



## **NIRB Application for Screening #125362**

### **Watershed and permafrost responses to a changing climate in the Resolute Bay area**

**Application Type:** New

**Project Type:** Scientific Research

**Application Date:** 6/27/2018 1:21:18 PM

**Period of operation:** from 0001-01-01 to 0001-01-01

**Proposed Authorization:** from 0001-01-01 to 0001-01-01

**Project Proponent:** Queen's University, Scott Lamoureux  
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## DETAILS

### Non-technical project proposal description

English: As climate warms, permafrost degradation is accelerating, with numerous impacts on ground stability and soil erosion. Simultaneously, precipitation regimes are expected to shift toward more rainfall and less snow, affecting late summer water quality and sediment transport in rivers. The modification of hydrology is a concern for water quality and availability in Arctic communities and will directly impact freshwater ecosystems, which are among the most vulnerable yet the most poorly understood in North America. This project is aimed at investigating potential effects of permafrost degradation and of increased rainfall on the hydrology, water quality and sediment dynamics of the McMaster River near Resolute Bay, Nunavut. This research will act as a parallel study to the watershed the community is using as a water source, and will provide crucial knowledge of permafrost and hydrological conditions in and around the community. Fieldwork will be performed by Michel Paquette, and based at the Polar Continental Shelf Program (PCSP) in Resolute Bay. The field sites will be accessed by ATV during the month or so of operation. Water sampling of 2L of water for ion, DOC, isotopic composition and sediment concentration will be conducted bi-weekly, and during intense precipitation events at major junctions of the river. Samples will be filtered in the Dr. Roy M. "Fritz" Koerner Laboratory at PCSP, and prepared for further analysis at the Facility for Biogeochemical Research on Environmental Change and the Cryosphere of Queen's University upon return. Permafrost coring will be performed in 6 locations (including Resolute Bay) using a modified portable earth auger, in order to determine ground ice content and ice composition in selected environmental settings. The cores will be described in-situ and transported to the Geocryolab at the University of Montreal for analysis. Research is conducted near Resolute Bay, where concerns arose in the community concerning permafrost stability since a landslide event occurred in 2017. The facilities and support of PCSP as well as the expressed interest in the community make it an ideal occasion to provide key information to decision makers, while also producing general scientific knowledge. Employment of community members, and general outreach and communication with the community during the field season will provide essential feedback to our research. Community involvement could result in permafrost coring and permafrost temperature monitoring in the hamlet of Resolute Bay, possibly in partnership with the population and/or the local school. Data will be used to publish papers in scientific journals, as well as to provide information to local officials. We will provide feedback to the community on our finding during the 2019 field season, and potentially during the winter months if research funding allows a visit.

French: Les hausses de températures associées aux changements climatiques engendrent une dégradation du pergélisol, encourageant des impacts sur les conditions de stabilité et d'érosion des sols. Simultanément, la modification du régime des précipitations vers davantage de pluie risque de modifier la qualité des eaux de surfaces ainsi que le transport de sédiments dans les rivières. La modification des régimes hydrologiques est particulièrement problématique pour les ressources en eaux des communautés nordiques, et affectera directement les écosystèmes d'eaux douces arctiques, qui sont parmi les plus vulnérables et les moins bien compris de l'Amérique du Nord. Le projet s'intéresse aux effets potentiels de la dégradation du pergélisol et des pluies accrues sur l'hydrologie, la qualité des eaux et les dynamiques sédimentaires de la rivière McMaster, près de Resolute Bay, au Nunavut. La recherche servira de parallèle au bassin versant utilisé comme source d'eau par la communauté. Elle procurera une connaissance essentielle des conditions de pergélisol et de l'hydrologie à l'intérieur et autour de la communauté. Les travaux de terrain seront basés au Programme du Plateau Continental Polaire (PPCP) à Resolute Bay et exécutés par Michel Paquette. Les sites de recherche sont accessibles par véhicule tout-terrain pendant les mois d'opération. Des échantillons de 2L d'eau seront collectés aux jonctions principales de la rivière deux fois par semaine ainsi que pendant et après des événements de précipitation intenses. Les eaux récoltées seront filtrées au laboratoire de Dr. Roy M. "Fritz" Koerner au PPCP, et seront préparés afin d'être transportés vers le Facility for Biogeochemical Research on Environmental Change and the Cryosphere de l'Université Queen's, où seront analysés les contenus en ions, en carbone organique dissout et en isotopes stables contenus dans l'eau. L'échantillonnage du pergélisol sera effectué par forage et carottage à l'aide d'une foreuse à carottier portative. Un total de 6 sites seront choisis (incluant Resolute Bay) afin de déterminer la composition du sol et de la glace dans différents environnements. Les carottes seront décrites in-situ avant d'être transportées au Geocryolab de l'Université de Montréal pour analyses complètes. La recherche prendra place près de Resolute Bay, où la communauté a récemment communiqué ses inquiétudes à la suite d'un glissement de terrain lié au dégel du pergélisol en 2017. Les installations et le soutien de PPCP, ainsi que l'intérêt exprimé par la communauté font du projet une occasion idéale de fournir aux dirigeants des informations clés sur les conditions environnementales, tout en profitant du savoir local afin d'être guidé pour produire de la connaissance scientifique. Il est prévu, lors du développement des relations avec la communauté, d'employer des membres de la communauté et d'établir une communication où nous communiquons nos résultats et où la communauté nous présente ses impressions et ses préoccupations afin de guider davantage nos recherches. Le développement d'une relation adéquate entre l'équipe de recherche et la communauté pourrait résulter, par exemple, dans des opérations clés de forage et de mesure des températures du pergélisol à Resolute Bay, les données possiblement acquises et traitées par des membres de la communauté. Les données recueillies seront utilisées afin de publier des articles dans des journaux scientifiques, ainsi qu'afin de fournir de

