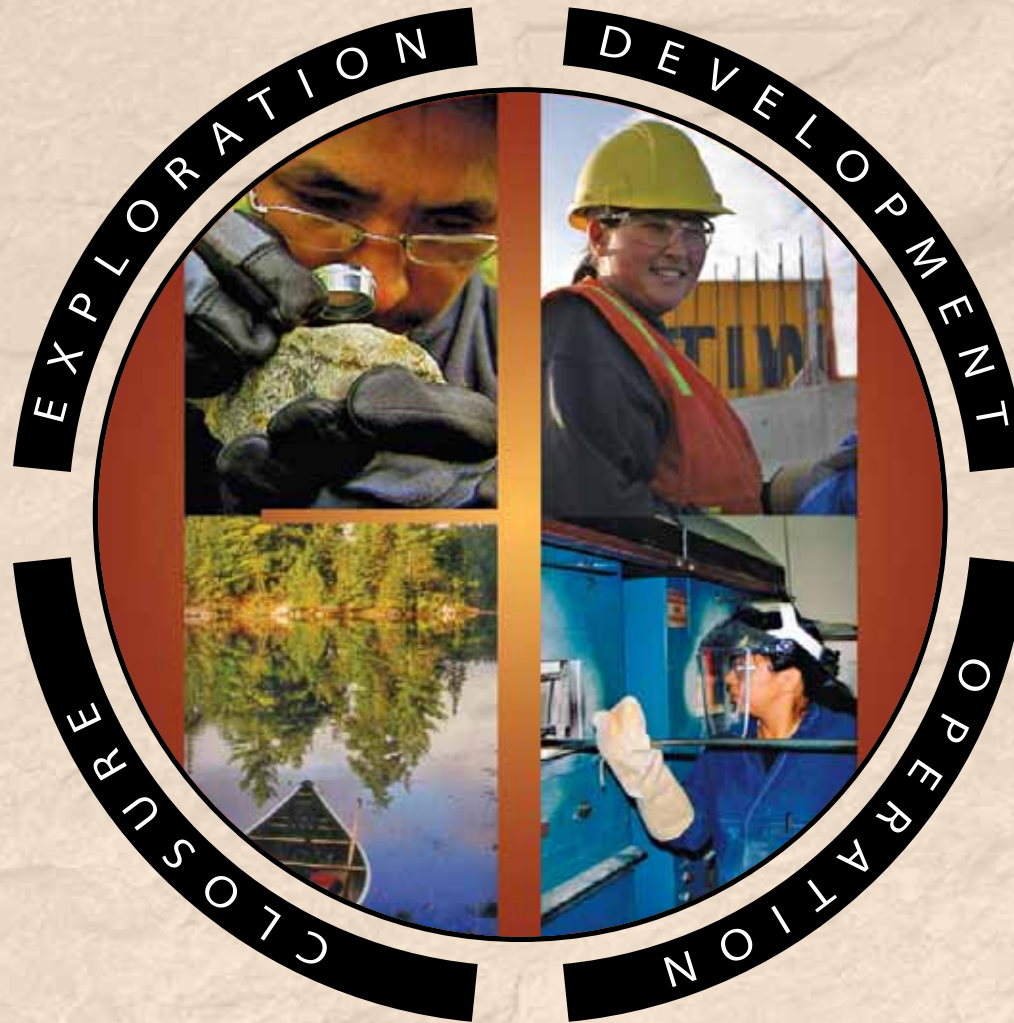


# Mining Information Kit for Aboriginal Communities





Government of Canada  
Gouvernement du Canada



MAC  
The Mining Association of Canada  
L'Association minière du Canada



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CAMA: [www.aboriginalminerals.com](http://www.aboriginalminerals.com)

INAC: [www.ainc-inac.gc.ca/ps/nap/minmin\\_e.html](http://www.ainc-inac.gc.ca/ps/nap/minmin_e.html)

NRCan: [www.nrcan.gc.ca/mms/abor-auto/mine-kit\\_e.htm](http://www.nrcan.gc.ca/mms/abor-auto/mine-kit_e.htm)

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**MINERAL  
EXPLORATION**



**MINE  
DEVELOPMENT**



**MINE  
OPERATION**



**MINE CLOSURE**



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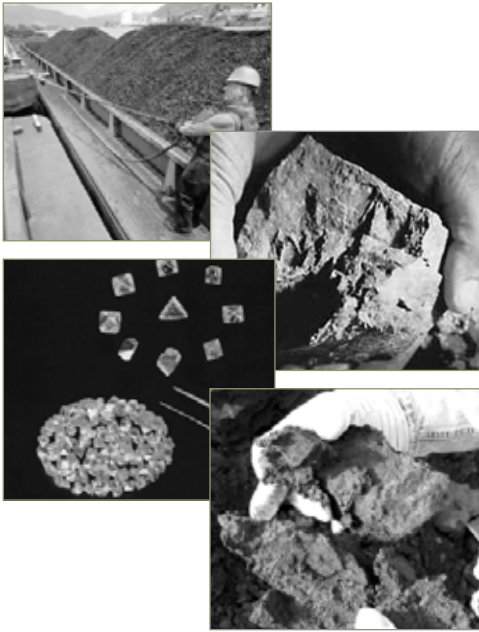
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# Introduction



Welcome to the Mining Information Kit for Aboriginal Communities.

Mining has been part of the North American economy for centuries. Not only did Aboriginal people use native rocks, they also recovered from these rocks materials that had a variety of uses including tools, weapons, and decorative objects. They mined rocks for native copper, flint, chert, siltstone, obsidian and ochre. Copper was used in the making of spear points for fishing and harpoons. Flint was used for starting fire and the manufacturing of knives, scrapers, spear points and arrowheads. Red ochre was used to paint stories on rock faces throughout North America. Aboriginal people had an extensive trade network and traded these materials throughout the Americas. To varying degrees, the recovery and use of minerals have always been part of Aboriginal culture.

Mining continues to be an important part of Aboriginal culture. Today, Aboriginal employment and participation in mining have reached unprecedented levels. However, there are still many opportunities to be realized by Aboriginal communities. This Information Kit was developed to help Aboriginal communities better understand the mining cycle and to identify the many opportunities that mining can bring to communities. There are opportunities for relationship building between Aboriginal communities and the mining industry, opportunities for communities to build capacity, opportunities for meaningful participation throughout the mining cycle, and the potential for significant economic and business growth.

Canada is one of the largest mining nations in the world, producing more than 60 minerals and metals. At the start of 2005, over 200 producing mining establishments (metal, nonmetal and coal mines), more than 3000 stone quarries and sand & gravel pits, and about 50 nonferrous smelters & refineries and steel mills were operating in Canada. The five most important minerals in terms of 2005 estimates of Canadian production value were nickel (\$3.3 billion), potash (\$2.8 billion), copper (\$2.5 billion), gold (\$2.0 billion), and diamonds (\$1.7 billion).

## Facts & Figures

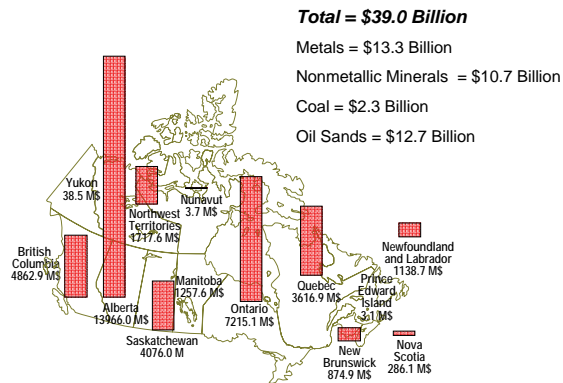
*Approximately 1200 Aboriginal communities are located within 200 km of minerals and metals activities in Canada.*

*(Source: Natural Resources Canada)*

The goal of this Information Kit is to increase the ability of Aboriginal people to understand and participate in exploration and mining-related activities.

The Information Kit structure is designed to explain the mining cycle – from prospecting and exploration – through mining operations – to mine closure and reclamation. It contains four modules that match the main phases of the mining cycle (refer to Appendix I). They are: Mineral Exploration, Mine Development, Mine Operation, and Mine Closure.

### Value of Canadian Mine Production, by Province and Territory, 2005



Note: Data are based on preliminary estimates.

Sources: Natural Resources Canada, from a federal-provincial-territorial survey on mining and exploration companies; Statistics Canada

The modules work together, but can also be used separately. Although there is some duplication from module to module, this is done to allow each module to be used on a stand-alone basis. Also, there is a glossary of terms at the end of this publication that provides definitions for words that are bolded in the text.

Within each of the four main modules, there are five common topic areas. They are:

- **Overview:** explains the purpose, main activities and key participants during each phase of the mining cycle.
- **Acts and Regulations:** identifies the general regulatory requirements, laws, and licences and permits that apply during each phase of the mining cycle.
- **Environmental and Social Impacts:** identifies the most likely impacts on people and the environment that a community may experience during each phase of the mining cycle. Ideas for monitoring, lessening impacts (mitigation), and community input are included.

- **Community Employment and Other Economic Opportunities:** identifies the many different economic and business opportunities that may be available to Aboriginal communities as a result of mining activity. This section also has ideas on how Aboriginal communities can build capacity (knowledge, skills, opportunity).
- **Community Experiences:** provides examples of strategies and success stories of Aboriginal communities dealing with the challenges of mineral resource development. It includes examples of Aboriginal-industry leading practices.

With a greater understanding of mineral activities and the mining cycle, there is increased opportunity for Aboriginal participation in mining.

The idea for the development of an Information Kit came as a recommendation resulting from a national survey of Aboriginal communities near mining projects conducted by the Canadian Aboriginal Minerals Association. The project partners include:

- Natural Resources Canada
- Indian and Northern Affairs Canada
- Prospectors and Developers Association of Canada
- The Mining Association of Canada
- Canadian Aboriginal Minerals Association

This Information Kit is designed to be received and used as a complementary tool to existing instruments and as a living document. Discussion and feedback are welcome and will help expand and enrich future editions.

# MINERAL EXPLORATION

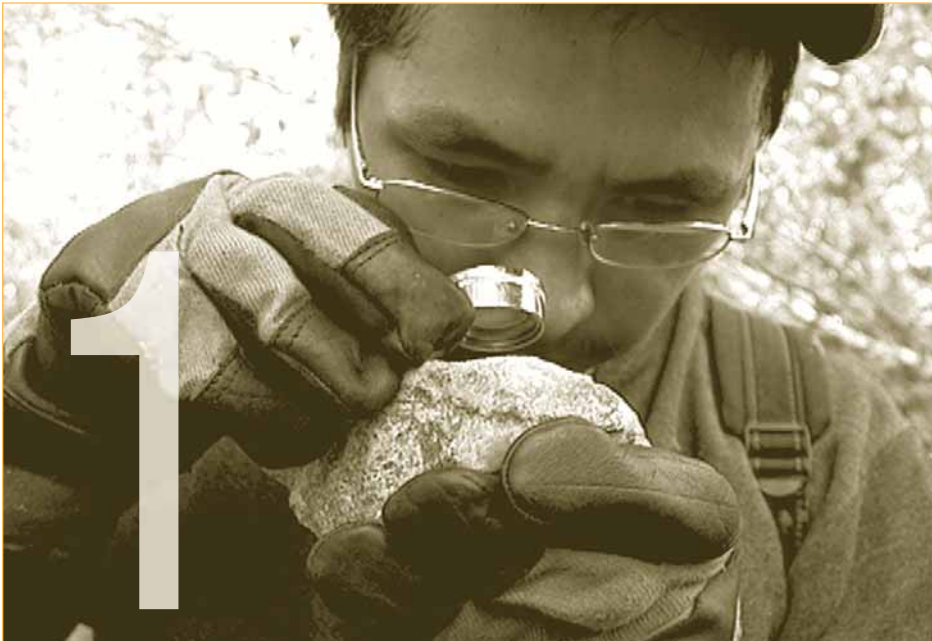
Overview

Acts and Regulations

Environmental and Social Impacts

Community Employment and  
Other Economic Opportunities

Community Experiences





## 1.1 Overview

This section of the mineral exploration module explains the purpose of mineral exploration, identifies the main activities and players, and outlines opportunities for Aboriginal communities to get involved during exploration.

have a certain type of ore deposit that could be developed as a resource. For example, the types of rocks (geology) in parts of Nunavut are similar to rocks found in other areas of Canada where gold deposits have already been discovered. This early work involves reviewing maps, surveys and reports available from the provincial/territorial and Canadian Geological Surveys or universities.

### *Types of Mineral Exploration*

- Preliminary or “grassroots” exploration involves looking for a deposit in an area where the mineral or metal has not been found before.
- “Brownfield” exploration is the search for additional deposits near a known mine.
- On-mine-site exploration is done to expand a mineral resource that has already been found and developed on the property of an existing mine.



### What Is Mineral Exploration?

Mineral exploration is the first phase of the mining cycle. It is the search for mineral deposits. Every new mine has its beginnings as an exploration project; however, most exploration projects will not advance to become mines.

The purpose of exploration is to locate a new source of metal or useful minerals. This includes industrial minerals (such as silica used in the making of glass or clay minerals used in the making of ceramics), metals (such as iron, lead, zinc, copper, etc.), and precious metals and gemstones (such as gold and diamonds).

The exploration phase starts with identifying large areas that may

The purpose of exploration is

### Facts & Figures

*The success rate for exploration is extremely low for “grassroots” exploration. Fewer than 1 in 10 000 mineral showings discovered actually become a mine.*

### *Success Rates*

The success rate is extremely low for grassroots exploration. A prospector would be fortunate to find one or two prospects that become a mine in his or her lifetime. If grassroots exploration



leads to the discovery of a mineral prospect or “showing,” many of these mineral showings (10s to 100s) need to be examined to discover one that can be taken to the next stage. Of the prospects that get to the intermediate stage, few are worth being taken to the advanced exploration stage and fewer still go beyond that. It has been estimated that fewer than 1 in 10 000 mineral showings discovered actually become a mine.

### *Time Frames*

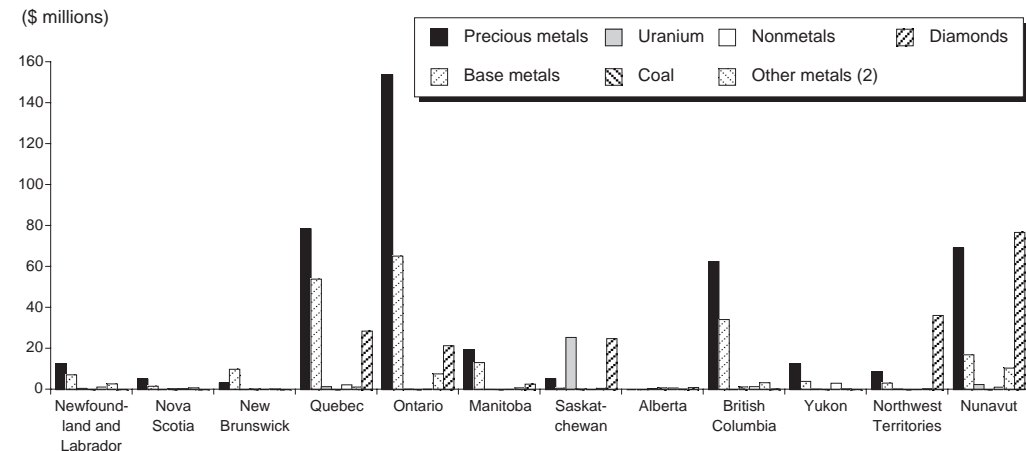
Exploration is a very slow process. For exploration programs where a promising mineral showing is discovered, it will take at least 7 to 10 years before the start of a new mine. In some cases, it can take longer depending upon a number of factors, including the willingness of investors to advance the money to explore more fully over the years. A property can be explored many times, by different companies, without success. Properties can also change ownership many times during this stage.

### *Canadian Mineral Exploration Expenditures*

The role of the junior exploration sector has become increasingly important in mineral exploration. In 2004, junior company spending on exploration in Canada overtook senior company spending.

In 2004, exploration expenditures reached \$903 million, compared to \$538 million in 2003. Precious metals ranked first representing close to 50% of total exploration expenditures in 2004, followed by base metals and diamonds at around 20% each. Together, Ontario, Nunavut and Quebec accounted for 65% of total exploration expenditures in 2004. Exploration is defined here as activities conducted to search for, discover and carry out the first delineation of a previously unknown mineral deposit to establish its potential economic value (tonnage and grade) and to justify further work.

Exploration Expenditures (1) by Province and Territory, by Mineral Commodity, 2004



(1) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre-feasibility studies, environmental and land access costs. (2) Includes ferrous metal.

Source: Natural Resources Canada



## What Are the Mineral Exploration Activities?

### *Prospecting*

Prospecting is the hunt for mineral deposits. It is the least disruptive exploration activity. It takes place in the summer. It is highly competitive and therefore a very secretive activity until the prospector has secured a mining claim.

Prospecting is a low-intensity activity. It can take many forms, from a prospector walking through the bush with a rock hammer and gold pan, to a prospector using sophisticated tools to identify exact positions using satellites (global positioning system [GPS]). It largely includes prospectors walking the ground examining and mapping rock types and collecting rock and soil samples by hand for either mineral or chemical analysis.



If there are signs of minerals, prospecting activities progress to more detailed work programs (more sampling, small portable drilling). These programs may be started to get deeper or larger samples that can be checked in a lab.

Basic geoscience surveys, such as geological mapping and even satellite coverage, help guide the search for a

mine. Many mineral deposits are structurally controlled, so understanding the basic structural geology of an area (i.e., how the rocks have been folded and faulted) is very important.

After the rocks have been examined on the ground, geological mapping is created to show the location of different types of rocks or structures of the earth. Provincial and territorial geological surveys do most of the mapping in Canada. Prospectors use geological maps to locate the best areas to explore for minerals that could lead to a mine. Maps can greatly reduce the search time.

During prospecting, a community may notice prospectors walking around. If there are no towns or other facilities near the exploration area, a small exploration camp is usually set up. The camp is often set up quickly at the start of the program and may be left in place for several seasons. The camp may consist of a few wall tents or trailers. The size and type of camp will depend on the length of the job and the number of people staying at the camp. Small aircraft for bringing in supplies, taking out samples and sending prospectors onto the land usually support the camp.

These activities do not mean that a mine is going to be developed but, rather, that there are people searching for signs of minerals.



### *Mining Claim Staking*

If a prospector believes that further work is justified, a mining claim

will be staked. A prospecting licence is needed to stake a claim. The licence required to stake a claim can be applied for at a mining recorder's office. Claim staking is used in all provinces and territories as a way of indicating to the government and other prospectors/exploration companies the area that a claim staker wishes to explore. A claim staker may decide to stake a mining claim if test results (called **assays**) show the presence of minerals with some value.

Once a claim is staked and approved by the appropriate government agency, it gives the prospector/company the exclusive right to explore that piece of ground for a certain time. It does NOT mean the prospector or exploration company owns the land; it means just that no one else can collect samples or do other exploration work on it.

In order to keep claims in good standing, a minimum amount of work “expenditures” must be done and assessment reports must be given to the appropriate government body. These assessment reports show the results of

the work done by the prospector. They can be viewed by the public through provincial, territorial, or federal mine offices. If no money is spent within a given time frame, the claim will expire and the mineral rights will return to the government. At this point, someone else can re-stake the land.

Any area of open **Crown Land** can be staked, including land traditionally used by Aboriginal people and communities. Crown Land is land that is owned by all Canadians and that is administered and regulated by government (surface and mineral rights). Anyone can purchase a prospector’s licence and prospect on Crown Land. This is known as “free entry.”

In addition to Crown Land, staking and prospecting are allowed on private land. Private land is any land that is owned by private individuals or corporations rather than the Crown. The mineral rights are usually still owned by the Crown. In some parts of Canada, Aboriginal people own both the surface and mineral rights, based on land claims agreements.

Areas that cannot be staked include:

- Land on an Indian Reserve;
- Land in a registered plan, subdivision or town site;



- Parks or other protected areas; and
- Land already staked by another prospector or mining company.

In most **jurisdictions**, claim staking is done on the ground. This is called physical staking. Claim posts are pounded into the ground in a certain pattern to mark the boundary of the ground to be explored. Claim tags are put on the posts to identify the claim itself, the staker, and the date the ground was staked. The claim must then be filed at the mining recorder's office. Information is available on how to stake claims and file the paperwork. There is also a fee for registering a claim.

