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NUNAVUT WATER BOARD
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WATER LICENCE APPLICATION FORM

Application for: (check one)

___ **New** ___ **Amendment** _√_ **Renewal** ___ **Assignment**

LICENCE NO:
(for NWB use only)

1. NAME AND MAILING ADDRESS OF APPLICANT/LICENSEE

Hamlet of Pangnirtung

Phone: (867) 473-8953
Fax: (867) 473-8832
e-mail: _____

2. ADDRESS OF CORPORATE OFFICE IN CANADA (if applicable)

N/A

Phone: _____
Fax: _____
e-mail: _____

3. LOCATION OF UNDERTAKING (describe and attach a topographical map, indicating the main components of the Undertaking)

Latitude: 66°09' N Longitude: 65°45' W NTS Map No. _____ Scale _____

4. DESCRIPTION OF UNDERTAKING (attach plans and drawings)

See attached additional information.

5. TYPE OF UNDERTAKING (A supplementary questionnaire must be submitted with the application for undertakings listed in **"bold"**)

___ Industrial
___ **Mine Development**
___ **Advanced Exploration**
___ **Exploratory Drilling**
___ **Remote/Tourism Camps**
_√_ **Municipal**
___ Power
___ Other (describe): _____

6. WATER USE

- [√] To obtain water
- [ ] To modify the bed or bank of a watercourse
- [ ] To alter the flow of , or store, water
- [ ] To cross a watercourse
- [ ] To divert a watercourse
- [ ] Flood control
- [ ] Other (describe): _____

7. QUANTITY OF WATER INVOLVED (litres per second, litres per day or cubic metres per year, including both quantity to be used and quality to be returned to source)

The annual water use rate will be approximately 252,000 litres per day at the end of the ten-year licence period.

8. WASTE (for each type of waste describe: composition, quantity, methods of treatment and disposal, etc.)

- [√] Sewage
- [√] Solid Waste
- [ ] Hazardous
- [√] Bulky Items/Scrap Metal
- [√] Waste oil
- [ ] Greywater
- [ ] Sludges
- [ ] Other (describe):_____

9. PERSONS OR PROPERTIES AFFECTED BY THIS UNDERTAKING (give name, mailing address and location; attach if necessary)

None

Land Use Permit

DIAND	___ Yes ___ No	If no, date expected _____
Regional Inuit Association	___ Yes ___ No	If no, date expected _____
Commissioner	___ Yes ___ No	If no, date expected _____

10. PREDICTED ENVIRONMENTAL IMPACTS OF UNDERTAKING AND PROPOSED MITIGATION MEASURES (direct, indirect, cumulative impacts, etc.)

See attached additional information.

NIRB Screening ___ Yes ___ No If no, date expected _____

NIRB has not reviewed this project.

11. INUIT WATER RIGHTS

Will the project or activity substantially affect the quality, quantity, or flow of water flowing through Inuit Owned Lands and the rights of Inuit under Article 20 of the Nunavut Land Claims Agreement?

No.

11. (Continued)

If yes, has the applicant entered into an agreement with the Designated Inuit organization to pay compensation for any loss or damage that may be caused by the alteration. If no compensation agreement has been made, how will compensation be determined?

12. CONTRACTORS AND SUB -CONTRACTORS (name, address and functions)

None

13. STUDIES UNDERTAKEN TO DATE (list and attach copies of studies, reports, research, etc.)

See attached additional information.

14. THE FOLLOWING DOCUMENTS MUST BE INCLUDED WITH THE APPLICATION FOR THE REGULATORY PROCESS TO BEGIN

Supplementary Questionnaire (where applicable: see section 5) _√_ Yes ___ No If no, date expected _____

Inuktitut/English Summary of Project _√_ Yes ___ No If no, date expected _____

Application fee $30.00 (c/o of Receiver General for Canada) ___ Yes ___No If no, date expected _____

15. PROPOSED TIME SCHEDULE

___ Annual (or) _√_ Multi Year

Start Date: 2002 Completion Date: 2012

William Kilabuk	Planning and Lands Administrator		May 21,2002
Name (Print)	**Title (Print)**	**Signature**	**Date**

For Nunavut Water Board use only

APPLICATION FEE **Amount: $**_____ **Receipt No.:**

WATER USE DEPOSIT **Amount: $**_____ **Receipt No.:**

Pangnirtung Water Licence Application

(1) Name and Mailing Address of Applicant:

Hamlet of Pangnirtung

Telephone: (867) 473-8953
Fax: (867) 472-8832

(2) Address if Head Office in Canada if Incorporated: N/A

(3) Location of Undertaking:

Pangnirtung is located on the south-east shore of Pangnirtung Fiord, on the Cumberland Peninsula of Baffin Island. Situated at 66° 09' N latitude and 65° 45' W longitudes, the Hamlet is 298 air km north of Iqaluit and 2,333 air km north-east of Yellowknife.

