ᓄᓇᕘᒥ ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᑲᑎᒪᔨᖏᑦᑎᒍᑦ ᑐᒃᓯᖅᑑᑦ ᖅᑭᒥᖅᕈᔭᒃᓴᖅ #125775

Talik mapping and conceptual models of subpermafrost groundwater-surface water connectivity to support decision making regarding mining development facilities

ᑐᒃᓯᖅᑑᑕᐅᔪᖅ ᖅᑲᓄᐃᑦᑑᓂᖓ:	New
ᐱᓕᕆᐊᕆᔭᐅᔪᒪᔫᑉ ᖅᑲᓄᐃᑦᑑᓂᖓ:	Scientific Research
ᐅᓪᓗᖓ ᑐᒃᓯᖅᑑᑎᓕᐊᕕᓂᐅᑉ:	2/27/2023 3:31:20 PM
Period of operation:	from 0001-01-01 to 0001-01-01
ᑲᔪᓯᒃᑲᐃᐳᓂᐊᕋᓯᒥᔭᐅᔪᑦ:	from 0001-01-01 to 0001-01-01
ᐱᓕᕆᐊᖅᑲᕈᒪᔪᖅ:	Anne-Marie LeBLanc Natural Resources Canada 601 Booth St Ottawa Ontario K1A 0E8 Canada ᐅᖄᓚᐅᑏᑦ: 3435436283, ᓱᑲᔪᒃᑯᑦ:

ᑐᓴᐅᒪᔭᒃᓴᑦ

ᖃᓄᐃᑦᑑᑎᓂᒃ ᐱᓕᕆᐊᖃᖅᓂᐊᕆᐊᖕᒪᓐᓂᒃ

ᖃᓪᓗᓈᑎᑐᑦ: This activity will develop new methods to detect and predict the presence of taliks (unfrozen ground in areas of permafrost often found beneath lakes and rivers). It will also explore new ways of understanding the flows and connectivity of surface water (lakes) and groundwater (below the base of permafrost) through these unfrozen (talik) and often fractured bedrock areas. Inadequate knowledge about the presence of taliks and processes related to groundwater flow taking place in taliks can impact mining operations, water management, and surrounding lakes (e.g., inflow of hypersaline groundwater; lake level lowering and reduction of groundwater flow to neighboring lakes connected by taliks). The knowledge acquired through the proposed research will assist in planning mine development and assessing potential impacts of mining activities and the effect of climate change on lakes and groundwaters.Our field operations will be based out of Rankin Inlet with no camp being established, no structures being erected on land and no long-term development. Municipal systems will be used for all infrastructure needs including waste disposal and water supply. Field operations will be conducted by truck, ATV, and snowmobile using established access trails and snowmobiles routes.The study will take place within the vicinity of the Rankin Inlet area (radius of 25-30 km) in 2023 and 2024. In spring 2023, 2 weeks of fieldwork will be required for water sampling, in-situ water properties measurements, and geophysical (on lake ice) measurements in deep lakes (~>2m depth). During summer 2023, 2 weeks of fieldwork will be required for water sampling, semi-permanent installation of lake bottom instruments in shallow lakes (~<2m depth) that are completely frozen in winter (via small inflatable boats), and permafrost coring. In summer 2024, fieldwork would involve follow-ups at established sites for data collection and retrieval of semi-permanent instruments.The study of Rankin Inlet's water bodies will include the use of a Niskin sampling bottle (to collect lake water samples), a multi-parameter water probe (to assess the physicochemical characteristics of the lakes), passive diffusion samplers (to detect the nature and amount of dissolved gases in the water column), and semi-permanent installation of 1-2 osmosis pumps (to collect waters in 1-2 lake during an entire year). A small two-person hand drill will also used to collect permafrost core samples of in 2-3 locations near Rankin Inlet. Finally, a ground-based geophysical survey device will be dragged along the lake ice surface (or behind a boat) and uses electromagnetic sensing technology to measure the thickness of unfrozen ground beneath lakes.

