

**Closure and Reclamation Plans – Preparation Guidelines**  
**for**  
**Mines within the Mackenzie Valley**

Developed and (to be) adopted by the Land and Water Boards of the Mackenzie Valley

To ensure a common understanding of important closure and reclamation terminology, the following definitions and acronyms are integral in the understanding of the concept of closure and reclamation and are provided here to ensure consistent interpretation of these guidelines:

### **Definitions**

*Closure Goal:* is a broad statement (or set of statements) that provides the vision and purpose of reclamation. The goal is met when the company has satisfied all closure objectives. Clarification: The closure goal is a broad high-level statement and by its nature cannot be directly measured.

*Global Objective:* are closure objectives that will apply to the entire development, regardless of mine type or location. While providing greater detail than the goal, they are generally too broad to be measurable although they provide guidance in the development of criteria and consideration of options.

*Component-Specific Objective:* are closure objectives that describe what the reclamation activities are aiming to achieve. Closure objectives should also take into consideration the physical stability, chemical stability, and future use and aesthetics at the site. Component specific objectives must be measurable.

*Closure Criteria:* performance measures that establish when an objective has been satisfied. These become standards that measure the performance of closure activities in successfully meeting closure objectives. Closure criteria may have a temporal component. (e.g., testing will be done for 2, 5, 10 years)

*Closure Option:* closure options are the actions that are expected to achieve the closure objective. A set of alternative options should be evaluated for each mine component.

*Reclamation Research:* reclamation research is conducted to address uncertainties in environmental risks (e.g., predicted negative residual effects that are not acceptable); reclamation research plans are designed to provide data and information which will reduce uncertainties to acceptable levels of risk. The research should be completed throughout the life of the mine to facilitate the transition from mining and milling activities to closure activities.

*Engineering Study:* engineering studies are conducted to reduce unknowns associated with the design and engineering of various facilities; although unknowns may not present an environmental risk, it may be difficult (e.g., at the time of ICRP preparation) to estimate final closure costs, which form a critical part of determining financial security.

### **Acronyms**

|          |   |
|----------|---|
| CRP:     | Closure and Reclamation Plan                                  |
| CRP-PG:  | Closure and Reclamation Plan Preparation Guideline            |
| EA:      | Environmental Assessment                                      |
| GLWB:    | Gwich'in Land and Water Board                                 |
| INAC:    | Indian and Northern Affairs Canada                            |
| MRG-NWT: | Minesite Reclamation Guidelines for the Northwest Territories |

## **Background and Purpose**

In 2006, the Department of Indian Affairs and Northern Development (INAC) prepared the *Mine Site Reclamation Guidelines for the Northwest Territories (MSRG-NWT)*. This document was an outgrowth of over 20 years of development and collaboration between the Northwest Territories Water Board, INAC, aboriginal community members, scientific experts, mine representatives, regulatory authorities, and other affected parties. The process first began as a stipulation that Abandonment and Restoration Plans must be submitted as a requirement of water licenses and land leases<sup>1</sup>, which led to the development of guidelines in 1990; *Guidelines for Abandonment and Restoration Planning for Mines in the Northwest Territories*. Then in 2002, INAC issued the *Mine Site Reclamation Policy for the Northwest Territories*. This policy document laid the foundation for how environmental protection and the disposition of liability related to mine closure in the Northwest Territories are to be approached. By 2006, the guidelines related to reclamation processes and procedures were updated and expanded from the 1990 version and were intended to compliment the 2002 *Mine Site Reclamation Policy*.

The 2006 INAC guidelines provides key concepts related to closure and reclamation, whether temporary or permanent closure, provides an overview of the process that a proponent would need to follow during the closure and reclamation planning process, and provides important environmental issues that would likely need to be addressed (e.g., acid rock drainage and metal leaching, re-vegetation, contaminated sites, physical stability of the land and facilities). The MSRG-NWT also provides technical summaries of various issues and concerns that might be expected with different mine components, including underground workings, open pit workings, waste rock and overburden piles, tailings impoundments and containment systems, buildings and infrastructure, landfills and other waste disposal areas, and water management systems.

The MSRG-NWT does not, however, provide an example or a step-by-step procedure of the level of detail that might be expected in a Closure and Reclamation Plan (CRP). As a result, over the last decade mining proponents have submitted to NWT land and water boards a wide range of CRP's that have consisted of varying levels of detail and information. The inconsistencies are primarily a result of the lack of specific direction regarding the preparation of a CRP, and the resultant varying interpretations of what should be included in a CRP. Secondly, the inconsistencies are due to variable project footprints, proponent approaches to mining and reclamation, and the type and level of reviewer (intervener) involvement. This has created complexities during the period of preparation and review of a CRP, causing inefficiencies in the review process and ultimately lengthening the process.

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<sup>1</sup> A requirement in the application for a Type "A" water licence is the submission of a preliminary closure and reclamation plan (PCRCP) which describes the general goals of how the site will be closed and how the proponent will obtain input from the appropriate communities. After the mine has been constructed, an Interim Closure and Reclamation Plan (ICRP) must be submitted which contains a more thorough evaluation of closure objectives, closure criteria, and closure options.

As a result of these inconsistencies, there is a need to establish an all-inclusive, uniform approach that reduces uncertainty in the CRP process. Further, any approach should provide for the possible expansion or reduction of information depending on the extent, magnitude, duration, etc. of each mining activity and/or operation.

Thus, this guideline provided by the Land and Water Boards of the Mackenzie Valley is intended to supplement the 2006 INAC Guideline and provide proponents, regulators and other interested parties with a uniform approach in the form of detailed annotated outlines for the development and preparation of CRPs. The Closure Reclamation Plan Preparation Guideline (CRP-PG) is not intended to replace the 2006 MSRG-NWT, but to augment them by providing a uniform approach and reducing uncertainties. The CRP-PG provides a framework for how much information is needed, the kind of information that is needed, and what the framework for developing timelines should be. The CRP-PG:

- integrates and includes the concepts described in the INAC MSRG-NWT;
- provides industry, government and public with clear expectations;
- increases the clarity regarding potential environmental liability for proponent and government; and
- helps to quickly build a consensus on the scope of the CRP, which encourages positive support relationships with all the parties involved.

This document outlines the detailed content and processes that a proponent should consider during the development of a closure and reclamation plan for the three primary stages of development, including 1) Mineral Exploration and Camps, 2) Advanced Exploration – Bulk Sampling and 3) Mining and Milling. These guidelines will provide direction on the level of detail that is expected at each stage of a project. Proponents are more likely to have success with the closure planning process by following these guidelines.

This process also recognizes several principles of closure and reclamation that are essential during all stages of development that should be incorporated into closure and reclamation planning:

- a transparent and inclusive process,
- accountability and consistency on the part of the proponent regulator and reviewers,
- an objectives-based approach with measurable criteria,
- appropriate inclusion of Traditional Knowledge throughout the CRP process, and
- a regular review and update of the Closure and Reclamation Plan.

## Process for the Development of CRPs

The CRP-PG provides annotated outlines for CRPs in the Mackenzie Valley associated with:

- 1) Mineral Exploration and Camps (Appendix 1),
- 2) Advanced Exploration – Bulk Sampling (Appendix 2), and
- 3) Mining and Milling (Appendix 3).

The outlines in the appendices are meant to provide the minimum requirements for the CRP and also provide overall guidance during preliminary, interim and final stages. For a preliminary and interim CRP, the focus, context and content will likely be limited due to the preliminary or interim status of the mining project. For example, in the early stages of a mining project various scenarios might have to be considered: the configuration of a lake created from leaving an open pit, the final configuration of a breached dam, or the final location and/or footprint of a waste rock storage area. Thus, the final CRP will be less ambiguous and less predictive than an interim CRP (e.g., there might be more emphasis on the need for specific reclamation research plans during an interim stage to address the numerous uncertainties).

