



Mount Nansen Remediation Project

Review of Phase 1 (30% Design Phase)

Cost Estimate Scope and Bases

Submitted to:

**Assessment and Abandoned Mines
Energy Mines and Resources
Whitehorse, YT**

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1 Introduction

1.1 Background

The Phase 1 (30% Design Phase) Cost Estimate Report for the Mount Nansen Remediation Project (MNRP) (AMEC, 2014) provided an execution estimate considerably higher than the estimate available as Phase 1 was initiated (\$90 M vs. \$34 M). Following their review, Aboriginal Affairs and Northern Development Canada (AANDC), the federal funding partner for the MNRP, indicated that a review of opportunities for reducing execution cost estimates should be undertaken before initiating Phase 2 (60% Design Phase) design development activity. The scope of work outlined in this document was developed to respond to this request.

1.2 Objective

Assessment and Abandoned Mines' (AAM) specified objective for the work was to review the costs included in the Phase 1 estimate with the intent to identify potential reductions in the overall project cost. This was to be done by reviewing potential adjustments to the techniques and/or approaches proposed for implementing the selected remedial approach (i.e. Option 4 in the pre-Phase 1 alternative evaluations) by optimizing these techniques, or by adjusting the assumptions associated with the definition of Option 4.

1.3 Scope of Work

The scope of work for the cost review was outlined in a document forwarded by AAM on August 7, 2014. The work was to include the following steps:

- Teleconference with AAM, AANDC and Little Salmon Carmacks First Nation (LSCFN) to identify potential areas for further consideration.
- Reviewing costs included in the AACE (Association for Advancement of Cost Engineering) Class 3 cost estimate and the previous cost estimate for this project (LORAX/AECOM) to produce a report that identifies any potential reductions. Any incremental risks to the Partners associated with the cost reductions were to be identified as part of the process. The report was to be presented using a table(s) to compare AMEC's cost estimate and assumptions to the LORAX/AECOM cost estimate, the reason for the cost difference (e.g. scope missed by either estimate, low or high unit rates, assumptions/conservatism, general difference), identification of potential reductions or efficiencies and any resulting risks.
- Workshop with AAM, AANDC and LSCFN in Whitehorse to present the findings of the cost refinement exercise.

The work was not to include a value engineering exercise, which may or may not be the next steps following the cost refinement above.

1.4 Methodology

AMEC's methodology for addressing the scope of work was comprised of the following three tasks:

- Cost reconciliation;
- Estimating assumptions review and update; and
- Estimating sensitivity assessment.

1.4.1 Cost Reconciliation

AMEC completed a reconciliation of the pre-Phase 1 LORAX/AECOM estimate and the Phase 1 AMEC estimate. This reconciliation was intended to identify:

- Any previously unidentified scope elements that were added to the Phase 1 estimate;
- Key elements of the project scope and/or the associated execution methods that exhibit significant differences between the estimates; and
- The primary drivers for cost differences in those scope areas/execution methods (e.g. differences in quantity, pricing and/or execution methodology).

1.4.2 Updating Estimating Assumptions

One of the dangers in any cost review exercise is the tendency to “cherry pick” estimating assumptions to reduce costs to thresholds that meet a pre-determined objective. To avoid this, it is important to apply a consistent and objective approach to setting assumptions that may be required in the context of considerable uncertainty, and that kind of effort was reflected in establishing the Phase 1 estimating assumptions. Nevertheless, it was known that there were some modifications to key assumptions that could be defended. AMEC reviewed these key assumptions in light of developments since the conclusion of Phase 1 to identify where modifications could be justified, or to identify those scope elements where equally valid estimating assumptions could produce a significant range in cost outcomes.

1.4.3 Assessment of Estimating Uncertainties (Sensitivity Assessment)

There are a variety of methods that could be applied to characterize and quantify uncertainties in an estimate. A cost risk analysis could be undertaken to illustrate the impact of likely ranges in quantities and prices on the probabilities of various cost outcomes. These exercises can be labour intensive and may not add justifiable value at this stage. They are likely to identify those components of uncertainty that are already known to influence the estimate, and predict a fairly wide range of possible cost outcomes.

For this exercise, AMEC completed a relatively straightforward cost sensitivity analysis intended to quantify the influence of those inputs known to carry the greatest uncertainty (i.e. defining a consensus range for the most sensitive quantities and/or prices and determining the influence on final estimate ranges). This effort did not attach probabilities to specific cost outcomes, but provided a reasonable characterization of the relationship between estimate variability and key estimating inputs and assumptions.

AMEC also addressed some of those key variables where assumptions about contractor execution methods and capabilities have a strong influence on estimate outcomes. In some cases, conservative assumptions about likely contractor methods increased the estimate. As part of this assessment, AMEC attempted to quantify how more liberal assumptions about likely contractor responses to tender specifications could influence the estimate.

1.4.4 Meetings

1.4.4.1 Kick-off Teleconference

The cost review was initiated with a teleconference on September 17, 2014 attended by representatives of AAM, AANDC, LSCFN and key members of the AMEC estimating team. The teleconference focused on:

- A review of the scope of work to ensure alignment on activity and deliverables;
- The formats anticipated for the cost reconciliation and the sensitivity assessment; and
- Discussion around key scope areas and potential adjustments to assumptions that strongly influence the estimate.

1.4.4.2 Cost Review Workshop

A cost review workshop was conducted on October 23, 2014 in Whitehorse (attended by AAM, AANDC, LSCFN, and AMEC) that focused on the draft outcomes of AMEC's cost review and continued the discussions around scope adjustments and their estimated influence on project costs.

2 Estimate Reconciliation

2.1 Overview

The cost review began with a detailed reconciliation of the pre-Phase 1 AECOM estimate against the Phase 1 AMEC estimate. This section confirms the source estimates that were compared, explains the format that was used for the reconciliation of quantities and costs, and presents key findings made regarding the following reconciliation objectives:

- Identify any previously unidentified scope elements that were added to the Phase 1 estimate;
- Identify key elements of the project scope and/or the associated execution methods that exhibit significant differences between the estimates; and
- Identify the primary drivers for cost differences in those scope areas/execution methods (e.g. differences in quantity, pricing and/or execution methodology).

2.2 Source Estimates

The source documents for the reconciliation were the estimate completed for AAM during the pre-Phase 1 option selection work and the Phase 1 estimate completed by AMEC. The specific documents were as follows:

- Pre-Phase 1 (the “AECOM Estimate”) - a consolidation of the pre-Phase 1 estimate was provided by AECOM (2011). This document, in turn, consolidated or referenced information from the following supporting estimates:
 - AECOM (2010) provided costs for the core elements (largely materials handling scopes) for the various remedial options under consideration at the time;
 - Altura (2010) provided costs for surface reclamation and scope elements that were common to all remedial options;
 - Golder (2010) provided costs for the Open Pit cover;
 - AECOM (2009) provided costs for project water treatment requirements;
 - Altura (2011) provided costs for water quality mitigation actions that might be required in future (i.e. potential Adaptive Management costs);
- Phase 1 (the “AMEC Estimate”) - the final Phase 1 estimate is provided by AMEC (2014).

2.3 Key Option 4 Tenets and Driving Project Criteria

In reconciling the AECOM and AMEC estimates, it is useful to consider how remedial Option 4 was defined and interpreted for each.



2.3.1 AECOM

The AECOM estimate was based on the statement of Option 4 objectives and scope elements that are provided in Table 2.3.1-1 (LORAX, 2011).

Table 2.3.1-1: Pre-Phase 1 Option 4 Objectives and Scope Elements

Option 4 Objectives	
1) Remove the geotechnical liability associated with maintaining a tailings dam in the Dome Creek Valley;	
2) Restore the Dome Creek valley in the area of the TSF to a more natural condition compatible with the original land use;	
3) Minimize the potential for tailings oxidation and ML/ARD through the maintenance of dry conditions within the tailings deposits (minimize infiltration); and	
4) Restore area of open pit to a condition more compatible with the original land use via tailings and waste rock backfill.	
Option 4 Scope Elements	
Closure Element	Description
Tailings and Pit	Relocation of approximately 300,000 m ³ of tailings and contaminated soil to the open pit. Tailings will be stored in a dry condition to the extent possible through storage of tailings above the water table and placement of a synthetic cover designed to minimize infiltration. The cover will also serve to physically stabilize the tailings to prevent water/wind erosion.
In-Pit Dam	Preliminary assessment indicates that an in-pit dam structure will not be required.
Waste Rock	Relocation of ~344,000 m ³ of waste rock to open pit. Approximately 156,000 m ³ of waste rock will be left in place and regraded and revegetated as necessary.
Tailings and Storage Facility	Relocation of tailings will allow restoration of the Dome Creek valley in the area of the TSF to a condition compatible with the original land use.
Pony Creek Adit	Additional measures may be required to provide a more effective seal of the adit to minimize the hydraulic connection between the pit and Pony Creek.

2.3.2 AMEC

For the AMEC estimate, the key tenets of Option 4 were summarized as follows:

- Tailings relocation and dam decommissioning followed by restoration of the Dome Creek valley;
- Placement of “low moisture” tailings;
- Maintenance of tailings above the water table;
- Provision of stable and useable backfilled pit surfaces over reasonable timeframes (i.e. without creating practically indefinite restrictions on land use); and
- Maintenance of downstream surface water quality within recognized regulatory standards.

These tenets are of necessity fairly broad and required interpretations by the AMEC design team for translation into a specific Design Base Case for which an execution schedule and cost estimate could be developed. To facilitate this translation, AMEC applied the following “Driving Project Criteria” which interpret the key project tenets in ways that can be connected to the anticipated performance of specific execution plans and methods:

- The “Stable Surfaces Criterion” - refers to the provision of stable and useable backfilled pit surfaces over reasonable timelines. The performance of the pit cover ultimately depends on complex and largely unpredictable interactions between and amongst a number of key design elements (e.g. the moisture content of tails (which, in turn, is influenced by the required/ desired removal method), the methods of placement, the degree of mixing with waste rock, pit groundwater conditions and the physical configuration of the pit). Meeting the stable surfaces criterion by attempting reliable, quantitative predictions of these interactions would be difficult, costly and probably counterproductive (e.g. it cannot be done without defining specific tailings removal methods which would then counterproductively constrain the procurement process; i.e. contractors could not bring forward potentially better approaches). The approach AMEC took to this criterion was to apply professional judgement to the definition of an integrated execution method that was considered likely to meet the need for a stable pit surface, without defining the specific quantitative performance outcomes for each of the relevant design media (e.g. tails moisture, tails compaction specification). In effect, the method has been defined and fixed, and the performance outcomes have not, except that those outcomes are expected to fall within acceptable limits.
- The “Water Quality Criterion” - refers to the maintenance of downstream surface water quality within recognized regulatory standards. This is a critical project outcome and some of the key Option 4 tenets (specifically the placement of low moisture tailings and the maintenance of tailings above the water table) are really intended as a means to this end, and are not, in and of themselves, independent performance requirements. Indeed, for a great many design decisions/ elements (e.g. the kinds of, and how much, waste rock must go into the pit), there are a variety of potential selections that are ultimately determined by their influence on downstream surface water quality. Again, reliably predicting how all of these design decisions interact to produce a particular water quality is extraordinarily complex and indeed may simply not be possible. This leads to the reliance on professional judgement to define approaches that are likely (but not certain) to be successful and the development of robust (and potentially costly) Adaptive Management measures to mitigate intolerable uncertainties.
- The “Proven Methods Criterion” - refers to the application of methods that are known, or are judged likely, to be feasible at Mount Nansen. In short, this means that we need to be confident that the combination of methods and equipment proposed in the Base Case will work. Again, this determination relies on professional judgement and is limited by the experience of the design team. It is entirely possible that a broader group of experienced and capable contractors, whose business relies on the development of ever more competitively cost effective methods, could propose more efficient processes during the procurement process.
- The “Pit Volume Criterion” - refers to the maintenance of materials directed to the pit containment structure within the physical constraints and/or boundaries that apply to the site. This criterion acknowledges that there are physical constraints to the lands available for pit containment that the project has no control over and that therefore become physical boundary conditions for the design (e.g. the public access road to the north which must not be disturbed by the works).

- The “Safety Criterion” - refers to the application of methods consistent with recognized standards of construction health and safety. This criterion acknowledges that it has to be possible to execute the proposed plan safely. This may be self-evident, but could have a significant influence on the detailed development of specific methods for key scope areas (it is part of the reason for proposing wellpoint dewatering prior to tailings excavation for example).

2.3.3 Reconciliation Implications

There are differences in how the central objectives and features of Option 4 were described in the AECOM and AMEC estimates. However, the differences in cost between the AECOM and AMEC estimates are not grounded in any significant changes in the basic tenets of the selected remedial approach, but rather from evolutions in the thinking about execution methods and schedules that were, in turn, influenced by the additional site characterization data and design development activity brought to bear during Phase 1.

2.4 Reconciliation Formats

Sections 2.4.1 and 2.4.2 present the formats used to compare the estimated costs and work quantities contained in the two reconciled estimates. The common thread between much of the information is the Activity ID coding assigned to the Primavera construction schedule that accompanied the 30% AMEC estimate submitted in Phase 1 (AMEC, 2014).

2.4.1 Detailed Estimate Reconciliation

Based on the breakdown of the work and the levels of detail available, it was decided to use the AMEC estimate as the base case and compare the AECOM estimate to it. Two lump sum items from the AECOM estimate (Restoration of Dome Creek Valley and Common Elements) were also broken down into smaller components for easier comparison to the AMEC estimate.

For the reconciliation, the 30% AMEC estimate was first rearranged into significant work groupings. AECOM cost estimate items were then assigned as applicable to comparable work groupings. To add clarity, the AMEC scope items were left aligned and assigned a black font, while the AECOM scope items were right aligned in the same column and assigned a red font. Three columns were added on the right hand side of the detailed reconciliation to clarify the scope of the work if necessary and to characterize the variance into quantity driven and price driven components.

Refer to Table 2.4.1-1 for the summary level cost reconciliation results and to Appendix 2A for the detailed reconciliation, as well as summaries of the two source estimates used for the exercise. For the summary reconciliation in Table 2.4.1-1, the Q4 2010 AECOM estimate numbers were escalated by 9% (based on AMEC data for cost escalation between 2010 and 2014) to bring them in line with the Q1 2014 AMEC estimate (i.e. they do not match the numbers shown in the detailed reconciliation in Appendix 2A).

Mount Nansen Remediation Project - Review of Cost Estimate Scope and Bases
(per Engineering Agreement C00025524 dated 26 August 2014)

Table 2.4.1-1 Estimate Reconciliation Summary

Markup on 2010 AECOM costs (see other tab) to account for inflation between Q4 2010 and Q1 2014 -----> 9.0 %

COST ITEM	Notes	AMEC Q1 2014 \$Cdn	AECOM Q1 2014 \$Cdn (2010 marked up)	VARIANCE	VARIANCE (% of Total)
DETAIL DESIGN, CONSTRUCTION DOCUMENTS		2,250,000	1,943,164	306,836	0.5%
QC/QA DURING CONSTRUCTION		3,000,000	2,140,878	859,122	1.5%
SITE MAINTENANCE BETWEEN CONSTRUCTION SEASONS		2,100,000	0	2,100,000	3.7%
MOBILIZATION / DEMOBILIZATION		2,855,880	436,000	2,419,880	4.3%
SEDIMENT CONTROL		544,714	54,500	490,214	0.9%
HAUL ROADS AND PIT WALLS		764,775	0	764,775	1.4%
PONY CREEK ADIT PLUG		198,609	272,500	-73,891	-0.1%
DEMOLITION AND HAZARDOUS PRODUCTS REMOVAL		3,573,753	2,205,070	1,368,683	2.4%
WATER TREATMENT PLANT		7,342,774	2,180,000	5,162,774	9.2%
WELL POINT DEWATERING SYSTEM		11,300,437	0	11,300,437	20.2%
WASTE ROCK TO OPEN PIT		4,879,835	1,874,800	3,005,035	5.4%
WASTE ROCK TO TSF FOR EQUIPMENT SUPPORT AND MIXING, THEN TO OPEN PIT WITH THE TAILINGS	1	4,734,065	0	4,734,065	8.4%
TAILINGS TO OPEN PIT		5,152,979	4,905,000	247,979	0.4%
SUBEXCAVATION TO OPEN PIT		1,045,089	143,880	901,209	1.6%
MISC WASTE PRODUCTS TO OPEN PIT		1,027,265	375,096	652,169	1.2%
REMOVE TSF DAM		1,560,680	1,482,400	78,280	0.1%
DOME CREEK RESTORATION		3,506,236	1,406,100	2,100,136	3.7%
EXPLORATION TRENCHES		347,419	222,425	124,994	0.2%
LANDFORMING & REVEGETATION		2,037,530	932,631	1,104,898	2.0%
DECOMMISSION SITE ROADS		630,881	171,174	459,707	0.8%
COVER OVER OPEN PIT		7,675,238	2,812,200	4,863,038	8.7%
CONTINGENCY		13,305,632	6,094,904	7,210,728	12.9%
O&M COSTS (NPV)		4,738,729	4,087,500	651,229	1.2%
DESIGN CONTINGENCIES (NPV)		1,411,859	0	1,411,859	2.5%
ADAPTIVE MANAGEMENT (NPV)		3,819,844	0	3,819,844	6.8%
		89,804,221	33,740,222	56,063,999	100.0%

Notes
1. Line items were for tailings and rock movements to the pit were separated in this way to facilitate a more meaningful comparison between the AECOM and AMEC figures for tailings relocation, even though the AMEC method involved mixing with rock and the AECOM assumption did not. The AMEC estimate developed a total blended cost for the movement of tailings and rock to the pit, and then partitioned this total between rock and tailings to facilitate the desired comparison.

2.4.2 Detailed Quantity Reconciliation

As noted previously, the common thread through much of the reconciliation exercise is the Activity ID coding used in the Primavera construction schedule developed in Phase 1. That schedule also included a column showing the quantities of work on which the individual schedule durations were based.

The first step in the reconciliation of estimate quantities was to provide as much detail as possible on the makeup of the quantities shown in the Primavera schedule. The details of that breakdown can be found in Appendix 2B. The broken down quantities were also colour coded and summarized into major quantity groupings at the bottom of the spreadsheet.

Appendix 2B also contains a second detailed quantities reconciliation that identifies the sources of rock and tailings used for the various components in the closed out facility, allowing a higher level understanding of material movements onsite during closure.

Finally, a summary reconciliation of the quantities is presented in Table 2.4.2-1. The quantities in the table are colour coded to correlate with the detailed reconciliation quantities in Appendix 2B.

2.5 Reconciliation Findings

2.5.1 Estimate Objectives

Before undertaking any detailed assessment of differences between the AECOM and AMEC estimates, it is useful to consider that they were provided for different purposes, at different points in the project development process. The AECOM estimate was developed from design concepts and intended primarily to support selection of a preferred remedial option. The AMEC estimate was the first to focus on a single remedial approach, and was prepared from a design that reflected the additional development resulting from Phase 1 activity. In short, the AECOM estimate focused on points of difference among alternatives, while the AMEC estimate was the first cost milestone on a prescribed development path for a specific design scope. It could be expected then that there would be significant variations between these two estimates. Differing objectives may not account for the full separation between the estimates, but it was likely a significant contributing factor.

Mount Nansen Remediation Project - Review of Cost Estimate Scope and Bases
(per Engineering Agreement C00025524 dated 26 August 2014)
Summary Reconciliation of Main Quantities

Table 2.4.2-1 Quantity Reconciliation Summary

Item	QUANTITY ITEM	AMEC (m3)	AECOM (m3)	Reconciliation Comments
1	Tailings relocated to open pit	237,100	300,000	The volume discrepancy will be investigated in the 60% design phase. It may be necessary to know the specific AECOM assumptions that were used to derive their quantity.
2	TSF subexc relocated to open pit	50,600	11,000	The difference is due to differing assumptions by AMEC and AECOM for subexcavation depths (with a possible small component from differing footprint areas).
3	PAG rock first used for TSF mixing before transfer to open pit	143,550	0	AMEC volume is 50% of items 1 and 2. AECOM assumed no rock movement to the TSF. This rock is, by definition, PAG and will need to be moved to the open pit regardless.
4	PAG rock relocated directly to pit	237,952	300,000	AMEC's quantity for PAG rock (items 3 & 4) is larger than AECOM's volume assumption of 300,000 m3. The discrepancy will need to be investigated more closely in the 60% phase.
5	NAG rock relocated to pit for platform	43,300	44,000	No comment.
6	NAG rock relocated to buttress	68,200	0	The AMEC design requires a rock buttress at the pit entrance, while the AECOM scheme does not.
7	NAG rock relocated to TSF for protection of exposed surfaces	137,250	0	This is a change from the AECOM design. AMEC has assumed that the sand layer over the exposed TSF footprint will need to be protected for long term performance.
8	Miscellaneous other contaminated soils	30,834	0	The AECOM estimate covers some minor qties with lump sums. AMEC's volume includes the TSF toe berm, hydrocarbon contamination, small tailings spills, ore stockpile, concrete.
9	Dam material used for exposed TSF protection	34,325	32,760	No comment.
10	Dam material returned to original borrow pits	0	47,240	The AMEC estimate assumes that all dam fills not used to cover the TSF will be stockpiled in the open pit area for later use in the permanent cover.
11	Dam material stockpiled for later use in final open pit cover	69,890	80,000	The total quantity for items 9, 10, 11 are quite different between the AMEC and AECOM estimates. This discrepancy will be investigated during the 60% design phase.
12	NAG rock for interim cover over open pit	24,000	0	There are major differences between the AMEC and AECOM cover cross-sections and aerial extent. The cover design will be relooked at during the 60% design phase.
13	Victoria creek sand for interim cover over open pit	80,000	0	The 30% estimate assumed no further disturbance within the IOC after closure. Sand was assumed brought in from a temporary borrow area 5 km away in Victoria Creek.
14	Final cover over open pit	72,000	43,000	See item 12 comment.

Note: The color coding correlates to the quantity breakdown by schedule activity in Appendix 2B



2.5.2 Detailed Estimate Reconciliation

The total cost estimate variance between the Phase 1 AMEC estimate (\$89.8 million) and the pre-Phase 1 AECOM estimate (\$33.7 million including 9% escalation) is \$56.1 million. The following presents the major sources identified as contributing to this variance.

From the summary cost reconciliation in Table 2.4.1-1, it is clear that the following items were excluded from the 2010 AECOM estimate:

- Site maintenance between construction seasons (\$2.1 million);
- Haul road and pit wall stabilization (\$0.7 million);
- Wellpoint dewatering (\$11.3 million);
- PAG rock/tails mixing (\$4.7 million);
- Design contingencies (\$1.4 million); and
- Adaptive management items (\$3.8 million).

These missing scope items alone account for some \$29 million (including the associated 20% contingency) of the difference between the AECOM and AMEC estimates. It is interesting to note that combining this missing scope with the applicable upper and lower variances of the AECOM and AMEC estimates covers much of the Table 2.4.1-1 variance, as follows:

• Upper bound variance on AECOM Class D estimate (i.e. +40%)	\$13.5 million
• Lower bound variance on AMEC Class 3 estimate (i.e. -15%)	\$13.5 million
• Missing scope elements	<u>\$29.0 million</u>
Total:	\$56.0 million

In addition, major differences between the AECOM and AMEC estimates can also be attributed to the following items.

- **The general approach to the two estimates as introduced in Section 2.5.1.** Unlike the AMEC estimate, it is believed that the AECOM unit cost rates do not completely account for all contractor indirects that will be incurred to perform the direct work scope items, such as contractor site overhead staff, camp catering and housekeeping, haul road improvements, and major sediment and water management works required during construction. In addition, the AMEC estimate was based on, and integrated with, an execution schedule tied to judgements of individual activity durations.
- **The general methodology assumed for removing the tailings from the TSF.** Although the AECOM estimate has little detailed cost breakdown information related to their assumed tailings removal methodology, the unit rate used for tailings removal does not allow for much more than loading the tailings, hauling them to the open pit, and depositing them in their final location. AECOM assumed the execution method was based on winter relocation of frozen and partially frozen materials.

To reduce the risk of contractor non-performance and lower the moisture content of the materials stored under cover at the open pit, AMEC assumed a much more robust approach for removal of the tailings and deposition in the pit. Based on the 2013 Site Investigation (SI) findings, AMEC concluded that rock platforms should be built over the in situ tailing surfaces with potentially acid generating (PAG) rock from nearby waste dumps, with those platforms used for excavator and haul truck traffic and wellpoint operations, before being mixed with the tailings at the work face benches when loading into trucks. The handling characteristics of the in situ tailings are further improved by installing and operating a series of well points ahead of the excavation operations. Not including the cost of loading, hauling, and dumping the tailings (which are close between the two estimates according to Table 2.4.1-1, but based on different quantities as discussed in the next subsection), the cost variance between the two estimates resulting from different excavation methodologies is approximately \$16 million.

In short, the AMEC methodology aligns with the project need to provide conditions in the backfilled pit consistent with the development, within reasonable timelines, of a stable pit cover and reclamation surface. AECOM's concept involves relocating tailings largely at their in-place moisture content and does not explicitly define how the result can provide surfaces stable enough to sustain the specified pit cover.