ᐅᐃᕖᑎᑐᑦ: NA

ᐃᓄᒃᑎᑐᑦ: ᑖᓐᓇ ᐱᓕᕆᐊᒃᓴᖅ ᐱᕚᓪᓕᐊᓂᐊᖅᑐᑦ ᓄᑖᓂᒃ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᓂᒃ ᖃᐅᔨᓂᐊᕐᓗᑎᒃ ᐊᒻᒪᓗ ᓇᓚᐅᑦᓵᕈᓯᐊᕐᓗᑎᒃ ᑕᓕᖕᓂᒃ (ᕿᕿᓯᒪᙱᑦᑐᑦ ᓄᓇᐅᑉ ᐊᑖᓂ ᓇᓂᔭᓯᖃᑦᑕᖅᑐᑦ ᐊᑖᓂ ᑕᓯᕐᓂᒃ ᐊᒻᒪᓗ ᑰᑦ). ᖃᐅᔨᓇᓱᖕᓂᐊᖕᒥᔪᑦ ᓄᑖᓂᑦ ᑐᑭᓯᔾᔪᑕᐅᔪᓐᓇᖅᑐᓂᑦ ᑯᐱᔪᓂᑦ ᑲᓯᖕᓂᖕᒥᓐᓂᓪᓗ ᓄᓇᐅᑉ ᖄᖕᒐᓂᑦ ᐃᒪᖕᒥᑦ ᓄᓇᐅᑉ ᖄᖕᒐᓂᑦ (ᓄᓇᐅᑉ ᐃᑭᐊᖕᒪᓂ ᖁᐊᖕᒍᐃᓐᓇᐅᔭᖅᑐᒥᑦ) ᑖᒃᑯᑎᒎᓇ ᖁᐊᖕᒍᐊᑎᒍᑦ (ᑕᑕᓕᒃ) ᓇᒡᕖᖅᑕᐅᒐᔪᒃᐸᒃᓗᓂᓗ ᖃᐃᖅᓯᒫᑦ. ᖃᐅᔨᒪᙱᓗᐊᕐᓂᖅ ᐱᑕᖃᕐᓂᖕᒪᓂᒃ ᑕᓕᒃᓂᒃ (taliks) ᐊᒻᒪᓗ ᐱᕚᓪᓕᐊᓂᐅᔪᓂᒃ ᐱᔾᔪᑎᖃᖅᑐᓂᒃ ᓄᓇᐅᑉ ᐃᑭᐊᖕᒪᓂ ᐃᒪᕐᒥᒃ ᑯᐱᔪᒥᒃ ᑕᓪᓗᕈᑎᐅᑉ ᐃᓗᐊᓂ ᐊᒃᑐᖅᓯᓂᖃᕈᕐᓇᖅᑐᖅ ᐅᔭᕋᒃᑕᓇᐊᑉ ᐊᐅᓚᓂᖕᒪᓂᒃ, ᐃᒪᕐᒥᒃ ᐊᐅᓚᑦᑎᓂᖅ, ᐊᒻᒪᓗ ᑕᓯᐅᑉ ᖃᓂᒋᔮᓂᑦ (ᓲᕐᓗ, ᑯᐱᔪᖅ hypersaline-ᒥᑦ ᐃᒪᖅ; ᑕᓯᖅ ᐊᑦᑎᒃᓯᒥᐊᕐᓂᖅ ᐊᒻᒪᓗ ᒥᒃᓴᒥᐊᕐᓂᖅ ᓄᓇᐅᑉ ᐃᑭᐊᖕᒪᓂᑦ ᑰᒃᑐᒥᑦ ᖃᓂᒋᔭᖕᒥᓐᓄᑦ ᑕᓯᕐᓄᑦ ᐊᒃᑐᐊᔪᓄᑦ taliks-ᓄᑦ). ᖃᐅᔨᒪᔭᐅᔪᑦ ᐱᔭᐅᓯᒪᔪᑦ ᑐᒃᓯᕋᖅᓗᑎᒃ ᖃᐅᔨᓴᕐᓂᕐᒧᑦ ᐊᑲᔪᕐᓂᐊᖅᑐᑦ ᐸᕐᓇᐅᑎᓂᒃ ᐅᔭᕋᖅᑕᕐᕕᒃ ᐱᓕᕆᐊᓂᔭᐅᕚᓪᓕᐊᔪᑦ ᐊᒻᒪᓗ ᖃᐅᔨᓴᑦᓱᑎᒃ ᐆᑦᑐᕋᐅᑎᒃᓴᓂᒃ ᑕᐃᒪᐅᑐᐃᓐᓇᓕᐊᖅᑐᑦ ᐱᔾᔪᑎᒋᔭᐅᔪᑦ ᐅᔭᕋᖕᓂᐊᕐᓂᕐᒧᑦ ᐱᓕᕆᐊᓕᔭᐅᔪᑦ ᐊᒻᒪᓗ ᐱᔾᔪᑎᒋᔭᐅᔪᑦ ᓯᓚ ᐊᓯᙳᖅᐸᓪᓕᐊᓂᖓ ᑕᓯᕐᓂ ᐊᒻᒪᓗ ᓄᓇᐅᑉ ᐊᑖᓂ ᐃᒪᕐᓂᒃ.ᓇᔪᖅᕕᐅᑦ ᐱᓕᕝᕕᒃ ᐊᐅᓚᓂᖕᒥᑦ ᑐᙵᕕᖃᕐᓂᐊᖅᑕᖓ ᑲᖏᖅᖢᓂᖅ ᑕᒻᒫᕐᕕᖃᙱᓪᓗᓂ, ᓴᓇᔨᒪᔪᑦ ᓯᖁᑦᑕᐅᓚᙱᑦᑐᑦ ᓄᓇᒥ ᐊᒻᒪᓗ ᐊᑯᓂᐅᙱᑦᑐᒥᒃ ᐱᓕᕆᐊᓕᔭᐅᓂᐊᖅᑐᑦ. ᓄᓇᓕᒥ ᐋᖅᑭᒃᓯᒪᔪᑦ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᑦ ᑕᒪᒃᑭᓐᓄᑦ ᓴᓇᕝᕕᓄᑦ ᐊᑐᖅᑕᐅᔭᕆᐊᖃᖅᑐᑦ ᐃᓚᒥᓗᒥᑦ ᐊᑦᑕᑯᐃᑦ ᐊᒻᒪᓗ ᐃᒥᖅᕕᒃ. ᓇᔪᖅᐱᒻᒥ ᐊᐅᓚᑕᐅᔪᑦ ᐱᓕᕆᔭᐅᔪᑦ ᐱᓕᕆᐊᓕᔭᐅᓂᐊᖅᑐᑦ ᓄᓇᓯᐅᑎᒃᑯᑦ, Hᐋᓐᓇᒃᑯᑦ, ᐊᒻᒪᓗ ᓯᑭᑑᑦ ᐊᑐᖅᑕᐅᔪᓐᓇᖅᑐᑦ ᐊᖅᑯᑎᓄᑦ ᐊᒻᒪᓗ ᓯᑭᑑᑦ ᐊᖅᑯᑎᖕᒥᑦ.ᖃᐅᔨᓴᖅᑕᐅᓂᐊᖅᑐᑦ ᐱᓕᕆᐊᓕᔭᐅᓂᐊᖅᑐᑦ ᑲᖏᖅᖢᓂᐅᑉ ᓯᓚᑖᓂ (ᐅᖓᓯᖕᓂᖃᕐᓂᐊᖅᑐᖅ 25-30 ᑭᓚᒦᑐᓄᑦ) 2023 ᐊᒻᒪᓗ2024. ᐅᐱᕐᖓᒃᓵᒃᑯᑦ 2023, ᒪᕐᕉ (2) ᓴᓇᑦᑕᐃᓕᓂᒃ ᐱᓕᕆᐊᓕᔭᐅᔪᑦ ᐱᔭᐅᔭᕆᐊᖃᖅᑐᑦ ᖃᐅᔨᓴᕈᑎᒃᓴᓄᑦ ᐆᑦᑐᕋᐅᑎᑦ, ᐊᑦᑐᖅᑕᐅᓯᒪᙱᑦᑐᓂᒃ ᓇᒻᒥᓂᖅ ᐆᑦᑐᖅᑕᐅᔪᑦ, ᐊᒻᒪᓗ ᓄᓇᓕᕆᓂᕐᒧᑦ ᖃᐅᔨᓴᕐᓂᖅ (ᑕᓯᐅᖅ ᓯᑯᓯᒪᔪᖅ) ᐆᑦᑐᕋᐅᑎᑦ

