November 4, 2023

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RE: Submission of 2023 Annual Geotechnical Inspection – 2023 Report 2. October 2023

Under Part D, Item 18 of Baffinland Iron Mines Corporation's (Baffinland) Type "A" Water Licence 2AM-MRY1325 Amendment No. 1 (Water Licence), Baffinland is required to conduct biannual geotechnical inspections of specified Mary River Project (the 'Project") infrastructure. Part D, Item 18, of the Water Licence states that:

> "The Licensee shall conduct inspections of the earthworks and geological and hydrological regimes of the Project biannually during the summer or as otherwise approved by the Board [Nunavut Water Board] in writing. The inspection shall be conducted by a Geotechnical Engineer and the inspection report shall be submitted to the Board within sixty (60) days of the inspection, including a cover letter from the Licensee outlining an implementation plan to respond to the Engineer's recommendations."

The second geotechnical inspection for 2023 was conducted by Laszlo Bodi, M.Sc., P.Eng., Principal Civil/Geotechnical Engineer with WSP Environment and Infrastructure Canada Limited. The focus of the inspection was on the Water Licence related infrastructure located at the Mary River Mine Site and Milne Port. The second geotechnical inspection for 2023 was conducted between August 30 and September 5, 2023.

During the inspection, the following structures and facilities were inspected:

1.0 Mary River Mine Site

a) Berms of Polishing Wastewater Stabilization Ponds (3 ponds).
b) Berms around hazardous waste disposal cells - (HWB-1 to HWB-7).
c) MS-06, MS-07, MS-08 and MS-11 surface water management ponds and adjacent ditches.
d) Berms around the former generator fuel bladder cell.
e) Fuel storage berms (3) – Aerodrome jet-fuel storage, MS-03 and MS-03B diesel fuel farms.
f) Solid-waste disposal site (non-hazardous landfill facility and two adjacent landfarm cells).
g) Camp Lake settling check dams and berms.
h) Water (effluent) Discharge Area
i) QMR2 and D1Q1 rock quarries.
j) KM106 run-of-mine ore storage area and adjacent drainage ditch.

2.0 Milne Inlet Port Site

a) Berms of hazardous waste disposal cells - (HWB-01 through HWB-04).
b) Berms of the MP-01A Polishing Waste Stabilization Pond (PWSP).
c) Berms around the MP-03 fuel tank farm.
d) Berms around the MP-04 land-farm and MP-04A contaminated snow disposal cell.
e) Berms of Surface Water Management Ponds #3, MP-05, MP-06 and MP-06A and drainage ditches adjacent to the ore stockpiles near the ship loader.
f) Q01 rock quarry and the adjacent south and north quarry ditch network.
g) Surface water collection ditches (P-SWD-3, -5, -6, -7, W3/W14, 380-Person Camp, and PSC ditches).
h) Tote Road Ditches and Culverts (conveying some of the surface water from the Q01 rock quarry area).
i) Effluent Discharge Pipe and Slope
j) LP-5 Storage Pad.
k) The Western Petroleum Fuel Module at the OHT fuel station.

3.0 Tote Road between the Mary River Mine and Milne Inlet Port

a) Bridges along the Tote Road (4).
b) A culvert and adjacent check dams at KM33+000 (Lake access road)
c) Section of the Mine Haul Road (MHR) between the crusher pad and the open pit (Mary River)
d) Comments in connection with the impact of roads on permafrost

The attached report (Attachment 1) presents the findings and recommendations of the second inspection for the aforementioned structures. The following subsections of this letter summarize completed actions from the first 2023 geotechnical inspection, and Baffinland's plan for implementing the recommendations identified in the second 2023 geotechnical inspection report (in bold).

Completed Items from June 2023 Geotechnical Inspection No. 1

1.1 Hazardous Waste –Cell Berms

1.1.1 Hazardous Waste-Cell Berms (HWB-1 to HWB-7)

June 2023 Geotechnical Inspection No. 1 Baffinland Action: Berm sections disturbed by foot and truck traffic will continue to be maintained during routine maintenance activities. Baffinland continues to educate personnel on access to berms.

Completed/Ongoing

1.1.3 Hazardous Waste Berm - HWB-3 and HWB-4

June 2023 Geotechnical Inspection No. 1 Baffinland Action: Baffinland will remove the wooden pallets and wooden pallet debris, to prevent potential damage to the liner, during routine maintenance activities.

Completed

1.1.4 Hazardous Waste Berm - HWB-6

June 2023 Geotechnical Inspection No. 1 Baffinland Action: Baffinland will remove the wooden pallets and wooden pallet debris, to prevent potential damage to the liner, during routine maintenance activities. Berm sections disturbed by foot and truck traffic will continue to be maintained during routine maintenance activities. Baffinland continues to educate personnel on access to berms. HWB-6 is used for temporary storage until materials are packaged for shipment and therefore additional storage capacity is not currently required at this facility.

Completed/Ongoing

1.1.5 Hazardous Waste Berm - HWB-7

June 2023 Geotechnical Inspection No. 1 Baffinland Action: Storm water retained within containment areas associated with the Project's HWBs is discharged to the receiving environment following water quality analysis and treatment, if required. Baffinland will continue to discharge storm water from HWB-7 as needed to ensure adequate freeboard is maintained within the pond.

Completed

1.2 Surface Water Management Ponds

1.2.1 MS-06 - Surface Water Management Pond Adjacent to the Crusher Facility (CF)

June 2023 Geotechnical Inspection No. 1 Baffinland Action A minor problem with the liner was noted at the spillway; likely due to strong wind lifting up the edges of the liner on the top of the berm at the spillway. It is recommended that the size and number of sandbags, weighing down the liner, be increased to prevent such uplift.

Completed

1.2.2 MS-07 - Surface Water Management Pond Adjacent to the KM106 ROM Facility

June 2023 Geotechnical Inspection No. 1 Baffinland Action: The sump was pumped dry and prepared for riprap placement pending equipment availability. As local topography does not allow for gravity drainage, Baffinland will continue to manage this area via active pumping.

Completed/Ongoing

1.2.3 MS-08 – Surface Water Management Pond Adjacent to the Waste Rock Facility (WRF)

June 2023 Geotechnical Inspection No. 1 Baffinland Action: Baffinland will repair the damaged berm section and liner when the contractors are on site during summer 2023. A field investigation determined that there is minimal risk to the Geotube pond capacity due to the location of the damage on the top of the crest.
Completed

1.2.4 MS-11 – Surface Water Management Pond and Dam at KM105

June 2023 Geotechnical Inspection No. 1 Baffinland Action: As recommended by the design engineer, Baffinland will continue to monitor the topography of the south embankment and implement corrective actions as per the design engineer's recommendations to prevent potential slope instability.

Ongoing

1.3 Mary River Landfarm (Solid Waste Disposal Area and Two Landfarm Cells)

June 2023 Geotechnical Inspection No. 1 Baffinland Action: The slopes of the berms (upstream and downstream) appear to be steeper than the designed inclination of 2H:1V. Also, It is recommended that the deficiencies be repaired/rectified in both cells. The problems should also be considered (lessons learned) in the design and construction of the still planned two additional cells to prevent such problems in the future.

The loose granular material anchoring the liner on the top of the berms has settled significantly, resulting in a long depression along the top of the berms. The water in the sump has resulted in slumping of the granular cover layer on top of the liner, which resulted in erosion (slumping) of the granular cover layer on the slope of the berms.

Completed

1.4 QMR2 Rock Quarry

June 2023 Geotechnical Inspection No. 1 Baffinland Action: To maintain traffic safety and stable side slopes when the operation in this facility resumes, the ponding water at the quarry's main level should be properly drained from the area down on the side-slope located immediately next to the plateau. It is recommended that consideration be given to the installation of a slope-drain pipe, chute, or flume drain, as an erosion protection measure.

Ponding water continues to cover a section of the main level of the quarry, with potential to cause slope stability and traffic safety issues in the area. Baffinland will review QMR2 quarry water management requirements with the design consultant that is currently assisting with Modification No. 13 Water Management Plans and have a remedial plan prepared prior to freshet 2024.

Ongoing

1.5 Diversion Berm at the KM-106 Ore Storage Area (MS-07)

June 2023 Geotechnical Inspection No. 1 Baffinland Action: It is recommended to cover the base and slopes of the temporary containment sump adjacent to the facility diversion berm with riprap. It is also suggested to drain the collected water from the sump to the pond by gravity if the topography of the area would allow.

The sump was pumped dry and prepared for riprap placement which is planned to be actioned pending equipment availability. As local topography does not allow for gravity drainage, Baffinland will continue to manage this area via active pumping.

Completed/Ongoing

2.0 Milne Port Site

2.1 MP-05 Surface Water Management Pond

June 2023 Geotechnical Inspection No. 1 Baffinland Action:

a) Minor liner damage was noted near the crest of the southern inlet channel to the pond. The liner in that area should be repaired as soon as practically possible. Baffinland will repair the minor liner damage.

b) Ponding water was noted at the south end of the east ditch, indicating that the ditch should be deepened/excavated in that area to facilitate uninterrupted water flow to the MP-05 pond. The start and end points of the long ditch should be surveyed and a gentle slope of the base of the ditch should be provided toward the MP-05 pond. Baffinland will reestablish the ditch to design criteria to ensure effective drainage to the MP-05 pond when conditions permit.

Completed

2.3 Surface Water Collection Ditches

2.3.1 Surface Water Drainage Ditch - P-SWD-3

June 2023 Geotechnical Inspection No. 1 Baffinland Action:

a) Sloughing of the sides of the P-SWD-3 ditch, adjacent to the LP2 laydown area, has occurred at several locations along the ditch however the ditch is not able to convey the collected water to the required location due to drainage issues. To improve the drainage capability of this ditch, it is recommended that it should be redesigned and reconstructed to drain the large amount of surface water from the snow-stockpile located to the north-east. The design must consider the fact that large amount of snow is stockpiled adjacent to this ditch every winter that generates excessive quantity of run-off water in the spring/summer that must be drained more efficiently toward the north-east. During the reconstruction, the culvert in the ditch beneath the access road to the snow stockpile should also be reinstalled to the correct invert levels (inlet and outlet). It is also suggested that a perimeter diversion berm be provided around the snow stockpile area and the surface water generated by the melting snow be conveyed to the P-SWD-3 ditch in a separate new drainage ditch. To prevent the migration of fine soil particles from the ditch to the environment, a rock-fill check dam must be installed/constructed at the discharge point of the upgraded/reconstructed ditch.

   Baffinland will complete the remaining improvement work in this drainage ditch as conditions allow. In the interim, all water will continue to be actively pumped downstream of this area to the proper receiving location until permanent remedial work to the drainage ditch is complete.

Ongoing

b) Debris visible in the northern part of the ditch should be removed. Baffinland will remove the debris from the northern part of the ditch, to prevent potential damage, during routine maintenance activities.

Completed

2.3.2 Surface Water Drainage Ditch - P-SWD-5

June 2023 Geotechnical Inspection No. 1 Baffinland Action: A short section of the P-SWD-5 ditch was noted with missing riprap and continuous water seepage from the side-slope was observed resulting in the periodic sloughing/erosion of the side of the ditch along this short section. It is recommended that the finer soil, currently forming the side of the ditch, be removed to a depth of around 1 m and replaced with crushed rock fill. To minimize migration of fine soil particles from the quarry pad to the ditch, the crushed rock fill should be placed over geotextile. There is also a clogged culvert along this ditch, located beneath the road at the entrance to the quarry. The clogged culvert should be cleaned or replaced if necessary; preferably with a larger diameter culvert.

Baffinland will review Q1 water management requirements and prepare a remedial plan for freshet 2024.