The community is situated on a gently sloping beach at the bottom of a large horseshoe-shaped valley. It lies on the remains of a tidal beach, an old river delta, and glacial drift, which is composed primarily of silty sand mixed with boulders. The heavily jointed and faulted bedrock is largely metamorphic. Bedrock outcrops are common along the beaches adjacent to the Hamlet as well as on the slopes to the south.

The settlement is bounded on the north and west by the fiord, on the south by steep hills and on the east by the Duval River. Due to the narrowness of the site, expansion can only take place parallel to the beach.

Permafrost in the area is continuous. The maximum depth of annual thaw ranges from between 0.5 to 1.5 m, depending on the thickness of the moss cover and the properties of the underlying soils.

Vegetation consists of lichens and thick mosses with stands of hardy grasses.

Pangnirtung receives an average of 16.2 cm of rainfall and 180.3 cm of snowfall annually. Mean annual precipitation totals 34.8 cm. July mean high and low temperatures are 11.1° C and 3.9° C. January mean high and low temperatures are -25.6° C and -37.8° C. The winds are east and west and annually average 24 km/h.

Cumberland Sound was visited by Davis in 1585. During the seventeenth century, whaling ships gathered in the area. Business alliances and marriages between the whalers and the Inuit were often formed. While the whaling industry began to decline in the early twentieth century, the renewed white fox trade gave rise to the opening of the Hudson Bay Company post in 1921.

The RCMP started a detachment in 1923. In 1926, the Anglican Mission moved to the community from Blacklead Island, the main whaling station of previous generations. Shortly after, a hospital was established; a nursing station and school would follow.

In the 1930's, a failed attempt to establish a settlement at Devon Island had the community in transition. The dog epidemic of 1960, which decimated four-fifths of Kimmirut's canine population, also affected Pangnirtung, although not to the same degree. Outlying camps moved into the community for stability and most stayed.

Marine mammal harvesting, tourism, and the sale of arts and crafts are the economic mainstays of the Hamlet. Cumberland Sound was traditionally a very active location for hunting and whaling. European ships decimated populations of belugas, right whale and narwhal during the 18th and 19th centuries. Sealing, whaling, fishing, polar bear and caribou hunting are still vital economic activities for the community.

Opening in 1968, the Pangnirtung Co-operative created a means to promote Inuit arts and crafts throughout Canada and the world. Carrying carvings, prints and textiles, the co-operative was rebuilt in 1994 after fire destroyed the building. Pangnirtung prints and toques are unique to the Hamlet.

The Hamlet is the south entrance point to Auyuittuq National Park, the home of the Penny Ice Cap, large mountains and massive retreating glaciers. The Park, known for its ice climbing and backpacking opportunities, draws adventurers from across the globe.

Pangnirtung gained Hamlet status on April 1, 1972. The Hamlet was traditionally known as "Panniqtuuq", meaning 'lots of caribou'.

(4) Description of Undertaking:

Water and Sanitation:

Water Supply and Treatment:

The Hamlet traditionally obtained its water from the Duval River during the summer and early fall. During the early winter, ice from the river was melted for water. Once it froze, a small river across the Fiord was used.

The present water supply system consists of an intake pipeline that extends from the bank of the Duval River, along a ditch to the reservoir and the truckfill building, which is located on the top edge of the reservoir.

Water is treated by hypochlorination as the delivery truck is being filled. Each fall when the reservoir is filled, barrels of hydrofluosilic acid are used to batch fluoridate the water. The water in the reservoir is properly mixed to prevent pooling of the fluoride.

The Hamlet's supply water was found to be of excellent chemical quality based on its clarity, softness, slight acidity, and lack of dissolved solids. The water was found to be poorly buffered. These characteristics indicate a very soft water, potentially corrosive when in contact with metallic materials.

