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

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ᐃᓈᓂᓪᓴᓄᓪᓇ: New

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ᐃᓈᓂᓪᓴᓄᓪᓇ: Scientific Research

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

ᐃᓈᓂᓪᓴᓄᓪᓇ ᐃᓈᓂᓪᓴᓄᓪᓇ: from 0001-01-01 to 0001-01-01

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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 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 findings during the 2019 field season, and potentially during the winter months if research funding allows a visit.

▷ΔΛΝΔ: 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

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

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McMaster River Watershed	Researching	Municipal	Scientific research has been conducted in the watershed since the 1960s by other parties.	Archeological sites in the area have already been established and will be avoided.	The nearest limit of the watershed is about 2.5 km from Resolute Bay.
North Lake River	Researching	Municipal	To our knowledge, no scientific research has been conducted in the river, but lakes and biology research have certainly been conducted in the surrounding in the past.	The area is not an archeological site, and is well explored by local residents	The community of Resolute Bay is 7 km away from the watershed.
Resolute Bay	Researching	Municipal	Hamlet of Resolute Bay	N/A	N/A

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ᑲᑯᑦᕐᕈᑦᕐᕈᑦ ᑲᑦᕐ	Phillip Manik	Hunters Trappers Organizations	2018-02-24

◁▷↳σ◁⁹⁶▷⁹⁶

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Portable core drill	1	3m	Permafrost coring down to 3m
ATV	1	2m	tansport

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0	Grab sampling	McMaster River, North River

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 11: Municipal Development

[illegible]

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.

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[illegible]

Miscellaneous Project Information

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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

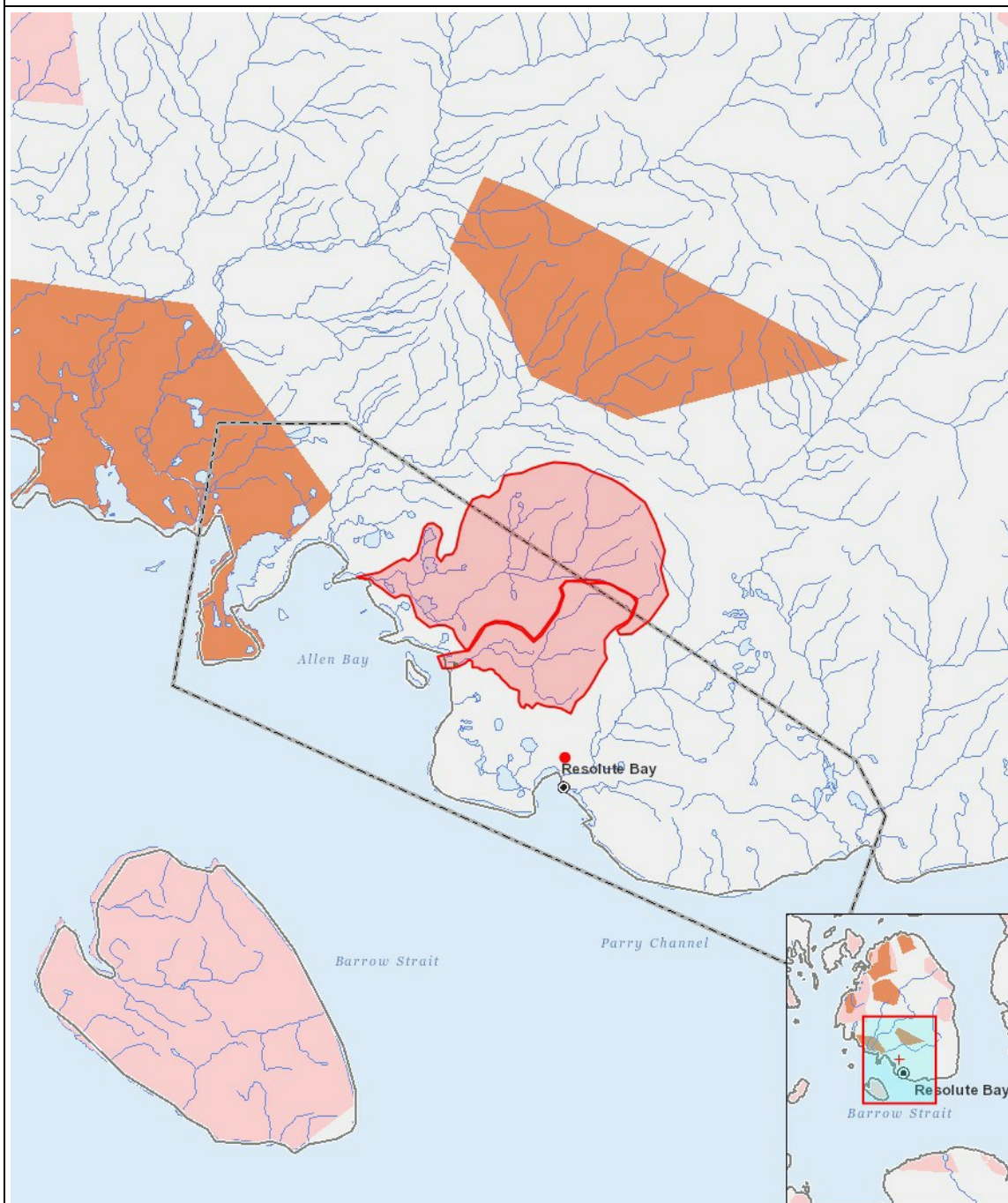
Impacts

$\mathcal{L}(\mathcal{A}) \cap \mathcal{L}(\mathcal{B}) = \mathcal{L}(\mathcal{A} \cap \mathcal{B})$

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($P = \langle b \rangle \dot{a} p \cap \langle a \rangle \dot{a} \langle b \rangle^c$, $N = \langle b \rangle \dot{a} p \cap \langle \langle \langle \langle a \rangle \dot{a} \rangle \dot{a} \rangle \dot{a} \rangle^c$, $M = \langle b \rangle \dot{a} p \cap \langle \langle \langle \langle \langle a \rangle \dot{a} \rangle \dot{a} \rangle \dot{a} \rangle^c$, $U = \langle \langle \langle \langle \langle a \rangle \dot{a} \rangle \dot{a} \rangle \dot{a} \rangle^c$)

PROJECT MAP



LIST OF PROJECT GEOMETRIES:

- | | | |
|---|---------|--------------------------|
| 1 | polygon | McMaster River Watershed |
| 2 | polygon | North Lake River |
| 3 | point | Resolute Bay |