ᑕᓯᐅᖅ ᐊᑎᓂᖓᓂ (~>2 ᒥᑕ ᐃᑎᓂᖓ). ᐊᐅᔭᒃᑯᑦ 2023, ᒪᕐᕿ (2) ᓴᓇᑦᑕᐃᓕᓂᒃ ᐱᓕᕆᐊᕆᔭᐅᔪᑦ ᐱᔭᐅᔭᕆᐊᕐᑲᖅᑐᑦ ᖃᐅᔨᓴᕈᑎᒃᓴᓄᑦ ᐆᑦᑐᕋᐅᑎᑦ, ᓇᑉᕿ–ᖃᐅᔨᓴᕈᑎ ᐃᓕᔭᐅᔪᖅ ᑕᓯᐅᑉ ᐊᑖᓄᑦ ᓴᓇᒐᒃᓴᑦ ᓯᒃᑲᑦᑐᒥ ᑕᓲᑦ (~<2m ᐃᑎᔪᖅ) ᕿᕿᖓᔪᖅ ᐅᑭᐅᒃᑯᑦ (ᐊᑐᕐᓗᒋᑦ ᖄᕈᓐᓇᙱᑦᑐᑦ ᐅᒥᐊᑦ), ᐊᒻᒪᓗ ᐃᓚᒃᓴᐃᑦ ᓱᕋᕐᓇᖅᑐᓂᒃ ᖃᐅᔨᓴᕈᑎ. ᐊᐅᔭᒃᑯᑦ 2024, ᓇᔪᕐᕕᒃ ᐱᓕᕆᐊᒃᓴᖅ ᐃᓚᖕᑲᕐᓂᐊᖅᑐᖅ ᖃᐅᔨᓴᕈᑎᑦ ᐃᓕᑕᕆᔭᐅᓯᒪᔪᑦ ᓇᔪᕐᕕᒻᒧᑦ ᑎᑎᕋᖅᓯᒪᔪᑦ ᑲᑎᖅᓯᐃᓂᖅ ᐊᒻᒪᓗ ᐅᑎᖅᑎᑦᑎᓂᖅ ᓇᑉᓈ–ᖃᐅᔨᓴᕈᑎ ᓴᓇᕐᕈᑎᑦ.ᖃᐅᔨᓴᕐᓂᐊᖅᑐᖅ ᑲᖏᖅᓱᓂᕐᒥ ᐃᒪᖏᓐᓂᒃ ᐃᓚᖕᑲᕐᓂᐊᖅᐳᖅ ᓂᑯᑭᓂᒃ ᖃᐅᔨᓴᒐᒃᓴᓂᒃ (ᑕᓯᐅᑉ ᐃᒪᖓᓂᒃ ᖃᐅᔨᓴᒐᒃᓴᓂᒃ ᑲᑎᖅᓯᐃᓗᑎᒃ), ᖃᐢᓯᑲᓪᓛᓗᖕᓂ ᐃᒪᖕᑲᖅᑎᒋᔪᒥᒃ ᖃᐅᔨᓴᕐᓂᐊᕐᓗᓂ (ᖃᐅᔨᓴᕐᓗᒋᑦ ᑎᒥᖏᑦ ᐃᓚᐅᕈᑎᒃᓴᑦ ᖃᓄᐃᑦᑑᓂᖏᑦ ᑕᓯᕐᓂᒃ), ᓱᕈᔾᔭᐃᒃᑯᑎᓂᒃ ᖃᐅᔨᓴᒐᒃᓴᓂᒃ (ᖃᐅᔨᓴᕐᓗᒋᑦ ᖃᓄᐃᑦᑑᓂᖏᑦ ᐊᒻᒪ ᖃᓄᖅ ᐊᖏᑎᒋᖕᒪᖔᑕ ᐃᒪᕐᒦᑦᑐᑦ), ᐊᒻᒪ 1-2 ᐃᕐᒥᕝᕕ ᓯᓪᓗᒃ (ᐃᒪᕐᓂᒃ ᑲᑎᖅᓯᐃᓗᑎᒃ 1-2 ᑕᓯᕐᒥ ᐊᕐᕿᒍᓕᒫᒥ). ᒪᕐᕿᖕᓂᒃ ᐃᓅᖕᓂᒃ ᐊᒡᒐᒧᑦ ᐃᑰᑕᖅᑐᕐᑲᕐᑲᑦᑕᕐᓂᐊᕆᕙᖅ ᑲᑎᖅᓯᐃᔾᔪᑕᐅᓗᓂ ᖁᐊᖑᐃᓐᓇᖅᑐᖅ ᓄᓇᐅᑉ ᐃᑭᐊᖓᓂ ᖃᐅᔨᓴᒐᒃᓴᓪᓗᐊᑕᓂᒃ 2-3–ᓂ ᐃᓂᓂ ᑲᖏᖅᓱᓂᐅᑉ ᖃᓂᒥᔮᓂ. ᑭᖑᓪᓕᖅᐹᒥ, ᓄᓇᒥ–ᑐᙵᕕᓕᒃ ᓄᓇᐅᑉ ᖃᓄᐃᓕᖓᓂᖓᓄᑦ ᖃᐅᔨᓴᕈᑎ ᒪᓂᑫᐅᓂᐊᖅᐳᖅ ᑕᓯᐅᑉ ᖄᖓᓂ (ᐅᒥᐊᑉ ᑐᓄᐊᒍᑦ) ᐊᑐᖅᐸᓪᓗᑎᓪᓗ electromagnetic–ᒧᑦ ᖃᐅᔨᓴᕈᑎᓂᒃ ᖃᐅᔨᓴᕈᑕᐅᓗᑎᒃ ᐃᔾᔪᓂᖏᑦ ᖁᐊᖑᙱᑦᑐᑦ ᑕᓯᑦ.

