EXECUTIVE SUMMARY

The Lupin Mine (Lupin or Lupin Mine or Site) is located approximately 285 kilometres (km) southeast of Kugluktuk, in the Kitikmeot Region of Nunavut and is owned by Lupin Mines Incorporate (LMI), a wholly owned indirect subsidiary of Mandalay Resources Corporation. It is an underground gold mine that was in operation from 1982 to 2005 with temporary suspensions of activities between January 1998 and April 2000, and again between August 2003 and March 2004. The mine resumed production in March 2004 until February 2005. Since 2005, the Site has remained in Care and Maintenance.

An important part of closing the mine will be ensuring that the site is returned to a condition that protects the health and safety of Nunavut residents and the environment around the Lupin Mine. LMI is committed to ensuring that this occurs through the preparation of a complete Final Closure and Reclamation plan (the Plan) for remediation of the Lupin Mine that considers the historic uses of this area by Inuit. Included in the document are:

- an overview of LMI and their approach to final reclamation
- a history of the site and reclamation completed to date
- a description of baseline (pre-mining) environmental conditions
- a description of mine operations and existing project facilities
- a description of current environmental conditions
- an overview of progressive reclamation and their associated post operational activities
- details of the permanent closure and reclamation activities for each mine facility or component including:
  - closure objectives
  - proposed remediation activities
  - scheduling
  - environmental conditions and assessment of post reclamation risks to human and environmental health
  - associated financial liabilities

In addition, LMI has submitted various documents in support of the FCRP which provide detailed accounts of scientific and engineering studies (i.e., Updated Phase I II Environmental Site Assessment).

The following highlights components of the FCRP:

1) **Regulatory Framework –** The property consists of five contiguous mining leases covering 6,758 hectares (ha) on crown land. LMI holds the mining leases under the *Territorial Lands Act*.

   LMI currently holds a Type A Water Licence 2AM-LUP1520 (Water Licence) for the Lupin Gold Mine. The Water Licence is valid until 18 August 2020 and in good standing. This FCRP is being submitted to the Nunavut Water Board (NWB or Board) in accordance with Part I, Item 6 of water licence 2AM-LUP1520. LMI is, by way of submission of the FCRP, in accordance with Part I, Item 7, providing the Board in writing confirmation of intent to move to Final Closure and Reclamation phase for the Site.

This FCRP has been prepared based on the current site conditions and it provides the concepts and activities for the full closure and reclamation of the Site. Upon acceptance, this FCRP will supersede the existing ICRP.

2) **Global Objectives –** The overarching objective or purpose of this Plan is to return the Site and affected areas to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities. The overall closure goal is supported by the three closure principles of Physical Stability, Chemical Stability and Future Use and Aesthetics for each component of the Project.

3) **Physical Environment –** The area of the mine site is of sparse vegetation, in the barren land tundra of Nunavut. It is typified as having sparse low lying vegetation which is extremely tolerant and well adapted to the climatic conditions. Some of the more prevalent types of habitat that can be found throughout the area include upland and lowland tundra, wet meadows and gentle slopes.

Climate in this region is classed as semi-arid subarctic, with an average annual precipitation of approximately 300 millimetres (mm). August is the wettest month with average rainfall of 59.8 mm. The annual average temperature is -10.9 degrees Celsius (°C); July is the warmest month with average temperature of 11.7 °C, whereas January is the coldest month with a monthly average of -29.7 ºC.

The Site is located in the tundra zone of the Canadian Shield, in an area of continuous permafrost. Terrain in the vicinity of the Site is generally low and undulating, ranging between 470 and 505 m elevation. Numerous shallow lakes and streams occur in depressions throughout the area.

Much of the Site exhibits bedrock at surface, and it is typified by “tombstone” topography over some of its area. These “tombstone” features resemble grave markers and occur as a result of ice- jacking action in heavily jointed rocks where joints tend to be pseudo-vertical and near-horizontal. The frost heave blocks are of various sizes and are scattered in a chaotic fashion. Removal of a block raised by this action would reveal an underlying mass of permanent ice.

