Baffinland

December 16, 2019

Jonathon Mesher
Water Resources Officer, CIRNAC
Nunavut District, Nunavut Region
P.O. Box 100
Iqaluit, NU X0A 0H0

RE: Water Licence 2AM-MRY1325 September 2019 Inspection

A Water Licence Inspection was conducted on September 17-19, 2019, at Baffinland's Mary River Project by the Crown-Indigenous Relations Northern Affairs Canada (CIRNAC) Water Resource Officer and Environmental Assessment Specialist. During the inspection, some immediate concerns were identified regarding the Milne Port ore stockpile ditching system. The inspector requested that the ore pad ditches be restored to function to convey water to the respective settling ponds specifically the NE and SE corner of the ore pad within thirty (30) days of discovery. A letter was provided on October 17, 2019 confirming that this work has been completed as requested.

The attached Table 1 provides a summary the Inspector's key observations and concerns requiring response for December 15, 2019. Baffinland has detailed responses to these items in Table 1.

Should you require further information, please feel free to contact the undersigned at (647) 253-0596 Ext. 6016.

Prepared by:

Connor Devereaux
Environmental Superintendent

Reviewed by:

Christopher Murray
Environmental & Regulatory Compliance Manager

Attachments:
Attachment 1: 2AM-MRY1325 September 2019 Inspection Report
Attachment 2: Table 1- Baffinland's Responses
Attachment 3: Trigger Action Response Plan (TARP) for Potential Erosion and Sediment Release Events
Attachment 4: Mine Operations 2020 Freshet and Mine Haul Road Water Management Improvements

Cc: Assol Kubeisinova, Karén Kharatyan (NWB)
Chris Spencer (QIA)
Justin Hack, Jeremy Fraser (CIRNAC)
Tim Sewell, Megan Lorde-Hoyle, Lou Kamermans, Shawn Stevens, Amanda McKenzie (Baffinland)

Attachment 1:
2AM-MRY1325 September 2019 Inspection Report

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INSPECTION FORM

☒ Original
☐ Follow-Up Report

Licensee	Licensee Representative
Baffinland Iron Mines Corporation(BIMC)	William Bowden
Licence No. / Expiry	**Representative's Title**
2AM-MRY1325	Environmental Superintendent
Land / Other Authorizations	**Land / Other Authorizations**
8BC-MRY1416, 2BE-MRY1421	N2014X0012, N2014Q0016, N2014C0013
Date of Inspection	**Inspector**
September 16-19th, 2019	Jonathan MESHER

Activities Inspected

☒ Camp ☐ Drilling ☒ Mining ☐ Construction ☐ Reclamation ☐ Fuel Storage
☒ Roads/Hauling ☐ Other: ☐ Other: Municipality

SECTION 1 ☒ **Comments** (s.__) ☐ **Non-Compliance with Act or Licence** (s.__) ☐ **Action Required** (s.__)

Inspector Statement

A water licence inspection was conducted at Mary River and Milne Inlet to ensure compliance with the terms and conditions of the Water Licence 2AM-MRY1325. This inspection was conducted by Water Resource Officer JONATHAN MESHER on September 16th through 19th, 2019.

Inspection

1. **Tote Road, Bridges and associated Water management structures.**
   - **a)** During the inspection it was noted that no work has been completed on the bridges as recommended in the "2019 Geotechnical Inspection Report No. 1 (July 2019)".
   - **b)** The inspector noted significant amounts of sediment under the bridges. The licensee installed wood on the bridges in an attempt to prevent this deposit of sediment to the rivers below. During the inspection the bridges were covered in mud and sediment rich waters was trickling off the bridges onto the rocks below. See Photos 1 and 2 for images of the sediment accumulation under the bridges.
   - **c)** Km 63 Bridge had signs of erosion upstream on the port side of the bridge. The licensee is to install the appropriate erosion control measures in order to prevent further sediment from entering the surrounding waterways. See photos 3 and 4 for upstream and downstream images of the erosion.
   - **d)** Throughout the Tote Road the licensee is cutting small ditches with the grader to aid in keeping water off the roads. Some of the ditches constructed are eroding and do not appear to be constructed to the standard. The inspector is recommending that the licensee install ditches to the approved design, as described in the Hatch document Design Criteria "CIVIL" where required.

2. **Ore Stockpile and associated water management structures.**
   - **a)** During the inspection there was ore blocking the flow path of water in a ditch on the North West side of the Ore Stockpile Pad. The licensee is to remove this Ore. See photo 5
   - **b)** The licensee has upgraded the ditch leading into MP-05. No concerns were noted regarding this construction.
   - **c)** The Inspector identified discrepancies between the Ore Stockpile Pad and the provided AS-BUILT/ Issue for construction drawings (IFC) produced by HATCH (H349000-2133-10-035-0002). The Pad appears to be missing outer berms and the ditches on the SE side near the entrance. Once identified, the inspector requested the licensee to install the required ditches within 30 days as of September 17, 2019 and is to install all berms described in the engineered drawings. The missing ditches and berms are approximately within the red circle on Photo 6.
   - d) The ditches East of MP-06 did not appear to have the proper sloping, low points are visible. This would likely cause pooling of water.

3. **Waste Rock Stockpile and associated Water management structures.**
   - **a)** At the time of the inspection, the upgrades on the sedimentation pond were approximately 75 % completed with the full upgrade expected on or about October 24th, 2019. No concerns were noted at time of the inspection. See photo 7 for work being done at the time of the inspection.
   - **b)** At the time of the inspection the licensee had completed the installation and required upgrades to the ditches. During the inspection the ditches were snow covered. A more in-depth inspection will be conducted during open water season.
   - **c)** The licensee is still investigating what the potential causes of the leak from the Waste Rock Stockpile Pond were; one potential cause is the lack of granular fill placed upon the existing tundra. The inspector is requesting that the licensee provides the reason for this leak once determined.

4. **Mine Haul Road**
   - **a)** The licensee is having issues with preventing/controlling erosion on the side on the Mine Haul Road. This erosion appears to be caused by the culvert outlets on the downhill side of the Mine Haul Road. See photo 8 for erosion mentioned above.
   - **b)** As stated in Part D, item 5 of the Water Licence 2AM-MRY1325; "The Licensee shall implement sediment and erosion control measures, as required, prior to and during the Construction and Operations Phases of the Mary River Project to prevent and/or minimize sediment loading into Water." It is evident that erosion control measures are required. The licensee is to develop a plan to stop this erosion from occurring. This plan is to be submitted to the NWB for review to ensure its adequacy prior to December 15th, 2019. This timeline will ensure it has enough time to be reviewed prior to Fresher 2020.

5. **Ore Crushing Area and associated water management structures.**
   - **a)** At the time of the inspection the ditch system around the stockpile was not functioning as intended. The licensee is currently pumping water into the ponds from the pooling water on the Pad. The licensee is to ensure this water management structure is functional prior to freshet 2020. See photo 9 for the pumping occurring.
   - **b)** As mentioned in previous inspection reports the slope of the ditches do not appear to be properly graded as there are visible low points. The inspector is requesting a summary of any construction work that has been completed to this ditch system since January 1st, 2018.
   - **c)** The ditches on the North West side of the Crusher pad are covered with or possibly constructed of Ore. In this same area there is visible Ore outside the containment area. The inspector is requesting this Ore to be removed or for the licensee to provide approval for the usage of Ore as construction material. See Photo 10 for the ditch and berm that is laden with Ore.
   - **d)** The licensee does not appear to be able to deal with surface water on and adjacent to the Ore Crusher pad. The inspector it requesting that the licensee develop a plan to deal with the constantly pooling water to the North West side of the pad (on the left of Photo 10) and the pad its self.

6. **Jet A fuel berm near the Runway**
   - a) During the inspection there were signs of erosion on the south berm wall. This erosion appears to be occurring due to water flowing off the runway towards the outer road. The licensee it to employ the appropriate erosion control measures to prevent this from occurring in the future. See photo 11 for the area of erosion.

7. **Ore used a construction material/ outside of containment.**
   - **a)** During the inspection there were multiple areas in both Mile Inlet and Mary River sites where Ore was being used as a construction material and/or being stored outside containment area. The licensee is to remove this Ore or to provide the approval for this usage of Ore as construction material. The following are the areas identified during the inspections; behind the old HTO cabin, next to MSC AC wing, old tire shop next to ore stockpile, the original bulk sample and the Northwest side of the crusher pad.