Inuinnaqtun: NA

Personnel

Personnel on site: 6

Days on site: 28

Total Person days: 168

Operations Phase: from 2023-04-01 to 2025-03-31

ᐱᑕᓇᐊᓇᔭᐅᓂᐊᖅᑐᑦ

ᓇᒥ	ᖃᓄᐃᑦᑑᒥᑦ ᐱᑕᓇᐊᖃᕐᓂᐊᖅᐸ	ᑭᒃᑯᑦ ᓄᓇᖁᑖᓂ	ᑐᓴᐅᒪᔭᒃᓴᑦ ᓄᓇᐅᑉ ᖃᓄᖅ ᐊᑐᖓᐅᓚᐅᖅᓯᒪᔭᓇᐊᖕᖓᓐᓂᒃ	ᐃᑦᓴᕐᓂᑕᖃᕐᐱᐅᕙᓚᐅᖅᐸ ᐃᓄᒃᓄᑦ ᓇᔪᖅᑕᐅᖃᑦᑕᕐᓂᑰᕙᓗ ᑕᐃᑦᓱᒪᓂᑐᖃᐅᓕᖅᑐᖅ	ᖃᓂᓐᓂᖅᐹᖅ ᓄᓇᓕᒋᔭᐅᔪᖅ ᐊᒻᒪᓗ ᓴᐳᒻᒥᒃᓰᑲᐅᕙᓗ ᓱᓇᓄᑦ
Lakes within 30km of Rankin Inlet (Northern Half)	Researching	Municipal	Rankin Inlet is a majority Inuit community on the northwestern shore of Hudson Bay. With a population of about 2,975 (2021 census) it is the second largest settlement in Nunavut and the administrative and regional centre of the Kivalliq region. Rankin Inlet has the largest percentage of non-Indigenous people living in the community within the Keewatin Region. The town council that governs the Hamlet of Rankin Inlet consists of 6 councillors, a mayor, and a deputy mayor.	Iqalugaarjuup Nunanga Territorial ParkEncompassing an large esker and a chain of lakes this park is nesting for loons, long-tailed ducks, sandhill cranes, and other tundra birds. The park is also home to ancient Inuit settlement, it is also the place a distinctive rocky outcrop called 'Ijiraliq'.	Sites we are interested in sampling would fall withing a 30km radius of the Rankin Inlet hamlet.
Lakes within 30km of Rankin Inlet (Northern Half)	Researching	Inuit Owned Surface Lands	Rankin Inlet is a majority Inuit community on the northwestern shore of Hudson Bay. With a population of about 2,975 (2021 census) it is the second largest settlement in Nunavut and the administrative and regional centre of the Kivalliq region. Rankin Inlet has the largest percentage of non-Indigenous people living in the community within the Keewatin Region. The town council that governs the Hamlet of Rankin Inlet consists of 6 councillors, a mayor, and a deputy mayor.	Iqalugaarjuup Nunanga Territorial ParkEncompassing an large esker and a chain of lakes this park is nesting for loons, long-tailed ducks, sandhill cranes, and other tundra birds. The park is also home to ancient Inuit settlement, it is also the place a distinctive rocky outcrop called 'Ijiraliq'.	Sites we are interested in sampling would fall withing a 30km radius of the Rankin Inlet hamlet.

