CHAPTER 7

Mine site rehabilitation

Philippe-André Lafrance, Olivia Dawson, Jean Dionne, Robert Lacroix, Martine Paradis, Sophie Proulx, Anderson Santos, Sophie Turcotte and Malek Zetchi

7.1 Introduction

The Mining Act stipulates that a rehabilitation and restoration plan must be approved prior to the issuance of a mining lease required for mining activities. This plan namely describes the type of restoration work to be performed and the total amount of the financial guarantee required.

In addition to active mining projects and mines in operation, in Québec there are «abandoned» mine sites. The owners of these sites are unknown or insolvent. The MERN has decided to take action and rehabilitate these mine sites. It also monitors sites that were surrendered to the State in the past, or where a certificate has been issued to release the owner from further rehabilitation obligations pursuant to the Mining Act.

7.2 Active mines

The government, by way of regulation, has introduced measures to reduce the risk to the State of having to assume mine site rehabilitation costs. Since August 22, 2013, the amount of the financial guarantee required corresponds to 100% of the cost of restoration work for the entire mine site. This guarantee is paid in three instalments (50%, 25%, 25%) over a two-year period.

In 2014, after these measures came into effect, an amount of $221 million was paid in financial guarantees by mining companies, bringing the total amount of guarantees held by the MERN to $435 million.

7.3 Mine sites under the responsibility of the State (surrendered, released or abandoned)

Environmental liabilities

In 2006, to assess the extent of its environmental liabilities, the government requested that all ministries and government agencies compile an inventory of abandoned contaminated sites. The MERN completed its inventory of mine sites on March 31, 2011.

The amount of money required to rehabilitate abandoned mine sites is recorded as a reduction of the environmental liabilities related to contaminated sites included in the government’s consolidated financial statements.
As at March 31, 2014, a total of 713 mine sites were included in the Québec government's inventory of environmental liabilities. The cost to restore these sites is estimated at $808 million. Among these,

- 488 are exploration sites:
  - 275 exploration sites in Nunavik. Some of these sites require clean-up due to waste and refuse left on site;
  - 213 exploration sites on Cree territory, where clean-up is expected to begin shortly.

- 213 are mining sites:
  - 114 sites have been rehabilitated or secured. The MERN is responsible for monitoring and maintaining these sites;
  - 16 sites are currently undergoing rehabilitation;
  - 40 sites are in need of rehabilitation work;
  - 43 sites are in need of securement work.

- 12 sites are quarries and/or sand pits. Restoration work has already been carried out at six of these sites.

From April 1 to December 31, 2014, the Mines Sector devoted $13.6 million to carry out rehabilitation work on abandoned mine sites.

The complete list of mine sites inventoried in the government's environmental liabilities is available on the MERN website at the following address:

www.mern.gouv.qc.ca/mines/restauration/restauration-sites-miniers-abandonnes.jsp

Figure 7.1 shows the location of sites where rehabilitation and securement work was carried out by the MERN in 2014.

Characterization studies

The Direction de la restauration des sites miniers (DRSM) wishes to gain a better understanding of the environmental impacts of abandoned mine sites. To this end, it has implemented a qualification program for the environmental characterization of sites where rehabilitation work is required. Environmental characterization is the first step leading to the development of a rehabilitation plan. It namely serves to assess the actual impacts of each abandoned mine site on its environment, a critical step in the preparation of an estimate of rehabilitation costs, and can also serve to determine which mine sites should be restored in priority.

In 2014, under this program, five service providers successfully qualified to perform characterization work on abandoned mine sites.

Rehabilitation work

Estrie (05)
Suffield

This former zinc and copper mine is located about 10 km southwest of Sherbrooke. Mined ore was shipped to a processing plant located nearby, and as a result, there is no tailings pond on site. However, there is a waste pile covering a surface area of about one hectare.

Following characterization of the site, it was determined that the waste rock was potentially (high risk) acid-generating and leachable. Higher concentrations of zinc, nickel and copper were measured in surface water and groundwater on site.