[illegible]

Operations Phase: from 2018-07-23 to 2018-08-20

## Activities

Location	Activity Type	Land Status	Site history	Site archaeological or paleontological value	Proximity to the nearest communities and any protected areas
Resolute Bay	Researching	Municipal	Hamlet of Resolute Bay	N/A	N/A
McMaster River sampling site 1	Scientific/International Polar Year Research	Municipal	No known site history	No known archeological value. Any encountered archeological site will be avoided during our research	About 8 km North of Resolute Bay
McMaster River sampling site 2	Scientific/International Polar Year Research	Municipal	No known site history	No known archeological value. Any encountered archeological site will be avoided during our research	About 7 km North of Resolute Bay
McMaster River sampling site 3	Scientific/International Polar Year Research	Municipal	No known site history	No known archeological value. Any encountered archeological site will be avoided during our research	About 5 km North of Resolute Bay
McMaster River sampling site 4	Scientific/International Polar Year Research	Municipal	No known site history	No known archeological value. Any encountered archeological site will be avoided during our research	About 5 km North of Resolute Bay
McMaster River sampling site 5	Scientific/International Polar Year Research	Municipal	No known site history	No known archeological value. Any encountered archeological site will be avoided during our research	About 8 km North-West of Resolute Bay
Permafrost coring site 1	Scientific/International Polar Year Research	Municipal	No known site history	No known archeological value. Any encountered archeological site will be avoided during our research	About 7 km North of Resolute Bay
Permafrost coring site 2	Scientific/International Polar Year Research	Municipal	No known site history	No known archeological value. Any encountered archeological site will be avoided during our research	About 8 km North of Resolute Bay
Permafrost coring site 3	Scientific/International Polar Year Research	Municipal	No known site history	No known archeological value. Any encountered archeological site will be avoided during our research	About 7 km North of Resolute Bay
Permafrost coring site 4	Scientific/International Polar Year Research	Municipal	No known site history	No known archeological value.	About 7 km North of

				Any encountered archeological site will be avoided during our research	Resolute Bay
Permafrost coring site 5	Scientific/International Polar Year Research	Municipal	No known site history	No known archeological value. Any encountered archeological site will be avoided during our research	About 8 km North-West of Resolute Bay

#### Community Involvement & Regional Benefits

Community	Name	Organization	Date Contacted
Resolute Bay	Phillip Manik	Hunters Trappers Organizations	2018-02-24

## Authorizations

Indicate the areas in which the project is located:

North Baffin

### Authorizations

Regulatory Authority	Authorization Description	Current Status	Date Issued / Applied	Expiry Date
Nunavut Research Institute	N/A	Not Yet Applied		

### Project transportation types

Transportation Type	Proposed Use	Length of Use
Land	ATV transport on the roads an in the watershed	

### Project accomodation types

Other,

## Material Use

Equipment to be used (including drills, pumps, aircraft, vehicles, etc)

Equipment Type	Quantity	Size - Dimensions	Proposed Use
Portable core drill	1	3m	Permafrost coring down to 3m
ATV	1	2m	tansport

