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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT ADDENDUM REPORT FOR

KMC
KAMATIVI MINING COMPANY

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KAMATIVI LITHIUM BASED MINERALS

Exploration; Mining & Processing

[PROJECT NUMBER 8751]

MATABELELAND NORTH PROVINCE

PREFACE

Kamativi Mining Company (Pvt) Ltd enrolled Geovannah Consultancy Pvt Ltd's Consultancy services to compile a comprehensive Environmental and Social Impact Assessment (ESIA) Addendum for its lithium based minerals (Tin, Tantalite and Lithium) exploration, mining and processing activities within their mining tenement. The compilation of this document involved Geovannah Consultancy ESIA team members and various other stakeholders whose input is constitutive of this ESIA. This document will be the working document for environmental management at Kamativi Mine and it updates all the environmental liabilities associated with the environmental, social, cultural and heritage aspects of the project. The document also incorporates the additional Dry Tailings Facility and ancillary facilities, Amblygonite Separation Project, Tin-Nobium-Tantalum Separation Project which were initially not part of the original EIA document, projected impacts and the mitigation measures. The additional facilities will be presented onto the Siting of Works Plan Attached.

DOCUMENT CONTROL

FINAL ENVIRONMENTAL IMPACT ASSESSMENT ADDENDUM REPORT FOR THE KAMATIVI LITHIUM-BASED MINERALS EXPLORATION, MINING AND PROCESSING PROJECT

APRIL 2026.

	NAME	SIGNATURE	DATE
COMPILED BY	EIA TEAM		
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LIST OF ACCRONYMS

COP	Cost of Production
CPU	Civil Protection Unit
CSR	Corporate Social Responsibility
DA	District Administrator
EIA	Environmental Impact Assessment
EMA	Environmental Management Agency
EIA	Environmental Management Plan
GPS	Global Positioning System
FPIC	Free, Prior and Informed Consent
IAPs	Interested and Affected Parties
MSDS	Material Safety Data Sheet
HDPE	High Density Poly Ethylene
HRDC	Hwange Rural District Council
NSSA	National Social Security Authority
PPE	Personal Protective Equipment
Zim Parks	Zimbabwe Parks and Wildlife Authority
SHE	Safety Heath and Environment
SI	Statutory Instrument
TOR	Terms of Reference
TSF	Tailings Storage Facility
KMC	Kamativi Mining Company
ZINWA	Zimbabwe National Water Authority

THE PROJECT PROPONENT DETAILS

FULL NAME	**Jianguo Ye**
NAME OF COMPANY	Kamativi Mining Company (Pvt) Ltd
ADDRESS	Unit 4A Iona Close, Borrowdale Road Harare
PROJECT TYPE	Lithium-Based Minerals (Tin, Tantalite and Lithium) Exploration, Mining and Processing
PROJECT NAME	Kamativi Mine
PROJECT PHYSICAL ADDRESS	Kamativi Mine, Ward 11, Hwange
CONTACT NUMBER	+263 775 827 384.

DECLARATION OF THE OFFICIAL RESPONSIBLE FOR IMPLEMENTATION OF THE EIA AT KAMATIVI MINE

The official responsible for environmental issues at Kamativi Mine will be **Mr Liang.**

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EXECUTIVE SUMMARY

Kamativi Mining Company (Pvt) Ltd is carrying out Exploration, Mining and Processing of Lithium-based minerals. The project is registered with the Environmental Management Agency under project number **8751**. The project is projected to have a production capacity of 0.3 million tonnes of raw ore extraction per annum in the first phase (Phase 1) of production with an anticipated recovery rate of 50 000 tonness lithium concentrate per annum. In the second phase (Phase 2) of the project life cycle, the production capacity is anticipated to 2 million tonnes of raw ore production and an estimated recovery rate of 300 000 tonnes of lithium concentrate per annum. Then the mine can process around 23 million tonnes of raw ore. Over time the Kamativi Mine operations have changed in scope and this entails material alterations in the project's environmental footprint. Section 105 (c) of the Environmental Management Act (Chapter 20:27) obligates a project proponent to whom an ESIA certificate has been issued in terms of section 100 of the Act to inform the Director-General of the changes. This document also serves as a notification of the changes to the Kamativi Mine project as well as the ESIA thereto. The documents also incorporates the additional dry is a comprehensive Environmental and Social Impact Assessment covering the Kamativi Mine exploration, mining and processing of the lithium based minerals. The documents also incorporates the additional dry tailings facility and ancillary facilities, Ambligonite Seperation Project, Tin-Nobium-Tantalum Separation Project associated impacts and mitigation thereto.

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CHAPTER ONE: INTRODUCTION

1.0 INTRODUCTION

The quest by KMC to update the environmental liabilities associated with the changes in the scope of the Kamativi Mine project, necessitated the compilation of the addendum report which is being submitted to the Agency as a fulfilment to the Environmental laws of the country. The document therefore is a comprehensive Environmental and Social Impact Assessment [ESIA] covering the exploration, mining and processing of Kamativi Lithium-based minerals at the mine. It is imperative to highlight that the Kamativi Mine project is a prescribed project with all its facets listed in the First Schedule of the Environmental Management Act (Chapter 20:27) N^{o} 7 (a), (b) and (c). The project area is located 29 kilometres eastwards by road from Cross-Dete township which located along the Bulawayo-Victoria Falls highway.

1.1 PROJECT BACKGROUND

Kamativi is a mining town in north-western Zimbabwe, in Hwange district of Matabeleland north province. The population of the town, and its peripheries, is an estimated 7,000 people, most of whom are former miners, laid off from work following closure of the mine in 1994. Mining operations ran for about 58 years prior to then, before low tin prices at the time forced indefinite suspension of business. The Hwange Rural District Council (HRDC) subsequently took over the administration of the town from the Zimbabwe Mining Development Company (ZMDC).

The Kamativi Mine Company has a valid ESIA certificate covering mainly the mining operations at the old mine. Small operations started on the pegmatite in 1936 and in 1970 the state Industrial Development Corporation (IDC) took a majority share (later transferred to ZMDC in 1986). The mine also used to produce small amounts of tantalite, spodumene (Li) and beryllium.

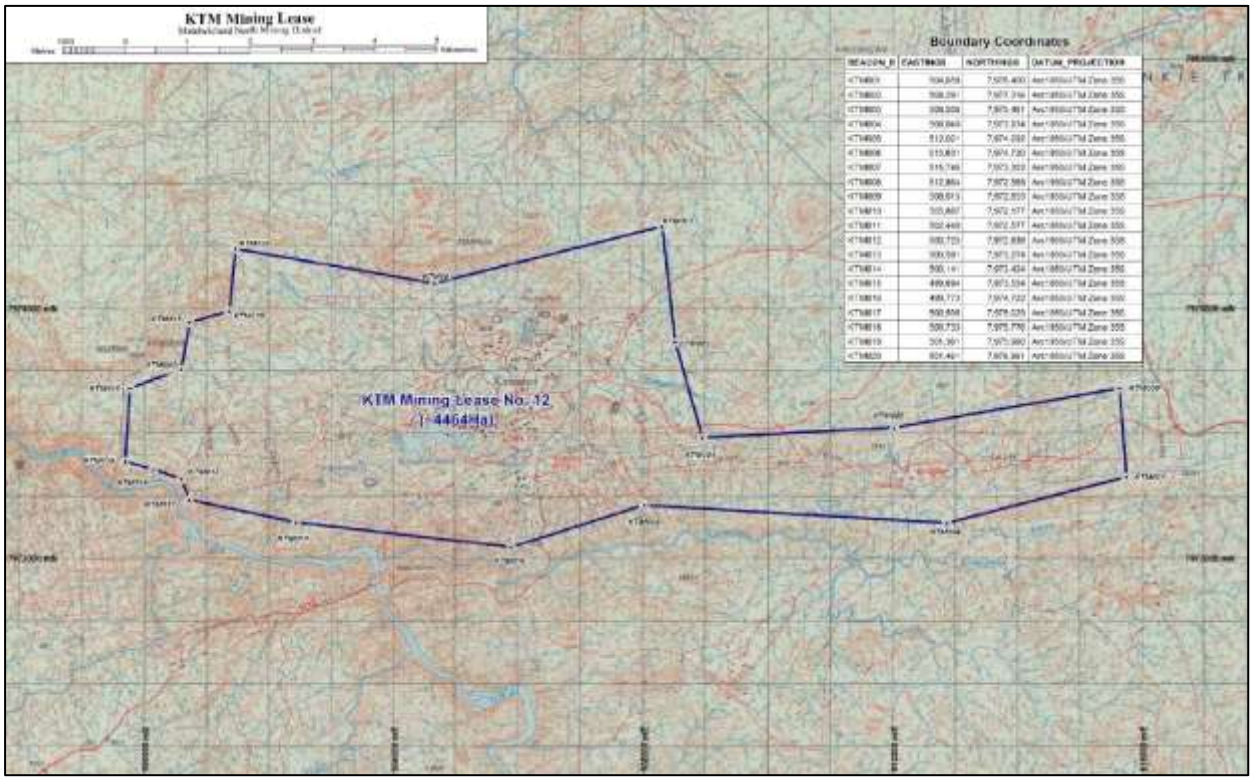


Fig 1.1: The Location of the Kamativi Mine Claims

1.2 THE OBJECTIVES OF THE KMC ADDENDUM REPORT

- Notify the Director-General of EMA of the expanded scope of the Kamativi Mine project in compliance with section 105 (c) of the Environmental Management Act (Chapter 20:27)
- To update the environmental, social,cultural and heritage liabilities associated with the Kamativi Mine project.

- To identify the actual and potential environmental, social, cultural and heritage problems associated with the Exploration, Mining and Processing of minerals at Kamativi Mine.
- To comprehensively document the environmental, social, cultural and heritage impact assessment for the Kamativi Mine exploration, mining and processing.
- To document the rehabilitation plan for the Kamativi Mine exploration, mining and processing.
- To provide an opportunity for the affected people like compound dwellers owner, local authorities among others, to participate in the devising of the EIA addendum through stakeholder consultation.

1.3 THE BENEFITS OF THIS ESIA ADDENDUM REPORT

- Provision of a working document for environmental, social, cultural and heritage management at Kamativi Mine.
- Provides a reference document for environmental, social, cultural and heritage monitoring of the Kamativi Mine project.
- Predicts significant adverse impacts and screens out environmentally, socially, culturally unsound components of the project.
- Facilitates internalization of the Kamativi Mine project environmental, social, cultural and heritage externalities.

1.4 ESIA METHODOLOGY

The EIA study for the Kamativi Mine project was done through a combination of various techniques and procedures which include:

- ✓ Desktop Review
- ✓ Field Assessments
- ✓ Observation
- ✓ Stakeholder Consultation

1.4.1 Desktop Review

Desktop review of secondary data provided a detailed description of the exploration, mining and processing project with respect to spatial coverage, preliminary design layout, magnitude, implementation schedules as well as human resources. Relevant documents were reviewed to obtain information on the baseline information in general but specifically at the project site. This document review provided further understanding the Kamativi Mine project design (site plan and designs), land use, local micro-environmental conditions, data on adjacent land use practices, development strategies and plans (local and national) as well as the policy and legal documents among others. Others included area maps, relevant pieces of legislations, regulations as well as the weekly, monthly and quarterly reports that were done for the individual facets of the Kamativi Mine project.

1.4.2 Field Assessments

Physical evaluation of the project area was carried out with specific focus on spatial manifestation of the exploration pits and trenches, TSF, land use patterns, exploration trenches, hydrological features and vegetation patterns. There was also an evaluation of the current environmental status with respect to physical, biological and socio-economic perspectives. It was a systematic

field inspection backed with available documentation and direct interviews. Field evaluation was planned to enable determination of the exact physical environmental, social, cultural and heritage features to be affected within the tenement and proximal environs. In addition to identifying the potential positive and negative impacts, field assessments contributed understanding the exploration, mining and processing of Tin, Tantalite and Lithium at Kamativi Mine. The field survey adopted various techniques of baseline data collection on the existing environmental, social, cultural and heritage conditions, namely:

- ✓ Field observations and recordings including photography the project site and its vicinity using a combination of remote sensing techniques, a drone and I phone 16 Promax camera.
- ✓ Use of checklists for determining potential environmental, social, cultural and heritage impacts of the project.
- ✓ GPS Mapping

1.4.3 Observation

Detailed field observation assessment was undertaken to enable determination of the exact socioeconomic activities within KMC tenement. Among the broad focal areas for which observation was done included other projects, land use. Checklists were used along with observations to check on possible environmental, social, cultural and heritage impacts of the project on the environment. In this assessment, checklists were utilized to: facilitate identification of potential environmental, social, cultural and heritage impacts; provide a means of comparing the predicted environmental impacts; indicate

the magnitude of both positive and negative environmental, social, cultural and heritage impacts; indicate possible adverse environmental, social, cultural and heritage impacts that are potentially significant but about which sufficient information can be obtained to make a reliable prediction; and indicate negative potential environmental impacts in the project area, which merit mitigation measures and monitoring during project implementation.

1.5 THE ESIA ADDENDUM SYNOPSIS

This is a comprehensive ESIA document which will contain the following:

- The Environmental Baseline
- Kamativi Mine Project Description
- Legislative and Administrative Framework
- Stakeholder Consultation Socio-Economic Impact Assessment
- Impact Identification and Analysis
- Environmental Management Plan Matrix
- Kamativi Mine Rehabilitation Plan
- Corporate Social Responsibility [CSR] Plan for KMC.

CHAPTER TWO: THE ENVIRONMENTAL BASELINE

2.0 INTRODUCTION

The environmental baseline is a facet of ESIA that specifically investigates the environmental setting of the Kamativi Mine pegged area. The baseline details the spatial manifestation of the Kamativi Mine pegged area, the biophysical and socio-economic conditions currently obtaining in the project area. It is imperative to establish the baseline conditions since it aids the environmental monitoring process. The biophysical aspects include the flora and fauna, water quality, hydrology and geology of the area. The Socio-economic baseline includes the social services, income sources, population and administrative set up at and around Kamativi Mine. The capacity of the Kamativi Mine to host the project sustainably will also be assessed from the baseline study.

The existing infrastructure within the Kamativi mine include the Old Tin Smelting Plant, Office Building which housed the old offices for the ZMDC management, Old pits mostly un-rehabilitated, Three schools, Police Camp, Ministry of Transport Offices and a Hospital. There is a company that's obtaining Lithium Tailings Dumps ores from the mining Lease area and is doing so called Bravura with the blessing of the Zimbabwean government.

2.1 HYDROLOGY.

The Kamativi area falls under the Gwayi catchment, and this catchment covers the whole of Matabeleland North province, parts of the Midlands province and Matabeleland South province. Rivers in the Gwayi Catchment flow north towards the Zambezi River. The major relief feature that determines the direction of flow in Zimbabwe is the Watershed. Potential evaporation rates exceed rainfall in the Kamativi area, except during the rainy season. Subsurface water can only contribute to runoff if a hydraulic gradient exists. The slope of the water table usually conforms to the slope of the land above.



Fig 2.1 the Kamativi Dam

The major hydrological feature in the kamativi area is the Kamativi Dam which is an artificial Lake, and the catchment for the area is the Gwayi catchment area. The dam supplies the water requirements for running of the Kamativi mine. There are implements allocated for the drawing water from the dam, particularly the water Bowsers especially for construction purposes and other activities currently obtaining at the mine.



*Fig 2.2 the hydrological features dissecting the Kamativi pegged area***.**

Munsaka collected water Samples from different water sources in Kamativi during part of the wet and dry seasons in 2016. Arsenic concentrations exceed the Zimbabwe and World Health Organization's health-based guidelines for drinking, in five out of six main sources, including tap water. Two other water sources had concentrations of aluminium and manganese that exceeded the

standards on at least one occasion. The distribution of trace metal concentrations by geographic location of the water bodies suggests that proximity to the mine influences the concentration of trace metal pollutants. Faecal contamination was evident in raw water, as indicated by the presence of E. coli and faecal coliforms. It was concluded that the water did not meet the standards for drinking water and needs treatment. It was also determined that the mine has an impact on the water quality and there is a risk of arsenic toxicity. A recommendation was made that Kamativi reintroduces full water treatment and treats for trace metals, particularly arsenic. Ongoing monitoring and evaluation is also needed to gauge improvements, lessen pollution, and prevent future impacts. Further research is required to determine the source and speciation of arsenic within the mining area and to predictively assess impacts of the proposed reopening of the mine on the local water supply system.



Fig 2.3: Pits within the mining tenement which accumulate rain water.

There are pits within the Kamativi claims. The dam is fed by rainwater and it is perennially filled. The dam is perennially filled with water. Since the Kamativi area is highly mountainous, the pits area also likely being filled up by base flow, receiving water from the fissures within the mountains.

2.2 GEOLOGY

The Dete-Kamativi Inlier is a sequence of metamorphic rocks which are exposed through late Palaeozoic, Mesozoic and Cenozoic cover rocks of the Karoo and Kalahari basins in western Zimbabwe. The rocks of the Inlier consist of granodioritic orthogneisses, granites, and highly deformed and metamorphosed supracrustal sequences which have been subdivided into the Malaputese, Inyantue, Tshontanda and Kamativi formations. These metasedimentary rocks have undergone amphibolite - to granulite - facies

metamorphism (Lockett, 1979a, Lockett, 1979b). Treloar, 1988, Master, 1991, Master et al., 2010 interpreted these rocks to be the highly metamorphosed supracrustal correlatives of units constituting the Magondi Supergroup in the main Magondi Belt. Additionally, Master et al. (2010) proposed a model in which the Magondi Orogeny was the result of the collision of the Zimbabwe Craton with an as yet unidentified terrane to the west. As this terrane approached the Zimbabwe Craton, a calc-alkaline magmatic arc developed on the western edge of the Zimbabwe Craton, this was then followed by collision which formed the high-grade metamorphic rocks of the Magondi Belt (including those of the Dete-Kamativi Inlier).

In order to constrain the depositional and magmatic history of the poorly understood Dete-Kamativi Inlier, they have studied a suite of four metasedimentary supracrustal rocks, and eight granitoids and granitoid gneisses from this region. U-Pb dating of individual zircon grains was done using a combination of Laser-Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS), and Secondary Ion Mass Spectrometry (SIMS). Detrital zircon grains from the metasedimentary units are expected to disclose information about their provenance as well as to give maximum ages of deposition. Zircon grains from the meta-igneous granitoids and gneisses were dated so as to establish both the implacement ages and the timing of any metamorphic overprints. Xenocrystic zircon grains from these rocks would furthermore reveal information about crustal inheritance.

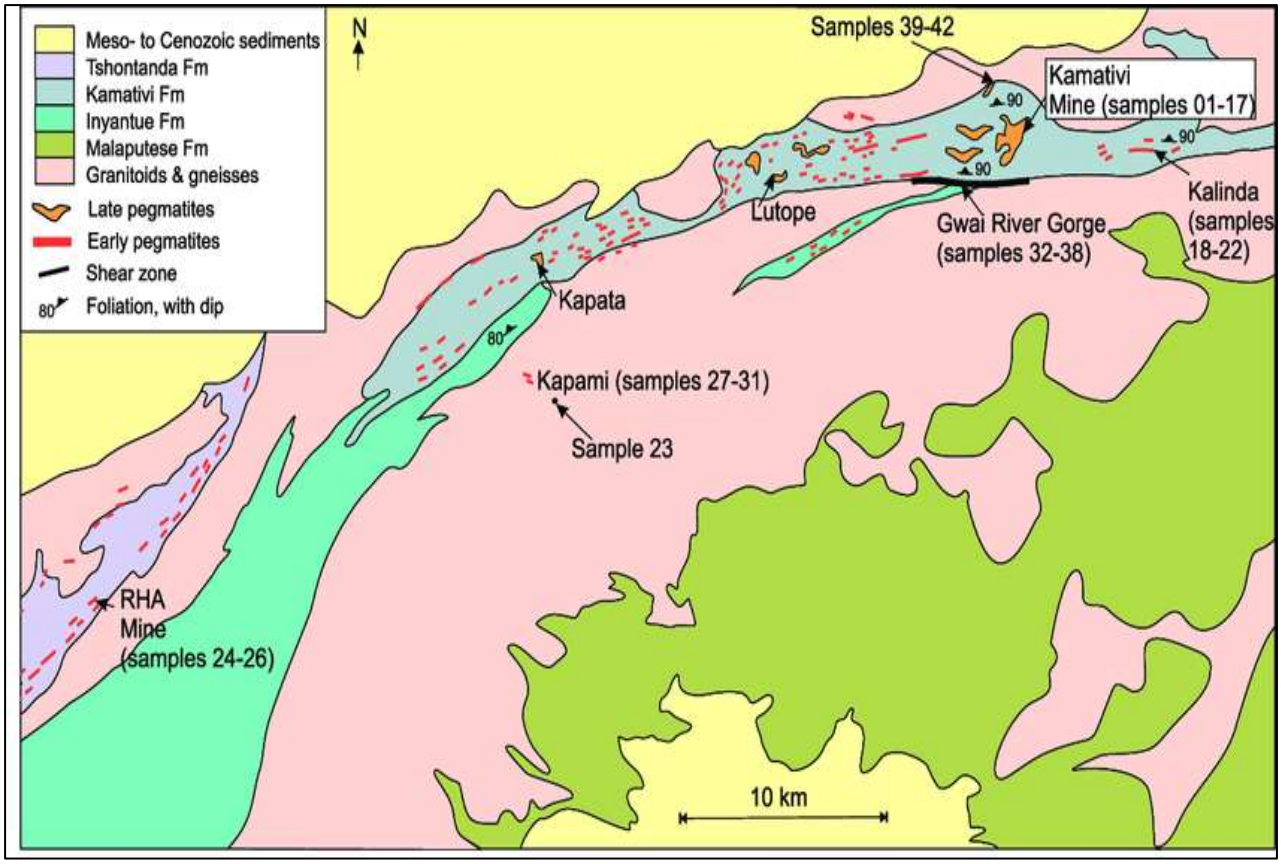


Fig 2.4: Regional Geology of the Dete-Kamativi area.

2.3 SITE SOILS

The soils in and around the Kamativi project site depict a lot of diversity owing to several factors. The Hwange area is generally dominated by the Kalahari sands type of soils. This diversity is suggested by the changing vegetation pattern, where forests and woodlands on the upper positions alternate with grasslands, in the floodplains. It seems likely that the large number of factors participating in the soil formation in this area, i.e. hydric conditions, topography, nature of the soil parent material (i.e. Aeolian or alluvial), impact of biological activity (termites and plants), as well as fires (natural or caused by arson), must lead to a high soil heterogeneity and diversity. The vulnerability of soils to wind erosion mainly depends on:

- Surface roughness.

- Wind speed.
- Soil moisture.
- Vegetative cover.



Fig 2.5: Kamativi Mine Site soils

2.4 THE FLORAL COMPONENTS OF THE PROJECT SITE

This area is considered to be a transition between miombo and mopane woodlands as evidenced by the existence of both tree species in a relative balance. The main trees and grasses that constitute the area under study included: Colophospermum mopane, Zanthoxylum clava-herculis L, Adelia ricinella L, Euclea divinorum, Commiphora angolensis, Terminalia sericea, Pavetta schumanniana, Bridelia mollis, Gymnosporia putterlickioides,Sabal minor, Opuntia ficus-indica, Vachellia nebrownii, Cucumis ficifolius,Senna singueanna, Berehemia discolo, Syzygium cordatum, Boscia angustifolia,

Dichrostachys cinerea, Combretum elaeagnoides,Ekebergia benguelensis, Maytenus senegalensis, Pleurostylia africana, Bauhinia thonningii, Climbers.



Fig 2.6: Tree Species in the Kamativi Mine Environs

Grasses common in the area under study included: Eragrostis rigidior, Cenchrus spp, commiphora spp, pogonarthria spp, aristida spp, Sporobolus pyramidalis, Melinis repens, cat's tail bullrushes and Enneapogon cenchroides.

2.5 TOPOGRAPHY OF THE KAMATIVI AREA.

The topography of the Kamativi area is highly undulating, with a mountaneous range on the western and eastern parts of the tenement. However it is key to note that the altitude of the Hwange area is generally low with a range of 600m-1200 metres above sea level. The Kamativi area is largely mountainous and has a rich ecological diversity. The elevation of the Kamativi area is specifically 919 metres above sea level, which is quite close to the elevation of Hwange area which sits on 900 metres above sea level.

2.6 THE OLD TIN PROCESSING PLANT

The Kamativi mine used to process Tin before its closure in the year 1994, owing to the global fall in Tin prices. The post closure period experienced a general dilapidation of the site equipment, road infrastructure and dwellings. However, the general degradation of the site post closure has seen the new owners reclaiming the site. Demolition of the new site may give rise to a new form of waste in the form of demolition waste hence this old phenomenon needs to be handled with care. The establishment of the new site for the processing of the minerals has already been identified and this plant will be situated on a new site exact site different from where the old plant smelting plant was situated.



Fig 2.7: Old Tin smelting plant.

2.7 UNREHABILITATED OPEN PITS

The KMC inherited two main un-rehabilitated pits from ZMDC. These pits are Pit 1 and Pit 2 within KMC's mining area and away from community people and livestock. KMC has continued mining activities around Pit 2.



Fig 2.8: Abandoned open pit 2 within the mine.

CHAPTER THREE: KMC PROJECT DESCRIPTION

3.0 INTRODUCTION

The KMC Project involves Exploration, Mining and Processing of Lithium-based minerals. There are also other ancillary components of the project which have positive and negative impacts on the environment. The auxiliary activities provide working support to the operation of the exploration, mining and beneficiation activities at the KMC. Description of the project facets and implements is key for impact identification and analysis.

3.1 THE KMC DETAILED EXPLORATION PLAN.

3.1.2 Types of exploration

The exploration works explored in this EIA may be subject to change, depending on the results of work carried out, changes in technology and changes in the economic framework. The following are the types of exploration being envisaged at KMC.

- ↔ A geophysical survey: the systematic collection of geophysical data for spatial studies. Detection and analysis of the geophysical signals forms the core of Geophysical signal processing. The magnetic and gravitational fields emanating from the Earth's interior hold essential information concerning seismic activities and the internal structure. Hence, detection and analysis of the electric and Magnetic fields is very crucial. As the Electromagnetic and gravitational waves are multi-dimensional signals.

↔ Geochemical survey***:*** Geochemical surveys are surveys of the chemistry of mineral deposits. They are done by, among other things, sampling soils, waters, and bedrock to identify areas of anomalous mineral values and quantities that may in turn identify mineral deposits

- **Sample taking** eight batch of samples up to No.2191 have been sent to Harare for sample preparation and testing. Due to lad repairs in the lab, the samples pile up and wait for be tested. Communications have been made between KMC and Lab and they are working on weekend to push for earlier release of the results.

Plan of the Borehole Location

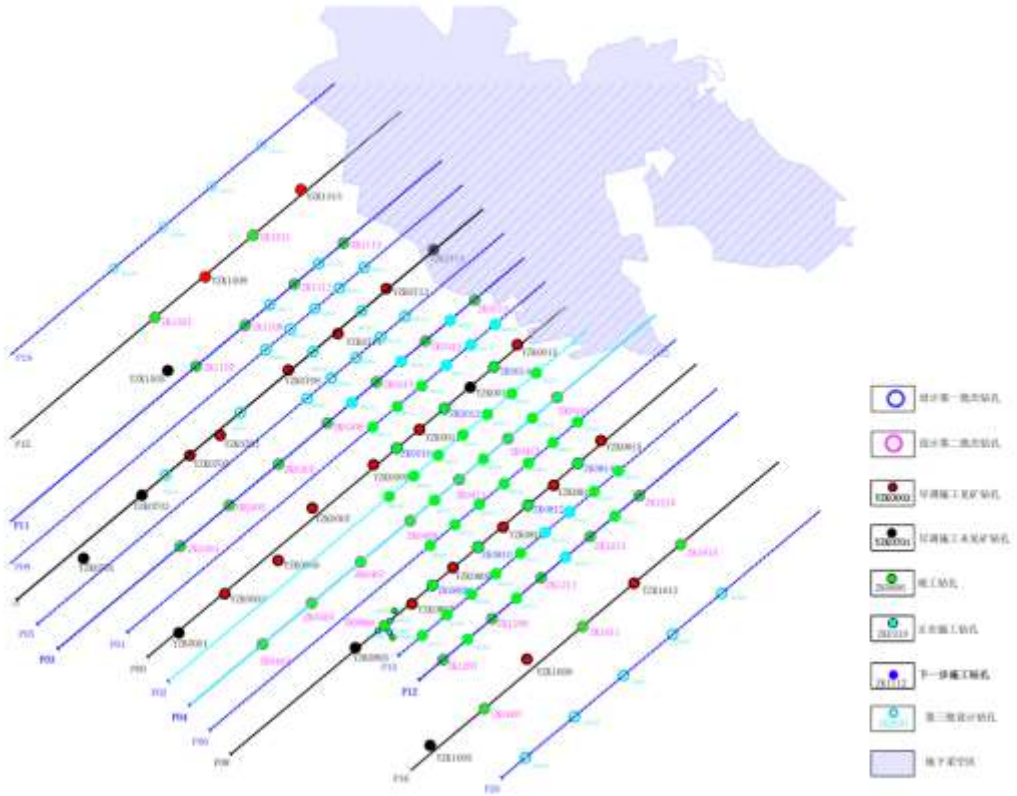


Fig 3.1 plan for exploration borehole set up.

Collecting a representative sample of the elements of a data stream.

Geochemical surveys are proposed for the tenement, although it is recognised that there will be benefit from a modern multi-element geochemical survey. .

↔ Trenching: A trench is a type of excavation or in the ground that is generally deeper than it is wide (as opposed to a wider gully, or ditch), and narrow compared with its length (as opposed to a simple hole or pit).

- Has been done over parts of the project in the past, but some trenching still remains outstanding for the Geo Physical Survey.

Trenching can be done at 1 metre wide and 4 metres depth, and trenches must be judiciously located, excavated safely and adequately shored.

↔ Surface stripping: Stripping means any activity that removes the vegetative surface cover including tree removal, clearing, grubbing, and storage or removal of topsoil.

May be needed as a follow-up to the trenching. Likely targets where stripping may be needed will be areas identified having a potential for the discoverability of the mineral.

↔ Drilling is needed on each of the targets. While not discounted, percussion drilling is not thought likely. Drilling envisaged is all diamond drilling. Most will be from surface, but underground based drilling will be done in future based on the viability of the project.

3.1.2.1 Operation procedures for Diamond drilling.

Diamond core drilling, utilises a diamond impregnated drill bit attached to the end of of a hollow drill to cut a cylindrical core of solid rock. The diamonds used are fine to micro fine industrial grade diamonds.They are set within a matrix of varying hardness, diamond size and dosing can be varied according to the rock geology. Holes within the bit allow water to be delivered to the cutting face, and the water provides three essential functions of lubrication, cooling and removal of drill cuttings from the hole.

3.1.2.2 Update of Phase-two infill drilling in Kamativi

Drilling 4867.16 meters drilled with **8** rigs during the month of September 2022. The drilling rate increased but still fall behind target of 300 meters per day. Another 3 more rigs did not arrive on site because there is a huge delay of testing at the lab in Harare. 2000 samples have been prepared and awaiting to

be tested. The lab did not catch up with the drilling speed. In the end of November 2022, the drilling team will have a maintenance schedule and drillers can also have a break during the period. More testing results will be expected and to be used for resources calculation and drilling plan adjustment. The total design drilling meters is **13500** meters for Phase-two infill drilling stage. And there will be a cross with spacing 45*45, even 22.5*22.5 meters at the suggestion from site geologist and SRK chief geologist to increase the confidence level and also for production purpose to identify the first area for mining.