Contwoyto Lake is the major water body in the region, with a surface area of approximately 95,900 ha and a drainage area of 8,000 square kilometres (km^2). Contwoyto Lake has two outlets in the Burnside River, which flows from the northwest end of the lake towards Bathurst Inlet, and the Back River at the southeast end of the lake, which flows into Pellatt Lake. The main body of Contwoyto Lake lies to the east and south of the mine site. To the north of the mine, a portion of the lake extends to the west and south, terminating in a narrow bay (Sun Bay) which lies directly west of the mine site.

The aquatic habitat in the receiving environment immediately downstream of the tailings area is comprised of three shallow lakes, two streams (Seep Creek and Concession Creek), two shallow ponds, and two embayment areas of Contwoyto Lake (Inner and Outer Sun Bay). Most of the small lakes and ponds freeze to the bottom in winter. Due to low winter flows, both Seep Creek and Concession Creek freeze to the bottom in winter. As a consequence, over wintering habitat for fish is limited primarily to Outer Sun Bay and the main body of Contwoyto Lake.

4) **Overview Mine Operations –** The Lupin gold deposit is situated in an Archean metaturbidite sequence of the Contwoyto Formation, part of the Yellowknife Supergroup of supracrustal metasedimentary and meta-volcanic rocks of the Slave Geologic Province. The rocks have been subjected to both regional and contact metamorphism and to several phases of deformation and intrusion. The bedrock at the Site consists of a mixture of low grade metamorphosed argillite, siltstone, slate, greywacke, and quartzite, generally phyllite.

The Lupin ore unit is composed of the Centre Zone, East Zone, West Zone and L19 Zone, all of which are contained within a continuous, isoclinally folded, steeply dipping unit of amphibolitic iron formation within the Contwoyto Formation. This unit has been followed for a strike length of 3,000 m and a dip length of 1,500 m.

Initial geological information indicated enough ore reserves to provide six years of production, based on the potential to develop in excess of two million tons of ore with a mill designed to process an average of 950 tonnes per day.

In August 1980, the decision was made to proceed with development and construction of the Lupin Mine. Waste rock generated from the development of the underground workings was used to build the pad surrounding the mill and as roadbed material. Plant design was based on being able to air freight all the components to site. The transportation of personnel to the site was accomplished with a Convair 640, which also carried a total of 7 million pounds of supplies such as perishables and repair parts during construction.

The Lupin Mine was in operation from 1982 to 2005 with temporary suspensions of activities between January 1998 and April 2000, and again between August 2003 and March 2004.

From 1983 to 1993, the Lupin Mine underwent a number of other expansions and operational changes to increase the mining and milling capacity to a nominal 2,300 tonnes per day. The main production shaft was deepened on two separate occasions to a final depth of 1,210 m below surface and the old sinking compartment was converted into a cage compartment. In April 2001, a production winze was commissioned between the 1050 level and 1340 level. This infrastructure allowed mucking below the elevation of the crusher to be carried out more productively, thus extending the depth, and life, of the mine. The -15% decline drift, or ramp, which permits mobile equipment to access all the mine levels, extends from surface to the 1560 m level. The lowest developed level in the mine is at the 1550 m elevation. In December 1994, the paste backfill plant was completed, which provided critical ground support in production areas while reducing the amount of tailings reporting to the Tailings Containment Area (TCA).

The mine resumed production in March 2004 until February 2005. Mill throughput in these last years of operation, March 2004 to February 2005, averaged approximately 1,200 tonnes per day, significantly less than in previous years. Production ceased in 2005; at that time, the Site was put under care and maintenance. No active mining has since occurred.

