Project Dashboard

Coastal hazard assessment in Kugluktuk and Grise Fiord (Aujuittuq), Nunavut (149466)

Proposal Status: **Conformity Determination Issued**

Project Overview

Type of application: **New**

Proponent name:	Stephanie Coulombe
Company:	Polar Knowledge Canada

Schedule:

Start Date:	2021-07-01
End Date:	2021-08-31
Operation Type:	Annual

Project Description:

Many arctic communities are vulnerable to coastal erosion. As wave action and sea levels rise, along with increased storm frequency and permafrost thaw, the Arctic coastline is being heavily eroded, which poses a substantial threat to coastal communities. These processes are causing buildings, roads and areas of cultural significance to be undermined as coastlines subside and collapse into the sea. Coastal vulnerability in Grise Fiord was recently brought up by the community members and the Iviq Hunters and Trappers Association (HTA) as a top priority issue in a context of climate change. Preliminary virtual discussions with community members and elders underlined a general perception of a changing coastal environment in Grise Fiord. In Kuglutuk, the community wishes to addressing the coastal erosion and possible future environmental hazard that relates to climate change impact which is occurring particularly along the mouth of the Coppermine River that connects in the Arctic Ocean where the Old Cemetery is particularly located, which holds a sentimental landmark for residents of Kugluktuk. As climate changes in the Arctic, adaptation strategies are required in these communities in order to minimize the damages to roads and infrastructures. These two communities have chosen to partner with the integrated geoscientist team from the Université du Québec à Rimouski (UQAR), Polar Knowledge Canada (POLAR) and the Geological Survey of Canada to address these challenges. This project has been submitted to the Climate Change Preparedness in the North (CCPN) Program (CIRNAC). Funding from this program will allow these two communities and our team to move ahead with this project. Over the past few months, preliminary discussions have already been started with CIRNAC and community members and the team will continue to work closely with these communities in different stages of the research process (e.g. project design, data collection, interpretation of results) in order to find better adaptation strategies. This project will establish a first quantitative assessment of coastal hazards, a shoreline evolution analysis and propose a coastal flood map for these communities. This project has five specific objectives: 1-Increase our knowledge of the coastal erosion processes, wave and current conditions, and permafrost conditions; 2-Model the wave and current conditions in the nearshore based on available historical wind datasets; 3-Establish a coastal hazard map based on numerical and empirical models of total coastal water levels; 4-Involve local youth in the coastal hazard assessment to provide training and skill-building opportunities. The field methodology involves the following steps: 1.Coastal erosion rates and permafrost degradation features (e.g. gullies, sinkholes, thermokarst subsidence) will be monitored using historical aerial photography, satellite images time-lapse photography and drone surveys. 2.Drone surveys will be conducted over the communities to recreate the coastal topography using photogrammetric analysis. This work will be carried out with local assistants to create a local expertise to conduct other similar repeated surveys throughout the following years. This will help in understanding the coastal dynamics and beach changes. 3.Wave and water level will be acquired using both an offshore buoy and nearshore bottom-mounted sensors. This will help in understanding wave energy dissipation between the offshore zone and the beach, and to better assess the contribution of nearshore processes to the total water level on the beach, such as wave setup and run-up. These datasets will be directly integrated into hazard modelling, but also to validate the wave model results. Wave simulations will need to be validated against observations prior the creation of coastal risk maps in order to minimize the uncertainties prior the selection of any adaptation strategies. 4.A first preliminary coastal flood assessment will be carried out, and flood maps will be produced. Coastal erosion and flood hotspots will be identified with this approach. 5.Permafrost samples will be collected using a portable earth drill. This will allow to recover intact permafrost samples for further laboratory analysis. To operate this portable drill, gasoline and oil are needed and it will be stored in a shed. It should also be noted that the team will carry a small spill kit in the field, ensuring we have a handy response to potential spill. 7.Permafrost temperatures will be measured and monitored