The objective of the selected rehabilitation scenario is to prevent oxygen and water from coming in contact with waste rock. To do so, the waste rock will be confined in an impervious cell with a polyethylene geomembrane. A public call for tenders was launched in the winter of 2015 to select the company that will perform this work. Site rehabilitation is expected to be completed in August 2015.

Outaouais (07)
Lac Renzy

The former Lac Renzy mine is located approximately 40 km west of kilometre 294 on Route 117, within the Poirier outfitter’s territory.

Mining operations at this nickel and copper mine took place from 1969 to 1972. Nearly 0.8 Mt of ore were mined in an open pit and were processed on site.
The site was characterized in the fall of 2012 and the spring of 2013. Results indicate that mine tailings and waste rock are potentially acid-generating and leachable. In addition, certain metals show concentrations in soils, sediments, surface water and groundwater that exceed criteria established by the MDDELCC.

A complementary characterization study was carried out in the fall of 2014, and a rehabilitation plan will be prepared in the winter of 2015. Rehabilitation work may begin in the summer of 2015 and continue into 2016.

**New Calumet**

The New Calumet mine site is located 6 km west of the village of Bryson, in the Outaouais region. This former lead and zinc mine was in operation from 1943 to 1968. Mining activities generated a volume of 1.3 million m³ of mine tailings that were deposited in three tailings ponds covering a total surface area of about 20 hectares.

Mine tailings in the three tailings ponds are potentially (high risk) acid-generating and leachable. On site, surface water and groundwater are contaminated with metals (zinc, cadmium, copper and lead), with concentrations exceeding MDDELCC criteria. Wind erosion of mine tailings has also led to soil contamination on the surface.

In 2014, the rehabilitation plan and detailed engineering of the rehabilitation scenario were completed. In the winter of 2015, the selected design will be tested in the laboratory to determine its effectiveness in field conditions inherent to the New Calumet site. Rehabilitation work will begin in 2015 and will be completed in 2016.

**Abitibi-Témiscamingue (08)**

**Barvue**

The Barvue mine site is located about 50 km north of Val-d'Or. This former zinc and silver mine was in operation from 1952 to 1957. More than 5 Mt of ore were extracted and processed on site. These activities generated a tailings pond of roughly 35 hectares.

A major breach of the north tailings dam during mining operations generated a tailings spill covering a surface area of about 28 hectares along the shores of Ruisseau Marcotte, a tributary of Rivière Laflamme.

The characterization study completed in the spring of 2009 demonstrated the acid-generating nature of the mine tailings and the need to improve the slope stability of the tailings dam. A rehabilitation plan for the entire site was developed in 2011. The selected rehabilitation scenario involved the installation of a multilayer covering including a textured high-density polyethylene geomembrane to prevent oxidation of the mine tailings and consequently, acid mine drainage.

Rehabilitation work began in the winter of 2011 with the construction of an access road and tree removal in areas to be restored. During the summer and fall of 2012, dikes around the former tailings pond were stabilized and reshaped. Consolidation of the north dam required the construction of a berm and a partial derivation of Ruisseau Marcotte.
In 2013, nearly 400,000 m³ of acid-generating mine tailings were removed from the banks of Ruisseau Marcotte, and the latter were subsequently landscaped and revegetated. Two settling ponds were also built during the year. Containment and revegetation of the tailings pond, the final phase of the project, began in the winter of 2014. This work is expected to be completed in the fall of 2015.

East Malartic

Located in the town of Malartic, this former gold mine was one of the most important in the Abitibi-Témiscamingue region when it was in operation from 1938 to 1979.

Since 2010, following the signature of the East-Osisko Project Agreement between the MERN and Osisko Mining Corporation (now the Canadian Malartic GP), the mining company is responsible for the management and rehabilitation of the mine site. Under the partnership agreement, rehabilitation costs, estimated at $23 million, are shared equally among the two partners, i.e., at $11.5 million each. The maximum contribution for the MERN has been set at $11.5 million.

