August 28, 2008

Jeffrey Holwell
A/Manager, Land Administration
Indian and Northern Affairs Canada
P.O. Box 100
Iqaluit, Nunavut X0A 0H0
Fax # (867) 975-4286

Leslie Payette
Nunavut Impact Review Board
P.O. Box 1360
Cambridge Bay, NU
FAX (867) 983-2574

Phyllis Beaulieu
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU
FAX (867) 360-6369

Jennifer Wilman
Manager, Research Liaison
Nunavut Research Institute
P.O. Box 1720
Iqaluit, Nunavut X0A 0H0
Fax # (867) 979-7109

Dear Mr. Holwell, Ms. Payette, Ms. Beaulieu, Ms. Wilman,

Re: NWB 3BC-BGI Devon Icecap Project – University of Alberta

The NPC has completed its review of the above noted project proposal. It conforms to the North Baffin Regional Land Use Plan (NBRLUP), subject to the attached.

By this letter and additional enclosures, the NPC is forwarding the project proposal with this determination to NIRB for screening.

The applicant has undertaken to comply with the attached requirements. The authorizing agencies to which this letter is addressed are responsible under the *Nunavut Land Claims Agreement* to implement any of the attached requirements by incorporating the requirements directly, or otherwise ensuring that they must be met, in the terms and conditions of any authorizations issued.

My office would be pleased to discuss with these agencies how best to implement these requirements and to review any draft authorizations that the agencies wish to provide for that purpose.

And, this conformity determination applies only to the above noted applications as submitted. Therefore, the proponent must ensure other applications for a permit under this project proposal not listed above are forwarded to NPC for a conformity determination against the NBRLUP, and notify the NPC immediately if any material to the project proposal is changed before authorizations are issued.

Yours truly,

Bobby Suluk
Regional Planning Co-ordinator, NPC

Cc: Martin Sharp, University of Alberta

Application #

NUNAVUT PLANNING COMMISSION
APPLICATION TO DETERMINE CONFORMITY
WITH THE NORTH BAFFIN REGIONAL LAND USE PLAN

All applicants for a project proposal shall comply with the requirements listed below. The relevant sections of the plan are noted in each requirement.

GENERAL

2. **Environmental Protection:** *s3.3.11.8:* The applicant undertakes to prevent any new occurrences of pollution, garbage and contamination at the site of the development.

   (Yes) No

3. **Removal of Fuel Drums:** *s3.3.11.8:* The applicant undertakes to remove all drums safely from the site and dispose of the drums in a safe manner.

   (Yes) No

4. **New Site Restoration and Clean Up:** *s3.3.11.1 and Appendix C, s1:* The applicant undertakes to clean up the site and restore the site to its natural condition to the greatest extent possible.

   (Yes) No

5. **Old Site Restoration and Clean Up:** *s3.3.11.2:* The applicant undertakes to clean up the site and restore the site to its original condition to the greatest extent possible, including any work required due to the applicant's action prior to this application.

   (Yes) No

6. **Low-Level Air Flights:** *Appendix C, s3:* Will the applicant avoid all low-level flights?

   Yes (No)

   i. If not, explain why such flights are or may be absolutely necessary.

Access to site is by Twin Otter only. Some helicopter use to access remote parts of ice cap. Work cannot be done without this. There is minimal wildlife on the ice cap so disturbance should not be a concern

ii. If such flights are or may be absolutely necessary, will they avoid disturbance to people and wildlife?

(Yes) No

No people to disturb
Animal wildlife

iii. If not, explain why it is not possible to avoid such disturbance.

HERITAGE RESOURCES

10. **Reporting of Archaeological Sites:** *s3 3.9.3 and Appendix C, s2 and s8*: Will the applicant immediately report the discovery of all suspected archaeological sites to the Department of Culture, Language, Elders and Youth (GN)?