- **Reclamation of the TSF footprint.** It is clear that there are large differences between the two estimates when it comes to reclamation of the TSF area once the tailings are removed. Those differences begin with the amount of subexcavation assumed below the TSF footprint about \$1 million) and the treatment of the exposed ground surfaces. AMEC assumes that a 300 mm layer of sand will be placed first, and then overlaid with a 1,200 mm layer of non-acid generating (NAG) rock before final contouring and revegetation. Although the AMEC and AECOM estimates for Dome Creek reclamation are similar for the sand cover and revegetation components, the AMEC assumption for armouring the entire area with NAG rock adds over \$2 million to the project costs.
- **Water treatment.** The two estimates vary by over \$5 million, largely because AMEC concluded that a larger, fixed (vs. mobile) plant with additional process units would be needed.
- **Landforming.** The AMEC estimate may be slightly conservative regarding the amount of rough grading and revegetation required after removal of all NAG and hydrocarbon contaminated materials. This will be examined more closely in the 60% design phase, once clear consensus is reached on expectations for the site's final appearance.
- **Removal of hazardous materials from site.** It's likely the AMEC cost for this item will be lowered in the 60% design phase, potentially by more than \$1 million, with agreement from the Project Partners on the final disposal location (onsite versus offsite).
- **Open pit cover.** The two estimates vary widely in scope and cost (over \$5 million), with the AMEC estimate assuming an interim cover followed by a final engineered cover, and the AECOM estimate a final less complex cover only.

- **Contingency.** The AMEC estimate contains more than \$7 million in additional contingency, but this is strictly the result of the overall increase in capital costs since the AMEC markup is 20% compared to AECOM's 30%. AMEC used a lower rate to reflect the level of effort put into developing the contractor methodology and project costs and note that it is lower than what is typically used for a 30% level of design.

2.5.3 Detailed Quantity Reconciliation

There are some relatively large quantity differences between the AMEC and AECOM estimates that will need to be investigated during the 60% design phase. The main differences are:

- **Tailings.** The AECOM estimate assumes about 25% more tailings than does the AMEC estimate (300,000 m³ versus 237,000 m³). This is offset by an AMEC unit cost that is about 40% higher than the AECOM unit rate, bringing the total tailings relocation costs within \$0.5 million of one another.
- **Waste Rock.** The total volume of rock ultimately placed in the open pit varies from 344,000 m³ in the AECOM estimate to almost 525,000 m³ in the AMEC estimate. It is not possible to pinpoint where the differences originate since the AECOM volume is not broken down into source components.
- **TSF Subexcavation.** The volume difference of 40,000 m³ between the two estimates is based mostly on the depth of excavation assumed below the tailings, with another small component originating from differences in assumed footprint areas.
- **Dam Fills.** The AECOM estimate assumes a dam volume that is about 50% greater than the one used in the AMEC estimate. As with the tailings, the higher unit costs in the AMEC estimate to move that material offsets the lower volumes used and results in total removal costs that are similar between the two estimates (roughly \$1.4 million).
- **Open Pit Cover.** As indicated in Section 2.4.2, the AECOM and AMEC cover designs are very different. It is, therefore, not surprising that the quantities for the individual schemes are also very different, with the AMEC cover requiring twice the volume of granular fill materials than the AECOM scheme. In addition, the AMEC cover section includes a clay/plastic composite section of geosynthetic materials. Part of the reason for the major differences may be the larger footprint occupied by the AMEC cover.

2.5.4 Summary Comments

As a consequence of the above reconciliation findings, important action items during subsequent reviews or design development will include:

- **Scope of work.** It will be important to address more specifically the assumed contractor methodology to remove the tailings and relocate them to the pit (in particular the need for dewatering and waste rock mixing), clarify the expectations from the Project Partners with regards to final landforming and revegetation, confirm the need for rock armouring within the TSF footprint, look more closely at water treatment options (including adjustments to the

project construction schedule to reduce treatment rates), and agree on an Open Pit cover section that “better” reflects the quality of backfilled rock and tailings placed beneath it.

- **Quantities.** Confirming quantities to the greatest accuracy possible will be very important because of the ripple effect those quantities have throughout the estimate and construction schedule. Unlike costs which are based on more subjective estimator assumptions, developing accurate quantities should be a more straightforward action that definitively removes uncertainty from the overall project estimate and schedule.
- **Unit Prices.** Pricing is a function of the assumed quantities, execution method and schedule, and so, as a largely dependent variable, may have less prominence in future estimate developments and reviews. However, pricing will nonetheless be an important consideration, particularly for those items subject to uncertainties relating to quantities and methods.
- **Project Schedule.** Schedule activities are driven by quantities of work and estimator productivity assumptions. Although few changes are expected in the project schedule at this time, assuming an earlier start in Season #1 and a relook at possible multi-shifting in earlier years may provide some opportunities for cost reductions.

3 Estimate Assumptions

3.1 Review Scope and Objectives

This component of the estimate review is intended to identify any changes to key estimate assumptions that might be defended based on design developments post Phase 1, or based on reconsideration of the Phase 1 estimate variables. The focus is on scope areas where uncertainties relating to project requirements and/or outcomes are thought to be significant and where, as a consequence, there is a comparatively wide range in possible estimate assumptions that strongly influence the final estimate.

3.2 Key Scope Areas and Alternate Assumptions

Table 3.2-1 provides a summary of key project scope areas and the influence of assumptions applied in these areas on the cost estimate. This table focuses on those elements of the project that are known to carry significant uncertainty with respect to scope and/or execution method(s) and that, given their nature and/or scale, are likely to have significant influences on total project costs. The table also provides broad characterizations of the level of conservatism reflected in assumptions, and outlines alternate assumptions that will be considered in the cost sensitivity assessment (Section 4).

It should be noted that estimate changes resulting from the alternate assumptions in Table 3.2-1 are outside of the normal estimating tolerance that would be associated with an AACE (Association for Advancement of Cost Engineering) Class 3 estimate (typically -15 to +25%). These alternate assumptions are intended to focus on scope and/or execution method changes, rather than the normal estimating variance that would apply to a defined scope.

3.3 Review Limitations

It is important to recognize some of the limitations to, and/or constraints on, any re-examination of estimate assumptions undertaken at this stage. Design development activity has not progressed materially post Phase 1 (other than the conduct of a supplementary Site Investigation Program in the summer of 2014 (AMEC, 2014a)), so that the outcomes of the more detailed considerations of key project variables that are contemplated for Phase 2 are not yet available. This will limit the range of assumption variations that can be supported technically.

In addition, it will be important to avoid any tendency to preferentially select optimistic estimating assumptions with a view towards reducing the resulting estimate. Reviews that consistently bias assumption selection so as to reduce the estimate in those key scope areas that carry significant uncertainty (and, therefore, have a relatively wide range of possible estimate assumptions) is arbitrary, unsupported technically and will produce a revision to the estimate with little real meaning.

Table 3.2-1: Summary of Key Estimating Assumptions

Key Scope Area	Basis of Phase 1 Estimate	Characterization of Phase 1 Assumptions	Potential Range of Assumption Adjustments
1. Civil Quantities			
<p>Civil quantities refers to the large volume material categories that will require movement and/or handling to affect remediation, specifically:</p> <ul style="list-style-type: none"> • Tailings; • Dam fill; • Waste rock; and • Contaminated soils and rock <p>To a large degree, remediation for the Mount Nansen property means relocation of these key material categories (i.e. civil materials management and remediation are, to a large degree, the same thing), meaning that the quantity estimates for these material categories have a major influence on the estimate.</p>	<p>The Phase 1 civil quantity estimates were developed using contemporary civil software (AutoCAD and Eaglepoint) and the site topographic and LiDAR data available (Canada Digital Elevation Data (CDED) topo and AAM supplied LiDAR survey). Some key inputs to this process relied on interpretations and/or judgements about the physical extents of particular material categories, namely:</p> <ul style="list-style-type: none"> • The base of the tailings; • The limits of contaminated sand fill; • The depth of contamination below the TSF footprint; • The limits of contaminated soils and rocks in the mill area; and • The extent of tailings movement and deposition within the Dome Creek valley outside the immediate limits of the TSF. 	<p>Generally speaking, AMEC's assumptions about the physical extents of material categories that are poorly understood were in the middle of the range of possible assumptions. There is more than a small probability that the actual material limits could combine in ways that reduce the total materials handling liability. Of course, this observation goes both ways, and volumes could increase. In addition, the 2014 SI work (i.e. post Phase 1) suggests that contaminated sediment impacts in the Dome Creek valley beyond the TSF are greater than previously thought.</p>	<p>AMEC's judgement would be that a range of $\pm 20\%$ on key quantities that are influenced by poorly defined material limits would be reasonable for the sensitivity analysis (again, this is beyond the normal variance in civil quantity estimating described in Section 3.2). This range has been incorporated into the lower and upper bound sensitivity assessments. Greater resolution or definition of this range cannot be supported without the more detailed examinations and calculations that will form part of Phase 2. In addition, assumed sediment volumes in the Dome Creek valley outside of the TSF will be increased by roughly 100% for the upper bound sensitivity assessment to evaluate the potential cost impact of the increased creek bed sediment removal scope that has been identified post Phase 1.</p>
2. Waste Rock Characterization			
<p>This is related to the civil quantities issue in that it influences the volumes of waste rock that are ultimately directed to the Open Pit. The issue is the potential challenge related to distinguishing between PAG and non-PAG waste rock during project execution. Managing and/or mitigating this challenge might require extensions to the execution schedule and/or additional costs for onsite laboratory capabilities.</p>	<p>The Phase 1 estimate assumed that PAG/non-PAG distinctions could be made without significantly influencing project execution schedules or support requirements (i.e. on the basis of pre-execution characterization data or readily applied field protocols).</p>	<p>This Phase 1 estimating assumption was comparatively liberal in that there is a good possibility that direct analytical measures will be required to make reliable PAG/non-PAG distinctions in practice. This will likely require the development and maintenance of a fairly robust onsite analytical capability with an associated sampling capability and infrastructure. In addition, the effectiveness and efficiency of these capabilities will have practical limits that could result in some proportion of the non-PAG inventory being directed to the Open Pit.</p>	<p>AMEC has assumed that the PAG/non-PAG field differentiation issue can be adequately managed during field execution via the development and maintenance of an onsite sampling and testing capability, and that applying this capability will not compromise the efficiency of the materials handling operation, or the proportion of the non-PAG rock inventory directed to the Open Pit. For the upper bound sensitivity assessment, AMEC has assumed upfront laboratory development costs of \$100,000 and annual operating costs (including staffing) of \$500,000 for this sampling and testing capability.</p>



Key Scope Area	Basis of Phase 1 Estimate	Characterization of Phase 1 Assumptions	Potential Range of Assumption Adjustments
3. Materials Handling Methods			
<p>The specific techniques used to move the major civil material categories, particularly tailings, to the Open Pit has a fundamental influence on both the execution schedule and total project cost. The assumptions about methods reflect AMEC's interpretations of how several key project uncertainties (e.g. tailings handling and placement characteristics) might be managed and/or mitigated (i.e. these assumptions are not only critical to the estimate, they must be made within a context of considerable uncertainty).</p>	<p>The Phase 1 Design Base Case and estimate assumed conventional truck and shovel movement of key material categories. Wet tailings were assumed to be managed via upfront wellpoint dewatering and mixing of tails with PAG rock (i.e. a significant portion of the PAG rock inventory destined for the Open Pit is double handled). The general PAG/tails mixing ratio was set at between 1:2 to 1:2.5 for the Phase 1 estimate. In addition, the Phase 1 concept assumed that a certain proportion of the PAG inventory would be used at the TSF (prior to disposition in the Open Pit) to provide trafficable surfaces on the TSF excavation benches and haul roads.</p>	<p>AMEC views the assumed dewatering/mixing/truck and shovel methods as a robust approach for managing and mitigating the uncertainties related to tailings movement and placement. It is possible, indeed likely, that an experienced and well equipped contractor could propose an alternative combination of methods and equipment that could lower costs, particularly if contractors could mitigate their commercial risks by undertaking some form of trial prior to full scale execution. In addition to assumptions about the general execution methods, AMEC's Phase 1 estimate relies on assumptions about the effectiveness of tailings dewatering (see subsequent table entry), the required PAG rock/tails mixing ratio and the interrelation between these variables. AMEC's assumption for PAG/tails mixing is in the middle of a potentially fairly wide range for this variable, which is influenced not only by tailings handling requirements, but by the configuration and height of excavation benches within the TSF.</p>	<p>For the lower bound sensitivity analysis, a general materials handling scope and price reduction factor of 20% will be applied. Absent more detailed analysis, greater resolution of this figure is not possible; it simply reflects AMEC's view that there is a good possibility that a successful engagement of the contracting community in an appropriately structured procurement strategy (see Section 5.1.2) could identify more cost effective materials handling methods.</p> <p>A variation of $\pm 30\%$ on the potential PAG/tails mixing ratio will also be considered in the sensitivity assessment.</p>



Key Scope Area	Basis of Phase 1 Estimate	Characterization of Phase 1 Assumptions	Potential Range of Assumption Adjustments
4. Water Treatment			
<p>Pit and pond waters will require treatment both to provide unencumbered access to key work areas and to meet water quality release standards.</p>	<p>The Phase 1 estimate includes the construction of a fixed (i.e. non mobile) water treatment plant dedicated to the project's requirements.</p> <p>The Phase 1 estimate assumed that most of the onsite water inventory would need to be treated over a relatively short time frame to support the assumed execution schedule (i.e. onsite water storage was not used to attenuate the peak plant throughput capacity).</p> <p>Finally, the assumed Phase 1 treatment plant incorporated a comparatively broad inventory of process units to accommodate the full range of critical parameters that could report to the plant.</p>	<p>The assumed water treatment configuration and capacity is viewed as conservative. It was known at the outset that costs could likely be reduced by optimizing the provision of onsite water storage with plant throughput capacity, and via a more detailed examination of process unit and reagent consumption requirements.</p>	<p>Post Phase 1 treatability testing undertaken during the 2014 SI program suggests that a 15% reduction in the scope of the treatment capability can likely be defended (AMEC, 2014a). This reduction will be reflected in the lower bound sensitivity assessment.</p> <p>In addition, a general 20% reduction in treatment scope/cost will be applied to reflect AMEC's judgement about the potential outcome of the storage vs. capacity optimization planned for Phase 2.</p>
5. Open Pit Cover			
<p>The cover used to limit water and oxygen ingress into the backfilled Open Pit is a significant component of the project scope because of both its influence on project outcomes (i.e. surface water quality) and because of its nature, scale and hence, cost. In addition, the cover will be subject to substantial differential settlements and the methods assumed to mitigate these settlements have a significant influence on costs.</p>	<p>The Phase 1 estimate assumed that the problem of large and somewhat unpredictable differential cover sediments would be addressed by replacing an interim cover (constructed with locally available granular materials) by a permanent structure constructed after tailings consolidation has reduced differential settlements to more manageable levels (assumed to occur some 10 years after interim cover placement). The permanent cover was assumed to be a composite, geosynthetically based structure.</p>	<p>The Phase 1 interim/permanent cover concept is viewed to be a conservative approach to mitigating differential settlements. It may be possible to lower costs by relying more on cover maintenance and/or repair than complete replacement.</p>	<p>The lower bound sensitivity assessment will assume the interim cover is replaced by a thicker sand/bentonite mix that will be more amenable to regular regrading and maintenance. The assessment will assume that this alternate cover concept will avoid the need for replacement in year 10. Absent the Phase 2 design, performance modelling and estimating needed to support this alternative cover concept, the sensitivity assessment will simply assume parity between the Phase 1 interim and alternate cover concept costs, and delete the expense related to cover replacement in season 10 and the subsequent maintenance costs originally included in the estimate for this permanent cover.</p>



Key Scope Area	Basis of Phase 1 Estimate	Characterization of Phase 1 Assumptions	Potential Range of Assumption Adjustments
6. Dewatering			
<p>A wellpoint dewatering system is used both to meet the Option 4 objective of “low moisture tails” and to provide conditions in the TSF compatible with a safe truck and shovel removal operation. The assumed dewatering system is of a significant scale, and is closely integrated with the execution schedule and, therefore, has a significant influence on project costs.</p>	<p>The Phase 1 estimate assumed a wellpoint dewatering system operated on a 25 m grid over the TSF, with production characteristics consistent with complete dewatering over two summer construction seasons. These assumptions were based on a consideration of the physical characteristics of the tailings, what is known about the variation of those characteristics, and typical wellpoint system efficiencies (i.e. at this stage of project development, site specific field trial or pilot data that are often used to refine system designs and efficiencies were not available).</p>	<p>The Phase 1 dewatering assumptions were of necessity made within a wide range of possibilities. The assumed wellpoint densities and production characteristics could be viewed as generally conservative. It should be noted that costs for these systems are fairly sensitive to relatively modest adjustments in assumed spacing and production.</p>	<p>For the lower bound sensitivity analysis, AMEC has made the following adjustments:</p> <ul style="list-style-type: none"> • Increasing the required wellpoint spacing from a 25 m grid to a 30 m grid; and • Increasing wellpoint production capacity by 30%. <p>Combining these elements reduces the required scope and cost of the dewatering effort by some 50%.</p>
7. Reclamation of the TSF Footprint			
<p>The removal of the TSF will leave an excavation in the Dome Creek valley that must be stabilized thermally, geotechnically and hydraulically by the placement of appropriately graded fill.</p>	<p>The Phase 1 estimate assumed that the remediated TSF footprint would be stabilized by placing a 1.2 m layer of NAG waste rock over a bedding of imported sand. This stabilization is required to mitigate hydraulic erosion forces and thermal effects at disturbed/undisturbed land interfaces.</p>	<p>The thickness of the NAG waste rock cover was conservatively set at 1.2 m. There is a reasonable possibility that detailed design activities would support a reduction in this thickness.</p>	<p>For the lower bound sensitivity assessment, AMEC has reduced the NAG waste rock cover thickness by 25%.</p>
8. Reclamation Concept			
<p>The costs of reclamation are influenced by the extent to which vegetated surfaces (as opposed to graded granular surfaces) are included in the Reclamation Plan.</p>	<p>The Phase 1 Reclamation Plan acknowledged the limited availability of organic substrates and the associated constraints on reclamation plans by limiting revegetation efforts to patches in specified areas and spacings.</p>	<p>Current regulations provide considerable latitude in the specific prescriptions proposed for restoring land capability and aesthetics. The extent to which revegetation features in the Reclamation Plan depends, therefore, in no small part on the subjective preferences of the Project Partners. It is possible that a non-vegetated reclamation concept relying on regraded granular surfaces could be defended, provided this was accepted by the Partners.</p>	<p>The lower bound sensitivity assessment assumes that all revegetation elements (including the associated trials and/or plots) are removed from the estimate.</p>



Key Scope Area	Basis of Phase 1 Estimate	Characterization of Phase 1 Assumptions	Potential Range of Assumption Adjustments
9. Special Waste Disposition			
<p>A portion of the contaminated soil/rock inventory is anticipated to exhibit parameter levels above regulatory thresholds defining special or hazardous waste. This designation invokes additional handling and disposition requirements for the materials involved.</p>	<p>This Phase 1 estimate assumed that the relatively modest proportion of Mount Nansen soils/rocks likely to be categorized as special waste would be directed to an existing, appropriately permitted facility near Fort Nelson, BC. This assumption was made largely to avoid the permitting and public consultation liabilities that are often created by locating special waste disposition facilities (usually landfills) on a source site.</p>	<p>While the Mount Nansen volumes involved are likely to be comparatively small, the very high unit costs of transport and disposal make this line item a significant contributor to the total project estimate. The decision to mitigate potential permitting and consultation liabilities via offsite disposition can be viewed as a conservative one. Technically, there is little reason to believe that an appropriate disposal capability for these materials could not be incorporated at much lower unit cost into the broader Open Pit containment design.</p>	<p>The lower bound sensitivity assessment will assume that the special waste inventory will be directed to an appropriately engineered and dedicated location within the Open Pit containment structure. The incremental development costs for this dedicated containment structure will be assumed to be \$100/m³.</p>
10. Design Contingencies			
<p>These are measures considered during Phase 1 to mitigate the risks that unacceptable degradations of downstream surface water quality could develop at some time following remediation.</p>	<p>The Phase 1 estimate included provisions for design contingencies focused on facilitating the collection of pit seepage (should they become necessary) to ensure compliant surface water quality.</p>	<p>The provision of these design contingencies was based on a conservative interpretation of pit containment and cover performance over the long term. There is a reasonable probability that acceptable water qualities could be realized without invoking these measures.</p>	<p>The lower bound sensitivity assessment will delete the provisions for design contingencies focused on mitigating surface water quality compliance risks.</p>
11. Adaptive Management			
<p>These are measures considered during Phase 1 to mitigate the risks that unacceptable degradations of downstream surface water quality could develop at some time following remediation.</p>	<p>The Phase 1 estimate included provisions for Adaptive Management measures ranging up to the long term treatment of pit seepage to ensure compliant surface water quality.</p>	<p>The provision of these Adaptive Management measures was based on a conservative interpretation of pit containment and cover performance over the long term. There is a reasonable probability that acceptable water qualities could be realized without invoking these measures.</p>	<p>The lower bound sensitivity assessment will delete the provisions for Adaptive Management measures focused on mitigating surface water quality compliance risks.</p>

4 Sensitivity Assessment

4.1 Format

The cost sensitivity analysis was undertaken using the worksheets presented as Tables 4.1-1 and 4.1-2. These worksheets capture the range of input variations described in Table 3.2-1. The worksheets include both potential decreases and increases to scope and/or cost. Potential decreases are described in the lower bound estimate provided in Table 4.1-1, while potential increases are shown in the upper bound estimate provided in Table 4.1-2.

Tables 4.1-1 and 4.1-2 were developed using the following structure and format:

- The basic format borrows from the summary worksheet prepared for the Phase 1 estimate which presents costs for each construction season in the assumed execution schedule and then adds general project costs (e.g. design development, tendering, contingencies and Adaptive Management requirements) as individual line items.
- For the purposes of the sensitivity assessment, line items for each construction season were sorted from greatest to lowest cost. This was done to focus reviews on those higher cost elements having the greatest influence on the overall estimate.
- Columns have been added to the worksheet to facilitate the adjustment of costs for each line item by a single specified factor. Another column has been added to describe the rationale for selecting the factor noted. Those line items that have been adjusted in the sensitivity assessment from the base estimate are identified by shading.
- The worksheet also incorporates selectable factors to assess inputs that apply globally to the estimate. These selectable factors are grouped and described at the top of the worksheet. Colour coding has been used to identify those particular line items that have been influenced by an individual factor.
- Adjustments to civil quantities that a factor might produce were completed in ways that maintained the overall materials balance (i.e. the linkages that exist between and amongst the various material categories were maintained as a single key input quantity was varied).
- Indirect costs have not been re-estimated, but simply modified in proportion to the change in direct costs, and then redistributed amongst the line items, again in proportion to the revised distribution of direct costs.

