Muskwa-Kechika Management Area

Monitoring and Restoration
For
Industrial Developments

Prepared for:
Muskwa-Kechika Advisory Board

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Summary

Construction activities, access, operational activities and restoration activities related to industrial developments can result in disturbance to and disruption of the ecological processes and wilderness values associated with the Muskwa-Kechika Management Area. The challenge is to establish goals relating to developments creating the 'smallest footprint for the shortest period' and outline a methodology that ensures industrial activities are timely, effective and demonstrate real benefits to business processes as well as minimizing impacts to environmental and wilderness values.

To be successful is going to require stepping back from the progressive process approach currently used for planning, approving and constructing many development projects to an approach that is more staggered than lineal with a proactive focus on activities that will hasten ecological recovery from disturbances.

The objectives identified for this report,

1. Development of a scientific monitoring methodology that clearly links the strategic direction with operational activities and criteria identified in Pre-Tenure Plans (PTP).
2. Develop a process to determine when a project disturbance is considered returned to a natural state as indicated in the PTP's.
3. Develop templates for reporting out strategic and operational level monitoring of activities in the M-KMA.
4. Provide a set of indicators that will measure the values addressed in the Muskwa-Kechika Advisory Board(M-KAB) wilderness definition.

Comprehensive project planning, coinciding mitigation activities and on site monitoring activities will be key to the successful integration of ecological restoration, oil and gas construction, operational logistics and business processes.

The monitoring methodology outlined in the report will address operational level activities such as construction and maintenance, strategic indicators relative to achieving PTP targets, and outcomes of mitigation activities intended to return disturbed areas to their natural state.

Returning disturbed areas to their natural state is consistent with ecological restoration. Many projects and reports regarding ecological restoration address the restoration as a standalone project conducted after site degradation due to natural disturbances or human activities. The recommendation that provides the greatest challenge in this report is incorporating mitigation and restoration activities into the project planning process at the earliest stages, so that not only the wilderness and ecological values important to the Muskwa – Kechika Advisory Board are addressed but also the cost effectiveness for the project proponents business plan.

Recording and reporting templates for monitoring provide a framework to build upon depending on the specific nature, location, scope and values at risk for a particular project. As with indicators and outcomes; values, risks and indicators related to monitoring need to be identified for each project with appropriate revisions.

Introduction

The Muskwa-Kechika Management Area (MKMA) is approximately 6.4 million hectares in size. Approximately 1.6 million hectares in parks and protected areas where industrial developments are not allowed, with the remaining 4.8 million hectares potentially open to industrial developments that can demonstrate consistency with the *Muskwa-Ketchika Management Area Act* management objectives for the area.

The MKMA was initially identified through the Land and Resource Management Planning process in north-eastern British Columbia. The area was recognized as unique due to its large size, largely unroaded nature, as well as the ecological and geographical diversity represented within.

The MKMA Act and the subsequent Order-in-Council MKMA Management Plan, were created to provide guidance regarding management of the natural resources and activities within the MKMA.

Additionally a public advisory board, the Muskwa-Kechika Advisory Board, was appointed by the Premier to provide advice to government.

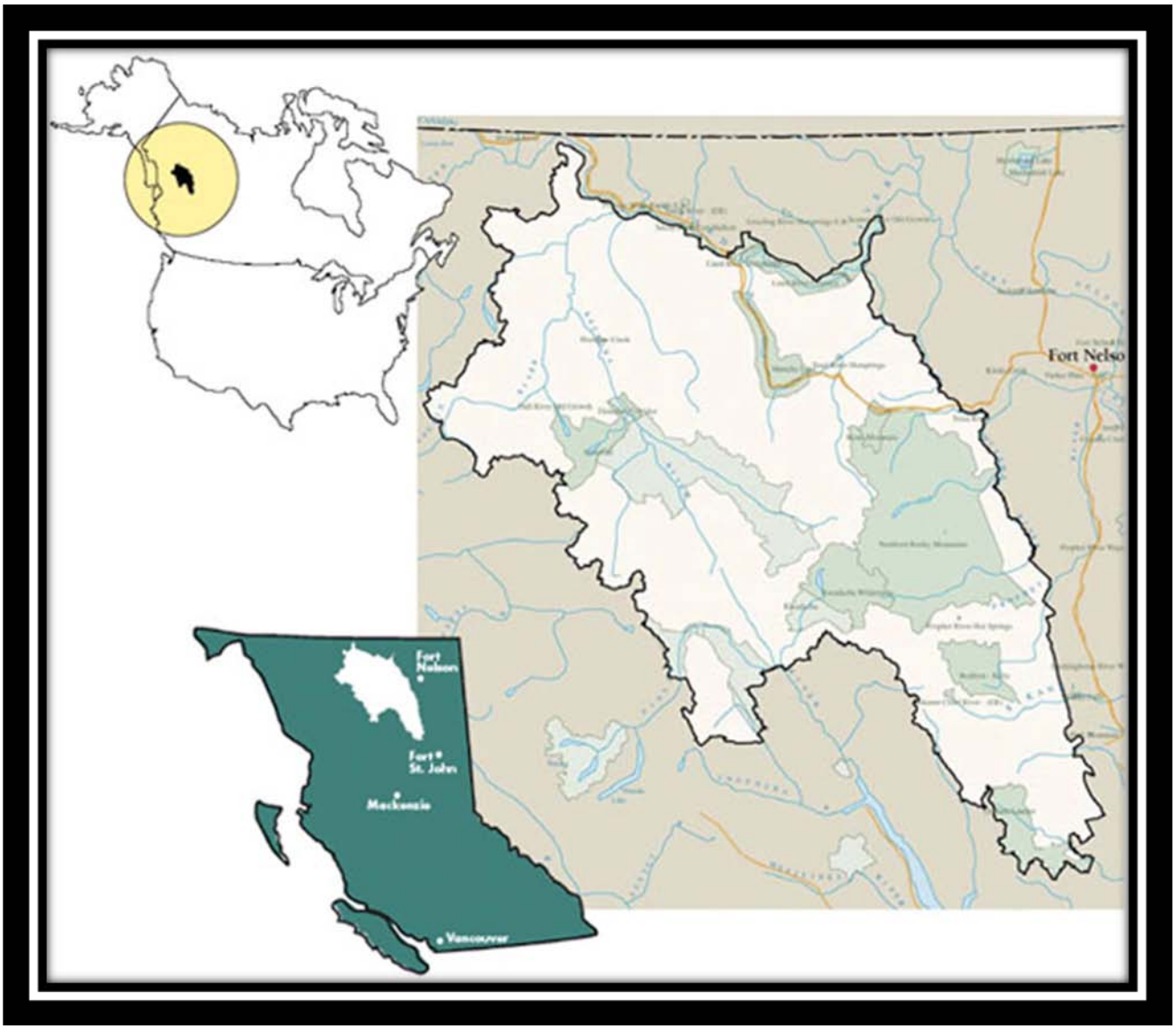
The Muskwa-Kechika Advisory Board has established a vision for the MKMA.

