Appendix CRP: Research Projects

Site Components	Research Projects	Papers	Description
TSF and RSF	The Research Institute of Mines and Environment (RIME) has conducted a number of studies and investigations at Agnico Eagle's Meadowbank Mine and associated facilities. The following summarizes the articles pertaining to the Meadowbank facilities.	Resistance of a soapstone waste rock to freeze-thaw and wet-dry cycles: implications for use in a reclamation cover in the Canadian Arctic Vincent Boulanger-Martel, Bruno Bussière, and Jean Côté	The durability of non-potentially acid-generating (NPAG) soapstone waste rock was investigated with respect to freeze-thaw and wet-dry cycles, to be used as a cover material for reclamation of tailings and waste rock storage facilities. No single methodology exists to accurately characterize a materials resistance to freeze/thaw and wet/dry cycles, so a series of index tests were chosen from existing literature to analyze pore space properties and static physical integrity.
		Thermal behaviour and performance of two field experimental insulation covers to control sulfide oxidation at Meadowbank mine, Nunavut Vincent Boulanger-Martel, Bruno Bussière, and Jean Côté	The proposed insulation cover for the Meadowbank mine TSF was validated via laboratory and field tests conducted on two instrumented experimental cells.
		Insulation covers with capillary barrier effects to control sulfide oxidation in the Arctic Vincent Boulanger-Martel, Bruno Bussière, and Jean Côté	The performance of an insulation or thermal cover with capillary barrier effects (CCBEs) used for reclamation of a tailings storage facility (TSF) was investigated for the Meadowbank mine site in both a laboratory and field setting. The objectives of the insulation cover in a permafrost environment was to control the temperature and limit oxygen ingress of the potentially acid-generating (PAG) tailings.
		Thermal conductivity of Meadowbank's mine waste rocks and tailings Vincent Boulanger-Martel, Andrée Poirier, Jean Côté, and Bruno Bussière	A predictive thermal conductivity model was calibrated based on laboratory data to assess the thermal conductivity of solid particles and the unfrozen/frozen thermal conductivity as a function of saturation. Materials assessed include compacted NPAG waste rock, PAG waste rock, and tailings.
		Design, construction, and preliminary performance of an insulation cover with capillary barrier at Meadowbank Mine, Nunavut Vincent Boulanger-Martel, Bruno Bussière, Jean Côté, and Patrice Gagnon	This study is a preliminary report which is appropriately detailed and summarized above in insulation covers with capillary barrier effects to control sulfide oxidation in the Arctic.
		Thermal-Hydrological-Chemical Modeling of a Covered Waste Rock Pile in a Permafrost Region Xueying Yi, Danyang Su, Bruno Bussière, and K. Ulrich Mayer	A reactive transport model was developed using the MIN3P-HPC software to understand the thermal-hydrological and chemical processes governing a covered waste rock pile under permafrost conditions located in Nunavut Canada.
			Effect of particle size and temperature on arsenic release from the Whale Tail Project waste rock.

Site Components	Research Projects	Description
IVR Geochemistry	Assessment of leaching potential from exposed IVR Walls through pit wall leaching stations	Installation of pit wall stations and analysis of leaching water to assess the risk associated with different lithologies in IVR.
Water Quality	Toxicity water blend assessment	The objectives of the blend testing completed by RIME student was to evaluate the toxicity to trout and daphnia for certain blend of various site water.
	Algae identification	Algae denitrification tests were completed by RIME student over the summer. It looked at protocols for attenuation, algae degradation, and algae TSS removal.
Meadowbank Fisheries Research Advisory Group; MFRAG	In 2019, Agnico Eagle confirmed interest in MFRAG participation by DFO, the Kivalliq Inuit Association (KivIA), and the Baker Lake Hunters and Trappers Organization (BLHTO).	Study 1 - Assessment of Changes in Aquatic Productivity and Fish Populations Due to Flooding (H. Swanson) — This research study aims to understand changes in small-bodied fish metrics indicative of population productivity during and after flooding in the Whale Tail Lake area. Changes in productivity will be related to water quality variables and qualitatively related to habitat characteristics.