Water Storage and Distribution:

In 1968, an unlined in-ground storage reservoir was constructed in the moraine area just west of the Duval River. Material was pushed downslope and to the sides to form berms, while the upslope was left at grade.

The soil used in the reservoir's construction is a gravelly, bouldery sand. Initially the reservoir leaked badly and was susceptible to contamination due to the inflow of silty groundwater; this was likely due to faulty installation. In 1973, a liner was installed to mitigate the problems of air entrapment, hydrostatic uplift, and leaks due to the puncture of the liner.

The new reservoir (1987), located to the east of the Duval River, 1.4 km from the community, has a ten-month storage capacity of 120,000,000 L. It was constructed in the side of a slope between an upper and lower plateau, with the longer dimensions parallel to the hill in an east-west direction.

The reservoir facility includes a truckfill station, a sub-drainage system and a filling line from the river. At the truckfill station, water is discharged from an overhead swingpipe. The pumps are capable of discharging 125 IG/min. A remote pump control and water meter readout, reset and warning alarm are installed outside the station. The pump controls have a pump start and stop-override.

Water is delivered to the community by four trucks. A 1990 (5455 L), a 1988 (4546 L), a 1993 (6819 L), and a 1995 (6819 L) are used. All water deliveries are metered.

Sewage Collection and Disposal:

The Hamlet of Pangnirtung depends upon a trucked sewage collection system. Households and businesses are equipped with independent holding tanks, which are periodically pumped out by the Hamlet's collection trucks. The Hamlet operates three (3) 4,500 litre sewage trucks and one (1) 9,000 litre sewage truck. A spare sewage truck is also available. Wastewater collection is carried out seven (7) days a week, according to the following schedule:

- Monday: 8:30-17:00 and 18:00-21:00
- Tuesday: 8:30-17:00 and 18:00-21:00
- Wednesday: 8:30-17:00;
- Thursday: 8:30-17:00;
- Friday: 8:30-17:00;
- Saturday: 9:00-21:00; and

- Sunday: 9:00 -17:00.

The collected sewage is disposed of at the existing facility, located approximately 1.7 Km to the northeast of the community, adjacent to the existing incinerator building. The facility consists of a truck turn around and a small basin, into which the sewage trucks discharge. The basin is outletted by an uncontrolled ditch of approximately 100 m in length, which discharges directly in the fiord. The existing facility provides only minimal retention, and essentially no treatment. Dilution of the effluent with the receiving water is the only treatment.

Wastewater generation projections have been based on projections of domestic water use. According to the *Water and Sewage Facilities Capital Program: Standards and Criteria* issued by GNWT, the basic residential rate for water use in a community with truck service is 90 lpcd. The only industry in Pangnirtung is the fish plant. The fish plant wash water accounts for 3,800 m^3 of the Hamlet's annual water usage. The plant is operational on a yearly basis; however, its operations may peak during certain months.

Solid Waste Collection and Disposal:

A 1990 Ford model F-450 truck is used for the collection of wastes. The solid waste site is located past the sewage dump site on the road north-east from the Hamlet. The site receives materials such as household waste, construction waste, metals, vehicles, fish offal, honeybags and carcasses.

An incinerator installed in the early-1980's is no longer used due to mechanical problems and excessive operating costs.

(5) Type of Undertaking:

Municipal

(6) Water Use:

To obtain Water

(7) Quantity of Water involved:

Population Estimates:

Based on the 1996 census, the population of Pangnirtung was 1,243 for that year. The population by ethnic distribution is 95% Inuit and 5% non-aboriginal. The population by age and sex distribution is as follows: 0-4 (15%), 5-14 (25%), 15-64 (58%), 65+ (3%); 50% male and 50% female. The Government of Nunavut has published population projections for the community. These will be used for the remainder of this report.

Table 1: Population Projections

Calendar Year	Population
2002	1575
2007	1756
2012	1955
2017	2160
2022	2377

Water Demand Projections:

The Municipal and Community Affairs (MACA) planning guidelines project per capita water use in a community through the following equations:

(1) RWU x (1.0 + (0.00023 x Population) **Population < 2,000**

(2) RWU x (-1.0 + (0.323 x Ln(Population)) **2,000 < Population < 10,000**

(3) RWU x 2 **Population > 10,000**

The RWU or residential water use is estimated to be 90 litres per capita (Lpcd) for populations lower than 2000. The RWU is estimated to be 220 Lpcd for populations greater than 2000.

