LSCFN Review
Mt. Nansen Options Report
September 30, 2008

1.0 Introduction

The LSCFN Advisory Committee for Mt. Nansen Mine closure planning has reviewed the "Options for Closure of the Mt. Nansen Mine, Technical Review Version" (the Options Report). The Advisory Committee is comprised of Leta Blackjack, Community Coordinator; Robert Moar, Lands And Resources Officer; Mike Vance, Lands And Resources Director; James Baker, Implementation Director; Joe Bellmore, Land, Fish and Wildlife Manager; Johnny Sam, Traditional Coordinator; and Bill Slater, technical advisor.

This report provides the results of the Advisory Committee's review, compiled from discussion at two meetings held in August and September 2008 and a site visit held in August 2008. In completing the review, the Advisory Committee considered input received at past community meetings about the Mt. Nansen closure planning project.

As a basis for conducting its review of the Options Report, the Advisory Committee first identified our understanding of the overall purposes of the report. In general, the Options Report is considered to be the fundamental document to support upcoming options evaluation and final decision-making processes. We envision that both processes will involve all three governments, with the options evaluation conducted by working level and technical staff, while the decision-making will be conducted by senior bureaucrats or politicians, based in part on the outcomes of the options evaluation process. The Advisory Committee conducted its review with the interpretation that, in order to achieve its intended purpose, the Options Report needs to include three main components: (1) rationale for implementing a closure plan, identifying important issues and objectives, (2) description of the options under consideration, and (3) description of expected performance of each option in achieving the desired objectives.

Section 2 of this report addresses the Advisory Committee's comments about the rationale component of the Options Report, while Section 3 addresses the options descriptions and Section 4 addresses the description of performance.

Overall, the Advisory Committee believes that substantial additional information is required to support upcoming options analysis and decision-making processes. While information deficiencies occur in all three main areas of the report, much of the information is likely already available from reports on past programs and studies. Additional work may be required to address some information requirements. Despite the information requirements identified, LSCFN supports the desire to proceed quickly with closure options decisions and hopes to work with the other governments to ensure that information requirements can be addressed quickly.

2.0 The Rationale

Parts of Sections 1 and 2 of the Options Report provide the rationale for undertaking closure activities at the Mt. Nansen site, with Section 2 describing some existing issues as well as issues that could arise in the future while Section 1 describes the objectives that need to be achieved. In LSCFN's view, this "rationale" component of the Options Report would present a stronger case for dedicating resources to the closure project with the addition of some more detail about closure criteria and important values and some enhancement of the descriptions of issues.

2.1 Closure Objectives and Criteria

Section 1.3.2 of the Options Report describes the process used to identify closure objectives for the project. The resulting objectives are provided in Appendix C and include objectives related to human health and safety, environment, land use, socio-economic benefits and liability/risk. LSCFN and its citizens provided significant input for the development of the objectives and generally support the stated objectives.

In a general sense, LSCFN elders have expressed a desire that the closure plan should provide an outcome that is as close as possible to complete reclamation (i.e. returning the site as close to its original condition as possible). The elders have acknowledged that this is not necessarily an expectation for their own lifetime, but something that needs to be established as an overall long-term goal for the reclamation project.

Because the Options Report will be used as a primary supporting document for decision-making about Mt. Nansen closure, it should describe the key closure criteria that will apply. This should include flood and earthquake design events as well as water quality criteria. The selection of flood and earthquake design events should consider guidelines established by the Canadian Dam Association, while recognizing the environmental, cultural and spiritual importance of the downstream environment to LSCFN citizens. The water quality criteria should rely on guidelines and protocols established by the CCME.

Soils too

2.2 Values

The primary basis for carrying out closure activities at the Mt. Nansen site relates to the protection and restoration of the environmental, cultural and traditional use values in the area. The rationale component of the Options Report would benefit from a brief description of these values because these are the reasons that our people, especially our elders, feel harmed by the damage that has occurred and think the area is important. Including this information in the Options Report will help other decision-makers to understand the values that are at stake.

2.3 Issues

Section 2.2 of the Options Report provides a brief description of site environmental issues. LSCFN believes that this section needs to provide a strong rationale for completing a closure plan, because this will form the basis for future decisions to allocate resources to the project. As such, it needs to provide a thorough description of current and potential future issues at the site. It should identify and discuss unacceptable existing conditions as well as potential future effects including risks. Issues of importance to LSCFN are identified below, along with some comments about the adequacy of their characterization in the Options Report.

2.3.1 Physical Stability of Structures

LSCFN considers the physical stability of structures including the tailings dam, Dome Creek diversion and spillway to be of critical importance. As such, the current condition of these structures and their ability to withstand severe flood and earthquake events is a critically important issue. The currently available information suggests that:

- The tailings dam does not meet Canadian Dam Association standards for performance under earthquake conditions;
- The tailings dam likely does not meet Canadian Dam Association standards for performance under static conditions if water levels increase – as a result of other events that could include a failure of the diversion;
- The diversion spillway is probably unstable in flows larger than a 1:20 year event;
- The tailings dam could be subject to piping, but this was identified as "unquantifiable" in the previous dam safety assessment; and
- The Dome Creek diversion has never met design performance expectations for leakage and requires ongoing maintenance to maintain effective gradients.

