

# **Operations and Maintenance Manual for the Wastewater Treatment Facility Hamlet of Clyde River**

Prepared for:

**Department of Community Government and Services  
Government of Nunavut**

**Volume I**

**Trow Associates Inc.**

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**Operations and Maintenance Manual**  
**for the**  
**Wastewater Treatment Facility**  
**Hamlet of Clyde River**

**Chapter 1 – Manual Document Control**

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**Operations and Maintenance Manual**  
**for the**  
**Wastewater Treatment Facility**  
**Hamlet of Clyde River**

**Chapter 2 – Index**

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**Chapter 3 – Background and Design Data**

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### 3.1 Introduction

This Manual has been produced to establish standard operation and maintenance protocols for the management and treatment of sewage within the Hamlet of Clyde River. Information presented in this manual has been developed based on the document “*Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories, 1996*”.

This operation and maintenance (O&M) manual is intended to instruct designated operators of the sewage lagoon facility on the O&M procedures required to comply with conditions set forth by the Nunavut Water Board in water licence 3BM-CLY 0308.

### 3.2 Preceding Lagoon

The location of the previous sewage lagoon is approximately 1,200 metres west of the Hamlet of Clyde River and 800 metres north of Patricia Bay. In the vicinity of the lagoon is a scrap metal dump located to the north and the community landfill to the east all services by the same access road. There is a small watercourse to the west of the lagoon which runs south to Patricia Bay.

The previous sewage lagoon did not have sufficient holding capacity for the present population size of Clyde River of 870 people. The berms of the lagoon were failing and raw sewage was leaking out of the toes of the berms in several places. The previous lagoon was constructed in 1976. It was an unlined earth lagoon with a reported capacity of approximately 11,600 m<sup>3</sup> and was designed to hold sewage for 365 days with annual discharge.

The previous sewage lagoon did not meet the storage requirements of the Hamlet, and effluent samples taken in August 2006 did not meet the regulatory requirements of the Hamlet’s water licence.

### 3.3 Existing Water Supply

The Hamlet currently obtains its drinking water from a natural lake located 1,200m north of the community. This lake is fed by a series of larger lakes and a drainage basin all north of the water supply lake. The water supply facility is located on the south side of the lake with inclined pipes leading out into the lake where water is withdrawn.

Chlorination is required for disinfection of the raw water, and treated drinking water is delivered by water truck to homes and facilities.

The existing water supply and its corresponding watershed are not influenced by the current location of the sewage lagoon system. The two sites are separated by approximately 1,500 metres with the lagoon draining directly to Patricia Bay.

### 3.4 Site Selection

The site location was based on the scope of works as presented in the “*Clyde River Sewage Management – Planning Study (2003)*” – completed by Dillon Consulting Limited. The report indicated that the existing site is suited for sewage treatment and the feedback from community officials and regulators approved the location.

The existing site complies with the separation requirements of the Public Health Act (450m buffer), Transport Canada (3000m airport buffer), and the community water supply (400m buffer). The existing road servicing the lagoon is cleared and maintained year round to access the community solid waste site, metal dump as well as the current lagoon system. Figure 3.1 shows the location of the lagoon site with respect to the hamlet centre, water supply lake, and the airport.

**Figure 3.1 Location Plan and Setbacks**



### 3.5 Sewage Treatment

The proposed sewage treatment facility must meet the long term needs of the Hamlet, as well as the regulatory requirements of the Hamlet’s water licence. The Water and Sewage Facility Capital Program Standards and Criteria indicate the design horizon for sewage lagoons is to be between 15 – 20 years. As per the direction of the Community and Government Service, Government of Nunavut, the design horizon for this facility shall be the year 2028.

The wastewater treatment system utilizes the sewage lagoons as the main method of treatment, with the filter strip wetlands providing additional treatment prior to the release to the environment.

The project will not have long term negative effects on the environment or wildlife. Most effects are related to construction activities and are short term and all effects can be mitigated by applying suitable mitigation measures.

As monitoring the performance of natural wetlands is difficult, the Hamlet of Clyde River's water license has set the compliance point for the wastewater treatment system at the discharge of the lagoon. This point represents the last point of measurement and control for the system. The water license further recognizes the treatment potential of the natural wetland and has set the compliance criteria recognizing the treatment the effluent will receive through the wetland.

### **3.6 Population Projections**

The population projections for this project will be based on "Nunavut: Community Population Projections, 2010 to 2036" as published by the Nunavut Bureau of Statistics 'June 2010'. The Nunavut Bureau of Statistics population projections provide projected populations of the Nunavut communities to the year 2036. As a planning horizon for this project, the values published up to 2028 will be used to evaluate the effluent production rates produced by the community.

The table below summarizes the population projections to the year 2028.

**Table 3.1 - Population Projections**

<b>Planning Year</b>	<b>Year</b>	<b>Population</b>	<b>Planning Year</b>	<b>Year</b>	<b>Population</b>
	2006	856	10	2018	1017
	2007	868	11	2019	1031
0	2008	883	12	2020	1044
1	2009	895	13	2021	1056
2	2010	908	14	2022	1068
3	2011	922	15	2023	1080
4	2012	935	16	2024	1093
5	2013	949	17	2025	1107
6	2014	963	18	2026	1120
7	2015	977	19	2027	1135
8	2016	991	<b>20</b>	<b>2028</b>	<b>1149</b>
9	2017	1004			

The design population for the end of the design horizon, 2028, is projected to be 1149 persons.

### 3.7 Sewage Generation

Sewage generation rates are generally assumed to be equal to the water consumption rates for a community, with the water consumption rate being the total of the residential and non-residential water consumption. The Water and Sewage Facility Capital Program Standards and Criteria provide the following design values and formulae for estimating the water consumption and therefore the sewage generation rates for communities.

The residential water usage (RWU) for a community is based on the method of water delivery and sewage collection in the community. The per capita water usage rates for the different methods of water delivery and sewage collection are summarized in the Table 3.2.

**Table 3.2 - Residential Water Usage**

Service Method	Residential Water Usage (RWU)
Trucked water and sewage	90 lpcd
Piped water and sewage	225 lpcd
Piped water supply and truck sewage pump out	110 lpcd
Trucked water delivery and individual septic fields	100 lpcd

The Hamlet of Clyde River has a trucked water and sewage system, therefore the RWU for the community from table 3.2 is equal to 90 lpcd.

Non-residential water usage by a community tends to increase with increases in the population. To determine the Total Community Water Usage (TCWU), the Residential Water Usage is adjusted based on population to provide a Total Water Usage Per Capital. The daily water consumption by the community is equal to the population multiplied by the Total Water Usage Per Capital. The Total Water Usage Per Capital, including residential and non residential activities are estimated based on the equations in Table 3.3 – Total Community Water Usage.

**Table 3.3 - Total Community Water Usage**

Community Population	Total Water Use Per Capita
0 – 2000	$RWU \times (1.0 + 0.00023 \times \text{Population})$
2000 – 10,000	$RWU \times [-1.0 + \{0.323 \times \ln(\text{Population})\}]$
Over 10,000	$RWU \times 2.0$

The daily water consumption, and therefore the sewage generated by the community, is equal to the population multiplied by the Total Water Usage Per Capital. Based on the design population of 1149 for the year 2028, and a total water usage per capita rate of 114 lpcd, the daily sewage generation rate is equal to 131,000 lpd. This is equal to a yearly sewage generation rate of 47,800 m<sup>3</sup>.

### 3.8 Influent Characteristics

The characteristics of sewage generated in a community are heavily dependent on the type of installation and sanitary facilities. The Hamlet of Clyde River water and sewage system's utilize holding tanks and truck delivery and collection systems. The waste generated from this arrangement is considered to be "Moderately Diluted Wastewater", as per the Cold Climate Utility Manual. Table 3.4 - Characteristics of Basic Wastewater Categories is an excerpt from the Cold Climate Utilities Manual, summarizing the characteristics of moderately diluted wastewater.

**Table 3.4 –Waste Water Characteristics**

Parameter	Units	Moderately Diluted
BOD <sub>5</sub>	mg/L	460
COD	mg/L	1000
Suspended Solids	mg/L	490
Total Nitrogen	mg/l as N	--
Phosphorus	mg/L as P	--

‘Canadian Society for Civil Engineering, 1986, *Cold Climate Utilities Manual*

### 3.9 Regulatory Requirements

The sewage treatment facility will be required to meet the effluent quality standards as set out in the Hamlet's water licence. The effluent quality standards set out in the water licence are summarized in the Table 3.5 - Effluent Quality Standards.

**Table 3.5 – Effluent Quality Standards at Monitoring Points CLY-4 and CLY-5**

Parameters	Maximum Average Concentration
BOD <sub>5</sub>	120mg/L
Total suspended solids (TSS)	180mg/L
Faecal coliforms	1 x 10 <sup>6</sup> CFU/dl
Oil and grease	No visible sheen
pH	6 and 9

### 3.10 Seasonal Climatic Conditions

The average annual rainfall in Clyde River is 4.6 cm and the average annual snowfall is 203 cm (RWDI, 2008). Temperatures in the summer range between 0 and 8°C and in winter between -22.5°C and -30°C. It is generally quite windy with an average wind speed of 14.4 km/h (Dillon, 2003). Permafrost is present in the soil; it recedes to approximately 1m below the surface in the summer time. Table 3.6 summarizes the Seasonal Climatic Conditions. The data presented is

extracted from the climatic normals from the National Climate Data and Information Archive posted by Environment Canada.

**Table 3.6 – Monthly Precipitation**

<b>Month</b>	<b>Precipitation Rate</b>	<b>Average Daily Maximum Temperature</b>	<b>Average Daily Minimum Temperature</b>
January	8 mm	-24.2 °C	-31.9°C
February	4 mm	-25.6 °C	-33.4°C
March	7 mm	-22.7 °C	-31.5°C
April	10 mm	-14.1°C	-23.9°C
May	17 mm	-4.3°C	-12.7°C
June	23 mm	3.6°C	-2.3°C
July	35 mm	8.2°C	0.6°C
August	41 mm	7.1°C	-0.6°C
September	43 mm	2.4°C	-2.4°C
October	31 mm	-4.5°C	-10.6°C
November	16 mm	-13.8 °C	-21.0°C
December	7 mm	-21.0 °C	-28.5°C

### **3.11 Contact List**

<b>Title</b>	<b>Phone Number</b>
Senior Administrative Officer (SAO)	867-924-6220
Baffin Regional Director (Timoon Toonoo)	867-897-3601
Baffin Regional Engineer (Bhabesh Roy)	867-899-7314
Engineering, Trow (Matt Berrigan)	613-688-1899
Spill Contact: Territorial 24-hour Spill Line	867-920-8130
Indian and Northern Affairs Canada Inspector	867-669-2761
GN-Emergency Measures Officer	888-624-4043
Clyde River Health Centre	867-924-6377
RCMP (Clyde River)	867-924-1111
Environment Canada (Emergency) Yellowknife	867-669-4725
GN Environment Health Office	867-975-4817
First Air Cargo	1-800-267-1247 867-924-6365

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**Chapter 4 – Sewage Disposal System**

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## **4.1 Operational Plan**

The sewage lagoon system for Clyde River is a storage lagoon providing the capacity to store the municipal sewage generated over the period of one year.

## **4.2 Site Personal**

The responsibility of the Hamlets lagoon operations are overseen by the Senior Administrative Officer (SAO). The SAO is responsible for the Forman who conducts the day to day operation and maintenance of the sewage system together with one or two Hamlet employed labours to operate the sewage collection vehicles and help maintain the system.

## **4.3 Operational Procedures**

The following details the proposed operations of the sewage treatment system for the Hamlet.

### **Operation and Maintenance Duties**

#### **Daily**

- Collection of municipal wastewater from holding tanks and delivery to the sewage lagoon system.
- Minimize spills, and immediately clean up when they occur.
- Repairs to Equipment when breakdowns occur.
- Maintain road, discharge point, and truck turning pads as required free of snow.
- Record Operation and Maintenance information as required.

#### **Weekly**

- Remove non-sewage materials from the lagoon. Floating materials such as plastic bags should be removed and solid items disposed at the solid waste site adjacent to the lagoon.
- Assess truck discharge location and containment berms for erosion.
- Record Operation and Maintenance information as required.

#### **Monthly**

- Preventative measures and maintenance on sewage trucks.
- Assess inventory of parts for truck maintenance.
- Grade and maintain the access road as required.

- Conduct monitoring program as required.
- Record Operation and Maintenance information as required.

### **Yearly**

- Conduct annual monitoring program.
- Review the operation and maintenance records to evaluate the effectiveness of the sewage treatment system and plan for the upcoming year.

### **Collecting Operations**

Wastewater is collected from the holding tanks of each residential and municipal serviced structure within the Hamlet. Suction trucks pump the wastewater out of the holding tanks through an outside service pipe accessible to the truck. The quick-connect fitting, on the service pipe and truck intake hosepipe, gives the operator a fast and reliable connection reducing spills and speeding up the operation.

The service truck will follow a predetermined set circuit throughout the Hamlet collecting the wastewater until the holding tank is full. Once full, the truck will travel out to the lagoon site, discharge the continece and then return to the collection circuit where it left off. Some structures will have to be serviced more then once per circuit, the Hamlet office, hotel, and other high wastewater producing structures may require a higher frequency. These high producers will have to be schedule on a more regular basis.

Each time the wastewater is trucked and discharged into the lagoon. The sewage truck backs up to a chute on the gravel pad at the lagoon, and the valve is opened. Wastewater is discharged through the chute into the lagoon.

### **Detention Operations**

#### **September 15 – August 15**

Sewage trucks discharge to the lagoons over an eleven month period, beginning with the first decanted lagoon. During this period the lagoons act as a long term detention system containing the frozen and untreated effluent until treatment can have effect.

### **Decanting Operations**

#### **August 15 – September 15**

Mid-August the filter strip wetlands are now ice-free and considered active. The lagoons are decanted during this period to provide a continuous release of effluent over the filter strip during the optimal period for treatment. The release rate would be controlled by pumping. During this period the sewage trucks will continue discharging to the lagoon.

Decanting will be done with a six inch portable priming assisted centrifugal pump driven by a liquid cooled diesel engine. The pump will be stored until the decanting period has begun where it will be transported and connected to the decanting infrastructure. The pump will be in operation for an average eight hour day for approximately four weeks, the entire decanting period.

The lagoons will be decanted to the south through the natural filter strip wetlands, and ultimately treated effluent will be released to Patricia Bay.

For public safety, the lagoon operator should publicly inform the Hamlet about the start time, date and estimated duration of the discharge before discharge is started.

#### **4.4 Record Keeping and Recording**

Records should be kept to assist in planning for yearly operations and to assist in the evaluation of the effectiveness of the sewage treatment facility. Copies of records pertaining to operation and maintenance of the sewage lagoon should be kept at both the Hamlet Office and the Maintenance Garage and be maintained by the Hamlet Forman. Information that must be included in these records is listed below:

- Approximate volume of any effluent discharged to the environment.
- Cell level before and after discharge.
- Time required discharging each lagoon cell.
- Details of any maintenance undertaken at site.
- Volume of municipal potable water
- Dates of collecting and submitting samples to laboratory.
- Record sheets.
- Copy of the Hamlet's water licence.
- Copies of all manuals pertaining to the operation and maintenance of the Sewage Lagoon Facility.

Wastewater volumes will be approximated by the monthly municipal water volumes. Sewage trucks are not equipped with flow meters and therefore the last form of reliable consumption measurement is made at the water treatment plant. This flow measurement will reflect the approximate wastewater volume generated by the Hamlet and must be included in the records.

## 4.5 Health and Safety

Due to the potential health hazards associated with sewage handling and treatment, the following safety procedures should be obeyed in order to minimize health risks to personnel working in and around the wastewater facilities:

- Equipment is to be kept clean.
- Wear protective clothing such as gloves and boots at all times.
- Work cloths should not be worn home.
- Hands to be washed frequently, as a minimum before eating and after work.
- Personnel should receive appropriate vaccinations and ensure they are kept up-to-date.
- Change rooms for changing in and out of work clothes as well as storage lockers to store work clothes should be provided on site.
- Clothes washing facilities should be available on site to wash soiled work clothes.
- Visit the Health Clinic for all injuries. When working with wastewater the smallest cut or scratch is potentially dangerous.

Lagoons cells are facilities for treating human and industrial wastes, and as such people should be advised to keep away from them.

## 4.6 Spill Contingency Plan

A spill contingency plan has been developed for the Hamlet that identifies the procedures to follow when a spill of any hazardous material has occurred and can be found in Appendix A. Information presented in the spill contingency plan has been developed based on the document “*Guidelines for Spill Contingency Planning; Indian and Northern Affairs Canada, April 2007*” (INAC, 2007).

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**Chapter 5 – Maintenance**

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## 5.1 Berm Composition

Wastewater treatment lagoons are designed and constructed for the purpose of providing the right environmental conditions for bacteriological processes to proceed. They should be easily and safely operated without causing any adverse effects to the environment. The requirements of good wastewater treatment can be met if lagoon cells are constructed and maintained in such a way as to:

- Control berm seepage.
- Contain the quantity of effluent without interfering with the desired freeboard.
- Maintain an access road around the cells for inspection purposes.
- Maintain the overflow at the designed operating level installed between the primary and secondary cell.

To accomplish this, the berms were designed, constructed and rehabilitated with a minimum 3.5H:1V internal slope and 2.75H:1V external slope with a 4m crest. The berm core is comprised of compacted Granular 'C', and where the original cell berms were used, Granular 'C' was keyed into the side slopes.

As per the recommendations of the geotechnical report and geothermal analysis, a liner on the upstream slope to provide an impermeable boundary will be installed, with an internal ice core dam providing secondary containment. This impermeable liner is installed into the underlying soils, ensuring the liner is keyed into an impermeable surface, i.e. the permafrost. Improvements to the existing cells will follow the same specifications on the existing berms, slopes will be improved to 3.5H:1V and will be keyed into the steep side slopes of the existing cell.

## 5.2 Berm Monitoring

Berm monitoring will be vital during the early operational years to ensure the proper freeze-back of permafrost into the base soils and berm core. Temperature records from the berms will also timeline the permafrost levels on a yearly basis summarizing the characteristics of the active layer at the lagoon.

### Thermistors

Berm temperatures will be recorded by a data logger at each of the installed thermistor casings along the crest of the berm to model the permafrost. The thermistors are installed with a series of sensors going down to a final depth of approximately 8.0 – 10.0 metres into the berm foundation strata. Monitoring will trace the lower limit of the active permafrost revealing an early warning if the permafrost does not recover.

A sample monitoring sheet is found in Appendix C which requests the observed temperature for the thermistors at the various monitoring sites along the berm. Temperatures are recorded in

degrees Celsius for the array of sensors corresponding to the thermistor. This data sheet will contain the information collected from all monitoring site thermistors for the observed date and stored periodically together with the QA/QC sampling data.

The coordinates and the bead depths of each thermistor string are listed in Table 5.2 below.

