Hamlet of Gjoa Haven, Nunavut

Solid Waste Treatment Facility

Operation and Maintenance (O&M) Plan

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Aug 15, 2013

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Pictures and Map

O & M manual:

The purpose of O & M manual is to assist community staff in the proper operation and maintenance of their waste disposal facilities. The O & M manual is includes a description-

- How facilities are operated and maintained
- How often the activities are performed and who is responsible for the compliance
- Location of facilities and proximity to receiving water body
- Frequency of inspection of berms, drainage and dams
- Removal of hazardous and toxic materials from waste disposal facilities
- Controlling leachate run-off and leachate water discharge quality
- Runoff and drainage control within inner perimeter and over wetland facility
- Treatment of contaminated drainage if any
- Prevention of windblown debris from waste facility during summer and fall
- Managing hazardous waste and metals
- Segregation of domestic, metal and recyclable waste materials
- Method and frequency of site maintenance including berm, fence, gate, access way etc.
- Frequency and method of on-site incineration if permitted.

The manual demonstrates to the Water Board that the community is capable of operating and managing their waste sites. The following is a list (but not limited) of the main components of the O & M manual for sewage and Solid waste disposal facilities:

A. Introduction:
   - Purpose of the manual
   - Location of the community
   - Basic geographical information such as precipitation data, permafrost, hydrological information
   - Map of community and location of sewage and solid waste facility
   - Population and projected growth trend

B. Background:
   - Where the water source
   - How solid waste are collected and quantity of daily/weekly/monthly collection
   - Waste generation and composition projections
   - Solid waste management and disposal system
   - History of facility development, time of operation, change and modification if any
   - Location of wetland and trend of wetland condition during summer, winter and fall

C. Operation and Maintenance of Solid Waste Disposal Facility
   - Location of solid waste disposal facility, area and dimension of the facility
   - Distance of water bodies and drainage paths
   - Distance of airport and runway from the facility
   - Prevailing wind trend
   - Segregation of solid wastes into sections such as bulky waste, oil, honey bag, refuse area, hazardous waste, metals and recyclable waste.
   - Operators name, working hours and contact numbers
   - Classification of solid wastes including hazardous and toxic substances
   - Disposal procedure
   - Basic maintenance procedure and frequency of maintenance including waste compaction, methods of preventing windblown debris, fencing, signs, odor control, burning, squeezing, leachate drainage etc.
   - Cover materials piles on site or source of collection
   - Safety procedure of operators
   - Site records showing site visits of inspector, sampling, maintenance and any other activities.
   - Alternatives to burning wastes

D. Hazardous Waste Management
   - Handling of hazardous wastes
   - Segregation
   - Storage
   - Classification of types of hazardous wastes found in the community
   - Collection and disposal procedure
   - Site record showing the collection, description of hazardous, volume, clean up carrier name & description, copies of the Form for Transport of Dangerous Goods (TDG) and persons removing wastes from site
   - Safety procedure of operator to follow when dealing with hazardous wastes such as Workplace Hazardous Materials Information System (WHMIS)

E. Emergency Responses
   - Fire - procedure to follow in case of an event, persons and department to notify
   - Spill – contingency plan for spills and reporting procedure

F. References of reports, guidelines and other documents used to develop the manual

1.0 Introduction

1.1 Hamlet Description

The Hamlet of Gjoa is on the South-East coast of King William Island on the North-West Passage at 68^0 N latitude and 96^0 W longitudes, approximately 1100 km North-East of Yellowknife, sitting 40 m above sea level on sand and boulders form terrain within the Kitikmeot region of Nunavut. It is a zone of continuous permafrost, on sand, gravel bedrock predominates in the higher hills and gently rolling terrain comprising numerous lakes and ponds, covered with thin layer of tundra vegetation & grasses. Despite poor soil quality, various types of lichen, moss, willow, heather and wildflowers grow in the area. Wildlife in the area mainly ground squirrels, lemmings, weasels, arctic hares, arctic foxes, ringed seals and numerous species of birds and fish.

Climate of Gjoa Haven is reasonable summers and extremely cold winter, average mean temperature in January -39^0C to -23^0C and July high & low 13.9^0 C and 7.2^0C. Seasonal rainfall average 5 cm, snow fall average 25 cm and mean precipitation 8 cm.

The community has a population of approximately 1260 (2006), with an approximate 5.0 percent projected growth rate over the 20-year design period. Community infrastructure includes:

- A water treatment plant, which draws water from the Swan Lake, transport it to the treatment plant through a 2.3 km buried line and stores it after treatment for trucked water to holding tanks in each building
- A Solid Waste Management Facility, which includes a bulky metals disposal area
- A hazardous waste oil storage area and a battery and other materials storage area next to the solid waste site.

1.2 Nunavut Water Board Licence

The Hamlet of Gjoa Haven operates their municipal water, sewage, and solid waste facilities under the Nunavut Water Board (NWB) License 3GJO-0409, dated of issue January 08, 2004 and Expiry January 31, 2009. Part G, Section 1 requires that an Operation and Maintenance (O&M) Plan be submitted for the facilities in accordance with applicable regulations and guidelines. This document was created to provide staff with O&M procedures for the proposed Sewage Treatment Facility. A renewal to the NWB license is being requested.

The O&M Plan of the Waste Treatment Facility will be used in conjunction with the normal operating procedures. This document provides a list of tasks and procedures that will assist the Hamlet's operations staff in the O&M of the facility.

This O&M Plan should be updated when the amended NWB license is issued.

1.3 Climate of the Community

Gjoa Haven is affected by Arctic air masses and experiences a maritime Arctic climate characterized by short cool summers, and long cold winters. The mean annual air temperature is -12°C. Monthly averages range from -39°C low, -23^0C high in January to 7^0C &13°C in July. Gjoa Haven receives about 8 cm of precipitation per year, of which 5 cm falls as rain between June and September. Prevailing winds are from the east in the summer and from the southwest in the winter. The mean wind speed is approximately 17.5 km/hr. Tracking weather conditions will be important during lagoon discharge in the summer.

2.0 Solid waste Facility

2.1 Site Description

The solid waste disposal facility for Gjoa Haven is located approximately 975 m east of the community, south of sewage lagoon. Access to the site is via a gravel road. The solid waste facility has three main areas: (i) one area is for general municipal waste disposal, (ii) one area for bulky wastes and (iii) the other area for hazardous waste. The site layout is shown in **Figure Map A**. The general municipal waste area is fenced, but does not have a gate and so access to the community is not limited. Waste is piled and crushed within the fenced area and time to time burns during summer and fall routine basis depending on weather.

2.2 Waste Disposal:

This is the largest disposal area where general household, restaurant, institution, co-op store and construction wastes are placed. The area is approximately 140 m east of access road and 120 m wide. The site is protected by an earthen berm in two sides preventing runoff from entering into the site and directing any flow to the south corner. The 8 ft high fence surrounds the site and preventing off migration of windblown debris.