Ln is the natural logarithm.

Equation 1 assumes that the population is using a delivery system to transfer water to the population.

Equation 2 assumes the development of a piping system to transfer the water to members of a community.

Table 2 provides a water use projection using MACA planning guidelines. The current water use per capita of the Hamlet of Pangnirtung is estimated to be 122.5 lpcd. This water use per capita determined through the MACA planning model corresponds to an annual water use of 70,184,610 Litres. The water use at the end of the 10-year water licence will be 91,632,590 Litres.

Therefore, the Hamlet requests an annual water use rate of 92,000,000 Litres.

Table 2 – Water demand Projections.

Planning Year	Calendar Year	Total Population #	Projected Water Use lpcd	Daily Projected Volume litres	Annual Projected Volume Litres
	2000	1,506	121.2	182,488	66,608,246
	2001	1,539	121.8	187,316	68,370,212
0	2002	1,575	122.5	192,287	70,184,610
	2003	1,613	123.2	197,406	72,053,194
	2004	1,651	123.9	202,679	73,977,785
	2005	1,687	124.6	208,110	75,960,271
	2006	1,722	125.3	213,706	78,002,607
5	2007	1,756	126.0	219,471	80,106,824
	2008	1,792	126.8	225,411	82,275,026
	2009	1,831	127.6	231,533	84,509,396
	2010	1,870	128.4	237,842	86,812,200
	2011	1,905	129.2	244,345	89,185,785
10	2012	1,955	130.0	251,048	91,632,590
	2013	1,995	130.8	257,959	94,155,142
	2014	2,032	131.9	265,085	96,756,066
	2015	2,074	132.5	272,433	99,438,084
	2016	2,117	133.4	280,011	102,204,015
15	2017	2,160	134.3	287,827	105,056,855
	2018	2,202	135.3	295,889	107,999,485
	2019	2,243	136.2	304,206	111,035,190
	2020	2,280	137.2	312,787	114,167,255
	2021	2,328	138.2	321,641	117,398,965
20	2022	2,377	139.2	330,779	120,734,335

(8) Waste Deposited:

Sewage:

The current volume for the year 2001 of sewage generated by the community of Pangnirtung is 68,370,212 litres annually corresponding to the annual water use. In 2012, the annual volume of sewage generated by the Hamlet will be 91,632,590 litres.

The collection of sewage takes place 7 days a week. Primarily, sewage is collected from the sewage holding tanks located at the residences, the hotel and the commercial buildings in the community. The size of the holding tanks in the residences range from 3,400 litres to 4,500 litres with the 3,400 litre tanks being the most common. The holding tanks for commercial buildings are usually 13,500 litres.

The collected sewage is taken to a disposal facility approximately 1.7 km to the north of the hamlet and just southeast of the solid waste dumpsite. The sewage unloading area is a small basin that has been excavated into the ground. A truck turn around area was built to allow the trucks to back up to unload.

The Hamlet of Pangnirtung's sewage system includes individual holding tanks and truck collection and disposal. Wastewater produced by such a system is considered to be moderately diluted. In comparison to wastewater generated in the south, this would be considered moderately high, with organic strength two (2) to three (3) times more than the typical seen in southern Canada. This would strongly affect the application of many treatment methods commonly used in the south.

A new mechanical wastewater treatment system for the Hamlet of Pangnirtung is now in the design stage. The proposed system is to make use of the existing incinerator building. The incinerator is no longer operational and will be removed from the building. The extent to which the building will have to be rehabilitated is not yet known however on initial review of the digital photos it is expected that the building will be stripped down to the foundation & structure and retrofitted to suit the new facility requirements. FSC will complete a detailed investigation of the facility and coordinate discussions with BCA to determine the specific renovation requirements.

Solid Waste:

Collection of solid wastes is performed 5 days per week. Household waste is collected once or twice per week depending upon the need to do so. The garbage is placed by the residents into plastic bags and then into wooden garbage containers located at the front of each residence.

The current solid disposal site is operated as a modified landfill. The material that is deposited is periodically compacted.