Ongoing

2.3.3 Surface Water Drainage Ditch – P-SWD-6

June 2023 Geotechnical Inspection No. 1 Baffinland Action: A large quantity of ponding water is present that is not able to flow into the P-SWD-6 ditch because the culvert invert level is located above the water level. Water from the area flows away from the P-SWD-6 ditch toward the south end of the PSWD-5 ditch. The flow currently occurs uncontrolled over the surface of the nearby road, presenting continuous risk to traffic. It is recommended that the area where water is ponding be connected to the P-SWD-5 ditch by extending that ditch and installing additional culverts.

Baffinland will review Q1 quarry water management requirements and prepare a remedial plan by freshet 2024.

Ongoing

2.3.5 Surface Water Drainage Ditch – 380M Ditch

June 2023 Geotechnical Inspection No. 1 Baffinland Action: The culvert connecting the east and south ditches is completely clogged, resulting in ponding water within the east ditch. It is recommended that the culvert be cleaned as soon as possible.

Completed

2.3.6 Surface Water Drainage Ditch – PSC

June 2023 Geotechnical Inspection No. 1 Baffinland Action: Minor localized slope movements/failure at the west end of the ditch should be repaired, regraded and the riprap rock fill cover reinstated. The sloughing of the slope is apparently caused by frequent water seepage from the granular fill of the LP-2 laydown that likely is a result of the inefficient drainage of surface water from the P-SWD-3 ditch that seeps into the LP-2 laydown and most likely exits at the location in the PSC ditch requiring repairs. Once

the drainage conditions in the P-SWD-3 ditch are improved/rectified, the failed slope at the PSC ditch can also be repaired. The reparation should include the removal of disturbed riprap from the affected area, placement of geotextile on the exposed surface of native soils and replacement of the rock-fill riprap. Based on field observations, the outflow end of the ditch must also be upgraded by the installation of geotextile and riprap along the base and side-slopes of the ditch. To prevent the migration of fine soil particles from the ditch to the environment a rock-fill check dam must also be installed/constructed at the discharge point of the upgraded/reconstructed ditch.

Baffinland will repair and regrade the identified area in the ditch where localized slope movements/failure have occurred and reinstate the riprap rock cover. Baffinland will inspect and, if required, repair the invert level of the west ditch section culvert, prior to completion of the construction of the PSC drainage ditch.

Ongoing

2.4 Milne Port WWTP Effluent Discharge

June 2023 Geotechnical Inspection No. 1 Baffinland Action: The sandy valley floor downstream of the WWTP effluent discharge location requires additional crushed rock fill placed over high-strength geotextile fabric to prevent erosion and undermining of the adjacent embankment slopes and to provide adequate support for the heavy casing pipe.

Baffinland previously placed material at the WWTP effluent discharge location; however, will reassess the area and add additional material as necessary to prevent erosion and provide adequate casing support.

Completed/Ongoing

3.0 Tote Road between the Mary River Mine and Milne Inlet Port

3.1 Tote Road Bridges

3.1.1 Tote Road KM17 Bridge

June 2023 Geotechnical Inspection No. 1 Baffinland Action: Some elements of the historic abutments steel bolt-a-bin structures are damaged. The damaged elements should be removed, together with part of the sandy backfill from behind them (from the face of the abutment). The sand should then be replaced with clean crushed rock-fill to prevent erosion of the finer soil from the old abutments.

Baffinland will remove damaged bolt-a-bin structure elements and aggregate from the damaged bins adjacent to the bridges as planned during late summer 2023 when the ground is sufficiently thawed.

Completed

3.1.2 Tote Road KM80 Bridge

June 2023 Geotechnical Inspection No. 1 Baffinland Action: Some damages to the upper part of the bolt-a-bin cribs were observed. It is recommended that guardrails be installed at both ends of the bridge at both sides of the road to prevent further damage to the cribs.

A third-party bridge inspector recently identified deficiencies in the KM80 bridge abutments. An engineered plan is being developed to straighten the bridge abutments. Execution is planned for 2024, pending engineered evaluation.

Ongoing

3.2 Tote Road Borrow Pits

June 2023 Geotechnical Inspection No. 1 Baffinland Action:

a) When the historic borrow pits at KM 6.9 and 7.7 were infilled, the base of the borrow area was leveled/graded, just slightly above the crest elevation of the adjacent road. The poor grade control and lack of drainage ditch can result in unwanted surface water flow onto the road from both sides, wherever the surface of the road is located at somewhat lower elevation. It is recommended that critical road sections with such poor grade and drainage controls be mapped, and the drainage conditions be improved by providing adequate side-ditches along the road, wherever the elevation of the road surface is located somewhat lower than the adjacent ground surface. The drainage ditches should be constructed as specified in the Project's Civil Design Criteria and Drawings.

Baffinland has engaged a third-party consultant to conduct a full review of the current status of all historic borrow sources with a complete update to the 2019 Tetra Tech report. A multi-year action plan is being developed for implementation in future years.

Ongoing

b) The toe of the slope at the historic borrow pit at KM28.9 to KM29, which is located relatively close to the edge of the road, appears to be as steep as 1H:1V. The raveling face of the slope and the development of tension cracks indicate further slumping of the slope can be expected in the future. Although there is no immediate risk to the traffic on the road, the sloughing soil from the steep slope may gradually fill up the drainage ditch along the road and prevent surface water from flowing properly in the ditch which could cause instability of the edge of road embankments. At the subject road section, it is suggested that the slope be reshaped (cut back) to shallower inclination (preferably to 2H:1V) and the drainage ditch be cleaned of soils, as soon as practically possible.

Baffinland has engaged a third-party consultant to conduct a full review of the current status of all historic borrow sources with a complete update to the 2019 Tetra Tech report. A multi-year action plan is being developed for implementation in future years.

Ongoing

3.3 Culvert and Adjacent Check Dam at KM33+000

June 2023 Geotechnical Inspection No. 1 Baffinland Action: The inlet of the culvert has been damaged recently, potentially clogging the culvert. To provide uninterrupted flow, the culvert should be replaced as soon as practically possible. More rock-fill should also be placed around the inlet, while the silt deposited at the front of the outlet should be removed. The crest of the nearby check-dams show some loss of rock-fill, which should be replaced as soon as practically possible.

Baffinland is implementing a prioritized culvert replacement project starting in Q4 2023, with the intent of all culverts along the Tote Road being repaired, upgraded, or replaced as necessary based on risk. Current plans that are in the permitting process are to address 20 culverts that represent the highest risks to fish passage. Furthermore, inspection and maintenance plans are being developed for assessing requirements and ensuring effectiveness of erosion and sediment control features. This process is being overseen by a Certified Inspector of Sediment and Erosion Controls (CISEC).

Ongoing

2023 September Geotechnical Inspection No. 2 Findings and Action Items

1.0 Mary River Site

1.1 Hazardous Waste –Cell Berms

1.1.1 Hazardous Waste-Cell Berms (HWB-1 to HWB-7)

September 2023 Geotechnical Inspection No. 2 Action Item: There is no visible instability at the berms (sloughing, excessive settlement, or tension cracks), other than some minor disturbance/soil displacement caused by foot and truck traffic on the surface of the slopes and crests at a few locations.

Foot and truck traffic on the slopes and crest of the berms will be limited to maintain the integrity and stability of the berms. Trucks may only use the designated ramps to access the cells and those ramps should be maintained.

1.1.2 Hazardous Waste Berm – HWB-1 and HWB-5

September 2023 Geotechnical Inspection No. 2 Action Item: Both cells are currently not being used. Upgrades to the liner is recommended if they were to be used in the future.

1.1.4 Hazardous Waste Berm - HWB-6

September 2023 Geotechnical Inspection No. 2 Action Item: The crest and slopes of the berms have been disturbed at a few locations (boulders and containers placed on the berm). Site services were notified about the issue during the September inspection, and the problem was rectified the following day. Stored materials should be disposed in and taken out of the cell through the access ramp only, not over the shallow perimeter berms.

Foot and truck traffic on the slopes and crest of the berms will be limited to maintain the integrity and stability of the berms. Trucks may only use the designated ramps to access the cells and those ramps should be maintained.

1.2 Surface Water Management Ponds

1.2.1 MS-06 - Surface Water Management Pond Adjacent to the Crusher Facility (CF)

September 2023 Geotechnical Inspection No. 2 Action Item: The small sandbags may still need to be replaced with larger sandbags or used truck tires, to weigh down the liner more efficiently against stronger wind.

The culvert located near the south-east corner of the pond, within an adjacent drainage ditch. Based on field observation, the culvert requires cleaning (removal of trapped silt and sand from the pipe),

Baffinland will monitor the liner and place additional sandbags or heavier objects as required to ensure the liner does not lift. The identified culvert will be cleaned as required.

1.2.3 MS-08 – Surface Water Management Pond Adjacent to the Waste Rock Facility (WRF)

September 2023 Geotechnical Inspection No. 2 Action Item: There is a lined treatment cell (geotube pond) located immediately next to the WRF water treatment plant. A small section of the liner at the south-west section of the berm is still damaged and will require repair as soon as practically.

This repair was completed.

1.2.4 MS-11 – Surface Water Management Pond and Dam at KM105

September 2023 Geotechnical Inspection No. 2 Action Item: The anchor trench along the road next to the south MS-11 pond's slope is loosely filled and cracked. Some crushed stone has already been placed into some of the cracks. The cracks in the ground should be backfilled and regraded to minimize water infiltration into the ground next to the slope, to prevent potential slope instability in the future.

Baffinland will address the anchor trench cracks as per the Engineer of Record's advice.

1.4 QMR2 Rock Quarry

September 2023 Geotechnical Inspection No. 2 Action Item: Ponded water remains a potential for slope stability issues and traffic safety issues. It is recommended that consideration be given to the installation of a slope-drain pipe, chute, or flume drain from the sump, as an erosion protection measure on the side-slope, instead of letting the water flowing uncontrolled along the edge of the access road Baffinland will review QMR2 quarry water management requirements with the design consultant that is currently assisting with Modification No. 13 Water Management Plans and have a remedial plan prepared prior to freshet 2024.

Although there is no activity currently present at the quarry, the exposed slopes appear to be stable condition overall, with a few localized fall hazards (loose boulders) noted at the upper and lower levels of the quarry in some areas. Access is restricted but if the area is to become active in the future these areas should be assessed.

1.5 Diversion Berm at the KM-106 Ore Storage Area (MS-07)

September 2023 Geotechnical Inspection No. 2 Action Item: Run-off water is collecting in the new drainage ditch and a sump. The drainage ditch is covered with riprap and the sump will also need to be covered by crushed rock to minimize siltation of the collected water, which is being pumped into the nearby MS-07 pond.

Baffinland will apply riprap to the sump and continue to manage via active pumping.

2.0 Milne Port Site

2.2 Q01 Rock Quarry

September 2023 Geotechnical Inspection No. 2 Action Item: A large area of the quarry's lower level was covered with ponding water, indicating poor surface drainage control. The drainage situation should be rectified at this site by draining all surface water into the nearby drainage ditches, prior to restarting the operation in the quarry. It is suggested that additional drainage ditches be provided to improve the control of surface water.

2.3 Surface Water Collection Ditches

2.3.1 Surface Water Drainage Ditch - P-SWD-3

September 2023 Geotechnical Inspection No. 2 Action Item: Sloughing at the side slopes of the P-SWD-3 ditch, adjacent to the LP-2 laydown area, has occurred at several locations. It is evident that the sloughing of the slopes is a direct result of uncontrolled sheet-flow of surface water (melting snow from the adjacent snow-stockpile), flowing into the ditch that is not able to convey the water to the designated discharge location. The ditch invert currently slopes gently toward south-west, while the ditch was designed (and should) to drain the collected water toward north-east.