In some provinces, claim staking is done by map. This is called map staking. British Columbia, Quebec, and Newfoundland and Labrador have developed an electronic, web-based system for mineral claim staking that allows people to acquire mineral rights by selecting a claim on an electronic map over the Internet rather than staking a claim on the ground.

### *Detailed Exploration*

Once a claim has been staked, the exploration program will move forward to determine if there is a mineral occurrence worth further

investigation. Based on the results of its initial prospecting work, the company will decide whether to continue with more detailed exploration.

### **Facts & Figures**

*Any area of Crown Land not specifically protected from mining development, including land traditionally used by Aboriginal people, can be staked.*



Many mineral deposits are not exposed at the surface of the earth, but are buried beneath soil, glacial **tills** or other rock formations. To test if minerals are present, it is often necessary to look beneath the surface materials to see what is there. This is done using advanced techniques such as geophysical and geochemical surveys, and

diamond drilling programs. To prepare for this advanced work, various surveys must be planned. For the surveys to be exact, a map grid is created on the land marked by narrow cut-lines in forest or by a long line of pickets on open land. Once this grid has been done, geophysical instruments can be carried along the grid and more precise work can be done, including trenching (cutting a long ditch in the ground). At this stage, the community may notice not only increased work on the ground, but also a helicopter or an airplane carrying special antennas or instruments pulled through the air.

### Sampling and Drilling

Initial prospecting takes small samples, whereas trenching, in soil or rock, can provide a larger and more representative sampling of a mineral occurrence. If earlier work indicates that there is the possibility of a mineral deposit underground, the exploration company must now be able to sample that rock to estimate the extent and shape of that mineral deposit. A diamond drill is used to cut through rock, going down hundreds of metres and bringing up lengths of cored rock (drill core). Typically, an average drill program would cost several times the total amount spent so far. The cost is per metre and varies depending on the location of activity (north is more expensive) and the availability of drilling contractors. The samples



are then sent to laboratories for “assay” and the company will analyze the results.

are then sent to laboratories for “assay” and the company will analyze the results.

### Environmental Baseline Work

Although environmental baseline studies are normally done at the advanced exploration phase, companies are encouraged to do some environmental baseline work during the exploration activity period. These are studies of soil and vegetation types, wildlife, and water analysis. These studies could include collecting water samples for testing or having an elder identify cultural areas that are to be respected. The background data provide a reference point that can be used to measure the impacts of a project over time and, if the project goes ahead, that can be used in the environmental assessments.

### Facts & Figures

*During detailed exploration, the community may notice not only increased work on the ground, but also a helicopter or an airplane carrying special antennas or instruments pulled through the air.*





### *Preliminary Deposit Evaluation*

The evaluation phase is the period during and after the field program where samples and survey information are carefully reviewed to see if the work that has been done is encouraging enough to continue with more detailed and expensive activities, such as detailed drilling and **bulk sampling**, and then advance to mine development.

### Who Are the Main Players in Mineral Exploration?



#### *Governments*

Provincial/territorial governments support mineral exploration by developing and providing geological maps and reports that guide prospectors and exploration companies to areas with mineral potential. Also, some jurisdictions enable prospectors, through special programs of training and limited financial support, to promote grassroots mineral exploration. Government also has a regulatory role of administering mineral claims and providing work permits for exploration activities.



#### *Prospectors*

A prospector is usually the first person to look for minerals in a new area. Anyone can prospect. Prospectors can work

for themselves or for exploration and mining companies. They usually work alone or in small groups. Prospectors start by purchasing a licence and then looking for areas that have shown evidence of certain minerals or favourable geology. They use maps and reports created by government geological surveys to pick areas to explore.



A prospector may get funding called “**grub staking**” from a company to cover some of his/her expenses. Usually, a staking deal would mean that the company would keep some interest in a discovery.



#### *Junior Exploration Companies*

A junior exploration company is a smaller company, typically with three to five employees, most of whom are professional geologists. Often junior companies are not large enough to operate a mine. They tend to focus on exploration, looking for mineral deposits that could be developed into

### Facts & Figures

*The community of Kasabonika Lake First Nations develops and supports local prospectors through the creation of the “Kasabonika Prospectors Alliance” for training and information sharing. They work with exploration companies and encourage their members to stake their own claims.*



mines. They are publicly owned. This means that they depend on investors to provide the funds to acquire land and conduct exploration programs. When a worthwhile mineral deposit is found, some junior exploration companies go into production themselves, but usually they sell an interest or become a partner with a senior mining company.

### *Senior Mining Companies*



Senior mining companies operate one or more mines. They have many employees with experience in a wide range of mining-related activities. Senior mining companies conduct exploration programs on the mine property in hopes of increasing the mine life.

### *Contractors/Service Providers*



Many contractors are needed during mineral exploration for specialized expertise or services. The main contracts are for:

- *Drilling Companies*

Drilling companies generally act as contractors to mineral exploration companies and provide drilling services.

- *Expeditors*

Expeditors are very important to exploration companies. They provide key supplies and services, usually from the nearest communities. They can also set up camps, arrange aircraft and supplies, and provide other services like claim staking and line cutting.

- *Helicopter Services*

Helicopters are needed in many remote areas where there are no roads. Helicopters are used for moving people, supplies and drilling equipment into field areas. Pilots and engineers are provided along with the helicopter and stay at the camp with the exploration group.



- *Geophysical Survey Companies*

Junior companies and mining operators contract geophysical survey companies to search for ore deposits. They do this by measuring the earth's magnetic fields and the gravitational properties of rocks and minerals. Some ore deposits may have special properties (like

### **Facts & Figures**

*Opportunities exist for Aboriginal people to be involved in the services aspect of mineral exploration. Many contractors are needed during exploration, including prospectors, line cutters, caterers, equipment suppliers, and construction workers for camps.*





containing magnetic minerals or being more dense than the surrounding rocks) that help the companies find the mineral area.

- *Geological Services*

Geological services include mapping of the rocks or soils/tills and collection of surface samples or rocks. The samples and maps provide useful clues on the location of orebodies.

- *Caterers*

A caterer is someone, usually from a local community, who provides food and cleaning services to an exploration camp or a mine.

- *Local Businesses*

Local businesses provide companies with the goods and services they need to support exploration activities.



- *Investors and Financiers*

Junior exploration companies carry out most of the exploration activities. In order to fund their work, the juniors need investment and financing. This investment can come from private individuals or by raising money on the stock market.

Investors find the Canadian exploration and mining industry attractive for many reasons, including its tax and regulatory climate, skilled work force, and infrastructure.

### How Can Aboriginal Communities Get Involved in Mineral Exploration?

Unless a mineral deposit is brought into production (a 1 in 10 000 chance), Aboriginal communities are most likely to participate in and be affected by mineral exploration. Although the benefits and opportunities are not as significant as in later phases of the mining cycle, mineral exploration projects are an important way for communities to learn about the benefits, opportunities and impacts of mining.

Exploration projects vary in scope. Some may simply involve gathering rock samples, while others may involve establishing a camp for 6 to 10 people with a helicopter and drilling rig. Some may involve digging trenches or detailed mapping. Whatever the scope of the project, it is important for communities to have open dialogue with the company involved. Governments encourage prospectors and exploration companies to talk to Aboriginal community members before going onto the land. Prospectors and exploration companies have found that early discussion with Aboriginal community members is in





everyone's interest.

Early community involvement allows both the community and the company to learn. The company can explain what the project involves,



where it is located, and who will be doing the work. Community members can ask questions or raise concerns. With their in-depth knowledge of the land, elders may be able to recommend good sites to establish a camp and point out significant locations to avoid, such as ceremonial sites, traplines, and hunting grounds.

Through early engagement, a community can learn about the needs of the exploration company. Perhaps the company needs a cook, a supply of food, a helicopter, or employees to help with the exploration activities. Learning about these needs will help the community identify and respond to potential economic, employment and business opportunities. It will also help identify training needs.

## 1.2 Acts and Regulations

This section identifies the general legal and regulatory requirements, jurisdictions, and licences and permits that apply during mineral exploration.

Canada is somewhat distinctive in that responsibility for matters affecting mining activities is shared by the provincial, territorial and federal governments. The responsibility for managing mineral resources has been granted to the provinces and territories, with the exception of Nunavut, the Northwest Territories and Indian Reserves, where it rests with the federal government through Indian and Northern Affairs Canada (INAC). The provinces, the Yukon and INAC have put in place mining-related acts and regulations for the administration of exploration, mining activities, and closure.

The rules governing land acquisition vary greatly by jurisdiction (i.e., province and territory). Mineral claim staking, map staking, prospecting permits, etc., are used in various jurisdictions. Individuals must check with the specific jurisdiction and follow its regulations.

### What Are the Jurisdictions?

There are many jurisdictions across Canada and the regulations covering mineral exploration are

### Facts & Figures

*By working closely together and through the signing of a Memorandum of Understanding (MOU), the Timiskaming First Nation (TFN) and Tres-Or Resources Ltd. have participated in the discovery of a diamond-bearing kimberlite in Ontario. The TFN has established an Economic Development Committee to proactively assist in the education and development of skilled workers.*





largely similar, but with regional differences. Normally, ownership of the surface land is separate from ownership of the sub-surface (including mineral rights). So, just because someone owns the surface does not mean they own the sub-surface mineral rights below the land.

There are two types of land available for exploration: Crown Lands and privately owned lands. The federal government through INAC is responsible for federal Crown Lands in Nunavut, the Northwest Territories, and on Indian Reserves, and has legislation covering its use. Provinces and the Yukon are responsible for Crown Lands within their province/territory and have legislation covering its use and disposition. Government controls surface and sub-surface rights for provincial, territorial and federal Crown Land. Exploration is generally allowed on all Crown Land except for land that is specifically protected from mines or other development (for example, national parks).

Privately owned land includes, among others, farmland, city land, and Aboriginal-owned lands, including Indian Reserves. Access to privately owned lands is prohibited unless consent is given and compensation is paid to the surface rights holders.

## Facts & Figures

*Aboriginal-owned land is becoming significant. In Nunavut, the Inuit own large tracts of land called Inuit Owned Lands. For these lands, the Inuit enjoy surface rights and, in selected cases, sub-surface rights. Nunavut Tunngavik Incorporated (NTI) oversees the use of Inuit-owned lands in Nunavut. Where land claims are in negotiation, the federal government makes interim (temporary) land arrangements to protect Aboriginal interests during the negotiations.*

*(Source: [www.tunngavik.com](http://www.tunngavik.com))*

## What Licences and Permits Are Required?

The requirement for licences and permits in the exploration phase varies between provinces and territories. It also varies depending on the type of exploration work being done. The table below shows a summary of the permits that may be required during different exploration activities.

Exploration Permits	
Activity	Possible Permits Required
Basic prospecting	Prospectors licence
Airborne surveys	No permits required
Claim staking	Register claims according to requirements of the area
Ground exploration/drilling	Land use permit (depending on the amount of work and size of project)
Tree cutting	Permit to cut trees
Camp and drilling program	A land use permit is required for larger projects that have a camp and helicopter
Road construction for access, fuel storage or exploration trenching	Various permits may be required

## 1.3 Environmental and Social Impacts

This section identifies the possible environmental and social impacts a community may experience during mineral exploration. Ideas for monitoring and reducing impacts (mitigation), and community participation are included.

### What Are the Potential Environmental Impacts?

Environmental impacts during mineral exploration are usually very low, especially during grassroots exploration.

The Canadian mining industry is a world leader in environmentally safe and clean exploration practices. The Canadian exploration industry (as represented by the Prospectors and Developers Association of Canada [PDAC]) has its own “Exploration Code of Conduct.” It defines the way that prospectors and exploration companies agree to work in the field. They understand that they have to respect the rights of others, to operate safely, and to take care not to harm the wildlife, land or water. They need to follow provincial or territorial and federal laws and respect the communities they operate near.

With these measures in place, negative impacts are reduced, but they are still possible. Some of the main impacts and how they are minimized are shown in the table below.

Environmental Impacts		
Type	Condition	Mitigation
Land use	Camp construction	Government regulations for camps, roads and airstrips
	Road construction	
	Airstrip construction	
	Line cutting	Minimize area
	Drilling programs	Established drill waste disposal
	Fuel storage	Fuel storage standards Spill recovery plans
Water quality	Waste from drilling programs (mud)	Carefully plan and locate drill program to prevent water contamination
Wildlife	Animals attracted to garbage and food waste	Burn garbage and food waste Fly out/remove cans and glass items
	Migratory patterns affected by presence of humans	Teach wildlife awareness to crews in camp
	Migratory patterns affected by noise from helicopters, planes, and drill rigs	Keep aircraft away from migrating animals

### Facts & Figures

*The Prospectors and Developers Association of Canada has produced a best practices handbook for exploration companies called “E3.” It gives many examples of how exploration companies work to minimize the environmental effects of exploration.*

*(Source: [www.pdac.ca](http://www.pdac.ca))*





## What Environmental Monitoring Is Required?

As the amount of activity is usually very small during exploration, the exploration company will do most of the environmental monitoring.

Monitoring may involve checking:

- the fuel storage area;
- that waste is properly disposed of;
- that food is not left where animals can get it; and
- that no unwanted waste remains after drilling rigs leave.

Companies must also follow the conditions of any permits or licences granted to conduct exploration. Government inspectors will likely visit the site to make sure that conditions imposed on the licences and/or permits are being met and that all regulations are being respected. For larger exploration projects, spill plans (i.e., fuel) and waste disposal plans will likely be required.

## What Are the Potential Social Impacts?

Social impacts at the exploration stage are likely to be minimal and tend to be positive. Listed in the table below are some possible impacts. Learning about these impacts may help

communities understand and anticipate the effects of exploration.

Another possible impact of exploration may be unrealistic expectations about the development of a mine. Most exploration activity will not advance to mine development.

Social Impacts			
Type		Positive and Negative Effects	Community Response
Social	Shift work/rotational work	<p>Less time to spend on traditional activities</p> <p>Workers and their families are separated for several days or weeks</p> <p>Marital stress</p> <p>Members leaving the community (because they now have money and good-paying jobs)</p> <p>Members leaving their skilled jobs in the community to take mining-related jobs. The community then has to spend money to train new workers</p>	<p>Plan activities around work schedule</p> <p>Create support groups or programs to minimize the separation stress experienced by families</p>
Economic	<p>Increased employment levels</p> <p>Increased income levels</p>	<p>Increased training and skill development opportunities</p> <p>Increased buying power</p> <p>Creates positive role models</p> <p>More money flowing into a community could result in more liquor and/or drugs coming into the community</p> <p>Widens the gap between the employed and unemployed</p>	<p>Use the positive working role models within the community</p> <p>Create addiction response programs and support groups</p>
Cultural	Strangers in the community	<p>Increased population</p> <p>Strains existing services</p> <p>Worsens existing social problems</p>	<p>Offer cultural awareness training, delivered by members of the community, to ensure new people in the community understand its values and traditions</p>



## What Are the Opportunities for Community Participation?

The major community input during early exploration is usually through direct communication with the company carrying out the project. Governments encourage prospectors and exploration companies to communicate with Band Councils and to talk to Aboriginal community members before going onto the land.

This is the time for communities to ask questions, raise concerns, and learn about the exploration process. Early consultations can serve to alert communities to the many challenges and opportunities that may lie ahead and are an opportunity to ask important questions such as:

- “Do we want to get involved in mining-related businesses?”
- “What are the employment/business opportunities?”
- “What are the potential negative impacts and how do we minimize them?”

Having answers to these questions will help to prepare the community should an exploration project lead to larger investment.

The mining company and the community should arrange a follow-up meeting. This should happen after the fieldwork is complete

and the company has analyzed the results, which could take many months.

Depending on the size and the location of the exploration project, communities may also have input through a permitting board or agency that will want to obtain local views and concerns on the consequences of issuing a permit. This is another way to raise environmental or social concerns.

## 1.4 Community Employment and Other Economic Opportunities

This section identifies the employment and other economic opportunities available to Aboriginal communities during exploration. It also includes ideas on how Aboriginal communities can increase their readiness to participate in mining exploration activities.

### What Are the Employment Opportunities?

Job opportunities during exploration projects may be limited and short term, lasting only a few weeks to a few months. These opportunities are often attractive to Aboriginal communities because they allow community members to

### Facts & Figures

*Early engagement can serve as a turning point for communities. The Kasabonika Lake First Nation community increased its participation through newsletters, meetings, radio, and surveys. The community also negotiated a “step-by-step” approach to the mineral exploration process.*





gain useful experience and skills expertise that may be transferable to other economic

sectors. The lengths of the jobs depend on whether the exploration project is successful.



any local hires to make sure they are safe and equipped to do the job.

Early discussions with the company will allow the community to find out which jobs are available. The community may want to help the company by organizing a venue for interviews and advertising available positions throughout the community. The community may also decide to conduct a skills and education inventory of its members.

### What Are the Other Economic Opportunities?

Projects usually hire specialists – geologists, geophysicists, drill operators, and pilots – to carry out the exploration work. To become a specialist requires a university or college degree or on-the-job training. However, projects may also need less specialized personnel, including field assistants, camp staff, line cutters, prospectors, and samplers.

Exploration projects may require environmental baseline work. This work will also provide opportunities for local people to assist with fisheries and wildlife studies. Companies will train

#### Facts & Figures

*The close location of Aboriginal communities to major exploration and mining projects presents a window of opportunity for both Aboriginal people and industry. Aboriginal communities are increasingly becoming recognized as key contributors to the minerals and metals sector for labour and supply, especially in remote areas.*

*(Source: Natural Resources Canada)*

Economic opportunities for communities during early exploration are limited. Each community is unique and will be equipped differently to capture possible economic opportunities.

Types of business opportunities generated by exploration include:

- Digging and trenching with heavy equipment;
- Tree planting;
- Construction of camps/camp staff;





- Food, accommodation, and catering;
- Expediting;
- Helicopter/air support rental;
- Equipment/vehicle rental and fuel;
- Drilling contracting;
- Transportation and freight services; and
- Environmental baseline studies.

Junior exploration companies usually have only a few full-time employees and they are generally specialists such as geologists. When it comes to organizing a field program, they commonly employ an expediting company to organize activities like camp setup, transportation, and catering. If such a business is available in a community, then it will be in a good position to provide services to the company.

Exploration projects are usually on tight time schedules and limited budgets. During discussions, the exploration company will describe its plan and time frame. There is usually not enough time for communities to develop businesses to assist the exploration company; however, the community may want to ask the company to keep them informed of its exploration expectations for the next season so that it can prepare for possible economic

opportunities. The opportunities will mainly be in assisting geologists and in environmental studies.

### *Training Opportunities*

Exploration activities offer Aboriginal communities a number of options for economic and business development, including the training of future Aboriginal prospectors. Some communities have developed their own training programs to teach people how to prospect. Because of their knowledge of the land around them, local community members are in an excellent position to become prospectors.



### **Facts & Figures**

*The James Bay Cree of northern Quebec run the Mistassini Geological Resources Centre. The Centre's goal is to increase economic development through mining. The Centre provides training, information and consulting services about prospecting, exploration and other activities. It also plays a role in making sure that mining operations on Cree territory respect traditional land use and have no adverse effects on people, animals and land.*

In the North, Indian and Northern Affairs Canada (INAC) and the college system have collaborated to create training programs. Other communities have formed their own exploration companies. There is the potential for economic benefits through these activities. If the prospecting is successful and encouraging samples are found, the prospector may be able to interest exploration companies in forming a **joint venture** or to **option** a property to ensure that further work is carried out.



## 1.5 Community Experiences: Talisman Consulting

*Canada's mineral-rich landscape will always challenge geologists to search for economic mineral deposits. Exploration activities continue to take place across Canada. Hundreds of millions of dollars are spent annually to fund the search. It is this spending that creates economic opportunities for Aboriginal communities. There are many examples where exploration companies have established very good relationships with communities and from these positive relationships, economic and employment opportunities have grown as exploration continues. The diamond discoveries in the Northwest Territories, the Raglan nickel/copper discovery in northern Quebec, the Musselwhite gold discovery in Ontario, and the Eskay Creek gold/silver discovery in northwestern British Columbia are just a few examples. However, no matter how well planned, most exploration projects will not advance to the development stage.*

*Chief Glenn Nolan of the Missanabie Cree First Nation has considerable experience with exploration activities and communities across Canada through his company, Talisman Consulting. His experiences are summarized below.*

### Community Summary

From 1981 through to 1987, Talisman Consulting conducted prospecting and geophysics activities for its junior mining clients involved in exploration. Working in and around remote communities in northern Ontario, Manitoba, Saskatchewan, British Columbia and the Northwest Territories often required accessing land on First Nations traditional territory.

