

# Lupin Mines Incorporated

January 19, 2017

Karen Kharatyan  
A/Manager of Licencing  
Nunavut Water Board  
Gjoa Haven, NU X0E 1J0

**Re: Lupin Mines Incorporated Comments on Nunavut Water Board's Third Party Technical Review of Lupin Gold Mine Reclamation Security Estimates**

Dear Mr. Kharatyan,

Lupin Mines Incorporated (LMI) would like to thank the Nunavut Water Board (NWB) for the opportunity to provide comments on Knight Piesold's (KP) *Third Party Technical Review of Reclamation Security Estimates for the Lupin Gold Mine, Nunavut* (the KP Report).

LMI encloses its detailed comments on the KP Report as Appendix A to this letter. For convenience of reviewers, LMI has embedded its comments within the text of the KP Report under the heading "LMI Response". As you are aware LMI has also retained Mr. Ken Bocking (MSc, P.Eng.) of Golder Associates to complete an Independent update of the Lupin Mine closure costs as one of the terms of our recent Water Licence. Mr Bocking has spent three days on site as part of this work and was on site at the time of the visit by NWB, KP and INAC. He has also completed a detailed review of all associated documentation associated with site closure and reclamation as part of his mandate. We have therefore asked Mr Bocking to provide his comments on the KP Report.

Mr. Bocking's comments are reflected under the heading "Golder Response". Mr. Bocking has also prepared an estimate based on the most recent Reclaim model and this is attached as Appendix B to this letter. This estimate will be updated for the September 2017 submission but it reflects the site at 2016, without including any credit for work completed in the 2016 season. The Golder estimate differs in several areas from the most recent LMI estimate but on reviewing this with Mr. Booking we concur that it provides an accurate assessment of the overall costs required to reclaim the Lupin site at the end of 2016 and therefore we are including it as part of our submission.

LMI was pleased to note that in many key areas, the KP Report supported LMI's assumptions and recommendations. In others, the KP Report provides recommendations which LMI has responded to with a proposed increase to the LMI reclamation security estimate.

While LMI has included detailed comments on the recommendations included in the KP Report in the attached document, LMI has identified three key areas where there is outstanding significant disagreement, namely:

- Costs to be allocated to replacement of fuel - As agreed by all parties during 2016, provided LMI is able to provide continuing evidence of the volumes of fuel available at site and evidence that the fuel is of a useable quality, there is no need to include a cost allocation for fuel purchase and disposal of existing fuel at site.
- Camp rates - As set out in detail in the attached document, both INAC and LMI are of the view that evidence of **actual and current** camp costs should be preferred to the RECLAIM rate recommended by KP, which would result in an allocation of camp costs almost three times the actual rates.
- Unit rates - KP appears to have misunderstood the basis for LMI's unit rates, which were not based on a prorated 2005 rate but instead based on actual costs for similar work completed by third party contractors at site during 2016.

With respect to process, it appears that several of the recommendations in the KP Report may be based on misunderstanding or missing information. For this reason, LMI requests that the NWB host a teleconference to discuss issues relating to the KP Report, as described in its December 8, 2016 correspondence. LMI's third party Golder Associates reclamation expert would also attend the call in order to provide the NWB staff, KP and INAC with an opportunity to ask any questions arising out of Mr. Bocking's comments on the KP Report. . In LMI's submission, such a conference ought to also address the concerns raised by INAC about this process as described in INAC's letter of January 19, 2017.

While LMI may have further comments on INAC's comments on the KP report, LMI respectfully disagrees with INAC's comments on the following points:

- INAC has suggested that the 2016 Interim Abandonment and Reclamation Plan (2016 IARP) should not have been used by KP in the preparation of the KP report. In LMI's view, KP, as an expert in reclamation, was entitled to review the 2016 IARP and make its own assessment of the reasonableness of the 2016 IARP when giving technical advice to the NWB;
- INAC has suggested that conclusions in the KP report with respect to unit costs, indirect costs, and period for interim care are not consistent with INAC's experience at other mine sites. In response, LMI notes that each site has different issues and requirements which must be considered independently and that a variation from INAC's past experience at other, different sites does not mean that KP Report (or LMI's estimate) is inadequate; and
- INAC appears to have misunderstood KP's conclusion that there is no further security required for potential additional contamination in or around the fuel facilities. KP, as an independent expert advising the NWB, has reviewed both parties' positions and concluded that INAC has made an assumption about additional contamination, but that the assumption cannot be confirmed. In LMI's submission, KP is correct to not allocate any additional security for a speculative and unconfirmed concern and LMI submits that the NWB should accept KP's conclusion on this point. Further, as this amendment application was brought by INAC, LMI

submits that fairness requires INAC to bear the burden of proving the necessity of additional reclamation security as it would be unfair to require LMI to disprove speculative concerns.

Please do not hesitate to contact Karyn Lewis at 778-386-7340 or [klewis@elginmining.com](mailto:kewis@elginmining.com) if you have any questions or require further comments.

Respectfully submitted,

*"Karyn Lewis"*

Karyn Lewis  
Project Coordinator

## **Appendix A**

### **LMI Response to the Third Party Technical Review of Lupin Gold Mine Reclamation Security Estimate**

**LUPIN MINES INCORPORATED**  
**RESPONSES TO THIRD PARTY TECHNICAL REVIEW**  
**OF LUPIN GOLD MINE RECLAMATION SECURITY ESTIMATE**

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LMI has included KP's comments and has responded below each recommendation in text boxes.

### **3 KP's FINDINGS**

#### **3.1. KP GENERAL**

The detailed cost comparison is presented as Table B.1 in Appendix B. The assumptions or basis for estimate made by both LMI and INAC are summarized in the table along with KP's comments on the Parties' reclamation security estimates and KP's resultant reclamation security estimate.

Further discussion on each major cost item is provided below, organized based on the RECLAIM 7.0 layout developed and used by INAC, as presented by Arcadis (2015).

#### **3.2. DIRECT COSTS**

##### **3.2.1. Underground Mine**

Entrances to the underground include five (5) shafts and one portal. Closure measures for the underground include capping or covering the entrances to eliminate access. It is expected that all hazardous materials would be removed from the underground workings prior to removing access. The assumptions made by LMI and INAC in this regard are described below.

- **Control Access** INAC and LMI have used the same unit rate for capping the 5 raises. There is considerable difference in the unit rates applied to backfilling the open stope and adits: LMI used \$3.50/m<sup>3</sup> based on the RECLAIM 6.1 high unit rate for dozing soil piles. INAC used a rate of \$14.20/m<sup>3</sup> based on the cost to excavate/load/haul/spread/compact. KP noted sufficient stockpiles adjacent the open stope such that LMI's assumption of dozing nearby soil is reasonable.
- INAC included the cost for a crown pillar study and LMI did not include this cost. A crown pill study will be required at the Central and West Zones to confirm that subsidence will not be a hazard post-closure.
- **Remove Hazardous Materials** - INAC included costs to decommission and decontaminate any underground equipment left underground. LMI has indicated that equipment has been removed from the underground workings or area. There

is no way to verify that this work was completed without investigating, though during the site visit KP observed electrical junction boxes in cold storage, which supports LMI's assertion that equipment had been removed from the underground workings (Appendix A). Additionally, the underground area is already flooded, so to inspect or remove any remaining material would require dewatering of the underground area.

KP recommends the reclamation costs for this item be revised as follows:

- LMI's/INAC's cost for the five (5) engineered caps
- LMI's cost for backfilling the open stope and adit
- Exclude costs to remove hazardous materials
- INAC's cost for a crown pillar study

**LMI RESPONSE:**

**Although we believe the work and designs completed to date are sufficient in terms of crown pillar studies we accept KP's recommendation and commit to completing a final review of the stability of the central and west zones. LMI will therefore add \$25,000 to the estimate to complete this work.**

**Tailings Impoundment**

The tailings containment area (TCA) at Lupin consists of:

- Five (5) cells containing tailings (Cells 1 through 5)
- Two (2) ponds (Ponds 1 and 2)
- Eight (8) perimeter dams (Dam 1A, 1B, 1C, and Dam 2 through Dam 6)
- Nine (9) internal dams (Dam 3a through 3e, Dams J through N, and the Divider Dykes)

All dams are constructed from esker sand and gravels, with the perimeter dams incorporating a geosynthetics liner for seepage control. All the perimeter dams are designed as frozen core dams founded on permafrost. Generally, the perimeter dams range in height from 1 to 8 metres. The internal dam heights range from 6 to 12 metres (Norwest, 2016).

KP understands from the site visit that repairs were recently completed on the M dam, and repairs were being completed on a section of the cover where standing water has been known to historically accumulate (Appendix A). During the site visit, it was also noted that the northwest corner of Cell 4 contains exposed tailings. Any submerged tailings would also likely become exposed with a lowering of water levels in Cell 4. The current IARP does not account for the management of these tailings.

The closure concept for tailings is to encapsulate the potentially acid-generating tailings within a water saturated esker material cover. This would effectively isolate the tailings from the environment and limit oxygen transfer through to the sulphide contained in the tailings and thus prevent acid generation. At final closure, a system of rip-rap spillways will be constructed to permit natural water flow to the environment. LMI's 2016 IARP describes a number of proposed work activities:

- Breach the divider dyke
- Construct spillways within J-Dam and Dam 1A
- Dam enhancement using quarried rip rap to reduce slopes to 2.5H:1V
- Covering of tailings with a partially saturated 1-m thick granular cover
- Disposal of the tailings pipeline (8.5 km length) in the mine workings
- Disposal of two tailings pump stations

Progressive reclamation is ongoing and has now been completed at several cells. Currently, Cells 1 and 2 appear to be completely reclaimed, while Cell 3 appears to be approximately 80% covered and Cell 5 appears to be approximately 70% covered. According to Norwest (2016), approximately 84% of the entire TCA has been covered by at least 1 m of sand/gravel cover. The uncovered portions of Cells 3 and 5 represent future areas for tailings deposition that were established during the restart of operations (LMI, 2014).

As the progressive reclamation is being completed, some of the internal dams (3a, 3b, 3c, 3e) are incorporated into the cover and are no longer considered as individual dams (Norwest, 2016).

Water management within the TCA during the current care and maintenance phase involves directing runoff and seepage from Cell 3 into Cell 4. The water in Cell 4 then flows through the Divider Dykes either through the control structure or via seepage into Pond 1. Cell 5 runoff is pumped directly into Pond 1. Pond 1 water level is managed by

siphoning water into Pond 2. Water treatment is carried out by treating the water in-situ in Pond 2, by adding in lime to raise the pH. Precipitates from this treatment are deposited in Pond 2. The treated water in Pond 2 is siphoned into the environment in accordance with the Water Licence requirements (NWB, 2015). Pond 2 does not have any flood overflow structures, such as a spillway or a control gate, to manage the water level. All discharge is retained and restricted until water quality meets the discharge requirement outlined in the Water Licence.

The NWB noted that substantial disagreement exists between the Parties in regard to the tailings cover requirements: past, existing and into the future. Reclamation measures associated with the TCA and the assumptions made by the Parties, are described below.

- **Stabilize Embankment(s)** - According to the 2016 IARP, LMI (2016) was in the process of updating the stability analyses for all dams to meet the latest Canadian Dam Safety Guidelines (CDA, 2013). During the site visit, KP learned that repairs were recently completed on the M dam. A Dam Safety Review was completed by SRK Consulting in 2015 (SRK, 2016) and a Dam Safety Inspection of the TCA containment structures was completed in 2016 by Norwest. Norwest (2016) identified several high priority maintenance items.

The IARP contemplated dam enhancements involving the placement of quarried rip rap to reduce slopes to 2.5H:1V. LMI assumed that 80,000 m<sup>3</sup> of rip rap would be used to stabilize embankments, whereas INAC estimated the quantity of material required to be 100,000 m<sup>3</sup>. Both quantities are similar to one another and neither is supported by engineering design. KP recommends using the mid-point of the two quantities (90,000 m<sup>3</sup>). LMI used a specified unit rate of \$15.20/m<sup>3</sup> and INAC used RECLAIM's high unit rate of \$17.80/m<sup>3</sup>. Since LMI's specified rate is between the low and high values for this rate, LMI's rate appears reasonable.

KP also recommends that the costs to address the high priority maintenance items identified by Norwest (2016) be added to the reclamation cost estimate.

#### **LMI RESPONSE**

**As per KP's comment Dam M has already been completed. The final cost was less than \$200,000, completed by a third party contractor for which documentation is proprietary, including rip rap placement, backfill and compaction to the satisfaction of the geotechnical engineer. As confirmed by the Norwest geotechnical engineer, the recommended repairs by Norwest (2016) for Dam K and Dam M are within the**



footprint of the closure slope stabilization and LMI's estimate already included the estimated 80,000 m<sup>3</sup> slated for the closure work. Therefore, it is not necessary to add additional costs to the repairs to Dam K and Dam M to the closure cost estimate. The recommended repairs for the divider dyke should be not considered as part of closure work also as the dyke is intended to be breached and has no need for additional stabilization. . Therefore, LMI believes that 80,000 m<sup>3</sup> and a unit rate of 15.20m3 is more than adequate to complete the repairs at Dam K.

LMI does not believe that the maintenance items identified by Norwest should be included in the cost estimate. These repairs are related to best engineering practice and future operations, and should not be considered as inclusive work prerequisite to final closure reclamation.

**GOLDER COMMENTS:**

It appears that KP has not agreed to \$7.24 because it is based on an old (2005) construction cost (albeit adjusted for inflation). It is more defensible to use the documented costs from 2016, which we understand amount to \$7.02/m3. These are lower in part because LMI has supplied the fuel to the Contractor; however that is valid since it would be the case in any future construction as well. (The RECLAIM rate of \$9.30/m3 presumably includes fuel costs. Using this rate and also costing \$1.39/l for fuel supply is actually double counting.)

- **Cover Tailings** - The IARP proposes a partially saturated soil cover over the tailings. LMI has been actively placing cover in 2016 and Norwest (2016) estimated that 84% of the TCA has been covered.

LMI and INAC assumed different quantities to cover the tailings. LMI specified 241,328 m3 of soil cover, corresponding to a 1 m cover over a 241,328 m2 area as specified in the IARP. INAC used a larger quantity of material of 375,000 m3, which appeared in LMI's 2012 reclamation estimate. LMI's quantity is consistent with the IARP and is assumed to be more precise on this basis.

LMI used a unit rate of \$7.24/m3. LMI's unit cost is based upon prorated actual costs from 2005. INAC used the low RECLAIM unit rate of \$9.30/m3 for excavate, long-haul, spread and compact. KP recommends that LMI's quantity estimate and INAC's more current unit rate be adopted for this item.

