0.08	<0.08
Ethylbenzene	µg/g	0.05	0.082	<0.05	<0.05	<0.05
Xylenes (Total)	µg/g	0.07	11	<0.07	<0.07	<0.07
C6 - C10 (F1)	µg/g	5	320	13	32	23
C6 - C10 (F1 minus BTEX)	µg/g	5		13	32	23
C>10 - C16 (F2)	µg/g	10	260	160	760	900
C>16 - C34 (F3)	µg/g	50	1700	<50	180	230
C>34 - C50 (F4)	µg/g	50	3300	<50	<50	<50
Moisture Content	%	0.1		9.4	8.3	8.4

RDL - Reported Detection Limit

BOLD - indicates exceedance in the license requirements or CCME standards

CCME - Canadian Council of Ministers of the Environment, Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health, Updated 2007

* Soil guidelines used were for a coarse soil, subsoil. Industrial land use.

Table 4: Whale Cove Landfarm Soil Sample Results, September 12, 2008

Parameter	Unit	RDL	CCME Guideline (Industrial Use)*	Landfarm		
				LFRM-1	LFRM-2	LFRM-3
Hydrocarbons						
Benzene	µg/g	0.10	0.03	<0.10	<0.10	<0.10
Toluene	µg/g	0.08	0.37	<0.08	<0.08	<0.08
Ethylbenzene	µg/g	0.05	0.082	<0.05	<0.05	<0.05
Xylenes (Total)	µg/g	0.07	11	<0.07	<0.07	<0.07
C6 - C10 (F1)	µg/g	5		13	32	23
C6 - C10 (F1 minus BTEX)	µg/g	5		13	32	23
C>10 - C16 (F2)	µg/g	10		160	760	900
C>16 - C34 (F3)	µg/g	50		<50	180	230
C>34 - C50 (F4)	µg/g	50		<50	<50	<50
Moisture Content	%	0.1		9.4	8.3	8.4

RDL - Reported Detection Limit

BOLD - indicates exceedance in the license requirements or CCME standards

CCME - Canadian Council of Ministers of the Environment, Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health, Updated 2007

* Soil guidelines used were for a coarse soil, subsoil.

Table 5: Summary of Water Quality Samples (2001, 2002, 2003, 2008)

Parameter	Unit	CCME Standards (Fresh water)	2001			2002		2003			2008				
			WHA-1	WHA-2	WHA-3	WHA-1	WHA-3	WHA-1	WHA-2	WHA-3	SL - 1	SL-2	SL-3 (WHA-3)	LF - 1	LF-2 (WHA-2)
Colour	TCU		10			**20**	50	5	80	50	140	50	37	27	28
Electrical Conductivity	µS/cm		279	849	657	310	542	285	527	586	690	659	552	1200	1200
pH	N/A		8.5	7.7	7.3	7.92	8.05	7.5	7.77	7.49	7.86	8.24	8.4	8.07	8.37
Turbidity	NTU		2.7			4.2	17	1.9	114	5.6	15	1.6	0.6	16	1.3
Alkalinity (as CaCO3)	mg/L						137				166	187	145	207	220
Bicarbonate (as CaCO3)	mg/L										166	187	142	207	216
Total Hardness (as CaCO3)	mg/L					70.1					97	134	124	278	281
Ammonia as N	mg/L		0.009	0.595	13	0.091	0.014	0.052	0.859	3.17	18.6	1.83	<0.02	0.65	0.08
Calcium	mg/L					20.2		22.8	37.9	40.3	27.7	42.1	37	77.7	74.9
Chloride	mg/L		46			52.4					91.6	94.2	85.8	227	234
Fluoride	mg/L										<0.05	<0.05	0.06	0.12	0.14
Magnesium	mg/L					4.78		4.19	8.89	5.93	6.76	7.07	7.73	20.4	22.9
Manganese	mg/L		<0.004	0.029				0.0073	0.124	0.408	0.083	0.074	0.006	0.292	0.065
Nitrate and Nitrite as N	mg/L		<0.008	0.725	0.114	<0.008	0.924	<0.008	0.951	0.366	0.36	1	<0.05	<0.05	0.27
Orthophosphate as P	mg/L										3.08	1.1	<0.10	<0.10	<0.10
Potassium	mg/L					1.8		1.61	5.24	9.1	16	13	7.2	9.27	11.7
Reactive Silica	mg/L					1.05					9.33	7.53	**0.15**	5.43	2.84
Sodium	mg/L		27.4			30.3		25	44.1	59.9	79.4	75.2	64.5	132	131
Sulphate	mg/L		11			12		10		7	29.3	5.62	9.17	72.2	57.6
Total Dissolved Solids	mg/L					173	323				402	372	324	702	672
Total Organic Carbon	mg/L					3.7	17.3	4.1	7.3		35	14.7	10.3	8.5	8.7
Total Phosphorus	mg/L				3.12	0.034	0.486				4.1	1.36	< 0.05	0.14	0.09
Total Suspended Solids	mg/L		138	3		<3	20	<3	170	6	<10	<10	<10	<10	26
BOD $_{(5)}$	mg/L		<2		6	<2	9				<5	<5	<5	<5	<5
Fecal Coliform	CFU/100ml		8		<100						12000	7	300	30	1
Aluminum	mg/L	0.1						<0.03	**4.6**	0.032	**0.426**	0.013	**0.005**	0.009	0.008
Arsenic	mg/L	0.005	<0.001	0.0014				<0.001	**0.006**	**0.006**	<0.003	**0.007**	<0.003	**0.006**	0.003
Barium	mg/L							0.0104	0.0549	0.0156	0.006	0.009	0.012	0.036	0.019
Boron	mg/L										0.099	0.078	0.059	0.212	0.248
Bromide	mg/L										0.23	0.21	0.09	0.79	0.82
Cadmium	mg/L	0.000017	<0.003	<0.003				0.0002	0.0002	0.0001	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium	mg/L		<0.003	0.005				0.0265	0.0137	0.0012	0.003	0.003	<0.003	0.008	0.005
Cobalt	mg/L		<0.001	<0.001				<0.0001	0.0039	0.002					
Copper	mg/L	0.002-0.004[1]	0.003	**0.005**				0.0021	**0.022**	0.0057	**0.018**	<0.003	<0.003	**<0.003**	<0.003
Iron	mg/L	0.300	0.032	**0.349**				0.05	**7.42**	**1.481**	0.296	**0.346**	0.076	**2.01**	**0.311**
Lead	mg/L	0.001-0.007[1]	<0.001	<0.001				0.0001	0.0035	0.0003	<0.002	<0.002	<0.002	<0.002	**<0.002**
Mercury	mg/L	0.000026	<0.0001	<0.0001				0.00029	<0.0001	0.00003	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	mg/L	0.073						0.0014	**0.075**	0.0011	<0.002	<0.002	0.002	0.057	0.033
Nickel	mg/L	0.025-0.150[1]	<0.001	0.003				0.001	0.146	0.0056	0.003	0.003	<0.003	**0.004**	0.004
Selenium	mg/L	0.001						<0.001	0.001	0.001	<0.004	<0.004	<0.004	<0.004	<0.004
Silver	mg/L	0.0001						**<0.0001**	<0.0001	<0.0001	<0.002	<0.002	<0.002	<0.002	<0.002
Strontium	mg/L							0.11	0.222	0.187	0.109	0.203	0.214	0.503	0.562
Thallium	mg/L	0.0008						<0.0001	0.0001	<0.0001	<0.006	<0.006	<0.006	<0.006	<0.006
Titanium	mg/L							0.0024	0.26	0.003	0.007	<0.002	<0.002	<0.002	<0.002
Uranium	mg/L							<0.0001	0.0019	0.0001	<0.002	<0.002	<0.002	<0.002	<0.002
Vanadium	mg/L							0.0008	0.012	0.0005	<0.002	<0.002	<0.002	0.002	**0.002**
Zinc	mg/L	0.03	<0.01	0.02				<0.01	0.02	0.014	**0.046**	0.012	0.013	0.023	0.014
Phenols	mg/L				<0.005					0.0008	0.003	0.002	<0.001	0.008	0.001

BOLD - indicates exceedance of CCME standards

CCME - Canadian Council of Ministers of the Environment, Canadian Water Quality Guidelines for the Protection of Aquatic Life, Updated 2007

[1] Value depends on water hardness, see CCME Guidelines

Reported and Method Detection Limits varied between labs. See Certificates of Analysis in Appendix C

Figures

Map Reference:
Map Art Publishing

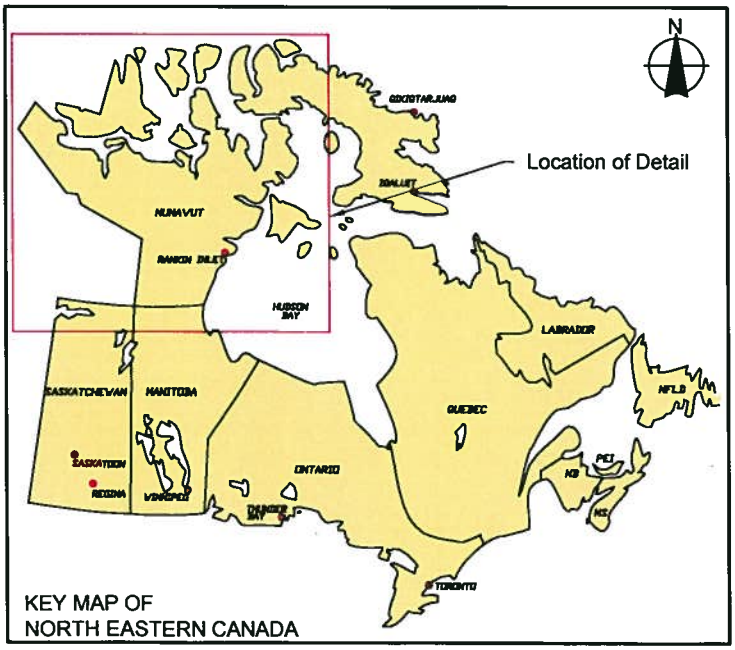

FIGURE 1 - SITE LOCATION MAP

HAMLET OF WHALE COVE
WHALE COVE, NUNAVUT

ANNUAL REPORT 2008

October 2008
Project Number: N-O14851

Prepared by: C. Sheppard

Verified by: J. Walls

NUNA BURNSIDE

14851 ANNUAL REPORT 2008 SL.dwg

Plot Time: Nov 28, 2008 - 12:47pm

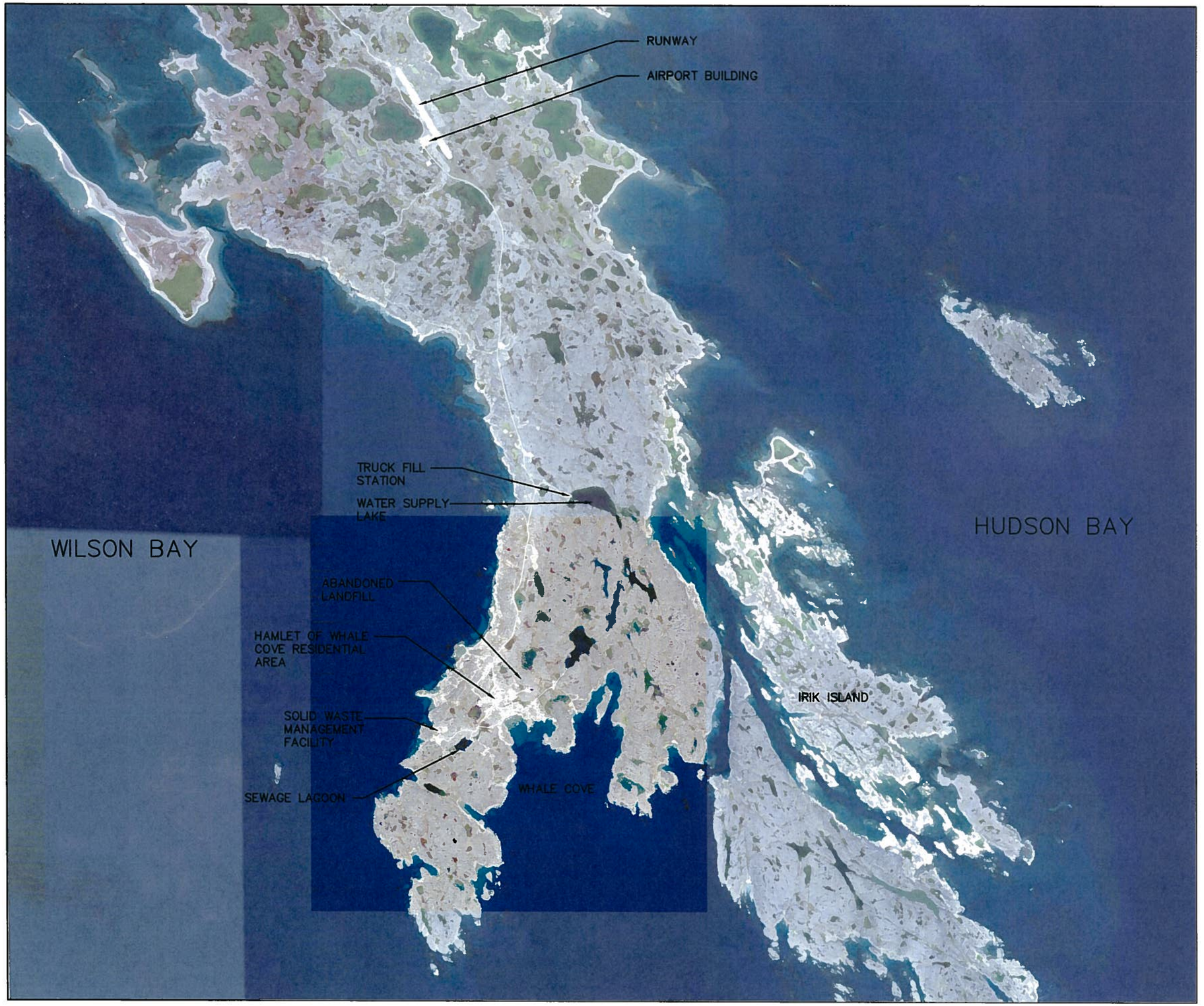

FIGURE 2

HAMLET OF WHALE COVE
WHALE COVE, NUNAVUT
ANNUAL REPORT 2008

COMMUNITY PLAN

Satellite Image Source:
Background colour satellite image obtained from Google Earth Pro.