8. Spill identified during the inspection.

a) During the inspection at the Sailivik Waste Water Treatment Plant, the inspector identified an active leak from a sea can holding sewage sludge, this sludge was stored inside clear garbage bags that appear to have been tossed into a leaky sea can. The bags which the sludge was stored in were on top of cardboard; the placement of this cardboard led the inspector to believe that this identified spill is not an isolated incident but rather has been ongoing for a while with the licensee's full knowledge. At the time of the inspection the inspector was informed that this sea can was used all summer long. See photo 12 for this storage of sludge.

b) Section 5.6.1 of the Hazardous Materials and Hazardous Waste Management plan (BAF-PH1-830-P16-0011), explains how Hazardous waste is intended to be stored on site. Baffinlands current storage was not in a sound, sealed or on an undamaged container and it was not stored in a manner to prevent spills. Therefore, the licensee appears to be out of compliance with the Hazardous Materials and Hazardous Waste Management plan. The licensee is to discontinue the usage of sea cans as secondary containment and to develop a plan for the storage of this sludge prior to the disposal. The licensee is obliged to notify this inspector once the plan has been developed for storage of the sludge prior to disposal. The plan must adhere to the terms and conditions of the license.

9. Spill locations inspected at the time of the inspection

a) Mine Site Complex (MSC) lift stations. At the time of the inspections all MSC lift stations appeared to be properly remediated and no concerns were noted. Therefore, the inspector is closing the following spills;16-065,16-210, 16-316, 16-374, 16-377, 16-403,17-008, 17-012, 17-014, 17-026, 17-032, 17-045, 17-133, 17-215, 18-037, 18-050, 18-051, 18-062, 18-089, 18-098, 19-099, 18-118, 18-131, 18-140, 18-153, 18-451, 18-481, 19-002.

b) MSC Waste Water Treatment Plant (WWTP). At the time of the inspections the MSC WWTP appeared to be properly remediated and no concerns were noted. Therefore, the inspector is closing the following spills; 16-327, 16-434, 17-045, 18-016.

c) Drainages flowing through and adjacent to the Mary River Site that lead into Shear Down Lake; these areas have been experiencing annual elevated TSS significantly above the allowed 30mg/L for more than 3 years. Due to this annual failure to comply with PART F, Item 27, Table 11 the Inspector is requesting that the licensee develop a plan to ensure that this annual act of non-compliance discontinues. This plan is to be submitted to the NWB and the inspector for review to ensure its adequacy prior to December 15th, 2019.

d) Drainages flowing through and adjacent to the Mary River Site that lead into Camp Lake; these areas have been experiencing annual elevated TSS significantly above the allowed 30mg/L for more than 3 years. Due to this annual failure to comply with PART F, Item 27, Table 11, the Inspector is requesting that the licensee develop a plan to ensure that this annual act of non-compliance discontinues This plan is to be submitted to the NWB and the inspector for review to ensure its adequacy prior to December 15th, 2019.

e) Spill 19-201 was a spill of DEF fluid onto a laydown area at approximately W71° 19' 16" N79° 20' 07". No concerns were noted at the time of the inspection and the site appears to be properly remediated.

Comments	☒ Non-Compliance with Act or Licence	☒ Action Required

The following is a list of non-compliance and actions required by the Licensee.

I. To install the appropriate erosion control measures to prevent further sediment from entering the surrounding waterways at the Km 63 Bridge.

II. Remove the Ore from all unauthorized areas around the site including ditches and the areas identified in 7A above.

III. To install the uninstalled ditches on the Ore stockpile within 30 days of the inspection and to provide a plan to install the required ditches/diversion berms around the Ore stockpile as described in the

HATCH For Construction drawings H349000-2133-10-035-0003.

IV. To ensure that all ditches on site are constructed, as described, in the engineered drawings and are operating as intended.

V. To provide the findings of the internal investigation on why the waste rock stockpile pond was leaking.

VI. To install the appropriate erosion control measures to prevent further erosion on the side of the Mine Haul road.

VII. The licensee is to discontinue the usage of sea cans as a secondary containment and to develop a plan for the storage of this sludge prior to the disposal.

VIII. To prevent future acts of non-compliance at Camp Lake and Shear Down Lake (unapproved levels of TSS) The licensee is to develop a plan to prevent this annual failure to comply with PART F, Item 27, Table 11 which states; “All Contact Water and surface runoff from the site Drainage and Surface Water Management Systems where flow may directly or indirectly enter a water body, shall be sampled weekly during the Operations Phase of the Project and must not exceed the following Effluent quality limits: Total Suspended solids-Maximum Average concentration 15 mg/L- Maximum Concentration of any grab sample 30mg/L” The licensee is required to develop the plan mentioned above prior to December 15th, 2019.

Licensee or Representative	**Inspector’s Name**
	Jonathan Mesher
Signature	**Signature**
	
Date	**Date**
	10/8/2019

Office Use Only:	Follow-up report to be issued by Inspector	☐ Yes	☐ No

CC: Licensing Department, NWB
Justin Hack, Manager of Field Operations, CIRNAC

PHOTO LOG

Date	**Camera**	**Inspector**	**Authorization**
	Sony Cyber-shot	J.Mesher	2AM-MRY
Photo Log		**Location Iqaluit**	

Photo 1

Description: sediment under bridges

Date	Camera	Inspector	Authorization
	Sony Cyber-shot	J.Mesher	2AM-MRY
Photo Log		**Location Iqaluit**	

Photo 2

Description: sediment under bridges.

Date	Camera	Inspector	Authorization
	Sony Cyber-shot	J.Mesher	2AM-MRY
Photo Log		**Location Iqaluit**	

Photo 3

Description: erosion near bridge

Date	Camera	Inspector	Authorization
	Sony Cyber-shot	J.Mesher	2AM-MRY
Photo Log		**Location Iqaluit**	
Photo 4			

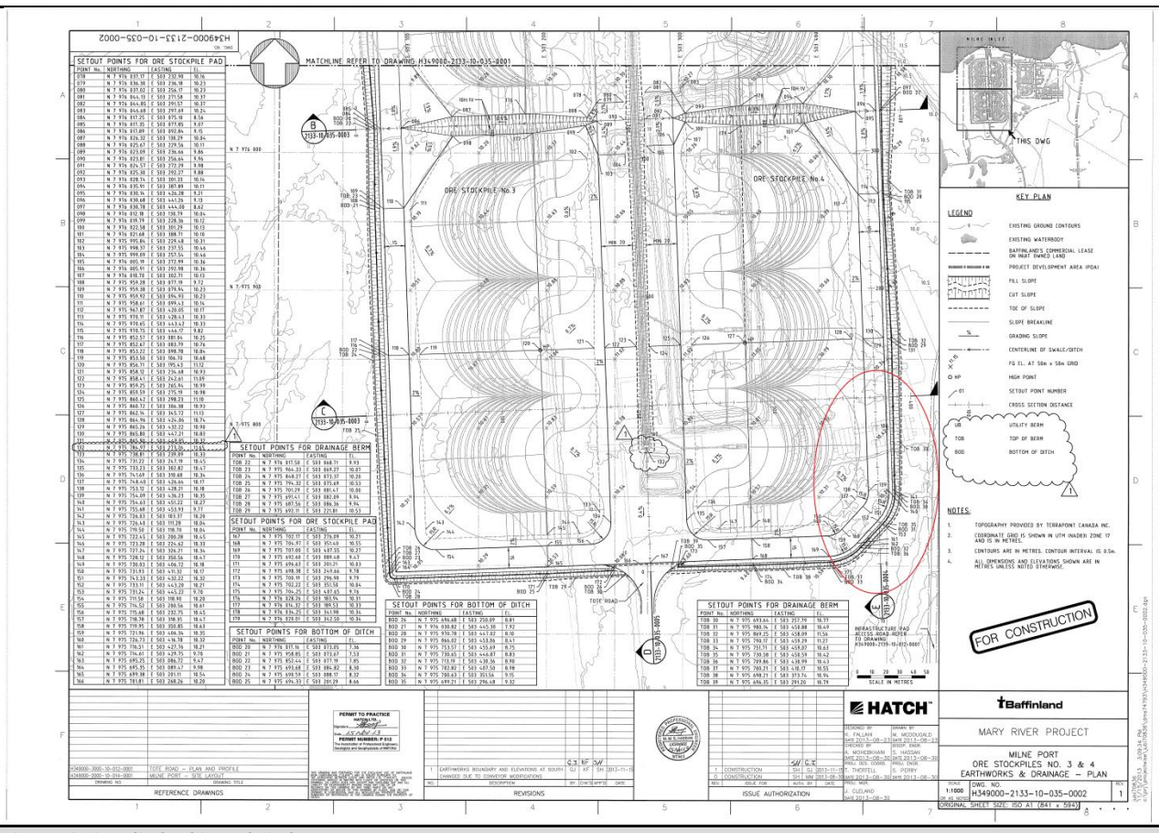
Description: erosion near bridge

Date	Camera	Inspector	Authorization
	Sony Cyber-shot	J.Mesher	2AM-MRY
Photo Log		**Location Iqaluit**	
Photo 5			

