Baffinland
Iron Mines Corporation

BHM Project No. 16-094

BAFFINLAND IRON MINES CORPORATION

ANNUAL GEOTECHNICAL INSPECTIONS
MARY RIVER PROJECT
INITIAL INSPECTION OF TWO
JULY 2016

Prepared for:
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July 31, 2016

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Attention: Jeff Bush
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RE: ANNUAL GEOTECHNICAL INSPECTIONS
BAFFINLAND IRON MINES CORPORATION
OUR REFERENCE NO. 16-094

1.0 INTRODUCTION

Barry H. Martin, P. Eng., Consulting Engineer, completed the eighth annual water licence geotechnical inspection of the following on-site engineered facilities as required by Licence No. 2AM-MRY 1325 of the Nunavut Water Board:

Pit Walls
Quarries
Landfills
Land Farms
Bulk Fuel Storage Facilities
Sediment Ponds
Collection Ponds
Polishing and Waste Stabilization Ponds

The inspection that took place July 28th to July 30th, 2016 is the first phase of a biannual inspection to be carried out within the open water shipping season at the two Baffinland sites, in Mary River at the mine site, and at Milne Inlet at the port facility.

The inspections were carried out in accordance with the guidelines set out in "Dam Safety Guidelines 2007" as published by the Canadian Dam Association.

The inspections were completed by Mr. Barry H. Martin, P. Eng., the design Engineer for the initial containment facilities both at Mary River and Milne Inlet, the runaway extension, initial bridges on the connecting road, the solid waste disposal site as well as continuing construction of select mine infrastructure.

The eight previous annual water licence geotechnical inspections were completed by Mr. Martin. You shall note that Hazardous Waste Containment Structures have been assigned designations in the report that were established by the Environmental group in past years.

The facilities inspected are as per the following:

Mary River Site
Bulk Fuel Storage Containment
Generator Fuel Storage Facility Containment
Polishing/Waste Stabilization Pond No. 1
Polishing/Waste Stabilization Ponds Nos. 2 and 3 (constructed as a two-cell structure)
Helicopter Fuel Cell Containment
Barrel Fuel Containment (constructed as a two-cell structure) (MS-HWB-3 and MS-HWB-4)
Hazardous Waste Storage (MS-HWB-2)
Enviro-Tank Storage (constructed contiguous with hazardous waste storage and stove oil storage) (MS-HWB-1)
Stove Oil Storage (MS-HWB-5)
Solid Waste Disposal Site
Minesite Steel Fuel Tank Farm Containment
Quarry
Crusher Pad Drainage Containment
Waste Pile Drainage Containment
Jet "A" Aircraft Containment
Hazardous Waste Containment (MS-HWB-6)

A site plan for the Mary River site showing most structures reviewed is attached.

Milne Inlet Site
Hazardous Waste Storage (constructed as a two-cell structure) (MP-HWB-3 and MP-HWB-4)
Fuel Tank Farm
New Sewage Effluent Pond (PWSP)
Land Farm
Contaminated Snow Containment
Sediment Ponds East and West
Quarry
Loading Area Contaminated Storage (MP-HWB-1)
Fuelling Facility Containment

A site plan for the Milne Inlet site showing most structures reviewed is attached.

2.0 METHODOLOGY FOR INSPECTION

The geotechnical inspector was Barry H. Martin, P. Eng., who reviewed the two sites for the first of the biannual inspections on July 28th, 2016 to July 30th, 2016 just as the annual shipping season commenced with the arrival of the first ship into port. There is a further inspection planned to take place at the end of the shipping season at the end of September / beginning of October.

The inspections primarily focused on the following aspects:

1. The structures were inspected for conformance with the design basis as presented in "as-constructed" and "as-built" drawings (provided in the first and subsequent reports).

2. The structures were specifically inspected for settlement, cracking, and seepage through the berms.

3. The areas around the structures were examined for evidence of seepage.

4. Quarry walls were reviewed for relative stability. I note that the quarries were active removal areas and long term stability was not yet established.

5. New structures recently constructed were reviewed for conformity with design drawings.

6. Photographs were taken to document observations made during the inspection and are attached.

3.0 MARY RIVER CAMP

3.01 General

As with other years, there had been some rainfall at Mary River preceding this first inspection and it was expected that there would be some water in the containment dykes.