**Table 5.2 Thermistor String Bead Locations**

Thermistor		1	2	3V	3H	4	5
Coordinates UTM	N	7818241.8	7818217.9	7818155.2	7818155.2	7818142.1	7818235.5
	E	513695.3	513806.7	513715.1	513715.1	513623.9	513560.8
Beads	Depth of Bead in meters (m) of Thermistor						
1 <sup>st</sup>		0	0	0	4.25	0	0
2 <sup>nd</sup>		0.5	0.5	0.5	4.5	0.5	0.5
3 <sup>rd</sup>		1	1	1	4.5	1	1
4 <sup>th</sup>		2	2	2	4.5	2	2
5 <sup>th</sup>		4	4	4	5.5	4	4
6 <sup>th</sup>		6	6	6	6.5	6	6
7 <sup>th</sup>		8	8	8	7.5	8	8
8 <sup>th</sup>		10	10	10	-	10	10

It is recommended that temperature readings be taken at noon on a daily or weekly basis, depending on the time of the year. The following procedures will be performed for the operation and maintenance of the thermistors:

- The thermistors are recoding temperatures at one minute intervals continuously. It is therefore important to download and clear the memory frequently.
- Calibration of the thermistors as specified by the supplier/manufacturer on an as required basis

Monitoring in the fall, corresponding to the decanting operations when the permafrost will be at its maximum retraction will be vital to understanding the lower limits of active layer.

Retrieving temperature values from the thermistors is explained in the manufactures “Instruction Manual” found in Appendix D.

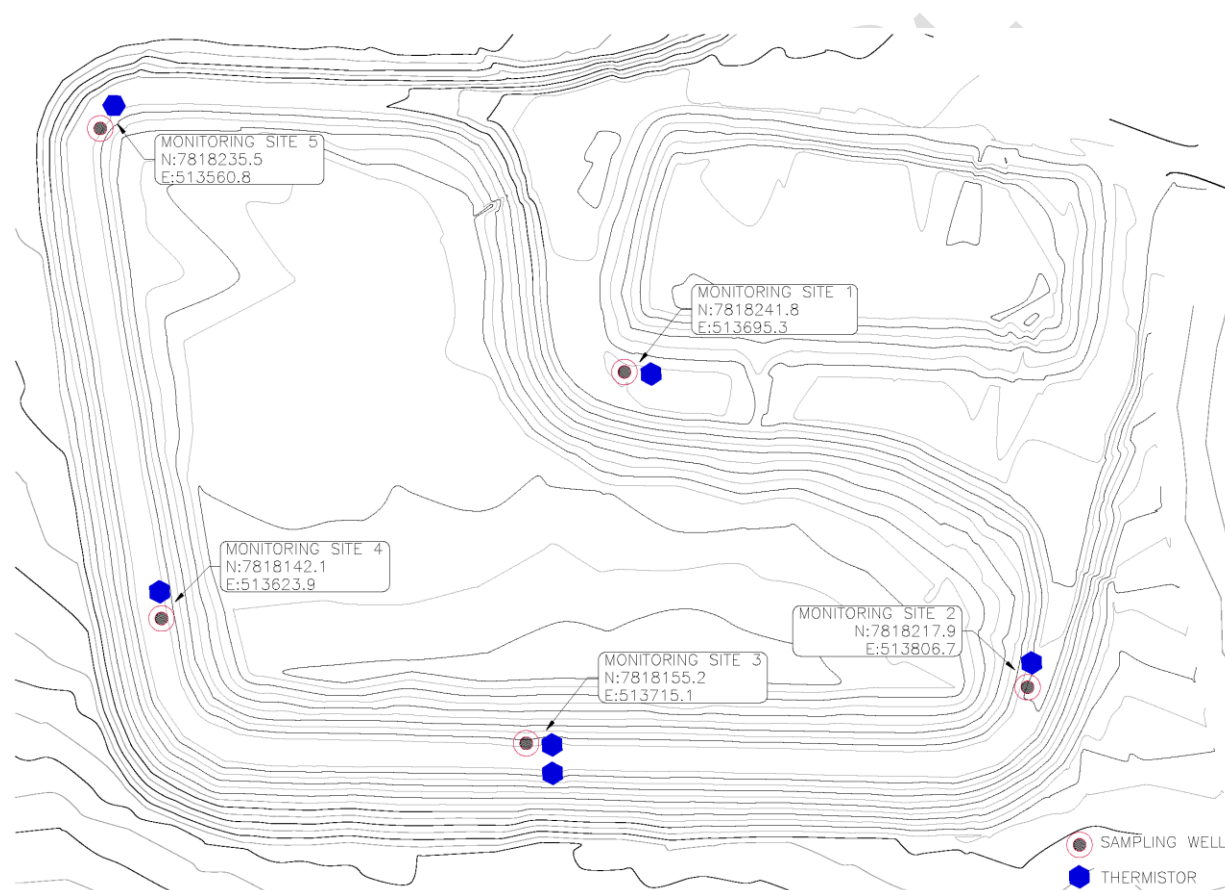
## Sampling Wells

In addition to thermistors, a series of standpipes will be installed to monitor seepage. The standpipes should be monitored yearly, early to mid fall, for the presence of seepage. Sampling procedures will follow the QA/QC requirements in Chapter 6.

## Settlement Monitoring

Considering that the berms would be constructed on ice rich soils, it is recommended that settlements of the berms should be monitored for 2 to 3 years subsequent to completion of construction. The settlement readings should be undertaken at the beginning of spring and prior to on set of winter. The settlements should be referenced to the bench mark noted in the site plans.

**Figure 5.2 Monitoring Site Locations**



## 5.3 Sludge Management

It is anticipated that the sewage lagoon will not require desludging during its 20 year design life, the available storage for sludge is greater than the quantity estimated to be generated.

Effluent quality will guide when a sludge management program is implemented. Monitoring of the effluent from the lagoon will indicate when the performance of the lagoon starts to degrade. Degradation of the performance of a lagoon is normally caused by sludge accumulation and will be the indicator to desludge the lagoon.

Prior to disposal, the sludge must be tested to ensure the disposal method chosen is safe and environmentally responsible.

## **Assessment Criteria**

Evaluating the analytical results obtained by sludge sampling, the Government of Nunavut defaults to criteria established by the Canadian Council of Ministers of the Environment (CCME). For soil, the CCME Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health (updated September 2007) is used to compare the metals and VOC analytical results. The CCME has also established the Canada-Wide Standards (CWS) for Petroleum Hydrocarbons (PHC) in Soil (April 2001), which is the federal remedial standard for petroleum impacted soils. The CCME and CWS criteria are based on four land use categories: i) agricultural; ii) residential/parkland; iii) commercial; and iv) industrial. As the sludge is to be disposed of at the landfill site, the industrial land use category is utilized for assessing the sledge management.

### **5.4 Snowdrift Management**

The wastewater lagoon is located in a relatively wind exposed area west of the Hamlet where drifting snow is not expected to be a major problem. The sloped terrain in this area is not sufficient to create significant drifting problems.

Large boulders are used as safety barriers. Driver safety measures are essential, but it must be understood that the boulders will cause snowdrifts to form around them, and they will also impede snow removal operations. The Hamlet will use a front-end loader to remove snow from the lagoon area as necessary. Snow should be dumped to the east side of the lagoon to reduce the potential of the piled snow causing secondary drifting on top of the travelled berm.

### **5.5 Filter Strip Wetland**

Vegetated filter strips are described as areas of vegetation designed to remove sediment and other pollutants from surface water runoff. A vegetated filter strip is an area that maintains soil aeration as opposed to a wetland that, at times, exhibits anaerobic soil conditions.

The filter strip wetland area is 23.5 hectares (58 acres) in size approximately 720 m long and 325 m wide with a slope of 6 to 7 %. Treatment of the pre-treated sewage in the filter strip wetland area will include removal of TSS, BOD, nutrients and pathogens.

Geotechnical investigations carried out in August 2007 found that the soil in the filter strip wetland area is comprised of silty sand with permafrost at 1 m in the summer months. This type of soil is suitable for infiltration processes and will facilitate the two main processes of contaminant removal from pre-treated sewage.

### **5.6 Filter Strip Protection**

Arctic tundra and wetland vegetation communities are very sensitive to physical damage and take a long time to recover from disturbances. Arctic plant species have very slow growth rates and areas damaged by construction activities will not re-vegetate for many years. It is therefore

important that construction equipment and trucks do not enter the wetland area. Damage to the wetland area would result in a decrease in treatment efficiency.

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**Chapter 6 – QA / QC**

## **6.1 Quality Assurance and Quality Control Monitoring**

A key component to the operations and maintenance of the sewage lagoon system is a sampling/monitoring program. The following quality assurance (QA) and quality control (QC) program should be implemented to ensure that the analytical results received are accurate and dependable. A QA/QC program is a system of documented checks that validate the reliability of the data collected regarding any given site. Quality Assurance is a system that ensures that quality control procedures are correctly performed and documented. Quality Control refers to the established procedures observed both in the field and in the laboratory, designed to ensure that the resulting end data meet intended quality objectives.

The proposed program will help monitor the treatment while verifying compliance with regulations. As well, it will model the treatment process which will help to understand the performance of the lagoon for future development and modifications to the current system.

It is important such a program be implemented by the Hamlet as a part of the annual operations for the facility. Local members of the community that operate the system are to be trained on the proper operation and procedure methods used in the sampling/monitoring program. In addition, quality and safety training will also be included which will ensure that the high quality data will be obtained.

## **6.2 Sampling Points**

Monitoring the operation and efficiency of the system will be accomplished through the establishment of eight sampling points. Sampling will provide information regarding the performance of the system and help identify any degradation to the treatment provided. Table 6.1 provides coordinates of the sampling points.

**Table 6.1 – Monitoring Points**

<b>Monitoring Program Station Number</b>	<b>Description</b>	<b>Northing UTM</b>	<b>Easting UTM</b>
CLY-3a	Raw Wastewater Discharge (existing cell)	7818328.8m	513784.1m
CLY-3b	Raw Wastewater Discharge (new cell)	7818263.4m	513822.5m
CLY-4	Lagoon Pump Discharge (existing cell)	7818255.9m	513834.3m
CLY-5	Lagoon Pump Discharge (new cell) (same as CLY-4)	7818255.9m	513834.3m
CLY-6a	Sampling Well at end of Wetlands	7817523.6m	514035.6m
CLY-6b	Surface water near sampling well at end of Wetlands	7817523.6m	514035.6m
CLY-7	Water five (5) metres from effluent entering Patricia Bay		
CLY-8	Sewage Sludge		

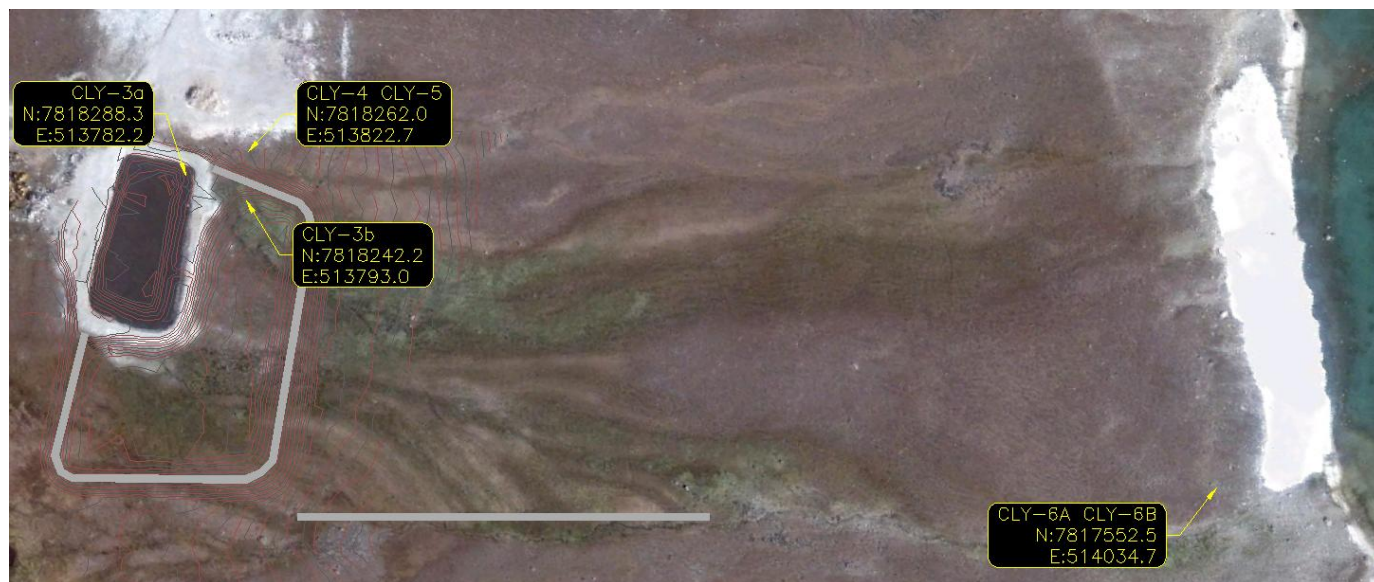
### 6.3 Sampling Frequency

The following outlines the Sampling Testing and Compliance requirements of the Wastewater Facility. Any other additional sampling during the year will be at the request of the regulatory agencies. Once collected, the samples will be shipped to the laboratory and analyzed using the same test/method/procedure. The flow rate of effluent discharge during the decanting period is required as well.

**Table 6.2 – Sampling Frequency**

<b>Monitoring Program Station Number</b>	<b>Description</b>	<b>Frequency</b>
CLY-3a	Raw Wastewater Discharge (existing cell)	Water Quality: Monthly and Annually
CLY-3b	Raw Wastewater Discharge (new cell)	Water Quality: Monthly and Annually
CLY-4	Lagoon Pump Discharge (existing cell)	Water Quality: Three Times Annually – Start, middle and end of decanting
CLY-5	Lagoon Pump Discharge (new cell) (same as CLY-4)	Water Quality: Three Times Annually – Start, middle and end of decanting
CLY-6a	Sampling Well at end of Wetlands	Water Quality: Three Times Annually – Start, middle and end of decanting
CLY-6b	Surface water at the end of the Wetland Area	Water Quality: Three Times Annually – Start, middle and end of decanting
CLY-7	Water five (5) metres from effluent enters Patricia Bay	Water Quality: Three Times Annually – Start, middle and end of decanting
CLY-8	Sewage Sludge	To be determined

Figure 6.1 Sampling Points



#### 6.4 Sampling Parameters

Samples should be analyzed for the following parameters:

Biochemical Oxygen Demand – BOD <sub>5</sub>	Faecal Coliforms
Total Suspended Solids	pH
Conductivity	Nitrate-Nitrite
Oil and Grease (visual)	Total Phenols
Magnesium	Calcium
Sodium	Potassium
Chloride	Sulphate
Total Hardness	Total Alkalinity
Ammonia Nitrogen	Total Zinc
Total Cadmium	Total Iron
Total Cobalt	Total Manganese
Total Chromium	Total Nickel
Total Copper	Total Lead
Total Aluminum	Total Arsenic
Total Mercury	Total Organic Carbon (TOC) <sub>q</sub>

## 6.5 Compliance Points

The water license has set the lagoon discharge as the compliance point for the new wastewater facility as it is the last point of measurement and control. The effluent released from the Lagoon must meet the criteria list in Table 6.3. This criteria recognizes the treatment ability of the filter strip.

**Table 6.3 – Effluent Criteria at the Compliance Point**

Parameter	Maximum Average Concentration
BOD <sub>5</sub>	120 mg/L
Total Suspended Solids (TSS)	180 mg/L
Faecal Coliforms	1 x 10 <sup>6</sup> CFU/100mL
Oil and Grease	No visible sheen
pH	Between 6 and 9

## 6.6 Laboratory Requirements

All analyses shall be performed by a laboratory certified by the Canadian Association for Laboratory Accreditation (CALA), or as otherwise approved by an Analyst.

## 6.7 Sampling Procedures

The sampling procedures should be as per “Quality Assurance (QA) and Quality Control (QC) Guidelines for use by Class “B” Licenses in Collecting Representative water samples in the field”.

All sampling, sample preservation and analyses will be in accordance with methods described in the current edition of Standard Methods for the Examination of Water and Wastewater (American Public Health Association, American Water Works Association, and Water Environment Federation, most current edition).

To obtain meaningful results from the analysis, the following five factors are of particular importance:

- Sample collection at designated time and location.
- Correct usage of container/sample bottle for parameter being tested.
- Correct labeling of sample bottles and filling out record/field sheet.
- Correct procedure for field sampling.
- Proper and timely shipment of samples to the laboratory.

## 6.8 Lagoon Water and Sludge Sampling

Prior to sampling, the appropriate sample bottles/vials, along with coolers and ice packs should be requested from the analytical laboratory.

Latex or nitrile gloves should be worn during sampling and should be replaced with fresh gloves after all sample containers are filled at each sampling location. Sampling equipment such as sampling poles should be cleaned with soap and water after each sample is collected to prevent cross-contamination.

### For lagoon water samples

- Using a sampling pole, plunge the container into the lagoon water neck first. Immerse to a depth of 10 to 20 cm, depending on the depth of the lagoon. Fill the sampling container with the mouth facing slightly upwards.

### For lagoon sludge samples

- Using a sampling pole, plunge the container into the lagoon water neck first to maintain an air pocket within the container. Once contact with the sludge is felt, immerse container into sludge neck first to a depth of 5 to 10 cm. Fill the sampling container with sludge and raise sample bottle neck first to prevent sample spillage.

All sample containers should be tightly sealed and properly labelled with the sample ID, date and time of sample collection, location of sample collection and parameters to be analyzed. The outside of the bottles should be cleaned with soap and water prior to placing the samples in the cooler. The samples should be stored on ice in a cooler until delivery to the laboratory. A chain of custody form should be filled out completely and be used to track the samples. Keep the last page and give it to the project manager along with the field notes.

## 6.9 Groundwater Sampling

In permafrost regions, water may be present for at least part of the year in the active layer. For the purposes of this document, this water is considered groundwater.

Dedicated Waterra™ pumps and tubing or bailers should be installed in each well. Dedicated sampling equipment minimizes the risk of cross-contamination.

Since, water standing in a well is generally not thought to be representative of the conditions within the water bearing formation, well purging is typically done to ensure formation water is sampled. However, in the case of permafrost regions, well purging is not recommended due to the limited amount of water likely to be present in the active layer. Instead, the available groundwater should be collected into the laboratory supplied sample containers and all sample containers should be tightly sealed and properly labelled with the sample ID, date and time of sample collection, location of sample collection and parameters to be analyzed. The samples should be stored on ice in a cooler until delivery to the laboratory. A chain of custody form

should be filled out completely and be used to track the samples. Keep the last page and give it to the project manager along with the field notes.

## **6.10 Quality Assurance and Quality Control Program**

### Prevention of Cross Contamination

Proper field protocols reduce the chances of cross contamination in the field. As outlined above, latex or nitrile gloves should be worn during sampling and should be replaced with fresh gloves after all sample containers are filled at each sampling location. Sampling equipment such as sampling poles should be cleaned after each sample is collected to prevent cross-contamination.