Table 4.1-1 Mount Nansen Remediation Project - 30% Design Phase Cost Estimate Sensitivity Analysis - Lower Bound Estimate

Assumed changes to key Base Estimate variables (see Table 3.2-1)

Variable	Sensitivity Analysis Adjustment
PAG to Tailings Mixing Requirement (% change in PAG to TSF volume) (see Table 3.2-1; Scope Item 3)	-30
Design Contingencies (% change in Base Estimate scope)	-100
Adaptive Management Requirements (% change in Base Estimate scope)	-100
Permanent Cover (% change in Base Estimate scope) (see Table 3.2-1; Scope Item 5)	-100
Reduction in O&M Costs to reflect Permanent Cover deletion (% change in Base Estimate scope)	-20
Various (this color coding identifies line item adjustments to the Base Estimate in addition to those noted above)	see "Sensitivity Analysis Assumption" column

Schedule Activity ID	Description of Work	Sensitivity Analysis Assumption (Reduced Scope/Price)	Assumed Scope/Price Reduction (%)	Quantity		Unit	\$/unit	DIRECT COST BREAKDOWN						DIRECT COSTS	INDIRECT COSTS	TOTAL COSTS (2014 \$ Cdn)		
				Base Estimate	Adjusted Estimate			EQUIPMENT		LABOUR		OTHER						
								Base Estimate	Adjusted Estimate	Base Estimate	Adjusted Estimate	Base Estimate	Adjusted Estimate					
Detail design, construction documents, support during tender phase															2,250,000			
															2,250,000		Subtotal	
Season #1 (single shift)																		
145	Construct / Commission Water Treatment Plant	Cost of this line item has been reduced to reflect: -15% reduction accounting for reductions in process unit requirements and reagent consumption based on site specific treatability testing (see Table 3.2-1; Scope Item 4); -20% reduction accounting for the potential outcome of storage vs. capacity optimization (see Table 3.2-1; Scope Item 4).	35					750,000	487,500	1,000,000	650,000	3,250,000	2,112,500	3,250,000	1,111,407	4,361,407		
110	Contractor Mobilization & Early Works (camp trailers, office trailers)							96,450		169,420		610,000		875,870	0	875,870		
115	Construct / Install Stewide Runoff & Sediment Control Measures							218,260		143,136		50,000		411,396	140,686	552,082		
120	Upgrade Haul Roads & Crossing Over TSF Diversion Ditch							221,790		80,808		25,000		327,598	112,029	439,627		
130	Install Safety Measures In Pit							100,000				50,000		250,000	85,493	335,493		
150	Set Up & Pump Water From Pit Through Water Treatment Plant							23,445		6,552		200,000		229,997	78,652	308,649		
125	Upgrade Tunnel Plug In Pony Creek Adit	Reduction reflects possibility that adit needs little more work than access control for decommissioning.	75					30,000	7,500	45,000	11,250	75,000	18,750	37,500	12,824	50,324		
140	Begin Mill Demolition (mostly inside stripping)							30,000		105,000		15,000		150,000	51,296	201,296		
155	Contractor Demobilization							4,650		10,920		122,500		138,070	0	138,070		
135	Establish Revegetation Test Plots	Line item reduced to reflect deletion of the vegetation component of the Reclamation Plan (see Table 3.2-1; Scope Item 8).	100					26,215	0	15,036	0	25,000	0	0	0	0		
OH1	Contractor Indirects	Indirects adjusted in proportion to change in Direct costs						401,583	299,657	490,054	365,673	1,242,388	927,057	0	0	0		
															5,670,431	1,592,387	7,262,818	Subtotal
% indirects to direct costs ---->																28.1		
Engineering QC/QA during Season #1 construction															500,000			
General site maintenance during winter months between Season #1 and Season #2 (currently done by Denison)															700,000			
															1,200,000		Subtotal	
Season #2 (single shift)																		
245	Move Wellpoint Setup During Tailings Excavation	Reduction in scope/cost reflects (see Table 3.2-1; Scope Item 6): - increasing the required wellpoint spacing from a 25 m grid to a 30 m grid; and - increasing wellpoint production capacity by 30%.	40					1,918,800	1,151,280	438,797	263,278	150,000	90,000	1,594,558	702,306	2,296,865		
250	Haul Tailings / Rock Mixture From TSF To The Pit	The 20% reduction accounts for the possibility that engagement of the contracting community during procurement identifies efficiencies in materials handling processes (see Table 3.2-1; Scope Item 3). This reduction is incremental to that associated with the noted reduction in the PAG/Tails mixing ratio.	20	63,250	60,600	cm	17.91	983,130	715,648	287,837	209,525	0	0	746,138	345,486	1,091,624		
265	Complete All Mill And Site Infrastructure Demolition							120,000		420,000		60,000		600,000	280,872	880,872		
235	Haul PAG Rock From SW Lower Pit To TSF (initial rock cover over central wet areas)			46,500	32,550	cm	17.31	424,458	297,120	124,155	86,909	0	0	394,029	179,259	573,288		
260	Haul PAG Rock From Waste Rock Dumps To Pit (forming horizontal layers at 2 m intervals)			40,800	63,450	cm	17.31	372,426	578,180	108,936	169,412	0	0	748,591	349,432	1,098,023		
215	Haul NAG Rock From South Pit To Pit Bottom (for platform to 1190 m)			38,750		cm	17.96	396,188		108,218		0		474,406	221,446	695,852		
240	Setup Initial WellPoint Configuration And Connect System To Water Treatment Plant	Reduction in scope/cost reflects (see Table 3.2-1; Scope Item 6): - increasing the required wellpoint spacing from a 25 m grid to a 30 m grid; and - increasing wellpoint production capacity by 30%.	40					70,000	42,000	115,000	69,000	215,000	129,000	240,000	112,029	352,029		
230	Set Up & Pump Water From TSF Through Water Treatment Plant							29,985		6,552		250,000		286,537	133,751	420,288		
220	Haul Processed Filters To Pit Bottom (placed over top of NAG platform)			4,550		cm	72.69	42,150		12,707		170,625		225,481	105,252	330,733		
225	Reshape Pit Entrance (relocate ore to pit bottom, bring in NAG rock to flatten grades)							167,686		46,342		0		214,028	99,905	313,934		
255	Haul PAG Rock From West Mid Pit To TSF (for equipment support and mixing with tailings)			29,000	20,300	cm	9.87	150,256	105,179	44,805	31,364	0	0	136,543	63,736	200,279		
210	Contractor Mobilization And Spring Break Cleanup							18,600		52,560		162,500		233,660	0	233,660		
270	Contractor Demobilization And Site Winterizing							9,300		21,840		197,500		228,640	0	228,640		
OH2	Contractor Indirects	Indirects adjusted in proportion to change in Direct costs						903,285	708,905	887,350	696,399	1,512,945	1,187,370	0	0	0		
															6,016,611	2,592,674	8,609,285	Subtotal
% indirects to direct costs ---->																43.1		
Engineering QC/QA during Season #2 construction															750,000			
General site maintenance during winter months between Season #2 and Season #3 (currently done by Denison)															700,000			
															1,450,000		Subtotal	

Table 4.1-1 Mount Nansen Remediation Project - 30% Design Phase Cost Estimate Sensitivity Analysis - Lower Bound Estimate

Assumed changes to key Base Estimate variables (see Table 3.2-1)

Variable	Sensitivity Analysis Adjustment
PAG to Tailings Mixing Requirement (% change in PAG to TSF volume) (see Table 3.2-1; Scope Item 3)	-30
Design Contingencies (% change in Base Estimate scope)	-100
Adaptive Management Requirements (% change in Base Estimate scope)	-100
Permanent Cover (% change in Base Estimate scope) (see Table 3.2-1; Scope Item 5)	-100
Reduction in O&M Costs to reflect Permanent Cover deletion (% change in Base Estimate scope)	-20
Various (this color coding identifies line item adjustments to the Base Estimate in addition to those noted above)	see "Sensitivity Analysis Assumption" column

Schedule Activity ID	Description of Work	Sensitivity Analysis Assumption (Reduced Scope/Price)	Assumed Scope/Price Reduction (%)	Quantity		Unit	\$/unit	DIRECT COST BREAKDOWN						DIRECT COSTS	INDIRECT COSTS	TOTAL COSTS (2014 \$ Cdn)
				Base Estimate	Adjusted Estimate			EQUIPMENT		LABOUR		OTHER				
								Base Estimate	Adjusted Estimate	Base Estimate	Adjusted Estimate	Base Estimate	Adjusted Estimate			
Season #3 (double shift for Activity 325)																
325	Haul Tailings / Rock Mixture From TSF To The Pit (incl subexc below tailings & u/s dam berm)	Cost of this line item has been reduced to reflect: -10% reduction accounting for the possibility that contamination has not extended as far below the TSF footprint as originally estimated (see Table 3.2-1; Scope Item 1); -20% reduction accounting for the possibility that engagement of the contracting community during procurement identifies efficiencies in materials handling processes (see Table 3.2-1; Scope Item 3); -the noted reduction in the PAG/Tails mixing ratio.	30	353,200	332,785	cm	13.49	4,307,936	4,058,937	1,221,189	1,150,604	0	0	3,646,679	1,118,506	4,765,185
315	Move Wellpoint Setup During Tailings Excavation	Reduction in scope/cost reflects (see Table 3.2-1; Scope Item 8): - increasing the required wellpoint spacing from a 25 m grid to a 30 m grid; and - increasing wellpoint production capacity by 30%.	40					4,059,000	2,435,400	928,224	556,934	300,000	180,000	3,172,334	973,015	4,145,350
375	Place Interim Cover Over Pit (0.3 m crushed NAG, 1.0 m of Victoria Creek S&G)			104,000		cm	25.25	1,093,600	1,093,600	364,080	364,080	552,000	552,000	2,009,680	616,407	2,626,087
360	Remove Special Waste For Disposal Off Site	Line item reduced to reflect on-site disposition in a dedicated portion of the pit containment structure rather than off-site disposal.	90					0	0	0	0	2,500,000	250,000	2,500,000	0	250,000
335	Place NAG Rock From The Mill & The W. Lower Pit Areas Over The TSF Sand Bedding (1.2 m)	Line item quantity/cost reduced to reflect lower NAG rock thickness (see Table 3.2-1; Scope Item 7)	25	137,250	102,938	cm	10.93	1,183,190	887,392	347,574	260,680	0	0	1,148,073	352,136	1,500,209
355	Haul PAG Rock From Waste Rock Dumps To Pit (forming horizontal layers at 2 m intervals)			170,280	190,695	cm	11.00	1,106,288	1,238,922	326,938	366,134	0	0	1,605,056	492,301	2,097,357
350	Haul PAG, Tailings, And Hydrocarbons From Various Areas On Site To Pit	The reduction accounts for the possibility that contamination has not extended as far originally estimated (see Table 3.2-1; Scope Item 1).	20	44,506	593,247	cm	18.07	593,247	474,598	176,125	140,900	0	0	615,498	188,785	804,283
345	Haul NAG Rock From Various Waste Dumps To The Pit For Buttress At South End			63,200		cm	14.42	528,115		169,218		0		697,333	213,885	911,218
310	Contractor Mobilization And Spring Break Cleanup							52,900		116,340		442,500		611,740	0	611,740
320	Haul PAG Rock From West Mid Pit To TSF (for equipment support and mixing with tailings)			68,050	47,635	cm	8.79	352,684	246,809	105,137	73,596	0	0	326,405	98,274	418,679
380	Contractor Demobilization And Site Winterizing							18,600		43,680		290,000		352,280	0	352,280
330	Remove Sand From The TSF Dam And Place Over Exposed Surfaces In The TSF (300 mm)			34,325		cm	9.70	196,244		58,518		0		254,763	76,141	332,903
370	Rough Grade Mill And Camp Areas							196,000		26,400		0		182,400	55,946	238,346
340	Reconstruct Dome Creek And Its Riparian Zone Through The TSF Area							93,056		28,000		25,000		146,056	44,798	190,854
365	Rough Grade Remaining Waste Rock Dump Areas							78,000		13,200		0		91,200	27,973	119,173
OH3	Contractor Indirects	Indirects adjusted in proportion to change in Direct costs						1,574,045	1,067,852	1,398,504	966,568	3,191,383	2,205,706	0	0	0
													15,103,496	4,260,166	19,363,662	Subtotal
													% indirects to direct costs ---->			28.2
													Engineering QC/QA during Season #3 construction			1,500,000
													General site maintenance during winter months between Season #3 and Season #4 (currently done by Denison)			700,000
													Subtotal			2,200,000
Season #4 (single shift)																
415	Remove Balance Of TSF and Seepage Pond Dams And Stockpile In Area of Pit Cover			69,890		cm	17.66	637,965	637,965	186,606	186,606	0	0	824,571	409,446	1,234,017
440	Final Grade And Revegetate The Waste Dump & Pit Cover Areas	Line item reduced to reflect deletion of the vegetation component of the Reclamation Plan (see Table 3.2-1; Scope Item 8).	50					132,000	66,000	222,720	111,360	303,550	151,775	329,135	163,434	492,569
430	Final Grade And Revegetate The TSF And Dam Areas	Line item reduced to reflect deletion of the vegetation component of the Reclamation Plan (see Table 3.2-1; Scope Item 8).	50					111,375	55,688	187,920	93,960	260,625	130,313	279,960	139,016	418,976
450	Decommission All Site Roads (unless required for long term care & maintenance)							343,140		83,076		0		426,216	211,640	637,856
435	Final Grade And Revegetate The Mill And Camp Areas	Line item reduced to reflect deletion of the vegetation component of the Reclamation Plan (see Table 3.2-1; Scope Item 8).	50					82,500	41,250	139,200	69,600	190,500	95,250	206,100	102,340	308,440
420	Haul Sand & Rock From Stockpile And Place Over Exposed Dam Areas			35,000		cm	11.11	200,103	59,669	59,669		0		259,772	128,992	388,764
445	Backfill And Revegetate The Exploration Trenches							127,463		107,250				234,713	116,548	351,261
455	Final Site Cleanup And Contractor Demobilization							6,975		16,380		257,500		280,855	0	280,855
410	Contractor Mobilization And Spring Break Cleanup							16,275		45,990		72,500		134,765	0	134,765
425	Reconstruct Dome Creek And Its Riparian Zone Through The Dam Areas							23,264		7,000		6,250		36,514	18,131	54,645
OH4	Contractor Indirects	Indirects adjusted in proportion to change in Direct costs						366,985	288,829	434,170	341,706	837,336	659,011	0	0	0
													3,012,601	1,289,546	4,302,147	Subtotal
													% indirects to direct costs ---->			42.8
													Engineering QC/QA during Season #4 construction			250,000
													General site O&M between interim cover & final cover			0
													Subtotal			250,000
													Final Cover in Season #10 (granular materials, synthetic liners, borrow development & reclaim) (Base)			4,991,915
													Final Cover in Season #10 (granular materials, synthetic liners, borrow development & reclaim) (Adjusted)			0
													Subtotal			0
													Contingency 20%			46,887,913
													O&M Costs (NPV)			9,377,583
													O&M Costs (NPV) (Adjusted)			56,265,495
													GRAND SUBTOTAL			4,738,729
													Design Contingencies (NPV) (Base)			3,790,983
													Design Contingencies (NPV) (Adjusted)			1,411,859
													Adaptive Management (NPV) (Base)			0
													Adaptive Management (NPV) (Adjusted)			3,815,844
													GRAND TOTAL (Adjusted)			0
													GRAND TOTAL (Adjusted)			60,056,478

Table 4.1-2 Mount Nansen Remediation Project - 30% Design Phase Cost Estimate Sensitivity Analysis - Upper Bound Estimate

Assumed changes to key Base Estimate variables (see Table 3.2-1)

Variable	Sensitivity Analysis Adjustment
PAG to Tailings Mixing Requirement (% change in PAG to TSF volume) (see Table 3.2-1; Scope Item 3)	30
Design Contingencies (% change in Base Estimate scope)	0
Adaptive Management Requirements (% change in Base Estimate scope)	0
Permanent Cover (% change in Base Estimate scope) (see Table 3.2-1; Scope Item 5)	0
Reduction in O&M Costs to reflect Permanent Cover deletion (% change in Base Estimate scope)	0
Various (this color coding identifies line item adjustments to the Base Estimate in addition to those noted above)	see "Sensitivity Analysis Assumption" column

Schedule Activity ID	Description of Work	Sensitivity Analysis Assumption (Increased Scope/Price)	Assumed Scope/Price Increase (%)	Quantity		Unit	\$/unit	DIRECT COST BREAKDOWN						DIRECT COSTS	INDIRECT COSTS	TOTAL COSTS (2014 \$ Cdn)		
				Base Estimate	Adjusted Estimate			EQUIPMENT		LABOUR		OTHER						
								Base Estimate	Adjusted Estimate	Base Estimate	Adjusted Estimate	Base Estimate	Adjusted Estimate					
Detail design, construction documents, support during tender phase															2,250,000			
															2,250,000		Subtotal	
Season #1 (single shift)																		
145	Construct / Commission Water Treatment Plant							750,000	750,000	1,000,000	1,000,000	3,250,000	3,250,000	5,000,000	1,648,322	6,648,322		
110	Contractor Mobilization & Early Works (camp trailers, office trailers)	Line item increased to account for development of on-site laboratory for NAG/PAG differentiation.	15					96,450	110,918	169,420	194,833	610,000	701,500	1,007,251	0	1,007,251		
115	Construct / Install Sidewalk Runoff & Sediment Control Measures							218,260		143,136		50,000		411,396	135,623	547,019		
120	Upgrade Haul Roads & Crossing Over TSF Diversion Ditch							221,790		80,858		25,000		327,598	107,997	435,595		
130	Install Safety Measures In Pit							100,000		100,000		50,000		250,000	82,416	332,416		
150	Set Up & Pump Water From Pit Through Water Treatment Plant							23,445		6,552		200,000		229,997	75,822	305,819		
125	Upgrade Tunnel Plug In Pony Creek Adit							30,000	30,000	45,000	45,000	75,000	75,000	150,000	49,450	199,450		
140	Begin Mill Demolition (mostly inside stripping)							30,000		105,000		15,000		150,000	49,450	199,450		
155	Contractor Demobilization							4,650		10,920		122,500		138,070	0	138,070		
135	Establish Revegetation Test Plots							26,215	26,215	15,036	15,036	25,000	25,000	66,251	21,841	88,092		
OH1	Contractor Indirects	Indirects adjusted in proportion to change in Direct costs						401,583	408,525	490,054	498,526	1,242,388	1,263,867	0	0	0		
															7,730,563	2,170,919	9,901,482	Subtotal
															% indirects to direct costs ---->		28.1	
															Engineering QC/QA during Season #1 construction (Base)		500,000	
															Engineering QC/QA during Season #1 construction (Adjusted; see Table 3.2-1; Scope Item 2)		1,000,000	
															General site maintenance during winter months between Season #1 and Season #2 (currently done by Denison)		700,000	
															Subtotal		1,700,000	
Season #2 (single shift)																		
245	Move Wellpoint Setup During Tailings Excavation							1,919,800	1,919,800	438,797	438,797	150,000	150,000	2,567,597	1,147,128	3,654,724		
250	Haul Tailings / Rock Mixture From TSF To The Pit			83,250	105,900	cm	22.25	983,130	1,250,613	287,837	366,149	0	0	1,616,782	739,605	2,356,388		
265	Complete All Mill And Site Infrastructure Demolition							120,000		420,000		60,000		600,000	274,477	874,477		
235	Haul PAG Rock From SW Lower Pile To TSF (initial rock cover over central wet areas)			46,500	60,450	cm	17.20	434,468	551,795	124,155	181,402	0	0	713,197	328,260	1,033,456		
260	Haul PAG Rock From Waste Rock Dumps To Pit (forming horizontal layers at 2 m intervals)			40,800	18,150	cm	17.20	372,428	165,675	108,936	48,461	0	0	214,136	97,959	312,095		
215	Haul NAG Rock From South Pile To Pit Bottom (for platform to 1190 m)			38,750		cm	17.84	386,188		108,218		0		474,406	217,022	691,428		
240	Setup Initial Wellpoint Configuration And Connect System To Water Treatment Plant							70,000	70,000	115,000	115,000	215,000	215,000	400,000	182,984	582,984		
230	Set Up & Pump Water From TSF Through Water Treatment Plant							29,985		6,552		250,000		286,537	131,079	417,616		
220	Haul Processed Filters To Pit Bottom (placed over top of NAG platform)			4,550		cm	72.23	42,150		12,707		170,625		225,481	103,149	328,630		
225	Reshape Pit Entrance (relocate ore to pit bottom, bring in NAG rock to flatten grades)							167,686		46,342		0		214,028	97,910	311,938		
255	Haul PAG Rock From West Mid Pile To TSF (for equipment support and mixing with tailings)			29,000	37,700	cm	9.80	150,256	195,333	44,805	58,247	0	0	253,580	116,003	369,582		
210	Contractor Mobilization And Spring Break Cleanup							18,600		52,560		162,500		233,660	0	233,660		
270	Contractor Demobilization And Site Winterizing							9,300		21,840		197,500		228,640	0	228,640		
OH2	Contractor Indirects	Indirects adjusted in proportion to change in Direct costs						903,285	938,829	887,350	922,267	1,512,945	1,572,479	0	0	0		
															7,968,023	3,433,575	11,401,599	Subtotal
															% indirects to direct costs ---->		43.1	
															Engineering QC/QA during Season #2 construction		750,000	
															Engineering QC/QA during Season #1 construction (Adjusted; see Table 3.2-1; Scope Item 2)		1,250,000	
															General site maintenance during winter months between Season #2 and Season #3 (currently done by Denison)		700,000	
															Subtotal		1,950,000	

Table 4.1-2 Mount Nansen Remediation Project - 30% Design Phase Cost Estimate Sensitivity Analysis - Upper Bound Estimate

Assumed changes to key Base Estimate variables (see Table 3.2-1)

Variable	Sensitivity Analysis Adjustment
PAG to Tailings Mixing Requirement (% change in PAG to TSF volume) (see Table 3.2-1; Scope Item 3)	30
Design Contingencies (% change in Base Estimate scope)	0
Adaptive Management Requirements (% change in Base Estimate scope)	0
Permanent Cover (% change in Base Estimate scope) (see Table 3.2-1; Scope Item 5)	0
Reduction in O&M Costs to reflect Permanent Cover deletion (% change in Base Estimate scope)	0
Various (this color coding identifies line item adjustments to the Base Estimate in addition to those noted above)	see "Sensitivity Analysis Assumption" column

Schedule Activity ID	Description of Work	Sensitivity Analysis Assumption (Increased Scope/Price)	Assumed Scope/Price Increase (%)	Quantity		Unit	\$/unit	DIRECT COST BREAKDOWN						DIRECT COSTS	INDIRECT COSTS	TOTAL COSTS (2014 \$ Cdn)
				Base Estimate	Adjusted Estimate			EQUIPMENT		LABOUR		OTHER				
								Base Estimate	Adjusted Estimate	Base Estimate	Adjusted Estimate	Base Estimate	Adjusted Estimate			
Season #3 (double shift for Activity 325)																
325	Haul Tailings / Rock Mixture From TSF To The Pit (incl subexc below tailings & ul's dam berm)	Cost of this line item has been increased to reflect: -10% increase accounting for the possibility that contamination has extended farther below the TSF footprint than originally estimated (see Table 3.2-1; Scope Item 1); the 20% quantity variation referenced in the table has been assumed to produce at 10% change in this line item); -the noted increase in the PAG/Tailis mixing ratio.	10	353,200	373,615	cm	24.26	4,307,936	4,556,935	1,221,189	1,291,774	0	0	6,433,580	2,135,325	8,568,906
315	Move Wellpoint Setup During Tailings Excavation							4,059,000	4,059,000	928,224	928,224	300,000	300,000	5,287,224	1,754,846	7,042,070
375	Place Interim Cover Over Pit (0.3 m crushed NAG, 1.0 m of Victoria Creek S&G)			104,000		cm	25.74	1,093,600	1,093,600	364,080	364,080	552,000	552,000	2,009,680	667,019	2,676,699
360	Remove Special Waste For Disposal Off Site							0	0	0	0	2,500,000	2,500,000	2,500,000	0	2,500,000
335	Place NAG Rock From The Mill & The W. Lower Pile Areas Over The TSF Sand Bedding (1.2 m)			137,250	137,250	cm	14.85	1,183,190	1,183,190	347,574	347,574	0	0	1,530,763	508,065	2,038,829
355	Haul PAG Rock From Waste Rock Dumps To Pit (forming horizontal layers at 2 m intervals)			170,280	149,865	cm	11.21	1,106,288	973,654	326,938	287,741	0	0	1,261,395	418,661	1,680,056
350	Haul PAG, Tailings, And Hydrocarbons From Various Areas On Site To Pit	The increase accounts for: -the possibility that contamination has extended farther than originally estimated (see Table 3.2-1; Scope Item 1); -a 100% increase in the volume of contaminated sediments outside the TSF area (this translates into an approximately 25% increase in the cost of this line item).	45	44,506		cm	33.39	593,247	860,209	178,125	255,381	0	0	1,115,590	370,268	1,485,857
345	Haul NAG Rock From Various Waste Dumps To The Pit For Buttress At South End			63,200		cm	14.70	528,115		169,218		0		697,333	231,447	928,780
310	Contractor Mobilization And Spring Break Cleanup							52,900		116,340		442,500		611,740	0	611,740
320	Haul PAG Rock From West Mid Pile To TSF (for equipment support and mixing with tailings)			68,050	88,465	cm	8.96	352,594	458,359	105,137	136,678	0	0	595,038	197,405	792,533
380	Contractor Demobilization And Site Winterizing							18,600		43,680		290,000		352,280	0	352,280
330	Remove Sand From The TSF Dam And Place Over Exposed Surfaces In The TSF (300 mm)			34,325		cm	9.89	196,244		58,518		0		254,763	84,556	339,319
370	Rough Grade Mill And Camp Areas							156,000		26,400		0		182,400	60,539	242,939
340	Reconstruct Dome Creek And Its Riparian Zone Through The TSF Area							93,056		28,000		25,000		146,056	48,476	194,532
365	Rough Grade Remaining Waste Rock Dump Areas							78,000		13,200		0		91,200	30,270	121,470
OH3	Contractor Indirects	Indirects adjusted in proportion to change in Direct costs						1,574,045	1,661,644	1,368,504	1,476,334	3,191,383	3,368,990	0	0	0
													23,069,041	6,596,967	29,666,009	Subtotal
													% indirects to direct costs ---->			28.2

Engineering QC/QA during Season #3 construction	1,500,000
Engineering QC/QA during Season #1 construction (Adjusted; see Table 3.2-1; Scope Item 2)	2,000,000
General site maintenance during winter months between Season #3 and Season #4 (currently done by Denison)	700,000
Subtotal	2,700,000

Season #4 (single shift)																
415	Remove Balance Of TSF and Seepage Pond Dams And Stockpile In Area of Pit Cover			69,890		cm	17.46	637,965	637,965	186,606	186,606	0	0	824,571	395,950	1,220,521
440	Final Grade And Revegetate The Waste Dump & Pit Cover Areas							132,000	132,000	222,720	222,720	303,550	303,550	688,270	316,094	974,364
430	Final Grade And Revegetate The TSF And Dam Areas							111,375	111,375	187,520	187,520	260,625	260,625	559,920	268,868	828,788
450	Decommission All Site Roads (unless required for long term care & maintenance)							343,140		83,076		0		426,216	204,955	630,881
435	Final Grade And Revegetate The Mill And Camp Areas							82,500		139,200		190,500		412,200	197,834	610,034
420	Haul Sand & Rock From Stockpile And Place Over Exposed Dam Areas			35,000		cm	10.99	200,103	69,669	69,669	139,200	190,500	190,500	259,772	124,740	384,512
445	Backfill And Revegetate The Exploration Trenches							107,250		107,250		0		214,500	112,767	327,267
455	Final Site Cleanup And Contractor Demobilization							6,975		16,380		257,500		280,855	0	280,855
410	Contractor Mobilization And Spring Break Cleanup							16,275		45,990		72,500		134,765	0	134,765
425	Reconstruct Dome Creek And Its Riparian Zone Through The Dam Areas							23,264		7,000		6,250		36,514	17,534	54,047
OH4	Contractor Indirects	Indirects adjusted in proportion to change in Direct costs						366,985	366,985	434,170	434,170	837,336	837,336	0	0	0
													3,827,796	1,638,491	5,466,287	Subtotal
													% indirects to direct costs ---->			42.8

Engineering QC/QA during Season #4 construction	250,000
General site O&M between interim cover & final cover	0
Subtotal	250,000

Final Cover in Season #10 (granular materials, synthetic liners, borrow development & reclaim) (Base)	4,991,915
Final Cover in Season #10 (granular materials, synthetic liners, borrow development & reclaim) (Adjusted)	4,991,915
Subtotal	4,991,915

Total CAPEX (Adjusted)	70,187,291
Contingency 20%	14,037,459
GRAND SUBTOTAL	84,224,750
O&M Costs (NPV)	4,738,729
O&M Costs (NPV) (Adjusted)	4,738,729
Design Contingencies (NPV) (Base)	1,411,859
Design Contingencies (NPV) (Adjusted)	1,411,859
Adaptive Management (NPV) (Base)	3,819,844
Adaptive Management (NPV) (Adjusted)	3,819,844
GRAND TOTAL (Adjusted)	94,195,182

4.2 Assessment Outcomes

Tables 4.1-1 and 4.1-2 are developed from the potential adjustments to key estimating assumptions that were described and rationalized in Table 3.2-1. Table 4.2-1 summarizes both the lower and upper bound estimates against the base estimate and tabulates the variances from the base for each. These tables describe a lower bound estimate of about \$60 M and an upper bound of \$94 M, on a base estimate of some \$90 M. The position of the base estimate within the limits of this range can be viewed as a rough indication of the degree of conservatism in the base estimate. However, this interpretation should be applied with caution, absent a more systematic, risk based quantification of the probabilities that might be attached to these figures.