Lakes within 30km of Rankin Inlet (Northern Half)	Researching	Crown	Rankin Inlet is a majority Inuit community on the northwestern shore of Hudson Bay. With a population of about 2,975 (2021 census) it is the second largest settlement in Nunavut and the administrative and regional centre of the Kivalliq region. Rankin Inlet has the largest percentage of non-Indigenous people living in the community within the Keewatin Region. The town council that governs the Hamlet of Rankin Inlet consists of 6 councillors, a mayor, and a deputy mayor.	qalugaarjuup Nunanga Territorial ParkEncompassing an large esker and a chain of lakes this park is nesting for loons, long-tailed ducks, sandhill cranes, and other tundra birds. The park is also home to ancient Inuit settlement, it is also the place a distinctive rocky outcrop called 'Ijiraliq'.	Sites we are interested in sampling would fall withing a 30km radius of the Rankin Inlet hamlet.

ᓄᓇᓕᐅᑉ ᐃᓚᐅᖃᑕᐅᓂᖓ ᓄᓇᓖᓪᓗ ᐊᕕᒃᑐᖅᓯᒪᐅᕐᓂᖓᓄᑦ ᐃᑲᔪᑕᐅᔪᓐᓇᖅᑐᑦ

ᓄᓇᓕᒥᔭᖅ	ᐊᑏᑦ	ᑲᑐᔾᔨᐊᖃᑎᒌᒥᔭᖅ	ᖃᖓᒍ ᑐᓴᖅᑎᑕᐅᓚᐅᓇᐊᖕᒥᓐᓂᒃ
ᑲᖏᖅᖠᓂᖅ	Jorgan Aitaok	Nunavut Tunngavik Incorporated	2023-02-10
ᑲᖏᖅᖠᓂᖅ	Luis Manzo	Kivalliq Inuit Association	2023-02-10
ᑲᖏᖅᖠᓂᖅ	Mayor Harry Towtongie	Hamlet of Rankin Inlet	2023-02-10
ᑲᖏᖅᖠᓂᖅ	Andre Aokaut	Kangiqliniq Hunters & Trappers Organization	2023-02-10

ᓚᐃᓴᓐᓰᑦ ᐱᒧᖕᓇᐅᑏ ᐊᖏᖅᑕᐅᓯᒪᔪᑦ

ᓇᒦᒥᐊᖏᓐᓂᒃ ᐱᓕᕆᐊᕆᕐᕕᐅᓂᐊᖅᑐᑦ ᑎᑎᕋᕐᓗᒋᑦ:

Kivalliq

ᓚᐃᓴᓐᓰᑦ ᐱᒧᖕᓇᐅᑏ ᐊᖏᖅᑕᐅᓯᒪᔪᑦ

ᒐᕙᒪᒋᔭᐅᔫᑉ ᐊᕕᒃᑐᖅᓯᒪᐅᕐᓂᖓᓐᓂ ᒪᓕᒐᕐᓅᖓᔪᓂᒃ ᐱᕐᑯᔭᕐᓅᖓᔪᓂᒡᓗ ᑲᒪᔩᑦ ᐱᔪᖕᓇᐅᑎᑖᕈᑎᓂᒃ ᓚᐃᓴᓐᓯᓄᓪᓗ ᑲᔪᓯᒃᑲᐃᔩᑦ	ᖃᓄᐃᑦᑐᓪᓚᕆᐅᕙ ᓚᐃᓴᓐᓯᑖᕈᑕᐅᔪᖅ ᐱᔪᖕᓇᐅᑎᑖᕈᑕᐅᔪᖅ ᐊᖏᖅᑕᐅᔪᕐᓗᓐᓃᑦ	ᒫᓐᓇ ᖃᓄᐃᓕᖓᕙ	ᐅᓪᓗᒥ ᑐᓂᔭᖅ/ ᑐᒃᓯᖅᑑᑕᐅᓚᐅᖅᓯᒪᔪᖅ	ᑭᒡᓕᖅᑲᕐᕕᖓ
ᓄᓇᕗᒥ ᖃᐅᔨᓴᖅᑐᓕᕆᔨᒃᑯᑦ	Scientific Research Licence	Not Yet Applied		
ᓄᓇᕘᒥ ᐃᒪᓕᕆᔩᑦ ᑲᑎᒪᔨᖏᑦ	Approval to Use Water/Deposit Water Without a Licence	Not Yet Applied		
ᑭᕙᓪᓕᖅ ᐃᓄᐃᑦ ᑲᑐᔾᔨᖃᑎᒌᒃᑯᖏᑦ	Land Use Licence I	Not Yet Applied		

Project transportation types

Transportation Type	ᓯᓇᒧᑦ ᐊᑐᒐᐅᓂᐊᖅᐸ	Length of Use
Water	A zodiac boat would be used for lake water sampling and deployment for on-water geophysical surveys.	
Land	On land transportation would be via trucks, ATVs (during summer on roads) and snowmobiles (on lake ice, trails and roads in spring) back and forth from Rankin Inlet to selected field sites.	