To avoid runoff from crossing the site the access road is used for drainage control on the northeast side of the site. The remaining three sites have 2.0 meter high berms. These berms provide drainage control by preventing overland drainage from being contaminated with runoff from the landfill site, as well as providing a visual barrier to the public.

A fence was constructed along the top of the perimeter berms and along the access road. It gives site security and it helps in the control of windblown litter. The interior of the site makes use of inner berms to segregate the different disposal areas.

However, the fence has partially blown down leading to an increase in wind blown litter around the site. There are no planned changes in the solid waste site although a new fence is needed.

In 1990, Heinke and Wong prepared a waste characterization study for Iqaluit, Broughton Island, and Pangnirtung. Table 3 shows the results for the hamlet of Pangnirtung.

Table 3 - Estimated Solid Waste Composition

Food Wastes	19.3
Cardboard	12.1
Newsprint	0.4
Other Paper Products	15.2
Cans	5.5
Other Metal Products	3.9
Plastics, Rubber, Leather	8.8
Glass, Ceramics	2.6
Textiles	4.1
Wood	13.4
Diapers	3.1
Dirt	11.6
Total	**100.0 %**

Solid Waste Volume Projections:

Table 4 – Solid Waste Projections for the Hamlet of Pangnirtung

Planning Year	Calendar Year	Total Population	Projected Daily Rate (m^3pcd)	Projected Daily Volume (m^3/day)	Projected Daily Weight (tonnes)	Projected Annual Volume (m/day)	Projected Annual Weight (tonnes)
	1996	1286	0.014	18.0	1.8	6571	651
	1997	1319	0.014	18.6	1.8	6806	674
	1998	1352	0.014	19.3	1.9	7048	698
0	1999	1387	0.014	20.0	2.0	7300	723
	2000	1422	0.015	20.7	2.1	7560	748
	2001	1458	0.015	21.5	2.1	7830	775
	2002	1495	0.015	22.2	2.2	8109	803
	2003	1533	0.015	23.0	2.3	8398	831
5	2004	1572	0.015	23.8	2.4	8697	861
	2005	1612	0.015	24.7	2.4	9007	892
	2006	1653	0.015	25.6	2.5	9328	924
	2007	1695	0.016	26.5	2.6	9661	956
	2008	1738	0.016	27.4	2.7	10005	991
10	2009	1782	0.016	28.4	2.8	10362	1026
	2010	1827	0.016	29.4	2.9	10732	1062
	2011	1873	0.016	30.5	3.0	11114	1100
	2012	1921	0.016	31.5	3.1	11511	1140
	2013	1970	0.017	32.7	3.2	11921	1180
15	2014	2020	0.017	33.8	3.3	12346	1222
	2015	2071	0.017	35.0	3.5	12786	1266
	2016	2124	0.017	36.3	3.6	13242	1311
	2017	2178	0.017	37.6	3.7	13714	1358
	2018	2233	0.017	38.9	3.9	14203	1406
20	2019	2290	0.018	40.3	4.0	14710	1456
	2020	2348	0.018	41.7	4.1	15234	1508
	2021	2408	0.018	43.2	4.3	15777	1562
	2022	2469	0.018	44.8	4.4	16340	1618

(9) Other Persons or Properties Affected by this Undertaking:

None.

(10) Predicted Environmental Impacts of Undertaking and Proposed Mitigation:

The disposal of solid waste may have local site effects due to the clearing of vegetation, and contamination at the site. In addition, there may be some contamination of groundwater.

Procedures such as the segregation of wastes, promotion of recycling or salvaging will be used to minimize the volume of disposed solid waste. Fencing will be installed to limit the spread of debris by wind will be used to reduce litter.

The disposal of sewage may have local site effects due to the increased nutrients available.

(11) Contractor and Sub-Contractor:

None.

(12) Studies Undertaken to Date:

Stanley Associates Engineering Ltd. Sanitation Sites planning Study, Pangnirtung, NT, for MACA, August 1993.

Oliver, Mangione, McCalla & Associates Ltd Hamlet of Pangnirtung Solid Waste Disposal Site Design Report, February 1995.

(13) Proposed Time Schedule:

Multi Year

Start Date: 2002 Completion Date: 2012

(14) Other Relevant Information to the Water Licence Application: