CLOSURE OF THE LUMBY QUINTO MINE SITE

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ABSTRACT

The Lumby Quinto Mine Site is located approximately 27 km east of Vernon, BC. It is built on the side of Saddle Mountain and overlooks the town of Lumby. The Quinto Mine was an "abandoned underground mine" which has a long history dating back to 1900. No mining or exploration activities have occurred on the property since 1994. The site was acquired by Consolidated Thompson in 2008. The new owner determined that the site needed to be closed. When the last operation closed, everything was left including buildings and milling equipment. The site also included adits, two small tailings storage facilities, a water storage pond, ore stockpiles, and waste rock. The ponds were located on the floodplain of Bessette Creek. Additional drilling was done on the floodplain for metal analysis and a bat study was carried out for the adits. Based on the findings of the detailed investigation, a closure plan was developed. This involved removal of buildings, backfilling of the adits with waste rock and backfilling the ponds. The ore was removed from the site. Material was sorted on site and recycled, as much as possible. The site was closed using local demolition and earthworks operators and reclaimed. All closure activities were monitored. The site was closed in 2011.

KEY WORDS: Reclamation, Revegetation, Demolition,Topsoil, Adits, Tailings

INTRODUCTION

Quinto Mining Corporation, a subsidiary of Consolidated Thompson (now Cliffs Natural Resources Inc.), Montreal, Quebec requested Rescan to develop a reclamation and closure plan for the former Quinto Mine site. Consolidated Thompson inherited the property in 2008 through an acquisition. The Property is located on the west side of Saddle Mountain overlooking the town of Lumby, BC, approximately 27 km east of Vernon, BC. The Property has a long history of operations and owners. Over time, there have been numerous exploration activities and some mining, which has left a legacy of adits, mine buildings, mill workings, four large ATCO trailers, two small tailings storage facilities (TSF), a small water storage pond, roads, and piles of ore and refuse including a camper and construction and household waste in various locations on the property, primarily near the mill buildings. The site overlooks the floodplain of Bessette Creek. The tailings storage facilities and the water storage pond are located on the floodplain. Currently there is a permit attached to the Property for a muscovite operation. The Company will not be proceeding with the muscovite operation and wished to have the Property closed. No mining or exploration activities have occurred on the property since 1994. The closure plan that was developed included all components related to the Quinto Mine site associated with Quinto Mining Corporation, as well as, those aspects affected by former operators. Part of Saddle Mountain is under forest cover and part has been cleared and is used for grazing. The floodplain is generally used for hay production or grazing.

The goal of the reclamation and closure plan was to rehabilitate the site to be compatible with the surrounding land use.
The reclamation and closure plan was developed and it was approved by the BC Ministry of Energy and Mines (MEM). Quinto Mining Corporation then requested that Rescan proceed to the next step and close the site. This paper describes the reclamation and closure plan and the activities carried out to close the site.

PART A- DEVELOPMENT OF THE RECLAMATION AND CLOSURE PLAN

Regulatory Requirements

MEM requires a reclamation and closure plan in support of an application for a notice of closure under Part 10 of the Health, Safety and Reclamation Code for Mines in British Columbia. The Project was never a major mine and is not an operating mine. Requirements for an application for closure of the Quinto Mine site include:

- closing all facilities;
- removing stockpiled ore;
- reclaiming exposed soils;
- reclaiming the plant site;
- removing all refuse; and
- resloping the waste rock pile.

Methods

Review of Existing Information

A review of the mining history of the site was required to determine the nature of the operation and the potential areas of disturbance. Existing reports and documentation were obtained through MEM, Victoria. Information was also obtained from Consolidated Thompson and from personnel who had been associated with the site. A review of the geology and climate was also carried out as this supported the reclamation and closure plan.

Site Investigation

A site visit was undertaken to determine the current state of the site and buildings and to collect samples for chemical analysis to provide information to develop the closure plan. An on-site inspection was made in October 2009. The Rescan team consisted of a soil/reclamation specialist, a contaminated site specialist, a geotechnical stability specialist, and an assistant. A visit was made to the site by an engineer (Bourcet Engineering, Vernon, BC), in February 2010, to determine the condition of the buildings remaining on the property.