2.2.1 Bulky waste area:

Non-combustible items such as house sewage and water tanks, house appliances, scrap snowmobiles, damage automobiles vehicles, body parts are placed at this waste area.

2.2.2 Hazardous waste area:

This is basically a part of bulky waste area which has been designed for storing hazardous materials such as paint, aerosol container, batteries those are to be placed inside pallets and cover with plastic sheet all around.

2.3 Waste Quantities:

The rate of refuge generation based on Government of Nunavut guidelines is:
0.010 m3/cd

The equation for calculating solid waste generation is:

Solid waste Generation (m3/d) = 0.01 m3/cd x (1+0.00023 x population)

The factor of 0.00023 x population represents the commercial & industrial solid waste uses.

Population data for Gjoa Haven obtained from the Nunavut Bureau of Statistics (2010). Using available data for 2009 through 2020, population projections for 2009 to 2020 estimated using an average growth rate of 5% per year. The Table below illustrates the estimated population of Gjoa Haven from 2009 through 2020. Based on the estimate, Gjoa Haven's population will be 1,974 in the year 2020.

Based on waste generation per year per person, cumulative amount by the year 2014 over 72,000 m3 and at the end of year 2020 will be over 102,000 m3.

Year	Population at the year	Waste Generation /year (m3)	Cumulative Waste (m3)
2009	1154	4,556	**48,762**
2010	1211	4,603	53,365
2011	1272	4,653	58,018
2012	1336	4,706	62,724
2013	1403	4,762	67,486
2014	1472	4,819	72,305
2015	1546	4,880	77,185
2016	1624	4,945	82,129
2017	1703	5,010	87,139
2018	1790	5,082	92,222
2019	1880	5,157	97,378
2020	1974	5,234	102,613

The cumulative amount 48,762 m3 shows above are the volume generated for last couple years since the facility developed and stored on site in access to those have reduced from site though seasonal burning and removing from site time to time. Currently, the facility is getting more heaping lines of solid waste and metal dump, reducing the capacity for future dump. Segregation and proper heaping of wastes are important in managing the solid waste site which is in plan for compliance and the O & M manual for information and operation.

2.4 Waste Collection

Refuse is collected in a two-man stake truck. Each residence is provided with two 45 gallon barrels. These barrels are used as burning barrels, however garbage collection is carried daily, much of the waste collected is unburned and later burned at the waste site. The characteristic of solid waste generated are domestic and commercial. Domestic wastes are typically household wastes such as food, packing materials, cardboard, household articles and daily uses other materials. Appliances, oil drums, equipment, recreational stuff, computer parts, books, paper all are considered as household waste. Commercial waste may include building materials, paper & crafts waste, drums, auto parts, oil filters, animal residual accessories, grocery box & cartons etc. Table below is showing a typical composition of waste in a northern community.

Component	% by weight
Food stuff	15.9
Cardboard	9.3
News print and flyers	0.3
Books and other paper products	14
Pop cans	5
Metal bottles	6.5
Rubber, plastic, leather	8.9
Cloths and textile	3.3
Glass, ceramics	1.7
Wood and wood products	20
Personal hygiene, diaper etc.	10.3
Napkins, cleaner, rags etc.	4.8
Total	**100 %**

Source: Guidelines for Planning, Design, Operation & Maintenance of Solid Waste Site in the Northern Community, Heinke & Wong, 1991

Form : Monthly Waste Collection and Disposal Log

Hamlet of Gjoa Haven

Month:---------- Truck #: ----------

Date	Number of Trips	Volume per Trip (m3)	Total Daily Volume (m3)	Comments
1	4	5	20	
2	5	5	25	
3	4	5	20	
4	4	5	20	
5	5	5	20	
6	0			
7	0			
8	6	5	30	
9	5	5	25	
10				
11				
12				
13				
14				
15				

Note: *Data records in column 2, 3 and 4 shows some example of waste collection records on daily collection from the community.*

2.5 Site Operation & Personnel

The Hamlet Foreman is responsible for the overall operation of the solid waste facility as well as the maintenance necessary. Regular 2 full time operators are employed for site management and operation of solid waste site including the sewage waste facility and wetland since all these facilities are mostly related and connected in operation. Moreover, additional employment of causal staff as required during summer time to operate garbage collection and disposal. Name and contact numbers of responsible employee are as below. The SAO is the main contact and backup for coordination and information with his contact number.

Operators Name	Title	contact number
Jacob Keanik	Hamlet Forman	867-360-6138
Adam Halluqtalik	Hamlet Operator	867-360-6138
Troy Beaulieu	Land Administrator	867-360-7141 x6
Gord Dinney	SAO	867-360-7141

2.6 Operational Procedure

- Waste collected from house hold barrel, transport inside cover vehicle (truck) and dump in appropriate area as indicated in dumping plan.
- Identification of dumping cell inside the facility and direction signs at the entrance are available and visible to the facility users. Hamlet operator remains responsible in maintaining these signage and direction information.
- Dumping restricted to a manageable quantity on each area at time. More than manageable quantity can be handled with the help of hamlet operators. Users are advised to contact the operator at the available contact numbers at the facility ahead of dumping their wastes. Manageable quantity restricted for the purpose of proper segregation and management of future storage.
- Burning of combustible materials inside the protected area as required @ 2-3 times a week depending on weather and volume of generation. Burning is only suggested when hamlet operator is present at work and control the burning amount. Non-aerobic burning facility can be planned on available funding situation and amount of combustible materials generation. In Nunavut, restriction of onsite burning is not yet in effect, but in thought and discussion. Once restriction comes in effect, provision of onsite burning will be no longer in use for municipal solid waste facility.
- Provision is designed for compaction of dumps using Cat D6H to a max 2.5m thick layer. More quantity or thicker dump requires heavier equipment- hamlet do not requires such equipment unless a full improvement of the facility comes in plan. In future, such improvement and extension might be required, unless shipment of bulk materials from the site in plan.

2.6.1 Bulky waste area operation

Procedure for bulky waste dumping and storing is in an organized way starting from the back of the specified cell or spot and moving towards the front of the facility. This is required for better management of the facility and safety of the operator. Bulky materials are considered temporarily permanent at the slot until full removal of bulky stuff from site or compaction down to ground. Therefore, suggested procedure is:

- Heap the bulky waste whenever possible like composting and in assurance of safety against falling down.

2.6.2 Special Considerations

- Spring cleanup:

  After snow melts, a spring cleanup program for each year in segregating and collecting loose dumps from heaping stacks, possible burning and burry operation is required.

