5 – TRANSMISSION LINE AND INTERCONNECTIONS

5.1 SITE CONDITIONS AND ROUTING

The proposed transmission line route from the Jaynes Inlet facility to Iqaluit is shown on Figure 5.1. The total length is approximately 84 km. For much of its length, the transmission line will follow a well-defined valley which is approximately 5 to 10 km inland of the western shore of Frobisher Bay.

From the Jaynes Inlet powerhouse, the transmission line will cross the river and follow the base of the mountains along the west side of a north-trending valley that follows the north tributary of the lower lake. Much of the terrain along the route is exposed bedrock, which provides ideal founding conditions. Elsewhere there are blankets and veneers of till, which mainly consist of alluvial sand and gravel with some glaciofluvial sands and gravels.

Along a section between the Jaynes Inlet and Armshow South sites, there is a narrow gorge section that exposes the bedrock for approximately 15 km . There are boulders scattered on the sides of the gorge that could pose a rockfall hazard. At the base of the gorge is a boulder field. Northwest of the gorge is generally thick glacial till until the Armshow River. The till in this area has been observed to be cobbley boulders with some sand and gravel.

The transmission line arriving at the Armshow River will circle around the upper lake and stay close to the west side of the Nunngarut hillside (Figure 1.5). This is an attempt to both limit visibility of the line from the coast and to avoid the Tuurngaqtaliup Tasinga valley, which is an important travel route for park visitors and travellers of the Kimmirut trail. The transmission line will cross the Armshow River near the future Armshow South powerhouse. QEC expects to engage its stakeholders on the routing of the transmission line in this area, in order to ensure that the proposed routing minimizes visual impacts.

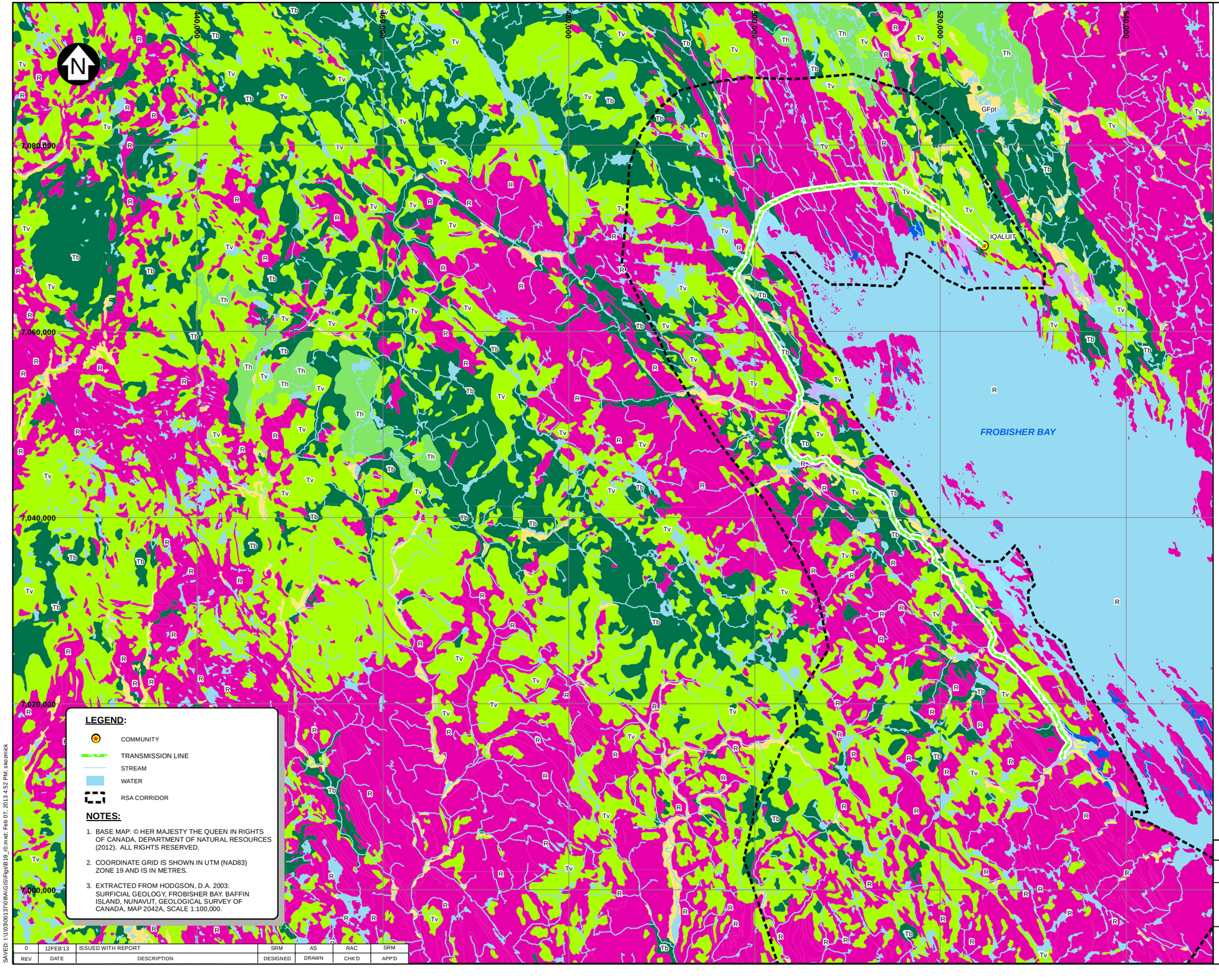
From the Armshow River, the transmission line will cross and continue to run north along the natural ridges along the west side of the north tributary of the Bay of Two Rivers . The ground conditions from the Armshow River to Iqaluit have been observed to be mainly veneers of glacial till overlying bedrock. Except for the head of the bay, where there is lower relief ground, an abundance of water features, and a relative absence of bedrock.

The transmission line will continue into Iqaluit, circumventing Sylvia Grinnell Territorial Park to the north (Figure 5.2). Based on information provided by the City of Iqaluit, the transmission line is expected to avoid the watershed protection area for Lake Geraldine as it routes into the substation at the main power plant.

5.2 TRANSMISSION LINE DESIGN

The wood-pole transmission line will be rated at a voltage of 69 kV. The design of the transmission lines will be in compliance with the Canadian Standards Association (CSA) standard for Overhead Systems (CAN/CSA C22.3 No. 1-10 – part of the Canadian Electrical Code Part III).

Conductor installation will be undertaken in accordance with the Institute of Electrical and Electronics Engineers (IEEE) Guide to the Installation of Overhead Transmission Line Conductors (Standard 524).



SURFICIAL DEPOSITS

QUATERNARY

HOLOCENE

Fpt **FLUVIAL DEPOSITS (nonglacial alluvial floodplain, terrace, fan, and delta topsets):** gravel, sand, boulders, minor silt, and muck; 1-10 m thick; deposited in braidplains.

Mv **Marine Veneer:** sand, silt, and gravel; 0.5-2 m thick; discontinuous cover of littoral and offshore sediment including beach ridges and sea-ice rafted debris; mimics surface of underlying till or rock. Fine-grained sediment bears a continuous vegetation cover patterned with subparallel rills.

GLACIAL MARINE DEPOSITS: sand, silt, gravel, and, boulders, 2-30 m thick; deposited in the high proglacial sea.

GMd **Glacial marine delta:** sand silt, boulders, and gravel: 2-20 m thick; massive to crossbedded sediments that courseb upwards in ice-contact deposits or at termination of outwash trains of meltwater channels.

GMb **Glacial marine blanket:** sand silt, minor gravel, and dropstones; 2-30 m thick; deposited from suspension and iceberg rafting; locally capped by Holocene marine regression sediments.

GLACIOFLUVIAL DEPOSITS: gravel and sand; 1-30 m thick; deposited by meltwater behind, at, and in front of ice margins.

GFpt **Glaciofluvial outwash:** stratified gravel and sand; 1-30 m thick; proglacial floodplains, terraces, and fans; includes kame terraces, minor subglacial and subaquatic deposits, glacial marine deltas at marine limit; may include washed till surfaces with few lines.

Gr **Glaciofluvial ice-contact deposits (eskers and kames):** poorly stratified to sorted gravel, sand, and boulders; 5-20 m thick; forming ridges and hummocks.

EALRY HOLOCENE AND WISCONSINAN

TILL: clast-supported silty sand, dominantly cobble - and boulder - size igneous and metamorphic clasts; 0.5 - 20 m thick; deposited in subglacial and ice-marginal environments of local ice caps and of the Foxe Ice Dome. Minor silty till deposited on Hudson Strait coast by Labrador and central Laurentide.

Th **Hummocky till:** diamicton which may be underlain by remnant glacier ice: 1 - 20 m thick; rolling to hummocky; mainly in Frobisher Bay moraines.

Tb **Till blanket:** diamicton; 1 - 10 m thick; undulating plain with minor fluted, hummocky, ridged, ribbed, or channelled areas; solifluction lobes on steeper slopes; thick end moraines; minor till veneer or glaciofluvial outwash; rare glaciolacustrine fines.

Tv **Till veneer:** diamicton; 0.5 - 2 m thick; >40% of area is till, <60% of area is rock ledges and knobs, and rubble; bedrock topography is evident; minor till blanket; minor colluvium, including talus, colluvium fans, solifluction lobes, and undifferentiated valley-bottom deposits; minor washed-till boulder fields.

BEDROCK

QUATERNARY AND PRE-QUATERNARY

R **BEDROCK AND ROCK WEATHERING PRODUCTS:** intact and frost-riven outcrop, discontinuous cover of rubble, boulders, gravel, sand, and minor silt; glacially scoured to frost-rived or disaggregated outcrop; <40% till and boulder fields (including till from which finer fraction was washed by glacial meltwater or a higher sea), and colluvium; very minor fluvial deposits; muck, or raised marine nearshore and shoreline deposits. Topography varibale from rolling to rough with some major and numerous minor ridges and scarps. Vegetation continuous to absent, low Arctic to mid-Arctic, depending on substrate, exposure, and elevation.