Given the status of the tailings containment and water management facilities, it appears that these facilities present a significant risk at the site. While the options report does identify physical stability issues (s. 2.2.1.1), it would benefit from some stronger statements about current status and the risks presented. rationale for selection of option

For example, the report suggests that the spillway stability is not currently an issue because water levels are relatively low in the dam. Regardless of current water levels in the dam, the spillway presents a significant risk in flood conditions because it must pass water from the diversion, something that it currently may not do for floods greater than a 1:20 year event. Likewise, the dam stability presents a significant risk in earthquake conditions and possibly in flood conditions. In LSCFN's view, physical stability concerns are one of the main reasons for implementing a closure plan at Mt. Nansen and they need to be stated strongly.

2.3.2 Effects on Water Quality

LSCFN also considers existing and potential effects on water quality to be of critical importance. This includes effects from waste rock, pit, tailings, mill area, low-grade ore

and old exploration activities. The Options Report discusses water quality issues in Sections 2.2.1.3 and 2.2.3. Generally, the report concludes that site water quality is not currently problematic and that acid rock drainage and metal leaching are not a significant concern. This seems to suggest that there is little potential for water quality concerns at Mt. Nansen. In LSCFN's view, the data and reports available do not fully support these conclusions.

The systematic comparison of site water quality conditions to the CCME guidelines has only recently been initiated and some method detection limits (MDLs) have not been adequate for comparison purposes. Previous evaluations of water quality have generally relied on comparison with former water licence discharge criteria and have concluded that zinc is the primary contaminant of concern (with some consideration of arsenic). Even the most recent evaluation of water quality, the "Mt. Nansen Porewater Tailings Assessment" (Lorax, 2008) primarily relied on these same criteria for water quality comparison purposes. The recent data collected with more sensitive MDLs highlight that at least one other parameter (cadmium) may be of equal or greater concern than those identified earlier. For example, water in the pit appears to exceed the CCME guideline (0.000017 mg/L) by several hundred times (almost 1000x in some cases). Tailings porewater also exceeds the levels by almost 100x in some areas. 100:1 dilution at Victoria

It also appears that future acid generation and contaminant leaching remains a possibility, depending on remediation approaches. Lorax completed the most recent comprehensive review of available information about tailings characteristics and concludes that "Mt. Nansen tailings will likely be acid generating in the absence of mitigating factors" (Lorax, 2008, p. 3-6) and has suggested that the tailings need to remain saturated in order to prevent future concerns.

Lorax also identifies some concern about the long-term stability of arsenic in the tailings. Sample data show a slowly increasing trend for arsenic. Levels remain well below the former licence discharge criterion, but significantly exceed the CCME guideline of 0.005 mg/L.

Sampling by Lorax indicates that some porewater in the tailings represents isolated porewater from operations. Lorax concludes that this condition is relatively rare. However, it is represented by one of eleven samples collected for the Lorax evaluation and could represent a significant volume of water that may lead to future effects. 9%

For waste rock, ABA and leach testing results reported in the Options Report identify some rock types that will likely be subject to metal leaching and acid generation. While these appear to represent a small portion of the waste rock, depending on their locations and remediation methods, they could lead to significant loading to local surface waters. Results from some composite samples also suggest that waste rock could be problematic.

Overall, it appears that the Mt. Nansen site has significant potential to adversely affect local water quality if appropriate closure measures are not taken. The water quality effects could arise from all of the major site components including the pit, tailings and

waste rock. The Options Report needs to highlight these significant water quality issues as a rationale for effective reclamation responses at the site. It would benefit from some prediction of potential loading from each main source and the water quality effects if these loads were added to Dome and/or Victoria Creek.

2.3.3 *Effects on Plants and Animals*

The potential effect of the Mt. Nansen site on plants and animals has been identified by LSCFN citizens as a third issue of significant importance. People remain concerned about the contamination of plants and animals in the vicinity – contamination that could arise from dust, access to waste materials (tailings, waste rock, low-grade ore, mill area) or previous activities (i.e. blackened vegetation). The terrestrial effects program (EDI, 2007) identified some elevated levels of contaminants in plants near the site, and some ongoing dispersion of contaminants especially from the tailings.

