QIA 2014 COMPREHENSIVE SECURITY ESTIMATE

FOR BAFFINLAND IRON MINES CORPORATION'S MARY RIVER PROJECT ACTIVITIES OCCURRING ON INUIT OWNED LANDS

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1.0 INTRODUCTION

ARKTIS Solutions Inc. (ARKTIS) was commissioned by the Qikiqtani Inuit Association (QIA) to complete a financial security assessment for the Baffinland Iron Minerals Corporation's (BIMC) Mary River Project (the Project) including all activities (whether affecting land or water) occurring on Inuit Owned Lands (IOL) prior to the year 2013 (exploration and bulk sampling activities) and for the year 2013 and up to the end of the year 2014 (construction activities). The purpose of this security assessment is to establish a new baseline for the financial security amount for the Project up to the end of 2014 using information made more readily available by BIMC and through regular monthly meetings with BIMC; and, to set the course for development of annual security adjustment of the reclamation security amount based on all of the anticipated closure and reclamation costs at the end of the upcoming year as per Section 9 of the Commercial Lease.

Reclamation security presented herein does not include activities on Crown lands (e.g., Steensby Inlet, Mid Rail camp). The estimate also does not address the Type B Exploration licence (2BE-MRY1421) obtained by BIMC on April 17th, 2014, which requires detailed review of BIMC's Abandonment and Reclamation (A&R) Plan report for activities permitted by the licence.

Article 19 of the Nunavut Land Claims Agreement establishes private ownership of selected surface and subsurface lands for Inuit. The Qikiqtani Inuit Association (QIA) is a landowner within the Qikiqtani (Baffin) region of Nunavut. Select components of the Project are, or are anticipated to be, situated on IOL. Surface IOL parcels are managed by QIA, and in the case for the Project, this management is addressed through the Commercial Lease (Q13C301), agreed between the QIA and BIMC. Further, BIMC holds a Type A (2AM-MRY1325) and two Type B (2BB-MRY1421 and 2BE-MRY1421) water licences with the Nunavut Water Board (NWB) for the Project that require further operational and closure requirements for the Project. The Commercial Lease requires a reclamation security deposit, to be determined and held by QIA, for financial liability occurring on IOL as a result of the Project.

The NWB also requires a reclamation security deposit to be held by the Minister for financial liability occurring on Crown lands and freshwater. Part C of the Type A Water Licence also allows for an annual adjustment of the reclamation security at the end of the upcoming year. In response to Schedule C of the Type A Water Licence, QIA is to participate in the NWB lead Annual Security Review process for the Project. Part of the Annual Security Review involves QIA presenting the amount of reclamation security held or to be held under the Commercial Lease specifically for IOL, in order to assist the NWB in determining security to be held by the Crown.

This report is structured as follows:

- Section 2.0 outlines the methodology and assumptions to develop the reclamation security estimate;
- Section 3.0 presents the analysis and results of the reclamation security estimate;
- Section 4.0 provides discussion of the results and summarizes recommendations;
- Section 5.0 lists the reference documents utilized in the estimate of the reclamation security; and,
- Section 6.0 provides a disclaimer for the contents of the report and a closure of the document.

2.0 METHODOLOGY

The reclamation security estimate herein has been developed in accordance with the QIA Abandonment and Reclamation Policy (QIA, 2013; herein after referred to as the QIA A&R Policy) and also generally applies the principles outlined within the Nunavut Tunngavik Incorporated (2008) "Reclamation Policy" and AANDC

(2002) "Mine Site Reclamation Policy for Nunavut". Select principles with respect to sustainable resource development include:

- Return the land to a safe and stable condition that maintains the ecosystem integrity and that is consistent with Inuit societal and cultural needs and aspirations;
- Adequate security is to be provided to ensure the cost of reclamation, including shutdown, closure and post-closure, is born by the operator of the mine;
- Following mine closure, mining companies or their future owners will continue to be responsible for the site, including the remediation of any environmental complication which may develop;
- Every mine will, at all times, have a mine closure and reclamation plan, which includes measures to be taken in the event of a temporary closure; and,
- Estimates of reclamation costs in reclamation security determination are to be based on the cost of having the necessary reclamation work completed by a third party contractor if the operator defaults. The estimates should also include contingency factors that are reflective of the reclamation undertaken.

The approach taken in preparing this reclamation security estimate generally involved the following:

- Review of available information and completion of a site inspection (August 2013 and August 2014 site audits completed by ARKTIS) to further understand the Project;
- Assess the proposed reclamation objectives and activities for completeness and potential for success;
- Where there is uncertainty in the reclamation objectives or activities, describe the conditions that would produce an acceptable closure scenario;
- Consolidate the reclamation activities from which to apply a cost estimate to execute; and,
- Calculate the reclamation security estimate from direct and indirect costs.

The reclamation security amount for the Project was calculated from the sum of direct costs and indirect costs associated with the Project for pre-2013, 2013 and 2014 activities on IOL. The reclamation security estimate is based on the information available at the time of this report development. The following primary documentation was utilized to define the Project and closure conditions:

- BIMC's 2013 and 2014 Work Plans (BIMC 2013a and 2013b);
- BIMC's Master Building Matrix (H349000-1000-00-144-0001, Rev. 4);
- BIMC's Mechanical Equipment and Mobile Equipment List (H349000-1000-50-144-0001, Rev. 0);
- BIMC's 2014 Complete Financial Security Assessment (BIMC 2014);
- BIMC's Abandonment and Reclamation plan (BIMC 2013d); and,
- The QIA A&R Policy.

The following general approach was used to develop the direct costs:

- The Project was separated into reclamation components occurring on IOL;
- For each reclamation component, the objective (i.e., condition) at closure was selected;
- For each reclamation component, the reclamation actions required to achieve the closure objective were selected;
- For each reclamation action, a quantity was specified and a unit cost was determined from first principals using industry standard cost data;
- The reclamation security amount associated with each reclamation action was calculated as the product of the quantity and unit cost; and,

- The reclamation security amount for each reclamation component was calculated as the sum of the reclamation security amount for each reclamation action.

The indirect costs were calculated as the sum of the following:

- Demobilization of materials (i.e., fuel, hazardous materials/wastes, explosives)
- Worker accommodations and air transportation;
- Fuel required for reclamation;
- Closure and Post Closure Monitoring (including pre-closure shutdown, care and maintenance, QIA inspections, geotechnical inspections, environmental site assessment, and environmental monitoring);
- Engineering fees;
- Construction management and project management fees; and,
- Global contingency.

2.1 Direct Cost and Indirect Cost based on Unit Costs

The ARKTIS reclamation security estimate generally applied the following to calculate the Project direct costs. Complete details of the reclamation components, actions, quantities, and unit costs for all activities up to the end of 2014 are provided in **Appendix A**.

- Reclamation components were selected based on BIMC's 2014 Complete Project Financial Security Estimate (BIMC 2014) and through regular meetings between QIA/ARKTIS and BIMC/HATCH. Consistent with BIMC 2014, reclamation components are generally categorized as follows:
- Site Works;
- Mobile Equipment;
- Buildings (Contaminated);
- Buildings (Not Contaminated);
- Bulks;
- Packaged Facilities;
- Mechanical Equipment; and,
- Others (Additional components determined by ARKTIS).
- Reclamation objectives and actions were selected based on BIMC's abandonment and reclamation plan and reclamation security estimates.
- When available, the quantities associated with each reclamation action were selected based on BIMC's Work Plans, "Issued for Construction" drawings, or reclamation security estimates.

Instances where BIMC's documentation was not applied in the ARKTIS reclamation security were a result of the following:

- When there was disagreement between BIMC's reclamation security approach from that specified in the QIA A&R Policy;
- Where there were items missing from BIMC's list of reclamation components as determined by ARKTIS;
- Where there was uncertainty with BIMC's reclamation actions; and,
- Where there was uncertainty with BIMC's quantities or unit costs associated with reclamation actions.

2.1.1 Unit Costs

ARKTIS' unit costs for reclamation actions were selected based on one or more of the following methods, and further detailed below and within **Appendix B**.

- Construction costing data (labour and equipment rates, equipment type and costs, and productivity) for North America, published by RS Means (developed by Reed Construction Data), with location factors to account for the Project area;
- Shipping costs as published from a sealift company in the region (Nunavut Eastern Arctic Shipping or NEAS);
- Crew transportation costing from jet charter data supplied by BIMC and charter for local Nunavut air transportation to surrounding communities;
- Crew accommodation costs supplied by BIMC and determined from actual camp operation costs experienced by BIMC on-site;
- Actual hazardous materials and explosives back haul costs supplied to QIA by BIMC based on BIMC site experiences to date;
- Fuel backhaul cost data from QIA contacted dedicated charter vessel for marine transportation of fuel;
- ARKTIS' experience in construction projects in the region.