Description: ore in ditch at ore stockpile

Date	Camera	Inspector	Authorization
	Sony Cyber-shot	J.Mesher	2AM-MRY
Photo Log		**Location Iqaluit**	

Photo 6



Description: missing ditched in red circle

Date	Camera	Inspector	Authorization
	Sony Cyber-shot	J.Mesher	2AM-MRY
Photo Log		**Location Iqaluit**	

Photo 7

Description: waste rock stockpile pond upgrades

Date	Camera	Inspector	Authorization
	Sony Cyber-shot	J.Mesher	2AM-MRY

Photo Log **Location Iqaluit**

Photo 8

Description: erosion near mine haul road

Date	Camera	Inspector	Authorization
	Sony Cyber-shot	J.Mesher	2AM-MRY

Photo Log **Location Iqaluit**

Photo 9

Description: Crusher pad water pumping

Date	Camera	Inspector	Authorization
	Sony Cyber-shot	J.Mesher	2AM-MRY
Photo Log		**Location Iqaluit**	

Photo 10

Description: ore in ditch and outside containment. On the left there is a area where water regularly pools

Date	Camera	Inspector	Authorization
	Sony Cyber-shot	J.Mesher	2AM-MRY
Photo Log		**Location Iqaluit**	

Photo 11

Description: erosion on Jet A fuel berm.

Date	Camera	Inspector	Authorization
	Sony Cyber-shot	J.Mesher	2AM-MRY
Photo Log		**Location Iqaluit**	

Photo 12

Description: erosion on Jet A fuel berm.

Attachment 2:
Table 1 Baffinland Responses

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Baffinland

Table 1 – Baffinland Responses to CIRNAC Water Licence Inspection – September 2019

Project Location	Description of Concern or Finding	Recommended Action	Timeline	Response
Mine Haul Road	The licensee is having issues with preventing/ controlling erosion on the side on the Mine Haul Road. This erosion appears to be caused by the culvert outlets on the downhill side of the Mine Haul Road. Photo 8. As stated in Part D, item 5 of the Water Licence 2AM-MRY1325; "The Licensee shall implement sediment and erosion control measures, as required, prior to and during the Construction and Operations Phases of the Mary River Project to prevent and/or minimize sediment loading into Water." It is evident that erosion control measures are required.	To install the appropriate erosion control measures to prevent further erosion on the side of the Mine Haul road. BIMC is to develop a plan to stop this erosion from occurring. This plan is to be submitted to the NWB for review to ensure its adequacy prior to December 15, 2019.	December 15, 2019	Surface water management is required for mining operations to ensure compliance with applicable regulations. Water management structures are maintained throughout the lifecycle of the Project and are modified based on lessons learned to accommodate future development. Historically, there have been issues related to releases of sediment during freshet along the Mine Haul Road. In an effort to identify the triggers, actions, and responses required during these events, Baffinland has documented lessons learned that can be applied to future sediment release occurrences. Through this exercise, it has been identified that water from a portion of the Mine Haul Road is directed to a series of check dams along the Magazine Road at Km 106, initially constructed in 2016. Regular sediment removal from the check dams occurs to maintain their capacity, as it was noted sediment buildup reduced their efficacy. Select culvert inlets were blocked in 2018 to direct flows to this series of check dams. In 2019, the existing check dams were repaired and reinforced, and additional check dams were constructed using gabion baskets. This construction increased the retention time of the flows through these check dams. Check dams were also constructed at KM108.5 in 2019 after suspended sediment was observed along this section of the road. Silt fences are installed annually to address minor flows of concern along the road and direct flows away from sensitive areas. The removal of surface material in Arctic regions can cause the underlying permafrost to melt and result in the pooling of water, destabilization of landforms and sedimentation and erosion issues. To mitigate possible permafrost degradation from surface material removal, the following measures will be implemented throughout the Project. • Removal of surface material should be avoided where possible to reduce permafrost degradation and will occur only at approved locations; • Areas will be graded by filling in low areas rather than cutting into high areas, where feasible; • Erosion control will be evaluated for areas where removal of surface material is required; and, • Use of insulating material or erosion control material, such as concrete fabric or riprap, will be utilized to reduce erosion and potential permafrost degradation, as required. In addition to the mitigations listed above, Baffinland's Surface Water and Aquatic Ecosystem Management Plan outlines the sedimentation and erosion controls utilized at the Project. Where required, these controls, as detailed in Table 4-1, may be used alone or in combination to achieve a more effective control. In response to CIRNAC's request to devise a plan to prevent further release of sediment laden water along the Mine Haul Road, a two tiered approach has been developed. Baffinland will continue to implement existing controls detailed in the Surface Water and Aquatic Ecosystem Management Plan and Mine Operations 2020 Freshet and Mine Haul Road Water Management Improvements (Attachment 5) prior to and throughout freshet 2020 as a short term solution, and has initiated development of a long term water management plan with support from a third party consultant. Based on the timelines required to develop a detailed water management plan, Baffinland plans to submit the plan in Q3 2020. In the interim, Baffinland has developed a Trigger Action Response Plan (TARP) for Potential Erosion and Sediment Release Events to provide a transparent summary of the monitoring required and responsibilities in managing environmental performance onsite. The plan will be utilized for additional training and allocation of resources with various departments in 2020. In preparation for freshet in 2020, a detailed Mine Site Freshet Monitoring Program will be submitted and freshet preparedness meeting held with various regulators to outline further mitigations. This information will be included in the long-term water management plan.