Project accomodation types

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ᐱᖁᑦ ᐊᖕᒥᐋᖅ ᐊᑐᖅᑕᐅᓂᐅᓴᐋᖅ ᐃᓚᖃᓯᐅᑎᓗᒥᑦ ᐃᑰᑕᐃᑦ, ᒥᖦᓗᐊᕈᑏᑦ, ᖃᖓᑕᓲᖅ, ᓄᓇᓯᐅᑦ ᐊᓯᖏᖦᓗ

ᐊᖕᒥᐋᖅ ᐱᖁᑦ ᐊᑐᒐᐅᓂᐊᖅᑐᖅ ᖃᓄᐃᑦᑑᓂᖓ	ᖃᑦᓯᐅᖏᑦ	ᐊᖏᓂᖏᑦ - ᐳᖅᑐᓂᖏᑦ	ᓱᓇᒧᑦ ᐊᑐᒐᐅᓂᐊᖅᐸ
Osmo-samplers	1 or 2	13 1/8 x 13 1/8 x 11 inches	The yearlong monitoring of water quality parameters at the bottom of one or two lakes of interest will be done using 1-2 osmosamplers. Those semi-permanent devices collect ~1ml/day of water from lakes using an osmosis pump. They do not make any noise and fit inside a standard milk crate. The osmosamplers will be left to collect lake bottom waters for one year.
Multi-parameter sonde	1	23x3.5 inches	Depth profile measurements using a tethered multi-parameter sonde will provide information on the physicochemical characteristics of lacustrine basins of interest at different depths. Alike the water sampling, sonding of the lakes will be done via an ice cover hole during the spring or via boats during the summer (for smaller lakes). This does not require the collection of water and is complete within several minutes.
Passive diffusion samplers	20	20x1/4 inches	A set of tethered passive diffusion samplers (a set of two copper tubes connected by a silicone sleeve) will be left to equilibrate with the dissolved gases in the water column of several lakes. Those will be tied to a rope anchored on the lake's ice cover for a period of a week. Derived

			data will provide clues on the amount and nature of dissolved gases (clues to determine if there is any infiltration of groundwater in those basins).
Earth Auger	1	22.6 X 14.2 X 11.0 inches	The sampling of shallow (~<2m in length; ~10cm wide) permafrost cores (n=~15) is also planned. Data emanating from their analysis will provide information on the chemical composition of the entrapped water in those frozen soils. Sampling will be done using a portable earth drill system and a coring tube. Disturbance to the surrounding vegetation will be minimized by laying plywood and/or a tarp on the ground surface around the hole.
Permafrost coring tube	1	40x5 inches	The sampling of shallow (~<2m in length; ~10cm wide) permafrost cores (n=~15) is also planned. Data emanating from their analysis will provide information on the chemical composition of the entrapped water in those frozen soils. Sampling will be done using a portable earth drill system and a coring tube. Disturbance to the surrounding vegetation will be minimized by laying plywood and/or a tarp on the ground surface around the hole.
Transmitter (loop of wire) for TEM survey	1	100m loop	Time-domain electromagnetics (TEM), a geophysical survey technique, will be used to measure the electrical properties of the ground. This technique requires the temporary installation

			of a loop of wire on the ground surface (can be a single wire in a large loop (100m×100m) or multiple wires in a smaller loop (5m×5m)) in which an electrical current is passed to create a magnetic field in the subsurface. It will be used to detect unfrozen sections of the ground below lakes (i.e. taliks).
Receiver (for TEM survey)	1	4x12.5x16 inches	Time-domain electromagnetics (TEM), a geophysical survey technique, will be used to measure the electrical properties of the ground. This technique requires the temporary installation of a loop of wire on the ground surface (can be a single wire in a large loop (100m×100m) or multiple wires in a smaller loop (5m×5m)) in which an electrical current is passed to create a magnetic field in the subsurface. It will be used to detect unfrozen sections of the ground below lakes (i.e. taliks).
Niskin 1010 (1.7L) bottle	1	20x5 inches	The collection of surface and deep water samples will involve the use of a Niskin; it does not require the installation of any semi-permanent instruments. The Niskin bottle is a cylindrical plastic bottle that is lowered into a water body of interest to collect water samples at various depths. Water sampling will mostly occur during the spring via holes drilled (using an ice drill and a 2-person auger) through the lakes' ice cover (3-4L max).

Truck	1	3x4m	Travel within Rankin Inlet municipal limitsAccess to Meliadine Mine facilities
Field portable Durridge RAD7 Radon detector	1	11.5 x 8.5 x 11 inches	A field deployable detector will be used to assess the concentration of Radon-222 in groundwater and surface water samples.
Snowmobile	2	1.5mx1.5m	Travel within Rankin Inlet municipal limits and on local access trails/snowmobile trails.
ATV	2	1.5x1.5m	Travel within Rankin Inlet municipal limits and on local access trails.
Futura 380 zodiac boat	1	12’11” x 5’6”	This zodiac boat will be used for lake water sampling and deployment for on-water geophysical surveys.
DJI Matrice 300 RTK Drone	1	32 x 26.4 x 17 inches	This Drone will be used for the water sampling (max depth of 30 feet) in conjunction with a Speedip system.
DJI Inspire 1 (V 2.0) Drone	1	21.4 x 23 x 11.7 inches	This Drone will be used for thermal imaging of lakes (to detect groundwater infiltrations).