2.1.1.1. Labour and Equipment Costs

RS Means (online version 5.0.6) was used to obtain labour and equipment costs. Cost data is representative of the second quarter of 2014. Unit costs include overhead and profit, which would be required by an independent third party contractor, as per the QIA A&R Policy. RS Means has provided construction costs for more than 70 years and the costing data is updated quarterly. The factors that RS Means applies to determine costs and industry trends are summarized in **Appendix C**. All costs derived in RS Means represent U.S. national averages. RS Means provides location factors to adjust the U.S. national averages to a particular location. Location factors are provided for more than 70 areas in Canada. The location factor is a collection of multipliers that are applied to the U.S. national average cost of the same item. ARKTIS utilized the RS Means location factor for Ottawa of 1.038 for equipment and 1.05 for labour to transform the U.S. national averages to Ottawa, which is a southern access point to Nunavut. Since RS Means does not provide a location factor for Nunavut, additional location factors were selected (value of 2.5 for equipment and 1.6 for labour) and applied to the Ottawa costing to transform it to a costing representative of the Project area.

The Nunavut location factor was estimated based on analysis of typical labour and equipment rates charged by Nunavut contractors during construction projects, based on ARKTIS' experience (see **Appendix B** for comparison), to the labour and equipment rates for RS Means data in Ottawa. It should be noted that these costs are associated with construction projects within established Nunavut communities. As such, there is uncertainty with the appropriate location factor to be applied to the Project area. It could be argued that the cost index associated with the Mary River Project should be higher than the estimated value considering the additional "remoteness" of the site compared to an established Nunavut community.

It is ARKTIS' opinion that the unit rates developed herein are considered representative of Nunavut, include profit and overhead, and are not based on preferred/negotiated rates.

RS Means was also used to estimate the amount of time required for each activity based on the productivity of the appropriate crew and equipment associated with the specific reclamation action. The number of personnel required to undertake reclamation activities were determined from the crew sizes, which in turn provided the total person days to complete all reclamation activities. Similarly, the type and number of equipment for reclamation was derived from the equipment list associated with a given crew.

2.1.1.2. Shipping

The marine shipping costs for cargo were estimated by selecting Area A on the Nunavut Eastern Arctic Shipping Inc. (NEAS) Sealift Rates for the 2014 Shipping Season (which includes communities in relative close proximity to the Milne Port, such as Arctic Bay and Pond Inlet), and NEAS Insurance Premiums reference sheets (**Appendix C**). NEAS costing includes movement between beach (high water mark) to/from dock in southern port.

The following costs were selected for cargo as they relate to development of direct unit costs as detailed in Section 3 below:

- For southbound shipment, general cargo rate of $98.22/$m^3$ and an insurance premium of $4.80/$m^3$ were selected resulting in a total general cargo rate of $103.02/$m^3$.
- For northbound shipment, general cargo rate of $151.11/$m^3$ and an insurance premium of $4.80/$m^3$ were selected resulting in a total general cargo rate of $155.91/$m^3$.

2.1.1.3. Fuel (Backhaul and Supply for Reclamation)

Based on QIA discussions with a charter vessel company, a unit cost of $0.10/L for a dedicated vessel to back haul bulk fuel from Milne Inlet to a refinery at a southern port was selected. Fuel costs for mobilization of fuel required for reclamation, which includes fuel for mobile equipment use and heating for accommodations, was derived as $0.38/L, from a report by Transys Research Group (TRG 2009; refer to **Appendix C**), who were commissioned by ARKTIS in 2009 to examine shipping costs to and from the Project.

2.1.1.4. Reclamation Crews

ARKTIS reclamation security accounts for the need for personnel to execute the reclamation activities. The personnel requirements in the ARKTIS analysis were calculated based on the reclamation actions and the crew productivity. The total person days for the reclamation of all site components was determined, for which 30% were to be assumed person days for Nunavut residents and 70% person days for southern crews. The 30%/70% division of crews applies in particular to crew transportation costs. ARKTIS obtained from a charter airline company a unit cost of $1,260/passenger ($24,000.00/19 passengers) per return charter flight between the Mine Site and surrounding communities in Nunavut's Baffin Region (refer to **Appendix C**). BIMC supplied the unit cost of $1,532/passenger ($118,000.00/77 passengers) for return charter flights between the Mine Site and southern Canada. The number of return flights over the course of complete site reclamation was determined assuming crew shifts of three (3) weeks on and three (3) weeks off. Additionally, the total person days determined from the reclamation actions and crew productivity were used to calculate total crew accommodation costs which was simply the total person days multiplied by a unit cost of $226.00/person/day supplied by BIMC.

2.1.1.5. Hazardous Materials/Waste and Explosives Backhaul

Shipping and disposal costs for hazardous materials were obtained from actual site related unit costs supplied by BIMC and based on BIMC experience in shipping and disposing of these materials as part of their regular operations on-site.

2.2 Indirect Costs based on Percentages

The ARKTIS reclamation security estimate includes indirect costs based on percentages associated with engineering; construction management and project management; and, contingency fees. Engineering, project management and contract administration fees were calculated as the fee percentage multiplied by the direct costs and for project management and contract administration, some indirect costs for the Project (refer to **Section 3.2.13** below). The contingency fee was calculated as the fee percentage multiplied by the direct cost and all indirect costs with the exception of mobilization and demobilization for the Project.

2.2.1 Engineering Fees

The Ontario Society of Professional Engineers (OSPE, 2012) provides guidance on the selection of engineering fees as a percentage of "construction costs", which is defined as the contract price(s) of all elements of the project designed by, or on behalf of, the professional engineer, including the general contractor's overhead and profit and all applicable taxes, except HST.

The OSPE recommended fees are based on historical data reported by the Professional Engineers Ontario and on survey data received from professional engineers and clients. The OSPE recommended fees apply to undeveloped areas where complexity is not introduced by existing structures and suggest that an additional fee should be negotiated for services related to demolition work.

In its 2012 fee guideline, the OSPE states an engineering design services fee of 4.6% is fair and equitable compensation for projects of average complexity with construction costs in excess of $10,000,000. By way of comparison, the Consulting Engineers of British Columbia (CEBC, 2009) recommend an engineering design services fee of 4.1% and 3.9% for infrastructure engineering projects of average complexity with constructions costs of $10,000,000 and $20,000,000 respectively. For infrastructure engineering projects with above average complexity with constructions costs of $10,000,000 and $20,000,000, the CEBC (2009) recommends an engineering design services fee of 5.7% and 5.4% respectively.

Based on the fact that the current reclamation activities are of average complexity, an engineering design fee of 3.9% of direct costs was selected for use herein.

2.2.2 Contract Administration and Project Management

In its 2012 fee guideline, the OSPE also provides guidance on the fees associated with contract administration and project management. For construction projects costing more than $10,000,000, the total fees for contract administration and project management are reported as 9.4% of construction costs. This is the value that ARKTIS used in its security estimate.

2.2.3 Contingency

ARKTIS' contingency fee calculation was applied to direct costs and all indirect costs excluding those associated with mobilization and demobilization.

As required by the QIA A&R Policy, the contingency amount applied to the Project was selected based on Aboriginal Affairs and Northern Development Canada's recommendations that have been applied to their estimates of reclamation security for northern mining projects, as detailed in **Table 1**. In general, contingency is higher when the reclamation activities are conceptual in nature and lower for a detailed or final reclamation plan. Based on the Table 3, reclamation details of the Project were considered to range from the "preliminary or budget level" (15% contingency) for the following primary reasons:

- Although "for-construction" or "as-built" drawings were provided for many components of the Project, which are required to initially build the infrastructure, no such type of drawings were provided for site conditions at closure that depict site conditions after reclamation. Thus, the lowest type of contingency to apply, based on a lack of reclamation construction drawings, was 15%.
- The BIMC abandonment and reclamation plan was considered to provide a general level of engineering detail associated with reclamation which largely consisted of a description of the closure actions to achieve the objectives. However, no specifications (or reclamation drawings as described above) were provided to define how a contractor is to execute the reclamation activities. Thus, the applicable contingency, based on availability of engineering detail, was considered to be in the range of 15%.

Table 1: Summary of Contingency Fees by Estimate Type

Estimate Type	Descriptions	Appropriate Contingency
Detailed or project control.	Based upon detailed engineering take-offs and written quotes.	±5%
Definitive or construction drawing phase.	Based upon detailed engineering take-offs and written quotes.	±10%
Preliminary or budget level.	Little detailed engineering and costs based upon verbal quotes.	±15%
Feasibility or advanced conceptual.	Engineering may be 10% complete and costs based upon typical unit costs.	±20%
Pre-feasibility, conceptual or trade-off study.	Very basic engineering only and costs based upon typical unit costs.	±25%

Note: **Table 1** is sourced from the QIA A&R Policy

3.0 ANALYSIS AND RESULTS

3.1 Direct Cost Analysis

Through the methodology described above ARKTIS determined unit costs and quantities for each of the reclamation activities defined through monthly BIMC/HATCH and QIA/ARKTIS meetings, 2013 and 2014 site audits, review of 2013 sea-lift manifests and the BIMC 2014 Complete Project Financial Security Assessment report (BIMC 2014) dated October 10, 2014. The complete list of direct cost reclamation activities can be found in **Table 2** below and are described in detail here.