N

0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0
Kilometers

1:50,000
October 2008
Project Number: N-O14851

Projection: UTM Zone 15
Datum: NAD83

Prepared by: C. Sheppard

Verified by: J. Walls

BURNSIDE

Revision #: 1

14851 ANNUAL REPORT 2008 CP.dwg

Plot Time: Feb 02, 2009 - 3:01pm

FIGURE 3

HAMLET OF WHALE COVE
WHALE COVE, NUNAVUT
ANNUAL REPORT 2008

SAMPLING LOCATIONS

LEGEND

- LANDFILL SITE OUTLINE *(Approximate area = 8,868m²)*
- BEDROCK QUARRY OUTLINE
- 7.62m (25 ft) CONTOUR LINES *(Obtained from the N.T.S. digital database)*
- 1.52m (5 ft) INTERPOLATED CONTOUR LINES *(Interpolated from the N.T.S. 25 ft contours)*
- INTERPRETED SURFACE WATER FLOW DIRECTION
- WATER SAMPLE LOCATION (By Nuna Burnside, September 2008)

Satellite Image Source:
Background 2006 Quickbird satellite image obtained from the Government of Nunavut.

N

0 40 80 120 160 200 240 280 320
Meters

1:4,000
September 2008
Project Number: N-O14851

Projection: UTM Zone 15
Datum: NAD83

Prepared by: C. Sheppard

Verified by: J. Walls

Nuna BURNSIDE

Revision #: 1

14851 ANNUAL REPORT 2008 SLF SAMPLING.dwg

Plot Time: Feb 02, 2009 - 3:02pm

BURNSIDE

Appendix A
Water License

P.O. Box 119
Gjoa Haven, NU X0B 1J0
Tel: (867) 360-6338
Fax: (867) 360-6369

ᓄᓇᕗᑦ ᐃᒪᓕᕆᔨᑦ ᑲᑎᒪᔨᖏᑦ
NUNAVUT WATER BOARD
NUNAVUT IMALIRIYIN KATIMAYINGI

File No: NWB3WHA0207

September 18, 2002

Imalda Angooteluk
Senior Administrative Officer
Hamlet of Whale Cove
P.O. Box 120
Whale Cove, Nunavut X0C 0J0
Email: hamwhale@arctic.ca

RE: NWB Licence No. NWB3WHA0207

Dear Imalda:

Please find attached Licence No. NWB3WHA0207 issued to the Hamlet of Whale Cove by the Nunavut Water Board **(Motion #: 2002-10)** pursuant to its authority under Article 13 of the *Agreement between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in Right of Canada*. The terms and conditions of the attached Licence related to water use and waste disposal are an integral part of this approval.

Sincerely,

Philippe di Pizzo
Executive Director

Enclosure: Licence No. **NWB3WHA0207**

cc: Paul Smith, DIAND Iqaluit
C. Bodykevich, DIAND Inspector
Tongola Sandy, KIA
Gladys Joudrey, NIRB
Josee Gallipeau, NWMBoard
P. Pacholek, EC
P. Partridge, DSD
J. DeGroot, DFO

P.O. BOX 119
GJOA HAVEN, NU X0B 1J0
TEL: (867) 360-6338
FAX: (867) 360-6369

ᓇᓗᓀ ᐃᒪᓕᕆᔨᓂᖅ ᑲᑎᒪᔨᖏᑦ
NUNAVUT WATER BOARD
NUNAVUT IMALIRIYIN KATIMAYINGI

DECISION

LICENCE NUMBER: NWB3WHA0207

This is the decision of the Nunavut Water Board (NWB) with respect to an application for a Licence dated 02 April 2002, made by:

Hamlet of Whale Cove

to allow for the use of water and disposal of waste for the Hamlet at Whale Cove, Nunavut.

With respect to this application, the NWB gave notice to the public that the Hamlet had filed an application for a water licence.

DECISION

After having been satisfied that the application was exempt from the requirement for screening by the Nunavut Impact Review Board in accordance with S. 12.3.2 of the *Nunavut Land Claim Agreement* (NLCA), the NWB decided that the application could go through the regulatory process. After reviewing the submission of the Applicant and written comments expressed by interested parties, the NWB, having given due regard to the facts and circumstances, the merits of the submissions made to it and to the purpose, scope and intent of the *Nunavut Land Claims Agreement* and of the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (NWNSRTA), decided to waive the requirement to hold a public hearing and furthermore to delegate its authority to approve the application to the Chief Administrative Officer pursuant to S. 49(a) of the NWNSRTA and determined that:

Licence Number NWB3WHA0207 be issued subject to the terms and conditions contained therein. (Motion #: 2002-10)

SIGNED this _____ day of September, 2002 at Gjoa Haven, NU.

Philippe di Pizzo
Chief Administrative Officer

Chief Administrative Officer

TABLE OF CONTENTS

I. INTRODUCTION

Following an application filed by the Hamlet of Whale Cove on April 2, 2002 to the Nunavut Water Board, the Board conducted an initial assessment of the Hamlet's request for a municipal water licence for water use and waste disposal activities within the Hamlet. The assessment was conducted so that the Nunavut Water Board could make a fully informed decision on the application. The application was referred for review and comments to Federal, Territorial and local organizations. Based upon the results of this initial assessment and the technical review, including consideration of any potential accidents, malfunctions, or cumulative environmental effects that the overall project might have in the area, the Board concluded that this application was complete and could go through the regulatory process.

In accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* S. 55.1 and Article 13 of the *Nunavut Land Claims Agreement*, public notice of the application was posted. No public concerns were expressed, and the NWB waived the requirement to hold a public hearing for the application. Authority to approve the application was delegated to the Chief Administrative Officer pursuant to S. 13.7.5 of the *Agreement*. After considering and reviewing the comments submitted by interested parties, the NWB has issued licence NWB3WHA0207.

II. GENERAL CONSIDERATIONS

Term of the Licence

In accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* S. 45, the NWB may issue a licence for a term not exceeding twenty-five years. The NWB believes that a term of five years is appropriate. Because this is the first licence issued to the Hamlet by the Nunavut Water Board, a 5-year licence will allow enough time for the Hamlet to establish a consistent compliance record. The 5-year licence will allow the Licensee to properly carry out the terms and conditions of the licence and to ensure that sufficient time is given to permit the Licensee to develop, submit, and implement the plans required under the licence to the satisfaction of the NWB.

Annual Report

The requirements imposed on the Licensee in this licence are for the purpose of ensuring that the NWB has an accurate annual update of municipal activities during a calendar year. This information is maintained on the public registry and is available to any interested parties upon request. Refer to attached standard form for completing Annual Report (see Attachment I).

Regulated Parameters

Effluent quality criteria imposed in this Licence are consistent with the *Guidelines for the Discharge of Treated Municipal Wastewater in the Northwest Territories* (Northwest Territories Water Board; 1992), and follow advice received from both the Department of Indian and Northern Affairs and Environment Canada.

Operation and Maintenance Manual (O&M)

The purpose of an Operation and Maintenance Manual is to assist Hamlet staff in the proper operation and maintenance of their waste disposal facilities. The manual should demonstrate to the Nunavut Water Board that the Hamlet is capable of operating and maintaining all waste disposal sites adequately. The Plan should be completed using the *Guidelines for the Preparation of an s and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories* (Duong and Kent, 1996; see Attachment II).

Abandonment and Restoration (A&R)

To ensure that all future abandoned facilities are reclaimed in an appropriate manner, the NWB has imposed the requirement for the submission of Abandonment and Restoration Plans. These plans should be submitted when the Licensee files preliminary design drawings for the construction of new facilities to replace existing ones.

Surveillance Network Program

The Surveillance Network Program (SNP) is a monitoring program established to collect data on water quality to assess the effectiveness of treatment for protection of public health and to assess potential impacts to the environment associated with the municipal facilities. As this is the first Municipal Water Licence issued to the Hamlet by the Board, minimum requirements have been imposed, but additional sampling may be required by an Inspector.

Quality Assurance/Quality Control (QA/QC) Plan

The requirements to develop a QA/QC Plan imposed on the Licensee in this licence are for the purpose of ensuring the NWB that samples taken in the field as part of the SNP will maintain a high quality, so as to accurately represent the physical and chemical nature of the samples being taken.

LICENCE NWB3WHA0207

Pursuant to the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in Right of Canada*, the Nunavut Water Board, hereinafter referred to as the Board, hereby grants to

HAMLET OF WHALE COVE
(Licensee)

of **WHALE COVE, NUNAVUT, X0C 0J0**
(Mailing Address)

hereinafter called the Licensee, the right to alter, divert or otherwise use water for a period subject to restrictions and conditions contained within this licence:

Licence Number **NWB3WHA0207**

Water Management Area **NUNAVUT 05**

Location **WHALE COVE, NUNAVUT**

Purpose **WATER USE AND WASTE DISPOSAL**

Description **MUNICIPAL UNDERTAKINGS**

Quantity of Water Not to be Exceeded **30,000 CUBIC METRES ANNUALLY**

Date of Licence **SEPTEMBER 1, 2002**

Expiry Date of Licence **AUGUST 31, 2007**

Dated this ____ of September 2002 at Gjoa Haven, NU.

Philippe di Pizzo
Chief Administrative Officer

PART A: SCOPE AND DEFINITIONS

1. Scope

a. This Licence allows for the use of water and the disposal of waste for municipal undertakings at the Hamlet of Whale Cove, Nunavut (62°11'N, 92°35'W);

b. This Licence is issued subject to the conditions contained herein with respect to the taking of water and the depositing of waste of any type in any waters or in any place under any conditions where such waste or any other waste that results from the deposits of such waste may enter any waters. Whenever new Regulations are made or existing Regulations are amended by the Governor in Council under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*, or other statutes imposing more stringent conditions relating to the quantity or type of waste that may be so deposited or under which any such waste may be so deposited, this Licence shall be deemed, upon promulgation of such Regulations, to be subject to such requirements; and;

c. Compliance with the terms and conditions of this Licence does not absolve the Licensee from responsibility for compliance with the requirements of all applicable Federal, Territorial and Municipal legislation.

2. Definitions

In this Licence: **NWB3WHA0207**

"**Act**" means the *Nunavut Waters and Nunavut Surface Rights Tribunal Act;*

"**Amendment**" means a change to original terms and conditions of this licence requiring correction, addition or deletion of specific terms and conditions of the licence; modifications inconsistent with the terms of the set terms and conditions of the Licence;

"**Analyst**" means an Analyst designated by the Minister under Section 85 (1) of the *Act*;

"**Appurtenant undertaking**" means an undertaking in relation to which a use of waters or a deposit of waste is permitted by a licence issued by the Board;

"**Average Concentration**" means the arithmetic mean of the last four consecutive analytical results for contained in composite or grab samples collected from the Waste Facility's final discharge point;

"**Average Concentration For Faecal Coliforms**" means the geometric mean of the last four consecutive analytical results for faecal coliforms contained in composite or grab samples collected from the Waste Facility's final discharge point;

"**Board**" means the Nunavut Water Board established under the *Nunavut Land Claims Agreement*;

"**Chief Administrative Officer**" means the Executive Director of the Nunavut Water Board;

"**Commercial Waste Water**" means water and associated waste generated by the operation of a commercial enterprise, but does not include toilet wastes or greywater;

"**Effluent**" means treated or untreated liquid waste material that is discharged into the environment from a structure such as a settling pond or a treatment plant;

"**Freeboard**" means the vertical distance between water line and crest on a dam or dyke's upstream slope;

"**Grab Sample**" means a single water or wastewater sample taken at a time and place representative of the total discharge;

"**Greywater**" means all liquid wastes from showers, baths, sinks, kitchens and domestic washing facilities, but does not include toilet wastes;

"**Inspector**" means an Inspector designated by the Minister under Section 85 (1) of the *Act*;

"**Licensee**" means the holder of this Licence;

"**Modification**" means an alteration to a physical work that introduces new structure or eliminates an existing structure and does not alter the purpose or function of the work, but does not include an expansion, and changes to the operating system that are consistent with the terms of this Licence and do not require amendment;

"**Nunavut Land Claims Agreement**" **(NLCA)** means the "Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada," including its preamble and schedules, and any amendments to that agreement made pursuant to it;

"**Sewage**" means all toilet wastes and greywater;

"**Sewage Disposal Facilities**" comprises the area and engineered lagoon and decant structures designed to contain sewage as described in the Application for Water Licence filed by the Applicant on April 2, 2002;

"**Solid Waste Disposal Facilities**" comprises the area and associated structures designed to contain solid waste (landfill site) as described in the Application for Water Licence filed by the Applicant on April 2, 2002;

"**Surveillance Network Program**" means a monitoring program established to collect data on surface water and groundwater quality to assess impacts to the environment of an appurtenant undertaking.

"**Toilet Wastes**" means all human excreta and associated products, but does not include greywater;

"**Waste**" means, as defined in S.4 of the *Act*, any substance that, by itself or in combination with other substances found in water, would have the effect of altering the quality of any water to which the substance is added to an extent that is detrimental to its use by people or by any animal, fish or plant, or any water that would have that effect because of the quantity or concentration of the substances contained in it or because it has been treated or changed, by heat or other means;

"**Waste Disposal Facilities**" means all facilities designated for the disposal of waste, and includes the Sewage Disposal Facilities, Solid Waste Disposal Facilities, and Bagged Toilet Waste Disposal Facilities, as described in the Application for Water Licence filed by the Applicant on April 2, 2002; and

"**Water Supply Facilities**" comprises the area and associated intake infrastructure at Fish Lake, as described in the Application for Water Licence filed by the Applicant on April 2, 2002.

PART B: GENERAL CONDITIONS

1. The Licensee shall file an Annual Report with the Board not later than March 31st of the year following the calendar year reported which shall contain the following information:

   i. tabular summaries of all data generated under the "Surveillance Network Program";

   ii. the monthly and annual quantities in cubic metres of fresh water obtained from all sources;

   iii. the monthly and annual quantities in cubic metres of each and all waste discharged;

   iv. a summary of modifications and/or major maintenance work carried out on the Water Supply and Waste Disposal Facilities, including all associated structures and

facilities;

v. a list of unauthorized discharges and summary of follow-up action taken;

vi. a summary of any abandonment and restoration work completed during the year and an outline of any work anticipated for the next year;

vii. a summary of any studies, reports and plans (e.g., Operation and Maintenance, Abandonment and Restoration, QA/QC) requested by the Board that relate to waste disposal, water use or reclamation, and a brief description of any future studies planned;

viii. any other details on water use or waste disposal requested by the Board by November 1st of the year being reported; and

2. The Licensee shall comply with the "Surveillance Network Program" described in this Licence, and any amendments to the "Surveillance Network Program" as may be made from time to time, pursuant to the conditions of this Licence.

3. The "Surveillance Network Program" and compliance dates specified in the Licence may be modified at the discretion of the Board.

4. Meters, devices or other such methods used for measuring the volumes of water used and waste discharged shall be installed, operated and maintained by the Licensee to the satisfaction of an Inspector.