Project Location	Description of Concern or Finding	Recommended Action	Timeline	Response
Mary River Site, Camp Lake	Drainages flowing through and adjacent to the Mary River Site that lead into Camp Lake; these areas have been experiencing annual elevated TSS significantly above the allowed 30mg/L for more than 3 years. Due to this annual failure to comply with PART F, Item 27, Table 11, the Inspector is requesting that the licensee develop a plan to ensure that this annual act of non-compliance discontinues. This plan is to be submitted to the NWB and the inspector for review to ensure its adequacy prior to December 15th, 2019.	The Inspector is requesting that the BIMC develop a plan to ensure that this annual act of non-compliance discontinues. This plan is to be submitted to the NWB and the inspector for review to ensure its adequacy prior to December 15, 2019.	December 15, 2019	Historically, there have been issues related to releases of sediment as a result of seasonal temperature fluctuations and release of sediment into Camp Lake. In an effort to prevent further release, Baffinland has documented lessons learned that can be applied to future operations. Through this exercise, it has been recommended that the dust-impacted snow be removed from around BG-01 inlet/outlet and culvert steaming occur annually prior to freshet. Silt curtains are installed at the tributary outfalls into Camp Lake and elsewhere on the tributaries where feasible, and silt fences are installed annually to address minor flows of concern from the road and air strip. Check dams were constructed in 2017 and reinforced in 2018 and 2019. Regular sediment removal from the check dams occurs to maintain their capacity, as it was noted sediment buildup reduced their efficacy. Snow is removed from these check dams and surrounding areas prior to freshet. A new dust suppressant product, Dust Stop, has been procured, trialed, and will be used on the Tote Road in 2020 to further reduce the potential for dust deposition on snow. In addition to the mitigations listed above, Baffinland's Surface Water and Aquatic Ecosystem Management Plan outlines the sedimentation and erosion controls used at the Project. Where required, these controls as detailed in Table 4-1 may be used alone or in combination to achieve a more effective control. In response to CIRNAC's request to devise a plan to prevent further release of sediment laden water into Camp Lake, a two tiered approach has been developed. Baffinland will continue to implement existing controls detailed in the Surface Water and Aquatic Ecosystem Management Plan prior to and throughout freshet 2020 as a short term solution, and has initiated development of a long term water management plan with support from a third party consultant. Based on the timelines required to develop a detailed water management plan, Baffinland plans to submit the plan in Q3 2020. In the interim, Baffinland has developed a Trigger Action Response Plan (TARP) for potential erosion and sediment release events to provide a simple and transparent summary of the monitoring of environmental performance. The plan will be utilized for additional training and allocation of resources with various departments in 2020. Baffinland has identified the following high risk historical problematic areas that likely contribute to elevated total suspended solids in the Camp Lake drainages: • Camp Lake Jetty Road, with contributions from the Weatherhaven laydown and air strip runoff • BG-01, with contributions from dust-impacted snow buildup around the culvert, Tote Road runoff and air strip drainage • KM101 to KM102 Tote Road runoff • QMR2 access road runoff In preparation for freshet in 2020, a detailed Mine Site Freshet Monitoring Program will be submitted and freshet preparedness meeting held with various regulators to outline further mitigations. This information will be included in the long-term water management plan.
Mine Site, Sheardown Lake	Drainages flowing through and adjacent to the Mary River Site that lead into Sheardown Lake; these areas have been experiencing annual elevated TSS significantly above the allowed 30mg/L for more than 3 years. Due to this annual failure to comply with PART F, Item 27, Table 11 the Inspector is requesting that the licensee develop a plan to ensure that this annual act of non-compliance discontinues. This plan is to be submitted to the NWB and the inspector for review to ensure its adequacy prior to December 15th, 2019.	The Inspector is requesting that the BIMC develop a plan to ensure that this annual act of non-compliance discontinues. This plan is to be submitted to the NWB and the inspector for review to ensure its adequacy prior to December 15, 2019.	December 15, 2019	At the Mary River Project site, streams and river systems typically begin to flow in late May with the onset of snow and ice melt. Peak flows occur in June or July with rising temperatures and rapid corresponding snowmelt, before dropping steadily through to September or October when flows essentially cease. Historically, there have been issues related to releases of sediment during this rapid temperature fluctuation and snow melt resulting in the release of sediment into Sheardown Lake. In an effort to prevent further release, Baffinland has documented lessons learned that can be applied to future operations. Removal of dust-impacted snow from around culvert inlet/ outlets and culvert steaming occurs annually prior to freshet. Silt curtains are installed at the outfall into Sheardown Lake and along the tributaries where feasible, and silt fences are installed annually to address minor flows of concern from the road. Check dams were constructed in 2019 to address the runoff from the Sailiivik camp laydown. Baffinland completed installing hoods and shrouds on all crusher conveyors in 2019. A new dust suppressant product, Dust Stop, has been procured, trialed, and will be used on the Tote Road in 2020. In addition to the mitigations listed above, Baffinland's Surface Water and Aquatic Ecosystem Management Plan outlines the sedimentation and erosion controls used at the Project. Where required, these controls as detailed in Table 4-1 may be used alone or in combination to achieve a more effective control. In response to CIRNAC's request to devise a plan to prevent further release of sediment laden water into Sheardown Lake, a two tiered approach has been developed. Baffinland will continue to implement existing controls detailed in the Surface Water and Aquatic Ecosystem Management Plan prior to and throughout freshet 2020 as a short term solution, and has initiated development of a long term water management plan with support from a third party consultant. Based on the timelines required to develop a detailed water management plan, Baffinland plans to submit the plan in Q3 2020.

Project Location	Description of Concern or Finding	Recommended Action	Timeline	Response
				In the interim, Baffinland has developed a Trigger Action Response Plan (TARP) for Potential Erosion and Sediment Release Events to provide a transparent summary of the monitoring of environmental performance. The plan will be utilized for additional training and allocation of resources with various departments in 2020. Baffinland has identified the following High Risk historical problematic areas that contribute to elevated TSS in the Sheardown Lake drainages: • CV-186, with contributions from dust-impacted snow buildup around the culvert and Tote Road runoff • CV-187, with contributions from dust-impacted snow buildup around the culvert, and Tote Road and Sailiivik camp laydown runoff • Drainage behind the MSC, with contributions from haul road runoff In preparation for freshet in 2020, a detailed Mine Site Freshet Monitoring Program will be submitted and freshet preparedness meeting held with various regulators to outline further mitigations. This information will be included in the long-term water management plan.

Attachment 3:
Trigger Action Response Plan

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Table 2 – Trigger Action Responses Plan (TARP) for Potential Erosion and Sediment Release Events

Trigger	Action	Response	Responsibility
Observations identifying potential causes of erosion and sediment issues.	Investigate and identify potential sources and activities that may lead to an exceedance in total suspended solids. This can include, but not limited to: construction based activities on land or near water (e.g. ditching, roads, signs of erosion, drilling, sediment deposition, run-off, etc.), effectiveness of erosion and sediment controls, contact water movement. Reference Table 4-1 of the Surface Water and Aquatic Ecosystem Management Plan, for a list of erosion and sediment control measures. Refer to coordination meetings in preparation for freshet, and allocation of responsibilities as per each department. Ensure equipment is readily available.	Contact BIM Environment and assist in implementing appropriate control measures focused at the source of the issue.	All employees working for or on behalf of the Operation (via visual observation). Reportable to Site Supervisor immediately. Supervisor to report BIM Environment. BIM Environment to appropriately allocate responsibilities and actions to various BIM Departments based on specific needs.
Severe weather period in the forecast, as per on-site weather stations and weather alerts.	Assess risk for site and plan appropriate mitigation measures. This includes but is not limited to Table 4-1 Sediment and Erosion Controls. Complete snow removal in prioritized areas as per the Snow Management Plan.	Communicate with BIM Environment to develop an incident (sediment release, melting event, freshet, high precipitation) specific response plan. Communicate plan to workforce which may include: • Implementing additional mitigation techniques and/or facilities • Reducing or re-scheduling tasks (e.g., Reduce activities to non-ground disturbing related tasks)	BIM Environment, BIM Mine Operations, BIM Road Maintenance

Trigger	Action	Response	Responsibility
Personnel not aware of Plan for Erosion and Sediment Control	Identify areas to improve current training programs.	Review environmental awareness training content and delivery method.	BIM Environment, BIM Training
TSS exceedance of Water Licence Criteria	During and after a suspected exceedance of the authorized limit, water samples will be taken at key locations for TSS testing. Record results, report, investigate and communicate to external stakeholders in line with regulatory requirements and Baffinland's Spill Contingency Plan and Surface Water and Aquatic Ecosystem Management Plan.	If sediment attributed to Project infrastructure, review and modify controls. Communicate incident investigation outcomes with regulatory authority via follow up spill reports and the QIA NWB Annual Report for Operations.	All employees working for or on behalf of the Operation (via visual observation). Reportable to Site Supervisor immediately. Supervisor to report BIM Environment. BIM Environment to appropriately allocate responsibilities and actions to various BIM Departments based on specific needs.
Regulatory Feedback	Record feedback details, investigate and communicate to external stakeholders in line with Baffinland management plans.	If sediment is attributed to Project infrastructure, review and modify controls. Respond to regulatory authority with outcomes of the investigation.	BIM Environment and Operations

Attachment 4:
Mine Operations 2020 Freshet and Mine Haul Road Water Management Improvements

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Baffinland Iron Mines Corporation

Mine Operations 2020
Freshet and Mine Haul Road Water Management Improvements

Prepared By: Daniel Janusauskas
Department: Mine Ops
Title: Technical Services Superintendent
Date: December 15, 2019
Signature:

Approved By: Simon Fleury
Department: Mine Ops
Title: Mine Manager
Date: December 15, 2019
Signature:

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1 INTRODUCTION

The purpose of this document is to detail the 2020 Mine Operations freshet and Mine Haul Road (MHR) water management strategy, planning and execution. Baffinland will continue to implement existing controls detailed in the Surface Water and Aquatic Ecosystem Management Plan prior to and throughout freshet 2020 as a short term solution, and will be initiating the development of a long term water management plan with support from a third party consultant in 2020. Based on the timelines required to develop a detailed water management plan, Baffinland plans to submit the plan in Q3 2020. Further details of ongoing and future work are provided is Section 3.

