

Ontario Leads the Way in Abandoned Mine Rehabilitation

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Abstract

The Ontario government is taking a leading role in the rehabilitation of Abandoned Mines.

During the “Sudbury ’99: Mining and the Environment II” conference, the Ontario Minister of Northern Development and Mines announced a four year, \$27 million abandoned mines rehabilitation program. This fund was to be used to conduct mine rehabilitation on Ontario's Crown-held abandoned mine sites.

The Abandoned Mines Rehabilitation Fund has now completed its four year period and more than 55 rehabilitation projects have been successfully undertaken. These projects include the rehabilitation of abandoned mine sites that had been posing either a public health and safety risk, or an environmental concern.

Introduction

Ontario has a long and proud history of mining, which has been responsible for much of both the economic and the social growth and development of the province. However, historically the focus of the owners of those mines, as well as the legislation itself, has been on removing the mineral commodities from the ground at a profit, and not on the rehabilitation of the mine features once mining had ceased. Although much money was garnered from mining companies and individuals through taxation, none of this was set aside for assuring mine rehabilitation.

The Ontario government has now realized that, with the number of sites that are now the Crown's responsibility, it must take an active and leading role in abandoned mine rehabilitation.

Ontario's Mining Act, R.S.O. 1990

In 1991, Ontario's *Mining Act* was amended and Part VII was bolstered to deal with the operation and rehabilitation of mines to ensure that mining lands are eventually returned to a safe and uncontaminated state. The new Part VII requirements set out an obligation for proponents of all existing

mines, as well as any new ones, to submit a closure plan to document the rehabilitation steps that are to be taken at the end of the mine's life. One of the components of a Closure Plan is Financial Assurance that must be submitted by the proponent for the government to be able to utilize in the event that the proponent is either unable or unwilling to conduct the measures set out by that Closure Plan.

In order to deal with Ontario's abandoned mines, which are those that had ceased production and closed prior to Part VII coming into effect, the new legislation placed an obligation on the owners of all mine sites to “progressively rehabilitate” the mine features even when there is no Closure Plan in place. The new Part VII also provided the Director of Mine Rehabilitation with the power to order an owner of an abandoned mine to provide a closure plan to rehabilitate the site.

Year 2000 Amendments to Part VII

To reduce the lengthy approval process for closure plans and to clarify other areas of Part VII, amendments were made which received Royal Assent in January 1996. However, these were not proclaimed until

June 30, 2000, allowing the amendment of the Part VII Regulation, which included the new Ontario Mine Rehabilitation Code. This new Code provides additional standards that must be met when conducting mine rehabilitation.

Prior to proclamation of the new Part VII amendments, anyone conducting “progressive rehabilitation” could do it any way they saw fit. However, the year 2000 amendments established two new requirements for “progressive rehabilitation”. The first was that any “progressive rehabilitation”, including that being conducted on an abandoned mine site, must meet the requirements of the prescribed standards. The second was that anyone conducting “progressive rehabilitation” must report the measures that were conducted within 60 days of the work being completed. This requirement now serves to ensure that Ontario’s Abandoned Mines Information System (AMIS) data are kept up to date, as well as to allow an audit of the work.

Another improvement in the amendments was the provision of “emergency powers” to the Minister. If the Minister has reasonable grounds to believe that a mine hazard is causing or is likely to cause an “immediate and dangerous adverse effect” he or she may now direct employees or agents of the Ministry to conduct whatever measures are required to end the adverse effect.

The current Part VII legislation can be found at the following web sites:

Mining Act R.S.O. 2000:
http://192.75.156.68/DBLaws/Statutes/English/90m14_e.htm

O.Reg. 240/00:
http://192.75.156.68/DBLaws/Regs/English/00240_e.htm

Ontario’s Abandoned Mines Information System (AMIS)

The AMIS database was first developed in the late 1980s to catalogue abandoned mines in the Timmins area. Over the following few years the database was expanded to include all known abandoned mine sites in the Province and data were collected for those mine sites from all available historical documentation. From these data it has been determined that there are about 6,000 known abandoned mine sites in Ontario, containing about 18,500 individual mine features, and these sites range in magnitude from single, shallow mine shafts and deep trenches or pits, to mines that have produced millions of tons of ore.