5. The Licensee shall, within ninety (90) days after the first visit of the Inspector, post the necessary signs, where possible, to identify the stations of the "Surveillance Network Program." All signage postings shall be in the Official Languages of Nunavut, and shall be located and maintained to the satisfaction of an Inspector.

6. The Licensee shall immediately report to the 24-Hour Spill Report Line (867-920-8130) any spills of Waste, which are reported to or observed by the Licensee, within the municipal boundaries or in the areas of the Water Supply or Waste Disposal Facilities.

7. The Licensee shall ensure a copy of this Licence is maintained at the municipal office and at the site of operation at all times. Any communication with respect to this Licence shall be made in writing to the attention of:

(i) **Chief Administrative Officer:**

Executive Director
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU X0B 1J0
Telephone: (867) 360-6338
Fax: (867) 360-6369

(ii) **Inspector Contact:**

Water Resources Officer
Nunavut District, Nunavut Region
P.O. Box 100
Iqaluit, NU X0A 0H0
Telephone: (867) 975-4298
Fax: (867) 979-6445

(iii) **Analyst Contact:**

Taiga Laboratories
Department of Indian and Northern Affairs
4601 - 52 Avenue, P.O. Box 1500
Yellowknife, NT X1A 2R3
Telephone: (867) 669-2781
Fax: (867) 669-2718

8. The Licensee shall submit one paper copy and one electronic copy of all reports, studies, and plans to the Board. Reports or studies submitted to the Board by the Licensee shall include a detailed executive summary in Inuktitut.

PART C: CONDITIONS APPLYING TO WATER USE

1. The Licensee shall obtain all fresh water from Fish Lake using the Water Supply Facilities or as otherwise approved by the Board.

2. The annual quantity of water used for all purposes shall not exceed 30,000 cubic metres.

3. The Licensee shall maintain the Water Supply Facilities to the satisfaction of the Inspector.

4. The water intake hose used on the water pumps shall be equipped with a screen with a mesh size sufficient to ensure no entrainment of fish.

PART D: CONDITIONS APPLYING TO WASTE DISPOSAL

1. The Licensee shall direct all piped and pumpout Sewage to the Sewage Disposal Facilities or as otherwise approved by the Board.

2. All Effluent discharged from the Sewage Disposal Facilities at "Surveillance Network Program" Station Number WHA-3 shall meet the following effluent quality standards:

Parameter	Maximum Average Concentration
Faecal Coliforms	1 x 10^6CFU/dl
BOD_5	120 mg/L
Total Suspended Solids	180 mg/L
Oil and grease	No visible sheen
pH	between 6 and 9

3. A Freeboard limit of 1.0 metre, or as recommended by a qualified geotechnical engineer and as approved by the Board, shall be maintained at all dykes and earthfill structures associated with the Sewage Disposal Facilities.

4. The Licensee shall advise an Inspector at least ten (10) days prior to initiating any decant of the sewage lagoon.

5. The sewage lagoon shall be maintained and operated in such a manner as to prevent structural failure.

6. The Licensee shall maintain the Sewage Disposal Facilities to the satisfaction of an Inspector.

7. The Licensee shall dispose of and contain all solid wastes at the Solid Waste Disposal Facilities or as otherwise approved by the Board.

8. The Licensee shall implement measures to ensure hazardous materials and/or leachate from the Solid Waste Disposal Facility does not enter water.

PART E: CONDITIONS APPLYING TO MODIFICATION AND CONSTRUCTION

1. The Licensee shall submit to the Board for approval design drawings stamped by a qualified engineer registered in the Nunavut prior to the construction of any dams, dykes or structures intended to contain, withhold, divert or retain water or wastes.

2. The Licensee may, without written approval from the Board, carry out modifications to the Water Supply and Waste Disposal Facilities provided that such modifications are consistent with the terms of this Licence and the following requirements are met:

   i. the Licensee has notified the Board in writing of such proposed modifications at least sixty (60) days prior to beginning the modifications;

   ii. said modifications do not place the Licensee in contravention of the Licence or the *Act*;

   iii. the Board has not, during the sixty (60) days following notification of the proposed modifications, informed the Licensee that review of the proposal will require more than sixty (60) days; and

   iv. the Board has not rejected the proposed modifications.

3. Modifications for which all of the conditions referred to in Part E, Item 1, have not been met may be carried out only with written approval from the Board.

4. The Licensee shall provide as built plans/drawings of the modifications referred to in this Licence within ninety (90) days of completion of the modifications.

PART F: CONDITIONS APPLYING TO OPERATION AND MAINTENANCE

1. The Licensee shall, before September 1, 2003 submit to the Board for approval, a plan for the Operation and Maintenance of the Sewage and Solid Waste Disposal Facilities in accordance with *"Guidelines for preparing an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities"* (October 1996).

2. The Licensee shall implement the Plan specified in Part F, Item 1 as and when approved by the Board.

3. The Licensee shall revise the Plan referred to in Part F, Item 1, if not acceptable to the Board. The revised Plan shall be submitted to the Board for approval within thirty (30) days of notification of the Board decision.

4. If, during the period of this Licence, an unauthorized discharge of waste occurs, or if such a discharge is foreseeable, the Licensee shall:

   i. employ the appropriate contingency plan as provided for in the Operation and Maintenance Plan;

   ii. report the incident immediately via the 24-Hour Spill Reporting Line at (867) 920-8130 and to an Inspector; and

   iii. submit to an Inspector a detailed report on each occurrence not later than thirty (30) days after initially reporting the event.

PART G: CONDITIONS APPLYING TO ABANDONMENT AND RESTORATION

1. The Licensee shall submit to the Board for approval an Abandonment and Restoration Plan at least six (6) months prior to abandoning any facilities and the construction of new facilities to replace existing ones. The Plan shall include, but not be limited to where applicable:

   i. water intake facilities;

   ii. the water treatment and waste disposal sites and facilities;

   iii. petroleum and chemical storage areas;

   iv. any site affected by waste spills;

   v. leachate prevention;

   vi. an implementation schedule;

   vii. maps delineating all disturbed areas, and site facilities;

   viii. consideration of altered drainage patterns;

ix. type and source of cover materials;

x. future area use;

xi. hazardous wastes; and

xii. a proposal identifying measures by which restoration costs will be financed by the Licensee upon abandonment.

2. The Licensee shall implement the plan specified in Part G, Item 1 as and when approved by the Board.

3. The Licensee shall revise the Plan referred to in Part G, Item 1 if not approved. The revised Plan shall be submitted to the Board for approval within thirty (30) days of receiving notification of the Board's decision.

4. The Licensee shall complete the restoration work within the time schedule specified in the Plan, or as subsequently revised and approved by the Board.

PART H: CONDITIONS APPLYING TO THE SURVEILLANCE NETWORK PROGRAM

1. The Licensee shall maintain Surveillance Stations at the following locations:

Station Number	Description
WHA-1	Raw Water supply prior to treatment
WHA-2	Runoff from the Solid Waste Disposal Facilities
WHA-3	Effluent discharge from the Sewage Disposal Facilities

2. The Licensee shall sample monthly at Surveillance Stations WHA-2 and WHA-3 during the months of May to August, inclusive.

3. The Licensee shall analyze samples collected at Station Number WHA-2 and WHA-3 for the following parameters:

BOD	Faecal Coliforms
pH	Conductivity
Total Suspended Solids	Ammonia Nitrogen
Nitrate-Nitrite	Oil and Grease (visual)
Total Phenols	Sulphate
Sodium	Potassium
Magnesium	Calcium
Total Arsenic	Total Cadmium
Total Copper	Total Chromium
Total Iron	Total Lead
Total Mercury	Total Nickel
Total Zinc	

4. Additional sampling and analysis may be requested by an Inspector;

5. The Licensee shall conform to the Quality Assurance/Quality Control (QA/QC) Plan which shall be provided to the Licensee by the NWB within 60 days of the issuance of this licence;

6. All sampling, sample preservation and analyses shall be conducted in accordance with methods prescribed in the current edition of *Standard Methods for the Examination of Water and Wastewater*, or by such other methods approved by the Board;

7. All analyses shall be performed in a Canadian Association of Environmental Analytical Laboratories (CAEAL) Certified Laboratory, or as otherwise approved by an Analyst;

8. The Licensee shall measure and record in cubic metres the monthly and annual quantities of water pumped from Surveillance Network Program Station Number WHA-1 for all purposes;

9. The Licensee shall measure and record the annual quantities of sewage solids removed from the Sewage Disposal Facility;

10. The Licensee shall, unless otherwise requested by an Inspector, include all of the data and information required by the "Surveillance Network Program" in the Licensee's Annual Report, as required *per* Part B, Item 1; and

11. Modifications to the Surveillance Network Program may be made only upon written approval of the Chief Administrative Officer.

BURNSIDE

Appendix B
NWB Annual Report Form

NWB Annual Report **Year being reported:** 2008

License No: NWB3WHA0207 **Issued Date:** September 1, 2002
Expiry Date: July 31, 2007

Project Name: Whale Cove Water Use and Waste Disposal

Licensee: Hamlet of Whale Cove

Mailing Address:
The Hamlet of Whale Cove
P.O. Box 120
Whale Cove, Nunavut
X0C 0J0

Name of Company filing Annual Report (**if different from Name of Licensee please clarify relationship between the two entities, if applicable**):
Nuna Burnside Engineering and Environmental Ltd.
Consulting Firm retained by the Hamlet

General Background Information on the Project (***optional**):
See attached report

License Requirements: the licensee must provide the following information in accordance with

Part B | Item 1

A summary report of water use and waste disposal activities, including, but not limited to: methods of obtaining water; sewage and greywater management; drill waste management; solid and hazardous waste management.

Water Source(s): Fish Lake Water Intake

Water Quantity:

30,000	Quantity Allowable Domestic (cu.m)
14,457	Actual Quantity Used Domestic (cu.m)
	Quantity Allowable Drilling (cu.m)
	Total Quantity Used Drilling (cu.m)

Waste Management and/or Disposal

- [x] Solid Waste Disposal
- [x] Sewage
- [ ] Drill Waste
- [ ] Greywater
- [ ] Hazardous
- [ ] Other:

Additional Details:
See attached report

A list of unauthorized discharges and a summary of follow-up actions taken.

Spill No.: (as reported to the Spill Hot-line)
Date of Spill:
Date of Notification to an Inspector:
Additional Details: (impacts to water, mitigation measures, short/long term monitoring, etc)

Revisions to the Spill Contingency Plan

Other: (see additional details)

Additional Details:

A Spill Contingency Plan has been submitted by Nuna Burnside, as part of Environmental Emergency Contingency Plan for Hamlet of Whale Cove.

Revisions to the Abandonment and Restoration Plan

Other: (see additional details)

Additional Details:

An abandonment and restoration plan for the Whale Cove landfill was submitted as part of the Solid Waste Facility Operations and Maintenance Plan by Nuna Burnside

Progressive Reclamation Work Undertaken

Additional Details (i.e., work completed and future works proposed)

Solid waste facility upgrades are proposed as discussed in the report

Results of the Monitoring Program including:

The GPS Co-ordinates (in degrees, minutes and seconds of latitude and longitude) of each location where sources of water are utilized;

Details described below

Additional Details:

Fish Lake Water Intake - 62°11'46.99"N 92°33'42.62"W

The GPS Co-ordinates (in degrees, minutes and seconds of latitude and longitude) of each location where wastes associated with the license are deposited;

Details described below

Additional Details:

Sewage Lagoon - 62°10'07.16"N 92°35'15.02"W
Landfill - 62°10'11.82"N 92°35'35.83"W

Results of any additional sampling and/or analysis that was requested by an Inspector

No additional sampling requested by an Inspector or the Board

Additional Details: (date of request, analysis of results, data attached, etc)

See water license renewal submission by Nuna Burnside

Any other details on water use or waste disposal requested by the Board by November 1 of the year being reported.

No additional sampling requested by an Inspector or the Board

Additional Details: (Attached or provided below)

Any responses or follow-up actions on inspection/compliance reports

Inspection Report received by the Licensee (Date):

Additional Details: (Dates of Report, Follow-up by the Licensee)

See details in attached report

Any additional comments or information for the Board to consider

See attached report

Date Submitted:	November 12, 2008	
Submitted/Prepared by:	Jim Walls, Nuna Burnside Engineering and Environmental	
Contact Information:	**Tel:**	519-941-5331
	Fax:	519-941-8120
	email:	jwalls@rjburnside.com

Appendix C
Site Photographs

Photo 1: Ponding water at entrance to fill area

Photo 2: Active fill area and burn pile. Looking northeast.

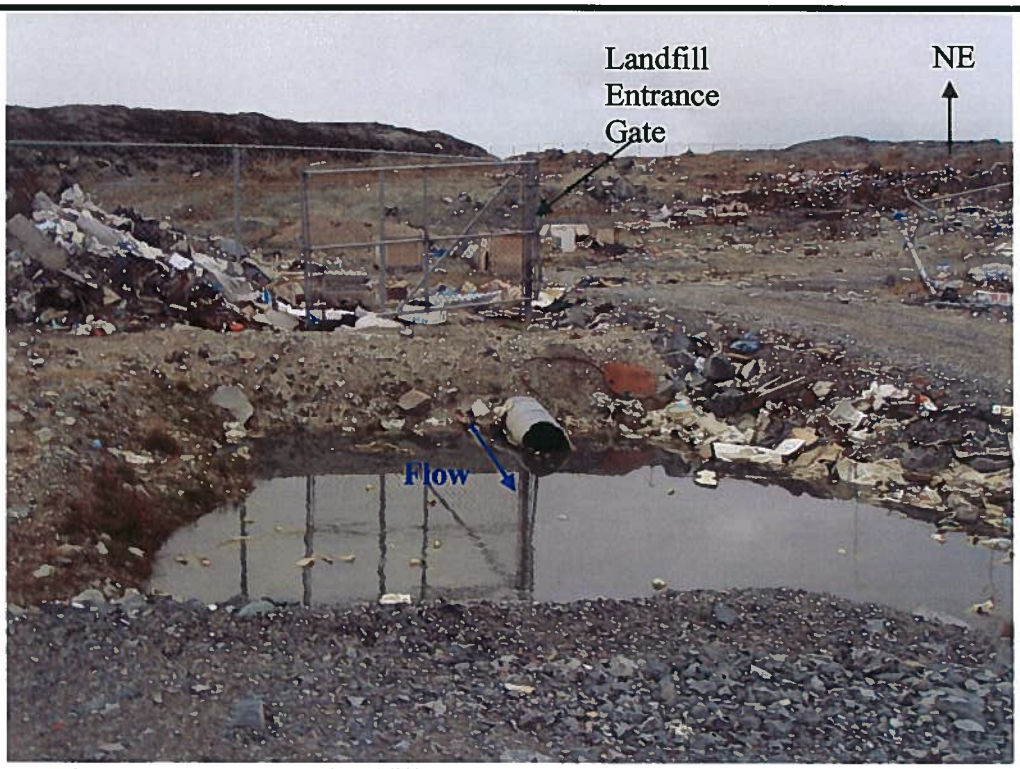

Photo 3: Entrance to landfill area, culvert draining water out of landfill

Photo 4: Water ponding outside of landfill area, Sample location LF-1. Looking west.