Fig 3.2: The KMC Exploration Drill Rig.

3.1.3 Exploration Target areas

The exploration objective is to find a deposit of the targeted type, size and quality. The targeted areas have been identified mainly basing on the availability of historical data in the area. There are numerous targets for exploration on the KMC, based on the available information. Historic data is available over the KMC pegged area of varying quality and quantity. The target areas can be grouped into 4 zones. Exploration targets the whole tenement, soil samples have been taken from the old dumps as well as new drill boreholes have been identified across the length and breadth of the tenement.

3.1.3.2 The Exploration schedule

The KMC as a phased and planned exploration plan for its tenement, the exploration is anticipated to be completed within a stipulated period of time depending on the results of the exploration conducted.

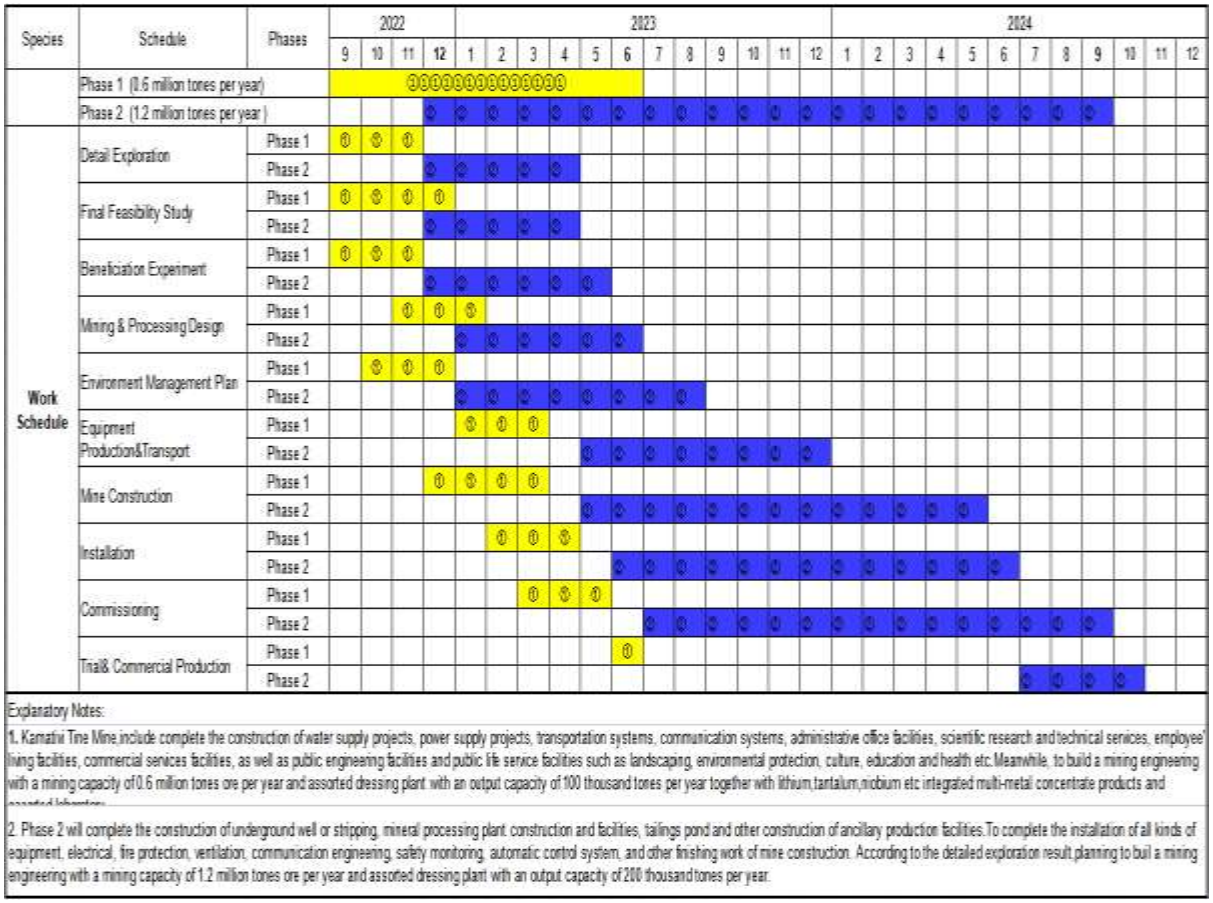


Fig 3.3 the KMC Exploration schedules

Phase One: 38 holes totaling 2140m drilled in the open cast area for phase one production purpose.

Phase Two: 15000 meters drilled up to date during Phase Two Detailed Drilling at spacing 90*90m, even 45*45m. Phase two detailed drilling will conclude by early January 2023.

It is important to note that in the current updated exploration phase, KMC is mainly implementing **Diamond drilling** and this is the main exploration

methodology being implemented. Of paramount importance is the fact that the exploration schedule is not time bound for now and exploration is being conducted within the pegged area for KMC. No exploration activities are being conducted outside the pegged area hence now new impacts outside of the scope of the ESIA are being experienced.

3.2 DESCRIPTION OF THE KMC MINING

The KMC is currently working from a single open pit mine. There are plans to explore opportunities for underground in future if economic conditions and other factors permit. The mineralized area includes general access,production benches, cleaning benches, open pit drainage system, etc.



Fig 3.4 The Current open pit mine

3.2.1 Site Clearing

Site clearing is going to be done on an extensive scale since the KMC project is a gigantic project both in terms of the scale and its special coverage. Site clearing is imperative to access the desired mineral seam. In both exploration and the construction of the water storage facility, massive clearing of the site soils and site flora is envisaged. Site clearing is done with a bulldozer, however it is crucial to note that bush clearing will be limited to areas earmarked for exploration activities per se, and shall not be conducted in a haphazard manner. Bush clearing activities involve the felling of trees and the removal of the thicket. After bush clearing, the contractor will proceed to strip the top soils.

3.2.2 Stripping of the top soils

The stripping depths of top soils in most exploration works is 2 metres, however, depending on the KMC site soil profile, the contractor shall be guided by the soil profile of the host environment. Excavators and Articulated dump trucks are allocated for stripping of the top soils. The top soils are heaped separately from the rest of the overburden material as they would want to rehabilitate the land.

3.2.3 The Mining Plan.

Open Cast Mining to happen at BH0806 area

Mining is to kick off at BH0806 area (seen map below) near previous open cast mining area. We will continue open cast mining from this old open cast. Blasting drill rig is on site, excavator is clearing surface weathered earth for rig to sit on.



Fig 3.5: Open case area



Fig 3.6: the Blasting rig on site

There are mining areas that have already been identified basing on the historical data available for the mine, however, pending the conclusion of the exploration works, more mining areas are expected to be commissioned. The mining method envisaged is a properly benched open pit mining for the Tenement.

3.2.3.1 Determination of the Open pit mining boundary.

Based on the selected optimal boundary, the proposed location of the concentrator and waste dump (the concentrator and mining industrial site are located in the west of the boundary, and waste dump is located in the south of the boundary), the terrain conditions around the orebody and the existing road conditions in the mining area, the proposed road development and haulage method, and the haulage direction and distance of ore and waste rock, the ore inlet and outlet of the open-pit boundary are set up on the northwest side of the mining area, and the inlet and outlet of the waste rock are set up on the south side of the mining area. According to the slope parameters, the open pit mining boundary is formed by delineating the boundary.

3.2.3.2 Development of conveyancing system.

The pit is close to the primary crushing station. In order to allocate ore, the temporary ore stockpile shall be set up between the pit and the primary crushing station. The transportation endpoint of the ore is the primary crushing station and the stockpile, while the main transportation routes in the mining area are mobile routes, which means the ore transportation routes are not fixed. The mining area is sunken and open-pit, and the main ore occurrence is at an elevation of 870m~795m. The elevation of the unloading platform at the primary crushing station of the concentrator is 946m, and the transportation distance of the ore outside the boundary is about 700m. The size of the mining pit is small, and the horizontal transportation distance is short, mainly for uphill transportation. The overall transportation distance of the ore is short, with an average transportation distance of only 1.9km. Moreover, the service life of open pit mining is short, which is only suitable for full truck haulage

3.2.3.3 Water proof and drainage of Open Pit.

According to the mining process, a circular interception ditch will be constructed along the outer boundary topography. Surface water outside the boundary will be intercepted and discharged to prevent the external catchment from flowing into the boundary. The catchment with an elevation below 900m of the open-pit boundary closed loop of the IV orebody converges into the bottom of the pit. The elevation at the bottom of the pit is 742.5m, with a height difference of 157.5m. Due to the large height difference, a segmented interception relay drainage method is adopted. A fixed pump station is set at elevation of 810m, and the mobile pump at the bottom of the pit transports the waste water to the pond at elevation of 810m, which is then discharged by the pump at elevation of 810m to the interception ditch at elevation of 900m for discharge.

3.2.4 Blasting Operations

Conventional blasting operations include drilling holes, placing a charge and detonator in each hole, detonating the charge, and clearing away the broken material. Blasting operations are a necessary tool for the mobilization of the ores and accessing the seam.



Fig 3.7: The blasting operations at KMC.

3.2.4.1 Explosive Magazine

The proponent store explosives used for blasting operations in mining of Lithium based mineral ore. The explosives are stored in a safe manner in terms of the Mining Explosives regulations. The proponent store explosives used for blasting operations in mining of the Lithium based minerals. The explosives are stored in a safe manner in terms of the Mining Explosives regulations. The explosives magazine is located in an area which is far from human dwellings and properly secured to ensure public safety. The transportation and use of explosives shall be led by a qualified person with a Mine Blasting License (MBL) or a better qualification. The explosives magazine is meant to primarily store the explosives that are going to be used in blasting operations for detonation of mineral bearing rocks.

It is important to note that the proposed explosives magazine has now been constructed and is at operational level. The magazine is licensed and KMC has a valid Hazardous substances Storage and Use license which they apply for and renew annually. Explosives are primarily used for blasting operations within the mine.



Fig 3.8: highly secure concretized explosives magazine (30 Tonne).

The explosives magazine is constructed and managed in line with the Explosives Regulations and KMC has since aligned its operations with the provisions of statutory Instrument 109 of 1990 by appointing Mr Munyaradzi Murapa as the mine manager, a holder of a Full Blasting Licence (FBL) by qualification.



Fig 3.9: The explosives loading.

3.2.4.2 The explosives material Shed.

KMC has constructed a Shed outside the perimeter fence of the phase 2 plant, approximately 200 metres to the west of the explosives magazine room. The shed is meant for the storage of Fertilizers mainly Ammonium Nitrate mixed with FO and diesel for some blasting operations. The shed was constructed after the issuance of the ESIA certificate and it is under security surveillance the whole day.



Fig 3.10: The explosives materials shed.

3.3 THE MINERAL PROCESSING DETAILED DESCRIPTION.

The ores for the minerals explored can be beneficiated using various methods, including magnetic separation, gravity concentration, electrostatic separation, and flotation to separate gangue minerals. Flotation is the most frequently utilized beneficiation technique. It is found that gravity concentration and flotation are the main beneficiation methods used in many plants around the world. However the KMC is going to utilise the Gravity and Flotation method for Lithium based minerals recovery. The gravity separation targets mainly the Tin and Tantalite, and the Flotation method is for the Lithium. The Gravity and Flotation come into play at the end of the crushing process.

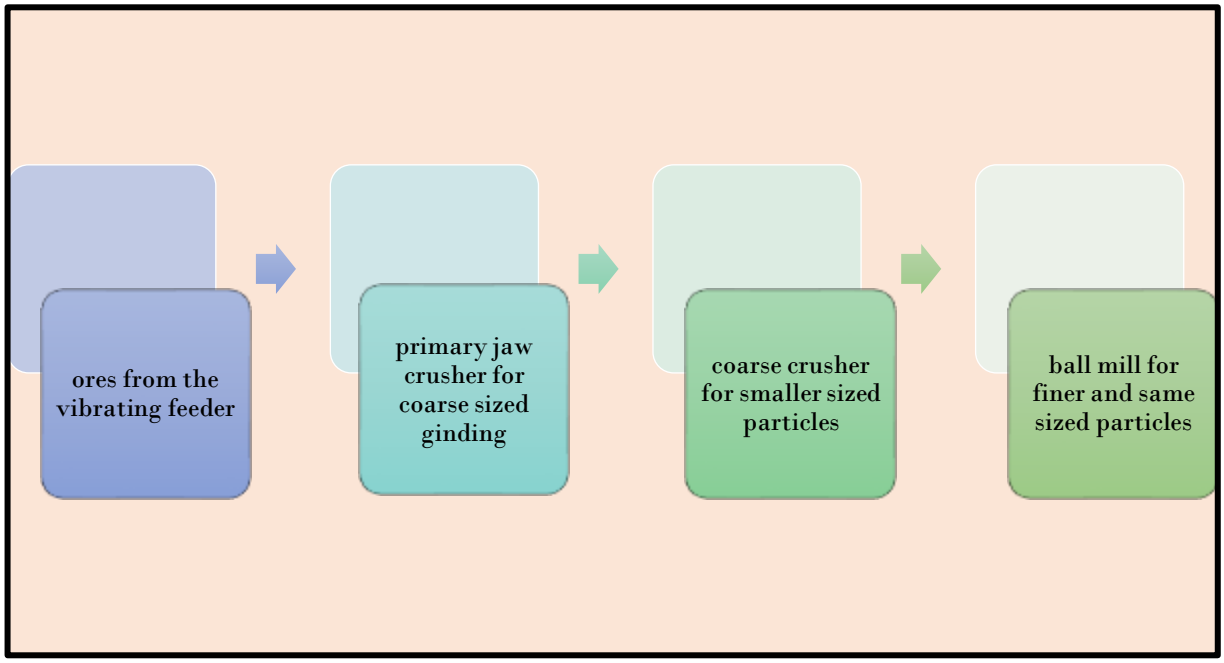
3.3.1 The Crushing Stage.

Crushing and grinding is the key technology of processing plant, which not only affects the capital capex, but also determines the stability and production cost of processing to a great extent. Given the particle size requirements, according to "more crushing and less grinding, energy saving and consumption reduction" and the controllability of particle size, a three-stage and one closed-circuit crushing process is used, and the particle size of the final crushed product is -10mm.The beneficiation method used is magnetic separation method plus gravity separation method.

The crusher operates at a rate of 130 tonnes per hour and its Jaw crusher

When the ore is brought to the tipping bin by front end loaders, it is then fed by apron feeder to the primary jaw crusher. It is then withdrawn from the apron feeder at a controlled rate of 130 tons per hour. The crushed material of three quarter stones is transferred to the Conveyor belt(s) passing through a water spray to wet the process.

3.3. 2. Process flow for reduction/crushing



The particle size reduction phase.

3.3.3 Automation and instrumentation of the crushing system.

The contents of detection and control in this system include: from primary crushing plant to the top of the fine ore bin, centralized operation and monitoring in the crushing control room, so as to realize remote one-key interlocking start and stop, signal collection and monitoring of electrical equipment running status in the process, and fault interlocking protection; monitoring the current signal of high-power equipment, monitoring the frequency and current signal of the

frequency conversion equipment, remote control and adjusting of the frequency; detection and interlock protection of the cord-pull and deviation signals of belt conveyor; realizing unattended belt conveyor, ore bin and other areas, but other posts are mainly routine inspected.

The automatic material distribution function of the fine ore bin is realized. According to the change of material level in the bin, the moving position of the tripper is controlled to realize automatic material distribution.

3.3.4 The Plant Lay out

The lithium based mineral processing is going to be operated on a phased approach. The phase 1 Plant, targeting approximately 0.3 million Tonnes of ores per annum will be slightly different from the second phase plant which is expected to process 2 million tonnes of Lithium based minerals per annum.

3.3.4.1. The Phase 1 Plant Layout.

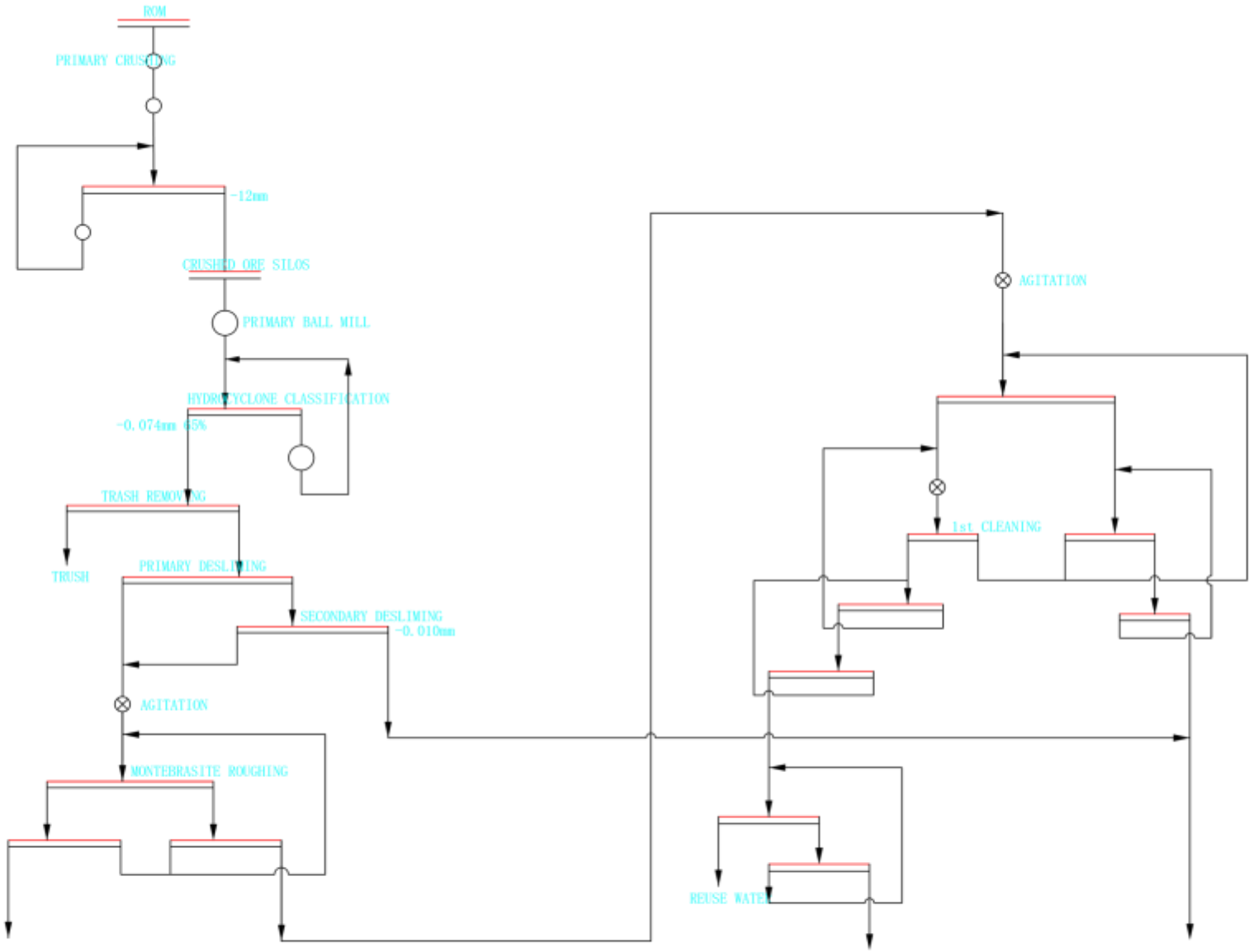

ROM
PRIMARY CRUSHING
-12mm
CRUSHED ORE SILOS
PRIMARY BALL MILL
HYDROCYCLONE CLASSIFICATION
-0.074mm 65%
TRASH REMOVING
TRUSH
PRIMARY DESLIMING
SECONDARY DESLIMING
-0.010mm
AGITATION
MONTEBRASITE ROUGHING
AGITATION
1st CLEANING
REUSE WATER



Fig 3.11 the phase 2 Plant layout

3.3.4.2 The Phase 2 Plant layout

The Phase 2 Plant process begins with the stockpiling of the Raw materials, which is the main feed material into the processing plant. The feedstock is primarily Pegmatite rock which contain the lithium-based minerals. The feedstock is fed into the primary crushing unit which mainly consists of the Jaw Crusher (1) during the first phase of the project. The Jaw crusher crushes the feedstock to a diameter of three quarter stones as the feed material is transported via a conveyor belt into the Coarse Crusher which is also part of the primary crushing unit. Materials that do not meet the required diameter are conveyed back in a circulating Unit to the jaw Crusher for further refining before they are screened to the Secondary Unit.

The feedstock from the primary crushing unit is then sieved by a vibrating screen and only materials that meet the required the required diameter are allowed to pass through to the

secondary crushing system which mainly consists of the Ball Mill. In the secondary unit, the feedstock is grinded by the Ball ill to a fine diameter of 10 mmm and below.

The feedstock is temporarily stored in the Silos before it is conveyed into the Main Plant. In the Main Plant, Spodumene processing can be used for positive flotation or reverse flotation. The positive flotation process is the process of preferential flotation of spodumene. The method is to add sodium hydroxide to the slurry at the beginning to stir and scrub to remove the pollutants on the surface. After desliming and washing, then follow the following three methods to deal with

(1) First float mica, then float spodumene, and finally float feldspar.

(2) First float spodumene, then float mica, then float feldspar.

(3) Mixed flotation of spodumene and mica, and finally pumice.

The reverse flotation operation process is carried out in alkaline pulp, with dextrin, starch, etc. as spodumene inhibitors, terpineol oil as a foaming agent, and amine cationic collectors for flotation of quartz, feldspar, mica, etc. Gangue mineral, after the iron is removed from the product in the tank, it is spodumene.

In the main plant, the Reagant preparation is done and the Reagant mainly consists of and this happens in the Flotation bay.

The concentrate is then Thickened and Filtered at the last stage of the process.

3.3.5 The Flotation and Magnetic Separation.

Flotation.

Based on the metallurgical test data and suggestions of the owner, this design considered the lepidolite flotation and spodumene flotation. The flotation of lepidolite uses the process of “one roughing, one sweeping and one refining”, and the flotation lepidolite concentrate should be processed by dehydration. The lepidolite flotation tailings are stirred and scrubbed before

spodumene flotation. The spodumene flotation process is “one roughing, three sweeping and three refining”. Spodumene flotation tailings should be sent to tailings concentration, and spodumene flotation concentrate should be sent to magnetic and gravity separation. Graded or concentrated lithium ore pulp is mixed with the flotation reagents in the mixing tank. It is then sent to the flotation cell. Due to the rotation of the impeller, the pulp and the air are sucked into the flotation cell at the same time and the air is pulverised into bubbles. The ore particles with strong surface hydrophobicity will adhere to the bubbles, float on the surface of the ore slurry together to form a foam layer and finally be scraped out and the scraped part is the lithium ore concentrate. This is the main commercial product. The ore particles with strong surface hydrophilicity do not adhere to the bubbles and will be discharged out of the tank with the slurry flow.

3.3.6 KMC Laboratory

KMC has built its own laboratory in Kamativi. Now there are 5 lab technicians and 2 assistants. KMC used to send samples for testing in Harare, which is far and slow. Now KMC can do sampling and testing with its own plan and under control. The main equipment includes jaw crusher, grinding machine, hot plates and AAS. With the expanding of the mining and processing activity, more equipment and personnel will be deployed to meet the testing demand. Another standard lab will be constructed in phase two factory.

It is important to note that the laboratory in the phase plant has now been successfully completed and fully operational and consists of various sections or rooms with each of them carrying specific functions for the mine:

- Changing room
- Instrumental analysis room
- Balance room- for weighing received samples.

- ↗ Calibration room.
- ↗ Sample room –samples from exploration and plant for analysis.
- ↗ Chemical analysis room
- ↗ Pulverise room

The laboratory has a specific Standard Operational procedures (SOPs) for each room depending on the requirements of that particular section. However, it is imperative to note that the Standard Operating procedure for each room is on display for all to see and follow the SOPs



Fig 3.12 Phase 2 plant laboratory.

3.3. 7 Power Supply

According to the relevant data provided by the proponent, Management department of Kamativi Mine discussed with Zimbabwe Power Supply Authority (ZESA) and professional engineers

(Harare High Voltage Building), and finally determined to use power supply line (88kV), single circuit overhead, with a power supply distance of about 70km from Hwange.

According to the technical and economic comparison of economic operation and voltage loss, a general step-down substation (88/33/10kV) is built in the mine load center, and a three-phase three winding air-cooled on load voltage regulating transformer is set (88/33/10kV), which is specifically designed by the local power sector.

The power distribution room (10kv) of the total voltage drop supplies power to the substations and high-voltage motors of each plants in a radial manner. According to the overall process layout, a substation is set at the appropriate position of each plant to supply power to the processing. According to the electrical equipment provided by each sectors, the power load of the mine is estimated by using the demand coefficient method.

3.3.8 WATER SUPPLY DEMAMDS FOR THE PROCESSING PLANT.

Water source (s)	Kamativi dam
Quantities	2 Million Cubic metres of water per annum.
Water requirements per day/week month, mega liters of water for the plant.	Water pumped directly to the plant, an additional Water Storage facility proposed for the project.
Licenses for water abstraction for the plant.	Application have been made to ZINWA, for water use agreement,
Other competing water uses	No present interest since KMC enjoy exclusive rights to the Dam, the Kamativi dam is owned by ZINWA.
Material resource allocation for water availability eg Mega tanks, water bowsers, pipeline etc.	Water bowsers are sometimes used for domestic water but may be needed sporadically in terms of emergencies.

Total production water consumption at design stage is 2 million m^3/year (fire water is not included). The reuse rate of processing water is 65 %. There is Kamativi dam about 1km away from the west of the site offices, and almost 400 metres from the mineral processing plant, where the water quality and quantity can meet the mine, and can be used as a fresh water source for mine production. Up to November 2025, KMC has reduced fresh water usage to 5% and recycled water pegged at 95% for production because of water recycled at the No.1 tailings dam.



Plate 3.13 Primary source of processing water.

In order to supplement the excess water requirements for the running of the plant, the KMC has identified an alternative water storage facility downstream of the Kamativi Dam.

3.3.8.1 The Supplementary Water Storage Facility.

The water storage facility is specifically meant to harvest water for complementing the primary source of water for running the plant. The Kamativi dam being the main source of processing water has the ability to supply 2 million cubic metres of water per annum which has been deemed inadequate for the processing plant requirements. The water storage facility shall supply the additional shortfall. The Water Storage facility has a capacity of supplying the addition 1 million cubic which is the expected shortfall for the running of the processing plant.

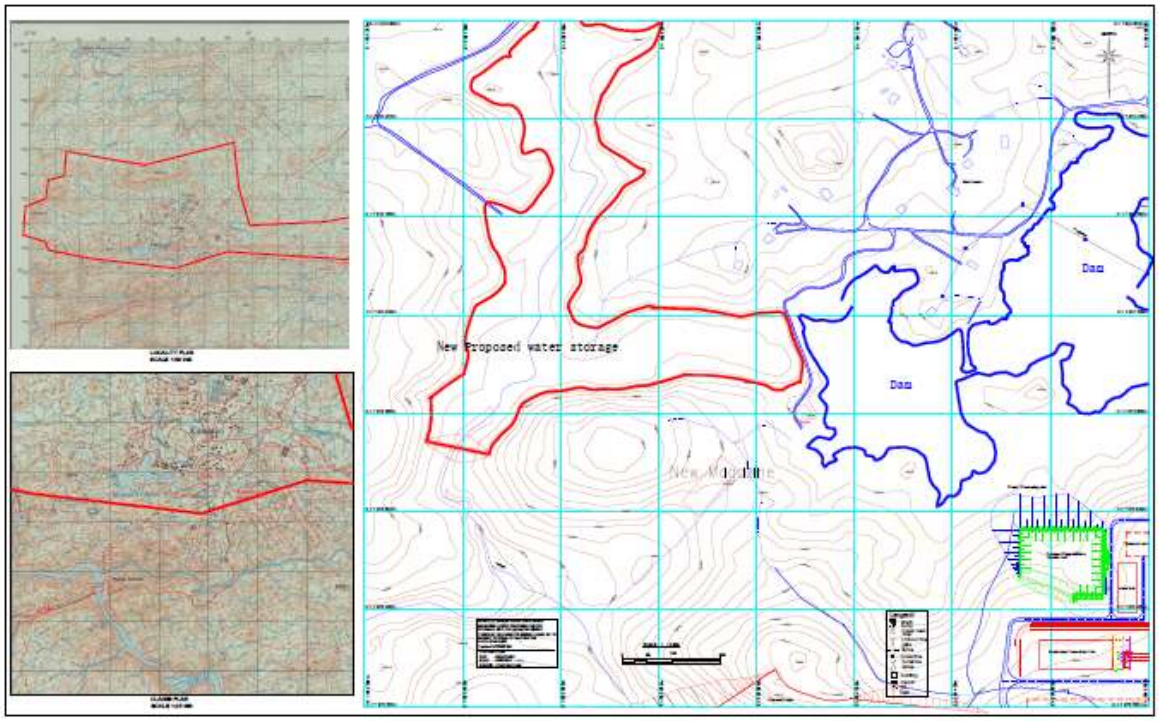


Fig 3.14 the additional water storage facility model.

3.3.8 THE TSF

The components of the TSF are a combination of best practices and legal requirements. The objectives of these features are to ensure that the process water and the storm water do not directly interact. The purpose of these structures is also to physically demarcate the boundaries of the tailings. The detailed tailings dam design provided for the following features:

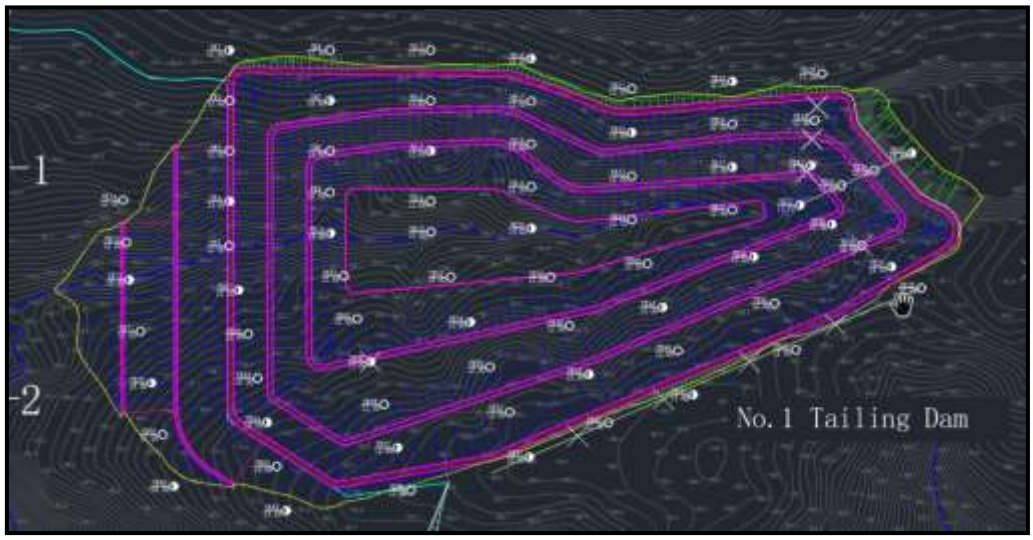


Fig 3.15 the proposed tailings dam model.

KMC has in a bid to reduce its footprint on the environment introduced a Dry tailings facility from the wet discharge system initially proposed and implemented. The new dry tailings facility is a huge feat towards water conservation efforts by the company given that the kamativi area is also a water deficient area.