"The MuskwaKechika Management Area is a globally significant area of wilderness, wildlife and cultures, to be maintained in perpetuity, where world class integrated resource management decision-making is practiced ensuring that resource development and other human activities take place in harmony with wilderness quality, wildlife and the dynamic ecosystems on which they depend"

The *Muskwa-Kechika Management Area Act* (the *M-KMA Act*) establishes the requirement for pre-tenure planning for oil and gas exploration and development in the Muskwa-Kechika Management Area (M-KMA) prior to the disposition of petroleum and natural gas rights. It draws on management direction in approved Land and Resource Management Plans covering the MKMA. Pre-tenure plans are intended to:

- encourage and guide environmentally-responsible development of oil and gas resources by providing results-oriented management direction that ensures oil and gas activities are consistent with the *M-KMA Act*;
- provide a sustainable resource management framework to address social well-being, environmental conservation and economic prosperity, and
- identify roles and responsibilities for ongoing monitoring of progress in achieving the results anticipated by the pre-tenure plan.

Figure 1 - Muskwa-Kechika Management Area
Map indicating comparative size and general location



Background

In 2007 the Integrated Land Management Bureau(ILMB) initiated the '*Oil and Gas Development Monitoring Framework'* project for the Muskwa-Kechika Management Area (M-KMA).

The initial project had three objectives:

1. Development of a monitoring methodology that clearly links the strategic direction from the Pre-Tenure Plan process with operational activities and critieria.
2. Identify a process to determine when disturbance from a project is considered returned to a natural state and is then taken "off the books" as identified in the Pre-Tenure Plan process.
3. Development of a template for reporting on strategic and operational level monitoring of oil and gas activities in the M-KMA.

"*Recommendations for Reclamation/Restoration and Monitoring Resource Development within the Muskwa-Kechika Management Area*" was the initial report completed by Green Tree Resource Contracting Ltd. The report included recommendations for a comprehensive and coordinated planning process as well as a field monitoring procedure.

In 2008, ILMB staff, field tested the monitoring procedure and evaluation criteria at oil and gas development sites within the southern portion of the M-KMA. "*Muskwa-Kechika Management Area Oil and Gas Development Monitoring 2008*" is the report of the field observations and testing of the monitoring procedure.

Note: Sites visited in 2008 and 2010 were almost exclusively sites where the development ceased after the initial drilling stage.

The objectives for the 2010 portion of the '*Oil and Gas Development Monitoring Framework'* project included:

- Development of a scientific monitoring methodology that clearly links the strategic direction with operational activities and criteria identified in Pre-Tenure Plans (PTP).
- Develop a process to determine when a project disturbance is considered returned to a natural state as indicated in the PTP's.
- Develop templates for reporting out strategic and operational level monitoring of activities in the M-KMA.
- Provide a set of indicators that will measure the values addressed in the Muskwa-Kechika Advisory Board(M-KAB) wilderness definition.

Restoration Goals in the Muskwa-Ketchika

Muskwa-Kechika Management Area Act (the *M-KMA Act*)

The preamble of the Act identifies the M-KMA as an area of unique wilderness of global significance and outlines the following management intent with respect to oil and gas activities:

"… to maintain in perpetuity the wilderness quality, and the diversity and abundance of wildlife and the ecosystems on which it depends while allowing resource development and use…….. including …….. oil and gas exploration and development."

Muskwa-Kechika Management Plan

Sections 7.0 to 10.0 of the Muskwa-Kechika Management Plan specify objectives for management. Local strategic plans are expected to meet the objectives and strategies of the Management Plan, however it is also recognized that feedback from local strategic plans may lead to amendments to the Management Plan. The Management Plan provides for certain authorizations approved prior to the Management Plan coming into force to be exempt from the Management Plan.
The General Management Direction in the Management Plan conveys three main points:

- *The management intent for the M-KMA is to ensure wilderness characteristics, wildlife and its habitat are maintained over time, while allowing resource development and use, including …….. oil and gas exploration and development.*
- *The integration of management activities especially related to the planning, development and management of road accesses within the M-KMA is central to achieving this intent.*
- *The long-term objective is to return lands to their natural state, as much as possible, as development activities are completed.*

Muskwa-Kechika Advisory Board An Operational Wilderness Definition February 29, 2004

Wilderness Definition: Wilderness consists of two inter-related concepts, an ecological system maintaining its ecological integrity, based on best scientific analysis, and a large area perceived by humans to be natural or wild, based on anthropocentric criteria.

Definitions:

"ecological system" - ecosystem: a self-sustaining community of plant and animal species, the non-living components of the environment on which that community depends, and the interrelationships between all of these.

"ecological integrity" - a state or condition where structures and functions of the ecological system (or ecosystem) remain unimpaired by human-caused disturbances, where all native species are present at viable population levels and where, within successional limits, the ecosystem is likely to persist and evolve naturally. Ecosystems have integrity when their components (plants, animals and other organisms) and processes (such as growth, reproduction, predator-prey relationships, and disturbance regimes) are functioning within a natural range of variation.

"large area" - an area greater than 5000 ha. (as suggested by the Wilderness Advisory Committee, 1986.)

"perceived by humans" - in the opinion of a neutral human observer or observers familiar with the ecosystem or area.

"natural" – perceived as unaffected by humans or human activities, particularly industrial activities, where environmental characteristics are within the range of historic variability that existed prior to European settlement.

"wild" –where ecological systems, including predator prey systems, exist in a state similar to that which existed prior to European settlement, in a landscape where there is a large probability of experiencing human solitude.

"Post European"- after the date of arrival of Europeans on the North American Continent.

