

BUREAU GÉOSCIENTIFIQUE CANADA-NUNAVUT

KANATAMI-NUNAVUMI GEOSCIENCE TITIGAKVIIT



December 18, 2018

Nunavut Water Board Licensing Department P.O. Box 119 Gjoa Haven, NU X0B 1JO 867-360-6338

Re: Year-end report and cancellation of Licence no. 8WLC-FHG1819 - Fury and Hecla Geoscience Project

Dear Nunavut Water Board,

The Canada-Nunavut Geoscience Office has completed the first year of field-based geoscience mapping in the area on Baffin Island immediately north of Fury and Hecla Strait. After reviewing the information about the Fury and Hecla Geoscience Project provided below, please recognize this letter as our official year-end report and notice of cancellation for Licence no. 8WLC-FHG1819.

Planning and coordination for the second year of field-based geoscience mapping is on-track to take place in 2019, and a new Application for Approval for the Use of Water and Deposit of Waste Without a Licence will be submitted to the Nunavut Water Board early next spring detailing the aspects of that work.

Should you have any questions regarding the information provided in this report, please contact Linda Ham, Chief Geologist, at the Canada-Nunavut Geoscience Office by e-mail (<u>Linda.Ham@Canada.ca</u>) or phone (867-975-4412).

Regards,

Holly Steenkamp, M.Sc. Regional Mapping Geoscientist Canada-Nunavut Geoscience Office

867-222-9223







Fury and Hecla Geoscience Project 2018 Year-End Report

Locations of sites

The Fury and Hecla Geoscience Project used the camp, airstrip, and helipad sites as planned and indicated in licence application documentation; however, the sites intended for the Ivisarak Lake and Neergaard Lake fuel caches were not suitable for landing a Twin Otter on tundra tires, so the pilots had to scout new locations that they deemed suitable for landing and take-off.

Site	Latitude (DMS)	Longitude (DMS)
Gifford River Camp	70° 24′ 02.5″ N	83° 23′ 19.3″ W
Gifford River Airstrip (~320° orientation; 350 m length)	70° 24′ 06.3″ N	83° 23′ 42.9″ W
Gifford River Helipad/Fuel Cache	70° 24′ 00.4″ N	83° 23′ 36.2″ W
Ivisarak Lake Cache (planned, not suitable for fixed-wing landing)	70° 35′ 35.0″ N	86° 10′ 00.3″ W
Ivisarak Lake Cache (used)	70° 06′ 53.4″ N	86° 06′ 51.0″ W
Neergaard Lake Cache (planned, not suitable for fixed-wing landing)	70° 19′ 53.3″ N	80° 18′ 55.4″ W
Neergaard Lake Cache (used)	70° 07′ 01.2″ N	80° 35′ 35.5″ W



Timeline of events

Events	Dates
Mobilization of Gifford River Camp and fuel caches (Twin Otter-supported)	July 5–16
Field work (helicopter-supported)	July 13–August 14
Demobilization of Gifford River Camp (Twin Otter-Supported)	August 15–18
Clean-up of Fuel Caches (Twin Otter-Supported)	August 15–18; August 29

Field party personnel began arriving in Igloolik on July 5th to complete pre-field preparations and assist with camp mobilization. A Twin Otter aircraft, contracted from Kenn Borek Air Ltd. via the Polar Continental Shelf Program under Project no. 309-18, mobilized all fuel, field gear, and camp equipment into the Gifford River Camp and fuel cache sites from July 5th to 16th. During this time, Discovery Mining Services Ltd. was contract to build the turn-key







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camp at the Gifford River Camp location, with the assistance of 3 labourers hired from Igloolik. The camp-build contract included installation of all camp infrastructure including tent structures, plumbing, electricity lines, and satellite communications.