Fig 3.16: the wet deposition

KMC have made modifications to the existing TSF in terms of the size, the old TSF is lined as depicted on the photo plates above with HDPE material. A full report on the TSF specification, operational capacity and environmental design considerations are factored in the TSF report in the appendices. The old TSF has been modified in terms of its height. KMC has installed a new software to monitor the stability of the TSF called the GNSS.



Fig 3.17: the GNSS software.

The safety monitoring of tailings pond is an important means to ensure the safe operation of tailings pond. It is necessary to arrange necessary monitoring items and corresponding facilities and conduct regular monitoring based on factors such as tailings pond design grade, dam construction mode, topographic and geological conditions, as well as geographical environment.

The tailings pond is a Grade III pond and adopts wet discharge method. According to the Safety Regulation for Tailings Pond (GB39496-2020), the monitoring content of the tailings pond includes dam displacement, phreatic line, dry beach length and slope, pond water level, precipitation, displacement of geological landslide mass in the pond area, and video monitoring of TSF

important parts such as inlet and outlet of the flood discharge system. The safety monitoring of the tailings pond shall be combined with manual inspections and safety inspections. The service life of the 1# tailings pond is short, the waste dump is located downstream of the tailings pond and the downstream dam slope of the tailings dam is compacted, so the monitoring facilities of the tailings pond can be appropriately simplified. In this project, the main monitoring content includes: surface displacement of tailings dam body, phreatic line of dam body, water level of tailings pond, precipitation, and video monitoring of inlet and outlet of the flood discharge system and the ore drawing area. The management personnel shall regularly observe the displacement of the dam body and the water level of the pond, and report the results to the management department regularly, which shall study and analyze the operation status of the tailings dam, and take corresponding measures in a timely manner if any abnormalities are found.

3.3.1 The Dry Tailings.

Kamativi Mining Company plans to construct of a new tailings dump that is focused on the disposal of the dry tailing that are generated form the production process.

.The facility is to be lined with HDPE lining to ensure that there is no pollution that may occur from the dump.

Advantages of the dry tailings dam

- ↗ Reduced risk of failure
- ↗ Less of water usage
- ↗ Smaller foot print- stacked more compactly
- ↗ Potential for reclamation (land)
- ↗ They minimize water pollution risks.

NB: site specific conditions: Tailings management strategies should consider local climate, water availability and regulations.

Formation of the dry tailings.

The slurry is dehydrated by dehydration equipment. The first stage is to use a thickener to thicken the concentrate and gain a higher density. The proponent will make use of a High Density Underflow thickener (HDU) that is capable of dewatering and delivering underflow with solid percentage up to 75%. An HDU reduces filtering cost and tailings transport cost. The proponent will then use a disc vacuum filter machine to filter water, and dry lithium concentrate ore. The dry tailings are generated after the lepidolite and feldspar flotation (for Lepidolite and feldspar flotation refer to.



Fig 3.18 the dry tailing dispatch point.

3.4 KMC ANCILLIARY ACTIVITIES AND INFRASTRUCTURE

3.4.1 Kamativi Mining Company Administration Block

There is an administration block that houses the main offices. The administration of all the Kamativi Mining Company project activities are done from this building. The proponent keeps the offices well-kept and has done some landscaping to maintain high standards of aesthetics. The block is well ventilated and has enough ablution facilities to service all the visitors and the employees who work there. The admin offices are the former mine club facilities for Kamativi Mine.



Fig 3.19: The KMC Site Offices.

3.4.3 Storage of Hazardous Substances

3.4. 3.1 Inventory of hazardous substances stored on the KMC site.

Currently there are 3* 30 000 diesel tanks on site to meet the onsite demand for energy. The Energy mix at the KMC provides versatile and sustainable source of energy and a fluid running of the company's operations in the face of intermittent electricity supplies in the country. The mine stores on site chemicals in form of diesel. A licence for storage and use of hazardous substances shall be applied for in line with EMA requirements as enshrined in the law **(Environmental Management (Hazardous substances, pesticides and other toxic substances) regulations, as read with S.I 268 of 2018)** and the approved EMP. The mine shall obtain the relevant licence from EMA and pay corresponding bills in line with the class of the hazardous substance. The fuel tanks are underground and dangers for fire outbreak are minimised. Fire extinguishers shall be installed close to the diesel tanks and every other necessary precautions be taken including

having an Emergency preparedness plan in place. The diesel tanks shall be installed under the natural ground surface. KMC has also conducted an addendum for the new diesel storage facility with 6* 90 000 litres diesel tanks to supplement its energy needs and the project is certified with the Environmental management Agency. The bulk diesel storage facilities is a huge boost in the energy matrix of KMC.

3.4.5 The machine Repair Workshop.

KMC has constructed a machinery repair workshop and anauto repair workshop at their premises, the workshop is located west of the main mining open pit mine and east of the Crushing phase 2 plant. The workshop is handy in the running of the mine specifically for servicing of vehicles both heavy and light vehicles for KMC. The workshop also is crucial for machinery repairs, assembling, car wash, tyre fitment and dispatch of used oils. The use of pressure vessels on the workshop is notable and thus safety, health and environmental issues associated with the workshop need to be addressed.



Fig 3.20: the machinery repair workshop.

KMC has a hazardous waste generation license for the waste oils generated from the machine repair workshop. However, KMC has prioritized environmental protection by selling the used oils to recyclers in Hwange town so that no waste oils are disposed into the environment.

3.4.6 The Chemicals Warehouse (Reagents Warehouse).

KMC stores some chemicals onsite mainly reagents for the flotation process and these chemical are specifically stored on the Chemicals warehouse on the phase 2 plant premises. The chemicals mainly stored on the KMC premises are diesel, sulphiric acid and sodium carbonate. The chemicals have their safety data sheets in place as a management tool. KMC has further complied by the Environmental legislation by acquiring the importation licences for hazardous substances in the red class which includes but is not limited to fSulphiric acid, sodium chloride and Sodium carbonate.

3.4.7 The Amblygonite Separation Project and Tin–Niobium–Tantalum Separation Project

To Increase the quality of spodumene concentrate, and to increase the recovery of pegmatite bearing minerals, the company is planning to do Amblygonite Separation Project to recover amblygonite concentrate from lithium and Tin–Niobium–Tantalum Separation Project for tin and tantalum. These two facilities will be located around Phase 2 Plant area.

CHAPTER FOUR: LEGISLATIVE AND ADMINISTRATIVE FRAMEWORK

4.0 INTRODUCTION

This Chapter focuses on the applicable pieces of legislation that govern the Kamativi Mine project. The objective is to ensure that the project is consistent with the legal requirements, international standards, organizational performance standards and best practices during every stage of the project implementation**.**

4.1 THE REGULATING INSTITUTIONS RELEVANT TO THE PROJECT

INSTITUTION	AREA OF RESPONSIBILITY
Ministry of Mines and Mining Development	• Granting of Mineral Rights • Mine Inspections • Monitoring of Mines
Environmental Management Agency	• Review of EIA Reports • Compliance Inspections • Environmental Education and Awareness
Hwange Rural District Council	• Coordinating the Developmental Activities of the area • Collection of Development Levies
ZINWA	• Management of Water Resources
Ministry of Lands, Agriculture, Water, Climate and Rural Resettlement	• Administration of the land in the local farmers and assisting in maintenance of cordial relations between the miner and the farmer. • The ministry of Lands is the farm allocating authority.

Forestry Commission	• Granting of timber licenses
District Development Coordinator	• Chairs the Civil Protection Unit
Councilor	• Coordination of Developmental Activities at Ward level
National Social Security Authority (NSSA)	• Enforcement of SI 68 of 1990 (Accident prevention and compensation Scheme). • Occupational Safety and health Promotions

4.2 ENVIRONMENTAL REGULATIONS

4.2.1 The Environmental Management Act [Chapter 20:27]

This is an act to provide for the sustainable management natural resources and protection of the environment; the prevention of pollution and environmental degradation. The Act regulates the management of natural resources. The Act prescribes in its First Schedule projects that require EIA certification prior to implementation. Section 105 (c) of the Environmental Management Act (Chapter 20:27) obligates a project proponent to whom an EIA certificate has been issued in terms of section 100 of the Act to inform the Director-General of the changes. *The KMC project has a valid ESIA certificate which expires on the 2nd of April and is compliant with the environmental laws of the country.*

4.2.2 Statutory Instrument 7 of 2007 [EIA and Ecosystems Protection] Regulations

The Statutory Instrument sets out the procedure for conducting EIAs and makes it mandatory for project developers to engage registered consultants (to EMA) to conduct Environmental Impact Assessment studies for the prescribed projects. Section 13 (2) of the SI makes it mandatory for the developer to submit quarterly reports on issues that may arise during implementation of the project. Failure to submit the quarterly report attracts a fine not exceeding level 14 or imprisonment for 12 *KMC has engaged Geovannah Consultancy, a registered Consultancy*

Company to compile a comprehensive ESIA addendum report on their behalf. KMC shall be submitting their environmental reports on a quarterly basis.

4.2.3 Statutory Instrument 6 of 2007 [Effluent and Solid Waste Disposal] Regulations

The SI provides for the regulation of solid and effluent waste disposal at various operations including mining operations. The SI operationalizes sections 60-62 and 69-70 of the Environmental Management Act (Chapter 20:27). Disposal of solid and effluent waste is done under permits regulated by EMA depending on toxicity of the waste disposed. The SI requires a person to submit an application for a blue, yellow or red license in the Form ESWD 1 together with, the appropriate fee to the Agency before disposing waste or effluent into a public stream or into any other surface or ground water, whether directly or through drainage or seepage.

It also regulates the disposal of waste (solid waste and effluent) Uses polluter pays principle through licensing which is according to the following four classes:

Blue; – in respect of a disposal which is considered to be environmentally safe.

Green; - in respect of disposal that is considered to present a low environmental hazard

Yellow; - in respect of a disposal which is considered to present a medium environmental hazard

Red; - in respect of a disposal that is considered to present a high environmental hazard.

Section 22 of this SI requires the lining of all solid waste disposal facilities**.** The SI provides the water quality standards in which the effluent should be discharged into the environment.

4.2.4 Statutory Instrument 268 of 2018 [Hazardous substance, Pesticides and Other Substances] Regulations

The regulations provide for the classification of hazardous substances and the procedure for licensing of the transportation, handling, use and disposal of hazardous substances, pesticides and other toxic substances. It also stipulates conditions for application of these permits which are

also administered by the Environmental Management Agency. *KMC will make applications for Hazardous Substances licenses for the storage and handling of petroleum distillates and hazardous chemicals onsite.*

4.3 Forestry Act [Chapter 19:05]

The Forest Act provides for the administration, control and management of state forests by the Forestry Commission. It also protects private forests and deals with the use of service station timber, control of burning and trade of forest produce. Section 41 of the Act prohibits cutting, felling, injuring or destroying any forest produce except with a written consent from the Minister. Section 44 of the Act restricts the exercising of rights to timber under service station law. Any right to timber, which is conferred upon a service station r under the service station law, or any title to land may be exercised only if such a service station r obtains a service station timber permit issued by the Forest Commission. *KMC has to abide by the laws being enforced by the Forestry Commission regarding timber clearance in the area.*

4.3 MINING REGULATIONS

4.3.1 Mines and Minerals Act [Chapter 21:05]

The Mines and Minerals Act (Chapter 21:05) of 1996 is administered by the Ministry of Mines and provides for mining of all mineral resources in Zimbabwe. It provides for the granting of mining rights. Section 269 requires the miner to fill in all shafts, open surface workings and excavations or to deal with them permanently to ensure the safety of people and livestock before a certificate of quittance is issued. Sections 267 and 312 provide for the rehabilitation of an abandoned forfeited or cancelled mining operation. *KMC has to abide by these provisions in conjunction with the environmental laws of the country.*

4.3.2 Statutory Instrument 109 of 1990 Mining [Management and Safety] Regulations

The SI provides for the regulation of Occupational Safety and Health issues in the mining sector. Part II provides for surface protection and Section 18 states that where large cracks or subsidence have taken place or are likely to take place by virtue of mining operations, the area shall be fenced in or enclosed for the safety of people or animals. Section 20 prohibits deposits of waste products, sand or waste rock in areas where cracks and subsidence exist or are likely to occur.

Part III deals with protection in working places while part V has some limits to underground pollution from dangerous gases and dust. Section 192 regulates noise levels to below 90 dB (A) and the circumstances deemed necessary for eye protection in the work areas.

4.3.3 Statutory Instrument 182 of 1995 Mining (Health and Sanitation) Regulations

The SI covers health and sanitation in the mining industry. The following sections have environmental control facets; Section 5 requires that all mines and dwelling places thereon be kept in a sanitary condition and adequately drained. Sections 9, 10, 11, 12 and 13 stipulate provisions for adequate latrines, maintenance and disposal of night soil at a mining operation. Section 22 makes provision for safe drinking water and prohibits use of polluted water for domestic purposes. *KMC has to ensure proper health and sanitation in the mine residence.*

4.3.4 Explosives Act [Chapter 10:08]

The Explosives Act provides for the manufacture, transportation, handling and storage of explosives. Section 3 prohibits any person to purchase, acquire or have in his possession any explosive unless he holds a permit. Section 7 of the Act prohibits the storage of explosives except in licensed premises. No person is allowed to store explosives in any premises unless he/she is a holder of a blasting license. As per section 9, no person shall prepare, press home or fire an explosive charge or conduct any blasting operations unless he is a holder or is under the direct

supervision of the holder of a blasting license. *KMC has a licenced holder of a blasting license who supervises the blasting operations at KMC.*

Section 73 provides for the application of a license to keep or store explosives. The application shall be made in writing and shall be lodged with the inspector of the mining district where the explosives are to be kept or stored. Explosives should be stored in a magazine as provided by the regulations. Section 80 specifies that any person who wishes to construct a magazine shall submit plans of the design and specifications of the magazine to the Chief Inspector. *KMC has ensured storage of the explosives at the mine is in line with the Act.*

4.4.2 Public Health Act

Generally, the Public Health Act makes provisions for the public health by providing for the safeguarding of public health. The relevant section of this Act deals with sanitation and housing applicable when accommodating workers. It provides for the control of activities and situations that have potential to affect public health. *KMC should provide for the adequate sanitary conditions for the Mine workers.*

4.4 LOCAL AREA ADMINSTRATIVE REGULATIONS

4.4.1 The Rural District Councils Act (Chapter 29:13)

The Act provides for the payment of land levies to the Rural District Council payable by the owner of a mining location situated on rural land within the council area as given in Section 96(1) (b). *In line with the Act, KMC should continue paying all the applicable taxes to Hwange RDC.*

4.5 WATER ACT [CHAPTER 20:24]

The Water Act provides for the development and utilisation of water resources of Zimbabwe, grants of permits for the abstraction and use of water, control of use of water when water is in

short supply, protection of the environment and the prevention and control of water pollution and for the matters incidental to or connected with the foregoing. Control of use of water is also done through the installation of meters for measuring and recording the amount of water abstracted as spelt out by Section 43. **KMC SHOULD ENGAGE ZINWA FOR ALL WATER RELATED ABSTRACTION ISSUES AND SINKING OF BOREHOLES WHEN THE NEED ARISES.**

4.6 LABOUR RELATIONS ACT (CHAPTER 28:01) REVISED EDITION 1996

This Act is set to, among other things, declare and define the fundamental rights of employees; to define unfair labour practices; to regulate conditions of employment and other related matters; to provide for the control of wages and salaries; to provide for the appointment and functions of workers committees; to regulate the negotiation, scope and enforcement of collective bargaining agreements. It also provides for protection of both the employees and employers. The act provides for recruitment to be conducted without discrimination on grounds of race, tribe, and place of origin, political opinion, colour, creed, gender, pregnancy, HIV/AIDS status or any disability.

4.6.1 LABOUR RELATIONS (GENERAL) REGULATIONS, 1985

These regulations set the guidelines for the running of all labour related organisations. It provides for their licensing, arrangement of meetings, and the codes of practise in handling employment cases and or disputes. **The proponent will comply.**

4.7.0 ROAD ACT (CAP 13:12)

The Road Act, Chapter 13:12, provides the overall framework for the development of roads. The act provides for the conservation of natural resources in road development through the prohibition of the construction of roads, access roads, extraction of materials and disposal of spoil in

demarcated forests without consultation with the authority responsible for the forest. Amendments to the Road Act (2000) effected the following changes and additions to the Act:

- Establishment of a road fund whose primary purpose will be financing road works especially road maintenance works. Money collected for this fund is through levies on e.g. fuel, vehicle licensing;
- Provides for road authorities in respect to urban and rural roads. State highway authorities will be in charge of Regional, primary and secondary roads. Urban local authorities will be responsible for urban roads and rural district councils concerned with all tertiary feed roads
- Conservation of the environment and the involvement of the public during road construction and other matters relation to roads.

The proponent will be constructing site roads and Ministry of transport has been consulted and will provide assistance if needed in the future.

4.7.1 ROAD TRAFFIC CONSTRUCTION, EQUIPMENT AND USE, AXLE REGULATIONS

The road traffic construction, equipment and use, axle regulations stipulate the Gross Vehicle Mass (GVM) for heavy vehicles. It is important that project vehicles transporting materials and equipment meet these Axle limits as required by the Vehicle Inspection Department.

4.8 PETROLEUM ACT (CHAPTER 13:22)

This Act provides for the establishment of the Petroleum Regulatory Authority and its functions and management; to provide for the licensing and regulation of the petroleum industry; and to provide for matters incidental to or connected with the foregoing. Part 3 ,Section 5 of this Act stipulates that the operations of the Authority shall be controlled and managed by a board to be known as the Petroleum Regulatory Authority Board which shall consist of five members appointed by the Minister after consultation with the President. According to Part 4 of the Act the

funds of the authority shall consist of fees, levies and other income accruing to the Authority from licences issued, other things done by it in terms of this Act and such moneys as may be payable to the Authority from moneys appropriated for purposes by Act of Parliament and such other moneys as may vest in or accrue to the Authority, whether in the course of its operations or otherwise. Above all the Minister may give the Board such general directions relating to the policy the Authority is to observe in the exercise of its functions as the Minister considers to be necessary in the National interest as noted in Part 5 of the Act.

Licensing requirements are condensed in Part 6 of the Act where no person other than a petroleum company licensed under this Part shall procure, sell or produce any petroleum product. Procurement licence, retailing licence, production licence and general duties of licensees are all provided for in this Part of the Act and applications are made direct to the Authority. In retrospect, a licensee shall not assign, cede or transfer its petroleum licence by way of sale, exchange or otherwise, without prior consent of the Authority. Renewal, amendment, enforcement and cancellation of licence are all made subject to the Authority as presented in this Act. Part 7 of the Act provides for the establishment of the Fuel Price Stabilisation Fund whose management and control shall be vested in the Minister as trustee of the fund. The fund`s object is to stabilise the price at which fuel is sold to consumers by paying out such bounties or subsidies for the local production of fuel and contributions towards any scheme approved by the Minister for the direct stabilisation of the prices. In terms of consumer protection, the Authority requires every licensee to develop and submit to the authority; customer service standards and customer complaint standards (Part 8).Maintenance of Strategic Reserves by NOCZIM after consultation with the Minister is also touched on Part 9 of the same Act. Any person aggrieved by the decision of the Authority may appeal to the Administrative Court. The Minister may after consultation with the

Authority, make regulations prescribing all matters which by this Act are required to be prescribed or which in the opinion of the Authority are necessary or convenient to be prescribed for carrying out or giving effect to this Act. The proponent is compelled to fully comply with this piece of legislation.

CHAPTER FIVE: STAKEHOLDER CONSULTATION

5.0 INTRODUCTION

Stakeholder consultation is really about initiating and sustaining constructive external relationships over time. It results in a relationship of mutual benefit. It also enables to identify trends and emerging challenges which are currently or will in the future impact the organisation. Stakeholder consultation is provided for by the Environmental Management Act (CAP: 20:21),Section 4 which empowers the local community to participate in the implementation and promulgation of legislation and policies that secure sustainable management of natural resources while promoting justifiable economic and social development. Providing opportunities for input from a diverse group of stakeholders is very important to sound design implementation of the early development of a project. Both primary and secondary data sources were utilized in stakeholder consultations where interviews and observations were used as methods of gathering data from different stakeholders interested in KMC project.

5.1 OBJECTIVES AND BENEFITS FOR STAKEHOLDER CONSULTATIONS

- To inform different stakeholders about the Free, Prior and Informed Consent practice by KMC.
- To identify the cultural heritage practices by indigenous communities in the vicinity of KMC Mining area.
- To identify possible negative and positive socio-cultural impacts associated with the KMC current operations. It also helps to identify mitigation measures on the indigenous people socio-cultural impacts associated with the KMC project.
- It also helps in legitimizing the KMC operations

- It increases ownership by stakeholders who feel the project is taking in account their views and motivates them to sponsor the project which ultimately leads to sustainability.
- Better access to decision making processes resulting in the delivery of more efficient and responsive services. The consultations seeks to identify how indigenous people of different cultures make their decisions. This is to ensure that KMC make policies that align with the Free, Prior and Informed Consent Principle.
- Enables the voices of the stakeholders to be heard and by so doing that the level of trust in the relationship increases

5.2 PRINCIPLES GOVERNING STAKEHOLDER CONSULTATION

5.2.1 Transparent

This involved communication with key stakeholders about engagement opportunities that may be of interest to them. This involved letting stakeholders know the purpose of engagement and how their input will be used. The process included all relevant stakeholders on KMC project extending representation beyond obvious stakeholders to all those perceived to have a share in or an impact associated with risks of the endeavor under consideration.

5.2.2 Relevance

The consultations relevantly listened and talk to interested and affected indigenous people about socio-cultural concerns that matter to them. When we convened the participants we had a clear understanding about what was up for discussion and the scope of a possible change. The consultations focused on the KMC project and indigenous people to make sure that any outcome remains relevant to the area under study.

5.2.3 Inclusive

We engaged with a range of views and perspectives that reflected the diversity of stakeholders and target populations, thereby reducing barriers to participation, whether physical, cultural, geographical, linguistic, information or other. Indigenous people together with other organizations within the vicinity of the KMC project area.

5.2.4 Accountable

To be accountable in our stakeholder consultations, we committed to making public what we heard from participants and reported back to stakeholders to explain decisions including how input was used. An opportunity is provided for both stakeholders and those responsible for the process to give feedback on the approaches and tools used on the outcomes.

5.2.5 Adoptable

Commitment to continuously learn and adopt was also encompassed in our stakeholder engagement approach.

5.2.6 Fairness and Responsiveness

In order to make sure that our stakeholder consultations yielded fruit, information about the project processes were shared with all stakeholders. This uniformly empowered our stakeholders with needed information for them to air their views with adequate information on the KMC exploration, mining and processing of lithium based minerals.

5.3 IDENTIFICATION OF KEY STAKEHOLDERS.

The first step of a stakeholder analysis was to identify the key stakeholders associated with the KMC exploration, mining and processing of lithium based minerals. That is those who are affected by the project outcome whether negatively or positively or those who can affect the outcomes of a proposed intervention from the large array of institutions and individuals that

could potentially affect or be affected by the proposed project. The stakeholder identification for the KMC project considered the following aspects

5.3.1 Finding out which indigenous people could be affected by the KMC project.

The consultant used diverse sources of information to find out the indigenous people that could be affected by the KMC project operations. These are Indigenous peoples' self-governance entities, community- based organizations, Hwange RDC councils and organizations, non-profit, organizations and NGOs and national censuses. Through the information from the local Chief Nekatambe and Headman Galuza, the consultant managed to find out the villages in the vicinity of the KMC project area. Moreover, the consultant also used the information already gathered by the KMC Community Liaison Personnel (Mr Moyo) about the local community and how they interact. This helped to identify indigenous people's representatives who are individuals and institutions of their own choice, and who are accountable and legitimate to those they represent, in consultation, negotiation, decision-making and consent-seeking. In conclusion, based on extensive documentation and reasonable interpretation of all available evidence, it is concluded that "no Indigenous Peoples are present in the Kamativi mine area or affected by its operations. "

5.3.2 Interviews and talks in and around the project area

This method was used to in order to understand the indigenous people's language, customs, land usage patterns and their rights regarding the KMC territory. This also helped the consultant to document and disaggregate data for each of the respective Indigenous Peoples' communities that could be affected and to Identify vulnerable groups affected by the project, and any challenges to their participation in the interviews.

5.3.3 Cross-Checking the existence of mobile communities

These mobile communities refers to those groups that migrate seasonally across a territory depending on their mode of livelihood. Examples include hunter-gatherers, pastoralists, shifting agriculturalists and temporary labourers.

5.3.4 Explanation of whom the consultant represented and the mandate

The nature of the KMC project, the intention to respect FPIC in relations with the community, and a draft timeline of the steps that could lead from initial talks to negotiation, and to a final decision by the community were all in consideration during the stakeholder consultations.

5.4 STAKEHOLDER CONSULTATION METHODOLOGY

Primary and secondary data sources were utilized to gather information from different stakeholders. Different tools of data collection were used during the consultations to make sure that the consultations are meaningfully free, prior and informed to all stakeholders. These are,

5.4.1 Approach the Indigenous people self-governance systems and structures

The Consultant approached Chief Nekatambe the traditional chief for the KMC mining area to inform him about the intentions of the KMC to uphold the indigenous people Free, Prior and Informed Consent principle in their operations at the mine. The chief welcomed the development and give the consultant a go ahead to see the Headman of the area Mr. Galuza who would then notify other local leaders. On the 21st of August 2025, the consultant managed to meet with Headman Galuza for the way forward. A meeting was arranged on the 4th of September 2025 where all the local community would meet at an all stakeholder consultation meeting where KMC would explain the project in detail to the local people.



Fig 5.2: The Consultant, Headman Galuza and KMC representative at the Headman's Homestead

5.4.2 Stakeholder Consultation Notifications

Stakeholders were notified prior to the consultations. Notification letters were distributed to different stakeholders on 21 and 22 August 2025, notifying them about the proposed stakeholder consultations to be contacted together with KMC brief project description.

5.4.3 Meetings:

On the 4th of September 2025 a stakeholder consultation meeting was conducted at KMC premises between the indigenous people and KMC. The meeting mainly focused on explaining the mandate of KMC in upholding the FPIC principle in their company policies and to empower the local communities in their involvement in the day to day running of the mine. The meeting also focused on explaining the detailed description of the Kamativi Mining Company project so that people can have a clear understanding of the project activities and how they are being affected.


SOUTH AFRICA



Fig 5.2: Meeting with the surrounding communities

5.4.4 Interviews

Interviews were used as a data collection tool from different stakeholders ranging from Indigenous people/groups representatives and Local institutions. The use of these interviews as a data collection method begins with the assumption that the participant's perspectives affect the success of the project.

5.4.4.1 Informed Consent

Stakeholders were given an informed consent form by the consultant. The intent is that stakeholders can participate freely with full information about what it means for them to take part, and that they give consent before they participate. The consultant explained to the participants what taking part in the KMC ESIA consultation will mean for them, enable them to make an informed choice about whether to take part (or not) and feel free to express their wishes.

5.4.4.1 Questionnaire

A carefully worded **questionnaire** was administered to different stakeholders to gather information on negative and positive impacts of the KMC project. The questionnaire also encompassed the cultural heritage issues together with how the cultural heritage sites can be respected and protected during the project operations. This was done in order to encourage free and open responses and to accommodate comprehensive coverage of topics and to encourage capturing respondent's perceptions in their own words.

5.4.5 Observations

Observational techniques were also used to gather firsthand data. This provided with an opportunity to collect data on a wide range of community behaviors and to capture a great variety of interactions. By directly observing operations and activities, this helped develop a holistic perspective. This method also helped in learning about issues the participants were unaware of and those they were unwilling or unable to discuss candidly in an interview.

5.4.6 Literature research

Literature research was also used to gather information on the socio-cultural activities of the Kamativi indigenous people that is their ethnic, tribal groups, language, things of cultural importance and other social, economic and cultural heritage aspects. This involved data from existing resources.

5.5 OUTCOME OF STAKEHOLDER CONSULTATION

CHIEF NEKATAMBE

Issues raised	Mitigation/enhancement

Effect on the local culture	KMC will continue engaging the community so as to protect the cultural heritage of the nearby communities**.**
Social mischiefs like prostitution and drug abuse	Health education campaigns Police presence to monitor drug abuse
Cultural heritage sites	**Importance/ Mitigation**
Chingehari Mountain	Appeasing the ancestors Rain making ceremonies

HEADMAN GALUZA

Issues raised	**Mitigation/enhancement**
There is a nearby Chingehari which is a mountain of cultural importance where people used to gather to talk to traditional spirits	The Chingehari mountain is not going to be affected by KMC process as the area is far away from the mining target areas.
We are looking for better lives in the future like jobs, so that we can alleviate poverty. We have much difficulties on water access	KMC is supposed to continue employing local people at the mine and give the local community access to water

PHANUEL MILAZI (TRIBAL CHIEF)

Issues raised	**Mitigation/enhancement**

Miners must protect our heritage and the graves for the future generations	KMC intends to protect the cultural heritages of the local people. Exhumation and reburial will be done in consultation with the local people.
Employment creation	KMC should continue to consider the local people for employment
Cultural heritage sites	**Importance and mitigation**
Chingehari and graves situated within the mining area. Annually	That is where the chiefs and the community do rituals. The site is approximately 10km from the KMC mining area hence it won't be disturbed by the KMC operations

WARD 11 COUNCILLOR

Issues raised	**Mitigation/enhancement**
Dust	Dust suppression measures are in place to mollify the effects of dust emissions
Noise	Use of sound attenuation equipment
Air pollution	Emissions surveys are being conducted quarterly so as to keep the air quality at stipulated levels.
Erosion of the local practices	Local practices are to be respected and protected by the mining company

Employment creation	Give priority to local people when recruiting
Paying of fees to under privileged children	KMC to continue helping the under privileged people in the local community
Cultural Heritages sites	**Importance/Mitigation**
Chingehari	Used for rain making ceremony and to appease the ancestors. The site won't be affected by the mine in the near future since it is far away from the KMC mining target areas

GOLIATH SIBANDA (SENA VILLAGE HEAD)

Issues raised	**Mitigation/enhancement**
Pits	Rehabilitation and fencing
Removal of the graves	Exhumation to be done after proper consultation with the relevant authorities
Dust	Dust suppression measures to be in place
Cultural Heritage sites	**Importance/ mitigation**
Chingehari mountain	Appeasing the ancestors when starting mining activities Rain making ceremonies

MINISTRY OF HEALTH

Issues raised	**Mitigation/enhancement**
Land scape alteration eg creation of pits	Mine rehabilitation
Habitat destruction ie displacing wildlife	Avoid random clearing of the land The mining activities to be done within the mine boundaries
Deforestation leading to loss of biodiversity	Random clearing of the land to be avoided
Soil erosion and pollution	Mechanical conservation works to be in place
Social impacts: Increased health risks	Periodic health tests for employees Provision of proper PPE to the workers
Water depletion	Practice water recycling
Job creation	Employment of the local people
Infrastructure development	This lead to community development
Community development programs and improved living standards	KMC to continue paying all the taxes to relevant authorities
Foreign exchange earnings, increased Gvt revenue and diversification of economy	
Cultural Heritage sites	**Importance/Mitigation**
Chingehari i.e Senalyabankombwe	Identity and belonging-helps connect individuals and community with their past

	Preserve history Tourism and economic benefits through tourism. The place is used to appease the ancestral spirits when need arises As mitigation measures, all cultural heritage sites, artifacts and traditions are going to be documented and conserved. In any case that the cultural heritage sites are damaged KMC should put some effort to restore the sites

AGRITEX

Issues raised	**Mitigation/enhancement**
Dry Tailings Dump- Dust emissions can cause respiratory problems -soil and crop contamination -loss of land and vegetation	The Dry tailings are going to be located far from the KMC areas of works so as to limit the interaction of the dump and the workers
Tailings storage facility-Risk of structural failure which can contaminate downstream rivers -ground water contamination -surface water contamination	Properly engineered TSF is going to be constructed Lining of the TSF GNSS monitoring the dam movement

-long term land use restrictions and legacy liability	
Social cultural impact-displacement and loss of homes -social tensions -loss of livelihoods(agriculture) -loss of heritage sites	The KMC mining target areas are far from homesteads hence no relocation of the people is to be done Social tensions can be avoided through continuous engagement between the mine and the local community
Community benefits-environmental protection, improved infrastructures -job creation -access to water and health and safety	All community benefits are to be enhanced by KMC
National benefits-economic growth, sustainable mining -water conservation, climate change mitigation -technology transfer and skills development	All the positive impacts must be enhanced
Cultural heritage sites	**Importance/ mitigation**
Chingehari mountain, graves/cemeteries	Documentation of all buildings and other structures before damage -plan for respectful relocation/reburial

	-establishment of buffers to protect these sites -continuous consultation with elders, traditional leaders, community members to find out unrecorded sites

ZRP

Issues raised	**Mitigation/enhancement**
Environmental degradation and pollution	Mitigation measures are in place to minimize environmental degradation and pollution at the mine
Employment creation and economic development	Employ local people
Cultural Heritage sites	**Importance/Mitigation**
Graves	These graves are important to the local Tonga people who often conduct some cultural rituals periodically -proper exhumation and reburial is going to be conducted

KAMATIVI PRIMARY SCHOOL

Issues raised	**Mitigation/enhancement**
Emissions of dust	Dust suppression measures are in place

Destruction of vegetation	Avoid random clearing of the land
The project has given bread winners some income which has improved our lives	Enhancement of the positive impacts

WOMAN AFFAIRS

Issues raised	**Mitigation/enhancement**
Due to the increase in population due to mining activities there is also a rise in prostitution leading to high rates of STIs and HIV infections. There is also an increase in drug and substance abuse due to more money circulation and employment created which is also contributing to Gender Based Violence issues	Health education to the locals and the mine workers so as to minimize the spread of STI's and HIV. Police presents in the area can also help in minimizing drug abuse
There is employment creation leading to money circulation -opening up of businesses and markets improving people's standard of living -Improved infrastructure	Employment of the local people and the locals can also start new businesses due to high rate of local employment at KMC
Cultural Heritage sites	**Importance/ Mitigation**

Chingahari cultural site	They are believed to protect the community as well as preserving local minerals -It is also believed to give guidance whenever there are issues which need to be addressed in the community -traditional practices include rain making ceremonies where the elders go and plead for good rains and a good harvest to Chingahari ancestors. **-**Rituals are also done when elders appeal to ancestors when there is calamity, need protection, and introducing new investors in the community -Chingehari mountain is far from KMC mining area hence the mine operations won't affect this site of cultural importance -KMC is willing to follow all the cultural procedures to avoid any calamity befalling the communities and to respect by any means the traditional practices of the indigenous people.