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ᓱᓇᒍᑦ ᐅᖅᓱᒃᓴᒡᒥᐊᖅ ᐊᑐᕐᐅᓂᐊᖅᐸ	ᖃᓄᐃᑦᑐᓕᖕᐅᕙ ᐅᖅᓱᒃᓴᒡᒥᐊᖅ	ᖃᑦᓯᐅᕐᑦ ᐅᖅᓱᒃᓴᖃᐅᑏᑦ	ᑑᒃᓴᐅᑉ ᐃᒪᖄᖅᑎᒋᔪᙳᕐᓂᖓ	ᑲᑎᖕᓄᑦ	ᑑᒃᓴᐃᑦ ᐊᒥᓲᓂᖏᑦ	ᓱᓇᒍᑦ ᐊᑐᕐᐅᓂᐊᖅᐸ
Gasoline	fuel	2	20	40	Liters	This fuel will be used for the Earth auger.

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ᐅᖕᓄ ᑕᒫᖅ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᖅ	ᖃᓄᖅ ᐃᒥᖅᑕᖃᑦᑕᕐᓂᐊᖅᐸᑦ	ᓇᑭᑦ ᐃᒥᖅᑕᖃᑦᑕᕐᓂᐊᖅᐸᑦ
1	Water (0.004m3/day) will be sampled from lakes for scientific analyses. Municipal source will be used for personal purposes (0.6m3/day).	Lakes would be situated within 30km of Rankin Inlet (for scientific purposes). Municipal source will be used for personal purposes.

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ᐱᓕᓇᐊᓇᔭᐅᔨᒪᔨᒍᑦ ᐱᓕᓇᐊᓇᔭᐅᓂᐊᖅᑐᖅ	ᖃᓄᐃᐃᑦᑐᖅ ᐊᑲᑕᔪᖅ	ᖃᓄᐃᑎᒋ ᐊᑲᑕᔪᑦ ᓴᖅᑭᐊᓂᐊᖅᑐᓇᔭᐅᕐᓂᑦ	ᖃᓄᐃᓂᖅ ᐊᑲᑕᖅᑕᐅᓂᐊᖅᐸ	ᓴᓗᒡᒪᖅᓴᐅᑎᑲᓴᓄᖅᓂᐅᓂᐊᖅᑐᑦ
Researching	ᐊᑲᑕᔪᑦ ᐃᓱᐊᓪᓚᑕᐅᔨᓐᓇᖅᑐᑦ	50kg	Municipal	NA
Researching	ᐃᒪᐃᑦ ᐊᑐᖅᑕᐅᕆᔨᖅᓯᒪᔨᑦ	100L per person per day=12600L	Municipal	NA
Researching	ᐊᑲᑕᔪᑦ ᐃᓱᐊᓪᓚᑕᐅᔨᓐᓇᖅᑭᑦᑐᑦ	50kg	Municipal	NA
Researching	ᖃᓄᖅᑕᓪᓚᓂᓕᖅ	100L per person per day=12600L	Municipal system	NA

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Environmental impact is estimated to be very low, and no long-term environmental impacts are expected. The study would involve small amount of water sampling (~<2L) and shallow permafrost coring (~<3m). We do not plan on sampling sediments at the lake bottom. No permanent installation are planned on the ground while device and loggers will be contain in a milk crane seating at the bottom of one or two lakes and kept in place for the duration of the study. The proposed work would not have any important impact on the wildlife or major habitats that support the wildlife. No temporary camp will be installed. All work would be conducted based out of the community of Rankin Inlet. Study sites would be finalized during the first week of fieldwork. Proposed reclamation plan: Permafrost drill holes would be fill with sand and the vegetation cover kept and put back in place to avoid tripping and thawing of the ground. The geophysical surveys would be conducted on frozen lake surfaces using loops of cables that would be immediately removed once surveys are completed (within minutes-hours). Osmo-samplers and loggers for water and pressure measurements would be removed from lake bottom at the end of the study.

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

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Refer to Environmental Impacts for permafrost and associated vegetation cover mitigation measures.

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Refer to Environmental Impacts for permafrost and associated vegetation cover mitigation measures.

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We plan on hiring someone from the community while on the land (and on lake ice) to guide us through their land and help with the fieldwork (or as a wildlife monitor).

Miscellaneous Project Information

Existing permafrost studies based in Rankin Inlet since 2016 would provide complementary context and permafrost data to this proposed activity (NRI Research License number 03 009 23R-M, starts April 1st, 2023, expires on December 31, 2023). Hence, an alternative option for fieldwork schedule (see the non-technical description of the project proposal) may involve doing all water sampling and in-situ water properties measurements in late summer of 2023 (and in spring 2024, if needed) whereas geophysical surveys on lake ice could be conducted in spring 2023 according to research license # 03 009 23R-M's conditions (and in spring 2024, if needed).

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In addition to the Environmental impact section, below are specific impact related to the usage of machines: -Small boats: inflatable boats with or without a small motor would be used in summer for ponds/shallow lakes. There use would not create disturbance of lakes. -As an alternative of a boat, a drone may be used for the water sampling. The drone (Matrice 300 RTK, 9 kg) is equipped with a Speedip water sampling system (max depth of 10 m). -A second drone (Inspire 1 v2, 3.5 kg) equipped with a thermal camera would be used to detect groundwater infiltration and select sampling locations within a lake. All flights would be conducted outside of aerodrome areas as required by Nav Canada for a pilot with a basic certification. A pilot with a basic certification to fly this type of drones (more

than 250 grams and less than 25 kg) will be part of the field team. All flights would also be conducted in late summer/beginning (September) to avoid any disturbance with caribou and we would make sure to stay away from any wildlife or private cabins. -Osmo-samplers: Device that collects water continuously in lakes via osmosis, i.e., passage of water through semipermeable membranes. The device is noise free and collect less than 1L per year. The device seat at the bottom of lakes and does not create disturbance. -Light Drilling machine for permafrost coring: Disturbance to the surrounding vegetation would be minimized by laying plywood and/or a tarp on the ground surface. Shallow drilling sometimes requires the use of water, but all water is returned to the ground and nothing is added to the water. - Ground geophysics: These surveys are conducted by one to three people. The survey device consists of a loop of wires (transmitter) and a receiver, both installed on the lake ice surface. The loop is stationary (for a sounding) or dragged along lake ice surface (to create a 2D profile) and uses electromagnetic sensing technology to produce an image of the ground below the lake. Surveys are non-invasive and involve no disturbance of the land, water or ice.