On July 9th, Holly Steenkamp (Field Party Leader) and Alessandro Ielpi (field party member) arrived at Gifford River Camp to assist Discovery Mining Services Ltd. with set up of specific camp equipment in preparation of the arrival of the remaining field party, who stayed in Igloolik to assist with mobilizing Twin Otter loads, welcoming incoming personnel, and completing local contracting. On July 13th, the complete group of field personnel in Igloolik were brought out to Gifford River Camp, and the final steps of camp set up were completed. The first helicopter and pilot (Hudson Bay Helicopters Ltd.) also arrived in camp that day. Discovery Mining Services Ltd. continued to work on the camp until its completion on July 14th. The Twin Otter continued to mobilize fuel to the Gifford River Camp and fuel caches until July 16th.

July 14th was the first day of field work. All field crew members were set out in two helicopter loads to the same location and conducted a group traverse to ensure that all field electronic and communication gear was operating properly, and that all geological observations were being appropriately and uniformly recorded by each crew member. From July 15th to August 13th, individual teams of 2, 3, or 4 people conducted daily traverses, created detailed maps at specific sites, and made targeted helicopter stops at isolated outcrops for map infilling of the Precambrian (rocks 540 million years old or older) geology in the study area.

The helicopter contract with Hudson Bay Helicopters Ltd. ended on July 18th, and this machine returned to Igloolik on July 19th and on to other projects. A new contract with Summit Helicopters began on July 19th, so this machine arrived at Gifford River Camp on July 18th to prepare for work. Summit Helicopters conducted the remainder of the work with the Precambrian geology crews through the end of the field season, returning to Igloolik on August 15th.

A third helicopter contract with Universal Helicopters Newfoundland and Labrador LP. began on July 21st and was solely dedicated to with working with the Paleozoic and surficial geologists. This contract ended on August 5th and the helicopter returned to Igloolik to begin work on a different project.

On August 15th, Discovery Mining Services Ltd. (including the same local labourers that had been hired for the camp build) and Kenn Borek's Twin Otter returned to Igloolik to begin demobilization. Field crews at Gifford River Camp prepared field equipment for demobilization prior to their return to Igloolik later that day. All field gear, fuel drums, and waste was demobilized back to Igloolik over the course of a few days, and Gifford River Camp and Neergaard Lake Cache were completely cleaned up by August 19th. Due to poor weather conditions, the Twin Otter could not access the Ivisarak Lake Cache during this planned demobilization schedule. However, the Polar Continental Shelf Program organized a separate flight on August 29th to pick up the remaining drums and fuel berms from the Ivisarak Lake Cache, and at that point all the Fury and Hecla Geoscience Project activities in the study area were reclaimed.

Gifford River Camp

Infrastructure

Gifford River Camp was designed as a single-season camp, with the intention that all gear, supplies, and infrastructure would be removed at the end of the 2018 field work. Discovery Mining Services Ltd. was contracted to provide turn-key camp-build and take-down services, and they provided the expertise and much of the equipment and supplies to build the camp's infrastructure. The Gifford River Camp consisted of a Kitchen tent, a Dry/shower tent, Office tent, four VIP sleeper tents, several Eureka K-2 sleeper tents for field crews, a wooden outhouse, and a Helicopter/Sample tent adjacent to the large fuel berm. All structures and waste pits were set up to be >120 ft (~40 m) from the high-water line of the Gifford River.







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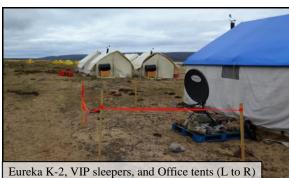
The Kitchen tent comprised two 12'x16' gable tents connected end-to-end, with the kitchen housed in the back end, and the mess area in the front end. The kitchen area had two propane-fueled stoves with ovens, and two propane-fueled 12 cubic-ft refrigerators. A double sink was fitted with PVC tubing that filtered all greywater through a grease trap before draining into a pit dug behind the kitchen in sandy, well-drained soil. A 20 cubic-ft electric chest freezer was placed outside the front of the kitchen.