3.1.1 Fill Application

Fill application is related to cover of the existing Mary River landfill and the on-site disposal of decommissioned buildings, mechanical and mobile equipment and other non-hazardous, inert materials. The development of the fill application unit cost involved determination of the cost to drill and blast, excavate, haul, spread and compact the rock fill material. Detailed calculation of the fill application unit cost can be found in **Appendix B**. The resulting fill application unit cost was calculated to be **$43.31/m^2**.

The quantities of fill application were determined from the volume of all decommissioned materials suitable for disposal on-site (non-hazardous) and include all buildings, slab foundations, Tote Road bridges, Baffinland owned mechanical and mobile equipment, HDPE liners, miscellaneous equipment and materials, site cabling and piping, culverts, incinerators, decontaminated diesel fuel storage tanks, potable water structures, precast concrete, sewage treatment plant, non-fuel storage tanks, timber cribbing, and the reclaim conveyor. It is assumed that fold-away, modular buildings, vendor packaged facilities (i.e. sewage treatment plant, incinerators, etc.) medium diesel tanks and large diesel tanks can be disposed of within their foot print and at half the installed/original height; soft-walled buildings are assumed to be disposed of within 1/3 of their installed footprint; the largest tanks are assumed to be disposed of within their foot print and 1/3 the installed tank height; small diesel tanks and non-fuel storage tanks are assumed to be crushed to half their original volume; culverts are assumed to be crushed to 76mm thickness; and all other disposed materials (i.e. mobile and mechanical equipment, concrete, miscellaneous equipment and materials) are disposed of at their original volumes. Original volumes were determined from the following key reference materials:

- BIMC's Master Building Matrix (H349000-1000-00-144-0001, Rev. 4);
- BIMC's Mechanical Equipment and Mobile Equipment List (H349000-1000-50-144-0001, Rev. 0);
- 2013 Sea-lift Manifests (Vessels 1 through 9)

The total sum of the volumes was found to be 204,838 m^3. The area of fill application was then determined by assuming an on-site disposal location with a depth of 10 m, resulting in a landfill cover area of **20,484 m^2** (including 6,821 m^2 for cover of the existing Mary River landfill). **Note, that the resulting fill application areas and therefore the cost to cover landfills is heavily dependent on the depth of the disposal location. To date the disposal location is not determined. As such, emphasis should be placed on having BIMC determine the final disposal location.**

3.1.2 Grade and Re-Contour

Grade and re-contour of all disturbed areas at site, to reinstate to near original grades, includes all infrastructure pads (i.e. accommodations pads), laydown areas, ore stockpile, roads, quarries, and borrow sources. Within the BIMC 2014 Complete Financial Security Assessment (BIMC 2014), grade and re-contour was broken down into four different components. For ease of comparison, ARKTIS adopted this breakdown as follows:

- Grade and Re-Contour;
- Grade and Re-Contour of Building Footprints;
- Grade and Re-Contour with Liner
- Grade and re-contour significant disturbed areas.

3.1.2.1. <u>Grade and Re-contour/Grade and Re-contour of Building Footprints</u>

Unit cost for grade and re-contour and grade and re-contour of building footprints were determined from the costs to rip the areas and bull doze to acceptable finished grades. Detailed calculation can be found in **Appendix B**. The resulting grade and re-contour; and, grade and re-contour of building footprints unit cost was calculated to be **$1.93/m^2$**.

Areas of required grade and re-contour were determined from scaled measurement of disturbed areas from the following drawings or direct from documentation:

- Milne Port Infrastructure Footprint Layout for Reclamation (H349000-2000-00-015-0020, Rev. B);

- Mine Site Infrastructure Footprint Layout for Reclamation (H349000-4000-00-015-0020, Rev. B)
- BIMC's 2014 Complete Financial Security Assessment (Quarry and Borrow Source Areas);
- Issued for Construction Earthworks Drawings

Areas of required grade and re-contour of building footprints were determined from:

- BIMC's Master Building Matrix (H349000-1000-00-144-0001, Rev. 4);

The resulting areas for grade and re-contour; and, grade and re-contour of building footprints were found to be **2,489,189 m^2** and **27,569 m^2**, respectively.

3.1.2.2. Grade and Re-contour with Liner

The unit cost to grade and re-contour bermed and lined areas such as fuel containment dykes, hazardous waste storage areas, and grey water storage earth infrastructure was the same as above, for standard grade and re-contour, \$1.93/m^2. Though, the unit cost for grade and re-contour with a liner includes the cost to remove the liner which assumes a removal cost equal to 1/3 the cost to install the liner (labour only). Detailed calculation can be found in **Appendix B**. The resulting unit cost, for removal of the liner only, was found to be \$3.41/m^2. Therefore the total unit cost for grade and re-contour with liner was the sum of the costs, or **\$5.34/m^2**.

Areas of bermed and lined infrastructure were determined from scaled measurement from the following key reference drawings:

- Milne Port Infrastructure Footprint Layout for Reclamation (H349000-2000-00-015-0020, Rev. B);
- Mine Site Infrastructure Footprint Layout for Reclamation (H349000-4000-00-015-0020, Rev. B);
- Issued for Construction Earthworks Drawings.

The total area of bermed/lined areas, or grade and re-contour with liner was found to be **115,708 m^2**.

3.1.2.3. Grade and Re-contour Significantly Disturbed Areas

The unit cost for grade and re-contour significantly disturbed areas was derived from the unit cost for standard grade and re-contour, but with a productivity equal to 2/3 that of the standard grade and re-contour (or 50% increase in man-hours and equipment hours as per BIMC 2014, Section 7.3), resulting in a unit cost of **\$2.90/m^2**. Detailed calculation can be found in **Appendix B**.

Quantity determination for grade and re-contour significantly disturbed areas was obtained from the BIMC 2014 Complete Project Financial Security Assessment which identified the borrow source at kilometre 97 as significantly disturbed as well as other unidentified high priority borrow sources along the Tote Road, resulting in areas of 157,012 m^2 and 31,521 m^2, respectively, totalling **188,533 m^2** for grade and re-contour significantly disturbed areas.

3.1.3 Culvert Removal

The unit cost for culvert removal was derived from the cost to excavate to the top of the culvert, remove and load the culvert and to transport overland from an average distance of 25 km. The average distance of 25 km was determined based on the assumption that culverts on the ±50 km half of the road closest to Milne Port or the Mine Site will be transported to the closest site. As such, the furthest haul distance for any culvert will be 50 km down to the shortest distance approaching 0 km, resulting in an assumed average of 25 km. The depth to culvert is assumed to be on average, 1.22 m. The average culvert diameter and length was assumed to be 0.61 m and 20 m, respectively. The resulting culvert removal unit cost was calculated to be **$978.78/culvert**. Detailed calculation can be found in **Appendix B**.

Culverts are located along the Tote Road and site roads within Milne Port and the Mine Site. The quantity of culverts was determined from the following reference documents:

- Tote Road, Culvert Data (H349000-3000-10-088-0030 to 0034, Rev. 0);
- Mine Haul Road, Overall Layout (H349000-4221-10-014-0001, Rev. 0);
- Milne Port, Infrastructure Pad Access Road (H349000-2139-10-012-0001, Rev. 0);
- Milne Port, Ore Stockpile to Fuel Tank Farm Road (H349000-2139-10-012-0002, Rev. 0);
- Milne Port, Raw Water Intake Road (H349000-2139-10-012-0003 and 004, Rev. 0);
- Mine Site, Explosives Facilities Road (H349000-4139-10-012-0003, Rev. 0)
- Mine Site, Infrastructure Pads Access Road (H349000-4139-10-012-0004, Rev. 0);
- Mine Site, Raw Water Intake Road & Utility Berm (H349000-4139-10-012-0006 to 0008, Rev. 0); and,
- BIMC's 2014 Complete Financial Security Assessment (BIMC 2014).

The total quantity of culverts was found to be **383 culverts**.

3.1.4 Bridge Removal

Bridge removal unit cost was derived from the cost to demolish the bridge and to short haul for landfill. The detailed calculation can be found in **Appendix B**. The unit cost was calculated based on an area unit cost of $588.01/m^2 multiplied by the average area of all four Tote Road bridges of 427.8 m^2, resulting in a lump sum unit cost of **$251,552.72/bridge**. The average area of the four Tote Road bridges was determined from the following drawings:

- Tote Road, River Crossing at Sta. 17 (H349000-3132-10-042-0001, Rev. 0);
- Tote Road, River Crossing at Sta. 62 (H349000-3133-10-042-0001, Rev. 0);
- Tote Road, River Crossing at Sta. 80 (H349000-3134-10-042-0001, Rev. 0);
- Tote Road, River Crossing at Sta. 97 (H349000-3135-10-042-0001, Rev. 0).

The quantity of bridges (**4**) was confirmed through ARKTIS 2014 Site Audit site visit.