Several themes a proponent should keep in mind as they move through the various stages of developing a CRP:

- EA predictions are not “pollute-up-to limits”; closure objectives should be set to achieve the best possible outcomes;
- The level of community engagement changes as one moves through the various stages of development (i.e., it may be less intensive during ‘Advanced Mineral Exploration’ than during ‘Mining and Mill Development’). Community engagement, however, is a requirement of the licence application process so proponents should be starting during the advanced exploration stage; and
- As one progresses through the different stages of the closure and reclamation planning process (i.e., from preliminary to interim to final), sections will be refined to reflect completed elements, lessons learned, and issues that are still outstanding.

Specific timelines for the development of a preliminary, interim and final CRP will depend on the life of the mine and will be decided by the regulatory Board and outlined in the proponent’s water licence. The following descriptions provide the intent of the CRP during the three stages of mining.

***Mineral Exploration and Camps*** - The intent of the CRP for mineral exploration sites is to provide a description of the approach that would be taken to close and reclaim the site following the completion of exploration activities, assuming no further exploration, sampling, and mining activities will occur on site.

**Advanced Mineral Exploration – Bulk Sampling** - The intent of a closure and reclamation plan at this stage of development is to provide a description of the approach that would be taken to close the project site following the completion of the bulk sampling, either temporarily pending further exploration work or project development, or permanently should the project not proceed to a mine.

If a proponent intends for their project to progress in to the final stage of development; Mining and Milling, it is highly recommended that they contact the appropriate Land and Water Board to begin preparing their Type 'A' application well in advance.

**Mining and Milling** – The intent of the closure and reclamation plan during mining operations, is to provide detailed descriptions of various approaches that will be or are proposed to be used to reclaim the site while achieving all the reclamation goals.

The development of the outlines in the appendices incorporate lessons learned from previous closure and reclamation planning processes, which benefited from deliberations among various regulatory agencies, aboriginal representatives, community members and proponents. A principal theme in constructing the outline is to simplify the process for all involved. The outlines are designed to reduce ambiguities between proponents and stakeholders so that those involved are not starting from scratch each time, while also having realistic expectations of what the final products should look like. The intent is to simplify the review process once an application is received. Further, the outlines are designed to be compatible for each stage of development, so as the project evolves from the mineral exploration stage, through advance exploration and then to mine/mill development, the same order and type of information is required, but only in more detail.

#### **Preliminary Closure and Reclamation Plan (PCRP)**

A PCRP is based on the proponent's proposed mine plan and must be submitted as part of a Type 'A' application in order for that application to be deemed complete. Community engagement must be conducted during the development of the PCRP because that input will be critical for important closure decisions made during the environmental assessment (EA). Determining appropriate closure options should be integrated with a level of community engagement to build consensus upfront.

As a proponent goes forward from the EA, the level of community engagement should not decrease, but rather become more focused on addressing specific issues and providing input into closure objectives, closure options and closure criteria. It is important also to report back to the communities to obtain feedback and produce an acceptable CRP. Proposed closure objectives, alternatives analyses, and proposed closure criteria are expected in a PCRP to understand the proponent's intent.

#### **Interim Closure and Reclamation Plan (ICRP)**

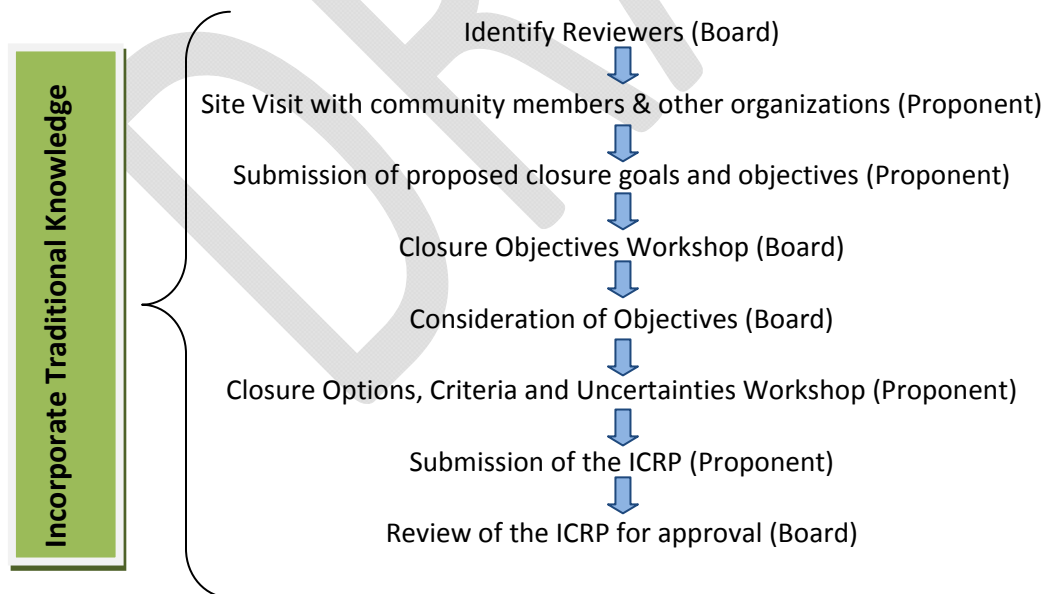
The proponent's mine plan may have changed as a result of the EA and/or mine development alternatives; similarly, sections of the PCRP will change as the first version of the ICRP is developed.

Several iterations of an ICRP may be necessary depending on the mine life of the project as ICRP's are generally revised on a 3-yr cycle. Consequently, the content and focus of the ICRP will become more refined as the project progresses towards closure and subsequent versions of the ICRP are produced.

One of the main purposes of the ICRP is to identify uncertainties surrounding certain closure options that guide corresponding areas for reclamation research during operations prior to closure. For example, during the early stages of a mine one may have these questions: What will water quality be in open pits if they are flooded to create pit lakes? If the tailings containment area was vegetated, would it be safe for wildlife? In these cases, research should begin early enough in the process so that there are acceptable levels of uncertainty at closure. Similar to reclamation research, the level of detail of an engineering study (i.e., determine surface stability on a tailings facility after vegetative cover and rock capping are complete) will begin to increase as proponents progress from the PCRCP to the last version of the ICRP.

The ICRP is also used to progress from the initial closure objectives, as presented in the PCRCP, into more solidified closure objectives as consensus is built with stakeholders. The exercise of collectively developing closure objectives is particularly useful in that involved parties have the opportunity to gain an understanding of the complexity of certain objectives and the difficulty of setting measurable closure criteria.

The Boards have developed a general process for submitting and ICRP that will satisfy the requirements and include the general principles of closure and reclamation expected within the Mackenzie Valley. The following presents a generic process, including the specific steps and the responsible party for each, for the development of an ICRP. A more detailed outline is included as Appendix 4.



## **Final Closure and Reclamation Plan (FCRP)**

As a project life moves forward, the level of analysis and deliberation regarding certain alternatives will diminish as closure options are carried out. However, an explanation or an appendix of which options were considered, and why they were chosen, should be included.

Residual effects of certain closure options should be more detailed in the FCRP because more information and studies will be available to determine the duration, frequency, and magnitude of the effects. At this stage, the level of detail and certainty surrounding post-closure monitoring and contingency planning should increase drastically relative to the ICRP.