LSCFN believes that the ongoing dispersion of contaminants to the terrestrial environment remains one of the primary issues that a closure plan should address. This, along with the aesthetic disturbance issues leads to significant effects on traditional use of the area by LSCFN citizens, and ongoing spiritual effects arising from the damage to our home. Addressing these issues will be critical for re-building our people's confidence in the area's environment and re-establishing past traditional use patterns. The Options Report should identify the importance of the effects on plants and animals as well as aesthetic issues as further rationale for implementing a closure plan – especially since these issues provide primary rationale for some closure activities.

soils

2.3.4 *Floods, Earthquakes and Climate Change*

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LSCFN citizens are concerned about whether extreme events could lead to significant effects from the Mt. Nansen site. People have expressed concern about effects from floods, earthquakes and climate change. As described above, LSCFN believes that floods and earthquakes present a significant risk for the structures at the site. Global climate warming also appears to present a similar risk. Permafrost is prevalent in the Dome Creek valley, especially on the north-facing side. The tailings dam and seepage collection pond dam were constructed to take advantage of the permafrost conditions. The deterioration of the permafrost in the valley presents a risk to long-term performance of these facilities and possibly others. In the absence of a good understanding about the permafrost conditions and the changes that may arise due to global climate warming, LSCFN believes that the effects of global climate change remain an issue for the site.

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3.0 **The Options**

Section 3 of the Options Report provides the descriptions of the options that are currently under consideration: What can be done to address the issues that have been identified and protect the values in the area? To allow for effective decision-making, the options descriptions need sufficient detail so that we can all understand what will be done in each case, and envision what the outcomes of each option will be. In our view, meeting these

needs will require additional details about the options. Also, some seminal decisions about closure approaches need to be made to support the development of all options. In general, we believe that the information is available to make these decisions and move forward with the development of closure options in sufficient detail to proceed with options analysis and evaluation. In this section of our review report, we are identifying some of the formative decisions that need to be made, and providing specific recommendations about the options descriptions.

3.1 Seminal Decisions

3.1.1 Should the Tailings be Saturated or Unsaturated?

The question of final tailings storage conditions is pivotal for many mining projects and is likely important for Mt. Nansen. Tailings that are subject to acid generation are most chemically stable if stored in a saturated condition. In other cases, it is often best to store tailings where contact with water is limited (unsaturated and isolated), to avoid mobilization of soluble or leachable contaminants. At the Mt. Nansen site, the two most practical tailings closure options envision storage of tailings in the pit or in the existing location. In both cases, the final condition of the tailings could be managed to keep the tailings saturated or unsaturated, depending on the desired final condition. However, the project planning needs to consider which condition is most appropriate, and the options need to be developed to produce the most effective final storage condition.

Several investigations and studies for the Mt. Nansen site have considered tailings storage options, generally identifying and evaluating closure concepts that are similar to those described in the Options Report. Other programs have investigated the tailings and porewater chemistry, considering both existing conditions and future behaviour. The "Mt. Nansen Porewater Tailings Assessment" (Lorax, 2008) is the most recent investigation. To support development of the report and recommendations, Lorax considered the previous investigations and studies. While Lorax identifies potential concerns about tailings storage in both saturated and un-saturated conditions, the report appears to reach a final conclusion that saturated storage would minimize the degree of chemical and water quality risk for the Mt. Nansen tailings. The descriptions in the Options Report do not currently address the issue of saturated or un-saturated storage for tailings but the issue needs to be addressed to refine all of the tailings options.

3.1.2 Should Waste Materials be Covered before Re-vegetation?

In mine reclamation projects, waste (tailings, waste rock) covers can serve a variety of purposes including:

- Reducing water infiltration to minimize mobilization of soluble contaminants and/or minimize oxidation and acid generation,
- Providing a medium to support vegetation growth,
- Preventing direct contact by animals or people with contaminants contained in waste materials,
- Preventing uptake of contaminants in plants growing on the waste,

Borrow sources - identify ↓ Bruce Fulcher

- Preventing dusting from waste surfaces, and
- Reducing oxygen ingress into the waste to minimize oxidation and acid generation.

Effectively describing the closure options requires decision-making about whether covers will be required for the waste materials at Mt. Nansen and, if so, what those covers are intended to achieve. For tailings relocation, the Options Report proposes use of a soil cover, but for other options, decisions about covers are not presented. Requirements for covers create significant implications for all of the closure options – in relation to both environmental and cost implications.

Several investigations and studies at Mt. Nansen have considered factors that are important for deciding whether covers on waste materials will be needed.

- The "Mt. Nansen Terrestrial and Aquatic Effects Study" (EDI, 2007) included collection of vegetation samples from plants growing on waste materials. Plants growing on tailings and low-grade ore had significantly elevated contaminant levels. Those growing on waste rock had variable but generally elevated contaminant levels.
- The "Mt. Nansen Mine Reclamation Report" (Arctic Alpine Reclamation Group, 2006) identified possible re-vegetation prescriptions for waste materials.
- Various studies have considered the chemistry of waste materials (tailings and waste rock) allowing for interpretation of the potential water quality implications of leaving waste materials exposed.

The evidence generally seems to suggest that covering of waste materials would be prudent to prevent future effects on both the aquatic and terrestrial environments.

3.2 Specific Options

For each specific closure option for the tailings and pit as well as many of the "activities with no options," additional details will be required to support a common understanding of the activities and selection of an appropriate closure plan. Key outstanding information requirements for each option and activity are identified below. The descriptions of the options should include figures that illustrate the proposed activities. They would also benefit from a general description of the proposed sequence and schedule.