A monitoring program is in place to test storm water that does accumulate within the containment structures. As reviewed, the water that does not meet the water licence effluent requirements is treated on site prior to release. In some cases, water collected within the structures has been pumped out.

At the Bulk Fuel Storage Facility Containment, the water that collects within the dyke is treated at the end of the containment structure.

As with the report last year there are some new code names assigned to the containment structures.

The Bulk Fuel Storage Containment (Exploration Phase Bladder Farm) is coming due for decommissioning and is currently used to store barrels of fuel, lubricant cubes, and a large fuel tank.

3.02 Bulk Fuel Storage Facility (Exploration Phase Bladder Farm)

General Conditions

The Bulk Fuel Storage Facility still exists but it is no longer utilized as a bulk fuel storage facility. There are a number of full fuel barrels now stored within the berms, as well as a large fuel tank.

The granular cover over the geotextile and liner is still in place within the containment structure and is awaiting land farming and a fair amount of water at one end awaiting treatment is contained within the dykes.

Stability

At the time of this review, water had not been removed for a period from within the containment and water was ponding above the level of the gravel within the bottom of the containment at the north end of the facility.

At the load-out end of the facility there was minor water ponding within the dykes.

The soil structure is considered stable in the present condition and is in conformance with the design basis for the facility.

The presence of water within the structure and at the load-out area is an indication of the integrity of the liner.

The dykes have been built up recently to reinforce the concept of no loader travel over the dykes.

Recommendations

We have no recommendations with respect to this containment structure as it awaits decommissioning other than to note that it may make an ideal land farm.

3.03 Generator Fuel Storage Containment (Exploration Phase)

This particular containment structure is currently being decommissioned. The fuel bladder that was contained within the dyke had been removed prior to our second inspection in 2015.

The granular fill over the geotextile and liner shall require landfarming with the material from the bulk fuel storage facility.

There is no indication that the liner is compromised and decommissioning should proceed when the granular cover is either moved to a land farm or other containment. There is water ponding within the structure.

3.04 Polishing/Waste Stabilization Pond #1

General Conditions

PWSP No. 1 continues to be utilized as a holding facility for sewage plant effluent that does not meet water effluent quality criteria.

Currently the pond is being used primarily as a repository for off spec sewage and sewage sludge forming in lift stations.

The supernatant from PWSP No. 1 is periodically decanted to PWSPs Nos. 2 and 3 where it is tested and treated as required to meet Water Licence effluent requirements.

At the time of our visit there was less than fifty percent of capacity in use and the structure readily conforms to its design intent.

Stability

Our review of this area around the pond at the base of the slopes showed no sign of seepage and hence we conclude that the liner has been effective in containing sewage and there are no tears or ruptures in the membrane, excepting some minor tears from past activity at the top of the dyke well above the allowable effluent level in the structure, in the horizontal portion of the membrane.

A review of the top of the dyke showed no indication of cracking or settlement which would indicate stresses within the structure.

Many of the tears that had occurred in the liner on the top of the dyke have been patched during the period between reviews in 2008 and 2009 and are holding well. As well, there are no signs of weather related deterioration of the liner where it is exposed.

There appears to be no sign of erosion of the dykes, even with the precipitation that has occurred over the lifetime of the facility.

The minor settlements that have taken place have had little effect on the integrity of the structure.

Recommendations

We have no recommendations with respect to this containment facility.

3.05 Polishing Ponds/Waste Stabilization Ponds #2 and #3

General Conditions

The structure was designed and constructed as a two-cell structure.

The supernatant from PWSP #1 is currently discharged to PWSPs Nos. 2 and 3. The treated effluent is tested for Water Licence effluent requirements, treated if necessary, and discharged to the environment.

At the time of our visit there was considerable freeboard to accommodate further sewage and the structure readily conforms to its design intent. Both cells were almost empty and contained less than 1' of liquid which was the capacity allowed for sludge in the design.

Stability

Our review of the area around the pond at the base of the slopes showed no sign of seepage and hence we conclude that the liner has been effective in containing the sewage and there are no tears or ruptures in the membrane.

Longitudinal cracking which appeared in the dykes of PWSP #3 due to the melt of permafrost wedges in 2009 has not reoccurred and we consider this structure to be stable in its present condition.

Monitoring points have been set upon the top of the dyke and have been monitored since 2009. Settlements have occurred since that time. These settlements have not led any stress cracks in the structure. Monitoring has been discontinued.