Estimates have been made that it will cost approximately \$300 million to rehabilitate all of the abandoned mine sites in Ontario. Of these, it has been further estimated that it will cost about \$120 million to rehabilitate the 30% to 40% of these sites that have reverted to the Crown.

The AMIS data now consist of not only the digital information stored in the AMIS database but also various other materials available only as paper copies. This includes material such as site inspection reports, various correspondence and notes, documentation of rehabilitation that has taken place on the site and even occasionally various “rehabilitation plans” that have been developed for the site by either the government or the proponent.

During a previous special Abandoned Mines funding program, about 2,400 of the Province's abandoned mines had Site Assessment Reports conducted on them in 1993 and 1994. These assessments were completed by consulting firms contracted by the Ministry, and provided a detailed on-site documentation for each site. The information collected included:

- the location of each site,
- a description of each mine feature on the site and any form of protection in place at the time of the inspection,
- a recommendation as to the appropriate rehabilitation that should be conducted on each feature, as well as an estimate of the cost, and
- a determination of the Abandoned Mines Hazard (AMHAZ) rating and ranking for each feature. (AMHAZ is a mine hazard prioritization system developed by Ontario. However, due to application problems, it has been determined that the AMHAZ results must be re-calculated using a computer decision process.)

Unfortunately this funding ended before the remainder of the Province's abandoned mine sites could have Site Assessments conducted.

The AMIS database has evolved over the years through various software platforms. However, to date the database has not been available on-line over the Internet, and the data can only be obtained by contacting the Ministry's Abandoned Mines Office. This will be changing in the next several months as the AMIS database will become one of the layers available through the Ministry of Natural Resources' (MNR) Land Information Ontario (LIO) GIS system. Once the database is available through LIO, users will be able to obtain Abandoned Mines information directly over the Internet, along with the various other data sets that will be available on LIO. However, it must be noted that the various hard copy material referred to above will not yet be available on LIO, so it will still often be worthwhile to contact the

Abandoned Mines Office to obtain this information even after the AMIS database is available on-line.

The Abandoned Mines Rehabilitation Fund, 1999 - 2003

On September 15, 1999, during the "Sudbury '99: Mining and Environment II" conference, Minister Tim Hudak announced a four-year, \$27 million Abandoned Mine Rehabilitation Fund. The Fund was to be used for the rehabilitation of primarily Crown-held sites and was available as follows:

- \$2 million during Year 1
- \$5 million during Year 2
- \$10 million during each of Years 3 and 4

The four year Fund expired on March 31st, 2003, and the following is a listing of the abandoned mine rehabilitation projects that were undertaken during its course.

Year 1 – 1999/2000

The first year of the Fund was used to conduct rehabilitation over as broad an area of the Province as possible. To this end, three projects were selected as follows:

- one project dealt with the rehabilitation of a group of 32 "small" Crown-held sites, each one of which consisted of one or more small, but nonetheless dangerous, mine features. The average cost of rehabilitation was less than \$23,000 per site.
- the rehabilitation of the North Coldstream Mine site. Although there was a private mining rights holder for the site, the Crown had become the owner of the site's buildings – some of which were covering some of the mining rights holder's responsibilities. By conducting the rehabilitation of the surface structures, in concert with the efforts of

the private sector, a much larger rehabilitation project was completed.

- MNM's participation in the on-going rehabilitation of the Hollinger/McIntyre Mine sites in Timmins. These lands were expected to revert back to the Crown after the dissolution of the site's previous owner, Royal Oak Mines Ltd. However, Kinross Gold Corporation was interested in obtaining certain of Royal Oak's land holdings and, since the receivers would not allow the land holdings to be broken up, Kinross took over all of the Royal Oak lands on the condition that Ontario would share in the cost of the rehabilitation of various of the abandoned features on the properties. The work that was conducted during Year 1 included:

- McKane Motor Sales: MNM purchased the McKane property because of subsidence issues and backfilled the openings.
- First Avenue, Schumacher: conducted geotechnical investigations and monitoring to determine which lanes of the street could continue to be utilized.
- Highway 101 Corridor Study: examined mine workings beneath Hwy 101 to confirm the long-term stability of strategic points along the highway and near the water tower. All areas were found to be stable.
- Muskoka Delivery Services: investigated mine workings near the building to address the owner's concerns.
- Extencare Home: investigated mine workings near the building to address the owner's concerns. Two shafts on the property were re-capped during 2000.
- Acklands – Grainger/Feldman's Timber Properties: conducted geotechnical studies to determine the location and extent of the sub-surface workings, and their potential effect on the surface.
- Hollinger Golf Club: completed refilling of open holes caused by further

subsidence during the year 2000. Two geotechnical studies have been completed to provide an inventory and preliminary assessment of mine workings with possible rehabilitation strategies.