using a thermistor string and a datalogging system installed in 1 or 2 borehole(s). Such measurements are necessary to detect how climate change provokes the thawing of permafrost. 8.Stratigraphic sections in landslide scars will be excavated, cleaned and described in order to better understand the surficial geology and geomorphology of the area and assess the sensitivity of soil to erosion. The only permanent structure we intend to install in the field is rather small. It is a vertical 3-inch ABS pipe rising about one meter out of the ground. This pipe shelters the thermistor cable and the data logger that will measure and record soil temperature data. The first phase of this research project is planned to be conducted in the year 2021-2023 (following rules and restrictions against pandemic spread of Covid-19 issued by the Department of Health Government of Nunavut if until this mentioned timeline still applicable). Approximately twelve people will be involved in the 2021 field season with an emphasis on youth engagement. A group of youths from Kugluktuk and Grise Fjord and a summer student from Cambridge Bay (POLAR) will be selected to join the researchers doing the land assessment during a few days for training opportunities in coastal and permafrost surveys, monitoring techniques and to learn about how the assessment is being done. A local elder will also participate to bring their knowledge on the change that has occurred in the area. Additionally, a local bear monitor will be hired to accompany the team in the field. People from Rimouski and Cambridge Bay will travel to Kugluktuk and Grise Fjord by plane. Once in Kugluktuk and Grise Fjord, all staff will use ATVs and/or trucks and/or boat to access the study sites.

Personnel:

Persons:	12
Days:	45

Project Map

List of all project geometries:

ID	Geometry	Location Name
7028	polygon	Kugluktuk erosion assessment
7029	polygon	Grise Fjord erosion assessment

Planning Regions:
Qikiqtani
Kivalliq

Affected Areas and Land Types
Municipal
Settlement Area
North Baffin Planning Region

Project Land Use and Authorizations

Project Land Use
Scientific Research
Scientific Research

Licensing Agencies
NIRB: Screening Decision Report
NRI: Scientific Research Licence

Other Licensing Requirements
No data found.

Material Use

Equipment

Type	Quantity	Size	Use
Portable earth auger	1	100 cm x 60 cm x 60 cm	Permafrost drilling with sampling
GNSS system	1	100 cm x 30 cm	High-precision mapping

Small fixed-wing drone	1	116 cm (wingspan)	High-precision mapping (Aerial surveys of the coastal zone)
Buoys	1	42 cm x 31 cm	Measure wave and water levels (ice-free season). The instrument will be retrieved before freeze-up.
Bottom-mounted sensors	3	3 cm x 10 cm	Measure wave and water levels in the intertidal zone during low tide. All the sensors will be retrieved before freeze-up
Automatic time-lapsed cameras	3	10 cm x 10 cm x 10cm	Monitor and quantify coastal erosion in relations to storms.
ATVs	5	240 cm x 117 cm x 135 cm	Travel to study sites

Fuel Use

Type	Container(s)	Capacity	UOM	Use
Gasoline	1	20	Liters	Portable earth auger refuelling.

Hazardous Material and Chemical Use

Type	Container(s)	Capacity	UOM	Use
No records found.				

Water Consumption

Daily Amount (m^3)	Retrieval Method	Retrieval Location
0		

Waste and Impacts

Environmental Impacts

Drilling activities conducted for permafrost characterization will only take place in some specific areas. The potential impact would be of very local extent (approximately 15 m2) and non-permanent. The coring activities will have to be made in respect to the environment and our teamwork is committed to act cautiously when it comes to drilling. In order to prevent soil contamination by leakage of fuel or oil, a spill-kit will always be readily available on-site prior to and during all drilling operations for an immediate clean up. A wooden board will always be used at the coring sites to protect the area around the boring hole where the active layer could be sensitive to multiple trampling. The drilling activities are always done with high environment cautiousness (e.g. spill kit, wooden boards, filling of the boring holes for permafrost to renew. As for our fieldwork activities related to mapping (GNSS, drone) and monitoring (time-lapsed cameras) and data acquisition (sensors, buoys) is non-invasive, so there will be no environmental impacts.

Waste Management

Waste Type	Quantity Generated	Treatement Method	Disposal Method
No data found.			