KAMATIVI SECONDARY

Issues raised	Mitigation/enhancement
Unfilled drilling holes on the ground	Rehabilitation and fencing of the area
Employment to people especially from the community	Employment of the local people

BANK ABC

Issues raised	Mitigation/enhancement
Pollution in all its forms	Dust suppression measures are in place
Work related accidents	Provision of proper PPE and safety training
Top posts to foreigners at the expense of the local people	Employment of local people
Technological development	Skills and technology transfer
Infrastructure development	KMC to participate in community development projects

CHAPTER SIX: SOCIO-ECONOMIC IMPACT ASSESSMENT

6.0 INTRODUCTION

.Socio-economic Impact Assessment includes the process of analysing, monitoring, and managing the intended and unintended social and economic consequences of planned interventions and any social change processes invoked by those interventions. It is also a field of applied socio-economic research and practice that developed originally in response to the requirements of environmental regulations. Socio-economic impact assessment introduces knowledge about the social and economic implications of a project into the planning, decision-making and management process associated with that project. It is also a concept that has many different connotations for development practitioners and academics. In this study the phrase 'socio-economic impact' represents both the negative and positive developmental influences that the KMC activities have on the social and economic well-being of the indigenous people.

6.1 OBJECTIVES OF THE SOCIO-ECONOMIC IMPACT ASSESSMENT

The objectives of this study are to gain an understanding of the following areas of social and economic development as per the requirements of the whole Environmental and Social Impact Assessment process.

- Identification of major socio-economic issues associated with the Kamativi Mine project in the local area
- To evaluate if the local communities will benefit socio-economically from the KMC project
- Findings from impact assessment are used to inform the responsible authorities so that they find proper decision on whether the activity should be authorized taking into consideration the conditions that will mitigate the impacts to win acceptable levels or should reduced

- Identification of potential mitigation measures to lessen the socio-economic risks related to the proposed KMC additional components

6.2 BENEFITS OF THE SOCIO-ECONOMIC IMPACT ASSESSMENT

- The opinions of the public may be incorporated at the stage of project design and used to maximise benefits
- Conflict over projects may be minimised by ensuring that as many interests as possible are considered in decisions and appropriate mitigation strategies are put in place.
- Helps mining companies make contributions that lead to socially sustainable environment. This implies deliberate efforts on the part of the mining companies to improve the social and economic infrastructure of local communities, with a focus on:
    a. Improving education in the surrounding communities by building schools
    b. Improving health care delivery by building hospitals and health clinics
    c. Improving skill levels of community members so that they can secure employment opportunities in the mine and be economically active
    d. Improve safety within their mines so that families in the mining communities are not left without bread winners
    e. Improve housing in local communities by building decent housing facilities that enhance the dignity of those who occupy them
    f. Improve water and sanitation infrastructure to enhance the quality of life of local communities

6.3 SOCIO-ECONOMIC ENVIRONMENT BASELINE

The main goal of the baseline survey was to understand and document the prevailing conditions of the local community and environment in the pilot areas of the project. Face to face interviews

with local people and observations were used to gather information on the existing situation at and around the project site. The baseline study looked at the following,

- People's way of life, how they live, work, play and interact with one another on a day-to-day basis
- Their culture , that is shared beliefs, customs and values
- Their community cohesion, stability, character, services and facility
- Their environment, the quality of air and water people use, the availability and quality of the food they eat, the level of dust and noise they are exposed to

6.3.1 Socio-Economic Structure

6.3.2 Demographic Profile

Demographic profile refers to particular characteristics of a population. Demographic information provides data regarding research participants and is necessary for the determination of whether the individuals in a particular study are a representative sample of the target population for generalization purposes.

6.3.2.1 Population density

The Kamativi area is now highly populated due to the refurbishment of the KMC. This influenced the influx of people in the area in search of employment opportunities. There are 6 villages in the vicinity of KMC with an average population around 6500 people.

6.3.2.2 Sex ratio

Averagely, there are more men than women in the area due to prevailing mining activities in the area where most men work in mines and men tend to move inward in search of employment in the area.

6.3.3 Local Authority and traditional leadership

The area is in the jurisdiction of Hwange Rural District Council. It is also in ward 11 with Joshua Tshuma as the current ward councilor. The KMC mine is under the traditional leadership of Chief Nekatambe and Headman Galuza.

6.3.4 Source of Livelihood

Most people in the area rely on Subsistence farming. Livestock rearing is also associated with the area where cattle and goats are most produced. Some local people now work at KMC and other nearby mines like Bravura. Small scale tin mining and alluvial gold mining in Gwayi River also serves as a source of livelihood for the local communities, sometimes at a very low level. The mine has also engaged the people who did ASM and makes sure they are involved within the mine development.

6.3.5 Culture and religion

Culture can be defined as shared patterns of behaviours and interactions, cognitive constructs and understanding that is learned by socialization. Thus, it can be seen as the growth of a group identity fostered by social patterns unique to the group. It encompasses religion, food, what people wear, how we wear it, our language, marriage, music and what we believe is right or wrong. The Kamativi area generally is known for its ethnic diversity due to its capacity to attract foreign people, with Ndebele, Tonga, Nambya, Shona and English languages being the most spoken. Most people practice Christianity and some practice African Traditional Religion.

6.3.6 Health and education

The Kamativi area has improved accessibility to health and education. The nearby schools include, St Theresa primary school, Kamativi secondary and United Primary school. The nearby health facility is Mission clinic. All these facilities are easily accessible by communities near the project site and KMC help develop these facilities as part of its CSR projects.

6.3.8 Transport and communication

The site area has got tarred road linking the area with the Bulawayo –Victoria Falls highway. To access the Kamativi Mine one is supposed to turn east at cross Dete when travelling in the Vic Falls-Bulawayo highway. People use private and public transport as their main methods of transport. People mainly use cell phones to communicate with others if not face to face, with Econet and Netone being the main network providers in the area.

6.4 SOCIO-ECONOMIC IMPACTS

6.4.1 Socio-economic Impact Assessment and Analysis

Definition

Socio-economic impact assessment refers to the systematic analysis used during Environmental Impact Assessment to identify and evaluate the potential socio-economic and cultural impacts of a proposed development on the lives and circumstances of people. A robust assessment of socio-economic impacts of the project can help to ensure that the impact of developments on communities and the economy are fully understood and that any adverse impacts can be reduced whilst any positive impacts on the lives and economy of the country can be emphasized. Socio-economic impact assessment entails different stages involving scoping, profiling baseline conditions, predicting impacts based on information gathered from issues scoping, baseline profiling and past experiences to predict possible socio-economic impacts. Identifying and applying mitigation is also a critical issue when assessing and analysing socio-economic impacts.

6.4.2 Socio economic Impact assessment methodology

Two principles were used in assessing these impacts, which are, order of causation and measure of significance.

a.) **Order of Causation**

Direct Impacts: direct impacts are due to a specific project related activity

Indirect impacts: these which are not a direct result of the project, often produced away from or as a result of a complex impact pathway.

Induced: The cumulative impacts can be, due to induced actions of projects and activities that may occur if the action under assessment is implemented such as growth inducing impacts and other effects related to induced changes to the pattern of future land use or additional road network, population density or growth rate. Induced actions may not be officially announced or be part of any official plan. Increase in workforce and nearby communities contributes to this effect. They usually have no direct relationship with the action under assessment and represent the growth- inducing potential of an action. New roads leading from those constructed for a project, increased recreational activities, and construction of new service facilities are examples of induce actions.

Cumulative: Cumulative impact consists of an impact that is created as a result of the combination of the project evaluated in the ESIA together with other projects causing related impacts**.** These impacts occur when the incremental impact of the project is combined with the cumulative effects of other past, present and reasonably foreseeable future projects.

The order of causation for each impact will be shown by ticking in the appropriate box as shown below

IMPACT	**ORDER OF CAUSATION**			
	Direct	**Indirect**	**Induced**	**Cumulative**
Demographic Impacts		**X**		

b.) Measure of significance

Rating		Description
5	**VERY HIGH**	Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts, there is no possible mitigation or remedial activity which could offset the impact.
4	**High**	Impact is of substantial order within the bounds of impacts, which could occur. In the case of adverse impacts, mitigation or remedial activity is feasible but difficult, expensive, time-consuming or some combination of these.
3	**Moderate**	Impact is real but not substantial in relation to other impacts, which might take effect within the bounds of those which could occur. In the case of adverse impacts: mitigation or remedial activity is both feasible and fairly easily possible.
2	**Low**	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts, mitigation or remedial activity is either easily achieved or little will be required, or both.
1	**Very low**	Impact is negligible within the bounds of impacts which could occur. In the case of adverse impacts, almost no mitigation or remedial activity is needed, and any minor steps which might be needed are easy, cheap, and simple.

For every project activity or aspect, various socio-economic impacts were listed. Every negative impact is allocated a value as per each of the following

- Probability [likelihood]
- Extent
- Duration [frequency]
- Magnitude [intensity/ severity]

The probability, extent, duration, magnitude and rating for each socio economic impact will be shown by ticking in an appropriate box.

Socio-economic significance rating key

probability	Very high **x**	High	Medium	Low	
Extent	Beyond boundaries	National **x**	Local	Project area	
duration	Permanent	Long term **x**	Medium term	Short term	
Magnitude (Severity)	Very severe	Severe	Moderate **x**	Low	
RATING	**1**	**2**	**3**	**4 x**	**5**

6.5 NEGATIVE SOCIO-ECONOMIC IMPACTS ASSOCIATED WITH THE PROJECT

6.5.1 Demographic Impacts

These refers to socio-economic characteristics of a population expressed statistically, such as age, sex, education level, income level, marital status, occupation, religion, birth rate, death rate, average size of a family, average age at marriage among others**.** The KMC project attracted

workers from other regions causing migration inflows and a change in the local demographic structure. A gender imbalance can emerged due to the prevalence of male workers, undermining social cohesion and spreading problems of psychological or behavioural nature for example alcoholism, drug addiction, prostitution among others.

a. Gender Imbalance

Impact Interpretation

Gender imbalance is a disparity between males and females in a population. Sectors like mining often fail to attract female applicants but, even if they do, they struggle to keep them because of inhospitable work cultures and gender discrimination against career progression. Mining projects have found it particularly difficult to attract female applicants because of the long working hours, lack of flexibility and work-life balance leading to male dominated society. This had a negative impact on sex ratio. That creates competition amongst men for limited female counterpart in the area. There is also a tendency by miners where they go after local married women leading to conflicts.

Impact assessment and analysis

IMPACT	**ORDER OF CAUSATION**			
	Direct	**Indirect**	**Induced**	**Cumulative**
Gender imbalance			**X**	

Impact significance rating key

Probability	Very high	High **x**	Medium	Low
Extent	Beyond boundaries	National	Local **x**	Project area

Duration	Permanent	Long term **x**	Medium term	Short term	
Magnitude (Severity)	Very severe	Severe **x**	moderate	Low	
RATING	**1**	**2**	**3 x**	**4**	**5**

Mitigation

Women are an underused talent pool that could tackle the country's skill shortage, enhance productivity and steer the economy. Encouraging women's participation in the labour force by promoting women's entry into the labour force and protecting them from gender-based violence in the workplace is important to reduce gender imbalance in the mining societies. As noted above, there is a significant gender gap in employment in the mining industry. Strategies to reduce this gap may include:

• Training women to move into employment sectors identified for growth that are now dominated by men

• Providing incentives to employers to tap women's higher levels of education by making them managers or administrators

• KMC should also develop gender-specific policies, including recruitment and skills development strategies for women, which could be developed in partnership with governments, trade unions, and Non-Governmental Organisations.

b. Social Tensions

Impact Interpretation

Since there was an inflow inward the project area as people looked for jobs. This led to pressure on available resources and informal and illegal dwellings developed. Social tensions emerged as local people are against the employment of foreign people and illegal settlements.

Impact assessment and analysis

IMPACT	ORDER OF CAUSATION			
	Direct	**Indirect**	**Induced**	**Cumulative**
Social tensions			**X**	

Impact significance rating key

probability	Very high	High	Medium **x**	Low	
Extent	Beyond boundaries	National	Local **x**	Project area	
duration	Permanent	Long term	Medium term	Short term **x**	
Magnitude (Severity)	Very severe	Severe **x**	Moderate	Low	
RATING	**1**	**2 x**	**3**	**4**	**5**

Mitigation

Developing dispute resolution and consultation mechanisms to channel foster dialogue and conflict resolution among actors is important. A dispute resolution would provide a channel for parties involved in social tensions to air their grievances. It is also important that KMC continue employing local people who already have legal settlements near the project site to avoid movement of people from far communities. The responsible authorities should act to also avoid illegal settlements in the area.

c. Crime rate increase

Impact Interpretation

Experience suggests that in most mining environment, there is high prevalence of drug-related crimes. Following possible business expansion and high employment rate in the area, alcoholism general theft and robbery can increase in Kamativi area.

Impact assessment and analysis

IMPACT	**ORDER OF CAUSATION**			
	Direct	**Indirect**	**Induced**	**Cumulative**
Crime rate increase		**X**		

Impact significance rating key

probability	Very high	High	Medium **x**	Low	
Extent	Beyond boundaries	National	Local **x**	Project area	
duration	Permanent	Long term **x**	Medium term	Short term	
Magnitude (Severity)	Very severe **x**	Severe	Moderate	Low	
RATING	**1**	**2**	**3**	**4 x**	**5**

Mitigation

Community crime prevention programs or strategies to combat crimes are supposed to be in place. The diversity of approaches includes, neighbourhood watch, community policing,

equipping the existing police base in the area and other comprehensive or multi-disciplinary efforts. These strategies may seek to engage residents, community and faith-based organizations, and local government agencies in addressing the factors that contribute to the community's crime, delinquency, and disorder.

d. Cultural erosion

Impact Interpretation

Culture refers to change in the customs, skills, arts, language, and other interrelated learned behaviour patterns of people that set them apart as a distinct group or society. The influx of new individuals from other regions of the country or other countries usually results in the introduction of new lifestyles and patterns of behaviour, which often arouses resentment from the local community **.**Due to influx of different people from other societies and Chinese people as the owners of KMC, there is a high probability of disappearance of local culture in Kamativi. The Chinese people will affect local culture through different language, skills and arts. There can also be a possibility that the Chinese might be involved in sexual relationships with local people since many of them do not bring their counterparts leading to a situation where culture is eroded through cross cultural marriages. However the impact can be advantageous in one way or the other.

Impact assessment and analysis

IMPACT	**ORDER OF CAUSATION**			
	Direct	**Indirect**	**Induced**	**Cumulative**
Cultural erosion		**X**		

Impact significance rating key

probability	Very high **x**	High	Medium	Low

Extent	Beyond boundaries	National **x**	Local	Project area	
duration	Permanent	Long term **x**	Medium term	Short term	
Magnitude (Severity)	Very severe	Severe	Moderate	Low **x**	
RATING	**1 x**	**2**	**3**	**4**	**5**

Mitigation

It must be clearly understood that today people must put efforts to study and understand their own culture properly and I strongly urge our nation leaders to help in its renaissance and preservation. Furthermore, KMC should always protect and respect the culture of the local people.

6.5.2 Health impacts

a. Respiratory health problems

Impact interpretation

The continuous exposure of miners to the smoke and fumes derived from blasting involves potentially harmful elements that put them at a greater risk for developing several respiratory illnesses. Mining brings about mostly respiratory health problems such as chronic bronchitis, and asthma. Additionally, several factors such as the airborne exposure levels, the element being mined, certain pre-existing conditions of the miner, genetic factors and much more can exacerbate the extent of injury that will be imposed to the miner.

Impact assessment and analysis

IMPACT	ORDER OF CAUSATION			
	Direct	**Indirect**	**Induced**	**Cumulative**
Respiratory health problems	**X**			

Impact significance rating key

probability	Very high	High **x**	Medium	Low	
Extent	Beyond boundaries	National	Local	Project area **x**	
Duration	Permanent	Long term **x**	Medium term	Short term	
Magnitude (Severity)	Very severe **x**	Severe	moderate	Low	
RATING	**1**	**2**	**3**	**4 x**	**5**

Mitigation

Maintaining a safe environment for workers in mining, exploration and processing is a critical task.

Some of the mitigation measures are as follows

- minimise miners exposure to airborne dust
- wear respiratory PPE correctly
- being aware of dust sources at the workplace
- regularly attend periodic health assessment
- maintain adequate ventilation and sprays at the mine
- avoid operating downwind of dust sources if possible

b. sexually transmitted diseases

Impact interpretation

Sex workers, multiple concurrent partners and secret sexual activities increase in mining townships as many women find it to be a source of income. It is characterized as one which is predictable and constant as many men either unmarried or married, will be separated from their sexual partners for prolonged periods of time. Sexual promiscuity and prostitution has led to the spread of HIV/AIDS. Mining areas are traditionally associated with high HIV/AIDS rates due to in migration of single family job-seekers into the local area.

Impact assessment and analysis

IMPACT	**ORDER OF CAUSATION**			
	Direct	**Indirect**	**Induced**	**Cumulative**
Sexually transmitted diseases		**X**		

Impact significance rating key

Probability	Very high	High	Medium **x**	Low	
Extent	Beyond boundaries	National	Local **x**	Project area	
Duration	Permanent	Long term **x**	Medium term	Short term	
Magnitude (Severity)	Very severe **x**	Severe	Moderate	Low	
RATING	**1**	**2**	**3 x**	**4**	**5**

Mitigation

Both Government and KMC have a role to play with the Ministry of Health taking a leading role in setting polices for prevention, management, and care of the disease and project proponent serving as key agent in sending messages on prevention and supporting treatment. The workplace is an opportune environment for disseminating information on prevention techniques and behavioural change. The proponent should develop context-specific policies that respond to the country situation and the needs of the workers. Elements in the policy could include the following:

• Information about HIV/AIDS and how it is transmitted

• Educational measures to enhance understanding of personal risk and promote enabling strategies

• Practical prevention measures which encourage and support behavioural change

• Measures for the care and support of affected workers, whether it is they or a family member who is living with HIV/AIDS

c. Noise

Impact interpretation

Noise is expected from blasting and vehicles at the site. The noise impact could range from high to medium significance during the time of operations. Noise is expected to affect people who stay near project operations and the mine workers.

Impact assessment and analysis

IMPACT	**ORDER OF CAUSATION**			
	Direct	**Indirect**	**Induced**	**Cumulative**

Noise	**X**			

Impact significance rating key

Probability	Very high	High	Medium **x**	Low	
Extent	Beyond boundaries	National	Local	Project area **x**	
duration	Permanent	Long term **x**	Medium term	Short term	
Magnitude (Severity)	Very severe	Severe	Moderate	Low **x**	
RATING	**1 x**	**2**	**3**	**4**	**5**

Mitigation

- There should be selection of mining vehicles and ore beneficiation equipment for lower sound levels.
- Regular maintenance of sound attenuation equipment
- Enclosing noise equipment in buildings with sound absorbing materials.
- Noise protection clothing to be given to site workers
- Alerting people before blasting

d. Injuries

Impact interpretation

Many miners die from mining accidents. Fly rocks from blasting can also put in danger the lives of people and valuables nearby.

Impact assessment and analysis

IMPACT	ORDER OF CAUSATION			
	Direct	**Indirect**	**Induced**	**Cumulative**
Injuries	**X**			

Impact significance rating key

Probability	Very high	High **x**	Medium	Low	
Extent	Beyond boundaries	National	Local	Project area **x**	
Duration	Permanent	Long term **x**	Medium term	Short term	
Magnitude (Severity)	Very severe	Severe **x**	Moderate	Low	
RATING	**1**	**2**	**3**	**4 x**	**5**

Mitigation

To counter such high risk problems from blasting and vibrations, blasts should have to be designed and monitored with the objective of avoiding damage from fly rock, air blast and ground vibration. The risk of causing injuries to human beings or vehicle damage by fly rock should be minimized by closing off sections of public roads. Some of the effective mitigation measures are as follows,

- Parking too far from blasting area
- Blasting Operator or helper should remain inside a blast shelter or in a protected location
- adequate guarding of the access roads leading to the blast area
- Limiting the Presence of loose stones at the blast site

6.5.3 Land use and Territorial impacts

Limited access to land has consequent impact on livelihood, food insecurity, and loss of protected areas. Agricultural production could be affected by mining activities in several ways. Mining could lead to a rise in local wages, reduce profit margins in agriculture, and lead to the exit of many families from farming

a) Land Competition

Impact interpretation

Land competition can arise when the KMC project endanger the wellbeing of local population leading to their impoverishment. The introduction of the KMC project can affect future extension of local people farms and planning which implies a negative impact on livelihood, shelter and consequent food insecurity. There will be opencast mining at the project area which undoubtedly leads to the development of dangerous pits in the area. There is a high risk of loss of lives for both human beings and animals in the area if the pits are not well monitored and protected

Impact assessment and analysis

IMPACT	**ORDER OF CAUSATION**			
	Direct	**Indirect**	**Induced**	**Cumulative**
Land competition	**X**			

Impact significance rating key

Probability	Very high **x**	High	Medium	Low

Extent	Beyond boundaries	National	Local	Project area **x**	
duration	Permanent	Long term **x**	Medium term	Short term	
Magnitude (Severity)	Very severe	Severe **x**	Moderate	Low	
RATING	**1**	**2**	**3**	**4 x**	**5**

Mitigation

The KMC project is located in a mountainous area which does not support crop farming hence the impact is negligible. Intensive agricultural methods should also be utilized to cater limited farming land. Fencing the mining area becomes a good measure to minimize the risks caused by the mining pits. Moreso, there is need to rehabilitate those pits as a long term mitigation to counter the problems caused by abandoned mine pits.

b) Lack of stakeholder inclusion

Impact interpretation

Lack of stakeholder inclusion and non-involvement of indigenous communities can be problematic. There can be unsustainable partnerships between KMC, communities and local municipality. Integrated development helps to maximise the resources and establish projects that can make a significant impact. The nature of development that is currently taking place need integration of the indigenous people. If not, this usually has a negative impact on the sustainability of the project because you will find that there is no buy in from the community side who are the recipients of development.

Impact assessment and analysis

IMPACT	ORDER OF CAUSATION			
	Direct	**Indirect**	**Induced**	**Cumulative**
Lack of stakeholder inclusion			**X**	

Impact significance rating key

probability	Very high **x**	High	Medium	Low	
Extent	Beyond boundaries	National **x**	Local	Project area	
Duration	Permanent	Long term **x**	Medium term	Short term	
Magnitude (Severity)	Very severe	Severe **x**	moderate	Low	
RATING	**1**	**2**	**3**	**4 x**	**5**

Mitigation

It is imperative that the management of KMC take these concerns from the community members seriously so that their relationship with them is improved. Improving this relationship is vital for long-term mining business in the area, otherwise there is risk of losing significant revenue due to social protests as result of dissatisfaction on the part of the communities.

The improved Communication and Information Dissemination Strategies by KMC enables communities to make quality decisions about their involvement and determines the best possible ways to work together as partners. This is critically important even in creating labour plans, which

include hiring of the mining work force and accruing benefits such as housing and medical benefits, to mention a few. The benefits of information flows far outweigh the costs associated with information asymmetries, which can eventually hinder efficient stakeholder relationships.

KMC also have the community liaison office to foster the continuous engagement with the local people thereby enhancing the grievance handling mechanism between indigenous people and KMC

c.) Impact on cultural heritage sites

Impact Interpretation

The areas of cultural importance in Kamativi can be affected by the mine activities at KMC. There is Chingehari Sacred Mountain which is a site of cultural importance to the local people. There are also graves within the KMC mining area. KMC intends to exhume and rebury the 14 graves at grave site 1.

Impact assessment and analysis

IMPACT	**ORDER OF CAUSATION**			
	Direct	**Indirect**	**Induced**	**Cumulative**
Impact on cultural heritage sites		**X**		

Impact significance rating key

probability	Very high	High	Medium **x**	Low
Extent	Beyond boundaries	National	Local **x**	Project area

duration	Permanent	Long term **x**	Medium term	Short term	
Magnitude (Severity)	Very severe **x**	Severe	Moderate	Low	
RATING	**1**	**2**	**3**	**4 x**	**5**

Mitigation

- As indicated by local community members, there should be respectful relocation/reburial of the exhumed graves as part of their traditional customs. Where possible and in adherence to professional conduct, community members especially relatives must be allowed to participate in the exhumation and reburial process through conducting their ritual ceremonies or taking part in the actual exhumation exercise
- The possibility of affecting the Chingehari Sacred Mountain is limited since the KMC mining target area is far from the mountain. However regular and continuous engagements between KMC and traditional leadership's representatives should be maintained to make sure that all areas of cultural importance are protected.

6.5.4 Human rights

a) Indigenous rights

Impact interpretation

Human rights are the basic rights and freedoms that belong to every person in the world as a virtue of being born. They are based on important principles like dignity, fairness, respect and equality. Human rights are protected by the law. They can never be taken away, although they can sometimes be restricted for example if a person breaks the law, or in the interests of national security. Violation of human rights can have different forms, including discrimination of vulnerable

groups, lack of stakeholder inclusion and respect of indigenous populations, human rights abuse and impacts on cultural and aesthetic.

Impact assessment and analysis

IMPACT	**ORDER OF CAUSATION**			
	Direct	**Indirect**	**Induced**	**Cumulative**
Human rights violation			**X**	

Impact significance rating key

probability	Very high	High	Medium **x**	Low	
Extent	Beyond boundaries	National	Local	Project area **x**	
Duration	Permanent	Long term **x**	Medium term	Short term	
Magnitude (Severity)	Very severe	Severe **x**	Moderate	Low	
RATING	**1**	**2**	**3 x**	**4**	**5**

Mitigation

- KMC quest to respect indigenous people's rights through continuous consultations with the local people and company policy.
- Staff involved in recruiting and personnel decisions should be especially trained in the policies and procedures of the organization and any applicable legal requirements. However, all staff should at least receive a copy of any written policy which outlines the

right of employees and job applicants to be treated without discrimination and with respect for their privacy. It may also be useful to circulate the Key Points from these Guidelines to relevant staff.

- Grievance and complaint process

Internal grievance procedures will maximize the possibilities for resolving a complaint within KMC.

- written policy and procedure

b) Poor working conditions and Unfair remuneration

Impact interpretation

These are conditions in which an individual or staff works, including but not limited to such things as amenities, physical environment, stress and noise levels, degree of safety or danger, and the like. Employees working conditions might be affected by factors including health and safety, security and working hours. Poor working conditions can damage miner's health and put their safety at risk.

Impact assessment and analysis

IMPACT	**ORDER OF CAUSATION**			
	Direct	**Indirect**	**Induced**	**Cumulative**
Poor working conditions and poor remuneration	**X**			

Impact significance rating key

probability	Very high	High	Medium **x**	Low

Extent	Beyond boundaries	National	Local	Project area **x**	
Duration	Permanent	Long term **x**	Medium term	Short term	
Magnitude (Severity)	Very severe	Severe **x**	Moderate	Low	
RATING	**1**	**2**	**3**	**4 x**	**5**

Mitigation

- Both the employer and employees should decide what could be harmful and take precautions to stop it
- Access to training and information on job safely
- providing equipment and protective clothing needed and ensure it is maintained
- record injuries, diseases and dangerous incidents at work and report these to the Health and Safety Executive where relevant
- have insurance that covers workers in case they get hurt at work or ill through work
- reaching a consensus with employees on wages
- the company should adhere to best standards on workers remuneration

6.6 POSITIVE SOCIO-ECONOMIC IMPACTS ASSOCIATED WITH THE PROJECT

a. Culture Enrichment

Cultural enrichment is defined as any activity that enables exchange of differing ideas, beliefs, rituals, customs and traditions between people with different or similar ethnic or social backgrounds. The KMC project allows Chinese, local people and those from other districts to

share cultural and social experiences and knowledge. Cultural enrichment can be encouraged to promote this exchange in order to foster mutual understanding and tolerance in the project area. Cultural diversity is important because our country, workplaces, and schools increasingly consist of various cultural, racial, and ethnic groups. We can learn from one another, but first we must have a level of understanding about each other in order to facilitate collaboration and cooperation. Learning about other cultures helps people understand different perspectives within the world in which they live, and helps dispel negative stereotypes and personal biases about different groups.

b. Employment creation

It is of no doubt that the KMC project benefited people in terms of employment creation. The employment of local people is essential and should be incorporated into mining agreements and company policy. KMC has already the local people and the local leadership is convinced about KMC recruiting policy.

c. Skills development

One way that projects can contribute to sustainable development is by building human capital through direct training and education of the work force. Employment of local people is often constrained by a shortage of skills within a community. This project can be seen as significant opportunity for workers and other members of local communities to develop skills. Skills training should not be limited to workers but should be extended to Kamativi community as a whole. The design of programmes should consider the need for alternative economic activities to support the community during and after the life of the mine. Skills development should be linked to educational trusts to ensure that opportunities continue after the mine closure.

d. Local development

Mining companies make a wide range of contributions to communities by, for example, donating supplies, providing bonuses for service providers to work in remote areas, or donating funds for the construction of facilities. This can be done thorough corporate social responsibility which can be defined as, the obligation of miners to take actions which protect and improve the welfare of society as a whole, along with their own interests. This definition highlights two aspects of corporate social responsibility. The first aspect talks to protecting the welfare of society, i.e. to avoid the negative impacts on society, while the second aspect talks to improving the welfare of society. In that regard KMC should therefore intervene in the provision of social and economic services for example, water and sanitation, electricity, road development, schools and hospitals. It is imperative to take note that in terms of CSR, KMC has already done justice to the local community as they are helping in community development projects.