- Windblown protection

  The perimeter wire mesh fence to a height of 8 ft to retain garbage inside and protect the facility from debris coming inside shall be maintained with proper maintenance of fence. Provision of debris collection from inside and close proximity to fence outside shall be maintained using manual labour or garbage pick-up and place them either inside burn pit or as allocated pile. Provision of surface drainage all around inside the fence for snow melt and rain water run-off to retention sump of the waste site shall be maintained.

- Winter operation:

  Consideration should be taken for using suitable cover materials and heaping bulky wastes in the fall to protect waste from snow piles during winter. Site compaction to loose materials can be considered as an option in keeping the bulky waste in place. Hamlet uses manual labour each fall in piling the bulky wastes until such scope of pushing down waste into ground and cover with dry cover materials.

- Scavenging

  Public access is permitted during working hours and as per additional time request. Couple of steps and consideration are being taken to reduce the occurrence of scavenging such as burning in suitable weather day, compressing and water spraying. A dumping plan has been posted at the dump site and community posters placed in public areas for awareness and information in taking right decision in managing waste and public health.

2.7 Site safety and worker safety:

Waste disposal facility contains many different types of materials and hazardous substances along with garbage dump. Therefore, safety precaution should be taken to the facility worker, user and other personnel involved in operation and maintenance work.

- Safety boots, gloves and eye protection always to be maintained during working or using the facility.
- Hands wash frequently and as minimum after the work and before eating.
- Operator should stand clear and at safe distance during burning dumps.
- Provision for appropriate vaccinations for worker, operator and user as needed
- Only trained personnel are allowed to handle hazardous materials.

2.8 Site Records:

Records should be kept to assist in planning operation, maintenance and repair of solid waste facility. The information should be reviewed yearly to evaluate the effectiveness of operation and future forecast. The record will be kept in Hamlet Office and information maintained by Operation Manager. Record shall be covered including:

- Number of trips makes per day and approximate volume of sewage discharged
- Information of any monitoring for the day of a plan for next day(s)
- Results of monitoring program
- Any maintenance carried, required or in plan for the day or later the date

2.8.1 House hold waste:

- Number of trips and loads per day:
  3-4 trips per Truck and 7-10 loads per day

- Date of trip, capacity of truck and total volume of the day:
  1 truck of 1000 cubic ft capacity and total volume calculates from number of trips times the capacity.

- Volume of burning materials for the day (if any)
- Date, type and amount of cover materials (if any)

2.8.2 Bulky waste:

- Itemize quantity of bulky waste
- Number of trips and volume for the day of bulky waste disposed at site
- Amount of bulky waste shipped off or moved out (if any)
- Date when the site is full

2.8.3 Hazardous materials:

- Number of trips to the site and date of trip(s)
- Type of materials placed and condition of materials during disposal

2.9 Resource and Personnel

The Hamlet Forman is responsible for overall operation of the sewage collection, transportation and treatment facility as well as general operation and monitoring. One person is employed to operate each sewage truck. The hamlet is operating such two trucks with two full time drivers and one truck as backup in case of failure or regular one. Regular 5 days a week service with overtime operation during Saturday and Sunday in the case of emergency.

Contact person for any information and action as below:

Operators Name	Title	contact number
Jacob Keanik	Hamlet Forman	867-360-6138
Troy Beaulieu	Land Administrator	867-360-7141 x6
Gord Dinny	SAO	867-360-7141

3.0 Water License Requirements

As outlined in the NWB water license, regular monitoring of run-off and Treatment Facility is required. The Monitoring Program is to include effluent samples collected at various places including the Final Discharge Point of the Wetland Treatment System, during the months of June to October, inclusive. Several factors are particularly important to produce the required results:

- Collection of samples at the suitable time outlined in the requirement of the licence
- Use of correct and clean sampling container for parameters being tested
- Sampling from correct location and representing level or depth of flowing effluent
- Labelling of samples with correct time and date and filling necessary information
- Correct handling of sample bottles during sampling and storing for shipping out
- Shipping samples as quickly as possible in the correct container as outlined and recommended by the laboratory for complete testing procedure.

Sample locations GJO-4 is the run-off discharge point from the solid waste facility prior to entering the ocean. Sampling and monitoring is to be conducted by collecting grab samples of effluent collected shall be analyzed for the following parameters:

- Biological Oxygen Demand (BOD)
- Total Suspended Solids (TSS)
- Conductivity
- Oil and Grease (OGG) (Visual)
- Magnesium (Mg)
- Sodium (Na)
- Chloride (C1)
- Total Hardness
- Ammonia as Nitrogen (NH3-N)
- Total Cadmium (Cd)
- Total Cobalt (Co)
- Total Chromium (Cr)
- Total Copper (Cu)
- Total Aluminium (Al)
- Total Mercury (Hg)
- Faecal Coliforms (FC)
- pH
- Nitrate and Nitrite as Nitrogen (NO3-NO2
- Total Phenols (Total-P)
- Calcium (Ca)
- Potassium (K)
- Sulphate (SO4)
- Total Alkalinity
- Total Zinc (Zn)
- Total Iron (Fe)
- Total Manganese (Mn)
- Total Nickel (Ni)
- Total Lead (Pb)
- Total Arsenic (As)
- Total Organic Carbon (TOC)

Additional analytical parameters, which could become a requirement of the NWB water license or be requested by an Inspector as defined in the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*. Other parameters can be added as needed.

Sampling completed by the Hamlet of Gjoa Haven shall be in accordance with the Hamlet of Gjoa Haven Monitoring Program and Quality Assurance/Quality Control (QA/QC) Plan.

4.0 Training

Staff training is an important aspect of the operation of a Solid Waste Facility. Staff must be adequately trained to follow this O&M Plan and operate the facility. This O&M Plan is dependent on sufficient site specific training to allow staff to operate the facility.

5.0 Maintenance procedure:

Proper maintenance is important to ensure the efficient operation of all components and capacity of the facility to its life cycle period. Two main types of maintenance measures based on activity and purposes:

(i) Waste collection & storage maintenance and
(ii) Waste site maintenance.

Garbage waste collection is conducted from Monday through Friday in regular working hours regardless of holiday and additional special services upon request during government holidays. Mostly the sequence is:

- Residential garbage collection 3 days per week: Monday, Wednesday, and Friday
- Commercial and institutional collection at least twice per week: Tuesday, Thursday. Additional days for collection and disposal may be increased for an extra fee and request.

A monthly tipping fee is collected from customers of receiving regular service. Per day or per trip charges to the parties who are not in the regular list, but receives services on request. All fees go to Hamlet's account and profile to annual services and maintenance activities of these facilities.

