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Nunalingni Kavamatkunillu Pivikhaqautikkut
Regional Municipal Planning Engineer
Department of Community and Government Services,
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Pond Inlet, Nunavut

Mr. David Hohnstein,
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Nunavut Water Bard
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Nuanvut

May 14, 2008

File No: NWB3PAN0207 Renewal

Review of Water License renewal application for the Hamlet of Pangnirtung:
License No: 3BM- PAN0207: Response Letter

Dear Mr. Hohnstein,

I am writing you in response to your letter dated April 17, 2008 regarding the renewal of the Water License which was issued on December 1, 2002 and expired at the end of November, 2007. A renewal application was sent on November 20, 2007.

I also would like to clarify that the Hamlet is the owner and applicant of this Water License and is thus responsible for carrying out the conditions set therein. As a Regional Municipal Planning Engineer (RMPE), I am only providing technical assistance to the Hamlet in this Water License renewal process.

Since the License was issued in 2001, INAC conducted several inspections and the inspector has provided these reports to the Hamlet. The Hamlet has been also informed of the infractions outlined in the reports and given the time to comply with them. It is unfortunate that due to non-continuity at the Hamlet office, these requirements did not get proper attention so they could be addressed in a timely manner.

The hamlet is proposing both short-term and long-term plans for the management of both their domestic sewage and their municipal solid waste. Please note that the long term solution is not part of the renewal of this existing Water License, but is presented here as an indication of the overall direction the hamlet intends to take. Our goal is to bring the Hamlet first into compliance with the terms of the recently expired water license. Once the licensed is renewed, within the life

time of this license, the long-term solutions should be more fully developed, and requests will be submitted for amendments of this license.

Therefore, we are requesting a Water License for a minimum of five years. We will work with the hamlet to give them technical advice and other assistance as required so that they can complete all the remedial short-term works within 120 days from the date of this letter.

I would request that I be kept informed of this license renewal process. If you have any question or concerns, please contact me at any time. Thank you.

Sincerely Yours,

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Water License for the Hamlet of Pangnirtung: License No: 3BM- PAN0207
Short and Long Term Plans

On behalf of the Hamlet of Pangnirtung, we are submitting the following short and long term plans for improving the municipal solid waste facilities and the sewage treatment system.

As an integral part of both our short and long-term approach, in 2005, GN-CGS in collaboration of the Hamlet started working with Dillon Consulting Ltd on Sludge disposal facility as a remedial action of the inspector's direction. Once the short remaining life of the existing landfill site became apparent, this study was merged into a broader combination of feasibility study of the Solid Waste Management, as well as a Comprehensive performance evaluation of the Wastewater Treatment Plant. These studies were completed in 2007.

1. SHORT TERM SOLUTIONS

The Hamlet of Pangnirtung (population approximately 1,760) has committed to undertake the following short term remedial works that will address the Inspector's Direction. These will be completed as soon as weather permits:

Existing Solid Waste Site (Modified Landfill):

Modified landfilling is defined as "a method of disposing solid waste on land in a manner that protects human health and the environment. Applying engineering principles, solid waste is confined to the smallest practical area, reduced to the smallest practical volume and covered routinely with a cost-effective layer of earth."[1] The existing landfill site measures roughly 150m x 70m (scaled from the drawing at the end of this document). The hamlet has undertaken to carry out the following actions in the existing Municipal Solid Waste Site within the next 120 days:

1. **Compact** any existing exposed organic and household wastes and cover up with about 100mm soil, compacting by bulldozer.
2. **Segregation** of the solid waste stream will be accomplished by designating specific areas for the following:
    - Hazardous wastes: From studies in other arctic communities, we have found that hazardous wastes comprise only about 2% of the total waste stream. Most of the substances are grease, waste oils, glycol, and household hazardous wastes such as batteries, oil based paint, and solvents. Since the quantity is relatively small, safe storage until ultimate removal from the community will be practiced. The hazardous waste area will be lined with an approved impermeable clay liner and bermed to preserve the integrity of the active layer from possible contamination. An area approximately 15m x 30 m will be provided. Note that waste oil and glycol will be placed in sealed 45-gallon drums and stored off-site in a locked sea-can until approved disposal or removal can be arranged.
    - Honey bag, animal carcass, and sewage sludge disposal area: These wastes represent a bio-hazard, and must be isolated from the rest of the site. Another bermed and lined cell will be created to receive these organic wastes. The area

[1] Ferguson Simek Clark (FSC) Engineers & Architects, Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in NWT, April 21, 2003

will be separated from the area where fish processing solids are stored (see below) by a lined berm. The mechanical wastewater treatment plant produces the bulk of these wastes, at a current rate of 0.74 m^3 per day, increasing to 0.82 m^3 in five years.[2] After five years, this would translate to a total accumulation of approximately 1,700 m^3. A lined area in the existing landfill will be set aside, with a 1 m deep depression excavated this summer. Assuming the volume of water leaching out would roughly equal the volume of compacted fill, a total area of approximately 25 m square will be required. The bags of sludge and other animal wastes will be covered with 100 mm of local soil every two weeks starting at spring break-up and ending just before the onset of winter. It is not necessary or feasible to cover during the cold season. A separate cell may be developed to the eastern part of the existing site for managing sludge wastes separately. This option is only considered if the existing site is found inadequate.