To improve the drainage capability of this ditch it is recommended that it should be reconstructed to drain the large quantity of surface water from the snow-dump to the north-east. The culvert in the ditch beneath the access road to the snow-dump is currently clogged with soil and its invert level is located well above the invert of the ditch. This culvert should be reinstalled to the correct invert level (to be specified during the redesign process). To prevent the migration of fine soil particles from the ditch to the environment, a rockfill check dam must be installed/constructed at the discharge point of the upgraded/reconstructed ditch.

Baffinland will complete the remaining improvement work in this drainage ditch in 2024. In the interim, all water will continue to be actively pumped downstream of this area to the proper receiving location until permanent remedial work to the drainage ditch is complete.

2.3.2 Surface Water Drainage Ditch - P-SWD-5

September 2023 Geotechnical Inspection No. 2 Action Item: A section of the P-SWD-5 ("Q01-North") ditch was noted with missing riprap. It appears that there is continuous subsurface water seepage from within the adjacent granular pad of the quarry at this location, resulting in periodic sloughing/erosion of the side of the ditch just along this short section. It is recommended that the somewhat finer soil, currently forming the side of the ditch, be removed to a depth of around 1 m and replaced with crushed rock fill. To minimize migration of fine soil particles from the quarry pad to the ditch, the crushed rock fill should be placed over a layer of geotextile fabric. The improvement of this section of the ditch shall be completed with the formation/excavation of additional drainage ditches, required to rectify the large ponding water across the lower level of the quarry.

Baffinland will review Q1 quarry water management requirements and have a remedial plan prepared by freshet 2025.

2.3.3 Surface Water Drainage Ditch – P-SWD-6

September 2023 Geotechnical Inspection No. 2 Action Item: A large quantity of ponding water is present that is not able to flow into the P-SWD-6 ditch because the culvert invert level is located above the water

level. Ponded water flows uncontrolled over the surface of the nearby access road. It is recommended that surface water from the pond and from the surrounding quarry area should be drained to a nearby valley. The upgraded drainage system will require the design and construction of new erosion-controlled drainage components in and adjacent to the valley (new ditches with geotextile and riprap cover, and at least three (3) new culverts. One of the new culverts will need to replace the inefficient culvert.

Baffinland will review Q1 quarry water management requirements and have a remedial plan prepared by freshet 2024.

2.3.4 W3/W14 ditch

September 2023 Geotechnical Inspection No. 2 Action Item: A culvert at the west end of the W3/W14 ditch**,** where the geotextile and crushed rock riprap is missing from the ditch just at the front of the pipe's inlet.

Baffinland will place geotextile and crushed rock riprap as required.

2.3.6 Surface Water Drainage Ditch – PSC

September 2023 Geotechnical Inspection No. 2 Action Item: Localized slope degradation/sloughing is still visible at a short section of the ditch. The sloughing of the slope is apparently caused by frequent water seepage from the granular fill of the LP-2 laydown pad. It is likely that the frequent seepage at this location is a result of the inefficient drainage of surface water within the P-SWD-3 ditch. The collected surface water in the P-SWD-3 ditch should drain toward its north-east end. However, currently the water flows to the opposite direction. At the south-west end of the ditch the collected water seeps into the granular fill pad of the LP-2 laydown area and most likely exits at the location where the frequent slope problem is visible at the **PSC** ditch. It is recommended that the drainage conditions at the **P-SWD-3** and **PSC** ditches be reviewed and rectified as early as practically possible. Once the drainage conditions in the P-SWD-3 ditch would be improved/rectified, the failed slope at the PSC ditch can also be repaired. The reparation should include the removal of disturbed riprap from the affected area, placement of geotextile on the exposed surface of native soils and placement of new, clean rockfill riprap. Based on field observations, the outflow end of the ditch must also be upgraded by the installation of geotextile and riprap along the base and side-slopes of the ditch. To prevent the migration of fine soil particles from the ditch to the environment, a rockfill check dam must also be installed/constructed at the discharge point of the upgraded/reconstructed ditch.

Baffinland will repair and regrade the identified area in the ditch where localized slope movements/failure have occurred and reinstate the riprap rock cover. Baffinland will inspect the area in Q2 2024 and, if required, repair the invert level of the west ditch section culvert, prior to completion of the construction of the PSC drainage ditch.

2.4 Milne Port WWTP Effluent Discharge

September 2023 Geotechnical Inspection No. 2 Action Item: The slope in the immediate vicinity of the discharge point is covered with riprap; however, deterioration of the adjacent slopes of the valley, comprising native sandy soils, is visible.
In order to prevent further deterioration of the sandy slopes it is recommended that the valley beneath the casing pipe be filled with crushed rock fill, placed over high-strength geotextile fabric, Terrafix600R or stronger.

Baffinland will reassess the area and add additional material as necessary to prevent erosion and provide adequate casing support.

2.5 Western Globe Fuel Module (WGFM)

September 2023 Geotechnical Inspection No. 2 Action Item: The facility was designed with a drainage control hump and the entrance and exit to prevent oily surface water escaping the refueling area. Under the heavy truck traffic at the station, those humps were flattened/spread in the past but shall be reinstated. It is suggested that the edges of the liner beneath the road fill be exposed using hydrovac, and the humps reconstructed as designed.

Baffinland will assess the area in 2024 and determine the requirements for a drainage control hump at the facility.

3.0 Tote Road between the Mary River Mine and Milne Inlet Port

3.1 Tote Road Bridges

3.3 Culvert and Adjacent Check Dam at KM33+000

September 2023 Geotechnical Inspection No. 2 Action Item: The culvert's inlet has been damaged recently, potentially clogging the culvert. To provide uninterrupted flow, the culvert should be cleaned or replaced as soon as practically possible. More rockfill should also be placed around the culvert's inlet, while the silt deposited at the front of its outlet should be removed. The crest of the nearby check-dams show some loss of rock fill. The crest of the dams should be raised by placing additional rock fill and the ditch behind the dams should be cleaned (fine soil removed).

Baffinland is implementing a prioritized culvert replacement project starting in Q4 2023, with the intent of all culverts along the Tote Road being repaired, upgraded, or replaced as necessary based on risk. Current plans that are in the permitting process are to address 20 culverts that represent the highest risks to fish passage. Furthermore, inspection and maintenance plans are being developed for assessing requirements and ensuring effectiveness of erosion and sediment control features. This process is being overseen by a Certified Inspector of Sediment and Erosion Controls (CISEC).

3.4 Comments in Connection with the Impacts of Roads on Permafrost

There are some hazards having potential impact on infrastructure components that are related to the thawing/melting of the upper veneer of the permafrost, such as weakening of frozen slopes resulting in landslides or avalanches; effect of thaw settlement and frost heave on infrastructure components causing cracking or collapse of roads, buildings and bridges, or the combinations or chain reactions of these processes. Although some of these hazards are present along the Tote Road between Mary River and Milne Inlet Port, the actual extent of such potential problems does not reach serious level since the impact on the permafrost along the road is limited.

In summary, the impact of the road on the permafrost was generally limited and mostly occurred during the construction of the road. However, there are a few visible deficiencies that could have adverse effect on the stability of the road embankment and slopes, on traffic safety and on the thickness and condition of the active layer locally.
The most visible deficiencies are:

- Poor drainage (surface water control) along sections of the road embankment, particularly next to cut slopes and shallow embankments. An assessment of runoff and drainage along the Tote Road is being completed as part of a separate deliverable, and will address these deficiencies, prioritized according to risk.
- Short culverts represent another hazard to the road embankments and to the truck traffic. These shorter culverts and narrower roadways will be assessed along with all crossings, and prioritized based on overall risk.

In summary, the impact of road construction on the permafrost between Mary River and Milne Inlet Port was relatively low and generally occurred during construction. Current, potentially adverse effects can be attributed to poor surface water and erosion control along the sides of the road at several locations. These deficiencies can be rectified by the installation of appropriate culverts and by implementing a more efficient surface water controls.

Baffinland maintains several management plans for the monitoring and maintenance of the tote road and will continue to assess and update plans and tote road conditions as necessary.

We trust that this submission meets the requirements for geotechnical inspections as outlined in the Water License. Should you have any questions, please do not hesitate to contact the undersigned.

Regards,

Todd Swenson
Environmental Superintendent

Attachments:

Attachment 1: Annual Geotechnical Inspectoins – 2023 Report No. 2 Mary River Project – Nunavut, October 31, 2023

Cc: Karén Kharatyan (NWB)
Chris Spencer, Conor Goddard, Hugh Karpik (QIA)
Omer Pasalic, Sean Noble-Nowdluk, Jeremy Fraser (CIRNAC)
Tim Sewell, Megan Lorde-Hoyle, Lou Kamermans, Francois Gaudreau, Martin Beausejour, Connor Devereaux, Katie Babin, Allison Parker, Dale Kristoff (Baffinland)

Baffinland

Attachment 1

2023 Geotechnical Inspection Report No. 2

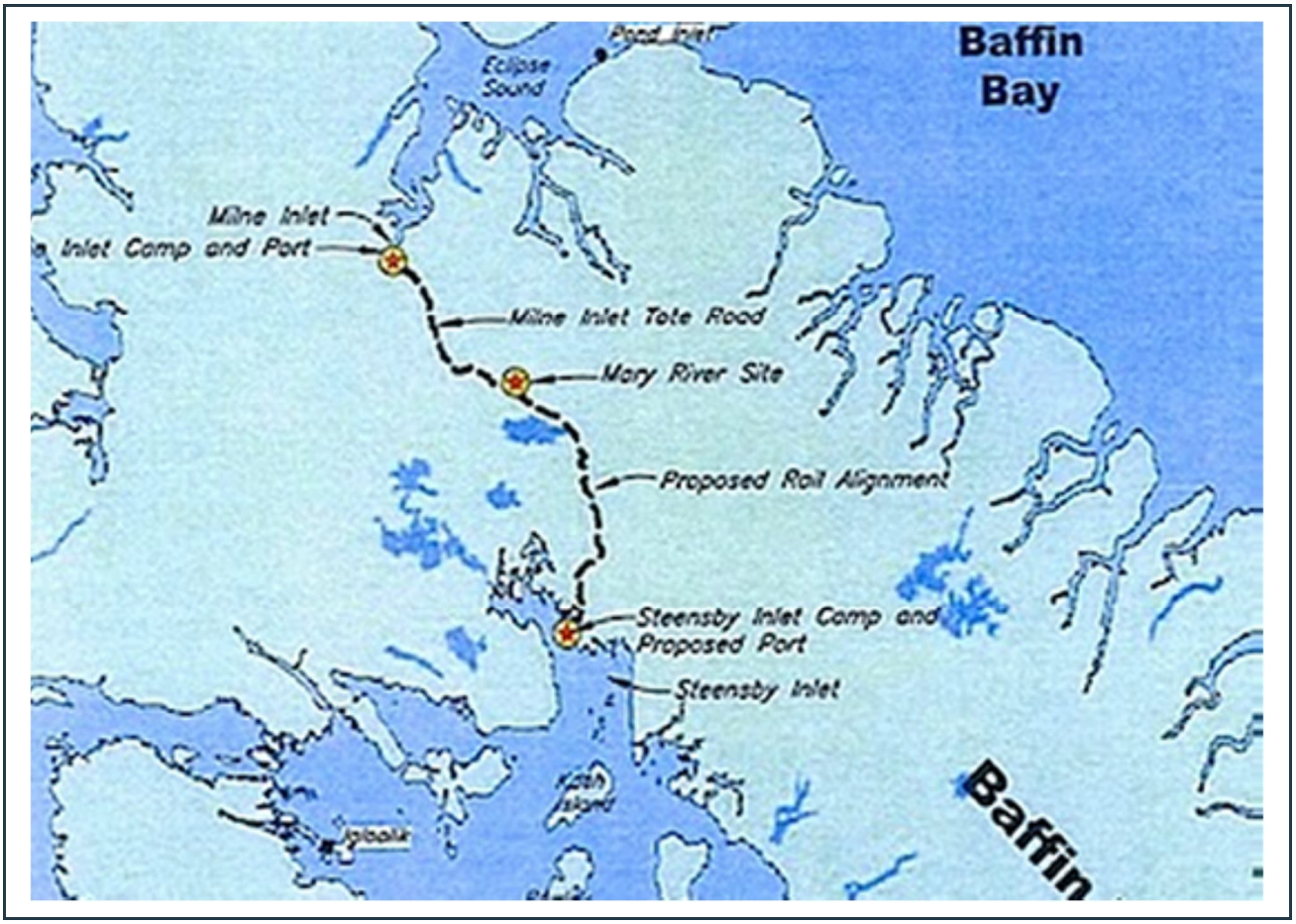
2275 Upper Middle Road East, Suite 300 | Oakville, ON, Canada L6H 0C3
Main: 416.364.8820 | Fax: 416.364.0193 | www.baffinland.com

BIM Corporation

October 31, 2023
Project #: OMGM2212-23

Annual Geotechnical Inspections – 2023 Report 2.