### Community Involvement

Because most communities were accessible only by air or winter road, such as Webequie First Nation, located about 350 kilometres north of Geraldton, Ontario, Talisman found it more efficient to phone the community leaders before visiting in order to arrange a convenient time for both parties to meet.

When speaking with the local Band Economic Development Officer or Chief, Mr. Nolan did the following:

- Asked permission to enter the traditional land;
- Summarized the nature of the work;





- Identified the expected time frame of the project; and
- Described what type of economic benefits the community could expect.

Subsequent face-to-face meetings then allowed Talisman and the community to outline the specifics of the work and exchange ideas on the best ways to proceed. Because contracts ran no more than six weeks, Mr. Nolan explained that disruption to the land (e.g., line cutting) would be minimal, and he outlined the target areas on a map. Also, to avoid future misunderstandings, Mr. Nolan ensured that he took the time to describe the exploration stage of mining to the community, explaining that only in rare cases does exploration lead to the discovery of a deposit suitable for mine development.

When Mr. Nolan worked for a major company, he often had to sign a confidentiality agreement. This agreement made sure that his client held ownership over the claims he staked. The secrecy often meant that background knowledge of the project was limited, even for Talisman. By approaching the communities in an honest way and explaining the competitive reasons behind the



confidentiality, Mr. Nolan avoided any potential conflict.

## Economic and Business Opportunities

Economic benefits came to the community as part of Talisman's policy to hire local residents. The community helped by recommending qualified people. Once a labour force was established, the community experienced further economic benefits through the purchase of local food and supplies.

By being respectful and initiating contact with First Nations leaders before starting work and encouraging community involvement from then on, Talisman never experienced any delays or conflicts. The company's successful performance record helped establish smooth relations for successful exploration activities in the future.

For more information, contact the Missanabie Cree First Nation at [www.missanabiecree.com](http://www.missanabiecree.com).

# MINE DEVELOPMENT

**Overview**

**Acts and Regulations**

**Environmental and Social Impacts**

**Community Employment and  
Other Economic Opportunities**

**Community Experiences**





## 2.1 Overview

This section explains the purpose of mine development, identifies the main activities and players, and outlines opportunities for Aboriginal communities to get involved during mine development.

### What Is Mine Development?



Mine development is the second phase of the mining cycle. The purposes of this important phase are to learn about the potential value of a mineral deposit, determine if it can be mined profitably to the benefit of the mining company and the region, and if so, to build a mine. In order to build a mine, the ore deposit must be large

and valuable enough to pay for the costs of construction (**capital costs**) and for the costs to operate the mine (operating costs). Factors that determine if a resource is economical to mine include:

- Location of the resource;
- Type of mineral and access to **infrastructure** (roads, airstrips, etc.).

For example, it may be possible to mine diamonds in a remote area with little infrastructure, but not lead/zinc. This is because diamonds are high value/low volume, whereas lead/zinc is lower value and higher volume;

- Accessibility of the resource;
- Size of the resource;
- Value of the resource;
- Market prices;
- Distance from markets and supply points;
- Ability to recover the resource in an environmentally safe way;
- Regulatory regime; and
- Availability of qualified work force.

The main activities of mine development include:

- Collecting more technical, environmental and socio-economic data to increase the company's knowledge of the resources. This means more samples, more drill holes, and more field tests;
- Developing the mine plan and infrastructure;
- Consultations between government and mining companies to make sure that

regulations are met. Mining companies also consult with communities to make sure that their needs and requirements are addressed;

- Evaluating financial, socio-economic and environmental impacts;
- Obtaining permits and licences;
- The final evaluation of the project is carried out and the production decision is taken; and
- The mine and its facilities are built, ready to start operations.

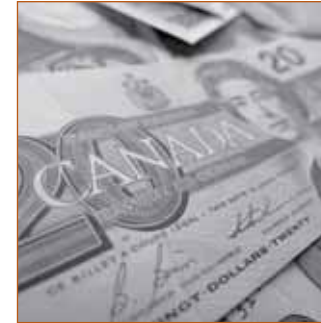
### Time Frames

Mine development can take anywhere from 5 to 10 years. The time needed depends on where the mine is located, how large and complex the development is (including infrastructure needs and availability), and the regional regulations and review processes. In general, it takes:

- two to three years for test work and studies (environmental

baseline studies and **feasibility** studies);

- one to three years for environmental assessment and permitting; and
- two to four years to build the mine and infrastructure.



### Costs

It generally costs between \$50 million and \$500 million or more to develop a mine. The cost depends on:

- Type of mine;
- Size of the mine (the larger the mine, the higher the cost);
- Location of the mine; and
- Amount of work and time required to do the test work, collect the data, and complete environmental studies and permitting.

Test work, studies and permitting can cost in the \$10 million range (this can climb as high as \$100 million if special facilities are needed on-site for additional testing



### Facts & Figures

*Ekati and Diavik, two diamond mines built in the Northwest Territories, had start-up costs of \$750 million and \$1.3 billion, respectively. These costs were very high because the mines are large, remote, and had technological challenges. Smaller mines closer to highways, electricity and other infrastructure would have start-up costs closer to \$300 million.*

*(Source: BHP Billiton Diamonds and Diavik Diamond Mine)*





and data collection, as is the case for diamond mines). Construction costs are often in the \$100 million range.

### What Are the Mine Development Activities?

If initial exploration leads to positive results, the project moves from exploration to the deposit evaluation and mine planning stage. During this stage, the mining company will increase its activities and investment to determine if the mineral deposit is worthwhile (viable) and if a mine can be developed. It is in this stage that the mining company will prepare the design of the mine. Once evaluation and planning are completed and a decision on building a mine has been taken, construction can start. Depending on the location and the type of mineral, mine development activities may include:

#### *Detailed Drilling*

The drilling extracts drill core (cylindrical samples of the rock) for analysis. Detailed drilling (drill holes spaced at close intervals) is required to precisely define the shape and size of the deposits.



#### *Detailed Analysis and Evaluation*



Samples are analyzed to find out the grade (the quantity of metals, diamonds or other commodities) and to assess the value of the deposit.

#### *Bulk Sampling*

Bulk sampling gives large and representative mineralized samples. It is used to determine the **metallurgical** characteristics of the material. The sample is tested in a testing plant that recovers the minerals. A test mine may be built to identify new technologies



needed to recover the minerals.

#### *Environmental Baseline Studies*

Environmental work takes place during this stage along with the other field activities. Environmental baseline studies are a required part of the environmental approval



process. These studies are used to establish the state of the environment, including wildlife, and then to determine if there will be any changes.

### *Preliminary Design and Engineering (Prefeasibility)*

The preliminary design and engineering stage of mine development occurs at the prefeasibility phase. The prefeasibility is an intermediate activity meant to verify a project's potential before investing money into additional detailed work.

### *Feasibility Studies*

Feasibility studies are a series of planning studies and evaluation reports of the geological, engineering, economic, legal and site data. The purpose of feasibility studies is to evaluate all aspects of a project, review the plans, identify risks, refine the cost estimates, and decide whether a mineral deposit can be mined profitably.

Feasibility studies usually include the following (see table):

Feasibility Studies	
Geology and resource determination	How large is the deposit or resource? What is the grade of the minerals or metals in the deposit?
Mine planning	What will be mined? How will it be mined (open pit/surface or underground)? What equipment will be used to mine it?
Process plant test work and plant design	What is the best way to extract the minerals or metals (for example) from the host rock? Will there be a <b>smelter</b> ?
Infrastructure planning	What roads, airstrips, camps and complexes will be needed?
Water and waste management planning	What are the water supply needs? What are the discharge quality requirements? How can waste be safely disposed of?
Environmental and socio-economic planning	What are the main issues from the environmental and socio-economic studies? How can plans address these issues?
Mine closure and reclamation plan	What are the best approaches for reclamation and closure?
Operating cost estimates	How many workers are required? What types and amounts of equipment and supplies are required during operations? What are the annual operating costs?
Capital costs	What are the costs to plan, design, permit and construct the facilities?
Financial analysis	What are the costs to borrow money to build and operate the mine? What is the yearly cost and annual earnings? What is the expected profit or loss?



### *Mine Closure and Reclamation Plan*

An important step in planning is the mine closure and **reclamation** plan. This plan is a detailed report on how the mine site will be cleaned up and restored once mining operations are completed. The direct closure impact of all areas of a mine site should be addressed as an integral part of the design criteria during the detailed engineering phase of the project. This includes removal of structures, how to handle tailings, how to dispose of chemicals and hydrocarbons, waste rock slope stability, pit shut-down, and revegetation of terrain.

Governments now usually insist that the company provide a financial assurance (e.g., a **bond**) to cover unexpected closure problems or failures. This financial assurance can be required before the start of construction (i.e., before liability is created). If mine closure and reclamation are too expensive, the proposed mine may not move on to production.

#### **Facts & Figures**

*Most important in the planning process is the safety and consideration of workers and the local environment. A closure and reclamation plan explains how the company will **rehabilitate** the mine site once the ore runs out and the mine closes.*



### *Permitting and Environmental Assessment*

As the mine development activities increase and

become more intense, permits will be required. The mining company will submit a project description to governments or local boards if feasibility studies are encouraging and show that there is a potential project. This will start the environmental assessment process. This process must be completed before moving to final feasibility and the start of construction.





### Negotiation of Agreements

The types of agreements negotiated between a mining company and the community at this stage vary and may include Impact and Benefits Agreements, Memoranda of Understanding, and Participation Agreements.

Even if formal agreements are in general not legally required, this is still an excellent time for the mining company and Aboriginal groups to develop a good relationship.

### Sales Contracts

During early feasibility, assumptions are made on sales of the mineral(s) to be mined. However, before final feasibility, the actual terms and conditions of sales must be negotiated and defined. This is the role of a sales contract – which is the sale of a product to a customer.

In addition to sales contracts, a very important activity is to establish affordable transportation to get the product to the customer. This may require the use of ports and ships.



Agreements		
Type of Agreement	Definition	Example
Memorandum of Understanding (MOU)	MOUs are simply a way of creating an understanding between a community and a mining or exploration company. The MOU defines principles for working together for mutual benefit. MOUs are not legally binding contractual arrangements (like IBAs).	The Timiskaming First Nation (TFN) and Tres-Or Resources signed a Memorandum of Understanding covering exploration on lands the TFN claims as its traditional territory. The MOU provides a framework in which the company and the First Nation can mutually participate in exploration and potential discoveries.
Impact and Benefits Agreement (IBA)	An IBA is a contractual agreement between an Aboriginal community or entity and a mining company. It defines agreements made between the two parties about employment opportunities, business opportunities, and training. The IBA spells out the obligations of each party in these areas and the funding arrangements as appropriate to the development. The content of an IBA varies depending on current important issues.	In 1994, Inmet Mining Company and the Cree of Mistassini signed an IBA related to operation of the Troilus gold mine, located near James Bay, with particular emphasis on employment. As of 2005, the Troilus mine employs 285 people of whom 17% are Cree.  Another example is the Raglan Agreement between Falconbridge and the Inuit of northern Quebec. This is an historic agreement that saw the introduction of “revenue sharing.”
Participation Agreement (PA)	PAs are essentially the same as IBAs.	The Diavik Diamond mine has four PAs in place covering the construction and operation phases of the mine.



### *Final/Bankable Feasibility*

During final/**bankable feasibility**, all existing feasibility studies are reviewed. The permitting, environmental assessment, closure costs, and negotiated agreements are also reviewed. The objective is to determine a final costing for the project so that the final investment decision can go ahead.

### *Project Financing*

Once a final costing is known, the mining company needs to secure project financing. The bankable study is used to demonstrate a project's feasibility and to help secure investment. Companies may need to borrow the money from a bank or raise money by issuing stocks on the stock market. Large mining companies may be self-funding.

### *Investment Decision by Mining Company*

The final investment decision – whether to build the mine – happens when the final feasibility study is finished, project financing is secured, and permits are received. The Board of Directors of the mining company will make the final decision on whether to move ahead and build the mine.

Although it is hard to imagine, given how much work, money and time have been invested to get to this point, the decision could be to

NOT go ahead with the project because of uncertainty in the markets. This means that all agreements negotiated to this point are conditional agreements that depend on whether the company decides to go ahead.



### *Construction*

Construction refers to the development of the entire facility, including the mine, processing plant (mill), and all related infrastructure.



Infrastructure development includes all facilities needed to support the operation, other than the mine

and process plant (mill). This stage requires most of the money and provides most of the jobs. A company does not usually commit to construction until the details of all permitting and regulatory requirements have been confirmed. Common activities during construction include:

- Site preparation;
- Clearing and initial preparation for mining (i.e., overburden removal);
- Construction of accommodations;

- Construction of process and site facilities (i.e., mills, offices, etc.);
- Building roads and airstrips (installation of power lines and railway);
- Training programs for personnel; and
- Installation of environmental protection equipment.

## Who Are the Main Players in Mine Development?



### *Junior Exploration Companies*

Junior exploration companies are not usually directly involved in mine development. They do not have the resources, neither money nor people, to develop and build a mine. Typically, when they find something promising during exploration, they will seek a senior mining company to invest in the property and take on the role of manager and operator. In some cases, the junior company or prospector that did the exploration work may become a partner or sell its stake to a larger company.

There are some exceptions. Tahera Diamond Corporation is a junior mining company that is developing the Jericho diamond mine in Nunavut.



### *Senior Mining Companies*

Senior mining companies are the main players in mine development. They are the manager and operator, and are involved in all activities from exploration through construction and operations.



### *Consulting Firms*

Consulting firms could be hired by the mining company to help them with feasibility studies, detail design, construction management, and project management activities.



### *Equipment Suppliers*

Equipment suppliers manufacture and sell equipment to the mining company and often provide maintenance services in the operating phase.



### *Governments*

Governments set the rules for permitting, manage the permitting process, and issue the required permits. They conduct the environmental assessment process.

In Canada, the provinces are the primary regulators of mine development. The provinces are responsible for granting most permits. Since 2001, the Yukon now exercises provincial-type responsibilities. In the Northwest Territories and Nunavut, the



federal government plays a major role through Indian and Northern Affairs Canada (INAC). The main federal departments involved in environmental assessments and permitting are Natural Resources Canada (NRCan), the Department of Fisheries and Oceans (DFO), Environment Canada (EC), Transport Canada, and INAC.



### *Financial Institutions*

Once a project has reached the development stage, the cost of proceeding through development and production is very high compared to the initial exploration stage. Depending on the size of the mineral deposit and the eventual mine, the cost can range from \$10 million to \$2 billion. Most mining companies will raise these funds through a combination of individual and institutional investors through the markets (equity financing) and by borrowing money from the banks (debt financing). For very large deposits that cost billions of dollars to develop, large mining companies will sometimes pool their resources into a partnership.



### *Construction Companies*

Construction companies and contractors are hired to build the roads and plant sites, put up the buildings, and construct the process plant and

infrastructure needed for a mine operation to go into production. They provide skilled workers, heavy mobile equipment, tools and supplies, and a history of successful construction in similar industries.

Construction companies and other contractors often provide employment for local workers, which can often lead to permanent employment at the mine.



### *Communities*

The mine development phase offers communities the greatest opportunity for involvement. The environmental assessment process and the many consultations required to determine if the project can develop into a mine are opportune times for the community and the mine developer to identify community opportunities.



## **How Can Aboriginal Communities Get Involved in Mine Development?**

A wide range of community **consultations** often take place during the mine development process, including:

- Public meetings and hearings;
- Open houses;
- Workshops;
- Focus groups;
- Interviews; and
- Meetings and consultations related to environmental assessment and licence and permit applications.

Communities provide input and feedback on a proposed project during the consultations, raise issues and concerns, and identify potential impacts.

Consultations allow communities to participate in a meaningful way and to experience a sense of ownership of the project.

Anyone potentially affected by the mine development would attend the consultations, including:

- Chiefs or mayors;
- Band councils and band members;
- Aboriginal community organizations;
- Renewable resource boards/committees;
- Aboriginal land corporations;
- Local and regional governments;
- Community members;

- Non-governmental organizations (NGOs); and
- Media.

The results of consultations may affect the decisions of Aboriginal/ community organizations and even co-management boards in land claim jurisdictions (i.e., Mackenzie Valley Land and Water Board).



Another typical result from consultations is scheduled site visits to actually see the land where the development is proposed. Elders often visit the site so that they can better see what is being proposed on what may be considered traditional lands. From an environmental monitoring standpoint, site visits also serve to monitor development.

Communities also provide input during the mine development process by reviewing project descriptions, leading traditional knowledge studies, and developing participation or impact and benefits agreements with the mining company.

INAC provides financial assistance to enable First Nations and Inuit groups to enter into various types of negotiations with a mining company.

### Facts & Figures

*Exploration and mining companies, in addition to complying with regulatory regimes at the federal, provincial and territorial levels, are voluntarily adopting environmental management practices, including the application of traditional knowledge, to respond to community concerns about the potential effects of mining.*





## 2.2 Acts and Regulations

This section identifies the general regulatory requirements, licences, permits and leases that may apply during mine development.

Mine development regulations are complex and vary between provinces, territories and Indian Reserves. The purpose of all regulations is to develop the mine in a way that will benefit people and minimize potential negative impacts on the environment.

The *Canadian Environmental Assessment Act* and the requirement to include traditional knowledge as part of the mine planning process are particularly important. They provide Aboriginal communities with the opportunity to get involved early in the process.

### What Licences and Permits Are Required?

Permit and licence requirements, and their application processes, vary in different regulatory jurisdictions in Canada. Provincial and territorial regulatory authorities generally administer permits. The federal government through INAC administers permits and licences in Nunavut, the Northwest Territories, and on Indian Reserves. Several federal departments have permits, licences or authorizations that apply to mining projects.

Key permits include those related to land and water use, mine closure and reclamation plans, and camp construction permits. The following table outlines the general licences and permits required during mine development.

Key Development Permits	
Water	Provincial and territorial agencies (guided by the Council of Ministers of the Environment [CCME] guidelines) generally control water discharge criteria and water licences Water crossings permits are issued under the <i>Navigable Waters Protection Act</i>
Fish	Authorization under Section 35 of the <i>Fisheries Act</i> is required if impacts on fish habitat are expected Fisheries and Oceans Canada (DFO) has developed various guidelines to make sure that there is no net loss to fish habitat
Wildlife	In the case of potential effects on migratory wildlife, the <i>Canadian Migratory Bird Convention Act</i> applies and, in the case of endangered and threatened species, the <i>Canadian Species at Risk Act</i> applies The provinces and territories also have a range of policies and legislation addressing wildlife and species at risk issues
Mine construction and development	Construction permits for buildings Explosives permits Authorization from provincial/territorial departments to allow excavation to go ahead

## What Is a Mining Lease?

A mining lease is “a legal contract for the right to work a mine and extract the mineral or other valuable deposits done under prescribed conditions of time, price, rental, or royalties.” A mining lease is required to develop a property into a mine. Mining leases require a surveyor to survey claim boundaries. Leases are valid in most provinces/territories for 20 or 21 years and can be renewed. Some jurisdictions impose certain conditions upon the renewal of mining leases (for example, the property must be the site of an active or closed mine).

Mineral rights have been government-owned since the early 1900s and cannot be purchased, only leased, by individuals or companies. Different owners can hold surface and mineral rights on the same property. The regulation of mining activities on publicly owned mineral leases falls under provincial/territorial/federal government jurisdiction. There is separate mining rights legislation for each of the 10 Canadian provinces and the Yukon, with the Canada Mining Regulations applying in the Northwest Territories and Nunavut. Indian Mining Regulations apply on Indian Reserves.

## 2.3 Environmental and Social Impacts

This section identifies the potential environmental and social impacts a community may experience during mine development. It also explains the purpose of an environmental assessment. Types of environmental monitoring, mitigation measures, and opportunities for community input are included.

### What Are the Potential Environmental Impacts?

Every mine development is unique and will affect the environment in different ways. Using modern technologies, sound planning, and rigorous impact monitoring, specialists can reduce these impacts.