1.1 PROPERTY DESCRIPTION, CLIMATE, RESOURCES AND PHYSIOGRAPHY

The Project area is located in Nunavut on the northern half of Baffin Island at Latitude 71°N and Longitude 79°W approximately 160 km south of Mittimatalik (Pond Inlet), 270 km southeast of Arctic Bay, 300 km north of Hall Beach, and 1,000 km northwest of Iqaluit, the capital of the Nunavut Territory as shown in Figure 1.

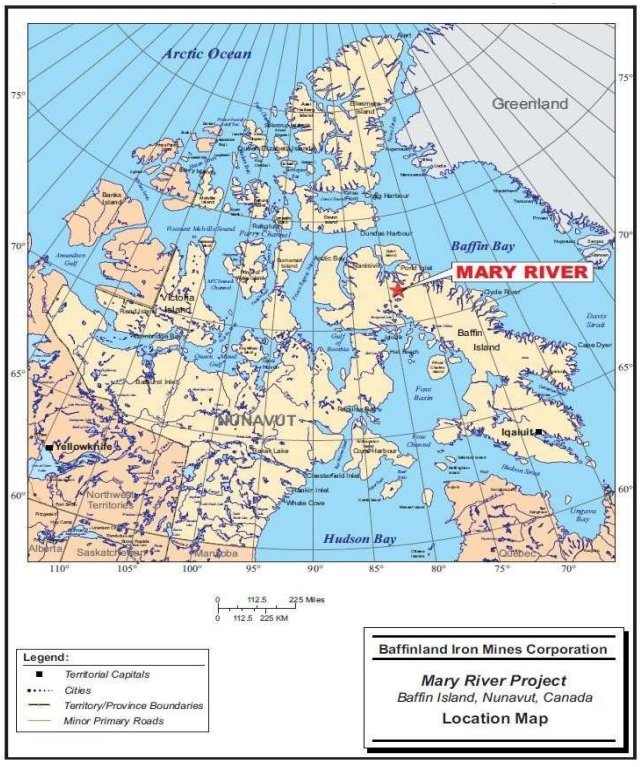


Figure 1 Location of the Mine

Milne Inlet, the closest navigable water, is located 100 km to the northwest of Nuluujaak Mountain, the site of the Mary River Deposit No. 1. A tote road connects the Mary River deposits with Milne Inlet.

The climate is typically high Arctic, with long cold winters and short cool summers. Frost-free conditions are from late June to late August. There is continuous daylight from early May to early August and continuous darkness from mid-November to mid-February. The months of July and August bring maritime influences and are usually the wettest (snow may still occur).

The Mary River iron deposits are situated close to the Central Borden Fault Zone, a major tectonic (structural discontinuity) and morphological feature which separates topographically lower land to the southwest from a higher plateau to the northeast which is deeply dissected by river valleys.

The Project lies within the zone of continuous permafrost, with an active layer thickness of up to two metres and a total permafrost depth of about 600 m. The extremely cold temperatures of the region, combined with permafrost ground conditions, result in a short period of runoff that typically occurs from June to September. All rivers and creeks, with perhaps the exception of the very largest systems, freeze solid during the winter months. The runoff coefficient is very high, due to the combination of low temperatures, low infiltration, and minimal vegetative cover and, correspondingly, surface water is abundant, and the region is dotted with thousands of small lakes and streams.

2 GENERAL WATER MANAGEMENT CONCEPT

The Mine Haul Road (MHR) was originally developed for use with a fleet of CAT 777 haul trucks. Currently, run-off water from the mountain side and precipitation that collects on the MHR is collected and managed using ditches, culverts and check dams. In 2016 as part of a haul road drainage improvement project, the upstream ditch was improved by deepening sections and installing geotextile and armouring in addition to the installation of additional culverts. Erosion and sediment loading is additionally controlled by Mine operations by controlling the flow of water through the culverts during periods of lower flow and diverting it to check dams and other drainages prior to discharge.

2.1 SEDIMENT SOURCES

The following are identified as the primary sources of sediment water runoff from Mine Haul Road into culverts and ditches

- Erosion at some culvert locations. The lack of sufficient rip rap placement at culverts inlets and outlets, even those with flatter slopes, also results in erosion of the road embankment.
- Insufficient drainage of the running surface resulting in runoff and erosion of running surface. Runoff along steeper sections of the road increases erosion of the road and sediment loading to the ditches and culverts.
- Insufficient armouring of roadside ditches. Erosion of the ditches in steeper sections results in sediment-laden flows that report to the receiving environment.

- Cut-slope instability resulting from permafrost degradation. Ice-rich permafrost and fine-grained soils, upon thawing, result in sediment-laden flows to ditches, culverts, the road surface, and directly to the receiving environment.

2.2 SLOPE INSTABILITY AND EROSION ALONG THE MINE HAUL ROAD

Concentrated flows from water that accumulates along the MHR and which passes through the associated culverts can channelize the flow causing both thermal and mechanical erosion, entraining sediment into the tributary below that flows into the Mary River. This channelized flowing water and erosion has caused some permafrost thaw which reduces the soils strength making them more prone to erosion.

Remediation of these erosion channels is a considerable challenge because:

- The slope is very steep;
- The drop from the edge of the road is significant;
- The natural permafrost soils are ice-rich;
- The very thin vegetation mat overlying the soil is easily disturbed; and
- Access to the slope is limited.

The culvert outlets will be redesigned to encourage sheet flow rather than the concentrated flow currently occurring. As part of the water management study conditions on the deposit slope and along the haul road will be reviewed to be able to develop appropriate water management strategies and remediation work.

3 2020 MINE WATER MANAGEMENT STUDY

A study of water management in the mine area will be undertaken in 2020 to develop a comprehensive plan to manage drainage in and around the open pit, waste rock facility and associated roads. This study will be focused on developing a plan for required structures over a longer time period to allow for the development of a holistic and comprehensive strategy rather than one targeted at one specific area. The mining area covers a large surface area with varying slopes, ground conditions and drainage features which need to be taken into consideration. It is expected that this study and preliminary engineering design work will be completed by end of Q3 2020.

Due to the seasonal weather and resource constraints and based on past experience, a key recognition for the overall project is that a phased approached for construction is required when implementing or constructing large earthwork projects in permafrost conditions. The results of the 2020 water management study will be evaluated by Baffinland and development of the structures would then be appropriately scheduled. In the interim, continued management of water along the MHR and the overall mine site will continue and several improvement projects are planned (see section below).

4 KM106 CHECK DAM IMPROVEMENTS

A series of check dams in proximity to KM106 of the mine haul road are used to control sediment loading of water that is discharged into Mary River. In 2019, remedial work and improvements were undertaken to improve settling capacity and reduce outlet sediment levels. Photos of the check dams installation and improvements can be found in Figure 2, Figure 3 and Figure 4.

This construction increased the retention time of the flows through these check dams. Check dams were constructed at KM108.5 in 2019 after observed sediment was flowing along this section of the road. Silt fences are installed annually to address minor flows of concern along the road and direct flows away from sensitive areas.

In 2020, additional check dams constructed using gabion baskets will be installed. Mine operations will also evaluate the installation of additional check dams in other locations further upstream of the KM106 location.

Figure 2: 2019 KM 106 Check Dam Upgrades from Above

Figure 3: 2019 KM106 Check Dam and Gabion Basket Upgrades

Figure 4: 2019 KM106 Check Dam

5 FRESHET WATER MANAGEMENT

5.1 SNOW REMOVAL PLAN

A snow removal plan has been developed for the mine haul road to limit the accumulation of snow in areas that might cause issues during freshet. Figure 5 illustrates the areas and directions in which snow can be dumped to limit melt water flowing into areas where it can gather sediments. Limits have been set around culverts to reduce the potential for blocking culverts and melt water that would report into the culverts.