- Municipal solid waste cell area: This will be a large area set off to store household food wastes, paper, ceramics, wood, cans, plastics, textiles, and discarded glass – the normal products of routine garbage collection . According to standard guidelines, the expected volume of household solid waste can be estimated from the following equation[3] and Nunavut population projections[4].

Total Community Solid Waste Volume (m^3) in Any Year

$$\text{Volume(year)} = 365\ V\ P_1\ (1+G) + 0.084\ V\ P_1^{\,2}\ (1+G)^{2n}$$

Total Community Solid Waste Volume (m^3) in a Planning Horizon

$$\text{Volume(horizon)} = \frac{365\ VP_1}{\ln(1+G)}\left[(1+G)^{PH} - (1+G)\right] + \frac{0.084\ VP_1^{\,2}}{2\ln(1+G)}\left[(1+G)^{2PH} - (1+G)^2\right]$$

Where, V = average residential solid waste volume (m^3/person/day)
= 0.015 m3/person/day (FSC, 2000)

P_n = population in n^{th} year (persons); P_1 = population in current year (persons)

G = average community population growth rate (persons/year)

PH = planning horizon (years)

Pangnirtung has an average projected growth rate of 2% from 2006 to 2012. Based on this equation, the accumulated volume of MSW waste by the end of 2011 will be 44,600 m^3. Compacting at a standard 3:1 compaction, this gives a cumulative volume of almost 14,900 m^3, which using the area method with a second layer[5], for example, will require an additional area of approximately 60m x 40m. The drawings available show that the topography is not flat, which may increase the potential for landfilling and covering against the slopes (see figure from Dillon Report at the end of this document).

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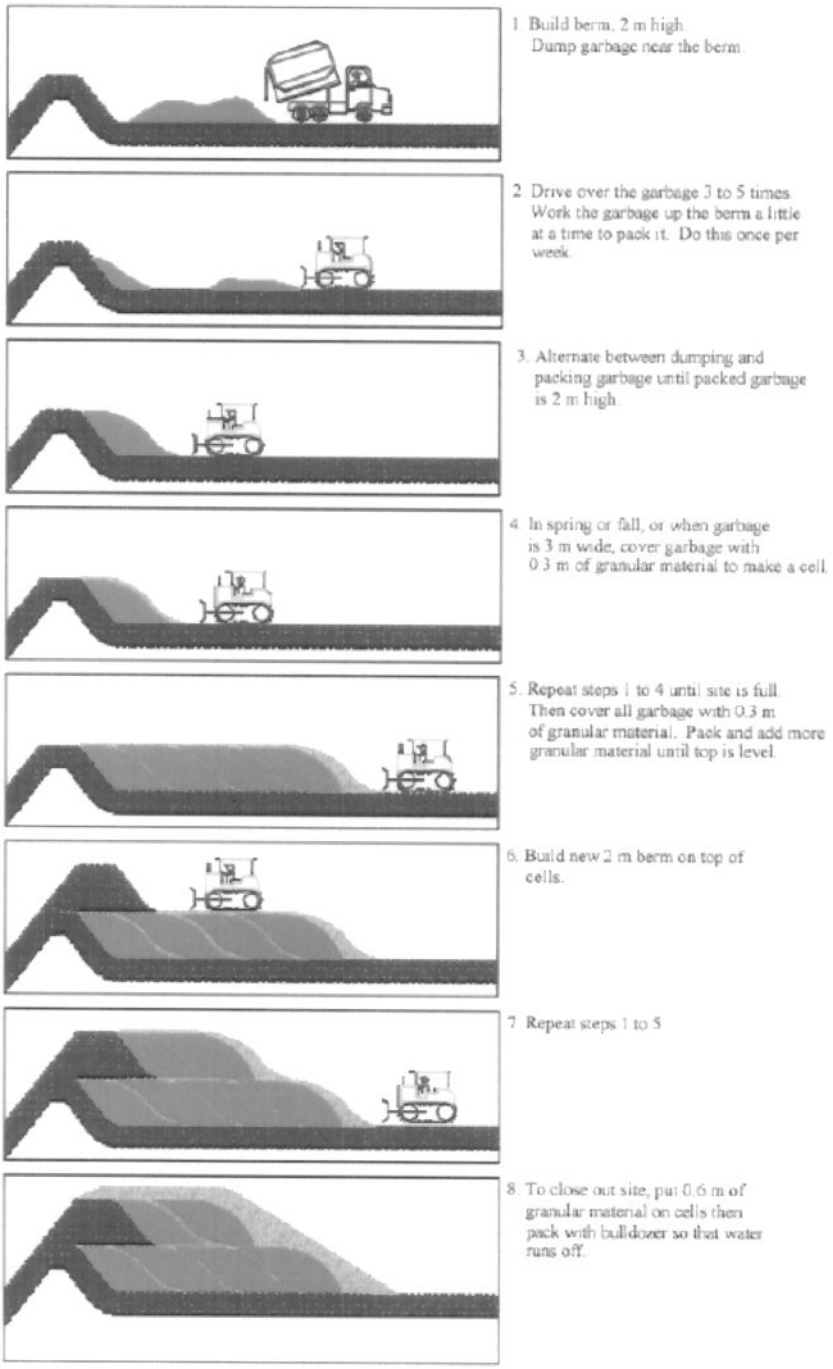
[2] Dillon Consulting, Feasibility Study on Solid Waste Management in Pangnirtung, NU, September, 2007, p 3
[3] FSC, Guidelines, p. 8
[4] Nunavut Bureau of Statistics, Nunavut: Community Population Projections, 2000-2020
[5] FSC, Guidelines, p. 28