3.1.5 Timber Cribbing

Timber cribbing is used as a foundation to support modular buildings. ARKTIS adopted person hour and equipment hour assumptions presented to ARKTIS, by HATCH during the monthly meeting between BIMC/HATCH and QIA/ARKTIS since they appeared to be reasonable for the scope of reclamation work which involved loading of timber cribbing and hauling to landfill. However, ARKTIS labour and equipment rates developed using RS Means were applied to the HATCH person hours and equipment hours to generate an independent unit cost. Detailed calculation can be found in **Appendix B**. Using the assumption that a single set of timber cribbing supports a building area of 44.59 m^2 (consistent with BIMC assumption) the resulting unit cost for timber cribbing removal and disposal was calculated to be **$20.60/m^2** of building area.

The total area of buildings supported by timber cribbing was calculated from the BIMC Master Building Matrix (H349000-1000-00-144-0001, Rev. 4) and included the accommodation modular buildings, office modular buildings, washcars, construction offices, etc. The total area of buildings supported by timber cribbing was found to be **16,068 m^2**.

3.1.6 Precast Foundations

The unit cost for removal, load, and hauling to landfill for precast foundations was first determined based on a unit of volume (m^3) then converted to an area unit cost through assumption that the quantity of precast foundations was 0.26 m^3 per 1 m^2 of building. The resulting unit cost was found to be \$140.52/m^3 and converted to **\$36.54/m^2**. Detailed calculation can be found in **Appendix B**.

ARKTIS referenced the 2013 Sealift Manifests to determine the total volume of precast units delivered to site. A volume quantity was first established since precast foundation units were found to vary in size. The total volume of precast foundation was found to be 1,262 m^3. During the ARKTIS 2014 Site Audit, it was noted that large "Jersey" barriers were located throughout site and that concrete "sleepers" were installed, ready to receive the new reclaim conveyer. The "Jersey" barriers and concrete "sleepers" for the reclaim conveyor are also precast concrete structures and as such ARKTIS used the precast foundations unit cost to account for removal of the "Jersey" barriers and concrete sleepers. The respective volumes, using the 2013 Sealift Manifests, were found to be 178 m^3 and 128 m^3. As such the total volume of precast concrete units to be reclaimed was calculated to be 1,568 m^3.

For the purpose of determining the equivalent area of precast foundations, for easy comparison with BIMC quantities, ARKTIS determined the total cost for precast foundations using the volume unit cost and volume quantity above, divided by the total area unit cost [(\$140.52/m^3 x 1568 m^3)/\$36.54/m^2] to obtain the total equivalent area of precast foundation of **6,032 m^2**.

3.1.7 Slab on Grade

Reclamation of concrete slab on grade is limited to drilling of holes through the slab to allow for through slab drainage of water. ARKTIS adopted the BIMC/HATCH assumption that drill holes could be completed in 7.5 min. for every 1 m^2 of slab by a single labourer and light equipment. The resulting ARKTIS unit cost was calculated as **\$28.16/m^2**. Detailed calculation can be found in **Appendix B**.

The quantity for concrete slab on grade was determined using the BIMC Master Building Matrix (H349000-1000-00-144-0001, Rev. 4) where building with slab on grade floors are identified and the areas were calculated based on the foot print of the buildings. The resulting area of concrete slab on grade was found to be **9,751 m^2**.

3.1.8 Mobile Equipment

The unit cost for decontamination, load, haul and landfill of mobile equipment was determined using assumptions of person and equipment hours stated in BIMC's 2014 Complete Financial Security Assessment, which upon examination and review appeared to be reasonable. However, ARKTIS labour and equipment rates were applied to these person and equipment hours to develop independent unit costs. Detailed calculation of the unit cost for light, medium and heavy mobile equipment can be found in **Appendix B**. The resulting unit costs were found to be **\$938.16/light, \$1,559.26/medium and \$2,251.31/heavy**.

The quantity of light, medium and heavy mobile equipment was determined from the quantities presented by BIMC within BIMC's 2014 Complete Financial Security Assessment. Note, ARKTIS determined higher quantities of mobile equipment for each category (light, medium and heavy). The discrepancy in quantity likely represents third party mobile equipment on-site or results from an inventory system not in place at the time of this financial security assessment and as such, limited understanding of exact numbers of mobile equipment on-site. As such, for the purposes of this assessment ARKTIS assumed that the discrepancy in quantity of mobile equipment represents the third party mobile equipment at site, requiring demobilization south. However, to adequately and accurately determine the number, type and model of each third party owned mobile equipment for the purposes of financial security, an "enterprise level accounting system" must be put in place as reported by BIMC during September 29, 2014 to October 1, 2014 meetings between BIMC/HATCH and QIA/ARKTIS. Accounting of any additional mobile equipment, from that reported by BIMC (see below), was deferred until such time that an adequate inventory system is implemented.

The quantity of light, medium and heavy mobile equipment presented by BIMC as BIMC owned was **180 units**, **84 units** and **122 units**, respectively.

3.1.9 Buildings (Not Contaminated)

ARKTIS divided buildings into categories within the financial security estimate which include modular buildings (single and multiple modules); fold-away buildings and soft-walled (tent) buildings; and, other buildings which represent legacy buildings noted on site during both the 2013 and 2014 site audits completed by ARKTIS. Additionally, during the 2014 site audit additional temporary construction warehouses and offices were noted and were therefore included herein.

3.1.9.1. Modular Buildings (Not Contaminated)

Development of unit costs for modular buildings assumed not to be contaminated were based on costs to demolish the building, load and short haul to landfill location. Detailed calculation can be found in **Appendix B**. The resulting unit cost was calculated to be **$61.48/m^2**.

For the purposes of comparison with BIMC results, the modular buildings are further divided into single trailer, double trailer (2 or more), and prefabricated special modular all of which require the same unit cost for reclamation. Non-contaminated modular building quantities were obtained from BIMC's Master Building Matrix (H349000-1000-00-144-0001, Rev. 4) and were calculated to be **914 m^2** (single trailer), **1,414 m^2** (double trailer), and **12,073 m^2** (prefabricated special modular).

3.1.9.2. Fold-away, Soft-Walled, and Other Buildings (Not Contaminated)

Unit costs for the fold-away building teardown, soft-walled building teardown and other buildings demolition were assumed to be similar; as such, the same unit cost was used herein for each building type. As per modular buildings, the unit costs were developed based on the cost to demolish, load and short haul to landfill. The resulting unit cost was calculated to be **$41.35/m^2**. Detailed calculations can be found in **Appendix B**.

Quantities for fold-away and soft-walled buildings were also determined from BIMC's Master Building Matrix (H349000-1000-00-144-0001, Rev. 4) with results of **1,672 m^2** and **9,279 m^2**, respectively.

Other buildings were identified separate from all other buildings as they represent legacy buildings which are not listed on BIMC's Master Building Matrix (H349000-1000-00-144-0001, Rev. 4). These buildings include wood framed and sheathed structures, small to medium sized pre-fabricated steel buildings, and some legacy tent structures. The total quantity of other buildings was determined to be **642 m^2**.

3.1.9.3. Temporary Construction Warehouses and Offices

The unit cost for demolition, load and haul temporary construction warehouses and offices was selected to be similar to non-contaminated modular buildings which was calculated to be **$61.48/m^2** as per Section 3.1.9.1 above.

The building area quantities were determined from either on-site measurement of the buildings during the 2014 site audit, or from inspection of site audit photographs where dimensions could be easily determined from standard sizes of sea-containers (for sea-container temporary structures). The total quantity was calculated to be **995 m^2**.

3.1.10 Building (Contaminated)

Buildings assumed to be contaminated were also divided into modular buildings (single and multiple modules); fold-away buildings and soft-walled (tent) buildings; and, other buildings.

3.1.10.1. Modular Buildings (Contaminated)

Development of unit costs for contaminated modular buildings were similar to those for non-contaminated with the exception that the productivity was assumed to be reduced to 1/3 the daily output of non-contaminated modular buildings to account for the complexity introduced when decontamination of the building is required. This results in a higher unit rate for removal of contaminated modular buildings equal to **\$184.43/m^2**. Refer to **Appendix B** for detailed calculations.

The contaminated modular buildings were also divided into single trailer, double trailer (2 or more), and prefabricated special modular. Using the BIMC Master Building Matrix (H349000-1000-00-144-0001, Rev. 4) the quantities for each type were found to be **327 m^2** (single), **1,340 m^2** (double trailer), and, **1,161 m^2** (prefabricated special modular).

3.1.10.2. Fold-away, Soft-Walled, and Other Buildings (Contaminated)

For fold-away, soft-walled and other building teardown the unit cost was developed similar to that of non-contaminated; though, again, the productivity was reduced to 1/3 the non-contaminated building of similar type to account for decontamination. The reduced productivity results in a unit cost for contaminated fold-away, soft-walled and other building teardown of **\$143.71/m^2**.