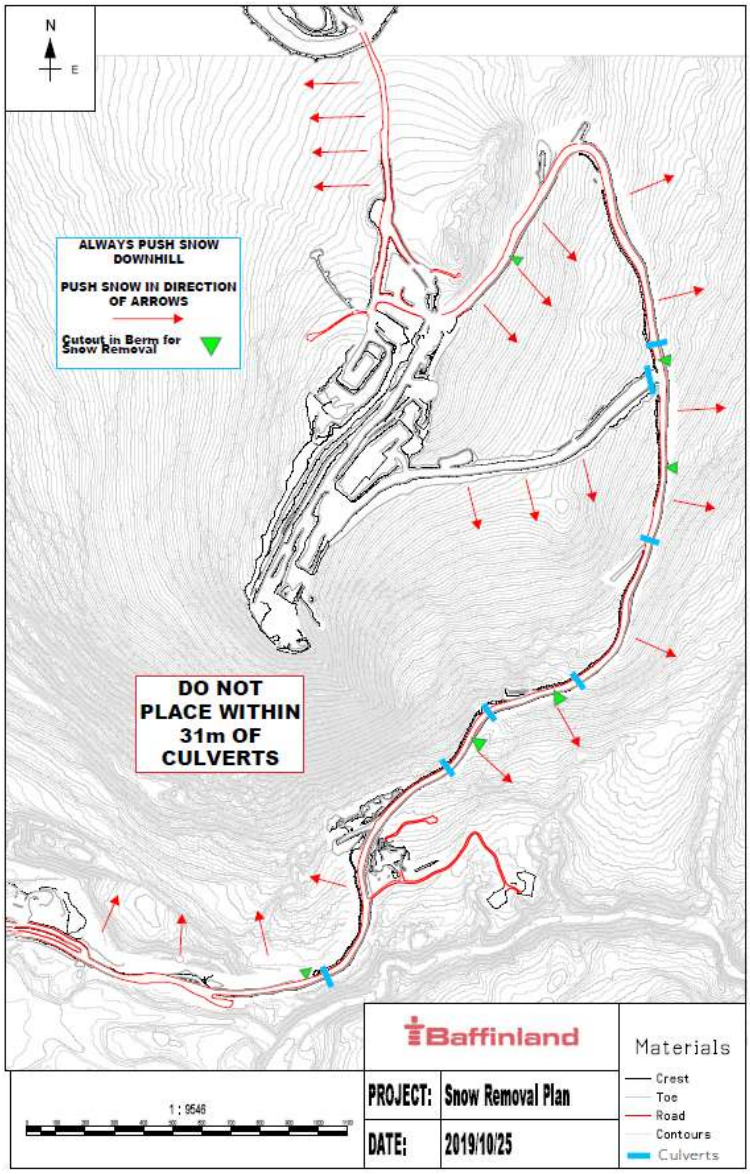


Figure 5: 2019 Snow Removal Plan

5.2 FRESHET PREPARATION

Prior to the start of the freshet period and throughout the melting season, Mine Operations takes steps to ensure that water management structures are prepared to handle the flows and volumes of water that will begin to report to them. A checklist has been prepared for implementation in 2020 to ensure that all steps are completed on a regular basis (Figure 6).

Mine Freshet Management Checklist: Baffinland

Date:_____ Inspector:_____

Snow Management			
Ditches			
Have ditches been cleared of excess snow?		Yes	No
Comments:			
Culverts			
Are culvert ends staked with a 31m radius?		Yes	No
Have culvert inlets been cleared of snow and sediments?		Yes	No
Comments:			
Snow Removal Mine Haul Road			
Clean snow off berms		Yes	No
Comments:			

Erosion and Sediment Controls		
Culverts		
Are inlets crushed?	Yes	No
Has inlet been eroded?	Yes	No
Is culvert armoring still adequate?	Yes	No
Have culverts been cleared of debris	Yes	No
Are inlet sumps adequate	Yes	No
Comments:		
Ditches		
Are ditches to design?	Yes	No
Are check dams in place?	Yes	No
Does the road require silt fencing	Yes	No
Comments:		

Figure 6: Mine Freshet Management Checklist

6 MINE HAUL ROAD UPGRADE PROJECT

As part of the mine's acquisition of larger CAT 793 haul trucks, the approved upgrade of the existing MHR is currently under construction. The upgraded road design involves widening of the haul road by an average 5 metres and raising of the road surface in order to provide a more consistent and shallower grade throughout sections of the road (Figure 8). As a result of these activities, the culverts will also be extended and the downstream outflow pad will be reconstructed to spread out the flow (Figure 9). The main ditch will also be expanded (as part of the road raise) and the ditch armouring will be adjusted as required to increase the overall capacity and effectiveness on the upstream side of the MHR.

The MHR upgrade will also involve regrading of the road surface with the inclusion of more defined crowning and/or cross-slope to better direct water into the ditches.

Overall, these improvements will allow Mine Operations to have greater control over water flow through culverts and in the main ditch during major rain events. Improvements to the ditching will reduce overflow onto the MHR during heavy rain events and reduce sediment loading from the washing of the road surface. A large ditch capacity will allow great flexibility in controlling the flow into culverts to help control the quantity of water flowing through the existing downstream channels based on the flow being observed