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## **Appendix 1**

### **Closure and Reclamation Plan Requirements for Mineral Exploration Projects**

#### **1. Introduction**

1.1. Purpose

1.2. Closure Objectives

#### **2. Project Description**

2.1. History of the site

2.2. Pre-development environmental conditions

2.3. Description of Project Components

2.3.1. Camp

2.3.2. Fuel Storage

2.3.3. Drilling Locations

2.3.4. Winter Road and/or Geophysical Survey Lines

2.4. Permit and/or Licence requirements for Closure and Reclamation

2.5. Security

#### **3. Proposed Closure and Reclamation Activities**

3.1. Camp

3.2. Fuel Storage

3.3. Drilling Locations

3.4. Winter Road and/or Geophysical Survey Lines

#### **4. Closure Schedule**

4.1. Seasonal or Temporary Closure and Reclamation

4.2. Permanent Closure and Reclamation Activities

## **Appendix 2**

### **Closure and Reclamation Plan Requirements for Advanced Exploration**

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#### **1.0 Executive Summary**

#### **2.0 Introduction**

##### **2.1 Purpose and Scope of the Closure and Reclamation Plan**

Provide introductory descriptions of proponent and project including overall spatial and temporal extent of the exploration program, supported with a general statement of goals of closure and reclamation.

##### **2.2 Closure and Reclamation Planning Team**

Describe, list or show (e.g., with organization chart) any important organizational relationships and specific responsibilities (accountability structure) that will facilitate and manage the reclamation and closure process; include any consultants working on behalf of the proponent and their reporting relationships.

##### **2.3 Community Engagement**

Describe approach to building consensus among community leaders to integrate local community values into closure and reclamation planning, including any strategies for engaging community leaders and members into CRP development and implementation. The level of community involvement might be expected to increase based on size of exploration camp, duration of exploration activities (single year versus multiple year), complexity of facility development, traditional significance of certain residents and anticipated future land use.

##### **2.4 Closure Plan Regulatory Requirements**

Provide a tabulated summary (see example below) of all existing and potential permits and authorizations by jurisdiction that will be required for closure, including for example, water license, land use permit, and a DFO Authorization that will be required for closure.

**Example Table of Permits, Authorizations and Agreements**

| List of Existing Permits, Authorizations and Agreements | Responsible Authority and Contact Information |
|---|---|
| e.g., Type B Water License                              | e.g., Wek 'eezhi Land and Water Board         |
|   |   |
| List of Needed Permits, Authorizations and Agreements   | Responsible Authority and Contact Information |
|   |   |
|   |   |

In addition to the above requirements there may be additional guidelines that the proponent will have to follow (i.e., to minimize effects from Acid Rock Drainage/Metal Leaching), and the proponent may also have their own company closure standards.

**3.0 Project Environment**

Provide an overview of the pre-development (or pre-project) conditions, specifically any current/historic baseline data/information for those environments where the exploration activities will likely have an effect or be affected. Where appropriate, use maps, tables and figures to help summarize and depict locations, data and information. The amount of information provided should reflect the anticipated effects of the exploration program and the need to understand specific processes including:

3.1 **Atmospheric Environment** - climate (meteorology) and air quality

3.2 **Physical Environment** - physiography/topography; geology/geomorphology; soils and ground cover; permafrost; surface water and groundwater hydrology; surface water and groundwater quality; acid rock drainage/metal leaching potential

3.3 **Chemical Environment** – soil and sediment chemistry, surface water quality (i.e., lakes, streams, springs) and groundwater quality (i.e., from production and/or monitoring wells); and acid rock drainage/metal leaching potential

3.4 **Biologic Environment** – terrestrial wildlife and wildlife habitat; avifauna and their habitat; aquatic resources (fresh and marine) and their habitat; vegetation

3.5 **Social (Human) Environment** - land use; socio-economic; cultural and heritage resources; archaeology assessments

## 4.0 Project Description

**4.1 Location and Access** - describe regional and local contexts of affected areas including how the exploration site is accessed (including any seasonal limitations), provide relevant coordinate references; use a reasonably detailed map and/or photomosaic.

**4.2 Site History** – provide summary of previous exploration and development related to any mining-related activities, while focusing on activities that have led to the current project. This would also include any ownership changes and a synopsis of any regulatory activities to date. This information should be presented in chronological order; tabulate the information if the site history is extensive.

**4.3 Site Geology** – describe geology including basic lithologies and structure sufficiently to support proposed exploration activities.

**4.4 Bulk Sampling/Exploration Program** – provide a detailed summary of the proposed activities including size/volume of sampling, areal extent and footprint of exploration activities.

**4.5 Project Components and Facilities** - describe sizes, footprints and relative locations (on a site map) of all facilities that have been and will be used during the exploration program, including:

- changes to landscape and underground (open pits, quarries, adits, portals, decline ramps, workings, vent raises)
- any built facilities (waste rock pile, ore stockpiles, tailings, landfills)
- any water and wastewater management facilities (sewage lagoons, settling ponds, diversions, man-made channels)
- fuel, explosives and chemical storage and handling facilities and practices (including any proposed or existing hydrocarbon remediation areas)
- buildings (including trailers for admin, sleeping quarters, mechanical shops, kitchen, etc); describe the power source for these buildings and for the site in general
- access roads and borrow areas
- any historical facilities not being used

## 5.0 Requirements for Permanent Closure and Reclamation

### 5.1 Definition of Permanent Closure

The following is the accepted definition of permanent closure: Permanent closure is the final closure of an exploration site with no foreseeable intent by the existing proponent to return to

either active exploration or mining. Permanent closure indicates that the proponent intends to have no activity on the site, aside from post-closure monitoring and potential contingency actions. Permanent closure does not preclude renewed interest at the existing site or in the area at a time beyond the foreseeable future.

### **5.2 Permanent Closure Requirements for Specific Components and Facilities**

Describe in detail the closure process and reclamation measure for each of the components and facilities listed above in Section 3.5. The descriptions should include pre-disturbance and existing conditions. Show all relevant and important water bodies (including watershed boundaries), topographic modifications, vegetation changes and changes to the built environment. Use photographs, maps and photomosaics where appropriate to depict conditions. Each component and facility should be discussed in a separate subsection unless the closure plan and reclamation measures are the same.

### **5.3 Reclamation Objectives and Closure Criteria**

**Closure objectives** are specified for each component or facility in terms of the basic valued components such as air, land, water, wildlife, community, health and safety, etc. Example closure objectives could include:

For Air:

- Dust levels that are safe for humans and wildlife.
- Dust levels that don't inhibit native vegetation from reproducing or being grazed upon.

For Land:

- Waste rock pile surfaces are stabilized to prevent slope failures and erosion.
- Use indigenous vegetation for rehabilitation work.

For Water:

- Water quality is safe for humans and wildlife.
- Surface drainage patterns are returned to pre-development conditions.

For Wildlife:

- Surface of facility is safe for wildlife use and travel.
- Fish habitat compensation agreements have been completed for DFO authorizations

For Health and Safety:

- Appropriate safety control measures are in place for reclamation activities associated with reclaiming the open pit.

For Community:

- Community land use expectations and Traditional Knowledge have been considered in closure planning.

**Closure Criteria** – criteria are developed for each closure objective; they can be site-specific or adopted from territorial/federal standards. These criteria would be meaningful and measurable over a given time frame. Closure criteria can be numerical values or narrative statements, depending on the closure objective being measured.

**Actions/Measurements** – These include site-specific activities such as physical inspections, sampling, monitoring, or conducting an assessment that are designed to document and demonstrate compliance with criteria.

**Reclamation Research or Engineering Studies Reference** – this includes, referencing the specific research plan(s) and/or engineering studies as described below in Section 5.4. Research may be needed to address the existing uncertainties in environmental risks because the predicted negative residual effects are not acceptable (i.e., they cannot be demonstrated to meet closure criteria at the current state of understanding). Research or engineering studies or calculations may also be needed to determine how best to implement a desired closure option or reach a desired closure objective.

**Monitoring Reference** – this includes referencing specific monitoring plan(s) as described below in Section 5.6. Monitoring plans will be an essential element in demonstrating when closure criteria are met.