Quantities obtained from the BIMC Master Building Matrix (H349000-1000-00-144-0001, Rev. 4) for fold-away, soft-walled and other buildings were found to be **9,571 m^2**, **2,562 m^2**, and **51 m^2**, respectively.

3.1.11 ISO Shipping Container

As noted on-site during 2014 site audit investigations, some buildings were constructed from prefabricated ISO shipping containers (i.e. communication sheds and emergency shelters) and similar to buildings, were classified as non-contaminated and contaminated. The development of unit costs were based on person hours and equipment hours as presented within the BIMC 2014 Complete Project Financial Security Assessment and verified by ARKTIS to be reasonable. As well, contaminated ISO shipping container removal was assumed be less productive by a factor of 0.33. The associated unit cost for non-contaminated and contaminated sea-containers were calculated to be **\$35.73/m^2** and **\$70.08/m^2**, respectively. Detailed calculations can be found in **Appendix B**.

Quantities of sea-containers used as buildings were obtained from the BIMC Master Building Matrix (H349000-1000-00-144-0001, Rev. 4). The quantity of non-contaminated and contaminated ISO sea-containers was found to be **1,092 m^2** and **461 m^2**, respectively.

Note, that the ISO shipping containers discussed here do not include shipping containers on site used for storage and shipping and not as buildings. These type of shipping containers are discussed below.

3.1.12 Piping and Cabling

Piping and cabling were found, during the 2014 site audit to be spread over long distances on-site to deliver water or move waste waters; and, to deliver power throughout site. The unit cost for removal of the piping and cabling was based on person hours and equipment hours presented by BIMC within the BIMC 2014 Complete Project Financial Security Assessment, and verified by ARKTIS to be reasonable. However, as per typical procedures described above, ARKTIS applied ARKTIS generated labour and equipment rates to the BIMC person hours and equipment hours to generate an independent unit cost of **$58.43/m** for piping and **$27.78/m** for cabling. Detailed calculation can be found in **Appendix B**.

Quantities for both piping and cabling were obtained directly from the BIMC 2014 Complete Project Financial Security Assessment which indicated that **19,623 m** of piping and **27,300 m** of cabling existed on-site.

Within the ARKTIS financial security, piping was divided into sub-categories, particularly for the calculation of landfill volumes, including HDPE Piping varying in diameters of 50mm, 76mm and 102mm; carbon steel piping; and, heat traced piping varying in diameters of 50mm, 76mm and 102mm. The same unit cost for piping removal was applied to each piping type and the sum of the lengths for each piping type represent the quantities presented above.

3.1.13 Incinerator, Potable Water, and Sewage Treatment Plant (Vendor Packages)

The unit cost development for incinerator, potable water and sewage treatment plant removal was based on BIMC person hours and equipment hours for each vendor package, verified by ARKTIS to be reasonable, and include the cost to dissemble and decontaminate, load and haul to landfill. The ARKTIS labour and equipment rates were applied to the BIMC person and equipment hours for each package to generate the unit costs of **$9,422.75/package** for both incinerator and potable water plants; and, **$10,772.79/package** for the sewage treatment plant. Detailed calculation can be found in **Appendix B**.

Quantities for each vendor package were obtained from the BIMC Master Building Matrix (H349000-1000-00-144-0001, Rev. 4) and confirmed to be **two (2) packages** for each, incinerator, potable water and sewage treatment plant.

3.1.14 Mechanical Equipment

The unit cost for decontamination, load, haul and landfill of mechanical equipment was determined using assumptions of person and equipment hours stated in BIMC's 2014 Complete Project Financial Security Assessment, which upon examination and review by ARKTIS appeared to be reasonable. However, ARKTIS labour and equipment rates were applied to these person and equipment hours to develop independent unit costs. Detailed calculation of the unit cost for each of the light, medium and heavy mechanical equipment owned by BIMC can be found in **Appendix B**. The resulting unit costs were found to be **$1,784.11/light, $4,276.14/medium and $41,937.03/heavy**.

The quantity of light, medium and heavy mechanical equipment owned by BIMC was determined from the quantities presented by BIMC within BIMC's 2014 Complete Project Financial Security Assessment. Note, ARKTIS determined higher quantities of mobile equipment for the light and heavy equipment categories, but not for medium equipment. As such, the ARKTIS quantity for medium equipment was retained for ARKTIS use herein. The discrepancy in quantity between light and heavy equipment likely represents third party mechanical equipment on-site or results from an inventory system not in place at the time of this financial security assessment and as such, limited understanding of exact numbers of mechanical equipment on-site. As such, for the purposes of this assessment ARKTIS assumed that the discrepancy in quantity of mechanical equipment represents the third party mechanical equipment at site, requiring demobilization south. Similar to mobile equipment, to adequately and accurately determine the number, type and model of each third party owned mechanical equipment for the purposes of financial security, an "enterprise level accounting system" must be put in place as reported by BIMC. Accounting of any additional mechanical equipment, from that reported by BIMC (see below), was deferred until such time that an adequate inventory system is implemented.

The quantity of light and heavy mobile equipment presented by BIMC as BIMC owned was **175 units light** and **27 units heavy**. The ARKTIS generated quantity of **111 units for medium equipment** was used herein.

3.1.15 Light and Medium Non-Fuel Storage Tanks

Unit costs for reclamation of both light and medium non-fuel storage tanks were derived from the cost to cut free the tanks from in place piping, load, and haul the tanks to landfill. The daily output for completion was assumed to be the removal of 2 for light non-fuel tanks and 1 for medium non-fuel tanks. The resulting unit costs were found to be **$2,462.81/light tank** and **$6,604.21/medium tank**. Detailed calculation can be found in **Appendix B**.

The quantities for both light and medium non-fuel storage tanks were generated from the combination of on-site inventory of the tanks by ARKTIS within the 2014 Site Audit site investigation and the following reference documents:

- 2013 Sealift Manifests (Vessels 1 through 9); and,
- BIMC's Mechanical Equipment and Mobile Equipment List (H349000-1000-50-144-0001, Rev. 0).

The resulting quantities were **32 light tanks** and **16 medium tanks**.

3.1.16 Diesel and Jet-A Fuel Storage Tanks

Diesel and Jet-A fuel storage tanks were divided into the following categories, as per BIMC's 2014 Complete Project Financial Security Assessment, for ease of comparison:

- Small Diesel Storage Tanks
- Medium Diesel Storage Tanks
- Large Diesel Storage Tanks
- Largest Diesel Storage Tanks

3.1.16.1. Small Diesel Storage Tanks

Small diesel storage tanks include tanks of 10,000L to 20,000L storage capacity. Unit cost development included cost to decontaminate (remove fuels from tanks), load, and haul to landfill. In the development of the unit cost, it is assumed that four (4) tanks could be reclaimed per day, providing a unit cost of **$3,080.58/small diesel fuel storage tank**. Detailed calculation can be found in **Appendix B** below.

Through on-site investigation during 2013 and 2014 site audits completed by ARKTIS and cross referencing a number of tanks identified during the audit with the 2013 Sealift Manifests (Vessel 1 through 9) the quantity of small diesel fuel storage tanks was determined to be **29 tanks**.

3.1.16.2. Medium, Large and Largest Diesel Fuel Tanks

Medium diesel fuel storage tanks, within the financial security assessment, are defined as 500,000 L to 750,000 L diesel fuel storage tanks (including Jet-A); while large and largest diesel fuel tanks are considered tanks with storage capacities of 5 million litres (ML) and 12 ML, respectively. The unit cost for reclamation of each diesel fuel tank size was first determined based on area of the tanks (tank foot print) and included the cost to remove fuel, decontaminate, demolish, load and haul. The resulting area unit cost for reclamation of bulk diesel fuel storage tanks was found to be $208.07/m^2 (medium tank), $218.89 (large tank), and $227.73 (largest tank). Using the area unit costs, lump sums for each tank size could be generated based on the actual foot prints of the tanks which were calculated to be 82.52 m^2 for medium tanks, 514.72 m^2 for large tanks, and 794.22 m2 for the largest tanks. The resulting lump sum unit costs were therefore found to be **$17,169.52/medium tank**, **$112,668.70/large tank** and **$180,864.02/largest tank**. Detailed calculation can be found in **Appendix B**.

Similar to BIMC, ARKTIS determined the quantity of medium, large and largest diesel fuel storage tanks based on the total intended quantity of tanks which could be constructed within the containment dykes in both Milne Port and the Mine Site, which from the reference drawings below, where found to be **8 medium diesel fuel/Jet-A storage tanks** (four 500,000L diesel fuel storage tanks at the Mine Site and four 750,000 L Jet-A fuel storage tanks at Milne Port), **2 large diesel fuel storage tanks** at Milne Port and **4 largest diesel fuel storage tanks** at Milne Port. Note that some conservatism exists here since the fourth 12ML diesel fuel storage tank has not been constructed at site.