(Yes) No

11. **Carving Stone Deposits:** Appendix C, s9. Will the applicant report any discoveries of carving stone deposits to the Qikiqtani Inuit Association?

(Yes) No

SCIENTIFIC RESEARCH

17. **Scientific Research:** *s3.3.7.3:* Does the project proposal involve scientific research?

(Yes) No

If yes, will the applicant integrate all available and relevant local and traditional knowledge when conducting its research?

(Yes) No

18. **Consultation with Nunavut Research Institute:** *s3.3.7.6:* Has the applicant consulted with the Nunavut Research Institute about research topics that would benefit or interest local residents?

Yes No

i. Describe the results of your consultation.

We have an NRI Permit. Community consultation is part of permitting process. We have never received any feedback from communities.

ii. If no, explain why.

It appears our work at the ice caps is of limited interest to local communities - though we do inform them of our plans and results.

19. **Local Services and Local Employment:** *s3.3.7.4:* Will the applicant rely on local services and employment where possible?

(Yes) No

i. Describe the services retained and the people to be employed.

We purchase some food from the Co-op in Resolute Bay. We use First Air for shipping goods and equipment

ii. If no, explain why it is not possible.

20. **Communication on Scientific Research:** *s3.2.8 and s3.3.7.5:* The applicant will, at minimum, translate a summary of its work into Inuktitut and communicate with communities using language that is clear and non-technical. The results of all scientific research shall be made available to the affected communities as soon as possible.

(Yes) No

22. **Code of Good Conduct for Land Users:** *Appendix C:* The applicant undertakes to adhere to the code of Good Conduct at all times.

(Yes) No

I, MARTIN SHARP (name of applicant), certify that the information I have given in this application is true and correct and hereby make the above undertakings which form part of my application for a project proposal within the meaning of the Nunavut Land Claims Agreement.

Date: 28-8-08 Signature of Applicant: [signature]

3150-1571

Effective June 16, 2006

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

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NUNAVUT IMALIRIYIN KATIMAYINGI
NUNAVUT WATER BOARD
OFFICE DES EAUX DU NUNAVUT

WATER LICENCE
SCHEDULE III - APPLICATION FORM

Application for: (check one)

x **New** ☐ **Renewal** ☐ **Amendment** ☐ **Assignment** ☐ **Cancellation**

LICENCE NO:
(for NWB use only)

1. **NAME AND MAILING ADDRESS OF APPLICANT/LICENSEE**

Martin Sharp
Earth and Atmospheric Sciences
1-26 Earth Science Building
University of Alberta
Edmonton, Alberta, T6G 2E3

Phone: 780 492 5249
Fax: 780 492 2030
e-mail: martin.sharp@ualberta.ca

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

Phone: _____
Fax: _____
e-mail: _____

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

Devon Island ice cap, Nunavut

Latitude: **75° 33.46' N** Longitude: **81° 29.68'**
NTS Map Sheet No. 48H 48E Scale: 1:250,000

4. **DESCRIPTION OF UNDERTAKING** (attach plans and drawings)

Scientific study of the dynamics and recent changes in the Devon Island ice cap, with a particular focus on the surface hydrology and flow of the Belcher Glacier. Work is conducted largely by parties of 2 people from small camps. In the spring, these camps are highly mobile and parties usually spend only a few days in each spot. In summer (June and July), camps may be occupied for several weeks at a time. Water use is for domestic consumption only.

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

☐ **Industrial**
☐ **Mining and Milling** (includes exploration/drilling)
☐ **Municipal** (includes camps/lodges)
☐ Power
☐ Agricultural
☐ **Conservation**
☐ Recreational
x **Miscellaneous** (describe below):

Small field research camps with domestic water use and disposal of domestic waste. Installation of hydrological monitoring equipment in some lakes and streams on ice cap surface

See Schedule II of *Northwest Territories Waters Regulations* for Description of Undertakings

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6. WATER USE

X To obtain water
☐ To cross a watercourse
☐ To modify the bed or bank of a watercourse
☐ Flood control
☐ To divert a watercourse
☐ To alter the flow of, or store, water

☐ Other (describe): **Temporary installations to monitor water level (pressure transducers) and quality (sensors for electrical conductivity, pH, dissolved oxygen, temperature) are set up on a small number of streams and lakes on the ice cap surface**

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

Water use x 100m³/day or less
☐ Greater than 100m³/day; if greater, indicate quantities to be used for each purpose (camp, drilling, etc.)