**LMI RESPONSE:**

LMI's unit rate is not based only on prorated actual costs from 2005. It is also based on the current costs and unit rates based on work completed at site during -2016. LMI's rate is based on the actual third party costs to complete this work. As an example, LMI has retained a third party contractor who is currently covering Cell 5 at costs lower than the LMI \$7.24 unit rate. Please note that it clearly states in the estimate that RECLAIM unit rates are a tool to assist in completing an estimate when actual costs are not available. LMI has been able to provide actual costs. During the site visit, in October 2016 by the NWB, INAC and KP, all parties witnessed the turn-around times, load times, dump times which were all well within the unit rate costs provide by LMI. Furthermore, LMI provided the unit rates during the site visit (both paper and electronic copies) for work completed during the 2016 work season, not the prorated actual costs from 2005 as stated above, to both INAC, KP and the NWB (please see Appendix C and Appendix E).

**For all of these reasons, LMI's rate of \$7.24 should be applied by the Board.**

Tailings observed during the site visit in the northwest corner of Cell 4 will require appropriate closure measures. The likely approach will be to excavate and place the tailings in Cell 4 at a new location that will be beneath the partially saturated cover. The quantity of tailings at this location requiring management is currently unknown, though LMI has demarcated the extent of tailings with wooden stakes. It is recommended that LMI include the management of these tailings in the next revision to its IARP and update the reclamation security estimate for this item, accordingly.

INAC also included costs for revegetation (\$200,000). While re-vegetation is not specified in the IARP, INAC included this item because of the following requirement in Part I, Item 8 of the current water licence: *"...the Licensee shall implement Progressive Reclamation, including progressive covering of the tailings and re-vegetation where feasible, as soon as is realistically possible."* KP understands why INAC has included this cost item based on direction provided in the water licence. The reclamation cost estimate, however, should be based on the current version of the IARP. What is feasible with respect to revegetation is a technical determination beyond the scope of this third-party review.

INAC also included (\$186,000) for repairs to the existing soil cover.

KP recommends that the latest RECLAIM unit rate used by INAC be adopted for this item; costs for revegetation should be excluded, but costs for cover repair should be included. An allowance of \$100,000 should be included to excavate and dispose of tailings from the northwest corner of Cell 4. LMI may seek a credit for progressively covering the tailings.

**LMI RESPONSE:**

**LMI acknowledged the small amount of tailings located at Cell 4, which is has fenced off, will need management and will include it in the next revision to the IARP. The remediation approach might be cover in place or excavate and relocate, as determined by best practice recommendations**

**LMI accepts KP's recommendation to include \$100,000 to complete the remediation work at Cell 4.ended by qualified person.**

**The work to complete minor cover repairs was completed during the 2016 work season, as observed by the NWB, INAC and KP, during the site visit. This area was recognized for repair over several years and is the only area that has ever been identified as requiring repair since tailings cover was commenced in the 1990's. Therefore, LMI does not agree that \$186,000 should be included for cover repairs.**

**Of note, as observed and commented on by KP personnel the tailings cover "was in excellent condition" considering how long it had been in place. The KP personnel also commented on the natural vegetation that was occurring on the tailings cover.**

**Remove Tailings Discharge** - There is a 6-km long tailings line external to the TCA, and 2.5 km of tailings line within the TCA, according to the IARP.

Both Parties are in agreement on the cost of this item. KP suggests that this unit rate (\$57.33/m) could be replaced with the low RECLAIM unit rate for large pipelines since the pipeline is not being salvaged and will be disposed of on-site. The additional 2.5 km of tailings pipeline located within the TCA should be included in this cost item.

**LMI RESPONSE:**

**LMI agrees with the comment by KP but would like to note that, as observed during the site visit, that all of the tailings pipe has already been dismantled and is ready to be either be put back to together for future operations or easily removed and place in the landfill. Therefore a portion of the work has already been completed and LMI has**

taken this into consideration in their estimate when determining the time required to remove all piping in the tailings area.

LMI agrees with KP's assessment that the lower RECLAIM unit rate should be used.

**GOLDER COMMENTS:**

LMI provided a cost of \$18.39/m (i.e., \$110,346 for 6,000 m) provided by an independent engineering estimate. This allows for disposal of pipe in the on-site landfill.

- **Upgrade Spillway** - LMI assumed a rip rap quantity of 20,000 m<sup>3</sup> to construct the two spillways, with a unit rate of \$28.37/m<sup>3</sup>. INAC used the same quantity of rip rap with a slightly higher rate of \$30.75. Both rates are based on a long haul and are considerably higher than the rates presented by both Parties for rip rap to be used in stabilizing the embankments. KP recommends applying LMI's unit rate for rip rap used to stabilize the dams (\$15.20/m<sup>3</sup>).

INAC included costs for excavating the channels and for geotextile fabric, and LMI did not. INAC's quantities appear reasonable, though a long haul/spread and compact unit rate (SC3H) was used for excavating soil under high specifications. It should be sufficient to place and spread the excavated material close to the spillway, such that a lower unit rate such as SC1H could be applied.

**LMI RESPONSE:**

The rate provided for the Rip Rap by LMI was prior to sufficient suitable Rip Rap being identified in the area beside the proposed spillway openings. Furthermore, on review of the design with the consulting geotechnical engineer it was determined that minimal Rip Rap will be required and it will be along the sides of two excavated cuts with minimal flow. This will be included in the updated IARP filed with the 2016 Annual Report.

**GOLDER COMMENTS:**

Golder estimated lower quantities of excavation, rip rap and geotextile based on the following geometry: two spillways, each with a 10 m bottom width with 4:1 sideslopes and a dam height of 7 m. Excavation is simple dozing with disposal nearby downstream using SB1L at \$4.30/m<sup>3</sup>. Rip rap is to be borrowed from rip rap on adjacent dams and shorelines above the final water level using an RR3L rate of \$7.00/m<sup>3</sup>.

- **Specialized Items** - Both Parties included the same costs for installing permanent instrumentation for monitoring.

**Treat Supernatant** - INAC included an allowance to treat supernatant during reclamation of the TCA, which appears appropriate.

**LMI RESPONSE:**

KP's recommendation is not necessary as LMI has already included treatment of the TCA under post closure monitoring/surface water sampling at \$300,000. We agree with KP's and INAC's assessment that \$100,000 of this amount would be to treat supernatant. LMI's \$300,000 is for the 3 years of interim care and maintenance (as there was no interim care and maintenance included in RECLAIM 6.1), which includes water sampling as well treatment of Pond 2 prior to the final discharge.

**GOLDER COMMENTS:**

On the "Water Management" sheet, we have allowed for one-time treatment of water associated with lowering Pond 1 and Pond 2 each by 1.9 m. See Section 3.2.5.

### **3.2.2. Waste Rock**

Approximately 1,000,000 m<sup>3</sup> of waste rock was used in construction of site facilities including dam construction, road building, laydown areas and building foundation preparation (URS, 2005 in Arcadis, 2015). An unknown quantity of waste rock remains stockpiled at the ball field area. A portion of this stockpile was relocated to the TCA in recent years.

Two previous studies characterized waste rock across the site. Arcadis (2015) noted that URS (2005) tested the coarse cobble fraction of waste rock from roadbeds, tailings dams, the airstrip and the mill complex pad. Approximately 30% of the waste rock samples tested contained sulphide concentrations above 0.3%; however only one of these samples had an acidic paste pH. The results of the 2004 program showed that a portion of the Lupin waste rock had the potential for acid generation. The alkaline pH values of the waste rock indicated acid generation had not yet occurred, even in those samples considered potentially acid generating (URS, 2005).

A subsequent Phase I and 2 Environmental Site Assessment (ESA) conducted by Morrow (2006) reported that the median concentration of arsenic in the development waste rock is 1,140 mg/kg. A seepage assessment found that 40% of the seeps sampled in 2005 were

acidic (Morrow, 2006).

LMI's reclamation cost estimate does not include any cost to assess or manage potentially acid generating (PAG) waste rock, though this will be required. LMI (Page 9) and INAC both note that further work will be required to evaluate options for final disposal of PAG waste rock, and assess methods for identifying this material during excavation, if segregation of the rock be the preferred disposal option.

The assumptions made by LMI and INAC in regard to the reclamation requirements presented in Table B.1 are described below.

- **Further Geochemical Characterization of Waste Rock** - Further geochemical evaluation of the waste rock across the site will be required to understand the nature and extent of acid rock drainage/metal leaching (ARD/ML), to support an options assessment of final disposal options. INAC identified a cost of \$20,000 to cover the geochemical analyses of 100 waste rock samples. However, INAC did not include costs for sample collection (personnel and equipment) or data analysis by a qualified geochemist.

KP recommends the cost be included to complete a geochemical evaluation aimed at understanding the nature or ARD/ML impacts and hence waste rock disposal options. All associated costs should be included (sample collection, lab testing and data interpretation).

The Morrow (2006) study identifies a median arsenic concentration in the waste rock well in exceedance of site remediation guidelines. Therefore, the additional geochemical evaluation should include investigation of arsenic.

- **Risk Assessment** - LMI's IARP states that soil with elevated concentrations of metals (including arsenic) identified by the Morrow (2006) study will be managed on a risk-based approach, and that the risk assessment will be completed during final reclamation and closure planning (page 38). A cost will need to be allocated to complete the risk assessment.
- **Waste Rock Options Assessment** - Though a waste rock options study was identified by both LMI and INAC, neither party allocated a cost to complete such a study.

In the absence of an options study and alternative disposal plans, INAC assumed that 40% of the 1,000,000 m<sup>3</sup> of waste rock (400,000 m<sup>3</sup>) of the waste rock may be potentially acid generating (PAG), requiring disposal in the TCA (100,000 m<sup>3</sup>)

and underground (300,000 m3).

KP recommends a cost be allocated to a waste rock disposal options study. The options assessment should address the viability of and site-specific costs associated with disposing of waste rock in the TCA versus underground. For example, the options study should confirm that adequate space exists for any waste rock allocated for disposal underground, and costs to dewater the underground (if required) should be identified.

- **Relocate Dumps** - Both parties assumed 400,000 m3 of ARD/ML waste rock will require disposal in the TCA or underground. LMI applied a unit rate of \$4.72/m3, which is the RECLAIM 6.1 rate for excavation and short-haul of waste rock or rip rap. INAC used a unit rate of \$8.90/m3 (code SC3L for the excavation/load/short haul/spread and compact).

KP recommends that the RECLAIM 7.0 unit rate RR3 (\$7.00/m3) be used for this item.

#### **LMI RESPONSE:**

**LMI does not agree with KP's recommendation for a unit rate of \$7.00/m3. LMI specifically removed the rock from the ballpark as it was identified as the highest risk of potential ARD and also the longest haul distance for disposal. The rates provided at site were for these actual 2016 costs and therefore reflect the LMI estimate (see attached Appendix C and Appendix E). Secondly, it was clearly observed by all parties during the site visit that any potential ARD is minimal and that the estimate of 400,000 m3 is most likely significantly overestimated. Therefore, we agree with KP's suggestion to complete an options assessment but this should not be allocated as a separate cost items as this would be included in the ESA cost. .**

**During the water licence renewal process potential ARD was discussed extensively. The NWB accepted the amount in the LMI's estimate to complete and updated environmental site assessment and they included conditions in the renewed licence address the issue. The NWB Board Decision states the following:**

#### ***"Acid Rock Drainage***

***Applicant indicated in its application that in the early 2000, acid producing rock was identified at the project site. Subsequent to that, in 2004 and 2005, studies of the rock used for site construction indicated that 40% were Potentially Acid***

*Generating (PAG) as reflected or assumed in the Interim Abandonment and Reclamation Plan. The proponent has indicated that segregation may not be the most cost effective approach to managing the PAG rock located on the project site; therefore, it proposes to undertake more detailed options for evaluation prior to closure and to tailor any further investigation to support further advancement of a preferred option.*

*AANDC in its submission and at the public hearing recommended that that detailed waste rock characterization study be included in the licence to identify the total quantity of PAG material at the project site and to assess any ground water contamination.*

*The NWB has reviewed the information provided by both the licensee and interveners in determining that an assessment should be conducted for PAG material associated with the site. Conditions related to the assessment are included Part G in the Licence.” [LMI notes this was corrected to Part I of the renewed Licence]*

*The following are the renewed licence conditions addressing potential ARD.*

*9. The Licensee shall submit to the Board for review, as part of any application to amend and/or renew the Licence, or to commence active reclamation of the Project site, an updated or revised version of the Environmental Site Assessment conducted for the Project in 2006.*

*10. The Licensee shall, as part of the updated Environmental Site Assessment required under Part I, Item 9, conduct a detailed rock characterization study or program to determine the total quantity (inventory) of Potentially Acid Generating (PAG) material associated with the Project site and identify any potential contamination that may be linked to such material. A written report of the results obtained and analyses conducted shall be submitted to the Board for review as part of any application to amend and/or renew the Licence, or notification to commence active reclamation of the Project site.*

*LMI's is in the planning stages to commence the required work to complete the updated environmental site assessment. LMI commits to \$200,000 to complete an updated environmental site assessment which will include but not be limited to waste rock and hydrocarbon soil contamination.*

**GOLDER COMMENTS:**



It is understood that the LMI rate of \$4.72/m<sup>3</sup> is based on documented costs for 2016 haul of rock from the Ballpark area to the TCA. The rate considers haul of rock to three disposal areas: TCA, crown pillar and adit. The rate is adjusted for different truck haul cycle times for each location.

We have also allowed for dozer recontouring of 20 hectares of area with exposed waste rock after PAG rock is removed. This will promote runoff over the surface and reduce infiltration and possible leaching, especially in the permafrost setting.

It is understood that LMI agrees to an allowance of \$200K for an environmental site assessment (ESA), which will include: additional geochemical testing on waste rock, a waste rock options assessment and a risk assessment.

### **3.2.3. Buildings and Equipment**

Most of the original buildings remain at the site, including the mill, powerhouse, headframe, hoist room, maintenance shops and storage buildings. Closure measures include isolating the buildings (removing water, sewer, glycol heating systems), removing any hazardous materials, and demolishing and placing the waste in the closure landfill.

A designated substances survey of the mill buildings was completed by Arctic Response in 2012. This survey identified the following:

- No friable asbestos-containing materials (ACMs) were identified in the survey. The surveyors observed fiberglass pipe insulation at certain locations but noted that large portions of the buildings were not surveyed. Floor and ceiling tiles were analyzed and were determined to be not ACMs (<1% asbestos).
- The majority of paint tested in the survey is lead-containing.
- Mould was identified throughout the buildings.

The recovery plant and lab were assessed to be high risk areas due to the presence or potential presence of chemicals and due to mould contamination (Arctic Response, 2012).

The potential for double counting was identified by the NWB as an issue of substantial disagreement between the Parties. KP found that LMI used high unit rates for building removal that should be sufficient to account for management of hazardous materials associated with building removal. INAC's building decommissioning estimates applied LMI's high unit costs for building removal, but also included costs for building decontamination and hazardous materials removal accounted for elsewhere by INAC.

INAC's building decommissioning estimates applied LMI's high unit costs for building removal without recognition that the costs included a number of items also accounted elsewhere by INAC. The overall cost for buildings is similar between The Parties (LMI estimated \$6,664,708 and INAC estimated \$6,577,883).