There appears to be no sign of erosion of the dykes and plants are continuing to seed themselves on the dykes. This growth is minimal, but increasing.

There are small bubbles formed by air trapped under the enviroliner that were present in the first review that are probably the result of wrinkles in the liner that should disappear if further liquid is added to the cell.

Recommendations

We have no recommendations with respect to this containment facility.

3.06 Helicopter Fuel Tank Containment

General Conditions

The structure was designed and constructed as a single cell structure that contains a 1000 gal fuel storage tank.

The structure currently conforms to its design intent.

In the past, a liner clad wood curb had been added to the top of the berm to prevent the erosion of gravel off the berm, caused by pulling the fuel hose from within the dyke out to the helicopters to provide them with fuel.

As it is the intent of the mine to use fuel that is available in barrels, a temporary cell has been constructed to contain the barrels with a one piece liner and wood timbers.

Stability

Our review of the area around the pond at the base of the slopes showed no sign of seepage. There is wet sand in the bottom of the containment indicating the integrity of the liner.

A review of the exterior and the top of the berms showed no sign of cracking or settlement which would indicate stress within the structure.

The structure is considered to be stable in its present condition.

Recommendations

We have no recommendations with respect to this structure. It is assumed the temporary containment shall be removed when the barrel fuel has been utilized.

3.07 Barrel Fuel Containment (MS-HWB-3 and MS-HWB-4)

General Conditions

This particular structure which we called "Barrel Fuel Containment" in our previous inspection reports is a two-cell structure which is currently used to accommodate cubes of lubricant and barrels in the east cell and cubes of lubricant and antifreeze in the west cell.

Stability

Our review of the area around this containment structure showed no sign of seepage. This shows that there is reasonably little chance of tearing or rupture of the membrane having taken place.

A review of the exterior and top of the dyke showed no sign of cracking or settlement which would indicate stresses within the structure.

The structure is considered to be stable in its present condition.

As with the Bulk Fuel Storage Containment, the dykes have been built up to discourage any possible travel over these dykes.

Recommendations

We have no recommendations at this time.

3.08 Hazardous Waste Storage (MS-HWB-2)

General Conditions

This particular cell was constructed contiguous with an existing cell, which is referred to on site as the "Enviro Tank Storage", from drawings by our office in 2010 and conforms to our drawings. It is also contiguous with the Stove Oil Storage cell.

This structure contains barrels and bags of hazardous waste.

Stability

Our review of the area around this cell at the base of the slopes, showed no sign of seepage. There is water ponding in this structure.

The structure appears to be stable in its present condition. The water confirms the integrity of the liner.

Recommendations

There are no recommendations at this time.

3.09 Enviro Tank Storage (MS-HWB-1)

General Conditions

This particular structure is constructed contiguous with the Hazardous Waste Storage constructed in 2010 and the Stove Oil Storage cell. It was utilized as a wash down cell during the past seasons. It is currently not being used and access is blocked.

Stability

In 2014 there was concern for the integrity of this cell as the cell was dry and the geotextile was exposed from heavy traffic during our initial inspection. During our second inspection, the cell was holding a small amount of water confirming limited integrity of the liner.

The cell is dry this year raising concerns anew on the integrity of the liner. We concur with the fact that use of this cell has been abandoned and the cover in the cell awaits landfarming.

Recommendations

We recommend that the geotextile over the liner be checked and the granular cover be made good prior to continuing use of this cell or that this cell be permanently decommissioned.

3.10 Stove Oil Storage (now MS-HWB-5)

General Conditions

This particular structure had been used to store barrels of stove fuel in past years and is still utilized for this purpose of storing barrel fuel.

Currently, access to this cell has been blocked with granular fill.

This structure was constructed in accordance with a standardized drawing provided by this office utilizing a one piece liner.

Stability

Our review of the exterior and the top of the dyke showed no sign of seepage. This shows that there is reasonably little chance of tearing or rupture of the membrane having taken place.

A review of the exterior and the top of the dyke showed no sign of cracking or settlement which would indicate stresses with the structure.

There is water contained within the cell confirming the integrity of the liner.

The structure is considered to be stable in its present condition.

3.11 Solid Waste Disposal Site

The solid waste disposal site is currently entering the second phase of its construction. The first lift of solid waste has been placed and covered fully and appears to be doing exactly what it was proposed to do at the design stage.