5.1 Waste collecting vehicle and equipment maintenance:

The waste collecting vehicles or trucks shall be maintained in a good working condition to ensure the collection services not interrupted or delayed or disrupted. For this reason, it is planned for a backup vehicle either owned by hamlet or available for contracting services. This maintenance consideration included:

- The vehicle should be equipped with at least a shovel and brush to clean up accidental spills during garbage collection.
- Waste collecting vehicle should be facilitated to all weather condition and provision for

keeping basic safety tools.

- The vehicle should be cleaned periodically and as needed, serviced and inspected with changing servicing fluids as recommended from manufacturer.
- Operator log book shall be maintained with inspection documentation in taking action by the next user.
- The collection vehicle shall be parked inside heated garage when leaving idle and not using during the winter.
- The standby garbage truck shall be available for use when primary vehicle is down for maintenance.

5.2 Waste storage facility maintenance:

- Residential and commercial storage containers shall be kept in good condition and in a visible location where sewage truck has access and reachable for picking garbage. Separate containers shall be provided for recycle materials and pick up separately.
- Garbage containers shall be covered to prevent windblown debris from littering and animal entry for debris picking outside of the container. A chain and hook system cover can be encouraged for easy opening of container during garbage picking.
- Recycle materials shall be stored separately for possible return to manufacturer or store for shipping out once such arrangement available. Such recycle materials are included pop can, plastic container, plastic bottle, pipe, electronic and electric materials, computer parts etc.(refer to the picture added at back of this manual)**.**
- A separate arrangement for hazardous and radioactive materials collection shall be made such as halogen tube bulb, auto switch, led etc. community posturing and labeling on the container with awareness sign shall be made for user understanding of hazardous substances.
- Private burning of wastes within the community shall be discouraged due to smoke and fire hazards control.
- Bulky wastes shall be picked up as priority basis which normally drop outside of the household garbage container to ensure aesthetic and safety issues.

5.3 Berm and Fence maintenance:

Waste facility is protected by a perimeter earth-gravel berm from free run off to wetland when snow melts and leachate water collect to lower sump area during summer and fall. The fence serves dual purposes of restricting illegal public & animal access and reducing migration of windblown debris into the facility. During summer and fall, some important maintenance shall be carried out such as:

- Fence should be verified and tighten connection causing failure of containment.
- Fence should be inspected for failure or connections of openings to control debris out.
- Fence post should be inspected for frost heave and holding fence sides in position
- Fence should be cleared of windblown debris which cause more wind pressure onto the

post members and attract animal for pushing against fence for their foods.

- Fence should be free of snow melt or rain water stagnant which loose the support
- Fence should be free of animal sitting on fence wire or storing foods or nests.
- Fence can be colored or painted to make durable, weather protect and aesthetic.
- No burning should be close near to fence and contact of hazardous materials.

5.4 Sign maintenance:

5.4.1 Monitoring Locations

Monitoring stations are displayed on Figures 3 and 4. Until the lagoon is fully operational, the current monitoring stations for the existing lagoon will continue to be used. The following is a description of each monitoring location as outlined in the requested amendment to the NWB license:

GJO-4 Final discharge point of Solid waste run-off on wetland before mixing to ocean

GJO-5 Solid waste leachate collection point to a sump inside the facility berm

Sampling locations has been chosen precisely using GPS points taken shown below. Signs shall be kept to mark each location and alert the public.

Sampling Station	GPS Location		Description	comments
	Latitude	Longitude		
GJO-1	N 68^0 39$'$ 22.9$''$	W 95^0 55$'$ 06.5$''$	Raw Water supply at Swan Lake	Volume of water collected from lake
GJO-2	N 68^0 37$'$ 05$''$	W 95^0 50$'$ 42$''$	Effluent Final discharge point from Solid Waste	Outside the berm, on meandering wetland
GJO-3	N 68^0 37$'$ 28.8$''$	W 95^0 50$'$ 21.9$''$	Raw Sewage at Truck offload point	Detention cell sewage lagoon
GJO-4	N 68^0 37$'$ 23$''$	W 95^0 50$'$ 39$''$	Effluent Final discharge point of solid waste facility	Natural flow On wetland shallow channel
GJO-5	N 68^0 37$'$ 05$''$	W 95^0 50$'$ 44$''$	Solid Waste Leachate retention inside berm	New station. Sample collect only when decanting requires

5.4.2 Monitoring Procedures

The Solid Waste Treatment Facility O & M Plan provides details for site staff. The O & M Plan includes a short term and long term planning process, which would prompt the Hamlet to prepare for expansion and closure as the facility reaches the later years of its design life. New O & M manuals will be in place whenever new facility takes over the management program. Hamlet operators remain responsible in implementing the manual in managing the solid waste facility as a guide. But, on site instantaneous decision can be made in deciding disposal and storage depending on situation and type of waste. Hamlet employed full time operator and Forman maintain weekly inspection of facility containment and storage facility and updating information in the Field log. Extensive summer monitoring includes segregation of waste and storing in specific location. Continuous storage and heaping wastes facilitates in composting wastes and lead to landfill facility.

Hamlet operators with MTO training through GN and GN hired consultant are maintaining the solid waste facility and updating items as identified in AANDC inspection reports. Hamlet has an extensive monitoring plan for this year including waste separation, storage facility protection which will be continued until a new facility install for solid waste management for Gjoa Haven. A compliance Plan will be available at the hamlet and with the Board for information and implementation purposes.

Monitoring signage station-2, Solid waste run-off on wetland Final discharge, outside of Solid waste site

Monitoring signage station-4, Sewage Effluent run-off on wetland Final discharge

6.0 Emergency Response and Contingencies

In the event of an emergency, guidance regarding containment and site emergency response can be obtained from the following sources (Table 1):

Table 1: Emergency Contacts

Contact	Location	Telephone Number	Fax Number
INAC – Water/Wastewater Resources Manager	Iqaluit	(867) 975-4550	(867) 979-6445
Hamlet of Gjoa Haven– SAO	Gjoa Haven	(867) 360-7141	(867) 360-6309
Government of Nunavut (Regional Engineer)	Cambridge Bay	(867) 983-4156	(867) 983-4123
Environment Canada – Inspector	Iqaluit	(867) 975-4644	(867) 975-4594
Fire Department	Gjoa Haven	(867) 360-7141	
RCMP Detachment	Gjoa Haven	(867) 360-0123	(867) 360-3390
Community Health Center	Gjoa Haven	(867) 360-4531	(867) 360-3115

Contingency plans are designed to provide site staff with direction and options when there is an unexpected event or accident.

The Environmental Emergency Contingency Plan, Hamlet of Gjoa Haven (prepared as a separate document) provides procedures and direction in the case of a spill or accident.

As outlined in the Contingency Plan, the health and safety of workers and the public are the first priority.