Water returned to source
0 m³/day

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

x Sewage
x Solid Waste
☐ Hazardous
☐ Bulky Items/Scrap Metal
☐ Waste oil
x Greywater
☐ Sludges
☐ Other describe): .....

All solid waste is bagged and removed from site: Greywater is disposed of by pouring into crevasses (<5L per day max); In spring sewage is collected, frozen and removed from site for disposal; In summer, this is not always possible, in which case all toilet paper is burned and waste is disposed of down crevasses to avoid direct input to surface water.

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

Every year we obtain a research license from the Nunavut Research Institute. The licensing process involves environmental impact screening by NIRB. No research activities take place on Inuit owned lands. Camps are not occupied for long enough for a DIAND land use permit to be needed.

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.)

Every effort is made to minimize impacts. Bear safety dictates that we keep clean camps. We try to remove all garbage and as much human waste as possible. Camps are small and mobile to minimize impact at single sites. Grey water and some sewage are disposed of down crevasses away from streams to avoid any possibility of surface water contamination.

NIRB Screening x Yes ☐ No If no, date expected .....

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

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.)

Burgess, D.O. and Sharp, M. Recent changes in thickness of the Devon Island ice cap, Canada. Journal of Geophysical Research (Solid Earth). Accepted 8 April 2008.

Colgan, W., Davis, J. and Sharp, M. 2008. Is the high elevation region of the Devon Island ice cap thickening? Journal of Glaciology 186, 428-436.

Bell, C, Mair, D., Burgess, D., Sharp, M., Demuth, M.N., Cawkwell, F., Bingham, R.G, and Wadham, J. 2008. Spatial and temporal variability in the snowpack of a high Arctic ice cap: implications for mass change measurements. Annals of Glaciology 48, 159-170.

Colgan, W. and Sharp, M. 2008. Combined oceanic and atmospheric influences on net accumulation on the Devon Island Ice Cap, Nunavut, Canada. Journal of Glaciology 54, 28-40.

Mair, D., Burgess, D. and Sharp, M., 2005. 37-year mass balance of the Devon Island Ice Cap, Nunavut, Canada, determined by shallow ice coring and melt modelling. *Journal of Geophysical Research (Earth Surface)* 110, F01011, doi:10.1029/2003JF000099.

Burgess, D., Sharp, M., Mair, D., Dowdeswell, J. and Benham, T. 2005. Flow dynamics and iceberg calving rates of the Devon Ice Cap, Nunavut, Canada. *Journal of Glaciology* 51, 219-230.

Dowdeswell, J.A., Benham, T.J., Gorman, M.R., Burgess, D., and Sharp, M. 2004. Form and flow of the Devon Island Ice Cap, Canadian Arctic. *Journal of Geophysical Research (Earth Surface)*, 109, F02002, doi:10.1029/2003JF000095.

Burgess, D. and Sharp, M. 2004. Recent changes in areal extent of the Devon Island Ice Cap, Nunavut, Canada. *Arctic, Antarctic and Alpine Research* 36, 261-271.

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

Supplementary Questionnaire (where applicable: see section 5) X Yes ☐ No If no, date expected .....