- Bulky waste area: Bulky wastes typically comprise white goods (refridgerators, ranges, water tanks, etc) and car, snowmobile and ATV bodies, as well as old tires, clean storage tanks, and engines drained of fluids. These materials will be placed in a separate area, open to periodic access by members of the community who may wish to remove parts still usable. At the end of a year, the picked-over material will be crushed by dozer and piled aside, in order to make room for the

following year's input. To enable this, the hamlet will undertake to remove and stockpile only the scrap metal wastes within an area approximately 15m wide along the east edge of the site.

- Commercial fish processing waste from the local fish processing plant will be stored in a pit that will be excavated below the level of the permafrost, thus to facilitate encapsulation of these wastes as per the term of Water License. This offal is delivered by the processing plant at a rate of roughly 1.5 to 2 m^3 per day of plant operation (approximately 115 days a year). Thus the pit will be designed to accommodate 230 m^3 each year.[6] If a 1 m depth (below the permafrost active layer) is achieved, this would mean, for example, that a trench measuring 3 m x 75 m long would be required each year, to be covered up at the beginning and end of the cold months, and at at least two week intervals during the warm months.

3. Fencing: Fencing and periodic covering of waste is essential to minimize wind-blown debris. Much of the area is already fenced, with a perimeter fencing of approximately 544 m. However, where the fence requires either repair, replacement, or area expanded, this will be accomplished as well.
4. Signage: Appropriate signs will be posted delineating various areas.
5. Further actions by the hamlet at the existing MSW site:
    - The existing intermingled bags of sewage sludge and fish processing wastes near the North Wall (reference: letter from INAC October 4, 2006 and NWB letter dated April 17, 2008) will be buried in the permafrost in situ. Other areas that require remediation will be attended to at this time.
    - Where the North West corner of the facility is washed out will be repaired, and further leaching or runoff will be controlled by a lined berm.
    - A sump pit will be created in order to accumulating leachate coming from the site. A combination of berms and ditches will be constructed at the downslope of the facility to divert or contain any leachate that may enter Pangnritung Fiord.

Old Sewage Lagoon Site:

1. The old sewage lagoon is almost at capacity. Due to accepting liquid fish waste water into this Lagoon, it is now open and uncovered to the elements allowing sludge to enter into Pangnirtung Fiord. Crushed materials will be dumped to prevent this from occurring as a remedial action (NWB letter dated April 17, 2008).

Community and Government Services (CGS) has committed to help the hamlet develop any engineered drawings and technical specifications necessary to complete the above work, and to provide clay liner. In addition, the RMPE will continue to provide engineering advice on best practices, and will work with the hamlet to develop, over the next 120 days, the following documents as required by the water license:

- As-built drawings for remedial works
- A sampling an monitoring plan according to Part H, Section 4 and Part G of the water license
- An Operation and Maintenance Manual

[6] Dillon Consulting, Feasibility Study on Solid Waste Management in Pangnirtung, NU, September, 2007, p 3

- A Spill Contingency Plan
- A QA/QC Plan
- A detail abandonment and restoration plan

Should it be necessary for expediency, CGS has committed to work with Dillon Consulting Ltd to produce the above documentation within 120 days of the date of the letter accompanying this document.