- Shaft Cap and Raise Investigations: conducted a study involving 40 shafts and raises at various locations. The study focused on areas where cap construction documentation was poor or non-existent. Experience has shown that some old caps were poorly built. Each site was investigated and new caps were constructed as necessary.

Year 2 – 2000/01

Focus during the second year moved to conducting several larger projects, including the completion of all of the remaining Site Assessment Reports. It was calculated that there were almost 3,800 known abandoned mine sites, within seven separate districts, that had not had a Site Assessment conducted during 1993 and 1994. Nine Site Assessment projects were tendered to complete this work and all of these sites, as well as several hundred previously unknown ones, were visited, assessed, mapped, precisely located using high-accuracy GPS (with post-processing), and had a site assessment report completed.

The other projects that were undertaken during 2000/01 included the following studies and rehabilitation projects:

- The Caland Mine site, Atikokan: three projects involving the demolition of the surface structures such as the headframe, office building, pelletizing plant and the PCB storage building, after the PCBs had been removed by the contractor, and the capping of the main shaft.
- The Zenmac Tailings site, Schrieber: work involved the stabilization of the existing tailings impoundment structure, grading and drainage improvements of

the tailings surface, construction of a spillway, emplacement of a new soil layer, and revegetation of the site.

- The Toburn Mine site, Kirkland Lake: capped two open shafts and fenced off a third containing a large population of bats. This work was contracted after a complaint was made regarding a child having gone down one of the shafts. Although the complaint was fraudulent, it was recognized that the scenario could easily have happened, so the work was undertaken anyway. At the request of the Municipality and the historical society, special care was taken to ensure that the historic headframe was left intact after the enclosed shaft was capped. This headframe is the only one remaining from the original discoveries in Kirkland Lake.
- The Hunter Mine site, Timmins: assisted the Ministry of Natural Resources (MNR) in the funding of the demolition of the surface structures on the site.
- The Bicroft Mine site, Highlands East: completed a radiometric survey and began the process of a Site Specific Risk Assessment (SSRA) according to the Ministry of the Environment (MOE) guidelines.
- The Kam Kotia Mine Site, Timmins*: two separate projects were conducted on this site successively in order to be able to begin the rehabilitation of the site in Year 3 of the Fund. These projects were:
 1. A study to determine an appropriate plan to conduct the full rehabilitation of the site. SENES Consultants Limited determined that this rehabilitation will be a five-phase process, each phase of which will take a year or less to complete and will result in a complete and distinct improvement to the site.
 2. A design and engineering study for Phases “A” and “B” of the SENES rehabilitation plan, once MNDM had agreed to fund those two phases from the

remainder of the Abandoned Mine Rehabilitation Fund.

- * For complete information regarding the Kam Kotia Mine site projects, please see the paper entitled “The Rehabilitation Of The Kam Kotia Mine: An Acid Generating Abandoned Tailings Site” by Hamblin & Kord, in the Sudbury 2003 conference proceedings.
- The Central Patricia Mine site, Pickle Lake: conducted a geotechnical study to design and engineer an appropriate rehabilitation measure to replace the Bailey bridge that was constructed in 1994 as a temporary measure, on a span of local highway that overlies a thin surface crown pillar.
- The North Pines Mine site, Sioux Lookout: conducted a geotechnical study to determine if the mine workings from 1921 were located under the local highway prior to a re-surfacing contract being planned by the Ministry of Transportation. Ground penetrating radar was utilized to map the site and it was determined that the workings are not beneath the highway right-of-way.
- ERG Emergency Work, Timmins: funds were provided to the City of Timmins to deal with an emergency situation with an SO₂ tank at the ERG site.
- The Kinross Joint Venture, Timmins: work continued on the rehabilitation of a number of mine hazards under the joint venture partnership with Kinross.