SCALE 5 2.5 0 5 10 15 20 km

QULLIQ ENERGY CORPORATION

IQALUIT HYDROELECTRIC PROJECT

TRANSMISSION LINE ROUTING WITH SURFICIAL GEOLOGY

Knight Piésold CONSULTING

P/A NO. NB103-137/8 | REF NO. 1

FIGURE 5.1 | REV 0

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D
0	12FEB'13	ISSUED WITH REPORT	SRM	AS	RAC	SRM

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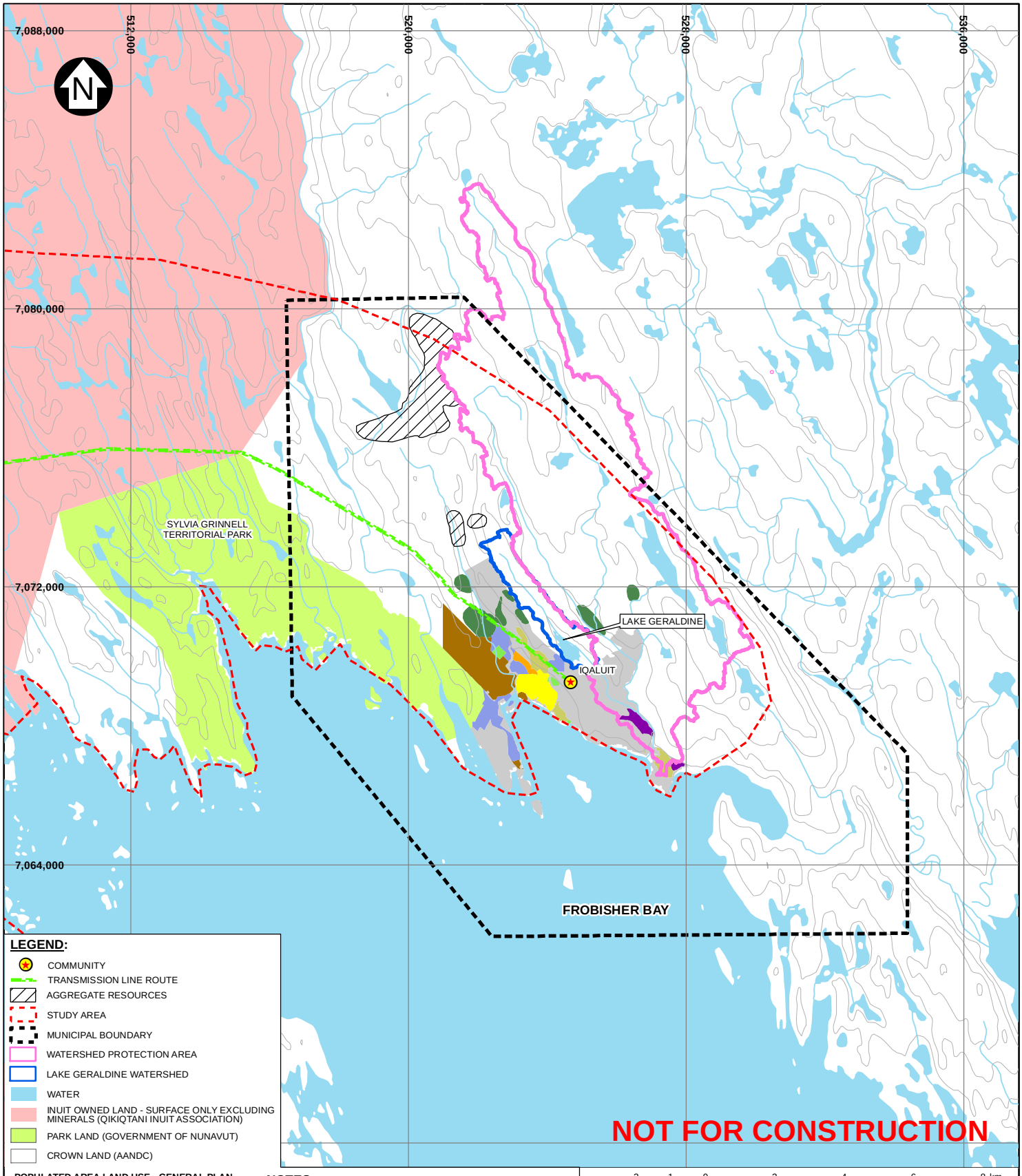

LEGEND:

- COMMUNITY
- TRANSMISSION LINE ROUTE
- AGGREGATE RESOURCES
- STUDY AREA
- MUNICIPAL BOUNDARY
- WATERSHED PROTECTION AREA
- LAKE GERALDINE WATERSHED
- WATER
- INUIT OWNED LAND - SURFACE ONLY EXCLUDING MINERALS (QIKIQTANI INUIT ASSOCIATION)
- PARK LAND (GOVERNMENT OF NUNAVUT)
- CROWN LAND (AANDC)

POPULATED AREA LAND USE - GENERAL PLAN

- AGGREGATE RESOURCES
- COMMERCIAL
- CORE AREA
- FUTURE DEVELOPMENT AREAS
- INDUSTRIAL
- INSTITUTIONAL
- OPEN SPACE
- RESIDENTIAL COMMUNITY
- TRANSPORTATION FACILITY

NOTES:

1. BASE MAP: © HER MAJESTY THE QUEEN IN RIGHTS OF CANADA DEPARTMENT OF NATURAL RESOURCES (2009). ALL RIGHTS RESERVED.
2. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N.
3. CONTOUR INTERVAL IS 60 METRES.
4. BOUNDARIES OF INUIT OWNED LAND PROVIDED BY NUNAVUT TUNNGAVIK INCORPORATED (2012). HTTP://WWW.NTILANDS.COM/DATA.HTML
5. GENERAL LAND USE DATA AND GERLADINE LAKE DATA PROVIDED BY THE CITY OF IQALUIT (2012).

SCALE 2 1 0 2 4 6 8 km

QULLIQ ENERGY CORPORATION

IQALUIT HYDROELECTRIC PROJECT

PRELIMINARY TRANSMISSION LINE ROUTING INTO IQALUIT

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D
0	12FEB'13	ISSUED WITH REPORT	RAC	SWK	RAC	SRM

Knight Piésold CONSULTING

P/A NO. NB103-137/8

REF NO. 1

FIGURE 5.2

REV 0

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The arctic conditions pose a number of additional design complexities on the design, including potential frost jacking of poles and ice loading on the transmission line. It is for this reason that the routing attempts to maximize bedrock. Bedrock foundations will consist of placing the wooden poles into steel anchors that are bolted into bedrock. Where softer ground conditions exist, backfilled culverts will be used above grade for pole foundations. This is a common practice in arctic communities.

5.3 INTERCONNECTIONS

Electrical switchyards are required at each site to step-up the generation voltage to a suitable transmission voltage (i.e. likely 13.8 kV to 69 kV). Each interconnection is to be located as close as possible to the powerhouse in order to reduce conductor losses from the generators to the transformers.

Each switchyard will be constructed on engineered structural fill in the vicinity of the powerhouses.

6 – WORKFORCE REQUIREMENTS

6.1 CONSTRUCTION

Most of the new employment opportunities presented by the Project will be during the construction of each facility. Table 6.1 presents a breakdown of the anticipated construction-related positions. Approximately 90 positions will be required each construction year, between a small owner's team, an engineering, procurement and construction management (EPCM) contractor, and a general construction contractor. There will also be additional employment opportunities generated by the projects during the construction stage associated with camp, transport and logistical services out of Iqaluit. These will most likely be coordinated by the general construction contractor.

6.2 OPERATION

During the operational phase of the projects the employment opportunities will include both full time and contract maintenance positions.

- **Regular Operation** - During the regular operation of the facilities, the projects will most likely be remotely controlled from QEC headquarters in Iqaluit. It is also proposed that there will be one or two full time caretakers at each of the facilities to respond to minor outages and maintenance requirements. Operator's accommodation will be provided adjacent to each powerhouse site.
- **Annual Maintenance Inspections** - Annual maintenance inspections will also be carried out by specialist dam safety, structural, mechanical and electrical engineers and this will likely take place over a single week each year. There will be environmental monitoring requirements at intervals throughout the year to ensure the projects are being operated in accordance with the approved regulatory requirements. There will be regular maintenance inspections (four times per year) along the transmission line. During the summer months these inspections will likely be conducted via helicopter, and during the winter months via snow mobile.
- **Major Maintenance and Refurbishments** - Every 10 to 15 years there will be a major maintenance inspection and servicing of the projects. This will likely take place over a 4 week period in the summer, with up to ten technicians and engineers involved. The same will be applicable to the transmission lines, with major maintenance inspections and servicing taking place every 10 to 15 years with a crew of about ten to fifteen technicians and engineers.

Table 6.1 Construction Workforce Requirements

Employer	Job Description	Person Years (1,500 hrs/yr)	2016	2017	2018
Owner's Team	Project Manager	3	1	1	1
	Contract Administrator	3	1	1	1
	Project Coordinator	3	1	1	1
	Community Relations	3	1	1	1
		12	**4**	**4**	**4**
Engineering Supervision	Project Manager	3	1	1	1
	Contract Administrator	3	1	1	1
	Scheduler	3	1	1	1
	Environmental superintendent	3	1	1	1
	Environmental coordinators	12	4	4	4
		24	**8**	**8**	**8**
Contractors	Volvo Operator	6	2	2	2
	Truck Driver (concrete, transport)	6	2	2	2
	Loader Operators	6	2	2	2
	Back Hoe Operator	6	2	2	2
	Dozer, Grader Operators	3	1	1	1
	Crane Operators	3	1	1	1
	Boom Truck Operators	3	1	1	1
	Labourer	30	10	10	10
	Concrete Finisher	6	2	2	2
	First Aid Attendant	3	1	1	1
	Carpenter	30	10	10	10
	Electrician	12	4	4	4
	Highline Electrician	15	5	5	5
	Welder	18	6	6	6
	Millwrite	6	2	2	2
	Driller	7	3	2	2
	Blaster	3	1	1	1
	Powder Men	3	1	1	1
	Batch Plant	3	1	1	1
	Surveyor	5	2	2	1
	Surveyor Rodman	6	2	2	2
	Rod Buster	9	3	3	3
	Iron Worker Structural	6	2	2	2
	Mechanic	9	3	3	3
	Lube Person	3	1	1	1
	Cooks	6	2	2	2
	House Keeping	6	2	2	2
	Reception	3	1	1	1
	Office Clerk	3	1	1	1

Employer	Job Description	Person Years (1,500 hrs/yr)	2016	2017	2018
Contractors	Bear monitor	9	3	3	3
	Engineer Student	3	1	1	1
			80	**79**	**78**
	Totals	**273**	**92**	**91**	**90**

NOTES:

1. THE NUMBER OF IQALUIT BASED JOBS WILL BE LARGELY DEPENDENT ON AVAILABLE SKILLS IN AND AROUND IQALUIT. THE CONTRACTORS CONSTRUCTION TECHNIQUES AND EQUIPMENT WILL ALSO AFFECT THE NUMBER OF JOBS.