"possible and practicable-" the goal is that best established practices and methods will be utilized, with new and innovative methods utilized where it is predicted they will create a better management outcome.

Wilderness Characteristics

Wilderness Characteristics are those elements that comprise Wilderness. If Wilderness is a large area perceived by humans as natural or wild, with an ecological system maintaining its ecological integrity, then Wilderness Characteristics include the following:

- an area greater than 5000 ha. that is perceived to be unaffected by humans, and is within the range of natural variation, where the landscape is perceived to be wild, or in a state similar to that which existed prior to European settlement, and where there is a high probability of encountering human solitude,
- a landscape where evidence of post-European-contact human activity including road access or linear corridors, industrial facilities or other infrastructure, lights, sounds, or smells, is not apparent to a neutral observer, and
- an ecosystem in a state or condition where the structures and functions of the system are unimpaired by human-caused disturbances, and where native species are present at population levels within the range of natural variation, with their processes (such as growth, evolution, and reproduction) intact.

Wilderness Quality

"Wilderness quality" is a measure of the degree to which the ecosystem and landscape retain "wilderness characteristics." It is the responsibility of the proponents of activities that would affect or alter the wilderness characteristics to measure wilderness quality on both a project-by-project and a cumulative basis. The benchmark for measuring wilderness quality should be the wilderness characteristics that exist prior to the initiation of the project, and the goal should be to return the landscape to a state that restores that level of wilderness quality over time. The objective is to maintain wilderness characteristics to the extent possible. Where they are fully maintained, wilderness quality is high. The M-KMA Act implicitly recognizes that "wilderness" cannot be maintained at all times in a landscape where industrial activity takes place, and requires that it is "wilderness characteristics" that must be maintained over time. This means that "wilderness quality" will decline for periods of time in areas where industrial activity is taking place. For instance, in the case of an open pit mine, wilderness quality may decline for many decades. However, in all cases this period must be kept as short as possible and practicable, in order that ecological integrity, and the human perception of wilderness, be maintained over time.

Planning

Project management experts will tell you that all successful projects begin with a clear definition of the end result. Hence the need for a comprehensive project plan that clearly identifies the expected end result of the entire project, the risks and the values to be addressed, the structure of the job, the sequencing and timing of project components, the objectives to be met and what the outcome should like upon completion.

The benefits of planning, related to resource developments, minimizing environmental impacts and business case benefits, are promoted in an extensive list of guidelines, processes, regulations and documents. Of the many little sayings that relate to planning situations; including "an ounce of prevention is worth a pound of cure" and "if you fail to plan, you plan to fail" the following quote from Bruce G. Posner seemed to put planning in a straight forward and applicable perspective.

Beyond the loathing and the fear lies one of the best-kept secrets in American business. "Planning," it turns out, is really no more – and no less – than another word for good management.

-Bruce G. Posner -

A review of plans and planning was not an identified output for this document. But, in order for the identified outputs to be utilized in an effective and functional manner, the completion of a comprehensive plan is the core requirement (hub of the development process). Plans must address all components of a project, from conception to complete restoration. See Figure 2.

In order for plans and planning information to be successfully communicated to all pertinent levels of people involved in the project the plans must be written and formatted with a focus on the specific project, be functional, realistically attainable and be written in plain English.

Plans must reflect the importance and influence that base line data collection has on both monitoring and restoration. Monitoring is a primary activity to determine if restoration objectives are being achieved. Incorporating mitigation activities that are intended to minimize the time frame for portions of a project to reach restoration objectives changes the timing of restoration monitoring activities to the extent that restoration monitoring may overlap with construction monitoring.

Several references to planning exist within M-KMA documents, such as the following:

The vision statement from the M-KAB includes the words " *world class integrated resource management decision-making"*. That statement seems very compatible with 'good management' and consistent with good comprehensive planning.

The Pre-tenure plans represent one level of strategic planning and the *Pre Tenure Plans – Recommended Final Pre Tenure Plan document May 2004* (PTP document) identifies "*responsible planning and management of oil and gas activities are essential to implementing the sustainable management framework that forms the basis of pre-tenure plans in the M-KMA*." This document also identifies development plans, including restoration plans, as important outputs to pre-tenure planning.

"*The Development Plan is the most important output to pre-tenure planning. A development plan covers all phases of the development proposal, identifies potential impacts of activities, and identifies measures to avoid or* ***mitigate*** *impacts. Site-specific assessments are expected to be undertaken in development planning. A restoration plan specifying actions for restoration of disturbances is also part of development planning*."

Currently, the typical project development process for oil and gas developments is a very lineal series of steps progressing from project planning and approvals, to construction, to production and operations with restoration viewed as the final step with an unknown timeframe. Each of the steps are often handled as a separate project instead of components of a larger project. This lineal progression of project development has, on occasion, resulted in planning being viewed as a means to obtain an approval rather than the core or hub of a framework built for the life of the project. See Figure 2.

A greater likelihood of success in achieving the desired future state, if an alternative project development process incorporating monitoring and restoration activities into overall project plans at the earliest possible stage and utilizing monitoring and restoration activities, as the pivot point of hub for many, if not all, phases of a project. See Figure 3.

Two of the components of a good comprehensive planning process are to identify key values and risks to the identified key values. One of the short comings in project planning and management is to identify risks but do only the bare minimum or nothing to address them. For a company to manage the risk posed to key environmental values, they must also understand their own organizations actual (not avowed) thresholds for perceiving and tolerating risk. Every organization has its own risk culture and it is often wordless or expressed as “that’s how we do things around here”.

As important as planning is, the on the ground deliverables require flexibility to ensure effectiveness from both an environmental and business perspective. Despite the best pre-project assessments and data collection there are just too many variables, climate, ecological and human based, to expect a plan to document all of them. Adaptive management and flexibility should not be interpreted as; ‘knee jerk reactions’ are the norm or even acceptable when conditions change or contingencies need to be addressed.

By identifying concepts or conceptual mitigations to identified risks in the planning process and planning for contingencies there is a greater likelihood of having the right people, the right equipment, the right materials and the right mind set available to deal with changes at the site level.

Monitoring

As identified in the planning and restoration sections, monitoring related activities must be included at the earliest stages of project planning, even if some aspects of the monitoring plan are conceptual. Monitoring plans, along with restoration plans and comprehensive development plans will form the core or hub around which all stages of project development will be based. This is intended to provide continuity to the project.