In April 2010, a Rescan bat specialist carried out the first part of an assessment of the upper and middle adits for bat use. Under the Code, adits must be assessed for use as wildlife habitat as bat habitat cannot be destroyed. There are a number of bats in the southern interior of the Okanagan that are listed as species or endangered, by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The first visit was to assess for hibernating bats. A second assessment was carried out in July to determine if migrating bats were using the adits. In April 2010, a contractor secured all building and trailers on site and the upper and middle adits against human entry.

Contamination, Equipment, and Refuse

For the contamination assessment, areas where previous activities occurred or where human created materials existed were identified. Grab samples were taken when an unidentified, potentially hazardous material was found or where a potentially contaminated area was suspected. Notable common hazardous materials were specifically searched for such as asbestos, polychlorinated biphenyls (PCBs), hydrocarbons, lead contaminated paint, and other chemicals or liquid wastes. Only hand tools were used for the contaminated soil investigation. Nine samples were collected from the buildings and refuse piles. One water sample was collected from a vertical cross section of the thickener tank using a polyethylene plastic well bailer. Three soil samples were collected from near a battery pile using a soil auger. One liquid sample was collected from a green drum in the mill and two oil samples were collected from oil storage tanks in the mill using plastic disposable syringes. Respiratory protection was used when sampling the unknown materials. Two paint chip samples from inside the mill building were taken using a metal scraper. Water was also collected from the pipe from the upper adit. Samples were sent to ALS Canada Ltd. in Vancouver, BC (an accredited environmental analytical laboratory).

Mining and milling equipment were identified noting the location and condition. Aboveground storage tanks (ASTs) and potential underground storage tanks (USTs) were noted. Refuse dumps were identified and inspected.

Geotechnical Stability

The geotechnical stability of major mine components at the Lumby Quinto Mine site was assessed. The assessment consisted of a review of available documents obtained from government sources, reports and maps obtained from Quinto Mining Corp., and an inspection of the mine site on October 29, 2009. The documentation review and site inspection were undertaken to provide an assessment of the existing conditions and geotechnical stability of the waste rock piles and dumps, entrances to the underground workings, tailings storage facilities, and site roads. No obvious signs of instability were noted during the inspection of the waste rock piles or the tailings management facilities. Two of the adits had signs of human entry.

Reclamation

Fifteen soil/material samples were collected for laboratory analysis from various mine site areas as part of the reclamation program. These included:

- samples from a water filled trench (dugout) (at approximately 865 metres above sea level)
- waste rock piles and ore
- bagged graphite sample from outside of mine buildings
- bagged graphite from inside of the mine buildings
- mixed material in barrels in the mine buildings
- pails of material in the core stacking area
- north tailings storage facility (berm)
- tailings from the north storage facility
- tailings from the middle tailings storage facility
- soils from the former water storage pond

The tailings and water storage ponds were drained. The middle tailings pond and the water storage pond had naturally vegetated. The northern tailings pond had previously had a liner placed over the tailings (in preparation of a new mining operation which did not occur). This had been removed and was lying to the side. As well, two 2.5 m pits were excavated in the floodplain adjacent to the tailings storage facilities. Samples were collected every 25 cm to 250 cm depth. All samples were sent to ALS Laboratory, Vancouver. Analysis included pH, total cyanide, and metals (28). The results of the analysis were compared to the Agricultural, Residential/Urban Park, and Commercial/Industrial BC Contaminated Site Regulations (CSR).

Mining History

The history of the site dates back to 1900 and operations included a lead/zinc operation, a gold project, and other mine activities with the most recent operation being a muscovite mining attempt. The early mining phase from the lower and middle adits occurred between 1968 and 1981 (Sanguinetti Engineering Ltd. 1998). An additional adit was collared 15 m below the mill and extended 27 m. Between 1988 and 1994, a second phase, primarily exploration, occurred from upper adit. A west pit and three trench excavations were located northeast and east northeast of the upper adit on a 1998 plan of underground workings but no pit was identified.