### Proper Field Note Taking Procedures

Proper documentation of all aspects of the sampling program (i.e., field notes and Chain of Custody forms) is essential. Be sure to note any deviations that could potentially cause sampling bias (i.e., broken bottles). It is also important that field notes include the date and time of the sampling event, the meteorological conditions at the time of sampling (ambient temperature, whether it is raining or snowing, etc.).

### Quality Control Samples

Cross contamination is a common source of error in sampling procedures. QC samples help you identify when and how contamination might occur. There are various types of QC samples including: blind duplicates, field blanks, and trip blanks. A blind duplicate is a duplicate sample that is not labelled as such. The purpose of the blind duplicate sample is to ensure analytical precision. A field blank is a sample of analyte free (i.e., clean) water poured into the container in the field, preserved and shipped to the laboratory with field samples and is analyzed along with field samples to check contamination from field conditions during sampling. A trip blank is a clean water sample that stays unopened and that remains with collected samples during transportation and is analyzed along with field samples to check residual contamination (i.e., to determine if cross contamination occurs during shipping).

Trow recommends the following number of quality control samples based on the number of samples collected:

- 10% field blanks
- 10% blind duplicates
- 1 trip blank per shipping container (cooler)

If the total number of samples collected is less than five, include at a minimum, one blind duplicate and one trip blank.

### Sampling Containers, Preservation and Hold Times

Containers, preservatives, holding times, and sample volumes with respect to the target analyses should be selected in accordance with the appropriate protocols (Canadian Council for Ministers of the Environment or CCME). All water samples should be collected in laboratory approved containers with the proper preservative, where applicable.

### Sample Identification Requirements

All sample containers must be labelled to prevent misidentification of samples. As mentioned above, the sample containers should be identified with the sample ID, the client ID, date and time of sample collection, location of sample collection and parameters to be analyzed.

### Chain of Custody

A chain of custody must accompany the shipment of samples to the laboratory. A legal Chain of Custody is a special type of sample custody that requires the physical possession, transport and storage of a sample be documented in writing. On the chain of custody, you indicate what analyses are to be done by the laboratory and who should receive the results. Keep the last page and give it to the project manager along with the field notes.

### Sample Transmittal Documentation

All samples should be logged into the laboratory to verify that all records were complete, correct and entered into the sample custody records.

### Initial Check of Samples and Documentation

The following checks are generally performed by the laboratory upon receipt:

- Verification of the integrity and condition of all sample coolers.
- Verification of the integrity and condition of all sample containers.
- Checks for leakage, cracked or broken closures or containers, evidence of grossly contaminated container exteriors or shipping cooler interiors, and obvious odours, etc.
- Verification of receipt of complete documentation for each container.
- Verification that sample identification numbers on sample transmittal forms corresponds to sample identification numbers on the sample containers.
- Verifications that holding times were met and samples were kept cool during transit.

---

## **Appendix A – Spill Contingency Plan**



# Spill Response Plan Wastewater Treatment Site

Clyde River, Nunavut

Prepared For:  
Hamlet of Clyde River  
Nunavut  
X0A 0E0

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Project No: OTT-00019055-A0  
Report date: December 2010



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### NT-NU Spill Report Form

## 1.0 Introduction

Trow Associates Inc. was retained by the Government of Nunavut – Department of Community and Government Services to prepare a Spill Response Plan (SRP) as part of the operation and maintenance of the Hamlet of Clyde River (Hamlet)'s wastewater treatment site (sewage lagoons). This SRP also demonstrates the Hamlet's stewardship in environmental management.

The purpose of the SRP is to address potential environmental spill incidents that may occur during the routine operation and maintenance activities of the wastewater treatment site. The SRP is designed to be protective of the local natural environment.

The SRP includes a review of appropriate government acts and regulations, the identification of foreseeable spill scenarios, spill response procedures and general health, safety and emergency response requirements necessary when conducting activities that may require contact with the subsurface materials. The SRP does not replace any Health & Safety protocols, procedures, etc. already established by the Hamlet but rather is intended to be complimentary to existing protocols.

Situations may arise during the site work that are beyond the scope of the safety procedures stated in this document. In such a situation, it may be necessary to stop on-site work until a revised procedure or SRP is prepared to reflect the changing conditions.

It is recommended that all persons involved with on-site operations read the SRP. If there are any questions regarding any aspect to this document, individuals are encouraged to contact Trow for additional information or clarification.

## 2.0 Site Description

The wastewater treatment site (sewage lagoons) in the vicinity of the Hamlet, for which this SRP was developed, is shown on Figure 1 (below). The sewage treatment facility comprises of the existing (upper) sewage lagoon and a newly constructed (lower) sewage lagoon.

**Figure 1: Location of the Wastewater Treatment Site, Clyde River, NU**



## 3.0 Regulations

With respect to spills, the Guidelines for Spill Contingency Planning<sup>1</sup> and Environmental Protection Act (R-068-93) require that all spill response plans include:

- The name, address and job title of the owner or person in charge, management or control of the facility;
- The name, job title and 24-hour telephone number for the person(s) responsible for activating the spill response plan;
- A description of the facility, a description of the type and amount of contaminants normally stored at the facility and a site map of the facility;
- The steps to be taken to report, contain, clean up and dispose of contaminants in the case of a spill;
- The means by which the spill response plan is activated;
- A description of the training provided to employees to respond to a spill;
- An inventory of and the location of response and clean-up equipment available to implement the spill response plan; and,
- The date the spill response plan was prepared.

<sup>1</sup> Prepared by Water Resources Division Indian and Northern Affairs Canada Yellowknife, NT April 2007

## 4.0 Contacts & Regulatory Authorities

The following table includes the contact information for the persons responsible for the facility. The persons listed below should be contacted in the event of a spill.

**Table 1: Contacts**

Name	Job Title	24-Hour Telephone #

In each instance that a spill is identified, the Emergency Spill Hotline and the INAC Water Resources Inspector shall be contacted as soon as possible. A NT-NU Spill Report Form (included) should also be completed and faxed to the Emergency Spill Hotline. The necessity to contact the other agencies will be contingent upon direction from the Emergency Spill Hotline.

**Emergency Spill Hotline: Phone: (867) 920-8130, Fax (867) 873-6924**

**INAC Water Resources Inspector: Phone: (867) 975-4295**

In addition to the local contacts described above, the following table summarizes the additional regulatory authorities that have a vested interest in the event of a spill.

**Table 2: Additional Agencies**

Agency	Legislation	Contact Phone #
<b>Nunavut Water Board</b>	Nunavut Waters and Surface Right Tribunal Act	(867) 360-6338
<b>Nunavut Impact Review Board</b>	Nunavut Land Claims Agreement Act	(867) 983-2593
<b>Environment Canada</b>	Canadian Environmental Protection Act, 1999	(867) 975-4464
<b>Transport Canada (Coast Guard)</b>	Transportation of Dangerous Goods Act	(867) 979-5269
<b>Department of Fisheries and Oceans</b>	Fisheries Act	(867) 645-2871

## 5.0 Potential Contaminants and Spill Scenarios

Potential spill scenarios are dependent on the types and volumes of materials that are being used on the sites and the activities being carried out. For the purpose of this SRP, spill sizes are described as small (<10 litres), medium (>10 litres and <100 litres) or large (>100 litres).

The primary potential contaminants at the wastewater treatment site include raw sewage and sewage sludge. Other materials (potential contaminants) that are anticipated to be present on the site include gasoline, diesel fuel, hydraulic oil, motor oil and other lubricants, antifreeze and coolants from sewage delivery trucks and any heavy equipment in use for maintenance purposes. Spills may be the result of any of the following occurrences:

- Leaks or breaches of the sewage lagoon berms;
- Spill during transfer of liquids (sewage);
- Leaks or ruptures of vehicular fuel or hydraulic oil storage tanks;
- Valve or line failure in systems on vehicles or operating equipment;
- Heat expansion due to overfilling;
- Vehicular accidents; and/or,
- Vandalism.

## 6.0 Reportable Spill Quantities

In the event of a spill, the following table is to be used as a guide to determine if the spill should be reported to the proper authorities. Any spilled quantities that exceed the specified amounts must be reported to the **Emergency Spills Hotline**. Spills of any quantity that occur near or into fish-bearing waters or sensitive environment, wildlife or habitat must be reported. In addition, spills of any quantity that pose an imminent threat to human health or life or listed species at risk or critical habitat must also be reported. It is recommended that any spill of significant size be reported and the advice received should be followed.

**Table 3: Reportable Quantities<sup>1</sup>**

Item	TDGA <sup>2</sup> Class	Contaminant	Amount Spilled
1	2	Explosives	Any amount
2	2.1	Compressed Gas (flammable)	Any amount of gas from containers with capacity greater than 100 kg
3	2.2	Compressed Gas (non-corrosive, non-flammable)	Any amount of gas from containers with capacity greater than 100 kg
4	2.3	Compressed Gas (toxic)	Any amount
5	2.4	Compressed Gas (corrosive)	Any amount
6	3.1, 3.2, 3.3	Flammable Liquid	100 L
7	4.1	Flammable Solid	25 kg
8	4.2	Spontaneously Combustible Solids	25 kg
9	4.3	Water Reactant Solids	25 kg
10	5.1	Oxidizing Substances	50 L or 50 kg
11	5.2	Organic Peroxides	1 L or 1 kg
12	6.1	Poisonous Substances	5 L or 5 kg
13	6.2	Infectious Substances	Any amount
14	7	Radioactive	Any amount
15	8	Corrosive Substances	5 L or 5 kg
16	9.1(in part)	Misc. products or Substances Excluding PCB Mixtures	50 L or 50 kg
17	9.2	Environmentally Hazardous	1 L or 1 kg

Item	TDGA <sup>2</sup> Class	Contaminant	Amount Spilled
18	9.3	Dangerous Wastes	5 L or 5 kg
19	9.1 (in part)	PCB Mixtures of 5 or More Parts Per Million	0.5 L or 0.5 kg
20	None	Other Contaminants	100 L or 100 kg

Notes:

- 1) Environmental Protection Act, Consolidation of Spill Contingency Planning and Reporting Regulations
- 2) TDGA Class – Transportation of Dangerous Goods Class under the *Transportation of Dangerous Goods Act*.

## 7.0 Spill Response Procedures

The following section describes the appropriate spill response procedures that should be followed in the event of a spill to various media (bedrock, gravel, soil, water, ice or snow).

### 7.1. Spills on Land

For spills on land (soil, gravel, sand, rock, and vegetation), the following procedure should be followed;

1. Extinguish all sources of ignition (i.e., shut off engines, no smoking).
2. If possible, identify the spilled material.
3. Make sure the area is safe for entry and the spill does not represent a threat to the health or safety of the responder or others at the spill site.
4. Assess whether the spill can be readily stopped or brought under control and if safe and possible, stop the source of the spill (i.e., plug hole, close valve, install upright container) or place tarp under spill source and build up tarp edges to contain spill.
5. If the spill is sufficiently large that it cannot be controlled with the materials at hand, the spill should be reported immediately.
6. Stop spilled liquids from spreading or entering waterways using absorbent materials or a soil dyke down slope from the spill.
7. Contact facility supervisor and report the spill.
8. If possible with materials at hand, clean up remaining spilled material and store in a secure container for disposal. Do not flush area with water.
9. If possible, pump any contained liquid into drums.
10. Complete a Spill Reporting Sheet.
11. Contact: Emergency Spill Hotline: Phone: (867) 920-8130, Fax (867) 873-6924 for additional advice.
12. Contact: INAC Water Resources Inspector: Phone: (867) 975-4295 to report the spill.
13. Submit to the INAC Water Resources Inspector, a detailed report including the GPS location of the spill, no later than thirty (30) days after initially reporting the event.

## 7.2. Spills on Water

For spills on water, the following procedure should be followed:

1. Extinguish all sources of ignition (i.e., shut off engines, no smoking).
2. If possible, identify the spilled material.
3. Make sure the area is safe for entry and the spill does not represent a threat to the health or safety of the responder or others at the spill site.
4. Assess whether the spill can be readily stopped or brought under control and if safe and possible, stop the source of the spill (i.e., plug hole, close valve, upright container).
5. If the spill is sufficiently large that it cannot be controlled with the materials at hand, spill report the spill immediately.
6. Use sorbant booms to contain spill for recovery, place sorbant sheets on water within boomed perimeter. For narrow waterways, place one or more booms across the waterway, down stream of the spill location and anchor boom ends on each bank. Store saturated sorbant sheets and booms in drums for disposal.
7. Contact facility supervisor and report the spill.
8. If possible with materials at hand, clean up remaining spilled material and store in a secure container.
9. Complete a Spill Reporting Sheet.
10. Contact: Emergency Spill Hotline: Phone: (867) 920-8130, Fax (867) 873-6924 for additional advice.
11. Contact: INAC Water Resources Inspector: Phone: (867) 975-4295 to report the spill.
12. Submit to the INAC Water Resources Inspector, a detailed report including the GPS location of the spill, no later than thirty (30) days after initially reporting the event.

## 7.3. Spills on Snow and Ice

Spills on ice present the potential for immediate access of the contaminants to water therefore, immediate response to the spill is essential. For spills on snow and ice, the following procedure should be followed:

1. Extinguish all sources of ignition (i.e., shut off engines, no smoking).
2. If possible, identify the spilled material.

3. Make sure the area is safe for entry (i.e., ice thickness) and the spill does not represent a threat to the health or safety of the responder or others at the spill site.
4. If the spill is sufficiently large that it cannot be controlled with the materials at hand, the spill should be reported immediately.
5. Assess whether the spill can be readily stopped or brought under control and if safe and possible, stop the source of the spill (i.e. plug hole, close valve, install upright container) or place tarp under spill source and build up tarp edges to contain spill.
6. Stop spilled liquids from spreading or entering waterways using absorbent materials or a snow/soil dyke.
7. Contact facility supervisor and report the spill.
8. If possible with materials at hand, clean up remaining spilled material and store in a secure container (i.e., drum, polyethylene bags). Store impacted snow in drums for disposal.
9. Contact: Emergency Spill Hotline: Phone: (867) 920-8130, Fax (867) 873-6924 for additional advice.
10. Contact: INAC Water Resources Inspector: Phone: (867) 975-4295 to report the spill.
11. Submit to the INAC Water Resources Inspector, a detailed report including the GPS location of the spill, no later than thirty (30) days after initially reporting the event.

#### **7.4. Additional Spill Delineation/Monitoring**

As a result of a large spill in which not all of the spilled material can be readily recovered as described above, additional delineation in the form of a subsurface investigation (i.e., test pits, boreholes, and monitoring wells) may be required to determine the lateral and vertical extents of the impacts to the subsurface soil and/or groundwater. The additional delineation/monitoring information will be used to develop an appropriate remediation plan. In such cases, a qualified environmental consultant should be retained to provide advice with respect to how to proceed with the additional assessment.

## 8.0 Spill Kit and Training Requirements

The following section presents the recommended minimum requirements for the content and number of spill kits that should be present.

### 8.1. Spill Kit

Each spill kit should be inspected regularly to ensure that it contains, as a minimum, the following:

- 1 – 205 litre, open top steel drum with a lid, bolting ring and gasket;
- 1 Spark proof shovel;
- 1 package of 10 disposable 5 mil polyethylene bags (approx. 65 cm x 100 cm);
- 4 – 12.5 cm (approx. 5”) x 3 m (approx. 10’) sorbant (oil-absorbing) booms;
- 10 kg bag of sorbant particulate;
- 1 bail of 50 cm x 50 cm (approx.) sorbant sheet (100 Sheets/bail);
- 1 x 5m x 5m approx. plastic tarp;
- 2 pairs of oil resistant gloves; and,
- 2 pairs of splash protective goggles.

### 8.2. Additional Spill Response Supplies

In addition to the materials contained in the spill kits, an inventory of the following supplies should be available for use if required.

- 10 – 205 litre, open top steel drum with a lid, bolting ring and gasket;
- 2 Spark proof shovels;
- 5 packages of 10 disposable 5 mil polyethylene bags (approx. 65 cm x 100 cm);
- 10 – 12.5 cm x 3 m sorbant (oil-absorbing) booms;
- 5 x 10 kg bags of sorbant particulate;
- 5 bails of 50 cm x 50 cm (approx.) sorbant sheet (100 Sheets/bail);
- 2 pairs of oil resistant gloves; and,
- 2 pairs of splash protective goggles.

### 8.3. Spill Kit Locations

The spill kit, with the exception of the shovel, can be contained within the 205 L drum which should be sealed securely to protect the contents. The drum should also be accessible without the use of tools (i.e., bolt ring only finger tight). The bolt ring should be inspected regularly to ensure that it turns freely and lubricated if it does not. At least one spill kit should be clearly identified and present on the site when a pit is being actively worked.

### 8.4. Training

To ensure the effectiveness of the SRP, the following actions should be followed:

1. The SRP should be reviewed, as a minimum, on an annual basis and updated as required by changes in operation and/or technology.
2. The SRP should be distributed to the personnel on the site.
3. The personnel should be informed of the locations of all potentially hazardous materials and their associated Material Safety Data Sheets (MSDS).
4. The personnel should be trained in the use of the MSDS and the techniques and materials used to contain and remediate spilled materials.
5. The personnel should be informed as to the importance of first response with respect to the protection of human health and safety, the environment, property, wildlife and the ecosystem by reducing the impact of spills.

## 9.0 General Safety Practices and Site Rules

The following is a list of site rules that should be followed to maintain safe working conditions during a spill response:

1. Eating, drinking, chewing gum and smoking are prohibited in contaminated or potentially contaminated areas, or where the possibility for the transfer of contamination exists. This would include areas of active excavation and metal removal.
2. Personnel who have worked on-site shall wash their hands and face thoroughly with soap and water and remove themselves from the spill area prior to eating, drinking or smoking.
3. All field crew workers should be aware of potentially dangerous situations that they should avoid (i.e. the presence of strong, irritating or nauseating odours). Field crew workers should also be familiar with the physical characteristics of the site including:
  - wind direction in relation to areas of known contamination;
  - accessibility to equipment and vehicles;
  - communications; and,
  - site access.

**Table 4: Outside Emergency Contacts**

Agency	Function	Phone Number
Hamlet of Clyde River	On-site Supervisor	(867) 924-6220
Clyde River Health Centre	Medical Emergency	(867) 924-6377
Fire	Fire, Accident or Rescue	(867) 979-4422
RCMP (Clyde River)	Security, Vandalism	(867) 924 -1111

## 10.0 Closure

This Spill Response Plan has been prepared for the Hamlet of Clyde River's wastewater treatment site. It does not replace, nor is intended to replace, the general provision of the applicable Federal and Territorial statutes regarding workplace safety or any protocols previously established by the Hamlet. Instead, it may be used to augment any existing plans.