Year 3 – 2001/02

Although a number of projects were again conducted during the third year of the Fund, the main focus that year was on the Phase “A” rehabilitation of the Kam Kotia Mine site*. Phase “A” involved the following two construction projects:

- Project #1: the construction of a new lime addition, high-density sludge treatment plant, as well as all of the required

infrastructure. This work has resulted in the capture of the acidic effluent flowing southwards from the North Impounded Tailings (NIT) and the South Unimpounded Tailings (SUT) tailings areas. The effluent is collected, treated and pumped back to the NIT where residual lime continues to somewhat neutralize the acidic tailings there.

- Project #2: constructed a new Tailings Impoundment Structure within the existing North Unimpounded Tailings (NUT) area. The project also reinforced the existing North-South dam that separates the higher elevation NIT tails from the NUT tails. The total impoundment dam structure is about four kilometers in length and required approximately 1.5 million m³ of clay and aggregate materials. Eventually this new impoundment area will be used to contain all of the remaining unimpounded tailings on the Kam Kotia Mine site.

The other projects that were conducted during Year 3 of the Fund are as follows:

- Bicroft Mine site, Bicroft: completed the SSRA for the site, according to the MOE guidelines.
- Toburn Mine site, Kirkland Lake: conducted a geotechnical and engineering study to determine the accurate locations of all sub-surface mine workings within the Toburn Mine site. The work determined that there were four areas on the site that could potentially pose an imminent danger to surface features, as follows:

1. the 101 stope, which was a narrow, near surface stope under the access road into the local trailer park, and, at its western end, was also between two privately held mobile homes at its eastern end.
2. the 102 stope, which was a large, near surface, open stope located beneath three privately held mobile homes in a local trailer park. After various negotiations, the Ministry purchased the three trailers,

thereby removing the residents from danger.

3. the 103 stope which has an extremely thin crown pillar beneath and adjacent to a railway track.
 4. the #1 shaft which was located under a paved entrance driveway at the local college, and has periodically settled.
- Provincial Mine site, Cobalt: conducted a geotechnical and engineering study to determine the accurate locations of all sub-surface mine workings within the Provincial Mine site.
 - Caland Mine site, Atikokan: completed the SSRA for the Pelletizing Plant site, which was begun during Year 2. This SSRA was required due to the extensive cadmium contamination that was found in the Pelletizing Plant area.
 - Coppercorp Mine site, Batchawana: conducted an emergency response to remove a beaver dam from a tailings impoundment spillway and to relieve the impounded water in a controlled fashion so as to avoid a tailings spill.
 - The Kinross Joint Venture, Timmins: work continued on about \$2.4 million of rehabilitation work on a number of projects under the joint venture partnership with Kinross.
 - Land Information Ontario (LIO) GIS System: began to integrate the AMIS database into the LIO GIS system. The AMIS data will be one of approximately 140 different data sets of "Lands" information that will eventually be provided through LIO.

Year 4 – 2002/03

The final year of the Fund once again focused primarily on the rehabilitation of the Kam Kotia Mine site*. The Phase "A" construction of the new NUT impoundment structure and the reinforcement of the North-South dam were to have been finished by

March 31st, 2002. However, due to the delayed contract award date and poor winter weather conditions, this work was not completed until the following July.

Then, during the winter of 2002/03, the Phase “B” rehabilitation of the site was carried out. This work involved the physical relocation of the tailings within the South Unimpounded Tailings (SUT) area to the new NUT impoundment area.

Another Year 4 project at Kam Kotia was the contracting of the first year of operation of the Lime Treatment Plant, which had been built during Year 3’s Phase “A” work. This first year of operation was considered to be the Plant’s commissioning period, and during that time an Operations and Maintenance Manual was written to meet one of the requirements of the MOE’s Certificates of Approval. The operation of this Plant, coupled with the Phase “B” rehabilitation work, should eventually result in a greatly reduced effect from the mine site itself to the areas south and southwest of the site – the areas where the local population lives.