Referenced drawings:

- Milne Port, Site Preparation Bulk Fuel Storage (H349000-2613-10-014-0001, Rev. 0)
- Mine Site, Site General Arrangement (H349000-4613-10-014-0001, Rev. 1)

3.1.17 Miscellaneous Items

A unit cost was developed to account for all miscellaneous items spread throughout the site (Milne Port and the Mine Site) including equipment less than 200 kg in weight and non-hazardous materials. The unit cost was developed based on the cost to load and haul miscellaneous items and assumes that 50 items can be reclaimed per day. The resulting unit cost was found to be **$80.21/each**. Detailed calculation can be found in **Appendix B**.

The generation of quantities for this reclamation component was heavily populated through both the 2013 and 2014 site audits completed by ARKTIS, where ARKTIS inventoried as much of the non-hazardous materials found throughout the site. The total number of miscellaneous items identified by ARKTIS was found to be approximately **385 items** with maximum weights of 200 kg.

3.1.18 Reclaim Conveyor

The unit cost for reclaim conveyor was obtained direct from BIMC's 2014 Complete Project Financial Security Assessment which included the cost to demolish, load, and haul to landfill. The unit cost was $1,329,441.31/reclaim conveyor of which there was only one. However, ARKTIS did validate the unit cost presented by BIMC, upon BIMC supply of typical documentation for installation of conveyors. The document which was an excerpt from "Man-hour Manuals and Other Books by John S. Page" supplied typical installation man hours for a number of conveyor widths ranging from approximately 460 mm to 1070 mm and lengths from 3 m to 305m. Note, the reclaim conveyor at site is 1520 mm wide and 850 m long. As such, extrapolation of the table data for a conveyor width of 1520 mm as supplied within the BIMC documentation found that approximately 5500 man hours/305m of conveyor at 1520 mm width would be required to install the reclaim conveyor on-site. As noted, the reclaim conveyor is 850 m long. As such, the resulting man hours was calculated to be 5500 man hours multiplied by 850m/305m, resulting in approximately 15,328 man hours to install the 1520 mm by 850 m long reclaim conveyor. Using the assumption that the reclaim conveyor could be decommissioned using 1/3 the installation hours, or approximately 5109 person and equipment hours, and in this case using the ARKTIS labour and equipment costs of $115.00/person and for ease of calculation the BIMC blended equipment rate of $150.00/equipment for every man hour, the cost to decommission and dispose of the reclaim conveyor is estimated to be $1,353,885.00 which was the approximate value presented by BIMC. Since the calculation for reclaim conveyor presented by ARKTIS herein was simply a check of the cost used by BIMC to confirm order of magnitude, the BIMC cost of **$1,329,441.31/reclaim conveyor** was used within the ARKTIS security estimate.

3.1.19 Contaminated Soil

ARKTIS included a unit cost for the removal of localized areas of contaminated soil, not located within a lined berm, which included costs to excavate, load, and short haul contaminated soil to landfarm. The resulting unit cost was found to be **$30.79/m^3**. Detailed calculation of contaminated soil unit cost can be found in **Appendix B**.

The quantity of contaminated soil was calculated from areas of heavy equipment and industrial related activities primarily surrounding pre-2013 infrastructure such as workshops, helicopter laydown, and incinerator laydowns; and, contaminated soil noted on site during 2014 site audit, stored in Quatrex bags and/or piled on sheets of geomembrane (as noted during 2014 site audit at the Mine Site maintenance area adjacent to the Weatherhaven accommodations). For laydown areas the depth of soil contamination was assumed to be 0.5 m and the percentage of affected soil was assumed to be 50%. The resulting quantity of contaminated soil required to be excavated and transported to landfarm was approximately **2,862 m^3**.

3.1.20 Airstrip Lighting

The unit cost for airstrip lighting removal, load and haul to landfill was assumed to be very similar to the unit cost for reclamation of site cabling. As such, the unit cost used was **$27.78/m** (refer to Section 3.1.12 above). Detailed calculation can be found in **Appendix B**.

The total quantity of the airstrip lighting was assumed to be the length of the airstrip on either side of the strip, resulting in a quantity of **4000 m**. The referenced drawing used to determine this length was:

- Mine Site, Aerodrome Site Plan (H349000-4400-10-014-0001, Rev. 0)

3.1.21 Camp Mats

During the 2014 site audit, ARKTIS noted that below each of the modular buildings and timber cribbing "foundation" there were "camp mats" which consisted of wood enclosed within a steel box frame. The 2013 Sealift Manifests (Vessels 1 through 9) were used to identify two sizes of camp mats. Unit costs for each camp mat size were developed and included costs to load and haul the camp mats for landfill disposal. Camp mat size 1 averaged a volume of 2.64 m^3 per mat and camp mat size 2 averaged a volume of 7.67 m^3 per mat. The unit cost for camp mat size 1 assumed that 25 mats could be reclaimed in a day and resulted in a unit cost of **$517.57/camp mat**. The unit cost for camp mat size 2 assume that 18 camp mats could be reclaimed in a day resulting in a unit cost of **$729.02/camp mat**. Detailed calculations can be found in **Appendix B**.

The quantity of both sizes of camp mat were determined from the 2013 Sealift Manifests (Vessels 1 through 9) and found that a total of **36 Size 1 camp mats** and **67 Size 2 camp mats** were shipped to site for use below modular buildings and associated timber cribbing.

3.1.22 Container Water Crossings

During the 2014 site audit, ARKTIS noted that not all water crossings originally built from sea-containers were removed at the time of the visit. As such, a cost was carried by ARKTIS to account for this reclamation component. Development of unit costing included the cost to remove containers from the water crossing, load, and short haul to the closest area (Milne Port or the Mine Site). Unit cost development was assumed to be similar to culvert removal with much of the effort to lift the container out of place assumed similar to excavation of soil from the top of a culvert. The resulting unit cost was determined to be **$2,437.53/container**. Detailed unit cost development can be found in **Appendix B**.

The quantity of containers was determined from site observation during the 2014 site audit and accounting for removal of 1 of the 4 container water crossings. The number of containers counted within the three remaining container water crossings was found to be **50 containers**.

3.1.23 Sea Containers

During the 2014 site audit, ARKTIS noted a significant number of sea-containers stored on site, used for storage themselves, or awaiting backhaul. As such, a separate unit cost for the assumed backhaul of each of the containers was obtained from the NEAS 2014 Shipping Cost Schedule for retrograde shipment of empty sea-containers, which was **$694.00/TEU** (twenty foot equivalent units).

The total number of containers counted on-site during the 2014 site audit were 684 twenty foot containers and 237 forty foot containers. Since the unit cost noted above represents twenty foot equivalent units, forty foot containers account for 2 TEU. As such the total TEU with respect to forty foot containers was calculated to be 474 TEU. As such the total containers on-site at the time of the 2014 site audit represents a quantity of 1,158 TEU. However, the number of sea containers was established during a time at site that was considered by BIMC to be an extreme case. Ideally, an implemented "enterprise level accounting system" could supply sufficient data to determine an average number of sea containers at site at any time. Until such time that an inventory system can be put in place, it was assumed that at least 50% of the ARKTIS noted 2014 site audit sea containers would be at site at any given time. As such, a total of **579 TEU** was used by ARKTIS herein.

3.2 Indirect Cost Analysis

3.2.1 Hazardous Materials/Wastes

Through the final meeting between BIMC/HATCH and QIA/ARKTIS, BIMC supplied ARKTIS with their unit cost to back haul and dispose of hazardous wastes of **$358.00/m^3** obtained from hazardous waste back hauls completed on-site.

The ARKTIS generated quantity for all hazardous materials and wastes on-site was obtained from the 2013 Sealift Manifest (Vessels 1 through 9) and the 2014 site visit, where ARKTIS completed a detailed inventory of all hazardous materials and wastes found on-site, complete with photo log. The quantity of all hazardous materials and wastes was found to be 7,389 m^3. However, this volume was considered by BIMC, during September 29, 2014 to October 1, 2014 meetings between BIMC/HATCH and QIA/ARKTIS, to be an extreme case since there was a reported back log in annual shipment of hazardous wastes off-site. As such, a volume of **5,500 m^3** of hazardous materials/wastes was assumed.

3.2.2 Explosives

Since there was restricted access to explosive storage on-site, ARKTIS could not confirm the quantity of explosives. As such, the quantity supplied within BIMC's 2014 Complete Project Financial Security Assessment was used. The BIMC supplied explosives quantity was **376,620 kg**.

Similar to the hazardous materials unit cost above, BIMC also supplied ARKTIS with their back haul and disposal cost for explosives of **$2.37/kg**.

3.2.3 Fuel

The cost to back haul fuel remaining on-site upon closure was determined to be **$0.10/L**. As indicated in the methodology above, the cost was determined through QIA discussions with a charter fuel vessel company.