Yours truly,

**Trow Associates Inc.**



Robert Renaud, M.Sc.  
Environmental Scientist  
Earth and Environment



Steven Burden, P.Eng.  
Manager  
Infrastructure - Municipal

## NT-NU Spill Report Form



Canada

# NT-NU SPILL REPORT

OIL, GASOLINE, CHEMICALS AND OTHER HAZARDOUS MATERIALS

NT-NU 24-HOUR SPILL REPORT LINE

TEL: (867) 920-8130

FAX: (867) 873-6924

EMAIL: spills@gov.nt.ca

**REPORT LINE USE ONLY**

A	REPORT DATE: MONTH – DAY – YEAR		REPORT TIME		<input type="checkbox"/> ORIGINAL SPILL REPORT, OR <input type="checkbox"/> UPDATE # _____ TO THE ORIGINAL SPILL REPORT	<b>REPORT NUMBER</b> _____	
	OCCURRENCE DATE: MONTH – DAY – YEAR		OCCURRENCE TIME				
C	LAND USE PERMIT NUMBER (IF APPLICABLE)			WATER LICENCE NUMBER (IF APPLICABLE)			
D	GEOGRAPHIC PLACE NAME OR DISTANCE AND DIRECTION FROM NAMED LOCATION				REGION <input type="checkbox"/> NWT <input type="checkbox"/> NUNAVUT <input type="checkbox"/> ADJACENT JURISDICTION OR OCEAN		
E	LATITUDE DEGREES                      MINUTES                      SECONDS			LONGITUDE DEGREES                      MINUTES                      SECONDS			
F	RESPONSIBLE PARTY OR VESSEL NAME		RESPONSIBLE PARTY ADDRESS OR OFFICE LOCATION				
G	ANY CONTRACTOR INVOLVED		CONTRACTOR ADDRESS OR OFFICE LOCATION				
H	PRODUCT SPILLED		QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES		U.N. NUMBER		
	SECOND PRODUCT SPILLED (IF APPLICABLE)		QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES		U.N. NUMBER		
I	SPILL SOURCE		SPILL CAUSE		AREA OF CONTAMINATION IN SQUARE METRES		
J	FACTORS AFFECTING SPILL OR RECOVERY		DESCRIBE ANY ASSISTANCE REQUIRED		HAZARDS TO PERSONS, PROPERTY OR ENVIRONMENT		
K	ADDITIONAL INFORMATION, COMMENTS, ACTIONS PROPOSED OR TAKEN TO CONTAIN, RECOVER OR DISPOSE OF SPILLED PRODUCT AND CONTAMINATED MATERIALS						
L	REPORTED TO SPILL LINE BY	POSITION	EMPLOYER	LOCATION CALLING FROM	TELEPHONE		
M	ANY ALTERNATE CONTACT	POSITION	EMPLOYER	ALTERNATE CONTACT LOCATION	ALTERNATE TELEPHONE		

**REPORT LINE USE ONLY**

N	RECEIVED AT SPILL LINE BY	POSITION	EMPLOYER	LOCATION CALLED	REPORT LINE NUMBER
		STATION OPERATOR		YELLOWKNIFE, NT	(867) 920-8130
LEAD AGENCY <input type="checkbox"/> EC <input type="checkbox"/> CCG <input type="checkbox"/> GNWT <input type="checkbox"/> GN <input type="checkbox"/> ILA <input type="checkbox"/> INAC <input type="checkbox"/> NEB <input type="checkbox"/> TC			SIGNIFICANCE <input type="checkbox"/> MINOR <input type="checkbox"/> MAJOR <input type="checkbox"/> UNKNOWN		FILE STATUS <input type="checkbox"/> OPEN <input type="checkbox"/> CLOSED
AGENCY		CONTACT NAME	CONTACT TIME	REMARKS	
LEAD AGENCY					
FIRST SUPPORT AGENCY					
SECOND SUPPORT AGENCY					
THIRD SUPPORT AGENCY					

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## **Appendix B – Water Licence**

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

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NUNAVUT WATER BOARD  
NUNAVUT IMALIRIYIN KATIMAYINGI  
OFFICE DES EAUX DU NUNAVUT

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File No.: 3BM-CLY0909

March 19, 2009

Mr. Sandy Kautuq  
Assistant Senior Administrative Officer  
Municipality of Clyde River  
Box 89  
Clyde River, NU  
X0A 0E0

**RE: NWB Licence No. 3BM-CLY0909**

Dear Mr. Kautuq:

Please find attached Licence No. 3BM-CLY0909 issued to the Hamlet of Clyde River by the Nunavut Water Board (NWB) 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.

If the Licensee contemplates the renewal of this Licence, it is the responsibility of the Licensee to apply to the NWB for its renewal. The past performance of the Licensee, new documentation and information, and issues raised during a public hearing, if the NWB is required to hold one, will be used to determine the terms and conditions of the Licence renewal. Note that if the Licence expires before the NWB issues a new one, then water use and waste disposal must cease, or the Licensee will be in contravention of the *Nunavut Land Claims Agreement* (NLCA) and the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (NWSRTA). However, the expiry or cancellation of a licence does not relieve the holder from any obligations imposed by the licence. The NWB recommends that an application for the renewal of this Licence be filed at least three (3) months prior to the Licence expiry date.

If the Licensee contemplates or requires an amendment to this Licence, the NWB may decide, in the public interest, to hold a public hearing. An application for amendment may be required for upgrades to the solid waste disposal facility. The Licensee should submit applications for amendment as soon as possible to give the NWB sufficient time to go through the amendment process. The process and timing may vary depending on the scope of the amendment, however a minimum of sixty (60) days is required from time of acceptance by the

NWB. It is the responsibility of the Licensee to ensure that all application materials have been received and acknowledged by the Manager of Licensing.

The NWB strongly recommends that the Licensee consult the comments received from interested persons on issues identified. This information is attached for your consideration.

Sincerely,

A handwritten signature in dark ink, appearing to read 'T. Kabloona', with a long horizontal flourish extending to the right.

Thomas Kabloona  
Nunavut Water Board, Chair

TK/tla/kt

Enclosure: Licence No. 3BM-CLY0909  
Comments from EC, GN-DoE, INAC, and GN-CLEY

cc: Qikiqtani Distribution List



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NUNAVUT WATER BOARD  
NUNAVUT IMALIRIYIN KATIMAYINGI  
OFFICE DES EAUX DU NUNAVUT

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## DECISION

### LICENCE NUMBER: 3BM-CLY0909

This is the decision of the Nunavut Water Board (NWB) with respect to an application for a Licence renewal received August 19, 2008 made by:

#### HAMLET OF CLYDE RIVER

to allow for the use of water and disposal of waste for the Hamlet of Clyde River, located within the Qikiqtani region of Nunavut. With respect to this application, the NWB gave notice to the public that the Hamlet had filed an application for a water licence renewal.

#### 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 Claims Agreement* (NLCA), the NWB decided that the application could proceed through the regulatory process. After reviewing the full 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 *NLCA* and of the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (NWNSRTA), decided to waive the requirement to hold a public hearing and determined that:

**Licence Number 3BM-CLY0909 be issued subject to the terms and conditions contained therein. (Motion #: 2008-20-L03)**

SIGNED this 18<sup>th</sup> day of March, 2009 at Gjoa Haven, NU.

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Thomas Kabloona  
Nunavut Water Board, Chair

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## **I. BACKGROUND**

The Hamlet of Clyde River has a population of approximately 940 and is located on Patricia Bay on the east coast of Baffin Island at the coordinates of 70°27'N latitude and 68°33'W longitude within the Qikiqtani Region of Nunavut.

Currently, the annual average wastewater discharge volume of the community is approximately 36,000 cubic metres. The existing wastewater treatment facility is undersized to satisfy the present demand of the community and has not fully complied with the current water licence NWB3CLY0308. A condition assessment study in 2003 recommended expansion of the existing facility, and, a new lagoon was designed to operate jointly with the existing facility so that both lagoons could function as storage cell lagoons and work in conjunction with an area of wetlands.

The project has been designed for a 20 year lifetime with a storage capacity of 58,500 cubic metres. Construction was to begin during the summer of 2008, however construction is currently planned for the 2009 and 2010 seasons.

## **II. PROCEDURAL HISTORY**

The NWB issued municipal water licence NWB3CLY0308 to the Hamlet of Clyde River on September 15, 2003, to allow for the use of water and disposal of waste.

On October 8, 2008, following a detailed assessment of an amendment application filed by the Licensee in conjunction with the Government of Nunavut Community Government Services (GN-CGS), the Board issued an amendment to water licence NWB3CLY0308 to allow for new activities to be carried out including:

- Rehabilitation of the existing Sewage Disposal Facility comprised of a sewage lagoon;
- Construction of a new sewage treatment cell to the south and west of the existing lagoon;
- Controlled effluent release to a Vegetated Filterstrip Wetland Area that is approximately 720 meters long, 325 meters wide, and flows into the marine environment at Patricia Bay; and
- Quarry development.

The original licence NWB3CLY0308 expired on September 15, 2008, during the licensing process for the requested amendment. Given that a renewal application for NWB3CLY0308 had been filed during the amendment process, the NWB extended the expiry date of the licence by six (6) months, from September 15, 2008 to March 15, 2009, to allow for processing of the renewal application and work to proceed under the amendment.

The application for renewal was submitted to the NWB by the Hamlet of Clyde River, in

conjunction with the GN-CGS on August 19, 2008. Information contained in the August 19, 2008 submission included:

- Application renewal cover letter signed by Sandy Kautuq, Assistant Senior Administrative Officer (SAO) for the Hamlet of Clyde River, dated August 19, 2008;
- Application summary in English;
- Application summary in Inuktitut;
- Water licence application form; and
- Municipal Questionnaire;

Following a preliminary review of the application documents, on October 30, 2008, the NWB requested a response and clarification on a few issues prior to distributing the application including:

- Anticipated changes to the solid waste disposal facility;
- Further changes to the sewage disposal facility;
- Hazardous waste disposal; and
- Compliance.

Subsequently, the Licensee submitted a document entitled *draft Spill Response Plan Aggregate Deposits, Clyde River, Nunavut*, prepared by Trow Associates Inc. (Trow), dated November 2008, Project no. OTCD00019055A.

On December 3, 2008 the GN-CGS submitted a response to the NWB's request and on December 8, 2008, the NWB publicly posted notice of the application in accordance with Section 55.1 of the Act and Article 13 of the *Nunavut Land Claims Agreement* (NLCA). This assessment process included the referral of the application to a variety of federal, territorial, and local organizations for review and comment.

No public concern was expressed during this review. Therefore, the NWB waived the requirement to hold a public hearing and proceeded with the application process.

The NWB received comments on the application from interested parties including Indian and Northern Affairs Canada (INAC), the Government of Nunavut Department of Environment (GN-DOE), the GN Department of Culture, Language, Elders, and Youth (CLEY), and Environment Canada (EC).

In addition, on January 8<sup>th</sup>, 2009, Trow submitted comments to the NWB on behalf of the GN-CGS regarding the water licence amendment to NWB3CLY0308, expressing concerns regarding the final discharge point for the Enhanced Sewage Disposal Facility, the discharge criteria, and the requirement within the Licence for sewage effluent to be proven non-acutely toxic.

On February 13<sup>th</sup>, 2009, the NWB facilitated a technical meeting via teleconference including representatives of GN-CGS, Trow, INAC, EC, and GN-DOE to discuss among other things the concerns outlined in Trow's January 8<sup>th</sup>, 2009 letter as well as the NWB's concerns regarding compliance with the amended licence NWB3CLY0308. This teleconference was followed up with a distribution of the meeting notes via email on March 3, 2009.

Based on the results of the detailed assessment of the renewal application file, including consideration of any potential accidents, malfunctions, or impacts to water that the overall project might have in the area, the Board has approved the application and has issued licence 3BM-CLY0909.

### **III. ISSUES**

#### **Compliance and Term of Licence**

In accordance with Section 45 of the Act, the NWB may issue a licence for a term not exceeding twenty-five years. In determining an appropriate term of a water licence, the Board considers a number of factors, including the results of INAC site inspections and the overall compliance record of the Applicant. In review of the previous water licence NWB3CLY0308 inspection reports, the NWB has noted that there were compliance issues and other related problems identified by the Inspector. A Municipal Water Use Inspection Report dated August 8, 2006 included the following issues:

- Unacceptable decant structure; and
- Insufficient freeboard

Another inspection conducted on July 13<sup>th</sup>, 2007 and reported on December 4, 2007 identified additional compliance issues and related problems including:

- Failure to submit annual reports including the results of the monitoring program;
- Failure to maintain the appropriate signage and warnings at Surveillance Network Program stations;
- Structural issues with the sewage lagoon;
- Failure to submit a Sewage and Solid Waste Disposal Operations and Maintenance Manual; and
- Failure to collect and submit for analysis the samples required as part of the Monitoring Program.

In addition, the NWB notes INAC's comments on the application submitted January 2, 2008 with respect to Part B Item #10 of amended licence NWB3CLY0308, requiring the Licensee to submit a Plan for Compliance within ninety (90) days of licence issuance or upon the filing of any application in relation to the licence within that time. To date, the NWB has not received a Plan for Compliance.

Through its own compliance assessment the NWB notes that the Quality Assurance/ Quality Control (QA/QC) Plan required as a condition of Part H Item 6 of amended licence NWB3CLY0308 to be submitted to the Analyst within sixty (60) days of Licence issuance, has not, to this date, been received by the NWB. Also, the Board is not in receipt of as-built drawings of any modifications to the existing Sewage Disposal Facility required in accordance with Part E Item 4 of licence NWB3CLY0308.

In its August 19<sup>th</sup> water licence application form, the Hamlet indicated a request for a term of five (5) years for the Licence renewal (September 15, 2008 to September 15, 2013). No comments were received from interested parties with respect to the length of term, however, based on issues with non-compliance that are related to the 2003 Licence renewal and again with the issuance of the Amendment No.1 in October, 2008, including non-compliance with administrative and reporting requirements, the NWB has decided on an eight month term for the Licence.

The eight month Licence term is intended to provide the Licensee time to take immediate action towards achieving full compliance with all Licence requirements for its existing facilities and to begin and complete the first year's construction of its Enhanced Sewage Disposal Facility, as part of this process. Upon submission of an application to renew the Licence in approximately five (5) months from the date of this Licence, the Board fully expects the Hamlet to be in compliance with the Licence. As per Part B, Item 12 of the Licence, the Licensee must submit a Plan for Compliance that clearly demonstrates how the Hamlet will achieve full compliance with the Licence conditions during this time period and subsequent licence term(s).

The NWB reminds the Licensee of its responsibility to be in compliance with the conditions of the Licence. If monitoring results demonstrate that effluent does not meet discharge limits, the Licensee is required to take the necessary measures to correct the situation and maintain compliance.

### **Plan for Compliance**

INAC noted in its comments dated January 2, 2008 regarding the condition of Part B Item 10 of amended licence NWB2CLY0308 requiring the Licensee to submit to the Board for approval, within ninety (90) days of licence issuance or upon the filing of any application in relation to the Licence within that time, a Plan for Compliance that clearly demonstrates the measures the Licensee will undertake, including an implementation schedule, to achieve full compliance with the conditions of the licence. This Plan was to include the issues raised in the inspector's reports. The Plan has not been received by the NWB. Although information was provided following a Teleconference meeting on February 13, 2009, the submission was not considered acceptable as the specific content requested was not provided and the document was poorly organized which included numerous scanned, secondary documents that were unreferenced. The NWB therefore requires that the Licensee, as a condition of this Licence renewal, submit a "Plan

For Compliance” to the Board, within a reduced time frame of **thirty (30) days** following the issuance of this renewal, for approval in writing.

### **Quality Assurance/ Quality Control Plan (QA/QC Plan)**

The Licensee to this date, has not submitted a QA/QC Plan as required in Part H Item 6 of amended licence NWB3CLY0308. As with the Plan for Compliance above, the NWB did receive, following the Teleconference of February 13, 2009, a submission that included several, unreferenced documents that somewhat inferred to be Quality Control and Quality Assurance procedures for monitoring, sampling and analyses. However this information was considered incomplete and therefore, the NWB requires that the Licensee, as a condition of this Licence renewal, submit a QA/QC Plan within **sixty (60) days** of issuance of this Licence renewal that has met the conditions of Part H, Item 13. This Plan is to be developed immediately in consultation with a Canadian Association of Environmental Analytical Laboratories (CAEAL) approved laboratory, chosen to perform the analyses required under Part H and Schedule 1, to address both the field and laboratory requirements of monitoring for this Licence under Part H. In addition, this Plan will need to be updated for inclusion in the Operation and Maintenance Plan for the Enhanced Sewage Disposal Facility as required in Part F Item 2.

### **Annual Report**

The previous licence NWB3CLY0308 included a condition requiring the submission of annual reports. As identified by the inspector, annual reporting including the results of the monitoring program have not been submitted. The GN-CGS advised the Board in its December 3, 2008 response to the NWB’s preliminary technical review that a monitoring program has been set up and the Hamlet staff are being trained. The Hamlet has been advised by the GN-CGS to follow-up on the annual report and to attach all laboratory test results with the annual report.

The NWB will maintain the condition in the License to produce annual reports. These reports are for the purpose of ensuring that the NWB has an accurate annual update of municipal activities during a calendar year with respect to water use and waste disposal. This information is maintained on the public registry and is available to interested parties upon request. A “*Standardized Form for Annual Reporting*” is to be used by the Licensee and is available for use by the Licensee at the NWB’s ftp site at:

<ftp://nunavutwaterboard.org/ADMINISTRATION/Standardized%20Forms/>.

Although an Annual Report has been received by the NWB for 2008, not all data generated under Part H, Monitoring Program was included. The Board is requiring the Licensee to submit all data generated under the previous Licence NWB3CLY0308 and the Amendment No.1 “Monitoring Program” to the Board within thirty (30) days of issuance of this Licence, 3BM-CLY0909.

## Operational Plans

The previous licence NWB3CLY0308, included a condition in Part F Item 1 requiring the submission of a Plan for the Operation and Maintenance (O&M) of the Sewage and Solid Waste Facilities before March 31, 2004. This plan has not been received. During the amendment process for NWB3CLY0308, the Licensee submitted a draft O&M Manual outline and indicated during a teleconference that a complete O&M Manual would be available prior to commissioning the Enhanced Sewage Disposal Facility. The amended licence NWB3CLY0308 continued to require submission of an O&M Manual for facilities currently in use, adding a condition that this Manual be revised and submitted ninety (90) days prior to commissioning of the Enhanced Sewage Disposal Facility, for approval of the Board in writing.

The O&M Manual required under Part F, Item 1, to be submitted within **sixty (60) days** following issuance of the Licence, and revision under Part F, Item 2 is to be developed to the satisfaction of the NWB and shall include plans for;

- a) the operation and maintenance of Water Supply Facilities;
- b) the operation and maintenance of **ALL** sewage and solid waste disposal facilities;
- c) hazardous waste management procedures;
- d) the management of sludge from the Sewage Disposal Facility and Enhanced Sewage Disposal Facility;
- e) the protection of the environment with regard to potential spills through day-to-day operations through a Spill Contingency Plan; and
- f) include a monitoring program Quality Assurance/Quality Control Plan.