Business opportunity

The expansion of KMC components will led to the increase in business opportunities in the area since many people are employ at KMC. High rate of employment in the area will therefore lead to more services demand. Local people can consequently utilize this opportunity to maximize or start new businesses in the area. The responsible authorities are therefore encouraged to enhance this opportunity by creating conducive environment where business people can operate their small businesses with affordable licenses**.**

e. National development

Minerals augment a great source of income directly and indirectly to an economy. Mineral resources are precious, non-renewable and limited in supply. Hence, every country acquires revenue levied on the minerals within its political boundaries. The country earn a lot of foreign exchange by exporting Lithium based minerals. An important growth driver of lithium is its use in

the batteries of electric vehicles. However, lithium is also used in the batteries of laptops and cell phones, as well as in the glass and ceramics industry. The indirect benefits of the proposed, mineral exploration and processing project are from its backward and forward linkages. With these linkages, it creates employment, raises industrial and agricultural production, extends market leading trade, commerce, transport and communication. All these factors generate employment and a laudable amount of income. Much of the sales income of the produce goes back into the economy to pay local wages to purchase supplies and materials and in some cases it returns as new funds available for additional local investment.

CHAPTER SEVEN: IMPACT IDENTIFICATION AND ANALYSIS

7.0 INTRODUCTION

An environmental impact is defined as a change in the environment, be it the physical/chemical, biological, cultural and or socio-economic environment. Any impact can be related to certain aspects of human activities in this environment and this impact can be either positive or negative. Impacts could also affect the environment directly or indirectly and the effect of it can be cumulative.

7.1 METHODOLOGY TO ASSES THE IMPACTS

In any process of identifying and recognizing impacts, one must recognize that the determination of impact significance is inherently an anthropocentric concept. Duinker and Beanlands, (1986) in DEAT 2002. Thompson (1988), (1990) in DEAT 2002 stated that the significance of an impact is an expression of the cost or value of an impact to society.

However, the tendency is always towards a system of quantifying the significance of the impacts so that it is a true representation of the existing situation on site. This will be done by using where ever possible, legal and scientific standards which are applicable

The significance of the aspects/impacts of the process will be rated by using a matrix derived from Plomp (2004) and adapted to some extent to fit this process. These matrixes use the consequence and the likelihood of the different aspects and associated impacts to determine the significance of the impacts.

The *consequence matrix* use parameters like *severity*, *duration* and *extent* of impact as well as *compliance* to standards. Values of 1-5 are assigned to the parameters that are added and averaged to determine the overall consequence. The same process is followed with the *likelihood* that consists of two parameters namely *frequency* and *probability*. The overall consequence and

the overall likelihood are then multiplied to give values ranging from 1 to 25. These values as shown in the following table are then used to rank the significance. It must be said however that in the end, a subjective judging of an impact can still be done, but the reasons for doing so must be qualified.

7.2 IMPACT SIGNIFICANCE

Three stages were utilized to establish significance of impacts as follows:

1. *Impact severity*: how severe is the impact (negligible, low, medium and high). The severity of an impact is a function of a range of considerations including:
   i) Impact magnitude
   ii) Impact extent
   iii) Impact duration; and
   iv) Receptor sensitivity.
2. *Likelihood of occurrence*: how likely is the impact to occur (none, low medium and high); and
3. *Identification of the impact significance,* which is the product of a combination of the above two variables.

The process for combining the severity of the impact with the likelihood of the impact is shown as matrix in Chapter 7.3 below.

7.3 THE IMPACT DERIVATION MATRIX

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No

Air/Noise pollution from vehicular usage		✓	*				IS	M	*	
Waste generation		✓				*	L	M	*	
Effluent and solid waste disposal	✓			*			IS	H	*	

Duration (S) Short= 0-5 years, (M) Medium= 6-10 years, (L) Long= >10, (P) Permanent

External: L= Local, IS= Immediate Surroundings, Intensity: L=Low, M=Medium, H=High

Severity

Low- Low cost/high potential to mitigate. Impacts easily reversible, non-harmful

Insignificant change/deterioration or disturbance to natural environments

Low-medium Low cost to mitigate Small/ potentially harmful Moderate change/deterioration or disturbance to natural environment.

Medium Substantial cost to mitigate. Potential to mitigate and potential to reverse impact. Harmful Significant change/ deterioration or disturbance to natural environment

Medium-high High cost to mitigate. Possible to mitigate Great/Very Harmful Very significant change/deterioration or disturbance to natural environment

High Prohibitive cost to mitigate. Little or no mechanism to mitigate. Irreversible. Extremely Harmful Disastrous change/deterioration or disturbance to natural environment

Duration

Low Up to one month

Low-medium One month to three months

Medium Three months to one year

Medium-high One to ten years

High	Beyond ten years

Extent

Low	Immediate/contained area
Low-medium	Surrounding area
Medium	Within urban edge
Medium-high	Within Rural District area
High	Regional, National and International

Frequency

Low	Once/more a year or once/more during operation
Low-medium	once/more in 6 months
Medium	once/more a month
Medium-high	Once/more a week
High	Daily

Probability

Low	Almost never/almost impossible
Low-medium	Very seldom/highly unlikely
Medium	Infrequent/unlikely/seldom
Medium-high	Often/Regularly/Likely/Possible
High	Daily/Highly likely/definitely

7.4 IMPACT IDENTIFICATION

Summary

The negative impacts include but are not limited to:

IMPACT ON WATER RESOURCES

- *Possible siltation of the Kamativi Dam in the vicinity of the project area due to exploration activities.*
- *Acid Mine Drainage.*
- *Pollution of water resources by sewage effluent.*
- *Risk of TSF Failure.*
- *Over subscription on the Kamativi Dam, leading to reduced water throughput downstream*
- *Renewed arsenic load in the dam due to re-opening of the mine.*
- *Possible pollution of water by accidental chemical spillages and oil spillages*

IMPACTS ON PUBLIC INFRASTRUCTURE

- *Closure of the road.*
- *Increased load on the road infrastructure.*

IMPACT ON ECOLOGICAL RESOURCES.

- *Loss of vegetation.*
- *Habitat loss.*
- *Habitat fragmentation.*
- *Loss of Biodiversity.*

IMPACTS ON THE LAND

- *Soil Erosion.*
- *Abandoned open pits and exploration trenches.*
- *Soil Pollution from Chemicals used in the processing plant.*
- *Soil compaction due to onsite transportation.*
- *Loss of Aesthetic value of the local environment.*

WASTE

- *Effluent from the Processing Plant*
- *Solid waste from the slurry.*
- *Oil waste from machinery*

OCCUPATIONAL SAFETY AND HEALTH IMPACTS

- *Noise Emissions.*
- *Blasting Fumes*
- *Fire hazards from diesel storage*
- *Human Wildlife conflicts.*
- *Vibration of the Mine Machinery.*
- *Possible injuries from the mine magazine.*
- *Poor Ergonomics.*
- *Working from Heights.*
- *Confined Spaces.*
- *Domestic animals and people falling into exploration pits.*
- *Fugitive Dust on Mine Roads and dry Tailings from the TSF.*

IMPACTS FROM THE MACHINE REPAIR WORKSHOP

- *Confined Spaces.*
- *Air pollution*
- *Water pollution*
- *Soil contamination*
- *Waste generation*
- *Resource consumption*

7.4 IMPACT ANALYSIS.

7.4.1 IMPACT ON WATER RESOURCES

1.) Siltation of the local Kamativi Dam during Lithium based- minerals exploration and solid waste disposal.

Impact identification

The Kamativi Mining Company's exploration is concerned with establishing the actual size of the mineral deposit. In doing so, various methods are employed including trenching, and drilling. These methods expose the soil particles to the agents of soil erosion namely wind and water. By loosening the soil particles, they become susceptible to soil erosion and they have huge potential of being washed away into the proximal Kamativi Dam and some pools within the Kamativi Mining Company's tenement. Extraction of top soils generates the geological waste, which mainly consists of overburden material in the form of, rock waste, lithological waste and vegetative material. These forms of waste have the potential of being washed away by rainfall if they are not properly secured and end up polluting the water resources within the Kamativi area. The slimes dam and the solid waste dump have the potential to contribute towards the erodible material load.

Impact evaluation

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Siltation of water resources		✓			*		IS	M	*	
								*		

The probability of the impact happening is high and the consequence of the impact is high since communities that depend on the Kamativi dam downstream would be affected by reduced water throughput.

Mitigation Strategies

- Secure the topsoil from the exploration points by use of guards.
- Dump stabilization by planting trees around the solid waste dump.
- Close the exploration trenches as soon as exploration is complete.
- Properly design the Slimes dam to minimize the risk of collapse.

2.) Acid Mine Drainage (AMD)

Impact identification

The exploration and mining activities at the Kamativi Mining Company can result in AMD is the result of the oxidation of sulphide minerals, chiefly iron pyrite or iron Disulphide and sulfuric acid. Activities associated with land disturbance for example exploration and mining can lead to AMD. Trenching and shaft sinking can lead to accumulation of water in trenches and the shafts.When the accumulated water comes in to contact with sulphide minerals and is aerated it can acidify and become contaminated with heavy metals as well as dissolved or suspended solids.

Acid Mine Drainage is a potentially severe hazard that can pollute surrounding soil, groundwater, and surface water. The primary sources for acid generation are sulfide minerals, such as pyrite (iron sulfide), which decompose in air and water. Many of these sulfide minerals originate from waste rock removed as overburden.

Impact evaluation

	Probability of Impact	

Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
AMD		✓			*		IS	H		*

The probability of the impact occurring is high since there would be exposure of the sulphide minerals to the earth's surface especially during exploration and mining, the duration of the impact is expected to be long term and the reversibility of the impact very much difficult until the project ceases to operate.

Mitigation Measures

- Regularly pump out water in the shafts
- The water from the shafts needs to be reused (for dust suppression, mineral beneficiation etc) to minimise contamination of the underground water.
- Overburden run-off collection and treatment with subsequent sediment control will be done.

3) Increased arsenic load in the Kamativi dam due to the opening of the mine.

The rate of arsenic release from sulfide minerals can be accelerated by mining activities, which expose the minerals to weathering processes during excavation. Also, arsenic can be mobilized by weathering of outdoor stored waste byproducts produced during the subsequent metal value recovery process. In the year 2016, Munsaka collected water Samples from different water sources in Kamativi during part of the wet and dry seasons in 2016. Arsenic concentrations exceed the Zimbabwe and World Health Organization's health-based guidelines for drinking, in five out of six main sources, including tap water. Two other water sources had concentrations of aluminium and manganese that exceeded the standards on at least one occasion. Inorganic arsenic is classified as a known human carcinogen by the International Agency for Research on

Cancer. Consuming a large amount of arsenic over a lifetime can increase the risk of cancer in internal organs such as the bladder, lungs, and liver. In areas with naturally high levels of arsenic in the groundwater, arsenic poisoning from drinking water is a serious concern. High concentrations of arsenic in lakes and streams can also be lethal to freshwater fish, invertebrates, and plant life. The increased opening of exploration pits exposes a lot of sulphide minerals to the ground which may resultantly lead to increased generation of arsenic in the Kamativi area.

Impact evaluation

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Loss of vegetation		✓			*		L	L	*	

The probability of the impact occurring is high since a lot of ground is expected to be covered in the exploration works will be immensely conducted, the duration of the impact is expected to be long term given the health effects associated with arsenic. The environmental and health risks associated with the ingestion of arsenic may not be reversible in the long term.

Mitigation Measures

- Avail the MSDS for all chemicals associated with the lithium processing.
- Conduct quarterly water tests for the kamativi dam and ground water sources.
- Regularly pump out water in the shafts
- The water from the shafts needs to be reused (for dust suppression, mineral beneficiation etc) to minimise contamination of the underground water.
- Overburden run-off collection and treatment with subsequent sediment control will be done.

4) Leachate from the TSF Facilities

KMC have in their possession two TSF facilities, the wet and dry TSF. The facilities handle the waste from the processing plant. There is a possibility of leachate contamination of the ground water resources from the TSF. Resources need to be allocated towards monitoring and maintaining the structural integrity of the TSF facilities.

Impact Evaluation.

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Leachate from the TSF facilities		✓			*		L	L	*	

Mitigation measures.

- Lining of the TSF using HDPE material.
- Sinking of monitoring boreholes
- Installation of software to monitor TSF stability especially the wet deposition TSF.
- Regular monitoring of the Facilities by personnel.

7.5.2 IMPACT ON ECOLOGICAL RESOURCES.

1.) Excessive site clearing leads to vegetation loss.

The site vegetation will be negatively affected by the Lithium-based minerals exploration and mining activities. Site clearing and the subsequent stripping of site topsoil reduces the vegetation's potential to flourish in the area. Project vehicles are expected to tramp on the vegetation in the tenement during exploratory works. Vegetation disruption leaves the site soil susceptible to erosion due to a lack of the vegetation's shear strength to bind the soil together.

Impact evaluation

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Loss of vegetation		✓			*		L	L	*	

Generally, exploration and mining works are anticipated to have a considerable disturbance on the huge expanse of the land which is covered by the special mining lease. Site clearing is going to be conducted on an extensive scale and the footprint of such activities considered to be very huge.

Mitigation measures:

- Use designated access routes
- Avoid off-road vehicular usage
- Avoid random site clearing
- Planting trees to be part of the KMC's Corporate Social Responsibility.
- Reforestation
- Rehabilitation using material that promotes vegetation growth

2.) Habitat loss

Impact identification:

Habitat loss is the process by which natural habitat is damaged or destroyed to such an extent that it no longer is capable of supporting the species and ecological communities that naturally occur there. The clearing of new exploration and mining sites will see site vegetation being cut down to allow access to the site and as preparation for the activity.

The most direct effect on wildlife on the Kamativi Mining Company is destruction or displacement of species in areas of excavation and piling of mine wastes. Mobile wildlife species, like game animals, birds, and predators, leave these areas. More sedentary animals, like invertebrates, many reptiles, burrowing rodents, and small mammals, may be more severely affected. Site clearing will see other animals and micro-organisms losing their homes. The birds' nests in the trees on the area of woks will be lost. The ants, termites and other micro-organisms will lose their habitats. Some animals and microorganisms living in the piled waste onsite will lose their habitats since the waste will be removed during site clearing.

Impact evaluation

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Habitat Loss		✓			*		L	M	*	

The likelihood of the impact is high since the site vegetation located on the area intended for work will be cut. It is obvious that vegetation will be cut. The impact will be moderate since most of the clearing has already been done.

Mitigation measures

- Avoid random cutting down of trees, site clearing to be done on the project area earmarked for exploration, mining or processing activities **ONLY**

3.) Habitat fragmentation

Impact identification:

Habitat fragmentation occurs when large areas of land are broken up into smaller and smaller patches during exploration, mining and processing infrastructural development making dispersal by native species from one patch to another difficult or impossible, and cutting off migratory routes. Isolation may lead to local decline of species, or genetic effects such as inbreeding. Species that require large patches of forest simply disappear.

Impact evaluation

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Habitat fragmentation		✓				*	IS	M	*	

It is obvious that there will be habitat fragmentation on the site and so the likelihood of the impact is high. The impact severity will be moderate since implementation of the project is done in an environmentally friendly way.

Mitigation measures

- Environmentally friendly site clearing.
- **NO** random cutting down of trees
- Demarcation of the site to localize habitat loses
- Planting of trees to create other habitats.

4.) Loss of Biodiversity

Impact identification:

To varying extents, almost every stage of the exploration cycle damages the environment. During mineral exploration and mining land should be cleared and top soil removed as the drill rigs

manoeuvre the landscape where the mineral deposits are thought to exist. Mining likewise has dire consequences on biodiversity. Habitat loses has a direct impact on the ecological community which will lose their homes as a result of the project implementation. The native birds will face extinction from the site as their nests will be destroyed. Some vegetation species will be lost as project will be implemented. Basically, project implementation will reduce the site's carrying capacity and will see the displacement of biota on the site environment.

Impact evaluation

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Biodiversity loss		✓			*		L	M	*	

The probability of biodiversity loss is high and the severity is high since both flora and fauna will be affected by the implementation of the project. The fact that the species found on aquatic ecosystems are endemic species makes the severity and likelihood to be high.

Mitigation Strategies

- Environmentally friendly site clearing.
- NO random cutting down of trees
- Demarcation of the site to localize habitat loses
- Planting of trees to create other habitats.

7.5.4 IMPACTS ON THE LAND.

1.) Soil Erosion

Exploration logically entails vegetation clearance through surface drilling and trenching and other forms of land clearance to access the mineral deposits. The removal of vegetation during site clearing eliminates the soil binding material leading to soil erosion. Excavation itself during the exploration and mining phase loosen the soil thereby increasing its susceptibility to soil erosion.

Impact evaluation

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Soil erosion		✓	*				L	M	*	

The likelihood of the impact occurrence is very high and the severity is also high. This therefore is a major impact of the project and has to receive priority in devising mitigation measures.

Mitigation measures

- Avoiding haphazard site clearance
- Erecting mechanical conservation works where possible
- Re-vegetation.

2.) Soil Pollution from chemicals

The Lithium-based minerals involves reagent preparation where sodium hydroxide is introduced into the system to acidify the minerals during Flotation. These chemicals need to be managed closely as their traces can be found in the resultant effluent. The chemicals have got the potential to contaminate ground water resources in the ambient environment. The storage of hazardous substances for example diesel and paints and other solvents on the mine site may lead to accidental spillages which also have the potential to contaminate the ground water resources.

The biggest potential for soil contamination is mainly confined to the TSF facility since the structure is gigantic and is expected to host waste for a long period before it is decommissioned.

Impact evaluation

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Soil pollution from chemicals		✓	*				L	H		*

The **probability** of soil contamination and erosion is **high** and extent will be on the project site. The duration of the impact is short term. Impact severity is consequently considered ***critical*** if it happens**.**

Mitigation measures

- Adhere to the MSDS for all the chemicals used in lithium processing to manage emergencies.
- The TSF should always be lined to prevent soil contamination.
- The dump should always be stabilized with vegetation to prevent possible contamination of the soil.
- Maintenance of storage and dispose areas to prevent accidental release into the soil environment will be done.
- The control of storm water runoff and prompt re-vegetation on disturbed areas will be carried out.
- Constant monitoring of the sewer system will be done to prevent any leakages into the soil and environment.

- The must always be lined to prevent any leakage of processing chemicals into the environment.

3.) Loss of Aesthetic value of the local environment

Impact identification

The KMC Exploration, Mining and Processing project has the potential to upset the aesthetic value of the environment. Visual outlook of the project site would be significantly affected by the piling of overburden, mineral ore and littering on the site, abandoned exploration trenches abandoned shaft openings, abandoned open pits and used TSF.

Impact evaluation

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Loss of aesthetic value of the land.		✓			*		L	L	*	

The likelihood of the impact happening is high and the significance is considerable. The duration of the impact is expected to long term. There are abandoned pits already in the tenement which needs to be rehabilitated depending on the mining plan for KMC.

Mitigation Measures

- Planned systematic piling up of the material unlike random piling.
- Leveling of the site as the mine is rehabilitated
- Backfilling of the trenches, open pits and shafts (Rehabilitation).

7.5.5 WASTE

1.) Effluent from the Processing Plant

Impact identification

The KMC project has a TSF which produces effluent. The effluent will have residual chemicals that were used during the processing of the Kamativi Mine's Lithium based minerals. Effluent will also come from the workshop in the form of waste water from cleaning and servicing of machinery. The sewage system of the mine also produces huge amounts of effluent. The chemicals used in the processing of the Lithium based minerals are used during Reagent preparation. The effluent is managed at the TSF level and the sewage facility hosts the human faecal material and will be managed independently.

Impact evaluation

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Effluent from the Lithium-based minerals processing plant.		✓			*		IS	M	*	

The project will always produce effluent to the impact likelihood of occurrence is high. However, there is robust effluent management system onsite such that the effluent's impact on the environment is minimized.

Mitigation Measures

- Drilling of adequate monitoring boreholes

- Quarterly Effluent survey
- Use of Standard operating procedures in order to produce effluent that is within the SI 6 stipulated tolerance standards
- Lining of the TSF

7.5.6 OCCUPATIONAL SAFETY AND HEALTH IMPACTS

1) Human wildlife conflicts

The Kamativi area is situated 29 km from the Hwange national park boundary, which is a park with the highest elephant populations in the Zimbabwe. The ever dwindling food reserves in the park coupled with competing land uses like mining activities in the park has resulted in increased migratory tendencies by wild animals encroaching into human settlements. This phenomenon has resulted in more pronounced human wildlife conflicts in the Hwange area. Closer home, the Kamativi dam is a rich source of fish for the compound dwellers, who mainly constitute the former employees of the company and their dependents. The peril of fishing in the dam comes in the presence of crocodiles and hippos in the dam which occasionally attack and kill the people who are into the fishing business.



Fig 7.1 the crocodile infested Kamativi Dam.

Impact Evaluation

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Human wildlife conflicts in the Kamativi area.		✓			*		IS	M	*	

The probability of the impact happening is high since the Kamativi area has high crocodile populations which endanger public safety. The duration of the impact is expected to be long term since the project is expected to employ many people on a long term basis. The impact is highly anticipated to be localized since there are no immediate land uses outside the mine.

Mitigation Measures.

- Farmers should cooperatively keep their farm against crop raiders to minimize crop loss by using most effective method in an area.
- The park authority should provide compensation for wildlife induced damage in and around the park.
- The Zim Parks should work hard to increase the awareness of the local people about the importance of wildlife conservation.
- The park authority should provide fence or other method that used to protect crops, peoples and livestock from threat.
- Stakeholders should reduce human settlements around the forest, expansion of farmland and cattle grazing in and around the National Park.

- To reduce the dependency of the local people in and around the national park, it is better to encourage the local people to plant trees for their various types of utilization.
- Investigate the viability of fencing off the Kamativi Dam to limit access to the dam.
- Deploy security personnel to the Kamativi Dam to monitor trespassing and fish poaching which expose people to crocodile attacks.

2.) Noise and Vibration of the Mine Machinery

There is noise from the site machinery, equipment and the vehicles. Machinery like the crusher, ball mill and conveyor belt make noise which may affect the worker's auditory system. The noise affects the employees' onsite as well as the wildlife that may stray near the site. The vibrating equipment like the scrubber and vibrating screen also affects the employees' onsite. Vibration may affect the worker's nervous system or contribute to "vibration white finger".

The vibrating machinery may also affect the employees' onsite. The vibration may affect the whole body or parts of the body. Pressure changes in the air cause the eardrum to vibrate. The vibrations are then transmitted to the malleus through the incus and to the stapes, which in turn is connected to the inner ear. The inner ear contains the cochlea, which contains the organ of corti. Inside the organ of corti are sensory hair cells surrounded by fluid. The movement of the bones in the middle ear causes the fluid in the inner ear to move as well and this in turn stirs the hair cells whose activity is picked up by the auditory nerve and sent to the brain where the movement is then perceived as sound and classified into categories as previously mentioned. Exposure of the ear to excessive noise results in temporary or permanent destruction of the hair cells resulting in reduced capacity to perceive sound. The effects of exposure to noise are many depending on the intensity and duration of exposure and these are now discussed.

Impact evaluation

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Noise and vibration.		✓	*				IS	M		*

The likelihood of the impact happening is high while the severity is medium. The impact significance is moderate.

Mitigation Measures

- Hearing Conservation Programs (HCPs)
- Replacement of old equipment to eliminate the hazards
- Regular servicing of the equipment as engineering control of the hazards
- Introducing rotational shiftwork to reduce hours of exposure per worker as an administrative control of the hazard
- Provision of PPE to the workers (Ear plugs/ muffs)

Environment	**PPE**
All working environments	Overalls and work suits
Possibility of falling objects on toes	Steel capped safety shoes
Falling objects on head	Hard hat
Flying objects that can get into the eye	Eye protection, safety goggles

Injury on hands	Gloves
Dark areas	Cap lamp
Small openings	Knee guards
Possibility of falling from heights	Safety chain.
Dust and fumes	Dust masks.

3) Fugitive Dust on Mine Roads

Impact identification

The Kamativi Mine site is susceptible to the generation of fugitive dust owing to the site conditions especially the soil type. Most of the site roads are primarily dirty roads and the site local climatic conditions exacerbates generation of dust on the Kamativi site. Evaporation rates exceed soil moisture content because of the extreme heat in the area. There is a great deal of dust generation in the KMC haul roads. There is also a danger of generation of chemical dust in the form of dry tailings from the TSF especially if the slimes dam is dry and on windy day.

There are efforts to suppress the dust in the form of watering the road surfaces by the proponent. However, the strategy has got flaws as far as the implementation is concerned.

Impact evaluation

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Fugitive dust on the mine roads.		✓	*				IS	M	*	

The likelihood of the impact occurring is very high while the impact severity is also high. However, it should be highlighted that the fugitive dust issue is not topical because the company has surfaced part of the mine roads with tar, and the rest are well maintained.

Mitigation Measures

- Increase the frequency of watering the roads
- Avoid speed when watering the surface
- Observe the prevailing weather patterns so as to make sure the watering is proportional to the prevailing weather conditions.
- Avoid strip watering of the roads
- Enhance the dust suppression strategies by adopting supplementary strategies like construction of wind breaks, artificial surfacing of site roads within the plant.

4) Poor Ergonomics

Impact identification

Ergonomics focuses on ensuring that the workplace is safe, comfortable, easy to use, and enhances performance. Completing an ergonomics assessment can help in the identification of any issues or problems that may currently affect the worker's health and productivity or that could cause potential hazardous in the future. Common reasons for ergonomic assessments:

• Special physical needs for employees (handicapped, postpartum, or injured workers)

• Testing of new office equipment and work station furniture

• Physical complaints by employees or worker's compensation compliance

The KMC needs to adopt a comprehensive Ergonomics plan in order to maintain a healthy workforce.

Mitigation Measures

- Proper work design
- Regular SHE Inspections
- Elimination of such ergonomic hazards in the work station

5) Pneumoconiosis from fugitive Mine Dust

Impact identification

The Lithium-based Exploration, Mining and Processing operations at the KMC have great potential to generate fugitive dust. Mining, maintenance or processing activities can result in the release of dust particles into the air. Exposure to dust in mining and quarrying continues to be a major risk to the health of workers.

Breathing in dust, such Mineral dust, silica dust and other finely powdered materials, can damage the lungs and airways. The risk to health varies depending on the size and nature of the dust particles.

Exposure to dust can cause irritation to the eyes, skin and respiratory tract, and prolonged exposure can lead to a range of serious lung diseases including silicosis, coal workers' pneumoconiosis (CWP), chronic obstructive pulmonary disease (COPD) and lung cancer.

Dust may lead to reduced vision on the site roads. The drivers may fail to see clearly as a result of the dust. The situation is exacerbated by the aridity characterizing the project area. The dust also affects the health of the workers. They cause Pneumoconiosis to the workers.

Impact evaluation

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Pneumoconiosis from mining dust		✓				*	IS	H		*

The likelihood of the impact happening is high while the severity is also high since the workers may inhale the dust. The impact significance is critical especially for workers with predisposing conditions in the form of underlying health problems.

Mitigation Measures

- Preplacement tests to determine the susceptibility of the worker to Pneumoconiosis.
- Worker medical surveillance
- Use water accumulating in the site pits to dampen the site regularly as a dust suppression measures.
- Robust Dust suppression measures.

6) Fire Hazards from fuel storage onsite.

Impact identification

Fuel in the form of diesel is highly flammable and the risk of fire is very high. Fire can happen if fuel comes into contact with a heat source capable of igniting it. An ignition spark might come from an electrical switch, a cigarette or a static electrical discharge. It is common knowledge that Chinese nationals have a strong affinity for smoking cigarettes and this can be a strong source of ignition at the Kamativi site. Fuel is a hazardous chemical since it is a flammable liquid. The risk of fire is posed by:

- ✓ *Storage of fuel*

- ✓ *Smoking by Employees or Customers*
- ✓ *Using Plastic Containers*
- ✓ *Compressed Air Systems to service customers who require tyre pressure*
- ✓ *Electrical equipment cable of generating heat sufficient to cause ignition*
- ✓ *Vehicle Movement*

There is considerable movement of cars and other vehicles on the forecourt which could lead to accidental collision with structures, people and other vehicles.

Impact evaluation

The likelihood of the impact happening is high and the significance is considerable since diesel is highly inflammable substance.

Mitigation Measures

- Identify hazardous areas and control all sources of ignition - use appropriate warning and hazard signs.
- Provide concretized, and non-combustible materials around the Diesel tanks to avoid fires around the tanks.
- Train staff in the safe use of the compressed air equipment
- Any electrical equipment (or mechanical equipment capable of generating enough heat to cause ignition) must be suitably rated and certified before they can be installed in a hazardous zone within the station.
- Drivers should be advised to turn off their vehicles' engines when refueling
- Don't smoke, light matches or use lighters at the service station
- Provision of dry sand, fire extinguishers at the site

7) Blasting fumes

The Blasting operations on the quarry mine produce fumes which remain trapped in the pits long after blasting has been completed. The workers who work in the quarry pits are at the risk of suffocating as a result of depleting the effect the fumes have on the oxygen.

Impact Evaluation

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Blasting Fumes		✓				*	IS	H		*

Mitigation Measures

- Allowing a lay off period after blasting to give room for the fumes to disperse before redeploying workers
- Maintain open air ventilation of the Lithium-based minerals mining pits.
- Rotating workers through shift work to control the time of exposure to the fumes.
- Ensure the blasting radius of 500 metres is maintained.

7.5.7 IMPACTS ON PUBLIC INFRASTRUCTURE

1) Destruction of the Dete-Kamativi road.

There is high probability that the 3 km stretch of the Cross Dete-Kamativi road that passes through the Kamativi Mine will be affected by the mining.

Impact Evaluation

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Diversion of the road.		✓				*	IS	H	*	



Fig 7.1: Blasting near the Road

Mitigation Measures

- A diversion of the 3km stretch will be necessary.
- Compile an Environmental Management Plan for the environmental liabilities associated with road construction.
- Adequate road signage to be installed
- Engage the affected parties, the landowners where the proposed road traverses.

2) Increased pressure on the Dete-Kamativi road.