Tailings Options

3.2.1 Tailings Option 1 – Leave Tailings In Place

The Options Report indicates that the leave-in-place option will include:

- upgrading the dam,
- upgrading the diversion,
- upgrading the spillway,
- re-sloping the tailings to drain water,

- installing wick drains and a drainage layer on the tailings to allow draining and consolidation of the tailings,
- covering the tailings with soil,
- re-vegetation of the tailings cover, and
- long-term maintenance and monitoring.

Additional information needed to understand the feasibility, approaches and implications for the leave-in-place option include the following.

- Details about the dam, diversion and spillway upgrades that will be required:
    - For the dam, the Options Report refers to concepts proposed by Brodie in 2002, including the use of a stabilizing buttress. However, dam safety assessments completed subsequent to Brodie's suggestions have shown that liquefiable foundation soils present a significant risk. It is not clear that a stabilizing buttress could address these conditions. If this option is to be considered further, the feasibility and methods for ensuring stability need to be confirmed.
    - The Options Report does not address methods for improving the diversion and spillway. The leave-in-place option, however, relies on reduced water levels behind the dam, requiring significant upgrades to the diversion. EBA (2004) proposed construction of a concrete diversion as a long-term solution, though this is not confirmed in the Options Report and the use of concrete for permanent mine closure facilities is uncommon. The spillway requires significant improvement to function as a closure facility. Feasibility and methods for upgrades need to be confirmed and described.
    - In all cases, physical stability of proposed closure facilities needs to be analyzed and confirmed, taking into consideration appropriate closure design events.
- Details about the proposed cover for the tailings materials. This should include details about the material properties, cover dimensions, filter requirements, expected cover performance and constructability. Potential material sources should be identified, because these could have significant environmental or cost implications for the option. EBA (2004) suggested the need for a drainage layer below the cover. The need for additional cover components should be confirmed.
- Details about the proposed drainage system that could include wick drains, drainage layer, drainage trench and French drain. For example, Brodie (2002) suggests that 1.5 m of waste rock will be required on the tailings surface to provide loading for tailings consolidation. Management of water from the drainage systems should also be addressed – as part of the overall water management approach.
- Proposed water management approaches for both implementation and post-closure need to be addressed. This should include management of clean water, contaminated water and extreme flows. It should also consider the final condition of the tailings (i.e. saturated vs. unsaturated). Potential requirements for future water treatment need to be considered and addressed as appropriate.

- Details about expected long-term maintenance and monitoring requirements should be provided to allow a more thorough understanding of the long-term implications associated with the option.

3.2.2 *Tailings Option 2: Move Tailings to New Facility*

The Options Report indicates that the move-to-new-facility option will include:

- Build a new tailings impoundment on a south-facing nearby terrace,
- Move tailings to the new impoundment,
- Treat water from the existing tailings
- Cut through the existing dam and put Dome Creek back in the valley,
- Re-vegetate the old tailings area, and
- Long-term maintenance and monitoring.

In general, LSCFN believes that the move-to-new-facility option does not warrant further consideration in the evaluation process for closure options at Mt. Nansen. The order of magnitude cost estimates completed to-date suggest that this is the most expensive option. This seems intuitively correct since the option requires completion of most of the activities that comprise both other options. While a new facility could likely address some of the significant concerns associated with the existing facility, it would still retain many of the same risks and potential environmental effects, though perhaps at a lower level. Because the move-to-new-facility option appears to have a higher cost without adding significant benefits, we recommend that the option be removed from future versions of the Options Report. However, we also recognize that it may have value in the Options Report in order to define the overall range of options. Including this option will complicate future options evaluation processes and needlessly add confusion during future community discussions, but these issues could be addressed if it is necessary to leave the option in the report.

Should the option be included in future versions of the Options Report, additional information needed to understand the feasibility, approaches and implications for the move-to-new-facility option include the following.

- Details about the proposed new tailings impoundment including location, foundation conditions, design, physical stability analyses, water management, use of liners, borrow sources, etc.
- Details about tailings relocation methodology including timing, schedule and methods,
- Details about placement of tailings in the new facility including addition of lime or other amendments,
- Decisions about use of cover materials, and if appropriate, proposed cover design details. This should include details about the material properties, cover dimensions, filter requirements, expected cover performance and constructability. Potential material sources should be identified, because these could have significant environmental or cost implications for the option.
- Proposed water management approaches for both implementation and post-closure need to be addressed. This should include management of clean water,

contaminated water and extreme flows. It should also consider the final condition of the tailings (i.e. saturated vs. unsaturated). Potential requirements for future water treatment need to be considered and addressed as appropriate.
- Details about re-grading and re-vegetation of the old tailings facility,
- Details about the re-establishment of Dome Creek, and
- Details about expected long-term maintenance and monitoring requirements should be provided to allow a more thorough understanding of the long-term implications associated with the option.