Geology

The regional geology of the area is underlain by rocks of Precambrian Age which consist of phyllite grit, feldspar phyllite, and argillite (Adtec Mining Consultants Inc. 1985). The phyllite grit has a calcareous matrix. The Precambrian metasediments have been intruded by a hornblende-diorite mass which may contain pyrite (Adtec Mining Consultants Inc, 1985). Hornblende diorite has been mapped at the southern end of Saddle Mountain and metamorphosed sedimentary rock and /or fine grained volcanic rocks have been mapped to the north (Sanguinetti Engineering Ltd 1998). The mineralization in the mine workings

consist of galena, sphalerite, pyrite, chalcopyrite, tetrahedrite, and native gold (Adtec Mining Consultants Inc. 1985). A micaceous, graphite, gold bearing Plateau Shear Zone occurs on the property (Sanguinetti Engineering Ltd. 1998). The ore was found to be not potentially acid generating (not PAG).

Climate

The project area has a moderate, continental climate. Winters are moderate and short with mean temperatures in the order of -4^{o}C. Summers are long, warm, and dry with mean summer temperatures in the order of 17^{o}C. Total precipitation averages 420 mm. The study area occurs in the Interior Douglas-fir Biogeoclimatic Zone.

Reclamation and Closure Plan

The results of the on-site investigation were used to design the reclamation and closure plan. The graphite operation had been carried out using water so the graphite in bags and the pails near the core shack did not need special handling. Arsenic in the ore exceeded BC CSR industrial guidelines. The plan was to backfill the adits with the ore. Arsenic, antimony, and copper in a portion of the tailings exceeded BC CSR industrial guidelines. The pH of the tailings was generally above 7. No contamination was found in the floodplain samples. The plan was to backfill the ponds with the berm material. The layer of tailings at the top of the berm were to be placed in the bottom of the dry pond area. These were then to be covered with the broken concrete brought from the mine site by truck. The rest of the berm, which consisted of floodplain material, was to spread over the broken concrete layer. The plan was to revegetate the area.

Potentially contaminated materials identified in the mill buildings during the site inspection included: oil from inside the mill, crusher, and flotation circuit equipment and an electrical box in the crusher room; an unlabelled green drum containing a flotation material; and ballasts and transformers from overhead fluorescent lights and electrical equipment. No PCBs were found in the oil found on-site. A barrel of solid processed material was sampled and found to exceed the BC CSR industrial guideline for copper. Car batteries were found near the mine buildings. The household waste did not contain contaminants. The plan was to separate these materials to be disposed of in a regulated facility.

There were older and new buildings. The buildings were clustered on the mine site and connected with a series of building up-slope to the grizzly. The buildings on the slopes were bolted into the bedrock or supported by concrete. The buildings were built on concrete foundations. The newer buildings were in good structural condition. The older buildings were in poor condition with partially removed support beams and stairs and other landings that were not safe. The metal roofs of the older buildings had large holes from vandalism which allowed precipitation to enter the structures. The buildings still contained mining equipment. Three large tanks were attached to the outside of the building and tanks were also found in various locations on the site. The tanks were empty except for one attached to the outside of the building. The lab analysis indicated the liquid was water. All of the buildings had been vandalized and included old broken furniture and other refuse. The plan was to remove all the refuse and mining equipment and then demolish the buildings, including the foundations.

No bats were found to permanently inhabit the adits but bats did use them periodically so the plan was to close the adits but allow for access for them. The upper adit was approximately 3 m by 3 m in size with a timber portal at the adit entrance. The adit has been sealed with a steel plate and a pile of waste rock had been placed in front, to cover the lower two thirds of the entrance. A small opening had left room for human access. The concern was that the timbers would decay with time and result in an unstable area. Therefore, the plan was to remove the timbers and steel door and to backfill it with ore to prevent any future access, except by bats. Two of the adits had been previously backfilled to an acceptable standard. The middle adit was located in the side of the mountain so access was difficult. It had been roughly sealed with boards which had been partially removed allowing access by humans. The plan was to backfill it with ore.