The Dry/Shower (10'x12' gable) tent housed a ~500 L plastic water reservoir used to store pumped water from the Gifford River. Water was pumped from the Gifford River using a Homelite AP 125 water pump (mixed gasoline-oil powered) once or twice daily (see next section). An electric water pump and plumbing were constructed to feed water from the reservoir through a hot-water-on-demand heating system (propane-fueled), and then on to the shower and wash basin in the Dry/Shower tent, and to the Kitchen tent. Greywater from the wash basin and shower were drained with PVC piping out the back of the tent into a pit dug in sandy, well-drained soil, like the Kitchen greywater line. All personal toiletries kits were stored in this tent. The Dry/Shower tent also housed the electrical panel, which drew from the gasoline-powered 3000 W Honda generator that was set up behind the tent and redistributed electricity through separate breakers to four double-outlets. Each double-outlet was designated for specific uses: Kitchen appliances and the water pump, the coffee pot and chest freezer, and 2 outlets for power run to the Office and VIP sleeper tents. The Honda generator ran from approximately 5:30AM to 10:00PM everyday and was housed under a wooden box to dampen the noise and protect it from the rain and wind. A 30,000 BTU diesel-powered heating stove was set up in the Dry/Shower tent and was lit to warm up the tent for drying clothing and boots. The diesel drum was housed outside of the tent in a 3'x3' mini-berm, along with jerry cans of gasoline for the Honda generator and containers of mixed fuel for the Homelite AP 125 water pump. A small spill kit was stationed next to this mini-berm.

The Office tent was arranged, like the Kitchen, with two 12'x16' gable tents linked end-to-end. A 30,000 BTU diesel-powered heating stove was set up at the far end of the Office, with the diesel drum located outside in a 3'x3' mini-berm. Electricity lines were run from the electrical panel in the Dry/Shower tent to the office for computer work stations, the field equipment charging station, and the satellite communications desk. Discovery Mining Services Ltd. provided a small satellite dish that was mounted to a wooden pallet outside of the office tent and connected to a communications board with VOIP phone and internet routers. A separate Iridium satellite phone was also stationed here as a secondary line of communications should the generator have been turned off, or if the satellite dish or routers were inoperable.

The four VIP sleeper tents (10'x12' gables) were each outfitted with electrical outlets and lighting, and a diesel-powered heating stove. As with the Dry/Shower and Office tents, the diesel drums connected to these heating stoves were each placed out the back of the tents in 3'x3' mini-berms. Initially, power for the electrical outlets and lighting were connected to a 1250 W Goal Zero solar-powered battery with two 30 W solar panels. This was the first time testing this green-technology in the field, and unfortunately the small solar panels could not generate enough power, especially during times of poor weather conditions, to cover the consumption of the VIP's (camp cook, helicopter pilots and engineers) that these tents were eventually switched to an electrical line from the electrical panel in the Dry/Shower tent.











Field crews slept in Eureka K-2 tents that were placed up-wind from the main camp in an area with well-drained sandy soil. These tents did not have power or heating.

Adjacent to the runway and helipad was the 20'x40' heavy-duty fuel berm where 81 drums of Jet-A, 2 extra drums of diesel, and 3 drums of gasoline were stored. Each drum is 205 L capacity. This berm was underlain by a full ground sheet, has 10-inch-tall sides, and was connected to two fuel-filtering water-drainage systems located in opposite corners of the berm. A 10'x12' gable tent was set up at the far end of the berm as a place to store helicopter equipment and tools, emergency drop-packs for the field crews, and rock samples collected for later analytical laboratory work.

Water use and waste disposal

Fresh water was pumped from the Gifford River once or twice daily into the 500 L (0.5 m³) plastic water reservoir in the Dry/Shower tent. A Homelite AP 125 water pump (1860 gal/hour) was stationed at the river's edge, and a water hose was run up the river bank for refilling the plastic reservoir in the Dry/Shower tent. The water pump was outfitted with a 6' long intake hose with a mesh screen on the end so fish, bugs, and debris were not captured during pumping. The water pump was mounted to a 1.5' x1.5' wooden platform so that it would always remain upright. The pump was always moved ~15' up away from the waters edge when not in use, especially during times of heavy rainfall, as the shoreline could move several feet up the bank. As stipulated in our Nunavut Water Board licence, the amount of pumped water was never greater than 1000 L (1 m³) per day. The daily water haul from the Gifford River was routinely documented, as shown in the table below. Until the water reservoir was installed on July 12, the camp builders were retrieving water from the river in plastic buckets. In total, approximately 200 L (0.2 m³) of water was hauled for drinking, cooking and dishwashing from July 5th to 12th.