The information described above can be **tabulated** for complex exploration sites by listing objectives, criteria and action for each valued component. The table can also provide references to other sections of the ICRP where related aspects of reclamation research or monitoring is discussed or described. Depending on the scope and length of closure objectives, the tables could be placed in an Appendix (i.e., note Appendix C in this outline).

**Example Table that Summarizes Closure Objectives, Criteria, Actions/Measurements and Relevant References for the Advance Exploration Program**

| Closure Objective  | Closure Criteria  | Actions - Measurements              | Reclamation Research Reference   | Monitoring Reference   |
|--|---|-------------------------------------|--|--|
| Water  |   |                                     |  |  |
| Surface drainage patterns are established to ensure runoff is channeled through the watershed. | Channel flow is occurring through constructed channels to downstream watershed. | Physical inspections and monitoring | If appropriate, reference specific research plan(s) in the ICRP that addresses surface drainage control. | If appropriate, reference specific monitoring plan(s) in the ICRP that addresses surface drainage control. |

| Land  |   |                                 |  |  |
|---|---|---------------------------------|--|--|
| Disturbed sites enhanced to encourage vegetation colonization.    | Minimum acceptable % of vegetation cover by specific target dates | Monthly monitoring and sampling | If appropriate, reference specific research plan(s) that addresses reclamation of land | If appropriate, reference specific monitoring plan(s) in the ICRP that addresses reclamation of land |
| Additional VECs (Air, Wildlife, Health & Safety, Community, etc.) |   |                                 |  |  |
|   |   |                                 |  |  |

#### 5.4 Reclamation Activities, Environmental and Engineering Work

This section should describe all demolition, construction or rehabilitation works that are planned for each exploration component. A logical sequence and timing of the works should be provided (i.e., re-grading comes before re-vegetation). Identify any critical paths (i.e., those that would impede the progress of inter-related tasks or the overall project process).

#### 5.5 Uncertainties and Information Needs

Describe the uncertainties in baseline data characterization and the predicted effects from exploration activities. Describe what data and information needs might still exist to help refine the predictions and whether there are any plans to collect data, re-analyze and/or research these topics.

#### 5.6 Monitoring, Maintenance and Reporting Program

The success of the closure and reclamation plan is contingent on the development and implementation of a functional monitoring program, which is initiated during exploration and continued on through post closure. Describe/list or tabulate the details of monitoring specific valuable environmental components and the physical and chemical stability of various facilities. Provide information on monitoring locations, the frequency and duration (post-closure) of monitoring and the criteria with which various parameters will be compared to.

Explain any maintenance activities that will occur during post-closure monitoring. Provide an outline for the monitoring reports and the frequency that these reports will be provided.

#### 5.7 Post Reclamation Landscape

Using maps, photos, photomosaics, etc as appropriate describe the final landscape after all reclamation is completed, based on fulfilling all closure objectives. Show all relevant and important water bodies (including watershed boundaries), topographic modifications, vegetation changes and changes to the built environment.

## **5.8 Contingency Program**

Describe how unforeseen events or conditions (e.g., something preventing the success of a reclamation activity) would be handled. Explain how any closure monitoring might be affected.

## **6.0 Progressive Reclamation**

### **6.1 Definition of Progressive Reclamation**

The following is the accepted definition of progressive reclamation: Progressive reclamation takes place prior to permanent closure to reclaim components and/or decommission facilities that no longer serve the objectives of the exploration program. These activities can be done during exploration activities with the available resources to reduce future reclamation costs, minimize the duration of environmental exposure and enhance environmental protection. Progressive reclamation may shorten the time for achieving reclamation objectives, and may provide valuable experience on the effectiveness of certain measures which might be implemented during permanent closure.

### **6.2 Prospective Facilities/Areas and Reclamation Activities**

Within the context of the goals of the overall closure and reclamation plan and the timeframe of the exploration program, describe/list those facilities and/or areas of the exploration site where progressive reclamation can be conducted; provide general descriptions that would include locations, areal extent, and a summary of potential methods that would likely be used.

## **7.0 Temporary or Interim Closure Measures**

### **7.1 Definition of Temporary Closure**

The following is the accepted definition of temporary closure: Temporary closure occurs when exploration activities cease with the intent of resuming activities in the near future. These closures can last for weeks or years based on planning, the need to analyze and understand the results of the exploration program as well as other economic, environmental and social factors.

### **7.2 Temporary Closure Goals and Objectives**

State the goals (e.g., protect human, wildlife and environment) and objectives (e.g., follow temporary closure strategies and measures as outlined by the Mine Reclamation Guidelines (INAC, 2006)) of temporary closure. These objectives should relate to specific aspects of the overall mine site and exploration program.

### **7.3 Temporary Closure Activities**

Describe activities and their closure methods that will occur for each facility/area to ensure the temporary closure objectives will be met. For example, for those explosives not used up during exploration and depending on the expected duration of temporary closure, explosives will be shipped off site or secured in powder magazines. Any security and access issues to ensure site safety is maintained should be described.

### **7.4 Temporary Closure Monitoring, Maintenance and Reporting Program**

Describe any monitoring activities that will occur during temporary closure to ensure that the goals and objectives of the closure and reclamation plan will be met. These may include components of an environmental baseline program.

### **7.5 Temporary Closure Schedule**

Describe the timing and sequence of events preparing for and occurring during temporary closure. Use charts or tables if the nature of activities is complex.

## **8.0 Post Closure Site Assessment**

Describe the projected environmental conditions after a permanent closure and reclamation of the exploration project site. Assess any post-reclamation (residual) risks to human and environmental health.

## **9.0 Financial Security**

Provide estimates of total liability associated with permanent closure, including any costs associated with progressive reclamation and temporary closure. Break down costs associated with each facility and area. Use tables where appropriate. The estimate should be presented to match the timing of closure and reclamation activities as depicted with the schedule as provided in Section 8.0, though to the end of post closure, including security and monitoring programs.

## **10.0 References**

### **Appendices**

- Glossary of Terms and Definitions
- List of Acronyms, Abbreviations, Units and Symbols
- Schedule of Exploration and Reclamation Activities to Permanent Closure

Depict (e.g., with chart) the period of exploration activities, and the initiation and conclusion of reclamation activities for each component/facility (or component/facility grouping). Also show any progressive reclamation, initiation and completion of studies to reduce uncertainties, and any required monitoring and reporting phases. Discuss contingencies for uncertainties in

schedule based on for example, extent and success of progressive reclamation, temporary closure and upset conditions (e.g., weather).

- Supporting Documents

Provide those documents used to support the characterization of baseline environmental data, (e.g., terrestrial studies, hydrology and aquatic studies, climate and air quality studies), geochemical analyses and predicted ARD/ML potential, and any relevant engineering work related to supporting the closure and reclamation plan.

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## Appendix 3

### **Annotated Outline for Preliminary, Interim & Final Closure & Reclamation Plans for Mines in the Mackenzie Valley**

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#### **1. Executive Summary**

#### **2. Introduction**

##### **2.1 Purpose and Scope of the Closure and Reclamation Plan**

Provide statements describing the purpose and scope of the Closure and Reclamation Plan (CRP) as it relates to Board requirements, interveners, and the public in general. Provide a general description of the project including principal responsible proponent(s) and the overall spatial and temporal extent of the mining project (this will be described in detail in Section 4). State whether this CRP is the preliminary plan (i.e., as part of the initial environmental assessment), a version of an interim plan or a final plan.

##### **2.2 Closure and Reclamation Plan Goals**

The goals of the closure and reclamation plan are summarized here. Goals are designed to prevent or minimize negative effects on the human and ecological environment (e.g. terrestrial and aquatic habitat). Example goals might be:

- protect public health and safety using known safe, responsible reclamation practices,
- minimize/eliminate residual environmental effects post closure,
- establish conditions that allow natural environment to recover from activities, and
- establish long-term physical and chemical stability in disturbed areas to reduce requirement for long term monitoring.