		Study 2 – Assessment of Impacts of the Baker Lake Wastewater Outflow on Fish Productivity and Fish Habitat (H. Swanson) — A research program lead by Dr. Rob Jamieson (Dalhousie University) is underway to assess the current status of the wastewater treatment system in the hamlet of Baker Lake and develop designs for upgrades. This study was awarded an NSERC Collaborative Research and Development grant (NSERC-CRD) in 2019 to supplement funding from Agnico Eagle. As part of this holistic assessment, key questions related to understanding fish health, fish habitat, nutrient status and fish productivity are included as offsetting for the Whale Tail Mine. The fish and fish habitat portion of the study is being conducted by Dr. Heidi Swanson (Laurier University, formerly the University of Waterloo).
		Study 3 – Literature Review and Field Validation of Northern Lake Fish Habitat Preferences (S. Doka) — Habitat preferences of northern fish species are not well understood, which causes significant uncertainty in habitat-based offset calculations. This study aims to: 1 - Identify literature data gaps in habitat associations of Meadowbank-area lake fishes such as Lake Trout, Arctic Char, and Round Whitefish, 2 - Field-test a variety of methods for filling data gaps.
		Study 4 – Arctic Grayling Occupancy Modelling (H. Swanson) — Objectives of this work were the development of occupancy models for Arctic grayling in the Meadowbank region, and a comparison of habitat predictors in this area with those observed in the NWT. Understanding the potential for occupancy of fluvial systems by fish species based on readily measurable habitat characteristics could facilitate and improve the accuracy of environmental impact assessment and offset planning.
		Study 5 – End-pit Lake Habitat Suitability Assessment — Fish use of re-flooded pit areas with good connectivity to natural systems is not well understood, yet these areas may represent a significant opportunity for fish habitat offsetting. Since multiple pits of various sizes at the Meadowbank Complex are planned to be reflooded in the relatively near term (2027 – 2029), there is an opportunity to thoroughly characterize fish use of pit lake habitat and population growth in re-flooded lakes through a research program. This study will aim to characterize fish use of new pit lake habitat in relation to habitat and water quality variables, and particularly in relation to reference systems. The research team and program details will be developed by the MFRAG prior to study initiation (est. 2026).
		Study 6 – eDNA Methods Development (J. Stetefeld and M. McDougall) — eDNA methods present a potentially useful tool for rapid and non-invasive assessments of fish communities but have not been significantly developed or validated for Arctic systems. The main goal of this project is to develop and optimize monitoring tools based on eDNA metabarcoding technology to assess fish species assemblages (presence/absence and relative abundance) in the Kivalliq region.
Contribution to Regional Wildlife Monitoring	Inu'tutit project	Agnico Eagle Mines has participated as a technical advisory group member of the Inu'tutit project since 2014. The Inu'tutit Initiative is part of longer term plan that is being led by a secretariat of key players made up of the NGMP, KivIA, INAC and Nunavut Water Board (NWB), and is being implemented through partnerships between the KivIA, federal and territorial governments, industry (Areva Resources and Agnico Eagle Mines), the Hamlet of Baker Lake and eventually, universities and academic institutions. More specifically, the Kivalliq Inuit Association (KivIA) has partnered with Indigenous and Northern Affairs Canada (INAC) and the Nunavut General Monitoring Plan (NGMP) to develop an Aquatic Cumulative Effects Monitoring Program (CEMP) for the Baker Lake Basin under the auspices of the Inu'tutit Initiative.
	GN caribou monitoring program	Meadowbank contributed to the regional GN caribou monitoring program which started in 2009.
	Zone of Influence	In 2017 Agnico Eagle worked with the GN to evaluate the Zone of Influence of the Meadowbank Mine, as it relates to caribou. Seasonal ranges are important to understand as Barren-ground caribou exhibit migratory behaviour between calving and wintering areas. Migratory animals use a variety (seasonal) of habitats to meet life-history requirements as they move across the landscape and sensory disturbance from development is hypothesized to reduce selection of preferred habitats.
	Raptor Monitoring	Agnico Eagle is also working with raptor researcher Dr. Alastair Franke from the University of Alberta to document presence of raptors in the Meadowbank area. Dr. Franke's Arctic Raptors group will be tracking changes that may occur as a result of mining activity and sharing results across the scientific community through publications
	PRISM-BBS	PRISM-BBS; collaboration agreement with ECCC for birds survey. Contribution to regional database.