The following sections summarize those parameters that have the greatest influence on the variances identified in Table 4.2-1.

4.2.1 Lower Bound Estimate

Table 4.2-1 indicates that the following assumptions/issues are likely to have the greatest influence on potential reductions from the base estimate (in declining order of importance):

- The specific materials handling methods applied for the movement of tailings and PAG rock to the Open Pit;
- The configuration and efficiency of the wellpoint dewatering system used to facilitate the excavation of tailings;
- The capacity, configuration and reagent consumption for the water treatment capability developed to accommodate waters incompatible with direct release;
- The pit cover concepts and maintenance protocols applied to mitigate post remediation differential settlements in the backfilled pit;
- The extent to which design contingencies and Adaptive Management protocols must be applied to mitigate risks associated with post remediation downstream surface water quality excursions;
- The approach taken for the disposition of contaminated soils categorized as special waste (i.e. onsite vs. offsite); and
- The extent to which reclamation concepts rely on revegetated vs. granular finished landscapes.

Table 4.2-1 Mount Nansen Remediation Project - 30% Design Phase Cost Estimate Sensitivity Analysis Summary

Assumed changes to key Base Estimate variables (see Table 3.2-1)

Variable	Sensitivity Analysis Adjustment (Lower Bound)	Sensitivity Analysis Adjustment (Upper Bound)
PAG to Tailings Mixing Requirement (% change in PAG to TSF volume) (see Table 3.2-1; Scope Item 3)	-30	30
Design Contingencies (% change in Base Estimate scope)	-100	0
Adaptive Management Requirements (% change in Base Estimate scope)	-100	0
Permanent Cover (% change in Base Estimate scope) (see Table 3.2-1; Scope Item 5)	-100	0
Reduction in O&M Costs to reflect Permanent Cover deletion (% change in Base Estimate scope)	-20	0
Various (this color coding identifies line item adjustments to the Base Estimate in addition to those noted above)	see "Sensitivity Analysis Assumption" column	see "Sensitivity Analysis Assumption" column

Schedule Activity ID	Description of Work	Lower Bound Adjustments		Upper Bound Adjustments		Lower Bound		Base	Upper Bound		Detail design, construction documents, support during tender phase
		Sensitivity Analysis Assumption (Reduced Scope/Price)	Assumed Scope/Price Reduction (%)	Sensitivity Analysis Assumption (Increased Scope/Price)	Assumed Scope/Price Increase (%)	Estimate	Variance from Base	Estimate	Variance from Base		
						Estimate	Variance from Base	Estimate	Variance from Base		
Season #1 (single shift)											
145	Construct / Commission Water Treatment Plant	Cost of this line item has been reduced to reflect: -15% reduction accounting for reductions in process unit requirements and reagent consumption based on site specific treatability testing (see Table 3.2-1; Scope Item 4); -20% reduction accounting for the potential outcome of storage vs. capacity optimization (see Table 3.2-1; Scope Item 4).	35			4,361,407	-2,258,901	6,620,308	6,648,322	28,013	Subtotal
110	Contractor Mobilization & Early Works (camp trailers, office trailers)			Line item increased to account for development of on-site laboratory for NAG/PAG differentiation.	15	875,870	0	875,870	1,007,251	131,381	
115	Construct / Install Site-wide Runoff & Sediment Control Measures					552,082	7,368	544,714	547,019	2,305	
120	Upgrade Haul Roads & Crossing Over TSF Diversion Ditch					439,627	5,867	433,760	435,595	1,835	
130	Install Safety Measures In Pit					335,493	4,477	331,015	332,416	1,401	
150	Set Up & Pump Water From Pit Through Water Treatment Plant					308,649	4,119	304,530	305,819	1,289	
125	Upgrade Tunnel Plug In Pony Creek Adit	Reduction reflects possibility that adit needs little more work than access control for decommissioning.	75			50,324	-148,285	198,609	199,450	840	
140	Begin Mill Demolition (mostly inside stripping)					201,296	2,686	198,609	199,450	840	
155	Contractor Demobilization					138,070	0	138,070	138,070	0	
135	Establish Revegetation Test Plots	Line item reduced to reflect deletion of the vegetation component of the Reclamation Plan (see Table 3.2-1; Scope Item 8).	100			0	-87,720	87,720	88,092	371	
OH1	Contractor Indirects	Indirects adjusted in proportion to change in Direct costs		Indirects adjusted in proportion to change in Direct costs		0	0	0	0	0	Subtotal
						7,262,818	-2,470,389	9,733,207	9,901,482	168,275	
Season #2 (single shift)											
245	Move Wellpoint Setup During Tailings Excavation	Reduction in scope/cost reflects (see Table 3.21; Scope Item 6): - Increasing the required wellpoint spacing from a 25 m grid to a 30 m grid; and - Increasing wellpoint production capacity by 30%.	40			2,206,865	-1,450,647	3,657,511	3,654,724	-2,787	
250	Haul Tailings / Rock Mixture From TSF To The Pit	The 20% reduction accounts for the possibility that engagement of the contracting community during procurement identifies efficiencies in materials handling processes (see Table 3.2-1; Scope Item 3). This reduction is incremental to that associated with the noted reduction in the PAG/Tails mixing ratio.	20			1,085,624	-768,174	1,853,798	2,356,368	502,570	
265	Complete All Mill And Site Infrastructure Demolition					880,072	4,928	875,143	874,477	-667	
235	Haul PAG Rock From SW Lower Pile To TSF (initial rock cover over central wet areas)					563,288	-236,903	800,191	1,039,456	239,265	
260	Haul PAG Rock From Waste Rock Dumps To Pit (forming horizontal layers at 2 m intervals)					1,098,023	395,919	702,103	312,095	-390,009	
215	Haul NAG Rock From South Pile To Pit Bottom (for platform to 1190 m)					695,852	3,897	691,955	691,428	-527	
240	Setup Initial Wellpoint Configuration And Connect System To Water Treatment Plant	Reduction in scope/cost reflects (see Table 3.21; Scope Item 6) - Increasing the required wellpoint spacing from a 25 m grid to a 30 m grid; and - Increasing wellpoint production capacity by 30%.	40			352,029	-231,400	583,429	582,984	-445	
230	Set Up & Pump Water From TSF Through Water Treatment Plant					420,288	2,353	417,935	417,616	-318	
220	Haul Processed Filters To Pit Bottom (placed over top of NAG platform)					330,733	1,852	328,881	328,630	-251	
225	Reshape Pit Entrance (relocate ore to pit bottom, bring in NAG rock to flatten grades)					313,934	1,758	312,176	311,938	-238	
255	Haul PAG Rock From West Mid Pile To TSF (for equipment support and mixing with tailings)					200,279	-84,232	284,511	369,582	85,071	
210	Contractor Mobilization And Spring Break Cleanup					233,660	0	233,660	233,660	0	
270	Contractor Demobilization And Site Winterizing					228,640	0	228,640	228,640	0	
OH2	Contractor Indirects	Indirects adjusted in proportion to change in Direct costs		Indirects adjusted in proportion to change in Direct costs		0	0	0	0	0	Subtotal
						8,609,285	-2,360,649	10,969,934	11,401,599	431,665	
Season #3 (single shift)											
						750,000	0	750,000	1,250,000	500,000	Engineering QC/QA during Season #2 construction
						700,000	0	700,000	700,000	0	General site maintenance during winter months between Season #2 and Season #3 (currently done by Denison)
						1,450,000	0	1,450,000	1,950,000	500,000	Subtotal

Table 4.2-1 Mount Nansen Remediation Project - 30% Design Phase Cost Estimate Sensitivity Analysis Summary

Assumed changes to key Base Estimate variables (see Table 3.2-1)

Variable	Sensitivity Analysis Adjustment (Lower Bound)	Sensitivity Analysis Adjustment (Upper Bound)
PAG to Tailings Mixing Requirement (% change in PAG to TSF volume) (see Table 3.2-1; Scope Item 3)	-30	30
Design Contingencies (% change in Base Estimate scope)	-100	0
Adaptive Management Requirements (% change in Base Estimate scope)	-100	0
Permanent Cover (% change in Base Estimate scope) (see Table 3.2-1; Scope Item 5)	-100	0
Reduction in O&M Costs to reflect Permanent Cover deletion (% change in Base Estimate scope)	-20	0
Various (this color coding identifies line item adjustments to the Base Estimate in addition to those noted above)	see "Sensitivity Analysis Assumption" column	see "Sensitivity Analysis Assumption" column

Schedule Activity ID	Description of Work	Lower Bound Adjustments		Upper Bound Adjustments		Lower Bound		Base	Upper Bound	
		Sensitivity Analysis Assumption (Reduced Scope/Price)	Assumed Scope/Price Reduction (%)	Sensitivity Analysis Assumption (Increased Scope/Price)	Assumed Scope/Price Increase (%)	Estimate	Variance from Base		Estimate	Variance from Base

Season #3 (double shift for Activity 325)

325	Haul Tailings / Rock Mixture From TSF To The Pit (incl subexc below tailings & u/s dam berm)	Cost of this line item has been reduced to reflect: -10% reduction accounting for the possibility that contamination has not extended as far below the TSF footprint as originally estimated (see Table 3.2-1; Scope Item 1); -20% reduction accounting for the possibility that engagement of the contracting community during procurement identifies efficiencies in materials handling processes (see Table 3.2-1; Scope Item 3); -the noted reduction in the PAG/Tails mixing ratio.	30	Cost of this line item has been increased to reflect: -10% increase accounting for the possibility that contamination has extended farther below the TSF footprint than originally estimated (see Table 3.2-1; Scope Item 1); the 20% quantity variation referenced in the table has been assumed to produce a 10% change in this line item); -the noted increase in the PAG/Tails mixing ratio.	10	4,765,185	-2,617,299	7,382,484	6,568,906	1,186,422
315	Move Wellpoint Setup During Tailings Excavation	Reduction in scope/cost reflects (see Table 3.21; Scope Item 6): - Increasing the required wellpoint spacing from a 25 m grid to a 30 m grid; and - Increasing wellpoint production capacity by 30%.	40			4,145,350	-2,914,147	7,059,497	7,042,070	-17,427
375	Place Interim Cover Over Pit (0.3 m crushed NAG, 1.0 m of Victoria Creek S&G)					2,626,087	-67,236	2,683,323	2,676,699	-6,624
360	Remove Special Waste For Disposal Off Site	Line item reduced to reflect on-site disposition in a dedicated portion of the pit containment structure rather than off-site disposal.	90			250,000	-2,250,000	2,500,000	2,500,000	0
335	Place NAG Rock From The Mill & The W. Lower Pile Areas Over The TSF Sand Bedding (1.2 m)	Line item quantity/cost reduced to reflect lower NAG rock thickness (see Table 3.2-1; Scope Item 7)	25			1,500,208	-543,666	2,043,874	2,038,829	-5,046
355	Haul PAG Rock From Waste Rock Dumps To Pit (forming horizontal layers at 2 m intervals)					2,097,357	183,716	1,913,641	1,680,056	-233,586
350	Haul PAG, Tailings, And Hydrocarbons From Various Areas On Site To Pit	The reduction accounts for the possibility that contamination has not extended as far originally estimated (see Table 3.2-1; Scope Item 1).	20	The increase accounts for: -the possibility that contamination has extended farther than originally estimated (see Table 3.2-1; Scope Item 1); -a 100% increase in the volume of contaminated sediments outside the TSF area (this translates into an approximately 25% increase in the cost of this line item).	45	804,283	-222,983	1,027,265	1,485,857	458,592
345	Haul NAG Rock From Various Waste Dumps To The Pit For Buttress At South End					911,218	-19,860	931,078	928,780	-2,298
310	Contractor Mobilization And Spring Break Cleanup					611,740	0	611,740	611,740	0
320	Haul PAG Rock From West Mid Pile To TSF (for equipment support and mixing with tailings)					418,679	-192,470	611,149	792,533	181,383
380	Contractor Demobilization And Site Winterizing					352,280	0	352,280	352,280	0
330	Remove Sand From The TSF Dam And Place Over Exposed Surfaces In The TSF (300 mm)					332,903	-7,256	340,159	339,319	-840
370	Rough Grade Mill And Camp Areas					238,346	-5,195	243,540	242,939	-601
340	Reconstruct Dome Creek And Its Riparian Zone Through The TSF Area					190,854	-4,160	195,013	194,532	-481
365	Rough Grade Remaining Waste Rock Dump Areas					119,173	-2,597	121,770	121,470	-301
OH3	Contractor Indirects	Indirects adjusted in proportion to change in Direct costs		Indirects adjusted in proportion to change in Direct costs		0	0	0	0	0
						19,363,662	-8,653,153	28,016,815	29,576,009	1,559,194

Subtotal

1,500,000	0	1,500,000	2,000,000	500,000	Engineering QC/QA during Season #3 construction
700,000	0	700,000	700,000	0	General site maintenance during winter months between Season #3 and Season #4 (currently done by Denison)
2,200,000	0	2,200,000	2,700,000	500,000	Subtotal

Table 4.2-1 Mount Nansen Remediation Project - 30% Design Phase Cost Estimate Sensitivity Analysis Summary

Assumed changes to key Base Estimate variables (see Table 3.2-1)

Variable	Sensitivity Analysis Adjustment (Lower Bound)	Sensitivity Analysis Adjustment (Upper Bound)
PAG to Tailings Mixing Requirement (% change in PAG to TSF volume) (see Table 3.2-1; Scope Item 3)	-30	30
Design Contingencies (% change in Base Estimate scope)	-100	0
Adaptive Management Requirements (% change in Base Estimate scope)	-100	0
Permanent Cover (% change in Base Estimate scope) (see Table 3.2-1; Scope Item 5)	-100	0
Reduction in O&M Costs to reflect Permanent Cover deletion (% change in Base Estimate scope)	-20	0
Various (this color coding identifies line item adjustments to the Base Estimate in addition to those noted above)	see "Sensitivity Analysis Assumption" column	see "Sensitivity Analysis Assumption" column

Schedule Activity ID	Description of Work	Lower Bound Adjustments		Upper Bound Adjustments		Lower Bound		Base	Upper Bound	
		Sensitivity Analysis Assumption (Reduced Scope/Price)	Assumed Scope/Price Reduction (%)	Sensitivity Analysis Assumption (Increased Scope/Price)	Assumed Scope/Price Increase (%)	Estimate	Variance from Base	Estimate	Variance from Base	
Season #4 (single shift)										
415	Remove Balance Of TSF and Seepage Pond Dams And Stockpile In Area of Pit Cover					1,234,017	13,495	1,220,521	1,220,521	0
440	Final Grade And Revegetate The Waste Dump & Pit Cover Areas	Line item reduced to reflect deletion of the vegetation component of the Reclamation Plan (see Table 3.2-1; Scope Item 8).	50			492,569	-481,795	974,364	974,364	0
430	Final Grade And Revegetate The TSF And Dam Areas	Line item reduced to reflect deletion of the vegetation component of the Reclamation Plan (see Table 3.2-1; Scope Item 8).	50			418,976	-409,812	828,788	828,788	0
450	Decommission All Site Roads (unless required for long term care & maintenance)					637,856	6,976	630,881	630,881	0
435	Final Grade And Revegetate The Mill And Camp Areas	Line item reduced to reflect deletion of the vegetation component of the Reclamation Plan (see Table 3.2-1; Scope Item 8).	50			308,440	-301,694	610,134	610,134	0
420	Haul Sand & Rock From Stockpile And Place Over Exposed Dam Areas					388,764	4,252	384,512	384,512	0
445	Backfill And Revegetate The Exploration Trenches					351,260	3,841	347,419	347,419	0
455	Final Site Cleanup And Contractor Demobilization					280,855	0	280,855	280,855	0
410	Contractor Mobilization And Spring Break Cleanup					134,765	0	134,765	134,765	0
425	Reconstruct Dome Creek And Its Riparian Zone Through The Dam Areas					54,645	598	54,047	54,047	0
OH4	Contractor Indirects	Indirects adjusted in proportion to change in Direct costs		Indirects adjusted in proportion to change in Direct costs		0	0	0	0	0
						4,302,147	-1,164,140	5,466,287	5,466,287	0

Subtotal

250,000	0	250,000	250,000	0	Engineering QC/QA during Season #4 construction
0	0	0	0	0	General site O&M between interim cover & final cover
250,000	0	250,000	250,000	0	Subtotal
4,991,915	0	4,991,915	4,991,915	0	Final Cover in Season #10 (granular materials, synthetic liners, borrow development & reclaim) (Base)
0	-4,991,915	4,991,915	4,991,915	0	Final Cover in Season #10 (granular materials, synthetic liners, borrow development & reclaim) (Adjusted)
0	-4,991,915	4,991,915	4,991,915	0	Subtotal
46,887,913	-19,640,245	66,528,158	70,187,291	3,659,134	Total CAPEX (Adjusted)
9,377,583	-3,928,049	13,305,632	14,037,458	731,827	Contingency 20%
56,265,495	-23,568,294	79,833,789	84,224,750	4,390,961	GRAND SUBTOTAL
4,738,729	0	4,738,729	4,738,729	0	O&M Costs (NPV)
3,790,983	-947,746	4,738,729	4,738,729	0	O&M Costs (NPV) (Adjusted)
1,411,859	0	1,411,859	1,411,859	0	Design Contingencies (NPV) (Base)
0	-1,411,859	1,411,859	1,411,859	0	Design Contingencies (NPV) (Adjusted)
3,819,844	0	3,819,844	3,819,844	0	Adaptive Management (NPV) (Base)
0	-3,819,844	3,819,844	3,819,844	0	Adaptive Management (NPV) (Adjusted)
60,056,478	-29,747,743	89,804,221	94,195,182	4,390,961	GRAND TOTAL (Adjusted)

4.2.2 Upper Bound Estimate

Table 4.2-1 indicates that the following assumptions/issues are likely to have the greatest influence on potential increases to the base estimate (in declining order of importance):

- The materials handling methods applied for the movement of tailings and PAG rock to the Open Pit (the appearance of this issue on both the lower and upper bound lists reflects the conclusion that the specific materials management methods and plans executed (and likely developed) by the contractor will have a major influence on project costs); and
- The methods used to distinguish in the field between PAG and non-PAG waste rocks during project execution.

4.3 Balancing Cost, Uncertainty and Risk

Ultimately, the objective of this review is to identify actions or opportunities for lowering the overall costs of the MNRP. It is useful then to consider what decisions might be required, and/or what outcomes are needed, to realize costs approaching the lower bound estimate for the MNRP that is outlined in Table 4.1-1. For some issues, realizing these lower costs may be a matter of taking on higher risks and accepting the negative consequences potentially associated with them. For others, it is not really a matter of taking discretionary risk management decisions, but rather, mitigating uncertainties in ways that produce positive cost outcomes through additional design development activity (e.g. the physical efficiency of dewatering, the required rock/tails mix ratio, water treatment process requirements and efficiency). Predicting the likelihood that any particular set of risk management decisions and/or design development outcomes will produce an estimate trending towards the lower bound is difficult, absent a more detailed cost risk analysis exercise. However, some qualitative judgements and comments relating to how these issues might play out can be offered. Table 4.3-1 provides an assessment along these lines for the key scope issues influencing the lower bound cost estimate for the MNRP.

Table 4.3-1: Assessment of Key Scope, Cost and Risk Issues

Issue	Desired Outcome	Probability of Desired Outcome	Partner Decisions/Actions Required	Associated Risks	Risk Consequences
1. Materials Handling Methods for Tailings and PAG Rock	Preferred contractor proposes field validated execution methods that improve efficiency of materials handling.	High; effective engagement of contracting community offers potential for identification of innovative materials handling proposals.	Adoption of procurement processes that include a large, or full scale field validation step Adoption of more liberal pit backfill performance objectives (e.g. acceptance of wet material placement)	Procurement process extends schedule without providing the efficiency improvements sought. Extended pit consolidation/settlement timelines render pit landscape unusable over an indefinite period. Alternate materials handling methods could compromise performance outcomes.	Moderate; unsuccessful trial/procurement process could introduce significant new costs and/or delays. Degradation in water quality; compromised pit cover integrity/stability.
2. Tailings dewatering system configuration and efficiency (in practice, this issue will be related to, and integrated with, Issue 1)	Per Issue 1	High; per Issue 1.	Per Issue 1.	Per Issue 1.	Moderate; per Issue 1.
3. Water Treatment System	A water treatment capacity with fewer process units, reduced reagent consumption and lower hydraulic throughput than the Phase 1 configuration.	High; it is likely that Phase 2 design development will identify savings in water treatment concepts.	Proceed with Phase 2 design development (i.e. issue requires uncertainty mitigation via design development; there are no discretionary risk management options currently available).	Phase 2 design does not lower cost estimate.	Low.
4. Pit Cover Concept	Single cover constructed at remediation that facilitates mitigation of differential settlements via maintenance and avoids the need for a second permanent cover.	Moderate; there is a reasonable probability that a single, maintainable cover concept can be developed.	Acceptance of greater cover maintenance liability and potentially a more extended period of limitations on the utility of the pit landscape.	Cover maintenance cannot adequately mitigate settlements, requiring a second, potentially more costly, permanent cover.	Low; failure of the concept means reverting, in large part, to the two cover concept that is in the current base estimate.
5. Maintenance of Compliant Surface Water Quality	Maintenance of water quality compliance without the need for design contingencies (i.e. pit drainage structures) or Adaptive Management protocols (principally, future water treatment).	Moderate; there is a reasonable probability that an effective pit containment concept could mitigate water quality concerns without additional supports.	Accepting a higher potential for water quality excursions and a reduced capacity for responding to those excursions.	Extended periods of non-compliant surface water quality that may not become evident for many years post remediation (i.e. when institutional memory of related issues and potential responses diminished).	High; water quality excursions would be difficult to address after the fact, and tolerating extended compliance excursions would undermine one of the central purposes for undertaking remediation at the Mount Nansen site.
6. Disposition of Soils Classified as Special Wastes	Disposal onsite (i.e. dedicated cell incorporated within pit containment structure).	High; proposal is technically straightforward to develop and defend.	Accepting additional permitting and public consultation liability associated with onsite special waste facility development.	Proposal for onsite disposition is rejected at a later stage of project development.	Low; rejection of concept means reverting to the base estimate (with perhaps some incremental costs related to delays and proposal development).
7. Use of Revegetation in Reclamation Concepts	Reclamation plans that do not rely on revegetated landscapes.	Moderate; proposal is technically straightforward to develop, but acceptance may be dependent on the subjective views of public stakeholders.	Accepting additional permitting and public consultation liability potentially associated with reclamation plans proposing granular landscapes.	Proposed reclamation plans rejected at a later stage of project development.	Low; rejection of the concept means reverting to the base estimate (with perhaps some incremental costs related to delays and proposal development).

5 Cost Reduction Opportunities

5.1 Reducing Uncertainty

5.1.1 Design Development

The sensitivity assessment in Section 4 attempts to characterize the influence of uncertainty on the Phase 1 cost estimate. The progression of any design beyond the 30% milestone (i.e. Phase 1) reduces uncertainties and increases the reliability of cost estimates, and AMEC expects that will apply to the MNRP. The sensitivity analysis illustrates the limits to providing more cost definition and certainty in advance of this additional design development activity. This section examines approaches for reducing, or at least managing uncertainty in ways that could lead to cost reductions, and discusses potential adjustments or changes to project scope elements that might also open opportunities for reduced costs.

5.1.2 Contractor Engagement

It is clear that additional work is required to define detailed execution strategies that properly balance execution performance, risk and cost. The Phase 2 design development scope includes examining those execution and procurement strategies that are most likely to achieve this. AMEC believes that the most effective way to finalize methods, mitigate detailed execution uncertainties, incorporate proprietary or innovative expertise, achieve fair pricing, and minimize chances of contractor non-performance, will be to engage the contracting community in the final development of detailed methods and prices. The most effective way to engage the contracting community will likely be to tender with facts and performance objectives/specifications only (no methods) and allow contractors to apply their expertise and equipment with as few boundary conditions as possible. For this to work, the design team must be confident that the objectives/specifications are achievable. The key project performance specifications will relate to placed fill characteristics (which could range anywhere from ‘placed within the pit’ to ‘placed to a specified Proctor density’).