Selected closure options should be consistent with the stated reclamation goals. If a strict standard is set in the goal statement that cannot be reasonably met, then the goal statement should be adjusted to accurately reflect what is feasible and reasonable. Similarly, if the goal

statement is not sufficiently robust or is vague, then it may prove to be inadequate for developing useful closure objectives.

**2.3 Closure and Reclamation Planning Team**

Describe, list or show (e.g., with organization chart) the important internal and external organizational relationships and specific responsibilities (accountability structure) that will facilitate and manage the reclamation and closure process; include any consultants working on behalf of the proponent and their reporting relationships.

**2.4 Community Engagement**

Describes approach to building consensus among community leaders to integrate local community values into closure and reclamation planning, including any strategies for engaging community leaders and members into CRP development and implementation. The level of community involvement will be expected to increase based on the size and duration of the project and the complexity of facility development, traditional significance of the area to residents and anticipated future land use.

**2.5 Closure Plan Requirements**

Provide a detailed tabulated summary (see example below) of all potential permits required and existing authorizations held by jurisdiction for closure. Regulatory elements being considered would include:

- Water License(s)
- DFO Authorization(s)
- Land Use Permit(s)
- Environmental Agreement(s)
- Service Leases
- Others

**Example Table of Permits and Authorizations**

| List of Existing Permits, Authorizations and Agreements | Responsible Authority and Contact Information |
|---|---|
|   |   |
|   |   |
| List of Needed Permits, Authorizations and Agreements   | Responsible Authority and Contact Information |
|   |   |
|   |   |

In addition to the above requirements there may be additional guidelines that the proponent will have to follow (i.e., INAC's ARD/ML guidelines). The proponent may also have their own company closure standards or want to reference guidelines not specific to CRPs or the NWT that they are following.

### **3.0 Project Environment**

Provide detailed descriptions of the project environment in the context of pre-disturbance (or pre-project) conditions and the current development status of the mine site. The amount of information presented for each subsection should be sufficient to establish baseline conditions so that specific criteria can be developed to demonstrate that the reclamation objectives are being met. Much of this information may be derived from an earlier Environmental Assessment, with updated data and information from monitoring plans, studies, and independent research for each environmental topic. The project environment should present the following five topics in this order (for uniformity and clarity among CRPs). Depending on the level of information available for each environment, it is also likely that subsections will be necessary for each of the primary topics (disciplines) listed below; the subsections should be grouped or split so that the information is logically presented.

#### **3.1 Atmospheric Environment**

Provide an overview of the regional and local climate setting, temperature and precipitation statistics and trends based on regional and project-specific climate station. Provide general descriptions of regional and site air quality conditions and how the existing mining development is affecting air quality (e.g. due to emissions and fugitive dust). Use tables and figures to help summarize and depict data. Climate and Air Quality discussions should be presented in separate subsections.

#### **3.2 Physical (or Terrestrial) Environment**

Provide an overview of the regional and local physiography (i.e. topography and relative relief, and drainage basin – surface water - characteristics), surficial and bedrock geology, extent and distribution of permafrost, geologic hazards and hydrogeology; use maps, photomosaics, tables and figures to help summarize and depict monitoring stations or wells, and other data and information.

#### **3.3 Chemical Environment**

Provide an overview of regional and local soil and sediment chemistry, surface water quality (i.e. lakes, streams, springs) and groundwater quality (i.e. from production and/or monitoring wells); and acid rock drainage/metal leaching potential; use maps, tables and figures to help summarize and depict sampling locations, data and information.

#### **3.4 Biological Environment**

Provide an overview of vegetation (flora), aquatic biota, terrestrial wildlife (fauna), avifauna and their respective habitats and the overall ecosystem(s); use maps, tables and figures to help summarize and depict monitoring locations, biogeoclimatic zones, habitat extent and boundaries; genera/species data and information.

### **3.5 Social (Human) Environment**

Provide summaries of the various potentially affected land uses including and overview of recent and traditional use sites, archaeological and cultural sites, protected and heritage sites, and future land uses. Provide any relevant socio-economic information that may be affected by the closure and reclamation of the mine.

## **4.0 Project Description**

A table of chronological site history as well as relevant documents and references should be included for this section.

### **4.1 Location and Access**

Describe regional and local contexts of affected areas, provide lat-long or N-E coordinate references where applicable – use detailed maps and photomosaics. Describe access points, methods, with seasonal variations and limitations.

### **4.2 Site History**

Provide a relevant summary of the history of ore discovery, exploration, and previous mining operations that have led to the current project. This would also include any ownership changes and a synopsis of the application, permitting and licensing process to date. This information should be presented in chronological order. Use figures and photos to depict major site changes and tables where the site history is complex and extensive.

### **4.3 Site Geology**

Describe regional and local geology, including major rock types and structure, to the level of detail appropriate to depict the mining resource, extraction methods that were/will be used, and the rationale for footprint and specific target areas. Use tables, maps, cross sections, photos and figures to help the presentation of relevant information.

### **4.4 Mine Plan**

This section should provide an overview of the project development (describing total footprint) with a description of the operating plan through closure as well as a discussion of the various options that were proposed by the company during the environmental assessment. This is sometimes referred to as a life of mine plan. The plan should be sufficiently detailed so that the conditions (i.e. dimensions, geometries, characteristics, material properties, etc) of each facility

can be estimated for the end of operations and then provide the basis for developing reclamation objectives.

- If open pit mine – describe mining and facilities sufficiently to understand how ore and waste rock were/are removed and what the pit geometry will be at closure (including dimensions with plan and cross section views), including access points, any geotechnical stability issues and exposed rock types; describe (quantify) dewatering requirements during operations and how this will differ from closure requirements
- If underground mine – describe mining methods and facilities sufficiently to understand how ore and waste rock will be/were removed and what final geometries of the adit-tunnel system will be – provide map showing elevations and dimensions of portals, adits and tunnels; describe (quantify) dewatering requirements during operations and how this will differ from closure requirements

Describe the development of any other aspects of the project that will require closure, decommissioning and reclamation, including waste rock storage development, ore processing, materials and waste management practices, and water treatment systems, etc.

Provide detailed descriptions of all facilities that have been and/or will be used during any further exploration, operations, decommissioning and closure. The descriptions should include sizes, footprints and relative locations (on a site map) with accompanying tables, figures, maps and photos as appropriate. The descriptions should also include the status (operating, permitted, lifespan, partially closed and any progressive reclamation completed, etc) of each component. Each facility (e.g., waste rock storage area) or facility grouping (e.g., dams, dykes, diversions and channels) should be presented in separate subsections for clarity. The extent of descriptions and discussions will vary for different types and sizes of projects. The mine components might include:

- changes to landscape and underground (open pits, adits, portals, decline ramps, workings, vent raises)
- any built facilities (country rock or waste rock storage areas, ore stockpiles, borrow areas, soil stockpiles, tailings containment areas, batch and crusher plants, landfills including any proposed or existing hydrocarbon remediation areas/cells)
- any water-retaining or control structures (e.g., ponds, dams, diversion channels, dykes)
- any wastewater management facilities (e.g., sewage lagoons, settling ponds)
- any constructed infrastructure (including permanent [e.g., with foundation] and/or temporary [e.g., trailers]) for project administrative needs, accommodation complexes or sleeping quarters, kitchen/mess halls, water and/or oil/gas pipelines, storage tanks, sewage and water treatment plants, mechanical shops, fuel/chemical/explosives

storage facilities (and practices), process plants, maintenance complexes, power plants, boiler plants, communication systems, explosives management structures, etc; describe the power source(s) for these buildings and for the site in general

- access roads and airstrips and associated infrastructure (e.g., bridges, culverts, ramps)
- any historical facilities not being used

## **5.0 Requirements for Permanent Closure and Reclamation**

### **5.1 Definition of Permanent Closure and Reclamation**

The following is the accepted definition of permanent closure: Permanent closure is the final closure of the mine site with no foreseeable intent by the existing proponent to return to either active exploration or mining. Permanent closure indicates that the proponent intends to have no activity on the site, aside from post-closure monitoring and potential contingency actions. Permanent closure does not preclude renewed interest at the existing site or in the area at a time beyond the foreseeable future.