The assumptions made by LMI and INAC in regard to the reclamation requirements presented in Table B.1 are described below.

- **Isolate Buildings** - The cost estimates for isolating the buildings (removing waste, water, glycol and sewer connections and distribution) are nearly identical for both Parties.
- **Decontaminate Buildings** - The Parties' costs to decontaminate buildings differs considerably.

LMI included a cost of \$193,572 reportedly based on a 2014 contractor rate. In Section 2.1 of LMI's reclamation cost estimate, LMI indicates that all cost estimates were reviewed by an experienced contractor. KP notes that while this is useful, it is not the same as a contractor cost estimate.

INAC included the following costs related to decontamination of buildings:

- Decontaminate oil, fuel - \$373,390
- Decontaminate offices/warehouse/accommodations - using the low RECLAIM unit rate of asbestos abatement - \$629,299
- Removal of asbestos on building siding - \$128,000

INAC's total cost for building decontamination is \$1,130,689. INAC appears to have prepared this cost estimate without the Arctic Response (2012) hygiene survey. As Arcadis states in Section 4.6 of its report that the asbestos abatement budget could be amended once the asbestos assessment report was reviewed by Arcadis. While the 2012 survey was not comprehensive, the survey identified fiberglass (not friable asbestos) within the pipe insulation that was observed. Further, representative sampling of floor and ceiling tiles established that these materials were not ACMs. The Arctic Response report notes that asbestos use in building construction had dramatically decreased during the period when the Lupin Mine buildings were constructed in 1982, making the presence of friable ACMs unlikely but still possible.

KP recommends the following:

- Retain LMI's cost estimate for decontamination of fuel and oil.
- Do not include costs for asbestos abatement, as the presence of tile asbestos has

not been confirmed and the presence of friable asbestos in pipe insulation is unlikely.

- Include INAC's cost of \$25,000 under chemical/soil area for a hazardous materials audit, to be conducted by LMI in the near future (Section 3.2.5). The hazardous materials audit should be sufficiently comprehensive to confirm with a high level of confidence suitable for building decommissioning (and reclamation costing) whether or not ACMs are present and require special management.

Arctic Response (2012) did identify extensive mould contamination throughout the buildings, which will require special protection measures during building decommissioning. However, the unit rate used for building removal (discussed below) is sufficiently high to account for this.

- **Remove Buildings** - LMI and INAC calculated building demolition costs using the same unit rate (\$128.00/m<sup>2</sup>) and similar total building areas (24,711 m<sup>2</sup> and 24,637 m<sup>2</sup>, respectively). The unit rate used by both Parties is well above the range of unit rates presented in RECLAIM for steel building teardown (\$45-\$65/m<sup>2</sup>).
- **Landfill for Demolition Waste** - LMI and INAC are in agreement on costs for cleanup of the boneyard and for operation of the landfill.

LMI has recently constructed a closure landfill. LMI may seek progressive reclamation credits if boneyard clean-up has been undertaken, and for the proportion of landfill operation that includes landfill construction.

- **Grade and Contour Pads** - Both Parties' cost estimates for concrete foundations and site grading are nearly identical. INAC proposed establishing islands of vegetation (\$20,000), but this is not in the IARP.
- **Reclaim Roads and Airstrip** - LMI's cost estimate includes scarifying roads and removing 22 culverts. INAC's cost estimate includes these items but also includes scarifying the airstrip. It was agreed between the Parties during the site visit for this assignment that the airstrip would not be scarified and would remain in place for long-term monitoring and/or future site redevelopment.

KP recommends carrying LMI's cost estimate for these items.

- **Fuel Tanks and Piping** - Both Parties' cost estimates for fuel tanks and piping are based on the same quantities of tanks and piping. LMI used a unit rate for fuel tank disposal of \$91.57/m<sup>2</sup> compared with INAC's unit rate of \$100.00/m<sup>2</sup>. INAC's

unit rate is based on the RECLAIM rates for steel teardown for salvage of \$67-\$100/m<sup>2</sup>. The steel tanks will be landfilled rather than salvaged, and on this basis, KP recommends using RECLAIM's high value for steel teardown (BRS1) of \$65/m<sup>2</sup>.

Both Parties assumed 2,000 m of fuel piping will require decommissioning, though LMI used a unit rate of \$57.33/m and INAC used RECLAIM's high unit rate for pipelines >6 inches in diameter of \$72.00/m. KP recommends that RECLAIM's high unit rate for small pipelines (PSRH) of \$24/m is more appropriate.

- **Other** - There is no cost in either estimate for decommissioning the main water supply line.

KP recommends that LMI include a cost for removing and landfilling the main water supply line using the low RECLAIM unit rate for small pipelines.

### **3.2.4. Chemicals, Hazardous Materials and Contaminated Soils**

As identified in Section 1.2, the NWB had noted that there remained substantial disagreement between the parties on the following items:

- Increased petroleum hydrocarbon contamination flagged by INAC over that included in LMI's original estimate.
- Remedial/waste management work completed by LMI since LMI/INAC estimates were prepared.
- Spills/releases or other additional contaminant impacts identified since LMI /INAC estimates prepared.
- Chemical and waste management/disposal requirements upon site closure and reclamation.

The assumptions made by LMI and INAC in regard to the reclamation requirements presented in Table B.1 are described below.

- **Hazardous Materials Audit** - LMI (2016) noted that large quantities of hazardous materials have been removed from site since the 2014 reclamation estimate was prepared, and documentation from the hazardous waste disposal contractor was forthcoming. A Hygiene Assessment completed in 2012 (Arctic Response, 2012). The survey identified lead paint and extensive mould damage. Asbestos-containing materials were not identified in the buildings, though the report authors acknowledged that the investigation of pipe insulation was not exhaustive. Chemicals were identified in the lab and cyanide residuals were suspected in the recovery plant. While not a detailed audit, the survey provides a

reasonable grasp of site conditions with respect to hazardous materials.

INAC included a cost estimate of \$25,000 for an audit, suggesting that this would consist of primarily an asbestos survey but also a chemical inventory at the time of closure. Arctic Response (2012) also noted the need for a detailed survey to inventory any ACMs.

KP agrees with INAC and Arctic Response that a comprehensive audit is required to confirm conclusively whether or not ACMs are present and need to be accounted for in building decommissioning.

**LMI RESPONSE:**

**KBL hazardous waste manifests for 2015 and 2016 work seasons are included in Appendix D. LMI has already identified and removed over 250,000 lbs of waste, including removing all hazardous waste from the hazardous waste storage area as well as all unusable batteries on-site, during the 2015 and 2016 work season. LMI has already completed an internal audit but LMI believes if the NWB agrees with KP that based on discussions with experts that an audit by a third party would cost no more than \$10,000 for two people to be at site for 3 days.**

- **Hazardous Materials Removal** - KP understands from LMI during the site visit that a large quantity of hazardous materials has been removed from site since 2014 (Appendix A). Drums are still located near the tank farm, though the largest quantity of hazardous material remaining at site is fuel. LMI (2016b) stated that fuel has been tested and meets specifications, and is therefore suitable for use. The nature of reclamation costing is to recognize that fuel may be off-spec at the time of final closure, and therefore any on-site fuel will need to be disposed of as off-spec fuel. LMI has not included any costs for the removal and disposal of hazardous materials, including fuel.

INAC included considerable costs for removal of the following hazardous materials:

- Waste oil removal - \$120,000
- Waste fuel removal - \$2,813,352
- Waste batteries - \$1,250
- Laboratory reagents - \$25,000
- Disposal fees - \$25,000

INAC's total cost for removal and disposal of these items is \$1,577,926. All except

the fuel are understood to be estimates; fuel is based upon LMI's fuel inventory in 2014 or 2015. LMI will have consumed a portion of this fuel with the various progressive reclamation activities underway.

In the absence of hazardous waste manifests provided by LMI and/or an updated hazardous materials inventory is generated (with updated fuel volume), KP recommends that INAC's cost estimate for hazardous materials removal be carried. LMI can apply for a credit once documentation has been provided updating on-site quantities of hazardous materials.

**LMI RESPONSE:**

**LMI has provided updates on hazardous waste materials located on site, including updated fuel volumes during the water licence process and is included in the Annual Reports. As an example, the KBL manifests for the 2015 and 2016 work seasons are shown in Appendix D to confirm that LMI removed all waste in the hazardous waste storage area and collated and removed a significant amount of waste collected at site. LMI takes every opportunity possible to remove waste.**

**KP is not accurate when it states that LMI has not included any costs for the removal and disposal of hazardous materials. As set out in the LMI estimate, such waste would be backhauled on the 48 twin otter flights, 20 Dash flights, 5 Herc flights and the ice road. These flights and ice road backhauls are more than sufficient to remove all waste due to the large amount already removed from site in the past two work seasons.**

- **Contaminated Soil Investigation** - The Phase 1 and 2 Environmental Site Assessment (ESA) relied upon by LMI was conducted in 2005, and therefore may not reflect current site conditions. As such, a follow up ESA at the time of final closure is appropriate. LMI budgeted \$75,706 for an ESA, whereas INAC budgeted \$600,000. INAC suspect's hydrocarbon contamination is present beneath the main tank farm (see next item below), so this should be included in the follow up ESA.

KP recommends that LMI seek one or more cost estimates to have a follow up ESA completed. The cost to complete such a supplemental investigation, in our experience, is in the order of \$200,000.

**LMI RESPONSE:**

See response 3.2.2 in regards to the updated environmental site assessment. LMI commits to adding \$200,000 to its estimate allocated to completion of an updated environmental site assessment which will include but not be limited to waste rock and hydrocarbon soil contamination. It is noted this work is currently in planning stages, and once completed LMI would seek a corresponding reduction to the security.

- **Contaminated Soil Removal** - LMI's estimate of the quantity of hydrocarbon-impacted soils requiring remediation was 40,000 m<sup>3</sup> based on an ESA by Morrow in 2006. INAC added a contingency of 25% to this amount because it suspects contamination exists under the tank farms due to a faulty liner. Buried fuel lines to day tanks were also noted as a potential source of contamination. The tanks need to first leak into the containment, and then the containment needs to be faulty. KP noted during the site visit that the liner in the main tank farm was holding water (Appendix A). KP suggests that INAC's assumption around additional contamination that has not been confirmed is not fair to LMI, and any such exceedances can be captured by the contingency applied to the total reclamation cost estimate. Therefore, **KP recommends that LMI's quantity be carried forward until new information suggests otherwise.**

**LMI RESPONSE:**

**LMI agrees with KP's assessment. LMI would like to note that the buried fuel lines to the day tanks were removed in 2014 to the satisfaction of Environment Canada and this was taken into account by the NWB in its October 2015 decision.**

In terms of unit rates, LMI's unit rate for managing contaminated soils is \$60.17/m<sup>3</sup>. LMI recently constructed the first cell of a landfarm for on-site treatment, and for this reason, INAC used the RECLAIM low unit rate of \$47/m<sup>3</sup>.

KP recommends that LMI's volume estimate and the RECLAIM low unit rate used by INAC be adopted to calculate the costs for on-site treatment of hydrocarbon-impacted soils.

**LMI RESPONSE:**

**LMI agrees with the KP's recommendation**

**3.2.5. Water Management**

Neither LMI or INAC included costs in this RECLAIM module. Short-term water treatment costs are included under post-closure monitoring and maintenance (Section 3.3.2).

**GOLDER COMMENTS:**

**We allowed for one time treatment of water associated with lowering the water levels in Pond 1 and Pond 2 each by 1.9 m just prior to closure. The estimated volume is 1.786 M m<sup>3</sup>. The treatment cost of \$0.15/m<sup>3</sup> was based on LMI records of costs for recent treatment. The cost is low because the treatment is simple lime addition to raise the pH to 8.0. (Many other sites using lime addition need to raise the pH much higher to precipitate metals.) We have not allowed for any post-closure water treatment because treatment should not be required once all the tailings are covered.**

**3.2.6. Interim Care and Maintenance**

This is another item for which there remained substantial disagreement between the parties. LMI's reclamation cost estimate was based on RECLAIM model version 6.1, which did not include a module for interim care and maintenance. INAC calculated a cost for interim care and maintenance based on operating the mine site under its current care and maintenance condition for 5 years.

MVLWB (2014) recommends that a period of time is required to transfer ownership of the site, retain a water licence for closure, procure contractors and mobilize to site. There is a reasonably high level of understanding of what will be involved in final closure at the Lupin Mine. However, the current water licence covers care and maintenance and early resumption of mining activities, so a new water licence would likely be required for final closure, and a Final Abandonment and Reclamation Plan would require development and water board approval. The window for mobilization is 2 months out of the year.

Considering these factors, KP recommends a 3-year interim care and maintenance period be assumed.



## **LMI RESPONSE**

KP's recommendation to include a value for a 3 year interim care and maintenance cost should not be accepted, as LMI has already included a care and maintenance cost under Post Closure and Monitoring ( as Interim Care and Maintenance was include in RECLAIM 6.1). As discussed during the site visit with the NWB, KP, INAC and LMI it was confirmed by NWB staff that INAC would not have to go through the same water licence, permitting process as LMI (our understanding is that Jericho is a precedent for this approach). Under the Nunavut Waters and Nunavut Surface Rights Tribunal Act, the Minister has the power to undertake necessary work on sites.

LMI's 3 years of interim care and maintenance allocation, under Post Closure Monitoring, determined the actual costs associated with interim care and maintenance for 3 years would be \$210,000 but LMI has included \$300,000 to be conservative. This includes final TCA treatment, water sampling, geotechnical inspections and general site maintenance.

## **GOLDER COMMENTS:**

The situation at Lupin is unlike that at many other mines in that most of the planning and engineering has already been done, as has most of the work in stabilizing the tailings area. The work that remains to be done largely comprises demolition work. This type of work is straightforward and could commence immediately after the first winter ice road is built. An interim care and maintenance period of two years is considered realistic at Lupin. We have allowed for 2 years on the ICM sheet in RECLAIM 7.0.

## **Summary of Direct Costs Review**

The resultant recommended direct costs for reclamation security are presented in comparison to the direct costs in LMI's and INAC's reclamation security estimates in Table 3.1.

The resultant estimate of direct costs from this third-party review was approximately \$21.2 million, which is slightly more than the midpoint between the Parties' estimates (the midpoint value is approximately \$20.6 million).