The concept of monitoring relates to a series of questions; that tend to be fairly consistent for any approach to monitoring:

- What do we already know?
  Gathering as much existing data for the project site or identify the data to be collected during pre-construction assessments as is pertinent to the parameters that are likely to be monitored. eg. If stream flow is going to be a parameter that will be monitored then ensure that stream flow volumes at all likely locations is part of the base line data collection.

- What do you want to know? Some examples include:
  - Soils: horizon depths, texture, pH, compaction
  - Vegetation: grasses, shrubs, overstory, successional stage, merchantability
  - Water: flow, turbidity, temperature, high water
  - Streams and Riparian: bed material, canopy cover, vegetation, morphology
  - Coarse Woody Debris presence
  - Visual
  - Site stability, erodibility,
  - Weather: on site conditions
  - Noise levels
  - Air Quality

- Where or what areas do you want to assess?
  Determining where parameters will be assessed is important to include in a monitoring plan. Are the parameters assessed on the entire area of the project or just site specific locations?

- When do we need to assess parameters?
  Some parameters may be monitored annually, seasonally, weekly, daily or even hourly depending on the parameter, risk to environmental values and comparability to existing or baseline data.

- How will the parameters be measured?
  Determine what methodology(s) are likely to provide consistent and accurate results.

- Who will be conducting monitoring activities?
  Clarify by position (staff, third party or other), qualifications and reporting protocol for the monitor(s).

- How will the data be reported and used?
  Will the data be submitted to or shared with others, to government agencies, or is the data for company records only?

Reviewing these questions at the initial planning stages will help to ensure that all the appropriate base line information is collected. The base line data is crucial to restoration process, particularly in determining when restoration is achieved.

Incorporating the process suggested in this document may result in monitoring both construction and mitigation activities on a single project at the same time. The focus of the monitors in such instances would involve monitoring for a combination of results and activities.

The basic goals of monitoring and associated reporting are to:

- Help ensure compliance with regulatory and permitting requirements.
- Identify variations from expected on monitored parameters.
- Identify trends that may result in unplanned results or result in inconsistencies with plans.
- Identify when there are or may be changes to the impacts on key values
- Identify options for adaptive management.

Monitoring planning should include the identification of who will be doing the monitoring, in house personnel or third party, and what will the reporting protocol be. The monitor should have some level of independence but still work as part of a project team. The monitor, or in the case of large projects, the monitoring team will be responsible for completing reports, completing technical work and acting as the lead for active operations with support from other supervisory staff and ideally all working on the site.

In order to ensure the support of all people on site and involved with the project for environmental and monitoring activities a certain level of understanding is important. Conducting orientations to enhance general awareness of environmental values and monitoring activities is recommended for all workers on the project. There may also be opportunities or the need to train some workers regarding the installation of specific mitigation or restoration activities.

Monitoring plans should consider all the potential parameters needed to address the desired future state. Those parameters then need to be assessed as to frequency of monitoring, specific locations for sampling, specific methodology for sampling, duration of sampling, location of reference points and/or photo points, seasonal timing, and other parameters that are appropriate.

Forms and reporting protocols need to reflect the entire spectrum of information to achieve objectives. The monitoring templates section of this report provides further suggestions.

Typically frequency of monitoring is highest during the construction stage of a project. Depending on the key values, the risk and the activity monitoring may be as frequently as every hour, turbidity readings during a direction drill under a stream, to annual monitoring.

An annual review of the overall permit parameters is recommended in addition to planned project activities and restoration monitoring.

Area of Influence

Determining the geographic scope for an industrial project monitoring plan is one of the most important and also more difficult components of the monitoring plan. The geographic scope is greatly influenced by the size and type of development proposed. Rarely is the risk to environmental values limited to the area identified in the project approval.

To adequately monitor some of the values impacted by development a proponent may need to identify areas outside of the approved project area that are influenced by activities related to the project. This area is identified as the 'area of influence'.

In the monitoring plan, the project proponent should identify 'areas of influence' based on the values that may be impacted and the practices to be implemented that will reduce the risk of impact beyond the approved project area.

Identifying areas of influence should be focused on values and impacts that may readily move beyond the project boundaries such as; water, air, noise and visual quality.

Achieving Restoration and Ecological Restoration

Determining when the restoration of any development project or disturbance is achieved, is a challenge even with a clearly defined objective(s) in place. Without clearly stated objectives, determining restoration success is extremely difficult at best. Incorporating the development of objective(s) and activities to achieve those objectives, even at a conceptual level, into the planning process at the earliest stages is vital to restoration success. Successful restoration typically requires two primary tools: the ability to identify activities to recreate desired ecosystems and the ability to determine if the activities are producing or have produced the desired changes. The latter is generally referred to as restoration monitoring.

Restoration related activities should be included in all aspects of project planning beginning at the earliest stages, even if some aspects of restoration are simply conceptual. Restoration plans, along with monitoring plans and comprehensive development plans will form the core or hub around which all stages of project development will be based.

There are numerous references to pre-existing and pre-development conditions as well as mention of ecosystem restoration, ecological integrity in documents relative to the Muskwa-Kechika Management Area. From the M-KMA Act to the management plan, to pre-tenure plans to the M-KAB definition of wilderness, the importance of ecological integrity and wilderness are clearly stated.

These references indicate that the overall objective of restoration activities or the desired future state for an oil and gas development project is to establish conditions that are consistent with the pre-development ecologically of the site. A suggested objective for restoration and mitigation activities is 'to return all disturbed areas to an ecological condition that resembles a known prior ecological condition or to another ecological condition that could be expected to develop naturally within the bounds of natural variation.'

The concept of a 'desired future state' is generally used to indicate the need for some level of foresight, planning and commitment from government, resource managers and industry as to the ecological condition in which an area should be maintained or restored to.

Describing the desired future state in detail so fine that it cannot reasonably be predicted or it is unattainable would serve little purpose.

The goal is to have oil and gas developments create the smallest disturbances practicable and for those disturbances to blend into the surrounding ecosystem in the shortest period of time. Realistically, a proponent of an oil and gas development project should be planning restoration activities relative to the disturbance associated with the project, keeping in mind the potential impact to the ecosystem as a whole.