Mary River Project – Nunavut



Location of the Mary River Mine and Milne Inlet Port on Baffin Island - Source: Nunatsiaq News

WSP E&I Canada Limited
6925 Century Avenue
Mississauga, Ontario, Canada, L5N 7K2

October 31, 2023
OMGM2212-23

Mr. Connor Devereaux - Environmental Manager, Mary River Iron Mine, BIM Corporation
Mr. Todd Swenson - Environmental Superintendent, Mary River Iron Mine, BIM Corporation
Ms. Katie Babin - Environmental Superintendent, Mary River Iron Mine, BIM Corporation
360 Oakville Place Drive, Suite 300,
Oakville, Ontario, L6H 6K8

Re: Annual Site Inspections and Reporting 2023 - Mary River Iron Mine Complex, Nunavut

WSP E&I Canada Limited has been retained by Baffinland Iron Mines Corporation to carry out Annual Geotechnical Engineering Services at the Mary River Project in Nunavut. Based on information and guidance, provided in connection with the site's infrastructure, the undersigned has completed the second of the two required inspections for 2023 and summarized the findings in the following report. In addition to field observations, the following historic reports had also been reviewed:

- Mary River Fueling Facility, Milne Inlet – Site Plan and Details (B.H. Martin, 2016)
- Annual Geotechnical Site Inspections (2019, 2020, 2021 and 2022 1st report) – Wood E&I
- Construction Summary Reports – Crusher Pad Sedimentation Pond Expansion (2019); Waste Rock Pond Expansion Drainage System; KM-106 Run of Mine Stockpile & Sedimentation Pond (2020) and Mine Site Land-farm Cell 1 and Cell 2 (2022)
- Inspection of the Milne Inlet Tote Road and Associated Borrow Sources – Tetra Tech (2019)
- Annual Geotechnical Site Inspections (2022 - 2nd and 2023 1st reports) – WSP E&I Canada Limited

We trust that the content of this report meets your expectations. Should you have any questions regarding the details presented in the following document, please do not hesitate to contact our office.

Sincerely,

WSP Environment & Infrastructure Canada Limited

Laszlo Bodi, M.Sc.; P.Eng. – Senior Principal Civil/Geotechnical Engineer
WSP Environment & Infrastructure Canada Ltd.

Table of Contents

Page

1.0 Introduction 4

2.0 Mary River Mine Site 15

2.1 Polishing/Waste Stabilization Ponds (3 PWS ponds) 15
2.2 Hazardous Waste-Cell Berms (HWB-1 to HWB-7) 16
2.3 MS-06, MS-07, MS-08 and MS-11 Surface Water Management Ponds 17
2.4 Berms of the Cell for Generator Fuel Bladders 19
2.5 Fuel Storage Berms (3) 19
2.6 Solid Waste Disposal Area and Two New Landfarm Cells 20
2.7 Camp Lake Settling Check Dams and Berms 21
2.8 Water (Effluent) Discharge Area 21
2.9 Rock Quarries (QMR2, D1Q1) and KM106 Ore Stockpile Area 21

3.0 Milne Inlet Port Site 22

3.1 Hazardous Waste-cell Berms (HWB-1 to HWB-4) 22
3.2 MP-01A Polishing Waste Stabilization Pond (PWSP) 23
3.3 MP-03 Fuel Tank Farm 23
3.4 MP-04 and 04A Land-farm and Contaminated Snow Disposal Cells 23
3.5 Surface Water Management Ponds and Ditches (Surface Water Management Pond #3, MP-05, MP-06 and MP-06A Ponds) 24
3.6 Q01 Rock Quarry 25
3.7 Surface Water Collection Ditches (P-SWD-3, -5, -6, -7, W3/W14, 380-Person Camp and PSC ditches) 25
3.8 Tote Road Ditches and Culverts 27
3.9 Effluent Discharge Pipe and Slope 27
3.10 LP-5 Storage Pad 27
3.11 Western Globe Fuel Module (WGFM) 27

4.0 Tote Road Between the Mary River Mine and Milne Inlet Port 28

4.1 Bridges (4) 28
4.2 Selected Culvert (1) and Adjacent Check Dams at KM33+000 29
4.3 Section of the Haul Road Between the Crusher Pad and the Open Pit (KM104 – KM106). 29
4.4 Comments in Connection with the Impact of Roads on Permafrost 29

5.0 Conclusion 33

6.0 Closing Remarks 34

1.0 Introduction

WSP Environment & Infrastructure Canada Ltd., has completed the second geotechnical field inspection of 2023 at the Mary River Project, which is a condition of the Type "A" Water Licence No: 2AM-MRY1325 – Amendment No.1 ("Water Licence").

Based on the requirements outlined in the Water Licence, the field inspections shall include the review of various facilities and structures that contain waste materials (hazardous and non-hazardous), and store or retain/convey water (surface water management ponds and ditches) at the Mary River Mine and Milne Inlet Port sites. The field review included visual assessment of the current condition of the berms and slopes and reporting on potential seepage/stability problems at the facilities, if any. In addition to the condition survey of the above noted infrastructure components, critical watercourse crossings (bridges) were also reviewed along the Tote Road connecting the Mary River Mine and Milne Inlet Port sites. Comments in connection with potential (minor) impact of the road on the permafrost are also presented.

As specified by the Nunavut Water Board, the conditions of the above listed infrastructure components need to be visually inspected twice a year and documented by photographs. The inspected structures and facilities in the fall (September) of 2023 included the following:

A. Mary River Mine Site

a) Berms of Polishing Wastewater Stabilization Ponds (3).
b) Berms around hazardous waste disposal cells - (HWB-1 to HWB-7).
c) MS-06, MS-07, MS-08 and MS-11 surface water management ponds and adjacent ditches.
d) Berms around the former generator fuel bladder cell.
e) Fuel storage berms (3) – Aerodrome jet-fuel storage, MS-03 and MS-03B diesel fuel farms.
f) Solid-waste disposal site (non-hazardous landfill facility and two adjacent landfarm cells).
g) Camp Lake settling check dams and berms.
h) Rock fill slope (riprap) at the water (effluent) discharge area.
i) QMR2 and D1Q1 rock quarries.
j) KM106 run-of-mine ore storage area and adjacent drainage ditch.

B. Milne Inlet Port Site

a) Berms of hazardous waste disposal cells - (HWB-1 through HWB-4).
b) Berms of the MP-01A Polishing Waste Stabilization Pond (PWSP).
c) Berms around the MP-03 fuel tank farm.
d) Berms around the MP-04 land-farm and MP-04A contaminated snow disposal cell.
e) Berms of Pond #3, MP-05, MP-06 and MP-06A surface water management ponds and drainage ditches adjacent to the ore stockpiles near the ship loader.
f) Q01 rock quarry and the adjacent south and north quarry ditch network.

g) Surface water collection ditches (P-SWD-3, -5, -6, -7, W3/W14, 380-Person Camp, and PSC ditches).
h) Twin Tote Road culverts (conveying some of the surface water from the Q01 rock quarry area).
i) Rock fill and slope at the water/effluent discharge area.
j) LP-5 Storage Pad.
k) The Western Petroleum Fuel Module at the OHT fuel station.

C. Tote Road Between the Mary River Mine and Milne Inlet Port

a) Bridges along the Tote Road (4).
b) A culvert and adjacent check dams at KM33+000 (Lake access road)
c) Section of the Mine Haul Road (MHR) between the crusher pad and the open pit (Mary River)
d) Comments in connection with the impact of roads on permafrost

The above listed infrastructure components were visually inspected between August 30 and September 5, 2023, by the author of this report, Laszlo Bodi M.Sc.; P.Eng. of WSP Environment & Infrastructure Canada Limited. During the inspection, the current condition of the structures was visually reviewed, and the findings of the inspection are summarized in the following report. The locations of the inspected infrastructure components, berms, settling ponds and ditches are shown in the following key maps:

a) Mary River Mine site – Central Zone - East (Figure 1), North-Eastern Zone (Figure 2), South-Eastern Zone (Figure 3), Central Zone - West (Figure 4), Southern Zone (Figure 5), and Western Zone (Figure 6)
b) Milne Inlet Port site – North-Eastern Zone (Figure 7), North-Western Zone (Figure 8), South-Western Zone (Figure 9), and South-Eastern Zone (Figure 10)
c) Representative section of the Tote Road close to the Milne Inlet port – (Figure 11)

Photographs of the inspected structures are shown in the following documents (attached to this report):

a) Appendix A: Mary River Mine site – Figures 12 to 51
b) Appendix B: Milne Inlet Port site - Figures 52 to 91
c) Appendix C: Bridges (4), a culvert (1) and adjacent check dams, a section of the haul Road between the ore crusher and the open pit (KM104-KM110), and images in connection with permafrost: Figures 92 to 112

Mary River Mine Site

Figure 1: Site layout – Mary River Mine Site - Central Zone – East, showing the MS-03 and MS-03B fuel farms and the MS-06 surface water management pond, located near the ore crushing facility. © 2023 Digital Globe, Inc.

Figure 2: Mary River Site layout – North-Eastern Zone – Waste rock facility with the MS-08 and geotube ponds – D1Q1 rock quarry area. © 2023 Digital Globe, Inc.

Figure 3: Site layout – Mary River Mine Site – South-Eastern Zone – KM106 run-of-mine ore storage area and KM106/MS-07 and KM105/MS-11 surface water management ponds. © 2023 Digital Globe, Inc.

Figure 4: Site layout – Mary River Mine Site – Central Zone - West – Jet-fuel storage cell and QMR2 rock quarry. © 2023 Digital Globe, Inc.

Figure 5: Site layout – Mary River Mine Site – Southern Zone – Non-hazardous landfill area with two new land-farm cells, and the effluent discharge location. © 2023 Digital Globe, Inc.

Figure 6: Site layout – Mary River Mine Site - Western Zone – PWS ponds (1-3), HWB hazardous waste storage cells (1-7), genset cell, and Camp Lake check dams. © 2023 Digital Globe, Inc.

Milne Inlet Port Site

Figure 7: Site layout – Milne Inlet Port Site – North-Eastern Zone. © 2023 Digital Globe, Inc.

Figure 8: Site layout – Milne Inlet Port Site – North-Western Zone. © 2023 Digital Globe, Inc.

Figure 9: Site layout – Milne Inlet Port Site – South-Western Zone. © 2023 Digital Globe, Inc.

Figure 10: Site layout – Milne Inlet Port Site – South-Eastern Zone. © 2023 Digital Globe, Inc.

Figure 11: View of a section of the Tote Road between the Mary River Mine and Milne Inlet Port.

Details of the recent condition survey of the individual infrastructure components, reviewed in September 2023, are summarized in the following sections of the report while the relevant photographs, maps and sketches are shown in Appendix A, B and C, as integral parts of this document.