		Reservoir Volume (L)		Volume Added (L)	
Date	Time	Before Fill	After Fill	During Fill	Cumulative
2018-07-06 to 12					~200
2018-07-12		0	300	300	500
2018-07-13	16:00	80	480	400	900
2018-07-14	19:45	270	500	230	1130
2018-07-15	20:30	145	500	355	1485
2018-07-16	12:20	210	490	280	1765
2018-07-17	09:00	140	500	360	2125
2018-07-18	08:15	135	500	365	2490
2018-07-18	20:00	200	500	300	2790
2018-07-19	20:00	135	500	365	3155
2018-07-20	08:00	200	500	300	3455
2018-07-20	21:00	200	500	300	3755
2018-07-21	20:00	135	500	365	4120
2018-07-22	17:45	150	500	350	4470
2018-07-23	07:30	135	500	365	4835
2018-07-23	17:30	200	500	300	5135
2018-07-24	11:00	175	500	325	5460
2018-07-25	07:45	135	500	365	5825
2018-07-25	05:20	200	500	300	6125
2018-07-26	09:45	130	490	360	6485
2018-07-27	18:00	165	500	335	6820
2018-07-27	14:20	180	500	320	7140







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2018-07-28	09:15	140	500	360	7500
2018-07-28	19:00	150	500	350	7850
2018-07-29	14:20	135	400	265	8115
2018-07-29	21:45	190	500	310	8425
2018-07-30	20:15	180	500	320	8745
2018-07-31	18:15	165	500	335	9080
2018-08-01	16:40	150	500	350	9430
2018-08-02	09:00	225	500	275	9705
2018-08-02	09:00	190	500	310	10015
2018-08-03	19:00	180	500	320	10335
2018-08-04	13:45	160	500	340	10675
2018-08-06	11:15	160	500	340	11015
2018-08-07	09:00	160	500	340	11355
2018-08-08	16:45	190	500	310	11665
2018-08-09	17:45	200	500	300	11965
2018-08-10	18:45	135	500	365	12330
2018-08-11	19:45	135	500	365	12695
2018-08-12	20:45	180	500	320	13015
2018-08-13	21:45	180	500	320	13335
2018-08-14	22:45	200	480	280	13615

Greywater from the Kitchen sink was funneled through a grease-trap and then into a hand-dug pit behind the Kitchen tent where the soil is well-drained and sandy. Similarly, greywater from the Dry/Shower tent (coming from the shower and wash basin) was funneled directly into a hand-dug pit in well-drained, sandy soil. Communal soaps, detergents, and cleaners purchased for use in the camp were all-natural and biodegradable. Field crew were also encouraged to bring biodegradable and environmentally friendly personal hygiene products, although this could not be enforced.

The camp had a wooden outhouse that was placed over a hand-dug pit in well-drained, sandy soil located between the Kitchen tent and the Airstrip. Once the pit became about half full, a new pit was dug nearby, the outhouse was moved in position over the new hole, and the old hole was covered over. Only disposal of human waste was permitted here, and all other waste was collected for incineration or back-haul and disposal in Igloolik's municipal landfill.

All combustible waste (paper, cardboard, most organic food waste, etc.) was collected and incinerated daily in a portable SmartAsh barrel incinerator. This device has an electric fan to promote complete incineration and reduce emissions. Accumulated ash was emptied from the barrel when needed and collected in extra sample buckets for back-haul to Igloolik. These buckets were disposed of at the municipal landfill.