7 – PUBLIC INVOLVEMENT AND CONSULTATION

7.1 STAKEHOLDER IDENTIFICATION

As the Nunavut-based public utility owned by the Government of Nunavut that is accountable to its ratepayers, QEC is cognizant of the importance of public involvement and conducting adequate consultation with its stakeholders.

The Iqaluit ratepayers are a prominent stakeholder group, and if a territory-wide power rate is established, then all ratepayers across Nunavut will be primary stakeholders. In addition to rate payers, a number of Inuit organizations, and agencies at the community, territorial and federal level are stakeholders. Table 7.1 presents a list of the key stakeholder agencies and groups (excluding ratepayers).

7.2 CONSULTATION DURING SITE SELECTION

QEC conducted considerable consultation with the three South Baffin communities of Iqaluit, Kimmirut and Pangnirtung during the period of 2005 through 2008. This was part of the work undertaken by the Corporation during their comprehensive study of hydroelectric potential within an approximate 100 km radius of Iqaluit to identify one or more preferred sites for development. Tables 7.2 and 7.3 presents a partial listing of the community and government consultation carried out during the site selection period.

In addition, the corporation established a “hydro committee” consisting of company and community representatives, as follows:

- QEC Chairperson
- Two QEC Directors
- City of Iqaluit
- Amarok Hunter and Trapper Association (HTA)
- Hamlet of Kimmirut
- Mayukalik HTA (Kimmirut)
- Hamlet of Pangnirtung
- Pangnirtung HTA
- Qikiqtani Inuit Association

The mandate of the hydro committee was to review the available data and identify a preferred site for development. The committee was established in 2006 and in March 2008 the committee issued a letter recommending the development of a hydroelectric facility on the mainstem of the Armshow River (termed “Armshow Long”) for the following reasons:

- The Armshow Long was a large project (at that time, estimated at 20 MW) which will meet Iqaluit’s energy requirements well into the future
- The Project was deemed to have modest environmental effects

At the time, Jaynes Inlet was discounted mainly because the project was considered too small (originally sized at 5 MW based on available hydrology) to meaningfully displace diesel power generation in Iqaluit.

TABLE 7.1

STAKEHOLDER REGISTER

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Stakeholder	Position	Mailing Address
FEDERAL AGENCIES		
Aboriginal Affairs and Northern Development Canada - Land Administration	Manager, Lands Administration Land Administrator Specialist	969 Qumugjuk Building PO Box 2000 Iqaluit NU X0A 0H0
AANDC - Headquarters	Chief, Environmental Policies and Studies	15 Eddy St, 10th Floor Gatineau, Quebec K1A 0H4
AANDC - Environment	Environmental Assessment Specialist Manager of Environment Regional Socio Economic Analyst	969 Qumugjuk Building PO Box 2000 Iqaluit NU X0A 0H0
AANDC - Mineral Resources Directorate	Manager, Mineral Resources	969 Qumugjuk Building PO Box 2000 Iqaluit NU X0A 0H0
AANDC - Intergovernmental Affairs and Inuit Relations Directorate	Director	1104 B - INUKSGAIT PLAZA II Iqaluit, Nunavut X0A 0H0
AANDC - Water Resources Department	Manager, Waters Water Management Specialist	969 Qumugjuk Building PO Box 2000 Iqaluit NU X0A 0H0
Canadian Coast Guard (Department of Fisheries and Oceans)	Director, Program Strategies Maritime Services Directorate	200 Kent Street Ottawa, Ontario K1A 0E6
Canadian Northern Economic Development Agency – Northern Projects Management Office (NPMO) (CanNor)	Project Manager – NPMO Manager, Economic Development	Allavvik Building Inuksugait Plaza IV box 40 Iqaluit Nunavut X0A 0H0
Department of Fisheries and Oceans	Area Director, Eastern Artic Area Office Senior Fish Habitat Biologist	PO Box 358, # 200-626 Tumiit Plaza Iqaluit NU X0A 0H0
	Senior MPR Analyst, Major Projects Review	200 Kent Street Ottawa, Ontario K1A 0E6
	Regional Manager, Environmental Assessment for Major Projects	501 University Crescent Winnipeg, Manitoba R3T 2N6
	Director, Program Strategies	200 Kent Street Ottawa, Ontario K1A 0E6
	Habitat Team Leader	1500 Paris Street, Unit 11 Sudbury, Ontario P3E 3B8
Environment Canada - Canadian Wildlife Service	Environmental Assessment Coordinator, Western Arctic Unit	PO Box 2310 5019-52nd Street, 4th Floor Yellowknife, NWT X1A 2P7
Environment Canada - Environmental Assessment	Environmental Assessment Coordinator	Qimugjuk Building PO Box 1870 Iqaluit Nunavut X0A 0H0
	Head, Environmental Assessment North	PO Box 2310 5019-52nd Street, 4th Floor Yellowknife, NWT X1A 2P7
	Manager, Environmental Assessment and Marine Programs	4999 - 98th Avenue Edmonton, Alberta T6B 2X3
	Environmental Assessment	351 St-Joseph Boulevard Gatineau, Quebec K1A 0H3
Environment Canada - Water Survey of Canada	Supervisor, Hydrological Services	Suite 150, 123 Main Street Winnipeg Manitoba R3C 4W2
Natural Resources Canada	Director	580 Booth Street 3rd Floor Room A8-3 Ottawa Ontario K1A 0E4
	Deputy Director, Sustainable Mining and Materials Policy Division Environmental Assessment Officer	580 Booth Street, 10th Floor, Room B5-2 Ottawa, Ontario K1A 0E4
Parks Canada - Environment		GOC Building Bldg 969 Federal Road PO Box 278 Iqaluit NU X0A 0H0
	Ecological Integrity Branch	25 Eddy Street Gatineau, Quebec K1A 0M5
Transport Canada – Navigable Waters Protection Program	Navigable Waters Protection Officer	1100-9700 Jasper Avenue Edmonton Alberta T5J 4E6
Transport Canada – Technical and Environmental Services	Environmental Officer	344 Edmonton Street Winnipeg Manitoba R3B 2L4
TERRITORIAL GOVERNMENT AGENCIES		
Department of Community and Government Services (CGS)		PO Box 1000 STN 700 4th Floor, W.G. Brown Building Iqaluit, Nunavut X0A 0H0
Department of Culture and Heritage		Box 1000, Stn, 800 Iqaluit, Nunavut X0A 0H0
Department of Economic Development & Transportation		Building 1104 A, Inuksugait Plaza PO Box 1000, Station 1500 Iqaluit, NU X0A 0H0
Department of Education		P.O. Box 1000, Station 910 2nd Floor Sivummut Building Iqaluit, NU X0A 0H0
Department of Environment		P.O. Box 1000, Stn. 1300 Iqaluit, NU X0A 0H0 Canada

TABLE 7.1

STAKEHOLDER REGISTER

Print Feb/14/13 15:15:40

Stakeholder	Position	Mailing Address
Department of Executive and Intergovernmental Affairs (EIA)	Avatilirinirq (Environmental) Coordinator	P.O. Box 1000 Station 200 Iqaluit, Nunavut X0A 0H0
Department of Finance		P.O. Box 1000, Station 330 Iqaluit, NU X0A-0H0
Department of Health and Social Services		P.O. Box 1000 Station 200 Iqaluit, Nunavut X0A 0H0
Nunavut Research Institute	Manager, Research Liaison	Box 1720 Iqaluit NU X0A 0H0 Building 959
	Manager, Research Design and Policy Development	
Worker's Compensation Board of the NWT and NU		Qamutiq Building, 2nd Floor 611 Queen Elizabeth Way Box 669 Iqaluit, NU X0A 0H0
INSTITUTES OF PUBLIC GOVERNMENT		
Nunavut Impact Review Board	Executive Director	PO Box 1360 Cambridge Bay NU X0B 0C0
	Director, Technical Services	PO Box 1360 Cambridge Bay NU X0B 0C0
Nunavut Parks and Special Places		P.O. Box 1000, Station 1340, Iqaluit, Nunavut X0A 0H0, Canada
Nunavut Planning Commission	Director of Plan Implementation	P.O. Box 2101 Cambridge Bay, Nunavut X0B 0C0
Nunavut Tourism		PO Box 1450 Iqaluit, NU X0A 0H0
Nunavut Water Board	Executive Director	P.O. Box 119 Gjoa Haven, NU X0B 1J0
	Director, Technical Services	Edmonton, Alberta
INUIT ORGANIZATIONS		
Nunavut Tunngavik Inc.		P.O. Box 638 Iqaluit, NU X0A 0H0
Qikiqtani Inuit Association	President	Igluvut Building, 2nd floor P.O. Box 1340 Iqaluit, NU X0A 0H0
	Director of Lands	
	Project Coordinator, Lands	
	Project Coordinator, Major Projects	
	Director of Major Projects	
COMMUNITIES		
City if Iqaluit	Director of Planning and Development	PO Box 460 Iqaluit, Nunavut, Canada X0A 0H0
Amorak HTA (Iqaluit)	Chairperson	Box 629 Iqaluit, NU X0A 0H0
	Secretary Treasurer	
	Manager	
Pangrirtung HTA	Chairperson	Box 2 Pangnirtung, NU X0A 0R0
	Secretary Treasurer	
	Manager	
Hamlet of Panrirtung	Senior Administrative Officer	PO Box 253 Pangnirtung Nunavut X0A 0R0
	Planning and Lands Administrator/Webmaster	
Hamlet of Kimmirut	Senior Administrative Officer	P.O. Box 120 Kimmirut, NU, X0A 0N0
	Community Economic Development Officer (CEDO)	
Mayukalik HTA (Kimmirut)	Chairperson	PO Box 99 Kimmirut, NU X0A 0N0
	Secretary Treasurer	
	Manager	

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Table 7.2 Community Engagement during the Site Selection Process