The Implementation of the KMC exploration, mining and processing has ignited the need for delivering material needs for the operation and daily running of the company for example diesel and explosives. The mine is dependent on services and goods from the city of Bulawayo, Hwange town and sometimes the city of Harare and even abroad. KMC also relies on road transport networks to deliver the lithium based processes products to various Ports like Durban and in order to achieve this, they rely on road network and to begin they use the Dete-Kamativi road. The road falls under the Jurisdiction of the Department of roads stationed at Binga. Servicing of this road seems very low and the pressure being put by heavy vehicles exacerbates the state of the road.

Impact Evaluation

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Pressure on the Dete-Kamativi road		✓				*	IS	H	*	

Mitigation Measures.

- KMC to help maintain the road as part of their CSR.
- Adhere to stipulated loads and avoid overloading.

7.6 IMPACTS ON MACHINE REPAIR WORKSHOP

1) Water pollution by chemicals from the workshop

Mechanical repair workshops embark on various activities chief among them is the servicing of vehicles both small and heavy vehicles for the running of the KMC. KMC generates used oils in the process and the storage or rather handling of the hazardous wastes needs to be done

diligently to avoid contamination of the surface and ground water resources by the used oils and other chemicals in the workshop.

Impact Evaluation

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Water pollution by chemicals from the workshop.		✓				*	IS	H	*	

Mitigation Measures

- KMC to prioritise proper containment of used oils to avoid leaks.
- Selling used oils to waste recyclers.
- Install an oil separator in the workshop.
- Good housekeeping to be practised.

2) Waste Generation

Impact Identification

Workshops generate various types of wastes when they are fully operational and these wastes range from scrap metals, hazardous wastes which all need proper disposal to avoid environmental degradation.

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No

Wastes from the workshop		✓				*	IS	H	*	

- Good housekeeping to be practised.
- Provide proper waste receptacles.
- All waste should be disposed according to regulatory standards.

3) High resource consumption.

Impact identification.

Equipment servicing requires energy, water and other resources contributing to environmental stresses if not manged properly.

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
High resource consumption		✓				*	IS	H	*	

Mitigation Measures.

- Water recycling and reuse is advised
- Implement energy efficient practises eg LED lighting.
- Turn off equipment when not in use.
- Regular maintenance of equipment to reduce energy consumption.
- Make maximum use of day light.

7.7 IMPACTS FROM THE DRY TAILINGS FACILITY.

1) Air quality is compromised

The dry tailings facility has the potential to generate windblown dust and compromise the ambient air quality. The severity of the impact is largely determined by wind speed and moisture content of the tailings.

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Air quality		✓				*	IS	H	*	

Mitigation measures

- Grow more trees to act as wind breaks
- Water sprays to stabilise the surface of the TSF
- Surface compaction.

2) Water pollution

The dry TSF has the potential to pollute both surface and ground water resources through erosion and leachate into the ground water resources. The management initiatives in place will be monitored against water pollution.

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Water pollution		✓				*	IS	H	*	

Mitigation measures

- HDPE or clay liner system to be introduced.
- Leachate collection and treatment system is advised.

3) Soil and ground water contamination.

The dry TSF has the potential to generate soil contamination through heavy metals or chemicals from the tailings and from acid rock drainage if sulphides are present in the TSF materials.

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Soil and water contamination		✓				*	IS	H	*	

Mitigation measures.

- Geochemical testing.
- Neutralisation additives.
- Ground water monitoring network
- Monitoring boreholes.

4) Biodiversity loss

The dry TSF requires land on which it is going to be sitting on. The most direct way in which it is going to affect biodiversity is through habitat fragmentation or habitat loss through displacement of certain organisms that resides at that particular piece of land.

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Biodiversity loss		✓				*	IS	H	*	

Mitigation measures

- Biodiversity offset program.
- Rehabilitation of the affected area.

5) Waste Generation

The TSF has the potential to generate waste in form of dry tailings materials and these materials require storage. The tailings by their nature are waste products of the mineral processing hence if there is no immediate use of these materials, they consume productive land.

	Probability of Impact									
Impact	Low	High	Duration				Extent	Intensity	Reversibility	
			S	M	L	P			Yes	No
Waste generation.		✓				*	IS	H	*	

Mitigation Measures.

- Beneficiation of tailings for backfill or cement production.
- Tailings re-processing for metal recovery.

7.7.1 THE IMPACTS MATRIX FOR KMC TSF FACILITIES.

The matrix used for the assessment of the impacts on the TSF facilities for KMC

is the 5*5 matrix. Using this risk rating methodology, the severity and the likelihood of the impact occurring are considered, since risk is a product of the two. The risk rating impact helps rank the potential TSF impacts and prioritize the impacts.

In order to achieve this objective, impacts need to be identified first, then impacts of similar nature are grouped into one bracket and the highest score in that particular group is achieve clarity, efficiency and materiality. Impacts with a high priority are given immediate attention and impact rating helps KMC in its decision making process and channel resources towards management of such impacts.

There is need to track performance of the impacts and re-rate them overtime after implementation of the mitigation measures to prove improvement for example dam breach systems if fully implemented may reduce the priority from High to medium over time. KMC has already implemented the Global Navigation Satellite System (GNSS) software system for monitoring the stability of the TSF Facilities.

Impact	Severity (1-5)	Probability (1-5)	Risk Rating S*P	Priority
Dam breach from overtopping.	5	3	15	**High**
Piping failure through embankment	4	3	12	**Medium**
Dust emissions	4	3	12	**Medium**
Surface water	2	4	8	**Medium**

contamination				
Ground water contamination.	5	1	5	**Low**

In the risk rating matrix,

High (16-125) - critical, needs immediate mitigation.

Medium (6-15) medium priority, monitor and mitigate.

Low (1-5) Low priority, routine management of the impacts.

Severity of the impact is determined by (magnitude +duration +reversibility) where 1= negligible, 5= catastrophic.

Probability (likelihood of occurrence) 1=rare, 5= certain

7.8 POSITIVE IMPACTS

- ↔ Enhancement of employment opportunities due to magnification of production at the mine.
- ↔ Increased Tin, Tantalite and Lithium Output and Contribution to GDP to satisfy both local and international demand for the minerals and associated services.
- ↔ Increased Production expectedly result in more CSR Programmes benefiting the community.
- ↔ Provision of Housing to the non-employees' part of the local community.
- ↔ Maintenance of Local Roads.
- ↔ Provision of water to the local community.

7.9 THE IMPACTS MATRIX FOR KMC.

The matrix used for the assessment of the impacts for KMC is the 5*5 matrix. Using this risk rating methodology, the severity and the likelihood of the impact occurring are considered, since risk is a product of the two.

In order to achieve this objective, impacts need to be identified first, then impacts of similar nature are grouped into one bracket and the highest score in that particular group is achieve clarity, efficiency and materiality. Impacts with a high priority are given immediate attention and impact rating helps KMC in its decision making process and channel resources towards management of such impacts.

There is need to track performance of the impacts and re-rate them overtime after implementation of the mitigation measures to prove improvement for

example dust suppression systems if fully implemented may reduce the priority from High to medium over time.

Impact	Severity (1-5)	Probability (1-5)	Risk Rating S*P	Priority
Fugitive dust	4	4	16	**High**
Water pollution through acid mine drainage	5	3	15	**Medium**
Noise and vibration	3	3	9	**Medium**
Land degradation	2	4	8	**Medium**
Occupational accidents	5	1	5	**Low**
Socio economic challenges	4	1	4	**Low**
Waste tailings spills	4	1	4	**Low**

In the risk rating matrix,

High (16-125) - critical, needs immediate mitigation.

Medium (6-15) medium priority, monitor and mitigate.

Low (1-5) Low priority, routine management of the impacts.

Severity of the impact is determined by (magnitude+duration+reversibility) where 1= negligible, 5= catastrophic.

Probability (likelihood of occurrence) 1=rare, 5= certain.

CHAPTER EIGHT: ENVIRONMENT MANAGEMENT PLAN MATRIX

8.0 INTRODUCTION

The environment management plan matrix presents a summary of management initiatives that will be required to ensure the identified potential impacts and benefits are mitigated and maximized respectively. It also indicates who will be responsible for undertaking the management initiative. The monitoring and evaluation indicators are also tabled in this chapter. The chapter also lays down the plan for monitoring the potential impacts during project implementation and decommissioning stages. Please note that this Environmental Management and Monitoring Plan is a strategic chapter which should be implemented in line with the activities outlined in chapter 7. The EIA is a management tool and not an activity checklist, so reference is required to Chapter 7 in EMA reviews and proponent implementation of the EIA.

8.1 EIA MATRIX FOR IMPACTS ON WATER RESOURCES

Issue	Mitigation Measures	Implementing Agent	Monitoring Agent	Timeframe	Frequency of Monitoring
Potential siltation of the Kamativi dam.	• Close the dewatering trench • Timing of exploration works when the weather is dry. • Secure the topsoil from the	KMC	EMA, ZINWA	Throughout the project's life span	Quarterly

	exploration points by use of guards. • Dump stabilization by planting trees around the solid waste dump. • Close the exploration trenches as soon as exploration is complete. • Properly design the Slimes dam to minimize the risk of collapse.				
Acid Mine Drainage	• Regularly pump out water in the exploration trenches. • The water from the shafts needs to be reused (for dust suppression, mineral beneficiation etc.) to minimize contamination of the underground water. • Overburden run-off collection and treatment with subsequent sediment control will be done.	KMC	EMA, ZINWA	Throughout the project's life span	Quarterly

	• Avail the MSDS for all chemicals associated with the lithium processing. • Conduct quarterly water tests for the kamativi dam and ground water sources.				
Increased arsenic load in the Kamativi dam due to the opening of the mine.	• Process water needs to be reused to minimise contamination of the underground water. • Lining of the slimes dam and tailings dump to minimize leakages into the environment. • The surface of the dumps needs to be limed and alkaline trenches dug to reduce the solubility of the chemicals hence reduce their mobility and potential to cause pollution to the water bodies. • The chemical leakages will be minimized	KMC	EMA, ZINWA	Throughout the project's life span	Quarterly

	so that their concentration will not exceed the assimilative capacity of the environment. • Collection/storage of leachates, seepages, wash-offs with subsequent treatment will be done so as to avoid adverse effects to the environment. • Proper sanitation and provision of domestic and sewage effluent treatment is required so as to maintain environmental integrity. • Overburden run-off collection and treatment with subsequent sediment control will be done. • In tailing dams and heaps, the large surface area enables decomposition of arsenic Actual degradation rates need to be detailed through test work on a site-specific basis using conditions that mimic, as closely as possible, the				

	types of solution and the natural processes that are likely to occur at that location. The values obtained from the tests will demonstrate the ability of natural degradation to reduce the arsenic concentration of solutions. •				
Leachate from the tailings (both dry and wet TSF)	• Sink monitoring boreholes to monitor ground water. • Lining of both the TSF facilities to entrap the leachate. • Quarterly monitoring of the ground water resources	KMC	EMA, ZINWA, HRDC.	Throughout the project's life cycle	Quarterly

8.2 EIA MATRIX FOR IMPACTS ON ECOLOGICAL RESOURCES

Issue	**Mitigation Measures**	**Implementing Agent**	**Monitoring Agent**	**Timeframe**	**Frequency of Monitoring**
Loss of vegetation	• Use designated access routes • Avoid off-road vehicular usage	KMC	Forestry Commission EMA, HRDC	Throughout the project's life span	Quarterly

	• Avoid random site clearing • Planting trees to be part of the KMC's Corporate Social Responsibility. • Reforestation • Rehabilitation using material that promotes vegetation growth				
Habitat loss	• Avoid random cutting down of trees, site clearing to be done on the mining area ONLY	KMC	Forestry Commission EMA, HRDC	Throughout the project's life span	Monthly
Habitat fragmentation	• Environmentally friendly site clearing. • **NO** random cutting down of trees • Demarcation of the site to localize habitat loses • Planting of trees to create other habitats.	KMC	Forestry Commission EMA, HRDC	Throughout the project's life span	Quarterly, Monthly
Loss of Biodiversity	• Environmentally friendly site clearing. • NO random cutting down of trees	KMC	Forestry Commission EMA, HRDC	Throughout the project's life span, At decommissioning	Quarterly

	• Demarcation of the site to localize habitat loses • Planting of trees to create other habitats.				

8.3 EIA MATRIX FOR IMPACTS ON THE LAND

Issue	Mitigation Measures	Implementing Agent	Monitoring Agent	Timeframe	Frequency of Monitoring
Soil Erosion	• Avoiding haphazard site clearance • Erecting mechanical conservation works where possible • Revegetation.	KMC	EMA, HRDC	Throughout the project's life span	Quarterly
Soil Pollution from Lithium-based processing chemicals.	• Avail the MSDS for all chemicals used in Lithium processing and follow the procedures for handling the chemicals. • The TSF should always be lined to prevent soil contamination. • The dump should always be stabilized with vegetation to prevent possible contamination of the soil.	KMC	EMA, HRDC	Throughout the project's life span	Quarterly

	• Phyto-remediation will be done at the dump i.e. planting plants that will extract heavy metals from the dump and minimise any possible leakage. • Maintenance of storage and dispose areas to prevent accidental release into the soil environment will be done. • The control of storm water runoff and prompt re-vegetation on disturbed areas will be carried out. • Constant monitoring of the sewer system will be done to prevent any leakages into the soil and environment. • The must always be lined to prevent any leakage of cyanide into the environment.				
Ground Subsidence after Blasting	• Proper Charging of the Blasting Operations	KMC Mining Department	Ministry of Mines, EMA, HRDC	Throughout the project's life span	Quarterly

	• Properly designed and planned blasting operations • Rehabilitation will be proportional to mining.				
Loss of Aesthetic value of the local environment	• Planned systematic piling up of the material unlike random piling. • Leveling of the site as the mine is rehabilitated • Backfilling of the trenches, open pits and shafts (Rehabilitation).	KMC Mining Department	Ministry of Mines, EMA, HRDC	Throughout the project's life span	Quarterly

8.4 EIA MATRIX FOR WASTE

Issue	**Mitigation Measures**	**Implementing Agent**	**Monitoring Agent**	**Timeframe**	**Frequency of Monitoring**
Effluent from the Processing Plant	• • Drilling of adequate monitoring boreholes • Quarterly Effluent survey • Use of Standard operating procedures in order to produce effluent that is within the SI 6 stipulated tolerance standards	KMC	EMA,HRDC, ZINWA	Throughout the project's life span	Quarterly

	• Lining of the TSF				

8.5 EIA MATRIX FOR OCCUPATIONAL HEALTH IMPACTS

Issue	Mitigation Measures	Implementing Agent	Monitoring Agent	Timeframe	Frequency of Monitoring
Noise and Vibration of the Mine Machinery	• Hearing Conservation Programs (HCPs) • Replacement of old equipment to eliminate the hazards • Regular servicing of the equipment as engineering control of the hazards • Introducing rotational shiftwork to reduce hours of exposure per worker as an administrative control of the hazard • Provision of PPE to the workers (Ear plugs/ muffs)	KMC SHE Department	EMA, NSSA	Throughout the project's life span	Quarterly
Blasting Fumes	• Allowing a lay off period after blasting to give room for the fumes to disperse before	KMC SHE Department	EMA, NSSA	Throughout the project's life span	Quarterly

	deploying underground workers • Proper ventilation of the shaft • Rotating workers through shifts • Ensure the blasting radius for the blasting operations is maintained and free of people.				
Poor Ergonomics	• Proper work design • Regular SHE Inspections • Elimination of such ergonomic hazards in the work station	KMC SHE Department	EMA, NSSA	Throughout the project's life span	Quarterly
Pneumoconiosis from fugitive Mine Dust	• Preplacement tests to determine the susceptibility of the worker to Pneumoconiosis. • Worker medical surveillance • Use water accumulating in the site pits to dampen the site regularly as a dust suppression measures.	KMC SHE Department	EMA, NSSA	Throughout the project's life span	Quarterly

	• Robust Dust suppression measures				
Fugitive Dust on Mine Roads.	• Increase the frequency of watering the roads • Avoid speed when watering the surface • Observe the prevailing weather patterns so as to make sure the watering is proportional to the prevailing weather conditions. • Avoid strip watering of the roads • Enhance the dust suppression strategies by adopting supplementary strategies like construction of wind breaks, artificial surfacing of site roads within the plant.	KMC	EMA, HRDC	Daily	Quarterly Throughout the project life span
Risk of Domestic animals falling in to pits	• Rehabilitation • Mining site perimeter fencing to localize the risk	KMC	EMA	Progressively	Throughout the project life span

	• Barricading the deep pits				
Human Wildlife conflicts	• Farmers should cooperatively keep their farm against crop raiders to minimize crop loss by using most effective method in an area. • The park authority should provide compensation for wildlife induced damage in and around the park. • The Zim Parks should work hard to increase the awareness of the local people about the importance of	KMC	Zim Parks, EMA	Progressively	Throughout the project lifespan.

	wildlife conservation. • The park authority should provide fence or other method that used to protect crops, peoples and livestock from threat. • Stakeholders should reduce human settlements around the forest, expansion of farmland and cattle grazing in and around the National Park. • To reduce the dependency of the local people in and around the national park, it is better to encourage the				

	local people to plant trees for their various types of utilization. • Investigate the viability of fencing off the Kamativi Dam to limit access to the dam. • Deploy security personnel to the Kamativi Dam to monitor trespassing and fish poaching which expose people to crocodile attacks. •				
Fire hazards from diesel storage onsite.	• Identify hazardous areas and control all sources of ignition - use appropriate	KMC	HRDC, DA, EMA	Progressively	

	warning and hazard signs. • Provide concretized, and non-combustible materials around the Diesel tanks to avoid fires around the tanks. • Train staff in the safe use of the compressed air equipment • Any electrical equipment (or mechanical equipment capable of generating enough heat to cause ignition) must be suitably rated and certified before they can be installed in a hazardous zone				

	within the station. • Drivers should be advised to turn off their vehicles' engines when refueling • Don't smoke, light matches or use lighters at the service station • Provision of dry sand, fire extinguishers at the site •				

8.6 EMP MATRIX FOR IMPACTS ON PUBLIC INFRASTRUCTURE.

Issue	Mitigation Measures	Implementing Agent	Monitoring Agent	Timeframe	Frequency of Monitoring
Destruction of the Dete-Kamativi road	• A diversion of the 3km stretch will be necessary. • Compile an Environmental	KMC	EMA, HRDC	Throughout the project's life span	Quarterly

	Management Plan for the environmental liabilities associated with road construction. • Adequate road signage to be installed • Engage the affected parties, the landowners where the proposed road traverses.				
Pressure on the Dete _Kamativi road	• KMC to help maintain the road as part of their CSR. • Adhere to stipulated loads and avoid overloading.	KMC	Dept of Roads, HRDC, VID.		

8.7 EMP MATRIX FOR IMPACTS ON MACHINE REPAIR WORKSHOP

Issue	**Mitigation Measures**	**Implementing Agent**	**Monitoring Agent**	**Timeframe**	**Frequency of Monitoring**

Water pollution from chemicals used in the workshop.	• KMC to prioritise proper containment of used oils to avoid leaks. • Selling used oils to waste recyclers. • Install an oil separator in the workshop. • Good housekeeping to be practised.	KMC	EMA, HRDC	Throughout the project's life span	Quarterly
High Resource consumption	• Water recycling and reuse is advised • Implement energy efficient practises eg LED lighting. • Turn off equipment when not in use. • Regular maintenance of equipment to reduce energy consumption. • Make maximum use of day light.	KMC	HRDC,EMA	Throughout the	Continous
Waste generation	• Water recycling and reuse is advised	KMC			

	• Implement energy efficient practises eg LED lighting. • Turn off equipment when not in use. • Regular maintenance of equipment to reduce energy consumption. • Make maximum use of day light.				

8.8 EMP MATRIX FOR IMPACTS FROM THE DRY TAILINGS FACILITY

Issue	**Mitigation Measures**	**Implementing Agent**	**Monitoring Agent**	**Timeframe**	**Frequency of Monitoring**
Air Quality issues	• Surface compaction, wetting or chemical stabilization • Dust suppression sprays • Wind fences • Regular monitoring.	KMC	EMA, HRDC	Throughout the project's life span	Quarterly
Water pollution	• Install HDPE liner system • Leachate collection system is advised.	KMC	HRDC,EMA, ZINWA.	Throughout the	Continous

	• Regular monitoring through water tests.				
Biodiversity loss	• Biodiversity offset program • Rehabilitation of the site.	KMC	HRDC, EMA		
Soil and ground water contamination	• Geochemical testing • Neutralization additives • Ground water monitoring network. • Monitoring boreholes.	KMC	HRDC, EMA, ZINWA		
Waste generation	• Beneficiation of tailings for backfill materials or cement. • Tailings re-processing for metal recovery.	KMC	HRDC, EMA.		

CHAPTER 9: KMC'S COPRORATE SOCIAL RESPONSIBILITY [CSR] PLAN

9.0 INTRODUCTION

Corporate Social Responsibility (CSR) is the concept that a company should play a positive role in the community and consider the environmental and social impact of business decisions. It embraces sustainability concepts, creating economic, social, and environmental value that is the Environmental, Social, and Governance. All three focus on non-financial factors that companies, large and small, should consider when making business decisions. The KMC initiative has brought life into the ghost town of Kamativi which had severely dilapidated due to its closure in the year 1994. Chief among the setbacks which the community experienced is the stealing of electricity infrastructure and water supply becoming erratic in the area.

9.1 THE KMC CSR OBJECTIVES

- ↔ Corporate social responsibility is a business model by which Kamativi Mining Company is making a concerted effort to operate in ways that enhance rather than degrade society and the environment.
- ↔ CSR helps both improve various aspects of society as well as promote a positive brand image of KMC and other companies that practise it.
- ↔ KMC's corporate responsibility programs are also a great way to raise morale in the workplace since most of the beneficiaries of the CSR are retrenched workers and compound dwellers.

9.2 THE KMC CSR ACTIVITIES

The CSR Programs completed to date.

9.2.1 Borehole drilling for community

The KMC initially was providing water using Bowsers to the inhabitants of the mine area before embarking full gear on the restoration of reliable running water to the residents. KMC has of late provided 2 solar boreholes and 5 000 litre tanks to the community to access reliable running water for their day-to-day needs. KMC is planning to drill more boreholes for the community as part of its broad CSR plan.



Fig 9.1 provision of water to the community

9.2.2 Water supply to the Primary School

The KMC has committed to supplying and upgrading the water supply needs for the Kamativi Primary School, one among many public facilities which are under the administration of the HRDC. The ghost town has erratic water

supplies owing to vandalism of infrastructure and KMC has committed to resuscitating the much needed precious liquid.



Fig 9.2 Water supplies to the primary school.

9.2.3 Supporting Emergency services in the community

The KMC has been supporting the local community initiates in times of emergencies through the donation of diesel to both the community and the ZRP for their functionality services.

9.2.4 Stakeholder engagements

It has become KMC's tradition to engage our stakeholders twice annually to appraise them on the developments that the mine may be wishing to undertake or would have undertaken. The company strongly believes that external engagements with the stakeholders is key in managing social, environmental and business risks. On the 23rd of December 2022, KMC held a Christmas

celebration party for the community in which the local traditional Chief was invited and partook in the celebrations.

9.2.5 Kamativi Merry Christmas Party with Community

On 23rd December 2022, KMC invited local stakeholders, like MP, Chief, HRDC CEO, ward councilor, Ruling party member and community people,together with company employees and KMC Chinese employees, to celebrate 2022 Merry Christmas. People sang and danced together, played game and tried luck winning solar lights and smart phones.



Fig 9.3 KMC Merry Chirstmas Party 2022

9.2.6 Supporting the local clinic

The KMC has provided the local clinic and capacitated them with solar batteries to the clinic to capacitate them to operate on a sustainable scale. The KMC has been handy in assisting the clinic with supply of face masks during the Covid 19 pandemic. They have also been helping with supplies of hand sanitizer to the clinic.

9.2.7 Assisting with Maintenance of the on and off site Roads

The KMC has sought to maintain the main road leading to Binga which is subscribed by the KMC vehicles and the general public. The state of the site roads on the Kamativi tenement have been prior to the resumption of operations by KMC, the company has since embarked on a massive rehabilitation of the site roads, including the gravel roads which had been in bad shape.

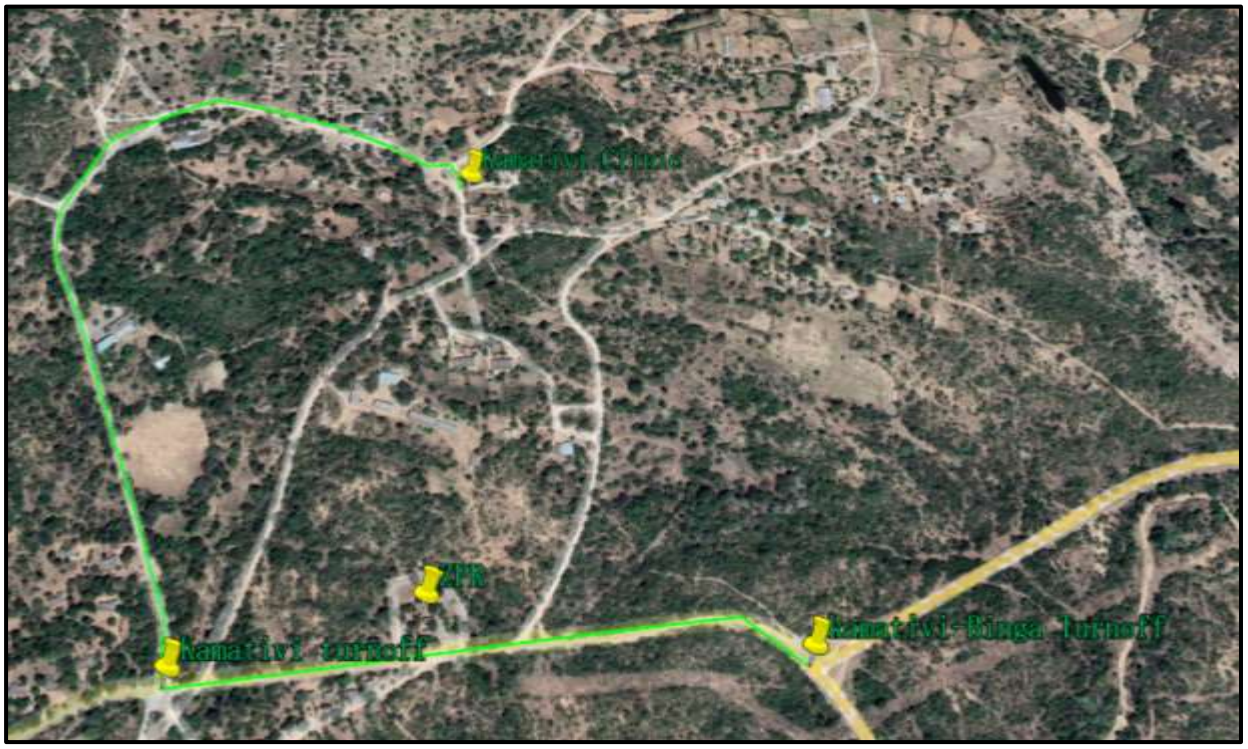


Fig 9.4: Kamativi Reviving Avenue

KMC is doing repairs and resealing of tar-road in Kamativi. It starts from Kamativi-Binga turnoff, passing through Kamativi turnoff and ends at Kamativi Clinic (shown in the photo below).The contractor is from Bulawayo. It will take 26 days to complete the road project. Solar street lights will also be installed to give light for people walking by in the evening. We call it **Kamativi Reviving Avenue** once it is ready. It is called **Youyi Road** (means friendship) from Kamativi Turnoff to Kamativi Clinic. The construction started from 17 November

and will be through in middle of December 2022.



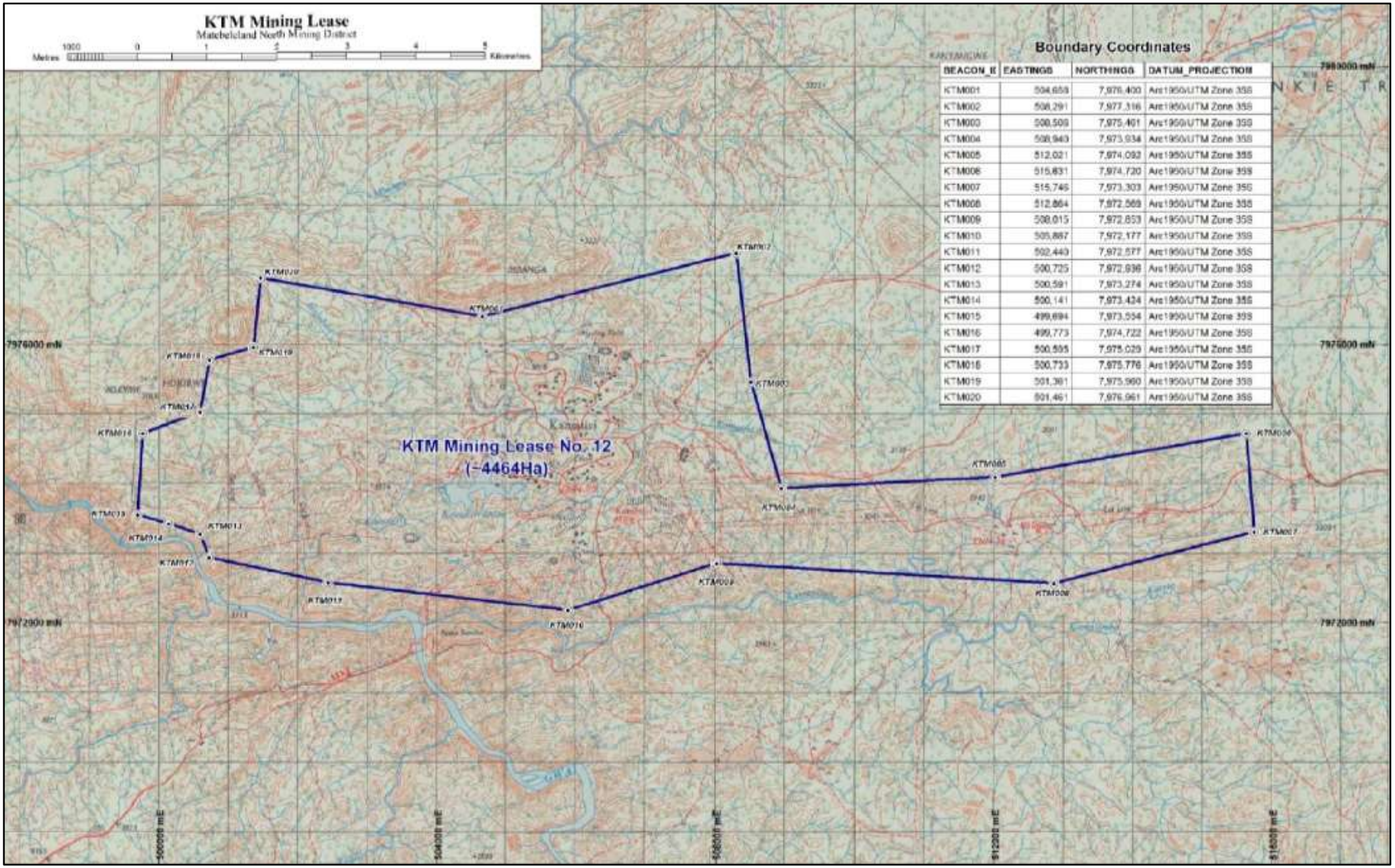
Fig 9.5 Earth-moving equipment working in Kamativi community

Additional CSR contributions.

KMC has embarked on other CSR programs to empower the neighbouring communities especially women empowerment through the following contributions.