Photo 5: Broken fence on north side of landfill. Looking east.

Photo 6: Barrels in ground securing fence posts heaved out of ground. Looking east.

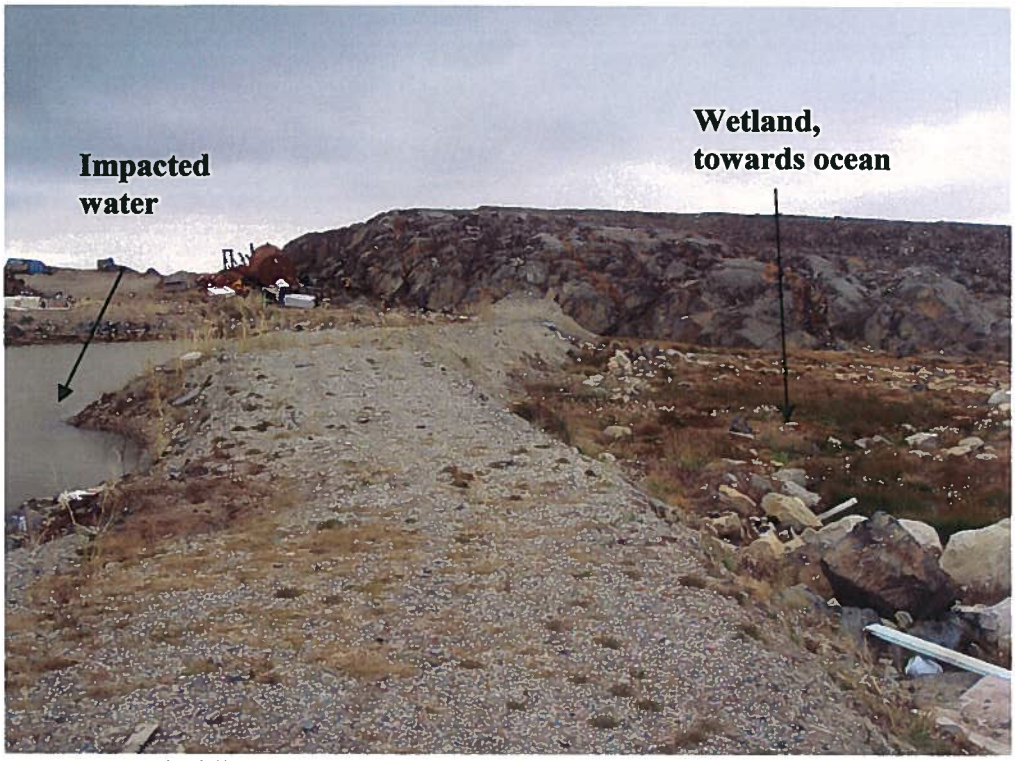

Photo 7: Berm holding water from landfill from discharging to ocean. Looking SW.

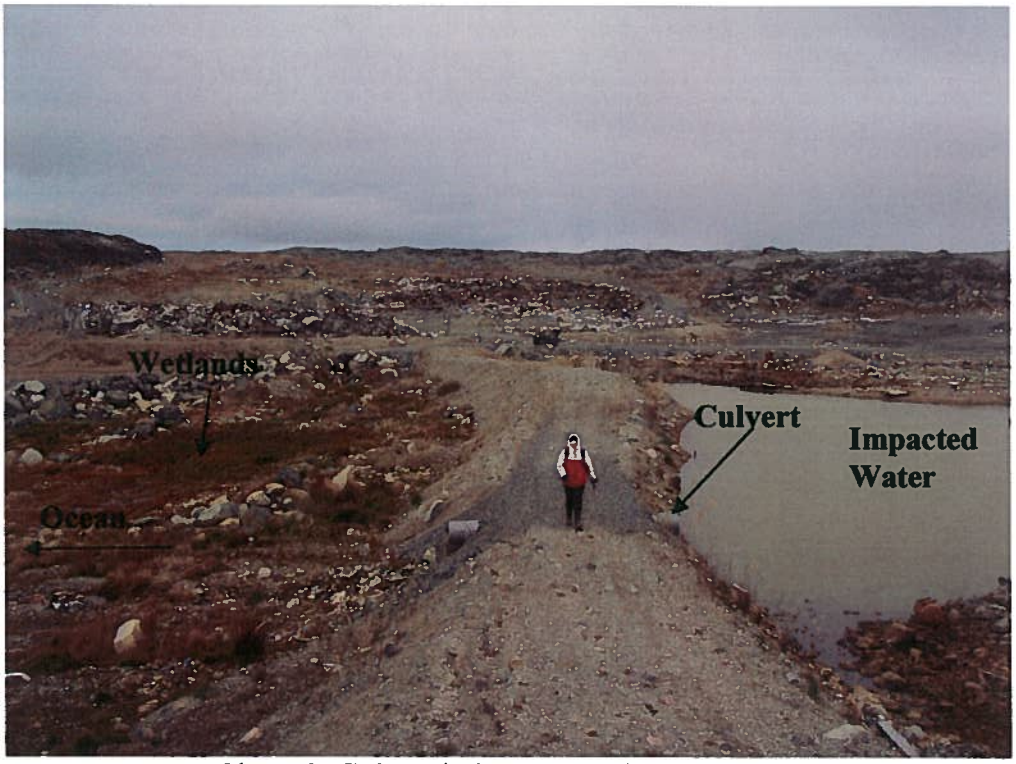

Photo 8: Culvert in berm. Looking northeast.

Photo 9: Landfill discharge towards ocean, LF-2 in distance. Looking NW.

Photo 10: Sample location LF-2. Looking SE.

Photo 11: Metal Waste Pile

Photo 12: Bulky Waste Disposal Area

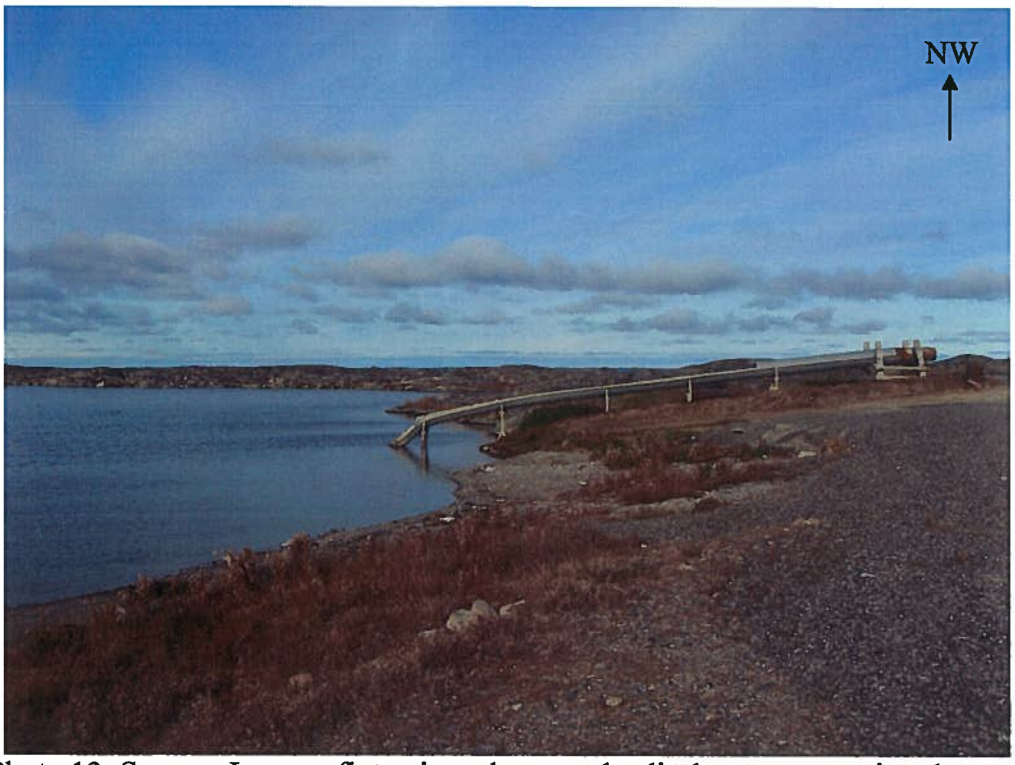

Photo 13: Sewage Lagoon flute pipe where trucks discharge sewage into lagoon.


Photo 14: Sample location SL-1, edge of lagoon near flute pipe. Looking South.

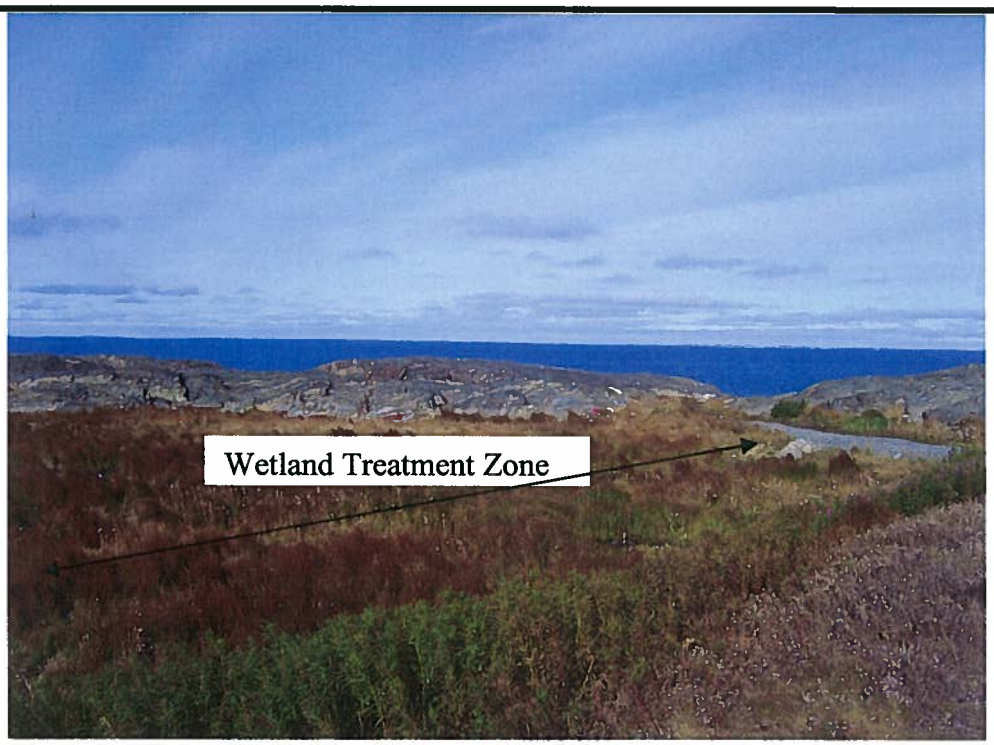

Photo 15: Wetlands down gradient of sewage lagoon. Looking SW.

Photo 16: Sample location SL-2, wetlands down gradient of sewage lagoon

Photo 17: Drainage towards ocean, sample location SL-3

Photo 18: Water Supply Facility on Fish Lake, Hamlet of Whale Cove

BURNSIDE

Appendix D
Laboratory Certificates of Analysis

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ON
CANADA L4Z 1Y2

PH: (905)712-5100
FAX: (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 08T293118

PROJECT NO: N-O 14131

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

Microbiological Analysis (water)

DATE SAMPLED: Sep 12, 2008 | **DATE RECEIVED: Sep 15, 2008** | **DATE REPORTED: Sep 24, 2008** | **SAMPLE TYPE: Water**

	Unit	G / S	RDL	SL - 1 1074867	SL - 2 1074868	SL - 3 1074869	LF - 1 1074870	LF - 2 1074871
Fecal Coliform	CFU/100ml		1	12000	7	300	30	1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ON
CANADA L4Z 1Y2

PH: (905)712-5100
FAX: (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 08T293118

PROJECT NO: N-O 14131

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

O. Reg 153 Petroleum Hydrocarbon F1 - F4 in Water

DATE SAMPLED: Sep 12, 2008 | **DATE RECEIVED: Sep 15, 2008** | **DATE REPORTED: Sep 24, 2008** | **SAMPLE TYPE: Water**

	Unit	G / S	RDL	SL - 1 1074867	LF - 2 1074871
C6 - C10 (F1)	µg/L		100	<100	<100
C6 - C10 (F1 minus BTEX)	µg/L		100	<100	<100
C>10 - C16 (F2)	µg/L		100	<100	<100
C6 - C16 (F1 + F2)	µg/L		100	<100	<100
C>16 - C34 (F3)	µg/L		500	<500	<500
C>34 - C50	µg/L		500	<500	<500
C>16 - C50 (F3 + F4)	µg/L		500	<500	<500
Gravimetric Heavy Hydrocarbons	µg/L		500	NA	NA

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

1074867-1074871

The C6-C10 fraction is calculated using Toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and nC34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16 - C50 and are only determined if the chromatogram of the C34 - C50 Hydrocarbons indicated that hydrocarbons >C50 are present.
Total C6-C50 results are corrected for BTEX and PAH contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified without the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ON
CANADA L4Z 1Y2

PH: (905)712-5100
FAX: (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 08T293118
PROJECT NO: N-O 14131

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

O. Reg 153 Petroleum Hydrocarbon F1 in Water

DATE SAMPLED: Sep 12, 2008 | **DATE RECEIVED: Sep 15, 2008** | **DATE REPORTED: Sep 24, 2008** | **SAMPLE TYPE: Water**

	Unit	G / S	RDL	LF - 1 1074870
C6 - C10 (F1)	µg/L		100	<100
C6 - C10 (F1 minus BTEX)	µg/L		100	<100

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

1074870 The C6-C10 fraction is calculated using Toluene response factor.
Total C6-C10 results are corrected for BTEX contributions.
nC6 and nC10 response factors are within 30% of Toluene response factor.
Extraction and holding times were met for this sample.
NA = Not Applicable

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ON
CANADA L4Z 1Y2

PH: (905)712-5100
FAX: (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 08T293118

PROJECT NO: N-O 14131

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

O. Reg. 153 - Petroleum Hydrocarbons F1 - F4 (C6 - C50) in Soil

DATE SAMPLED: Sep 12, 2008 | **DATE RECEIVED: Sep 15, 2008** | **DATE REPORTED: Sep 24, 2008** | **SAMPLE TYPE: Soil**

	Unit	G / S	RDL	LFRM - 1 1075590	LFRM - 2 1075591	LFRM - 3 1075592
Benzene	µg/g	0.002	0.10	<0.10	<0.10	<0.10
Toluene	µg/g	0.002	0.08	<0.08	<0.08	<0.08
Ethylbenzene	µg/g	0.002	0.05	<0.05	<0.05	<0.05
Xylenes (Total)	µg/g	0.002	0.07	<0.07	<0.07	<0.07
C6 - C10 (F1)	µg/g		5	13	32	23
C6 - C10 (F1 minus BTEX)	µg/g		5	13	32	23
C>10 - C16 (F2)	µg/g		10	160	760	900
C>16 - C34 (F3)	µg/g		50	<50	180	230
C>34 - C50 (F4)	µg/g		50	<50	<50	<50
Gravimetric Heavy Hydrocarbons	µg/g		50	NA	NA	NA
Moisture Content	%		0.1	9.4	8.3	8.4

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to T1(All)

1075590-1075592

Results are based on sample dry weight.
The C6-C10 fraction is calculated using toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
Total C6 - C50 results are corrected for BTEX contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified with the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.
Quality Control Data is available upon request.