Tailings produced since 2011 by the mining company are non-leachable and do not generate acid mine drainage. They are thickened and used to cover up the tailings from the former East Malartic mine.

In 2014, rehabilitation work continued and a report was submitted to the MERN demonstrating that the Canadian Malartic GP had now fulfilled its part of the agreement. Responsibility for the tailings pond now resides with the mining company.
East Sullivan

The East Sullivan mine, located approximately 6 km southwest of Val-d’Or, was in operation from 1949 to 1966. More than 15 Mt of acid-generating mine tailings were produced and deposited in a tailings pond that covers more than 200 hectares.

A 6-km-long impervious dike was constructed between 1992 and 1996 to contain the tailings pond and its spillage zones. Organic covering containing at least 2 metres of wood waste was deposited over a significant proportion of the mine tailings to create an oxygen barrier. Sludge from the Val-d’Or sewage treatment plant was incorporated as a surface amendment to promote the establishment of a permanent plant cover.

The site is the object of an annual monitoring and maintenance program. Monitoring namely involves collecting water samples, controlling the water level in the ponds and a visual inspection of the containment dike.

During an inspection made in June 2014, it was observed that a section of the west dike, which surrounds the tailings pond, had subsided by about 50 cm.

To avoid any possible breach during the spring thaw, the water level in the adjacent pond was lowered to a minimum, and remedial work was carried out in the fall of 2014. The annual monitoring and maintenance program continues.

Manitou

The Manitou site is located about 10 km southeast of Val-d’Or. Mining operations at this zinc, copper and lead deposit took place from 1942 to 1979 and produced nearly 11 Mt of acid-generating tailings that were deposited in two inadequately contained tailings ponds. The tailings were dispersed along the periphery of the accumulation area and along Ruisseau Manitou over a distance of 6.5 km, reaching Rivière Bourlamaque. The total surface area of land disturbed by mine tailings represents roughly 200 hectares, due in part to the effects of wind and water erosion.

Following the bankruptcy of the last mining titleholder in 2002, the MERN assumed responsibility for the Manitou site. At the end of 2006, an agreement between the MERN and Agnico Eagle Mines provided that alkaline mine tailings generated at the Goldex mine would be used to neutralize tailings at the Manitou site and rehabilitate the tailings pond. As a result of this agreement, no new tailings ponds were created to accumulate the tailings of the Goldex mine. Instead, tailings from the Goldex mine were shipped to the Manitou site through a pipeline over a distance of 23 km.

Nearly 8 Mt of tailings from the Goldex mine were shipped to the Manitou site. Deposition of mine tailings, which was initially planned over a period of eight years, was interrupted following a temporary shutdown of the Goldex mine in October 2011. During the interruption, a new rehabilitation scenario was developed to optimize the initial design. The new scenario calls for the deposition of 3.5 Mt of mine tailings from the Goldex mine until 2017. Deposition of Goldex tailings on the Manitou site resumed in October 2013.

Preissac Molybdénite B

This is a former molybdenum and bismuth mine located near the municipality of Preissac. The mine was active between 1962 and 1971, and produced about 2.2 Mt of ore, which was processed on site.
In 2011, an environmental characterization study was undertaken by the MERN. Samples of soils, mine tailings, sediments, surface water and groundwater were collected. Analyses indicated high concentrations of dioxins and furans in waste material, backfill and groundwater samples collected on the mine site and near Baie Indienne on Lac Fontbonne.

At the MERN’s request, the Direction de la santé publique of the Abitibi-Témiscamingue Health and Social Services Agency issued, in February 2014, a notice on the preliminary assessment of risks to human health addressed to the population in the area, in an effort to limit visits to the site and consumption of food grown in the area.

The next phase of the project, scheduled for 2015, will consist in developing solutions to rehabilitate the site, including rehabilitation of lands contaminated with dioxins and furans. Monitoring of environmental impacts will continue.

**Siscoe**

This gold deposit is located on Siscoe island in the middle of Lac De Montigny near Val-d’Or. It was mined from 1926 to 1949, and 3.3 Mt of ore were extracted.