- ↔ Scholarships for local students.
- ↔ Provision of feed to support a chicken raising project for women.

APPENDIX 1: 1: 50 000 TOPOGRAPHICAL MAP



Boundary Coordinates

BEACON_ID	EASTINGS	NORTHINGS	DATUM_PROJECTION
KTM001	504,659	7,976,400	Arc1950/UTM Zone 35S
KTM002	508,291	7,977,316	Arc1950/UTM Zone 35S
KTM003	508,509	7,975,401	Arc1950/UTM Zone 35S
KTM004	508,943	7,973,934	Arc1950/UTM Zone 35S
KTM005	512,021	7,974,092	Arc1950/UTM Zone 35S
KTM006	515,831	7,974,720	Arc1950/UTM Zone 35S
KTM007	515,746	7,973,303	Arc1950/UTM Zone 35S
KTM008	512,864	7,972,569	Arc1950/UTM Zone 35S
KTM009	508,015	7,972,853	Arc1950/UTM Zone 35S
KTM010	505,887	7,972,177	Arc1950/UTM Zone 35S
KTM011	502,449	7,972,577	Arc1950/UTM Zone 35S
KTM012	500,725	7,972,936	Arc1950/UTM Zone 35S
KTM013	500,591	7,973,274	Arc1950/UTM Zone 35S
KTM014	500,141	7,973,434	Arc1950/UTM Zone 35S
KTM015	499,694	7,973,554	Arc1950/UTM Zone 35S
KTM016	499,773	7,974,722	Arc1950/UTM Zone 35S
KTM017	500,595	7,975,029	Arc1950/UTM Zone 35S
KTM018	500,733	7,975,776	Arc1950/UTM Zone 35S
KTM019	501,391	7,975,960	Arc1950/UTM Zone 35S
KTM020	501,461	7,976,961	Arc1950/UTM Zone 35S

APPENDIX 2: KAMATIVI MINE GEOLOGICAL ENVIRONMENT PROTECTION AND LAND RECLAMATION PLAN

Kamativi Polymetallic Lithium Mine in Zimbabwe

Mine geological environment protection and land reclamation plan

Kamativi Mining Company (Private) Limited

June 2023

Kamativi Polymetallic Lithium Mine in Zimbabwe

Geological environmental protection and land reclamation plan

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Preface

I. Purpose of preparation

Land is the common foundation upon which human survival and development depend, maintaining the ecological security and material production needs of all humanity. Treating and rationally utilizing every inch of land, improving the ecological environment, and achieving sustainable management of land resources are key challenges faced by all humanity. Based on the universal principle of "the one who damages shall reclaim", and on the basis of mine geological environment assessment and land damage prediction, a scientific geological environment and land reclamation monitoring system is established, aiming to provide practical operational suggestions for mining enterprises. Through the implementation of this plan, the land damaged during mining and the waste generated can be effectively managed, the disturbed landform and vegetation can be restored, and the ecological environment in and around the mining area can be significantly improved. The plan also provides a basis for local governments to implement management, supervision, review, and reclamation fundraising, promotes unified planning of mining activities and ecological protection, incorporates mine geological environment protection and land reclamation goals into production plans, strengthens institutional management, and helps mining enterprises move towards sustainable development that coordinates socio-economic and ecological environments. In addition, organizational, technical, and financial safeguard measures that are in line with local conditions are proposed to ensure the smooth progress of mine geological environment protection and restoration governance work. This is not only related to the interests of mining enterprises and local governments, but also a responsible performance towards the common home of humanity.

II. Job Description

The Kamativi polymetallic lithium mine in Zimbabwe is a proposed mine. This plan mainly includes the assessment and prediction of the impact on the geological environment of the mine, the assessment and prediction of land damage in the mine, the scope of land reclamation, the design of the geological environment treatment and land reclamation plan for the mine, and the investment in geological environment treatment and reclamation of the mine. The content and requirements of each work are as follows:

1. By collecting data and combining it with field surveys, understand the general situation of mining enterprises, including the enterprise name, location, scope, distribution and general situation of adjacent mines; the nature of mining enterprises, the scale of mine construction and engineering layout; the designed production capacity and designed service life of mines; the reserves of mineral resources and the occurrence characteristics of ore beds; the layout of mine development, mining areas

or mining stages, mining methods, mining sequences, and the emission and disposal of solid and liquid wastes; as well as the socio-economic overview of the mining area.

2. The geological environmental conditions and land use status of the mining area have been basically ascertained, including topography, meteorology and hydrology, stratigraphic lithology, geological structure, hydrogeology, engineering geological phenomena, human engineering activities, land use status and planning, etc.

3. Basically identify the geological environmental issues in the mining area, the current status of geological disaster development and the resulting hazards, as well as the background of the geological environmental issues. Analyze and study the distribution patterns, formation mechanisms, and influencing factors of the main geological environmental issues. Conduct a current status and predictive assessment of the geological environmental impact in the assessment area, and divide the area into zones for mine geological environmental protection and restoration management.

4. Basically ascertain the current status of land damage in the mining area, conduct predictive assessments of potential land damage caused by mine construction, delineate the scope of responsibility for land reclamation, determine reclamation units, and evaluate the suitability of land reclamation.

5. For the zoning of mine geological environment protection and restoration governance, propose measures, monitoring schemes, and deployment for mine geological environment protection and restoration governance; for the scope of land reclamation responsibility, propose engineering measures, monitoring, and management and protection deployment for land reclamation.

6. Based on the workload and work deployment of mine geological environment protection and land reclamation, make an estimate of the funds and schedule for mine geological environment protection and land reclamation, and propose safeguard measures for mine geological environment protection and land reclamation.

1) Based on on-site investigation, measurement, and interviews, summarize and organize the types of damaged land, predict the types of land damage during the production process of the mine, assess the degree and scope of various types of land damage, and measure and summarize the area of various types of damaged land.

2) Analysis of damaged land. Based on the results of investigation, evaluation, and prediction, classify and statistically analyze the area of damaged land, determine the reclamation area for each type of damaged land, and reasonably determine the damaged and occupied areas during mine production, as well as their reclamation time and reclamation utilization type, based on the time, nature, and degree of damage to each type of land.

3) Calculation and planning of the quantities for mine geological environment protection and land reclamation works. Based on the reclamation planning, design reclamation schemes according to the technical requirements for various types of land

reclamation, clarify the technical standards and parameters to be achieved, calculate the quantities of reclamation works, and reasonably plan the land reclamation work schedule in conjunction with the mine production schedule.

4) Investment estimation for mine geological environment restoration and land reclamation. Based on the designed quantities, estimate the investment for mine geological environment restoration and land reclamation according to the market prices in Zimbabwe, specify the sources and arrangements of investment, and evaluate the benefits of land reclamation.

5) Clarify the organizational management, engineering technology, engineering investment, and other safeguard measures of the project, as well as the public participation situation.

III. Basis for Preparation

1. "Exploration Report on Polymetallic Lithium Deposit in Kamativi Mining Area, Matabeleland North Province, Zimbabwe" (605th Brigade of Sichuan Metallurgical Geological Exploration Bureau, May 2023);

2. Technical Manual for Feasibility Study of Kamativi Polymetallic Lithium Mine Project in Zimbabwe (China Nerin Engineering Technology Co., Ltd., June 2023);

3. "Geotechnical Engineering Investigation Report on the Kamativi Polymetallic Lithium Mine in Zimbabwe" (Pan-F GEO-ENGINEERING (PRIVATE) LIMITED, June 2023);

4. Other materials collected on-site and provided by the enterprise.

IV. Mathematical Foundation

(I) Main units of measurement

Area: hectare, mu, m^2, 10,000 m^2;

Length: mm, cm, m, km;

Volume: m^3;

Mass: g, kg, t;

Amount: US dollars, ten thousand US dollars.

(II) Coordinate system and projection information

Coordinate system: WGS 1984 coordinate system

Elevation system: Independent elevation system

Projection method: UTM projection 35-minute zone

V. Applicable period of the scheme

(I) Service life of mine

1. Service life of mine production

According to the "Technical Specification for Feasibility Study of the Kamativi Polymetallic Lithium Mine Project in Zimbabwe" prepared by Ruilin Design Institute in June 2023, the service life of the mine is determined to be 7 years (July 2023 - June 2030). In the subsequent mine construction process, due to changes in resource quantity or mining methods, the service life will be extended synchronously according to the latest mine design plan.

2. Service life of the scheme

The service life of this plan is 11 years, consisting of a 7-year mine construction and production period (July 2023 - June 2030), a 1-year mine geological environment protection and land reclamation period (July 2030 - June 2031), and a 3-year land reclamation management and protection period (July 2031 - June 2034).

3. Applicable period of the scheme

Due to factors such as changes in enterprise production planning and the actual geological environment of the mine, this plan should be revised every 5 years during its implementation. When the mine expands its production scale, expands the mining area, or changes the mining method, the mine geological environment protection and land reclamation plan should be re-prepared or revised. This plan serves as one of the technical bases for implementing geological environment protection, monitoring, and land reclamation in mine geological environment protection, and does not replace relevant engineering surveys and treatment designs. The applicable period of this plan is 5 years, from 2023 to 2028.

VI. Overview of preparation work

(I) Work procedures

The main work procedures for the preparation of this plan are as follows: data collection and comprehensive analysis, determination of the assessment scope and level → site survey, investigation of mine geological environment and land resources → determination of the assessment scope of mine geological environment and reclamation area → conduct of mine geological environmental impact assessment and land reclamation suitability evaluation → division of mine geological environmental protection and land reclamation areas → deployment of mine geological environmental protection and land reclamation projects → preparation of the "Geological Environmental Protection and Land Reclamation Plan for the Kamativi Polymetallic Lithium Mine in Zimbabwe". The specific technical route of this mine geological environmental protection and land reclamation plan is shown in Figure 0-1 below.

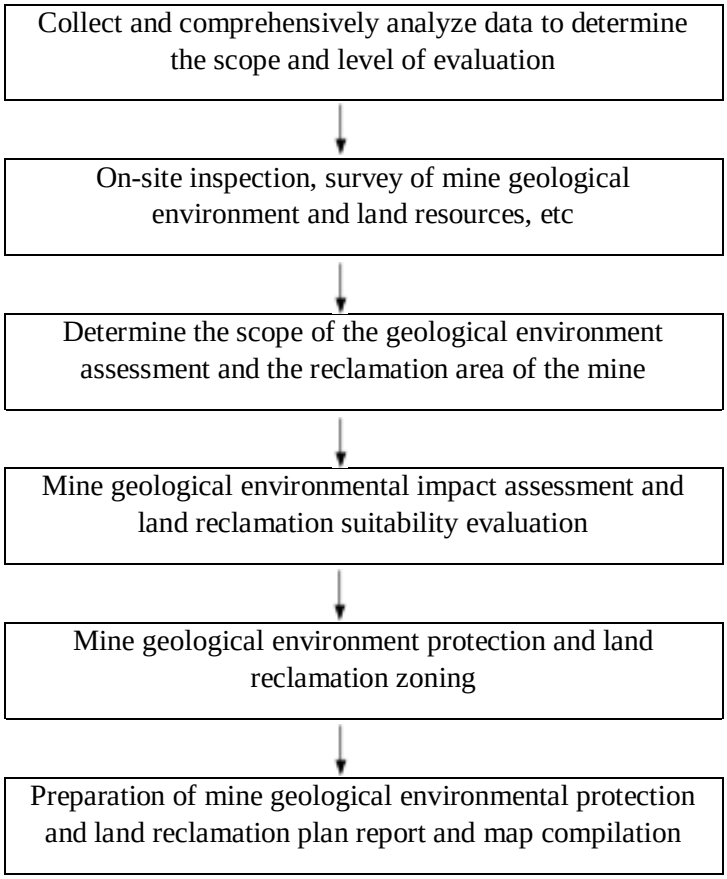


Figure 0-1 Work Procedure Block Diagram

(II) Working methods

Before initiating the preparation work, the scope of investigation and assessment, as well as the preliminary assessment level, are determined based on the comprehensive collection and analysis of relevant materials related to the construction project. Surveys on the current status of the mine geological environment and land resources are conducted, and the opinions of land reclamation obligors, relevant government departments, land use rights holders, and the public are extensively solicited. After the on-site investigation is completed, the collected data from the on-site investigation is comprehensively organized and analyzed in conjunction with the previously collected materials. The impact of the mine geological environment and land damage are assessed. Based on this, the division of mine geological environment protection and restoration zones, as well as the scope of land reclamation, are determined. Restoration measures and reclamation plans are formulated, protection and prevention, restoration engineering projects are proposed, monitoring plans are drafted, and management funding estimates and benefit analyses are conducted. The preliminary proposed mine geological environment protection and land reclamation plan is widely solicited for opinions from land reclamation obligors, relevant government departments, land use rights holders, and the public. Feasibility demonstrations are carried out from the perspectives of organization, economy, technology, and public acceptance. Finally, based on the coordinated demonstration results of the plan, land reclamation standards are determined, engineering designs are optimized, engineering quantity calculations and investment estimates are improved,

and detailed implementation plans for geological environment protection and land reclamation, as well as funding, technical, and organizational management guarantee measures, are refined.

1. Data collection and analysis

Before conducting field investigation work, it is necessary to fully collect, analyze, and organize relevant data, understand the geological environmental conditions and land resource status of the assessment area, analyze existing data, determine the content of supplementary data, and determine the scope and level of assessment. Based on this, the field investigation methods, survey routes, and survey content can be preliminarily determined.

2. Field investigation

The field survey was conducted using a method that involved alternating routes and focusing on geological environmental points. We ensured that every person we encountered was asked questions and every ditch we encountered was examined, combining interview surveys with practical investigations. The 1:2000 topographic map was used as the field hand map, and GPS and topographic and geomorphic verification were used for positioning at survey points. We conducted a focused investigation on areas that may be affected by mining activities, and took detailed records and photos of geological disaster points and important geological phenomena, ensuring the quality of the survey.

(1) Collect existing data on geological exploration, reserve verification, feasibility studies, preliminary designs, development and utilization plans, land status, and planning within the area.

(2) Determine the scope of investigation: The assessment scope is based on the mining area and the surface land use area. Considering the impact of mining activities on the surface after the ore body is extracted, the investigation scope is expanded by an additional 50m beyond the affected area. If there is a debris flow gully, the investigation scope is expanded to 500-2000m, with a total area of approximately 39.3km^2.

(3) Field investigation content: The investigation primarily focused on the transportation within the area, the status of mine construction, residents' drinking water wells, residential areas, vegetation coverage, soil conditions, topography, and geological environmental conditions under the current situation. The geological environmental issues within the assessment area have been basically identified.

3. Indoor data collation and comprehensive analysis

Based on a comprehensive analysis of existing data and actual survey data, we will conduct an assessment and predictive evaluation of the current impact of the mine geological environment, prepare relevant maps, divide prevention and control zones, determine restoration and control objectives and control projects, estimate

control costs, and ultimately submit the text, estimates, attachments, and accompanying drawings of the "Geological Environment Protection and Land Reclamation Plan for the Kamativi Polymetallic Lithium Mine in Zimbabwe".

(III) Workload of on-site investigation

In the early stages of preparing this plan, comprehensive data collection was conducted, and the on-site investigation of the geological environment was carried out in accordance with the relevant current national technical specifications. The accuracy of the work met the requirements of the current technical specifications and achieved the intended purpose of the work. The workload of the on-site investigation is shown in Table 0-1.

Table 0-1 Overview of Field Investigation Workload

serial number	work project	content	unit	quantity
1	collect data	"Exploration Report on Lithium Polymetallic Ore in Kamativi Mining Area, Matabeleland North Province, Zimbabwe"	copy	1
		"Technical Specification for Feasibility Study of the Kamativi Polymetallic Lithium Mine Project in Zimbabwe"	copy	1
		"Lithium Exploration Report of Kamativi Mining Area in Matabeleland North Province, Zimbabwe"	copy	1
		"Geotechnical Engineering Investigation Report on the Kamativi Polymetallic Lithium Mine in Zimbabwe"	copy	1
		Production status map of the mine in May 2023	copy	1
2	field survey	Survey area	km^2	38
		Investigate the route	articl	10
		Survey point	a	54
		settlement	place	4
		visitor count	perso	25
		Geological point	place	30
		Take relevant photos	Zhan	100
		Duration of investigation	sky	2
		Plant species within the region	plant	

Chapter 1 Basic Information of the Mine

I. Introduction to the Mine

Project Name: Multi-metal Lithium Mine in Kamativi Mining Area, Matabeleland North Province, Zimbabwe;

Geographical location: Kamativi, Hwange Town, Matabeleland North Province, western Zimbabwe;

Construction nature: production project;

Mineral type: spodumene;

Mining method: open-pit mining;

Production scale and capacity: 2.3 million tons/year;

Service duration: 7 years;

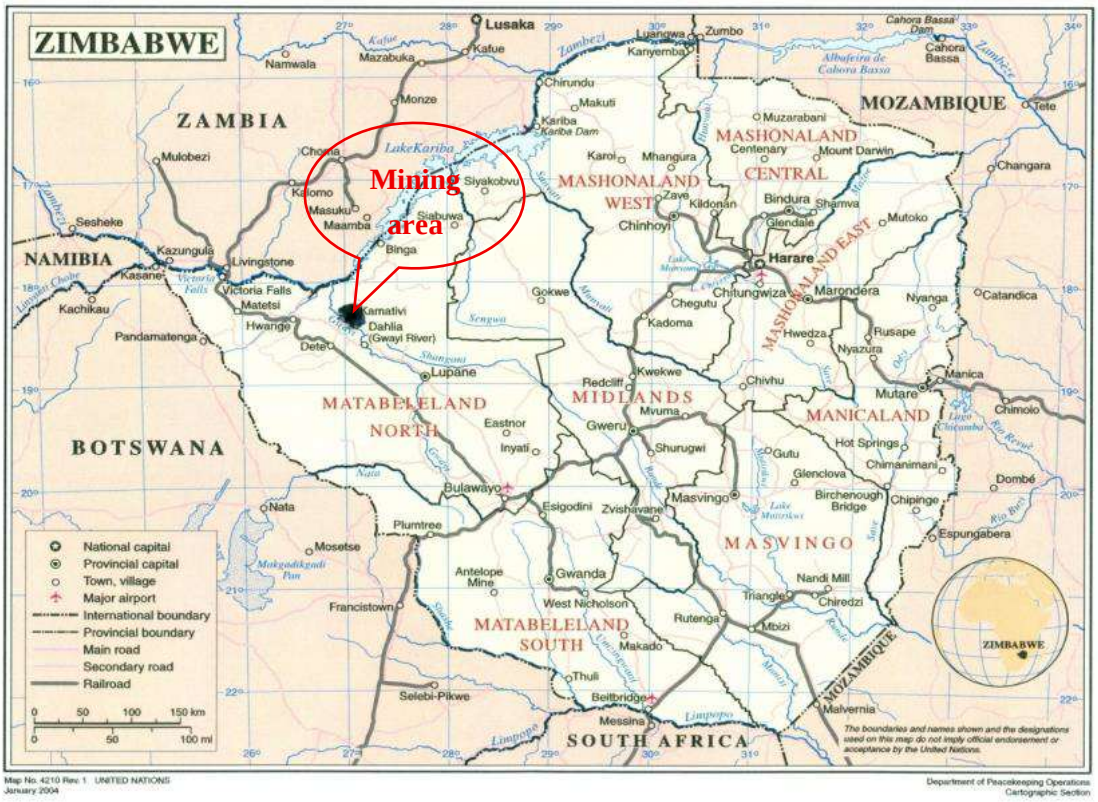
Mine area: 38km^2.

II. Scope of the mining area and coordinates of turning points

(I) Geographical location

The Kamativi lithium-polymetallic mining area is located in Matabeleland North province in western Zimbabwe, with a geographical location of 27°03′08″ E and 18°19′30″ S.

The transportation in the mining area is relatively convenient. There is a paved asphalt road connecting the mining area and the provincial capital, Bulawayo, with a distance of about 290 kilometers. Dete, located about 40 kilometers southwest of the mining area, has a railway freight yard, and the railway can reach the port of Beira in Mozambique. The nearest international commercial airport is Victoria Falls Airport, located about 180 kilometers west of the mining area. Additionally, there is a domestic airport in Dete, which is 44 kilometers away from the mining area.



1 Schematic diagram of traffic location

(II) Scope of the mining area and coordinates of turning points

Kamativi Mine was originally an old tin mine that commenced tin mining in 1935. It was shut down in 1994 due to the persistently low international tin prices. In 2020, it was re-registered as the Kamativi Polymetallic Lithium Mine in Zimbabwe, with the registered mine information as follows:

1 Table of coordinates of turning points within the scope of existing mining rights

Mining right holder	Kamativi mining company (Private) Limited			mining method	Open-pit mining
mine name	Kamativi Polymetallic Lithium Mine in Zimbabwe			Mining minerals	spodumene
production scale	2.3 million tons/year	Mine area	38km^2	mining depth	+950m～+742m
Turning point	X (UTM WGS 1984)	Y (UTM WGS 1984)	Inflection point	X (UTM WGS 1984)	Y (UTM WGS 1984)
1	504638	7976100	11	502436	7972290
2	508279	7977021	12	500704	7972628
3	508483	7975146	13	500587	7972966
4	508923	7973640	14	500117	7973120

5	512005	7973792	15	499677	7973242
6	515616	7974435	16	499765	7974410
7	515732	7972990	17	500587	7974718
8	512855	7972255	18	500705	7975486
9	508013	7972565	19	501350	7975670
10	505870	7971889	20	501438	7976654

III. Overview of the mine design plan

Based on the "Technical Specification for Feasibility Study of the Kamativi Polymetallic Lithium Mine Project in Zimbabwe" prepared and submitted by China Nerin Engineering Technology Co., Ltd. in June 2023, the main design details are summarized as follows:

(I) Construction scale and service life of the mine

The mining and beneficiation scale is 2.3 million tons per year, with a production capacity of 300,000 tons per year for workshop one and a production capacity of 2 million tons per year for the production line.

The production capacity of the mine is 2.3 million tons per year, and the service life of the mine is calculated according to the following formula:

$$T = Q\times(1-\rho)/A*(1-\gamma)$$

$$=1668.34*(1-5\%)/230*(1-1\%)$$

$$=6.96a$$

In the formula: T - mine service life, a

Q - Reserves within the open-pit boundary, 16.6834 million tons

A - Mine construction scale, 2.3 million tons per year

ρ - mining loss rate, 5%

γ - proportion of waste rock contamination, 1%

After calculation, the service life of the Kamativi polymetallic lithium mine is 7 years, including a 1-year infrastructure construction period.

(II)Layout of ground construction projects

The mine will operate in accordance with the "Technical Manual for Feasibility Study of the Kamativi Polymetallic Lithium Mine Project in Zimbabwe" (China Nerin Engineering Technology Co., Ltd., with mine production commencing in June 2023). According to the design plan, the mine will ultimately consist of various areas including open-pit mining sites, mining industrial sites, mineral processing industrial sites, warehouse areas, lean ore stockpile areas, tailings ponds, waste dump sites, gas

stations, mine roads, and explosive magazines. In addition to the above, the company intends to establish a new Chinese camp north of the mining work area. Each area is described as follows:

①Open-pit mine

The IV orebody is located in the central part of the mining area. The elevation of the waste rock access trench in the south is 910 m, the elevation of the pit bottom is 742.5 m, the maximum mining elevation is 945 m, and the elevation of the closure ring is 900 m. The open-pit boundary of the IV orebody is closed below an elevation of 900 m, where water flows into the pit bottom. The elevation of the pit bottom is 742.5 m, with an elevation difference of 157.5 m. Due to the large elevation difference, a segmented interception and relay drainage method is adopted. A fixed pump station is set at 810 m, and a mobile pump at the pit bottom transfers the wastewater to a pool at 810 m, which is then pumped by a water pump at 810 m to a 900 m intercepting ditch for gravity discharge. The area occupied is 518,700 m².

Orebody V is located in the northeast of the mining area. The elevation of the ore access ditch at the open-pit boundary of Orebody V is 915m, the elevation of the waste rock access ditch in the south is 900m, the elevation of the pit bottom is 780m, the highest mining elevation is 930m, and the elevation of the closure ring is 900m, with an elevation difference of 120m. Due to the large elevation difference, a segmented cutoff and relay drainage method is adopted. A fixed pump station is set at 840m, and a mobile pump at the pit bottom transports the wastewater to the pool at 840m, which is then pumped by the pump at 840m to the cutoff ditch at 900m for gravity discharge. The area occupied is 270,500 square meters.

③Ore beneficiation industrial site

The workshop line is located approximately 700 meters south of the Chinese camp at KMC, with a straight-line distance of about 500 meters to the north of the open-air boundary. The terrain where the concentrator is located gradually descends from south to north, and the overall site is relatively flat, with a natural terrain slope ranging from 5° to 10°. This terrain can basically meet the topographic slope requirements for process production. The earthwork volume for site leveling is relatively small, covering an area of 49,700 square meters.

The industrial site for mineral processing in Workshop 2 is located adjacent to the west side of the open-pit mining area, with an existing reservoir to the north and an existing hill to the south. The terrain elevation of this hill is utilized to arrange elevated water tanks and raw water purification facilities. The terrain where the processing plant is located gradually descends from south to north, and the overall site is relatively flat, with a natural terrain slope ranging from 5° to 10°, which can basically meet the terrain slope requirements for process production. The earthwork quantity for site leveling is relatively small. At the same time, the site is close to the test line, facilitating unified management. By expanding and reconstructing the existing road on the south side of the site, it can be used as the main concentrate

transportation road for the processing plant to the outside, covering an area of 370,700 square meters.

④Tailings pond

The wet-discharged tailings pond is located in the valley on the south side of the mineral processing industrial site of Workshop 2. The terrain within the valley is higher in the east and lower in the west, with topographic elevations ranging from 938m to 866m. The top elevation of the wet-discharged tailings dam is 936m, with a total storage capacity of approximately 4.99 million m^3 and a floor area of 362,400 m^2.

The dry-piled tailings pond is located in the valley to the southwest of the mineral processing industrial site of Workshop 2, with a straight-line distance of approximately 300 meters. It has a total storage capacity of approximately 3 million cubic meters and covers an area of 274,300 square meters.

⑤Lean ore stockyard

The lean ore stockyard is located in the valley on the southeast side of the mineral processing industrial site, adjacent to the open-pit mining area. It is approximately 300 meters away from the mineral processing industrial site in a straight line, covering an area of 148,000 square meters.

⑥Waste dump

The 1# waste dump is located in a valley approximately 260 meters south of the mineral processing industrial site in Workshop 2. The valley runs from northeast to southwest, with a topographic elevation ranging from 850 to 800 meters. The waste dump covers an area of 92,300 square meters and has a storage capacity of approximately 2.6 million cubic meters.

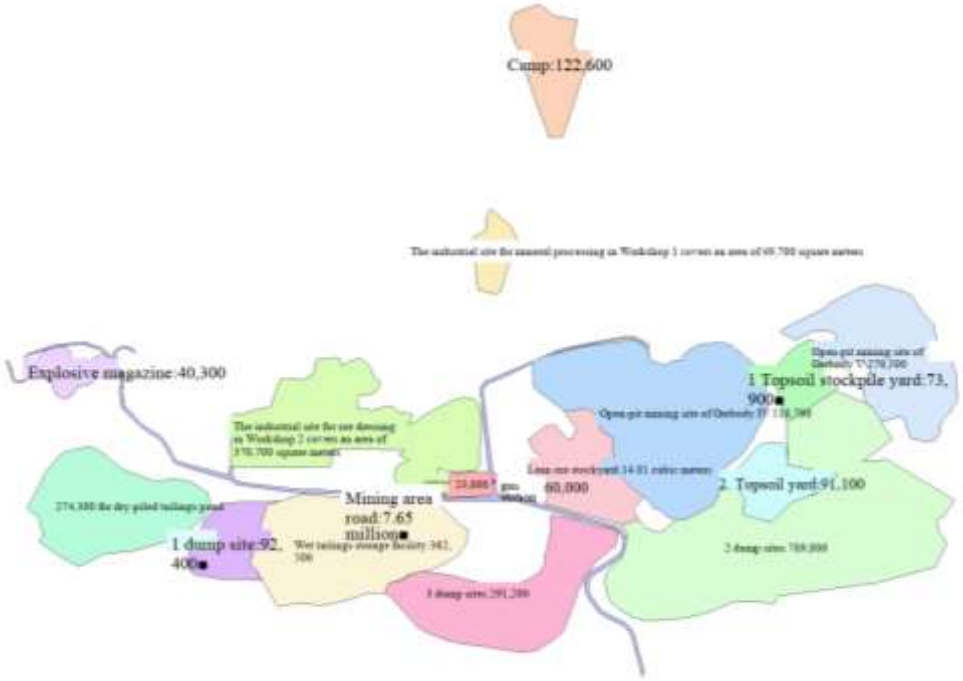
The 2# waste dump is located in a valley approximately 350 meters southeast of the open-pit boundary of Orebody IV. To the south of the plant site lies the external social road after being relocated. The valley runs from northeast to southwest, with a terrain elevation ranging from 880 to 844 meters. The waste dump is arranged while ensuring a safe distance from the external social road to the south, covering an area of 789,700 square meters and having a storage capacity of approximately 17 million cubic meters.

The 3# waste dump is located in a gully approximately 450 meters southwest of the open-pit boundary of Orebody IV. The gully runs from northeast to southwest, with a topographic elevation ranging from 850 to 800 meters. The waste dump covers an area of 291,200 square meters and has a storage capacity of approximately 8.2 million cubic meters.

⑥Other industrial site locations

The project includes a warehouse area, which is arranged adjacent to the north side of the mining industrial site. The raw ore stockpile area and ore unloading

platform are arranged close to the east side of the coarse crushing workshop, while the explosives magazine is located 700 meters west of the mineral processing industrial site.



1 General layout plan of the mine

2 Summary Table of Functional Zones in the Mine

serial number	Venue name	Area (10,000 m^2)
1	Open-pit mining area of Orebody V	27.0488
2	Open-pit mining area of Orebody IV	51.8674
3	1# Topsoil Storage Yard	7.3941
4	2# Topsoil Storage Yard	9.1133
5	Lean ore stockyard	14.8071
6	Wet-discharged tailings pond	36.2452
7	Dry-piled tailings pond	27.4295
8	1# Dump site	9.2352
9	3# waste dump	29.1209
10	2# waste dump	78.9786
11	Mine road	7.6464

serial number	Venue name	Area (10,000 m^2)
12	Industrial site for mineral processing in workshop one	4.9723
13	Beneficiation industrial site of workshop 2	37.0692
14	gas station	0.6046
15	warehouse	2.2964
16	explosives depot	4.0303
17	campsite	12.2640
Total:		360.1234

(III) Mine production plan

1. Mining method of mineral deposit

According to the geological report, the geological resource reserves of the mine are 35,132,800 tons. After deducting the open-pit mining reserves, the reserves north of the mining area, and the reserves within the influence range of the open-pit mining pits (within 20 meters of the pit shell are the ore pillars), the geological resource reserves within the underground mining design range are 3,948,900 tons.

To enhance production efficiency, reduce labor intensity, and maximize production capacity, this design recommends the adoption of mining methods that are simple in process and mature in technology. For thick ore bodies measuring 5 meters or more, the sublevel open stoping with subsequent backfilling method is selected. For ore bodies thinner than 5 meters, the shallow-hole room and pillar with subsequent backfilling method is employed. The proportion of ore reserves in the open stoping method is 85%, while that in the shallow-hole shrinkage method is 15%.