Certified By:

AGAT Laboratories
5835 COOPERS AVENUE
MISSISSAUGA, ON
CANADA L4Z 1Y2
PH: (905)712-5100
FAX: (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 08T293118
PROJECT NO: N-O 14131

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

O. Regulation 153 - Volatile Organic Compounds in Water

DATE SAMPLED: Sep 12, 2008 | **DATE RECEIVED: Sep 15, 2008** | **DATE REPORTED: Sep 24, 2008** | **SAMPLE TYPE: Water**

	Unit	G / S	RDL	SL - 1 1074867	RDL	LF - 1 1074870	LF - 2 1074871
Chloromethane	µg/L		0.80	<0.80	0.40	<0.40	<0.40
Vinyl Chloride	µg/L	0.5	0.34	<0.34	0.17	<0.17	<0.17
Bromomethane	µg/L	0.9	0.40	<0.40	0.20	<0.20	<0.20
Chloroethane	µg/L		0.40	<0.40	0.20	<0.20	<0.20
Trichlorofluoromethane	µg/L		0.80	<0.80	0.40	<0.40	<0.40
Acetone	µg/L		1.00	<1.00	0.50	<0.50	<0.50
1,1 Dichloroethene	µg/L	0.66	0.60	<0.60	0.30	<0.30	<0.30
Methylene Chloride	µg/L	50	0.60	<0.60	0.30	<0.30	<0.30
trans- 1,2-dichloroethylene	µg/L	100	0.40	<0.40	0.20	<0.20	<0.20
Methyl tert-butyl ether	µg/L	200	0.40	<0.40	0.20	<0.20	<0.20
1,1-Dichloroethane	µg/L	70	0.60	<0.60	0.30	<0.30	<0.30
Methyl Ethyl Ketone	µg/L	350	1.80	<1.80	0.90	<0.90	<0.90
cis- 1,2-Dichloroethylene	µg/L	70	0.40	<0.40	0.20	<0.20	<0.20
Chloroform	µg/L	0.5	0.40	<0.40	0.20	<0.20	<0.20
1,2 - Dichloroethane	µg/L	5.0	0.40	<0.40	0.20	<0.20	<0.20
1,1,1-Trichloroethane	µg/L	10	0.60	<0.60	0.30	0.52	<0.30
Carbon Tetrachloride	µg/L	0.5	0.40	<0.40	0.20	<0.20	<0.20
Benzene	µg/L	5.0	0.40	<0.40	0.20	<0.20	<0.20
1,2-Dichloropropane	µg/L	0.7	0.40	<0.40	0.20	<0.20	<0.20
Trichloroethylene	µg/L	20	0.40	<0.40	0.20	<0.20	<0.20
Bromodichloromethane	µg/L	5.0	0.40	<0.40	0.20	<0.20	<0.20
cis-1,3-Dichloropropene	ug/L		0.40	<0.40	0.20	<0.20	<0.20
Methyl Isobutyl Ketone	µg/L		0.60	<0.60	0.30	<0.30	<0.30
trans-1,3-Dichloropropene	µg/L		0.60	<0.60	0.30	<0.30	<0.30
1,1,2-Trichloroethane	µg/L	5	0.40	<0.40	0.20	<0.20	<0.20
Toluene	µg/L	0.8	0.40	0.69	0.20	1.2	<0.20
2-Hexanone	µg/L		0.60	<0.60	0.30	<0.30	<0.30
Dibromochloromethane	µg/L	0.5	0.20	<0.20	0.10	<0.10	<0.10
Ethylene Dibromide	µg/L	1.0	0.40	<0.40	0.20	<0.20	<0.20
Tetrachloroethene	µg/L	5.0	0.20	<0.20	0.10	<0.10	<0.10
1,1,1,2-Tetrachloroethane	µg/L	5.0	0.20	<0.20	0.10	<0.10	<0.10

Certified By:

AGAT Laboratories
5835 COOPERS AVENUE
MISSISSAUGA, ON
CANADA L4Z 1Y2
PH: (905)712-5100
FAX: (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 08T293118

PROJECT NO: N-O 14131

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

O. Regulation 153 - Volatile Organic Compounds in Water

DATE SAMPLED: Sep 12, 2008 | **DATE RECEIVED: Sep 15, 2008** | **DATE REPORTED: Sep 24, 2008** | **SAMPLE TYPE: Water**

	Unit	G / S	RDL	SL - 1 1074867	RDL	LF - 1 1074870	LF - 2 1074871
Chlorobenzene	µg/L	15	0.20	<0.20	0.10	<0.10	<0.10
Ethylbenzene	µg/L	2.4	0.20	<0.20	0.10	0.16	<0.10
m & p-Xylene	µg/L		0.40	<0.40	0.20	0.38	<0.20
Bromoform	µg/L	5.0	0.20	<0.20	0.10	<0.10	<0.10
Styrene	µg/L	4.0	0.20	<0.20	0.10	<0.10	<0.10
1,1,2,2-Tetrachloroethane	µg/L	1.0	0.20	<0.20	0.10	<0.10	<0.10
o-Xylene	µg/L		0.20	<0.20	0.10	0.23	<0.10
1,3-Dichlorobenzene	µg/L	2.5	0.20	<0.20	0.10	<0.10	<0.10
1,4-Dichlorobenzene	µg/L	1.0	0.20	<0.20	0.10	<0.10	<0.10
1,2-Dichlorobenzene	µg/L	2.5	0.20	<0.20	0.10	<0.10	<0.10
1,2,4-Trichlorobenzene	µg/L	0.5	0.60	<0.60	0.30	<0.30	<0.30
1,3-Dichloropropene (Cis + Trans)	µg/L	1.4	0.60	<0.60	0.30	<0.30	<0.30
Xylenes (Total)	µg/L	72	0.40	<0.40	0.20	0.61	<0.20

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to T1(All-GW)

1074867 Results relate only to the items tested.
Surrogate Recovery for Toluene-d8:119 %
Surrogate Recovery for 4-Bromofluorobenzene:92 %
Dilution factor= 2
The sample was diluted because it foamed. The method detection limit has been corrected for the dilution factor used.

1074870 Results relate only to the items tested.
Surrogate Recovery for Toluene-d8:114 %
Surrogate Recovery for 4-Bromofluorobenzene:85 %

1074871 Results relate only to the items tested.
Surrogate Recovery for Toluene-d8:119 %
Surrogate Recovery for 4-Bromofluorobenzene:85 %

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ON
CANADA L4Z 1Y2

PH: (905)712-5100
FAX: (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 08T293118

PROJECT NO: N-O 14131

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

Water Quality Assessment + TSS,Phenols & BOD

DATE SAMPLED: Sep 12, 2008 | **DATE RECEIVED: Sep 15, 2008** | **DATE REPORTED: Sep 24, 2008** | **SAMPLE TYPE: Water**

	Unit	G / S	RDL	SL - 1 1074867	RDL	SL - 2 1074868	SL - 3 1074869	LF - 1 1074870	LF - 2 1074871
Electrical Conductivity	uS/cm		2	690	2	659	552	1200	1200
pH	N/A		N/A	7.86	N/A	8.24	8.40	8.07	8.37
Saturation pH				7.65		7.46	7.60	7.13	7.10
Langelier Index	N/A			0.21		0.78	0.80	0.94	1.27
Total Dissolved Solids	mg/L		20	402	20	372	324	702	672
Total Suspended Solids	mg/L		10	<10	10	<10	<10	<10	26
Total Hardness (as CaCO3)	mg/L		10	97	10	134	124	278	281
Alkalinity (as CaCO3)	mg/L		5	166	5	187	145	207	220
% Difference/ Ion Balance			0.1	4.3	0.1	1.3	0.4	2.0	2.5
Bicarbonate (as CaCO3)	mg/L		5	166	5	187	142	207	216
Carbonate (as CaCO3)	mg/L		5	<5	5	<5	<5	<5	<5
Hydroxide (as CaCO3)	mg/L		5	<5	5	<5	<5	<5	<5
Fluoride	mg/L		0.05	<0.05	0.05	<0.05	0.06	0.12	0.14
Chloride	mg/L		0.10	91.6	0.10	94.2	85.8	227	234
Bromide	mg/L		0.05	0.23	0.05	0.21	0.09	0.79	0.82
Nitrate as N	mg/L		0.05	0.36	0.05	1.00	<0.05	<0.05	0.27
Nitrite as N	mg/L		0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05
Sulphate	mg/L		0.10	29.3	0.10	5.62	9.17	72.2	57.6
Orthophosphate as P	mg/L		0.10	3.08	0.10	1.10	<0.10	<0.10	<0.10
Total Phosphorus	mg/L		0.5	4.1	0.05	1.36	< 0.05	0.14	0.09
Ammonia as N	mg/L		0.02	18.6	0.02	1.83	<0.02	0.65	0.08
Total Organic Carbon	mg/L		0.5	35	0.5	14.7	10.3	8.5	8.7
Reactive Silica	mg/L		0.05	9.33	0.05	7.53	0.15	5.43	2.84
Colour	TCU		5	140	5	50	37	27	28
Turbidity	NTU		0.5	15	0.5	1.6	0.6	16	1.3
Calcium	mg/L		0.05	27.7	0.05	42.1	37.0	77.7	74.9
Magnesium	mg/L		0.05	6.76	0.05	7.07	7.73	20.4	22.9
Sodium	mg/L		0.05	79.4	0.05	75.2	64.5	132	131
Potassium	mg/L		0.05	16.0	0.05	13.0	7.20	9.27	11.7
Aluminum	mg/L		0.004	0.426	0.004	0.013	0.005	0.009	0.008
Arsenic	mg/L		0.003	<0.003	0.003	0.007	<0.003	0.006	0.003

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ON
CANADA L4Z 1Y2

PH: (905)712-5100
FAX: (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 08T293118

PROJECT NO: N-O 14131

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

Water Quality Assessment + TSS,Phenols & BOD

DATE SAMPLED: Sep 12, 2008 | **DATE RECEIVED: Sep 15, 2008** | **DATE REPORTED: Sep 24, 2008** | **SAMPLE TYPE: Water**

	Unit	G / S	RDL	SL - 1 1074867	RDL	SL - 2 1074868	SL - 3 1074869	LF - 1 1074870	LF - 2 1074871
Barium	mg/L		0.002	0.006	0.002	0.009	0.012	0.036	0.019
Boron	mg/L		0.010	0.099	0.010	0.078	0.059	0.212	0.248
Cadmium	mg/L		0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002
Chromium	mg/L		0.003	0.003	0.003	0.003	<0.003	0.008	0.005
Copper	mg/L		0.003	0.018	0.003	<0.003	<0.003	<0.003	<0.003
Iron	mg/L		0.010	0.296	0.010	0.346	0.076	2.01	0.311
Lead	mg/L		0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002
Manganese	mg/L		0.002	0.083	0.002	0.074	0.006	0.292	0.065
Mercury	mg/L		0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	mg/L		0.002	<0.002	0.002	<0.002	0.002	0.057	0.033
Nickel	mg/L		0.003	0.003	0.003	0.003	<0.003	0.004	0.004
Selenium	mg/L		0.004	<0.004	0.004	<0.004	<0.004	<0.004	<0.004
Silver	mg/L		0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002
Strontium	mg/L		0.005	0.109	0.005	0.203	0.214	0.503	0.562
Thallium	mg/L		0.006	<0.006	0.006	<0.006	<0.006	<0.006	<0.006
Titanium	mg/L		0.002	0.007	0.002	<0.002	<0.002	<0.002	<0.002
Uranium	mg/L		0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002
Vanadium	mg/L		0.002	<0.002	0.002	<0.002	<0.002	0.002	0.002
Zinc	mg/L		0.005	0.046	0.005	0.012	0.013	0.023	0.014
Phenols	mg/L		0.001	0.003	0.001	0.002	<0.001	0.008	0.001
BOD (5)	mg/L		5	<5	5	<5	<5	<5	<5

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ON
CANADA L4Z 1Y2

PH: (905)712-5100
FAX: (905)712-5122
http://www.agatlabs.com

Guideline Violation

AGAT WORK ORDER: 08T293118
PROJECT NO: N-O 14131

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

SAMPLE ID	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
1074870	T1(All-GW)	O. Regulation 153 - Volatile Organic Compounds in Water	Toluene	0.8	1.2

BURNSIDE

Appendix E
INAC Inspection Report (July 31, 2008)

Indian and Northern Affairs Canada | Affaires Indiennes et du Nord Canada

WATER USE INSPECTION REPORT

Date: July 31st ,2008	**Licensee Rep.** (Name/Title): Mr. Guy Enuapik – Hamlet Foreman
Licensee: Hamlet of Whale Cove	**Licence No.:** NWB3WHA0207 (Expired)

WATER SUPPLY

Source(s): Fish Lake	**Quantity used: Unknown** – Records incomplete
Owner:/Operator: Government of Nunavut	Treatment systems operated by C&GS , GN

Indicate: **A** - Acceptable **U** - Unacceptable **NA** - Not Applicable **NI** - Not Inspected

Intake Facilities: A	**Storage Structure:** A	**Treatment Systems:** A	**Chemical Storage:** NI
Flow Meas. Device: U	**Conveyance Lines:** A	**Pumping Stations:** A	**Screen : NI**

Comments: The Government of Nunavut, Dept. of Community and Government Services provides the oversight and drinking water treatment services for the community. Chlorine reservoir was nearly empty during period of Inspection and Pump house floor was covered with dead flies. Records were on site.