The permission to develop a mining project is decided on its eventual environmental **legacy** and community sustainability. The environmental impact assessment is meant to demonstrate how the development will affect the environment during mine operations and mine closure. The socio-economic assessment evaluates the social and economic **sustainability** during development, operations, and beyond closure of the mine.



The following chart outlines the types of environmental impacts possible during mine development.

Environmental Impacts		
Type	Condition	Mitigation
Land use	Construction of access roads and power lines; uncontrolled access to mine site	Plan to minimize land disturbance due to roads Install security gates
	Construction of buildings, workshops, processing plant, and permanent camp	Use community feedback in design and layout of buildings Minimize land use
	Bulk sampling and extensive drilling programs	Detailed planning to minimize land disturbance
	Fuel and chemical storage	Fuel storage standards Spill plans Fuel management programs
Air quality	Dust from roads and mining activities	Water roads to minimize dust emissions
Water quality	Chemicals in water discharge, mud or dirt getting into water bodies; erosion Clean the water; control drainage	Control drainage Make sure discharge criteria are met
Wildlife	Animals attracted to garbage and food waste	Waste management programs
	Migratory patterns affected by presence of humans, noise from aircraft, noise from blasting	Use environmental baseline work to understand wildlife activity in the area Educate employees and contractors to understand their responsibilities towards wildlife

Other environmental impacts and mitigation, depending on where a development is located, may include:

*Potential Impacts:*

- Loss of archaeological and heritage sites;
- Impacts on traditional and non-traditional land use;
- Impacts on water flows and quality; and
- Impacts on fish and fisheries.



*Mitigation:*

- Protection of land and identification and protection of archaeological and heritage sites;
- No hunting/ fishing zones and wildlife protection;





- Water quality monitoring and flow supplementation; and
- Protection of spawning and rearing areas and fish farming.

## What Environmental Studies Are Required?

Environmental baseline studies are generally required to complete an environmental impact assessment. They start as early as during the advanced exploration stage. These studies include developing a detailed description of the environment. Examples of surveys that may be completed include:

- Archaeology \*
- Land use
- Water quality
- Surface and ground water hydrology
- Vegetation
- Wildlife
- Administrators
- Traditional knowledge
- Terrain
- Socio-economic
- Air quality
- Aquatic resources (fisheries)
- Hydrogeology
- Noise
- Soils
- Acid rock drainage/metal leaching
- Fish habitats

\* Example: A scientist may survey the land for burial sites and historical land use patterns.

## What Is an Environmental Assessment?

An environmental assessment (EA) is a government-mandated (provincial, territorial, federal) process to identify and assess the potential environmental effects of a project before it is built. The purpose of the assessment is to minimize or prevent any negative environmental effects before they occur, and to mitigate the effects in order to reduce overall impacts. Both federal and provincial laws require some form of EA process to be conducted due to the nature of regulatory authorizations required by mining projects. This typically leads to concurrent provincial and federal EAs harmonized under one EA. In the North, most mining projects are assessed by impact review boards established by federal statutes.

The result of the environmental assessment is not to approve the project, but to show to responsible authorities that the environmental impacts are understood and can be mitigated. At the end of the assessment, the project may be approved in principle, but it will still need permits before it can be built.

In a typical environmental assessment process, there are mandatory elements for public participation. For federal environmental assessments, public participation is mandatory for comprehensive assessments, but not for



screenings. This involvement is required to start when an application (project submission) is submitted. Usually, the public and Aboriginal groups are contacted earlier in the process.

The *Canadian Environmental Assessment Act* (CEA Act) explains the full process that must be followed for federal environmental assessments. It explains when an environmental assessment is necessary and the responsibilities of the federal departments. Some of the departments of the Government of Canada have to give approvals for certain components of a project. These departments, called Responsible Authorities, are in charge of making sure that an environmental assessment is completed. They cannot give approvals for any part of the project until the environmental assessment is finished.

Typically, the federal environmental assessment process includes:

- Determining if an environmental assessment is required. It does not consider the likely effects of the project, simply whether or not the legislation or act applies;
- Identifying who could be involved;
- Planning the environmental assessment;

- Conducting analysis and preparing an environmental assessment report;
- Reviewing the environmental assessment report by federal departments;
- Making of environmental assessment decisions by Responsible Authorities; and
- Implementing mitigation program and monitoring (if required).



Environmental assessments may make full use of the traditional knowledge of Aboriginal people. The mining company is responsible for collecting traditional knowledge or making possible its inclusion. Traditional knowledge can be used to determine the environmental effects and evaluate how serious they are. Traditional knowledge will also be used to select the ways to reduce environmental effects.

Laws at the federal, provincial and territorial (Yukon) levels specify when environmental assessments or impact reviews are required and how to do them. The Government of

## Facts & Figures

*Aboriginal people can work with the mining company to ensure that great care is taken to protect historical and sacred sites, as well as migration routes and traplines, before mining starts.*



Canada will do an environmental assessment when certain federal authorizations are required. The provinces and territories will do environmental assessments when permits are needed under their laws.

In the case of a mining project, this means that there are often federal and provincial environmental assessments that are needed which are harmonized into one joint panel review. At the federal level, mining projects most often require an environmental assessment or impact review (in the North) because federal permits, authorizations or licences are required.

### What Environmental Monitoring Is Required?

Environmental monitoring is in place to provide early warning of negative impacts so that corrective actions can be quickly put in place. Environmental monitoring is usually a condition of the environmental permitting process. Environmental

### Facts & Figures

*The West Kitikmeot/Slave Study Society is a made-in-the-north success story. It is a partnership of Aboriginal and environmental organizations, government and industry that wishes to make sure the effects of development on the environment, wildlife and people of the WKSS area are minimal and that northern people get the maximum benefits.*

*The partners formed a registered society in 1996 and developed an initial five-year research program called the West Kitikmeot/Slave Study (WKSS) to provide an information base necessary to examine the long- and short-term effects of development in the WKSS area. The initial WKSS research program ended on March 31, 2001. Since that time, the WKSS has continued to fund several key projects during the interim period until regional monitoring systems are in place.*

*(Source: [www.wkss.nt.ca](http://www.wkss.nt.ca))*



monitoring makes sure that a company's Environmental Management Plan is being implemented as proposed. The objective of environmental monitoring is to make sure that all impacts are mitigated. A mining company usually performs the monitoring, analyzes the results, and reports them to government agencies or sometimes to community monitoring agencies.

Environmental monitoring during mine development includes monitoring water flows and quality, air quality, and fish habitat, and can include vegetation changes. Air quality is monitored for its potential impact on wildlife and humans. Scientists analyze these tests. Local people are often trained to carry out sampling and analysis procedures. As an example, direct changes in plant communities are watched for, as well as the presence or absence of non-native species. Vegetation is sampled and analyzed in a lab, particularly





for metal mines, for potential metals uptake and transfer to wildlife.

### What Are the Potential Social Impacts?

While mine development brings opportunities for employment and business to a community, it may also create new social issues or concerns for the community. The table below illustrates some of the positive and negative impacts of mine development.

### What Are the Opportunities for Community Participation?

Community input and information exchange should occur during each phase of the mining cycle starting with exploration. During mine development, the importance of meaningful community input is critical. This is the time, before a project goes into operation, for communities to “get their issues on the table” and “say what they mean.” In other words, this is when communities can gain a complete

Social Impacts			
Type		Positive and Negative Effects	Community Response
Social	Shift work/rotational work	Less time to spend on traditional activities Workers and their families are separated for several days or weeks	Plan activities around work schedule Create support groups or programs to minimize the separation stress experienced by families
Economic	Community partnerships and alliances developed	Increased business opportunities Employment Training opportunities Adds wealth to a community	Improve and enhance community infrastructure Work with the changing dynamics of the community
	Increased employment	Increased training and skill development opportunities Increased income Creates positive role models Widens the gap between the employed and unemployed	Use the positive working role models within the community Need to provide workshops on money management, saving of wages, banking, etc.
Cultural	Strangers in the community	Increased population Strains existing services Worsens existing social problems	Offer cultural awareness training, delivered by members of the community, to make sure new people in the community understand its values and traditions



understanding of the project, ensure that the developer understands the potential impacts from their perspective and knowledge base, and raise issues of community concern. In this

way, an environmental assessment can address deficiencies in information and incorporate necessary changes in mine planning. Once a mine is operating, community input and consultation focuses on monitoring the effectiveness of impact management plans (mitigation) established during the environmental assessment.

Traditional knowledge is an area where Aboriginal community input is significant. Traditional knowledge provides information about traditional land uses, alerts developers to migratory patterns of wildlife, and can inform developers about sensitive areas (hunting areas, cultural sites, migratory routes, etc.). Traditional knowledge may also be used to help identify environmental impacts, evaluate how

serious they are, and select ways to reduce any negative effects.

Consultation processes are designed to incorporate input from communities and promote the sharing of information. To get the most out of consultations, communities can prepare in advance by doing the following:

- Identifying potential impacts that need to be considered in project development;
- Conducting a skills inventory of residents interested in working at the mine;
- Beginning skills training;
- Identifying community business opportunities and capacities;
- Identifying the service and labour needs of the project;
- Setting up ways to communicate for current and ongoing consultations (i.e., key contacts); and
- Assessing needs for advice and information gathering.

Additionally, having community development and infrastructure plans in place before development will be of great value to the community throughout the mine development process. Communities should enter into discussions with government agencies as early



as possible during the licensing and permitting process.

To help communities in this area, provincial/territorial authorities and federal government departments may have programs to help communities and individuals take advantage of opportunities during mine development. Communities may decide to set up a number of committees during the mine development process to ensure impacts are recognized and mitigated. Possible committees include:

- A committee to review the environmental impact statement;
- Environmental and socio-economic monitoring committees;
- Community wellness committee;
- Business development opportunities committee;
- Training/hiring committee; and
- Community sustainability upon mine closure.

## 2.4 Community Employment and Other Economic Opportunities

This section identifies the employment and economic opportunities available to Aboriginal communities during mine development. It briefly describes the role of **Impact and Benefits Agreements, Joint Ventures, and Memoranda of Understanding**. Ideas for maximizing benefits are also included.

### Facts & Figures

*The Voisey's Bay Nickel Mine in Labrador surpassed all expectations for Aboriginal employment during its mine development phase. Since 2002, Aboriginal employees have filled more than 1100 construction jobs. At its peak, nearly 500 Innu or Inuit were working at the construction site.*

*(Source: Voisey's Bay Nickel Company, [www.vbnc.com](http://www.vbnc.com))*



## What Are the Employment Opportunities?

Communities can experience huge increases in employment during mine development depending on the size of the mine. A wide variety of jobs, from entry-level to professional, are available during mine development (see Jobs and Education Table). The mine developer and its contractors are the major employers.

Other employment sources are secondary support industries and service providers.

The economic impacts due to increased employment are significant to a community. Since many of the skills learned during mine development are transferable, a community can also benefit from the increased skill base of its residents.

Jobs and Education		
Type of Job	Education Requirements	Examples
Entry-level	Grade 12 education or equivalent If a community does not meet this, they can talk to the mining company about waiving the requirement for a period This can encourage young people to stay in school and allow time to meet the requirement	Trades helpers Heavy equipment operators Housekeeping services
Semi-skilled	Grade 12 education or equivalent Some work experience	Warehouse technicians Administrative assistants Trades occupations
Skilled	College diploma or trades certification	Trades occupations Safety coordinators Environmental technicians
Professional	University degree	Managers Engineers Geologists Scientists Accountants

## What Are the Other Economic Opportunities?

Communities can experience significant economic benefits during mine development. The main benefits come from increased economic opportunities. Communities and the mining company should work closely at the earliest opportunity to develop alliances and partnerships in the areas of training, employment and business opportunities.

A number of economic opportunities for communities exist during mine development, including infrastructure development and the provision of utilities. The following list identifies just a few of the



potential business opportunities available to communities. It includes:

- Camp catering and housekeeping;
- Site services;
- Surveying;
- Construction services;
- Contract mining – both underground and open pit;
- Supply of goods (e.g., safety equipment, oil, gas);
- Aircraft support – helicopters – fixed wing;
- Airport maintenance;
- Laboratory services;
- Environmental consulting; and
- A legacy project, like an arena or swimming pool.

Business opportunities will increase as a project moves through the steps of mine development. Communities should prepare to take part by asking these questions:

- “What businesses are currently available?”
- “What businesses are required?”
- “What are the capabilities of the community?”

- “Are there good joint-venture partners available?”

The process of building a business base in a community takes time as capacity is developed. A good example of this comes from the Northwest Territories where two large diamond mines were developed within five years of each other. As communities and local businesses gained experience, they increased their capacity and were much better equipped to take advantage of the opportunities presented by the second development.

Businesses may grow when longer-term contracts become available during mine operation.

Memoranda of Understanding (MOUs) may be negotiated during the early stages of mine development. They are typically an agreement between a mining company and the community and include information about the role of each party. MOUs may develop into an accord and possibly a legal agreement (e.g., an Impact and Benefits Agreement [IBA]) as the project progresses.

Once a company has made a commitment to develop a property, it should begin the process of developing IBAs or Participation Agreements (PAs) with local affected Aboriginal communities. IBAs or PAs are often created



between Aboriginal communities and mining companies. These agreements might include guidelines for hiring, business opportunities, and training and scholarships. An IBA or PA may make provisions for the preferential hiring of Aboriginal persons and may discuss how and when community members will receive training. An agreement will also likely explain the tendering process for business contracts and will outline any preferential treatment for Aboriginal/community businesses and require unbundling (breaking up) of larger contracts.

These agreements become confidential legal contracts. They will only be made public if agreed to by the community and the mining company.

Aboriginal businesses can enter into a joint venture with established businesses. A joint venture (JV) is a simple business arrangement between two companies or between an Aboriginal community and a company capable of supplying services or materials to an exploration or mining company.

A JV agreement defines the relationship between the two parties and specifies the training and employment opportunities. It also defines how profits from the JV business activities will be distributed.

There are many successful JVs. These can provide:

- Helicopter support;
- Catering; and
- Contract mining services.

One of the largest and most successful JVs is the NUNA group where a contract mining company has established a working relationship with the Inuit of Nunavut. Another example is Rescan Tahltan Environmental Consultants (RTEC). It is an environmental consulting joint venture between Rescan and the Tahltan Nation.

JVs are an excellent way to develop local business capacity to prepare for and take advantage of business opportunities related to mine development. Through a JV, a community business can increase the scope of its current services in order to help meet the service and support needs of the mine developer. JVs may be developed related to logistics support, the provision of goods and services, and a number of other areas, such as catering, fuel supply, housekeeping, and environmental consulting. In addition to increased business opportunities, JVs can also increase training opportunities for community residents.

## Facts & Figures

*The Voisey's Bay Nickel Company negotiated separate Impact and Benefits Agreements with the Innu Nation and the Labrador Inuit Association (LIA). These agreements establish specific employment objectives for Aboriginal people and identify specific business opportunities for Aboriginal companies and joint ventures.*

*Aboriginal companies were awarded procurement/construction contracts worth more than \$500 million.*

*(Source: Voisey's Bay Nickel Company, [www.vbnc.com](http://www.vbnc.com))*





## 2.5 Community Experiences: Musselwhite Mine

*The Musselwhite mine is located in northwestern Ontario on traditional First Nation land. Mine construction began in early 1996 and was completed by April 1997. The mine started commercial gold production in 1997. As of 2005, cumulative production exceeded 1.7 million ounces.*

*The Musselwhite mine is a joint venture owned by Placer Dome (68%) and Kinross Gold Corporation (32%). Placer Dome is the operator of the Musselwhite joint venture.*

*Musselwhite's relationships and agreements with the local communities are recognized as leading practices.*

### Community Summary and Involvement

The Cat Lake First Nation, North Caribou Lake First Nation, Kingfisher Lake First Nation, Wunnumin Lake First Nation, Shibogama First Nations Council, and Windigo First Nations Council signed the first Musselwhite Agreement in 1992 with the Musselwhite Joint Venturers (JVs). The federal and provincial governments also participated and signed the Agreement.

#### *Musselwhite Agreement*

The Musselwhite Agreement addressed these important topics:

- Preservation of the environment and heritage of the mine area;
- Local employment and business development opportunities; and
- Ensuring that communities received economic and other benefits from the mine.

The Agreement contained sections relating to:

- Financing of community projects;
- A preferred hiring policy for members of the signatory First Nations; and

- A maximum production capacity to ensure the benefit of the mine extended over a substantial period of time.

The Agreement also outlined compensation arrangements for North Caribou Lake First Nation trappers whose livelihood would be affected by mine development.

The Musselwhite Agreement was vital in establishing the terms for the development of the mine. Essentially, it represented that the local First Nations communities were giving the JVs a “social licence to operate.” This agreement ensured local First Nations support for the project throughout the permitting process.

#### *Construction (1996–1997)*

Having completed the mine design, developed a financially viable plan and obtained the necessary permitting, the JVs started the construction phase of mine development. Although the construction phase was relatively brief, it had the greatest impact in the short term and, if mishandled, had long-term implications. During construction, the JVs identified five key objectives:

1. To build the mine safely;
2. To build the mine in an environmentally sensitive manner;
3. To build the mine in harmony with surrounding communities;
4. To build the mine on budget; and
5. To build the mine on schedule.

JVs, First Nation communities, employees, contractors and government all worked together, within the terms specified in the Agreement, to achieve the goals.

### Lessons Learned

The mine operator and First Nations communities learned a number of lessons during the mine development phase.

### 1. *The Value of a Healthy Relationship*

This was a lesson learned many times over. Problems that happened during the mine development phase were identified and resolved amicably. Resources and valuable time were not wasted due to unnecessary work stoppage or by resolving issues in court.

Dialogue between the mine operator and First Nations that started during the exploration phase carried on throughout mine development and beyond. This ongoing communication led to a respectful relationship between the two parties. Cultural and historic awareness of the local context was an important realization in forming a relationship.

### 2. *The Musselwhite Agreement*

This agreement became a guide for participants on how the mine would be built and operated.

Because the document contained input from the JV and First Nations, both parties had ownership for the outcome of mine development and were committed to its success. Misunderstandings did occur and the intent of the Agreement became the basis for resolving issues. To help resolve issues, the Agreement stipulated that various committees be formed to monitor performance and ensure the spirit of the Agreement was being fulfilled.

The following are two examples of how disputes were resolved:

- Discovery of a tar-like substance found in a river draining the property led to concern that an oil spill into the environment had gone unreported. A commitment to operate a joint monitoring program with JV and First Nation personnel restored faith in the program and trust in the relationship when it was discovered that the unknown substance was mosquito larva.
- Achieving First Nation employment as specified in the Agreement was problematic. Ambitious training programs were undertaken for First Nation people

seeking work. Additionally, the JV insisted that outside contractors hire and train First Nation residents as a requirement to working on the construction site.

Both First Nation and Musselwhite representatives stress personal relationships as crucial to making the Agreement work. Most people agree that the mutual respect between both parties was essential to resolving disputes.

A First Nation negotiator is credited with saying “It is not what is in the agreement. You can write what you want. It is about the special personal relationship that helps to overcome legal obstacles.” On the other side, a JV representative stated, “Simply sticking to the narrowly defined terms of the agreement does not work. In order to make the agreement work you also need to address issues that are not directly related. You need to be seen as a flexible, concerned and trustworthy partner.”

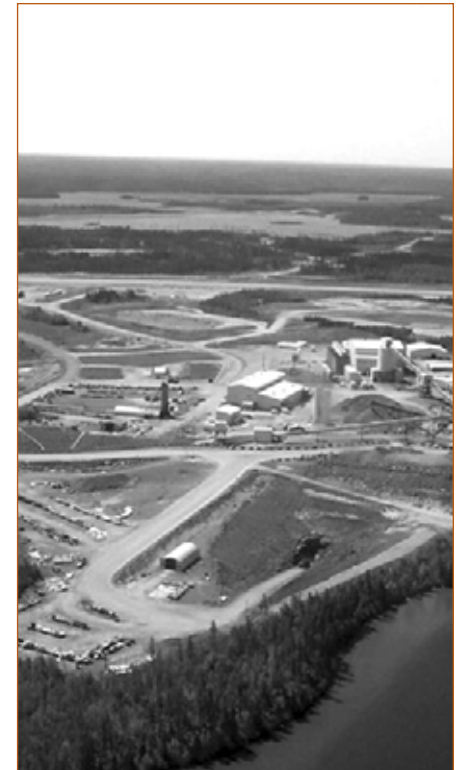
### 3. *A Commitment to a Long-Term Partnership*

The sense that the JV and First Nation people are in a long-term committed partnership is the glue that holds the relationship together. JV management publicly committed to accept its corporate responsibility to make Musselwhite a safe and profitable mine while respecting the environment and social progress, and without compromising communities, wellness or security. They also committed to the integration of best-practice standards for occupational health, safety, and environmental protection for all activities at the mine site from development through to closure. In return, First Nation communities supported the JV during the mine development phase by providing labour, goods and services, and their much-needed support for mine development during the formal permitting process.