To achieve fair pricing given the unmitigated uncertainties and risks that even capable contractors will need to manage after a comprehensive consideration of available data, AMEC believes that approaches in which the execution contract is staged in some fashion should be considered (see potential options outlined in Table 5.1.2-1). The point of the first stage would be to allow the contractor to refine methods and pricing, and for the Owner to re-tender subsequent phases if outcomes and/or pricing do not satisfy contracting objectives (i.e. a process that gives both contractor and Owner “off ramps” if the initial assessments of uncertainties, risks and costs are misjudged). The overriding point will be to achieve fair pricing (i.e. pricing not burdened with contingencies covering unmitigated risks) for the largest possible proportion of the materials inventory.

Table 5.1.2-1: Procurement Options Summary

Option	Pros/Cons	Comments
1. Standalone field trial tendered during latter stages of design	<p><u>Pros</u></p> <ul style="list-style-type: none"> Allows execution methods/pricing findings to be reflected in regulatory submissions and early project funding processes. <p><u>Cons</u></p> <ul style="list-style-type: none"> Not conducted at full scale; significantly limits utility of findings. No direct linkage to large scale scope; discourages contractors from being fully open with their expertise (i.e. they will be concerned about disclosing competitive advantages in the absence of a clear connection to a potential commercial upside). 	Cons outweigh pros unless Partners place compelling weight on early information or if alternate procurement strategies are simply not possible.
2. Stages full scale execution with procurement “off ramps”. <ul style="list-style-type: none"> Initial tender is a data/performance spec only; process open to all qualified contractors (i.e. follows a pre-qualification process). Owner defines a first stage scope that is anticipated to be sufficient to allow contractor to establish fair pricing (cannot let contractor define because if initial tender price too high, will extend first stage). At conclusion of Stage 1: <ul style="list-style-type: none"> Owner has access to all data (other than proprietary pricing) acquired during stage and that could be used by any contractor to develop fair pricing. Contractor submits pricing for balance of scope based on learnings/outcomes of Stage 1. Owner then has option of: <ul style="list-style-type: none"> <input type="checkbox"/> accepting contractor’s Stage 2 pricing; or <input type="checkbox"/> re-tendering Stage 2 with the expanded database provided by Stage 1 learnings/outcomes. 	<p><u>Pros</u></p> <ul style="list-style-type: none"> Reduces contractor’s commercial risks and thereby increases chances for securing fair pricing. Reduces Owner’s cost risk in the event that Stage 1 pricing is burdened by contingencies. Reduces potential for contractor non-performance in the face of unanticipated conditions. Can provide fair pricing based on full scale execution experience and data. <p><u>Cons</u></p> <ul style="list-style-type: none"> Gives incumbent contractor what may be perceived as unfair advantage for the Stage 2 scope. Replacing incumbent contractor would incur two mobilization charges (i.e. incumbent contractor’s Stage 2 pricing would consider/reflect this advantage). Extends execution schedule by adding, at a minimum, an assessment/re-pricing effort between the stages and, at a maximum, the need to incorporate a second tender process. May not be compatible with AAM/AANDC procurement processes and constraints. 	On balance, offers the best potential for engaging the contracting community and securing fair pricing for the largest component of project scope.



Option	Pros/Cons	Comments
3. Per Option 2 except that Stage 1 is scaled/executed as a trial (not a full scale mobilization).	<u>Pros</u> <ul style="list-style-type: none"> • Avoids potential for incurring two full mobilization charges. • Potentially reduces the overall execution schedule impact. <u>Cons</u> <ul style="list-style-type: none"> • Does not provide Stage 2 pricing based on full scale execution data (i.e. pricing would, therefore, still reflect the associated incremental uncertainties). 	Better than Option 1, but not as effective as Option 2. Might be considered if judged to be more compatible with AAM/AANDC procurement policies and constraints.
4. Per Option 3 except that at conclusion of Stage 1, the contractor provides target pricing (with rewards and penalties) for completion of Stage 2. The Owner and contractor would negotiate the basis for measuring performance against the target and the basis for quantifying rewards and penalties. If this negotiation was not successful, the Owner would retain the option of re-tendering Stage 2.	<u>Pros</u> <ul style="list-style-type: none"> • Reduced potential for incurring two full mobilization charges. • Potentially reduces overall execution schedule impact. • Provides both Owner and contractor with mechanism for mitigating cost risk of uncertainties and thereby increases the potential for achieving fair pricing. <u>Cons</u> <ul style="list-style-type: none"> • Does not provide Stage 2 pricing based on full scale execution data. • Difficulties of defining the basis of measuring performance against the target and of negotiating appropriate rewards and penalties. • May be relatively difficult to align with procurement policies and constraints. 	A variant of Option 3 that provides a mechanism for mitigating the uncertainties associated with a trial scale Stage 1.

AMEC recognizes that while contractor engagement during the procurement process may provide opportunities for cost reduction, it offers limited benefit for the purposes of the current cost review. The immediate requirement is to achieve sufficient clarity and alignment on potential costs to facilitate Partner approval for advancing the design. Any cost benefits provided by contractor engagement are likely to come later in the project development and execution process.

5.2 Scope Revisions

5.2.1 Within the Option 4 Concept

The scope of this review was to identify and consider cost reduction opportunities within the constraints and objectives of Option 4 (i.e. without re-examining the basic option assessment or selection process). The assumptions review and sensitivity analysis were based on alternate assumptions that were intended to satisfy the key tenets of Option 4, specifically:

- Tailings relocation and dam decommissioning followed by restoration of the Dome Creek valley;
- Placement of “low moisture” tailings;
- Maintenance of tailings above the water table;
- Provision of stable and useable backfilled pit surfaces over reasonable timeframes (i.e. without creating practically indefinite restrictions on land use); and
- Maintenance of downstream surface water quality within recognized regulatory standards.

Arguably, some of the alternate assumptions proposed may test the limits of these constraints. That said, there may also be additional cost reduction opportunities provided by a re-examination of the need for, and/or value provided by, these basic characteristics of Option 4 (e.g. are indefinite tailings consolidation timelines tolerable? Would the downstream ecological impacts of the above criteria water quality parameters be acceptable?).

5.2.2 Outside of the Option 4 Concept

As noted, this review was not intended to consider potential changes that would take the remedial plan outside of the basic definition of Option 4. In AMEC’s view, there would likely be additional cost reduction opportunities available if changes beyond the current definition of Option 4 were to be considered.

5.3 Value Engineering

Value Engineering (VE) is a process that the Partners could consider for systematically considering the alternate assumptions described herein, others that might come from a re-examination of the basic Option 4 characteristics and boundary conditions, or changes that might go beyond the current definition of Option 4.

5.3.1 Overview

VE is a systematic process used by a multidisciplinary team to improve the value of a project through the analysis of its functions. Value is defined as a fair return or equivalent in goods, services, or money for something exchanged. Value is commonly represented by the relationship:

$$\text{Value} = \text{Function/Resources}$$

where **function** is measured by the project's performance requirements and **resources** are measured in materials, labour, price, and time required to accomplish that function. A VE methodology focuses on improving value by identifying alternate ways to reliably accomplish a function that meets the performance expectations of the project (SAVE International, 2007).

5.3.2 VE Process

A VE process typically applies a plan that includes the following sequential phases (SAVE International, 2007):

.1 **Information Phase**

The team reviews and defines the current conditions of the project and identifies the goals of the study.

.2 **Function Analysis Phase**

The team defines the project functions and reviews and analyzes these functions to determine which need improvement, elimination, or creation to meet the project's goals.

.3 **Creative Phase**

The team employs creative techniques to identify other ways to perform the project's function(s).

.4 **Evaluation Phase**

The team follows a structured evaluation process to select those ideas that offer the potential for value improvement while delivering the project's function(s) and considering performance requirements and resource limits.

.5 **Development Phase**

The team develops the selected ideas into alternatives (or proposals) with a sufficient level of documentation to allow decision makers to determine if the alternative should be implemented.

.6 **Presentation Phase**

The team leader develops a report and/or presentation that documents and conveys the adequacy of the alternative(s) developed by the team and the associated value improvement opportunity.

5.3.3 VE Team

VE processes are normally undertaken by a dedicated VE Team facilitated by a VE Team Leader (SAVE International, 2007).



.1 **VE Team**

The Value Study Team is a **multidisciplinary group** of experienced professionals and project stakeholders. Team members are chosen based on their expertise and experience with the project. Sometimes individuals who have relevant expertise, but are not directly involved with the project are added to provide a different point of view.

.2 **VE Team Lead**

The **Value Team Leader** is experienced in value methodology techniques and is nominated to lead a study team using the VE Plan. VE Team leads often have specific VE training and credentials issued by recognized VE organizations or authorities.

6 Cost Review Workshop

6.1 Purpose and Agenda

The cost review scope of work included a workshop in Whitehorse with the Parties (i.e. AAM, AANDC and LSCFN) facilitated by AMEC. The purpose of the workshop was to:

- Outline the components of the cost review and present its findings;
- Continue discussions regarding cost reduction opportunities and strategies; and
- Review next steps.

The meeting agenda is included in the workshop materials provided in Appendix 6A. This agenda started with an introductory statement that provided some general context for the review. Much of the agenda was then given over to a presentation of the cost review document and its findings. The presentation slides are included in Appendix 6A. The final portion of the workshop was a discussion around design assumptions, potential alternatives to those assumptions and the Parties' requirements for final review outcomes.

6.2 Outcomes

The participants noted the challenges of making clear connections between key assumptions in the Design Base Case and the Option 4 performance requirements or criteria driving those assumptions. This lack of clarity is grounded in the fact that the general tenets of Option 4 are of necessity, fairly broad and required interpretation by the design team to identify specific plans and methods for addressing them (for example, what constitutes a stable pit surface does not easily or transparently translate into a specific compaction specification or relocation methodology). It was noted as well that this lack of clarity complicates the process of identifying potential changes to Base Case elements, performance and cost in ways that can be understood and assessed by the Parties. It was agreed that AMEC would consider summary approaches for clarifying these links between design elements and performance outcomes, and review the utility of those approaches in subsequent consultations with the Parties.

7 Summary and Conclusions

7.1 Cost Reconciliation

AMEC completed a reconciliation of the pre-Phase 1 LORAX/AECOM estimate and the Phase 1 AMEC estimate. This reconciliation was intended to identify:

- Any previously unidentified scope elements that were added to the Phase 1 estimate;
- Key elements of the project scope and/or the associated execution methods that exhibit significant differences between the estimates;
- The primary drivers for cost differences in those scope areas/execution methods (e.g. differences in quantity, pricing and/or execution methodology).

AMEC's review identified a variance between the Phase 1 AMEC estimate (\$89.8 million) and the pre-Phase 1 AECOM estimate (\$33.7 million including a 9% escalation to present in 2014 dollars) of \$56.1 million. The following incremental scope elements (i.e. included in the AMEC estimate, but not the AECOM estimate) contributed to this variance:

• Site maintenance between construction seasons	\$2.1 million
• Haul road and pit wall stabilization	\$0.7 million
• Wellpoint dewatering	\$11.3 million
• PAG rock/tails mixing	\$4.7 million
• Design contingencies	\$1.4 million
• Adaptive Management requirements	\$3.8 million
• Estimate contingency (on incremental scope items)	<u>\$4.8 million</u>
Total:	\$29.0 million

In addition, the following primary differences between the AMEC and AECOM estimates contributed to the variance:

- **The general approach to the two estimates.** The AMEC estimate accounts for all contractor indirects (e.g. contractor site overhead staff, camp catering and housekeeping, haul road improvements, and major sediment and water management works required during construction) and is based on an execution schedule based on estimated activity durations.
- **The general methodology assumed for removing the tailings from the TSF.** In short, the AMEC methodology aligns with the project need to provide conditions in the backfilled pit consistent with the development, within reasonable timelines, of a stable pit cover and reclamation surface. AECOM's concept involves relocating tailings largely at their in-place moisture content and does not explicitly define how the result can provide surfaces stable enough to sustain the specified pit cover.

- **Reclamation of the TSF footprint.** AMEC assumed that a more physically robust protection for exposed ground surfaces comprised of 300 mm of sand overlaid by a 1,200 mm layer of NAG rock would be needed to address permafrost conditions and to mitigate erosion potentials.
- **Water treatment.** AMEC assumed a fixed treatment capacity would be needed to address a larger hydraulic capacity than AECOM.
- **Landforming.** AMEC assumed a relatively comprehensive rough grading and revegetation plan would follow removal of all NAG and hydrocarbon contaminated materials.
- **Removal of hazardous materials from site.** AMEC assumed that all special waste soils would be directed to offsite, commercial disposition facilities.
- **Open pit cover.** The AMEC estimate applied a two cover concept incorporating an interim cover followed by a final engineered cover, while the AECOM estimate assumed a single, less complex cover.
- **Contingency.** The higher AMEC estimate attracted a higher absolute value for estimating contingency.

7.2 Cost Assumptions Review and Sensitivity Assessment

The assumptions applied for the key scope areas in AMEC's estimate were reviewed and potential alternates to these assumptions identified. Those alternate assumptions were then applied to the Phase 1 estimating format to assess the impact on costs. This exercise predicted a lower bound estimate of about \$60 M and an upper bound of \$94 M, on a base estimate of some \$90 M. The position of the base estimate within the limits of this range can be viewed as a rough indication of the degree of conservatism in the base estimate. However, this interpretation should be applied with caution, absent a more systematic, risk based quantification of the probabilities that might be attached to these figures.

The lower bound estimate was of particular interest, given the objectives of this review. The following assumptions/issues were found to have the greatest influence on potential reductions from the base estimate (in declining order of importance):

- The specific materials handling methods applied for the movement of tailings and PAG rock to the Open Pit;
- The configuration and efficiency of the wellpoint dewatering system used to facilitate the excavation of tailings;
- The capacity, configuration and reagent consumption for the water treatment capability developed to accommodate waters incompatible with direct release onsite;
- The pit cover concepts and maintenance protocols applied to mitigate post remediation differential settlements in the backfilled pit;

- The extent to which design contingencies and Adaptive Management protocols must be applied to mitigate risks associated with post remediation downstream surface water quality excursions;
- The approach taken for the disposition of contaminated soils categorized as special waste (i.e. onsite vs. offsite); and
- The extent to which reclamation concepts rely on revegetated vs. granular finished landscapes.

7.3 Cost Reduction Opportunities

The scope of this review was to identify and consider cost reduction opportunities within the constraints and objectives of Option 4 (i.e. without re-examining the basic option assessment or selection process). The assumptions review and sensitivity analysis were based on alternate assumptions that were intended to satisfy the key tenets of Option 4, specifically:

- Tailings relocation and dam decommissioning followed by restoration of the Dome Creek valley;
- Placement of “low moisture” tailings;
- Maintenance of tailings above the water table;
- Provision of stable and useable backfilled pit surfaces over reasonable timeframes (i.e. without creating practically indefinite restrictions on land use); and
- Maintenance of downstream surface water quality within recognized regulatory standards.

Arguably, some of the alternate assumptions proposed may test the limits of these constraints. That said, there may also be additional cost reduction opportunities provided by a re-examination of the need for, and/or value provided by, these basic characteristics of Option 4 (e.g. are indefinite tailings consolidation timelines tolerable? Would the downstream ecological impacts of the above criteria water quality parameters be acceptable?).

Identifying those alternate assumptions and/or revisions to the key tenets of Option 4 that will produce the desired cost reductions, while accommodating the needs and requirements of the Partners, will require additional review and consultation. Various approaches to this could be considered; for example, a Value Engineering (VE) process structured to systematically work through the issues involved with the Partners and their consultants could be undertaken.

A VE exercise would include a detailed consideration of the elements of the current Design Base (i.e. the basis of the current estimate), its derivation and bases. It might also be useful to posit a “Minimalist Base Case” that would be intended to bookend the lowest effort scope that could potentially satisfy the key tenets of Option 4 (adjusted as may be necessary). The Partners could then review the associated performance compromises, and incremental risks and uncertainties to determine if this Minimalist Base Case could be accepted, or where targeted supplements to this base might be required.

An example of a Minimalist Base Case for Option 4 would be as follows:

- No performance criteria applied to tailings and contaminated dam sands placed in the pit;
- No requirement for tailings dewatering prior to relocation;
- No relocation of waste rock (PAG or NAG) to the pit unless required to facilitate tails relocation and/or pit construction;
- No requirement to maintain pit groundwater levels below the tailings (i.e. elimination of the waste rock bench);
- No removal of tailings from creek beds outside the TSF footprint;
- No performance criteria for the pit cover beyond a broad objective to provide a trafficable surface at some point in the future;
- Surface reclamation limited to aesthetically driven recontouring of stockpiles and disturbed surfaces;
- no revegetation of finished surfaces; and
- Downstream surface water quality impacts assessed and managed via Adaptive Management.

In essence, this approach involves defining and applying a basic method specification, acknowledging the associated uncertainties with respect to performance outcomes, and committing to managing and/or mitigating those outcomes via maintenance and Adaptive Management. Physically, the method specification limits the scope to relocating the tailings as expeditiously as possible and with a minimum of treatment and/or conditioning, covering those tails with an end dumped waste rock cover, physical stabilization of the TSF footprint, dismantling and onsite disposition of structures and minimal recontouring and regrading of the remaining disturbed landscape.

Adopting a Base Case like this clearly means accepting some adjustments and compromises in the key tenets of Option 4, particularly related to downstream water quality and the stability and utility of final pit landscapes. Developing this Base Case would require some re-focusing of subsequent design development efforts to better understand the base performance outcomes that must be managed via maintenance and/or Adaptive Management. For example, given the compromises to downstream surface water quality that would likely be associated with this minimalist Base Case, it will be that much more important to understand if the worst case water quality outcomes are within the mitigative capabilities of the available Adaptive Management measures and technologies.

8 Limitations and Closure

This report was prepared exclusively for Assessment and Abandoned Mines, Energy Mines and Resources by AMEC Environment & Infrastructure, a wholly owned subsidiary of AMEC Americas Limited. The quality of information, conclusions and estimates contained herein is consistent with the level of effort involved in AMEC services and based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions and qualifications set forth in this report. This report is intended to be used by Assessment and Abandoned Mines, Energy Mines and Resources only, subject to the terms and conditions of its contract with AMEC. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

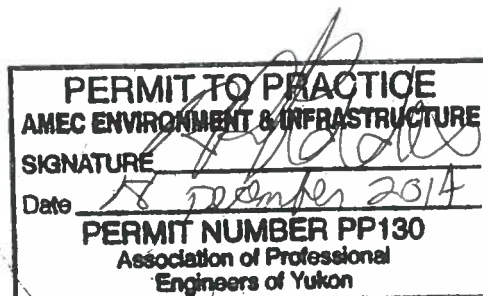
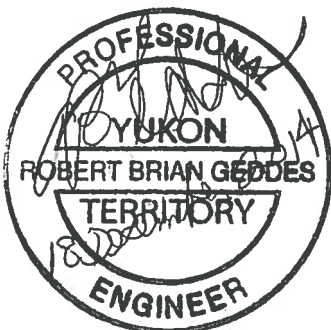
Yours truly,
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Appendix 2A – Detailed Cost Reconciliation Worksheets

Mount Nansen Remediation Project - Review of Cost Estimate Scope and Bases
(per Engineering Agreement C00025524 dated 26 August 2014)
Detail Reconciliation of AMEC and AECOM Estimates

Schedule Activity ID	Description of Work	Quantity	Unit	\$/unit	AMEC Q1 2014 \$Cdn	AECOM Q4 2010 \$Cdn	Reconciliation Comments		
							Scope	Quantities	Pricing/Total Cost
DETAIL DESIGN, CONSTRUCTION DOCUMENTS									
	Detail design, construction documents, support during tender phase				2,250,000				
	Pre-closure assessments - literature reviews, field investigations & ground truthing					178,000			Total AMEC engineering cost of \$5.3 million (including QC/QA costs below) over \$59.2 million in capex = 9%. Similarly, AECOM number = \$3.75 million / \$17.9 million = 21%. The AECOM percentage of 15% has been arbitrarily split 7% design, 8% construction.
	Consulting, engineering, design - say 7% of AECOM number					1,304,720			
	Dome Creek restoration - Design					100,000			
	Monitoring instrumentation					200,000			
	DETAIL DESIGN, CONSTRUCTION DOCUMENTS				2,250,000	1,782,720			
QC/QA DURING CONSTRUCTION									
	Engineering QC/QA during Season #1 construction				500,000				Total AMEC engineering cost of \$5.3 million (including design costs above) over \$59.2 million in capex = 9%. Similarly, AECOM number = \$3.75 million / \$17.9 million = 21%. The AECOM percentage of 15% has been arbitrarily split 7% design, 8% construction.
	Engineering QC/QA during Season #2 construction				750,000				
	Engineering QC/QA during Season #3 construction				1,500,000				
	Engineering QC/QA during Season #4 construction				250,000				
	QC/QA, reporting - say 8% of AECOM number					1,491,108			
	Dome Creek restoration - QC/QA, reporting					280,000			
	Pond #1 - QC/QA, reporting					30,000			
	Pond #2 - QC/QA, reporting					2,000			
	Pond #3 - Test pits, QC/QA, reporting					7,000			
	Watercourse - QC/QA, reporting					3,000			
	Remove tanks, residuals, soil/concrete - QC/QA, reporting					15,000			
	Remove mill buildings and other structures - QC/QA, reporting					50,000			
	Remove hazardous products, refuse, rail tanker - QC/QA, reporting					10,000			
	Disturbed mill areas - QC/QA, reporting					15,000			
	Camp area - QC/QA, reporting					15,000			
	Water tank area - QC/QA, reporting					3,000			
	Mine shop / laydown area - QC/QA, reporting					3,000			
	Mine roads - QC/QA, reporting					15,000			
	Haul roads - QC/QA, reporting					15,000			
	Trenches - QC/QA, reporting					10,000			
	QC/QA DURING CONSTRUCTION				3,000,000	1,964,108			
SITE MAINTENANCE BETWEEN CONSTRUCTION SEASONS									
	General site maintenance during winter months between Season #1 and Season #2 (currently done by Denison)				700,000				The AECOM estimate did not include this cost.
	General site maintenance during winter months between Season #2 and Season #3 (currently done by Denison)				700,000				
	General site maintenance during winter months between Season #3 and Season #4 (currently done by Denison)				700,000				
	General site O&M between interim cover & final cover				0				
	SITE MAINTENANCE BETWEEN CONSTRUCTION SEASONS				2,100,000	0			
MOBILIZATION / DEMOBILIZATION									
110	Contractor Mobilization & Early Works (camp trailers, office trailers)				875,870				The AMEC figure of \$2.9 million covers 4 construction seasons and includes \$1.5 million for equipment mob/demob and set up of field operations. \$750 k for a 100-man camp, \$120 k for camp winterizing and reopenings, \$100 k for camp removal, \$325 k for WTP winterizing and reopenings, \$100 k for WTP mothballing. It is believed the AECOM number covers 2 seasons. There are certainly opportunities for reducing the AMEC number, but even a \$1 million reduction leaves a cost that is 4.5 times the AECOM number.
155	Contractor Demobilization				138,070				
210	Contractor Mobilization And Spring Break Cleanup				233,660				
270	Contractor Demobilization And Site Winterizing				228,640				
310	Contractor Mobilization And Spring Break Cleanup				611,740				
380	Contractor Demobilization And Site Winterizing				352,280				
410	Contractor Mobilization And Spring Break Cleanup				134,765				
455	Final Site Cleanup And Contractor Demobilization				280,855				
	Mobilization					200,000			
	Partial Demobilization					150,000			
	Final Demobilization					50,000			
	MOBILIZATION / DEMOBILIZATION				2,855,880	400,000			

Mount Nansen Remediation Project - Review of Cost Estimate Scope and Bases
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Detail Reconciliation of AMEC and AECOM Estimates