WASTE DISPOSAL

Sewage: **Sewage Treatment System** (Prim./Sec/Ter.): **Primary cell and wetlands treatment**

Natural Water Body: No	**Continuous Discharge** (land or water): **seepages**	
Seasonal Discharge: Decanting	**Wetlands Treatment:** Y	**Trench:** None

Solid Waste: Non-combustible waste consolidated at waste metals area.
Owner/Operator: Hamlet of Whale Cove

Landfill: A- some segregation	**Burn & Landfill:** A	**Other:**

Indicate: **A** - Acceptable **U** - Unacceptable **NA** - Not Applicable **NI** - Not Inspected

Discharge Quality: U	**Decant Structure:** NI	**Erosion:** A
Discharge Meas. Device: NA	**Dyke Inspection:** NA	**Seepages:** U
Dams, Dykes: NI	**Freeboard:** A	**Spills:** A
Construction: NI	**O&M Plan:** U	**A&R Plan:** U
Periods of Discharge: Cont.	**Effluent Discharge Rate:** Unknown	

Comments: Sampled discharge from Waste metals area and Lagoon seepage.

FUEL STORAGE:

Waste Oil Storage: None noted **Owner/Operator:** Nunavut Power Corp.

Indicate: **A** - Acceptable **U** - Unacceptable **NA** - Not Applicable **NI** - Not Inspected

Berms & Liners: NI	**Water within Berms:** NI	**Evidence of Leaks:** NI
Drainage Pipes: NI	**Pump Station & Catchments Berm:** NI	
Pipeline Condition: NI	**Condition of Tanks: NI**	

SURVEILLANCE NETWORK PROGRAM (SNP)

Samples Collected: 0	**Owner /Operator:** No samples from Municipality have been submitted	
Samples Collected: 3	**INAC:** Potable- Lake, Effluent discharge, Dump Leachate	
Signs Posted	**SNP:** None	**Warning: Some signs were noted**
Records & Reporting: No records of water usage, waste discharge.		
Geotechnical Inspection: N/A		

Non-Compliance of Act or Licence: The Hamlet of Whale Cove does not currently have a water license. The Municipality is currently in contravention of the Act. The Community has not been collecting samples nor filing the required paperwork. The Municipality was advised to contact the Nunavut Water Board as soon as possible to process an application.

A.Keim
Inspector's Name

Sent by E-mail
Inspector's Signature

BURNSIDE

Appendix F
Canadian Water and Soil Quality Guidelines

Canadian Water Quality Guidelines for the Protection of Aquatic Life

SUMMARY TABLE

Update 7.0
September 2007

Summary of Canadian water quality guidelines for the protection of aquatic life.

	Freshwater		Marine	
Parameter[a]	**Concentration ($\mu g \cdot L^{-1}$)**	**Date[b]**	**Concentration ($\mu g \cdot L^{-1}$)**	**Date[b]**
Acenaphthene [See Polycyclic aromatic hydrocarbons (PAHs)]				
Acridine [See Polycyclic aromatic hydrocarbons (PAHs)]				
Aldicarb	1[c]	1993	0.15[c]	1993
Aldrin + Dieldrin[d]	~~0.004~~ [e,f]	1987		
Aluminium[d]	5–100[g]	1987		
Ammonia (total)	see factsheet	2001		
Ammonia (un-ionized)	19[h]	2001		
Aniline	2.2[i]	1993	Insufficient data	1993
Anthracene [See Polycyclic aromatic hydrocarbons (PAHs)]				
Arsenic[j]	5.0[k]	1997	12.5[c]	1997
Atrazine	1.8[i]	1989		
Benz*(a)*anthracene [See Polycyclic aromatic hydrocarbons (PAHs)]				
Benzene[j]	370[c, k]	1999	110[c]	1999
Benzo*(a)*pyrene [See Polycyclic aromatic hydrocarbons (PAHs)]				
2,2-Bis(*p*-chlorophenyl)-1,1,1-trichloroethane [See DDT (total)]				
Bromacil	5.0[c,i]	1997	Insufficient data	1997
Bromoform [See Halogenated methanes, Tribromomethane]				
Bromoxynil	5.0[i]	1993	Insufficient data	1993
Cadmium	0.017[c,l]	1996	0.12[i]	1996
Captan	1.3[c]	1991		
Carbaryl	0.20[i]	1997	0.32[c,i]	1997
Carbofuran	1.8[i]	1989		
Carbon tetrachloride [See Halogenated methanes, Tetrachloromethane]				
Chlordane[d]	~~0.006~~ [e,f]	1987		
Chlorinated benzenes				
Monochlorobenzene	1.3[c,k]	1997	25[c,k]	1997
1,2-Dichlorobenzene	0.70[c,k]	1997	42[c,k]	1997
1,3-Dichlorobenzene	150[c,k]	1997	Insufficient data[k]	1997
1,4-Dichlorobenzene	26[c,k]	1997	Insufficient data[k]	1997
1,2,3-Trichlorobenzene	8.0[c,k]	1997	Insufficient data[k]	1997
1,2,4-Trichlorobenzene	24[c,k]	1997	5.4[c,k]	1997
1,3,5-Trichlorobenzene[d]	Insufficient data[k]	1997	Insufficient data[k]	1997

Continued.

Parameter[a]	Freshwater		Marine	
	Concentration ($\mu g \cdot L^{-1}$)	Date[b]	Concentration ($\mu g \cdot L^{-1}$)	Date[b]
Chlorinated benzenes—Continued				
1,2,3,4-Tetrachlorobenzene	1.8[c,k]	1997	Insufficient data[k]	1997
1,2,3,5-Tetrachlorobenzene[d]	Insufficient data[k]	1997	Insufficient data[k]	1997
1,2,4,5-Tetrachlorobenzene[d]	Insufficient data[k]	1997	Insufficient data[k]	1997
Pentachlorobenzene	6.0[c,k]	1997	Insufficient data[k]	1997
Hexachlorobenzene[d]	Insufficient data[e,f,k]	1997	Insufficient data[k]	1997
Chlorinated ethanes				
1,2-Dichloroethane	100[c,i]	1991	Insufficient data	1991
1,1,1-Trichloroethane	Insufficient data	1991	Insufficient data	1991
1,1,2,2-Tetrachloroethane	Insufficient data	1991	Insufficient data	1991
Chlorinated ethenes				
1,1,2-Trichloroethene (Tichloroethylene; TCE)	21[c,i]	1991	Insufficient data	1991
1,1,2,2-Tetrachloroethene (Tetrachloroethylene; PCE)	111[c,i]	1993	Insufficient data	1993
Chlorinated methanes [See Halogenated methanes]				
Chlorinated phenols[d]				
Monochlorophenols	7	1987		
Dichlorophenols	0.2	1987		
Trichlorophenols	18	1987		
Tetrachlorophenols	1	1987		
Pentachlorophenol (PCP)	0.5	1987		
Chlorine, reactive [See Reactive chlorine species]				
Chloroform [See Halogenated methanes, Trichloromethane]				
4-Chloro-2-methyl phenoxy acetic acid [See MCPA]				
Chlorothalonil	0.18[c]	1994	0.36[c]	1994
Chlorpyrifos	0.0035	1997	0.002[c]	1997
Chromium				
Trivalent chromium (Cr(III))	8.9[c,k]	1997	56[c,k]	1997
Hexavalent chromium (Cr(VI))	1.0[k]	1997	1.5[k]	1997
Chrysene [See Polycyclic aromatic hydrocarbons (PAHs)]				
Colour	Narrative	1999	Narrative	1999
Copper[d]	2–4[m]	1987		
Cyanazine	2.0[c,i]	1990		
Cyanide[d]	5 (as free CN)	1987		
DDAC (Didecyl dimethyl ammonium chloride)	1.5[c]	1999	Insufficient data	1999
DDT (total)[d] (2,2-Bis(*p*-chlorophenyl)-1,1,1-trichloroethane; dichloro diphenyl trichloroethane)	~~0.001~~[e,f]	1987		
Debris (litter/settleable matter)			Narrative[c]	1996

Continued.

	Freshwater		Marine	
Parameter[a]	**Concentration ($\mu g \cdot L^{-1}$)**	**Date**[b]	**Concentration ($\mu g \cdot L^{-1}$)**	**Date**[b]
Deltamethrin	0.0004	1997	Insufficient data	1997
Deposited bedload sediment [See Total particulate matter]				
Dibromochloromethane [See Halogenated methanes]				
Dicamba	10[c,i]	1993		
Dichlorobenzene [See Chlorinated benzenes]				
Dichlorobromomethane [See Halogenated methanes]				
Dichloro diphenyl trichloroethane [See DDT (total)]				
Dichloroethane [See Chlorinated ethanes]				
Dichloroethylene [See Chlorinated ethanes, 1,2-Dichloroethane]				
Dichloromethane [See Halogenated methanes]				
Dichlorophenols [See Chlorinated phenols]				
2,4-Dichlorophenoxyacetic acid [see Phenoxy herbicides]				
Diclofop-methyl	6.1	1993		
Didecyl dimethyl ammonium chloride [See DDAC]				
Diethylene glycol [See Glycols]				
Di(2-ethylhexyl) phthalate [See Phthalate esters]				
Diisopropanolamine (DIPA)[aa]	1600[c]	2005	Insufficient data	2005
Dimethoate	6.2[c]	1993	Insufficient data	1993
Di-*n*-butyl phthalate [See Phthalate esters]				
Di-*n*-octyl phthalate [See Phthalate esters]				
Dinoseb	0.05	1992		
Dissolved gas supersaturation	Narrative	1999	Narrative	1999
Dissolved oxygen	5500–9500[k,n]	1999	>8000 and Narrative[c,k]	1996
Endosulfan[d]	0.02	1987		
Endrin[d]	~~0.0023~~[e,f]	1987		
Ethylbenzene[j]	90[c,k]	1996	25[c,k]	1996
Ethylene glycol [See Glycols]				
Fluoranthene [See Polycyclic aromatic hydrocarbons (PAHs)]				
Fluorene [See Polycyclic aromatic hydrocarbons (PAHs)]				
Glycols				
Ethylene glycol	192 000[k]	1997	Insufficient data	1997
Diethylene glycol	Insufficient data[k]	1997	Insufficient data	1997
Propylene glycol	500 000[k]	1997	Insufficient data	1997
Glyphosate	65[c]	1989		

Continued.

Parameter[a]	Freshwater		Marine	
	Concentration ($\mu g \cdot L^{-1}$)	Date[b]	Concentration ($\mu g \cdot L^{-1}$)	Date[b]
Halogenated methanes				
Monochloromethane (Methyl chloride)[d]	Insufficient data	1992	Insufficient data	1992
Dichloromethane (Methylene chloride)	98.1[c,i]	1992	Insufficient data	1992
Trichloromethane (Chloroform)	1.8[c,i]	1992	Insufficient data	1992
Tetrachloromethane (Carbon tetrachloride)	13.3[c,i]	1992	Insufficient data	1992
Monobromomethane (Methyl bromide)[d]	Insufficient data	1992	Insufficient data	1992
Tribromomethane (Bromoform)[d]	Insufficient data	1992	Insufficient data	1992
Dibromochloromethane[d]	Insufficient data	1992	Insufficient data	1992
Dichlorobromomethane[d]	Insufficient data	1992	Insufficient data	1992
HCBD [See Hexachlorobutadiene (HCBD)]				
Heptachlor (Heptachlor epoxide)[d]	~~0.01~~[e,f]	1987		
Hexachlorobenzene [See Chlorinated benzenes]				
Hexachlorobutadiene (HCBD)	1.3[c, k]	1999		
Hexachlorocyclohexane (Lindane)[d]	0.01	1987		
Hypochlorous acid [See Reactive chlorine species]				
Imidacloprid[aa]	0.23[c]	2007	0.65[c]	2007
Inorganic fluorides	120[c]	2002		
3-Iodo-2-propynyl butyl carbamate [See IPBC]				
IPBC (3-Iodo-2-propynyl butyl carbamate)	1.9[c]	1999		
Iron[d]	300	1987		
Lead[d]	1–7[o]	1987		
Lindane [See Hexachlorocyclohexane]				
Linuron	7.0[c]	1995	Insufficient data	1995
MCPA (4-Chloro-2-methyl phenoxy acetic acid; 2-methyl-4-chloro phenoxy acetic acid)	2.6[c]	1995	4.2[c]	1995
Mercury[v]				
Inorganic Mercury[v]	0.026	2003	0.016[c,w]	2003
Methylmercury[v]	0.004[c,w]	2003		
Methyl bromide [See Halogenated methanes, Monobromomethane]				
Methyl chloride [See Halogenated methanes, Monochloromethane]				
2-Methyl-4-chloro phenoxy acetic acid [See MCPA]				
Methylene chloride [See Halogenated methanes, Dichloromethane]				
Methyl *tertiary*-butyl ether [See MTBE]				
Metolachlor	7.8[c]	1991		
Metribuzin	1.0[c]	1990		
Molybdenum[j]	73[c]	1999		
Monobromomethane [See Halogenated methanes]				
Monochloramine [See Reactive chlorine species]				

Continued.

Parameter[a]	Freshwater		Marine	
	Concentration ($\mu g \cdot L^{-1}$)	Date[b]	Concentration ($\mu g \cdot L^{-1}$)	Date[b]
Monochlorobenzene [See Chlorinated benzenes]				
Monochloromethane [See Halogenated methanes]				
Monochlorophenols [See Chlorinated phenols]				
MTBE (methyl *tertiary*-butyl ether)	10 000[c]	2003	5 000[c]	2003
Naphthalene [See Polycyclic aromatic hydrocarbons (PAHs)]				
Nickel[d]	25–150[p]	1987		
Nitrate	13 000[c,u,y]	2003	16 000[c,u,y]	2003
Nitrite[d]	60[z]	1987		
Nonylphenol and its ethoxylates	1.0[c,t]	2002	0.7[c,t]	2002
Nutrients	Guidance Framework[x]	2004	Guidance Framework [aa,bb]	2007
Organotins				
Tributyltin	0.008[c]	1992	0.001[c]	1992
Tricyclohexyltin	Insufficient data	1992	Insufficient data	1992
Triphenyltin	0.022[c,i]	1992	Insufficient data	1992
Oxygen, dissolved [See Dissolved oxygen]				
PAHs [See Polycyclic aromatic hydrocarbons (PAHs)]				
PCBs [See Polychlorinated biphenyls (PCBs)(total)]				
PCE [See Chlorinated ethenes, 1,1,2,2-Tetrachloroethene]				
PCP [See Chlorinated phenols, Pentachlorophenol]				
Pentachlorobenzene [See Chlorinated benzenes]				
Pentachlorophenol [See Chlorinated phenols]				
Permethrin[aa]	0.004[c]	2006	0.001[c]	2006
pH[d]	6.5–9	1987	7.0–8.7 and Narrative	1996
Phenanthrene [See Polycyclic aromatic hydrocarbons (PAHs)]				
Phenols (mono- & dihydric)	4.0[k]	1999		
Phenoxy herbicides[d, q]	4.0	1987		
Phosphorus	Guidance Framework[x]	2004	Guidance Framework[bb]	2007
Phthalate esters				
Di-*n*-butyl phthalate	19[c]	1993	Insufficient data	1993
Di(2-ethylhexyl) phthalate	16[c]	1993	Insufficient data	1993
Di-*n*-octyl phthalate	Insufficient data	1993	Insufficient data	1993
Picloram	29[c]	1990		
Polychlorinated biphenyls (PCBs) (total)[d]	~~0.001~~[e,f]	1987	~~0.01~~[e,f]	1991

Continued.