The final Year 4 project involving the Kam Kotia site dealt with the refurbishing of a number of water wells to monitor groundwater levels and quality on the site. Since several of the existing wells could not be located or adequately used, replacement wells were subsequently installed. The current compliment of monitoring wells on the site will facilitate the development of an appropriate monitoring program, as required by one of the MOE Certificates of Approval.

The other projects that were conducted during Year 4 of the Fund were as follows:

- Central Patricia Mine site, Pickle Lake: constructed a new two lane bridge over the thin surface crown pillar underlying the highway. The new bridge replaces the single lane Bailey bridge that was installed as a temporary measure in 1994. This work was conducted in accordance

with the engineering and design project that was prepared for the site in Year 2.

- Coppercorp Mine site, Batchawana: the rehabilitation of the entire site was accomplished by: constructing seven concrete caps over the mine’s shaft and raise openings; backfilling an adit; removing and destroying the PCBs and PCB-contaminated materials remaining on the site; demolishing all of the remaining buildings on the site (with the one exception being the watchman’s house), and; conducting a general clean up of the site.
- Toburn Mine Site, Kirkland Lake: four projects were awarded to rehabilitate the four major mine hazards that had been identified during the Year 3 geotechnical and engineering study. The 101 and 103 stopes were backfilled with sand and low strength concrete. An appropriate area around the 102 stope was secured with a security fence after the three trailers had been removed. Finally, the #1 Shaft was capped and the college’s entrance driveway was repaved.
- Provincial Mine site, Cobalt: the site was rehabilitated in accordance with the Year 3 geotechnical and engineering study. #1 and #2 shafts were capped, and the #3 shaft, 2 raises and an open-cut were all backfilled with waste rock from the site. Most importantly, the historic headframe over the #2 shaft was left intact on the site, as requested by the municipality.
- The Porcupine Joint Venture, Timmins: work continued on about \$1.6 million of rehabilitation work on a number of projects under the joint venture partnership, which had been previously known as the Kinross Joint Venture. The name change was necessitated by the partnership of Placer Dome with Kinross on all projects in the Timmins camp.
- Caland Mine site, Atikokan: a “peer review was conducted on the SSRA that had been prepared for the Pelletizing Plant property. Once any concerns with

the SSRA have been appropriately addressed, a plan to conduct the final rehabilitation at the Pelletizing Plant will be available.

- Buffalo Ankerite Mine site, Timmins: a Director's Order was issued to the owner of the site to do immediate demolition of buildings on the site. However, when the owner was unable to comply, MNDM utilized the emergency provisions of the *Mining Act* and provided funds to the City of Timmins for them to contract the work.
- Lakeshore Tailings site, Kirkland Lake: an emergency project to stabilize and protect the Lakeshore Tailings was issued in two parts. The first dealt with the removal of beaver dams that were blocking the spillway, and the controlled release of the impounded water, on an area in the northeast that was Crown held. The second project dealt with the unblocking of two decant structures, and the controlled release of water, in the southwestern area of the site. The second project was located on privately held lands, but since the owner(s) could not be found, the Ministry conducted the work under the emergency response stipulations of the *Mining Act*.
- "Far North" Site Assessments: detailed site assessments were conducted on three sites in the far northwestern portion of the Province. These sites are the Sachigo River site, the Lingman Lake site, and the

Berens River site. The assessments are to be used to determine an appropriate rehabilitation plan for each of the sites or to provide guidance to any existing owners.

- Land Information Ontario (LIO) GIS System: continued with the work to integrate the AMIS database into the LIO GIS system.
- The rehabilitation of 10 "small" Crown-held sites throughout Ontario: conducted rehabilitation work on a number of "small" sites, as was originally done during Year 1 of the Fund. All of these sites were selected because the Ministry had received at least one complaint about the site, and each one consisted of one or more small, but dangerous, mine features. The average cost of rehabilitation was about \$19,200 per site.

After The Fund?

The Abandoned Mines Rehabilitation Fund has certainly gone a long way in rehabilitating a number of the Crown-held abandoned mine sites. Furthermore, the Ontario government is now able to lead the mining industry and the public by example regarding the rehabilitation of abandoned mines. However, the majority of the Crown-held sites in Ontario will still need eventual attention, including the balance that is required for the Kam Kotia Mine site.

Planning is underway to continue this work as funding is made available.