7.0 Reporting

The Nunavut Water Board License on Part B: General Conditions include the requirement to file an Annual Report with the NWB no later than March 31st of the next calendar year. The report shall include:

- Tabular summaries of all data generated under the "Monitoring Program"
- The monthly and annual quantities iof freshwater obtained from all sources
- The monthly and annual quantities of each and all waste discharged
- A summary of modifications and/or major maintenance work carried out on the Water Supply and Waste Disposal Facilities, including all associated structures
- A list of unauthorized discharges and summary of follow-up action taken
- A summary of any abandonment and restoration work completed during the year and an outline of any work anticipated for the next year
- A summary of any studies, reports and plans (i.e. Operation and Maintenance, Abandonment and Restoration, QA/QC) requested by the Board that relate to waste disposal, water use or reclamation, and a brief description of any future studies planned
- Any other details on water use or waste disposal requested by the Board by November 1st of the reporting year

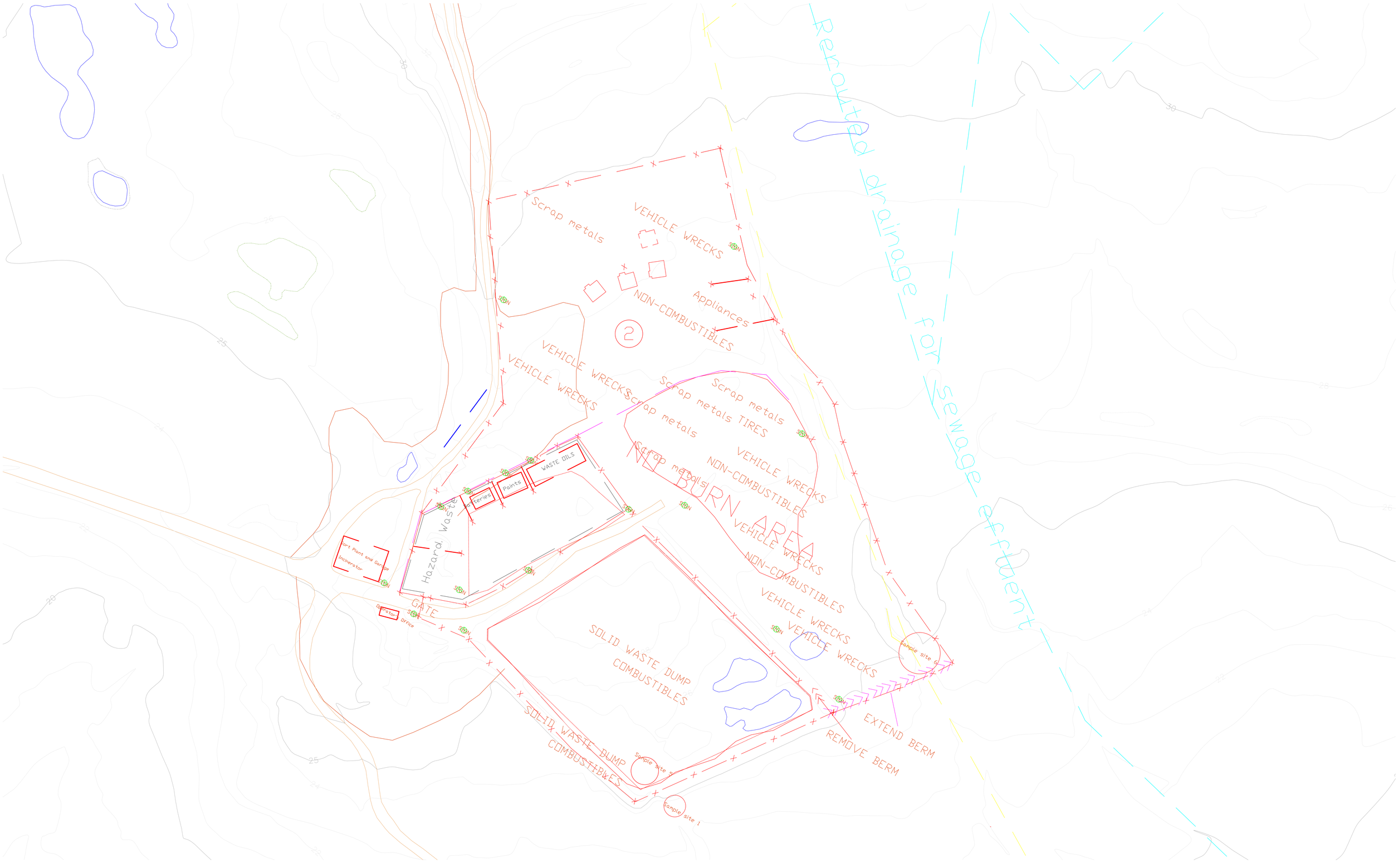
The creation of the report can be greatly simplified by staff regularly filling in the Site Form.

Hamlet of Gjoa Haven has identified of some illegal dump mainly heavy metals and home appliances outside of the fence and on wetland (reported AANDC inspection 2012& 2013). It has also reported mixing of metal dumps with hazardous and regular dumps in several locations inside the facility. Hamlet Operation and Maintenance program has prepared a compliance plan in implementing and managing the solid waste site this summer and continue next year as required, which is considered a supplementary plan of this manual, but remains in compliance to the requirements of the water licence.

Figure Map 'A': Site Layout of Solid Waste and Sewage facilities

Courtesy: Dillon Consulting Limited

Picture B: Community Poster for Recycles separation from MSW at the household storage


Rerouted drainage for sewage effluent
Scrap metals
VEHICLE WRECKS
NON-COMBUSTIBLES
Appliances
2
VEHICLE WRECKS
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Scrap metals
Scrap metals
Scrap metals TIRES
Scrap metals
VEHICLE WRECKS
NON-COMBUSTIBLES
NO BURN AREA
VEHICLE WRECKS
NON-COMBUSTIBLES
VEHICLE WRECKS
VEHICLE WRECKS
WASTE OILS
Paints
Batteries
Hazardous Waste
Dirt Plant and Garage
Incinerator
Director's Office
GATE
SOLID WASTE DUMP
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SOLID WASTE DUMP
COMBUSTIBLES
Sample site 2
Sample site 1
Sample site 3
EXTEND BERM
REMOVE BERM