3.2.3 Tailings Option 3: Move Tailings to Brown-McDade Pit

The Options Report indicates that the move-to-pit option will include:
- Move tailings to pit (probably by truck in winter),
- Cut through the existing dam and put Dome Creek back in the valley,
- Re-vegetate the old tailings area, and
- Long-term maintenance and monitoring.

Additional information needed to understand the feasibility, approaches and implications for the move-to-pit option include the following.
- Details about tailings relocation methodology including timing, schedule and methods,
- Details about the expected level of tailings in the pit including pit elevation/capacity curves and tailings quantities. Estimates by Brodie (2002) suggested that storage of tailings in the pit would require construction of dams at both the north and south ends. The need for such structures should be confirmed and design information provided as necessary.
- Details about the placement of materials in the pit including whether the pit will be drained prior to placement, potential addition of lime or other amendments, placement above or below water level, etc.
- Decisions about use of cover materials, and if appropriate, proposed cover design details. This should include details about the material properties, cover dimensions, filter requirements, expected cover performance and constructability. Potential material sources should be identified, because these could have significant environmental or cost implications for the option.
- Proposed water management approaches in the pit and valley for both implementation and post-closure need to be addressed. This should include management of clean water, contaminated water and extreme flows. It should also consider the final condition of the tailings (i.e. saturated vs. unsaturated). Potential requirements for future water treatment need to be considered and addressed as appropriate.
- Details about re-grading and re-vegetation of the old tailings facility,
- Details about the re-establishment of Dome Creek, and
- Additional details about expected long-term maintenance and monitoring requirements should be provided to allow a more thorough understanding of the long-term implications associated with the option.

Pit Options

The Options Report identifies three options for closure of the Brown-McDade pit: leaving the pit as is, partially filling the pit with waste and completely filling the pit with waste. While these are presented as three distinct options, we recognize that closure of the pit is a continuum of filling options, where the pit could be backfilled to any desirable level. As discussed previously, LSCFN elders have suggested that there may be value in filling the pit only to the level necessary to provide positive drainage and remove safety hazards.

The discussion of pit options identifies zinc as the only water quality parameter of concern. Although LSCFN has not done a thorough analysis of water quality data from the pit, recent water quality sampling results, analyzed with improved method detection limits, suggest that other parameters need to be considered. For example, cadmium concentrations in the pit exceed the CCME guidelines by at least several hundred times. The implications of these cadmium concentrations need to be considered and addressed in planning for pit closure.

3.2.4 Pit Option 1: Leave As Is

The Options Report indicates that the leave-as-is option for the pit will include:

- Construction of a berm or ditch around the pit to minimize potential for animals or people to fall from the pit walls, and
- Possible water treatment of pit water using bioremediation (fertilizer addition).

Additional information needed to understand the feasibility, approaches and implications for the leave-as-is option for the pit include the following.

- Proposed water management approaches and activities, including identification of water level management as well as proposed treatment methodologies and their effectiveness in addressing all contaminants of concern,
- Description of proposed berm or ditch,
- Description of reclamation methods for pit walls, pit floors and materials currently stored in the pit (i.e. low-grade ore), and
- Additional details about expected long-term maintenance and monitoring requirements should be provided to allow a more thorough understanding of the long-term implications associated with the option.

For this option, members of the LSCFN community believe that a fence around the pit may be required to help limit access of people and animals to the unsafe pit area.

3.2.5 Pit Option 2: Partially Fill

The Options Report presents the partially-fill option with a range of possible fill materials and quantities. Generally it indicates that the partially-fill option for the pit will include:

- Partial filling of the pit by relocating tailings or filling with waste rock to above the lake level,

- Potential construction of a berm around the perimeter of the pit, to minimize the potential for people or animals to fall from the pit walls,
- Potential placement of a low-permeability cap over the fill materials, and
- Potential disposal of building demolition waste in the pit.

Additional information needed to understand the feasibility, approaches and implications for the partially fill option for the pit include the following.

- Details about the proposed pit filling including materials, placement methods, need to drain pit prior to placement and addition of lime or other amendments,
- Decisions about the need for cover placement, and as appropriate details about proposed cover designs including details about the material properties, cover dimensions, filter requirements, expected cover performance and constructability. Potential material sources should be identified, because these could have significant environmental or cost implications for the option,
- Decisions about the need for a lining of the pit prior to tailings placement,
- Proposed water management approaches and activities including
    - Details about surface water management in the facility – i.e. will the pit be filled to a level that will allow positive drainage from the pit, or will surface water be managed in the pit?
    - Identification of water level management, taking into consideration the storage of waste materials in appropriate final conditions above or below water level as appropriate,
    - Proposed treatment methodologies and their effectiveness in addressing all contaminants of concern,
- Types and quantities of demolition materials to be placed in the pit, and
- Additional details about expected long-term maintenance and monitoring requirements should be provided to allow a more thorough understanding of the long-term implications associated with the option.

As with the leave-as-is option, members of the LSCFN community believe that a fence around the pit may be required to help limit access of people and animals to the unsafe pit area.