Non-combustible waste (metals, glass, plastics) were collected and crushed in extra sample buckets. These buckets were back-hauled to Igloolik and disposed of at the municipal landfill.

Special waste, such as e-waste, printer toner cartridges, and dead batteries were packed with the field equipment and returned to Ottawa for recycling.

Reclamation

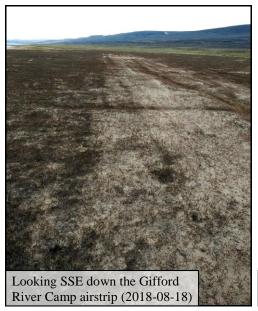
The Canada-Nunavut Geoscience Office staff and the Discovery Mining Services Ltd. demobilization team worked together to pack up all field equipment, break down tents, remove all wooden structures, and reclaim the area in and around the Gifford River Camp back to its original state. All fuel drums (full and empty, including those in the two fuel cache sites) were returned to Igloolik for storage. As Discovery Mining Services Ltd. team were the last on-site







at the Gifford River Camp, they provided the Canada-Nunavut Geoscience Office with photos showing the cleared camp site, and airstrip and helipad areas. All gear, equipment, garbage, and fuel drums were removed from the Gifford River Camp and the Neergaard Lake Cache by August 18th, and from the Ivisarak Lake Cache on August 29th.





Looking SSE at Gifford River Camp; only outlines in sand remain of VIP, Office, Kitchen, and Dry/Shower tents (2018-08-18)

Wildlife sightings

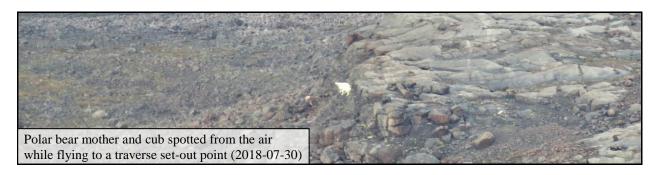
Field crews were instructed to note any wildlife sightings or encounters they had for reporting purposes. The table below documents these occurrences. The northern coastline of the Fury and Hecla Strait hosted great numbers of snow geese through their molting season. Several falcons were observed in areas where cliffs were sufficiently high (deeply incised river cuts just inland from the strait, for example).

		Wildlife		Location (NAD 83)	
Date	Time	Type	Count	Latitude (DMS)	Longitude (DMS)
2018-07-16	18:10	Caribou	4	UTM 47E07 West (while in flight)	
2018-07-17	18:12	Caribou	2	UTM 47F06 Central (while in flight)	
2018-07-19	11:30	Polar Bear	1	Near Ivisarak Lake Cache	
2018-07-20	10:00	Fox	1	70°04′25.9″ N	85°07′04.0″ W
2018-07-21	12:30	Caribou	1	70°14′01.9″ N	84°40′24.0″ W
2018-07-25	12:20	Hare	1	70°26′09.8″ N	83°32′09.2″ W
2018-07-29	10:00	Polar Bear	1	Swimming in ocean at the south end of Gifford Fiord	
2018-07-30	10:01	Polar Bear	2	70°07′10.0″ N	83°03′26.5″ W
2018-08-03	09:30	Fox	6–7	Near Neergaard Lake Cache	
2018-08-12	14:30	Polar Bear	1	~15 km north of Ivisarak Lake Cache	







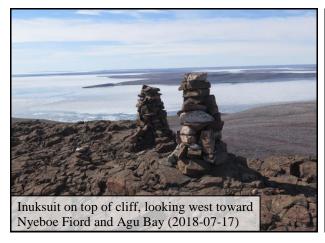


Other notable objects and sites found in the study area

Several objects and cultural sites were identified while flying or on daily traverses that are not related to this project. These are included in the table below.

We feel it is also important to mention that the cabins located at the south end of Asta Lake (about 10 km south of the Gifford River Camp) are in extremely poor condition and appear to house large amounts of garbage and waste (including camp fuel containers, metal debris, fuel drums, scrap wood, etc.). These sites may be having negative environmental impacts on their surroundings, and we hope that the appropriate agencies take note for future impact assessments.