### **5.2 Permanent Closure Requirements for Specific Components and Facilities**

Closure requirements are developed in detail for each major component or facility (as listed above in Section 4.4) of the operation. In some cases closure requirements will be the same for certain types of infrastructure (e.g., maintenance complexes, power plants, boiler plants), so these facilities can be dealt with as a group. For other facilities (e.g. a processed containment facility or a waste rock storage area), more unique closure objectives and reclamation methods are required, so these should be dealt with individually.

Each subsection or mine component grouping should have, at a minimum the following subsections:

#### **5.2.1 Pre-Disturbance, Existing and Final Mine Site Conditions**

Using maps, photos, photomosaics, etc as appropriate describe (compare and contrast) the pre-development (or pre-disturbance), existing, and projected mine site conditions. Show all relevant and important water bodies (including watershed boundaries), topographic modifications, vegetation changes and changes to the built environment. Describe any important or unique environmental conditions (i.e., atmospheric, physical, biological, chemical and/or social) for these mine components that will have a bearing on closure objectives.

#### **5.2.2 Reclamation Objectives and Closure Criteria**

Establishing closure objectives is perhaps the most important part of developing a successful closure and reclamation plan as it guides the entire planning process. Closure objectives are developed for each component (e.g., access roads, buildings, dams, diversion channels,

dykes, open pits, pipelines, processed kimberlite containment areas, storage tanks, waste rock piles, etc.) while considering the protection of a broad spectrum of valued components such as air, land, water, wildlife, community, health and safety, etc..

Example closure objectives would include:

- A final landscape that allows traditional use;
- Surface runoff and seepage water quality that is safe for humans and wildlife.

**Closure Criteria** – criteria are developed for each closure objective; they can be site-specific or adopted from territorial/federal standards. These criteria would be meaningful and measureable over a given time frame.

**Actions/Measurements** – These include site-specific activities such as physical inspections, sampling, monitoring, or conducting an assessment that are designed to document and demonstrate compliance with criteria.

**Reclamation Research Reference** – this includes, referencing the specific research plan(s) as described below in Section 5.2.6. Research may be needed to address the existing uncertainties in environmental risks, because the predicted negative residual effects are not acceptable (i.e., they cannot be demonstrated to meet closure criteria at the current state of understanding). Research or engineering calculations may also be needed to determine how best to implement a desired closure option or reach a desired closure objective.

**Monitoring Reference** – this includes referencing specific monitoring plan(s) as described below in Section 5.2.7. Monitoring plans will be an essential element in demonstrating when closure criteria are met.

The information described above is best tabulated for each component (i.e., open pits, waste rock piles, tailings containment areas, etc.), by listing objectives, criteria and action for each valued component. The table can also provide references to other sections of the CRP where related aspects of reclamation research or monitoring is discussed or described. Depending on the scope and length of closure objectives, the tables could be placed in an Appendix (i.e., note Appendix C in this outline).

**Example Table for Each Mine Component that Summarizes Closure Objectives, Criteria, Actions/Measurements and Relevant References**

| Closure Objective                     | Closure Criteria                                      | Actions - Measurements | Reclamation Research Reference                         | Monitoring Reference                                     |
|---------------------------------------|---|------------------------|--|--|
| Air                                   |   |                        |  |  |
| Dust levels that are safe for people, | Mean TSP concentrations do not exceed 60 ug/m3 annual | Weekly monitoring      | If appropriate, reference specific research plan(s) in | If appropriate, reference specific monitoring plan(s) in |

|  |   |                                 |  |  |
|--|---|---------------------------------|--|--|
| wildlife, and vegetation.                        | objective, and the 24 hr maximum acceptable concentration does not exceed 120 ug/m3 for the Canada Ambient Air Quality Objectives (NAAQO), and the NWT Ambient Air Quality Standards. | and sampling                    | the ICRP that addresses dust deposition  | the ICRP that addresses dust deposition  |
| Land   |   |                                 |  |  |
| Disturbed sites are suitable for Caribou grazing | Minimum acceptable % of vegetation cover by specific target dates   | Monthly monitoring and sampling | If appropriate, reference specific research plan(s) that addresses reclamation of land | If appropriate, reference specific monitoring plan(s) in the ICRP that addresses reclamation of land |

### 5.2.3 Alternative Closure Options, Identified Risks and Contingencies

This section presents “alternatives analyses” as appropriate, of various closure options per requirements in water licenses and/or land use permits, including a discussion of various risk scenarios and contingencies. The analysis should then be followed by a selection of preferred reclamation activities, including descriptions of management systems and accountabilities. This section should also consider any unique or novel closure situations or options. For example, explain how closure options are being developed for a complex mine that has more than one open pit, in which one pit may close prior to the other open pits. In this case, an early closure date for one pit may occur prior to a full evaluation of all closure options for the other open pits have been fully evaluated.

This section is dynamic in that it likely will be modified over time from development of the Initial Closure Plan through Interim Plans to the Final Closure and Reclamation Plan.

### 5.2.4 Reclamation Activities and Associated Engineering and Environmental Work

This section should describe all demolition, construction or rehabilitation works that are planned for each mine component. A logical sequence and timing of the works should be provided (i.e., re-grading comes before re-vegetation). A Gantt-type chart or equivalent should be used to depict temporal sequences of multiple tasks, including identifying critical paths (i.e., those that would impede the progress of inter-related tasks or the overall project process).

### 5.2.5 Residual Effects

As part of the post-closure environmental assessment described in Section 7.0, conduct an assessment of any potential negative residual effects which may remain after the reclamation work for each mine component has been completed. Provide results of any relevant risk assessments and contingencies to deal with the residual effects. Refer to

reclamation research plans (in the next sub-section) that are proposed to address the negative residual effects. Refer to Residual Effects Table in Appendix as necessary.

### **5.2.6 Uncertainties**

Uncertainties are defined as outstanding questions related to achieving the stated reclamation and closure objectives regarding physical, biological, chemical, and/or geographical aspects of the mine. It's the difference between what we know about certain options and what information is still outstanding in order to know how to achieve those closure objectives. The uncertainty leads to the development of specific reclamation research or engineering study plans.

#### Reclamation Research Plans

Reclamation research may be needed to address uncertainties in environmental risks (e.g., predicted negative residual effects are not acceptable). Reclamation research plans are designed to provide data and information which will reduce uncertainties to acceptable levels of risk. This means that for each closure objective the uncertainties must be defined and information needs must be described. Thus, the final formulation and execution of the reclamation research plan will have direct links to closure objectives, stated risk and uncertainties, and feasible approaches that can yield timely and effective reclamation solutions. An example reclamation research plan is provided in the Appendix.

#### Outstanding Engineering Issues/Questions

There may be unknowns associated with the design and engineering of various facilities. Although the unknowns may not present an environmental risk, it may be difficult (at the time of ICRP preparation) to estimate final closure costs, which form a critical part of determining financial security. Provide a tabulated summary describing the outstanding engineering issues and a brief description of any engineering studies and the associated timelines for completion of the studies.

### **5.2.7 Post-Closure Monitoring, Maintenance and Reporting**

The success of the closure and reclamation plan is contingent on the development and implementation of a functional monitoring program, which likely began during exploration stage, has continued during operations and will continue to occur through post closure. Provide a description of what will be monitored (e.g., fugitive dust, stream flow, wildlife movement) and their sampling locations, frequencies and duration, and the criteria with which various parameters will be compared to.