**Table 3.1      Comparison of Direct Costs**

Component/Activity	LMI Estimate	INAC Estimate	Resultant Estimate
Underground Mine	\$439,639	\$506,380	\$464,639
Tailings Facility	\$3,935,562	\$7,231,080	\$5,121,410
Rock Pile	\$1,887,702	\$3,580,000	\$3,200,000
Buildings and Equipment	\$6,664,708	\$6,577,883	\$6,402,466
Chemicals/Contaminated Soil Management	\$2,498,718	\$7,212,041	\$5,633,866
Surface and Groundwater Management	\$0	\$0	\$ 0
Interim Care and Maintenance <sup>1</sup>	\$0	\$644,488	\$386,693
<b>Total Direct Costs</b>	<b>\$15,426,332<sup>2</sup></b>	<b>\$25,751,872</b>	<b>\$21,209,074</b>

**NOTES:**

1. LMI DID NOT INCLUDE INTERIM CARE AND MAINTENANCE COSTS AS THIS MODULE WAS NOT INCLUDED IN RECLAIM 6.1.
2. LMI'S TOTAL IN TABLE 3.1 DOES NOT MATCH WITH LMI'S DIRECT COST TOTAL IN LMI'S ESTIMATE; LMI USED RECLAIM 6.1, WHICH INCLUDES POST-CLOSURE MONITORING AS A DIRECT COST. THE TOTALS ABOVE AND PRESENTED IN TABLE B.1 INCLUDE POST-CLOSURE MONITORING AS AN INDIRECT COST, CONSISTENT WITH RECLAIM 7.0.

### 3.3. INDIRECT COSTS

#### 3.3.1. Mobilization and Demobilization

The cost for mobilization and demobilization was another item of substantial disagreement between The Parties. The assumptions made by LMI and INAC in regard to mobilization and demobilization are described below.

- **Mobilize Heavy Equipment and Misc. Equipment** - LMI costed the mobilization and winterization of heavy equipment at \$1,010,000 (\$1.01M), compared to INAC's estimate of \$1.475M. LMI's proposed equipment fleet appears small, with only one excavator and one dump truck. KP recommends INAC's equipment list and corresponding mobilization cost be adopted. INAC included an allowance to mobilize minor tools and equipment, which is appropriate.

**LMI RESPONSE:**

In making its recommendation to include such an allowance, KP has not taken into account the equipment already at site that is currently being used to complete progressive reclamation. Taking into account the equipment already located at site, LMI's estimate is more conservative than INAC's estimate for this line item, as LMI has provided for more equipment. For this reason, the INAC equipment and corresponding

mobilization list should not be adopted and LMI's should be preferred.

As submitted during the 2015 water licencing process and as previously accepted by the NWB, LMI is of the view that it is important and appropriate to take into account the equipment at site. In support of this view, we note that INAC stated in their memoranda that based on visual observations, the equipment on site appears to be in "relatively good condition". LMI can confirm this observation as it operated the equipment this past season, which the NWB, INAC and KP were able to see during the site visit. Should equipment become unusable in the future, then costs for replacement equipment will be included in future estimates prepared by LMI. As stated above, LMI has already included mobilization and demobilization of an additional fleet of vehicles for closure in their estimate.

- **Mobilize Workers** - LMI did not include any costs for worker transportation to and from the site on rotation; INAC's estimate appears reasonable and should be adopted.

#### **LMI RESPONSE:**

LMI respectfully disagrees with KP's recommendation to adopt INAC mobilization costs, as the LMI estimate does include costs for worker transportation to and from site on rotation. LMI has included this cost in their cost estimate under Mobilization. The LMI cost estimate states that mobilization includes 48 twin otter flights, 20 Dash flights and 5 Herc flights for crews and supplies over the decommissioning period. This would explain the difference between KP and LMI's estimates for the Mobilization line item.

#### **GOLDER COMMENTS:**

It is understood that the demolition cost of \$128.00/m<sup>2</sup> is an all-inclusive cost which includes provision of labor. It is assumed that the allowance for labor hours includes the time for mobilization/demobilization of personnel for work rotations. As such, it is reasonable for LMI to allow only for provision of air flights, not for workers time during mobilization.

- **Worker Accommodations** - Camp operation costs were provided by LMI (\$489,454) and INAC (\$611,875). Both used the same unit rate but LMI assumed 220 man-months and INAC assumed 275 man-months. The man-month rate of \$2,225 used by both parties is equivalent to roughly \$75/day, which is low for the

supply of food to a remote camp site.

KP recommends INAC's quantity of man-months/man-days be applied at the high RECLAIM rate of \$175/man-day to calculate camp costs.

**LMI RESPONSE:**

LMI does not agree with KP's recommendation, as the INAC/RECLAIM rate is nearly three times the actual rate costs to run the Lupin camp. LMI has run the camp since 2011, with populations ranging from 5-10 workers to close to 100 workers as recently as 2013. Over that period LMI's costs have never exceeded \$60 per person/per day which includes camp cooking, cleaning, laundry and food and all these were third party contracts. While LMI used \$75 per day for its estimate, as recently as 2016 the actual costs were below \$60 per day on a third party contract basis. For these reasons, LMI is very confident in their unit rate for workers accommodations. LMI's unit rate, which INAC agrees with, should be the preferred rate as it is based on actual costs. RECLAIM rates are guideline rates when actual rates are unavailable.

- **Mobilize Fuel** - In Section 2.3 of Appendix A of LMI's cost estimate, LMI notes that 2.3 million litres of fuel is at site, but it has been assumed that fuel will be transported to site for the work. A cost for mobilizing fuel could not be located in LMI's mobilization cost module. LMI's earlier (2012) cost estimate had included a cost to mobilize fuel.

KP recommends adopting INAC's cost estimate to mobilize fuel to site.

**LMI RESPONSE:**

LMI disagrees with KP's recommendation to include a cost for fuel mobilization within the estimate. It was agreed upon between LMI, INAC and the NWB in previous meetings that should LMI have the fuel tested to confirm that it remains usable, that this would be removed from their estimate. This discussion was reflected on the mediation call held by NWB during 2016. The tests were completed, the results were filed with the NWB and posted on the public registry, and during the site visit the INAC representative stated to the NWB, LMI and KP that they would remove fuel from their estimate now that the test were provided.

In the NWB Board Decision dated May 11, 2015 the Board stated the following in

regards to fuel:

*“With respect to the potential for the fuel remaining on site to be available during reclamation (as in LMI’s estimate) contrasted with not only having to mobilize fuel to site to complete the reclamation but also to arrange for the disposal of fuel that was left on-site at closure because it was not only unusable but also constituted a waste (as in AANDC’s estimate), LMI indicated the following:*

*We believe that there is no reason to consider the fuel on site as -- as unusable. We used it this past summer. AANDC contractors used it last summer, and the fuel is of standard quality. LMI have also consulted engineers familiar with Reclaim, and nowhere does it say that the proponent cannot use the fuel. SRK has confirmed that it is permissible under Reclaim to assume use of fuel already on site for Reclaim purposes.<sup>43</sup>*

*Consequently, although the Board recognizes that, without the benefit of verification of current site conditions, the AANDC estimate was based on a worst case assumption of large volumes of unusable fuel being left on-site, the NWB prefers the assumptions provided by LMI’s 2014 update in this regard, as it was based on current knowledge of the status of the site and the usability of fuel volumes present on-site.”*

#### **GOLDER COMMENTS:**

It is evident to all that the fuel at Lupin is currently usable and therefore that the cost of supplying new fuel and removing old fuel are liabilities that do not currently apply at Lupin. There is a risk that the diesel fuel will eventually become unusable; however it would be more reasonable to test the fuel regularly and apply the liabilities only if and when it becomes unusable. It is understood that LMI has agreed to this approach.

It is also noted that, under “Hazardous Materials”, an allowance has been made to remove 2.344 M-liters of fuel. It is understood that the current inventory is about 1.9 M-liters; furthermore, this inventory will continue to drop progressively as further closure work is undertaken.

Equipment operation rates should assume that Contractors will continue to be supplied with fuel at the site. (By contrast, the equipment rates in the RECLAIM database are inclusive of fuel provided by the Contractor.) Given the remoteness of the site and the inventory of usable fuel available, which should be used, the only reasonable approach would be for LMI to continue to supply fuel to Contractors. Golder is not aware of any requirement that Contractor rates need to assume that they mobilize their own fuel to the site.

- **Winter Road** - Both Parties calculated the cost of opening the 586 km winter road twice: once for mobilization and a second time to demobilize contractor equipment. During KP's site visit, The Parties agreed that given the number of users of the winter road, that it was punitive for LMI to assume it would need to construct the entire 586 km length to the Lupin Mine. KP agrees that this would be appropriate. Other users in the area in the near term include the EKATI and Diavik mines at Lac De Gras, and the Gahcho Kué Mine. There may be winter roads constructed past Lupin supporting reclamation work at the abandoned Jericho Mine, but this will be incidental.

KP recommends that winter road construction costs be based on the assumption that other users will use the road to the turnoff to the Gahcho Kué Mine at roughly km 220. On this basis, LMI should revise its cost estimate based on current tariff rates established by the Tibbitt to Contwoyto Winter Road Joint Venture for the first 220 km to the Gahcho Kué turnoff, and the construction and operation of the subsequent 366 km of winter road to the Lupin Mine as the sole user. Unit rates for winter road construction are not presented in the LMI cost estimate, and different costs are presented for mobilization and demobilization. The revised cost estimate should clearly show the unit rates for road construction and use.

**LMI RESPONSE:**

**LMI does agree with KP's ice road cost estimate recommendation to revise LMI's cost estimate. Please see note above in regards to Mobilize Workers section 3.3.1.**

**3.3.2. Post-Closure Monitoring and Maintenance**

The appropriate term for post-closure monitoring and maintenance was another item for which there remained substantial disagreement between the parties. LMI assumed a post-closure monitoring period of 25 years, which is often selected as an appropriate duration of post-closure monitoring at sites where long-term/indefinite water treatment is not required. INAC recommended post-closure monitoring for a period of 100 years on the basis that the tailings are arsenic-containing and acid- generating, and that an adverse impact on the local environment as a result of a failure within the TCA is too great.

Based on available information, KP recommends that the 25-year post-closure monitoring period be retained.

**LMI RESPONSE:**

**LMI agrees with KP's recommendation that the 25 year post closure monitoring be retained.**

**3.3.3. Engineering**

Engineering should include the development of a Final Abandonment and Reclamation Plan and the subsequent preparation of issued for construction (IFC) drawings and specifications for the reclamation work (MVLWB, 2014). Closure concepts are reasonably well advanced in the current IARP, however, a Final ARP is yet to be produced. MVLWB (2014) recommends 5% engineering assuming a Final ARP has already been developed. Additional costs should be included for the development of a Final ARP and the associated water licensing.

KP recommends a rate of 8% of direct costs to cover engineering.

**LMI RESPONSE:**

**LMI calculated the cost of engineering based on discussions and estimates provided by their engineering consultants.**

**In fact, at the site visit the KP representative asked how the INAC number was developed at it appeared "extremely large". No answer was forthcoming from INAC. LMI did explain their basis during the site visit and subsequently followed up with the attached documentation showing the engineering estimate at \$545,000 – see Appendix E. LMI's has included \$650,254 in their cost estimate at 4%.**

**LMI would agree to potentially 5% but do not agree with the KP 8% as it appears excessive.**

**If one reviews the major work it would be for tailings and this has been completed and successfully implemented.**

**GOLDER COMMENTS:**

**The situation at Lupin is unlike that at some other mines in that most of the planning and engineering has already been done. This includes the design work for stabilizing the tailings area, as well as the design for the bioremediation system. The work that remains to be done largely comprises demolition work, which does not require much**

**engineering. For context, an allowance of around \$100K would be generous to upgrade the IARP to a Final ARP. In summary, an allowance of 4% of direct costs is reasonable.**

#### **3.3.4. Project Management**

Project management includes general project coordination, accounting and project control, QA/QC engineering, and as-built reports.

The MVLWB (2014) states that Project Management is normally 5% of project costs for a reclamation project that is not complex. KP suggests that final closure of the Lupin Mine is not complex. Further, it is expected that reclamation, once underway, can reasonably be completed in a single year. Project management costs should reflect the single year of closure of a relatively straight-forward reclamation project.

It may be worthwhile for LMI to develop project management costs from first principles (i.e., number of QA personnel on-site for a set duration, and other costs), or obtaining a third-party quotation. In the absence of such a cost estimate, KP recommends carrying INAC's rate of 5% of direct costs for project management.

#### **LMI RESPONSE:**

**LMI respectfully disagrees. LMI gave KP our basis of Project Management at the site visit and it was based on first principles developed with our engineers and consultants. LMI subsequently followed up with the attached documentation (see Appendix E) showing the main components included in Project Management. LMI's estimate was approx. \$630,000 but included \$650,254 in their cost estimate at 4%.**

#### **3.3.5. Health and Safety Plans/Monitoring and QA/QC**

This item includes the costs to develop a site-specific health and safety plan, training, and compliance monitoring. Health and safety costs are typically incorporated into third-party contractor rates.

MVLWB (2014) suggests that the inclusion of costs for worker health and safety for work related injury is common in government contracting processes. KP notes that inclusion of Health and safety costs in northern mine closure plans prepared using the RECLAIM model has not been consistent, and has ranged from 0% (Mary River and Meadowbank) to 1% (various exploration properties). KP suggests that health and safety is incorporated into the scope of project management.



A specific cost should not be included for health and safety.

**LMI RESPONSE:**

**LMI agrees with KP's recommendation.**

**3.3.6. Bonding/Insurance**

Bonding and insurance is included in third-party contractor rates. A cost should not be included for bonding/insurance.

**LMI RESPONSE:**

**LMI agrees with KP's recommendation.**

**3.3.7. Contingency**

The Parties disagreed as to the appropriate contingency to be applied to the reclamation cost estimate. LMI applied a 10% contingency factor, whereas INAC applied a 20% contingency factor.

Conservative assumptions have been incorporated into the cost estimates for waste rock (assumed 40% potentially acid generating) and possible petroleum hydrocarbon impacts beneath the tank farm. On this basis, a contingency factor in the higher range (20%) adds additional conservatism to INAC's estimate.

MVLWB (2014) suggests the following contingency rates:

- 10% definitive or IFC phase when engineering is mostly complete with some written quote
- 15% preliminary or budget level when little detailed engineering has been completed and costs are based on verbal quotes
- 20% feasibility or advanced conceptual level when engineering may be 10% completed and costs are based on typical unit costs

A number of LMI's rates are based on on-site costs incurred. KP suggests that 15% contingency better reflects the level of understanding of closure and associated reclamation costs.

#### **LMI RESPONSE:**

As stated in the NWB decision “With respect to the difference in contingency for uncertainty built into AANDC’s estimate (25%) and LMI’s contingency (10%), the Board finds that considerable uncertainty may arise in terms of what updates to the existing abandonment and reclamation plans would be necessary and what reclamation security may then be required in the event that the mine site were to return to active operations. However, with respect to the mine site’s current state of Care and Maintenance the site has been in this state from 2005 to present. As a result, in the Board’s view there is much less uncertainty regarding the abandonment and reclamation requirements and liability associated with the site while maintained in the current care and maintenance phase. Given that the Renewed and Amended Licence limits LMI to activities associated with care and maintenance and the transition to active operations, the Board does not see the need for the significant boost to the contingency built into the estimate.”