For more information, contact:

[www.kinross.com/op/mine-musselwhite/index.html](http://www.kinross.com/op/mine-musselwhite/index.html)

[www.goldcorp.com/gold\\_projects/musselwhite](http://www.goldcorp.com/gold_projects/musselwhite)



# MINE OPERATION

Overview

Acts and Regulations

Environmental and Social Impacts

Community Employment and  
Other Economic Opportunities

Community Experiences





### 3.1 Overview

This section explains the purpose of mine operation, identifies the main activities and players, and outlines opportunities for Aboriginal communities to get involved during operations.

#### What Is Mine Operation?



Mine operation is the third phase of the mining cycle. It is the process of producing a mineral product for the benefit of society, **stakeholders** and **shareholders**. A mine is operating when earth and/or rock are being excavated from the ground and the processing plant is producing **saleable** product.



There are two types of mines: underground and open pit.

A mine operation has four main work areas: excavation areas, processing plant, **waste** storage, and supporting services. The excavation areas are where earth and rock containing the mineral are excavated. The processing plant separates the rock that contains saleable material (**ore**) from the surrounding rock that is not saleable (**waste rock**). Mineral processing is done in multiple stages (e.g., concentrator or mill, wash plant) and uses different processes

depending on what is being mined. Some mine operations do not have a processing facility on site so the mined material is sent somewhere else to be processed. Waste storage facilities include areas for both waste rock and the material rejected from a mill (called **tailings**). Supporting services to a mine operation may include repair shops, labs to test the quality of the mined material, change rooms, living quarters, warehouses, and offices.

Every mine operation has mining and processing target rates. One key element is to determine rates of mining and processing that will ensure that all costs can be covered from sales of the product. These rates are evaluated during the feasibility studies before a mine starts operating. The rates are calculated to provide the highest level of efficiency (need to match the capital investment, size of orebody, and life of the mine). Producing too much, too fast could increase costs and hurt profits; producing too little, too slowly could hurt the economics of the mine because of reduced sales. The mine and the process must be designed and built to achieve the right balance.

#### *Time Frames*

The operating life of a mine can be as short as several years or as long as several decades. It can also be seasonal or operations can be year-long and shipments can be seasonal (if access

is difficult). Overall revenues must be able to at least recover exploration and construction expenses. Factors that affect how long a mine will operate include:

- **Commodity** price (demand, competition, and prices for the product in the world market);
- Production costs and production rates;
- Quality (grade) and quantity of ore that is economic to mine in the deposit;
- Size and shape of the body of material to be mined;
- Best possible economic mining rates;
- Mining methods, equipment, and associated costs;
- Depth of mining required below surface;
- Ground conditions and ability to mine safely; and
- Location.

Generally, with higher metal prices, lower-grade rock becomes ore. However, when the price of metal is lower, only higher-grade rock is able to be used as ore. An orebody can grow or shrink as prices and costs change.

### Costs

Mining uses labour, capital, energy and other inputs, all of which cost money. During mine operations, labour is usually the highest cost. Power, fuel and other consumables (heavy equipment, drill bits, tires, spare parts, etc.) are the next greatest expense.

The location of a mine has a major effect on both construction and operating costs. If the mine is located in a remote area, the mine operator may have to build a winter road to bring in supplies and take out ore or concentrate, and a diesel power plant to generate electricity. A major expense for remote mines is transportation costs to fly workers in and out of the mine. However, if the mine is located in a less remote area, it may be on an existing road system and close to power grids, or the government may agree to provide a road for access and power to help lower costs.

### What Are the Mine Operation Activities?

#### Hiring

When a mine goes into operation, it needs to hire both permanent employees and contractors. Companies will advertise in local, regional and national papers, depending on





the jobs to be filled. Some companies may have agreements (e.g., IBAs) to work directly with Aboriginal groups to find and hire local candidates (for example, Voisey's Bay [Newfoundland and Labrador], the Diavik and Ekati diamond mines [Northwest Territories], Raglan [Quebec], Musselwhite [Ontario], and Eskay Creek [BC]).

If local communities do not have candidates with the required skills and professional qualifications, the company must look “outside” and the recruitment search is extended regionally, nationally, and sometimes internationally. Companies prefer to hire locally where people already live. The local candidates are already close to mining sites and know about the land, geography and climate.

### *Training*

All new employees receive orientation training before starting on the job. This training helps employees

to understand the operation, but more importantly, to make sure they are safe on the job. Other training for new employees includes on-the-job training, cross-cultural training, trades



training, apprenticeships, and literacy and life skills training. Training can be delivered in classrooms, by computer-based programs, and by one-on-one instruction and mentoring.

Companies may partner with local communities, government and others to provide community-based training. Other companies may partner with local colleges and schools to provide technical training.

### *Commissioning*

Commissioning involves testing to see whether a new facility, process or equipment performs as it was designed. All processing and mining equipment must be commissioned before going into full production.

### *Production*

During production, waste rock must be mined away to recover the ore. Ore and waste both cost

money to excavate and process and so, to be efficient, mines try to mine as much ore and as little waste as possible.



### **Facts & Figures**

*To answer the needs of mining companies and mining workers, the Quebec government, together with various organizations, has developed a training program for underground mining. This program delivers training to Cree students in cooperation with the Cree School Board.*

*(Source: [www.cfpvaldor.qc.ca](http://www.cfpvaldor.qc.ca))*



When an operation starts up, a lot of waste must be excavated in order to reach the ore. In underground mines, this is called pre-production development. In open-pit mining, this is called pre-stripping. This early stage of mining can last from a few days to more than a year, depending on how much waste there is and how fast it can be removed.

Once enough waste has been removed, the mine is able to send ore to the processing plant, and the processing plant begins processing the ore. At this point, the mine is in “production.”

During production, waste still needs to be excavated in order to keep uncovering more ore. In underground mining, this is now called “development”; in open-pit mining, this is now called “stripping.” Development and/or stripping go hand-in-hand with production and are crucial to maintain production.

Full production generally means that the average mining and processing rates are meeting or exceeding the target rates developed during the feasibility study phase.

Improved market conditions may allow a mine to sell more product than planned and/or to sell it at a higher price than expected. When this happens, the mining company will try to increase production. Sometimes a mine operation can increase production for a

short time using its existing equipment and people, but the only way to achieve permanent increases is to expand the mine.

### *Mine Expansion*

Some mines may experience an expansion phase. Mine expansion can include:

- Enlarging the existing mine;
- Opening up more mine areas;
- Buying more equipment and hiring more people;
- Expanding the processing plant to process more ore;
- Changing the processing plant to process faster; and
- Doing more exploration work to try to find more ore.

## Who Are the Main Players in Mine Operation?



### *Junior Exploration Companies*

As a project goes into production, the junior company usually sells all or most of its ownership to a senior mining company, although there are exceptions. The senior mining company becomes the sole or majority owner and uses its expertise to operate and manage the new mine.





### *Senior Mining Companies*

Senior mining companies have the central role in the mining industry. They arrange financing, plan, develop, operate and manage mine operations. They also sell the product. Most senior mining companies have been in the mining business for decades and have several mine operations throughout the world. Mining generates a lot of money, but it also costs a lot of money to start and operate a mine. Senior mining companies, with their years of earnings and experience, are usually the only companies with the capacity to start and operate a mine.



### *Consulting Firms*

Consulting firms provide special knowledge and capability to mine operations. A mine operation could require assistance in areas such as rock and soil mechanics, safety, engineering, occupational health and ergonomics, labour relations, environmental science, and others.



### *Equipment Suppliers and Manufacturers*

Equipment suppliers have expert knowledge and experience for the machinery that they supply. They are usually certified journeyman mechanics or electricians, or will have engineering degrees, along with many years of work experience. During operations, equipment suppliers will help

assemble and commission equipment, provide training, advise on preventive maintenance, and provide ongoing technical support. In a large mine, they may set up shop to ensure that the equipment is properly maintained.



### *Construction Companies*

Construction companies build the roads, dams, plants and shops, buildings, offices, pipelines, and various other facilities, including water and power distribution systems, that are all required before a mine operation can go into production.

Large construction companies handle the commissioning of all buildings and facilities before handing them over to the mining company. Smaller construction companies work under the direction of large construction companies and may perform smaller projects under the direction of the mining company once a mine is in production.



### *Governments*

Inspectors from various government departments conduct regular inspections to make sure operators are complying with applicable environmental permits, licences or authorizations, including conditions and requirements specific to the project. They also collect royalties and taxes.



### *Service Providers*

Some organizations are needed to provide special services that a mining company cannot or chooses not to perform. Examples include helicopter and airplane services, on-site explosives manufacturing, site security, catering and camp operations, environmental specialists, graphic design, and publication. These organizations are called service providers.



### *Financial Institutions*

Institutions such as banks, investment companies, securities brokerages and stock exchanges focus on the financial needs of mining companies. A variety of institutions take part in providing loans, managing cash and investment holdings, obtaining investor funding, public listings, buying and selling shares, coordinating mergers and acquisitions, and posting bonds for closure liabilities.



### *Schools*

Secondary schools feed into the colleges and universities, so teachers and counsellors are beginning to work more closely with the mining industry to be able to help students plan their careers.

Major universities and research institutes conduct important scientific and social research.

Funded by government and industry, researchers work with mine operations to gather information and to share findings. The results of research can be used by many mines to improve performance.



Universities educate graduates in the fields of geology, engineering, business, science, and communications, all fields that a mine operation needs. Community colleges prepare graduates in other essential fields such as surveying, trades, engineering technology, computers, and office administration.

Most of the jobs at a mine that are challenging and involve responsibility usually require at least Grade 12 education or equivalent. This is to ensure that the person can do the job safely and properly.



### *Industry Associations*

Many mining companies participate in provincial/territorial and national associations to address common issues and provide a unified voice to the public and government. Most provinces/territories have a “Chamber of Mines” that represents the exploration and mining activity in the province/territory as a whole. Some provinces



and territories also have their own mining associations to help their provincial government shape policies that affect the industry. Industry associations also deliver benefits to their members, providing a forum for them to discuss matters of mutual interest and work collectively on research and the development of best practices. The Mining Association of Canada performs this role at a national level, dealing with federal policy makers.

### *Customers*



The customer is ultimately the most important player in the industry. There are immediate customers and final customers. Immediate customers include smelters, refineries, steel mills and many types of manufacturing plants, and selling agencies that mining companies deal with. Final customers are the retail consumers of all of the everyday goods that contain materials that came out of the ground. Final customers drive the markets that influence the selling prices.

Customers are many and varied, depending on the mineral product being produced and sold. Base metals such as copper and zinc are used for a variety of everyday goods. Precious metals such as gold and silver are used for jewellery and electronic components. Coal and oil sand are used to provide fuel and energy. Industrial minerals such as talc and potash are used to

produce a variety of goods including fertilizer, cement, baby powder, cat litter, etc. Diamonds are used in jewellery, industrial cutting blades and drill bits.

### **How Can Aboriginal Communities Get Involved in Mine Operation?**

Community involvement should occur throughout the mine cycle through employment, businesses and monitoring. The type and amount of community input and communication depend on many things, including if and what agreements are in place (e.g., IBAs, PAs).

Also, company representatives may visit communities to inform and provide updates on the operation. They may also publish project updates in newsletters and local newspapers. Companies may bring young people and elders to the site, host community visits, support family visits, meet with community employment officers, conduct community-based training, and meet with chiefs and council.

Companies may also visit local schools to encourage students to stay in school and attend career shows in schools to emphasize the types of jobs available and the education required. They may also visit communities to gain a better understanding of the lifestyles of their workers.

## 3.2 Acts and Regulations

This section identifies the conditions of leases, licences and permits. It also provides a listing of the major permits, licences and other instruments needed by one mine to operate. The actual licences and permits that a mine needs to operate depend on what jurisdiction the mine falls under.

Government passes acts and enables regulations to ensure mining occurs in a safe and environmentally friendly way. Companies must comply with the requirements of both federal and provincial/territorial acts and regulations.

### What Are the Conditions of Leases?

Leases authorize mining companies to access land for mine development. They are issued by provinces and territories with the exception of Nunavut and the Northwest Territories, and on Indian Reserves where leases are issued by the federal government (Indian and Northern Affairs Canada [INAC]). They set the boundaries where certain infrastructure can be built or deposited (i.e., tailings or waste rock piles) and set requirements on how to operate environmentally in each lease. Each lease requires a mine closure and reclamation plan, a yearly lease fee, and large security deposits.

The life of the mining lease varies by province/territory. In the Northwest Territories and Nunavut, on Crown lands, INAC issues both surface and sub-surface leases. The sub-surface leases have a term of up to 21 years whereas the surface leases have a term of up to 30 years. Also, Aboriginal organizations may grant authorization for land access and mineral tenure for certain lands.

### What Are the Conditions of Licences and Permits?

Government agencies issue licences, permits or authorizations and enforce the terms and conditions.

Generally, among the pieces of federal environmental legislation that most often apply to mine operation are the:

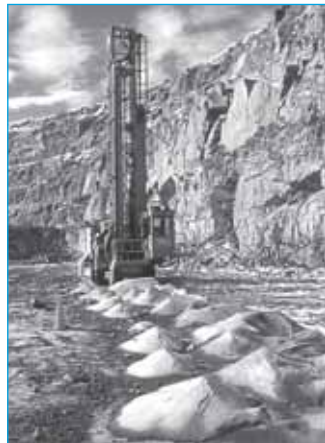
- *Canadian Environmental Protection Act (CEPA);*
- *Fisheries Act (FA);*
- *Explosives Act; and*
- *Navigable Water Protection Act.*

For example, in the case of operating metal mines, the Metal Mining Effluent Regulations apply. These are regulations under the *Fisheries Act*. There are also regulations administered by the Mines Inspector (WCB – Safety –

### Facts & Figures

*The diamond mines in the Northwest Territories use community-based consultation programs. They have Participation Agreements that are Aboriginal community based. The boards report to the communities and they publish annual reports. Update meetings are held annually in each of the participating communities.*





monthly – Health Inspector), which are under provincial/territorial jurisdiction.

The following list shows some of the permits, licences and other instruments that may be required to operate a mine depending on its jurisdiction:

- Fisheries authorization permit: Issued by Fisheries and Oceans Canada to allow a company to alter fish habitat.
- Navigable waters permit: Issued by the Coast Guard to allow for the construction of any structure in a lake or river that is considered navigable.
- Explosives permit: Issued by Natural Resources Canada to allow the storage and mixing of explosives at the mine site. The permit sets required distances away from other buildings and from waterways.
- Water licence: These provincial/territorial licences set conditions for water use, waste disposal, and water discharge.
- Quarry permit: Provincial/territorial permit to operate at the site.
- Aggregate permit: Provincial/territorial permit on the extraction and use of aggregate.

- Transmission line permit: Provincial/territorial permit required when a new transmission line is built.
- Domestic sewage permit: Provincial/territorial permit for the treatment and disposal of domestic sewage at the mine site.



### Other Instruments

Agreements such as Impact and Benefits Agreements (IBAs) with Aboriginal organizations are not conditions of regulatory approval in unsettled land claims areas. However, governments strongly suggest to mining companies to negotiate such agreements. IBAs may contain a wide variety of provisions, including a provision intended to protect the environment and monitor the environmental impacts of the mining project.

Regulatory approval may require impact monitoring agreements involving government agencies, First Nations and mining proponents. This agreement would serve to verify the accuracy of the environmental assessment and the effectiveness of mitigation measures. Often, Aboriginal communities actively participate in monitoring under these agreements.

### 3.3 Environmental and Social Impacts

This section identifies the potential environmental and social impacts a community may experience during mine operation. Ideas for monitoring, mitigation and community input are included.

#### What Are the Potential Environmental Impacts?

As in each of the mining phases, the intent during operations is to minimize the environmental impact to the water, land, air, wildlife and people as much as possible. Potential impacts are very well understood and can be mitigated effectively by using traditional knowledge and improved technologies.

Environmental impacts that may require mitigation measures, depending on where a development is located, may include:

#### *Potential Impacts:*

- Loss of archaeological and heritage sites;
- Impacts on traditional and non-traditional land use;
- Impacts on water flows and quality; and
- Impacts on fish and fisheries.

#### *Mitigation:*

- Protection of land and identification and protection of archaeological and heritage sites;
- No hunting/fishing zones and wildlife protection;
- Water quality monitoring and flow supplementation; and
- Protection of spawning and rearing areas and fish farming.

The following table outlines the type of impacts possible during mine operation and the mitigation measures.



Environmental Impacts		
Type	Condition	Mitigation
Land use	Land disturbance from mining activities – excavations in the mine, storage of waste rock	Minimize the mining footprint by using good planning and community input
	Tailings waste and tailings dams	Must be approved by government regulators Strict rules for locating, constructing and operating
Air quality	Dust from roads and mining Emissions from trucks and on-site power generation	Water roads to control dust Monitor emissions to determine effects on vegetation and air quality
Water quality	Dirt, rocks, or contaminated or unclean water enter streams or lakes	Establish a water management plan (which must be approved by the government) Train employees and contractors on the water management plan
Wildlife	Animals attracted to garbage and food waste	Use best practices for incineration of food waste and garbage Remove waste that cannot be incinerated A waste management plan and employee training will help minimize wildlife impacts
	Migratory patterns affected by presence of humans, noise from aircraft, noise from blasting	Observe animal behaviour and modify operations as required Avoid certain activities during migration

## What Environmental Monitoring Is Required?

The purpose of monitoring is to measure and evaluate impacts compared to baseline conditions before the operation. Companies and governments continually monitor the mining operation to identify any changes. If changes are found, the company can respond to the changes to prevent any long-term damage. Some changes are noticed immediately through monitoring (water samples) and others take a longer time to determine trends and impacts (wildlife monitoring). The basis for knowing that changes have occurred is the baseline studies that were begun early in the advanced exploration stage.

During operations, the government and mining companies monitor:

- Waste water;
- Wildlife;
- Air quality;
- Water quality;

- Aquatic effects;
- Fisheries and fish habitat; and
- Reclamation research.

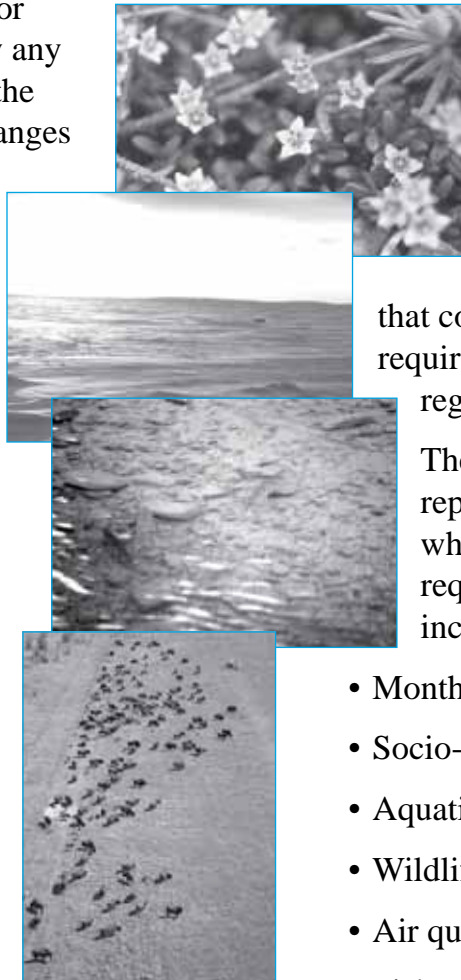
Aboriginal representatives from the affected communities may participate in or conduct these monitoring programs and studies.

Although rare, external monitoring agencies (independent) may be formed to act as a watchdog. They make sure

that companies meet their regulatory requirements, and they check that the regulators are doing their job.