Group	Date	Description
Iqaluit - Public Meetings		
Public	10-Oct-07	Project update on 2007 baseline studies
	16-Oct-07	Project update on socio-economic survey for the hydroelectric project
	22-Oct-07	Information and questions for cabin owners around Iqaluit
	07-Nov-07	Public meeting
	16-Nov-07	Project update on socio-economic survey for the hydroelectric project
Iqaluit - Community Groups		
Amarok Hunters and Trappers Association	10-Jun-05	Requested a representative to attend a QEC-stakeholder tour of an operating hydroelectric facility in Greenland
	27-Jun-05	Letter of invitation issued for a representative to attend a QEC-stakeholder tour of an operating hydroelectric facility in Greenland
	27-Sep-05	QEC briefed the Amarok HTA on the Project and invited the HTA to participate on site visits
	05-Oct-05	HTA representatives conducted site reconnaissance of candidate hydro sites with Knight Piésold and QEC
	10-Oct-05-14-Oct-05	QEC, Mayors and HTA representatives visited existing hydroelectric facility outside of Nuuk, Greenland
	07-Feb-06	Project update
	20-Feb-07	Presentation of Pre-Feasibility Study findings
	07-Aug-07	Project update
	23-Oct-07	Project update - socio-economic survey results
City of Iqaluit	17-Nov-05	Presentation of hydro concept and study and types of future employment
	28-Feb-06	QEC presented to the HTA board on hydro development in Iqaluit
	01-Sep-06	Public Presentation of Pre-Feasibility Study
	21-Oct-06	Hydro Pre-Feasibility Study and Residual Heat Iqaluit
	09-Nov-06 -10-Nov-06	Public Presentation of Pre-Feasibility Study
	20-Nov-06-21-Nov-06	Detailed Discussion on Hydro Specifics
	30-Nov-06	Pre-Feasibility Study presentation to existing and new councillors

Group	Date	Description
City of Iqaluit	04-Dec-06	Board Discussions
	01-Feb-07	Pre-Feasibility Study presentation
Enokseot Holdings / Elders of Iqaluit	25-Oct-07	Enokseot Holdings presented socio-economic survey findings to elders
IBC (Inuit Broadcasting Corporation)	27-Jun-05	Invitation for IBC to provide cameraman to record Greenland trip
Local Businesses	16-Nov-05	Knight Piésold and QEC presented the preliminary findings of the hydro prefeasibility study to Iqaluit business community
	28-May-07	QEC presenting information on Socio Economic Impact Assessment
	16-Jul-07	Further meeting on Socio Economic Impact Assessment and provided CD
	17-Jul-07	Further meeting on Socio Economic Impact Assessment and provided CD
	20-Jul-07	Natsiq requested to meet QEC Hydro people to introduce the colleges she will work with for the SEIA
	24-Aug-07	Update and further meeting on SEIA for Hydro project
	08-Nov-07	Information presented to the Iqaluit Business people on SEIA for hydro
Local Media	07-Mar-07	Press news up to date and this year's work on pre-feasibility further studies for Hydro around Iqaluit
Mayor	10-Jun-05	Community Representatives invited to visit a hydroelectric project in Greenland in anticipation of QEC exploring hydro power in Iqaluit
	27-Jun-05	Letter of invitation sent to Mayors and HTA boards. Community representatives invited to visit a hydroelectric project in Greenland in anticipation of QEC exploring hydro power in Iqaluit
	10-Oct-05-14-Oct-05	QEC, Mayors and HTA representatives visited existing hydroelectric facility outside of Nuuk, Greenland
Nunavut Research Institute (NRI)	05-Oct-05	Knight Piésold met with NRI to identify any researchers or local people who would be knowledgeable of the fisheries of the candidate watercourses
QEC	23-Jan-06-24-Jan-06	QEC Board established a committee consisting of 3 board members for hydro development planning
	26-Jan-07	Pre-Feasibility Study presentation
	23-Nov-07	CBC interview on Spring and summer project updates
	27-Nov-07	Public presentation English
	29-Nov-07	Public presentation Inuktitut
Qikiqtaaluk Corporation	29-Jul-05	Notified of QEC's plans to issue RFP to evaluate hydro power
Kimmirut - Public Meetings		
Public	23-Nov-06	Pre-Feasibility Study presentation
	19-Nov-07	Update on Kimmirut trip SEIA presentation
	06-Dec-07	Public meeting by Enokseot Holdings

Group	Date	Description
Kimmirut - Community Groups		
Hydro Committee	09-Jan-07	Hydro Committee discussions to make final recommendations
Mayor	10-Oct-05-14-Oct-05	QEC, Mayors and HTA representatives visited existing hydroelectric facility outside of Nuuk, Greenland
Mayukalik Hunters and Trappers Association	10-Oct-05-14-Oct-05	QEC, Mayors and HTA representatives visited existing hydroelectric facility outside of Nuuk, Greenland
	21-Feb-06	QEC presented to the HTA board on hydro development in Iqaluit
Pangnirtung - Public Meetings		
Public	30-Nov-06	Pre-Feasibility Study presentation
Pangnirtung - Community Groups		
Hamlet Council	07-Mar-06	QEC presented to the HTA board on hydro development in Iqaluit
Mayor	10-Oct-05-14-Oct-05	QEC, Mayors and HTA representatives visited existing hydroelectric facility outside of Nuuk, Greenland
Pangnirtung HTA	10-Oct-05-14-Oct-05	QEC, Mayors and HTA representatives visited existing hydroelectric facility outside of Nuuk, Greenland

Table 7.3 Government Engagement during the Site Selection Process

Date	Agency	Description
27-Jun-05	QIA	Invitation to QIA to attend a QEC-stakeholder tour of an operating hydroelectric facility in Greenland
29-Jul-05	Nunavut Tunngavik Inc. (NTI)	Notified NTI of QEC's plans and the proposed Greenland tour
29-Jul-05	QIA	Notified of QEC's plans to issue RFP to evaluate hydro power
05-Oct-05	Department of Fisheries and Oceans	Knight Piésold met with DFO to discuss available fisheries information for the candidate watercourses
06-Oct-05	QIA	QEC briefed QIA president and invited him on the Greenland tour
07-Oct-05	Government (DIAND, Finance, DOE)	QEC and Knight Piésold presented the Iqaluit Hydroelectric Project to various government representatives
07-Oct-05	QIA	Knight Piésold met with the lands administrator to discuss land tenure issues with development of hydro on Inuit Owned Lands
18-Nov-05	Indian and Northern Affairs Canada	Knight Piésold contacted INAC Environmental Assessment Department to discuss environmental assessment processes that could apply to a hydroelectric project
18-Nov-05	Indian and Northern Affairs Canada	Knight Piésold contacted INAC's Land Administration Department to discuss land tenure issues
21-Feb-06	Department of Environment	QEC presented to the Department on the results of the Pre-Feasibility Study
06-Mar-06	GN Deputy Ministers Committee	QEC presented to the Committee on the results of the Pre-Feasibility Study
21-Mar-06	Intergovernmental EA Coordinating Committee	QEC presented to the Committee on the results of the Pre-Feasibility Study
29-Jan-07	QIA	QEC presented to the QIA on the results of the Pre-Feasibility Study
26-27-Feb-07	Project Development Advisory Group	QEC presented to the Group on the results of the Pre-Feasibility Study
24-Apr-07	QIA	Update on present activities for Hydro studies
13-Jul-07	QIA	QEC meeting with the CLARC, discussing about the application for IQ Hydro sites
24-Oct-07	Government of Nunavut	Information present to GN on socio-economic survey results for the hydroelectric project

Subsequent to the hydro committee fulfilling their mandate and selecting a preferred project, additional hydrology data collected over the period of 2006 to 2008 was analyzed and it was found that more water (and therefore more power) is available at Jaynes Inlet, with was the lowest cost option. The higher runoff experienced at Jaynes Inlet as well as at the Armshow River appears to be due to orographic (elevation) influences. It has since been confirmed that Jaynes Inlet can provide sufficient energy to meet Iqaluit's current requirements. The proposed staging of two smaller projects is consistent with the hydro committee's desire for a long-term energy solution for Iqaluit.

7.3 RECENT CONSULTATION ACTIVITIES

After a period of dormancy between 2009 and 2011, due to a lack of funds to advance the Project, QEC resumed its activities on the project in the second half of 2012 with the initiation of a feasibility study. At the end of 2012, the corporation met with regulatory agencies, Inuit organizations and City of Iqaluit officials in a Resource Development Advisory Group (RDAG) meeting hosted by the Canadian Economic Development Agency (CanNor). One-on-one meetings were held with key agencies as a follow-up to the RDAG. Public meetings were held in Iqaluit, Kimmirut and Pangnirtung in late 2012 and early 2013. The record of consultation since the corporation resumed work on the Project is summarized in Table 7.4.

7.4 KEY OUTCOMES

Consultation carried out to date has started to define key issues and perspectives common to multiple stakeholders. Table 7.5 summarizes the key outcomes resulting from public involvement and consultation to date.

In summary, there has been minimal concern raised over development of the Jaynes Inlet site, and a modest amount of concern raised over the Armshow South site. Concern regarding the latter centres around both the importance of the area as a travel route and ice fishing destination, and preservation of the natural environment features of the Katannilik Territorial Park.

Table 7.4 Recent Consultation Activities

Date	Agency	Description
04-Feb-13	Kimmirut Public Meeting	Project update
04-Feb-13	Kimmirut Hamlet Council	Project update
04-Feb-13	Katannilik Parks Advisory Group	Project update
04-Feb-13	Kimmirut CLARC	Project update
13-Dec-12	DFO	Presented review of baseline studies
12-Dec-12	EC and CWS	Review of baseline studies
12-Dec-12	Iqaluit Public Meeting	Project update
12-Dec-12	Nunavut Parks	Project update
12-Dec-12	QIA - Community Lands and Resources Committee	Project update
11-Dec-12	2012 Resource Development Advisory Group	Project update
11-Dec-12	Iqaluit City Council	Project update
19-Oct-12	AANDC Lands and Water Resources	Review of land use and permitting requirements

Table 7.5 Key Outcomes of Engagement to Date

Key Message	Stakeholder(s)	QEC Response
Electricity rates are high, and Nunavut's dependency on diesel as an energy source means that Nunavummiut are vulnerable to increasing electricity rates with the anticipated increase in fuel prices over time	Various, including QEC	QEC is committed to exploring proven renewable energy options that are cost-competitive with the current cost of generating electricity by diesel. Fuel comprises 50% of QEC's cost to generate power, and the corporation is concerned that it is susceptible to rising fuel prices in the future.
Any renewable energy project developed for Iqaluit should meet the long-term energy requirements of the City	QEC's former Hydro Committee	The current proposal being put forth by QEC to develop Jaynes Inlet followed by Armshow South will address Iqaluit's growing electricity requirements for the next several decades.
There is concern generally over helicopter use affecting land users while out on the land	Various, including public and the QIA's Community Lands and Resources Committee (CLARC) in Iqaluit	QEC acknowledges this as a concern. It will be necessary to utilize helicopters during the construction and likely operation phases of the Project. The corporation is committed to minimizing the disturbance effects of helicopters to the extent reasonable.
The Travel routes to Kimmirut and ice fishing at Armshow South	Public, QIA and CLARC	QEC acknowledges that the Armshow South project is located along this important travel route, and that people cross the Armshow mainstem downstream of the future powerhouse and discharge as well as around the upper lake which will experience fluctuating water/ice levels. The Corporation is committed to working with its stakeholders to identify mitigating measures to address these issues.
The Armshow South site is located within the Katannilik Territorial Park, which is a natural environment park	Nunavut Parks	QEC acknowledges this concern as well as Nunavut Parks' commitment to working cooperatively with the corporation to address park-related concerns at Armshow South.
What other renewable energy options have been considered. Why isn't wind/solar/tidal energy being pursued?	Various stakeholders (public, agencies)	About 7 or 8 years ago, QEC evaluated wind power by approaching numerous wind energy companies. The bidders could not provide wind power to QEC at a cost lower than the current cost of diesel. Solar will not provide power for most of the year. Tidal power remains experimental and QEC has an obligation to its ratepayers to only pursue options that are proven and that are cost-competitive with diesel power.
Hydro development should not be pursued at sites located in Ward Inlet (this includes Cantley Bay and Anna Maria Port)	Amarok HTA (in a 2007 letter to QEC)	The Projects identified and considered in the site selection that are located at Ward Inlet are very costly and are not the preferred choice of QEC.