Parameter[a]	Freshwater		Marine	
	Concentration ($\mu g \cdot L^{-1}$)	Date[b]	Concentration ($\mu g \cdot L^{-1}$)	Date[b]
Polycyclic aromatic hydrocarbons (PAHs)				
Acenaphthene	5.8[c]	1999	Insufficient data	1999
Acridine	4.4[c]	1999	Insufficient data	1999
Anthracene	0.012[c]	1999	Insufficient data	1999
Benz*(a)*anthracene	0.018[c]	1999	Insufficient data	1999
Benzo*(a)*pyrene	0.015[c]	1999	Insufficient data	1999
Chrysene	Insufficient data	1999	Insufficient data	1999
Fluoranthene	0.04[c]	1999	Insufficient data	1999
Fluorene	3.0[c]	1999	Insufficient data	1999
Naphthalene	1.1[c]	1999	1.4[c]	1999
Phenanthrene	0.4[c]	1999	Insufficient data	1999
Pyrene	0.025[c]	1999	Insufficient data	1999
Quinoline	3.4[c]	1999	Insufficient data	1999
Propylene glycol [See Glycols]				
Pyrene [See Polycyclic aromatic hydrocarbons (PAHs)]				
Quinoline [See Polycyclic aromatic hydrocarbons (PAHs)]				
Reactive chlorine species (hypochlorous acid and monochloramine)	0.5 and Narrative	1999	0.5 and Narrative	1999
Salinity			<10% fluctuation[c]	1996
Selenium[d]	1.0	1987		
Silver[d]	0.1	1987		
Simazine	10	1991		
Streambed substrate [See Total particulate matter]				
Styrene	72[c]	1999		
Sulfolane[aa]	50 000[c]	2005	Insufficient data	2005
Suspended sediments [See Total particulate matter]				
TCE [See Chlorinated ethenes, 1,1,2-Trichloroethene]				
Tebuthiuron	1.6[c]	1995	Insufficient data	1995
Temperature	Narrative[s]	1987	Not to exceed ±1°C and Narrative[c]	1996
Tetrachlorobenzene [See Chlorinated benzenes]				
Tetrachloroethane [See Chlorinated ethanes]				
Tetrachloroethene [See Chlorinated ethenes]				
Tetrachloroethylene [See Chlorinated ethenes, 1,1,2,2-Tetrachloroethene]				

Continued.

Parameter[a]	Freshwater		Marine	
	Concentration ($\mu g \cdot L^{-1}$)	Date[b]	Concentration ($\mu g \cdot L^{-1}$)	Date[b]
Tetrachloromethane [See Halogenated methanes]				
Tetrachlorophenols [See Chlorinated phenols]				
Thallium[j]	0.8	1999		
Toluene	2.0[c,j,k]	1996	215[c,k]	1996
Total particulate matter				
Deposited bedload sediment	Insufficient data	1999	Insufficient data	1999
Streambed substrate	Narrative	1999	Narrative	1999
Suspended sediments	Narrative	1999	Narrative	1999
Turbidity	Narrative	1999	Narrative	1999
Toxaphene[d]	~~0.008~~ [e,f]	1987		
Triallate	0.24[c]	1992		
Tribromomethane [See Halogenated methanes]				
Tributyltin [See Organotins]				
Trichlorobenzene [See Chlorinated benzenes]				
Trichloroethane [See Chlorinated ethanes]				
Trichloroethene [See Chlorinated ethenes]				
Trichloroethylene [See Chlorinated ethenes, 1,1,2-Trichloroethene]				
Trichloromethane [See Halogenated methanes]				
Trichlorophenols [See Chlorinated phenols]				
Tricyclohexyltin [See Organotins]				
Trifluralin	0.20[i]	1993		
Triphenyltin [See Organotins]				
Turbidity [See Total particulate matter]				
Zinc[d]	30	1987		

[a]Unless otherwise indicated, supporting documents are available from the National Guidelines and Standards Office, Environment Canada.

[b]The guidelines dated 1987 have been carried over from *Canadian Water Quality Guidelines* (CCREM 1987) and no fact sheet was prepared. The guidelines dated 1989 to 1997 were developed and initially published in CCREM 1987 as appendixes on the date indicated. They are published as fact sheets in this document. Other guidelines dated 1997 and those dated 1999 are published for the first time in this document.

[c]Interim guideline.

[d]No fact sheet created. For more information on this guideline, please refer to *Canadian Water Quality Guidelines* (CCREM 1987).

[e]This guideline (originally published in *Canadian Water Quality Guidelines* [CCREM 1987 + Appendixes] in 1987 or 1991 [PCBs in marine waters]) is no longer recommended and the value is withdrawn. A water quality guideline is not recommended. Environmental exposure is predominantly via sediment, soil, and/or tissue, therefore, the reader is referred to the respective guidelines for these media.

[f]This substance meets the criteria for Track 1 substances under the national CCME Policy for the Management of Toxic Substances (PMTS) (i.e., persistent, bioaccumulative, primarily the result of human activity, and CEPA-toxic or equivalent), and should be subject to virtual elimination strategies. Guidelines can serve as action levels or interim management objectives towards virtual elimination.

[g]Aluminium guideline= 5 $\mu g \cdot L^{-1}$ at pH <6.5
= 100 $\mu g \cdot L^{-1}$ at pH ≥6.5

[h]Ammonia guideline: Expressed as µg unionized ammonia·L^{-1}. This would be equivalent to 15.2 µg ammonia-nitrogen·L^{-1}. Guideline for total ammonia is temperature and pH dependent, please consult factsheet for more information.

[i]Guideline value slightly modified from CCREM 1987 + Appendixes due to re-evaluation of the significant figures.

[j]The technical document for the guideline is available from the Ontario Ministry of the Environment.

[k]Substance has been re-evaluated since CCREM 1987 + Appendixes. Either a new guideline has been derived or insufficient data existed to derive a new guideline.

[l]Cadmium guideline = $10^{\{0.86[\log(\text{hardness})] - 3.2\}}$.

[m]Copper guideline = 2 $\mu g \cdot L^{-1}$ at a water hardness of 0–120 $mg \cdot L^{-1}$ (soft to medium) as $CaCO_3$
= 3 $\mu g \cdot L^{-1}$ at a water harness of 120–180 $mg \cdot L^{-1}$ (hard) as $CaCO_3$
= 4 $\mu g \cdot L^{-1}$ at a water harness >180 $mg \cdot L^{-1}$ (very hard) as $CaCO_3$

[n]Dissolved oxygen for warm-water biota: early life stages = 6000 $\mu g \cdot L^{-1}$
other life stages = 5500 $\mu g \cdot L^{-1}$
for cold-water biota: early life stages = 9500 $\mu g \cdot L^{-1}$
other life stages = 6500 $\mu g \cdot L^{-1}$

[o]Lead guideline = 1 $\mu g \cdot L^{-1}$ at a water harness of 0–60 $mg \cdot L^{-1}$ (soft) as $CaCO_3$
= 2 $\mu g \cdot L^{-1}$ at a water harness of 60–120 $mg \cdot L^{-1}$ (medium) as $CaCO_3$
= 4 $\mu g \cdot L^{-1}$ at a water harness of 120–180 $mg \cdot L^{-1}$ (hard) as $CaCO_3$
= 7 $\mu g \cdot L^{-1}$ at a water harness >180 $mg \cdot L^{-1}$ (very hard) as $CaCO_3$

[p]Nickel guideline = 25 $\mu g \cdot L^{-1}$ at a water harness of 0–60 $mg \cdot L^{-1}$ (soft) as $CaCO_3$
= 65 $\mu g \cdot L^{-1}$ at a water harness of 60–120 $mg \cdot L^{-1}$ (medium) as $CaCO_3$
= 110 $\mu g \cdot L^{-1}$ at a water harness of 120–180 $mg \cdot L^{-1}$ (hard) as $CaCO_3$
= 150 $\mu g \cdot L^{-1}$ at a water harness >180 $mg \cdot L^{-1}$ (very hard) as $CaCO_3$

[q]The guideline of 4.0 $\mu g \cdot L^{-1}$ for phenoxy herbicides is based on data for ester formulations of 2,4-dichlorophenoxyacetic acid.

[r]The technical document for the guideline is available from British Columbia Ministry of Environment, Lands and Parks.

[s]Temperature: (for more information, see CCREM 1987)

Thermal Stratification: Thermal additions to receiving waters should be such that thermal stratification and subsequent turnover dates are not altered from those existing prior to the addition of heat from artificial origins.

Maximum Weekly Average Temperature: Thermal additions to receiving waters should be such that the maximum weekly average temperature is not exceeded.

Short-term Exposure to Extreme Temperature: Thermal additions to receiving waters should be such that the short-term exposures to maximum temperatures are not exceeded. Exposures should not be so lengthy or frequent as to adversely affect the important species.

[t]Expressed on a TEQ basis using NP TEFs, see Table 2 in factsheet.

[u]For protection from direct toxic effects; the guidelines do not consider indirect effects due to eutrophication.

[v]May not prevent accumulation of methylmercury in aquatic life, therefore, may not protect wildlife that consume aquatic life; see factsheet for details. Consult also the appropriate Canadian Tissue Residue Guideline for the Protection of Wildlife Consumers of Aquatic Biota.

[w]May not fully protect higher trophic level fish; see factsheet for details.

[x]Canadian Guidance Framework for Phosphorus is for developing phosphorus guidelines (does not provide guidance on other freshwater nutrients). It provides Trigger Ranges for Total Phosphorus (see Guidance Framework for Phosphorus factsheet):

ultra-oligotrophic <4 $\mu g \cdot L^{-1}$
oligotrophic 4-10 $\mu g \cdot L^{-1}$
mesotrophic 10-20 $\mu g \cdot L^{-1}$
meso-eutrophic 20-35 $\mu g \cdot L^{-1}$
eutrophic 35-100 $\mu g \cdot L^{-1}$
hyper-eutrophic >100 $\mu g \cdot L^{-1}$

[y]Guidelines are expressed in μg nitrate$\cdot L^{-1}$. These values are equivalent to 2900 μg nitrate-nitrogen$\cdot L^{-1}$, and 3600 μg nitrate-nitrogen$\cdot L^{-1}$, for freshwater and marine respectively.

[z]Guideline is expressed as μg nitrite-nitrogen$\cdot L^{-1}$. This value is equivalent to 197 μg nitrite$\cdot L^{-1}$.

[aa]Supporting documents are available from the Canadian Council of Ministers of the Environment at http://www.ccme.ca/publications/ceqg_rcqe.html?category_id=125

[bb]The Canadian Guidance Framework for the Management of Nearshore Marine Systems is for developing nutrient (phosphorus and nitrogen) guidelines for nearshore marine systems. Refer to factsheet for details

Reference

CCREM (Canadian Council of Resource and Environment Ministers). 1987. Canadian water quality guidelines. Prepared by the Task Force on Water Quality Guidelines.

Reference listing:

Canadian Council of Ministers of the Environment. 2007. Canadian water quality guidelines for the protection of aquatic life: Summary table. Updated September, 2007. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

For further scientific information, contact:

Environment Canada
National Guidelines and Standards Office
351 St. Joseph Blvd.
Gatineau, Quebec, K1A 0H3
Phone: (819) 953-1550
Facsimile: (819) 956-5602
E-mail: ceqg-rcqe@ec.gc.ca
Internet: http://www.ec.gc.ca/ceqg-rcqe

For additional copies, contact:

CCME Documents
Toll Free: (800) 805-3025
www.ccme.ca

Aussi disponible en français

Excerpt from Publication No. 1299; ISBN 1-896997-34-1

Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health

SUMMARY TABLES

Update 7.0
September 2007

Table 1. Canadian Soil Quality Guidelines (mg·kg^{-1}).