The results of monitoring must be reported so that everyone will know what is happening. Typical reporting requirements for operating mines may include:

- Monthly water quantity and quality;
- Socio-economic reports;
- Aquatic effects;
- Wildlife effects;
- Air quality; and
- Fisheries and fish habitat.



### Facts & Figures

*The Raglan Committee is the formal forum between the Raglan mine in northern Quebec and the Inuit community. The Committee follows up on environmental matters and works to solve any potential problems.*

*(Source: [www.noranda.com/our\\_business/nickel/operations/raglan.htm](http://www.noranda.com/our_business/nickel/operations/raglan.htm))*







### What Are the Potential Social Impacts?

Developments such as mining bring with them risks and opportunities for the communities and people who live nearby. By identifying these risks and opportunities, communities can work to reduce negative impacts while gaining maximum benefits from the development.

The table to the right identifies some of the potential social impacts and possible responses to these impacts.

Social Impacts			
	Type	Positive and Negative Effects	Community Response
Social	Shift work/rotational work	<ul style="list-style-type: none"> <li>Less time to spend on traditional activities</li> <li>Workers and their families are separated for several days or weeks</li> <li>Adds wealth to a community</li> </ul>	<ul style="list-style-type: none"> <li>Plan activities around work schedule</li> <li>Create support groups or programs to minimize the separation stress experienced by families</li> <li>Work with the changing dynamics of the community</li> </ul>
Economic	Community partnerships and alliances developed	<ul style="list-style-type: none"> <li>Increased business opportunities</li> <li>Employment</li> <li>Wealth generation</li> <li>Training opportunities</li> </ul>	<ul style="list-style-type: none"> <li>Improve and enhance community infrastructure</li> </ul>
	Increased employment	<ul style="list-style-type: none"> <li>Increased training and skill development opportunities</li> <li>Creates positive role models</li> <li>Widens the gap between the employed and unemployed</li> </ul>	<ul style="list-style-type: none"> <li>Use the positive working role models within the community</li> </ul>
	Increased income	<ul style="list-style-type: none"> <li>Widens the gap between the employed and unemployed</li> <li>A sudden influx of money may lead to increased alcohol and drug use</li> </ul>	<ul style="list-style-type: none"> <li>Create addiction response program and support group</li> <li>Information campaign</li> </ul>
	Wage economy	<ul style="list-style-type: none"> <li>More money in the community</li> <li>Local community businesses can prosper</li> <li>Personal wealth increases and crime rates decrease</li> </ul>	<ul style="list-style-type: none"> <li>Ensure that the work is distributed in all communities</li> </ul>
Cultural	Strangers in the community	<ul style="list-style-type: none"> <li>Increased population</li> <li>Increased funding for traditional activities</li> <li>Strains existing services</li> <li>Aggravate existing social problems</li> <li>Pursuit of income at the expense of traditional activities</li> </ul>	<ul style="list-style-type: none"> <li>Offer cultural awareness training, delivered by members of the community, to make new people in the community understand the values and traditions of the community</li> <li>Support and maintain traditional activities</li> </ul>



### 3.4 Community Employment and Other Economic Opportunities

This section identifies the employment and economic opportunities available to members of Aboriginal communities during mine operation. It provides information on types of jobs, wages, and training opportunities. It also lists specific actions a community can take to increase its economic opportunities and benefits.

#### What Are the Employment Opportunities?

The more recent mine operations across Canada have recognized the potential of Aboriginal communities as a source of employees.

Employment and training opportunities are usually the most significant benefit for a community during mine operations. As a mine goes into operation, the percentage of local workers employed increases significantly.

Careers in the mining industry are very diverse. Jobs vary from trades to high-tech and use valuable skills. Senior mining companies

employ hundreds and sometimes thousands of workers at each mine. The following are the types of jobs in a typical mining operation:

- Miners
- Heavy equipment operators
- Pipe fitters
- Environmental scientists
- Supervisors
- Accountants
- Administrators
- Laboratory technicians
- Public relations specialists
- Administrative assistants
- Drillers and blasters
- Mechanics
- Carpenters
- Geologists
- Safety experts
- Clerks
- Managers and executives
- Assayers
- Marketing personnel
- Truck drivers
- Electricians
- Welders
- Surveyors
- Engineers and technicians
- Trainers
- Computer technicians
- Security officers
- Human resource specialists
- Nurses
- Photographers

#### Recruitment

Companies will have standards for recruitment of employees. They will conduct interviews and make sure that potential employees pass pre-employment medical and security checks. Through the relationship established with the company, a community

#### Facts & Figures

*Voisey's Bay Nickel Company exceeded Aboriginal employment targets for start-up (commissioning). Fifty percent of the start-up operations work force was Innu or Inuit.*

*(Source: Voisey's Bay Nickel Company, [www.vbnc.com](http://www.vbnc.com))*





can help potential employees learn about the interview process.

Once employed, a new world of personal opportunity opens up. From basic training to skills enhancement, from career planning to apprenticeships, a wealth of opportunities will unfold for new employees. The training will provide long-term skills benefits to Aboriginal people and contribute to community sustainability.

### Wages

Jobs in mining typically pay high wages, with average wages the highest of any industry in Canada. In 2003, the Canadian mining industry was the only industrial sector with average weekly wages above \$1000 per week. In remote northern mines, truck drivers can earn \$60 000 or more a year. As a person gains more skills and experience, his/her pay will increase. Actual wages depend on the type of mine,

its location, nature of the job, and supply and demand of workers. For example, Canada's coal mines offer the highest wages, followed by metal mining and nonferrous metal smelting and refining.

### Facts & Figures

*According to the 2001 Statistics Canada Census, Aboriginal employment in the mining industry accounted for 5.3% of the total mining labour force (excluding oil and gas), making mining the largest industrial employer of Aboriginal people in Canada. Since 1996, the mining sector has seen an increase of 21.1% in its Aboriginal work force.*

*"All the training I got is job-related. I didn't go to a special school or any courses for this job. We do have the option of taking an assayer training course and the company reimburses us."*

*Nora Shugakeesik, Musselwhite Mine*

*(Source: Mining Video "Our Community...Our Future," NRCan/MNDM)*

*Aboriginal people working in the minerals and metals sector have an average employment income twice that of the average for total Aboriginal people.*

*(Sources: Natural Resources Canada, Statistics Canada)*

### What On-the-Job Training Opportunities Exist?

There are many training opportunities for mine employees and contractors during operations. All new employees receive orientation training that usually includes an introduction to the company's vision and mission, safety practices, rules of behaviour, and information about site facilities and services.

Some positions require job-specific training. Training on equipment, procedures, and the importance to the overall process is provided when the employee starts the new job so the work will be done safely and





properly. The training is often one-on-one so that questions can be asked.



Mine operations recognize that there is value in employees learning the skills

of another job (cross-training). If someone is absent, another employee who has been trained could take over until the other employee returns or, if a position becomes vacant, an employee who has been trained would be qualified to apply for that position.

Mine operations usually have a number of positions for trade apprentices. Becoming a certified tradesperson requires an apprentice to work under a journeyman for a certain amount of time. Not only does an apprentice need to demonstrate the necessary skill, but the apprentice also needs to finish school and then pass exams.

The mining company may provide training that is designed to help employees and improve the company as a whole. This can include team-

building workshops, information sessions, additional technical training, leadership development, and basic literacy.

Mining companies often provide support when an employee finds a course outside of the company that can help job performance. This kind of personal development is usually expected to take place outside of work hours on the employee's own time. In some instances, the company may allow time off, with or without pay, if the course takes place during company time. However, financial support for course fees, books, and travel costs is usually available and includes either full or partial reimbursement after successfully completing the course. Anything from a one-hour seminar to a complete university degree by distance learning can be supported under these types of programs.

Mining companies sometimes create special initiatives for employees. Examples include: literacy programs, completion of secondary school general equivalency degrees (GED), pre-trades programs, community-based training, life-skills training, drug and alcohol awareness and rehabilitation, and management development programs.



## What Are the Other Economic Opportunities?



Mine operation can help build capacity for the future in training, employment, business support, and scholarships. Communities can realize significant economic opportunities during mine operation. The main benefits come from increased employment, business opportunities, and community infrastructure.

Opportunities for Aboriginal businesses that have provided services at the exploration and development phases become more substantial and longer term during mine operation. During mine development, business opportunities tend to be for one to three years, while during operations, contracts may be for five or more years and may be renewable.

As during the mine development phases, communities should prepare to take part and continue asking these important questions:

- “What businesses are currently available?”
- “What businesses are required?”

- “What are the capabilities of the community?”
- “Are there good joint-venture partners available?”

While answering these questions, the community should also talk with the mining company to make sure the relevant and required decisions are made.

The community should review the provisions of its agreement with the mining company. For example, Impact and Benefits Agreements might be in place. These agreements are meant to be used and will stimulate business opportunities. They should

### Facts & Figures

*In 1993, Syncrude and the Fort McKay First Nation partnered to move a small herd of 30 wood bison onto a section of land reclaimed by Syncrude. Today, the Beaver Creek Wood Bison Ranch is home to an award-winning herd that averages about 250 head with a 99 percent calving rate.*

*Syncrude and Fort McKay now aim to establish the commercial viability of the project, which has been co-managed by Fort McKay for several years. The ranch could provide considerable economic opportunity to the First Nations community. (Source: Syncrude Canada Ltd., [www.syncrude.ca](http://www.syncrude.ca))*





also review the tendering provisions of the agreement (as mining companies sometimes break



tenders into smaller pieces, which provides more opportunities to Aboriginal communities) and discuss opportunities



with the mining company. Many opportunities will exist, whether using

wholly owned businesses, joint ventures or other facilities.

The following list identifies some of the possible business opportunities available to communities. It includes:

- Camp catering and housekeeping;
- Site services;
- Surveying;
- Ongoing construction services;
- Recycling services;

- Contract mining – both underground and open pit;
- Supply of goods – for example, safety equipment;
- Aircraft support – helicopters and fixed wing;
- Airport maintenance;
- Laboratory services;
- Environmental consulting;
- Trucking; and
- Road maintenance.

Communities should also check with local, provincial and federal government agencies for help and resources.

### Facts & Figures

*Communities can realize significant economic opportunities during every stage of the mine operation, including business opportunities, skills development, and training, as well as investments in local infrastructure.*

*At the Eskay Creek mine in British Columbia, a contract is in place with the Tahltan Nation Development Corporation for the life of the mine for construction services and \$1 million in funding for a Healing Centre project.*

*(Source: [www.barrick.com](http://www.barrick.com))*





### *Maximize Economic Opportunities*

Communities can play an active role in increasing the type and amount of economic opportunities available to them by:

- Hiring a professional business manager to maximize their benefits from a project. These skills may be available in the community or a community may need to look outside to fill this need;
- Developing their own business and training capacity;
- Being creative and imaginative during the negotiation of any agreements;
- Beginning discussions about the development of partnerships with the mine developer as early as possible;
- Taking an inventory of the community's assets;
- Speaking to members from other communities; and
- Taking long-term perspectives (closure issues, training, strategic planning of resources).

### **Facts & Figures**

*Aboriginal companies and/or Aboriginal joint ventures are local suppliers of goods and services to the mining sector.*

- More than \$750 million = Syncrude Canada Ltd. (1992-2005)
- \$604 million = Diavik Diamond Mine (construction phase) and \$85 million in 2004
- More than \$500 million = Voisey's Bay Nickel Mine (2005)
- \$124 million = Ekati Diamond Mine (up to end of 2003)
- \$72 million = Raglan Mine (to 2004)



## 3.5 Community Experiences: Diavik Diamond Mine

*Diavik Diamond Mines Inc. manages and operates the Diavik Diamond Mine located 300 kilometres northeast of Yellowknife in the Northwest Territories. Diavik expects to mine over a 16- to 22-year period three diamond-bearing orebodies called kimberlite pipes, all located under the waters of Lac de Gras.*

### Community Summary

Before the mine was built, five local Aboriginal groups – the Dogrib First Nation, the Yellowknives Dene First Nation, the Kitikmeot Inuit Association, the North Slave Metis Alliance, and the Lutsel K'e Dene First Nation – entered into Participation Agreements with Diavik. The agreements solidify relationships and formalize Diavik's commitments to community capacity building, long-term independence, and economic sustainability. Most agreements have formalized implementation committees that function to externally verify Diavik's performance on socio-cultural and economic aspects, and to provide recommendations for improvement.

### Community Involvement

Communities are formally involved in monitoring and in an advisory capacity through the environmental monitoring advisory board created under the Environmental Agreement. The board includes representatives from the five neighbouring Aboriginal groups, governments and Diavik Diamond Mines Inc. Communities are also involved through the Diavik Communities Advisory Board under the Socio-Economic Monitoring Agreement and

in implementation committees under its Participation Agreements.

### Economic and Business Opportunities

Communities have realized many economic and business opportunities through their relationships with Diavik. In 2004, northern Aboriginal businesses and their joint ventures sold goods and services valued at some \$85 million in expenditures by Diavik. Examples of these opportunities include:

- Ekati Travco, a northern Aboriginal joint-venture company, built the addition to the accommodation complex.
- I&D Management, a 100% northern Aboriginal-owned company employing over 100 people, supplied the required staff and support workers to operate the three new haul trucks needed to meet increased production needs.
- Tli Cho Landtran Transport Ltd., a Dogrib company, trucked a high-tech robot with the kilns and ancillary equipment from Albuquerque, New Mexico, to Yellowknife. This robot is used to assist with diamond cleaning in the Product Splitting Facility's (PSF) technical cleaning area.
- Local communities also received contributions through donations, scholarships, sponsorships,







business venture development programs, and training. The five Dene, Metis, and Inuit groups that signed Participation Agreements also received direct payments from Diavik.

## Employment Opportunities

Five Aboriginal groups ratified the Socio-Economic Monitoring Agreement signed with the Government of the Northwest Territories. This agreement formalizes Diavik's commitment to employ northern and Aboriginal residents. As a result, communities have enjoyed significant employment opportunities at Diavik. The following are illustrations of Aboriginal employment at Diavik during operations in 2004:

- 38 percent Aboriginal employment (273 Aboriginal northerners employed).
- Several northern Aboriginal people are employed in supervisory and management positions.
- Northern Aboriginal groups and educational institutions are partnering with Diavik to develop an Aboriginal Management Development program, as part of an Aboriginal Employment Strategy, to ensure the number of Aboriginal people in supervisory and management positions increases.
- Northern businesses supply Diavik with approximately 50 percent of its work force.

- Examples of northern contractors supporting Diavik mine operations include:
  - I&D Management Services, which supplies heavy equipment operators;
  - Ek'ati Services, which supplies catering and camp services;
  - Tli Cho Logistics, which supplies site services;
  - SecureCheck for security; and
  - Denesoline Western Explosives.

These Aboriginal-owned companies and joint ventures have worked closely with Diavik to identify and pursue potential future business opportunities. In addition, some Aboriginal and northern businesses have entered into several long-term operations labour contracts with Diavik.

For more information, contact Diavik Diamond Mines at [www.diavik.ca](http://www.diavik.ca).

# MINE CLOSURE

Overview

Acts and Regulations

Environmental and Social Impacts

Community Employment and  
Other Economic Opportunities

Community Experiences





## 4.1 Overview

This section defines mine closure and describes the reasons why all mines eventually close. It also explains the necessary role of a mine closure and reclamation plan. The primary mine closure activities and players are identified, and so are opportunities for Aboriginal involvement, including in mine rehabilitation and monitoring.



### What Is Mine Closure?

Mine closure is the last phase of the mining cycle. Due to the nature of mineral deposits, they all have a finite life. While some deposits are very large and may generate a mine life of 50 years or more, other deposits may only produce a mine life of a few years. All mines have one thing in common – no matter how long they last, they all will close. Mining is a temporary land use.

Today, mine closure is defined as the orderly, safe and environmentally sound conversion of an operating mine to a closed state. Areas affected by mining activity should become viable and self-sustaining ecosystems that are compatible with a healthy environment and with human activities.

Mines close for different reasons, but the two most common are:

- 1) Running out of the ore resource; and
- 2) Low commodity or metal prices, which make the mine uneconomic to operate.

While closure is the last phase of the mining cycle, today planning for closure starts before the mine development phase. All governments in Canada have rules, legislation and regulations covering the closure process.

Mine closure is usually one of the most discussed issues with governments, companies and the public. Communities are concerned about what will be “left behind.” All stakeholders want to make sure that there are no contaminated sites now commonly referred to as “legacy issues.”

### *Time Frames*

The time frame needed for mine closure depends on many factors, including the size and complexity of the operation, the effects the mine has had on the environment, and the extent of regulatory review. Public input may also be a factor as some of the issues involved may raise public concerns that can take time to address.

Typically, it may take 2 to 10 years to shut down a mine. If long-term monitoring or

treatment is required, it may take decades before closure is considered complete.

### What Is a Mine Closure and Reclamation Plan?

Planning for mine closure starts during mine planning. The public usually reviews proposals for closure during the public consultations that occur as part of a project's environmental assessment. Under existing legislation, mine owners must submit a mine closure and reclamation plan to the provincial/territorial and/or federal government. Mining companies usually make great efforts to ensure that public views and concerns are heard and addressed during this consultation process.

The government must approve the initial closure and reclamation plans before any mine development work can begin. However, the development of final plans may take years of study and detailed engineering before being completed. The company must also put up money (e.g., a deposit or bond) to make sure that it can complete the reclamation, including shut-down, closure and post-closure. The financial assurance may be a few million dollars for a small mine or over \$100 million for a large mine. The deposit makes sure that the government will not be left with the responsibility of paying for a mine closure as has happened in the past

because abandoned mines become property of the governments.

A mine closure and reclamation plan for any mine is site-specific. It details how the mining company will close the mine site and return the surrounding land, as closely as possible, to its pre-mining state. Mine closure and reclamation activities include decisions on what to do with every component of the mine that was planned and put in place at the development stage, including, but not limited to:

- Buildings and other structures;
- Roads and airstrips;
- Tailings disposal facilities;
- Waste rock management, quarries and open pits;
- Petroleum and chemical storage areas and facilities;
- Pipelines and electrical transmission lines;
- Sewage and waste disposal areas and facilities;
- Mine and site drainage systems;
- Mine workings;
- Mine shaft, adit (passage ways), and decline openings;

#### Facts & Figures

*When a mine has exhausted its mineral supply, the disturbed area must be cleaned up and restored according to a mine closure and reclamation plan.*



- Site water quality, including water flows leaving the site;
- Recycling of materials; and
- Revegetation of the site.

A mine closure and reclamation plan should also:

- Indicate how progressive reclamation of the site will occur during the life of the operation;
- Provide cost estimates to close and reclaim the mine;
- Prepare a plan for temporary closure of the mine;
- Develop a plan for post-closure monitoring of the site; and
- Make sure that the site is left in a condition that will require little or no long-term care and maintenance.

Mine closure plans should be flexible and adaptable to new techniques and methods for protecting the environment and reducing environmental risks while ensuring liabilities are met. Good communications and consultation between governments, companies, and communities of interest will lead to the best solutions.

## What Are the Mine Closure Activities?

### *Shut-Down*

When all production has stopped, employees are progressively laid off leading up to the shut-down. A small labour force is kept on to permanently shut down equipment. The mine closure plan will indicate what types of skills are needed to shut down and demobilize equipment.

Before shut-down, the mine owner must notify various stakeholders, including employees, and employee representatives if any, various levels of government (municipal, provincial and federal), media, mining associations, and any other interested party.

The mine owner will carry out a final review of the mine closure plan and submit any changes needed to the government regulators for approval.

### *Decommissioning*

Decommissioning follows mine shut-down. Small crews decommission (take apart) mining and processing facilities and equipment. A contractor can do this work. Decommissioning includes:

- Draining hydraulic fluids and oils from mobile equipment;

- Draining pipelines;
- Removal and recovery of saleable equipment and parts;
- Clean-up and salvage of buildings;
- Recovery of warehouse materials, tools and consumables (i.e., oils, grease, etc.); and
- Disposing properly of all waste.



### Reclamation

Reclamation is the process of restoring disturbed land as closely as possible to its original condition when mining is finished. The process of reclamation can occur either during the life of the mine (progressive

reclamation) or after the mine has closed (reclamation).

All mine sites must be reclaimed according to applicable governmental regulations. This typically involves a number of activities including: re-shaping the land, restoring topsoil, and planting native grasses, trees or ground cover. Reclamation is done according to the approved closure and reclamation plan, which must be continuously updated by the mining

company and approved by the responsible government agency.