The Board acknowledges receipt of the document entitled *draft Spill Response Plan Aggregate Deposits, Clyde River, Nunavut*, prepared by Trow Associates Inc., dated November 2008, Project no. OTCD00019055A, submitted in accordance with Part F Item 6 of the amended licence NWB3CLY0308. As recommended by INAC, GN-DOE and EC in their written comments, the Board is requiring that this plan be revised and updated to address the parties' comments and be incorporated into the O&M Manual discussed above, for submission ninety (90) days prior to commissioning of the Enhanced Sewage Disposal Facility.

The purpose of the O&M Manual is to assist Hamlet staff in carrying out the procedures relating to the water use and waste disposal facilities. The O&M Manual should demonstrate to the NWB that the Hamlet is capable of operating and maintaining the infrastructure related to water use and waste disposal and to meet the requirements of the Licence. The O&M Manual should be based, at a minimum on the various NWB-approved guidelines available (i.e. *Guidelines for the Preparation of an Operations and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories*, Duong and Kent, 1996) and other regulatory guidelines as deemed appropriate.

## **Quarry**

The design of the Enhanced Sewage Disposal Facility as described in the application for amendment to water licence NWB3CLY0308, requires in excess of 40,000 cubic metres of granular material. Since the Hamlet's current quarry sites are being used for municipal needs and do not have sufficient material to complete the project, a new quarry site was approved for development under the amendment.

This quarry development underwent an environmental screening by NIRB and on June 18, 2008, NIRB issued its screening determination for file #08QN055 recommending that the project proposal proceed subject to specific terms and conditions. Conditions related to the mandate of the NWB regarding the use of water and disposal of waste, were incorporated into the amendment of NWB3CLY0308 and have been forwarded into this renewal.

In addition, the NWB is continuing to require as a new condition of the Licence amendment, that an undisturbed buffer zone of at least 100 metres be maintained between any proposed quarry operation and the normal high water mark of any water body.

## **Water Use**

The Hamlet of Clyde River currently uses Water Source Lake as its source of potable water with the quantity not to exceed 38,000 cubic meters annually. No concerns were raised by the parties in their written submissions as to the amount of water required by the Hamlet, the manner in which it is obtained, or the manner in which it will be used. The NWB has renewed the terms and conditions associated with water use accordingly.

## **Sewage**

The Hamlet of Clyde River currently utilizes a Sewage Disposal Facility approximately 1.2 km west of the municipality. Currently, the Sewage Disposal Facility is a single-cell exfiltration lagoon with a capacity of 19,500 m<sup>3</sup>. The effluent that exfiltrates from the lagoon berm proceeds downstream through an undefined natural wetland where it receives additional treatment prior to reaching the marine environment. The Board notes that to date no as-built drawings of the existing Sewage Disposal Facility have been received by the NWB in accordance with Part E Item 4 of licence NWB3CLY0308.

With an annual average wastewater discharge volume from the community of an estimated 36,636 cubic metres, the existing Sewage Disposal Facility is undersized and has failed to meet the effluent quality criteria of the Licence. As such, expansion of the existing facility was approved by the NWB in the scope of the amendment to water licence NWB3CLY0308, including the construction of a new lagoon to the south and west of the existing lagoon to supplement the current storage capacity.

The land between the current facility (and approved expansion) and Patricia Bay was also approved in the scope of the amendment to water licence NWB3CLY0308 to remain as a Vegetated Filter Strip Wetland Area. The treated sewage effluent will be pumped from the lagoon to the wetland area beginning in mid-August and continuing until mid to late September. The end of the Vegetated Filter Strip Wetland Area is located approximately 720 metres from the discharge point of the sewage lagoon, at Patricia Bay.

The Board acknowledges comments submitted by Trow Associates Inc. regarding the conditions of Amendment No.1 to water licence NWB2CLY0308, on the following three sewage related issues:

1. the final discharge point for the Enhanced Sewage Disposal Facility;
2. the discharge criteria for effluent discharged from the Enhanced Sewage Disposal Facility; and
3. the requirement for effluent discharged from the Enhanced Sewage Disposal Facility to be proven non-acutely toxic.

With respect to the first issue regarding Trow's concern with the contradictory nature of the inclusion of two separate Final Discharge Points and criteria, one at the discharge point of the sewage lagoon, and the second at the discharge of the wetlands, the Board does not fully agree with the argument provided by Trow. Trow argues that the final discharge point should be considered to be the end of the wetlands as the operator can control the rate of sewage applied to the wetlands and therefore has control of the quality of treatment from the wetlands. As noted by EC in their comments dated January 16, 2009 in response to Trow's concern, "real time" data is not available for effluent quality and in order to consider the wetland area discharge as a compliance point, real time data and evidence of treatment efficiency is required. As such, the Board has decided that in order to minimize the potential for release of poor quality effluent to Patricia Bay, that the Final Discharge Point and point of compliance be located at the point of discharge from the lagoon to the Vegetated Filter Strip Wetland Area. In order to determine the performance of the wetland as a secondary treatment system, the Board further requires that the quality of effluent leaving the wetland be monitored and reported.

With respect to the second issue regarding Trow's concern with the discharge criteria, the Board has agreed with Trow. The Board also notes EC's January 6, 2009 comments recommending that effluent quality standards applied to this licence should be at least equivalent to those outlined in the 1992 document "Guidelines for discharge of treated municipal wastewater in the Northwest Territories". According to Table 4.1 of the Guidelines, for a wastewater flow greater than 600 lcd, during summer months into a marine receiving environment, the discharge criteria for BOD<sub>5</sub> should be 80 mg/L and the discharge criteria for TSS should be 70 mg/L. Taking into consideration note (k) to Table 4.1 of the Guidelines which states that where wetlands are to be used as part of the treatment systems, limits may be chosen to suit the point of measurement and control, the Board has decided to set limits from the lagoon that are less strict than the 80/70 (BOD/TSS) standards and also, that are consistent with the previous licence NWB3CLY0308 to

take into account the potential for treatment of the wetland area. The discharge criteria for the existing Sewage Disposal Facility include Fecal Coliforms as a licensed parameter and the NWB is maintaining this requirement for the Enhanced Sewage Disposal Facility.

Furthermore, the Board refers the Licensee to EC's January 16<sup>th</sup> advice regarding the establishment of future discharge criteria for consideration upon licence renewal. EC recommends that the Hamlet investigate using the sewage treatment system to hold sewage in one cell while a longer decant is done from the second cell to take advantage of the growing (treatment) season without overwhelming the wetland vegetation. However, if shorter discharge periods are implemented, lower effluent discharge limits would be appropriate with some allowance made for polishing by the wetlands. EC's recommendations should be considered in the development of the O&M Manual.

With respect to the third issue of Trow's letter, concerning the requirement for effluent to be proven non-acutely toxic and that it is not a requirement of the Canadian Council Ministers of Environment Canada-wide Strategy for the Management of Municipal Wastewater effluent, the Board agrees with Trow, as long as there are no industrial inputs into the system. The Board notes EC's January 16<sup>th</sup> recommendations in making the decision to remove this requirement and refers the Licensee to EC's statement regarding acute toxicity testing done as part of the risk assessment and monitoring efforts of the CCME Strategy, if logistical constraints can be handled.

Furthermore, in making this decision, the Board also notes EC's January 6<sup>th</sup>, 2009 submission, advising the Licensee to ensure that any effluent discharged from the system's final discharge point is in compliance with Section 36(3) of the Fisheries Act. According to Section 36(3) of the Fisheries Act, the deposition of deleterious substances of any type, under any conditions where the deleterious substance, or any other deleterious substance that results from the deposit of the deleterious substance, may enter such water, is prohibited. The Licensee is further advised that compliance with this Licence does not absolve the Licensee from the responsibility to comply with other applicable legislation.

### **Solid Waste**

The Hamlet has one Solid Waste Disposal Facility located east of the lagoon. The site is unfenced, waste is not segregated and wastes are burned regularly. A waste oil storage area is located outside the landfill site. A metal dump is also located to the west of the lagoon. At the time of application, it was indicated that budgeting for optimization of the landfill site had been planned under the GN-CGS's Capital Planning Program for the period of 2009-2011.

Recommendations relevant to solid waste disposal operations in the Hamlet were received by INAC, EC, and the GN-DOE regarding waste segregation, fencing, open burning, hazardous waste, drainage management, and planned facility upgrades.

EC recommended that waste segregation practices should be identified and used to ensure removal of salvageable items and hazardous waste materials from the general waste and that dedicated locations should be identified for hazardous wastes, including batteries, waste oil, honey bags, animal carcasses, and contaminated soils. The Licensee is encouraged to consider those recommendations in the development of its O&M Manual and the NWB has modified the condition in Part D Item 7 of NWB3CLY0308 to require the Licensee segregates and stores all hazardous materials and/or hazardous waste, including waste oil, within the Solid Waste Disposal Facility in a manner as to prevent the deposit of deleterious substances into any water until such a time as proper disposal arrangements are made.

EC and GN-DOE both noted in their submissions that the Solid Waste Disposal Facility requires proper fencing. Fencing is required to control the spread of debris and to prevent waste entering waters. All solid waste is to be contained at the Solid Waste Disposal Facility under Part D Item 6 of the renewal Licence.

The Board acknowledges comments received by INAC, EC and GN-DOE regarding the Licensee's practice of open burning and advises the Licensee of the requirement to comply with the *Canada Wide Standards for Dioxin and Furans* and the *Canada Wide Standard for Mercury Emissions* for the management and incineration of municipal wastes. The Licensee is also advised to adhere to the GN-DOE policy document, entitled Municipal Solid Wastes Suitable for Open Burning.

EC provided recommendations regarding hazardous waste including waste oil and fuel barrels, as well as recommendations regarding drainage management to minimize leachate generation from the Solid Waste Disposal Facility. The Licensee is encouraged to consider those recommendations in the development of its operating procedures and the O&M Manual.

Finally, the Board notes the Licensee's plans with respect to upgrading its Solid Waste Disposal facility, including an increase in its area, the construction of separate cells for different types of waste, and recycling/waste reduction plans. The Board would like to take the opportunity to advise the Licensee that an application for amendment is required for the planned upgrades to the Solid Waste Disposal Facility. The Licensee should submit applications for amendment as soon as possible to give the NWB sufficient time to go through the amendment process. The process and timing may vary depending on the scope of the amendment, however a minimum of sixty (60) days is required from time of acceptance by the NWB.

## **Signage**

Recommendations regarding signage were received from EC and GN-DOE noting that signage at the Solid Waste Disposal Facility, the Sewage Disposal Facility and the Vegetated Filter Strip Wetland Area were required. The Board agrees with parties' recommendations and is requiring as a condition in Part B Item 7 of the licence renewal, that the Licensee post signs in the

appropriate areas to inform the public of the location of Water Supply Facilities and Waste Disposal Facilities and that all signs be in English and Inuktitut.

In addition, the Board is continuing to require that signage be posted to identify Monitoring Program station locations.

### **Monitoring**

The Board has revised the Monitoring Program requirements in this Licence renewal to reflect the changes to compliance monitoring for the Sewage Disposal Facility.

Specific changes include the removal of acute toxicity as a parameter to be monitored. In addition, the Monitoring Program no longer requires compliance monitoring at the end of the wetland, but maintains the requirement for water quality monitoring at that station to determine the performance of the wetland as a secondary treatment system.

Due to concerns regarding the effectiveness of wetland treatment, the Board has added a condition in Part H Item 16 of the License renewal, requiring the Licensee provide an indication of wastewater treatment levels upstream and downstream of the Vegetated Filter Strip Wetland Area in the annual report.

Within Amendment No.1, the Board had decided to impose additional thermal monitoring within the lagoon liner key trench and that the vertical thermistors and casings extend at least 5 metres below the base of the berm (ie below existing ground level).

In maintaining consistency with the previous licence and amendment issued, the Board has retained the condition, Part F, Item 5, to ensure that the additional thermistor stations are installed within the Key Trench of the Enhanced Sewage Disposal Facility berms and monitoring takes place. Additionally, the Board has retained the requirement for settlement monitoring of the lagoon berms. This monitoring data will be essential to the assessment of the geotechnical and geothermal performance of the lagoons following construction, as required in Part H Item 12.

## LICENCE 3BM-CLY0909

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

of THE HAMLET OF CLYDE RIVER  
(Licensee)  
BOX 89, CLYDE RIVER, NUNAVUT X0A 0E0  
(Mailing Address)

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

Licence Number 3BM-CLY0909

Water Management Area NUNAVUT 05

Location CLYDE RIVER, QIKIQTANI REGION, NU  
(Latitude 70°27'N and Longitude 68°33'W)

Purpose WATER USE AND WASTE DISPOSAL

Description MUNICIPAL UNDERTAKINGS

Quantity of Water Not to Exceed 30,000 CUBIC METRES ANNUALLY

Date of Licence MARCH 18, 2009

Expiry Date of Licence NOVEMBER 13, 2009

Dated this 18<sup>th</sup> of March, 2009 at Gjoa Haven, NU.



Thomas Kabloona  
Nunavut Water Board  
Chair

**PART A: SCOPE AND DEFINITIONS**

**1. Scope**

- a. This Licence allows for the use of water and the disposal of waste for a municipal undertaking at the Hamlet of Clyde River, Qikiqtani Region, Nunavut (70°27' N; 68°33'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: **3BM-CLY0909**

“**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;

“**Application for Water Licence Amendment**” means the application filed by the Hamlet of Clyde River and GN-CGS with the NWB on March 10<sup>th</sup>, 2008 including supporting documents.

“**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 for Fecal Coliforms”** means the geometric mean of the last four consecutive analytical results for fecal coliforms contained in composite or grab samples collected from the Sewage Disposal Facility’s and Enhanced Sewage Disposal 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;

**“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;

**“Engineer”** means a professional engineer registered to practice in Nunavut in accordance with the *Engineering, Geological and Geophysical Act (Nunavut)* S.N.W.T. 1998, c.38, s.5;

**“Enhanced Sewage Disposal Facility”** comprises the area and engineered sewage lagoons, decant structures, and Vegetated Filter Strip Wetland Area designed to contain and treat sewage as described in the Application for Water Licence Amendment filed by the Applicant on March 10, 2008 and illustrated in Drawings SP-1, CSM-1, SP-2, SEC-1, TD-1, DE-1, and DE-2 prepared by Trow Associates Inc., project no. 0TCD00019055A, dated August 30, 2007;

**“Final Discharge Point”** in respect of an effluent means an identifiable discharge point of a facility beyond which the operator of the facility no longer exercises control over the quality of the effluent;

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

**“Geotechnical Engineer”** means a professional engineer registered with the Association of Professional Engineers, Geologist and Geophysicists of Nunavut and whose principal field of specialization with the engineering properties of earth materials in dealing with man-made structures and earthworks that will be built on a site. These can include shallow and deep foundations, retaining walls, dams, and embankments;

**“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;

**“Monitoring Program”** means a monitoring program established to collect data on surface water and groundwater quality to assess impacts to the freshwater aquatic environment of an appurtenant undertaking;

**“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 Facility”** comprises the area and engineered lagoon and decant structures designed to contain and treat sewage as described in the Application for Water Licence filed by the Applicant on February 5<sup>th</sup>, 2003 and illustrated in Drawing No. 2002-1000-050;

**“Solid Waste Disposal Facility”** comprises the area and associated structures designed to contain solid waste as described in the Application for Water Licence filed by the Applicant on February 5, 2003 and illustrated in Drawing No. 2002-1000-050;

**“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 Facility, the Enhanced Sewage Disposal Facility, the Solid Waste Disposal Facility, and Bagged Toilet Waste Disposal Facility, as described in the Application for Water Licence filed by the Applicant on February 5, 2003 and illustrated

in Drawings No. 2002-1000-050, and as described in the Application for Water Licence Amendment filed by the Applicant on March 10, 2008;

**“Water Supply Facilities”** comprises the area and associated intake infrastructure at Water Source Lake, as described in the Application for Water Licence filed by the Applicant on February 5, 2003 and illustrated in Drawing No. 2002-1000-050; and

**“Vegetated Filter Strip Wetland Area”** comprises approximately 23.5 hectares of land immediately downstream of the sewage lagoon, for approximately 720 metres at a slope of 6 to 7% and includes the lagoon dewatering pump and infrastructure as well as diversion berm and fencing as described in the Application for Water Licence filed by the Applicant on March 10, 2008 and illustrated in Construction Drawings prepared by Trow Associates Inc. Project OTCD00019055A dated August 2007.

### **3. Enforcement**

- a. Failure to comply with this Licence will be a violation of the Act, subjecting the Licensee to the enforcement measures and the penalties provided for in the Act;
- b. All inspection and enforcement services regarding this Licence will be provided by Inspectors appointed under the Act;
- c. For the purpose of enforcing this Licence and with respect to the use of water and deposit or discharge of waste by the Licensee, Inspectors appointed under the Act, hold all powers, privileges and protections that are conferred upon them by the Act or by other applicable law; and
- d. The Licensee shall, in relation to any application to renew or amend the Licence, have in place a Plan for Compliance approved by the Board in writing, to achieve full compliance with the conditions of this Licence, or a Plan for Compliance must be submitted at the time of Application, in order for the Application to be deemed complete.