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Inuktitut and/or Innuinaqtun/English Summary of Project	X Yes	☐ No If no, date expected
Application fee of $30.00 (Payee Receiver General for Canada) 2008	☐ Yes	X No If no, date expected July 31,
Water Use fee of $30.00 (unless otherwise indicated in Section 9 of the *NWT Waters Regulations;* Payee Receiver General for Canada) 2008	☐ Yes	X No If no, date expected July 31,

15. **PROPOSED TIME SCHEDULE** (unless otherwise indicated, the NWB will consider the application for a five (5) year term)

☐ one year or less (or) x Multi Year

Start Date: 2004 Completion Date: Uncertain

Martin Sharp	Professor		July 3 2008
Name (Print)	**Title (Print)**	**Signature**	**Date**

For Nunavut Water Board office use only

APPLICATION FEE	**Amount: $**	**Pay ID No.:**
WATER USE DEPOSIT	**Amount: $**	**Pay ID No.:**

The Dynamic Response of Arctic Glaciers to Global Warming: A Canadian Contribution to International Polar Year Project Glaciodyn (IPY30)

Martin J. Sharp, *University of Alberta*
Luke Copland, *University of Ottawa*
Sarah Boon, *University of Northern British Columbia*
Jeff Kavanaugh, *University of Alberta*
Lev Tarasov *Memorial University*

Project Location:

This study will focus on the Belcher Glacier, which is located in the North East sector of the Devon Island ice cap, Nunavut (*75.6° N, 81.5° W*).

Time Frame:

May 1 – August 1, 2007 and 2008

Project Description:

The purpose of this project is to provide a better understanding of the mechanisms that control the flow rates of the Belcher Glacier. Identification of these factors should allow us to model how this glacier will respond to future climate warming and determine the impact that these changes will have on the mass balance of the ice cap as a whole.

Methodology:

The Belcher Glacier was chosen as the focus of study for this project because it is the most important pathway along which ice is transported from the interior of the Devon ice cap and deposited directly into the ocean. Variations in flow rates will be monitored by global positioning system (GPS) measurements performed at ~4 km intervals along the entire length of the glacier. These systems will be deployed in the summer of 2006 (NRI licence # 0201606N-M) and will continue to monitor glacier movement continuously until 2011. The presence of water at the glacier bed will be detected and the basal topography mapped using an Ice Penetrating Radar (IPR) system that will be towed by snowmobile along transects running parallel and perpendicular to glacier flow. Point studies using seismic reflection techniques will also be made at a small number of sites chosen on the basis of results of the radar surveys. Long-term snow accumulation rates will be measured at ~15 borehole locations throughout the Belcher Glacier catchment area. Spatial variability of accumulation will be tracked with the IPR system between the locations where long-term accumulation measurements were performed. Snow melt throughout the spring and summer seasons will be monitored with a series of temperature loggers and an automatic weather station that are to be deployed between the glacier terminus and the glacier head. The evolution of surface streams and ponds will be monitored by taking pictures of the glacier surface daily throughout the melt season with digital cameras mounted at 2 or 3 locations along the sidewall cliffs overlooking the

glacier valley. Tides in the area in front of the glacier will be monitored with a pressure transducer.