2.0 Mary River Mine Site

2.1 Polishing/Waste Stabilization Ponds (3 PWS ponds)

There are three (3) polishing/waste stabilization ponds, located adjacent to the airstrip, as shown in Figure 6. Pond #1 is a single structure, while Ponds #2 and #3 were constructed as twin-cells, as shown in Figure 12. The photograph in Figure 12 is a historic aerial image (taken by the author of this report) showing the robust and stable berms around the three stabilization ponds. As mentioned in previous inspection reports, these ponds were associated with the exploration phase of the mine, and currently serve as emergency holding ponds in case problems would arise, which would prevent the discharge of treated effluent directly to the receiving environment. The robust, stable berms around the ponds generally comprise granular materials (rock fill, sand, and gravel), with High Density Polyethylene (HDPE) geomembrane liners. No damage is visible on the membranes in the cells or on the upstream face of the slopes (see Figures 13 to 15).

A relatively common issue (although not a problem) in water storage ponds is the appearance of so-called “whales” within the ponds. Whales are sections of the liners which have risen (float) above the surface of shallow water, particularly in shallow ponds, where the weight of water above the liner is

minimal. Such small “whales” were visible during previous inspections at PWS ponds #2 and #3. Similar “whale” was noticed during the September 2023 inspection in pond #2, as shown in Figure 14; however, no damage to the liner or seepage from the ponds was noted.

2.2 Hazardous Waste-Cell Berms (HWB-1 to HWB-7)

There are seven (7) lined hazardous waste storage cells with stable perimeter berm structures at the Mary River mine site (HWB-1 to HWB-7). The HWB-6 cell is located at the north side of the airstrip near the incinerator, while the other six (6) cells are located opposite of HWB-6, at the south side of the airstrip, as shown in Figure 6, above. All seven (7) HWB cells are lined with HDPE liner, and comprise shallow, stable perimeter berms constructed from locally available, generally granular, thaw-stable soils. There is no visible instability at the berms (sloughing, excessive settlement, or tension cracks), other than some minor disturbance/soil displacement caused by foot and truck traffic on the surface of the slopes and crests at a few locations, as shown in the relevant images in Appendix A. It is recommended that foot and truck traffic on the slopes and crest of the berms be limited to maintain the integrity and stability of the berms. Trucks may only use the designated ramps to access the cells and those ramps should be maintained. Good example of well-maintained ramp is shown in Figure 36 at the jet-fuel farm at the airport. Note the timber beam in that image, incorporated in the crest of the berm to prevent displacement of the granular material under the wheels of the fuel trucks.

a) HWB-1

As shown in Figure 16, this cell is currently not in use. Concerns had been raised in the past that there is potential liner damage within this cell, and consequently no material has been stored in this cell since the concern was identified. However, as shown in Figure 16, ponding water was visible in the cell during the September 2023 inspection, indicating that the liner may still be intact. Having said that, Baffinland has previously committed to removing the old (potentially damaged) liner from this cell and replacing it with a new one should the use of HWB-1 be required again in the future.

b) HWB-2

As shown in Figure 17, shipping containers are currently stored in this cell. The robust perimeter berms around the cell appear to be stable and the presence of ponding water within the cell indicates good liner performance.

c) HWB-3 and HWB-4

These cells were constructed as “twin-cells” and were called “Fuel Containment” cells. As shown in Figures 18 and 19, both cells are holding fuel barrels, stored on wooden pallets, (jet-fuel and diesel). The shipping container and debris that were visible during the June 2023 inspection in cell 4, have been removed. The berms and liner around and within the two cells are in good condition and no seepage from either of the cells was noted during the September 2023 inspection.

d) HWB-5

As shown in Figure 20, this cell is currently empty. The shallow berms around the cell appear to be stable but no ponding water was visible in this cell indicating potential liner damage. As in the case of the adjacent cell 1, Baffinland has previously committed to removing the old liner from this cell as well and replacing it with a new one should the use of the HWB-5 cell be required in the future. As mentioned earlier for HWB-1, these two cells (1 and 5) should be reconstructed as one large new cell to replace the small capacity (and almost always full) HWB-6 cell, located near the incinerator.

e) HWB-6

The berms around this cell and the internal "floor" have been regraded and stabilized last year using clean granular fill. However, as shown in Figure 21, the cell was filled to its capacity recently and the crest and slopes of the berms have been disturbed at a few locations (boulders and containers placed on the berm). Site services were notified about the issue during the September inspection, and the problem was rectified the following day. The improved berm condition is shown in Figure 22. As requested in earlier reports, stored materials should be disposed in and taken out of the cell through the access ramp only, not over the shallow perimeter berms.

f) HWB-7

One (1) large fuel tank is stored in this cell together with oil-filled plastic containers, as shown in Figure 23. The perimeter berms around the cell appear to be stable and the ponding water within the cell is indicative of adequate liner performance. Due to the large quantity of melted snow in June 2023, this cell was full of ponding water at the time of the earlier (June) inspection; however, most of the water has been gradually removed from the cell and treated.

2.3 MS-06, MS-07, MS-08 and MS-11 Surface Water Management Ponds

a) MS-06 – Surface Water Management Pond Adjacent to the Crusher Pad

The MS-06 surface water management pond collects surface water from the area of the crusher pad. The surface water is collected in side-ditches, excavated around the crusher pad, and conveyed into the MS-06 pond. One of the culverts located under the adjacent road at the crusher pad entrance is connecting one of the side ditches with the north corner of the MS-06 surface water management pond. The culvert was recently cleaned and there is now uninterrupted flow of water through the culvert (see Figure 24).

There are two (2) intake locations to the pond at the northeast and southeast corners, and there is an emergency spillway located opposite to the intakes. The liner within the pond and on the upstream slopes of the stable berm appears to be intact; however, minor problem with the liner was noted at the spillway at the time of the June inspection, caused by strong wind lifting the edges of the liner on the top of the berm. That problem has been rectified by site services by placing additional sandbags on the edges of the liner, weighing it down to the berm, as shown in Figure 25. The small sandbags may still need to be

replaced with larger sandbags or used truck tires, to weigh down the liner more efficiently against stronger wind. No wet downstream slopes or toe seepage were visible at the time of the September visit.

A second culvert, shown in Figure 26, is located near the south-east corner of the pond, within an adjacent drainage ditch. Based on field observation, the culvert requires cleaning (removal of trapped silt and sand from the pipe), which problem was presented to site services during the visit.

b) MS-07 – Surface Water Management Pond Adjacent to the KM-106 Stockpile

The MS-07 surface water management pond is located adjacent to the KM-106 stockpile area. The pond has robust, stable perimeter berms and intact geomembrane liner, as shown in Figure 27. No stability or seepage related problems were observed at this pond during the September 2023 site visit.

c) MS-08 – Surface Water Management Pond Adjacent to the Waste Rock Facility

Waste rock from the open pit mining operation is disposed of in the waste rock facility WRF, which consists of waste rock piles, the MS-08 surface water management pond, and the continuously upgraded perimeter drainage ditches excavated around the facility. Surface runoff and seepage from the WRF is collected in the ditches and conveyed to the MS-08 pond. The MS-08 surface water management pond is bounded by robust and stable berm, and the pond is lined with HDPE liner that is secured in place in anchor trenches, extending down into the permafrost.

During the June 2023 inspection the MS-08 pond and both (east and west) side ditches were blanketed by thick snow. Hence, it was not possible to review the condition of the pond's liner and the ditches at that time. Figure 28 shows the stable, robust berm and intact liner of the MS-08 pond during the September 2023 visit. Note that there was some snow on the ground already during the first week of September this year. Figures 29 and 30 show the well-maintained drainage ditches around the waste rock dump facility, conveying the collected surface water to the MS-08 pond.

Water from the MS-08 pond can be pumped to the nearby designated facility for treatment, if required. There is a lined treatment cell (geotube pond) located immediately next to the WRF water treatment plant. As shown in Figure 31, (marked by the yellow circle), a small section of the liner at the south-west section of the berm is still damaged and will require repair as soon as practically possible. The water level in the pond should be kept low until the repair would be completed.

d) MS-11 – New Surface Water Management Pond at KM105

The KM105 surface water management pond (MS-11), shown in Figure 3, was designed, and constructed to provide sediment control for runoff water originating from the following catchment areas:

- The undisturbed areas upslope of the Mine Haul Road (MHR) and the KM105 ponds from which runoff cannot be easily diverted to other areas,
- The section of the MHR near the ponds, and
- The area of the ponds (north and south) themselves.

The pond includes an emergency spillway with an invert elevation of 220.5 m, which is the design maximum water level in the pond. At normal water level the pond has two separate areas: the "north and south ponds", as shown in Figure 3. As specified in the design, the upstream slopes of the pond embankments are lined with geomembrane liner, underlain by non-woven geotextile as a cushion layer. The geomembrane liner and non-woven geotextile extend up to the interior (upstream) slope of the embankments and are anchored at the crest. The geomembrane liner is covered with an additional layer of geotextile and a layer of compacted liner bedding, which in turn is covered with a layer of compacted transition material followed by more rockfill (riprap), as shown in Figure 32. As shown in the image (drill rig operating at the background), there is an ongoing geotechnical investigation at the base of the pond as part of the rehabilitation work at this pond.

Figure 33 shows the stable spillway that consists of a trapezoidal shaped inlet, constructed through the crest of the northwest embankment, and a stepped gabion basket outlet channel. A boulder apron is also shown in the image; constructed at the base of the spillway's outlet channel to dissipate energy as the potentially fast-flowing runoff would leave the spillway. A lined compacted pad is also shown in the image at the toe of the spillway. The pad will support geotubes at that location.

Figure 34 shows the loosely filled anchor trench with some wide, open gaps along the road next to the south MS-11 pond's slope. The gaps do not appear to be related to any slope movements in the area, however, should be backfilled and regraded to minimize water infiltration into the ground next to the slope, to prevent potential slope instability in the future. As shown in Figure 34, some crushed stone has already been placed into some of the gaps, however, the "landscaping" process should be finalized, and all open gaps should be eliminated by filling and regrading the area as soon as practically possible, preferably before the gaps would be filled with snow and ice.

2.4 Berms of the Cell for Generator Fuel Bladders

This cell has previously contained fuel bladders for the generators; however, it is currently storing mobile fuel tanks only. The cell is located south-west of hazardous waste cells, HWB-1 to HWB-5 (Figure 6). As shown in Figure 35, the stable perimeter berm around the cell generally comprises granular materials and the cell is lined. Ponding water within the cell indicates good liner performance.

2.5 Fuel Storage Berms (3)

There are three (3) fuel storage facilities at the Mary River mine site. One (1) is located at the airfield and two (2) adjacent to the main office complex of the mine, as shown in Figures 1 and 4. The berms and liners at these facilities are in excellent condition, as shown in the relevant images in Appendix A.

a) Jet-fuel Tank Farm

The jet-fuel tank farm is located adjacent to the airfield, and it is bounded by a stable perimeter berm. In addition, a second berm, constructed from crushed rock fill, provides additional protection at two (2) sides (Tote Road and airport parking area) of the facility. The fuel farm is lined to the crest of the perimeter

berms, and the liner within the cell appears to be in good condition. A well-constructed ramp at the berm provides safe vehicular access to the fuel tanks, stored within the cell (Figure 36).

b) MS-03 Diesel Fuel Tank Farm

The robust, stable berms around the MS-03 diesel fuel tank farm are in excellent condition (see Figure 37) and they are well maintained. Some ponding water within the cell indicates that the liner system is fully functional (i.e., no seepage from the cell is visible and the liner is well protected by granular fill throughout the facility). No problems with the liner were noted anywhere in this facility. In Figure 37 note the crushed rock fill on the downstream slope of the berm along the adjacent road, for additional protection against erosion.

c) MS-03B Fuel Tank Farm

A large capacity fuel tank farm is located adjacent to the Tote Road, as shown in Figure 38. This new tank farm was constructed as specified in the design drawings (subgrade, berms, bedding layer, liner, and protective cover). Based on site observations (presence of ponding water in the cell), the liner in the facility is intact, and all berms are stable and well maintained.