5) **Decommissioning and Remediation –** This FCRP has been prepared on the assumption that all facilities and installations that comprise the Lupin Mine Operations will ultimately be decommissioned, removed, or reclaimed under the terms of the land lease and in accordance with the reclamation requirements set out in the Water Licence.

a. Mine Workings (Underground) –

The Lupin underground workings include a 1,210 m vertical shaft and a decline drift, or ramp, to a depth of 1,560 m. A secondary hoist system (Winze) was installed in 2001 allowing hoist access to 1,340 m. The current mine depth is 1,550 m. There are also two other shafts open to surface: a fresh air raise and an exhaust raise. Incorporated into the underground facility were maintenance shops, an electrical shop and a primary crushing station. The winze and underground mine equipment were removed from site when the mine entered care and maintenance in 2006. All hazardous materials were removed from the underground workings. Any equipment left (disposed of) in the underground workings was drained of fluids.

Shafts will be backfilled to prevent animal or human entrance. Crown Pillars will be blasted down where required for stability or disposal. Contaminated soil and waste rock will be disposed of into open crown pillars. The combined volume available for underground disposal for the West Zone stope, the haulage shaft, the fresh air raise, and exhaust raise totals approximately 75,066 m^3 of underground storage volume. Crown pillars will be backfilled with rock fill (up to 1.5 m above surface to allow for settlement, then capped with 1.0 m of esker material.

The Lupin Mine was also serviced by an access ramp, which has already been sealed with a soil and rock plug and a locked fence installed to prevent access during the current phase of care and maintenance.

b. Borrows and Quarries –

The sand and gravel used for road and dam construction as well for covering the TCA cells since 1995 was obtained from the Fingers Lake esker. The Fingers Lake esker will continue to provide the cover material for the remaining TCA cells and will also be used for the reclamation of the other components of the Lupin Mine as described in Section 4.0. During closure implementation, the Finger Lakes esker area will be contoured and esker material will be used in the placement of erosion protection in drainage paths.

The two existing bedrock quarry areas; one within the TCA area and the other one near the Fingers Lake esker, are small and inactive and there are no plans to use these areas further during closure implementation.

c. Waste Rock–

Waste rock was generally used throughout the Site as pads, roadbed materials, in dam construction, airstrip stabilization, underground backfill, and laydown yards or for other purposes such as building foundation preparation. The estimated volume of waste rock on surface is about 1,000,000 m^3. Mine operations did not produce any stockpiles of overburden or unprocessed low grade ore.

Information on the geochemical characterization of the waste rock is provided in Section 0. Environmental site assessments in 2006 and 2017 indicated that up to 67% of the waste rock can be classified as Potentially Acid Generating (PAG) and that PAG samples were distributed across the site. Accordingly, the main objective of the reclamation of the waste rock is to limit the contact between the waste rock and surface water.

During closure implementation, waste rock containing high levels of As, CN, or P_bNO_3 will be disposed of in open shafts or crown pillars. Waste rock from perimeter areas will be disposed of into shafts or open crown pillars, into the landfill, or it will be consolidated into the central waste rock area. The waste rock remaining on surface will be contoured to shed water and then it will be capped with 1.0 m of esker material.

d. Tailings Containment Area –

As described in Sections 3.2.1 and 3.3.1, the tailings from Lupin milling and ore processing operations were deposited within a number of cells in the Lupin TCA. In accordance with the approved TCA 2004 Final Abandonment and Restauration Plan (Final TCA ARP) (Kinross 2005), as of the end of the 2017 construction season, a 1.0 m esker material cover had been completed over approximately 1,311,500 m^2 of the exposed tailings. As of the end of 2017, there remained approximately 123,500 m^2 of exposed tailings in Cell 5 and 86,000 m^2 in Cell 3. LMI intends to complete the placement of the cover by the end of the summer of 2019 as part of the approved Care and Maintenance activities.

The tailings pipeline will be removed and buried in the landfill. The treatment plant will be demolished and rubble will be disposed of in the landfill. Permanent monitoring instrumentation will be installed for the continued monitoring of site conditions.