8 – INCORPORATION OF TRADITIONAL KNOWLEDGE

QEC is committed to the incorporation of Inuit knowledge into its planning and operations of the proposed facilities. The Corporation conducted a land use study in 2006 (Knight Piésold, 2006c) and an Inuit knowledge study in 2006 and 2007 on five short-listed hydroelectric sites including the two subject sites. This included one-on-one interviews with elders from the three communities of Iqaluit, Kimmirut and Pangnirtung using a pre-determined list of questions organized by theme. Spatial information was recorded on maps that were digitized. The interviews and spatial information were summarized in a 2007 environmental baseline study report (Knight Piésold, 2008e). The information collected focused in Inuit knowledge and use of the lands in and around the candidate hydroelectric sites. The report also summarizes information on fish presence, water and ice conditions.

Key findings of the Inuit knowledge work conducted to date include:

- An absence of land or resource use in the vicinity of Jaynes Inlet. The off-shore area around Jaynes Inlet is, however, used by hunters and locals and cabins are found on the off-shore islands opposite Jaynes Inlet.
- The Armshow River system is used for fishing, mainly in the lower reaches where anadromous char are found. The north tributary at the Bay of Two Rivers is also an important fishing area for anadromous char and the area generally is ice fished in the spring. The upper reaches of the Armshow River contain winter pools with fish, but these are mainly landlocked Arctic char.
- The boundaries of the Katannilik Territorial Park define a traditional travel route between Iqaluit and Kimmirut that is still used today.
- The location of winter pools and the extent of tidal influence in the Bay of Two Rivers were delineated by the elders who participated in the initial study.

To support the development of an Environmental Impact Statement, QEC intends to conduct supplemental Inuit knowledge workshops in Iqaluit and Kimmirut in 2013. The workshops will be organized in coordination with the Community Lands and Resources Committees and Hunter and Trapper Associations. The workshops will collect additional Inuit knowledge on land and resource use in the areas as well as travel routes. The Project will also discuss potential impacts of the Project on land and resource use with a view towards identifying mitigating measures to address any effects and concerns.

9 – SUMMARY OF ENVIRONMENTAL CONDITIONS

9.1 GENERAL SETTING

The Armshow River and Jaynes Inlet project sites are located approximately 30 and 60 km southwest of Iqaluit and 94 and 85 km from Kimmirut, respectively (Figure 9.1). Iqaluit has a typically Arctic climate and is above the tree line. Average monthly temperatures are below freezing for eight months of the year. Iqaluit's precipitation averages just over 400 mm annually, much wetter than many other localities in the Canadian Arctic Archipelago, with the summer being the wettest season.

The temperature in Iqaluit in January averages -30°C, and in July it is 15°C. There are nearly 24 hours of daylight per day in June whereas in December there are 6 hours of daylight per day. The long cold winter begins in September and the ground is usually snow covered until June. July and August are the summer months.

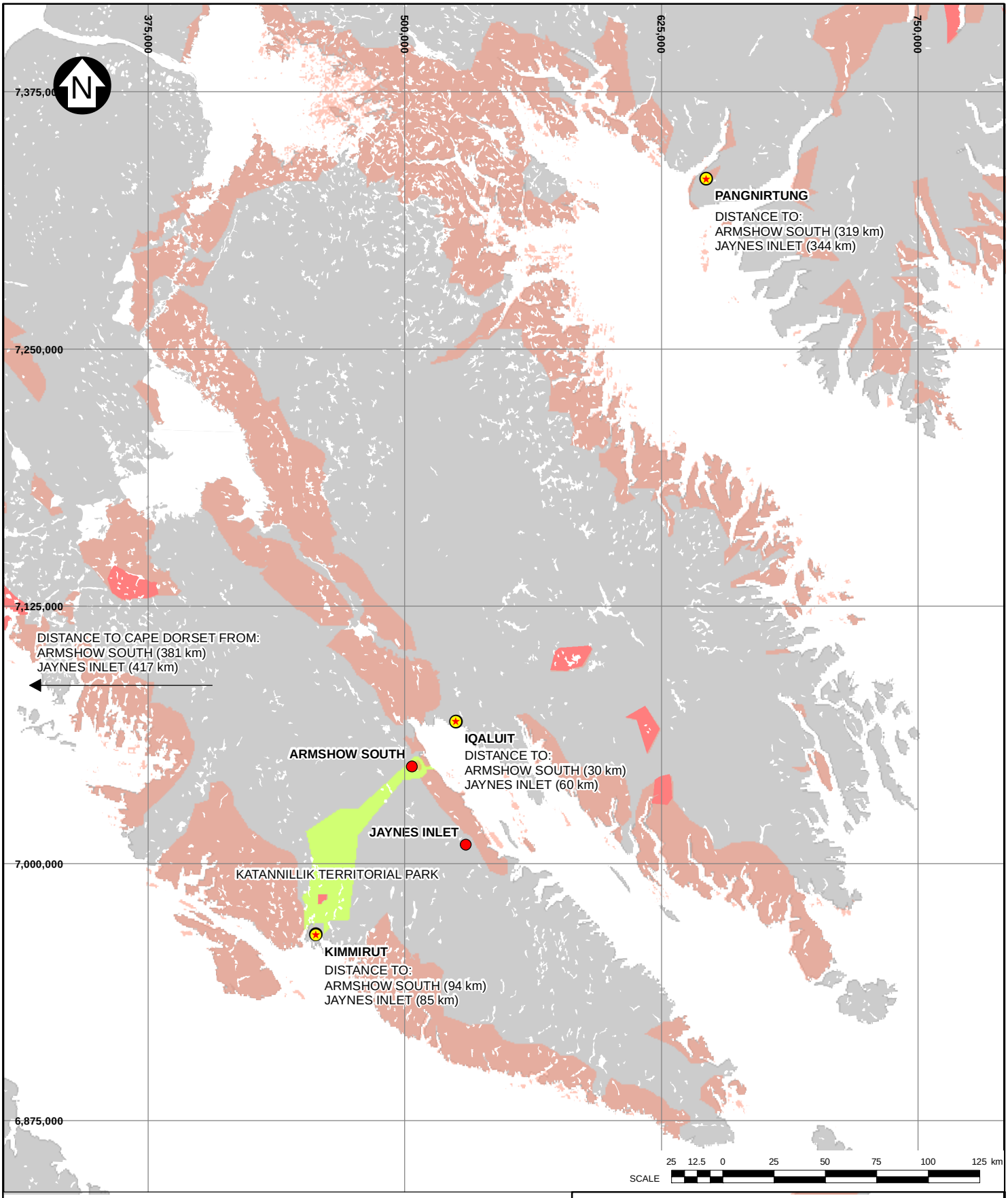
9.2 AQUATIC ENVIRONMENT

The open water period extends from about early June to late October. Water temperature as high as 14^{o}C have been recorded during summer in the Jaynes Inlet river system. The upper and lower lakes in the Jaynes Inlet watershed are not thermally stratified during summer or fall, but display a slight decrease in water temperature with depth. Ice thickness ranges from 1.3 to 1.8 m during winter.

Water quality in the Jaynes and Armshow stems is generally characterized as well oxygenated, clear, near neutral, soft, dilute, and nutrient poor with low primary productivity. Most metals and major ions occur in only very low levels and almost all samples for all water quality parameters fell below guidelines established by the Canadian Council of Ministers of the Environment (CCME) for the protection of aquatic life. Water quality is largely consistent throughout each river system and also between river systems.

Arctic char are the primary fish occurring in freshwater areas in the region, although small numbers of threespine stickleback also occur in some systems. Tributary habitat provides summer feeding habitat for juvenile char and lakes provide feeding and overwintering habitat for all char, as well as spawning habitat.

Jaynes Inlet supports char and stickleback, while only char have been documented from the Armshow River. Several populations of land-locked Arctic char, including dwarf variants, occur within the Jaynes Inlet system, separated by impassable waterfalls occurring along the watercourse. It is thought that anadromous char cannot access the Jaynes Inlet watershed because of a large falls at the entrance to the system. Three-spine stickleback only occur in the lower-most reaches of the Jaynes Inlet watershed. Populations of land-locked char also occur with the Armshow River system, notably in headwater lakes. Anadromous Arctic char winter in the lower most reach of the Armshow River. Although the extent to which these fish utilize freshwater habitat in the Armshow River is not certain, analysis of marine usage by char captured in upstream areas of the Armshow River suggest that most anadromous char do not move very far up the Armshow River.



LEGEND:

- COMMUNITY
- PROJECT LOCATION
- PARK LAND (GOVERNMENT OF NUNAVUT)

LAND OWNERSHIP

- INUIT OWNED LAND - SURFACE AND SUBSURFACE INCLUDING MINERALS
- INUIT OWNED LAND - SURFACE ONLY EXCLUDING MINERALS
- CROWN LAND (AANDC)

NOTES:

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2. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N.
3. BOUNDARIES OF INUIT OWNED LAND PROVIDED BY NUNAVUT TUNNAGAVIK INCORPORATED (2012). HTTP://NTILANDS.COM/DATA.HTML
4. CAMP LOCATIONS, KIMBERLITES, PROPOSED ACCESS ROAD AND CHIDLIAK CLAIMS DATA PROVIDED BY PEREGRINE DIAMONDS LTD. (2012).