### **PART B: GENERAL CONDITIONS**

1. The Licensee shall submit to the Board for review, within thirty (30) days of Licence 3BM-CLY0909 issuance, all available data generated under licence NWB3CLY0308 and subsequent amendment “Monitoring Program”.
2. The Licensee shall file an Annual Report with the Board, no later than March 31<sup>st</sup> of the year following the calendar year reported, which shall contain the following information:

- a. tabular summaries of all data generated under the “Monitoring Program”, including an interpretation and discussion of wastewater treatment levels of the Sewage Disposal Facilities and/or the Enhanced Sewage Disposal Facilities, as well as the treatment efficiency of the Vegetated Filter Strip Wetland Area;
- b. modifications to the “Monitoring Program” in accordance with Part H Item 17;
- c. the annual quantity of sludge removed from the Sewage Disposal Facility and the Enhanced Sewage Disposal Facility along with the treatment/storage/disposal provided, as required in Part H Item 6;
- d. the results of sampling and analyses of sewage sludge in accordance with the Operations and Maintenance Manual referred to in Part F Item 2, as required in Part H Item 8;
- e. An assessment of the geotechnical and geothermal performance of the Enhanced Sewage Disposal Facility including an analyses of the results from the thermistor, standpipe and settlement monitoring stations, as required in Part H Item 12;
- f. the monthly and annual quantities in cubic metres of fresh water obtained from all sources;
- g. the monthly and annual quantities in cubic metres of each and all waste discharged;
- h. 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;
- i. a list of unauthorized discharges and summary of follow-up action taken;
- j. any updates or revisions for manuals and plans (i.e., Operations and Maintenance Manual) as required by changes in operation and/or technology;
- k. detailed minutes of any public consultation and participation with local organizations and the residents of the community regarding licence amendments;
- l. a summary of any abandonment, restoration and closure work completed during the year and an outline of any work anticipated for the following year;
- m. a summary of any studies, reports, and plans (e.g., Operations and Maintenance, Abandonment, Restoration and Closure, QA/QC) requested by the Board that relate to waste disposal, water use or reclamation, and a brief description of any

future studies planned; and

- n. any other details on water use or waste disposal requested by the Board by November 1<sup>st</sup> of the year being reported.
3. The Licensee shall comply with the “Monitoring Program” described in this Licence, and any amendments to the “Monitoring Program” as may be made from time to time, pursuant to the conditions of this Licence.
4. The “Monitoring Program” and compliance dates specified in the Licence may be modified at the discretion of the Board.
5. 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.
6. The Licensee shall, within ninety (90) days after the first visit by the Inspector following issuance of this Licence, post the necessary signs to identify the stations of the “Monitoring Program”. All signage postings shall be in the Official Languages of Nunavut.
7. The Licensee shall post signs in the appropriate areas to inform the public of the locations of the Water Supply Facility and the Waste Disposal Facilities. All signage postings shall be in the Official Languages of Nunavut.
8. 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.
9. The Licensee shall ensure a copy of this Licence is maintained at the Municipal Office at all times. Any communication with respect to this Licence shall be made in writing to the attention of:

**(a) Manager of Licensing:**  
Nunavut Water Board  
P.O. Box 119  
Gjoa Haven, NU X0B 1J0  
Telephone: (867) 360-6338  
Fax: (867) 360-6369  
Email: [licensing@nunavutwaterboard.org](mailto:licensing@nunavutwaterboard.org)

**(b) Inspector Contact:**  
Water Resources Officer  
Nunavut District, Nunavut Region

P.O. Box 100  
Iqaluit, NU X0A 0H0  
Telephone: (867) 975-4295  
Fax: (867) 979-6445

10. 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.
11. The Licensee shall ensure that all document(s) and correspondence submitted by the Licensee, to the Board, are received and acknowledged by the Manager of Licensing.
12. The Licensee shall submit to the Board for approval, within **thirty (30) days** of issuance of this Licence, a Plan for Compliance that clearly demonstrates the measures the Licensee will undertake, including an implementation schedule, to achieve full compliance with the conditions of this Licence, including the issues raised during the public review of the application and those of the Inspector's Reports.
13. The Licensee shall, for all Plans, Manuals and Reports submitted under this Licence, include a proposed timetable for implementation. Plans, Manuals and Reports submitted, cannot be undertaken without subsequent written Board approval and direction. The Board may alter or modify a Plan, Manual or Report if necessary to achieve the legislative objectives and will notify the Licensee in writing of acceptance, rejection or alteration of the Plan.
14. The Licensee shall, for all Plans, Manuals and Reports submitted under this Licence, implement the Plan, Manual and Report as approved by the Board in writing.
15. Every Plan to be carried out pursuant to the terms and conditions of this Licence shall become a part of this Licence, and any additional terms and condition imposed upon approval of a Plan by the Board become part of this Licence. All terms and conditions of the Licence should be contemplated in the development of a Plan where appropriate.
16. This Licence is not assignable except as provided in Section 44 of the Act.

**PART C: CONDITIONS APPLYING TO WATER USE**

1. The Licensee shall obtain all fresh water from Water Source Lake using the Water Supply Facilities or as otherwise approved by the Board in writing.
2. The annual quantity of water, used for all purposes, shall not exceed thirty eight thousand (38,000) cubic metres.

3. The Licensee shall maintain the Water Supply Facilities to the satisfaction of the Inspector.
4. The Licensee shall equip all water intake hoses with a screen of appropriate mesh size to ensure that fish are not entrained and shall withdrawl water at a rate such that fish do not become impinged on the screen.
5. The Licensee shall not remove any material from below the ordinary high water mark of any water body unless otherwise approved by the Board in writing.
6. The Licensee shall not cause erosion to the banks of any body of water and shall provide necessary controls to prevent such erosion.

**PART D: CONDITIONS APPLYING TO WASTE DISPOSAL**

1. Prior to commissioning the Enhanced Sewage Disposal Facility, the Licensee shall direct all Sewage to the Sewage Disposal Facility. Following construction of the Enhanced Sewage Disposal Facility, the Licensee shall direct all Sewage to the Enhanced Sewage Disposal Facility, or as otherwise approved by the Board in writing.
2. All Effluent discharged from the Sewage Disposal Facility at Monitoring Program Station CLY-4 and from the Enhanced Sewage Disposal Facility at Monitoring Program Station CLY-5 shall not exceed the following effluent quality standards:

Parameter	Maximum Concentration of Any Grab Sample (mg/L)
BOD <sub>5</sub>	120 mg/L
Total Suspended Solids	180 mg/L
Fecal Coliforms	1 x 10 <sup>6</sup> CFU/100mL
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 in writing, shall be maintained at all dams, dykes or structures intended to contain, withhold, divert, or retain water or wastes.
4. The Licensee shall provide at least ten (10) days notification to an Inspector, prior to initiating the release of effluent from the Waste Disposal Facilities.
5. The Sewage Disposal Facility and the Enhanced Sewage Disposal Facility shall be maintained and operated, in such a manner as to prevent structural failure.

6. The Licensee shall dispose of and permanently contain all Solid Wastes at the Solid Waste Disposal Facility or as otherwise approved by the Board in writing.
7. The Licensee shall segregate and store all hazardous materials and/or hazardous waste, including waste oil, within the Solid Waste Disposal Facility in a manner as to prevent the deposit of deleterious substances into any water, until such a time as proper disposal arrangements are made.

**PART E: CONDITIONS APPLYING TO MODIFICATION AND CONSTRUCTION**

1. The Licensee shall implement the recommended options identified in the Water Licence Application document entitled “*Design Brief New Sewage Lagoon and Rehabilitation of Existing Sewage Lagoon for the Hamlet of Clyde River*” dated February 2008 and prepared by Trow Associates Inc. In the event of a conflict between the conditions of this Licence and the above referenced document, the conditions of this License shall prevail.
2. The Licensee shall submit to the Board for approval, design drawings stamped and signed by a qualified engineer registered in Nunavut, six (6) months prior to the construction of any dams, dykes or structures intended to contain, withhold, divert or retain water or wastes.
3. 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:
  - a. the Licensee has notified the Board in writing of such proposed modifications at least sixty (60) days prior to beginning the modifications;
  - b. these modifications do not place the Licensee in contravention of the Licence or the Act;
  - c. 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
  - d. the Board has not rejected the proposed modifications.
4. Modifications for which all of the conditions referred to in Part E, Item 3, have not been met, may only be carried out upon written approval from the Board. The Licensee shall provide as-built plans and drawings of the Modifications referred to in this Licence

within ninety (90) days of completion of the Modification. These plans and drawings shall be stamped by an Engineer.

5. All activities shall be conducted in such a way as to minimize impacts on surface drainage and the Licensee shall immediately undertake any corrective measures in the event of any impacts on surface drainage.
6. The Licensee shall ensure that sediment and erosion control measures are implemented prior to and maintained during activities carried out under this Part to prevent the release of sediment and minimize erosion.
7. The construction or disturbance of any stream/lake bed or banks of any definable water course are not permitted, unless authorized by the Board in writing.

**PART F: CONDITIONS APPLYING TO OPERATION AND MAINTENANCE**

1. The Licensee shall submit to the Board for approval in writing, within sixty (60) days of issuance of this Licence, an Operation and Maintenance Manual (O&M Manual) prepared where appropriate, in accordance with the “*Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories; 1996*”. This manual shall specifically address issues which were identified in the August 21, 2001 DIAND Inspection Report, with respect to the operations and facility capacity at the Sewage Disposal Facility and include the following Plans:
  - a. *Water Supply Facility Operation and Maintenance Plan;*
  - b. *Sewage and Solid Waste Operation and Maintenance Plan;*
  - c. *Hazardous Waste Management Plan;*
  - d. *Sludge Management Procedures;*
  - e. *Spill Contingency Plan, including updated Spill Response Plan for Aggregate Deposits; and*
  - f. *Monitoring Program Quality Assurance/Quality Control Plan (QA/QC Plan)*
2. The Licensee shall submit to the Board for approval, a minimum of ninety (90) days prior to commissioning of the Enhanced Sewage Disposal Facility, a revision to the Operations and Maintenance (O&M) Manual referred to in Part F Item 1. The Manual shall take into consideration the new facility and comments received during the application review.
3. The Licensee shall review the O&M Manual referred to in Part F, Item 1 and Item 2 as required by changes in operation and/or technology and modify accordingly. Revisions are to be submitted in the form of an Addendum to be included with the Annual Report.

4. If, during the period of this Licence, an unauthorized discharge of waste occurs, or if such a discharge is foreseeable, the Licensee shall:
  - a. employ the appropriate contingency measures as approved under the Operation and Maintenance Manual for the Hamlet of Clyde River;
  - b. report the incident immediately via the 24-Hour Spill Reporting Line at (867) 920-8130, to the Inspector at (867) 975-4295, and to the Government of Nunavut Department of Environment at (867) 975-7700; and
  - c. submit to the Inspector, a detailed report on each occurrence, not later than thirty (30) days after initially reporting the event, that provides the necessary information on the location (including the GPS coordinates), initial response action, remediation/clean-up, status of response (ongoing, complete), proposed disposal options for dealing with contaminated materials and any preventative measures to be implemented.
5. The Licensee shall, prior to commissioning of the Enhanced Sewage Disposal Facility, install thermistors, monitoring standpipes and settlement monitoring stations as described in the application documents, dated March 10, 2008. In addition, thermistors are to be installed within the key trench corresponding to each station of vertical thermistor installation, for the determination of permafrost development around the key trench and confirmation of design criteria with respect to the reliability of permafrost as an engineered system for seepage control.
6. The Licensee shall submit to the Board, prior to commencing construction or procurement of construction materials from the quarry, a revised final Spill Response Plan Aggregate Deposits, Clyde River, Nunavut, prepared by Trow Associates Inc., dated November 2008, Project no. OTCD00019055A, that specifically addresses the quarry site operations and existing facilities and takes into consideration issues raised by parties during the review process. This Plan is to be incorporated into the O&M Manual, Part F, Item 1, as an addendum upon approval by the Board in writing.
7. The Licensee shall maintain an undisturbed buffer zone of at least 100 metres between any proposed quarry operation and the normal high water mark of any water body.
8. An inspection of all engineered facilities related to the management of water and waste shall be carried out annually in July or August by a Geotechnical Engineer. The engineer's report shall be submitted to the Board within sixty (60) days of the inspection, including a covering letter from the Licensee outlining an implementation plan addressing each of the Engineer's recommendations.
9. The Licensee shall perform more frequent inspections of the engineered facilities at the request of an Inspector.

10. The Licensee shall ensure that sediment and erosion control measures are implemented prior to and maintained during activities carried out under this Part to prevent the release of sediment and minimize erosion.

**PART G: CONDITIONS APPLYING TO ABANDONMENT, RESTORATION AND CLOSURE**

1. The Licensee shall submit to the Board for approval, an *Abandonment, Restoration and Closure Plan*, at least six (6) months prior to a) abandoning of any facilities and b) the construction of new facilities to replace existing ones. Where applicable, the Plan shall include information on the following:
  - a. solid waste disposal facility;
  - b. water intake facilities;
  - c. the water treatment and waste disposal sites and facilities;
  - d. petroleum and chemical storage areas;
  - e. any site affected by waste spills;
  - f. leachate prevention;
  - g. an implementation schedule;
  - h. maps delineating all disturbed areas, and site facilities;
  - i. consideration of altered drainage patterns;
  - j. type and source of cover materials;
  - k. future area use;
  - l. hazardous wastes; and
  - m. a proposal identifying measures by which restoration costs will be financed by the Licensee upon abandonment.
2. For site reclamation purposes, the Licensee shall salvage top soil for future restoration of the site to promote re-vegetation.
3. The Licensee shall practice progressive reclamation of the quarry development in accordance with the restoration guidelines outlined in Indian and Northern Affairs Canada's document entitled *Environmental Guidelines for Pits and Quarries*, 1982.
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 MONITORING PROGRAM**

1. The Licensee shall maintain Monitoring Program Stations and implement the Program as described in Schedule I attached to this Licence and conditions under this Part.

2. The Licensee shall confirm the locations and GPS coordinates for all monitoring stations referred to in Part H Item 1, and Schedule I with an Inspector.
3. The Licensee shall sample water quality at Monitoring Program Stations CLY-4, CLY-5, CLY-6a, CLY-6b and CLY-7 a minimum of three (3) times annually, to include once upon commencement, once approximately mid-way through discharge, and once prior to discharge ending. Samples shall be analyzed for the following parameters:

Biochemical Oxygen Demand – BOD <sub>5</sub>	Fecal Coliforms
Total Suspended Solids	pH
Conductivity	Nitrate-Nitrite
Oil and Grease (visual)	
Magnesium	Calcium
Sodium	Potassium
Chloride	Sulphate
Total Hardness	Total Alkalinity
Ammonia Nitrogen	Total Zinc
Total Cadmium	Total Iron
Total Cobalt	Total Manganese
Total Chromium	Total Nickel
Total Copper	Total Lead
Total Aluminum	Total Arsenic
Total Mercury	Total Organic Carbon (TOC)
4. If the discharge at Station CLY-4 or CLY-5 has been suspended and subsequently restarted with more than a 48 hour lapse, the sampling sequence described in Part H, Item 3 of the Monitoring Program shall be repeated.
5. The Licensee shall measure and record in cubic metres, the monthly and annual quantities of water pumped from Monitoring Program Station CLY-1 for all purposes and effluent pumped or discharged from Monitoring Program Stations CLY-4 and CLY-5.
6. The Licensee shall measure and record the annual quantities of sludge removed from the Sewage Disposal Facility and the Enhanced Sewage Disposal Facility, along with the methods of treatment, storage, and disposal provided.
7. The Licensee shall sample water quality at Monitoring Stations CLY-2 and CLY-13 once at the beginning, middle and near the end of the season during observed flow. Samples shall be analyzed for the parameters listed in Part H Item 3 as well as Total Petroleum Hydrocarbons.

8. The Licensee shall sample and analyze sludge in accordance with the approved Operations and Maintenance Plan referred to in Part F Item (d).
9. The Licensee shall monitor annually in early to mid fall, prior to freezing, for the presence of seepage within standpipes at Monitoring Station(s) CLY-11. If seepage is observed, the licensee shall sample and analyze the seepage for the parameters listed in Part H Item 3.
10. The Licensee shall monitor temperature at Monitoring Station(s) CLY-9 and CLY-10, a minimum of once every two months for the first two years following construction of the Enhanced Sewage Disposal Facility, and twice annually thereafter, in early spring and mid to late fall.
11. The Licensee shall monitor settlement and displacement annually at Monitoring Station(s) CLY-12.
12. The Licensee shall provide the monitoring results for thermistor, standpipe, and settlement stations at Monitoring Stations CLY-9, CLY-10, CLY-11, and CLY-12 semi-annually, due no later than July 31 and January 31 of each year, for the first two years of monitoring. An annual assessment of the geotechnical and geothermal performance of the Enhanced Sewage Disposal Facility shall be provided as an addendum to the Annual Report.
13. The Licensee shall submit to the Board upon approval by an analyst, for inclusion with the O&M Manual, required under Part F, Item 1(f), a Quality Assurance/Quality Control (QA/QC) Plan. The Plan shall include up to date sampling methods to all applicable standards, acceptable to an accredited laboratory as required by Part H, Item 14 and Part H, Item 15. The Plan shall include a covering letter from the accredited laboratory and analyst, confirming acceptance of the Plan for analyses to be performed under this Licence.
14. 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 as approved by the Board in writing.
15. All analyses shall be performed in a laboratory accredited according to ISO/IEC Standard 17025. The accreditation shall be current and in good standing.
16. The Licensee shall include all of the data and information required by the Monitoring Program as well as an indication of wastewater treatment levels upstream and downstream of the Vegetate Filter Strip Wetland Area in the Licensee's annual report, as required *per* Part B, Item 2, or as requested by an Inspector.

17. Modifications to the Monitoring Program may be made only upon written approval from the Board. Requests for changes to the Monitoring Program should be forwarded to the NWB in writing, and should include the justification and appropriate evidence to support the change
18. Additional sampling and analysis may be requested by an Inspector.

**SCHEDULE I**  
**WATER LICENCE NO. 3BM-CLY0909**

<b>Monitoring</b>	<b>Description</b>	<b>Frequency</b>	<b>Status</b>
CLY-1	Raw water supply intake at Water Source Lake	<u>Volume:</u> Monthly and Annually	Active (Volume)
CLY-2	Runoff from the Solid Waste Disposal Facilities	Once at the beginning, middle and near the end of the season during observed flow/seepage	Active (Water Quality)
CLY-3a	Raw sewage at truck offload point (existing cell)	<u>Volume:</u> Monthly and Annually	Not Active (Volume)
CLY-3b	Raw sewage at truck offload point (new cell)	<u>Volume:</u> Monthly and Annually	Not Active - New (Volume)
CLY-4	Effluent discharge from existing Sewage Disposal Facility	<u>Volume:</u> Monthly and Annually <u>Water Quality:</u> Three times annually (as per Part H, Item 3);	Active (Volume and Water Quality)
CLY-5	Effluent discharge from Enhanced Sewage Disposal Facility (Lagoon decanting point)	Same as CLY-4	New (Volume, Water Quality)
CLY-6a	Sampling well at the end of Vegetated Filter Strip Wetland at location shown on drawing CSM-1	<u>Water Quality:</u> Three times annually (as per Part H, Item 3);	New (Water Quality)
CLY-6b	Surface water at the end of the Vegetated Filter Strip Wetland in vicinity of CLY-6a	<u>Water Quality:</u> Three times annually (as per Part H, Item 3);	New (Water Quality)
CLY-7	Water five (5) metres from the point where Effluent enters Patricia Bay	<u>Water Quality:</u> Three times annually (as per Part H, Item 3);	New (Water Quality)
CLY-8	Sewage sludge	To be determined in accordance with Part F Item 2(c) and Part H Items 10 and 15	New (Volume and Quality)

Monitoring	Description	Frequency	Status
CLY-9	All thermistors at locations shown in drawing SP-2 of the Application for Water Licence Amendment (casings to extend 5 m below the base of the berm)	<u>Temperature:</u> Minimum once every two months for the first two years following construction, then twice annually (early spring and mid to late fall) thereafter	New (Temperature)
CLY-10	All single-bead thermistors placed below the liner and into key trench at locations adjacent to those defined in CLY-9	Same as CLY-9	New (Temperature)
CLY-11	All standpipes at locations shown in drawing SP-2 of the Application for Water Licence Amendment	<u>Seepage:</u> Annually early to mid fall <u>Water Quality:</u> When seepage is observed	New (Seepage and Water Quality)
CLY-12	All settlement stations at locations adjacent to thermistors shown in drawing SP-2 of the Application for Water Licence Amendment	<u>Settlement:</u> Annually	New (location, elevation)
CLY-13	Runoff from the quarry site	Once at the beginning, middle and near the end of the season during observed flow	New (Water Quality)

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## **Appendix C – Geothermal Modeling**

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**Thermistor Record Sheet**

**MONITORING SITE**  
**(TEMPERATURE RECORDED IN DEGREES CELSIUS)**

SENSOR	DEPTH (m)	1	2	3	4	5
1	0					
2	0.5					
3	1					
4	2					
5	4					
6	6					
7	8					
8	10					
INITIALS/SIGNATURE:						
DATE:						

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## **Appendix D – Thermistor Data Collection**

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# Quickstart for Installation Validation of the Thermistor String

## 1.0 Installation Validation Steps

- Installation of the loggernet software on the computer
- Connect the thermistor string to the test box (using the rectangular-shaped connector)
- Turn the power on with the terminal block blade
- Start the computer and the LoggerNet Software (setup the connection)
- Monitor data
- Collect data

## 2.0 LoggerNet Software

### 2.1 Description

The LoggerNet is a fully featured Windows-based software package that allows direct communication with the test box using a RS-232 connection. A “Connect” screen provides real-time tools to set the datalogger clock in order to send the program to the datalogger and manually collect data using a computer. In addition, data can also be retrieved automatically, based on a predefined schedule. Measurements can be viewed in real-time on both numeric and graphical displays. In addition to these basic tools, the software package includes a datalogger program editor, a report generation tool and a data viewer with basic plotting capabilities.