The process of establishing the original site characteristics (ecosystems) that existed prior to land disturbance is the definition of restoration for the purposes of this report. The goal of restoration is to emulate the structure, function, diversity and dynamics of the specified ecosystem. It needs to be recognized that the footprint of human activity might not be erased in the short term and that a range of variability exists within any ecosystem. (Modified from Sinton Gerlin, H.M., M.G. Willoughby, A. Schoepf, K.E. Tannas and C.A. Tannas. 1996.)

So, what is ecological restoration? In general terms ecological restoration can be described as intentional activity that initiates or accelerates recovery of an ecosystem with respect to its function, integrity and sustainability. Ecological restoration on a project specific level could be described as the **'intentional activity'** that initiates, re-initiates or accelerates the processes that will lead to the establishment of an ecosystem that is characteristic of ecosystems naturally present in the area.

Ecological restoration projects have often been viewed as standalone projects conducted after industrial developments are complete or after natural disturbances have occurred. **The key challenge for industrial developments within the M-KMA is to identify, prepare and implement applicable mitigation activities as early as possible in the project, minimize re-disturbance of area as much as practicable, conduct mitigation and site stabilization so that it provides the greatest contribution to restoration goals at the earliest opportunity.**

It is important to remember that restoration and ecological restoration are forms of active management, and the responses of a site to restoration or mitigation activities cannot be predicted with certainty. Influences from natural events and climatic conditions may impact achievement of desired outcomes

Desired outcomes are individual restoration goals that form the basis for determining if restoration activities are likely to achieve the overall objective or desired future state. If all identified desired outcomes are positive, achieving the desired future state is very likely. Desired outcomes will typically address the presence of a positive factor for restoration or the absence of a factor that would negatively impact restoration. The use of one or several monitoring parameters may be needed to support a decision regarding a desired outcome being achieved or not. See Figure 4.

An example of a desired outcome statement is:

'If the monitoring results indicate that invasive plants and noxious weeds are absent then restoration will be considered to have reached its objective and no further monitoring or restoration will be necessary regarding this desired outcome. If invasive plants or noxious weeds are present, removal of these plants shall continue or be initiated and monitoring for their presence shall continue.'

The decision choices for desired outcomes will be that:

- the restoration has been successful and further restoration and monitoring are not necessary,
- the restoration has not yet reached its desired outcome but is proceeding toward success, and restoration and the associated monitoring should continue,
- the restoration has not been successful and is not trending toward the desired outcome. Causative factors should be evaluated; the restoration activities and associated monitoring should be revised.

When all desired outcomes for a defined area have been identified as successful then achieving the desired future state in that area is very reasonable expectation.

The desired outcomes are designed to be consistent with the objectives, and hence consistent with elements and criteria, identified for the M-KMA. The monitoring parameters associated with the desired outcomes do have some overlaps with the indicators and targets for objectives. See Figure 5.

Desired outcomes must be assessed on individual defined restoration units: geographical areas where mitigation or restoration activities have actively taken place and on areas intentionally identified for passive restoration. These areas are identified as restoration units. Restoration units will be stand alone polygons distinguished by the mitigation or restoration activity or combination of activities that occurs or timing of the activities that are different from immediately adjacent areas. Due to the potential variability of the response to mitigation and restoration activities it is not recommended that non adjacent restoration units where the activities are similar be lumped together for monitoring and reporting purposes.

When all the applicable desired outcomes are achieved on all restoration units within a project the overall objective or desired future state is considered achieved.

Figure 6 – Core Desired Outcomes

Desired Outcomes Restoration Unit 'XYD example'	Achieved	Trending to Achieved	N/A	Revision Required	Monitoring Parameters / Notes / Comments
Soil Conservation					
If the monitoring results indicate the absence of erosion and surface soil movement (surface instability) then restoration will be considered to have been reached its objective and no further monitoring & restoration will be necessary regarding this desired outcome.					No evidence of accelerated erosion and sedimentation No slumping of surface soils
If the monitoring results indicate the soil is capable of supporting vegetation then restoration will be considered to have reached its objective and no further monitoring & restoration will be necessary regarding this desired outcome.					Absence of soil compaction Presence of topsoil Surface is loose and rough Vegetation presence
Water Conservation					
If the monitoring results indicate that water quality through or downstream of the project is comparable to water quality upstream of the project for open water flow conditions through one year then restoration will be considered to have reached its objective and no further monitoring & restoration will be necessary regarding this desired outcome.					Turbidity readings Other potentials include: dissolved oxygen, temperature, pH, conductivity, etc.
If the monitoring results indicate that water quality through or downstream of the project is comparable to water quality upstream of the project for open water flow conditions through one year then restoration will be considered to have reached its objective and no further monitoring & restoration will be necessary regarding this desired outcome.					Stream flow volumes Timing of flow volumes Channel locations Flow concentrations
Vegetation					
If the monitoring results indicate that vegetation establishment has been achieved then restoration will be considered to have reached its objective and no further monitoring & restoration will be necessary regarding this desired outcome.					Absence of invasive plants and noxious weeds – ideal. Pre disturbance levels acceptable. Percent vegetative cover – 80% of pre disturbance. % composition of unacceptable non native plants.
If the monitoring results indicate that vegetative structure within 50% +/- of pre disturbance structures has been achieved then restoration will be considered					Coarse Woody Debris Shrub and Tree presence

to have reached its objective and no further monitoring & restoration will be necessary regarding this desired outcome.					
Riparian Areas					
If the monitoring results indicate that vegetative cover is greater than 80% of pre disturbance vegetative cover has been achieved then restoration will be considered to have reached its objective and no further monitoring & restoration will be necessary regarding this desired outcome.					Percent vegetative cover – 80% of pre disturbance. % composition of unacceptable non native plants.
If the monitoring results indicate that vegetative structure within 50% +/- of pre disturbance structures has been achieved then restoration will be considered to have reached its objective and no further monitoring & restoration will be necessary regarding this desired outcome.					Coarse Woody Debris Shrub and Tree presence Large organic debris – if present pre-disturbance.
If the monitoring results indicate that stream banks are stable with no point sources of sediment from previously disturbed areas then restoration will be considered to have reached its objective and no further monitoring & restoration will be necessary regarding this desired outcome.					No evidence of accelerated erosion and sedimentation No slumping of bank materials Turbidity
Visual					
If monitoring results indicate the absence of introduced materials, not part of the planned site stability, then restoration will be considered to have been reached its objective and no further monitoring & restoration will be necessary regarding this desired outcome.					Absence of all human introduces materials unless part of the design requirements for site stabilization.
If monitoring results indicate that project lines are softened by feathering existing vegetation or establishing vegetation then restoration will be considered to have been reached its objective and no further monitoring & restoration will be necessary regarding this desired outcome.					Planning options Vegetation establishment – particularly shrubs and trees.