LMI maintains that the LMI evidence before the Board shows that environmental risks relating to the Mine site are well known and accounted for within the closure plan and security posted, which include a 19% contingency. This approach is well supported by LMI’s approach to reclamation cost estimates. Quantities and material cost estimates that form the basis of this estimate are based on proper engineered data and supported by contractor unit rates based on site visits by an experienced Northern Contractor. It should be noted that the material amounts are generally very similar to those previously approved by the NWB, with the removal of the large amount of waste, progressive reclamation on Cell 5, construction of the landfarm, the site is in better condition than when the bond was set by the Board. The Lupin Mine licence is unlike many others in that it is a mature site with known quantities and significant studies completed and a final closure plan for the TCA, all of which are filed with the NWB. LMI’s 10% contingency is based on detailed analysis and is consistent with other projects at this life stage. There have been several technical papers published by authors with significant experience in mine site reclamation costs and estimates and the contingency amounts stated in these papers are consistent with that calculated by LMI. Furthermore, there is an additional \$1.4M in the security currently held by AANDC when compared to LMI’s cost estimate, which effectively brings the contingency to 19%, which is very precautionary and conservative given the high level of knowledge about the Mine site.

#### **3.3.8. Market Price Factor Adjustment**

The Parties have agreement that there is no need for a market price factor

adjustment to the reclamation cost estimates.

### 3.3.9. Summary of Indirect Costs Review

The resultant recommended indirect costs for reclamation security are presented in comparison to the direct costs in LMI's and INAC's reclamation security estimates in Table 3.2.

**Table 3.2 Comparison of Indirect Costs**

<b>Component/Activity</b>	<b>LMI Estimate</b>	<b>INAC Estimate</b>	<b>Resultant Third-Party Estimate</b>
Mobilization/Demobilization	\$4,917,904	\$8,078,895	\$6,671,462
Post-Closure Monitoring and Maintenance	\$830,014 <sup>1</sup>	\$2,186,376	\$830,014
Engineering (% of direct costs)	4%	10%	8%
Engineering	\$650,254	\$2,575,187	\$1,696,726
Project Management (% of direct costs)	4%	5%	5%
Project Management	\$650,254	\$1,287,594	\$1,060,454
Health & Safety / Monitoring & QA/QC	\$0	\$257,519	\$0
Bonding / Insurance	\$0	\$257,519	\$0
Contingency	\$1,625,634	\$5,150,374	\$3,181,361
Market Price Factor Adjustment	\$0	\$0	\$0
<b>Total Indirect Costs</b>	<b>\$8,674,060<sup>1</sup></b>	<b>\$19,793,464</b>	<b>\$13,440,017</b>

#### **NOTES:**

1. AS NOTED IN TABLE 3.1, LMI INCLUDED POST-CLOSURE MONITORING AS A DIRECT COST AS PER RECLAIM 6.1, NOT AS AN INDIRECT COST AS PER RECLAIM 7.0. THEREFORE, THE TOTAL INDIRECT COSTS SHOWN FOR LMI IN TABLE 3.2 DO NOT MATCH THE INDIRECT COST TOTAL OF LMI'S ESTIMATE.

The resultant estimate of indirect costs from this third-party review was approximately \$13.4 million, which is slightly less than the midpoint between the Parties' estimates (the midpoint value is approximately \$14.2 million).

### 3.4. OTHER ITEMS

Other items for which substantial disagreement between the Parties was noted by NWB are addressed below.

#### 3.4.1. Closure Planning Costs

NWB noted that the inclusion of closure planning costs such as potential amendments to the water licence, hearings, applications and reports is another area of substantial disagreement between The Parties. There is not a specific RECLAIM module that deals with such costs, but these costs would be incurred by any party (the proponent, or the government in a default situation) to execute the abandonment and reclamation plan. The MVLWB (2014) acknowledges this and recommends that costs be included for:

- Engagement with affected parties during closure planning, active closure and the post-closure phases
- Regulatory compliance costs, including administrative changes, submissions/reporting
- Finalizing the closure plan, including completion of outstanding studies or research
- An initial site assessment

KP recommends that such costs are most appropriately included in engineering costs. Closure planning costs have been incorporated into KP's recommended engineering cost of 8% of direct costs, rather than the standard 5% of direct costs recommended by MVLWB (2014).

**LMI RESPONSE:**

**LMI does not agree that this cost would increase the engineering estimate as outlined in LMI's response under Engineering (3.3.3) and Interim Care and Maintenance (3.2.6) where KP has included amounts for some of the items as described above.**

**3.4.2. Use of Fuel Left On-Site**

KP understands the use of fuel located on-site has been raised by LMI during discussions on reclamation security. LMI recently tested its fuel on-site to confirm that it remains suitable for use. As such, though LMI included the cost of mobilizing fuel to site in its 2012 reclamation cost estimate, it does not appear in the 2016 cost estimate.

KP acknowledges that LMI is able to use its fuel on-site to complete near-term reclamation activities. The costing of reclamation works as an activity to be carried out by a third-party in case of default in accordance with INAC (2002) and MVLWB (2014) does not permit the assumption that this fuel will be available and of suitable quality to support final reclamation when it does occur at an unknown time into the future.

**LMI RESPONSE:**

Please see response under 3.3.1- Mobilize Fuel.

Additionally, LMI would like to note that throughout the water licence renewal process there have been extensive discussions about fuel. Throughout the entire process INAC has not been able to provide any documentation showing that using fuel at site is not permitted. With respect to KP's final sentence in 3.4.2 above, LMI does not agree with KP's interpretation. INAC (2002) and MVLWB (2014) does not include any specific statements with respect to fuel. As provided in LMI's previous submissions SRK has confirmed that there are no provisions stating that fuel must be mobilized to site if there is already useable fuel at site. Currently LMI has more than sufficient fuel at site to continue progressive reclamation and to complete the work as described in the closure cost estimate. The volumes of fuel will be reported to the NWB annually to permit the NWB and INAC to confirm that this remains the case.

## **Appendix B**

### **GOLDER 2016 RECLAIM Estimate 7.0**

**SUMMARY OF COSTS**

<b>CAPITAL COSTS</b>	<b>COMPONENT NAME</b>	<b>COST</b>	<b>LAND LIABILITY</b>	<b>WATER LIABILITY</b>
OPEN PIT		\$0	\$0	\$0
UNDERGROUND MINE		\$464,445	\$0	\$464,445
TAILINGS FACILITY		\$3,295,727	\$0	\$3,295,727
ROCK PILE		\$2,298,000	\$0	\$2,298,000
BUILDINGS AND EQUIPMENT		\$4,439,147	\$0	\$4,439,147
CHEMICALS AND CONTAMINATED SOIL MANAGEMEN		\$2,440,672	\$0	\$2,440,672
SURFACE AND GROUNDWATER MANAGEMENT		\$277,900	-	\$277,900
INTERIM CARE AND MAINTENANCE		\$268,038	-	\$268,038
	<b>SUBTOTAL: Capital Costs</b>	<b>\$13,483,929</b>	<b>\$0</b>	<b>\$13,483,929</b>
	<b>PERCENT OF SUBTOTAL</b>		<b>0%</b>	<b>100%</b>

<b>INDIRECT COSTS</b>		<b>COST</b>	<b>LAND LIABILITY</b>	<b>WATER LIABILITY</b>
MOBILIZATION/DEMObILIZATION		\$4,829,258	\$0	\$4,829,258
POST-CLOSURE MONITORING AND MAINTENANCE		\$936,257	\$0	\$936,257
ENGINEERING	4%	\$539,357	\$0	\$539,357
PROJECT MANAGEMENT	5%	\$674,196	\$0	\$674,196
HEALTH AND SAFETY PLANS/MONITORING & QA/QC	0%	\$0	\$0	\$0
BONDING/INSURANCE	1%	\$134,839	\$0	\$134,839
CONTINGENCY	10%	\$1,348,393	\$0	\$1,348,393
MARKET PRICE FACTOR ADJUSTMENT	0%	\$0	\$0	\$0
	<b>SUBTOTAL: Indirect Costs</b>	<b>\$8,462,300</b>	<b>\$0</b>	<b>\$8,462,300</b>

<b>TOTAL COSTS</b>		<b>\$21,946,229</b>	<b>\$0</b>	<b>\$21,946,229</b>
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This is covered under Project management.

A contingency of 10% of direct costs can be justified based on a "risk-based" approach.

Underground Mine Name		UG Mine # 1						
ACTIVITY/MATERIAL	Notes	Unit	Qty	Code	Unit Cost	Cost Land	Cost	Water Cost
<b>CONTROL ACCESS</b>								
Fence		m		#N/A	\$0.00	\$0	\$0	\$0
Signs		each		#N/A	\$0.00	\$0	\$0	\$0
Block roads		m3		#N/A	\$0.00	\$0	\$0	\$0
Berm		m3		#N/A	\$0.00	\$0	\$0	\$0
Concrete wall in portal		m3		#N/A	\$0.00	\$0	\$0	\$0
Backfill portal #1	Plug portal with waste rock	m3	940	DSS	\$3.50	\$3,290	\$0	\$3,290
Backfill portal #2		m3		#N/A	\$0.00	\$0	\$0	\$0
Cap raise - 5 total		m3	5	RRSS	\$85,656.00	\$428,280	\$0	\$428,280
Cap raise #2		m3		#N/A	\$0.00	\$0	\$0	\$0
Cap shaft #1		m3		#N/A	\$0.00	\$0	\$0	\$0
Cap shaft #2		m3		#N/A	\$0.00	\$0	\$0	\$0
Backfill adits	Covered in portal backfill	m3	0	#N/A	\$0.00	\$0	\$0	\$0
Backfill open stope		m3	2,250	DSS	\$3.50	\$7,875	\$0	\$7,875
Concrete cap over open stope		m3		#N/A	\$0.00	\$0	\$0	\$0
Crown Pillar Study		each	1	#N/A	\$25,000.00	\$25,000	\$0	\$25,000
<b>REMOVE HAZARDOUS MATERIALS</b>								
Remove hazardous materials, U/G labor		manhrs		#N/A	\$0.00	\$0	\$0	\$0
Remove/decontam. stationary & elect. equip		mandays		#N/A	\$0.00	\$0	\$0	\$0
Remove/decontam. mobile equipment		each		#N/A	\$0.00	\$0	\$0	\$0
Remove misc. haz. mat & explosives		kg		#N/A	\$0.00	\$0	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0	\$0
<b>INSTALL BULKHEADS</b>								
Bulkheads to control water flow		each		#N/A	\$0.00	\$0	\$0	\$0
Grout bulkhead		m3		#N/A	\$0.00	\$0	\$0	\$0
<b>FLOOD MINE</b>								
Supply/install pump		each		#N/A	\$0.00	\$0	\$0	\$0
Supply/install piping system		each		#N/A	\$0.00	\$0	\$0	\$0
Operate pumps to flood workings		m3		#N/A	\$0.00	\$0	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0	\$0
<b>INSTALL GROUNDWATER COLLECTION SYSTEM</b>								
Excavate/install sumps		m2		#N/A	\$0.00	\$0	\$0	\$0
Install pumping wells		m3		#N/A	\$0.00	\$0	\$0	\$0
Install pumps/pipelines/power supply		LS		#N/A	\$0.00	\$0	\$0	\$0
<b>SPECIALIZED ITEMS</b>								
Install water quality monitoring pipes		each		#N/A	\$0.00	\$0	\$0	\$0
Install permanent pumping system		each		#N/A	\$0.00	\$0	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0	\$0
<b>Total</b>						\$464,445	\$0	\$464,445
<b>% of Total</b>							0%	100%

Added to agree with KP Review



## 1 Tailings Impoundment Name:

Pond # 1

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	% Cost	Land Cost	Water Cost
<b>CONTROL ACCESS</b>								
Fence		m		#N/A	\$0.00	\$0	\$0	\$0
Signs		each		#N/A	\$0.00	\$0	\$0	\$0
Berm		m3		#N/A	\$0.00	\$0	\$0	\$0
Block roads		m3		#N/A	\$0.00	\$0	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0	\$0
<b>STABILIZE EMBANKMENT(S)</b>								
Toe buttress, drainage layer		m3		#N/A	\$0.00	\$0	\$0	\$0
Toe buttress, bulk fill		m3		#N/A	\$0.00	\$0	\$0	\$0
Rip rap	Dam M has been repaired at lower unit costs	m3	80000	#N/A	\$15.20	\$1,216,000	\$0	\$1,216,000
Vegetate		ha		#N/A	\$0.00	\$0	\$0	\$0
Raise crest		m3		#N/A	\$0.00	\$0	\$0	\$0
Flatten slopes		m3		#N/A	\$0.00	\$0	\$0	\$0
Other		m3		#N/A	\$0.00	\$0	\$0	\$0
<b>COVER TAILINGS</b>								
Grade/shape tailings surface		m3		#N/A	\$0.00	\$0	\$0	\$0
Liner bedding		m3		#N/A	\$0.00	\$0	\$0	\$0
Subgrade preparation - compact		m2		#N/A	\$0.00	\$0	\$0	\$0
Supply geotextile/geosynthetic		m2		#N/A	\$0.00	\$0	\$0	\$0
Install geotextile/geosynthetic		m2		#N/A	\$0.00	\$0	\$0	\$0
Soil cover		m3		#N/A	\$0.00	\$0	\$0	\$0
Soil cover		m3	241328	SC4S	\$7.02	\$1,694,123	\$0	\$1,694,123
Vegetate		m2		#N/A	\$0.00	\$0	\$0	\$0
Excavate and dispose of tailings from Cell 4		allow	1	#N/A	\$100,000.00	\$100,000	\$0	\$100,000
<b>BURY PAG ROCK</b>								
Relocate PAG rock		m3		#N/A	\$0.00	\$0	\$0	\$0
Place cover over PAG rock		m3		#N/A	\$0.00	\$0	\$0	\$0
Raise crest of dam		m3		#N/A	\$0.00	\$0	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0	\$0
<b>STABILIZE DECANT SYSTEM</b>								
Excavate and replace		m3		#N/A	\$0.00	\$0	\$0	\$0
Plug/backfill with concrete or clay		m3		#N/A	\$0.00	\$0	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0	\$0
<b>REMOVE TAILINGS DISCHARGE</b>								
Cyclones		m3		#N/A	\$0.00	\$0	\$0	\$0
Pipe		m3	8500	PLRS	\$18.39	\$156,315	\$0	\$156,315
Remove reclaim barge		allow		#N/A	\$0.00	\$0	\$0	\$0
<b>CONSTRUCT DIVERSION DITCHES</b>								
Excavate ditches -soil		m3		#N/A	\$0.00	\$0	\$0	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0	\$0	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0	\$0	\$0
<b>FLOOD TAILINGS</b>								
Doze tailings to final contour		m3		#N/A	\$0.00	\$0	\$0	\$0
Raise crest of dam		m3		#N/A	\$0.00	\$0	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0	\$0
<b>UPGRADE SPILLWAY</b>								
Excavate channel, rock	Spillway on Dam 1A and Dam J	m3		#N/A	\$0.00	\$0	\$0	\$0
Excavate channel, soil		m3	12350	SB1L	\$4.30	\$53,105	\$0	\$53,105
Concrete		m3		#N/A	\$0.00	\$0	\$0	\$0
Rip rap		m3	936	RR3L	\$7.00	\$6,552	\$0	\$6,552
Geotextile		m2	2800	GSTL	\$3.44	\$9,632	\$0	\$9,632
<b>CONSTRUCT SEEPAGE COLLECTION POND</b>								
Excavate seepage collection pond		m3		#N/A	\$0.00	\$0	\$0	\$0
Doze & spread excavated material		m3		#N/A	\$0.00	\$0	\$0	\$0
Vegetate spread material		ha		#N/A	\$0.00	\$0	\$0	\$0
Bedding layer		m3		#N/A	\$0.00	\$0	\$0	\$0
Supply geomembrane		m2		#N/A	\$0.00	\$0	\$0	\$0
Install geomembrane		m2		#N/A	\$0.00	\$0	\$0	\$0
Erosion protection layer		m3		#N/A	\$0.00	\$0	\$0	\$0
<b>INSTALL GROUNDWATER COLLECTION SYSTEM</b>								
Excavate/install sumps		m3		#N/A	\$0.00	\$0	\$0	\$0
Install pumping wells		m3		#N/A	\$0.00	\$0	\$0	\$0
Install pumps/pipelines/power supply		LS		#N/A	\$0.00	\$0	\$0	\$0
<b>SPECIALIZED ITEMS</b>								
Install permanent instrumentation, supply & technician		each	1	#N/A	\$30,000.00	\$30,000	\$0	\$30,000
Install permanent instrumentation, drilling		each	1	#N/A	\$30,000.00	\$30,000		\$30,000
<b>TREAT SEEPAGE - see "Water Management" and "Water Treatment"</b>								
<b>TREAT SUPERNATANT</b>								
Pump water (to pit, U/G)		m3		#N/A	\$0.00	\$0	\$0	\$0
Equipment maintenance and parts		allow		#N/A	\$0.00	\$0	\$0	\$0
Supply reagents		tonne		#N/A	\$0.00	\$0	\$0	\$0
Annual treatment costs						\$0		
Number of years of treatment		years						
Total treatment costs						\$0		\$0
Total						\$3,295,727	\$0	\$3,295,727
% of Total							0%	100%