The quantity of fuel remaining on-site, for the purposes of financial security assessment, was determined to be neither extreme case of 100% fuel or 0% fuel remaining. Instead, the "QIA Approach" was to assume 50% of the total bulk fuel storage capacity on site remains under a reclamation scenario to be back hauled. The following drawings were used to determine the total fuel storage capacity on site:

- Mine Site, Site General Arrangement (H349000-4613-10-014-0001, Rev. 1)
- Mine Site, Dyke Sections & Details (H349000-4613-10-035-0001, Rev. 0)
- Milne Port – Site Preparation Bulk Fuel Storage Overall Plan (H349000-2613-10-014-0001, Rev. 0)

The total bulk fuel storage on-site was calculated to be 48 million litres (ML) Arctic Diesel (three 12ML tanks, two 5 ML tanks and four 0.5 ML tanks) and 3 ML Jet-A fuel (four 0.75 ML tanks) for a total of 51 ML. As such, 50% of this capacity is **25.5 ML** to be back hauled during reclamation. **Note, that the QIA financial security does not include a future 12 ML tank to be installed at Milne Port. Once constructed, this future 12 ML tank will be accounted for on future financial security adjustments.**

3.2.4 Contaminated Soil Treatment

Contaminated soil treatment is included in the indirect cost section simply because it does not have a percentage of engineering design added to the cost. This approach is used since little to no engineering would be required for the operation of tilling the contaminated soil within a landfarm or in place within bermed/lined areas on site. The unit cost for contaminated soil treatment was determined in conformance with the details provided within BIMC's 2014 Complete Project Financial Security Assessment and similar to the unit cost development for grade and re-contour where costs for ripping of areas and dozing of ripped materials were assumed. Key assumptions from BIMC's 2014 Complete Project Financial Security Assessment used in the calculation of the soil treatment cost include a total of 200 hours derived from a practical tilling season length of 10 weeks and tilling occurring once a week for 10 hours over a span of 2 years (10 weeks x 10 hours per week x 2 years = 200 hours). Based on these key assumptions a contaminated soil treatment unit cost of $13.45 m^3 was calculated. Detailed calculation can be found in **Appendix B**.

The quantity of contaminated soil requiring treatment was obtained from similar assumptions for contaminated soil excavation per Section 3.1.20 above and for all bermed/lined areas determined from the following reference documents:

- Milne Port Infrastructure Footprint Layout for Reclamation (H349000-2000-00-015-0020, Rev. B);
- Mine Site Infrastructure Footprint Layout for Reclamation (H349000-4000-00-015-0020, Rev. B);
- Issued for Construction Earthworks Drawings.

The total contaminated soil calculated was 18,325 m^3, providing a lump sum cost for contaminated soil treatment of **$246,536.50**.

3.2.5 Mobilization of Workers Required for Reclamation

As per Section 2.1 above, mobilization of workers by charter flight was based on lump sum costs for return flights between communities in the Qikiqtaaluk (Baffin) Region and the Mine Site for Northern residents who were assumed to represent 30% of the reclamation work force; and, charter flight between the Mine Site and a single hub in southern Canada for the remaining 70% workforce. The respective charter costs for Northern residents and crews from southern Canada were found to be **$24,000 for 19 passenger charter plane** ($1260/passenger) and **$118,000 for 77 passenger jet charter plane** ($1,530/passenger). The $24,000 charter rate for travel within Nunavut was obtained by ARKTIS from Unaalik Aviation (refer to quote within **Appendix C**); the $118,000 charter rate for travel to and from southern Canada was supplied by BIMC based on current charter costs incurred by BIMC for mobilization of workers for construction of the mine.

Based on all reclamation activities, the quantities for each reclamation activity detailed in Section 3.1 above, and the industry standard crew productivities provided by RS Means, the total person days to complete reclamation of the Project was determined to be **12,865 person days** (based on 10hrs/day). Assuming crew rotations of three weeks in and three weeks out, the total number of productive days at site were calculated to be 20 days. As above, 30% of the work force were assumed to be residents of the Qikiqtaaluk Region of Nunavut and therefore represent approximately 3,859 person days; the remaining 9,006 person days were allocated to crews from southern Canada. The number of return flights was calculated by dividing the person days by 20 productive site days multiplied by the number of passengers per charter. The results found that 11 flights were required to mobilize Nunavut residents and 6 flights were required to mobilize crews from southern Canada. As such, the costs for mobilization of Nunavut residents and residents of southern Canada were found to be $264,000 and $708,000, respectively. The sum of these amounts, **$972,000**, represents the total cost to mobilize workers for complete reclamation of the Project based on activities up to the end of 2014.

3.2.6 Worker Accommodation & Camp Operations

BIMC supplied a unit cost for worker accommodations of $226/person/day based on current camp accommodation costs incurred during construction of the mine. ARKTIS experience from involvement in construction projects in Nunavut found room and board costs charged by Nunavut contractors to be approximately $285/person/day. Though the costs of $285/person/day were associated with small camps capable of housing approximately 25 to 30 persons. As such, based on economies of scale, the unit cost of **$226/person/day** presented by BIMC appeared to be reasonable for camps with larger capacities to house personnel and was used herein to develop worker accommodation and camp operation costs.

The total person days of 12,865 was used to calculate worker accommodation and camp operation costs of **$2,907,490** ($226/person/day x 12,865 person days).

3.2.7 Mobilization and Demobilization of Reclamation Equipment

The mobilization and demobilization of reclamation equipment was derived from RS Means crews; the equipment used by each crew; the number of specific crews assumed to be required to complete the reclamation work within a reasonable period of time (i.e. four years for completion of reclamation); and, the cost to mobilize equipment to site using a unit cost of $155.91/$m^3$ per Section 2.1.1 above and the cost to demobilize equipment from site using a unit cost of $103.02/$m^3$ per Section 2.1.1 above. This analysis found that the cost to mobilize and demobilize mobile equipment for reclamation was approximately 10% of the direct costs. As such, for ease in determining mobilization/demobilization cost for reclamation mobile equipment in future financial security adjustments, 10% of the direct costs was adopted. The value of 10% direct costs is also consistent with industry standards in estimating mobilization/demobilization associated with construction projects.

3.2.8 Fuel for Reclamation Mobile Equipment

Fuel required for reclamation mobile equipment to complete the reclamation activities was based on the assumption, within the BIMC 2014 Complete Project Financial Security Assessment dated October 10, 2014, that fuel could be used from existing diesel fuel remaining on-site (which is in non-compliance with the QIA A&R Policy); though, ARKTIS was simply using this assumption, where BIMC assumed a reduction in the cost to back haul fuel in the amount of $263,000, to determine the associated volume of fuel, which at $0.10/L back haul costs, represents **2,630,000 L** required for reclamation mobile equipment.

From northbound shipping rates provided to ARKTIS by Transys Research in 2009 (refer to **Appendix C**), the cost per litres to mobilize fuel to site was determined based on a shipping cost of $9,122.55/TEU (twenty foot equivalent unit) when shipping by ISO container fuel tanks. One twenty foot long ISO container fuel tank (1 TEU) is capable of storing 24,000L of fuel. Therefore, the cost to ship fuel northbound by ISO container fuel tanks (1 TEU) was determined to be approximately **$0.38/L** ($9,122.55/24,000 L = $0.38/L).

Using this unit rate, the total cost to mobilize fuel for use during reclamation was calculated to be **$999,400** (2,630,000 L x $0.38/L).

3.2.9 Geotechnical Inspections

Costs for geotechnical inspections were derived from the BIMC Interim Mine Closure and Reclamation Plan (BAF-PH1-830-P16-0012, Rev. 2) dated June 27, 2014. To develop the geotechnical inspections cost, ARKTIS assumed 1 QIA representative and 3 Engineers would travel to site over a period of 6 days. A unit cost of $63,240/year was calculated which included professional fees for site review ($1,200/day), airfare ($2,500.00/person for commercial flights and $2,000/person charter flight), accommodation costs ($285.00/person/day for a smaller camp; consistent with ARKTIS experience with room and board costs for small construction camps in Nunavut) and professional fees for reporting. According to the BIMC Interim Mine Closure and Reclamation Plan, physical stability monitoring is to occur over five (5) years. As such the total cost for geotechnical inspections was determined to be **$316,200.00**.

3.2.10 Project Environmental Site Assessment

Costs for project environmental site assessment were completed similar to the derivation of unit cost for geotechnical inspection above. ARKTIS assumed 1 QIA representative and 3 Engineers would travel to site to complete the environmental site assessments over a period of 7 days. A unit cost of $71,580 per site investigation was determined and included professional fees for site review ($1,200/day), airfare ($2,500.00/person for commercial flights and $2,000/person charter flight), accommodation costs ($285.00/person/day for a smaller camp; consistent with ARKTIS experience with room and board costs for small construction camps in Nunavut) and professional fees for reporting. ARKTIS assumed that a single site visit would be completed for environmental site assessment and as such the total cost was found to be **$71,580.00**.

3.2.11 Closure and Post Closure Monitoring

During the final meeting of the monthly meetings held between BIMC/HATCH and QIA/ARKTIS it was agreed that the closure and post closure monitoring details were not well defined. BIMC indicated that this was a process that would be improved over time.