Wilderness Indicators

The PTP document identifies an objective for wilderness as 'Maintain pre-existing wilderness quality over time'. Many of the indicators and targets for this objective lack specifics but the intent of the M-KAB wilderness is fairly clear; keep disturbances as small as practically possible and restore disturbed areas as soon as possible. The PTP document refers to using the targets for Ecosystem Restoration as a surrogate.

The goals for maintaining, and where necessary, restoring wilderness quality should be:

- To ensure activities create the least impact possible and practicable on wilderness characteristics and quality during the period of construction and operation, in part by utilizing best project design
- to ensure impacts created are of as short a duration as possible and practicable, that restoration is "progressive" and proceeds as soon as possible, and
- to ensure pre-existing wilderness characteristics are restored as soon as possible and practicable after the conclusion of activities. In all cases, the goal should be a return to pre-existing wilderness conditions in one human lifetime, or 75 years after operations cease. (This time period is chosen since time periods longer than a human lifetime can be considered permanent from a human perspective.) Longer time periods may be acceptable under specific conditions, but only where it can be definitively demonstrated that ecological regeneration occurs at rates inconsistent with this goals.

To address the challenge for industrial developments within the M-KMA of identifying, preparing and implementing applicable mitigation activities as early as possible in the project, to conduct mitigation and site stabilization so that it provides the greatest contribution to restoration goals at the earliest opportunity staggered activity process is suggested. This staggered approach will help shape monitoring plans and address the elements and objectives for both restoration of ecosystems and wilderness.

Restoration Units

The 'key' to achieving successful restoration is the early establishment of restoration units and the desired outcomes for these units. The initial step is to identify restoration units, at least conceptual ones, at the earliest planning stages. The restoration units will be portions of the 'as built' project area where the mitigation and restoration activities are expected to be different than adjacent areas. This may be influenced by soils, slope, position on slope, timing of activities, research options and other mapped values. All disturbed areas will be associated with restoration unit polygons.

Restoration unit boundaries may be revised a number of times from the initial concepts. The first potential revision is at the permit approval stage. Is the planned project area the same as the permitted project area?

As the project proceeds the 'as built' area or disturbed area may vary from the permitted project area. Restoration units should be revised to be consistent with the 'as built' project. All portions of the 'as built' project area that do not have measures in place to protect soils from climatic or human activities the contribute to erosion and sedimentation will be considered 'exposed areas'.

As project construction proceeds, exposed area is being created. Depending on the mitigation activities undertaken by the project proponent and the timing of those activities, restoration unit boundaries may be revised further. The status of the restoration units may also be revised based on the mitigation activities. Through the construction and production phases of an oil and gas development the status of a restoration unit may be:

1. Exposed Area – exposed soils are not protected from climatic conditions, particularly rain and wind, surface water flows or human activities.

2. Transitional Surface Stabilization is established but is not supported by vegetation. – exposed soils have some sediment control and/or runoff control measures in place without vegetation or planned vegetation is not yet established.

3. Transitional Surface Stabilization is established and is supported by vegetation. – exposed soils have some sediment control and/or runoff control measures in place with vegetation, usually short term grasses, established.

4. Extended Surface Stabilization is established but is not supported by vegetation. – exposed soils have erosion control measures in place and/or engineered stabilization measures are in place without vegetation or planned vegetation is not yet established.

5. Extended Surface Stabilization is established and is supported by vegetation. – exposed soils have erosion control measures in place and/or engineered stabilization measures are in place and planned vegetation (suitable mixes of grasses, shrubs, trees or in combination) is established.

Within this status grouping of restoration units there some natural progressions expected, such as, transitional with no vegetation to transitional with vegetation and extended with no vegetation to extended with vegetation.

Once the decision is made to cease operation of a project and initiate restoration activities the status of the restoration units will be revised to one of three options.

1. Exposed Area – same description as above. This will include areas that have been considered exposed in the past and any new disturbances, such as a top soil pile being utilized.

2. Final Restoration Initiated – these areas will include new restoration activities and areas that previously had mitigation or restoration activities initiated but do not yet achieve the desired outcomes.

3. Final Restoration Achieved – areas previously stabilized by mitigation or restoration activities that achieve the desired outcomes.

See Figure 7.

The goal is to establish vegetation as early as possible in the project process so that potential risks and liabilities related to erosion and sedimentation are minimized, and desired outcomes can be acknowledged as soon as they are achieved. An additional goal is to support the business case of a project by completing work while equipment is currently on site as much as possible, reduce costs associated with reacting to unplanned incidents, reduce liability and reduce the overall effort and cost at the time of final restoration.

Monitoring Templates

Three templates are identified for recording and reporting monitoring data, activities and observations. The first template is a field form for documenting day to day information; the second is a monthly summary of daily monitoring activities and observations and the third template is designed to provide a running summary of disturbance area, mitigation and restoration progression as well as overlap with polygons representing key values or considerations.

The field form for recording day to day information is generally formatted in one of two ways, a fill in the blanks with dialog blocks for notes or a fill in the blanks with check boxes. The format is a matter of preference for the project proponent and their project team but is has to be usable and provide the information project managers and regulators will require. The example template of a field form presented in this section is a dialog block format to allow for example notes.

The monthly monitoring summary template is intended to highlight pertinent information for reporting purposes. Actual format choice would be up to the project proponent as would ensuring that pertinent information, anomalies, issues and trends can be identified and compared with plans or compared to other months.

The restoration status template provides the opportunity to regularly track mitigation and restoration results compared to disturbed area, habitat capability, visual sensitivity and other area sensitive indicators or targets. Some of the information documented, particularly the restoration unit status, could be updated and changed on a regular basis the restoration status report provides a running inventory of mitigation and restoration results. This information addresses some of the indicators and targets for the objectives and elements associated with the conservation of biological diversity criteria, most importantly element 1.4 – restoration of ecosystems which is also a surrogate for wilderness. The restoration status report should be updated monthly during snow free conditions or when mitigation and restoration activities are conducted.