In describing the partially-fill option for the pit, the Options Report addresses the cost of filling the pit with waste rock to various levels. The cost estimate is based on a relocation unit cost of $\$20/m^3$. This relocation cost seems extremely high for the proposed activity. Costs in the range of $\$5\text{-}7/m^3$ would be more similar to those experienced and predicted at other Yukon sites for similar activities. or $\$7/m^3$ for ore reloc.

3.2.6 Pit Option 3: Completely Fill

The Options report indicates that the completely-fill option for the pit will include:

- Complete filling of the pit with tailings and/or waste rock,
- Contouring and sloping of the backfilled material, to ensure positive drainage, and
- Re-vegetation of the backfilled material.

Additional information needed to understand the feasibility, approaches and implications for the completely-fill option for the pit include the following.

- Details about the proposed pit filling including materials, placement methods, need to drain pit prior to placement and addition of lime or other amendments,
- Decisions about the need for cover placement, and as appropriate details about proposed cover designs including details about the material properties, cover dimensions, filter requirements, expected cover performance and constructability. Potential material sources should be identified, because these could have significant environmental or cost implications for the option,
- Decisions about the need for a lining of the pit prior to waste placement,
- Proposed water management approaches and activities including
    - Details about surface water management in the facility,
    - Identification of water level management, taking into consideration the storage of waste materials in appropriate final conditions above or below water level as appropriate,
    - Proposed treatment methodologies and their effectiveness in addressing all contaminants of concern,
- Additional details about expected long-term maintenance and monitoring requirements should be provided to allow a more thorough understanding of the long-term implications associated with the option.

In describing the completely-fill option for the pit, the Options Report suggests that all pit filling options would lead to difficult conditions for collection of water from the pit because they remove access to the water. The difficulty of water collection should be further investigated because, regardless of whether it is filled with waste materials, the pit may offer an ideal location for collection of water. This depends on the relative permeability of the waste materials and the pit walls in the zones below the water table. The potential need for collection of water from the pit should be recognized for all options and the options descriptions should describe measures that would be necessary to achieve this. } yes.

3.3 Activities with No Options

For several closure plan components, a single option is identified. Regardless, the Options Report needs to describe what the proposed closure method will entail for these components. Additional information requirements are described below for these "activities with no options."

Waste Rock Stabilization and Vegetation: information about final slopes, need for covers, cover designs, re-vegetation approaches and species, as well as proposed maintenance, monitoring and contingency plans. Diane Listen report

Contaminants from Spills: information about quantities and locations of contaminants (i.e. hydrocarbons, reagents), proposed clean-up approaches, and locations, sizes and designs of remediation facilities (i.e. landfarms). post de-contam.

Building Removal: information about locations for landfilling of materials as well as quantities and types of materials.

3.4 Other Options and Activities

During the review of the Options Report by the LSCFN Advisory Committee, and during previous discussions with the LSCFN community, some other options and activities have been identified that should be considered in refining the options. These include:

- Elders have previously identified the possible option of filling the pit just to the level required to create a safe and aesthetically acceptable landscape in the area. A lower level of pit filling may be acceptable for achieving these objectives if combined with some re-sloping of upper pit walls.
- Layering of appropriate waste materials within the pit to provide water flows, saturation and or aquacludes, as appropriate. For example, course rock could be used to ensure continued flow of water from seep areas to the bottom of the pit. Course rock could also be used above and/or below tailings depending on desired storage conditions for tailings or to provide a water collection conduit.

LSCFN community members have often expressed concern about old exploration sites and trenches in the Mt. Nansen area and have requested that these be reclaimed as a component of the closure plan. Yukon Government has previously expressed concern about whether trench reclamation would lead to new disturbance and environmental impacts because many of the trenches and spoil piles are now covered in vegetation. As described in the Options Report, Yukon Government has reclaimed one long trench above the mill area for demonstration purposes, in order to understand the cost, feasibility and aesthetic implications of reclaiming old trenches.

Several LSCFN Advisory Committee and community members have observed the condition of the reclaimed trench. While the reclamation does change the appearance of the trench, it does not lead to short-term aesthetic conditions that are worse than those of other trenches. In the long-term, the conditions will improve because the linear disturbance of the terrain has been addressed. However, we are not currently aware of the costs associated with the reclamation completed.

Aside from the old trenches, there are other exploration sites near Mt. Nansen that should be cleaned up and reclaimed as part of the closure plan. One such site is shown in Photo 1 below. This area includes a large surface disturbance, with soil materials removed to expose mineral bearing rock. Though it is difficult to correlate specific locations, the lichen samples collected for the terrestrial effects program (EDI, 2005) indicate that metal levels may be slightly elevated in this area.

Further discussions with LSCFN community members, supported by review of existing data, could be used to prioritize specific exploration areas and trenches that should be addressed as part of the closure plan.

off claims - other owner.