\* for construction of passive treatment system refer to "Water Management"

LMI rate accepted by KP

241,328m<sup>2</sup> is a previously estimated number, which is kept for comparison purposes. Part of this area was covered in 2016 (to be accounted for later).

Lump sum recommended by KP and accepted by LMI

LMI Followup Memo presents a cost estimate of \$110,346 for 6000 m, prepared by an independent engineer based on disposal in the on-site landfill. (Compares with 343,990 (6,000\*57.33) submitted on 2014 cost for offsite disposal.) RECLAIM PLRL is \$22.00/ m.

Dozing has been included in the cover rate.

Remove existing rip rap from dam slopes and use to cover the spillway invert and channel slopes to 2 m flow depth. Place under spillway rip rap.

Allowed for on "Water Management" sheet because it will be a one-time treatment just prior to closure.

Rock Pile Name:									
ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	% Cost	Land Cost	Water Cost	
STABILIZE SLOPES									
Flatten slopes with dozer		m3		#N/A	\$0.00	\$0	\$0	\$0	
Flatten "bubble dump" areas		m3		#N/A	\$0.00	\$0	\$0	\$0	
Divert runoff, ditch mat'l A		m3		#N/A	\$0.00	\$0	\$0	\$0	
Divert runoff, ditch mat'l B		m3		#N/A	\$0.00	\$0	\$0	\$0	
Toe buttress, drain mat'l		m3		#N/A	\$0.00	\$0	\$0	\$0	
Toe buttress, fill mat'l A		m3		#N/A	\$0.00	\$0	\$0	\$0	
Toe buttress, fill mat'l B		m3		#N/A	\$0.00	\$0	\$0	\$0	
Other				#N/A	\$0.00	\$0	\$0	\$0	
COVER ROCK PILE									
Subgrade preparation - doze surface		m3		#N/A	\$0.00	\$0	\$0	\$0	
Soil cover - excavate,haul,spread&compact		m3		#N/A	\$0.00	\$0	\$0	\$0	
Rock cover - excavate,haul & spread		m3		#N/A	\$0.00	\$0	\$0	\$0	
Excavate downslope drainage channel & chute		m3		#N/A	\$0.00	\$0	\$0	\$0	
Rip rap drainage channel and chute		m3		#N/A	\$0.00	\$0	\$0	\$0	
Vegetate		ha		#N/A	\$0.00	\$0	\$0	\$0	
Other				#N/A	\$0.00	\$0	\$0	\$0	
VERY LOW PERMEABILITY COVER (in addition to above)									
Liner subgrade preparation - compact		m2		#N/A	\$0.00	\$0	\$0	\$0	
Supply geomembrane		m2		#N/A	\$0.00	\$0	\$0	\$0	
Install geomembrane		m2		#N/A	\$0.00	\$0	\$0	\$0	
Protective cover - excavate,haul,spread&compact		m3		#N/A	\$0.00	\$0	\$0	\$0	
Vegetate		ha		#N/A	\$0.00	\$0	\$0	\$0	
Install infiltration/seepage instrumentation		allow		#N/A	\$0.00	\$0	\$0	\$0	
CONSTRUCT DIVERSION DITCHES									
Excavate ditches -soil		m3		#N/A	\$0.00	\$0	\$0	\$0	
Excavate ditches -rock		m3		#N/A	\$0.00	\$0	\$0	\$0	
Rip rap in channel base		m3		#N/A	\$0.00	\$0	\$0	\$0	
CONSTRUCT SEEPAGE COLLECTION POND									
Excavate seepage collection pond		m3		#N/A	\$0.00	\$0	\$0	\$0	
Doze & spread excavated material		m3		#N/A	\$0.00	\$0	\$0	\$0	
Vegetate spread material		ha		#N/A	\$0.00	\$0	\$0	\$0	
Bedding layer		m3		#N/A	\$0.00	\$0	\$0	\$0	
Supply geomembrane		m2		#N/A	\$0.00	\$0	\$0	\$0	
Install geomembrane		m2		#N/A	\$0.00	\$0	\$0	\$0	
Erosion protection layer		m3		#N/A	\$0.00	\$0	\$0	\$0	
INSTALL GROUNDWATER COLLECTION SYSTEM									
Excavate/install sumps		m3		#N/A	\$0.00	\$0	\$0	\$0	
Install pumping wells		m3		#N/A	\$0.00	\$0	\$0	\$0	
Install pumps/pipelines/power supply		allow		#N/A	\$0.00	\$0	\$0	\$0	
RELOCATE DUMPS									
Load, haul, dump or doze		m3	400,000	RR4S	\$4.72	\$1,888,000	\$0	\$1,888,000	
Add lime		tonne		#N/A	\$0.00	\$0	\$0	\$0	
Contour reclaimed area		m2	200,000	DRL	\$1.05	\$210,000	\$0	\$210,000	
Environmental Site Assessment		allow	1	#N/A	####	\$200,000	\$0	\$200,000	
SPECIALIZED ITEMS									
Install permanent instrumentation		each		#N/A	\$0.00	\$0	\$0	\$0	
Install permanent instrumentation, drilling		each		#N/A	\$0.00	\$0	\$0	\$0	
TREAT ROCK PILE SEEPAGE - see "Water Management"									
HEAP LEACH SEEPAGE TREATMENT - Cyanide Detox									
Cyanide destruction water treatment pumping		m3		#N/A	\$0.00	\$0	\$0	\$0	
Reagents		tonnes		#N/A	\$0.00	\$0	\$0	\$0	
Electrician/mechanic to maintain treatment plant		allow		#N/A	\$0.00	\$0	\$0	\$0	
Equipment maintenance and parts		allow		#N/A	\$0.00	\$0	\$0	\$0	
				Annual treatment costs		\$0			
Number of years of treatment		years		Total treatment costs		\$0			\$0
HEAP LEACH SEEPAGE TREATMENT - ARD/ML**									
Upgrade/modify pumping system - report to WTP		allow		#N/A	\$0.00	\$0			\$0
Total						\$2,298,000		\$0	\$2,298,000
% of Total							0%		100%

LMI agrees that ESA will include: geochemical characterization of rock, options assessment and risk assessment.

\* For construction of passive treatment system refer to "Water Management". ARD/ML seepage treatment becomes post-closure water treatment cost

\*\*Heap leach ARD/ML seepage treatment becomes post-closure water treatment cost

## 1 Chemicals/Soil Area Name:

**Note:** The procedures, equipment and packaging for clean up and removal of chemicals or contaminated soils are highly dependent on the nature of the chemicals and their existing state of containment. Government guidelines should be consulted on an individual chemical basis. Any estimate made here should be considered very rough unless specific evaluations have been conducted.

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	% Cost	Land Cost	Water Cost
<b>HAZARDOUS MATERIALS AUDIT</b>								
Hazardous materials audit		allow	1	#N/A	\$25,000.00	\$25,000	\$0	\$25,000
<b>BUILDING DECONTAMINATION &amp; CONSOLIDATION OF HAZARDOUS MATERIALS</b>								
Environmental technician/coordinator		mandays		#N/A	\$0.00	\$0	\$0	\$0
Decontaminate: oil, fuel and glycol systems		m2	8,490	#N/A	\$22.80	\$193,572	\$0	\$193,572
Decontaminate maintenance shop		mandays		#N/A	\$0.00	\$0	\$0	\$0
Decontaminate power plant		mandays		#N/A	\$0.00	\$0	\$0	\$0
Decontaminate bulk fuel storage		mandays		#N/A	\$0.00	\$0	\$0	\$0
Decontaminate ANFO plant		mandays		#N/A	\$0.00	\$0	\$0	\$0
Decontaminate offices/warehouse/accom		mandays		#N/A	\$0.00	\$0	\$0	\$0
Removal of asbestos siding on buildings	Building are asbestos free	m2		#N/A	\$0.00	\$0	\$0	\$0
Removal of friable asbestos on equipment		m2		#N/A	\$0.00	\$0	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0	\$0
<b>HAZARDOUS MATERIALS REMOVAL</b>								
Waste oils	Assumed	litre	10,000	ORH	\$1.20	\$12,000	\$0	\$12,000
Waste fuel		litre		#N/A	\$0.00	\$0	\$0	\$0
Waste batteries		kg	500	#N/A	\$25.00	\$12,500	\$0	\$12,500
Assay & environmental lab reagents		kg		#N/A	\$0.00	\$0	\$0	\$0
Machine shop paints, solvents etc		litre	5,000	ORH	\$1.20	\$6,000	\$0	\$6,000
Glycol		litre		#N/A	\$0.00	\$0	\$0	\$0
Process reagents		kg		#N/A	\$0.00	\$0	\$0	\$0
Nuclear sources		allow		#N/A	\$0.00	\$0	\$0	\$0
Other hazardous materials		allow		#N/A	\$0.00	\$0	\$0	\$0
<b>HAZARDOUS MATERIALS</b>								
Transportation to disposal facility		allow		#N/A	\$0.00	\$0	\$0	\$0
Disposal fees		allow		#N/A	\$0.00	\$0	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0	\$0
<b>CONTAMINATED SOILS</b>								
Contam. soil investigation - Phase 1		each		#N/A	\$0.00	\$0	\$0	\$0
Contam. soil investigation - Phase 2	Additional investigation of ARD drainage	each	0	CS1L	\$7,500.00	\$0	\$0	\$0
<b>CONTAMINATED SOIL REMOVAL</b>								
Excavate and transport to onsite facility		m3	0	SC3S	\$47.00	\$0	\$0	\$0
Construct 4 additional landfarm cells		LS	1	#N/A	\$180,000.00	\$180,000	\$0	\$180,000
Excavate treated soils and move to on-site landfill		m3	0	SC3S	\$7.21	\$0	\$0	\$0
Manage hydrocarbon remediation at facility	Type-1 heavy fuel and oil	m3	40,000	CSRL	\$47.00	\$1,880,000	\$0	\$1,880,000
Type-2			2,000	CSRL	\$47.00	\$94,000	\$0	\$94,000
Type-3			800	CSRL	\$47.00	\$37,600	\$0	\$37,600
Reagents/stabilizing agent		m2		#N/A	\$0.00	\$0	\$0	\$0
Excavate and transport to offsite facility		m3		#N/A	\$0.00	\$0	\$0	\$0
Contour decontaminated area		m3		#N/A	\$0.00	\$0	\$0	\$0
<b>CONTAMINATED SOIL VERY LOW PERMEABILITY COVER</b>								
Supply geomembrane, HDPE, ES3, GCL		m2		#N/A	\$0.00	\$0	\$0	\$0
Upper and lower bedding layers		m3		#N/A	\$0.00	\$0	\$0	\$0
Install geomembrane, HDPE, ES3, GCL		m2		#N/A	\$0.00	\$0	\$0	\$0
Erosion protection layer		m3		#N/A	\$0.00	\$0	\$0	\$0
Vegetate		m2		#N/A	\$0.00	\$0	\$0	\$0
Install infiltration/seepage instrumentation		allow		#N/A	\$0.00	\$0	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0	\$0
<b>OTHER</b>								
				#N/A	\$0.00	\$0	\$0	\$0
<b>Total</b>						\$2,440,672	\$0	\$2,440,672
<b>% of Total</b>							0%	100%

Based on 2014 LMI contractor rate

Morrow completed Phase 1 and 2 ESA  
Additional ESA is included with \$200K under "Rock Pile"

Excavation is included in CSR rate.

Excavation is included in CSR rate.