Work is currently being done on building a berm on three sides of the disposal side at a level above the existing lift in advance of placing another lift. The berm is being constructed as per the berm on the first level that served us well over the past several years.

The blow fence has not been reinstalled yet. In the meantime, solid waste has been covered as it is installed and may be continued to be done in this manner to control "blow".

We are most pleased with what we saw at this site.

3.12 Minesite Steel Fuel Tank Farm Containment

General Conditions

All work appears to be complete excepting the installation of the sump pits that are on site awaiting installation and which shall be utilized to facilitate the removal of water that collects from precipitation.

There is water ponding in the bottom of the containment confirming the integrity of the liner. This ponding of water is now above the cover on the bottom of the containment.

Stability

All work appears to have been completed in accordance with drawings and we have no concerns with the stability of this containment structure.

Recommendations

We recommend that at least one sump be installed as per the drawings prepared for this facility and that when weather permits, removal of water within the containment.

3.14 Quarry QMR2

General Conditions

The quarry has well defined benches. The quarry faces at the benches appear clean.

The quarry is inactive at this time but definitely not closed.

The area where the road was undermined in September 2015 has undergone further quarrying and the access road is gone This area is a fractured zone and subject to subsidence as we noted while on site.

Stability

Care must be taken while quarrying in the unstable fractured zone.

3.14 Crusher Pad Drainage Containment

General Conditions

There is a new containment constructed to catch surface water flow from the crushing area and stockpile area at the minesite. The catchment ditches that had not been quite completed beyond the pond at the time of our last inspection, have now been completed for the entire pad.

Stability

The structure has been completed in accordance with drawings included in our earlier report in a most satisfactory manner.

Recommendations

We have no recommendations with respect to this containment structure.

3.15 Waste Stockpile Drainage Containment

Stability

The dyke appears stable at this time.

This particular structure has now been completed and is as shown on the aerial photograph for this structure. The structure is in place and only minor trimming is required at the inlet side. The outfall hose to pump the supernatant water over to the Mary River watershed is under construction with the pump in place on the dyke.

It is currently working as per the design intent.

3.16 Jet "A" Fuel Containment and Pump

This cell was constructed to replace the containment structure near the Weatherhaven Camp.

This cell now contains two double walled tanks and is located north of the air terminal buildings.

Stability

The cell was constructed using a one piece enviroliner and geotextile and was constructed in accordance with standardized drawings prepared in the past for such construction by our office.

There were no signs of cracking of the dykes. A granular ramp has been constructed over the dyke to facilitate access for snow removal. There was water ponding in the cell at the time of our inspection indicating the integrity of the liner.

Recommendations

We have no recommendations at this time.

3.17 Hazardous Waste Containment (MS-HW-6)

General Conditions

Although it was constructed in 2012, we first reported on it in 2015.

It is located near the incinerator and is utilized to store barrels of ash from the incinerator and other hazardous waste.

Stability

The cell was constructed utilizing a one piece enviroliner with geotextile and was constructed in accordance with standardized drawings prepared in the past for such construction by our office.

There is water ponding in the bottom of the cell confirming the integrity of the liner.

There were no signs of cracking of the dykes or seepage around the exterior of the dykes.

Recommendations

The liner at the back of the cell on the dyke has been torn while placing a pallet supporting hazardous waste into the cell. This torn liner should be repaired.

3.18 Overview

This report is the eighth annual Geotechnical Inspection at Mary River and Milne Inlet completed by this author on behalf of Baffinland Iron Mines Corporation and the second year of reporting covering the first of two inspections in one shipping season.

As set out in our past reports, there has been little or no erosion taken place from wind or rain and the dykes constructed of the sand/gravel soil have remained stable at slopes of 3:1 and 4:1.

As noted two years ago, there are only just now signs of settlement appearing at PWSP's 1, 2 and 3. The settlements are not differential settlements of the dykes but are minor overall settlements of the total structures with respect to the surrounding area.

These settlements appear to be settlements within the one metre ± active layer above the permafrost and are of little concern as the PWSP's are temporary structures and the settlements have no effect on the dyke stability.

It is expected that many of the structures that form the basis for the inspections set out in the biannual Geotechnical inspections shall be decommissioned as the mine facilities are finalized.

A number of these structures are awaiting the construction of a land farm to facilitate the disposal of contaminated granular fill from the bottom of containment cells.