## Detail Fuel and Hazardous Material Use

Detail fuel material use:	Fuel Type	Number of containers	Container Capacity	Total Amount	Units	Proposed Use
Gasoline	fuel	3	20	60	Liters	For ATV and Drill

## Water Consumption

Daily amount (m3)	Proposed water retrieval methods	Proposed water retrieval location
0	Grab sampling	McMaster River, North River

# Waste

## Waste Management

Project Activity	Type of Waste	Projected Amount Generated	Method of Disposal	Additional treatment procedures
Researching	Combustible wastes	1 kg/d	By PCSP	By PCSP
Camp	Greywater	50 l/d	By PCSP	by PCSP
Researching	Greywater	20 L/d	By PCSP	By PCSP
Camp	Non-Combustible wastes	1 kg/d	By PCSP	By PCSP
Camp	Sewage (human waste)	1L/d	By PCSP	By PCSP

### Environmental Impacts:

This project involves water sampling (< 10L per day, not everyday) from the two main rivers and coring permafrost in a few (~10) locations. All operations are to be performed on foot, except transport to and from the areas on an ATV. The potential impacts are very limited: 1) Soil disturbance in soil pits when permafrost coring. Mitigation: Backfilling the soil pits after the operation 2) Gas spill from ATV and Drill engine fueling operations. Mitigation: Use of a spill kit, filling in Polar continental shelf garage instead of in the field. The research is based at the Polar Shelf facilities, so all potential waste will be dealt with through their system



# **Additional Information**

**SECTION A1: Project Info**

**SECTION A2: Allweather Road**

**SECTION A3: Winter Road**

**SECTION B1: Project Info**

**SECTION B2: Exploration Activity**

**SECTION B3: Geosciences**

**SECTION B4: Drilling**

**SECTION B5: Stripping**

**SECTION B6: Underground Activity**

**SECTION B7: Waste Rock**

**SECTION B8: Stockpiles**

**SECTION B9: Mine Development**

**SECTION B10: Geology**

**SECTION B11: Mine**

**SECTION B12: Mill**

**SECTION C1: Pits**

**SECTION D1: Facility**

**SECTION D2: Facility Construction**

**SECTION D3: Facility Operation**

**SECTION D4: Vessel Use**

**SECTION E1: Offshore Survey**

**SECTION E2: Nearshore Survey**

**SECTION E3: Vessel Use**

## **SECTION F1: Site Cleanup**

## **SECTION G1: Well Authorization**

## **SECTION G2: Onland Exploration**

## **SECTION G3: Offshore Exploration**

## **SECTION G4: Rig**

## **SECTION H1: Vessel Use**

## **SECTION H2: Disposal At Sea**

## **SECTION I1: Municipal Development**

### **Description of Existing Environment: Physical Environment**

McMaster and North rivers are mostly natural environments, extending from Allen Bay to the interior of Cornwallis Island, up to 16 km inland. The area is a polar desert: slopes are mostly devoid of vegetation except close to the rivers and where lingering snowbanks occur. Permafrost depth is greater than 600m and active layer thaws to 40-70 cm depending on soil properties and conditions.

### **Description of Existing Environment: Biological Environment**

### **Description of Existing Environment: Socio-economic Environment**

### **Miscellaneous Project Information**

### **Identification of Impacts and Proposed Mitigation Measures**

This project involves water sampling (< 10L per day, not everyday) from the two main rivers and coring permafrost in a few (~10) locations. All operations are to be performed on foot, except transport to and from the areas on an ATV. The potential impacts are very limited: 1) Soil disturbance in soil pits when permafrost coring. Mitigation: Backfilling the soil pits after the operation 2) Gas spill from ATV and Drill engine fueling operations. Mitigation: Use of a spill kit, filling in Polar continental shelf garage instead of in the field. The research is based at the Polar Shelf facilities, so all potential waste will be dealt with through their system