			Location (NAD 83)	
Date	Time	Object/Site Description	Latitude (DMS)	Longitude (DMS)
2018-07-17	16:00	Two inuksuit on top of cliffs	70°19′11.3″ N	86°29′30.8″ W
2018-07-19	10:30	Old tent ring (half)	70°12′33.7″ N	81°24′29.6″ W
2018-07-19	12:20	Three old 303 Brit bullet casings on outcrop	70 13'15.5" N	81°16′51.2″ W
2018-07-31	11:00	Old tent ring	70°04′35.1″ N	81°55′03.4″ W
2018-07-31	14:00	Caribou skull buried with stones	70°06′14.4″ N	81°48′13.5″ W
2018-07-26	09:00	2 fuel drums in river	70°16′56.5″ N	84°30′01.9″ W
2018-07-25	16:00	Abandoned sled at river's edge with blue tarp	70°28′39.6″ N	83°42′55.0″ W
2018-07-31	09:30	Old fuel drum at inlet	70°04′19.6″ N	81°56′34.5″ W
2018-08-06	14:00	Old fuel drum on south shore of lake	70°09′46.5″ N	80°56′07.0″ W
2018-08-06	14:05	Old fuel drum between 2 ponds	70°09′45.0″ N	80°48′36.9″ W
2018-08-06	15:23	Old tent ring with inuksuit nearby	70°11′56.3″ N	81°38′33.3″ W











Socio-economic Impacts

The Fury and Hecla Geoscience Project relied heavily on the cooperation and involvement of businesses and service providers based in Igloolik during the 2018 field season. Grocery contracts were set up with the Igloolik Coop and Northern stores for \$25,000 each, although total purchases did not reach this limit. LRT Construction provided a front-end loader rental for mobilizing camp equipment and fuel, as well as a truck rental and staff housing during both mobilization and demobilization of camp. The Coop Hotel was also used to accommodate pilots and field crew who were swapped in and out of camp throughout the field season. Jet fuel was purchased from the Igloolik supply by the Twin Otters during camp mobilization and demobilization, as well as by the helicopters that moved in and out of town during and after the project. Upon camp demobilization, a Seacan was rented from the Igloolik Coop to store all the field equipment that would eventually be shipped back to Ottawa. The Igloolik Hamlet Office provided heavy equipment to move this Seacan to the Airport area for easy offloading of gear from each Twin Otter load, and then moved the Seacan to the beach for later movement to the NEAS barge.

Discovery Mining Services Ltd. is a northern-based business, located in Yellowknife, and was contracted with the stipulation that any camp-building crews, aside from the crew leader who was to be a Discovery Mining Services employee, were to be hired locally from Igloolik. Discovery Mining Services hired three local labourers from Igloolik to assist with the camp set-up and tear-down. Two men were stationed at the Gifford River Camp during camp mobilization and demobilization, while the third man assisted with loading and unloading the Twin Otter by operating the front-end loader in Igloolik.

A wildlife monitor was sought from Igloolik with the understanding that they must pass a health fitness exam and provide their own firearm and ammunition for the job. One man expressed interest, passed the health exam, and was brought to Gifford River Camp despite not having his own firearm. After three days in camp without being able to get his family members to bring his firearm from their summer camp to the airport for mobilization into Gifford River Camp, he returned to Igloolik on the last Twin Otter flight. The wildlife monitor position was announced again on the Igloolik radio and one person expressed interest but did not complete the health fitness exam, so the position was not refilled.

At the end of the field season a donation of approximately 20 boxes of fresh and non-perishable food, cleaning supplies and toiletries were dropped off at the Igloolik Community Centre during a community event where many children, adults, and elders were playing games and enjoying live music. A fishing pole and tackle that were purchased by one of the field crew were given to the event organizers as a prize to be awarded during one of that afternoon's games. The people at the event were very appreciative.

Finally, several of the field crew members purchased carvings and crafts directly from local artists as souvenirs of their time spent in Igloolik.