Schedule Activity ID	Description of Work	Quantity	Unit	\$/unit	AMEC Q1 2014 \$Cdn	AECOM Q4 2010 \$Cdn	Reconciliation Comments		
							Scope	Quantities	Pricing/Total Cost
SEDIMENT CONTROL									
115	Construct / Install Sitewide Runoff & Sediment Control Measures				544,714				
	Old ore transfer site - Temporary sediment control					5,000		The AMEC costs are based on equipment & labour hours over a 4 week period (1 hiab, 1 excavator, 1 dozer, 1 ADT, 1 backhoe/loader, 2 pickups, 4 labourers). There may also be some reasonably large scope items related to the diversion ditch. The AECOM number seems to only cover minor works in the mill area. Could justify reducing AMEC costs by say 25% once actual needs are better known.	
	Pond #1 - Temporary sediment control					20,000			
	Pond #2 - Temporary sediment control					5,000			
	Watercourse - Temporary sediment control					10,000			
	Disturbed mill areas - Temporary sediment control					10,000			
	SEDIMENT CONTROL				544,714	50,000			
HAUL ROADS AND PIT WALLS									
120	Upgrade Haul Roads & Crossing Over TSF Diversion Ditch				433,760			AECOM does not cover these costs. Both will be required.	
130	Install Safety Measures In Pit				331,015				
	HAUL ROADS AND PIT WALLS				764,775	0			
PONY CREEK ADIT PLUG									
125	Upgrade Tunnel Plug In Poney Creek Adit				198,609			Scope of work not defined. Differences between AMEC and AECOM number are not significant.	
	Plug Pony Creek adit					250,000			
	PONY CREEK ADIT PLUG				198,609	250,000			
DEMOLITION AND HAZARDOUS PRODUCTS REMOVAL									
140	Begin Mill Demolition (mostly inside stripping)				198,609				
265	Complete All Mill And Site Infrastructure Demolition				875,143				
360	Remove Special Waste For Disposal Off Site				2,500,000				
	Remove tanks, residual products					10,000			
	Remove mill buildings and other structures					1,500,000			
	Remove hazardous products, refuse, rail tanker					60,000			
	Camp area - Remove refuse/materials/tanks, dismantle buildings					155,000			
	Water tank area - Remove tank, building, piping					33,000			
	Mine shop / laydown area - Remove refuse, hazmats, dismantle buildings					90,000			
	Misc Infrastructure - Remove pipelines, powerlines, Victoria Creek p/h					175,000			
	DEMOLITION AND HAZARDOUS PRODUCTS REMOVAL				3,573,753	2,023,000			
WATER TREATMENT PLANT									
145	Construct / Commission Water Treatment Plant				6,620,308				
150	Set Up & Pump Water From Pit Through Water Treatment Plant				304,530				
230	Set Up & Pump Water From TSF Through Water Treatment Plant				417,935				
	Water treatment					2,000,000			
	WATER TREATMENT PLANT				7,342,774	2,000,000			
WELL POINT DEWATERING SYSTEM									
240	Setup Initial Wellpoint Configuration And Connect System To Water Treatment Plant				583,429				
245	Move Wellpoint Setup During Tailings Excavation				3,657,511				
315	Move Wellpoint Setup During Tailings Excavation				7,059,497				
	WELL POINT DEWATERING SYSTEM				11,300,437	0			
WASTE ROCK TO OPEN PIT									
215	Haul NAG Rock From South Pile To Pit Bottom (for platform to 1190 m)	38,750	cm	17.86	691,955			AMEC quantity of 330,580 m3 within 4% of the 344,000 m3 AECOM number. The AMEC number does NOT include the 143,550 m3 of rock first hauled to TSF for mixing/equip-traffic and then brought to the open pit. The AECOM number does NOT include the same PAG rock volume used by AMEC for mixing with tailings but which by definition will need to be stored in the open pit. If that volume is considered, the AECOM 344,000 m3 number is understated by 143,550 m3, slightly less if reduction is made to buttress NAG volume needs.	(\$14.76 AMEC average x (330,580 m3 AMEC volume - 344,000 m3 AECOM volume) = -\$198,079>. Considering the remoteness of the site, haul road grades and distances, and congestion in the loading and dumping areas, the AECOM cost of \$5.00 m3 is considered low.
220	Haul Processed Filters To Pit Bottom (placed over top of NAG platform)	4,550	cm	72.28	328,881				
225	Reshape Pit Entrance (relocate ore to pit bottom, bring in NAG rock to flatten grades)	13,000	cm	24.01	312,176				
260	Haul PAG Rock From Waste Rock Dumps To Pit (forming horizontal layers at 2 m intervals)	40,800	cm	17.21	702,103				
345	Haul NAG Rock From Various Waste Dumps To The Pit For Buttress At South End	63,200	cm	14.73	931,078				
355	Haul PAG Rock From Waste Rock Dumps To Pit (forming horizontal layers at 2 m intervals)	170,280	cm	11.24	1,913,641				
	Waste rock placement (bottom and top)	344,000	cm	5.00		1,720,000			
	WASTE ROCK TO OPEN PIT				4,879,835	1,720,000			

Mount Nansen Remediation Project - Review of Cost Estimate Scope and Bases
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Detail Reconciliation of AMEC and AECOM Estimates

Schedule Activity ID	Description of Work	Quantity	Unit	\$/unit	AMEC Q1 2014 \$Cdn	AECOM Q4 2010 \$Cdn	Reconciliation Comments		
							Scope	Quantities	Pricing/Total Cost
WASTE ROCK TO TSF FOR EQUIPMENT SUPPORT AND MIXING, THEN TO OPEN PIT WITH THE TAILINGS									
235	Haul PAG Rock From SW Lower Pile To TSF (initial rock cover over central wet areas)	46,500	cm	17.21	800,191				
250 (a)	Haul Tailings / Rock Mixture From TSF To The Pit - Rock fraction only	27,750	cm	22.27	617,993				
255	Haul PAG Rock From West Mid Pile To TSF (for equipment support and mixing with tailings)	29,000	cm	9.81	284,511				
320	Haul PAG Rock From West Mid Pile To TSF (for equipment support and mixing with tailings)	68,050	cm	8.98	611,149				
325 (a)	Haul Tailings / Rock Mixture From TSF To The Pit (incl subexc below tailings & u/s dam berm) - Rock fraction only	115,800	cm	20.90	2,420,220				
	WASTE ROCK TO TSF FOR EQUIPMENT SUPPORT AND MIXING, THEN TO OPEN PIT WITH THE TAILINGS				4,734,065		0		
TAILINGS TO OPEN PIT									
250 (b)	Haul Tailings / Rock Mixture From TSF To The Pit - Tailings fraction only	55,500	cm	22.27	1,235,985				
325 (b)	Haul Tailings / Rock Mixture From TSF To The Pit (incl subexc below tailings & u/s dam berm) - Tailings fraction only	181,600	cm	20.90	3,795,764				
325 (b)	Haul Tailings / Rock Mixture From TSF To The Pit (incl subexc below tailings & u/s dam berm) - Dam toe berm fraction only	5,800	cm	20.90	121,230				
	Transport and place tailings	300,000	cm	15.00			4,500,000		
	TAILINGS TO OPEN PIT				5,152,979		4,500,000		
SUBEXCAVATION TO OPEN PIT									
325 (b)	Haul Tailings / Rock Mixture From TSF To The Pit (incl subexc below tailings & u/s dam berm) - Subexc fraction only	50,000	cm	20.90	1,045,089				
	Excavate contaminated soils under TSF footprint	11,000	cm	12.00			132,000		
	SUBEXCAVATION TO OPEN PIT				1,045,089		132,000		
MISC WASTE PRODUCTS TO OPEN PIT									
350	Haul PAG, Tailings, And Hydrocarbons From Various Areas On Site To Pit	44,506	cm	23.08	1,027,265				
	Pond #1 - Temporary access improvement						30,000		
	Pond #1 - Remove tailings	1,000	cm	100.00			100,000		
	Pond #2 - Temporary access improvement						2,000		
	Pond #2 - Dewater, regrade, revegetate						10,625		
	Pond #3 - Dewater, remove liner/fills						9,000		
	Remove contaminated soils and concrete						20,000		
	Old ore transfer site - Remove reactive rock fill	6,500	cm	15.00			97,500		
	Mine shop / laydown area - Remove hydrocarbon contamination						25,000		
	Mine roads - Remove hydrocarbon contamination						5,000		
	Haul roads - Remove hydrocarbon contamination						20,000		
	Misc Infrastructure - Dispose remaining core						25,000		
	MISC WASTE PRODUCTS TO OPEN PIT				1,027,265		344,125		
REMOVE TSF DAM									
330	Remove Sand From The TSF Dam And Place Over Exposed Surfaces In The TSF (300 mm)	34,325	cm	9.91	340,159				
415	Remove Balance Of TSF and Seepage Pond Dams And Stockpile In Area of Pit Cover	69,890	cm	17.46	1,220,521				
	Relocate dam fill to borrow sources	80,000	cm	5.00			400,000		
	Relocate dam fill to pit	80,000	cm	12.00			960,000		
	REMOVE TSF DAM				1,560,680		1,360,000		
DOME CREEK RESTORATION									
330	Place Sand From The TSF Dam Over Exposed Surfaces In The TSF (300 mm) - costs included above w/ dam removal				0				
335	Place NAG Rock From The Mill & The W. Lower Pile Areas Over The TSF Sand Bedding (1.2 m)	137,250	cm	14.89	2,043,874				
420 (a)	Haul Sand & Rock From Stockpile And Place Over Exposed Dam Areas - Sand Fraction (300 mm)	7,000	cm	10.99	76,903				
420 (b)	Haul Sand & Rock From Stockpile And Place Over Exposed Dam Areas - Waste Rock Fraction (1200 m)	28,000	cm	10.99	307,610				
340	Reconstruct Dome Creek And Its Riparian Zone Through The TSF Area				195,013				
425	Reconstruct Dome Creek And Its Riparian Zone Through The Dam Areas				54,047				
430	Final Grade And Revegetate The TSF And Dam Areas	2.7	ha		828,788				
	Dome Creek restoration - Phase 1 over most of TSF area						670,000		
	Dome Creek restoration - Phase 2 after final dam removal						310,000		
	Dome Creek restoration - Phase 3 final season						310,000		
	DOME CREEK RESTORATION				3,506,236		1,290,000		

Mount Nansen Remediation Project - Review of Cost Estimate Scope and Bases
(per Engineering Agreement C00025524 dated 26 August 2014)
Detail Reconciliation of AMEC and AECOM Estimates

Schedule Activity ID	Description of Work	Quantity	Unit	\$/unit	AMEC Q1 2014 \$Cdn	AECOM Q4 2010 \$Cdn	Reconciliation Comments		
							Scope	Quantities	Pricing/Total Cost
EXPLORATION TRENCHES									
445	Backfill And Revegetate The Exploration Trenches	5.5	km		347,419				
	Trenches - Backfill, revegetate					204,060			
	EXPLORATION TRENCHES				347,419	204,060			
LANDFORMING & REVEGETATION (not including Dome Creek area)									
135	Establish Revegetation Test Plots				87,720				
365	Rough Grade Remaining Waste Rock Dump Areas	5.0	ha		121,770				
370	Rough Grade Mill And Camp Areas	10.0	ha		243,540				
435	Final Grade And Revegetate The Mill And Camp Areas	2.0	ha		610,134				
440	Final Grade And Revegetate The Waste Dump & Pit Cover Areas	3.2	ha		974,364				
	Misc Areas - Regrade, revegetate misc clearings and TSF periphery					208,600			
	Waste rock storage area - Regrade	12	ha	6,250		75,000			
	Waste rock storage area - Revegetate					48,000			
	Pond #1 - Regrade, revegetate					24,400			
	Watercourse - Regrade, revegetate					28,200			
	Disturbed mill areas - Control water flow, plug adit					269,100			
	Disturbed mill areas - Scarify, regrade, revegetate					96,000			
	Camp area - Scarify, regrade, revegetate					45,000			
	Water tank area - Regrade, revegetate					3,125			
	Mine shop / laydown area - Scarify, regrade, revegetate					12,200			
	Revegetate pit area, install signage and berm					46,000			
	LANDFORMING & REVEGETATION				2,037,530	855,625			
DECOMMISSION SITE ROADS									
450	Decommission All Site Roads (unless required for long term care & maintenance)	8.6	km		630,881				
	Mine roads - Regrade, revegetate					100,340		AMEC cost assumes 2 dozers and 1 excavator reclaiming 200 m of road per day. This effort can likely be reduced in the next design phase.	
	Haul roads - Regrade, revegetate					56,700			
	DECOMMISSION SITE ROADS				630,881	157,040			
COVER OVER OPEN PIT									
375	Place Interim Cover Over Pit (0.3 m crushed NAG, 1.0 m of sand & gravel)	104,000	cm	25.80	2,683,323				
1005 (a)	Final Cover in Season #10 (3 layers of granular materials x 24,000 m3 each, borrow development & reclaim)	72,000	cm	23.39	1,684,415				
1005 (b)	Final Cover in Season #10 (synthetic liners, plastic over GCL)	100,000	sm	33.08	3,307,500				
	Low infiltration synthetic cover	43,000	cm	55.00		2,365,000			
	Regrade and repair cover	43,000	cm	5.00		215,000			
	COVER OVER OPEN PIT				7,675,238	2,580,000			
CONTINGENCY									
	Contingency 20%				13,305,632				
	Contingency - 30%					5,591,655		Allowance to cover likely cost increases for items currently not specifically identified (aka known unknowns).	
	CONTINGENCY				13,305,632	5,591,655		AMEC used 20% (vs 30% by AECOM) to reflect more advanced design development & increased estimating effort.	
O&M COSTS (NPV)									
	O&M Costs (NPV)				4,738,729				
	Operation, Care & maintenance					3,750,000			
	O&M COSTS (NPV)				4,738,729	3,750,000			
DESIGN CONTINGENCIES (NPV)									
	Design Contingencies (NPV)				1,411,859				
	DESIGN CONTINGENCIES (NPV)				1,411,859	0			
ADAPTIVE MANAGEMENT (NPV)									
	Adaptive Management (NPV)				3,819,844				
	ADAPTIVE MANAGEMENT (NPV)				3,819,844	0			
	All costs in Q1 2014 \$Cdn				89,804,221	30,954,333			
					89,804,221	30,954,333			

Mount Nansen Remediation Project - Review of Cost Estimate Scope and Bases (per Engineering Agreement C00025524 dated 26 August 2014)
AMEC 2014 Cost Estimate Used for Reconciliation

AMEC
2014 \$ CDN

Schedule Activity ID	Description of Work	Quantity	Unit	\$/unit	EQUIPMENT	LABOUR	OTHER	DIRECT COSTS	INDIRECT COSTS	TOTAL COSTS
265	Complete All Mill And Site Infrastructure Demolition				120,000	420,000	60,000	600,000	275,143	875,143
270	Contractor Demobilization And Site Winterizing				9,300	21,840	197,500	228,640	0	228,640
OH2	Contractor Indirects				903,285	887,350	1,512,945	0	0	0
					5,576,265	2,675,099	2,718,570	7,666,354	3,303,580	10,969,934

Subtotal

% indirects to directs -----> 43.1

Engineering QC/QA during Season #2 construction	750,000
General site maintenance during winter months between Season #2 and Season #3 (currently done by Denison)	700,000
Subtotal	1,450,000

Subtotal

Season #3 (double shift for Activity 325)

310	Contractor Mobilization And Spring Break Cleanup				52,900	116,340	442,500	611,740	0	611,740
315	Move Wellpoint Setup During Tailings Excavation				4,059,000	928,224	300,000	5,287,224	1,772,273	7,059,497
320	Haul PAG Rock From West Mid Pile To TSF (for equipment support and mixing with tailings)	68,050	cm	8.98	352,584	105,137	0	457,721	153,428	611,149
325	Haul Tailings / Rock Mixture From TSF To The Pit (incl subexc below tailings & u/s dam berm)	353,200	cm	20.90	4,307,936	1,221,189	0	5,529,125	1,853,358	7,382,484
330	Remove Sand From The TSF Dam And Place Over Exposed Surfaces In The TSF (300 mm)	34,325	cm	9.91	196,244	58,518	0	254,763	85,396	340,159
335	Place NAG Rock From The Mill & The W. Lower Pile Areas Over The TSF Sand Bedding (1.2 m)	137,250	cm	14.89	1,183,190	347,574	0	1,530,763	513,111	2,043,874
340	Reconstruct Dome Creek And Its Riparian Zone Through The TSF Area				93,056	28,000	25,000	146,056	48,958	195,013
345	Haul NAG Rock From Various Waste Dumps To The Pit For Buttress At South End	63,200	cm	14.73	528,115	169,218	0	697,333	233,745	931,078
350	Haul PAG, Tailings, And Hydrocarbons From Various Areas On Site To Pit	44,506	cm	23.08	593,247	176,125	0	769,372	257,893	1,027,265
355	Haul PAG Rock From Waste Rock Dumps To Pit (forming horizontal layers at 2 m intervals)	170,280	cm	11.24	1,106,288	326,938	0	1,433,225	480,416	1,913,641
360	Remove Special Waste For Disposal Off Site				0	0	2,500,000	2,500,000		2,500,000
365	Rough Grade Remaining Waste Rock Dump Areas				78,000	13,200	0	91,200	30,570	121,770
370	Rough Grade Mill And Camp Areas				156,000	26,400	0	182,400	61,140	243,540
375	Place Interim Cover Over Pit (0.3 m crushed NAG, 1.0 m of sand & gravel)	104,000	cm	25.80	1,093,600	364,080	552,000	2,009,680	673,643	2,683,323
380	Contractor Demobilization And Site Winterizing				18,600	43,680	290,000	352,280	0	352,280
OH3	Contractor Indirects				1,574,045	1,398,504	3,191,383	0	0	0
					15,392,805	5,323,127	7,300,883	21,852,883	6,163,932	28,016,815

Subtotal

% indirects to directs -----> 28.2

Engineering QC/QA during Season #3 construction	1,500,000
General site maintenance during winter months between Season #3 and Season #4 (currently done by Denison)	700,000
Subtotal	2,200,000

Subtotal

Mount Nansen Remediation Project - Review of Cost Estimate Scope and Bases (per Engineering Agreement C00025524 dated 26 August 2014)
AMEC 2014 Cost Estimate Used for Reconciliation

AMEC
2014 \$ CDN

Schedule Activity ID	Description of Work	Quantity	Unit	\$/unit	EQUIPMENT	LABOUR	OTHER	DIRECT COSTS	INDIRECT COSTS	TOTAL COSTS
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Season #4 (single shift)

410	Contractor Mobilization And Spring Break Cleanup				16,275	45,990	72,500	134,765	0	134,765	
415	Remove Balance Of TSF and Seepage Pond Dams And Stockpile In Area of Pit Cover	69,890	cm	17.46	637,965	186,606	0	824,571	395,950	1,220,521	
420	Haul Sand & Rock From Stockpile And Place Over Exposed Dam Areas	35,000	cm	10.99	200,103	59,669	0	259,772	124,740	384,512	
425	Reconstruct Dome Creek And Its Riparian Zone Through The Dam Areas				23,264	7,000	6,250	36,514	17,534	54,047	
430	Final Grade And Revegetate The TSF And Dam Areas				111,375	187,920	260,625	559,920	268,868	828,788	
435	Final Grade And Revegetate The Mill And Camp Areas				82,500	139,200	190,500	412,200	197,934	610,134	
440	Final Grade And Revegetate The Waste Dump & Pit Cover Areas				132,000	222,720	303,550	658,270	316,094	974,364	
445	Backfill And Revegetate The Exploration Trenches				127,463	107,250	0	234,713	112,707	347,419	
450	Decommission All Site Roads (unless required for long term care & maintenance)				343,140	83,076	0	426,216	204,665	630,881	
455	Final Site Cleanup And Contractor Demobilization				6,975	16,380	257,500	280,855	0	280,855	
OH4	Contractor Indirects				366,985	434,170	837,336	0	0	0	
					2,048,044	1,489,981	1,928,261	3,827,796	1,638,491	5,466,287	Subtotal

% indirects to directs ----> 42.8

Engineering QC/QA during Season #4 construction	250,000	
General site O&M between interim cover & final cover	0	
Subtotal	250,000	

Final Cover in Season #10 (granular materials, synthetic liners, borrow development & reclaim)	4,991,915	
Subtotal	4,991,915	

	66,528,158	Total CAPEX
Contingency 20%	13,305,632	
	79,833,789	GRAND SUBTOTAL
O&M Costs (NPV)	4,738,729	
Design Contingencies (NPV)	1,411,859	
Adaptive Management (NPV)	3,819,844	
GRAND TOTAL	89,804,221	

Mount Nansen Remediation Project - Review of Cost Estimate Scope and Bases
(per Engineering Agreement C00025524 dated 26 August 2014)
AECOM 2010 Cost Estimate Used for Reconciliation

Cost Item	Quantity	Unit	\$/unit	Total Costs
Mobilization	1	ls	200,000	200,000
Partial Demobilization	1	ls	150,000	150,000
Final Demobilization	1	ls	50,000	50,000
Transport and place tailings	300,000	cm	15.00	4,500,000
Excavate contaminated soils under TSF footprint	11,000	cm	12.00	132,000
Relocate dam fill to borrow sources	80,000	cm	5.00	400,000
Relocate dam fill to pit	80,000	cm	12.00	960,000
Dome Creek restoration - Design	1	ls	100,000	100,000
Dome Creek restoration - QC/QA, reporting	1	ls	280,000	280,000
Dome Creek restoration - Phase 1 over most of TSF area	1	ls	670,000	670,000
Dome Creek restoration - Phase 2 after final dam removal	1	ls	310,000	310,000
Dome Creek restoration - Phase 3 final season	1	ls	310,000	310,000
Waste rock placement (bottom and top)	344,000	cm	5.00	1,720,000
Low infiltration synthetic cover	43,000	cm	55.00	2,365,000
Regrade and repair cover	43,000	cm	5.00	215,000
Revegetate pit area, install signage and berm	1	ls	46,000	46,000
Waste rock storage area - Regrade	12	ha	6,250	75,000
Waste rock storage area - Revegetate	1	ls	48,000	48,000
Plug Pony Creek adit	1	ls	250,000	250,000
Monitoring instrumentation	1	ls	200,000	200,000
Water treatment	1	ls	2,000,000	2,000,000
Old ore transfer site - Temporary sediment control	1	ls	5,000	5,000
Old ore transfer site - Remove reactive rock fill	6,500	cm	15.00	97,500
Pond #1 - Temporary sediment control	1	ls	20,000	20,000
Pond #1 - Temporary access improvement	1	ls	30,000	30,000
Pond #1 - Remove tailings	1,000	cm	100.00	100,000
Pond #1 - Regrade, revegetate	1	ls	24,400	24,400
Pond #1 - QC/QA, reporting	1	ls	30,000	30,000
Pond #2 - Temporary sediment control	1	ls	5,000	5,000
Pond #2 - Temporary access improvement	1	ls	2,000	2,000
Pond #2 - Dewater, regrade, revegetate	1	ls	10,625	10,625
Pond #2 - QC/QA, reporting	1	ls	2,000	2,000
Pond #3 - Dewater, remove liner/fills	1	ls	9,000	9,000
Pond #3 - Test pits, QC/QA, reporting	1	ls	7,000	7,000
Watercourse - Temporary sediment control	1	ls	10,000	10,000
Watercourse - Regrade, revegetate	1	ls	28,200	28,200
Watercourse - QC/QA, reporting	1	ls	3,000	3,000
Remove tanks, residual products	1	ls	10,000	10,000
Remove contaminated soils and concrete	1	ls	20,000	20,000
Remove tanks, residuals, soil/concrete - QC/QA, reporting	1	ls	15,000	15,000

Mount Nansen Remediation Project - Review of Cost Estimate Scope and Bases
(per Engineering Agreement C00025524 dated 26 August 2014)
AECOM 2010 Cost Estimate Used for Reconciliation

Cost Item	Quantity	Unit	\$/unit	Total Costs
Remove mill buildings and other structures	1	ls	1,500,000	1,500,000
Remove mill buildings and other structures - QC/QA, reporting	1	ls	50,000	50,000
Remove hazardous products, refuse, rail tanker	1	ls	60,000	60,000
Remove hazardous products, refuse, rail tanker - QC/QA, reporting	1	ls	10,000	10,000
Disturbed mill areas - Control water flow, plug adit	1	ls	269,100	269,100
Disturbed mill areas - Temporary sediment control	1	ls	10,000	10,000
Disturbed mill areas - Scarify, regrade, revegetate	1	ls	96,000	96,000
Disturbed mill areas - QC/QA, reporting	1	ls	15,000	15,000
Camp area - Remove refuse/materials/tanks, dismantle buildings	1	ls	155,000	155,000
Camp area - Scarify, regrade, revegetate	1	ls	45,000	45,000
Camp area - QC/QA, reporting	1	ls	15,000	15,000
Water tank area - Remove tank, building, piping	1	ls	33,000	33,000
Water tank area - Regrade, revegetate	1	ls	3,125	3,125
Water tank area - QC/QA, reporting	1	ls	3,000	3,000
Mine shop / laydown area - Remove refuse, hazmats, dismantle buildings	1	ls	90,000	90,000
Mine shop / laydown area - Remove hydrocarbon contamination	1	ls	25,000	25,000
Mine shop / laydown area - Scarify, regrade, revegetate	1	ls	12,200	12,200
Mine shop / laydown area - QC/QA, reporting	1	ls	3,000	3,000
Mine roads - Remove hydrocarbon contamination	1	ls	5,000	5,000
Mine roads - Regrade, revegetate	1	ls	100,340	100,340
Mine roads - QC/QA, reporting	1	ls	15,000	15,000
Haul roads - Remove hydrocarbon contamination	1	ls	35,000	20,000
Haul roads - Regrade, revegetate	1	ls	41,700	56,700
Haul roads - QC/QA, reporting	1	ls	15,000	15,000
Trenches - Backfill, revegetate	1	ls	204,060	204,060
Trenches - QC/QA, reporting	1	ls	15,000	10,000
Misc Infrastructure - Remove pipelines, powerlines, Victoria Creek p/h	1	ls	175,000	175,000
Misc Infrastructure - Dispose remaining core	1	ls	25,000	25,000
Misc Areas - Regrade, revegetate misc clearings and TSF periphery	1	ls	208,600	208,600
Consulting, engineering, design - say 7% of AECOM number	1	ls	1,304,720	1,304,720
QC/QA, reporting - say 8% of AECOM number	1	ls	1,491,108	1,491,108
Pre-closure assessments - literature reviews, field investigations & ground truthing	1	ls	178,000.00	178,000
Contingency - 30%	1	ls	5,591,655	5,591,655
Operation, Care & maintenance	1	ls	3,750,000.00	3,750,000
Note: Pink shaded items are common elements				30,954,333