2.6 Solid Waste Disposal Area and Two New Landfarm Cells

The non-hazardous solid waste disposal area is in the southern zone of the Mary River Mine site, as shown in Figure 5. Recently, two (2) new landfarm cells were constructed near the gate of the main landfill facility, as shown in Figure 39. It is understood that the number of new landfarm cells will be increased to three (3) as shown in the image. Cells #1 and #2 have been recently completed covering an approximate area of 10,180 m^2, while cell 3 will be completed later.

Figure 40 shows that only non-hazardous solid waste is deposited into the unlined main landfill facility and that the site is surrounded by a chain-link fence and a lockable gate.

Based on relevant documents prepared by Knight Piésold Consulting Engineers (KP), the new cells (1 and 2) were designed as above-ground structures to avoid disturbing permafrost. According to the KP design documents, the berms for the two completed cells were constructed using 100mm minus granular material and covered by 150mm thick 25mm minus clean sand and gravel. The bedding layer was installed as a cushion to the 60-mil (1.5 mm) HDPE geomembrane, which is used to prevent any potential contact water from seeping into the subgrade and berms and escaping the containment system. The liner is covered with a 300mm thick, clean sand and gravel layer in the cells (floor and side-slopes). All liner-edges are anchored into a 300mm x 300mm key trench, located along the top of the berms. As shown in Figure 39, the cells are designed with a sump, located in one of the corners of each cell.

During the June 2023 inspection it was noted that the loosely placed granular material within the key trenches on the top of the berms has settled, resulting in a long depression along the top of the berms, allowing increasing erosion/sloughing on the top and sides of the berms. In addition, the elevated level of collected water within the cells has resulted in erosion (slump) of the granular cover layer placed over the liner, which in turn resulted in the slump of sections of that granular cover layer from the slope of the

berms, near the areas of the sumps. As shown in Figures 41 and 42, both deficiencies have been rectified by filling the settled key trenches and covering the exposed liner sections with granular fill.

2.7 Camp Lake Settling Check Dams and Berms

The Camp Lake settling control berms and check dams (all stable and well-maintained) are located along the access road to the mine's water intake jetty. The primary purpose of these structures is to collect (trap) fine soil particles (silts and clays) that are eroded down from the adjacent slopes, and to prevent the siltation of the lake around the water intake structure. As shown in Figures 43 and 44 the rockfill riprap in the channel and the check-dams have been recently upgraded and a new gabion wall was installed along the road to the lake. The images show that the check-dams are working well, as intended. Figure 44 also shows a new check-dam, constructed adjacent to Camp Lake to capture suspended solids (silts and clays) potentially eroding from the nearby airfield area and to prevent siltation in the lake.

2.8 Water (Effluent) Discharge Area

The effluent discharge point is located south of the Mary River mine complex, as shown in Figure 5. There are two (2) discharge pipes at that location conveying the clean, discharged water down the slope's surface to the adjacent valley. Trucks also bring water for discharge to this location and let the water flow down on the embankment, comprising crushed rock fill, as shown in Figure 45. As shown in the image, the slope is well-protected against potential erosion by the rockfill.

2.9 Rock Quarries (QMR2, D1Q1) and KM106 Ore Stockpile Area

a) QMR2 Rock Quarry

There is no activity (blasting and crushing) going on currently in the QMR2 rock quarry (Figure 46). The exposed slopes (rock face) in the quarry appear to be in stable condition overall, with a few localized fall hazards (loose boulders) noted at the upper and lower levels of the quarry in some areas. As shown in the image; however, boulders have been placed along the toe and crest of the rock face to prevent unauthorized access to critical areas.

As mentioned in earlier inspection reports, the lowest plateau (main level) of the quarry still exhibits somewhat poor surface water control and therefore periodic ponding surface water (rain and melted snow) still covers a section of the quarry's lower level, as shown in Figure 47.

The ponding water is then flowing uninterrupted along the side of the access road, as shown in Figure 48, still eroding the edge of the road, and initiating erosion and some settlement of the road embankment. As pointed out in earlier reports, the uncontrolled surface water presents not only potential slope stability issues in the area, but also traffic safety issues as well, particularly during freezing periods. To maintain traffic safety and stable side slopes when the operation in this facility will resume, the surface water at the quarry's main level should be collected in drainage ditches and a sump, and then properly drained from the sump down on the side-slope of the plateau. The location of the suggested drainage path is marked in Figure 4 by a blue arrow. It is recommended that consideration be given to the

installation of a slope-drain pipe, chute, or flume drain from the sump, as an erosion protection measure on the side-slope, instead of letting the water flowing uncontrolled along the edge of the access road.

b) D1Q1 Rock Quarry

No blasting or crushing is currently carried out in this quarry and as shown in Figure 49, the access road to the quarry was blocked by piles of rockfill at the time of the inspection. The condition of the exposed rock faces in the quarry will be inspected during the 2024 site visits, after the quarry will be reopened.

c) Diversion Berm at the KM-106 Ore Storage Area

The area previously considered as the future D1Q2 rock quarry is now serving as an ore stockpile site. As shown in Figure 3, the area is located south of the open pit, along the east side of the mine haul road (MHR). The surface water from the stockpile area is diverted to the adjacent MS-07 pond; however, run-off water from the surrounding area is collected in a new drainage ditch and a sump, shown in Figures 50 and 51. The drainage ditch is covered with riprap and the sump will also need to be covered by crushed rock to minimize siltation of the collected water, which is being pumped into the nearby MS-07 pond.

3.0 Milne Inlet Port Site

3.1 Hazardous Waste-cell Berms (HWB-1 to HWB-4)

There are four (4) hazardous waste disposal cells, three (3) active and one (1) decommissioned, with stable perimeter berms at the Milne Inlet Port site. HWB-1 (active) and HWB-2 (decommissioned) cells are single detached structures, located north-east and south-east of the MP-03 fuel storage area, respectively. HWB-3 and HWB-4; however, were constructed as twin-cells, located south/south-west of the fuel storage area, as shown in Figure 7.

a) HWB-1

The HWB-1 is the largest cell of the four, bounded by stable perimeter berms, constructed of thaw-stable granular soils, as shown in Figures 52 and 53, in Appendix B. Shipping containers, fuel barrels and other materials are stored in the cell, as shown in Figure 52. Ponding water was visible in the rear sump area of the cell (Figure 53), indicating that the liner within the cell is intact and working as intended.

No seepage from the cell was visible around the downstream toe of the perimeter berm and the granular fill, covering and protecting the liner across the cell's interior, is well maintained.

b) HWB-2

The HWB-2 was a small waste storage cell that is no longer used to store hazardous waste. As shown in Figure 54, the cell has been completely decommissioned and the area has been filled/regraded with clean sand and gravel.

c) HWB-3 and HWB-4

The well-maintained HWB-3 and HWB-4 cells are located immediately next to each other (twin-cells), as shown in Figure 55 and Figure 56. These cells contained only shipping containers in the past; however, the cells have been recently emptied and "refurbished". Currently the cells contain fuel barrels on wooden pallets, with only two (2) shipping containers stored in HWB-4. The lined berms around the cells have been re-graded/raised and appear to be in stable condition with no indication of slope movements or seepage. It is also shown in the images that the granular fill inside the cells has been re-graded/lowered, as recommended in the June 2022 inspection report.

3.2 MP-01A Polishing Waste Stabilization Pond (PWSP)

The MP-01A polishing pond is located immediately south of the MP-03 fuel storage facility. As shown in Figure 57, the robust berms around the well-maintained pond are in excellent condition and the liner within the cell appears to be intact. No sign of slope instability, settlement or seepage from the pond was noted during the field inspection. As shown in the image, the pond is currently almost empty.

3.3 MP-03 Fuel Tank Farm

The MP-03 fuel tank farm occupies a large area in the center of the Milne Inlet Port. As shown in Figure 58, the facility is well maintained and all berms around the site are in excellent condition. The presence of ponding water in the facility is an indication of good liner performance. The site is fenced in, and no indication of instability or seepage was noted at and around the robust berms at this facility.

Figure 59 shows a pile of soil fill in the western part of the MP-03 fuel farm. Based on site information from site services, this material was part of the granular base within the cell, and it is potentially contaminated with some fuel. Hence, it should be left in place at its current location within the facility.

3.4 MP-04 and 04A Land-farm and Contaminated Snow Disposal Cells

The MP-04 land-farm is in the southern zone of the Port at higher elevation (on the top of a hill), adjacent to the rock quarry. It is a large cell that stores potentially contaminated soils, a few empty shipping and numerous plastic containers, as shown in Figure 60.

The lined, robust berms around the cell are in stable condition and the ponding water in one (1) corner of the cell indicates good liner performance. No wet downstream slopes or toe seepage were noted during the June 2023 site visit.

The MP-04A is a smaller cell, constructed immediately adjacent to cell MP-04 and is used generally for the disposal of contaminated snow. This pond is also bounded by stable perimeter berms, as shown in Figure 61. No seepage from the cell was noted anywhere around the downstream toe of the berms, and the ponding water within the cell indicates that the liner is in good condition.

3.5 Surface Water Management Ponds and Ditches (Surface Water Management Pond #3, MP-05, MP-06 and MP-06A Ponds)

The iron ore that is mined, crushed, and screened at the Mary River Mine site is transported to the Milne Inlet Port, and stockpiled across a large area near the ship-loader. Contact water (rain and melted snow) from the area is collected along the west and north sides of the ore stockpile in side-ditches and conveyed into four (4) surface water management ponds, strategically located around the ore storage area, as shown in Figure 7 and Figure 8.

a) Surface Water Management Pond #3

Surface Water Management Pond #3 is located west of the ore storage area, as shown in Figure 8. The pond is bounded along three (3) sides by lined stable berms (Figure 62) and contains two (2) sumps. The geomembrane liner and protective geotextile on the internal slope of the berms were designed to extend 2.5 m below the surface and are anchored into the underlying permafrost zone to prevent any seepage from the pond into the ground below and to the surrounding environment. The berms and liner are in excellent condition. Excess water from the pond is pumped into the nearby, large capacity MP-06 surface water management pond whenever necessary (see Figure 68, showing the relevant hose for pumping).

b) MP-05 Pond

The MP-05 surface water management pond is located adjacent to the north-east corner of the ore stockpile, while the MP-06 and MP-06A ponds were constructed at the north-west corner. The three ponds are in excellent condition with stable, well-maintained berms and intact geomembrane liners, as shown in Figures 63, 64, 66 and 67.

No instability, erosion or settlement was noted at the robust berms of the MP-05 pond and no toe seepage from the pond is visible anywhere around the pond's perimeter berm. A small liner damage was noted near the crest of the southern inlet channel to the pond during the previous (June 2023) inspection; however, that damage has been repaired since, as shown in Figure 64.

The surface water from around the ore stockpile is collected in well-maintained, clean drainage ditches, as shown in Figures 65 and 68.

c) MP-06 and MP-06A Ponds

The large surface water management pond adjacent to the north-west corner of the ore stockpile area is divided into two (2) cells (MP-06 and MP-06A) by a liner-covered internal berm. The main (south) part of the pond is called MP-06 and is shown in Figure 66. The northern cell is called the "overflow pond" MP-06A, shown in Figure 67. The liner in the ponds and the stable, robust perimeter berms are in good condition, and no seepage was noted from the ponds, indicating good liner performance.