This application note is intended to give the user a quickstart in getting the datalogger powered up and running. However, we strongly recommend that the user read the LoggerNet manual in order to get familiar with its features.

### 2.2 Software Installation

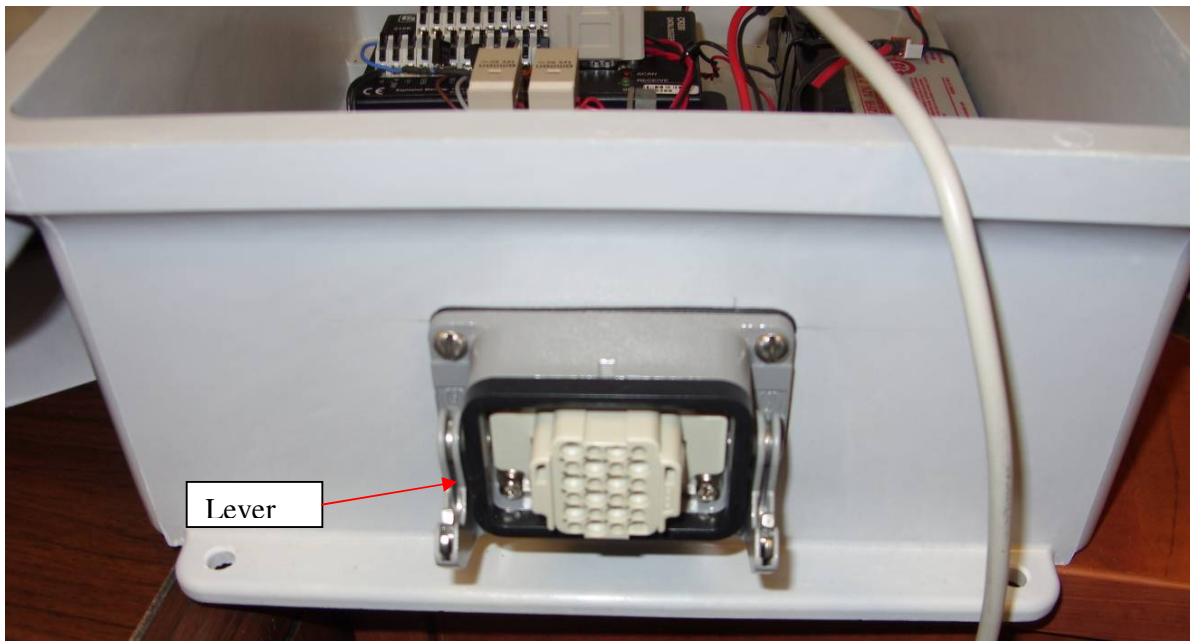
The LoggerNet is a collection of 32-bit programs designed for Intel-based computers running Microsoft Windows 2000, Windows XP or Vista.

As with all softwares, we strongly recommend that a back-up of critical files be performed before software installation. Place the installation disk in your computer's CD/DVD drive. If autorun is enabled, LoggerNet installation will start. If it does not start, select START > RUN from the Windows's START menu. Locate the SETUP.EXE file on the CD/DVD drive and click OK. Follow the instructions on the screen. Refer to the LoggerNet manual for further details.

When the installation is done, a LoggerNet icon will be placed on your desktop.

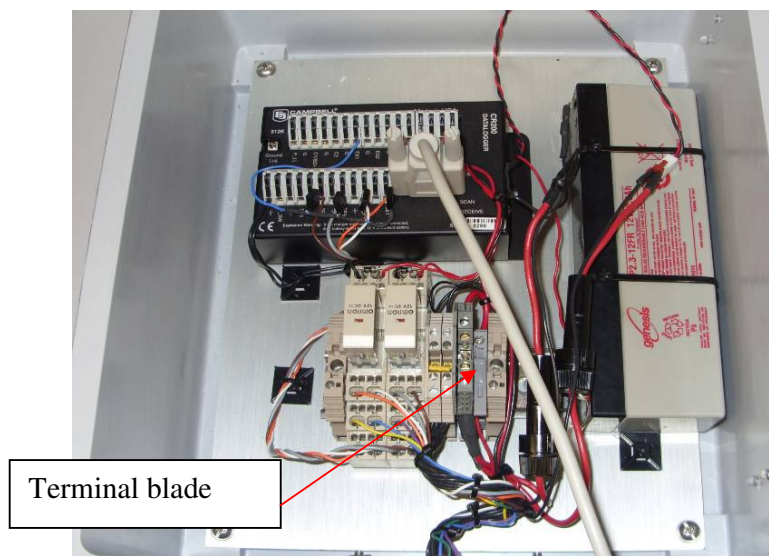


### 3.0 Connection of the Thermistor String to the Test Box



Connect the connector to the mating on the test box and lift up the lever to secure the connector in place. *NOTE: make sure to seal back the connector of the thermistor string to avoid any water infiltration in the connector before the final installation.*

### 4.0 Turn the Power On on the Test Box



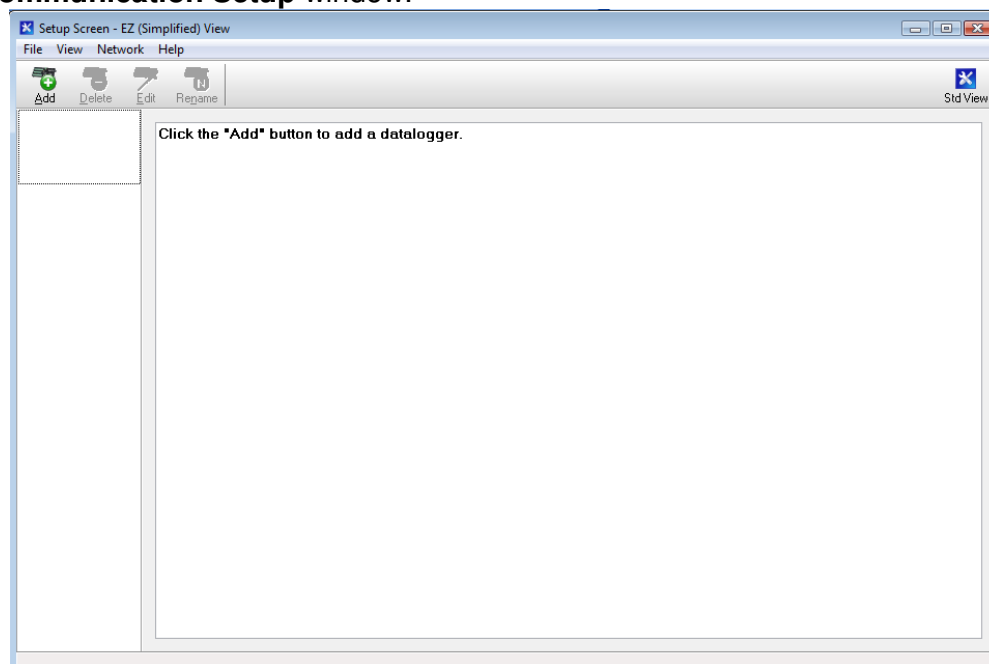
The terminal blade is used to turn the power OFF. Lower the blade to turn the unit ON. Make sure to raise the blade at the end of the test to avoid any battery drainage.

## 5.0 **Setup the Connection**

The hardware and software setups are done. The following steps describe the instructions to connect the datalogger, to collect or monitor data

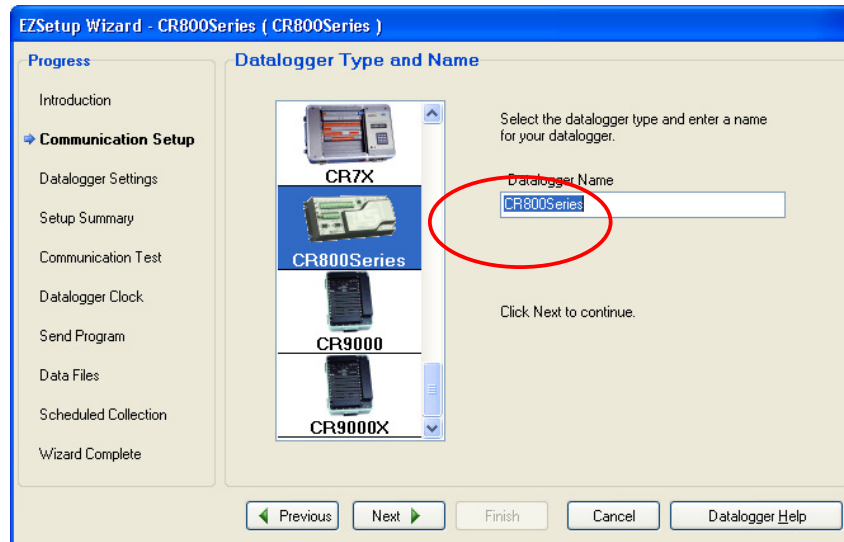
To start the LoggerNet, double click on the LoggerNet desktop icon.

- From the **MAIN / SETUP**, click **Add** and then click **Next**, which will get you to the **Communication Setup** window.

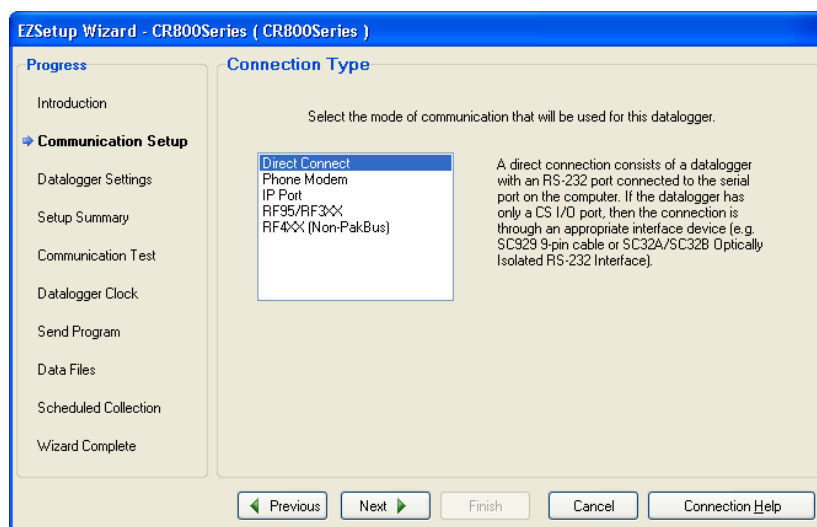


- Wait at least 15 seconds after powering up the unit before attempting to communicate with it.

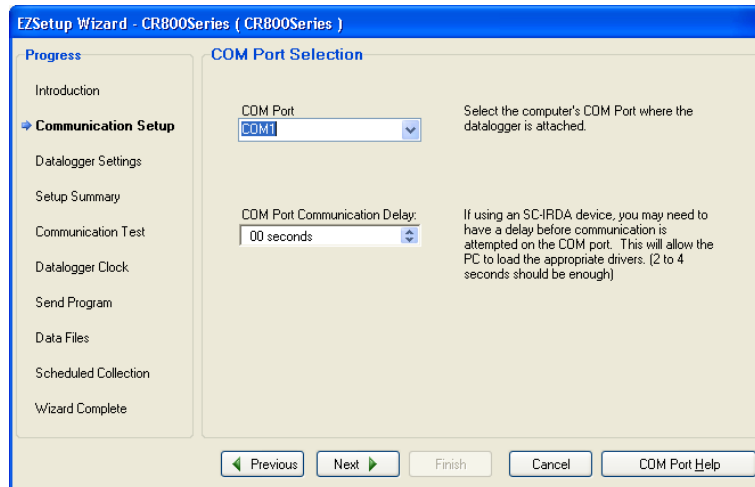
- Under **Datalogger Type and Name**, select **CR200 Series**, and next under **Datalogger Name**, choose a name that best represents your application. For example, type **Thermistor** and click **Next**. This datalogger name will be used later to connect to the Thermistor datalogger.



- Select **Direct Connect** and click **Next**.

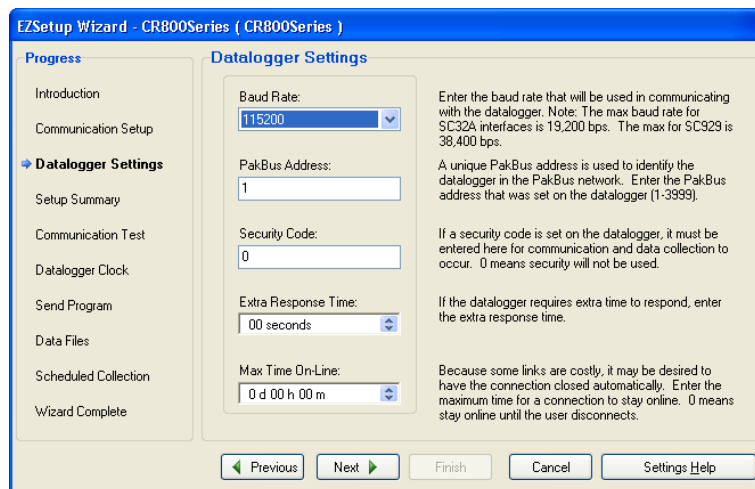


- Select the appropriate **COM port** on your computer. Usually, if you have a serial port on your computer, **COM 1** will be available. However, if you use a USB Serial adaptor, a virtual port will be created and a new COM port number will be assigned. Click **Next** when done.

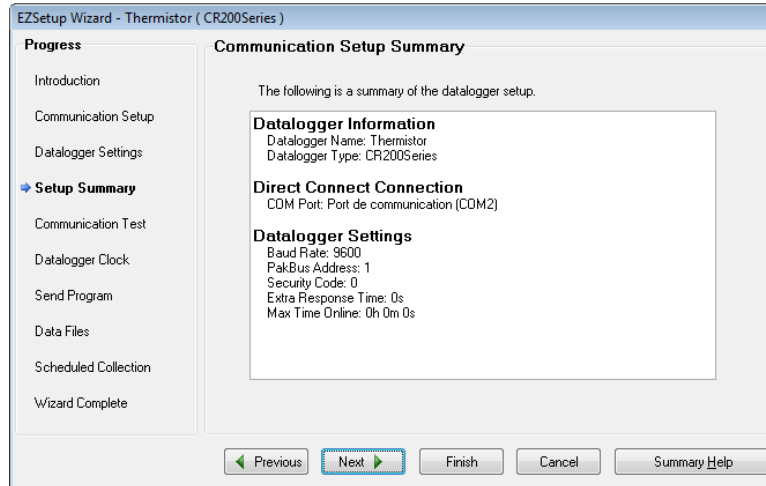


- Use the default parameters and click **Next**.

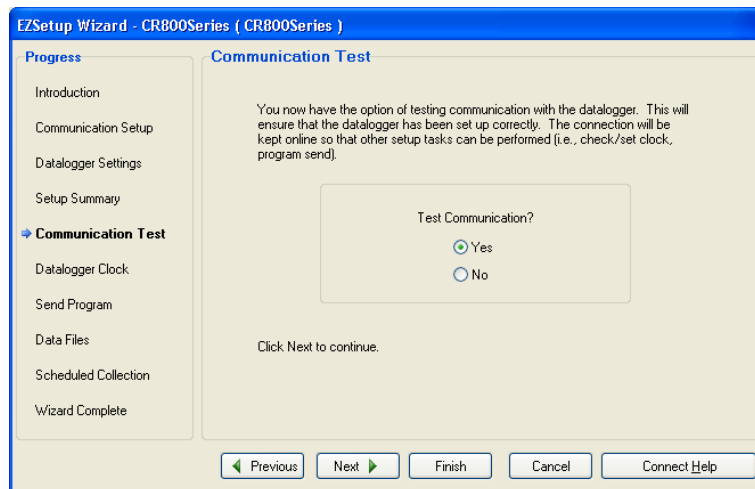
**Note:** If you use a USB Serial adapter you may need to lower the Baud Rate, in general **9600** works fine with the adapter.



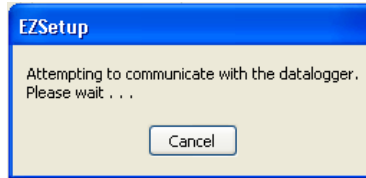
- The following window displays the Communication Setup Summary. Click **Next**.



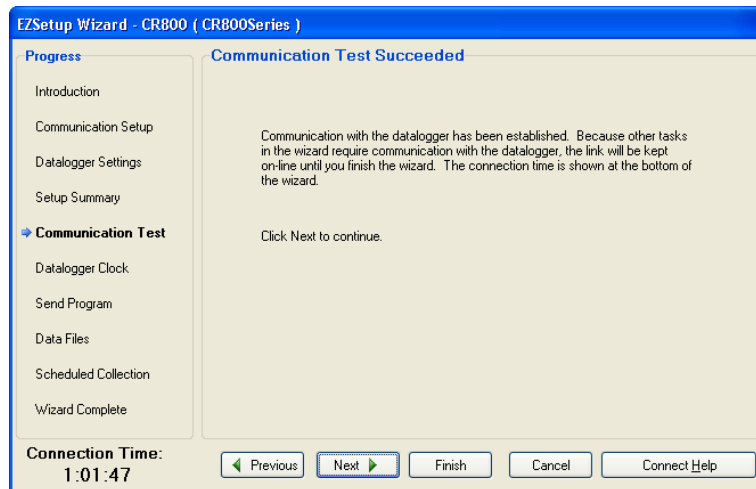
- To test the communication, select **Yes** and click **Next**.