### **Cumulative Effects**

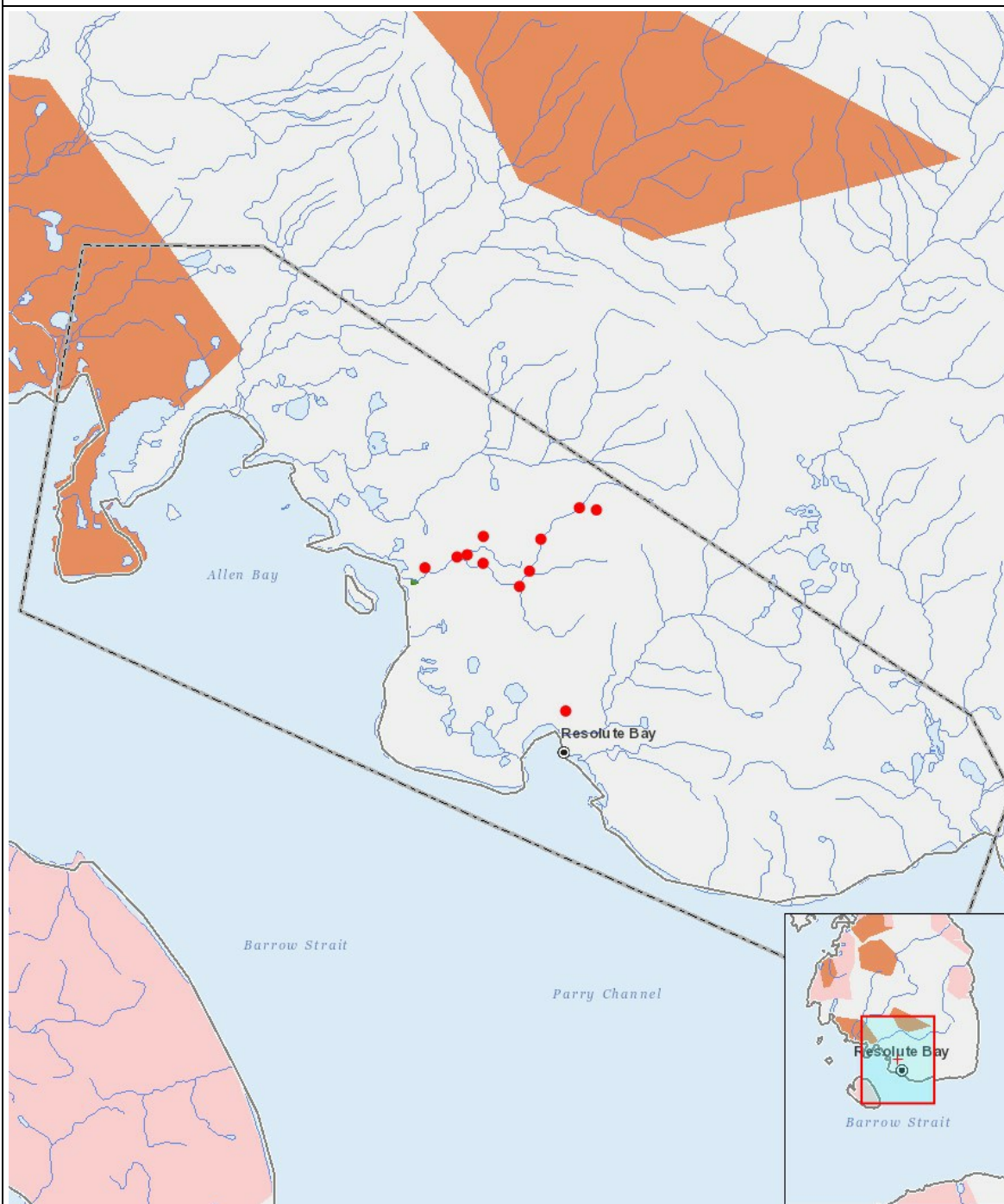
Impacts

Identification of Environmental Impacts

	PHYSICAL	Designated environmental areas	Ground stability	Permafrost	Hydrology / Limnology	Water quality	Climate conditions	Eskers and other unique or fragile landscapes	Surface and bedrock geology	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	Human health
Construction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Operation																									
Researching		-	-	-	-	-	-	-	-	-	-	-	M		-	-	-	-	-		-	-	-	-	-
Decommissioning																									
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(P = Positive, N = Negative and non-mitigatable, M = Negative and mitigatable, U = Unknown)

## PROJECT MAP



## LIST OF PROJECT GEOMETRIES:

1	point	Resolute Bay
2	point	McMaster River sampling site 5
3	point	McMaster River sampling site 2
4	point	McMaster River sampling site 3
5	point	McMaster River sampling site 4
6	point	McMaster River sampling site 1
7	point	Permafrost coring site 1
8	point	Permafrost coring site 2
9	point	Permafrost coring site 3
10	point	Permafrost coring site 4
11	point	Permafrost coring site 5