3.6 Q01 Rock Quarry

No activity was noted in the Q01 rock quarry at the time of the September inspection. The steep slopes (rock faces) in the quarry appear to be in stable condition with only minor weathering and bench erosion, as shown in Figure 69. However, large area of the quarry's lower level was covered with ponding water, indicating poor surface drainage control, as shown in Figure 70. The drainage situation should be rectified at this site by draining all surface water into the nearby drainage ditches, prior to restarting the operation in the quarry. It is suggested that additional drainage ditches be provided to improve the control of surface water.

3.7 Surface Water Collection Ditches (P-SWD-3, -5, -6, -7, W3/W14, 380-Person Camp and PSC ditches)

There are several surface water collection drainage ditches across the Milne Inlet Port site, some of them are still under construction or improvement, as shown in figures 71 to 83. These open ditches are excavated somewhat into the native soils and then their side-slopes and inverts are protected by crushed rock fill riprap or in many cases geotextile and riprap. Geotextile fabric has been used wherever the native subgrade along sections of the ditches is composed of somewhat finer soils to prevent migration of fines into the overlying crushed rock fill and eventually into the ditches. The issues (5) that were identified at these ditches during the September 2023 inspection are summarized below:

- As described in previous inspection reports, sloughing at the side slopes of the P-SWD-3 ditch, adjacent to the LP-2 laydown area, has occurred at several locations, as shown in Figures 71 and 72. It is evident that the sloughing of the slopes is a direct result of uncontrolled sheet-flow of surface water (melting snow from the adjacent snow-stockpile), flowing into the ditch that is not able to convey the water to the designated discharge location, marked by green circle "A" in Figure 7. As pointed out first in the 2021 inspection reports, the ditch invert currently slopes gently toward south-west, while the ditch was designed (and should) to drain the collected water toward north-east, toward the above noted discharge point (green circle "A" in Figure 7).

  To improve the drainage capability of this ditch it is recommended that it should be reconstructed to drain the large quantity of surface water from the snow-dump to the north-east (to green circle "A"). As shown in Figures 72 and 73, the culvert in the ditch beneath the access road to the snow-dump is currently clogged with soil and its invert level is located well above the invert of the ditch. This culvert should be reinstalled to the correct invert level (to be specified during the redesign process). To prevent the migration of fine soil particles from the ditch to the environment, a rockfill check dam must be installed/constructed at the discharge point of the upgraded/reconstructed ditch (green circle "A").

- A section of the P-SWD-5 ("Q01-North") ditch was noted with missing riprap, as shown in Figure 74. As reported earlier, it appears that there is continuous subsurface water seepage from within the adjacent granular pad of the quarry at this location, resulting in periodic sloughing/erosion of the side of the ditch just along this short section. It is recommended that the somewhat finer soil, currently

forming the side of the ditch, be removed to a depth of around 1 m and replaced with crushed rock fill. To minimize migration of fine soil particles from the quarry pad to the ditch, the crushed rock fill should be placed over a layer of geotextile fabric. The improvement of this section of the ditch shall be completed with the formation/excavation of additional drainage ditches, required to rectify the large ponding water across the lower level of the quarry.

- As shown in Figure 10, the P-SWD-6 ("Q01-South") ditch was constructed south of the rock quarry to drain surface water collected across the southern part of the quarry to strategically installed culverts at the south end of the ditch and subsequently to the west side of the Tote Road. Unfortunately, an area at the southern edge of the quarry was over-blasted, resulting in large quantity of ponding water there that is not able to flow into the P-SWD-6 ditch since its invert level is located well above the water level in this man-made pond. Figure 75 shows a section of the P-SWD-6 ditch with its invert above the adjacent ground levels. As mentioned in the June 2023 inspection report, the collected surface water from the over-blasted area of the quarry currently flows uncontrolled over the surface of the nearby access road, presenting continuous safety risk to the local traffic to and from the quarry. It is recommended that surface water from the pond and from the surrounding quarry area should be drained to a nearby valley, shown in Figure 76 and marked by a red rectangle in Figure 10. The upgraded drainage system will require the design and construction of new erosion-controlled drainage components in and adjacent to the valley (new ditches with geotextile and riprap cover, and at least three (3) new culverts. One of the new culverts will need to replace the inefficient culvert in the P-SWD-5 ("Q01-North") ditch, at the entrance to the quarry.
- As shown in Figure 79, there is a culvert at the west end of the W3/W14 ditch, where the geotextile and crushed rock riprap is missing from the ditch just at the front of the pipe's inlet. This discrepancy should be rectified as early as practically possible, by placing the necessary geotextile and riprap into the ditch.
- The PSC drainage ditch has a somewhat "L" shaped alignment (see Figure 7) and is located north of the P-SWD-3 drainage ditch along the northern edge of the LP-2 laydown area. As shown in Figure 82, localized slope degradation/sloughing is still visible at a short section of the ditch (marked by a red circle in Figure 7). The sloughing of the slope is apparently caused by frequent water seepage from the granular fill of the LP-2 laydown pad. It is likely that the frequent seepage at this location is a result of the inefficient drainage of surface water within the above discussed P-SWD-3 ditch.
  As pointed out above, the collected surface water in the P-SWD-3 ditch should drain toward its north-east end. However, currently the water flows to the opposite direction. At the south-west end of the ditch the collected water seeps into the granular fill pad of the LP-2 laydown area and most likely exits at the location where the frequent slope problem is visible at the PSC ditch (marked by the red circle in Figure 7). It is recommended that the drainage conditions at the P-SWD-3 and PSC ditches be reviewed and rectified as early as practically possible. Once the drainage conditions in the P-SWD-3 ditch would be improved/rectified, the failed slope at the PSC ditch can also be repaired. The reparation should include the removal of disturbed riprap from the affected area, placement of

geotextile on the exposed surface of native soils and placement of new, clean rockfill riprap. Based on field observations, the outflow end of the ditch must also be upgraded by the installation of geotextile and riprap along the base and side-slopes of the ditch, shown in Figure 83. To prevent the migration of fine soil particles from the ditch to the environment, a rockfill check dam must also be installed/constructed at the discharge point of the upgraded/reconstructed ditch (see the green circle "B" in Figure 7).

3.8 Tote Road Ditches and Culverts

Surface water from the P-SWD-6 drainage ditch is conveyed down toward the Tote Road through corrugated galvanized steel culverts, installed under an access road to the quarry and then under the Tote Road (Figures 84 and 85). The collected water is conveyed through the Tote Road culverts to small natural ponds, located along the west side of the Tote Road. Both culverts appear to be clean, and the seasonal flow through them is uninterrupted.

3.9 Effluent Discharge Pipe and Slope

The discharge end of the effluent water pipe in the Port is located just north of the fuel storage facility, as shown in Figure 7. The slope in the immediate vicinity of the discharge point is covered with riprap; however, deterioration of the adjacent slopes of the valley, comprising native sandy soils, is visible (Figures 86 and 87). As shown in Figure 87, there is a steel pipe bridging over the valley (frequently used by the Port's site services), supported by the slopes. In order to prevent further deterioration of the sandy slopes it is recommended that the valley beneath the casing pipe be filled with crushed rock fill, placed over high-strength geotextile fabric, Terrafix600R or stronger. Placement of such rock fill will prevent erosion of the fine soil particles from the valley to the bay and provide support for the heavy casing pipe.

3.10 LP-5 Storage Pad

A network of natural cracks and depressions were noted on the surface at the edge of the LP-5 storage area in 2022. This storage pad was apparently constructed over patterned native ground, where the periodic formation and thawing of ice wedges resulted in a network of "stripes" (depressions/cracks) within the active layer. It is most likely that this network of "ground depressions" was generally "eliminated" beneath most of the storage pad during its construction; however, a few depressions may still develop, particularly along the edges. As recommended earlier, the cracks have been filled recently with the same material that was used for the construction of the pad (clean sand and gravel), as shown in Figure 88.

3.11 Western Globe Fuel Module (WGFM)

The Western Globe Fuel Module (WGFM), shown in Figure 89, is located north of the 380 Camp. Figure 90 presents part of a historic design drawing (drawing number C01), showing a section of a 900 mm wide (at its crest) and 450 mm high drainage control hump with 10H:1V slopes, specified by B.H. Martin

Consulting Engineer and Architect in June 2016. The purpose of the humps at the entrance and exit points of the refueling station was to prevent oily surface water escaping the refueling area. As shown in Figure 90 the entire area of the refueling station has a liner beneath the road fill, which liner should also have a 10H:1V slope up to the internal edge of the 900 mm wide humps. Under the heavy truck traffic at the station, those humps were flattened/spread in the past but shall be reinstated. It is suggested that the edges of the liner beneath the road fill be exposed using hydrovac, and the humps reconstructed as designed.

4.0 Tote Road Between the Mary River Mine and Milne Inlet Port

Four (4) bridges and one (1) selected culvert with check dams were visually inspected during the September 2023 site visit. In addition, the condition of the mine haul road (MHR) between KM-104 and KM-110 was also reviewed and the results are presented here. The general condition of the foundations at the bridge abutments and the drainage control features at the mine haul road are summarized below, and the relevant images are shown in the attached Appendix C document. Comments are also presented at the end of the report in connection with the impact of the road on permafrost (if any).

4.1 Bridges (4)

a) Bridge 17 (located approximately 17 km from Milne Inlet Port)

As shown in Figure 92 and Figure 93, the abutments of this bridge appear to be stable, and no scour was noted in the riverbed around the abutments during the recent site visit. The abutments show no visible differential settlement or any structural discrepancy like deterioration of the steel bolt-a-bin abutments or sloughing of the riprap rock fill.

There were two (2) historic abutments located immediately adjacent to the “new” ones, but both have been recently removed at this bridge and replaced with rock fill, as shown in Figures 94 and 95. The rock fill slopes appear to be stable and provide additional erosion/scour protection to the adjacent abutments.

b) Bridge 63 (located approximately 63 km from Milne Inlet Port)

As shown in Figure 96 and Figure 97, the abutments of this bridge are stable and no scour around the abutments was noted during the site visit. The abutments show no visible differential settlement or any structural discrepancy like damages to the bolt-a-bin foundation cribs. There are the “remnants” of two (2) historic abutments (one of them is visible in Figure 97), located immediately adjacent to the “new” ones and some minor damages to the metal bins of both old abutments are visible. To prevent migration of fine soil particles into the river, a silt curtain was installed at the front of one of the old abutments, as shown in Figure 97.

c) Bridge 80 (located approximately 80 km from Milne Inlet Port)

As shown in Figures 98 and 99, the abutments of this bridge are stable and no scour around the abutments was noted during the site visit. As opposed to other bridges, the "old" bolt-a-bin abutments are still in relatively good condition at this location, as shown in Figure 98.

d) Bridge 97 (located approximately 97 km from Milne Inlet Port)

As shown in Figures 100 and 101, the abutments of this bridge appear to be stable and no scour in the riverbed around the foundations and approach embankments was noted during the September 2023 site visit. The abutments show no differential settlement or any structural discrepancy like deterioration of the foundation bins.

4.2 Selected Culvert (1) and Adjacent Check Dams at KM33+000

One culvert and adjacent check dams were inspected near the Lake Access Road at KM 33+000. As shown in Figure 102, the culvert's inlet has been damaged recently, potentially clogging the culvert. The image in Figure 103 also shows large quantity of finer soil, deposited at the front of the pipe's outlet. To provide uninterrupted flow, the culvert should be cleaned or replaced as soon as practically possible. More rockfill should also be placed around the culvert's inlet, while the silt deposited at the front of its outlet should be removed (Figure 103). The crest of the nearby check-dams (Figure 104), show some loss of rock fill. The crest of the dams should be raised by placing additional rock fill and the ditch behind the dams should be cleaned (fine soil removed).