ANNUAL REPORT

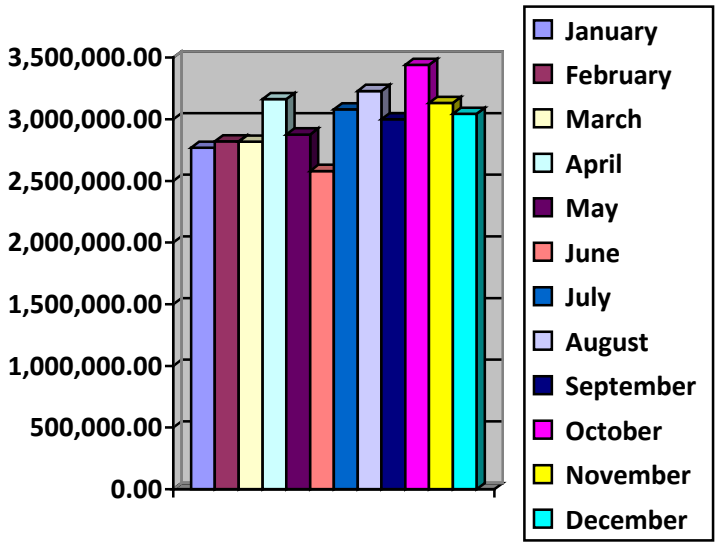
YEAR BEING REPORTED: 2012

The following information is compiled pursuant to the requirements of Part B, Item 1 of Water Licence Number NWB**3GJO-0409** issued to the **Gjoa Haven**

i) - iii) tabular summaries of all data generated under the "Monitoring Program"; monthly and annual quantities in cubic metres of freshwater obtained from all sources; monthly and annual quantities in cubic metres of each and all wastes discharged;

Attached are quantities of water used as reported in our On Tap Water Delivery System and the estimated discharge of sewage waste based on quantities used

Month Reported	Quantity of Water Obtained from all sources (litres)	Quantity of Sewage Waste Discharged
January	2,768,576.71	Same
February	2,820,136.28	Same
March	2,817,191.70	Same
April	3,162,235.60	Same
May	2,876,048.00	Same
June	2,580,736.90	Same
July	3,080,420.20	Same
August	3,229,565.40	Same
September	2,999,727.50	Same
October	3,440,088.00	Same
November	3,132,082.40	Same
December	3,043,711.90	Same
ANNUAL TOTAL	35,950,520.59	Same



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

- No modification or major maintenance carried out for water intake and transmission- existing water supply system, transmission line, re-heating stations and treatment system remains in operation with water intake from same water source Swan Lake.
- New sewage lagoon facility contract including wet land extension for discharge from new Lagoon has been awarded and scheduled for construction starts early in summer 2013. Construction of new Lagoon will facilitate effluent stream on wet land and onto ocean with sufficient retention time for natural treatment.

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

- No unauthorized discharge listed by the Board to follow up. But INAC Report 2011 indicated sign of untreated effluent outside the cell berm suspecting overflow or leakage underneath the berm. Overflow pipe has been installed inclined inward with freeboard more than 1.3 m with respect to lowest crest of berm. No overflow on berm or leak noticed since the repair of the berm. Sign of wetness outside the cell is from snowmelt water from surrounding due to the depression outside of berm in some localized area. Sample tests result also shows parameters of contamination within allowable lower limit in effluent.

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

- No abandonment or restoration work completed during the year 2012.
- Construction for new sewage lagoon scheduled to start with targeted completion by end 2013 and will be ready for operation by early 2014. Once completed and approved for operation, abandonment and restoration of existing lagoon will be taken for study. Expecting abandonment of existing lagoon and adjacent wetland sometime in 2014-15

vii. a summary of any studies requested by the Board that relate to **waste disposal**, **water use** or reclamation, and a brief description of any future studies planned;

- NWB has advised to propose for a 'Short Term Plan and undertaking with regard to the part G, item 1 for Abandonment & Restoration plan, O & M manual for Sewage Lagoon, Solid Waste Sites and Spill contingency Plan completed six (6) months prior to decommissioning of existing lagoon. Construction of new sewage lagoon project expected completion in late 2013 which included preparation of updated O & M manual, spill contingency plan (new sewage lagoon & wetland), and decommissioning of existing lagoon.

  Once finally determined the completion date, Abandonment and Restoration plan of existing Sewage lagoon will be carried and submitted to NWB for review and action. A "short Term Plan for compliance" has submitted the Board for review and approval.

- Capital program was not included the Solid Waste facility improvement, unless a separate project undertaken which were already in proposal and waiting for Federal Funding or Donor assistance. However, annual monitoring and maintenance were continued as per direction and instruction which included waste dump separation, segregation of metals and toxic materials, retention of effluent, sampling/decanting, safe storage of dump and protection of illegal dumping. Short Term Plan also covered such activities and operation until a new facility in place.
- GN has engaged EXP consultant to survey, study, review and preparation of operational document of solid waste site facility including intensive training program for hamlet operators. EXP will resume the field survey by the 3rd Week of February 2013. As outlined in the Short Term Plan, the hamlet will continue the operation and monitoring program with the direction of the Board, EXP and existing manuals until an updated manual in hand. The Board will be updated with the study and plan.

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

Water Licence remains expired with NWB since February 01, 2009 as reported without amendment and extension for non-Compliances.

Report from AANDC 2012 requested for submission of Annual Reports 2006 through 2010, updated O & M manual for sewage and solid waste sites, compliance plan and abandonment & Restoration plan of sewage lagoon.

Hamlet has already submitted the updated Annual Reports 2011 and 2012 now in place, it is too late to locate those Annual Reports 2006 and they will not match with current facilities using for water or sewage system. Hamlet has also submitted a short term and long term plan for compliances after the Inspector's visit of site facilities.

ix updates or revisions to the approved Operation and Maintenance Plans.

EXP consultant is expecting working with hamlet in regards to monitoring program, operator training, sewage and solid waste site facilities improving and updating O and M manuals.

New sewage lagoon construction contract integrated in providing O & M manual for sewage waste site and abandonment & restoration of existing sewage facility. Such documents will be available once the facility comes in operation and the Board will be updated accordingly.

ADDITIONAL INFORMATION THAT THE LICENSEE DEEMS USEFUL:

AANDC inspection report 2012, indicated unauthorised decanting of sewage waste to secondary lagoon, practically the lagoon is a single cell and an overflow pipe with more than 1.2 m free board for self-flow out of sewage once it fills up to the pipe flow level. This can happen during summer time when sewage melts and comes to its capacity. No manual and pump decanting requires. Lagoon berm has already been repaired since reported before and so as free board. Moreover, this lagoon will be no longer in use once new lagoon in place-expecting end of 2013. Hamlet has comprehensive plan for solid waste site management with the help of EXP consultant

FOLLOW-UP REGARDING INSPECTION/COMPLIANCE CONCERNS:

Part H: Monitoring program.