Closure and post closure monitoring includes Interim Care and Maintenance (ICM), active reclamation and post-reclamation periods. The ICM is typically 1 to 3 years; ARKTIS recommends accounting for a minimum of 2 years ICM for the Project including the costs for QIA to obtain and hold a water licence associated with closure and post closure activities.

Additionally, post-closure monitoring typically includes the following programs and reporting:

- Regulatory costs (annual report, management plans, progress reports, etc.);
- Surveillance network program (SNP) and aquatic effects monitoring program (AEMP);
- Geotechnical inspections;
- Vegetation monitoring program;
- Air quality monitoring program; and,
- Wildlife effects monitoring program.

Full scale monitoring occurs during the early years post closure. After this time, the monitoring programs are reduced in scope and frequency based on the assumption that various criteria of evaluation will have improved sufficiently to enable amendments to the water licence and land use permits to allow for reduced programs to be implemented.

Currently, it was agreed to carry a "place hold" cost of **$851,000** for closure and post closure monitoring. This amount will require re-adjustment in future financial security annual assessments when the closure programs are better defined by BIMC. The allocated security amount for closure and post closure monitoring shall include requirements for QIA to obtain and maintain a water licence.

3.2.12 Engineering Fees

As per Section 2.2.1, engineering fees were calculated to be 3.9% of direct costs only. The direct cost (refer to **Table 2** below) was determined to be $20,852,000. As such the total engineering fees were determined to be **$813,228**.

3.2.13 Supervision, Project Management & Contract Administration

As per Section 2.2.2, supervision, project management and contract administration costs were calculated to be 9.4% of direct costs and some indirect costs, including contaminated soil treatment, geotechnical inspections, project environmental site assessment, and closure and post closure monitoring. The total cost for supervision, project management and contract administration was calculated to be **$2,099,708**.

3.2.14 Contingency

As per Section 2.2.3, contingency applied to the direct costs and all indirect costs with the exception of mobilization and demobilization costs was 15%, in conformance with the QIA A&R Policy. The resulting cost for contingency was determined to be **$4,245,301**.

3.3 Summarized Results

Table 2 below summarizes the financial security amount determined by ARKTIS for the Project to the end of the year 2014. The table is structured to resemble Table 10-1 of the BIMC 2014 Complete Project Financial Security Assessment report for ease of comparison as required. However, the estimate, and therefore, the summary table, does not address the Type B Exploration licence (2BE-MRY1421).

Table 2: Summary of ARKTIS 2014 Global Financial Security Estimate – Direct Costs

Direct Cost					
Area	Item	Quantity	Unit	Unit Cost	Direct Cost
Site Works	Fill Application	20,484	m^2	$43.31	$887,055
	Grade and Re-Contour	2,498,189	m^2	$1.93	$4,830,330
	Grade and Re-Contour of Building Footprints	27,569	m^2	$1.93	$53,306
	Grade and Re-contour with Liner	115,708	m^2	$5.34	$617,881
	Grade and Re-contour Significant Disturbed Areas	188,533	m^2	$2.90	$546,802
	Culvert Removal	383	ea.	$978.78	$374,873
	Bridge Removal	4	ea.	$251,552.72	$1,006,211
	Timber Cribbing	16,068	m^2	$20.60	$330,940
	Precast Foundations	6,032	m^2	$36.54	$220,386
	Slab on Grade	9,751	m^2	$28.16	$274,623
Mobile Equipment	Light Mobile Equipment	180	ea.	$938.16	$168,869
	Medium Mobile Equipment	84	ea.	$1,559.26	$130,978
	Heavy Mobile Equipment	122	ea.	$2,251.31	$274,659
Buildings (Contaminated)	Single Trailer (Modular)	327	m^2	$184.43	$60,355
	Double Trailer (2 or More)	1,340	m^2	$184.43	$247,060
	Prefabricated Special Modular	1,161	m^2	$184.43	$214,068
	Fold Away Building	9,571	m^2	$143.71	$1,346,856
	Soft Walled Building (Tent)	2,562	m^2	$143.71	$368,184
	ISO Shipping Containers	461	m^2	$70.08	$32,302
	Other Buildings	51	m^2	$143.71	$7,270
Buildings (Not Contaminated)	Single Trailer (Modular)	914	m^2	$61.48	$56,205
	Double Trailer (2 or More)	1,414	m^2	$61.48	$86,933
	Prefabricated Special Modular	12,073	m^2	$61.48	$742,193
	Fold Away Building	1,672	m^2	$41.35	$69,155
	Soft Walled Building (Tent)	9,279	m^2	$41.35	$383,733
	Temporary Construction Warehouses and Office Allowances	995	m^2	$61.48	$61,146

Direct Cost					
Area	Item	Quantity	Unit	Unit Cost	Direct Cost
	ISO Shipping Containers	1,092	m²	$35.73	$39,009
	Other Buildings	642	m²	$41.35	$26,568
Bulks	Piping	19,623	m	$58.43	$1,146,651
	Cable	27,300	m	$27.78	$758,394
Packaged Facilities	Incinerator	2	ea.	$9,422.75	$18,845
	Potable Water	2	ea.	$9,422.75	$18,845
	Sewage Treatment Plant	2	ea.	$10,772.79	$21,546
Mechanical Equipment	Light Equipment	175	ea.	$1,784.11	$312,219
	Medium Equipment	111	ea.	$4,276.14	$474,652
	Heavy Equipment	27	ea.	$41,937.03	$1,132,300
	Light Tanks	32	ea.	$2,462.81	$78,810
	Medium Tanks	16	ea.	$6,604.21	$105,667
	Light Diesel Tanks	29	ea.	$3,080.58	$89,337
	Medium Diesel Tanks	8	ea.	$17,169.52	$137,356
	Large Diesel Tanks	2	ea.	$112,668.70	$225,337
	Largest Diesel Tanks	4	ea.	$180,864.02	$723,456
	Miscellaneous Items	385	ea.	$80.21	$30,882
	Reclaim Conveyor	1	ea.	$1,329,441.31	$1,329,441
Not Included by BIMC	Contaminated Soil (Excavate)	2,862	m³	$30.79	$88,136
	Airstrip Lighting	4,000	m	$27.78	$111,120
	Camp Mats (Size 1)	36	ea.	$517.57	$18,633
	Camp Mats (Size 2)	67	ea.	$729.02	$48,845
	Container Water Crossings	50	ea.	$2,437.53	$121,877
	Sea Containers	579	ea.	$694.00	$401,826
				SUB-TOTAL DIRECT COSTS	$20,852,000

Table 3: Summary of ARKTIS 2014 Global Financial Security Estimate – Indirect Costs

Indirect Costs		
Item		Indirect Cost
Off-site Disposal	Waste & Material	$679,932
	Disposal Cost Waste & Material	$1,289,068
	Fuel	$2,550,000
	Ammonium Nitrate	$875,999
Soil	Contaminated Soil Treatment	$246,536
Mob. & Demob.	Mobilization of Workers Required for Reclamation	$972,000
	Worker Accommodation & Camp Operations	$2,907,490
	Mobilization and Demobilization of Equipment and Materials by Sealift	$2,085,200
	Fuel for Reclamation Mobile Equipment	$999,400
Monitoring and Reporting	Geotechnical Inspections	$316,200
	Project Environmental Site Assessment	$71,580
	Closure & Post Closure Monitoring	$851,000
Other	Engineering Fees	$813,228
	Supervision, Project Management & Contract Administration	$2,099,708
	Contingency	$4,245,301
	SUB-TOTAL INDIRECT COSTS	$21,003,000

Table 4: Summary of Direct and Indirect Costs and Resulting Total Global Security

Total Costs	
Costing Type	Value
Direct Cost Estimate	$20,852,000
Indirect Cost Estimate	$21,003,000
Total Financial Security Estimate	**$41,855,000**

Therefore, the total financial security estimate determined by QIA for all activities on IOL up to the end of 2014 (including pre-2013 exploration and bulk sampling activities and 2013/2014 construction activities) is **$41,855,000**.

4.0 RECOMMENDATIONS

ARKTIS recommends that the reclamation security held by QIA (currently $39,793,000 pursuant to Q13C301 Commercial Lease) for IOL be adjusted by an increase of $2,062,000 to an aggregate reclamation security of **$41,855,000** for all activities up to the end of 2014. Note, as indicated above, this estimate does not include the financial security associated with the Type B Exploration licence (2BE-MRY1421).

5.0 REFERENCE DOCUMENTS

- Aboriginal Affairs and Northern Development Canada (2002). Mine Site Reclamation Policy for Nunavut.
- Baffinland Iron Mines Corporation (2013a). 2013 Work Plan.
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- Consulting Engineers of British Columbia (2009). Budget Guidelines for Consulting Engineering Services.
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- Qikiqtani Inuit Association (2013). Abandonment and Reclamation Policy for Inuit Owned Lands. Version 3.0.
- TranSys Research Ltd. (2009). Arctic Shipping Rates Weight and Volume Influence.

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