4.3 Section of the Haul Road Between the Crusher Pad and the Open Pit (KM104 – KM106).

The recently improved drainage condition along a section of the haul road between the crusher pad and the open pit was also reviewed during the September 2023 inspection. As shown in Figures 105 and 106, significant improvement to control surface erosion along the haul road was completed recently. The improvement included upgrading the side ditches along the uphill side of the haul road, as shown in both images. Run-off, flowing on the surface of the wide haul road is being captured by the formation/construction of whoa-boys and cross ditches, as shown in Figure 106. Whoa-boys are low profile, trafficable earth banks combined with shallow ditches across roads, and are very efficient to minimize erosion of unpaved roads.

4.4 Comments in Connection with the Impact of Roads on Permafrost.

Permafrost, or perennially frozen ground, is defined as a thermal condition. Earth materials (soils and rocks) in this thermal condition are described by the adjectives like perennially frozen soil, or perennially frozen rock, irrespective of their water and ice content. Moisture in the form of water and ground ice may or may not be present in the soils and rocks. Perennially frozen soil (or rock) without ice or with an ice content up to its pore volume (pore ice), is called dry permafrost.

As described in relevant literature, the forms of ground ice can be grouped into five main types:

- *pore ice,*
- *segregated ice,*
- *foliated or wedge ice,*
- *pingo ice, and*
- *buried ice.*

Pore ice, which fills or partially fills pore spaces in the ground is formed by pore water freezing in situ with no addition of water. Segregated ice includes relatively thin ice films, seams, lenses, pods, or layers generally 1 to 15 cm thick that grow in the ground by drawing in more water as the ground freezes. Pore and segregated ice are the most extensive type of ground ice, and in places they represent about 75% of the ground by volume.

Based on borehole results and field observations, pore and segregated ice appear to be the predominant ice formations within the relatively thin active layer in the Mary River area. Wedge and buried ice formations appear to be found at deeper elevations in deeper boreholes.

Wedge ice is the term for generally larger masses of ice growing in thermal contraction cracks in the permafrost zone. Pingo ice is clear, or relatively clear, and occurs in permafrost mostly horizontally or in lens-shaped masses. Such ice originates from groundwater under hydrostatic pressure. Buried ice in permafrost includes buried sea, lake, and river ice and recrystallized snow, as well as buried blocks of glacier ice.

The top layer of the ground near the surface is called active layer, underlain by the permanently frozen ground, as shown in Figure 107. The permafrost areas in Canada include continuous, discontinuous, sporadic, isolated, and subsea zones, as shown in Figure 108. As shown in the map, the Mary River project is in the northern area of the continuous permafrost zone, where the thickness of the permanently frozen ground is several hundred meters.

The active layer is the top layer of ground above the permafrost mass that thaws each summer and refreezes each fall until the next summer. Its thickness depends on many factors, including the degree and orientation of slope, vegetation, drainage, snow cover, soil, and rock type. Within the active layer the moisture content may vary from year to year depending on local weather and drainage conditions. In the northern part of Baffin Island, around Mary River, the thickness of the active layer is thin, generally less than 1.2 m, as shown in Figures 109 and 110. Figure 109 shows the range in ground temperature in a 15 m deep borehole, drilled and monitored in the nearby Pond Inlet by the Geological Survey and Natural Resources of Canada. As shown in the graph, the mean temperature in the ground was around -9°C. The temperature fluctuated within the 15 m depth, being approximately -25°C near the surface in the winters and around +7°C in the summers. The ground temperature was positive only within the active layer, with a thickness of 1.0 m only.

Thawing (and potentially melting) of the upper zone of the permafrost (immediately beneath the active layer) may be caused:

- By natural climatic cycles which can increase the temperature of the ground near the surface causing the upper zone of permafrost to thaw/melt (resulting in the variation in thickness of the active layer).
- Indirectly by human activity through changing climate or warming of ground over time due to the construction of heated infrastructure components like buildings (roads are not such components).
- Directly by human activity through disturbance of the upper zone of the ground, like large and potentially deep excavations (open pits, for example). When the active layer is disturbed or removed, the exposed permafrost (immediately beneath the active layer) will begin to thaw/melt. Such activity can be excavation/cut of zones along roads (transportation corridors), or excavation of ponds (solid and liquid waste management) etc.

There are some hazards having potential impact on infrastructure components that are related to the thawing/melting of the upper veneer of the permafrost, such as weakening of frozen slopes resulting in landslides or avalanches; effect of thaw settlement and frost heave on infrastructure components causing cracking or collapse of roads, buildings and bridges, or the combinations or chain reactions of these processes. Although some of these hazards are present along the Tote Road between Mary River and Milne Inlet Port, the actual extent of such potential problems does not reach serious level since the impact on the permafrost along the road is limited.

The Tote Road between Mary River and Milne Inlet Port was constructed by generally following the original topography and within the narrow, 30 m wide road alignment right-of-way (ROW) to minimize costs and the impact on the permafrost. As pointed out in the 2019 Tetra Tech report, material for the construction of generally shallow road embankments was sourced from within the active layer and comprised thaw-stable, generally granular materials. Instead of cutting deeper into the permafrost at limited sites, the fill materials were obtained from about 90 widely spaced borrow areas, where the cut into the ground (into the permafrost with potentially greater ice content) was limited. Images of two representative borrow areas with exposed slopes are shown in Figures 111 and 112. The slopes were generally excavated to their natural angle of repose, which are somewhat steeper than the desired slope inclination in road cuts. However, the toes of these slopes are generally located further away from the edge of the road (Figure 111) and do not represent any risk to the stability of the road. The stability of slopes that are located somewhat closer to the edge of the road (Figure 112) require continuous monitoring, and in case of potential (limited) movements/slides, they should be regraded.

As pointed out above, the material used for road construction generally comprises thaw-stable granular soils and the exposed subgrade along most part of the road also comprises thaw-stable granular soils with generally limited ice inclusion. This appears to be the reason that no serious road embankment or slope instability was reported to date. Of course, there are areas with finer soil deposits and somewhat

thicker/larger ice inclusion, which may result in some softening of the road structure, however these areas are reportedly controlled by the road maintenance team.

In summary, the impact of the road on the permafrost was generally limited and mostly occurred during the construction of the road. However, as pointed out in the 2019 Tetra Tech report and have been observed at several locations along the road during recent field inspections, there are a few visible deficiencies that could have adverse effect on the stability of the road embankment and slopes, on traffic safety and on the thickness and condition of the active layer locally. The most visible deficiencies are:

- Poor drainage (surface water control) along sections of the road embankment, particularly next to cut slopes and shallow embankments (Figures 112 and 113). Ponding water immediately next to road embankments may soften certain soils within the road structures (particularly within the side-slopes) and may impact the active layer by providing the source for excessive ice development within the road structure during freezing periods. Figure 112 shows a typical location of poor drainage. The low area between the road and the nearby cut slope collects all snow during winters (pushed off the road during snow clearing), which thaws in the summer resulting in problems in the road and in the slopes. Areas of trapped water should be monitored along the road and the water should be drained and kept away from the edge of the road embankment by excavating shallow but efficient ditches and installing more culverts at strategic locations. As recommended in the 2019 Tetra Tech report, water routed in ditches should be dissipated at discharge points by the installation of rock fill check dams. Good example of check dams is visible in Figure 104. Once installed, the condition of such dams should be monitored and maintained.
- Short culverts represent another hazard to the road embankments and to the truck traffic. It is understood that the width of the initial (early stage) road was narrower than the current, upgraded road. During road widening, new culverts have been installed at most locations; however, a few short culverts were left in place along the road. At those locations the road narrows quite substantially at a few places. At the narrow “bottleneck” there is no road shoulder or safety berm present, which condition can be an increased traffic safety risk (Figures 113 and 114). Additional problem with short culverts is the increased erosion of the road embankment at both ends of the culverts, as shown in Figure 115. The discharged water may result in the undermining of the adjacent embankment slope, which in turn initiates the sloughing of the embankment’s slope.

In summary, the impact of road construction on the permafrost, between Mary River and Milne Inlet Port, was relatively low and generally occurred during construction. Current, potentially adverse effect can be attributed to poor surface water and erosion control along the sides of the road at several locations. These deficiencies can be rectified by the installation of appropriate culverts and by implementing a more efficient surface water control in areas where large, trapped ponding water areas become visible during the early stage of the short thaw period of the years. It would be advantageous, if a condition survey would be completed along the road, to map the most critical locations (trapped surface water areas and

short culverts). Such survey should be completed during the early stage of the thaw period, when the melted snow (cleared from the road and pushed aside) might result in ponding water areas immediately adjacent to the road embankment.

5.0 Conclusion

WSP Environment & Infrastructure Canada Ltd., has completed the second of the two (2) required geotechnical site inspections of 2023 at the Mary River Project in Nunavut. Based on field observations, the condition of the inspected infrastructure components can be summarized as follow:

- The surface water management ponds and waste disposal areas are enclosed by relatively shallow, stable, in many cases robust, berms. The berms show no signs of instability, there are no tension cracks or excessive settlements, and no detrimental slope erosion is visible on the berms. These structures were constructed by using thaw-stable, generally granular, locally available materials, placed over thaw-stable subgrades. Foot traffic on the berms (crest and slopes) must be minimized, while truck traffic on them must always be avoided. Wherever truck traffic into the cells is necessary, ramps are provided, and those ramps shall be maintained in good condition. Some localized damages on the crest and slopes were noted at a few waste disposal cells (HWB-06, new land-farms etc.), however, most of those discrepancies have been rectified by site services during the September visit, immediately after the discrepancies were reported to them.
- The waste storage cells, and surface water management ponds comprise HDPE/LLDPE liners, which are in good condition. No seepage from the currently operating ponds and cells was noted. Minor damage to the liner was noted at one location only (geotube pond near the waste rock storage facility), as detailed above in this report and shown in the relevant image in Appendix A. As specified, the minor damage to the liner should be repaired as soon as practically possible.
- Open drainage ditches and culverts across the Mary River and Milne Port sites are generally in good condition with some erosion and sloughing of slopes visible at a few locations, particularly where the riprap slope protection is missing. As part of the maintenance program, the eroded sides of the ditches should be repaired/regraded, and the missing rock fill riprap replaced. One (1) of the drainage ditches in the Port (P-SWD-3) still requires special attention. Currently the floor of this drainage ditch slopes away from the designed discharge point (north-east end), which resulted in a situation where the ditch is discharging water into the granular fill pad of the LP-2 storage area and causing problems at the nearby PSC ditch as well. It is recommended that the P-SWD-3 ditch be redesigned and reconstructed to facilitate efficient drainage of all surface water to the north-east. The design must consider the fact that large amount of snow is stockpiled adjacent to this ditch every winter that generates excessive quantity of run-off water in the spring/summer that must be drained more efficiently toward the north-east. Installation of a rockfill check-dam at the outlet of that ditch is also recommended.

- Other problematic areas are the lower levels of the quarries both in Mary River and Milne Inlet Port. In the port the overall surface water control shall be reevaluated, and the drainage problems be solved. Installation of new culverts, improved drainage ditches and a new discharge point in a nearby valley will need to be included in the review and new design in the Port. In the main quarry in Mary River, the improvement in surface water control will need to include collection ditches, a sump, and a water discharge structure on the face of a high slope, as detailed in this report.
- The MS-11 surface water management ponds (north and south) at KM-105 in Mary River, were designed and constructed to provide sediment control for runoff, originating from large areas along the mine haul road. It was noted that the recently collected water from the pond has found its way within the active layer (bypassing the liner) and seeped toward downstream beneath the spillway. It is understood that the potential location of the leak is still under investigation and steps will be made to rectify the situation and bring the pond back into service.

6.0 Closing Remarks

We trust that the above technical report and its appendices provide you with satisfactory information in connection with the reviewed infrastructure components at the selected sites of the Mary River Project. Should you have any questions regarding this report, please do not hesitate to contact our office.

Sincerely,

WSP Environment & Infrastructure Ltd.

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