Item No.1: Four monitoring stations: - (i) GJO-1 (Raw Water at Swan lake)
(ii) GJO-2 (Effluent from Solid waste site (iii) GJO-3: (Raw Sewage at truck offload and (iv) GJO-4: (Effluent Final discharge point)

item 2: samples at monitoring stations:

samples collected on july 16, Aug 24 and Sep 17, 2012 and tested results
Wastewater/Sewage parameters

	MAC	units	July 16,2012		Aug 24,2012		17-Sep-12	
Parameter	Limits		GJO-2	GJO-4	GJO-2	GJO-4	GJO-2	GJO-4
Alkalinity		mg/L	327	314	312	358	288	317
Conductivity		µS/cm	2650	1020	1000	1100	910	989
P^H	6-9		6.92	7.5	7.74	7.4	7.78	7.74
TSS	100	mg/L	86	12	18	106	<3	4
Ammonia N2	80	mg/L	8.77	11.3	12.8	17.0	4.31	9.45
BOD		mg/L	77	5			3	4
Organic Carbon		mg/L	150	51.6	52	67.5	62.5	80
Nitrate N2		mg/L	<0.01	0.02	1		0.94	1.02
Calcium		mg/L	352	40.2	43.6	44.6	48.3	41.7
Chloride		mg/L	194	137	123	132	120	130
Hardness		mg/L	1120	224	238	240	254	233
Magnesium		mg/L	58.1	30	31.4	31.4	32.3	31.4
Potasium		mg/L	44.3	17.4	14.1	18.3	11.7	16.6
Sodium		mg/L	171	112	98	112	89.7	109
Sulphate		mg/L	892	4	1	2	11	8
Fecal Coliform	10000	CFU/100mL	820	125			124	48
Oil and Gas	5000	µg/L	non-vis	non-vis	non-vis	non-vis	non-vis	non-vis
Aluminium		µg/L	87	45.6	30.6	103	19.4	30.2
Arsenic	100	µg/L	12.9	7.7	7.4	27.1	3.8	6.3
Cadmium	10	µg/L	1.1	<0.1	<0.05	<0.1	<0.05	<0.05
Chromium	100	µg/L	3.4	0.3	0.7	1.1	1.2	0.5
Cobalt	50	µg/L	7.1	<0.1	3.1	2.4	2.3	4.0
Copper	200	µg/L	88.9	0.7	4.4	3.3	4.3	7.1
Iron		µg/L	25800	3130	2400	16400	1600	2540
Lead	50	µg/L	54.5	0.2	0.4	0.4	<0.1	<0.1
Manganese		µg/L	1090	155	193	279	122	167
Nickel	200	µg/L	22.7	6.8	9.4	7.9	9.2	12.8
Zinc	500	µg/L	826	<5	7	<0.4	11.9	0.8
Mercury	0.6	µg/L	0.12	0.03	<0.01	<0.01	0.02	0.01
PCB	1000	µg/L						
Phenols	20	µg/L						

ANNUAL REPORT

YEAR BEING REPORTED: 2011

The following information is compiled pursuant to the requirements of Part B, Item 1 of Water Licence # NWB**3GJO-0409** issued to the **Gjoa Haven**

i) - iii) tabular summaries of all data generated under the "Monitoring Program"; monthly and annual quantities in cubic metres of freshwater obtained from all sources; monthly and annual quantities in cubic metres of each and all wastes discharged;

Attached are quantities of water used as reported in our On Tap Water Delivery System and the estimated discharge of sewage waste based on quantities used

Month Reported	Quantity of Water Obtained from all sources (litres)	Quantity of Sewage Waste Discharged
January	3,119,195	Same
February	2,723,180	Same
March	3,045,389	Same
April	2,891,030	Same
May	2,943,596	Same
June	2,850,732	Same
July	2,941,163	Same
August	2,841,695	Same
September	2,836,964	Same
October	2,913,852	Same
November	2,420,308	Same
December	2,539,230	Same
ANNUAL TOTAL	31,229,370	Same

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

- Existing water supply system in operation. SCADA updating and pumps at intake system maintained with the feedback time to time.
- New sewage lagoon facility in design stage including wetland connection. Lagoon berm repair and increasing in Free-board height has been carried during the fiscal year 2010-11. Such repair prevents the possibility of overflow and prevents leakage of sewage effluent from the current Lagoon during the summer time. Also increase in height increases the ability of the Lagoon in full capacity as it was designed for.

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

- No unauthorized discharge listed during this year.
- No unauthorized discharge also happened during the period 2009-2010

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

No abandoned or restoration for water system, sewage waste and solid waste facilities for this year, but expecting an abandonment & restoration plan for current sewage lagoon sometime in summer 2013 once the new sewage lagoon be completed and operation.

Vii. A summary of any studies requested by the Board that relate to waste disposal, water use or reclamation, and a brief description of any future studies planned;

Existing Lagoon was losing capacity due to erosion of the berm and lowering freeboard. Board requested to review the Lagoon situation and effluent quality discharging into wetland (INAC report 2010)

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

Water Licence remains expired with NWB as reported by INAC report 2011 for non-Compliance of certain items such as ‘Monitoring program, annual reports with quantity of
water drawn and waste disposal, QA/QC plan for sewage and solid waste sites, Operation and Maintenance manual of sewage and solid waste facilities, spill contingency and emergency response plan on existing sewage lagoon and solid waste site.

ix. updates or revisions to the approved Operation and Maintenance Plans.

Existing Operation and Maintenance manuals are still in effect. But Board has notified the Hamlet that such O & M manual not yet submitted. Licence condition requires the O & M manual to be submitted with the Board within six months of the Licence approval. Since long time expires of the License status, the hamlet is proposing to have updated manuals instead for facilities those were upgraded by this time.

ADDITIONAL INFORMATION THAT THE LICENSEE DEEMS USEFUL:

Dillon Consultants has been working on sewage lagoon issue which has been addressed for water licensing renewal requirements. Reports requiring lagoon improvement as well as water licensing information expecting to be received by the end of 2012

FOLLOW-UP REGARDING INSPECTION/COMPLIANCE CONCERNS:

Attempted for waste sampling in compliance with the regulation, but too late for this season

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.:
130473

- FINAL REPORT -

Prepared For: Hamlet of Gjoa Haven

Address: P.O. Box 200
Gjoa Haven, NU
X0B 1J0

Attn: **Jacob Keanik** **Facsimile: (867) 360-6309**

Final report has been reviewed and approved by:

Angelique Ruzindana
Quality Assurance Officer

NOTES:

- Test methods and data are validated by the laboratory's Quality Assurance Program. Taiga Environmental Laboratory is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) as a testing laboratory for specific tests registered with CALA.
- Routine methods are based on recognized procedures from sources such as
  - Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF;
  - Environment Canada
  - USEPA
- Samples shall be kept for thirty (30) days after the final report is issued. All microbiological samples shall be disposed of immediately upon completion of analysis to minimize biohazardous risks to laboratory personnel. Please contact the laboratory if you have any special requirements.
- Final results are based on the specific tests at the time of analysis and do not represent the conditions during sampling.