There were several household refuse piles located on the property not associated with the mine operation, as well as the various abandoned vehicles. The plan was to remove these from the site. After the buildings and all other facilities were closed and the refuse removed, the plan was to reclaim the site by regrading steep slopes and revegetating the disturbed areas with rapidly establishing grasses. The areas to be reclaimed occurred as small pockets on the property. With time, the native species are predicted to encroach onto the reclaimed areas. The revegetation plan would also be consistent with the pasture/hay production use of the floodplain.

The reclamation and closure plan was accepted by the MEM. Quinto then requested that Rescan manage the closure of site according to the plan.

PART B: DEMOLITION, CLOSURE, AND RECLAMATION

The reclamation and closure activities were started in the spring of 2011 and completed by the fall of 2011. Rescan hired local contractors for the demolition and earthworks and carried out the monitoring of all site activities. The closure activities were divided into several categories:

- salvage of mining equipment;
- removal of refuse, old vehicles, old trailers, and old tanks;
- removal of hazardous waste;
- removal of buildings and structures;
- closure of adits;
- closure of tailings and water storage facilities; and
- reclamation of all disturbed areas.

Salvage of Mining Equipment

A local mining equipment salvage company removed all of the mining equipment from the site, which included a ball mill, flotation cells, jaw crusher, cyclone, cone crusher, a screen feed conveyor, and

various tanks (Plates 1 and 2). The grizzly and its housing were dismantled. Cranes were used to load the equipment on flat beds and the equipment was removed from site (Plate 3).

Plate 1. Mill equipment removed by the salvage company.

Plate 2. Cone crusher in the mill building.

Removal of Refuse, Old Vehicles, and Old Trailers

A local demolition company removed all refuse, vehicles, the four ATCO trailers, a vandalized camper, the core and core shack, and any other debris found on site including refuse left in the mine building (Plates 4 to 10). All of the trailers had been vandalized and one of the trailers had been demolished. Cranes were used to load the trailers onto flat beds and these were removed from site. Much of the refuse was household waste including discarded computer equipment, fencing, insulation, tires, and furniture. Most of it had been dumped over slopes and had to be removed by hand. The material was recycled, as much as possible, and non-recyclables were taken to a designated landfill off-site. Several old cars and trucks had been dumped in various locations, some near the top of Saddle Mountain. These were removed using a crane and a flat bed.

Plate 3. Loading the salvaged equipment for removal from the site.

Plate 4. One of the old vehicles that was removed from the site.

Plate 5. Piles of debris (before).

Plate 6. Cleaned up former debris site.

Removal of Hazardous Waste

Hazardous wastes were identified during the first on-site assessment. Light ballasts, old batteries, smoke alarms, liquids, metal-contaminated material (found in blue barrels), and various other materials were identified and set aside for pick-up by Hazco Environmental Services. These materials were packaged and transported to a regulated disposal facility.

Plate 7. Graphite samples and other refuse in the mine building.

Plate 8. Demolished ATCO trailer that was removed.

Plate 9. Core shack and pails (before).

Plate 10. Cone shack after reclamation and cleanup.

Demolition of Buildings

Once the buildings were emptied of equipment and refuse, they were demolished (Plates 11 and 13). The metal roofs were separated and the metal was recycled. Beams, trusses, and wood in good condition were separated and recycled. The foundations were broken up and transported by truck to the tailings pond to be used as backfill. A concrete pad near the core shack was also broken up and included with the rest of the broken concrete. The former building area was then re-sloped and contoured. The cut-slope adjacent to the buildings was pulled back and re-sloped. The disturbed areas were seeded (Plates 15 and 16).

Closure of Adits

The upper and middle adits were closed (Plate 17). The steel doors were removed from the upper adit and taken off-site for recycling. The timbers were then removed and were also taken off-site for recycling. The adit was backfilled with waste rock (Plate 18). A culvert was partially inserted into the backfilled adit to allow for bat use (Plate 19). The slope below the adit was regraded to reduce the steepness. The area was then seeded. The middle adit had been previously boarded up (Plate 20). Access to the middle adit was steep so a ramp was constructed to allow for large equipment access. For closure, the planks were removed from the entrance. A culvert was inserted to accommodate bats and the adit was backfilled (Plate 21). The slope was regraded and the area was revegetated (Plates 22 and 23).