Liquid Wastes Management:

Currently the Mechanical Wastewater Treatment Plant (WWTP) is functioning as a combination of RBC and Activated sludge process for treating only domestic wastewater of this community. At present, the WWTP is not meeting the expectations of the water license. In their recent report, Pangnirtung Waste Water Treatment Plant: Comprehensive Performance Evaluation (August, 2007), Dillon Consulting has suggested a short-term optimization plan that would "extend the effectiveness of the plant (ie: the plant will satisfy regulatory requirements) by approximately 3 to 5 years." (p. 20).

Proposed process flow schematic changes include:

- Continuously transfer RAS (Return Activated Sludge) from the Clarifiers to the Sewage Receiving Tank or the Screened Sewage Tank;
- Remove WAS (Waste Activated Sludge) from the Clarifiers to the Aerated Sludge Digester in daily batches;
- Eliminate the return of sludge from the Aerated Sludge Digester to the Screened Sewage Tank;
- Re-route the Clarifier scum sludge waste piping to the Aerated Sludge Digester instead of to the Equalization Tank;
- Increase the size of the Bioreactors' aeration system blower, from 5 hp to 7½ hp, could use existing "Sutorbilt" model 4HVP;
- Install a new in-line grinder on the feed line to the Bioreactors, following the Equalization Tank;
- Establish the timing of the operation of the RAS and WAS cycles;
- Increase the aeration in the digester;
- Intermittently aerate and decant digester supernatant to increase sludge solids; and
- Increase the removal frequency of sludge from the Aerated Sludge Digester to the Dewatering Bagger System.

Table 6. Treatment Parameter Changes after Biological System Modification at Average Organic Load 67 kg BOD/d and Average Hydraulic Load 130 m^3/d

Parameters	Existing Biological System	New Biological System (Low Cost Modification)
HRT [h]	5	26
SRT [d]	1 - 2	10 - 15
F/M [kg BOD/kg MLSS]	2.0	0.2
Total Vol. Bio-system [m3]	80	140
MLSS [mg/L]	1200	2500
BOD5 [mg/L]	>100	<50
TSS in Effluent [mg/L]	>150	<50
Sludge Removal -Dewatering cycles/week	1- 2 (No control)	4
Capacity of Air [CFM]	220	300
DO [mg/L O2]	<1.0	2 - 3
RAS [% avg. flow]	No control	50
WAS [kg solid/d]	No control	30 - 40

Further short-term improvements to the WWTP involve:

- providing a new office/laboratory
- isolating the electrical equipment so corrosion from sewage gases is minimized
- upgrading the ventilation system to provide a fume hood over the sludge bagging system
- reviewing the existing HVAC system and making recommendations to increase the air change per hour (ac/h) to at least 6.
- reducing erosion from the discharge point

Community and Government Services will work with the consultant to implement these upgrades. Funding for much of the work has already been identified. It is to be noted that more operator training is needed to ensure that operators stay current and new operators can be brought on to the team.

2. LONG TERM SOLUTIONS

While the commitment outlined above will meet the immediate needs of the hamlet until approximately 2012, clearly a coordinated long-term strategy is required.

- The present MSW site will be close to capacity. In addition, apparently the only viable direction that the community can expand is towards the north east – past the existing site. Thus the site must be abandoned and restored and a new site chosen or some alternative method of handling municipal solid waste must be found.
- The existing old lagoon must be closed and restored
- The wastewater treatment plant must be improved and augmented in order to effectively process additional effluent load from an increased population over a 20 year horizon.

These works will all require amendments to the water license at various times in the future.

The aforementioned reports by Dillon Consulting have laid the groundwork for proper long-term planning for a rapidly expanding community.

Further training of WWTP operators is necessary in order to ensure the safe and continued processing of sewage effluent.

CGS is committed in the long term to working with other GN departments and with the community to find solutions to the safe disposal of both the solid and liquid fish wastes from the fish processing plant. The WWTP is not designed to accept the high biological and intermittent loading from the processing plant. As a generally-accepted practice in other provinces, waste from animal protein processing plants is pre-treated at the plant itself prior to being discharged into the community wastewater stream.

Although it would be both unethical and illegal for the GN to commit to anything more than existing project budget capacities, we will undertake to continue to work with the hamlet so that practical, cost-effective long-term solutions are entered into the GN's Five Year Capital Plan, to be implemented when funding becomes available.

We trust that the approaches and solutions outlined herein will address the issues raised in the Nunavut Water Board's letter of April 17. We will be supplying the required documents discussed on pages four and five of this submission within 120 days of this date.