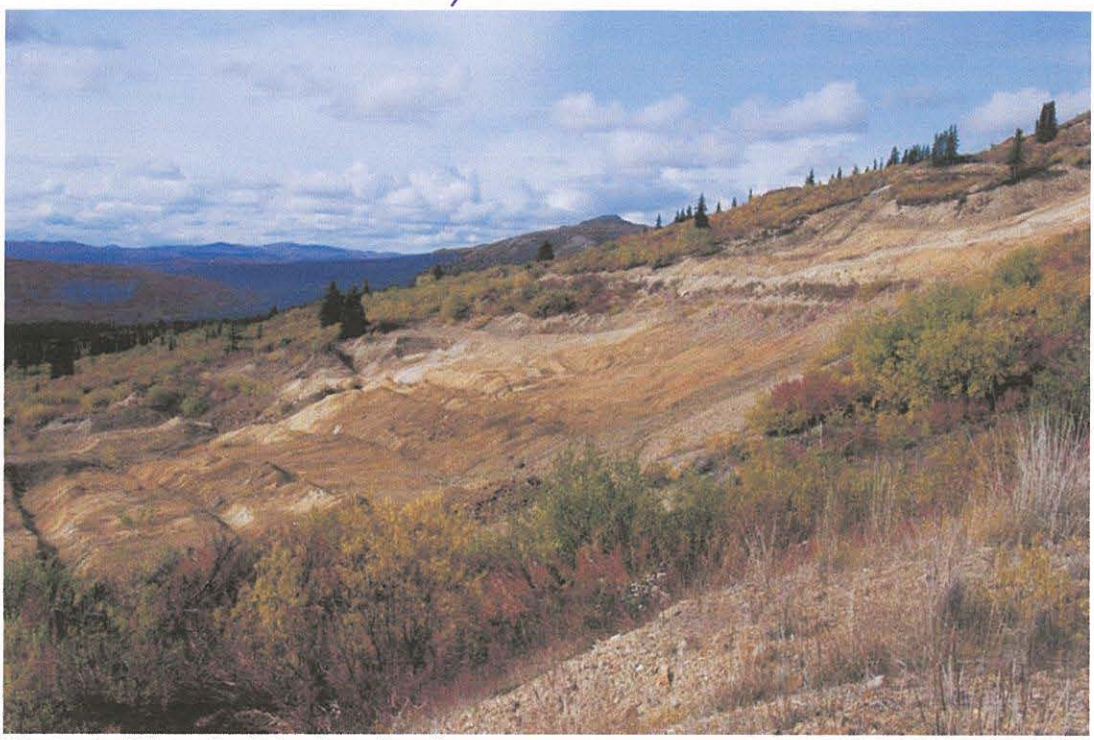

Photo 1: Disturbed Exploration Area

4.0 The Performance

The final component of the Options Report, presented in Sections 4 and 5, addresses the performance of the options that are under consideration. These sections need to provide information that allows participants in upcoming options evaluations and decisions to understand how well each of the options or activities perform in meeting the objectives and addressing the issues described in Sections 1 and 2. Prediction of the future performance of the options cannot be certain. As a result, the sections describing performance also need to consider the uncertainty (risk) associated with each of the options and activities.

In options analysis and decision-making, it will be important to understand the differences in performance between the options. To support this, the performance of all options needs to be addressed consistently, producing results that can be compared. The Options Report generally addresses some of the performance information requirements and identifies that the closure options will be assessed on their ability to address certain issues. But, the Options Report generally doesn't provide adequate option-specific information to understand the performance of each option. First cut.

4.1 Environment

All of the options are intended to address existing and predicted environmental issues at Mt. Nansen. Implementation of some options may lead to other environmental effects

that need to be considered and minimized, for example those associated with borrow sources or new surface disturbances. The performance of options in reducing existing and predicted effects while minimizing implementation impacts needs to be described for the aquatic, terrestrial and atmospheric environments.

The effectiveness of options for addressing and controlling effects on the aquatic environment may vary substantially for the proposed options because contaminant sources would be handled to greater or lesser extents, stored in different locations, and receive different final treatments. To understand potential differences, predictions of aquatic effects should be prepared for each option. This will require integration of information about water balances, current source loading, predicted source loading, contaminant flow paths and local hydrogeology and hydrology. Much of the required information is already available, but requires consolidation into a quantitative or qualitative model.

The effectiveness of options for addressing existing effects and controlling long-term effects on the terrestrial and atmospheric environments may also vary for options, depending on decisions about covering of various waste materials in the different options. Choices of cover types and potential for vegetative uptake of contaminants may also vary between alternatives. The options are likely to have different effects on the terrestrial and aquatic environments during implementation because options will involve different degrees of handling for sources of contamination though these may be short-term differences that have little relevance for decision-making. Current data are not sufficient to quantify current and potential terrestrial contamination by dusting, but may allow some qualitative description of expected differences in the degree of contamination expected from the range of options under consideration, which may be adequate for decision-making. Differences in timing/duration of expected terrestrial contamination by dusting can likely be quantified. Differences in contaminant uptake by plants growing on waste materials can be quantified, but depend on decisions about cover types and designs.