Explain any maintenance activities that will occur during post-closure monitoring. Provide an outline of the monitoring reports, the frequency that these reports will be provided and the management and accountability structure that will be responsible for undertaking this phase.

### **5.2.8 Post Reclamation Landscape**

Using maps, photos, photomosaics, etc as appropriate describe the final landscapes after all reclamation is completed, based on fulfilling all closure objectives. Show all relevant and important water bodies (including watershed boundaries), topographic modifications, vegetation changes and changes to the built environment. Describe any important or unique environmental conditions (i.e., atmospheric, physical, biological, chemical and/or social) for each mine components and how it affects closure objectives.

### **5.2.9 Contingency Program**

Describe how unforeseen events or conditions (e.g., something preventing the success of a reclamation activity) would be handled. Explain how any closure monitoring might be affected.

## **6 Progressive Reclamation**

Progressive reclamation is considered separately from overall closure as it is a key component that reviewers will want to evaluate separately. Nevertheless, any progressive reclamation should be an outgrowth of the overall stated closure objectives, in that the desired effect would be more effectively arrived at when progressive reclamation practices are implemented. Thus, separate progressive closure goals and objectives are not necessary.

### **6.1 Definition of Progressive Reclamation**

The following is the accepted definition of progressive reclamation: Progressive reclamation takes place prior to permanent closure to reclaim components and/or decommission facilities that no longer serve the objectives of the mining project. These activities can be done during operations with the available resources to reduce future reclamation costs, minimize the duration of environmental exposure and enhance environmental protection. Progressive reclamation may shorten the time for achieving reclamation objectives, and may provide valuable experience on the effectiveness of certain measures which might be implemented during permanent closure.

### **6.2 Prospective Facilities/Areas and Reclamation Activities**

Within the context of the goals of the overall closure and reclamation plan and the timeframe of the project, describe/list those facilities and/or areas of the exploration site where progressive reclamation can be or has already been conducted (this may be broken out into separate sections if necessary); provide general descriptions that would include locations, areal extent, and a summary of potential methods that would likely be used. This section can also be integrated with various aspects of specific reclamation research plans and/or monitoring plans, which provides opportunities to reduce uncertainties.

### **6.3 Progressive Reclamation Monitoring, Maintenance and Reporting Program**

Describe any monitoring activities that will occur solely for the purposes of addressing progressive reclamation to ensure that the goals and objectives of the closure and reclamation plan will be met. These may include components of an environmental baseline program or an existing surveillance network program.

## **7 Temporary or Interim Closure Measures**

### **7.1 Definition of Temporary/Interim Closure**

The following is the accepted definition of progressive reclamation: Temporary or Interim closure occurs when exploration activities cease with the intent of resuming activities in the near future. In this case a temporary closure might imply an unplanned closure, while interim might imply a planned closure of certain facilities in a complex mining project. These closures can last for weeks or years based on planning, the need to analyze and understand the results of an on-going exploration program as well as other economic, environmental and social factors.

### **7.2 Temporary Closure Goals, Objectives**

State the goals (e.g., protect human, wildlife and environment) and objectives (e.g., follow temporary closure strategies and measures as outlined by the Mine Reclamation Guidelines (INAC, 2006)) of the temporary closure plan. The objectives should relate to specific aspects of the overall mining project.

### **7.3 Temporary Closure Activities**

Describe activities and their closure methods that will occur for each facility/area to ensure the temporary closure objectives will be met, and for maintaining the stability and integrity of existing facilities and structures. For example, for those explosives not used up during exploration and depending on the expected duration of temporary closure, explosives will be shipped off site or secured in powder magazines. Explain any specific and unique elements or factors that need to be considered for a short-term or long-term shutdown. Provide a rationale for defining what is meant by short-term or long-term and why the management and/or activity will vary based on length of shutdown.

Describe any security and access issues to ensure site safety is maintained during temporary closure. Provide information on the management structure that will oversee the mine site during temporary closure including the number of on-site workers and others that would support a monitoring program.

### **7.4 Monitoring, Maintenance and Reporting**

Describe any monitoring activities that will occur during temporary closure to ensure that the goals and objectives of the closure and reclamation plan will be met. These may include components of an environmental baseline program.

### **7.5 Contingency Program**

Describe how unforeseen events or conditions (e.g., something preventing the success of a reclamation activity) would be handled. Explain how any closure monitoring might be affected.

### **7.6 Schedule**

Describe the anticipated timing and sequence of events preparing for and occurring during temporary closure. Provide descriptions for each facility and/or area affected. Use charts or tables if the nature of activities is complex. Provide estimate of closure duration and indicate, to the best known, if the temporary closure will be short-term or long-term if known.

## **8 Integrated Schedule of Activities approaching Permanent Closure**

Provide a “life of mine” schedule depicting operations, decommissioning, closure dates, reclamation activities for each mine component (or component grouping), any progressive reclamation, initiation and completion of research including pilot studies, and monitoring and reporting phases (including type of monitoring that reflects each valued environmental component). Discussion should be augmented with reference to GANTT-type chart that depicts overlapping activities and critical dates or pathways. Also discuss uncertainties in schedule based on for example, extent and success of progressive reclamation, temporary closure and upset conditions.

## **9 Post-Closure Site Assessment**

This chapter should provide a description or study design of how the proponent will assess the residual environmental impacts of the entire project (as a whole) once reclamation and closure activities have been completed, and provide a preliminary assessment of residual environmental impacts that are predicted to occur at the end of reclamation and closure activities. This implies that impacts are evident and measurable.

The presentation should discuss (in separate sections depending on length of analysis) residual impacts for each valued environmental component such as the physical components (air, land and water) and biological components (wildlife, avifauna and aquatic organisms and their habitat). The discussion needs to be integrated with the summary of residual effects from each mine component provided in Section 5.3.5.

## **10 Literature Cited**

### **11A Required Appendices**

Glossary of Terms and Definitions

Definitions section should include discipline-specific technical terms (e.g., processed kimberlite, esker, dewatering) and key generic terms (e.g., goals, objectives, criteria, etc.) explained in plain language.

List of Acronyms

List of Abbreviations

List of Units and Symbols

Detailed Tabulation of Closure Objectives and Criteria – tables developed per Section 5.2.2

Post Closure Monitoring and Reporting

Expected Cost of Closure and Reclamation

Reclamation Research and/or Engineering Study Plans

**Example Reclamation Research/Engineering Study Plan Outline:**

**1) Uncertainty** - States the uncertainty or the research/study question that will be addressed with respect to mine-component closure objectives. The uncertainty is defined as an outstanding question on how a physical, biological, chemical, and/or geographical aspect of the mine will be addressed through the research/study plan.

**2) Research/Study Objective** - States the purpose and desired outcome of the research/study.

**3) Research/Study Plan Overview** - The work may be stated as a list of the tasks necessary to meet the research/study objectives. Some of this work has already been completed. The overview may also provide the rationale for the timing, sequencing and priority of the work to be completed. The research/study tasks will be divided into three phases as follows:

3.1 Tasks completed

3.2 Tasks to be started prior to next version of ICRP is issued

3.3 Remaining tasks

**4) Findings of Research/Studies Completed** - Provide a summary of the status of the research/study to date (those Tasks completed in section 3.1 above). This provides the basis for assessing what data and information are still required, and provides for the flexibility of incorporating these assessments into future iterations of the Reclamation Research and/or Engineering Study Plans (and ICRP). This section may be presented in the four subsections: s

4.1 Summary of relevant results,

4.2 Application of lessons learned,

4.3 Description of the data and information still missing, and

4.4 Recommendations for future work.

**5) Remaining Research/Studies to be Completed** - Provide a detailed or conceptual level scope of work for each of the Tasks described above in Section 3.0. More detail is expected for those tasks to be completed prior to next version of ICRP is issued. This section is presented in the following two subsections:

5.1. Detailed scopes of work (how and when the data/information or analyses will be conducted) for those Tasks described in Section 3.2

5.2. Conceptual scopes of work for those Tasks described in Section 3.3

**6) Linkages to Other Research/Studies and LOM Plan** - Identify how this research/study project is linked to and affected by the results from other research plans/engineering studies, and how the timing of the research planning is linked to mining operations through the LOM Plan.