During closure implementation, the water inventory in the TCA ponds will be treated with lime and then released to lower the pond water levels. Permanent closure spillways will be constructed through Dam 1A and J Dam and lined with rip rap and geotextile. If any tailings are exposed when the ponds are lowered, the tailings will either be covered in place with 1.0 m of esker material or relocated to a covered area.

e. Mill Complex –

All metallurgical reagents used during operation in the Mill Complex, with the exception of lime, have been shipped off site during the current care and maintenance phase. The mill was given a complete wash down with the intent of gold recovery (visible gold that settles within the system) and any residual contaminants (from chemical use) were removed to the tailings impoundment prior to the current care and maintenance phase.

Mill buildings will be demolished; rubble will be disposed of in open crown pillars or landfill. Materials that can be economically salvaged will be consolidated and shipped off-site. Any concrete foundation slabs will be hoe-rammed, left in place and covered with 0.3 m of granular fill. Any asbestos containing materials will be safely disposed of in the landfill.

f. Landfill(s) and Other Waste Disposal –

The waste management facilities used at the Site are: an incinerator, a temporary "boneyard" (for decommissioned tanks, buildings, and equipment), a solid non-hazardous waste landfill, a landfarm, two burn pits (annual applications to DIAND are required for open burning) and waste oil storage. Waste materials that cannot be disposed of in a management facility on site are appropriately segregated, stored such that they are inaccessible to wildlife and later shipped to a third party waste receiver in Yellowknife, NWT.

Recyclable containers, primarily food and beverage containers, will be segregated and shipped off-site for management by a third party waste receiver.

All non-hazardous wastes will be disposed of in the existing landfill, including ash which will be removed from burn pits. Waste rock will be used to infill voids and create a stable contoured surface which drains freely. All non-hazardous and non-burnable waste (scrap metal, plastics, residue from burning) historically will be disposed at the site landfill and buried with waste rock on a regular basis. The waste in the landfill will be covered progressively during use.

All hazardous materials that cannot be disposed at the landfill, such as paints, batteries, solvents, chemicals and glycols will be assembled in a staging area and then shipped off-site for disposal.

The mine currently uses a small landfill adjacent to the Lower Sewage Lagoon. The approximate compacted volume of debris (non-hazardous, inert materials) to be generated during closure activities, by demolition of all of the buildings, the contents suitable for disposal, tanks, pipelines, etc. is estimated to be approximately 55,290 cubic metres. Barring salvage opportunities, landfill disposal will also be required for the approximately 20,000 cubic metres of materials stored on surface laydowns. No hazardous waste will be disposed of in the landfill.

With the aim of confining the demolition debris to the smallest practical area which can accommodate the anticipated quantity, while not impacting a presently undisturbed area, a new landfill (Demolition Landfill) is proposed to be constructed within the west end of the Upper Sewage Lagoon. This site is located in a natural basin, is readily accessible, and can be easily monitored.

Support Infrastructure –

i. Accommodation Facilities

Accommodation facilities will be demolished; rubble will be disposed the landfill.

ii. Freshwater Supply

The freshwater for the site is obtained from Contwoyto Lake approximately 1.5 km from the complex. A causeway/breakwater extending out into the lake supports a pump house building and docking facilities.

The freshwater supply pumps were decommissioned in 2006; as a care and maintenance requirement. Currently, freshwater is trucked from the breakwater on Contwoyto Lake to a water storage tank at the accommodation buildings. The water supply system will be removed for final closure; however the breakwater will be left in place for future use.

iii. Arsenic Treatment Facility

This facility, a steel frame/metal clad building, is located at the TCA between Ponds 1 and 2, at the south end of J-Dam. It was used for mixing of reagents (ferric sulphate and lime) for water treatment operations during the early 1990's and has been inactive since 1996. The facility has been partially decommissioned. All remaining components were flushed after use. The facility will be demolished and the rubble will be disposed in the landfill.