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QULLIQ ENERGY CORPORATION

IQALUIT HYDROELECTRIC PROJECT

COMMUNITIES IN THE VICINITY OF THE PROJECT

Knight Piésold CONSULTING

P/A NO. NB103-137/8

REF NO. 1

FIGURE 9.1

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Contaminant analyses results indicate that muscle tissue from Arctic char collected at Jaynes Inlet and the Armshow River had trace element and mercury concentrations below government standards.

Mixing of fresh and marine waters occurs in the inter-tidal bay at Jaynes Inlet, and in the Bay of Two Rivers at the mouth of the Armshow River. While completely covered at high tide, much of the Jaynes Inlet intertidal bay and the Bay of Two Rivers become exposed during periods of low tide.

Inlet shorelines consist of bedrock outcrops and narrow beaches comprised of boulder, cobble and finer grain sediments. Substrates are made up mainly of clay and sand with a small proportion of interspersed cobble and boulder. Where sampling was carried out at the Jaynes Inlet inter-tidal bay, nutrient levels were low, pH was near neutral, and turbidity was low.

9.3 TERRESTRIAL ENVIRONMENT

The regional study area is shown on Figure 1.1. There are six ecological land units (ELU) within the regional study area, listed below from most to least abundant:

- Ridged and Rounded Hills with Rolling Plains
- High Rugged Hills and Rolling Plains
- Low Rugged Hills and Ridges with Coastal Islands
- Moderate Hills, Islands, and Coastal Escarpments
- Low Rounded Hills and Rolling Plains
- Gently Rolling Plains

Elevation in the study area varies from 0 to 780 m and relief is highly variable. The most common land texture condition is low, rounded hills with gently rolling plains. Rugged hills with ridges, coastal escarpments, and coastal islands are also common. Bouldery sandy moraine over metamorphic and igneous bedrock is the most common surface material.

There are a total of 16 plant community (or vegetation) types that can be categorized into six dominant community components including lichen, moss, sedge, wood rush, heath, and dwarf birch. Lichens occur most frequently as the dominant community component throughout the regional study area with five plant community types. Heath is second in frequency as a dominant community component with four community types followed by sedges with three community types.

A total of 27 animal species were detected from ground and aerial surveys conducted previously for birds, terrestrial carnivores, and small mammals focusing on the Jaynes Inlet project area. These species included: 14 birds, 4 carnivorous mammals, 3 small herbivorous mammals, and 1 ungulate (caribou). There is evidence that all 27 animal species occurred in the Jaynes Inlet study area at least once during the year prior to the end of the sampling period. The five most abundant species (with 25+ individuals) found in the Jaynes Inlet area included Canada Goose, Common Eiders, Long-tailed Ducks, Glaucous Gulls, and American Pipits.

The majority of evidence of carnivorous mammals was restricted to the upper lake area at Jaynes Inlet. Tracks left by Wolves, Red Fox, Arctic Fox, and Weasel were observed. Snowy Owls and Glaucous Gulls were the only animals with multiple sightings that were more abundant in the area of the proposed transmission line relative to the Jaynes Inlet area.

The caribou study results indicate that there are only a few caribou presently using the Jaynes Inlet Project area based on the following: (1) none of the collected faeces were less than one year old, (2) vegetation plot analyses indicate that some areas have yet to recover from past heavy grazing, (3) there were very few visual sightings of caribou in the Project area by the field crews during August and September of 2008, and (4) the few caribou currently in the Project area have foraged where there were a variety of lichens and have avoided areas still recovering from past heavy grazing. It is believed that these findings would equally extend to the Armshow River and transmission line development areas.

9.4 SOCIO-ECONOMIC SETTING

Figure 9.2 presents the harvest locations recorded during the 5-year Nunavut Wildlife Harvest Study conducted between June 1996 and May 2001 (from Priest and Usher, 2004). The harvest study illustrates the land use patterns of Inuit hunters from the communities of Kimmirut, Iqaluit and Pangnirtung. The inland or terrestrial environment at the Jaynes Inlet project area is generally removed from existing land uses, though the off-shore or marine environment is used for marine harvesting, and several camps exist on the islands opposite the Jaynes Inlet inter-tidal bay.

The Armshow South site experiences a higher level of land use. The upper lake is located within the boundaries of the Katannilik Territorial Park, which covers a traditional travel route between Iqaluit and Kimmirut. Park shelters are located both immediately east of the upper lake and on the west side of the upper lake. While the park receives limited tourist use in the order of 1 to 2 groups per year, the route is more heavily used to travel between Iqaluit and Kimmirut by snowmobile during the winter months. Several pools on the Armshow mainstem, and pools and small lakes on a north tributary of the Armshow River, support overwintering populations of Arctic char that are fished through the ice by Iqaluitmiut. Additionally, a number of cabins are located on the coastal mainland south of the Bay of Two Rivers and on the islands opposite the mouth of the Armshow River.

Suspected archaeological features were noted on the alluvial terraces of the Bay of Two Rivers.

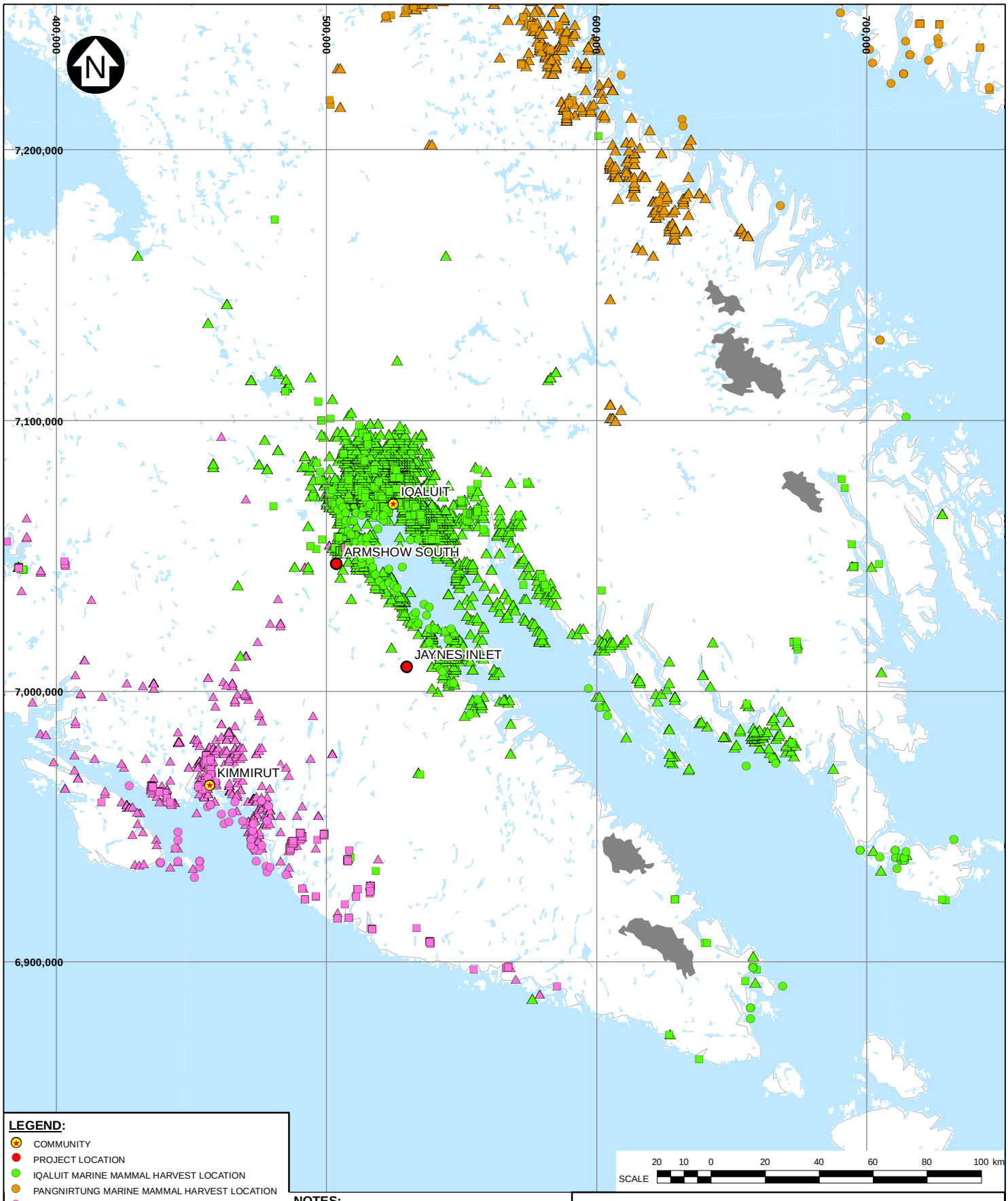
Additional information on environmental baseline conditions is available in the following reports:

- Jaynes Inlet HEP - Environmental Baseline Study - Final Report (RSW, 2011)
- Iqaluit Hydroelectric Project - 2007 Environmental Baseline Studies (Knight Piésold, 2008e)
- Aquatic Environment Investigations at the Armshow River, Baffin Island, Winter 2008 (North-South Consultants, 2008)

These reports are available at the following website:

http://www.nunavutpower.com/home/index.php?option=com_content&task=view&id=83

Supplemental baseline studies are planned for 2013.



LEGEND:

- COMMUNITY
- PROJECT LOCATION
- IQALUIT MARINE MAMMAL HARVEST LOCATION
- PANGNIRTUNG MARINE MAMMAL HARVEST LOCATION
- KIMMIRUT MARINE MAMMAL HARVEST LOCATION
- IQALUIT ARCTIC CHAR HARVEST LOCATION
- PANGNIRTUNG ARCTIC CHAR HARVEST LOCATION
- KIMMIRUT ARCTIC CHAR HARVEST LOCATION
- IQALUIT CARIBOU HARVEST LOCATION
- PANGNIRTUNG CARIBOU HARVEST LOCATION
- KIMMIRUT CARIBOU HARVEST LOCATION
- WINTER TRAIL (CHIDLIAK TO IQALUIT)
- GLACIER
- WATER

NOTES:

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2. COORDINATE GRID IS UTM (WGS84/NAD83) ZONE 19N.
3. HARVEST DATA FROM THE NUNAVUT WILDLIFE HARVEST STUDY (PRIEST AND USHER, 2004).
4. CAMP LOCATIONS, KIMBERLITES, PROPOSED ACCESS ROAD AND CHIDLIAK CLAIMS DATA PROVIDED BY PEREGRINE DIAMONDS LTD. (2012).