Plate 11. Mine site buildings.

Plate 12. Inside mine site building.

Plate 13. View of mine site from above.

Plate 14. View of mine site from above with loading of broken concrete.

Plate 15. Mine site before demolition and cleanup.

Plate 16. Reclaimed mine site.

Plate 17. Upper adit.

Plate 18. Backfilling of upper adit.

Plate 19. Upper adit after closure.

Plate 20. Middle adit.

Plate 21. Backfilling of middle adit.

Waste Rock and Ore

The waste rock had occurred in piles. The waste rock that was not used as backfill was flattened and spread out (Plate 24). Twenty loads of topsoil were brought in and spread over the waste rock (Plate 25). The areas were then revegetated (Plate 26). Ore piles were located in the vicinity of the grizzly. Originally the plan was to backfill the adits with the ore. However, a private individual who expressed interest in the ore contacted Rescan just before closure was to be carried out. An agreement was made with Quinto Mining and eighty-seven loads of ore were removed from the site. The ore had occurred in piles and had been spread on the existing road. Care was taken to remove all of the ore from the piles and the road base. The area was then regraded and seeded except for the road which will remain open according to the wishes of the property owner.

Plate 22. Steep access to middle adit (before).

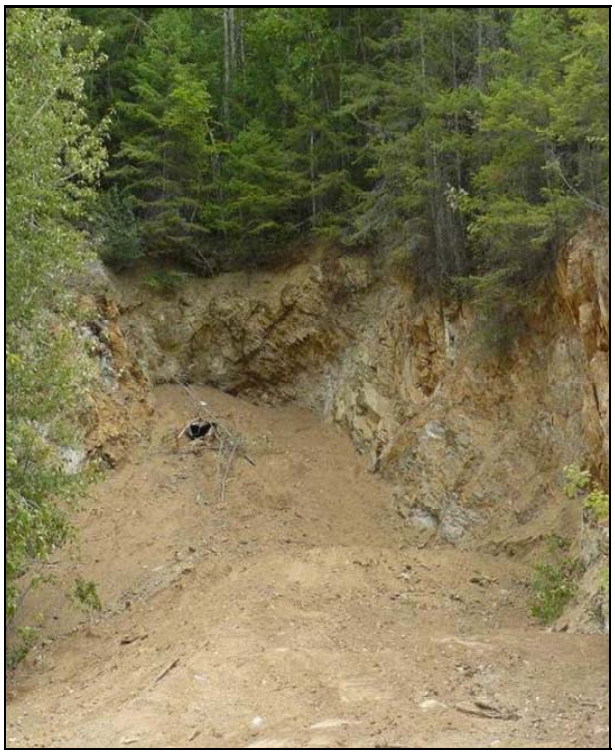

Plate 23. Regraded and backfilled middle adit.

Plate 24. Spreading waste rock piles.

Plate 25. Spreading topsoil over waste rock.

Closure of Tailings and Water Storage Ponds

The two tailings ponds and the water storage pond were closed according to the closure plan. The northern tailings pond had an HDPE liner that had been previously removed and set side. The liner was disposed of off-site. The upper part of the berm of the northern tailings pond consisted of tailings. These tailings were pushed back into the pond. The broken concrete from the building foundations was then placed in the pond bottom. The rest of the berm was used to backfill the pond (Plate 27). The area was regraded to match the adjacent landform. The area was then seeded. The berms around the middle pond and the water storage pond were also used to backfill the ponds (Plate 28). These were re-graded to match the surrounding landform and were vegetated (Plate 29).

Plate 26. Revegetated topsoil area (over waste rock).

Plate 27. Backfilling tailings pond.

Plate 28. Backfilling tailings pond.

Plate 29. Revegetated tailings pond.

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