1	Building / Equip Name:			Bldg / Equip #: 1						
ACTIVITY/MATERIAL		Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land Cost	Water Cost	
DISPOSE MOBILE EQUIPMENT										
Decontaminate and ship off-site			allow		#N/A	\$0.00	\$0		\$0	
Decontaminate and dispose on-site			allow		#N/A	\$0.00	\$0		\$0	
Other					#N/A	\$0.00	\$0		\$0	
REMOVE BUILDINGS - see note below										
Accommodation Complex			All Buildings sizes based on LMI 2014 areas	m2	7,329	BRS1L	\$45.00	\$329,805	\$0	\$329,805
Hoist Room and Travel Ways				m2	463	BRCS	\$128.00	\$59,264	\$0	\$59,264
Shaft House				m2	1253	BRCS	\$128.00	\$160,384	\$0	\$160,384
Warehouse				m2	4671	BRCS	\$128.00	\$597,888	\$0	\$597,888
Mill				m2	2864	BRCS	\$128.00	\$366,592	\$0	\$366,592
Powerhouse				m2	1645	BRCS	\$128.00	\$210,560	\$0	\$210,560
Headframe				m2	413	BRCS	\$128.00	\$52,864	\$0	\$52,864
Airlock Building and Freshair Intake				m2	366	BRCS	\$128.00	\$46,848	\$0	\$46,848
Pastefill Plant				m2	#N/A	\$0.00	\$0		\$0	Pastefill plant has already been removed. (Space will be used for bioremediation of HC soils.)
Cold Storage 2 buildings				m2	1855	BRS1L	\$45.00	\$83,475	\$0	\$83,475
Surface Mobile Shop				m2	1008	BRCS	\$128.00	\$129,024	\$0	\$129,024
Carpenter Shop				m2	482	BRS1L	\$45.00	\$21,690	\$0	\$21,690
As Treatment Plant Building				m2	177	BRCS	\$128.00	\$22,656	\$0	\$22,656
Pumphouse				m2	74	BRCS	\$128.00	\$9,472	\$0	\$9,472
Explosives Storage				m2	412	BRCS	\$128.00	\$52,736	\$0	\$52,736
Fire house				m2	31	BRCS	\$128.00	\$3,968	\$0	\$3,968
Emergency Power House				m2	117	BRCS	\$128.00	\$14,976	\$0	\$14,976
Weather Station and Storage Buildings				m2	566	BRS1L	\$45.00	\$25,470	\$0	\$25,470
Shop				m2	379	BRCS	\$128.00	\$48,512	\$0	\$48,512
Batch Plant				m2	118	BRCS	\$128.00	\$15,104	\$0	\$15,104
ATV Building				m2	172	BRS1L	\$45.00	\$7,740	\$0	\$7,740
Storage Facility at Laydown/Airstrip				m2	#N/A	\$0.00	\$0		\$0	
Fuel tanks		Tanks		m2	8,490	BRS1S	\$91.57	\$777,429	\$0	\$777,429
Fuel Tanks		Piping removal and disposal		m2	2,000	PLRS	\$18.39	\$36,780	\$0	\$36,780
Freshwater intake				m2	225	BRCS	\$128.00	\$28,800	\$0	\$28,800
Reclaim pumps				m2	#N/A	\$0.00	\$0		\$0	
Outfall & Diffuser				m2	#N/A	\$0.00	\$0		\$0	
Airstrip lighting, navigation, electrician				mandays	#N/A	\$0.00	\$0		\$0	
Airstrip lighting, navigation, mechanical				mandays	#N/A	\$0.00	\$0		\$0	
Break foundation slabs				m2	#N/A	\$0.00	\$0		\$0	It is planned to leave slabs in place and cover with granular.
Consolidate & dump boneyard debris				m3	1	#N/A	\$350,000.00	\$350,000	\$0	\$350,000
Other				m2	#N/A	\$0.00	\$0		\$0	
LANDFILL FOR DEMOLITION WASTE										
Place rock cover				m3	#N/A	\$0.00	\$0		\$0	
Place soil cover				m3	0	SB4L	\$5.50	\$0	\$0	
Operation of landfill				LS	1	#N/A	\$450,000.00	\$450,000	\$0	\$450,000
Vegetate				ha	#N/A	\$0.00	\$0		\$0	Assume this includes placement of 5 ha soil cover
Other				m3	#N/A	\$0.00	\$0		\$0	
GRADE AND CONTOUR PADS										
Grade/Contour Entire Mine Site Area				m2	230,000	DRL	\$1.05	\$241,500	\$0	\$241,500
Place 0.3 m granular fill over slabs				m3	7,500	SB4L	\$5.50	\$41,250	\$0	\$41,250
Accommodation Complex				ha	#N/A	\$0.00	\$0		\$0	
Process Facilities				ha	#N/A	\$0.00	\$0		\$0	
Offices, Repair, Lab, Warehouse				ha	#N/A	\$0.00	\$0		\$0	
Storage Facilities				ha	#N/A	\$0.00	\$0		\$0	
Water and Wastewater Treatment Facilities				ha	#N/A	\$0.00	\$0		\$0	
U/G Heating Plant				ha	#N/A	\$0.00	\$0		\$0	
Emulsion Plant				ha	#N/A	\$0.00	\$0		\$0	
Warehouse, Shops and Other				ha	#N/A	\$0.00	\$0		\$0	
Place rock cover				m3	#N/A	\$0.00	\$0		\$0	
Vegetate				ha	#N/A	\$0.00	\$0		\$0	
Other				m3	#N/A	\$0.00	\$0		\$0	
PUNCTURE LINED SUMPS										
Puncture liner and place soil cover				m3	#N/A	\$0.00	\$0		\$0	
RECLAIM ROADS										
Remove culverts				each	22	#N/A	\$500.00	\$11,000	\$0	\$11,000
Remove bridges				each		#N/A	\$0.00	\$0	\$0	
Scarify and install water breaks				ha	#N/A	\$0.00	\$0		\$0	
Scarify airstrip				ha	#N/A	\$0.00	\$0		\$0	Airstrip will stay in place
Scarify laydown areas		Scarify roads and grade		ha	12	SCFYH	\$6,030.00	\$72,360	\$0	\$72,360
Vegetate				ha	#N/A	\$0.00	\$0		\$0	
Other		Grade and counter esker borrow area		m3	180,000	DSL	\$0.95	\$171,000	\$0	\$171,000
SPECIALIZED ITEMS										
Dispose of misc. debris and laydown area refuse					#N/A	\$0.00	\$0		\$0	
Total							\$4,439,147		\$0	\$4,439,147
% of Total									0%	100%

Note: Unit costs are based on 3m high, single storey building. Scale larger building areas accordingly. E.g. 10m high building multiply area by 3.3 (10/3)

## 1 Capital Expenditures and Short Term Water Treatment identified in 'Instructions' worksheet

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	
BREACH DYKE EMBANKMENT							
Remove fill	Divider dyke in Cell 4	m3	0	SC1H	\$9.30	\$0	Breach of Divider Dyke in Cell 4 is provided under spillways in "Tailings" tab
Rip rap slope protection		m3	0	RR4L	\$7.60	\$0	
Contour water intake area		m3		#N/A	\$0.00	\$0	
STABILIZE SEDIMENT PONDS/WATER MANAGEMENT PONDS							
Place soil cover		m3		#N/A	\$0.00	\$0	
Doze & spread excavated material		m3		#N/A	\$0.00	\$0	
Vegetate spread material		ha		#N/A	\$0.00	\$0	
Rip rap in channel base		each		#N/A	\$0.00	\$0	
REDIRECT RUNOFF/CONSTRUCT DIVERSION DITCHES							
Excavate ditches -soil		m3		#N/A	\$0.00	\$0	
Excavate ditches -rock		m3		#N/A	\$0.00	\$0	
Stabilize side slopes		m3		#N/A	\$0.00	\$0	
Rip rap in channel base		m3		#N/A	\$0.00	\$0	
BREACH DITCHES							
Excavate breaches		m3		#N/A	\$0.00	\$0	
Backfill/recontour		m3		#N/A	\$0.00	\$0	
Install flow dissipation		m3		#N/A	\$0.00	\$0	
Vegetate remainder of ditch		m2		#N/A	\$0.00	\$0	
DECOMMISSION FRESH WATER SUPPLY							
Breach embankment		m		#N/A	\$0.00	\$0	Includes on Bldgs & Equipment
Remove pump		LS	1	#N/A	\$10,000.00	\$10,000	
Remove pipeline		m	0	#N/A	\$0.00	\$0	Assumed leave pipeline left in place
WATER CONTROL IN RECLAMATION QUARRY							
Install pumping system		LS		#N/A	\$0.00	\$0	
Remove pumping system		LS		#N/A	\$0.00	\$0	
REMOVE PIPELINES							
Remove pipes		m		#N/A	\$0.00	\$0	
Concrete plug deep pipes		m3		#N/A	\$0.00	\$0	
Other				#N/A	\$0.00	\$0	
GROUNDWATER COLLECTION SYSTEM							
Excavate/install sumps		m3		#N/A	\$0.00	\$0	
Install pumping wells		m3		#N/A	\$0.00	\$0	
Install pumps/pipelines/power supply		LS		#N/A	\$0.00	\$0	
CONSTRUCT CONTAMINATED WATER STORAGE POND							
Excavate pond		m3		#N/A	\$0.00	\$0	
Doze & spread excavated material		m3		#N/A	\$0.00	\$0	
Vegetate spread material		ha		#N/A	\$0.00	\$0	
Bedding layer		m3		#N/A	\$0.00	\$0	
Supply geomembrane		m2		#N/A	\$0.00	\$0	
Install geomembrane		m2		#N/A	\$0.00	\$0	
Erosion protection layer		m3		#N/A	\$0.00	\$0	
CONSTRUCT PASSIVE TREATMENT SYSTEM (e.g. Constructed Wetland)							
Construct access roads		km		#N/A	\$0.00	\$0	
Install HDPE piping system from collection pond		m		#N/A	\$0.00	\$0	
Inter-cell flow structures		allow		#N/A	\$0.00	\$0	
Install liners		m2		#N/A	\$0.00	\$0	
Install growth media		m3		#N/A	\$0.00	\$0	
Wetland vegetation		ha		#N/A	\$0.00	\$0	
CONSTRUCT WATER TREATMENT PLANT							
Build treatment plant		LS		#N/A	\$0.00	\$0	
Build sludge containment facility							
Treatment Plant Operation	Lime treatment	m3	1786000	TPOS	\$0.15	\$267,900	Water quality to be lime treated. estimated as follows: Pond 2 1000 x 700 m x 1.9 m and Pond 1 800 x 300 x 1.9 m. One time treatment only - not required after cover is completed.
Total						\$277,900	
For cost of long-term/post-closure water treatment see "WATER TREATMENT" Worksheet"							

For cost of long-term/post-closure water treatment see "WATER TREATMENT" Worksheet"

## 1 Interim Care and Maintenance

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
INTERIM CARE & MAINTENANCE						
on-site caretaker		manmonths		#N/A	0	\$0 As per LMI cost estimate 2014 in mobilization sheet
Spring extra personnel		manmonths	3	#N/A	13194	\$39,582
-electrician		manmonths		#N/A	0	\$0
-mechanic		manmonths	2	#N/A	11517	\$23,034
annual fuel		litre		#N/A	0	\$0 Available on site.
misc. supplies		allow		#N/A	0	\$0 Available on site.
pick-up truck		each		#N/A	0	\$0 Available on site.
small dozer		allow		#N/A	0	\$0 Available on site.
small excavator		allow		#N/A	0	\$0 Available on site.
snow machine		allow		#N/A	0	\$0 Available on site.
communications		allow	1	#N/A	25000	\$25,000
SNP/AEMP water sampling & reporting		each	1	#N/A	12360	\$12,360 From "PostClosure" sheet
geotechnical assessment		each	1	#N/A	22923.49	\$22,923 From "PostClosure" sheet
interim water treatment				#N/A		\$0 Covered under "Water Management"
Worker accommodations		mandays	150	ACCMS	74.13	\$11,120
				Annual Interim C&M Cost		\$134,019
Number of years of ICM		years	2	Total		\$268,038 Arcadis estimated \$644,488 for 5 year (\$128.9K per year).

## 1 Post-Closure Monitoring &amp; Maintenance:

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
MONITORING & INSPECTIONS						
Annual geotechnical inspection		each	10	#N/A	\$22,923.49	\$229,235
Survey inspection		each		#N/A	\$0.00	\$0
Monitoring years - 10	Includes Maintenance	Year	3	LMI	\$100,000.00	\$300,000
Regulatory costs*		each		#N/A	\$0.00	\$0
Site water monitoring (AEMP and SNP)	Water sampling	each	10	#N/A	\$12,360.00	\$123,600
- Active closure and flooding		each		#N/A	\$0.00	\$0
- Post pit flooding		each		#N/A	\$0.00	\$0
Air Quality Monitoring Program (AQMP)		each	0	#N/A	\$0.00	\$0
Environmental Effects Monitoring (EEM) after 3 years		each	1	#N/A	\$126,079.00	\$126,079
Wildlife Effects Monitoring Program (WEMP)		each	0	#N/A	\$0.00	\$0
Vegetation Monitoring		each		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
COVER MAINTENANCE						
Repair erosion - infill gullies		allow		#N/A	\$0.00	\$0
Repair erosion - upgrade diversion ditches		allow		#N/A	\$0.00	\$0
Remove problem vegetation		allow		#N/A	\$0.00	\$0
Repair animal damage		allow		#N/A	\$0.00	\$0
Repair/upgrade access controls		allow		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
SPILLWAY MAINTENANCE						
Repair erosion		m3		#N/A	\$0.00	\$0
Clear spillway		each		#N/A	\$0.00	\$0
CWTS MAINTENANCE						
Maintain flow, restore vegetation		allow		#N/A	\$0.00	\$0
POST-CLOSURE WATER TREATMENT						
Annual water treatment cost, from "Water Treatment"						\$0
Subtotal for first 10 years, undiscounted						\$778,914
Discount rate for calculation of net present value of post-closure cost, %				3.00%		
Number of years of post-closure activity				25 years		
Net Present Value of payment stream						\$936,257

\*Regulatory costs - annual reporting, management plans, progress reports etc.

From LMI 2014 cost estimate

As per LMI 2014 cost estimation

LMI 2014 Addendum (6180+6180)

Not required

Not required

One time lime treatment allowed for in "Water Management". No further treatment will be required after the cover is completed.