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QULLIQ ENERGY CORPORATION

IQALUIT HYDROELECTRIC PROJECT

WILDLIFE HARVEST LOCATIONS 1996-2001

Knight Piésold CONSULTING

P/A NO. NB103-137/8

REF NO. 1

FIGURE 9.2

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10 – IDENTIFICATION OF POTENTIAL ENVIRONMENTAL EFFECTS AND MITIGATION

10.1 SCREENING OF POTENTIAL EFFECTS

The potential effects of the construction, operation and decommissioning of the two hydroelectric facilities have been screened using NIRB's Part 2 form impact screening tables. Tables 10.1 and 10.2 present the interaction matrices for the Jaynes Inlet and Armshow South hydroelectric facilities, respectively.

In addition, identified mitigation and monitoring measures for the construction, operation and decommissioning of the Jaynes Inlet and Armshow South facilities is presented in Tables 10.3 and 10.4, respectively.

The decommissioning phase of each facility is assumed to be the design life of the facility, which is 40 years. A decommissioning phase is contemplated to ensure that the effects of the entire project life cycle are considered. In reality, hydroelectric facilities are rarely decommissioned. Instead, they undergo regular maintenance and periodic retrofits or maintenance programs.

10.2 POTENTIAL FOR CUMULATIVE EFFECTS

Major development projects can result in cumulative effects on valued ecosystem components or valued socio-economic components when the project has spatial and temporal overlaps with other major development projects. The combined effects of the two projects can be potentially significant even when the effects of the individual projects in isolation are insignificant.

The Nunavut Impact Review Board (NIRB, 2007) defines a cumulative effects assessment (CEA) as:

"The assessment of impacts on the biophysical and socio-economic environment that results from the incremental effects of a development when added to other past, present, and Reasonably Foreseeable Future Developments, regardless of what agency or person undertakes such other developments. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

A CEA will need to be completed as part of a future NIRB environmental review. The CEA will consist of three main steps:

- Determine whether the Project will have a residual effect on identified valued components (VECs and VSECs, together referred to as VCs)
- Assess the potential for the Project's residual effect to interact with residual effects resulting from other projects or activities (past, current, or future)
- Determine if the interaction of the residual Project effect, in combination with other project effects, is likely to meaningfully influence a VC

The temporal scale of the Project includes a project definition phase of approximately 2006 through 2015, a 3-year construction phase (2016 to 2018), and an operation phase based on a 40+ year design life (beyond 2058 for Jaynes Inlet, and beyond 2069 if the Armshow South facility was commissioned around 2030). The spatial scale of the Project is represented by the study area shown on Figure 1.1.

TABLE 10.1

IDENTIFICATION OF ENVIRONMENTAL IMPACTS - JAYNES INLET FACILITY

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		ENVIRONMENTAL COMPONENTS	PHYSICAL	designated environmental areas (i.e.. Parks, Wildlife Protected areas)	ground stability	permafrost	hydrology/ limnology	water quality	climate conditions	eskers and other unique or fragile landscapes	sediment and soil quality	tidal processes and bathymetry	air quality	noise levels	BIOLOGICAL	vegetation	wildlife, including habitat and migration patterns	birds, including habitat and migration patterns	aquatic species, incl. habitat and migration/spawning	wildlife protected areas	SOCIO-ECONOMIC	archaeological and cultural historic sites	employment	community wellness	community infrastructure	land use	human health
COMPONENTS/ACTIVITIES																											
CONSTRUCTION	Mobilization / demobilization by barge			0	0	0	0	0	0	0	0	1	1	1		0	0	0	1	0		2	P	0	0	1	0
	Camp construction and operation			0	0	0	0	0	0	0	1	0	1	1		2	2	2	0	0		2	P	0	0	2	0
	Fuel storage and dispensing			0	0	0	0	1	0	0	0	0	1	0		1	1	1	0	0		1	0	0	0	0	0
	Temporary diesel genset use			0	0	0	0	0	1	0	0	0	2	2		1	1	1	0	0		0	0	0	0	2	0
	Water takes for camp and concrete			0	0	0	2	1	0	0	0	0	0	0		1	1	1	1	0		0	0	0	0	0	0
	Sewage treatment and disposal			0	0	0	1	2	0	0	0	0	0	0		1	1	1	1	0		0	P	0	0	0	0
	Solid waste management			0	0	0	0	0	1	0	0	0	1	1		1	1	1	1	0		0	P	0	0	0	0
	Access road construction			0	2	2	0	1	1	0	1	0	1	2		2	2	2	1	0		2	P	0	0	2	0
	Powerhouse construction			0	2	2	0	1	1	0	1	0	1	2		2	2	2	1	0		2	P	0	0	1	0
	Penstock and tailrace construction			0	2	2	0	1	1	0	1	0	1	1		2	2	2	1	0		2	P	0	0	1	0
	Construction of outfall into lower lake			0	2	2	0	1	1	0	1	0	1	1		0	0	0	1	0		2	P	0	0	1	0
	Dam construction			0	2	2	1	1	1	0	1	0	2	2		1	1	1	2	0		2	P	0	0	1	0
	Intake drill, blast and excavate			0	2	2	1	1	1	0	1	0	2	2		1	1	1	1	0		2	P	0	0	1	0
	Disposal of excavation spoils			0	2	2	0	1	1	0	1	0	1	1		0	0	0	0	0		2	0	0	0	1	0
	Intake embankment construction			0	2	2	0	1	1	0	1	0	1	1		0	0	0	1	0		2	P	0	0	1	0
	Transmission line construction			2	1	1	0	1	1	0	1	0	1	2		1	1	1	1	0		2	P	0	0	2	0
	Helicopter use			0	0	0	0	0	1	0	0	0	1	2		0	0	0	0	0		1	P	0	P	2	0
OPERATION	Powerhouse operation			0	0	0	0	0	P	0	0	0	P	0		0	0	0	1	0		1	P	P	P	0	0
	Changing lake levels in upper lake			0	1	1	2	1	0	0	0	0	0	0		2	2	2	2	0		2	0	0	0	0	0
	Discharge from powerhouse in summer			0	1	0	2	1	0	0	1	0	0	0		0	0	0	0	0		0	0	0	0	0	0
	Discharge to Jaynes lower lake in winter			0	0	1	2	1	0	0	1	2	0	0		0	0	0	0	0		0	0	0	0	0	0
	Site access by helicopter			0	0	0	0	0	1	0	0	0	1	2		0	0	0	0	0		0	P	0	0	2	0
	Operator presence			0	0	0	0	1	1	0	0	0	0	1		1	1	1	0	0		1	P	0	0	1	0
	Transmission line maintenance			1	1	0	0	0	1	0	1	0	1	2		1	1	1	0	0		1	P	0	0	2	0
	Powerhouse and penstock maintenance			0	1	0	1	0	1	0	1	0	1	1		1	1	1	1	0		1	P	0	0	1	0

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NOTES:

1. PLEASE INDICATE IN THE MATRIX CELLS WHETHER THE INTERACTION CAUSES AN IMPACT AND WHETHER THE IMPACT IS:

- ***P*** *POSITIVE*
- ***0*** *NEGLIGIBLE INTERACTION*
- ***1*** *NEGATIVE MINOR INTERACTION*
- ***2*** *NEGATIVE MAJOR INTERACTION*
- ***U*** *UNKNOWN*

TABLE 10.2

IDENTIFICATION OF ENVIRONMENTAL IMPACTS - ARMSHOW SOUTH FACILITY

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		ENVIRONMENTAL COMPONENTS	PHYSICAL	designated environmental areas (i.e.. Parks, Wildlife Protected areas)	ground stability	permafrost	hydrology/ limnology	water quality	climate conditions	eskers and other unique or fragile landscapes	sediment and soil quality	tidal processes and bathymetry	air quality	noise levels	BIOLOGICAL	vegetation	wildlife, including habitat and migration patterns	birds, including habitat and migration patterns	aquatic species, incl. habitat and migration/spawning	wildlife protected areas	SOCIO-ECONOMIC	archaeological and cultural historic sites	employment	community wellness	community infrastructure	land use	human health
COMPONENTS/ACTIVITIES																											
CONSTRUCTION	Mobilization / demobilization by barge			0	0	0	0	0	0	0	0	1	1	1		0	0	0	1	0		2	P	0	0	1	0
	Camp construction and operation			0	0	0	0	0	0	0	1	0	1	1		2	2	2	0	0		2	P	0	0	2	0
	Fuel storage and dispensing			0	0	0	0	1	0	0	0	0	1	0		1	1	1	0	0		1	0	0	0	0	0
	Temporary diesel genset use			0	0	0	0	0	1	0	0	0	2	2		1	1	1	0	0		0	0	0	0	2	0
	Water takes for camp and concrete			0	0	0	2	1	0	0	0	0	0	0		1	1	1	1	0		0	0	0	0	0	0
	Sewage treatment and disposal			0	0	0	1	2	0	0	0	0	0	0		1	1	1	1	0		0	P	0	0	0	0
	Solid waste management			0	0	0	0	0	1	0	0	0	1	1		1	1	1	1	0		0	P	0	0	0	0
	Rock quarry development			2	2	2	1	2	0	0	2	0	1	2		2	2	2	0	0		2	P	0	0	2	0
	Access road construction			2	2	2	0	1	1	0	1	0	1	2		2	2	2	1	0		2	P	0	0	2	0
	Powerhouse construction			2	2	2	0	1	1	0	1	0	1	2		2	2	2	1	0		2	P	0	0	1	0
	Penstock and tailrace construction			2	2	2	0	1	1	0	1	0	1	1		2	2	2	1	0		2	P	0	0	1	0
	Construction of outfall into Armshow main			0	2	2	0	1	1	0	1	0	1	1		0	0	0	1	0		2	P	0	0	1	0
	Dam construction			2	2	2	1	1	1	0	1	0	2	2		1	1	1	2	0		2	P	0	0	1	0
	Disposal of excavation spoils			2	2	2	0	1	1	0	1	0	1	1		0	0	0	0	0		2	0	0	0	1	0
	Transmission line construction			0	1	1	0	1	1	0	1	0	1	2		1	1	1	1	0		2	P	0	0	2	0
	Helicopter use			2	0	0	0	0	1	0	0	0	1	2		0	0	0	0	0		1	P	0	P	2	0
OPERATION	Powerhouse operation			1	0	0	0	0	P	0	0	0	P	0		0	0	0	1	0		1	P	P	P	0	0
	Changing lake levels in upper lake			2	1	1	2	1	0	0	0	0	0	0		2	2	2	2	0		2	0	0	0	0	0
	Discharge from powerhouse in summer			0	1	0	2	1	0	0	1	0	0	0		0	0	0	0	0		0	0	0	0	0	0
	Discharge to Armshow River in winter			0	0	1	2	1	0	0	1	2	0	0		0	0	0	2	0		0	0	0	0	0	0
	Site access by helicopter			1	0	0	0	0	1	0	0	0	1	2		0	0	0	0	0		0	P	0	0	2	0
	Operator presence			1	0	0	0	1	1	0	0	0	0	1		1	1	1	0	0		1	P	0	0	1	0
	Transmission line maintenance			1	1	0	0	0	1	0	1	0	1	2		1	1	1	0	0		1	P	0	0	2	0
	Powerhouse and penstock maintenance			1	1	0	1	0	1	0	1	0	1	1		1	1	1	1	0		1	P	0	0	1	0