Appendix 2B – Detailed Quantity Breakdowns/Reconciliation

Mount Nansen Remediation Project - Review of Cost Estimate Scope and Bases
(per Engineering Agreement C00025524 dated 26 August 2014)
Material Volumes By Primavera Schedule Activities

Schedule Activity ID	Borrow Source	Destination	Purpose	Bank Volume (bcm)	Item	
215	South Pile - NAG rock	Open Pit	Rock platform	38,750	1	Crushed Items 6 + 11 = 50% of Items 7 +12 +13 Items 7 + 13 = 237,100 m3 Items 6 + 11 = 50% of Items 7 +12 +13 Items 7 + 13 = 237,100 m3
220	West Lower Pile - NAG rock	Open Pit	Rock platform	4,550	2	
225	Ore at pit entrance ramp	Open Pit	Final storage under pit cover	8,000	3	
225	South Pile - NAG rock	Open Pit	Open Pit Buttress	5,000	4	
				13,000		
235	SW Lower Pile - PAG rock	TSF	Equip traffic & mixing w/ tails	46,500	5	
250	Rock portion of tails/rock/subexc/toe berm mix	Open Pit	Final storage under pit cover	27,750	6	
250	Tails portion of tails/rock/subexc/toe berm mix	Open Pit	Final storage under pit cover	55,500	7	
				83,250		
255	West Mid Pile - PAG rock	TSF	Equip traffic & mixing w/ tails	29,000	8	
260	NW Pile - PAG rock	Open Pit	Final storage under pit cover	40,800	9	
320	West Mid Pile - PAG rock	TSF	Equip traffic & mixing w/ tails	68,050	10	
325	Rock portion of tails/rock/subexc/toe.berm mix	Open Pit	Final storage under pit cover	115,800	11	
325	Subexc portion of tails/rock/subexc/toe.berm mix	Open Pit	Final storage under pit cover	50,000	12	
325	Tails portion of tails/rock/subexc/toe.berm mix	Open Pit	Final storage under pit cover	181,600	13	
325	Toe.berm portion of tails/rock/subexc/toe.berm mix	Open Pit	Final storage under pit cover	5,800	14	
				353,200		
330	Sand from Main Dam and Seepage Dam	TSF Footprint	Protection of exposed TSF surfaces	34,325	15	
335	Mill Area - NAG rock	TSF Footprint	Protection of exposed TSF surfaces	79,800	16	
335	West Lower Pile - NAG rock	TSF Footprint	Protection of exposed TSF surfaces	57,450	17	
335	SW Upper Pile - NAG rock	TSF Footprint	Protection of exposed TSF surfaces	0	18	
				137,250		
345	South Pile - NAG rock	Open Pit	Open Pit Buttress	37,850	19	
345	SW Upper Pile - NAG rock	Open Pit	Open Pit Buttress	25,350	20	

Mount Nansen Remediation Project - Review of Cost Estimate Scope and Bases
(per Engineering Agreement C00025524 dated 26 August 2014)
Material Volumes By Primavera Schedule Activities

Schedule Activity ID	Borrow Source	Destination	Purpose	Bank Volume (bcm)	Item	
				63,200		
350	Concrete demolition waste	Open Pit	Final storage under pit cover	2,600	21	
350	Contaminated soils d/s of TSF seepage pond	Open Pit	Final storage under pit cover	1,000	22	
350	Hydrocarbon soils (Katzka, mill, roads)	Open Pit	Final storage under pit cover	9,422	23	
350	Ketza shop PAG rock	Open Pit	Final storage under pit cover	1,787	24	
350	Mill Area - PAG rock	Open Pit	Final storage under pit cover	12,120	25	
350	Roads - PAG rock	Open Pit	Final storage under pit cover	14,777	26	
350	Subexc under seepage pond area	Open Pit	Final storage under pit cover	600	27	
350	Tailings/soils from mill ponds	Open Pit	Final storage under pit cover	2,200	28	
				44,506		
355	East Pile - PAG rock	Open Pit	Final storage under pit cover	20,000	29	
355	NW Pile - PAG rock	Open Pit	Final storage under pit cover	115,617	30	
355	Ore stockpile	Open Pit	Final storage under pit cover	1,812	31	
355	West Mid Pile - PAG rock	Open Pit	Final storage under pit cover	32,851	32	
				170,280		
375	Sand	Open Pit	Interim cover	80,000	33	
375	West Lower Pile - NAG rock	Open Pit	Interim cover	24,000	34	Crushed
				104,000		
415	Sand from Main Dam and Seepage Dam	Stockpile Near Open Pit	To be used later for final cover	69,890	35	

Total NAG moved ----->	272,750	
Total PAG moved ----->	381,502	(including 143,550 m3 first used at TSF for mixing, then rehandled)
Total "Other Contaminated" moved ----->	30,834	
Tailings moved ----->	237,100	
Dam sand moved ----->	104,215	
Subexcavation moved ----->	50,600	
Sand moved ----->	80,000	

Mount Nansen Remediation Project - Review of Cost Estimate Scope and Bases (per Engineering Agreement C00025524 dated 26 August 2014)
Material Volumes By End Purpose

Activity ID	Borrow Source	Destination	End Purpose	Bank Volume (bcm)	Item	
215	South Pile - NAG rock	Open Pit	Rock platform at bottom of pit	38,750	1	Crushed
220	West Lower Pile - NAG rock	Open Pit	Rock platform at bottom of pit	4,550	2	
				43,300		
250	Tails portion of tails/rock/subexc/toeberm mix	Open Pit	Final storage under pit cover	55,500	7	
325	Tails portion of tails/rock/subexc/toe.berm mix	Open Pit	Final storage under pit cover	181,600	13	
325	Subexc portion of tails/rock/subexc/toe.berm mix	Open Pit	Final storage under pit cover	50,000	12	
				287,100		
250	Rock portion of tails/rock/subexc/toeberm mix	Open Pit	Final storage under pit cover	27,750	6	Items 6 + 11 = 50% of Items 7 +12 +13
325	Rock portion of tails/rock/subexc/toe.berm mix	Open Pit	Final storage under pit cover	115,800	11	
				143,550		
235	SW Lower Pile - PAG rock	TSF	Equip traffic & mixing w/ tails	46,500	5	Matches above subtotal
255	West Mid Pile - PAG rock	TSF	Equip traffic & mixing w/ tails	29,000	8	
320	West Mid Pile - PAG rock	TSF	Equip traffic & mixing w/ tails	68,050	10	
				143,550		
225	South Pile - NAG rock	Open Pit	Open Pit Buttress	5,000	4	
345	South Pile - NAG rock	Open Pit	Open Pit Buttress	37,850	19	
345	SW Upper Pile - NAG rock	Open Pit	Open Pit Buttress	25,350	20	
				68,200		
330	Sand from Main Dam and Seepage Dam	TSF Footprint	Protection of exposed TSF surfaces	34,325	15	Will be reduced to 17,200 m3 in 60% phase
335	Mill Area - NAG rock	TSF Footprint	Protection of exposed TSF surfaces	79,800	16	
335	West Lower Pile - NAG rock	TSF Footprint	Protection of exposed TSF surfaces	57,450	17	Will be increased to 50,400 m3 in 60% phase
335	SW Upper Pile - NAG rock	TSF Footprint	Protection of exposed TSF surfaces	0	18	
				171,575		

Mount Nansen Remediation Project - Review of Cost Estimate Scope and Bases (per Engineering Agreement C00025524 dated 26 August 2014)
Material Volumes By End Purpose

Activity ID	Borrow Source	Destination	End Purpose	Bank Volume (bcm)	Item	
260	NW Pile - PAG rock	Open Pit	Final storage under pit cover	40,800	9	Will be increased to 21,175 m3 in 60% phase
350	Ketza shop PAG rock	Open Pit	Final storage under pit cover	1,787	24	
350	Mill Area - PAG rock	Open Pit	Final storage under pit cover	12,120	25	
350	Roads - PAG rock	Open Pit	Final storage under pit cover	14,777	26	
355	East Pile - PAG rock	Open Pit	Final storage under pit cover	20,000	29	
355	NW Pile - PAG rock	Open Pit	Final storage under pit cover	115,617	30	
355	West Mid Pile - PAG rock	Open Pit	Final storage under pit cover	32,851	32	
				237,952		
225	Ore at pit entrance ramp	Open Pit	Final storage under pit cover	8,000	3	Crushed
325	Toe.berm portion of tails/rock/subexc/toe.berm mix	Open Pit	Final storage under pit cover	5,800	14	
350	Concrete demolition waste	Open Pit	Final storage under pit cover	2,600	21	
350	Contaminated soils d/s of TSF seepage pond	Open Pit	Final storage under pit cover	1,000	22	
350	Hydrocarbon soils (Katza, mill, roads)	Open Pit	Final storage under pit cover	9,422	23	
350	Subexc under seepage pond area	Open Pit	Final storage under pit cover	600	27	
350	Tailings/soils from mill ponds	Open Pit	Final storage under pit cover	2,200	28	
355	Ore stockpile	Open Pit	Final storage under pit cover	1,812	31	
				31,434		
375	Sand	Open Pit	Interim cover	80,000	33	
375	West Lower Pile - NAG rock	Open Pit	Interim cover	24,000	34	
				104,000		
415	Sand from Main Dam and Seepage Dam	Stockpile Near Open Pit	To be used later for final cover	69,890	35	
				69,890		



Appendix 6A – Cost Review Workshop Agenda and Presentation Slides

Meeting Agenda

Project Name: Mount Nansen Remediation Project - Cost Refinement Workshop

File No.: VM00605K.1.104

Location: Gold Room – Hougén Centre, Suite 230, 2nd floor & Teleconference, Whitehorse

Date: 23 October 2014, 08:30 to 16:30 (PDT)

Attendees:

Patricia Randell (AAM)	Fred Green (LSCFN)
Josée Perron (AAM)	Bill Slater (Consultant)
Luca Poloni (AAM)	Brian Geddes (AMEC)
Jason Berkers (AANDC)	Serge Chevrier (AMEC via phone)
Chris Dixon (AANDC)	Ed McRoberts (AMEC via phone)
Robert Moar (LSCFN)	Christine Peters (AMEC via phone)
Kim Winnicky (LSCFN)	

Objectives:

- Present findings of cost review.
- Continue discussions regarding cost reduction opportunities/strategies.
- Review next steps.

Review Context Statement:

The scope of this review was to identify and consider cost reduction opportunities within the constraints and objectives of Option 4 (i.e., without re-examining the basic option assessment or selection process). The review examines alternate assumptions that were intended to satisfy the key tenants of Option 4, specifically:

- tailings relocation and dam decommissioning;
- placement of “low moisture” tailings;
- maintenance of tailings above the water table;
- restriction of infiltration into contained tailings and PAG rock via engineered cover;
- provision of stable and useable backfilled pit surfaces over reasonable timeframes (i.e., without creating practically indefinite restrictions on land use); and
- maintenance of downstream surface water quality within recognized regulatory standards.

Some of the alternate assumptions proposed may test the limits of these constraints. However, there may be additional cost reduction opportunities provided by a re-examination of the need for, and/or value provided by, these basic characteristics of Option 4.



		<u>Section Lead</u>	<u>Time Check (Completion by)</u>
1.	Introductions	Geddes	08:30
2.	Presentation of Cost Review		
	2.1 Scope Overview	Geddes	08:45
	2.2 Estimate Reconciliation	Chevrier	10:15
	.1 Detailed Estimate Reconciliation		
	.2 Detailed Quantity Reconciliation		
	.3 Summary Comments		
	2.3 Assumptions Review	Geddes	12:15
	• Detailed Review and Discussion of Table 3.2-1		
	Lunch		12:45
	2.4 Sensitivity Assessment	Geddes	13:30
	.1 Lower Bound Estimate		
	.2 Upper Bound Estimate		
	.3 Cost, Uncertainty Risk Balance		
	2.5 Cost Reduction Opportunities	Geddes	14:30
	.1 Reducing Uncertainty		
	.2 Scope Revisions		
	.3 Value Engineering		
3.	Additional Cost Reduction Issues, Opportunities, Constraints	Geddes	15:30
	• General discussion under the following categories		
	– Scope		
	– Execution Methods		
	– Performance Outcomes		
	– Procurement Constraints		
4.	Wrap up and Summary	Geddes/ Randell	16:30

Mount Nansen Remediation Project

30% Design Phase

Review of Cost Estimate Scope and Bases

Assessment and Abandoned Mines

Whitehorse, YT

October 23, 2014

Review Objective



To review the costs included in AMEC's Phase 1 (i.e. 30% Design Phase) estimate to identify potential reductions in the overall project cost.

- Teleconference with AAM, AANDC and Little Salmon Carmacks First Nation (LSCFN) to identify potential areas for further consideration.
- Reviewing costs included in the Phase 1- Class 3 cost estimate and the previous cost estimate for this project (LORAX/AECOM - Class 5) to produce a report identifying potential reductions.
- Workshop with AAM, AANDC and LSCFN in Whitehorse to present the findings of the cost refinement exercise.

AMEC's methodology was comprised of the following three tasks:

- Cost reconciliation;
- Estimating assumptions review and update; and
- Cost sensitivity assessment.

A reconciliation of the pre-Phase 1 LORAX/AECOM (Class 5) estimate and the Phase 1 (Class 3) estimate to identify:

- Any previously unidentified scope elements that were added to the Phase 1 estimate;
- Key elements of the project scope and/or the associated execution methods that exhibit significant differences between the estimates; and
- The primary drivers for cost differences in those scope areas/execution methods (e.g. differences in quantity, pricing and/or execution methodology).

Updating Estimating Assumptions



Reviewed key assumptions in light of developments since the conclusion of Phase 1 to identify where modifications could be justified, or to identify those scope elements where equally valid estimating assumptions could change cost outcomes.

- Intended to quantify the influence of those inputs known to carry the greatest uncertainty (i.e. defining a consensus range for the most sensitive quantities and/or prices and determining the influence on final estimate ranges).
- Did not attach probabilities to specific cost outcomes.
- Addressed some of those key variables where assumptions about contractor execution methods and capabilities have a strong influence on estimate outcomes.

Estimate Reconciliation - Source Estimates



- Pre-Phase 1 Class 5 estimate (the “AECOM Estimate”) - a consolidation of the pre-Phase 1 estimate was provided by AECOM (2011) as a component of the alternatives assessment process that selected Option 4. This document consolidated or referenced information from the following supporting estimates:
 - AECOM (2010) provided costs for the core elements (largely materials handling scopes) for the various remedial options under consideration at the time;
 - Altura (2010) provided costs for surface reclamation and scope elements that were common to all remedial options;
 - Golder (2010) provided costs for the Open Pit cover;
 - AECOM (2009) provided costs for project water treatment requirements;
 - Altura (2011) provided costs for water quality mitigation actions that might be required in future (i.e. potential Adaptive Management costs);
- Phase 1 Class 3 estimate (the “AMEC Estimate”) - the final Phase 1 (30% Design Phase) estimate is provided by AMEC (2014).

- Used the AMEC estimate as the base case and compared to the AECOM estimate.
- AMEC estimate was first rearranged into significant work groupings.
- AECOM cost estimate items were then assigned as applicable to comparable work groupings.
- For clarity, the AMEC scope items were left aligned and assigned a black font, while the AECOM scope items were right aligned in the same column and assigned a red font.
- Three columns were added to clarify the scope of the work, if necessary, and to characterize the variance into quantity and price driven components.
- Table 2.3.1-1 provides summary level cost reconciliation.
- Appendix 2A provides detailed reconciliation for the summary reconciliation in Table 2.3.1-1.

Detailed Estimate Reconciliation (cont'd)



Table 2.3.1-1 Reconciliation Summary

Table 2.3.1-1 Estimate Reconciliation Summary

Make-up on 2010 ABCOM costs (see other tabs) to account for inflation between Q4 2010 and Q4 2014 -----

COST ITEM	AMEC Q4 2014 \$/m	ABCOM Q4 2014 \$/m (2010 market est)	VARIANCE
DETAILED DESIGN, CONSTRUCTION DOCUMENTS	2,250,000	1,842,154	408,846
COCA DURING CONSTRUCTION	3,000,000	2,140,878	859,122
SITE MAINTENANCE BETWEEN CONSTRUCTION SEASONS	2,100,000	0	2,100,000
MOBILIZATION / DEMOBILIZATION	2,850,000	438,000	2,412,000
BIOGAS CONTROL	844,714	84,800	759,914
HALL ROADS AND PIT WALLS	754,770	0	754,770
PONY CREEK ADIT PILES	128,800	372,800	(244,000)
DEMOLITION AND HAZARDOUS PRODUCTS REMOVAL	3,870,750	2,208,070	1,662,680
WATER TREATMENT PLANT	7,842,714	2,180,000	5,662,714
WELL POINT DEWATERING SYSTEM	11,200,437	0	11,200,437
WHITE ROCK TO OPEN PIT	4,878,800	1,874,800	3,004,000
WHITE ROCK TO TRF FOR EQUIPMENT SUPPORT AND MOONS, THEN TO OPEN PIT WITH THE TAILINGS	4,734,000	0	4,734,000
TRAILERS TO OPEN PIT	8,152,878	4,808,000	3,344,878
EXCAVATION TO OPEN PIT	1,048,000	140,000	908,000
MISC WHITE PRODUCTS TO OPEN PIT	1,027,288	378,000	649,288
REMOVE TRF DAM	1,880,000	1,480,400	399,600
DOMS CREEK RESTORATION	3,908,204	1,408,100	2,500,104
EXPLORATION TRENCHES	347,478	200,400	147,078
LANDFORMING & REVEGETATION	2,087,000	800,000	1,287,000
DECOMMISSION SITE ROADS	630,881	171,174	459,707
COVER OVER OPEN PIT	7,878,204	2,812,000	5,066,204
CONTINGENCY	13,200,000	8,024,804	5,175,196
OBM COSTS (NPV)	4,738,724	4,987,800	(249,076)
DEBON CONTINGENCY (NPV)	1,411,800	0	1,411,800
ADAPTIVE MANAGEMENT (NPV)	2,878,844	0	2,878,844
	89,804,221	33,740,222	56,064,000

- Summary reconciliation of the quantities is presented in Table 2.3.2-1.
- Quantities in the table are colour coded to correlate with the detailed reconciliation quantities in Appendix 2B.
- Detailed breakdown is colour coded and summarized into major quantity groupings at the bottom of the spreadsheet.
- Appendix 2B also contains a second detailed quantities reconciliation that identifies the sources of rock and tailings used for various remedial components.

Detailed Quantity Reconciliation (cont'd)



Table 2.3.2-1 Quantity Reconciliation Summary

Table 2.3.2-1 Quantity Reconciliation Summary

Item	QUANTITY ITEM	AMEC (#ft ³)	ARCCOM (#ft ³)	Reconciliation Comments		
				Group	Quantity	Timing/Total Use
1	Settings relocated to open pit	207,130	207,000			
2	TSP matting relocated to open pit	92,800	11,000			
3	MSD rock that used for TSP matting before transfer to open pit	102,580	0	MSD matting is 90% of items 1 and 2		
4	MSD rock relocated directly to pit	207,580	207,000			
5	MSD rock relocated to pit for platform	43,900	44,000			
6	MSD rock relocated to ballrooms	48,200	0			
7	MSD rock relocated to TSP for protection of exposed surfaces	107,280	0			
8	Miscellaneous other contaminated soils	20,000	0	MSD matting contains some minor soils with lamp soils		
9	Crust material used for exposed TSP protection	34,000	22,780			
10	Crust material returned to original source pits	0	47,280			
11	Crust material stockpiled for later use in final open pit cover	66,800	60,000			
12	MSD rock for interim cover over open pit	34,000	0			
13	Variable crust, sand/for interim cover over open pit	62,000	0			
14	Final cover over open pit	72,000	43,000			

Note: The site matting contains some quantity treatment by volume ratio in Appendix 10

Detailed Quantity Reconciliation (cont'd)



Appendix 2B – Detailed Quantity Reconciliation

Baseline Activity ID	Name/ Baseline	Description	Purpose	Mark Value (Sum)	Item	
210	South Pile - NAD rock	Open PE	Rock platform	38,750	1	Crested
220	West Lower Pile - NAD rock	Open PE	Rock platform	4,880	2	
230	One of pile extension (top)	Open PE	Final storage under pile cover	8,800	3	
230	South Pile - NAD rock	Open PE	Open PE Subarea	8,000	4	
				50,330		
230	EW Lower Pile - PAD rock	TSP	Supply mats & mixing of mats	48,800	5	Items 6+ 11 + 50% of Items 7+12 + 13 Items 7+ 12 + 137,000 m ²
230	Rock portion of Subarea/Subarea/Subarea m ²	Open PE	Final storage under pile cover	27,750	6	
230	Tide portion of Subarea/Subarea/Subarea m ²	Open PE	Final storage under pile cover	20,000	7	
				80,550		
230	West M ² Pile - PAD rock	TSP	Supply mats & mixing of mats	38,800	8	Items 6+ 11 + 50% of Items 7+12 + 13 Items 7+ 12 + 137,000 m ²
230	NE Pile - PAD rock	Open PE	Final storage under pile cover	48,800	9	
230	West M ² Pile - PAD rock	TSP	Supply mats & mixing of mats	48,800	10	
				136,400		
230	Rock portion of Subarea/Subarea/Subarea m ²	Open PE	Final storage under pile cover	118,800	11	Items 6+ 11 + 50% of Items 7+12 + 13 Items 7+ 12 + 137,000 m ²
230	Subarea portion of Subarea/Subarea/Subarea m ²	Open PE	Final storage under pile cover	50,000	12	
230	Tide portion of Subarea/Subarea/Subarea m ²	Open PE	Final storage under pile cover	181,800	13	
230	Two items portion of Subarea/Subarea/Subarea m ²	Open PE	Final storage under pile cover	8,800	14	
				359,400		
230	Barrel from West Channel Storage Dam	TSP Pile/pt	Protection of exposed TSP surfaces	14,500	15	
230	NE Area - NAD rock	TSP Pile/pt	Protection of exposed TSP surfaces	78,800	16	
230	West Lower Pile - NAD rock	TSP Pile/pt	Protection of exposed TSP surfaces	17,450	17	
230	EW Upper Pile - NAD rock	TSP Pile/pt	Protection of exposed TSP surfaces	0	18	
				107,750		
240	South Pile - NAD rock	Open PE	Open PE Subarea	37,850	19	
240	EW Upper Pile - NAD rock	Open PE	Open PE Subarea	38,350	20	

Reconciliation Findings – Detailed Estimate Reconciliation



The following items were excluded from the AECOM estimate:

- Site maintenance between construction seasons (\$2.1M);
- Haul road and pit wall stabilization (\$0.7M);
- Well point dewatering (\$11.3M);
- PAG rock/tails mixing (\$4.7M);
- Design contingencies (\$1.4 million); and
- Adaptive management items (\$3.8 million).

Reconciliation Findings – Detailed Estimate Reconciliation (cont'd)



Major differences can also be attributed to the following items:

- The general approach to the two estimates as introduced in Section 2.4.1.
- The general methodology assumed for removing the tailings from the TSF.
- Reclamation of the TSF footprint.
- Water treatment.
- Landforming.
- Removal of hazardous materials from site.
- Contingency.

Differences are evident in most of the primary material categories, specifically:

- Tailings.
- Waste rock.
- TSF subexcavation.
- Dam fills.
- Open Pit cover.

- Scope of work:
 - Methodology to remove the tailings and relocate them to the pit;
 - Final landforming and revegetation
 - Water treatment options
 - Open Pit cover concept
- Quantities:
 - Confirming quantities important
- Project Costs:
 - May be relatively minor, although some items will be re-examined based on potential quantity revisions
- Project Schedule:
 - Schedule activities are driven by quantities of work and estimator productivity assumptions

Review Scope and Objectives

- Intended to identify any changes to key estimate assumptions that might be defended based on design developments post Phase 1, or based on reconsideration of the Phase 1 estimate variables.

Key Scope Areas and Alternate Assumptions

- Table 3.2-1 provides a summary of key project scope areas and the influence of assumptions applied in these areas on the cost estimate.
- Focuses on those elements of the project that are known to carry considerable uncertainty and that are likely to have significant influences on total project costs.

Review Limitations

- Design development activity has not progressed materially post Phase 1 so that the outcomes of the more detailed considerations of key project variables that is contemplated for Phase 2 are not yet available.
- Important to avoid tendency to preferentially select optimistic estimating assumptions with a view towards reducing the resulting estimate.