The site includes two tailings ponds totalling approximately 30 hectares. The mine tailings leach copper but do not generate acid mine drainage. Surface water is contaminated with metals in concentrations exceeding MDDELCC criteria and continuously carries mine tailings into Lac De Montigny.

The rehabilitation plan, as well as plans and specifications, were prepared in 2013. The selected rehabilitation scenario consists of putting an end to water erosion of the mine tailings by installing a granular monolayer covering, building ditches and revegetating the entire site.

Rehabilitation work began in 2014 and will be completed in the summer of 2015.

**Nord-du-Québec (10)**

**Mine Principale**

The former Principale (Campbell) copper mine, one of the largest in the Chibougamau area, was active from 1953 to 1979. However, the mill continued to be fed by neighbouring mines until 2010, when the operator went bankrupt. The site covers a surface area of more than 300 hectares and encompasses three tailings ponds, a polishing pond and a mine site.

The Principale mine site is located within trapline O-59 of the Oujé-Bougoumou community and within the Chibougamau city limits. The two communities are very much involved in efforts to rehabilitate the site.

From 2010 to 2013, several studies were conducted in preparation for the site restoration, namely an environmental characterization of the site, an assessment of the geotechnical stability of crown pillars on the mine site and the preparation of a rehabilitation plan.

In 2014, laboratory tests were undertaken to validate the rehabilitation scenario. The MERN continued field data acquisition to improve its knowledge on the nature of the mine tailings and the hydrogeological conditions on site.

In August 2014, following a request made by the MERN in April 2013, the Evaluation Committee (COMEV) and the Review Committee (COMEX) issued a certificate of authorization detailing the conditions applicable to the rehabilitation project and environmental impact studies in order to begin rehabilitation work on the Principale mine site.
In 2015, the MERN will pursue efforts to commission an engineering firm to perform complementary studies, prepare plans and specifications, and supervise work leading to the rehabilitation of the former Principale mine site.

**Complementary characterization studies at the Principale mine.**

---

**Exploration sites in Nunavik**

An inventory conducted in 2001 identified 275 abandoned mineral exploration sites in Nunavik, 18 of which were deemed major.

In 2007, the Québec government, the Kativik Regional Government, the Makivik Corporation and the Nunavik Restor-Action Fund signed a partnership agreement with the aim of cleaning up these 18 major exploration sites.

The agreement was initially set to conclude in 2012 but was extended until 2017. The clean-up of all major sites is now practically completed and was done at a lower cost than initially anticipated, which made it possible to add the clean-up of 27 intermediate sites to the mandate.

**Other sites currently undergoing rehabilitation work**

The rehabilitation process has begun on the Darius (O’Brien), Pandora, Thompson Cadillac, Lapa (Zulapa), Waite-Amulet and Beattie mine sites in the Abitibi-Témiscamingue region, as well as on the Capelton site in the Estrie region. Rehabilitation work will continue over the next few years.

**7.4 Inspection and securement**

The MERN annually conducts a major inspection program of mine sites listed among its environmental liabilities, in order to identify potential risks to the environment and human safety, and to plan maintenance and securement work. The main purpose of this work is to secure former mine entrances and openings by installing fences and concrete slabs, or by backfilling.

In 2014, 166 abandoned mine sites were visited by MERN inspectors to ensure, among other things, the safety of these sites. Among these, nine sites were the object of securement or maintenance work. This work was carried out in the Mauricie, Estrie, Outaouais, Abitibi-Témiscamingue and Nord-du-Québec regions. The MERN installed or repaired fences on the Blackburn (North Hill), Derry, Gauthier, Pednaud and Wendell mine sites, and maintenance work was carried out on the spillways of tailings ponds at the Wood Cadillac, Opémiska, Chimo and Somex mine sites.
7.5 Conclusion

The MERN intends to meet the government objective stated in the 2012-2013 budget, and consequently reduce by 50% the mining environmental liabilities for which it is directly liable by the year 2022.
Figure 7.1 - Location of rehabilitation and securement work performed at orphaned mine sites in 2014.