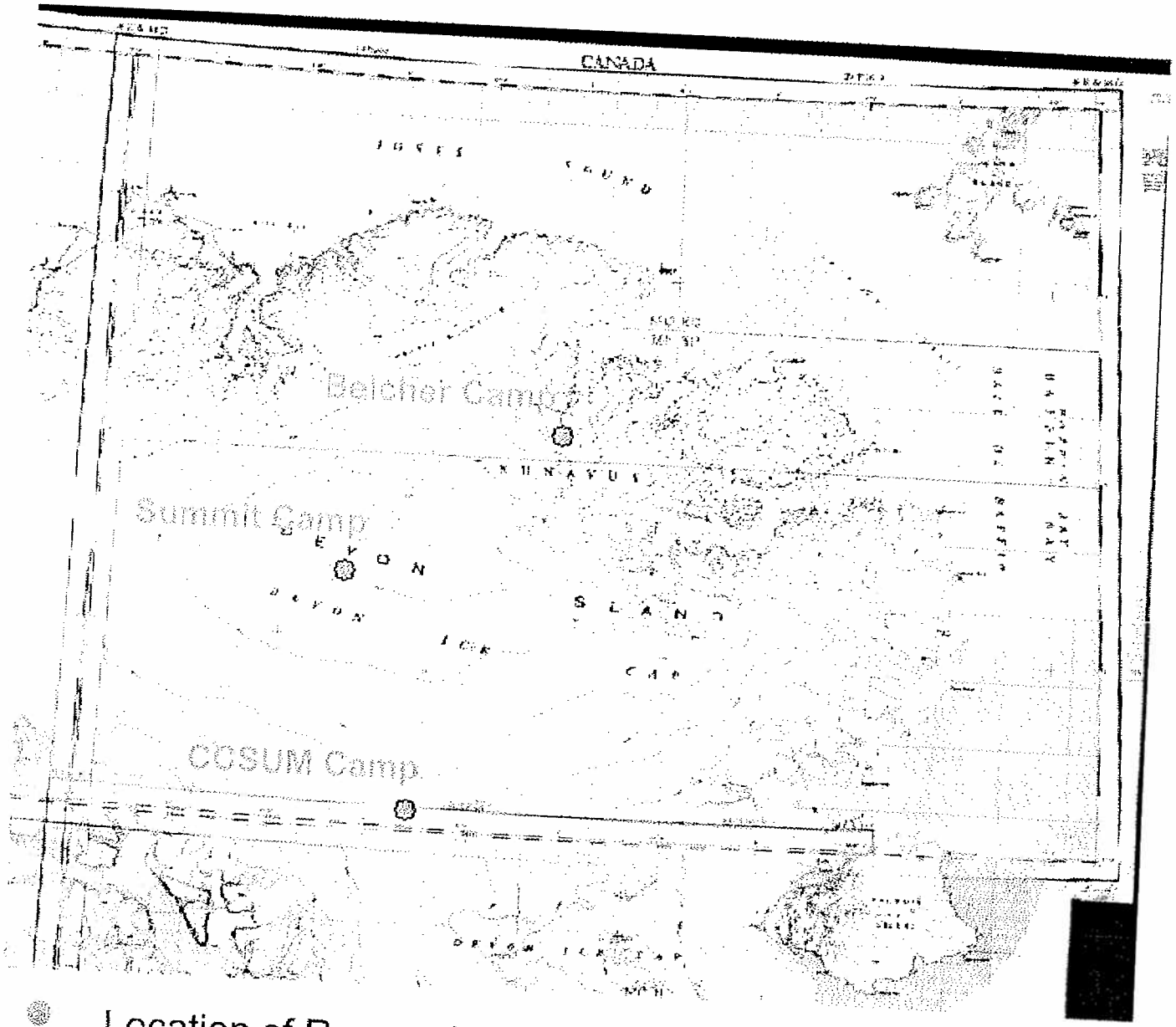
Travel along the glacier will be via snowmobile and komatiq sled and by helicopter. There will be as many as 3 mobile camps operating on the glacier at any one time as well as a base camp where equipment and fuel will be stored.

Data:

The data resulting from these field campaigns will be used to determine linkages between the local weather and tidal conditions and variable flow rates along the glacier. These data will also be input into a computer model to simulate how the flow rates of the glacier may change under climate warming situations.

Reporting:

In addition to publication in scientific journals and presented at conferences, results from this work will be presented through the usual NRI reporting process and at local communities such as Grise Fiord and Resolute Bay. Results will also be communicated through the local media (eg. *Above 'n' Beyond, Nunatsiaq News, CBC North, and Kivalliq News*) as well as the *Edmonton Journal*. In addition, progress and results will be posted on a web page maintained by the glaciology group at the University of Alberta.



Location of Research Camps on Devon ice cap, Nunavut