Cumulative Effects

Impacts

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	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
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(P = ᐊᖏᐅᓯᕈᑎᔨᓐᓇᖅᑐᑦ, N = ᐊᖏᐅᖅᑭᔨᔪᑕᐅᔨᓐᓇᖅᑐᑦ ᑭᓪᓕᐅᒥᔨᔪᓂᖅᑐᑕᐅᔨᓐᓇᖅᑐᑦ, M = ᐊᖏᐅᖅᑭᔨᔪᑕᐅᔨᓐᓇᖅᑐᑦ ᑭᓪᓕᐅᒥᔨᔪᓂᖅᑐᑕᐅᔨᓐᓇᖅᑐᑦ, U = ᖁᖏᐅᕆᒪᓐᓇᖅᑭᑐᖅ)

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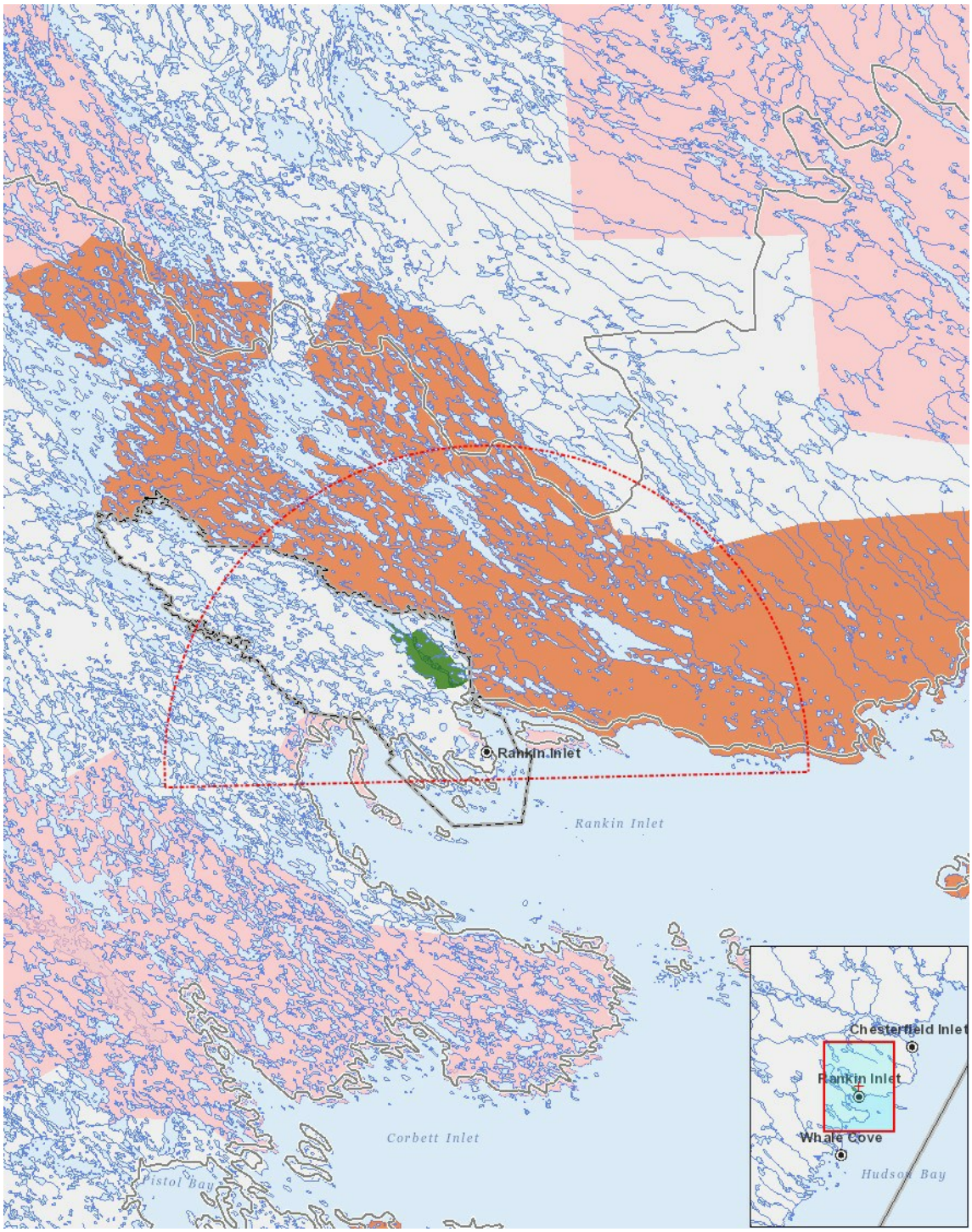

List of Project Geometries

1	polyline	Lakes within 30km of Rankin Inlet (Northern Half)