### Post-Closure

Environmental activities continue long after a company has finished mining an area. The owner is obligated under permit or licence conditions to reclaim the affected land and to monitor the success of the reclamation activities. The period of post-closure activity and monitoring varies and depends on the results.



Before



After

*The abandoned Coldstream mine site (Ontario) before and after rehabilitation.*

*(Source: Natural Resources Canada)*





Some mines may require long-term care and maintenance after closure. Examples include sites where:

- Mine discharge waters need to be treated;
- Tailings containment structures require periodic monitoring and maintenance; and
- Remediation technologies need to be monitored.

### Who Are the Main Players in Mine Closure?



#### *Mining Companies*

The mining company is responsible for full and proper environmental closure and reclamation of the mine operation once mining stops. The company must put the closure plan into action, implement decommissioning activities, and monitor the effectiveness of the closure activities. As reclamation is completed, funds from the initial deposit are released back to the company.



#### *Governments*

Government regulators and agencies enforce mining law and the terms of mining-related permits. Their acts, regulations, policies, and programs help ensure that the mining company establishes site-specific closure goals and objectives.

Regulatory agencies or boards then assess closure plans and make suggestions as required. If the company cannot close the mine properly, the government will use the deposit or bond provided by the company before the mine started to operate.



#### *Communities*

Because communities are involved throughout the mining cycle, they should be familiar and comfortable with the mine closure and reclamation plan. Community members affected by the closure include the employees, their families, suppliers, and business owners.

Industry and governments are expected to maintain and promote open and transparent discussions with the various community, public and special interest stakeholders. Throughout the closure process, the industry is accountable to, and required to consult with, those affected by closure activities.



#### *Others*

Consulting firms, service providers and non-governmental organizations (NGOs) may also play a role in mine closure.

## How Can Aboriginal Communities Get Involved in Mine Closure?

Mine closure is a natural part of the mining cycle. Even though it is inevitable, mine closure can still be an emotional and difficult time for communities located near a mine site that is closing.



Communities can manage the impacts of mine closure by planning well in advance, communicating with the mining company and government, understanding the process, and providing input. The goal is to develop strategies to lessen the negative impacts of the closure, obtain financial assistance, if available, and identify employment opportunities. Even during the mine closure phase, the mine can still create some value for the community in the form of jobs in reclamation and long-term maintenance and environmental monitoring. Alternative job creation and economic activities following closure can also be identified. For instance, the community may be able to attract other industries because of its trained work force.

## 4.2 Acts and Regulations

This section identifies the jurisdictions, responsibilities and liability issues associated with mine closure. It also outlines the conditions of licences and permits that apply during mine closure.

### Who Governs Mine Closure?

#### *Liability*

The licensed mine owner is responsible for mine closure and reclamation. During project evaluation and mine planning, the owner must submit an Environmental Impact Assessment. This report describes the initial closure plan and the costs to close the mine.

Federal or provincial governments make sure that mining companies give adequate financial assurance to guarantee the costs of reclamation (including shut-down, closure and post-closure). This means that the costs of reclamation are covered by the mine operator and not the government.

#### *Provincial/Territorial Government*

In the provinces and the Yukon, provincial/territorial governments regulate minerals and metals activity. These jurisdictions have enacted mining-related acts and regulations for the administration of mining activities,

### Facts & Figures

*Elliot Lake, Ontario, is an excellent example of alternative job creation and alternative land use. In 1996, the last of its 12 uranium mines shut down and 4500 jobs were lost. Using imagination and innovation, this former mining town recreated itself as a retirement haven. In addition, the city has now entered into a joint venture with Serpent River First Nation to establish a school of fine arts. There is even a field station focusing on mine reclamation and environmental research operating in the city.*

*This type of option will not be available to all communities, but it shows that with creative thinking and imagination, communities can create positive opportunities out of mine closure.*





including mine reclamation. The policy issues and priorities parallel those of the federal government.

### *Federal Government*

The Government of Canada is responsible for mine reclamation and closure in Nunavut, the Northwest Territories, and on Indian Reserves. In addition to the federal acts and regulations, much of the responsibility in the two territories now rests with local co-management boards.

Important federal environmental acts related to mine closure include the:

- *Canadian Environmental Protection Act (CEPA);*
- *Fisheries Act (FA);*
- *Canadian Environmental Assessment Act (CEAA);*
- Waters Acts of the Northwest Territories and Nunavut; and
- mine-site reclamation policies of Nunavut and the Northwest Territories.

## What Are the Conditions of Licences and Permits?

When a mine is nearing the end of production, the most recently approved mine closure plan is used as the basis for final decommissioning. It is common for government agencies to issue a new permit on shut-down of an operation to cover closure and develop a reclamation permit.

The reclamation permit governs all activities relating to decommissioning and reclamation. This permit may outline additional site-specific conditions and methods for reclamation of open pits, underground openings, tailings, and waste rock. This permit will include an Environmental Effects Monitoring Plan, an assessment of stability of embankments, a site characterization plan, and financial assurance. Site-specific air and sewage permits may be required for certain jurisdictions.

The government body regulating the site will also need to approve the owner's monitoring plan. Where joint jurisdictions occur, an oversight committee made up of federal-provincial environment and mining agencies, as well as public representation, may be developed.

### Facts & Figures

*In British Columbia, Boliden Westmin Resources operates a copper-lead-zinc mine that is surrounded by a Class A Park. All mining activities and the eventual reclamation and rehabilitation of the site fall under a park use permit. Constant environmental and safety monitoring is an integral part of the mine operation. Not only is recreation not affected, but mine tours have become an important attraction for park visitors.*

*(Source: [www.em.gov.bc.ca/mining/geosurv/Publications/InfoCirc/IC1995-07/mine.html](http://www.em.gov.bc.ca/mining/geosurv/Publications/InfoCirc/IC1995-07/mine.html))*

As reclamation work is successfully completed and environmental liability is reduced, the amount of financial assurance required will be reduced and any surplus will be refunded. An amount of financial assurance may be held back to cover future requirements for the site. In such cases, the mining company will be responsible for the care and maintenance of the site.

When the responsible government is satisfied that the operator has met the requirements for decommissioning and the objectives of the closure plan have been fully met, it will provide the mining company with a written acknowledgement of release and the site will be considered closed.

### 4.3 Environmental and Social Impacts

This section identifies the potential environmental and social impacts a community may experience during mine closure. Ideas for environmental monitoring, mitigation, and community input and response are included.

#### What Are the Potential Environmental Impacts?

Mine operators try to limit negative environmental impacts throughout mine operation and mine closure. As well, significant advances

in mining methods and technology for mine reclamation have minimized many negative impacts. Mining companies and governments are cooperating to develop cost-effective long-term closure strategies.

The main potential environmental impacts during mine closure are:

Environmental Impacts		
Type	Condition	Mitigation
Land use	Long-term stability of waste rock piles and mining slopes	Need annual inspections until permanent stability is demonstrated
	Tailings containment structures	Periodic monitoring and maintenance
Water quality	Acid mine drainage or metal leaching	Water treatment

#### What Environmental Monitoring Is Required?

##### *Monitoring Plans*

A monitoring program is used to assess the effectiveness of reclamation and mitigation measures after site shut-down and to identify corrective actions where needed. The mining company, together with governments (i.e., provincial/territorial, federal and municipal), will develop an environmental monitoring program to comply with metal mining effluent regulations and conditions of regulatory



approval. At some sites, a committee, including governments, the mining company and local communities, will be created to monitor progress. This monitoring program applies to all aspects of the mine life. During mine development and mine operation, the company monitors the impacts on water, wildlife and air, and provides this information to the regulators.

Monitoring programs, during the mine life and post-closure, assess:

- The accuracy of the environmental assessment;
- Any unforeseen environmental impacts; and
- The effectiveness of the mitigation measures.

Also, they guide changes to the environmental management program to address unpredicted changes and impacts.

The length of the monitoring phase is reviewed and confirmed when the mine closes and depends on the potential impacts and risks to the environment. If the site needs long-term care and maintenance, the mining company remains responsible for the

site, including remediation of any additional environmental issues arising after closure. The monitoring period may be extended to make sure remedial objectives are met.

### *Environmental Audits/Standard Practice*

The mine operator or an independent contractor will usually conduct inspections and compliance audits of contractor activities during shut-down, decommissioning and reclamation. Government regulators will do audits to validate the site inspection program and conformity to the closure plan.

Best practices for both regulatory and voluntary/non-regulatory efforts include policies, programs, technologies, reclamation research, and other measures that have been found to be cost-effective and environmentally

appropriate for the site. Best practices encompass and build on measures embodied within local, national and international initiatives.

### **What Are Orphaned/Abandoned Mines?**

The owner of a mine is responsible for reclamation of the mine site. If the owner of a mine cannot be found, or cannot

### **Facts & Figures**

*The Fort McKay First Nation participated in a research project in Alberta with Syncrude Ltd. on the potential to convert reclaimed oil sands to grassland and manage a wood bison population.*

*(Source: [www.syncrude.ca](http://www.syncrude.ca))*

afford to do the reclamation, the mine is called “orphaned” or “abandoned.” The federal and provincial governments are liable for orphaned/abandoned mines. Over history, mines have been abandoned in all mining jurisdictions in Canada. Fortunately, this is no longer occurring as current regulations ensure that mine owners are responsible for reclamation.

The assessment and remediation of orphaned and abandoned mine sites in Canada have received increased attention since the year 2000. With the establishment of the National Orphaned/Abandoned Mines Initiative (NOAMI) in 2002, the Canadian government signalled its commitment to address this serious environmental issue. NOAMI is a cooperative Canadian program that is guided by a committee consisting of the mining industry, federal/provincial/territorial governments, NGOs and Aboriginal Canadians. As part of the initiative, guiding principles were developed for meaningful community involvement in planning for and rehabilitating orphaned and abandoned mines and published in the pamphlet “Best Practices in Community Involvement” ([www.abandoned-mines.org](http://www.abandoned-mines.org)).

## What Are the Potential Social Impacts?

Mine closure has a potential long-lasting impact on a community. The immediate impact is the loss of jobs at the mine and income used to support the growth of a community. It also has a direct and indirect impact on local employment, businesses, and the sale of goods and services. These economic impacts can have major social impacts.

Careful planning from the start of the operations will help prepare communities for closure. From the day the mine opens, communities have to plan for closure, not only in a physical sense, but also in a socio-economic sense. Some of the main impacts and how they are minimized are shown in the table below.

Social Impacts			
Type		Positive and Negative Effects	Community Response
Social	Decrease in community capacity	Loss of social services	Need to acquire new sources for resources and capacity
Economic	Loss of employment	Reduction in income Unused skills	Assist with development of new economic opportunities
Cultural	End of employment phase	Return to traditional skills	Teach skills, mainly through elders

## Facts & Figures

*Aboriginal people could be involved in a variety of areas in mine rehabilitation, monitoring, and management. The proper closure and rehabilitation of a site may involve ongoing treatment and maintenance. As such, site monitoring and assessment are needed to minimize risks to the community and environment. As the community members are sometimes located near a site, they are often in a better position to monitor, manage and assess it.*



Communities can work with the company to reduce the negative impacts of mine closure by:

- Building community capacity to manage opportunities and impacts;
- Providing training and competency development; and
- Developing alternative and secondary industries (e.g., Aboriginal suppliers).

This may be part of any Impact and Benefits Agreements (IBAs).

This planning process should start during the mine development phase of the mining cycle.

### Facts & Figures

*Industry and governments have worked together to develop programs to provide retraining skills and opportunities for laid-off employees. The skills that an employee gains while working for a mining company may allow him/her to advance into other areas like trades, construction, medical technology, and administration.*

## 4.4 Community Employment and Other Economic Opportunities

This section identifies the employment and economic opportunities that exist for Aboriginal communities during mine closure. It also includes information on retraining opportunities.

### What Are the Employment Opportunities?

Only a small number of jobs are usually available during mine closure. The work involved in mine closure provides specialized business and employment opportunities that can often be applied to other mine sites. The main jobs available are for:

- Trades personnel – to dismantle equipment;
- Equipment operators and mechanics – to complete the earth-moving work necessary for reclamation;
- Inspectors – to inspect, sample and audit the closure activities as part of the safety and environmental plan; and
- Security and first aid personnel – in accordance with applicable laws and management plans.

Contractors are the main employers for these activities. Typically, arrangements are made to hire local qualified personnel for decommissioning and reclamation activities. A small number of employees may be kept on to supervise these activities.

Environmental monitoring training can be provided to enable Aboriginal people to be involved in site assessment and reporting.

Training can also be provided in the areas of community engagement and social capacity to make sure that rehabilitation plans and activities are in line with the values and interests of community members.



### What Are the Other Economic Opportunities?

The economic opportunities generated during mine closure are smaller than those associated with the mine development and mine operation phases. At the same time, by the time closure occurs, community businesses will be well experienced in providing services. Communities need to use innovation and creativity in order to capture the limited economic opportunities of closure.

Business opportunities related to closure activities include:

- Reclamation of the site;
- Planting trees;
- Establishing drainage systems;

- Water sampling and analysis;
- Possible ongoing water treatment;
- Dismantling transmission lines; and
- Ongoing site security.

The skills required for this work are largely gained during mine development and mine operation.

It is vital that the community look beyond the closing of the mine as a source of economic growth. Mine closure can usually be predicted, so communities can **diversify** the economy and begin to develop new economic activities years before the mine closes. Whether the future economic base will be tourism, manufacturing, agriculture, or any other activity, sound planning and use of the community's skill base will be essential.

Many communities have gone through the closure process and there are great examples (Port Hardy [British Columbia], Elliot Lake [Ontario], Kimberley [British Columbia]) on how to diversify a mining-based community economy. Mine closure could represent an opportunity to use the skills and capacity gained from participating in the mining cycle for new beginnings.



### Facts & Figures

*Through training and experience, the skills acquired in the mining industry can be transferable to other economic activities, often within the same community.*

*(Source: Natural Resources Canada)*



## 4.5 Community Experiences: Polaris Mine Closure

*The rich red buildings with a monster-sized Canadian flag on the roof contrasted against a carpet of snow served as a symbol of the modern age of Canadian mining for over 20 years. The Polaris mine was an example of vision, innovation and success in Canada's North. While the discovery, construction and operation of the mine is an amazing story, its closure and reclamation demonstrate excellent use of community input through consultation, water board processes, monitoring, and on-site work experience.*

### Background

The Polaris mine was an underground zinc-lead mine located on Little Cornwallis Island in Nunavut in the Canadian High Arctic. Polaris was the world's most northerly base-metal mine situated at about latitude 75° north and longitude 97° west, approximately 1400 kilometres from the North Pole. Resolute Bay is the nearest community – about 100 kilometres to the southeast.

After 21 years of operation, Polaris stopped production in September 2002, as forecast, due to depletion of the orebody. A two-year, \$53 million decommissioning and reclamation program was completed in September 2004.

Polaris was one of the most compact operations in Canada. Total land use was about 170 hectares. Surface facilities included a barge housing the concentrator, powerhouse, maintenance services, dryroom, warehouse and operating offices; a concentrate storage building for

11 months' production; and an accommodation complex with housing for up to 220 personnel. Other facilities included a conveyer ship loader system and an airstrip.

### Mine Closure and Reclamation

After stopping commercial production in 2002, a major project was started to decommission the mine and reclaim the site. The goal was to complete the program by October 2004. A detailed closure plan was developed based on environmental site assessment work done in 1999 and 2000. After extensive regulatory and public consultations, Nunavut and federal authorities gave all approvals.

In September 2002, an on-site work force began demolishing buildings. In April 2003, remediation of metals and hydrocarbon-contaminated sites began. Materials from the demolition were placed in a surface rock quarry and capped. Most of the remaining equipment and materials were removed in September 2004.

A small camp, several sea containers of supplies, and some heavy equipment remain on site for touch-up work and to support ongoing monitoring programs. Water quality monitoring in Garrow Lake, where the tailings were deposited, will continue until 2011.

SNC-Lavalin was the general contractor for the demolition of the structures and the clearing of the site. Gartner Lee Limited provided technical resources to assist

the company in securing its closure approvals and to supervise the environmental remediation of the site.

### Aboriginal Participation

The company actively sought the participation of the Nunavut community in the closure activities. Aboriginal engagement in the closure process consisted initially of consultation with communities that were affected by the process, specifically Resolute Bay and Grise Fiord.

Representatives traveled to the communities to present the drafts of the closure plans and to seek input and provide explanations of the process and procedures. The input on historical and future land use by the local residents was used to develop site-specific soil quality remediation objectives for the site. Local residents were invited to visit the site. The Nunavut Water Board also assigned a coordinator who spent time in the community while the plans were being developed and then made a number of trips to the site during its implementation while the demolition and reclamation work was being carried out in order to keep residents informed of the activities on site.

### Aboriginal Economic, Employment and Business Opportunities

The tenders for contracts for work at the site had to include a northern content component, thereby assuring that some of the economic benefits for the contracts went to northern residents.

Qikiqtaaluk Corporation, an Inuit-owned firm, was retained as a subcontractor of SNC Lavalin to provide equipment operators, mechanics, and general labourers.

Local residents were also hired and trained to assist with the environmental site assessment and to assist Gartner Lee Limited in guiding and assessing the effectiveness of the reclamation work in 2003.

Post-closure, local residents have assisted with the environmental monitoring of the site. They have also been retained by other mining companies as equipment operators and mechanics, and to monitor and guide environmental remediation activities.

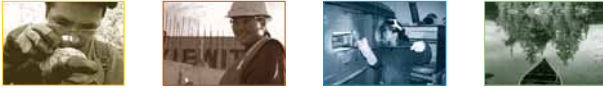
For more information, contact Teck Cominco Ltd. at [www.teckcominco.com](http://www.teckcominco.com).