iv. Explosives Magazine

The explosives storage magazine is located 2 km west of the TCA and consists of 2 steel-frame/metal clad buildings for Ammonium Nitrate/Fuel Oil (ANFO) storage, and historically numerous Sea-Containers for the storage of stick powder and other blasting products. There are currently no explosives on-site and no Sea-Containers at the explosives magazine. The storage facility will be used temporarily for the blasting of the West Zone crown pillar and then it will be demolished and the rubble will be disposed of in the landfill.

v. Roads and Airstrips

Roadways were constructed in part with mine development waste rock. Roads will be rehabilitated for closure (scarified and graded, cut through access roads and removal of culverts).

The old airstrip that was used during construction had been used as a laydown area after the new airstrip was operational. This area was slowly phased out as a storage location and, in 1998, the gravel/esker fill strip was graded to conform to the natural landscape with cuts and backsloping applied where necessary to promote natural drainage and reduce erosion. The surface was scarified utilizing a grader with a ripping attachment.

The main airstrip is 1,950 m (6400 ft.) in length and it was constructed of crushed waste rock produced from development underground. The drainage course in the area has been altered slightly in a lateral direction; however all runoff from both the east and west sides of the strip report in a northerly direction, eventually to Contwoyto Lake. The airstrip fueling facility has been removed and the fuelling area has been reclaimed. The airstrip will be left in place for public use after closure.

vi. Sewage and Refuse Facilities

The sewage facilities consist of several lift stations within the camp and an 800 m long 6 inch diameter insulated steel pipeline to the first of two sewage lakes. Alternatively, when, during Care and Maintenance, camp capacity requirements do not warrant its use; sewage and grey water are collected in a sewage tank at the accommodation buildings. The tank is then hauled to the Upper Sewage Lake wherein waste is deposited. A sewage line to convey camp sewage directly to the Upper Sewage Lake may be utilized.

Grey water originating from log cabin (guesthouse or office cabin or manager's house) use may be deposited in an adjacent leach pit. All sewage is to be discharged to the Sewage Lakes Disposal Facilities.

A 'permeable' type dam with an emergency overflow and a syphon exists between the first and second lake. Discharge from the second lake is controlled by the use of syphons. Water accumulating in the Lower Sewage Lake is tested prior to discharge to the environment. Discharge procedures are described in the Liquid Waste Management Plan.

For closure, the upper and lower dams will be breached and the breaches will be lined with rip rap and geotextile. The invert of the spillway will be set so that a small residual pond will remain in the former Upper Sewage Lake in order to reduce the possible transport of suspended solids. Natural revegetation of the former sewage lakes will be encouraged. Other sewage facilities will be dismantled and removed for closure.

vii. Tailings Pipeline

The tailings line has been flushed thoroughly with clean water and then partially dismantled, but left in place. For closure, the piping will be disposed of in the landfill. The tailings line foundation will be generally left intact with the exception of areas where drainage is controlled by culverts. The removal of culverts and the backsloping of the openings will ensure that minimal erosion takes place and proper drainage is achieved. Any other areas of water pooling along the tailings lines during spring melt will be opened up to provide unlimited drainage. The management of PAG material in the tailings line foundation and elevated metal concentrations in the adjacent soil will be as described in Section 4.3.2.3.

viii. Fuel Storage

The fuel storage facilities at Lupin included a main tank farm (including a system of 14 diesel tanks, 1 jet A tank and 9 individual tanks), a satellite tank farm (STF) (including a system of 10 diesel tanks and 2 gasoline tanks and a waste oil tank farm which included 2 waste oil tanks). In addition, there were 5 glycol tanks on-site and various individual tanks. Geomembrane liners were used for containment purposes.

At the end of 2017, there was an ample inventory of diesel fuel in storage at the site and it had been tested and verified as still useable. Most of this fuel will be consumed in undertaking the closure measures; diesel fuel that remains after closure is completed will be burnt on site. After the tanks are emptied they will be purged according to regulations and then cut up and disposed of in the landfill.