Substance[y]	Year revised/ released[a]	Land Use and Soil Texture							
		Agricultural*		Residential/ parkland*		Commercial*		Industrial*	
		Coarse	Fine	Coarse	Fine	Coarse	Fine	Coarse	Fine
Arsenic (inorganic)	1997	12[b]		12[b]		12[b]		12[b]	
Barium	2003	750[c]		500[c]		2000[c]		2000[c]	
Benzene									
Surface[w]	2004	0.030[t,u]	0.0068[t,u]	0.030[t,u]	0.0068[t,u]	0.030[t,u]	0.0068[t,u]	0.030[t,u]	0.0068[t,u]
Subsoil[w]	2004	0.030[t,u]	0.0068[t,u]	0.030[t,u]	0.0068[t,u]	0.030[t,u]	0.0068[t,u]	0.030[t,u]	0.0068[t,u]
Surface[x]	2004	0.0095[t,u]	0.0068[t,u]	0.0095[t,u]	0.0068[t,u]	0.030[t,u]	0.0068[t,u]	0.030[t,u]	0.0068[t,u]
Subsoil[x]	2004	0.011[t,u]	0.0068[t,u]	0.011[t,u]	0.0068[t,u]	0.030[t,u]	0.0068[t,u]	0.030[t,u]	0.0068[t,u]
Benzo*(a)*pyrene	1997	0.1[e]		0.7[f]		0.7[f]		0.7[f]	
Cadmium	1999	1.4[b]		10[g]		22[b]		22[b]	
Chromium									
Total chromium	1997	64[b]		64[b]		87[b]		87[b]	
Hexavalent chromium (VI)	1999	0.4[h]		0.4[h]		1.4[h]		1.4[h]	
Copper	1999	63[b]		63[b]		91[b]		91[b]	
Cyanide (free)	1997	0.9[b]		0.9[b]		8.0[b]		8.0[b]	
DDT (total)	1999	0.7[i]		0.7[i]		12[i, j]		12[i, j]	
Diisopropanolamine (DIPA)[z]	2006	180[b]		180[b]		180[b]		180[b]	
Ethylbenzene									
Surface	2004	0.082[t]	0.018[t,u]	0.082[t]	0.018[t,u]	0.082[t]	0.018[t,u]	0.082[t]	0.018[t,u]
Subsoil	2004	0.082[t]	0.018[t,u]	0.082[t]	0.018[t,u]	0.082[t]	0.018[t,u]	0.082[t]	0.018[t,u]
Ethylene glycol	1999	960[k]		960[k]		960[k]		960[k]	
Lead	1999	70[b]		140[b]		260[b]		600[b]	
Mercury (inorganic)	1999	6.6[b]		6.6[b]		24[b]		50[b]	
Naphthalene	1997	0.1[d]		0.6[h]		22[h]		22[h]	
Nickel	1999	50[l]		50[l]		50[l]		50[l]	
Nonylphenol (and its ethyloxylates)	2002	5.7[p]		5.7[p]		14[p]		14[p]	
Pentachlorophenol	1997	7.6[b]		7.6[b]		7.6[b]		7.6[b]	
Phenol	1997	3.8[b]		3.8[b]		3.8[b]		3.8[b]	
Polychlorinated biphenyls (PCBs)	1999	0.5[m]		1.3[l]		33[j,l]		33[j,l]	
Polychlorinated dibenzo-*p*-dioxins/ dibenzofurans (PCDD/Fs)	2002	4 ng TEQ·kg^{-1} [q]		4 ng TEQ·kg^{-1} [q]		4 ng TEQ·kg^{-1} [r]		4 ng TEQ·kg^{-1} [s]	
Propylene glycol	2006	Insufficient information[v]		Insufficient information[v]		Insufficient information[v]		Insufficient information[v]	
Selenium	2007	1[b]		1[b]		2.9[b]		2.9[b]	

Continued

Substance	Year revised/ released[a]	Land Use and Soil Texture							
		Agricultural*		Residential/ parkland*		Commercial*		Industrial*	
		Coarse	Fine	Coarse	Fine	Coarse	Fine	Coarse	Fine
Sulfolane[z]	2006	0.8[b]		0.8[b]		0.8[b]		0.8[b]	
Tetrachloroethylene	1997	0.1[e]		0.2[f]		0.5[f]		0.6[f]	
Thallium	1999	1[n]		1[o]		1[o]		1[o]	
Toluene									
Surface	2004	0.37[t]	0.08[t]	0.37[t]	0.08[t]	0.37[t]	0.08[t]	0.37[t]	0.08[t]
Subsoil	2004	0.37[t]	0.08[t]	0.37[t]	0.08[t]	0.37[t]	0.08[t]	0.37[t]	0.08[t]
Trichloroethylene	2006	0.01[b,u]		0.01[b,u]		0.01[b,u]		0.01[b,u]	
Uranium[z]	2007	23[t]		23[t]		33[t]		300[t]	
Vanadium	1997	130[l]		130[l]		130[i]		130[i]	
Xylenes									
Surface	2004	11[t]	2.4[t]	11[t]	2.4[t]	11[t]	2.4[t]	11[t]	2.4[t]
Subsoil	2004	11[t]	2.4[t]	11[t]	2.4[t]	11[t]	2.4[t]	11[t]	2.4[t]
Zinc	1999	200[l]		200[l]		360[l]		360[l]	

Notes: SQG_E = soil quality guideline for environmental health; SQG_{HH} = soil quality guideline for human health.

*For guidelines derived prior to 2004, differentiation between soil texture (coarse/fine) is not applicable.

[a]Guidelines released in 1997 were originally published in the working document entitled "Recommended Canadian Soil Quality Guidelines" (CCME 1997) and have been revised, edited, and reprinted here. Guidelines revised/released in 1999 are published here for the first time (see Table 2).

[b]Data are sufficient and adequate to calculate an SQG_{HH} and an SQG_E. Therefore the soil quality guideline is the lower of the two and represents a fully integrated *de novo* guideline for this land use, derived in accordance with the soil protocol (CCME 1996; 2006). The corresponding interim soil quality criterion (CCME 1991) is superseded by the soil quality guideline.

[c]Data are insufficient/inadequate to calculate an SQG_{HH}, a provisional SQG_{HH}, an SQG_E, or a provisional SQG_E. Therefore the interim soil quality criterion (CCME 1991) is retained as the soil quality guideline for this land use (see table 2).

[d]Data are sufficient and adequate to calculate only a provisional SQG_E. It is greater than the corresponding interim soil quality criterion (CCME 1991). Therefore, in consideration of receptors and/or pathways not examined, the interim soil quality criterion is retained as the soil quality guideline for this land use.

[e]Data are sufficient and adequate to calculate an SQG_{HH} and a provisional SQG_E. Both are greater than the corresponding interim soil quality criterion (CCME 1991). Therefore, in consideration of receptors and/or pathways not examined, the interim soil quality criterion is retained as the soil quality guideline for this land use.

[f]Data are sufficient and adequate to calculate an SQG_{HH} and a provisional SQG_E. Both are less than corresponding interim soil quality criterion (CCME 1991). Therefore the soil quality guideline supersedes the interim soil quality criterion for this land use.

[g]The soil–plant–human pathway was not considered in the guideline derivation. If produce gardens are present or planned, a site-specific objective must be derived to take into account the bioaccumulation potential (e.g., adopt the agricultural guideline as objective). The off-site migration check should be recalculated accordingly.

[h]Data are sufficient and adequate to calculate only a provisional SQG_E, which is less than the existing interim soil quality criterion (CCME 1991). Therefore the provisional soil quality guideline supersedes the interim soil quality criterion for this land use.

[i]Data are sufficient and adequate to calculate only an SQG_E. An interim soil quality criterion (CCME 1991) was not established for this land use, therefore the SQG_E becomes the soil quality guideline.

[j]In site-specific situations where the size and/or the location of commercial and industrial land uses may impact primary, secondary, or tertiary consumers, the soil and food ingestion guideline is recommended as the SQG_E.

[K]Data are sufficient and adequate to calculate only a provisional SQG_E.

[l]Data are sufficient and adequate to calculate only an SQG_E, which is less than the interim soil quality criterion (CCME 1991) for this land use. Therefore the SQG_E becomes the soil quality guideline, which supersedes the interim soil quality criterion for this land use.

[m]Data are sufficient and adequate to calculate only an SQG_E, which is greater than the interim soil quality criterion (CCME 1991) for this land use. Therefore the interim soil quality criterion (CCME 1991) is retained as the soil quality guideline for this land use.

[n]Data are sufficient and adequate to calculate a provisional SQG_{HH} and an SQG_E. The provisional SQG_{HH} is equal to the SQG_E and to the existing interim soil quality criterion (CCME 1991) and thus becomes the soil quality guideline, which supersedes the interim soil quality criterion for this land use.

[o]Data are sufficient and adequate to calculate a provisional SQG_{HH} and an SQG_E. The provisional SQG_{HH} is less than the SQG_E and thus becomes the soil quality guideline for this land use.

[p]Data are sufficient and adequate to calculate only an SQG_E. An interim soil quality criterion (CCME 1991) was not established for these substances, therefore, the SQG_E becomes the soil quality guideline.

[q]Data are sufficient and adequate to calculate only a provisional SQG_{HH}, which is less than the existing interim soil quality criterion (CCME 1991). Thus the provisional SQG_{HH} becomes the soil quality guideline, which supersedes the interim soil quality criterion for this land use.

[r]Data are sufficient and adequate to calculate only a provisional SQG_{HH}. An interim soil quality criterion (CCME 1991) was not established for this land use, therefore the provisional SQG_{HH} becomes the soil quality guideline.

[s]Data are sufficient and adequate to calculate only an SQG_{HH}. An interim soil quality criterion (CCME 1991) was not established for this land use, therefore the SQG_{HH} becomes the soil quality guideline.

[t]Data are sufficient and adequate to calculate an SQG_{HH} and an SQG_E. Therefore the soil quality guideline is the lower of the two and represents a fully integrated *de novo* guideline for this land use.

[u]This guideline value may be less than the common limit of detection in some jurisdictions. Contact jurisdictions for guidance.

[v]Data are sufficient and adequate to calculate only a preliminary SQG_{FWAL} (Soil Quality Guideline for freshwater aquatic life). This value is 6,210 $mg \cdot kg^{-1}$. See accompanying factsheet for further information.

[w]10^{-5} Incremental Risk

[x]10^{-6} Incremental Risk

[y]Unless otherwise indicated, supporting documents are available from the National Guidelines and Standards Office, Environment Canada.

[z]Supporting documents are available from the Canadian Council of Ministers of the Environment at http://www.ccme.ca/publications/ceqg_rcqe.html?category_id=125

References

CCME (Canadian Council of Ministers of the Environment). 1991. Interim Canadian environmental quality criteria for contaminated sites. CCME, Winnipeg.

———. 1996. A protocol for the derivation of environmental and human health soil quality guidelines. CCME, Winnipeg. [A summary of the protocol appears in Canadian environmental quality guidelines, Chapter 7, Canadian Council of Ministers of the Environment, 1999, Winnipeg.]

———. 1997. Recommended Canadian soil quality guidelines. CCME, Winnipeg.

———. 2006. A protocol for the derivation of environmental and human health soil quality guidelines. CCME, Winnipeg. [The protocol is available online through the CCME website at http://www.ccme.ca/publications/ceqg_rcqe.html?category_id=125]

Table 2. Interim remediation criteria for soil ($mg \cdot kg^{-1}$) that have not yet been replaced by Canadian Soil Quality Guidelines[1].

Parameter	Year released	Land use			
		Agricultural	Residential/ parkland	Commercial	Industrial
General Parameters					
Conductivity [dS/m]	1991	2	2	4	4
pH	1991	6 to 8	6 to 8	6 to 8	6 to 8
Sodium adsorption ratio	1991	5	5	12	12
Inorganic Parameters					
Antimony	1991	20	20	40	40
Beryllium	1991	4	4	8	8
Boron (hot water soluble)	1991	2	—	—	—
Cobalt	1991	40	50	300	300
Fluoride (total)	1991	200	400	2000	2000
Molybdenum	1991	5	10	40	40
Silver	1991	20	20	40	40
Sulphur (elemental)	1991	500	—	—	—
Tin	1991	5	50	300	300
Monocyclic Aromatic Hydrocarbons					
Chlorobenzene	1991	0.1	1	10	10
1,2-Dichlorobenzene	1991	0.1	1	10	10
1,3-Dichlorobenzene	1991	0.1	1	10	10
1,4-Dichlorobenzene	1991	0.1	1	10	10
Styrene	1991	0.1	5	50	50
Phenolic Compounds					
Chlorophenols[a] (each)	1991	0.05	0.5	5	5
Nonchlorinated[b] (each)	1991	0.1	1	10	10
Polycyclic Aromatic Hydrocarbons (PAHs)					
Benzo*(a)*anthracene	1991	0.1	1	10	10
Benzo*(b)*fluoranthene	1991	0.1	1	10	10
Benzo*(k)*fluoranthene	1991	0.1	1	10	10
Dibenz*(a,h)*anthracene	1991	0.1	1	10	10
Indeno(1,2,3-c,d)pyrene	1991	0.1	1	10	10
Phenanthrene	1991	0.1	5	50	50
Pyrene	1991	0.1	10	100	100
Chlorinated Hydrocarbons					
Chlorinated aliphatics[c] (each)	1991	0.1	5	50	50
Chlorobenzenes[d] (each)	1991	0.05	2	10	10
Hexachlorobenzene	1991	0.05	2	10	10
Hexachlorocyclohexane	1991	0.01	—	—	—
Miscellaneous Organic Parameters					
Nonchlorinated aliphatics (each)	1991	0.3	—	—	—
Phthalic acid esters (each)	1991	30	—	—	—
Quinoline	1991	0.1	—	—	—
Thiophene	1991	0.1	—	—	—

[1]**Notes:**

All values are in $mg \cdot kg^{-1}$ unless otherwise stated.

Guidelines released in 1991 were published in "Interim Canadian Environmental Quality Criteria for Contaminated Sites" (CCME, 1991).

These interim remediation criteria are considered generally protective of human and environmental health and were based on experience and professional judgement.

These interim criteria (CCME, 1991) should only be used when soil quality guidelines based on the CCME soil protocol (CCME, 1996; 2006) have not yet been developed for a given chemical. Also, because the interim remediation criteria were not developed using the soil protocol and its integral checks, they cannot be modified through the site specific remediation objective procedure.

[a]Chlorophenols include
chlorophenol isomers (ortho, meta, para)
dichlorophenols (2,6- 2,5- 2,4- 3,5- 2,3- 3,4-)
trichlorophenols (2,4,6- 2,3,6- 2,4,5- 2,3,4- 3,4,5-)
tetrachlorophenols (2,3,5,6- 2,3,4,5- 2,3,4,6-)

[b]Nonchlorinated phenolic compounds include
2,4-dimethylphenol
2,4-dinitrophenol
2-methyl 4,6-dinitrophenol
nitrophenol (2-,4-)
phenol
cresol

[c]Aliphatic chlorinated hydrocarbons include
chloroform
dichloroethane (1,1- 1,2-), dichloroethene (1,1- 1,2-)
dichloromethane
1,2-dichloropropane, 1,2-dichloropropene (cis and trans)
1,1,2,2-tetrachloroethane, tetrachloroethene
carbon tetrachloride
trichloroethane (1,1,1- 1,1,2-), trichloroethene

[d]Chlorobenzenes include
all trichlorobenzene isomers
all tetrachlorobenzene isomers
pentachlorobenzene

References

CCME (Canadian Council of Ministers of the Environment). 1991. Interim Canadian environmental quality criteria for contaminated sites. CCME, Winnipeg.

———. 1996. A protocol for the derivation of environmental and human health soil quality guidelines. CCME, Winnipeg. [A summary of the protocol appears in Canadian environmental quality guidelines, Chapter 7, Canadian Council of Ministers of the Environment, 1999, Winnipeg.]

———. 2006. A protocol for the derivation of environmental and human health soil quality guidelines. CCME, Winnipeg. [The protocol is available online through the CCME website at http://www.ccme.ca/publications/ceqg_rcqe.html?category_id=125]

Reference listing:

Canadian Council of Ministers of the Environment. 2007. Canadian soil quality guidelines for the protection of environmental and human health: Summary tables. Updated September, 2007. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

For further scientific information, contact:

Environment Canada
National Guidelines and Standards Office
351 boul. St. Joseph
Gatineau, Quebec, K1A 0H3
Phone: (819) 953-1550
Facsimile: (819) 956-5602
E-mail: ceqg-rcqe@ec.gc.ca
Internet: http://www.ec.gc.ca/ceqg-rcqe

For additional copies, contact:

CCME Documents
Toll Free: (800) 805-3025
Internet: http://www.ccme.ca

Aussi disponible en français.

Excerpt from Publication No. 1299; ISBN 1-896997-34-1