Mine Operation



Post-Closure





# Glossary

## **Assay**

*A chemical test performed on a sample of ore or mineral to determine its components.*

## **Bankable Feasibility**

*A comprehensive analysis of a project's economics used by the banking industry for financing purposes.*

## **Bond**

*A written agreement by which a mining company insures it will pay a certain sum of money if it does not perform certain duties properly, such as reclamation.*

## **Bulk Sampling**

*Removing mineralized rock in large quantities (frequently involving hundreds of tonnes) in order to do mineral processing tests.*

## **Capital Costs**

*Capital costs usually involve equipment and physical plant costs, not consumable supplies.*

## **Commodity**

*Physical substances, such as metals, that can be sold or exchanged in a marketplace.*

## **Consultation**

*Informative process that provides space for Aboriginal people to communicate meaningful feedback about mining projects and have this feedback acted upon by mining companies or government.*

## **Crown Land**

*Land owned by all Canadians that is administered and regulated by government (surface and mineral rights).*

## **Diversity**

*The act of making more diverse.*

## **Feasibility**

*The analysis that determines whether or not a mine would pay for itself and bring economic benefits.*

## **Grub Staking**

*Finances or supplies of food, etc., furnished to a prospector in return for an interest in any discoveries made.*

## **Impact and Benefits Agreement (IBA)**

*A contractual agreement, usually between an Aboriginal community or entity and a mining company.*

## **Infrastructure**

*The basic facilities, equipment, roads and installations needed for the functioning of a system, like a mine.*

## **Joint Venture (JV)**

*A partnership or conglomerate, often formed to share risk or expertise in relation to a particular project.*

## **Jurisdiction**

*The territorial range of authority or control.*

## **Legacy**

*Something handed down from an ancestor or a predecessor or from the past.*

## **Memorandum of Understanding (MOU)**

*A way of creating an understanding between a community and a mining or exploration company. The MOU defines principles for working together for mutual benefit.*

## **Metallurgical**

*Related to the process of extracting metals from their ores.*

## **Monitor**

*To keep close watch over; supervise.*

## **Option**

*An agreement to purchase a property reached between the property vendor and some other party that wishes to explore the property further.*

## **Ore**

*The naturally occurring material (rock) from which a mineral or minerals can be extracted at a profit.*

## **Orebody**

*A mineralized mass whose characteristics and economic limits have been examined.*

## **Reclamation**

*Restoration of mined land to original contour, use or condition.*

## **Rehabilitate**

*Process used to repair the impacts of mining on the environment.*

## **Saleable**

*Capable of being sold, fit for sale.*

## **Shareholder**

*One who owns shares (certificates representing units of ownership) of stock in a corporation.*

## **Smelter**

*Where ores are processed (using heat) to produce metals.*

## **Stakeholder**

*Any party that has an interest ("stake") in a project.*

## **Sustainability**

*Capacity for being continued.*

## **Tailings**

*Material rejected from a mill after most of the valuable minerals have been extracted.*

## **Till**

*Unsorted sediment deposited directly by a glacier and not reworked by melt water.*

## **Waste**

*Any substance that is useless or worthless.*

## **Waste Rock**

*Barren rock or mineralized material that is too low in grade to be economically processed.*



# Additional Resources

## Mining Sequence

[www.mndm.gov.on.ca/mndm/mines/mg/mgimages/miningsequence\\_e.doc](http://www.mndm.gov.on.ca/mndm/mines/mg/mgimages/miningsequence_e.doc)  
[www.placerdome.com/about/educentre/aboutmining.htm](http://www.placerdome.com/about/educentre/aboutmining.htm)  
[www.debeerscanada.com/files\\_2/exploration\\_stages\\_posters.html](http://www.debeerscanada.com/files_2/exploration_stages_posters.html)  
[www.falconbridge.com/about\\_us/mining\\_life\\_cycle.htm](http://www.falconbridge.com/about_us/mining_life_cycle.htm)  
[www.mcq.org/roc/en/plan.html](http://www.mcq.org/roc/en/plan.html)  
[www.serviceontario.ca/mining/english/default.htm](http://www.serviceontario.ca/mining/english/default.htm)

## Federal Government Sites

Canadian Environmental Assessment Agency: [www.ceaa-acee.gc.ca](http://www.ceaa-acee.gc.ca)

Natural Resources Canada: [www.nrcan.gc.ca](http://www.nrcan.gc.ca)

- Minerals and Metals Sector: [www.nrcan.gc.ca/mms](http://www.nrcan.gc.ca/mms)
- NRCan Aboriginal portal: [www.nrcan.gc.ca/aboriginal](http://www.nrcan.gc.ca/aboriginal)
- Maps of Aboriginal communities and mining activities: [www.nrcan.gc.ca/aboriginal/aboriginal-maps-e.htm](http://www.nrcan.gc.ca/aboriginal/aboriginal-maps-e.htm)
- Minerals and Metals Policy of Canada: [www.nrcan.gc.ca/mms/prod-serv/pubs-poli\\_e.htm](http://www.nrcan.gc.ca/mms/prod-serv/pubs-poli_e.htm)
- Mapping Federal-Provincial-Territorial Mining Knowledge: [http://mmsd1.mms.nrcan.gc.ca/maps/intro\\_e.asp](http://mmsd1.mms.nrcan.gc.ca/maps/intro_e.asp)

Indian and Northern Affairs Canada:

- General: [www.ainc-inac.gc.ca](http://www.ainc-inac.gc.ca)
- Guide to exploration and development in the NWT: <http://nwt-tno.inac-ainc.gc.ca/mpf/>
- Exploration and Mining on Crown Lands in Nunavut Guidebook: [www.ainc-inac.gc.ca/nu/nuv/mng\\_e.html](http://www.ainc-inac.gc.ca/nu/nuv/mng_e.html)
- Citizen's Guide to Mining in the NWT: [http://nwt-tno.inac-ainc.gc.ca/pdf/mn/CitizensMiningGuide\\_e.pdf](http://nwt-tno.inac-ainc.gc.ca/pdf/mn/CitizensMiningGuide_e.pdf)

## Provincial and Territorial Sites

Links to ministries/departments responsible for natural resources and mines in each province and territory:

- [www.nrcan.gc.ca/mms/lien/ptd\\_e.htm](http://www.nrcan.gc.ca/mms/lien/ptd_e.htm)

## Provincial On-Line Claims Staking

British Columbia: [www.em.gov.bc.ca/subwebs/mtonline/](http://www.em.gov.bc.ca/subwebs/mtonline/)

Newfoundland and Labrador: [www.nr.gov.nl.ca/mines&en](http://www.nr.gov.nl.ca/mines&en)

Quebec: <http://gestim.mrnfp.gouv.qc.ca/intro.asp>

## Environmental Sites

[www.e3mining.com](http://www.e3mining.com)

[www.pdac.ca/pdac/good-practices.html](http://www.pdac.ca/pdac/good-practices.html)

Canadian Council of Ministers of the Environment (CCME): [www.ccme.ca/about/](http://www.ccme.ca/about/)

## Mine-Site Rehabilitation

Nunavut: [www.ainc-inac.gc.ca/ps/nap/recpolnuna/index\\_e.html](http://www.ainc-inac.gc.ca/ps/nap/recpolnuna/index_e.html)

Northwest Territories: [www.ainc-inac.gc.ca/ps/nap/recpolnwt/index\\_e.html](http://www.ainc-inac.gc.ca/ps/nap/recpolnwt/index_e.html)

Quebec: [www.mrn.gouv.qc.ca/english/mines/rehabilitation/index.jsp](http://www.mrn.gouv.qc.ca/english/mines/rehabilitation/index.jsp)

Ontario: [www.mndm.gov.on.ca/mndm/mines/mg/rehab/default\\_e.asp](http://www.mndm.gov.on.ca/mndm/mines/mg/rehab/default_e.asp)

Example of rehabilitated mine site:

- [www.britanniaproject.com](http://www.britanniaproject.com)
- <http://sustainability.bhpbilliton.com/2005/repository/environment/caseStudies/caseStudies16.asp>
- [www.mcq.org/roc/en/restauration/restauration\\_4\\_2\\_2.html](http://www.mcq.org/roc/en/restauration/restauration_4_2_2.html)

Orphaned/abandoned mines: [www.abandoned-mines.org](http://www.abandoned-mines.org)

### Federal Legislation

Canadian Environmental Assessment Act: <http://laws.justice.gc.ca/en/C-15.2/index.html>

Canadian Environmental Protection Act: <http://laws.justice.gc.ca/en/C-15.31/>

Metal Mining Effluent Regulations: <http://laws.justice.gc.ca/en/F-14/SOR-2002-222/index.html>

Canada Mining Regulations: <http://laws.justice.gc.ca/en/F-7/C.R.C.-c.1516/index.html>

Indian Act and Indian Mining Regulations: <http://laws.justice.gc.ca/en/I-5/index.html>

Migrating Bird Act: [www.pnr-rpn.ec.gc.ca/nature/migratorybirds/dc00s06.en.html](http://www.pnr-rpn.ec.gc.ca/nature/migratorybirds/dc00s06.en.html)

Department of Fisheries and Oceans: [www.dfo-mpo.gc.ca](http://www.dfo-mpo.gc.ca)

- Fisheries Act: <http://laws.justice.gc.ca/en/F-14/index.html>
- Aboriginal Fisheries Strategy: [www.dfo-mpo.gc.ca/communic/fish\\_man/afs\\_e.htm](http://www.dfo-mpo.gc.ca/communic/fish_man/afs_e.htm)

Navigable Water Protection Act: <http://laws.justice.gc.ca/en/N-22/>

Explosives Act: [www.nrcan.gc.ca/mms/explosif/over/over\\_e.htm](http://www.nrcan.gc.ca/mms/explosif/over/over_e.htm)

Canadian Species at Risk Act: <http://laws.justice.gc.ca/en/s-15.3/text.html>

Northwest Territories Waters Act: <http://laws.justice.gc.ca/en/N-27.3/index.html>

Mackenzie Valley Land and Water Board: [www.mvlwb.com/html/introduction.htm](http://www.mvlwb.com/html/introduction.htm)

Nunavut Waters Act: <http://laws.justice.gc.ca/en/N-28.8/index.html>

### National Mining Associations

The Mining Association of Canada: [www.mining.ca](http://www.mining.ca)

Prospectors and Developers Association of Canada: [www.pdac.ca](http://www.pdac.ca)

Canadian Aboriginal Minerals Association: [www.aboriginalminerals.com](http://www.aboriginalminerals.com)

Canadian Institute of Mining, Metallurgy and Petroleum: [www.cim.org](http://www.cim.org)

### Provincial and Territorial Mining Associations

British Columbia: [www.amebc.ca](http://www.amebc.ca)

[www.mining.bc.ca](http://www.mining.bc.ca)

Yukon Chamber of Mines: [www.ycmines.ca](http://www.ycmines.ca)

Alberta: [www.acr-alberta.com/about\\_ACR/acr\\_summary.htm](http://www.acr-alberta.com/about_ACR/acr_summary.htm)

Northwest Territories and Nunavut Chamber of Mines: [www.miningnorth.com](http://www.miningnorth.com)

Ontario: [www.oma.on.ca](http://www.oma.on.ca)

[www.northernprospectors.on.ca](http://www.northernprospectors.on.ca)

Quebec: [www.amq-inc.com](http://www.amq-inc.com)

Nova Scotia: [www.prospectors.ns.ca](http://www.prospectors.ns.ca)

Newfoundland and Labrador: <http://nlcmr.ca/home/default.asp>

Saskatchewan Mining Association: [www.saskmining.ca](http://www.saskmining.ca)



# Additional Resources (continued)

## Prospectors Assistance Programs

Manitoba: [www.gov.mb.ca/iedm/mrd/busdev/incentives/mpap-toc.html](http://www.gov.mb.ca/iedm/mrd/busdev/incentives/mpap-toc.html)

Quebec: [www.mrnf.gouv.qc.ca/ministere/affaires/affaires-autochtones.jsp](http://www.mrnf.gouv.qc.ca/ministere/affaires/affaires-autochtones.jsp)

## Mining Training Programs

Native access to engineering program: [www.nativeaccess.com](http://www.nativeaccess.com)

Centre de formation professionnelle Val-d'Or: [www.cfpvaldor.qc.ca/html/entreprises/modules.html](http://www.cfpvaldor.qc.ca/html/entreprises/modules.html)

CANMET Experimental Mine of Natural Resources Canada: [www.nrcan.gc.ca/mms/canmet-mtb/mmsl-lmsm/mines/mech/mineexperimental/experimental-e.htm](http://www.nrcan.gc.ca/mms/canmet-mtb/mmsl-lmsm/mines/mech/mineexperimental/experimental-e.htm)

Saskatchewan Institute of Applied Science and Technology: [www.siastr.sk.ca/siastr/educationtraining/academicpartner/undergroundminercore.htm](http://www.siastr.sk.ca/siastr/educationtraining/academicpartner/undergroundminercore.htm)

Northlands College: [www.northlandscollege.sk.ca/Programs/mine\\_training.htm](http://www.northlandscollege.sk.ca/Programs/mine_training.htm)

College of the North Atlantic: [www.cna.nl.ca/programscourses/program-details.asp?cProgCode=254](http://www.cna.nl.ca/programscourses/program-details.asp?cProgCode=254)

Ontario Modular Training Programs: [www.edu.gov.on.ca/eng/training/apprenticeship/Skills/wrkfrce.html](http://www.edu.gov.on.ca/eng/training/apprenticeship/Skills/wrkfrce.html)

Assayer Certification Training Program: [www.mechanical.bc.ca/technology/chemsci/assay/index.shtml](http://www.mechanical.bc.ca/technology/chemsci/assay/index.shtml)

## Examples of Career Opportunities in Mining Industry

[www.rock-on.ca/careers.htm](http://www.rock-on.ca/careers.htm)

## Aboriginal Business

Native Investment and Trade Association: [www.native-invest-trade.com](http://www.native-invest-trade.com)

Northeast Aboriginal Business Centre: [www.aboriginalbusinesscentre.com](http://www.aboriginalbusinesscentre.com)

Aboriginal Business Canada: <http://strategis.ic.gc.ca/epic/internet/inabc-eac.nsf/Intro>

## Guidelines on Mining and Aboriginal Community Engagement

[www.gov.mb.ca/iedm/mrd/busdev/guideline/01.pdf](http://www.gov.mb.ca/iedm/mrd/busdev/guideline/01.pdf)

## Facts and Figures on Canadian Mining Industry

[www.miningworks.mining.ca/miningworks/Briefing\\_Room/Did\\_You\\_Know.html](http://www.miningworks.mining.ca/miningworks/Briefing_Room/Did_You_Know.html)

## Glossary of Mining Terms

General: [http://nwt-tno.inac-ainc.gc.ca/mpf/glossary/glossary\\_e.htm#L](http://nwt-tno.inac-ainc.gc.ca/mpf/glossary/glossary_e.htm#L)

[www.amebc.ca/primerglossary.htm](http://www.amebc.ca/primerglossary.htm)

Northwest Territories: NWT Mining-Related and Environmental Management Glossary, Department of Indian Affairs and Northern Development, 2004. For more information, contact: Department of Indian Affairs and Northern Development, P.O. Box 1500, 4914-50th Street, Yellowknife, NT X1A 2R3, Tel.: (867) 669-2500, E-mail: [NTcommunications@inac.gc.ca](mailto:NTcommunications@inac.gc.ca)

Ojibway: Eabametoong First Nation Glossary of Geological and Mining-Related Terms (Ontario Geological Survey, Miscellaneous Paper 170, 2004, \$100)

English/Cree/Oji-Cree/Ojibway Mining and Environmental Terminology Glossary (2003), Ojibway and Cree Cultural Centre and De Beers Canada (contact: Ojibway and Cree Cultural Centre, 273 Third Ave., Suite 204, Timmins, ON P4N 1E2, Tel.: (705) 267-7911, Web site: [www.occ.ca](http://www.occ.ca); or De Beers Canada, Suite 400, 65 Overlea Boulevard, Toronto, ON M4H 1P1, Tel.: (416) 645-1710, Web site: [www.debeerscanada.com](http://www.debeerscanada.com))

**Readings**

Canadian Institute of Resources Law, *A Guide to Impact and Benefits Agreement*, 1999.  
(can be ordered on-line at: [www.ucalgary.ca/~cirl/](http://www.ucalgary.ca/~cirl/))

Government of Canada, *Minerals and Metals: Towards a Sustainable Future*, Public Works and Government Services: Ottawa, Canada, 2000.  
(available at: [www.nrcan.gc.ca/mms/pdf/fu\\_e.pdf](http://www.nrcan.gc.ca/mms/pdf/fu_e.pdf))

International Institute for Environment and Development & World Business Council for Sustainable Development, *Breaking New Ground: Mining Minerals and Sustainable Development*. Earthprint: Hertfordshire, England, 2002.  
(available for order from: [www.earthprint.com](http://www.earthprint.com))

International Institute for Sustainable Development, *Out of Respect – The Taltheine, Mining, and the Seven Questions to Sustainability* ([www.iisd.org](http://www.iisd.org))

Jepsen, D., Joseph, B., McIntosh, B., McKnight, B., *Mineral Exploration, Mining and Aboriginal Community Engagement Guidebook*, BC & Yukon Chamber of Mines: Vancouver, 2005.

Natural Resources Canada, *The Social Dimension of Sustainable Development and the Mining Industry, A Background Paper*, Public Works and Government Services: Ottawa, 2003.  
(available at: [www.nrcan.gc.ca/mms/pdf/sdsd-e.pdf](http://www.nrcan.gc.ca/mms/pdf/sdsd-e.pdf))

Natural Resources Canada, *A History of Mining and Mineral Exploration in Canada and Outlook for the Future*, Public Works and Government Services: Ottawa 2002.  
(available at: [www.nrcan.gc.ca/mms/topi-suje/hist\\_e.htm](http://www.nrcan.gc.ca/mms/topi-suje/hist_e.htm))

The Northern Miner, *Mining Explained: A Guide to Prospecting and Mining*, Editor: Patrick Whiteway.  
(available for order by e-mailing [northernminer2@northernminer.com](mailto:northernminer2@northernminer.com))

The Sub-Committee of the Intergovernmental Working Group on the Mineral Industry, *Reports on Aboriginal Participation in Mining*.  
(available on-line at: [www.ainc-inac.gc.ca/ps/nap/aboparmi\\_e.html](http://www.ainc-inac.gc.ca/ps/nap/aboparmi_e.html))



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# Appendix I

## Definitions Used in the Mining Information Kit

There are several models to describe the mineral resource development sequence. Although similar overall, they differ from one another in terms of how the various steps are defined.

For the purpose of simplicity, the mining sequence used in this Mining Information Kit groups together certain steps and therefore differs from the generalized model of mineral resource development used by Natural Resources Canada (refer to the table on the next page).

Approved in 1997 by the federal, provincial and territorial governments and by the industry, the model is a more systematic approach that details the transition between the steps and facilitates a clear understanding of the economic value of projects. It includes, for each step, the objectives, evaluation methods, results, mineral resources inventory, investment, and risk.

For a description and detailed analysis of the generalized model, the reader can consult:  
[http://mmsd1.mms.nrcan.gc.ca/mmsd/exploration/default\\_e.asp](http://mmsd1.mms.nrcan.gc.ca/mmsd/exploration/default_e.asp).

## SUMMARY OF NRCan GENERALIZED MODEL OF MINERAL RESOURCE DEVELOPMENT

PHASES	MINERAL RESOURCE ASSESSMENT	MINERAL EXPLORATION					MINERAL DEPOSIT APPRAISAL				MINE COMPLEX DEVELOPMENT	MINE PRODUCTION	ENVIRONMENTAL RESTORATION
		Exploration planning	Regional reconnaissance	Prospecting, ground surveys	Verification of anomalies	Discovery, delimitation	Deposit definition	Engineering	Economics	Feasibility, production decision			
Stage	Surveys, research, synthesis	Exploration planning	Regional reconnaissance	Prospecting, ground surveys	Verification of anomalies	Discovery, delimitation	Deposit definition	Engineering	Economics	Feasibility, production decision	Construction	Production, marketing, renewal of reserves	Mine closure Decommissioning Restoration
Objectives	Supply information and tools to develop mineral potential.	Select targets. Establish exploration strategies.	Find regional anomalies. Select significant targets. Acquire claims or permits.	Confirm anomalies. Acquire additional claims.	Investigate anomalies. Find mineral showings.	Discover a mineral deposit. Appraise data to justify deposit appraisal.	Define characteristics of the deposit. Acquire data for engineering.	Establish technical feasibility. Obtain plans, cost estimates.	Carry out economic, financial, socio-political evaluation of the project.	Ensure validity of the project. Decide whether or not to undertake the project. Obtain permits.	Complete mine development and construction. Ensure mine and concentrator start-up.	Achieve planned rate and specifications of commercial production. Achieve profitability.	Restore the mine site to an environmentally acceptable condition. Ensure future quality of environment.
Evaluation methods	Surveys, research, compilation and synthesis	Research, review of information	Airborne surveys, aerial photography, prospecting	Ground surveys (geological, geophysical, geochemical)	Mapping, trenching, drilling, sampling	Stripping, mapping, drilling, down-hole geophysics, initial mineral processing tests, environmental surveys, resource estimation	Detailed mapping, sampling, drilling, environmental studies, mineral processing tests, pre-feasibility studies	Pilot tests, engineering design and planning, cost studies, pre-feasibility studies	Market and financial studies, risk analysis, pre-feasibility studies	Due diligence review of all data, evaluation of all factors and profitability	Project management methods, training programs, detailed start-up plan	Production management methods, exploration, deposit appraisal and development of new zones	Mine closure, decommissioning, restoration, monitoring
Results	Geoscientific database	Exploration projects	Regional anomalies	Local anomalies	Mineral showings	Mineral deposit	Deposit appraisal project		Mining project	Mining complex	Mineral production	Restored site	

Source: Canadian Minerals Yearbook, 2004 Review and Outlook, p. 2.2

## SUMMARY OF MINING INFORMATION KIT MINING SEQUENCE

MODULES	EXPLORATION		DEVELOPMENT			OPERATION	CLOSURE
	Preliminary	Detailed	Evaluation	Mine planning	Construction		
Activities	Review of geoscientific data, maps Airborne surveys Prospecting Claim staking Sampling	Detailed sampling Geophysical, geochemical ground surveys Mapping Drilling Environmental baseline work	Detailed drilling Detailed analysis and evaluation Bulk sampling Processing tests Pre-feasibility studies Environmental assessment	Mine and plant design Feasibility studies Mine closure and reclamation plan Permitting Negotiation of agreements Decision	Construction of mine and infrastructure, training programs	Hiring Training Commissioning Production Mine expansion	Shut-down Decommissioning Reclamation Post-closure activities

Source: Mining Information Kit for Aboriginal Communities