**7) Project Tracking and Schedule** - Describe the tracking of research/study progress. *(This should not be confused with reclamation monitoring (Appendix G) which tracks progress toward meeting closure criteria)*

**8) Costs** – Provide the expected costs for the reclamation research/engineering study plan activities.

**9) References** - Include references for completed research/studies.

### Summary of Community Engagement and Consultation

- Note that water and assessment boards consult with First Nations/Inuit, while proponents engage with First Nations/Inuit

## **11B Optional Appendices**

### Risks and Contingencies

Lessons Learned – provide a summary table of relevant on-site closure issues/concerns that have been dealt with successfully or unsuccessfully – in particular focusing on those lessons which would have direct application to managing closure for this project. For example, this table could take the form of the following:

| <b>Development</b>                        | <b>Activity Which Led to Lesson</b>                   | <b>Lesson Learned</b>   | <b>Adaptive Management Result</b>   |
|---|---|---|---|
| Ekati Diamond Mine - NWT                  | Infrastructure development in caribou migration paths | Potential for caribou passage to be impeded or for caribou to be injured/killed by infrastructure | Provided wildlife access ramps on haul roads; inokhoks were constructed around perimeter of site  |
| Brewery Creek Mine - Yukon                | Re-vegetation of reclaimed slopes                     | On-going fertilization over a period of 3 years was more important than rate of seed application. | Adjusted future re-vegetation programs to include maintenance fertilizing for additional years to develop stability and self-sustaining vegetation cover. |
| Polaris Mine and Nanisivik Mine - Nunavut | Management of hydrocarbon contaminated materials      | Placement of hydrocarbon contaminated materials in the underground workings                       | Hydrocarbon contaminated materials stabilized by encapsulation within the permafrost zone   |

## Appendix 4

### Process for the Development of an Interim Closure & Reclamation Plan for Mines in the Mackenzie Valley

| Event   | Responsibility   | Purpose   | Content   | Proposed Timeline |
|---|--|---|---|-------------------|
| Identification of Reviewers   | Land & Water Board   | <ul style="list-style-type: none"> <li>To identify appropriate individuals from each organization who are available and capable of participating in the following process as a reviewer</li> </ul>  |   |                   |
| Site visit with community members and all appropriate organizations | Proponent  | <ul style="list-style-type: none"> <li>To update all reviewers on the current status of closure at the project and review previous closure decisions and considerations made to date;</li> </ul>  |   |                   |
| Submission of proposed closure objectives to the Land & Water Board | Proponent  | <ul style="list-style-type: none"> <li>To provide for the documentation, review and verification of global and component-specific closure objectives, that will provide the foundation for the development of the interim closure plan and will eventually provide the basis for the evaluation of the Final Closure and Reclamation Plan;</li> <li>Outline areas of the 'Closure and Reclamation Plan Guidelines' that are not intended to be fully addressed at this update to the ICRP.</li> </ul> | <ul style="list-style-type: none"> <li>The overall closure goal(s) for the project at a conceptual level;</li> <li>A list of all the project components (i.e. wells, waste rock piles, fuel storage, airstrip, etc.);</li> <li>The proposed global and component-specific objectives for each component;</li> <li>When 'where appropriate or where practical' are used, it is intended to mean that this is the ideal goal and the oneness is on the proponent to provide rationale for why this objective, option or criteria isn't appropriate or practical.</li> </ul> |                   |
| <b>Review Period</b>  | <ul style="list-style-type: none"> <li>"Closure Goals and Objectives Workshop"</li> <li>Verification Period</li> </ul> | <ul style="list-style-type: none"> <li>To determine if consensus on the closure goals and objectives can be obtained;</li> <li>To ensure that all reviewers have a chance to review and comment on the proposed closure goals, objectives and work plan.</li> </ul>   |   |                   |
| <b>Board Decision</b>   |  | <ul style="list-style-type: none"> <li>To provide certainty to all parties regarding the project components, the</li> </ul>   | <ul style="list-style-type: none"> <li>A description of how the remainder of the review and approval process will proceed;</li> </ul>   |                   |

|               |  |                    |   |   |  |
|---------------|--|--------------------|---|---|--|
|               |  |                    | closure goal(s) and closure objectives that will be included in the updated ICRP.   | <ul style="list-style-type: none"> <li>• A list of the project components that will be included in the plan;</li> <li>• A decision to support the proposed closure definitions, closure goal(s) and closure objectives.</li> </ul>  |  |
|               | 'Closure Options, Criteria and Uncertainty Workshop'     | Proponent          | <ul style="list-style-type: none"> <li>• To present and obtain comment on proposed and alternative closure options in order to the proponent in identifying a preferred option;</li> <li>• To brainstorm potential measurable closure criteria that describe each closure objective;</li> <li>• To discuss areas of uncertainty with each closure option and identify specific 'Reclamation Research Plans' and 'Engineering Studies' to address each.</li> </ul> | <ul style="list-style-type: none"> <li>• Determining the strengths and weaknesses of closure options and areas of focused investigations to address information gaps (level of detail dependent on current stage of project);</li> <li>• Discussion of novel and previously considered closure options;</li> <li>• An evaluation of each closure option to ensure it is consistent with the overall reclamation goal, any global objectives and the relevant component-specific objective;</li> <li>• Proposed closure criteria.</li> </ul> |  |
|               | Submission of updated Interim Closure & Reclamation Plan | Proponent          | <ul style="list-style-type: none"> <li>• To fulfill Water Licence requirements;</li> </ul>  | Please refer to Appendix 3, titled ' <i>Annotated Outline for Preliminary, Interim &amp; Final Closure &amp; Reclamation Plans for Mines in the Mackenzie Valley</i> ' for an explanation of content to be included in the drafting of the plan.  |  |
| Review Period | Circulate ICRP update to all reviewers for comment       | Land & Water Board | <ul style="list-style-type: none"> <li>• To ensure commitments have been upheld and appropriate suggestions have been considered within the updated ICRP;</li> <li>• To ensure the proponent has an approved plan that is technically and socially sound; and</li> <li>• To identify any unresolved issues.</li> </ul>  |   |  |
|               | Send out reviewer comments to proponent for a response   | Land & Water Board | <ul style="list-style-type: none"> <li>• To allow the proponent to respond to reviewers comments;</li> <li>• To allow the Board to know whether the proponent has either committed to fulfilling requests from reviewers or has disagreed and offered a reasonable explanation.</li> </ul>  |   |  |

|  |                           |                    |   |   |  |
|--|---------------------------|--------------------|---|---|--|
|  | (possible) Board Workshop | Land & Water Board | <ul style="list-style-type: none"> <li>To potentially resolve any outstanding issues and provide further clarity to the Board and all parties.</li> </ul> | <ul style="list-style-type: none"> <li>This meeting will only be held if deemed necessary by the Board.</li> </ul>  |  |
|  | <b>Board Decision</b>     | Land & Water Board | <ul style="list-style-type: none"> <li>To consider the submission of the Closure and Reclamation Plan for approval.</li> </ul>                            | <ul style="list-style-type: none"> <li>Provide direction to the proponent on how to revise the closure and reclamation plan if necessary and outline the process for the review and approval of the RRP and RMP.</li> </ul> |  |

\*\*\*\*\* This process may be modified by the respective Board with sufficient rationale.

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