Table 3.2-1: Summary of Key Estimating Assumptions

Key Scope Area	Basis of Phase 1 Estimate	Characterization of Phase 1 Assumptions	Potential Range of Assumption Adjustments
1. Civil Quantities			
<p>Civil quantities refers to the large volume material categories that will require movement and/or handling to affect remediation, specifically:</p> <ul style="list-style-type: none"> • Tailings; • Dam fill; • Waste rock; and • Contaminated soils and rock <p>To a large degree, remediation for the Nansen property means relocation of these key material categories (i.e. civil materials management and remediation are, to a large degree, the same thing), meaning that the quantity estimates for these material categories have a major influence on the estimate.</p>	<p>The Phase 1 civil quantity estimates were developed using contemporary civil software (AutoCAD and Eaglepoint) and the site topographic and LiDAR data available (Canada Digital Elevation Data (CDED) topo and AAM supplied LiDAR survey). Some key inputs to this process relied on interpretations and/or judgements about the physical extents of particular material categories, namely:</p> <ul style="list-style-type: none"> • The base of the tailings; • The limits of contaminated sand fill; • The depth of contamination below the TSF footprint; • The limits of contaminated soils and rocks in the mill area; and • The extent of tailings movement and deposition within the Dome Creek valley outside the immediate limits of the TSF. 	<p>Generally speaking, AMEC's assumptions about the physical extents of material categories that are poorly understood were in the middle of the range of possible assumptions. There is more than a small probability that the actual material limits could combine in ways that reduce the total materials handling liability. Of course, this observation goes both ways, and volumes could increase. In addition, the 2014 SI work (i.e. post Phase 1) suggests that contaminated sediment impacts in the Dome Creek valley beyond the TSF are greater than previously thought.</p>	<p>AMEC's judgement would be that a range of $\pm 20\%$ on key quantities that are influenced by poorly defined material limits would be reasonable for the sensitivity analysis (again, this is beyond the normal variance in civil quantity estimating described in Section 3.2). This range has been incorporated into the lower and upper bound sensitivity assessments. Greater resolution or definition of this range can't be supported without the more detailed examinations and calculations that will form part of Phase 2.</p> <p>In addition, assumed sediment volumes in the Dome Creek valley outside of the TSF will be increased by roughly 100% for the upper bound sensitivity assessment to evaluate the potential cost impact of the increased creek bed sediment removal scope that has been identified post Phase 1.</p>

Table 3.2-1: Summary of Key Estimating Assumptions (cont'd)

Key Scope Area	Basis of Phase 1 Estimate	Characterization of Phase 1 Assumptions	Potential Range of Assumption Adjustments
2. Waste Rock Characterization			
<p>This is related to the civil quantities issue in that it influences the volumes of waste rock that are ultimately directed to the Open Pit. The issue is the potential challenge related to distinguishing between PAG and non-PAG waste rock during project execution. Managing and/or mitigating this challenge might require extensions to the execution schedule and/or additional costs for onsite laboratory capabilities.</p>	<p>The Phase 1 estimate assumed that PAG/non-PAG distinctions could be made without significantly influencing project execution schedules or support requirements (i.e. on the basis of pre-execution characterization data or readily applied field protocols).</p>	<p>This Phase 1 estimating assumption was comparatively liberal in that there is a good possibility that direct analytical measures will be required to make reliable PAG/non-PAG distinctions in practice. This will likely require the development and maintenance of a fairly robust onsite analytical capability with an associated sampling capability and infrastructure. In addition, the effectiveness and efficiency of these capabilities will have practical limits that could result in some proportion of the non-PAG inventory being directed to the Open Pit.</p>	<p>AMEC has assumed that the PAG/non-PAG field differentiation issue can be adequately managed during field execution via the development and maintenance of an onsite sampling and testing capability, and that applying this capability will not compromise the efficiency of the materials handling operation, or the proportion of the non-PAG rock inventory directed to the Open Pit. For the upper bound sensitivity assessment, AMEC has assumed upfront laboratory development costs of \$100,000 and annual operating costs (including staffing) of \$500,000 for this sampling and testing capability.</p>

Estimate Assumptions (cont'd)



Key Scope Area	Basis of Phase 1 Estimate	Characterization of Phase 1 Assumptions	Potential Range of Assumption Adjustments
3. Materials Handling Methods			
<p>The specific techniques used to move the major civil material categories, particularly tailings, to the Open Pit has a fundamental influence on both the execution schedule and total project cost. The assumptions about methods reflect AMEC's interpretations of how several key project uncertainties (e.g. tailings handling and placement characteristics) might be managed and/or mitigated (i.e. these assumptions are not only critical to the estimate, they must be made within a context of considerable uncertainty).</p>	<p>The Phase 1 Design Base Case and estimate assumed conventional truck and shovel movement of key material categories. Wet tailings were assumed to be managed via upfront wellpoint dewatering and mixing of tails with PAG rock (i.e. a significant portion of the PAG rock inventory destined for the Open Pit is double handled). The general PAG/tails mixing ratio was set at between 1:2 to 1:2.5 for the Phase 1 estimate. In addition, the Phase 1 concept assumed that a certain proportion of the PAG inventory would be used at the TSF (prior to disposition in the Open Pit) to provide trafficable surfaces on the TSF excavation benches and haul roads.</p>	<p>AMEC views the assumed dewatering/mixing/truck and shovel methods as a robust approach for managing and mitigating the uncertainties related to tailings movement and placement. It is possible, indeed likely, that an experienced and well equipped contractor could propose an alternative combination of methods and equipment that could lower costs, particularly if contractors could mitigate their commercial risks by undertaking some form of trial prior to full scale execution.</p> <p>In addition to assumptions about the general execution methods, AMEC's Phase 1 estimate relies on assumptions about the effectiveness of tailings dewatering (see subsequent table entry), the required PAG rock/tails mixing ratio and the interrelation between these variables. AMEC's assumption for PAG/tails mixing is in the middle of a potentially fairly wide range for this variable, which is influenced not only by tailings handling requirements, but by the configuration and height of excavation benches within the TSF.</p>	<p>For the lower bound sensitivity analysis, a general materials handling scope and price reduction factor of 20% will be applied. Absent more detailed analysis, great resolution of this figure is not possible; it simply reflects AMEC's view that there is a good possibility that a successful engagement of the contracting community in an appropriately structured procurement strategy (see Section 5.1.2) could identify more cost effective materials handling methods.</p> <p>A variation of $\pm 30\%$ on the potential PAG/tails mixing ratio will also be considered in the sensitivity assessment.</p>

Table 3.2-1: Summary of Key Estimating Assumptions (cont'd)

Key Scope Area	Basis of Phase 1 Estimate	Characterization of Phase 1 Assumptions	Potential Range of Assumption Adjustments
4. Water Treatment			
<p>Pit and pond waters will require treatment both to provide unencumbered access to key work areas and to meet water quality release standards.</p>	<p>The Phase 1 estimate includes the construction of a fixed (i.e. non mobile) water treatment plant dedicated to the project's requirements.</p> <p>The Phase 1 estimate assumed that most of the onsite water inventory would need to be treated over a relatively short time frame to support the assumed execution schedule (i.e. onsite water storage was not used to attenuate the peak plant throughput capacity).</p> <p>Finally, the assumed Phase 1 treatment plant incorporated a comparatively broad inventory of process units to accommodate the full range of critical parameters that could report to the plant.</p>	<p>The assumed water treatment configuration and capacity is viewed as conservative. It was known at the outset that costs could likely be reduced by optimizing the provision of onsite water storage with plant throughput capacity, and via a more detailed examination of process unit and reagent consumption requirements.</p>	<p>Post Phase 1 treatability testing undertaken during the 2014 SI program suggests that a 15% reduction in the scope of the treatment capability can likely be defended (AMEC, 2014a). This reduction will be reflected in the lower bound sensitivity assessment.</p> <p>In addition, a general 20% reduction in treatment scope/cost will be applied to reflect AMEC's judgement about the potential outcome of the storage vs. capacity optimization planned for Phase 2.</p>

Table 3.2-1: Summary of Key Estimating Assumptions (cont'd)

Key Scope Area	Basis of Phase 1 Estimate	Characterization of Phase 1 Assumptions	Potential Range of Assumption Adjustments
5. Open Pit Cover			
<p>The cover used to limit water and oxygen ingress into the backfilled Open Pit is a significant component of the project scope because of both its influence on project outcomes (i.e. surface water quality) and because of its nature, scale and hence, cost. In addition, the cover will be subject to substantial differential settlements and the methods assumed to mitigate these settlements have a significant influence on costs.</p>	<p>The Phase 1 estimate assumed that the problem of large and somewhat unpredictable differential cover sediments would be addressed by replacing an interim cover (constructed with locally available granular materials) by a permanent structure constructed after tailings consolidation has reduced differential settlements to more manageable levels (assumed to occur some 10 years after interim cover placement). The permanent cover was assumed to be a composite, geosynthetically based structure.</p>	<p>The Phase 1 interim/permanent cover concept is viewed to be a conservative approach to mitigating differential settlements. It may be possible to lower costs by relying more on cover maintenance and/or repair than complete replacement.</p>	<p>The lower bound sensitivity assessment will assume the interim cover is replaced by a thicker sand/bentonite mix that will be more amenable to regular regrading and maintenance. The assessment will assume that this alternate cover concept will avoid the need for replacement in year 10. Absent the Phase 2 design, performance modelling and estimating needed to support this alternative cover concept, the sensitivity assessment will simply assume parity between the Phase 1 interim and alternate cover concept costs, and delete the expense related to cover replacement in season 10 and the subsequent maintenance costs originally included in the estimate for this permanent cover.</p>

Table 3.2-1: Summary of Key Estimating Assumptions (cont'd)

Key Scope Area	Basis of Phase 1 Estimate	Characterization of Phase 1 Assumptions	Potential Range of Assumption Adjustments
6. Dewatering			
<p>A wellpoint dewatering system is used both to meet the Option 4 objective of “low moisture tails” and to provide conditions in the TSF compatible with a safe truck and shovel removal operation. The assumed dewatering system is of a significant scale, and is closely integrated with the execution schedule and, therefore, has a significant influence on project costs.</p>	<p>The Phase 1 estimate assumed a wellpoint dewatering system operated on a 25 m grid over the TSF, with production characteristics consistent with complete dewatering over two summer construction seasons. These assumptions were based on a consideration of the physical characteristics of the tailings, what is known about the variation of those characteristics, and typical wellpoint system efficiencies (i.e. none of the site specific field trial data that systems of this sort are typically designed from).</p>	<p>The Phase 1 dewatering assumptions were of necessity made within a wide range of possibilities. The assumed wellpoint densities and production characteristics could be viewed as generally conservative, but not unrealistically so. It should be noted that costs for these systems are fairly sensitive to relatively modest adjustments in assumed spacing and production.</p>	<p>For the lower bound sensitivity analysis, AMEC has made the following adjustments:</p> <ul style="list-style-type: none"> • Increasing the required wellpoint spacing from a 25 m grid to a 30 m grid; and • Increasing wellpoint production capacity by 30%. <p>Combining these elements reduces the required scope and cost of the dewatering effort by some 50%.</p>

Estimate Assumptions (cont'd)



Table 3.2-1: Summary of Key Estimating Assumptions (cont'd)

Key Scope Area	Basis of Phase 1 Estimate	Characterization of Phase 1 Assumptions	Potential Range of Assumption Adjustments
7. Reclamation of the TSF Footprint			
<p>The removal of the TSF will leave an excavation in the Dome Creek valley that must be stabilized thermally, geotechnically and hydraulically by the placement of appropriately graded fill.</p>	<p>The Phase 1 estimate assumed that the remediated TSF footprint would be stabilized by placing a 1.2 m layer of NAG waste rock over a bedding of imported sand.</p>	<p>The thickness of the NAG waste rock cover was conservatively set at 1.2 m. There is a reasonable possibility that detailed design activities would support a reduction in this thickness.</p>	<p>For the lower bound sensitivity assessment, AMEC has reduced the NAG waste rock cover thickness by 25%.</p>

Table 3.2-1: Summary of Key Estimating Assumptions (cont'd)

Key Scope Area	Basis of Phase 1 Estimate	Characterization of Phase 1 Assumptions	Potential Range of Assumption Adjustments
8. Reclamation Concept			
<p>The costs of reclamation are influenced by the extent to which vegetated surfaces (as opposed to graded granular surfaces) are included in the Reclamation Plan.</p>	<p>The Phase 1 Reclamation Plan acknowledged the limited availability of organic substrates and the associated constraints on reclamation plans by limiting revegetation efforts to patches in specified areas and spacings.</p>	<p>Current regulations provide considerable latitude in the specific prescriptions proposed for restoring land capability and aesthetics. The extent to which revegetation features in the Reclamation Plan depends, therefore, in no small part on the subjective preferences of the Project Partners. It is possible that a non-vegetated reclamation concept relying on regraded granular surfaces could be defended, provided this was accepted by the Partners.</p>	<p>The lower bound sensitivity assessment assumes that all revegetation elements (including the associated trials and/or plots) are removed from the estimate.</p>

Table 3.2-1: Summary of Key Estimating Assumptions (cont'd)

Key Scope Area	Basis of Phase 1 Estimate	Characterization of Phase 1 Assumptions	Potential Range of Assumption Adjustments
9. Special Waste Disposition			
<p>A portion of the contaminated soil/rock inventory is anticipated to exhibit parameter levels above regulatory thresholds defining special or hazardous waste. This designation invokes additional handling and disposition requirements for the materials involved.</p>	<p>This Phase 1 estimate assumed that the relatively modest proportion of Mount Nansen soils/rocks likely to be categorized as special waste would be directed to an existing, appropriately permitted facility near Fort Nelson, BC. This assumption was made largely to avoid the permitting and public consultation liabilities that are often created by locating special waste disposition facilities (usually landfills) on a source site.</p>	<p>While the Mount Nansen volumes involved are likely to be comparatively small, the very high unit costs of transport and disposal make this line item a significant contributor to the total project estimate. The decision to mitigate potential permitting and consultation liabilities via offsite disposition can be viewed as a conservative one. Technically, there is little reason to believe that an appropriate disposal capability for these materials could not be incorporated at much lower unit cost into the broader Open Pit containment design.</p>	<p>The lower bound sensitivity assessment will assume that the special waste inventory will be directed to an appropriately engineered and dedicated location within the Open Pit containment structure. The incremental development costs for this dedicated containment structure will be assumed to be \$100/m³.</p>

Table 3.2-1: Summary of Key Estimating Assumptions (cont'd)

Key Scope Area	Basis of Phase 1 Estimate	Characterization of Phase 1 Assumptions	Potential Range of Assumption Adjustments
10. Design Contingencies and Adaptive Management			
<p>These are measures considered during Phase 1 to mitigate the risks that unacceptable degradations of downstream surface water quality could develop at some time following remediation.</p>	<p>The Phase 1 estimate included provisions for design contingencies focused on facilitating the collection of pit seepage (should they become necessary) and for Adaptive Management measures ranging up to the long term treatment of pit seepage to ensure compliant surface water quality.</p>	<p>The provision of these design contingencies and Adaptive Management measures was based on a conservative interpretation of pit containment and cover performance over the long term. There is a reasonable probability that acceptable water qualities could be realized without invoking these measures.</p>	<p>The lower bound sensitivity assessment will delete the provisions for design contingencies and Adaptive Management measures focused on mitigating surface water quality compliance risks.</p>

Tables 4.1-1 (Lower Bound Estimate) and 4.1-2 (Upper Bound Estimate) structure and format:

- Borrow from the summary worksheet prepared for the Phase 1 estimate.
- Line items for each construction season were sorted from greatest to lowest cost.
- Columns have been added to facilitate the adjustment of costs for each line item by a single specified factor.
- Incorporates selectable factors to assess inputs that apply globally to the estimate.
- Colour coding has been used to identify those particular line items that have been influenced by an individual factor.
- Adjustments to civil quantities completed in ways that maintained the overall materials balance.
- Indirect costs modified in proportion to the change in direct costs.

Assessment Outcomes:

- Table 4.2-1 summarizes both the lower and upper bound estimates against the base estimate and tabulates the variances from the base for each.
- Tables describe a lower bound estimate of about \$60 M and an upper bound of \$94 M, on a base estimate of some \$90 M.
- Position of the base estimate within the limits of this range can be viewed as a rough indication of the degree of conservatism in the base estimate.
- This interpretation should be applied with caution, absent a more systematic, risk based quantification of cost probabilities.
- Lower and upper bounds are not definitive limits (i.e. 100% certainty); costs outside this range are possible.

Assessment Outcomes – Lower Bound Estimate:

The following assumptions/issues are likely to have the greatest influence on potential reductions from the base estimate (in declining order of importance):

- The pit cover concepts and maintenance protocols applied to mitigate post remediation differential settlements in the backfilled pit (\$5.9M);
- The extent to which design contingencies and Adaptive Management protocols must be applied to mitigate risks associated with post remediation downstream surface water quality excursions (\$5.2M);
- The configuration and efficiency of the wellpoint dewatering system used to facilitate the excavation of tailings (\$4.6M);
- The specific materials handling methods applied for the movement of tailings and PAG rock to the Open Pit (\$3.3M);
- The capacity, configuration and reagent consumption for the water treatment capability developed to accommodate waters incompatible with direct release onsite (\$2.3M);
- The approach taken for the disposition of contaminated soils categorized as special waste (i.e. onsite vs. offsite) (\$2.3M); and
- The extent to which reclamation concepts rely on revegetated vs. granular finished landscapes (\$1.3M).

Assessment Outcomes – Upper Bound Estimate:

The following assumptions/issues are likely to have the greatest influence on potential increases to the base estimate:

- The materials handling methods applied for the movement of tailings and PAG rock to the Open Pit (\$1.6M).
- The methods used to distinguish in the field between PAG and non-PAG waste rocks during project execution (\$1.6M).

Assessment Outcomes – Balancing Uncertainty, Risk and Cost

- Useful to consider what decisions might be required, and/or what outcomes are needed, to realize costs approaching the lower bound estimate.
- For some issues, realizing these lower costs may be a matter of taking on higher risks and accepting the negative consequences potentially associated with them.
- For others, it is not really a matter of taking discretionary risk management decisions, but rather, mitigating uncertainties in ways that produce positive cost outcomes through additional design development activity.
- Predicting the likelihood that any particular set of risk management decisions and/or design development outcomes will produce an estimate trending towards the lower bound is difficult, absent a more detailed cost risk analysis exercise.
- Table 4.3-1 provides some qualitative judgements and comments relating to how these issues might play out for the key scope issues influencing the lower bound cost estimate.

Sensitivity Assessment (cont'd)



Table 4.3-1: Assessment of Key Scope, Cost and Risk Issues

Issue	Desired Outcome	Probability of Desired Outcome	Partner Decisions/Actions Required	Associated Risks	Risk Consequences
1. Materials Handling Methods for Tailings and PAG Rock	Preferred contractor proposes field validated execution methods that improve efficiency of materials handling.	High; effective engagement of contracting community offers potential for identification of innovative materials handling proposals.	Adoption of procurement processes that include a large, or full scale field validation step Adoption of more liberal pit backfill performance objectives (e.g. acceptance of wet material placement)	Procurement process extends schedule without providing the efficiency improvements sought. Extended pit consolidation/settlement timelines render pit landscape unusable over an indefinite period.	Moderate; unsuccessful trial/procurement process could introduce significant new costs and/or delays.
2. Tailings dewatering system configuration and efficiency (in practice, this issue will be related to, and integrated with, Issue 1)	Per Issue 1	High; per Issue 1.	Per Issue 1.	Per Issue 1.	Moderate; per Issue 1.
3. Water Treatment System	A water treatment capacity with fewer process units, reduced reagent consumption and lower hydraulic throughput than the Phase 1 configuration.	High; it is likely that Phase 2 design development will identify savings in water treatment concepts.	Proceed with Phase 2 design development (i.e. issue requires uncertainty mitigation via design development; there are no discretionary risk management options currently available).	Phase 2 design does not lower cost estimate.	Low.
4. Pit Cover Concept	Single cover constructed at remediation that facilitates mitigation of differential settlements via maintenance and avoids the need for a second permanent cover.	Moderate; there is a reasonable probability that a single, maintainable cover concept can be developed.	Acceptance of greater cover maintenance liability and potentially a more extended period of limitations on the utility of the pit landscape.	Cover maintenance cannot adequately mitigate settlements, requiring a second, potentially more costly, permanent cover.	Low; failure of the concept means reverting, in large part, to the two cover concept that is in the current base estimate.
5. Maintenance of Compliant Surface Water Quality	Maintenance of water quality compliance without the need for design contingencies (i.e. pit drainage structures) or Adaptive Management protocols (principally, future water treatment).	Moderate; there is a reasonable probability that an effective pit containment concept could mitigate water quality concerns without additional supports.	Accepting a higher potential for water quality excursions and a reduced capacity for responding to those excursions.	Extended periods of non-compliant surface water quality that may not become evident for many years post remediation (i.e. when institutional memory of related issues and potential responses diminished).	High; water quality excursions would be difficult to address after the fact, and tolerating extended compliance excursions would undermine one of the central purposes for undertaking remediation at the Mount Nansen site.
6. Disposition of Soils Classified as Special Wastes	Disposal onsite (i.e. dedicated cell incorporated within pit containment structure).	High; proposal is technically straightforward to develop and defend.	Accepting additional permitting and public consultation liability associated with onsite special waste facility development.	Proposal for onsite disposition is rejected at a later stage of project development.	Low; rejection of concept means reverting to the base estimate (with perhaps some incremental costs related to delays and proposal development).
7. Use of Revegetation in Reclamation Concepts	Reclamation plans that do not rely on revegetated landscapes.	Moderate; proposal is technically straightforward to develop, but acceptance may be dependent on the subjective views of public stakeholders.	Accepting additional permitting and public consultation liability potentially associated with reclamation plans proposing granular landscapes.	Proposed reclamation plans rejected at a later stage of project development.	Low; rejection of the concept means reverting to the base estimate (with perhaps some incremental costs related to delays and proposal development).

Reducing Uncertainty

Design Development

- Progression of any design beyond the 30% milestone (i.e. Phase 1) reduces uncertainties and increases the reliability of cost estimates, and AMEC expects that will apply to the MNRP.

Contractor Engagement

- The most effective way to finalize methods, mitigate detailed execution uncertainties, incorporate proprietary or innovative expertise, achieve fair pricing, and minimize chances of contractor non-performance, will be to engage the contracting community in the final development of detailed methods and prices.
- To achieve fair pricing given the unmitigated uncertainties and risks that even capable contractors will need to manage after a comprehensive consideration of available data, AMEC believes that approaches in which the execution contract is staged in some fashion should be considered (Table 5.1.2-1).

Table 5.1.2-1: Procurement Options Summary

Option	Pros/Cons	Comments
<p>1. Standalone field trial tendered during latter stages of design</p>	<p><u>Pros</u></p> <ul style="list-style-type: none"> Allows execution methods/pricing findings to be reflected in regulatory submissions and early project funding processes. <p><u>Cons</u></p> <ul style="list-style-type: none"> Not conducted at full scale; significantly limits utility of findings. No direct linkage to large scale scope; discourages contractors from being fully open with their expertise (i.e. they will be concerned about disclosing competitive advantages in the absence of a clear connection to a potential commercial upside). 	<p>Cons outweigh pros unless Partners place compelling weight on early information or if alternate procurement strategies are simply not possible.</p>
<p>2. Stages full scale execution with procurement “off ramps”.</p> <ul style="list-style-type: none"> Initial tender is a data/performance spec only; process open to all qualified contractors (i.e. follows a pre-qualification process). Owner defines a first stage scope that is anticipated to be sufficient to allow contractor to establish fair pricing (can't let contractor define because if initial tender price too high, will extend first stage). At conclusion of Stage 1: <ul style="list-style-type: none"> Owner has access to all data (other than proprietary pricing) acquired during stage and that could be used by any contractor to develop fair pricing. Contractor submits pricing for balance of scope based on learnings/outcomes of Stage 1. Owner then has option of: <ul style="list-style-type: none"> <input type="checkbox"/> accepting contractor's Stage 2 pricing; or <input type="checkbox"/> re-tendering Stage 2 with the expanded database provided by Stage 1 learnings/outcomes. 	<p><u>Pros</u></p> <ul style="list-style-type: none"> Reduces contractor's commercial risks and thereby increases chances for securing fair pricing. Reduces Owner's cost risk in the event that Stage 1 pricing is burdened by contingencies. Reduces potential for contractor non-performance in the face of unanticipated conditions. Can provide fair pricing based on full scale execution experience and data. <p><u>Cons</u></p> <ul style="list-style-type: none"> Gives incumbent contractor what may be perceived as unfair advantage for the Stage 2 scope. Replacing incumbent contractor would incur two mobilization charges (i.e. incumbent contractor's Stage 2 pricing would consider/reflect this advantage). Extends execution schedule by adding, at a minimum, an assessment/re-pricing effort between the stages and, at a maximum, the need to incorporate a second tender process. May not be compatible with AAM/AANDC procurement processes and constraints. 	<p>On balance, offers the best potential for engaging the contracting community and securing fair pricing for the largest component of project scope.</p>

Scope Revisions

Within the Option 4 Concept

- Assumptions review and sensitivity analysis were based on alternate assumptions that were intended to satisfy the key tenants of Option 4, specifically:
 - tailings relocation and dam decommissioning;
 - placement of “low moisture” tailings;
 - maintenance of tailings above the water table;
 - restriction of infiltration into contained tailings and PAG rock via engineered cover;
 - provision of stable and useable backfilled pit surfaces over reasonable timeframes (i.e., without creating practically indefinite restrictions on land use); and
 - maintenance of downstream surface water quality within recognized regulatory standards.
- Additional cost reduction opportunities may be provided by a re-examination of the need for, and/or value provided by, these basic characteristics of Option 4.

Outside of the Option 4 Concept

- Additional cost reduction opportunities available if changes beyond the current definition of Option 4 were to be considered.

Value Engineering

■ Overview

- VE is a systematic process used by a multidisciplinary team to improve the value of a project through the analysis of its functions.
- Value is commonly represented by the relationship:

$$\text{Value} = \text{Function/Resources}$$

- VE Process
 1. Information Phase
 2. Function Analysis Phase
 3. Creative Phase
 4. Evaluation Phase
 5. Development Phase
 6. Presentation Phase

Cost Reduction Opportunities (cont'd)



- VE Team
 1. VE Team
 2. VE Team Lead