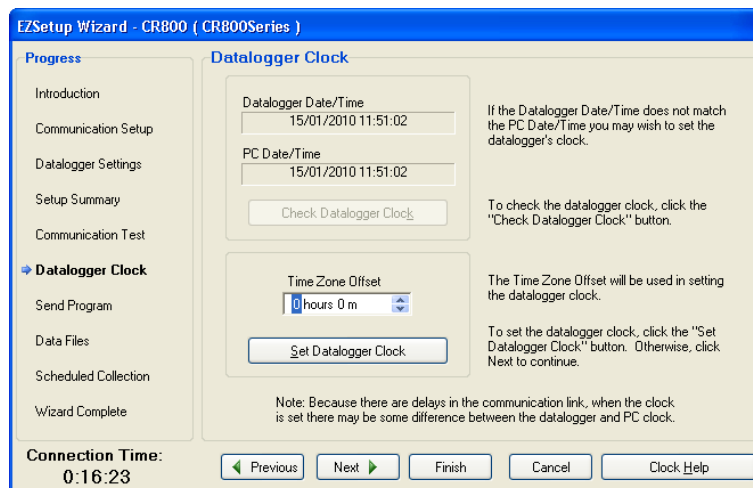
The following message will appear on the screen while your computer is attempting to communicate with the Thermistor datalogger.



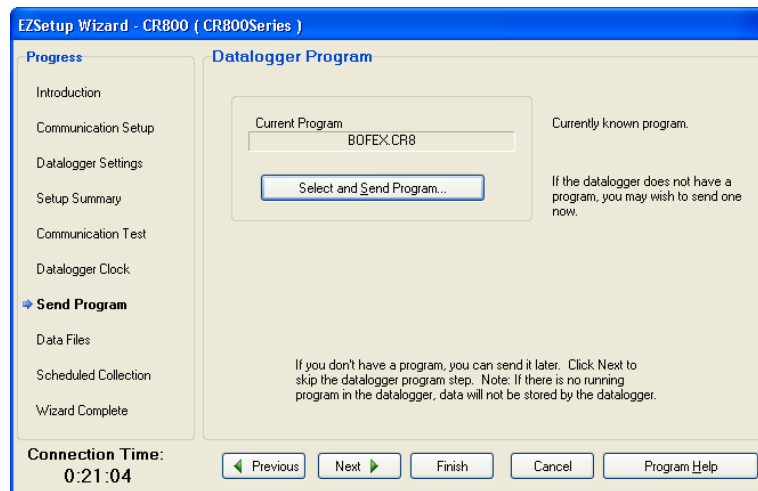
- The next windows will indicate if communication is successful. Click **Next**.



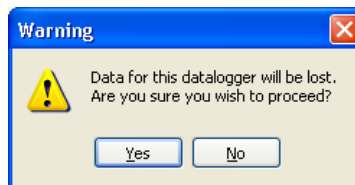
- Adjust the clock to set it at your local time zone. Make sure your computer is adjusted to your local time, then click **Set Datalogger Clock**. When done, click **Next**.



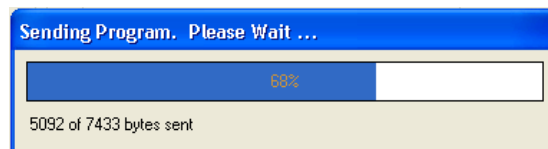
- The datalogger is usually shipped with the Application Program pre-loaded in the datalogger. The program will be displayed under **Current Program**. If it shows **no program** or if the program name shown is not for your application, you will need to upload your Application Program in the datalogger. Click **Finish** to save your settings. At this point, the datalogger setup is completed. To quit the **EZSetup** wizard, select **File** from the menu and click **Exit**. Proceed to section 4.2.



- To download your application program, click **Select and Send Program**. Locate the program on your computer's HD drive or on the one supplied by email, and click **Open**. The following warning message will be displayed on your screen. Click **Yes**.

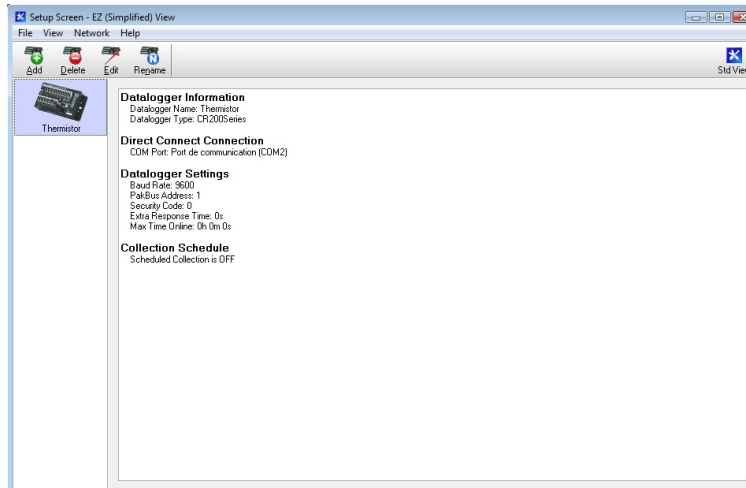


- A progress bar will display the download progress. If successful, a message will indicate it.



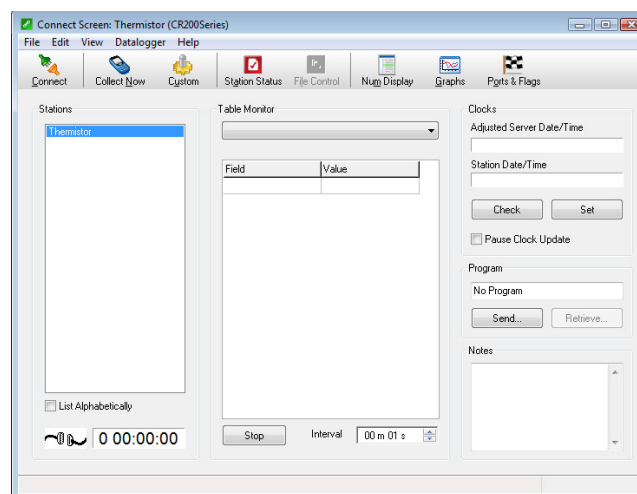
- Click **Finish** to save your settings. This completes the datalogger setup using the **EZSetup** wizard.

- To quit the **EZSetup**, select **File** from the **Menu**, and click **Exit**.

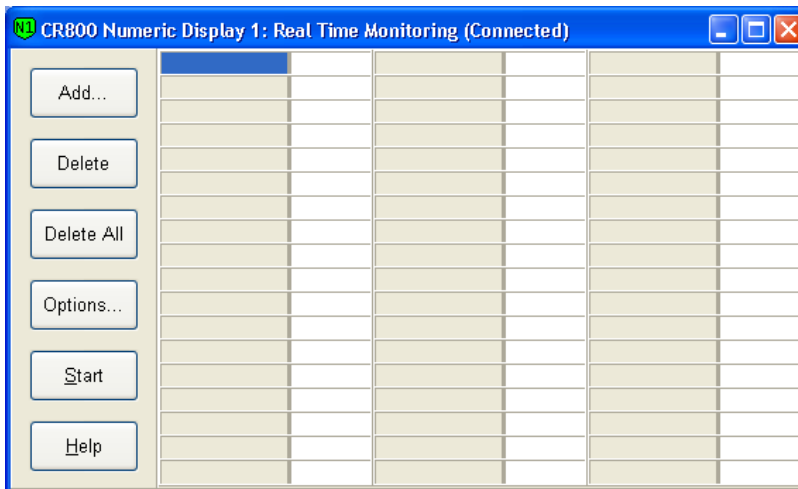


## 6.0 Monitoring Data With a Computer

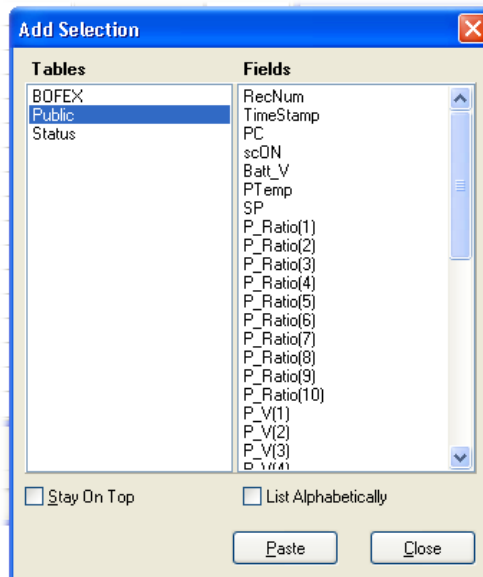
- Connect the supplied Serial Cable between the RS232 Input on the CR200 datalogger and your computer's serial port or USB Serial Adapter.
- Start the LoggerNet by double clicking on the LoggerNet desktop icon.
- From the **MAIN/CONNECT**, click on the station **Thermistor**, then **Connect**



- The cable at the bottom of the screen will be connected when the link will be established. Click **Num.Display/Display 1**. The following window should appear.



- Click the **Add** button and under **Tables**, highlight **Public**. The following window should appear.

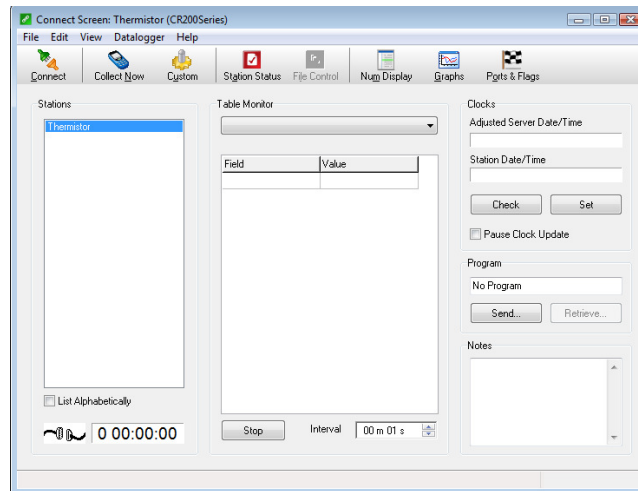


- Under **Fields**, select (highlight) the sensors (labels) you wish to view during the Test. You can use a combination of Shift & Ctrl keys on the computer's keyboard to select multiple labels. Next, on the **Display 1** window, highlight the location where you want to place the labels and finally, from the **Add Selection** window, click **Paste**. We recommend you to monitor the entire content in **Public**. The variable **Thermistor** represents the temperature and the value **Resistor** represents the resistor value of the thermistor.

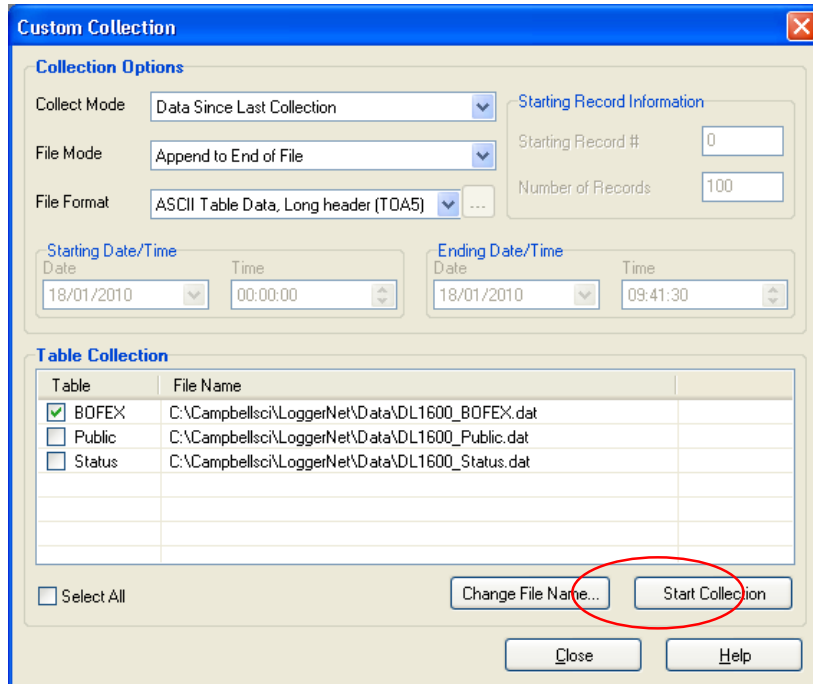
## 7.0 Collect Data

When a Test is completed, readings should be collected immediately. The following steps assume that the computer is already connected and that the LoggerNet is already running.

- From the **Connect Screen**, click the **Collect Now** button.



- Click on the Data\_X.dat file to see the content. The records are displayed in a table.
- To modify the data output, click **Custom** in the connect screen. The following screen will appear.



**Custom Collection**

**Collection Options**

Collect Mode: Data Since Last Collection

File Mode: Append to End of File

File Format: ASCII Table Data, Long header (TOA5)

**Starting Record Information**

Starting Record #: 0

Number of Records: 100

**Starting Date/Time**

Date: 18/01/2010 Time: 00:00:00

**Ending Date/Time**

Date: 18/01/2010 Time: 09:41:30

**Table Collection**

Table	File Name
<input checked="" type="checkbox"/> BOFEX	C:\Campbellsci\LoggerNet\Data\DL1600_BOFEX.dat
<input type="checkbox"/> Public	C:\Campbellsci\LoggerNet\Data\DL1600_Public.dat
<input type="checkbox"/> Status	C:\Campbellsci\LoggerNet\Data\DL1600_Status.dat

☐ Select All

Change File Name... Start Collection

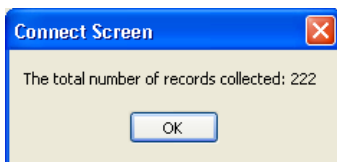
Close Help

- Under **Collection Options**, make sure the following options are selected:
  - **Data Since Last Collection**
  - **Append to End of File**
  - **ASCII Table Data, Long header (TOA5)**
- Under **Table Collection**, make sure that **Data\_X** is checked and that the file path where to save the file is defined. You do not need to check the **Public** and **Status** boxes.

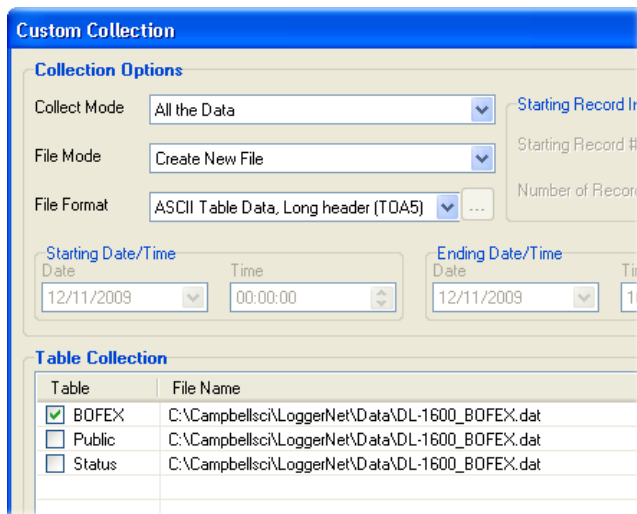
When collecting readings for the first time, you may need to collect all the data from the test box. This will set all memory pointers so that the next time you collect readings, the datalogger will know what readings were previously collected, and only new readings will be collected. All new readings will be appended to the previously collected file, or a new file will be created.

- Click **Start Collection**. The following message will appear, showing the collection progress and total records collected.

**Note:** A single record includes the timestamp, the record number, all sensors readings in Celcius degrees, and finally, the datalogger's battery voltage.



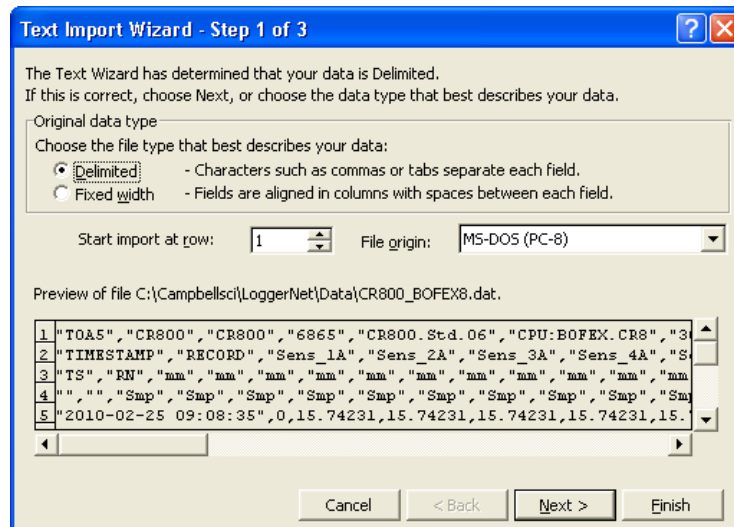
If the message window shows zero records collected, set the **Collection Options** as follow and do the **Start Collection** again.



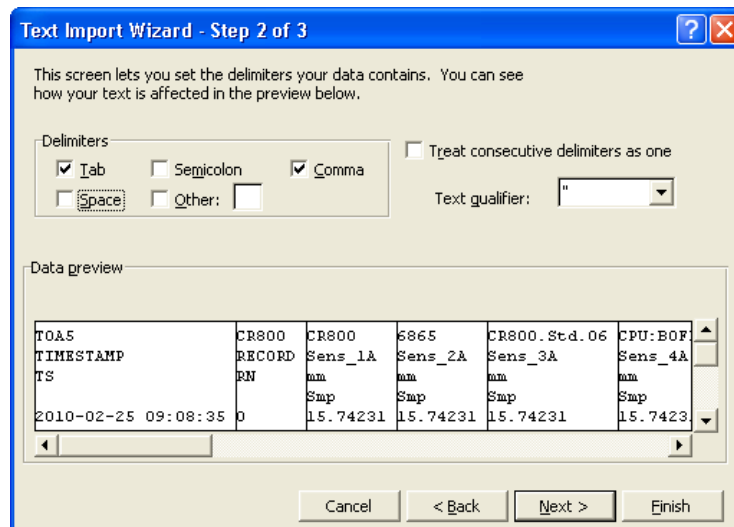
All collected readings are saved in the file specified under Table Collection. The readings saved with the file format **ASCII Table Data, Long header (TOA5)** are separated by commas (CSV) and can be imported into Microsoft Excel for data reduction.

## 7.1 Import Readings Into Excel

- Start Excel, go to **File > Open**, in the **Files of type** field, then select **All Files (\*)**.
- Locate and select the file to import and click **Open**. The Text Import Wizard will open.



- Select **Delimited** and click **Next**.



- Select **Tab**, **Comma** and click **Finish**.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	TOA5	CR800	CR800	6865	CR800	Stc	CPU:BOF	3022	BOFEX					
2	TIMESTAMP	RECORD	Sens_1A	Sens_2A	Sens_3A	Sens_4A	Sens_5A	Sens_1B	Sens_2B	Sens_3B	Sens_4B	Sens_5B	S_Range	Load
3	TS	RN	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	
4			Smp	Smp	Smp	Smp	Smp	Smp	Smp	Smp	Smp	Smp	Smp	Smp
5	25/09/2009 09:08	0	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	50	0
6	25/09/2009 09:08	1	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	50	0
7	25/09/2009 09:08	2	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	50	0
8	25/09/2009 09:08	3	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	50	0
9	25/09/2009 09:08	4	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	15.74231	50	0
10														

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## **Appendix E – Record Drawings**

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