ReportDate: Wednesday, July 17, 2013
Print Date: Wednesday, July 17, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130473

- CERTIFICATE OF ANALYSIS -

Client Sample ID: GJO-2 **Taiga Sample ID:** 001

Client Project: GJO 0713
Sample Type: Wastewater
Received Date: 05-Jul-13
Sampling Date: 04-Jul-13
Sampling Time: 10:30
Location: Gjoa Haven
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
Alkalinity, Total (as CaCO3)	349	0.4	mg/L	06-Jul-13	SM2320:B	
Conductivity, Specific (@ 25°C)	2630	0.4	µS/cm	06-Jul-13	SM2510:B	
pH	6.86		pH units	06-Jul-13	SM4500-H:B	
Solids, Total Suspended	84	3	mg/L	07-Jul-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as Nitrogen	12.0	0.005	mg/L	11-Jul-13	SM4500-NH3:	
Biochemical Oxygen Demand	>238.8	2	mg/L	05-Jul-13	SM5210:B	62
Organic Carbon, Total	292	0.5	mg/L	09-Jul-13	SM5310:B	
Major Ions						
Calcium	361	0.1	mg/L	05-Jul-13	SM4110:B	
Chloride	178	0.7	mg/L	05-Jul-13	SM4110:B	
Hardness	1140	0.7	mg/L	05-Jul-13	SM2340:B	
Magnesium	58.1	0.1	mg/L	05-Jul-13	SM4110:B	
Nitrate as Nitrogen	< 0.01	0.01	mg/L	05-Jul-13	SM4110:B	

ReportDate: Wednesday, July 17, 2013
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- CERTIFICATE OF ANALYSIS -

Client Sample ID: GJO-2 **Taiga Sample ID:** 001

Nitrite as Nitrogen	< 0.01	0.01	mg/L	05-Jul-13	SM4110:B
Potassium	53.0	0.1	mg/L	05-Jul-13	SM4110:B
Sodium	164	0.1	mg/L	05-Jul-13	SM4110:B
Sulphate	908	1	mg/L	05-Jul-13	SM4110:B
Microbiology					
Coliforms, Fecal (other)	13300	100	CFU/100mL	05-Jul-13	SM9222:D
Organics					
Oil and Grease, visible	Non-visible			10-Jul-13	Visual Exam
Trace Metals, Total					
Aluminum	182	0.6	µg/L	16-Jul-13	EPA200.8
Arsenic	10.6	0.2	µg/L	16-Jul-13	EPA200.8
Cadmium	0.57	0.05	µg/L	16-Jul-13	EPA200.8
Chromium	6.5	0.1	µg/L	16-Jul-13	EPA200.8
Cobalt	8.9	0.1	µg/L	16-Jul-13	EPA200.8
Copper	82.4	0.2	µg/L	16-Jul-13	EPA200.8
Iron	19600	5	µg/L	16-Jul-13	EPA200.8
Lead	23.8	0.1	µg/L	16-Jul-13	EPA200.8
Manganese	892	0.1	µg/L	16-Jul-13	EPA200.8
Mercury	0.16	0.01	µg/L	16-Jul-13	EPA200.8
Nickel	30.9	0.1	µg/L	16-Jul-13	EPA200.8
Zinc	1120	0.4	µg/L	16-Jul-13	EPA200.8

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Taiga Batch No.: 130473

- CERTIFICATE OF ANALYSIS -

Client Sample ID: GJO-4 **Taiga Sample ID:** 002

Client Project: GJO 0713
Sample Type: Sewage
Received Date: 05-Jul-13
Sampling Date: 04-Jul-13
Sampling Time: 10:30
Location: Gjoa Haven
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
Alkalinity, Total (as CaCO3)	284	0.4	mg/L	06-Jul-13	SM2320:B	
Conductivity, Specific (@ 25°C)	1040	0.4	µS/cm	06-Jul-13	SM2510:B	
pH	7.98		pH units	06-Jul-13	SM4500-H:B	
Solids, Total Suspended	38	3	mg/L	07-Jul-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as Nitrogen	24.1	0.005	mg/L	11-Jul-13	SM4500-NH3:	
Biochemical Oxygen Demand	31	2	mg/L	05-Jul-13	SM5210:B	
Organic Carbon, Total	61.0	0.5	mg/L	09-Jul-13	SM5310:B	
Major Ions						
Calcium	33.3	0.1	mg/L	05-Jul-13	SM4110:B	
Chloride	144	0.7	mg/L	05-Jul-13	SM4110:B	
Hardness	186	0.7	mg/L	06-Jul-13	SM2340:B	
Magnesium	25.0	0.1	mg/L	05-Jul-13	SM4110:B	
Nitrate as Nitrogen	2.28	0.01	mg/L	05-Jul-13	SM4110:B	
Nitrite as Nitrogen	0.23	0.01	mg/L	05-Jul-13	SM4110:B	

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- CERTIFICATE OF ANALYSIS -

Client Sample ID: GJO-4 **Taiga Sample ID:** 002

Potassium	21.5	0.1	mg/L	05-Jul-13	SM4110:B
Sodium	109	0.1	mg/L	05-Jul-13	SM4110:B
Sulphate	17	1	mg/L	05-Jul-13	SM4110:B
Microbiology					
Coliforms, Fecal (other)	1600	100	CFU/100mL	05-Jul-13	SM9222:D
Organics					
Oil and Grease, visible	Non-visible			10-Jul-13	Visual Exam
Trace Metals, Total					
Aluminum	46.9	0.6	µg/L	16-Jul-13	EPA200.8
Arsenic	9.9	0.2	µg/L	16-Jul-13	EPA200.8
Cadmium	0.06	0.05	µg/L	16-Jul-13	EPA200.8
Chromium	0.5	0.1	µg/L	16-Jul-13	EPA200.8
Cobalt	2.4	0.1	µg/L	16-Jul-13	EPA200.8
Copper	8.9	0.2	µg/L	16-Jul-13	EPA200.8
Iron	1760	5	µg/L	16-Jul-13	EPA200.8
Lead	3.1	0.1	µg/L	16-Jul-13	EPA200.8
Manganese	127	0.1	µg/L	16-Jul-13	EPA200.8
Mercury	0.03	0.01	µg/L	16-Jul-13	EPA200.8
Nickel	5.9	0.1	µg/L	16-Jul-13	EPA200.8
Zinc	7.7	0.4	µg/L	16-Jul-13	EPA200.8

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- CERTIFICATE OF ANALYSIS -

Client Sample ID: GJO-4 **Taiga Sample ID:** 002

- DATA QUALIFERS -

Data Qualifier Descriptions:

62 *Residual DO was less than 1 mg/L. Unable to repeat analysis at lower dilution. Holding time exceeded.*

*** Taiga analytical methods are based on the following standard analytical methods**

SM - Standard Methods for the Examination of Water and Wastewater

EPA - United States Environmental Protection Agency

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