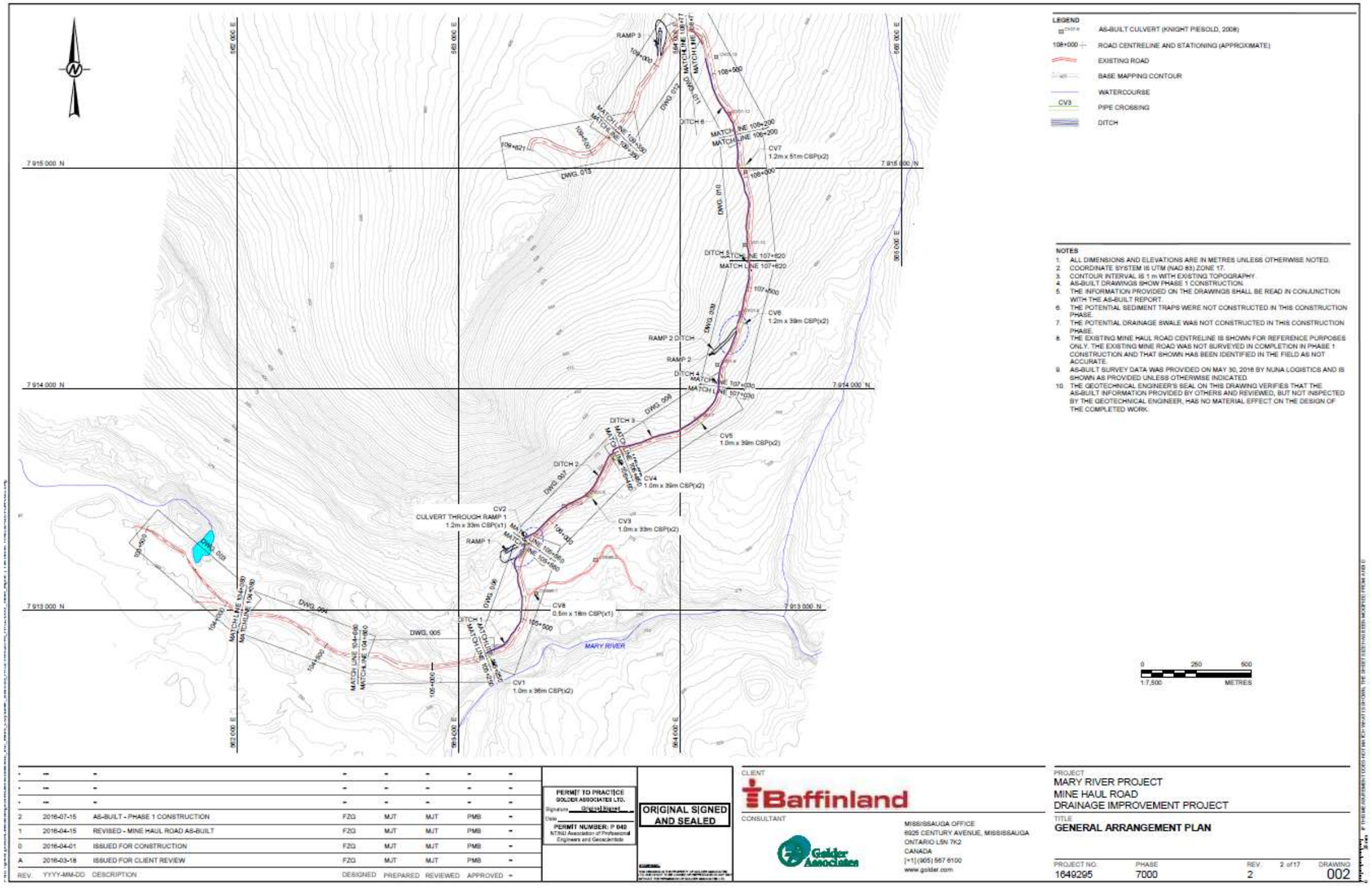


Figure 7: 2016 MHR Drainage Improvement As-Built Plan View

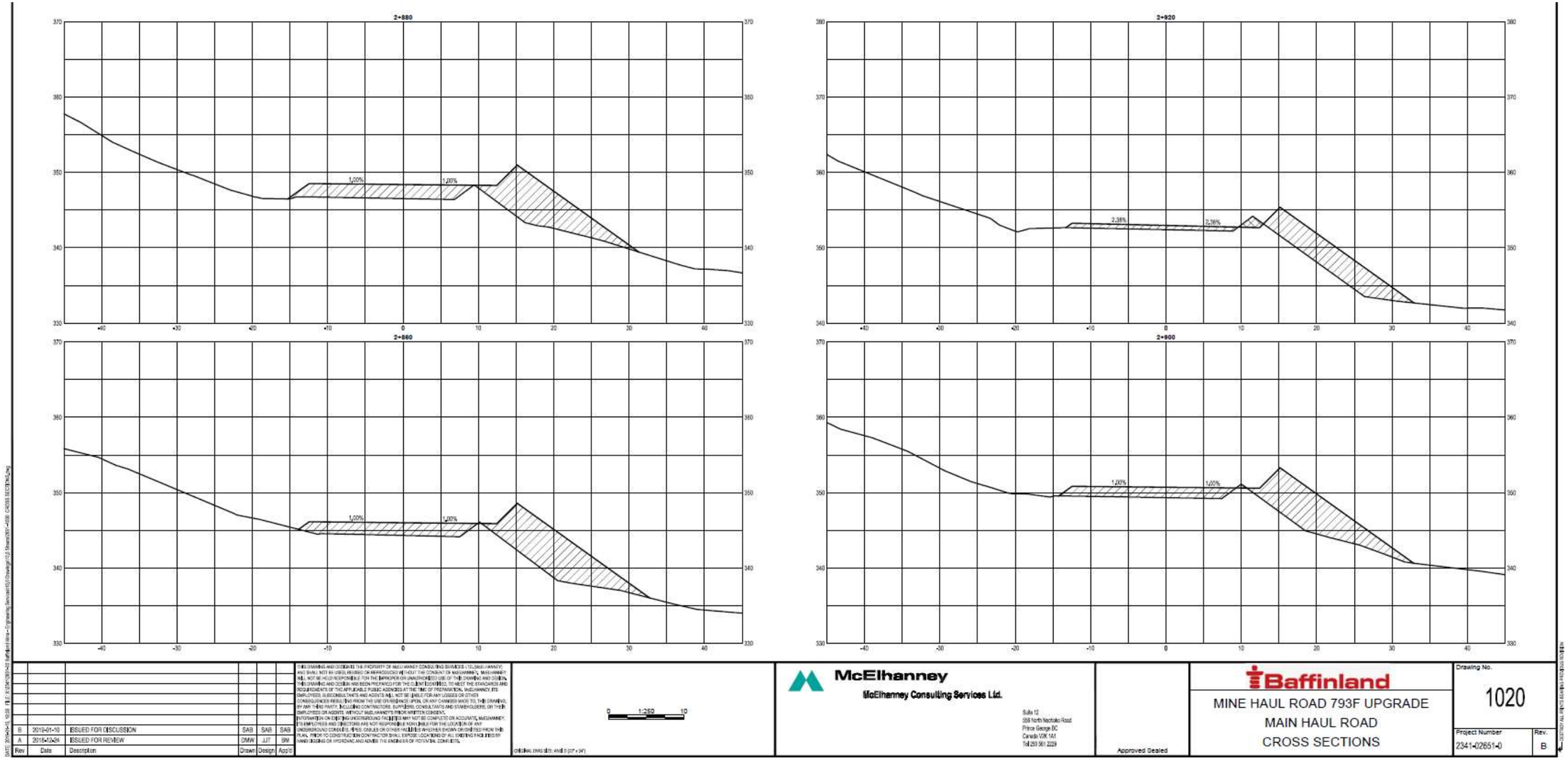
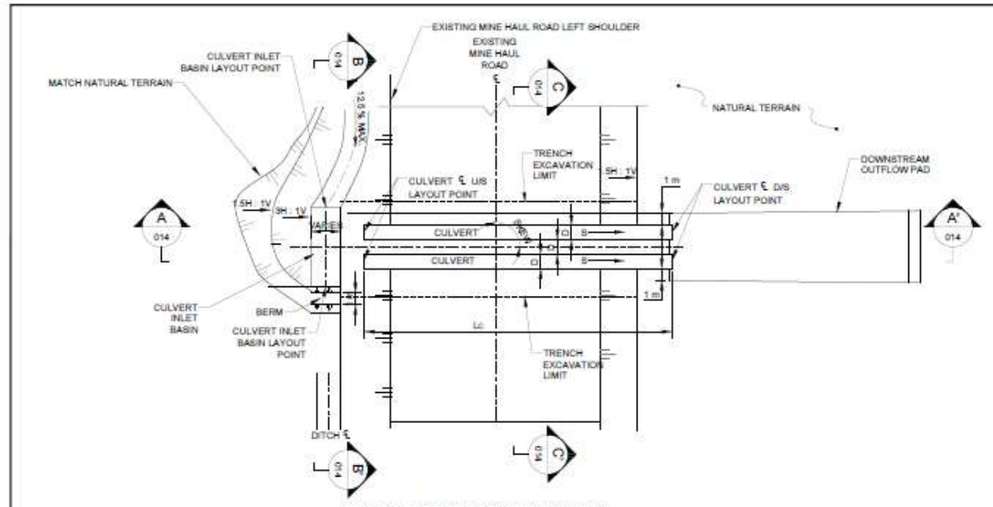
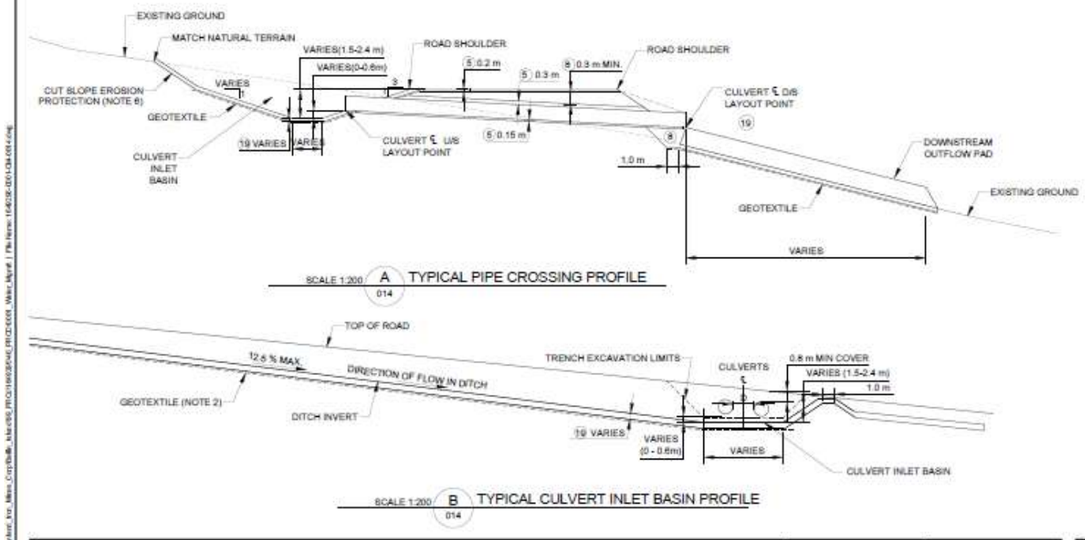
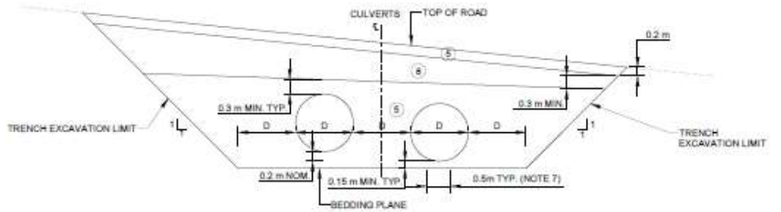


