

14 November 2016

Mosha Cote
Research Liaison
Nunavut Research Institute
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RE: Scientific Research License # 03 010 16N-A

Dear Mr. Cote,

Please accept this application for renewal of scientific research license # 03 010 16N-A for the year 2017. I have attached our Annual Summary Report for 2016 that details our research activities and findings in English and Inuktitut.

Currently, there are no anticipated substantive changes to the project objectives, field locations or research methods. However, parts of our summer 2016 fieldwork could not be completed and have been postponed to subsequent field seasons. Our anticipated fieldwork plans for 2017 are as follows:

- 1) March 2017: 2 personnel for 5 days to drill and instrument two ground temperature monitoring boreholes in developed and undeveloped sections of the Hamlet of Rankin Inlet. Procedures are as described in the original research proposal, but precise hole locations are being discussed with hamlet staff and land lease holders after passing council approval.
- 2) June/July 2017: 3 personnel for 15 days for permafrost coring and installation of shallow permafrost monitoring stations in the region of Rankin Inlet. Procedures and locations are as described in the original research proposal.
- 3) September/October 2017: 2 personnel for 8 days for data collection and observation at established sites.

Best Regards,

A handwritten signature in black ink, appearing to read "Greg Oldenborger".

Greg Oldenborger
Geological Survey of Canada
Natural Resources Canada
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greg.oldenborger@canada.ca

Annual Summary for Nunavut Scientific Research License # 03 010 16N-A

Permafrost and ground ice are important features of the Nunavut landscape that can significantly affect ground stability and land-based infrastructure. Knowledge of permafrost conditions is required to understand the response of permafrost to climate warming or landscape change. However, there is limited historical or contemporary permafrost data along the western coast of Hudson Bay. In the summer of 2016, the Geological Survey of Canada and the Canada-Nunavut Geoscience Office started a multi-year research study to provide geoscience data on permafrost for the western coast of Hudson Bay and the greater Kivalliq region of Nunavut. Fieldwork involved landscape observations, examination of surficial geological materials, installation of two ground temperature monitoring stations, and site selection for establishment of additional permafrost monitoring stations that represent a variety of conditions including developed and undeveloped land, and different geological settings. Other work involved analysis of satellite data and air photos for investigation of landscape change and remote mapping.

Field operations were based out of Rankin Inlet and conducted by truck, ATV and charter flight. The first stage of work involved short trips on the land to sample the surficial geology and to visit sites of landscape change identified by community members during previous engagement exercises. Samples of different surficial geological materials were acquired and returned to the GSC for analysis that will help in understanding permafrost conditions. Observations at sites of landscape change were documented and compared with other sources of geoscience information to better understand ground conditions and active permafrost processes shaping the land. In particular, many observations by community members of ground ice or ground movement are associated with glacial and marine sediments. In additions, many observations by community members involved changing water levels and lakes. We determined that all water bodies in the region exhibit significant inter-annual variations in surface area, but that small and large water bodies appear to exhibit a decadal growth in surface area. Further work is pending.

The second stage of work involved the selection of locations for installation of permafrost monitoring stations. Tentative locations for two deep ground temperature boreholes were established with the help of staff from the hamlet of Rankin Inlet. These sites were chosen to represent both developed and undeveloped land use scenarios. We plan to drill and instrument these holes in March 2017 pending hamlet and lease-holder approval. The temperature data will be made publically available and will record the thermal conditions of Rankin Inlet both now and in the future. Five additional sites were chosen in the vicinity of Rankin Inlet to represent different geological conditions for permafrost. These sites were described in terms of the geology and landscape. One site was instrumented with ground temperature and water sensors and we plan to instrument the remaining sites in the summer of 2017.

The third stage of work involved participation in a charter flight from Rankin Inlet to Ennadai Lake organized by the Government of Nunavut Economic Development and Transportation for outpost camp inspections. Ground surface observations were made from low-level flight along the Kazan River from Baker Lake to Ennadai Lake and from Ennadai Lake to Rankin Inlet. Observations were compared with satellite images for verification and training of satellite mapping methods. At Ennadai Lake, surficial geology and permafrost were observed and a ground temperature monitoring borehole was installed. This borehole will represent the vast

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