It is recommended that project proponents have a format for reporting environmental incidents such as spills and trespasses that can be incorporated into the reporting and results critieria. The environmental incident form should include information basics of what, where, when and how along with photos, action taken and reporting done. An example template is included in this section.

Figure 8 – Monitoring Field Report

Monitoring Field Report

Project: Date:

Name of Monitor:

Weather Conditions: *(At the site – remote weather station may be consideration)*
Temp. (C): % Cloud Cover: Precipitation:
24 HR precipitation: *(actual or estimate)* Ground conditions: *(eg. Dry, surface wet, saturated)*

Orientations / Training conducted: *Identify number of persons given M-KMA orientation or specific training and corporate affiliation.*

Equipment Inspections conducted: *Typically an inspection of equipment new to site for potential transport of invasive plants or noxious weeds & often safety equipment (first aid, fire, spill kit)*

Primary activities underway on site & location: *eg. Freezing in winter access from km 2 to km 3.*

Equipment in Use: *eg. Water trucks and grader.*

Secondary activities underway on site & location: *eg. Survey crew marking boundary of well site z-99-Y/11-Q-13.*

Incidents reported: *number of incidents and nature, eg. 1spill of hydraulic oil. Recommend a separate incident report to record details of incident, actions taken, reporting done, photo documentation, etc..*

Specific Monitoring Parameters: *Directed by activities, risk and desired outcomes*

Parameter	Location	GPS	Results	Conducted By	Time
turbidy	*Dream Creek*	*Easting/northing*	*5 NTU*	*Monitor Mike*	*0900 hrs*
turbidy	*Dream Creek*	*Easting/northing*	*6 NTU*	*Monitor Mike*	*1200 hrs*
flow	*Unnamed trib.*	*Easting/northing*	*2.5 CM/S*	*Monitor Mike*	*1000 hrs*

Wildlife Observations: *reported observations of wildlife or sign including species, number, location, time, behavior, sex, age, observed by, other observations. Eg. 4 caribou between km 4 and 5, crossed road about 1215 hrs, no large antlers but one appeared to be wearing a collar. Trucker Tom.*
Wildlife Mortalities: *details of observations and basic investigation. Eg. Group of ravens observed at Creepy Creek, north west of bridge. Found carcass of animal, mainly hair and some bones. Numerous wolf tracks at site. Animal appears to be a whitetail deer of smallish size. Spoke crew at tailgate – no collisions to report.*
Photo Log*: eg.*

- *series of 8 photos taken at spill from 320 excavator unit 3. Included with Incident report 02 on share drive.*
- *4 photos of animal carcass at Creepy Creek. Attached to field report, filed by date on share drive.*

Observations / Notes / Discussions: *This is the section that will likely contain the majority of Environmental Monitors notes. What is working and what is presenting challenges. What is on schedule and what changes may be addressed. Nature of applicable discussions and who with. Are risks to values changing. Visitors to site. Notes on regulatory compliance and plan consistency. Materials on site for mitigation activities. Inspection of fuel storage. Garbage clean up / site cleanliness. Boundary markings adequate or touchups. Material stock piles (top soil) or removal. Etc.*

Figure 9 – Monthly Monitoring Summary

Monthly Monitoring Summary	
For Month of: *July 2011*	Date Completed:
Completed by:	
Days site active:	Days monitor on site:
Weather summary: *seasonal conditions / drier or wetter than normal / strong winds / etc.*	
Coldest Temp. recorded:	Warmest temp. recorded:
Total Precip. For month:	Precip. For largest single rain event:
Environmental Incidents*: number of / nature of / recurring*	
Ha of new disturbance:	Total ha disturbed:
Ha of Trans. no vegetation:	Ha of Trans. with vegetation:
Ha of Extended no vegetation:	Ha of Extended with vegetation:
Restoration Units where desired outcomes achieved:	
Total wildlife observations: *number by species / sex / age. Notable location or characteristic information.*	
Total wildlife mortalities: *number by species. Are there consistencies in timing or location?*	
# of people orientated:	# of people trained:
Equipment inspections done:	
Summary: *highlights of activities, risks, impacts, adaptations. What works what doesn't. Who visited the site. Are there reoccurring issues. Milestones achieved. Are there issues that remain unaddressed? Weather related impacts? Etc.*	
Looking forward: *Planned activities to occur. Site visits expected and who. Upcoming challenges. Possible adaptations. Scheduling issues. Materials needed. General thinking ahead.*	

Figure 10 – Environmental Incident Report

ENVIRONMENTAL INCIDENT REPORT

Location: _____

Date & Time of Incident: _____

Names of Individuals Involved: (in incident, operators, providing assistance in containment or clean up)

_____

_____

_____

Nature of Incident: (circle most appropriate) - Spill - Water - Land - Trespass - Other

For Spills: (complete the following)

What has spilled? (circle most appropriate) - Hydraulic oil - Engine oil - Diesel fuel - Gasoline - Coolant - Other (identify)

_____

Source of spill? (identify the type of equipment or container/vessel spill originated from)

_____

Estimated volume of spill (preferably in litres): _____

For Incidents other than Spills: (complete the following)

Description of Incident or Observations: (include estimate of areas affected) _____

_____

_____

_____

For ALL Incidents: (describe actions taken to report, contain, and clean up incident)

_____

_____

_____

_____

_____

_____

All environmental incidents to be reported as soon as practicable **(all incidents must be reported within 24 hours)** to:

For the _____ Project:

The onsite or on call Environmental Monitor _____

_____

and the On Site Supervisor/ Manager:_____

Page 2: (To be completed by the Environmental Monitor or Site Supervisor)

Project Name: _____

Company: (include client, contractors or subcontractor if applicable) _____
_____

Report Received: (date and time) _____

Additional action taken or further action required: _____
_____
_____
_____
_____
_____
_____
_____
_____

Photo / Document: (were photos taken? By whom? Was a photo log or other document created or referenced?)
_____
_____

Reported to: (name & association) _____

When Reported: (date & time) _____

Reporting Method: (circle appropriate) - In Person – 1-800 - Other phone - Email - Fax

Date Action on Incident is complete: _____

Environmental Monitor or Site Supervisor/Manager:

_____
Print Name Signature Date

BC GOVERNMENT DANGEROUS GOODS SPILL REPORTING: 1-800-663-3456

Figure 11 – Restoration Status Tracking Table

Restoration Status Table for month ending July 31, 2011										
Restoration unit number & description	Total area (ha)	Restoration status	Biophysical class	Bioterrain risk class	(ha) of Visually senstive	Hectares of habitat class 1/2	Hectares of habitat class 3/4	Hectares of habitat class 5/6	Date Reviewed or revised	Review or revision by:
Restoration Unit #1 *Cut slope at km 2.5 access*	*0.75*	*Trans.* *No veg.*	*Steep slope warm aspect*	*H*	*0.0*	*0.25*	*0.5*	*0.0*	*2011/0707*	*MM*
Restoration Unit #2 *Fill slope at km 2.5 access*	*0.50*	*Trans* *No Veg.*	*Steep slope warm aspect*	*M*	*0.0*	*0.0*	*0.50*	*0.0*	*2011/0707*	*MM*
Restoration Unit #3 *All weather road km 2 to 3*	*1.0*	*Exposed*	*Warm aspect forest*	*M*	*0.0*	*0.0*	*1.0*	*0.0*	*2011/0707*	*MM*
Restoration Unit #4 riparian area at Big Creek crossing	*0.25*	*Extend* *No Veg.*	*Forested flood-plain*	*L*	*0.0*	*0.25*	*0.0*	*0.0*	*2011/07/31*	*MM*
Total Area – *should be consistent with as built area*	2.5									

Glossary

Accelerated Erosion – erosion caused or increased by human activities, such as industrial developments, municipal construction or agriculture, as opposed to naturally occurring erosion.

Area of Influence – a geographic area potentially impacted by activities associated with or attributed to a specific industrial development. The area of influence will likely be larger than the area identified in the development permit. The intent of the area of influence is to recognize the potential for impacts to extend beyond area identified in the development permit. The boundaries of areas of influence are to be realistic based on the specific key values present, specific activities proposed and specific management practices identified to reduce risks to the key values.

Areas of influence must be identified in monitoring and restoration programs.

Area of influence boundaries should be identified by the project proponent, realizing that some negotiation may occur.

Example: Key values identified are fisheries and water quality associated with a stream. Specific management practices identified in the proponents development planning documents include: that a clear span structure will be used; no fuel or equipment is to be stored within 100 meters of the stream; no fueling or repairs to equipment to be done within 100 meters of the stream; spill containment materials (spill kits) will be readily available; and a spill response procedure will be in place before development activities posing a risk commence. Area of influence for this specific example may be identified as the riparian area of the stream from approximately 200 meters upstream to1000 meters downstream of the proposed development.

If inspections identify that activities are not being conducted consistent with the specific management practices identified the area of influence boundaries may be revised to reflect an increased level of risk to the key values identified.

Ecological Restoration – the process of assisting the recovery of an ecosystem that has been impacted, damaged or degraded. It involves intentional activity that initiates or accelerates the recovery of an ecosystem with respect to its function, integrity and sustainability.

Desired Outcome – a description of the desired end point for direct restoration actions or interventions, after which ecosystem processes should be able to independently achieve the desired future state.

Desired Future State – a vision statement, especially in a land and resource management context that illustrates desired future land and resource conditions.

Mitigation Activities – activities intended to lessen environment impacts of an oil and gas development by moderating the intensity, duration or timing of the development.

Monitoring Parameters – distinguishing or defining characteristics or features, especially those that may be measured or quantified.

Reclamation - is the process of returning land to its former use or other acceptable uses. Reclaimed land is usually structurally less complex than restored land, but retains a relatively high level of ecosystem function. Reclaimed land will generally have the ability to support many of the land uses that existed prior to disturbance but it may not support specific land uses.

Restoration - is the process of establishing the original site characteristics (ecosystems) that existed prior to land disturbance. The goal is to emulate the structure, function, diversity and dynamics of the specified ecosystem. It needs to be recognized that the footprint of human activity might not be erased in the short term and that a range of variability exists within any ecosystem. (Sinton Gerlin, H.M., M.G. Willoughby, A. Schoepf, K.E. Tannas and C.A. Tannas. 1996.)

Remediation – the process of removal, reduction or neutralization of contaminants from a site to prevent or minimize any adverse effects on the environment.

Resilience – the ability of an ecosystem to regain structural and functional attributes that have suffered harm from stress or disturbance.

Permitted Project Area – area in hectares identified in development approval and/or permitting documents.

As Built Project Area – area in hectares of disturbance associated with the actual construction of an oil and gas development project. The as built project area may vary from the planned project area.

Transitional Surface Stabilization not supported by Vegetation – the area in hectares of disturbance that are stabilized without vegetation established on the area. Examples of stabilization may include sloping, track walking, sediment control BMP's are more prevalent than erosion control BMP's, mechanical stabilization methods, etc.. This applies to areas that have been seeded or planted but the vegetation is not yet established or vegetative coverage is minimal; generally less than one growing season since seeding or planting.

Extended Surface Stabilization not supported by Vegetation – the area in hectares of disturbance that are stabilized without vegetation established on the area. Erosion control BMP's are prevalent, mechanical stabilization methods, etc.. This applies to areas that have been seeded or planted but the vegetation coverage is minimal; generally less than one growing season since seeding or planting.

Transitional Surface Stabilization supported by Vegetation - the area in hectares of disturbance that have been stabilized and vegetation is established on the area. Sediment control BMP's are more prevalent than erosion control BMP's or other methods that may have been implemented.

Extended Surface Stabilization supported by Vegetation - the area in hectares of disturbance that have been stabilized and vegetation is established on the area. Erosion control BMP's are prevalent, mechanical stabilization methods or other methods and BMP's may have been implemented.

Final Restoration – refers to the activities undertaken once a decision is made to cease further development, production or other operations relative to the project.

Final Restoration Implemented – the area in hectares for which restoration activities have been or are actively being conducted and the desired outcome(s) have not yet been achieved. This may include areas previously identified as temporarily stabilized without vegetation, temporarily stabilized with vegetation, long term stabilized without vegetation, long term stabilized with vegetation or area at risk.

Final Restoration Achieved – the area in hectares for which restoration activities have been conducted and monitoring results indicate the desired outcome(s) have been met.

Exposed Area – the area of disturbance (exposed soils) that has not been stabilized and continues to be exposed to climatic elements.

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