In 2014 buried pipes were removed between the main tank farm and satellite tank farm. The fuel remaining in the satellite tank farm was used up in 2015. In 2017, a portion (approximately 500 m^3) of petroleum contaminated soils associated with the STF were removed and relocated to the landfarm for bioremediation. After treatment, the bioremediated soil will be used for site grading. It is planned that the remaining volume of contaminated soil will be relocated to underground locations for disposal, and that the tanks will be cleaned, and transported to the boneyard in 2018 for salvage or landfill disposal.

An updated Phase 1 and 2 Environmental Site Assessment carried out in 2017 indicated that there was a total of about 34,700 m^3 of petroleum hydrocarbon contaminated (PHC) soils present in a number of locations on the site. The PHC soils will be cleaned up and disposed of in the underground mine workings.

ix. Chemical Storage

During operations the mine had an inventory of chemicals which included: cyanide, lime, lead nitrate, zinc dust, flocculants, and ferric sulphate in major quantities and miscellaneous refinery reagents in much lesser quantities. Of the chemicals listed, only lime is held on-site during care and maintenance.

During closure implementation, any remaining paints, solvents, chemicals, glycols and hazardous materials will be drummed and shipped to off-site disposal; waste oil will be burned in the incinerators; diesel fuel will mostly be consumed during closure operations, with any remaining fuel being burned in incinerators; fuel tanks will be purged and disposed in accordance with the Canadian Environmental Protection Act Regulation; hydrocarbon contaminated soils will be buried in the underground workings (i.e., in shafts or open crown pillar voids); soil currently in landfarm will be bioremediated for use for reclamation. Fluids drained from on-site equipment will be burned in the incinerators where permitted or shipped off-site for disposal.

6) **Long Term Community Values –** throughout the reclamation process, LMI will continue to identify and discuss potential forms of benefit to northern communities including: disposal of assets; contracts and employment. LMI began community engagement in 2011 wit the Kitikmeot Inuit Association. Meetings have been held with comunicty representative and agencies as described in Appendix C of the FCRP.

7) **Post-Closure Management and Monitoring –** LMI will provide a project management team to oversee all remediation activities. Upon completion of active remediation, post-closure management of the site will be handled remotely by Discovery Mining Services (DMS) out of Yellowknife, Northwest Territories consistent with approach taken by LMI and DMS during the Care and Maintenance Phase. Post-Closure monitoring of the site will be conducted to confirm global objectives of physical stability, chemical stability, and future use and aesthetics are effective at the site after closure. A Post-Closure Monitoring plan has been developed and is provided in the FCRP (refer to Section 5.0). It is anticipated that active monitoring will occur for 2.5 years and passive monitoring will take approximately 5 years following completion of the reclamation work, or until the global objectives for the mine site can be confirmed.

8) **Implementation –** Remediation of the Lupin Mine site, as outlined in this plan, will require approval pursuant to the *Nunavut Project and Planning Assessment Act* and *Nunavut Waters and Nunavut Surface Rights Tribunal Act*. It is anticipated that this FCRP will be submitted to the Nunavut Water Board in July of 2018, as part of a water licence application.

   Throughout the licensing review process, LMI intends to continue public consultation on the FCRP. Reviews by the boards and regulatory agencies will also have formal requirements for public consultation.

   Although the schedule of the licensing process will ultimately be determined by the boards and authorizing agencies, it is anticipated the process will take 10 months from the date of submission to the regulatory agencies.

   Concurrent with the regulatory review process, LMI intends to continue implementation of the approved final closure of the TCA and ongoing care and maintenance measures to support full remediation.

   Under the schedule provided in this Plan, LMI intends to continue implementation of the approved reclamation activities in 2018 and proposes to complete the active reclamation of all major surface infrastructure in 2.5 years with passive closure period monitoring to occur for an additional 5 years.