4.2 Human health and safety

We understand that all of the options are intended to address human health and safety concerns at the site to some extent and we consider this a key objective of the closure plan.

The effectiveness in addressing human health effects associated with contaminants will be linked to differences in each option's effectiveness in minimizing contamination in the aquatic, terrestrial and atmospheric environments. We recognize that in some cases, the scale of differences in the environmental performance may be inconsequential for human health. The range of potential human health effects and the value of further detailed analysis should be reconsidered once we have a better understanding of the range of expected environmental performance. If performance of all options is expected to be similar, qualitative descriptions may be adequate.

The effectiveness of options in addressing human health effects for LSCFN citizens will also be linked to their perception of the clean-up effectiveness and the aesthetic conditions at the site. For people who have a traditional, spiritual and cultural link to the Mt. Nansen area, the continued degraded condition of the area affects their ability to pursue traditional activities in the area, leading to effects on their health. The options will perform differently in returning the area to a condition conducive to re-establishment of traditional activities. Performance in addressing this health issue should be addressed in the Options Report.

The primary remaining safety hazard at the site after closure will be that associated with the pit wall. Some options completely remove this hazard, while others address it by providing warnings and barriers. The performance of these two approaches is fundamentally different because one leaves a significant site risk.

4.3 Land Use

The options will perform differently in their ability to re-establish pre-mining land uses throughout the Mt. Nansen area. Differences will occur in both the areal extent of remaining disturbed/inaccessible areas, changes in future landscape and the timing of reclamation. Some options may allow reclamation of almost all areas while some will have unreclaimed areas (i.e. pit walls). Some options may require vegetation conditions that will attract or deter wildlife, or change aesthetic conditions. The performance of the options in these areas should be quantified and presented in the options report.

4.4 Socio-Economic Benefits

The potential for differences in the degree of socio-economic benefits for First Nation and local people should be considered. If performance is expected to be similar for all, this information should be presented. Differences may arise if some options require specialist contractors or employees, or are of a scale that exceeds the capacity of local contractors. If options are considered to be similar, the Options Report would benefit from a description of the broad strategies that will be taken to ensure local and First Nation socio-economic benefits. Potential for socio-economic effects should also be considered.

4.5 Cost

While cost differential for the options may not be a critical objective for LSCFN, we recognize that it is a critical decision-making objective for those parties with financial responsibility. LSCFN citizens recognize that cost will affect the decisions that are made and consider cost information to be an important component of the Options Report.

The current cost estimates for options are inadequate for decision-making. They are based on work completed by Brodie in 2002 and EBA in 2004. In many cases, these estimates are for options and activities that are substantially different from those now proposed. For example, the current tailings relocation proposal suggests relocation in

winter using trucks and loaders, while Brodie costing indicates partial use of hydraulic monitoring and EBA suggests dredging. Cost estimates for these activities could be substantially different. Similarly, cost estimates for dam upgrades include a buttress concept suggested by Brodie in 2002 to address his concern about liquefiable soils in the dam structure. Subsequent stability analyses suggest that the primary concern is liquefiable foundation soils. These are just two examples, but they illustrate the need for renewed cost estimates before any realistic comparison of options can be completed.

4.6 Uncertainties

Section 4.4 of the Options Report presents an initial list of potential hazards associated with the proposed options. The section provides some guidance about the performance uncertainty for the options but requires additional analysis. Descriptions of risks are provided, but do not include any discussion of likelihood – a fundamental component of understanding risk. The analysis would also benefit from a more systematic approach to ensure consistency of risk consideration for all options. Identification of contingency measures to address risks may also be needed. LSCFN citizens have expressed concern about risks and uncertainties at the site, though we have not completed a detailed evaluation of the risk information presented.

5.0 Conclusions and Next Steps

LSCFN has identified several areas in which the information provided in the Options Report needs to be supplemented to support upcoming options evaluation and decision-making processes. Information requirements fall in all key areas of the report – the rationale for closure (issues and objectives), description of options, and description of performance.

We recognize and support the desire to make some decisions about closure options and proceed with closure implementation as soon as possible. However, we do believe that additional information is required for informed decision-making and we would like to work with the closure planning team to compile this information in the most timely and efficient manner. There may be various methods for addressing information requirements. For example, the current Options Report may need to be revised to more thoroughly describe issues and options, while information requirements for describing performance may be addressed in other ways. Final performance interpretations may need to be incorporated into a revised options report after completion of an options analysis process. In order to identify creative solutions for addressing information requirements, we would welcome the opportunity to meet with the closure planning team in a workshop format to discuss the information requirements and identify approaches for addressing them.

We anticipate that options need to be presented to the LSCFN community for their consideration as we move towards evaluating and selecting appropriate closure options. Community input will likely be important LSCFN participants in the options evaluation process. However, we believe that further community presentation of options should

await some refinements of the options that need to be presented. It would be preferable to consolidate information and more thoroughly understand options and performance before presenting them to, and discussing them with, community members.