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NOTES:

1. PLEASE INDICATE IN THE MATRIX CELLS WHETHER THE INTERACTION CAUSES AN IMPACT AND WHETHER THE IMPACT IS:

- ***P*** *POSITIVE*
- ***0*** *NEGLIGIBLE INTERACTION*
- ***1*** *NEGATIVE MINOR INTERACTION*
- ***2*** *NEGATIVE MAJOR INTERACTION*
- ***U*** *UNKNOWN*

Table 10.3 Mitigation and Monitoring Plan - Jaynes Inlet Facility

Environmental Effects	Proposed Mitigation Measure	Implementation Schedule	Residual Impacts	Proposed Monitoring Schedule	Reporting Schedule
Effects to designated environmental areas (transmission line crossing Katannilik Territorial Park)	Work with Nunavut Parks and advisory committee(s) to minimize visual impacts of transmission line	Planning with stakeholders prior to submission of an Environmental Impact Statement; implementation during construction phase	Visual impacts to park users	No monitoring proposed	No reporting proposed
Ground stability due to site development / effects to permafrost	Conduct geotechnical investigations; design project and execute ground disturbing activities to minimize ground instability (i.e., maximize development on bedrock, minimize cuts into overburden, etc.)	Planning (feasibility study, detailed design) and construction	Minor ground disturbances	Monitoring during construction and immediately post-construction	No reporting proposed
Effects to hydrology and limnology due to water takes during construction	Identify water take locations with sufficient size so less than 10% of stream or lake will be removed.	Construction	Minor changes to flow	Monitoring during construction	Monthly and annually to Nunavut Water Board (water licence reporting)
Effects to hydrology and limnology due to changes in flow regime resulting from hydro operation	Powerhouse will discharge to stream during open water instead of lower lake	Operation	Constant flow through winter and reduced peak flows during freshet	Continuous during operation	Monthly and annually to Nunavut Water Board (water licence reporting)
Effects to sediment and soil quality due to quarry development	Minimize overburden disturbance by excavating exposed rock where possible`	Construction	Limited soil degradation	Monitoring during construction	No reporting proposed
Effects to sediment quality due to tailrace discharge to stream, lower lake and lower lake discharge to Jaynes Inlet	Discharges to stream will be to armoured; discharges to lower lake will be via an energy diffuser	Operation	Minor changes to sediment quality	Aquatic effects monitoring schedule to be determined	Annually (water licence reporting)
Air and noise emissions during construction	Minimize emissions with modern equipment and avoidance of land use areas to the extent possible	Mainly construction, operation	Air and noise emissions below applicable guidance	No monitoring proposed	No reporting proposed
Loss of vegetation due to ground disturbance and raising the upper lake water level	Minimize construction footprint	Construction	Loss of vegetation	Survey for species at risk during baseline studies	Report findings of species at risk surveys and estimated vegetation loss in EIS
Effects to wildlife and birds due to loss of habitat	Minimize footprint and identify and avoid key habitats to the extent possible	Construction	Permanently lost habitat	To be determined	To be determined
Effects to wildlife and birds due to zone of influence disturbances	Minimize footprint and identify and avoid key habitats to the extent possible	Operation	Temporary lost habitat	To be determined	To be determined

Environmental Effects	Proposed Mitigation Measure	Implementation Schedule	Residual Impacts	Proposed Monitoring Schedule	Reporting Schedule
Effects to aquatic species due to construction in and near fish bearing waters	Employ standard mitigation including DFO's operational statements	Construction	Temporary lost habitat	Monitoring during and post-construction as per Fisheries Authorization and water licence	Annually (water licence and fisheries authorization reporting)
Lost fish habitat due to damming and changing flows, including annual raising and lowering of lake levels	Identify offsets for lost mitigation	Operation	Permanently altered or destroyed habitat	Monitoring during and post-construction as per Fisheries Authorization and water licence	Follow-up monitoring of off-set success as specified in fisheries authorization
Loss of cultural resources through potential effects to archaeological sites due to ground disturbance activities	Archaeological surveys by licensed archaeologist; mitigation of potentially affected sites by systematic data recovery	Pre-construction/construction	None (mitigation expected to adequately recover affected sites)	Monitoring pre-construction	Submission of archaeological permit report annually following any archaeological surveys/mitigation
Employment	Maximize local employment during construction	Construction	Positive benefits of employment	Tracking of employment benefits	No reporting proposed
Community infrastructure	The project will increase infrastructure	Construction	Local business community enhanced by contracts	No monitoring proposed	No reporting proposed
Effects to land use as a result of project construction and operation	Minimize disturbance during construction and operation, mainly helicopter use around hunters	Construction and operation	Disturbance effects to land users	Stakeholder engagement plan / complaints register	NIRB Annual Report

NOTES:

1. RESIDUAL IMPACTS REFERS TO THOSE IMPACTS THAT REMAIN AFTER MITIGATION HAS BEEN IMPLEMENTED.

Table 10.4 Mitigation and Monitoring Plan - Armshow South Facility

Environmental Effects	Proposed Mitigation Measure(s)	Implementation Schedule	Residual Impacts	Proposed Monitoring Schedule	Reporting Schedule
Effects to designated environmental areas (Katannilik Territorial Park)	Work with Nunavut Parks and advisory committee(s) to address effects to the park natural features and use	Planning with stakeholders prior to submission of an EIS; implementation during construction phase	Impediments to travel by Inuit travelers and park users	Annually to confirm success of mitigation	To be determined
Ground stability due to site development / effects to permafrost	Conduct geotechnical investigations; minimize ground instability (i.e., maximize use of bedrock, minimize overburden cuts, etc.)	Planning (feasibility study, detailed design) and construction	Minor ground disturbances	Monitoring during construction and immediately post-construction	No reporting proposed
Effects to hydrology and limnology due to water takes during construction	Identify water take locations with sufficient size so less than 10% of stream or lake will be removed	Construction	Minor changes to flow	Monitoring during construction	Monthly and annually to Nunavut Water Board (water licence reporting)
Effects to hydrology and limnology due to changes in flow regime resulting from operation	Powerhouse will discharge to stream during open water instead of lower lake	Operation	Constant flow through winter and reduced peak flows during freshet	Continuous during operation	Monthly and annually to Nunavut Water Board (water licence reporting)
Effects to sediment and soil quality due to quarry development	Minimize overburden disturbance by excavating exposed rock where possible	Construction	Limited soil degradation	Monitoring during construction	No reporting proposed
Effects to sediment quality due to tailrace discharge to Armshow River	Discharges to stream will be to armoured; discharges to river will be via an energy diffuser	Operation	Minor changes to sediment quality	Aquatic effects monitoring schedule to be determined	Annually (water licence reporting)
Air and noise emissions during construction	Minimize emissions with modern equipment and avoid land use areas to the extent possible	Mainly construction, operation	Air and noise emissions below applicable guidance	No monitoring proposed	No reporting proposed
Loss of vegetation due to ground disturbance and raising the upper lake water level	Minimize construction footprint	Construction	Loss of vegetation	Survey for species at risk during baseline studies	Report findings of species at risk surveys and estimated vegetation loss in EIS
Effects to wildlife and birds due to loss of habitat	Minimize footprint and identify and avoid key habitats to the extent possible	Construction	Permanently lost habitat	To be determined	To be determined
Effects to wildlife and birds due to zone of influence disturbances	Minimize footprint and identify and avoid key habitats to the extent possible	Operation	Temporary lost habitat	To be determined	To be determined

Environmental Effects	Proposed Mitigation Measure(s)	Implementation Schedule	Residual Impacts	Proposed Monitoring Schedule	Reporting Schedule
Effects to aquatic species due to construction in and near fish bearing waters	Employ standard mitigation including DFO's operational statements	Construction	Temporary lost habitat	Monitoring during and post-construction as per Fisheries Authorization and water licence	Annually (water licence and fisheries authorization reporting)
Lost fish habitat due to damming and changing flows, including annual raising and lowering of lake levels	Identify offsets for lost mitigation	Operation	Permanently altered or destroyed habitat	Monitoring during and post-construction as per Fisheries Authorization and water licence	Follow-up monitoring of off-set success as specified in fisheries authorization
Loss of cultural resources due to ground disturbance activities	Archaeological surveys by licensed archaeologist; mitigation of potentially affected sites by systematic data recovery	Pre-construction/construction	None (mitigation expected to adequately recover affected sites)	Monitoring pre-construction	Archaeological permit report following any archaeological surveys/ mitigation
Employment	Maximize local employment during construction	Construction	Positive benefits of employment	Tracking of employment benefits	No reporting proposed
Community infrastructure	The project will increase infrastructure	Construction	Local business community enhanced by contracts	No monitoring proposed	No reporting proposed
Effects to land use as a result of project construction and operation	Minimize disturbance, mainly helicopter use around hunters; monitor ice thickness of Armshow South lake during operation; establish new trail and ice bridge during operation; install high-visibility markers for navigation	Construction and operation	Disturbance effects to land users; recommend no ice fishing below tailrace	Stakeholder engagement plan / complaints register	NIRB Annual Report
Warming/safety hut near plant operator building	A positive effect – refuge for travellers	Construction and operation	Positive benefits for travelers	No monitoring proposed	No reporting proposed

Other projects and activities were identified from stakeholder input, land use plans, government plans and published development plans for Nunavut. Other projects and activities that will be considered for the potential to interact with effects of this Project on VCs include:

- Mining and mineral exploration activities
- Decommissioned mines
- DEW-line decommissioning
- Air transport
- Military exercises
- Traditional and recreational hunting, fishing and foraging
- Communities
- Tourism and commercial recreation activities
- Climate change

From the above list, specific projects or activities likely to be considered in a future CEA include the advanced mineral exploration Chidliak Project located approximately 120 km east of Iqaluit. The recently approved Mary River Project in the North Baffin will likely have mainly socio-economic influences on Iqaluit, including demand on the local labour pool. These projects and the above-listed activities will be considered in more detail in an EIS.

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12 – CERTIFICATION

This report was prepared, reviewed and approved by the undersigned.

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