Refer to calculations on "Longterm Monitoring" sheet

## Annual Discount

3%

Year	Geotechnical and Water Sampling		Monitoring and Maintenance		EEM		Total Yearly
	Cost	Discounted Cost	Every 3 years	Discounted Cost	One Time	Discounted Cost	
1	-	-		-		-	-
2	-	-		-		-	-
3	35,283.5	32,289.4	100,000	91,514	126,079	115,380	239,184
4	35,283.5	31,348.9		-		-	31,349
5	35,283.5	30,435.8		-		-	30,436
6	35,283.5	29,549.4	100,000	83,748		-	113,298
7	35,283.5	28,688.7		-		-	28,689
8	35,283.5	27,853.1		-		-	27,853
9	35,283.5	27,041.9	100,000	76,642		-	103,684
10	35,283.5	26,254.2		-		-	26,254
11		-		-		-	-
12		-	100,000	70,138		-	70,138
13		-		-		-	-
14		-		-		-	-
15	35,283.5	22,647.1	100,000	64,186		-	86,833
16		-		-		-	-
17		-		-		-	-
18		-	100,000	58,739		-	58,739
19		-		-		-	-
20		-		-		-	-
21		-	100,000	53,755		-	53,755
22		-		-		-	-
23		-		-		-	-
24		-	100,000	49,193		-	49,193
25	35,283.5	16,851.6		-		-	16,852
Net Present Value:		272,960.2		547,916		115,380	936,257

Costs for geotechnical in years 1 and 2 are on interim care and maintenance sheet)



## 1 Mobilization/Demobilization:

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
MOBILIZE HEAVY EQUIPMENT						
Excavators		each	1	#N/A	150000	\$150,000
Dump trucks		each	1	#N/A	50000	\$50,000
Dozers		each	1	#N/A	150000	\$150,000
Demolition shears		each	2	#N/A	300000	\$600,000
Crane		each	1	#N/A	150000	\$150,000
Loader		each	1	#N/A	150000	\$150,000
Compactor		each		#N/A	0	\$0
Light duty vehicles		each	3	#N/A	20000	\$60,000
MOBILIZE MISC. EQUIPMENT						
Pump shipping		each		#N/A	0	\$0
Pipe shipping		m		#N/A	0	\$0
Minor tools and equipment		allow	1	#N/A	100000	\$100,000
Truck tires		allow		#N/A	0	\$0
Other				#N/A	0	\$0
MOBILIZE CAMP						
Reclamation activities		allow		#N/A	0	\$0
Long term reclamation activities (eg pump flooding)		allow		#N/A	0	\$0
MOBILIZE WORKERS						
Reclamation activities - transport	Twin Otter flights	each	48 MWL	4500.00		\$216,000
Reclamation activities - transport	Dash 7 flights	each	20 MWH	9100.00		\$182,000
Reclamation activities - transport	Hercules flights	each	5 #N/A	20000		\$100,000
Rotation over reclamation period		manhours	0 lab-sL	41		\$0
Reclamation activities - travel time		manday	0 ACCMH	175		\$0
Long term reclamation activities (eg pump flooding) - transport		each		#N/A	0	\$0
Long term reclamation activities (eg pump flooding) - travel time		each		#N/A	0	\$0
Monitoring Airfare		each		#N/A	0	\$0
WORKER ACCOMMODATIONS						
Reclamation activities		mandays	6,600	ACMMS	74.13	\$489,258
Long term reclamation activities (eg pump flooding)		manmonths		#N/A	0	\$0
MOBILIZE FUEL						
Fuel freight - reclamation activities		liter		#N/A	0	\$0
Fuel freight - long term reclamation activities		liter		#N/A	0	\$0
Fuel freight accommodations		liter		#N/A	0	\$0
WINTER ROAD						
Construction and operation	366 km GK to site times 2 seasons	km	732	WRCL	2000	\$1,464,000
Limited winter use		km		#N/A	0	\$0
Winter road tariff	20,000 tonnes x 220 km x 2 seasons	mtonne	8,800,000	WRUS	0.11	\$968,000
DEMOLIBIZE HEAVY EQUIPMENT						
Excavators		km		#N/A	0	\$0
Dump trucks		km		#N/A	0	\$0
Dozers		km		#N/A	0	\$0
Demolition shears		km		#N/A	0	\$0
Crane		km		#N/A	0	\$0
Loader		km		#N/A	0	\$0
Compactor		each		#N/A	0	\$0
Light duty vehicles		km		#N/A	0	\$0
Other		km		#N/A	0	\$0
DEMOLIBIZE WORKERS						
crew travel time		mandays		#N/A	0	\$0
crew transportation		each		#N/A	0	\$0
Total						\$4,829,258

Assumed the use of equipment on site, 2014 LMI estimation includes an additional 10 units of equipment will be brought in.

Flight numbers from LMI

Flight numbers from LMI

Flight numbers from LMI. Herc rate unknown and needs to be confirmed.

The demolition contractor's estimate of \$128/m2 includes provision of labour.

The demolition contractor's estimate of \$128/m2 includes mob/demob of labour.

220 man-months. Use existing facilities and kitchen.

Not required. Ample diesel fuel is available on site.

Low rate used because route is well established.

20,000 tonnes is LMI estimate. Assumed net of back haul in aircraft where feasible.

Rental of equipment while on site is under "Mobilize". Mob/demob is under "Winter Road"

Time is covered in contractor's quote for demolition. Demob cost is covered in flights under "Mobilization"

## Unit Cost Table (for refining unit costs see "Estimator" worksheet)

		Filter by unit					
ITEM	Detail	COST CODE	UNITS	LOW \$	HIGH \$	SPECIFIED \$	COMMENTS
Accommodation							
		ACCM	manday	100.00	175.00	74.13	From LMI costs of \$2225 / manmonth using existing camp
Buildings - Decontaminate							
	Asbestos	BDA	m2	25.60	51.20		Low: removal of asbestos siding & flooring; High: removal of insulated pipes, friable asbestos
Buildings - Remove							Unit costs are based on 3m high, single storey building. Scale areas accordingly.
	Wood	BRW	m2	27.50	41.00		
	Concrete	BRC	m2	40.00	65.00	128.00	Specified: puncture concrete foundation slabs
	Steel - teardown	BRS1	m2	45.00	65.00	91.57	
	Steel - for salvage	BRS2	m2	67.00	100.00		
Concrete work							
	Small pour	CSF	m3	426.50	639.75		Low: YK; High=1.5xLow
	Large pour	CLF	m3	353.50	530.25	2,130.00	Specified: concrete crown pillar
Contaminated Soils							
	ESA Phase 1	CS1	each	7500.00			Low: small, "clean" site
	ESA Phase 1	CS2	each	50000.00			Low: small, "clean" site
	Remediate on site	CSR	m3	47.00	146.00	60.17	Low - 1 cell is complete and cost to construct 4 more cells is already allowed for.
Dozing							
	doze rock piles	DR	m3	1.05	2.40		Low cost: doze crest off dump
	doze overburden/soil piles	DS	m3	0.95	3.80	3.50	Special rate. Ample rock is available near stopes.
Excavate Rock; Low Spec's and QA/QC							
	drill/blast/load/short haul	RB1	m3	11.40	17.05		Low:quarry operations for bulk fill
	drill/blast/load/long haul	RB2	m3	12.05	17.80		
	RB1 + spread and compact	RB3	m3	12.05	17.80		
	RB2 + spread and compact	RB4	m3	12.50	30.75		
	Specified activity	RBS	m3				
Excavate Rock; High Spec's and QA/QC							(e.g. ditch/spillway excavation)
	drill/blast/load/short haul	RC1	m3	12.05	17.80		Low:foundation excavation;High:spillway excavation
	drill/blast/load/long haul	RC2	m3	12.70	18.40		
	RC1 + spread and compact	RC3	m3	12.70	18.40		e.g. cover construction
	RC2 + spread and compact	RC4	m3	13.50	19.20		e.g. cover construction
	Specified activity	RCS	m3			175.00	Specified-drift excavation
Excavate Rip Rap							
	drill/blast/load/short haul/place	RR1	m3	13.50	17.75	15.20	High: quarry & place rip rap in channel
	drill/blast/load/long haul/place	RR2	m3	14.20	20.65		
	source is waste dump/short haul	RR3	m3	7.00			cost includes sorting
	source is waste dump/long haul	RR4	m3	7.60		4.72	S - Based on LMI costs for 2016 haul from Ballpark to TCA and average cycle times to 3 locations.
	Specified activity	RRS	m3			85,656.00	
Excavate Soil; Low Spec's and QA/QC							
	clear & grub	SBC	m2	3.40	5.00		
	excavate/load/short haul	SB1	m3	4.30	5.90		
	excavate/load/long haul	SB2	m3	4.60	7.30		
	SB1 + spread and compact	SB3	m3	5.10	8.90		Low: non-engineered; High:engineered
	SB2 + spread and compact	SB4	m3	5.50	11.00		Low: non-engineered; High:engineered
	Specified activity	SBS	m3	3.20	6.30		Low: rehandle waste rock dump by dozing; High:rehandle waste rock by hauling
	Tailings	SBT	m3	1.35	3.70	15.50	High:contour surface - wet or frozen; Specified:haul/place wet infill
Excavate Soil, High Spec's and QA/QC							
	excavate/load/short haul	SC1	m3	6.80	9.30		
	excavate/load/long haul	SC2	m3	7.10	11.75		
	SC1 + spread and compact	SC3	m3	8.90	14.20	7.21	Low: non-engineered; High:engineered
	SC2 + spread and compact	SC4	m3	9.30	23.20	7.02	Low: non-engineered; High:engineered (e.g. complex covers, low volume dam construction)
	Specified activity	SCS	m3			18.80	Backfill adit with waste rock
Fence							
		FNC	m	13.55	203.00		
Fuel and Electricity							
	Fuel cost - gas	FCG	litre	1.05	1.40		
	Fuel cost - diesel	FCD	litre	0.99	1.39		
	Fuel mobilization	FCM	litre	0.22	0.42		High: winter road usage
	Electricity	FCE	kW-h	0.17	0.19	0.49	Low and High:Yellowknife; Specified:diesel generator
Geo-Synthetics							
	geotextile	GST	m2	3.44			Supply and install
	geogrid	GSG	m2	5.75			
	liner, HDPE	GSHDPE	m2	7.95			Supply and install; large quantity
	liner, ES3	GSES3	m2	20.20			FOB Yellowknife
	geosynthetic installation	GSI	m2	3.16	14.00		Low:geotextile; High:ES3 or HDPE
	bentonite soil ammendment	GSBA	tonne	308.30	348.50		FOB Edmonton, add shipping & mixing
Grouting (/m3 of rock grouted)							
		grout	m3	236.55	286.75		High: cement, FOB Yellowknife
Labour & Equipment Rates							
	Site manager	sman	\$/hr	125.00	152.00		
	Supervisor	super	\$/hr	52.00	91.84		
	Registered engineer	eng	\$/hr	95.00	220.00		
	Environmental coordinator	envco	\$/hr	74.16	130.00		
	Environmental technologist	envtech	\$/hr	36.00			
	Electrician	elec	\$/hr	74.00	95.00		
	Journeyman - various	journey	\$/hr	44.00	71.79		
	Labour - skilled	lab-s	\$/hr	41.00	49.60		

**Unit Cost Table (for refining unit costs see "Estimator" worksheet)**

Filter by unit					
Labour - unskilled	lab-us	\$/hr	31.00	43.98	
Equipment operator	oper	\$/hr	41.00	65.00	
Heavy duty mechanic	mech	\$/hr	49.00	72.85	
Water treatment plant operator	oper-wt	\$/hr	41.00	59.86	
Security / first aid	safety	\$/hr	36.00	66.97	
Administrative staff	admin	\$/hr	38.00	57.89	
Equipment rates include operator and fuel					
Loader - 4 cu.yd (3.06m3)	load-s	\$/hr	175.00		
Loader - 7 cu.yd (5.35m3)	load-l	\$/hr	315.00		
Excavator - 26.76-30.84 tonnes	exc-s	\$/hr	190.00		
Excavator - 68.95+tonnes	exc-l	\$/hr	420.00		
Grader	grad	\$/hr	190.00		
Dump truck off hwy 30-50 tonnes	truck-s	\$/hr	225.00		
Dump truck off hwy 55-75 tonnes	truck-l	\$/hr	300.00		
dozer, small	dozers	\$/hr	205.00	260.00	
dozer, large	dozerl	\$/hr	490.00	565.00	
smooth drum compactor	comp	\$/hr	155.00		
scooptram, 6 yd3 bucket	scoop	\$/hr	170.00		
flat bed truck with hiab	hiab	\$/hr	155.00		
fuel truck	ftuck	\$/hr	150.00		
water truck	wtruck	\$/hr	58.00	150.00	
<b>Mobilize Heavy Equipment</b>					
Road access	MHER	kmtonne	3.40	10.25	
Air access	MHEA	kmtonne	12.00		cargo rate>500lb
<b>Mobilize Camp</b>					
Road access	MCR	each	50000.00		refurbish existing camp
<b>Mobilize Workers</b>					
flight	MW	each	4500.00	9100.00	Low:e.g. 8 passenger; High: Dash 7
<b>Oil Removal</b>					
oil removal	OR	litre	0.43	1.20	Low:waste oil heater; High: ship offsite
<b>PCB Removal</b>					
Remove from site	PCBR	litre	40.20	46.90	7.21 Low: shipping, handling & disposal from Yellowknife
<b>Pipes, small (&lt;6in dia.)</b>					
remove/dispose on site	PSR	m	1.00	24.00	Low: remove/dispose on site; High: remove/re-use
supply	PSS	m	6.10	11.10	Low:supply; High:supply and ship
install	PSI	m	25.00		
<b>Pipes, large (&gt;6in dia.)</b>					
remove/dispose on site	PLR	m	22.00	72.00	18.39 Low: remove/dispose on site; High: remove/re-use
supply	PLS	m	129.00	143.00	Low:supply; High:supply and ship
install	PLI	m	50.00		
<b>Power Lines</b>					
remove/dispose on site	POWR	m	25.50		
<b>Process Chemicals</b>					
Remove from site	PCR	kg	0.45	2.50	Low: shipping, handling & disposal from Yellowknife
<b>Pumps</b>					
Pump capital cost	PC	each	195000.00		
Pump shipping	PS	each	2500.00		
Pump operating cost	POC	m3	0.12		pump operating costs should be calculated based on pump capacity, fuel costs, etc.
Pump maintenance	PM	allow	25000.00		
<b>Pump sand BackFill</b>					
	PBF	m3	85.00	300.00	
<b>Scarify - road/mine site</b>					
	SCFY	ha	4300	6030	2150
<b>Shaft, Raise &amp; Portal Closures</b>					
Shaft & Raises	SR	m2	645.00	2132.00	Low:pre-cast concrete slabs, little site prep. Area=shaft+>1m all around
Portals	POR	m3	18.80	250.00	1200.00 Low:unit cost code SCS;High:excavate & backfill collapsed portal;Spec: installed pressure plug
<b>Site Inspection Report</b>					
	RPT	each	10000.00	20000.00	
<b>SpillWay - Clear</b>					
	SW	each	3000.00	7000.00	
<b>Survey/Instrumentation</b>					
	SI	each	1800.00	3600.00	2 person crew
<b>Treatment Plant - Construct</b>					
Small (< 1000 m3/d)	TPS	lump sum	9000000	15000000	
Large (> 1000 m3/d)	TPL	lump sum	15000000	46000000	
Constructed Wetland	CWTS	ha	200000	300000	
<b>Treatment Plant - Operate</b>					
	TPO	m3	0.35	2.00	0.15 TPOS is from Lupin costs for most recent treatment (i.e. simple lime addition to raise pH to 8)
<b>Treatment Chemicals</b>					
ferric sulphate	ferric	kg	1.19		
ferrous sulphate	ferrous	kg	1.32		
lime	lime	kg	0.56		
hydrogen peroxide, 35%	hperox	kg	1.50		
Sodium Metabisulfate	Nametab	kg	1.18		
Caustic soda, 50%	caustic	kg	0.74		
Sulfuric acid, 93%	sulfuric	kg	0.31		
floculant	flocc	kg	6.00		
copper sulphate	copper	kg			

**Unit Cost Table (for refining unit costs see "Estimator" worksheet)**

Filter by unit

shipping	shipping	kg	0.20		
<b>Vegetation</b>					
Hydroseed, Flat	VHF	ha	4000.00		
Hydroseed, Sloped	VHS	ha	4500.00		
Veg. blanket/erosion mat	VB	ha	13000.00		
Tree planting	VT	ha	2600.00	6000.00	
Wetland species	VW	ha			47.72
<b>Water Sampling/Analysis/Reporting</b>					
	WS	each	7000.00	10000.00	
<b>Winter Road</b>					
Construction	WRC	km	2000.00	11500.00	
Usage	WRU	kmtonne	0.29		0.11
LMI quote assuming shared use with diamond mines					