Figure 8: Mine Haul Road Upgrade Cross Section Examples







LEGEND

(5)	SCREENED MATERIAL
(8)	JAW RUN
(19)	EROSION PROTECTION (NOTE 9)

NOTES

1. PIPE CROSSING LAYOUT WAS ADJUSTED BASED ON ENCOUNTERED FIELD CONDITIONS AS DIRECTED BY THE OWNER'S REPRESENTATIVE.
2. GEOTEXTILE WAS PLACED IN ALL INLET BASINS AND OUTFLOW PADS EXCEPT AT CV2.
3. THE INLET BASINS WERE NOT CONSTRUCTED TO DESIGN DIMENSIONS DUE TO THE FROZEN GROUND CONDITIONS.
4. NO SURVEY INFORMATION WAS PROVIDED FOR THE DOWNSTREAM OUTFLOW PADS.
5. NO SURVEY INFORMATION WAS PROVIDED FOR THE BACKFILL LAYERS. LAYER THICKNESS WAS OBSERVED BY THE OWNER'S REPRESENTATIVE IN THE FIELD.
6. CULVERT SKEW WAS ADJUSTED BY THE OWNER'S REPRESENTATIVE BASED ON ENCOUNTERED FIELD CONDITIONS.
7. BEDDING WAS SHAPED TO RECEIVE THE PIPE.
8. IT IS RECOMMENDED THAT EROSION PROTECTION OF THE DOWNSTREAM OUTFLOW PAD BE EXTENDED TO A WATER BODY CAPABLE OF CONVEYING THE CONCENTRATED FLOW TO PREVENT EROSION OF THE NATURAL SOILS.
9. THE EROSION PROTECTION ROCK SIZE IS SMALLER THAN REQUIRED FOR THE SELECTED 1:10 YEAR DESIGN FLOW. THIS IN IN RECOGNITION OF THE AVAILABLE MATERIAL AND AT THE OWNER'S REQUEST. RIPRAP BLOCKS COULD MOBILIZE EVEN DURING FREQUENT FLOOD EVENTS, WHICH MIGHT IMPACT SIGNIFICANTLY THE OPERATION OF THE DRAINAGE SYSTEM. REGULAR MAINTENANCE WILL BE REQUIRED. FUTURE IMPROVEMENTS (I.E. REPLACEMENT OF EROSION PROTECTION WITH MATERIAL WITH LARGER ROCK SIZES, PLACEMENT OF GABION MATS) ARE RECOMMENDED.
10. REFER TO DWG. 002 FOR ADDITIONAL NOTES.
11. AS-BUILT SURVEY DATA WAS PROVIDED ON MAY 30, 2016 BY NUNA LOGISTICS AND IS SHOWN AS PROVIDED UNLESS OTHERWISE INDICATED.
12. THE GEOTECHNICAL ENGINEER'S SEAL ON THIS DRAWING VERIFIES THAT THE AS-BUILT INFORMATION PROVIDED BY OTHERS AND REVIEWED, BUT NOT INSPECTED BY THE GEOTECHNICAL ENGINEER, HAS NO MATERIAL EFFECT ON THE DESIGN OF THE COMPLETED WORK.

CULVERT SCHEDULE

CULVERT ID	FISH BEARING (Y/N)	NUMBER OF PIPES	DIAMETER, D (mm)	LENGTH L_{cp} (m)	TYPE	CULVERT CL LAYOUT AT UPSTREAM			CULVERT CL LAYOUT AT DOWNSTREAM			SLOPE, S (%)	SKEW (°)
						NORTHING	EASTING	U/S INV. ELEV. (m)	NORTHING	EASTING	D/S INV. ELEV. (m)		
CV1	N	2	1000	36.0	CSP	7912810.6 7912809.7	563134.8 563132.5	258.47 258.26	7912776.9 7912775.9	563147.9 563145.7	256.62 256.43	5%	90
CV2	N	1	1200	33.0	CSP	7913325.4	563298.6	298.12	7913292.0	563298.1	296.46	5%	-
CV3	N	2	1000	33.0	CSP	7913529.4 7913527.8	563583.7 563582.0	330.34 330.11	7913503.1 7913504.6	563603.7 563605.5	328.48 328.68	6% 4%	88
CV4	N	2	1000	39.0	CSP	7913707.4 7913706.3	563699.0 563697.8	356.04 355.78	7913675.4 7913676.7	563721.5 563723.2	353.80 353.96	6% 5%	96
CV5	N	2	1000	39.0	CSP	7913867.3 7913868.5	564079.1 564080.5	397.64 397.79	7913837.5 7913836.2	564104.3 564102.5	395.86 395.66	5% 5%	97
CV6	N	2	1200	39.0	CSP	7914306.9 7914304.6	564264.9 564264.0	436.40 436.20	7914291.3 7914293.5	564300.7 564301.6	434.30 434.50	5% 4%	97
CV7	N	2	1200	51.0	CSP	7915008.2 7915010.5	564263.1 564262.8	504.96 505.12	7915018.7 7915016.5	564313.2 564313.4	502.65 502.41	5% 5%	92
CV8	N	2	500	18.0	CSP	7913087.9	563332.5	274.52	7913073.2	563343.2	273.50	6%	-

0 2 4
1:50 METRES

0 10 20
1:200 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	-
-	---	-	-	-	-	-	-
-	---	-	-	-	-	-	-
-	---	-	-	-	-	-	-
2	2016-07-15	AS-BUILT - PHASE 1 CONSTRUCTION	FZG	MJT	MJT	PMB	-
1	2016-04-15	REVISED - MINE HAUL ROAD AS-BUILT	FZG	MJT	MJT	PMB	-
0	2016-04-01	ISSUED FOR CONSTRUCTION	FZG	MJT	MJT	PMB	-
A	2016-03-18	ISSUED FOR CLIENT REVIEW	FZG	MJT	MJT	PMB	-

PERMIT TO PRACTICE GOLDER ASSOCIATES LTD.
Signature
Date
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

ORIGINAL SIGNED AND SEALED

CLIENT: Baffinland

CONSULTANT: Golder Associates

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PROJECT
MARY RIVER PROJECT
MINE HAUL ROAD
DRAINAGE IMPROVEMENT PROJECT

TITLE
PIPE CROSSING TYPICAL DETAILS AND CULVERT SCHEDULE

PROJECT NO.	PHASE	REV.	14 of 17	DRAWING
1649295	7000	2		014

Figure 9: Typical Pipe Crossing and Culvert Details (from Golder, 2016)

7 SUPPORTING MINE INFRASTRUCTURE

7.1 PIT DEWATERING

Water in the Nuluujaak pit is primarily the result of precipitation, surface run-off and minor groundwater from active/thawed layer of rock exposed in the open pit. During spring and summer months, pumping infrastructure and a network of pipes is installed to manage run-off water from the pit and other facilities on site. If acidic water is encountered in the pit, it can be pumped to the WRF facility and associated water treatment plant.

7.2 WASTE ROCK FACILITY AND POND

The Waste Rock Facility (WRF) is located within the western watershed (opposite of the MHR) which drains into Camp Lake. A series of ditches excavated around the perimeter of the WRF direct runoff and seepage from the WRF to the WRF Pond which is located at the north toe of the WRF. The approved WRF Pond expansion to approximately 50,000 m3 capacity (Golder, 2018) is currently under phased construction. Expansion of the WRF Pond is expected to be completed by end of 2019. Collected flows are passed through a water treatment plant (WTP) and discharged to the catchment of a Mary River tributary.

7.3 WATER TREATMENT PLANT

Baffinland constructed a Water Treatment Plant (WTP) in 2018 to treat surface runoff collected at the WRF Pond. The WTP has a design treatment rate of 280 m3/hr and employs a process of coagulation, pH adjustment, flocculation, and filtration to treat water to within the parameters outlined in the Metal and Diamond Mining Effluent Regulations (MDMER) and Type ‘A’ Water Licence 2AM-MRY1325.

Detailed engineering and verification of the treatment process was carried out by McCue Engineering Contractors. Baffinland may revise the water treatment process, as required, to accommodate variability in the WTP intake chemistry to maintain compliance with the MDMER and Type ‘A’ Water Licence effluent discharge requirements.