The underground mining scale of the project can reach 1800t/d, with a total investment of 60962.89 thousand US dollars, all self-raised. Among them, the construction investment is 49908.56 thousand US dollars, and the working capital is 11054.33 thousand US dollars. After the implementation of the project, the average sales revenue during the production period will be 59253.95 thousand US dollars/a, the total cost will be 82909.32 thousand US dollars/a, the total profit will be -23655.37 thousand US dollars/a, and the net profit will be -23655.37 thousand US dollars/a. The underground mining project has no economic benefits and is not suitable for underground engineering construction.

The mining area once employed open-pit mining to extract tin resources. The open-pit formed in the southwest part of Orebody IV has exposed the orebody, with an exposed length of about 900m. The orebody is relatively thin, with a gentle

inclination and a thin covering layer in the southwest part, while it is buried up to 200m deep in the northeast part. Therefore, open-pit mining should continue to be used in the early stage for the southern part of Orebody IV. Orebody V is exposed to the surface and is suitable for open-pit mining. Later, underground mining can be planned under the condition of meeting safety and economic requirements.

2. Development and transportation methods of mineral deposits

(1) Ore development and transportation plan

The stope is located close to the primary crushing station. To facilitate ore blending, a temporary ore stockpile area needs to be established between the stope and the primary crushing station. The final destinations for ore transportation are the primary crushing station and the stockpile area, while the stope is mainly equipped with mobile haul roads. The stope is a sunken open-pit with a relatively small mining pit size and short horizontal transportation distance, mainly involving uphill transportation. The overall transportation distance for ore is short, with an average distance of only 1.9km. Moreover, the service life of open-pit mining is relatively short, making it only suitable for full-truck transportation.

(2) Waste rock development and transportation plan

The maximum waste rock stripping scale of this project is 23 million tons per year, and the waste rock yard is adjacent to two open-pit boundaries. The main occurrence elevation of waste rock ranges from 915m to 825m. The horizontal transportation distance within the stope is relatively short, and the main transportation distance is outside the boundary. Considering the short service life of Waste Rock Yard 1, it is believed that this project is more suitable for flexible and maneuverable full-truck transportation.

3. Mining and stripping methods

The ore body occurrence is a gently inclined thin ore body with a thickness ranging from 0.98m to 28.00m, averaging 12.63m. The southwest end is exposed to the surface, while the northeast end is buried up to a maximum depth of 200m. Due to the large stripping ratio and high stripping pressure, the southwest end with a thin covering layer will be mined first, and the mining direction will extend from southwest to northeast, in order to achieve rapid production and postpone stripping. The mining operation adopts a gentle slope mining process, while the stripping operation adopts a steep slope mining process.

To control dilution losses, a section trench is excavated along the strike of the ore body on the hanging wall, and the mining face advances towards the footwall. The mining operation adopts the measure of low-bench mining, dividing the 15m bench height into 2 to 3 smaller benches according to the elevation of the ore body occurrence, with a minimum working bench height of 5m. The stripping work advances towards the northeast, and the stripping operation adopts a working bench height of 15m, which is merged into a 30m bench when advancing to the final slope.

The minimum working platform width is 40m, the temporary non-working platform width is 10m, and the minimum working line length is 200m. The slope angle of the working bench is 75-70°, and the slope angle of the working side is about 17°. Due to the relatively thin ore body and gentle inclination, the dilution loss rate is expected to reach 8%.

4. Internal discharge of waste rock

The orebody of this deposit is gently sloping, and the mined-out areas formed after mining are suitable for internal dumping of waste rock. To ensure the safety of stripping operations during internal dumping of waste rock, it is arranged to commence internal dumping of waste rock when there are sufficient mined-out areas in the later stages of production. According to the stripping plan, a waste dump for internal dumping of waste rock is set up at the southwest corner of the final boundary, with a maximum capacity of 6.47 million cubic meters.

The waste rock dump site adopts a reverse dumping method, with the dumping section height matching the production operation steps. The waste rock stripping is mainly located in the northeast corner, transported along the platform to the mined-out area for dumping. The dumping steps are 15 meters high, the platform width is 15 meters, the step slope is 1:1.5, the total height of the dump pile is 75 meters, the final slope angle is 23.5 degrees, and the final platform elevation of the dump site is 900 meters.

(IV) Open-pit mining boundary

The elevation of the ore access trench at the open-pit boundary of Orebody IV is 900m, the elevation of the waste rock access trench in the south is 910m, the elevation of the pit bottom is 742.5m, the highest mining elevation is 945m, and the elevation of the closure ring is 900m. The size of the upper boundary is 1050m×800m.

The elevation of the ore access ditch at the open-pit boundary of Orebody V is 915m, the elevation of the waste rock access ditch in the south is 900m, the elevation of the pit bottom is 780m, the highest mining elevation is 930m, and the elevation of the closure circle is 900m. The size of the upper boundary opening is 760m×380m.

(V) Water prevention and control plan

According to the mining process, a circular intercepting ditch is set up along the outer edge of the boundary. The external catchment water outside the boundary is intercepted by the intercepting ditch and then discharged outside to prevent external catchment water from flowing into the boundary. The catchment water below the elevation of 900m in the enclosed area of the open-pit boundary of Orebody IV flows into the bottom of the pit. The bottom elevation of the pit is 742.5m, with an elevation difference of 157.5m. Due to the large elevation difference, a segmented intercepting and relay drainage method is adopted. A fixed pump station is set up at 810m, and a mobile pump at the bottom of the pit transports the wastewater to the pool at 810m,

which is then discharged by a pump at 810m to the intercepting ditch at 900m for gravity discharge.

The elevation of the enclosed boundary of Orebody V's open-pit is 900m, with a pit bottom elevation of 780m, resulting in an elevation difference of 120m. Due to the significant elevation difference, a segmented cutoff and relay drainage method is adopted. A fixed pump station is set up at 840m, and a mobile pump at the pit bottom transports the wastewater to the pool at 840m, which is then pumped by the 840m water pump to the cutoff ditch at 900m for gravity discharge.

IV. Production history and current status of the mine

The Kamativi polymetallic lithium mine in Zimbabwe is planned to be constructed from July 2023 to July 2024, with mining scheduled to commence in August 2024. The design unit is China Nerin Engineering Technology Co., Ltd. The designed production capacity is 2.3 million tons per year, and the ore to be mined is spodumene.

Chapter 2 Basic Information of the Mining Area

I. Natural Geography of the Mining Area

(I) Meteorological and hydrological conditions

The Kamativi lithium-polymetallic mining area is located in Matabeleland North province in western Zimbabwe, with a geographical location of 27°03′08″ E and 18°19′30″ S. The mining area covers an area of approximately 38km^2,

Most of Zimbabwe has a tropical savanna climate with an average annual temperature of 22℃. The country can generally be divided into a rainy season (summer) and a dry season (winter) throughout the year, with significant temperature differences between day and night. The summer season lasts from October to April, with an average temperature ranging from 15-25℃. The hottest period is from September to October, with temperatures reaching up to 35℃ at noon. The winter season runs from May to August, with an average temperature of 10℃-15℃. Over the past 30 years, the annual average rainfall has been 584.7mm, mostly concentrated in January to March and November to December. The predominant wind direction over the years has been easterly, with an average wind speed ranging from 3.1 to 4.3m/s over the past 30 years. The average relative humidity over the years has been between 53% and 68%. Soil erosion is mainly due to water erosion.

The work area is generally located within the Sogua River basin, where the stream system is underdeveloped. During the dry season, most streams dry up and cease flowing. The main water source in the area is the Kamativi Dam reservoir in the central part of the work area. The reservoir's water mainly comes from rainwater, mountain springs, and the Gwai River.



Photo 2-1: A distant view of the Kamativi Dam reservoir



Photo 2-2 Close-up of Kamativi Dam Reservoir

(II) Topography and landform

The mining area is located in the town of Hwange, in the western part of Matabeleland North Province. It features low mountains and hills, with the overall

terrain being higher in the east, south, and west and lower in the north. The highest point, located in the western part of the mining area, has an elevation of approximately 973 meters. The mining area is situated on the southern mountain slope. The main river in the area is the Gwai River, which is a seasonal flowing river. The lowest erosion datum in the area is located in the Gwai River bed in the southwest of the mining area, with an elevation of 660 meters.







1 Topography and landform of the mining area

(III) Vegetation

The terrain within the mining area is gentle, with an average slope of 5~10°. The land type is primarily grassland, and the vegetation is mostly grasses, shrubs, and a small amount of arid deciduous trees, which are unevenly distributed and mostly found near gullies.



2 Vegetation status in the project area

(IV) Soil

The project area is primarily composed of sandy soil. The soil layer ranges in thickness from 0.8 meters to 2.0 meters, with an average thickness of 1.0 meters.

Based on field surveys, the majority of soil types in the project area are yellow loam. The soil layer thickness in the area ranges from 0.8 meters to 3.0 meters, with a pH value between 5.5 and 6.5. The soil is yellowish-brown in color, with an alkaline nitrogen content of 54.3 ppm, available phosphorus of 12.6 ppm, available potassium of 102.4 ppm, and an organic matter content of 0.95 g/kg. The soil fertility is generally moderate. See Figure 2-2 for details.



3 Soil profile map of the project area

II. Geological and Environmental Background of the Mining Area

(I) Geology of the mining area

Zimbabwe is located in southeastern Africa and belongs to the typical cratonic block of southern Africa. The regional basement lithology is mainly composed of a

set of Precambrian medium-deep metamorphic mafic and felsic volcanic rocks and volcaniclastic rock systems; the upper lithology is mainly composed of Precambrian crystalline rocks and metamorphic rocks, with Phanerozoic sedimentary rocks-volcanic rocks only distributed in the western, southern, and northern regions.

The Kamativi mining area is located on the southern side of the Zambezi compresso-shear active belt in Zimbabwe, within the rare metal mineralization belt of the Kamativi uplift area on the western side of the Kalahari Basin.

1. Stratigraphy

The mining area primarily exposes the Kamativi Formation of the Proterozoic Sebakwian System, with a significant amount of porphyritic biotite granite bodies developed in its northern part. Additionally, there are sporadic outcrops of Quaternary eluvial deposits (Q4).

The Kamativi Formation is widely exposed within the mining area, with the main lithologies being muscovite schist and biotite (quartz) schist, locally intercalated with two-mica quartz schist. The schist mostly dips northward or southward at an angle of 70 to 90°. Except for some low-stress zones, there are no identifiable sedimentary structures. The attitude of the rock strata is 326 to 18°∠48 to 90°, with an exposed thickness ranging from 79.19 to 182.81m. Among them, the biotite (quartz) schist serves as the direct roof and floor of the ore-bearing pegmatite series, with a clear intrusion boundary between the two, mostly in an intrusive unconformable contact.

The Quaternary eluvial and deluvial deposits (Q4) are primarily distributed in the central part of the mining area and at the edge of the mining pits. They consist of slag heaps, floodplains, terraces, and various types of eluvial and deluvial deposits, with an exposed thickness generally ranging from 3 to 10 meters.

2. Structure

1) Fracture

Within the mining area, fault structures are developed before mineralization, but not after. Only some secondary ore-breaking structures (normal faults) are developed.

2) Wrinkles

A concealed anticlinal structure, presenting a short-axis dome shape, is developed in the mining area. It extends in a near north-south direction overall. This concealed anticlinal structure controls the occurrence and morphology of the ore bodies. The overall strike of the ore bodies is northwest to southeast, generally at an angle of 120 to 150 degrees. To the east of the axis of this concealed anticlinal structure, the ore bodies dip towards the northeast, with a general inclination of 0 to 10 degrees and local inclinations up to 20 degrees, showing a trend of steepening towards the east as it goes deeper; to the west of the axis, the ore bodies dip towards the southwest, with an inclination of 0 to 15 degrees and local inclinations up to 30

degrees, showing a trend of dipping towards the northwest as it goes deeper. The concealed anticlinal structure controls the occurrence of granite pegmatite and lithium-polymetallic ore bodies and is one of the important ore-controlling structures.

3) Fracture structure

The tensional (tensile shear or tensional shear-twist) fractures and joints oriented in the northwest-southeast direction are well developed within the mining area, exhibiting certain spacing and multi-phased characteristics. They directly control the occurrence form, spatial distribution, and occurrence characteristics of the ore-bearing pegmatite and lithium polymetallic ore bodies in the Kamativi mining area. At the intersection of this set of fractures with other fractures, the ore-bearing pegmatite shows enlargement or branching phenomena.

3. Magmatic rock

The magmatic rocks exposed in the mining area are primarily granite pegmatites (γρ). These rocks were formed in the Precambrian Paleoproterozoic intrusive system and occur in irregular, nearly east-west stripes. The granite pegmatites in the mining area can be divided into two types based on their lithology: tourmaline-bearing granite pegmatites and lithium-bearing granite pegmatites. The tourmaline-bearing granite pegmatites were intruded early into the two-mica schist basement strata and porphyritic biotite granite, distributed in irregular, nearly east-west stripes, with a strike nearly consistent with the regional tectonic zone. They contain beryllium but no lithium mineralization and occur in layered and lenticular forms, often consistent with the two-mica schist. The lithium-bearing granite pegmatites are of late-stage filling and infiltration type. Based on the early-intruded tourmaline-bearing granite pegmatites, they were formed by filling and infiltration along tensional fractures under the influence of left-lateral tectonic movements in regional ductile shear zones. They have a thickness ranging from 0.8 to 30 meters, with an average of about 10 meters. The lithium-bearing granite pegmatites are mainly flat-lying in the shallow part, gradually transitioning to gently dipping, steeply dipping, and laterally subducted types towards the deep part. They often occur in intrusive unconformable contact with mica (quartz) schist, and the ore bodies are all hosted in the later-infiltrated lithium-bearing granite pegmatites.

4. Surrounding rock alteration

The main types of alteration in the surrounding rocks of the ore deposit include lepidolite alteration, muscovite alteration, sericite alteration, biotite alteration, tourmaline alteration, and silicification. The alteration of the surrounding rocks near the ore generally occurs within a range of about 1.0m from the boundary of the pegmatite vein, and in some sections with developed joint fissures, it can extend to a range of 2.0 to 5.0m.

(II) Hydrogeology

1. Regional hydrogeological overview

Most regions in Zimbabwe are located at an altitude of over 300 meters, with a majority being plateau terrain and an average elevation of 1000 meters. There are three types of topography: high grassland, medium grassland, and low grassland. The eastern Inyangani Mountain, with an elevation of 2592 meters, is the highest point in the country.

The mining area is located in the town of Hwange, in the western part of Matabeleland North Province. It features low mountains and hills, with the overall terrain being higher in the east, south, and west and lower in the north. The highest point, located in the western part of the mining area, has an elevation of approximately 973 meters. The mining area is situated on the southern mountain slope. The main river in the area is the Gwai River, which is a seasonal flowing river. The lowest erosion base level in the area is located in the Gwai River bed in the southwest of the mining area, with an elevation of 660 meters.

Zimbabwe is located south of the equator, with most of its territory experiencing a tropical savanna climate. There are only two seasons in a year: dry and rainy. However, summer is the rainy season, while winter is the dry season, with a large temperature difference between day and night. According to the multi-year statistical data from the Zvisvane meteorological station in Zimbabwe (Table 4-1), summer lasts from November to April each year, with an average temperature ranging from 14°C to 28°C. The extreme maximum temperature in summer is 30.3°C, while the extreme minimum temperature in winter is 7.7°C. The annual total rainfall is 565.6mm. The annual average wind speed is 2.9Cup, the annual average humidity is 58.1%, and the annual average atmospheric pressure is 860.6%.

1 Statistical table of 30-year observation

project Item	July Jul.	August (August) Aug.	September Sep.	October Oct.	November Nov.	December Dec.	January Jan.	February Feb.	March Mar.	April Apr.	May May	June (June) Jun.
Maximum value (°C) Max. (°C)	22.9	25.7	28.9	29.9	30.3	29.9	29.9	29.1	28.9	27.2	25.4	23.1
Minimum value (°C) Min. (°C)	7.7	9.7	13.5	16.0	17.7	18.3	18.6	18.2	17.2	14.3	10.7	8.0
Rainfall (mm) Rainfall (mm)	1.7	4.3	8.9	37.6	69.8	116.7	116.3	111.2	52.5	32.4	9.8	4.4
Wind speed (Cup) Wind speed (Cup)	2.3	3.0	3.7	4.2	3.8	3.0	2.8	2.8	2.6	2.4	1.9	2.0
Relative humidity (%)	53.5	46.5	45.2	49.9	56.5	64.0	65.4	70.4	67.2	64.6	58.1	56.1

Relative humidity (%)												

The rainfall in the mining area is influenced by climate. From October to March of the following year, the temperature is relatively high, marking the rainy season, which is characterized by frequent rainstorms. Most of the rainfall occurs in the afternoon. From May to August, the temperature is lower, marking the dry season, during which there is basically no rainfall. The average annual rainfall in the mining area is 565.6mm, and the average daily rainfall during the rainy season is 9.24mm.

According to the "Tectonic Zoning Map of Zimbabwe", the fault structures within the region are primarily oriented in an east-west direction, followed by a near northeast direction. The main deep and major faults near the mining area are as follows, described individually:

①Zambezi Fault Zone: Located in the northern part of Zimbabwe, this active zone is a tectonic deformation zone formed by the long-term activity of the deep Zambezi Fault Zone, southward compression, and repeated near-east-west shear. Its main influence area includes the northern margin of the Zimbabwe Craton and the northern section of the Mangandi Fold Belt. On the northern margin of the craton, it is mainly manifested as a series of near-east-west shear fault activities, forming numerous large-scale mylonite zones. In the northern section of the Mangandi Fold Belt, it is mainly manifested as a series of near-east-west folds superimposed within a near-south-north fold belt, accompanied by the intrusion of a large number of granitic bodies, dykes, and pegmatites. The mining area is located on the southern side of this fault.

②Mount Darwin Fracture Zone: Located in the northern part of Zimbabwe, this fracture zone stretches from Kaloyan in the west, eastward through Mount Darwin, and northward to Kotwa, covering a distance of approximately 350km. It generally trends east-west. The mining area is situated on the southern side of this fracture.

③Mangandi Fault Zone: The Mangandi Fault Zone is located in the northwest of the Zimbabwe Craton, primarily in unconformable contact with the Zimbabwe Craton, with local fault contact. The northern part is cut by the deep Zambesi fault, the southwestern part is covered by the Kalahari Basin, and the central part exposes the Archean Karoo uplift. The mining area is located on the eastern side of this fault.

The sole recharge source of regional groundwater is atmospheric precipitation, and groundwater dynamics undergo seasonal variations in a cyclical manner with precipitation. Most of the precipitation collects in intermountain gullies, discharges directly, and then flows into the groundwater in depressions. A small portion of precipitation infiltrates into the groundwater along joints, fractures, and depressions, collecting in fractures. The groundwater circulation conditions are good, with short runoff paths, making it difficult to store. The groundwater is not abundant, the hydrogeological conditions are simple, and the water yield property is weak.

The surface water bodies near the mining area mainly include the Kamativi Reservoir and seasonal rivers in the central part of the mining area.

The Kamativi Reservoir is located in the central part of the mining area, covering an area of approximately 0.37 km^2, with a perimeter of about 5.0 km, a length of 1.2 km from east to west, and 0.78 km from north to south. The reservoir's water capacity mainly comes from rainwater, with the deepest point reaching about 30 m. It is primarily used for domestic water supply for local residents. According to interviews, during the rainstorm season, the highest water level is about 1 m higher than the usual level.

The seasonal river is located in the central part of the mining area. It spans approximately 4.80km within the mining area, with an elevation ranging from +874.0m to +924.0m. The river width varies between 1.50m and 25.00m, and its depth ranges from 0.30m to 1.00m. The seasonal river flows from the northeast and flows southwest, eventually merging into the Kamativi Reservoir. According to surveys and interviews, there is no water during the dry season, and it is replenished by atmospheric precipitation during the rainy season.

2. Hydrogeological conditions of the mining area

1) Water abundance of rock (ore) strata

(1) Groundwater type

The groundwater in the mining area is primarily composed of bedrock fissure water, followed by pore water in loose rock and soil.

Metamorphic rock fissure water

This type of groundwater is primarily distributed in the western, southern, and northeastern parts of the mining area. Fissure water occurs within shallow weathered and tectonic fissure zones, mainly in light black and light yellowish-brown mica (quartz) schist. According to field surveys, the spring water flow rate q is less than 0.1L/s, indicating weak water yield property.

②Magmatic rock fissure water

This type of groundwater is distributed in the northern, central, and eastern parts of the mining area. It is mainly hosted in granite and granite pegmatite. With a flow rate of $q < 0.1L/s$, its water yield property is classified as moderately low.

③Loose rock and soil pore water

This type is primarily distributed in the Quaternary (Q) eluvial loose layer, near the Kamativi Reservoir, and other soil layers. It is mainly recharged by atmospheric rainfall, with poor water yield property and a uniform flow rate of $q < 0.1L/s$. It exhibits significant seasonal variation, overflowing the surface in an infiltration manner during the rainy season and usually discharging nearby in the form of scattered flow into ponds and depressions. The loose rock and soil pore water directly

recharges the underlying bedrock fissure water, forming a water replenishment window. During dry spells, there is no water.

(2) Division of aquifers and confining layers

The exposed strata lithology in the mining area includes Quaternary eluvial slope deposits (Q), Proterozoic metamorphic rock mica (quartz) schist (m), and granite pegmatite (γρ). Among them, the Proterozoic metamorphic rock mica (quartz) schist (m) stratum is the main water-bearing stratum in the mining area, granite pegmatite (γρ) serves as a relatively impermeable layer, and Quaternary eluvial slope deposits (Q) are permeable layers.

Based on the stratigraphic lithology and the degree of fracture development, the exposed strata in the area are divided into aquifers, permeable layers, and impermeable layers, which are described as follows:

①Aquifer

The Proterozoic metamorphic rock mica (quartz) schist (m) aquifer consists of grayish yellow to grayish black mica (quartz) schist. This section of the mining area is not fully exposed, and it mainly exists as slopes on the landform, with steep cliffs formed in some areas. This layer is characterized by developed fractures, strong vertical infiltration of groundwater, and shallow groundwater storage, with a deep buried groundwater level. This layer serves as the aquifer for the top and bottom of the ore bed. No springs are exposed in the mining area.

②Permeable layer

The Quaternary (Q) permeable layer, primarily composed of sandy clay with minor breccia, is distributed in the Kamativi Reservoir and seasonal river areas of the mining area. It unconformably overlies other strata of various ages. Pore water is contained at the bottom of this layer or in low-lying areas. Seasonal spring points emerge at favorable topographic locations where it contacts the bedrock, with low flow rates. These springs are controlled by atmospheric rainfall, exhibit weak water yield properties, and undergo significant seasonal variations. They usually discharge nearby in low-lying areas in a dispersed manner.

③Water-resisting layer

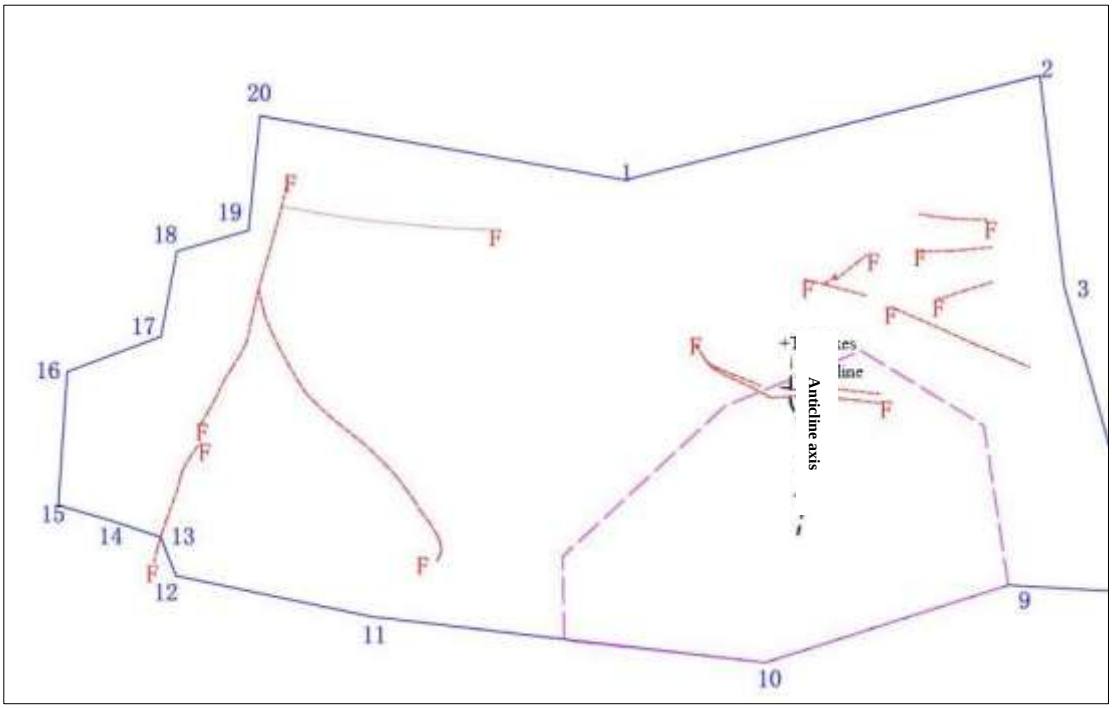
The granite pegmatite (γρ) aquiclude, consisting of grayish-white granite pegmatite, is primarily exposed in the northern and eastern parts of the mine. This layer is thick and relatively stable, with rare weathered fissure water on the surface. The flow rate, q, is less than 0.1L/s, which is extremely low. It tends to dry up during the dry season and serves as a regional aquiclude.

2) Hydrogeological characteristics of structural fracture zones

A concealed anticlinal structure (Figure 4-1) is developed in the central part of the mining area, presenting a short-axis dome shape. The overall strike of the ore

body is northwest to southeast, generally at an angle of 120° to 150°. East of the axis of this concealed anticlinal structure, the ore body dips to the northeast, with a general inclination of 0° to 10°, and locally up to 20°, showing a trend of steepening towards the east as it goes deeper; west of the axis, the ore body dips to the southwest, with an inclination of 0° to 15°, and locally up to 30°, showing a trend of dipping towards the northwest as it goes deeper.

The mining area is characterized by fault development, with most faults being normal faults. It is speculated that the fault fracture zones serve as water-conducting faults. According to the classification table of water yield properties of aquifers in the mining area, with Q≤1.0 L/s, the water yield property is classified as weak.



4 Schematic diagram of structural distribution within the mining right scope

3) Recharge, runoff, and discharge of surface water and groundwater

Regionally, the ore body of the mining area is located in the recharge zone of atmospheric precipitation. Most of the atmospheric precipitation collects directly through surface rivers and flows westward into the Kamativi Reservoir. The remaining part infiltrates into the ground through surface depressions, joints (fissures), etc., forming groundwater.

Groundwater within the mining area infiltrates vertically through vertical fractures in the upper permeable layer. When encountering an impermeable layer, it flows through lateral fractures and conduits, and discharges in the form of karst springs at low-lying areas where river valleys and gullies cross the strata. The groundwater flow path is short, with fast flow velocity, making it difficult to store.

In summary: The working area has a simple structure, with a short-axis dome-shaped anticlinal structure developed, and the fractures are not very developed; the

hydrogeological type of the ore deposit is a water-filled deposit dominated by bedrock fissure water; during the geological exploration stage, based on China's "Hydrogeological and Engineering Geological Exploration Specifications for Mining Areas" and in combination with the actual situation of the working area, the hydrogeological conditions are classified as medium.

3. Prediction and calculation of mine inflow

The main aquifer in the mining area has low water yield property and lacks hydrogeological parameters. In this study, we do not calculate the groundwater inflow, but only the rainfall runoff in the open pit.

A circular intercepting ditch is set up along the outer edge of the open-pit boundary of Orebody IV. Water collected outside the boundary is intercepted by the ditch and then discharged externally to prevent external water from flowing into the boundary. The elevation of the enclosed boundary of the open pit is 900m. Intercepting ditches are set up at elevations of 900m and 810m within the boundary. Water collected above 900m is intercepted by the 900m intercepting ditch and then flows out naturally. Water collected below 900m is intercepted by the ditch and pumped out of the boundary. A circular intercepting ditch is set up along the outer edge of the open-pit boundary of Orebody V. Water collected outside the boundary is intercepted by the ditch and then discharged externally to prevent external water from flowing into the boundary. The elevation of the enclosed boundary of the open pit is 900m. Intercepting ditches are set up at elevations of 900m and 840m within the boundary. Water collected above 900m is intercepted by the 900m intercepting ditch and then flows out naturally. Water collected below 900m is intercepted by the ditch and pumped out of the boundary.

Based on the conditions provided by the mining discipline, the mining scale is 2.3 million tons per year. This mine is a large-scale lithium mine, and the design rainstorm frequency is selected as 5%. The design frequency involves a continuous 7-day rainstorm amount of 236.36mm

(1) Rainstorm runoff calculation

Calculate the runoff volume of a 3-day rainstorm according to the following formula:

$$Q_p = FH_{7dP}\varphi_{max}$$

In the formula, Q_P—— refers to the runoff volume of a rainstorm with a frequency of 5% over a duration of 7 days, m^3;

F - catchment area of each platform within the open-pit depression, m^2;

H_{7dP}-- Rainstorm amount lasting for 7 days with a frequency of 5%, m;

φ_{max}-- Rainstorm surface runoff coefficient, 0.7.

The calculation results are presented in Table 4-2.

2 Design frequency rainstorm runoff

	Steps (m) Bench (m)	H_{7dP} (mm/7d)	F (m^2)	φ_{max}	Q_P(m^3/7d)
Orebody IV IV orebody	900~810	576547	0.7	236.36	95391
	810~742.5	125907	0.7	236.36	20832
Orebody V V orebody	900~840	170544	0.7	236.36	28217
	840~780	94353	0.7	236.36	15611

(2) Calculation of normal rainfall runoff during the rainy season

According to the 30-year rainfall statistics of the Hwange region, the rainy season is generally concentrated between November and April, with an average daily rainfall of 9.24mm.

Calculate the normal rainfall runoff during the rainy season according to the following formula:

$$Q_z = FH\varphi$$

In the formula, Q_z—— normal rainfall runoff during the rainy season, m^3;

F - catchment area of the open pit depression, m^2;

H - average daily rainfall during the rainy season, m;

φ-- The surface runoff coefficient for normal rainfall is 0.65.

The calculation results are presented in Table 4-3.

3 Normal rainfall runoff during the rainy season

	Steps (m) Bench (m)	H (mm)	F (m^2)	φ	Q_z (m^3/d)
Orebody IV IV orebody	900~810	9.24	576547	0.65	3463
	810~742.5	9.24	125907	0.65	756
Orebody V V orebody	900~840	9.24	170544	0.65	1024
	840~780	9.24	94353	0.65	567

(3) Calculation of annual rainfall runoff

Based on the 30-year rainfall statistics of the Hwange region, the average annual rainfall over many years is 565.6mm, with a surface runoff coefficientφ taken as 0.65.

Calculate the normal rainfall runoff during the rainy season according to the following formula:

$$Q_z = FH\varphi$$

In the formula, Q_z—— annual rainfall runoff, m^3;

F - catchment area of the open pit depression, m^2;

H - average annual rainfall over many years, m;

φ-- Annual rainfall surface runoff coefficient, 0.65.

The calculation results are shown in Table 4-4.

4 Annual rainfall runoff

	Steps (m) Bench (m)	**H** (mm)	**F** (m^2)	**φ**	**Q_z** (m^3/d)
Orebody IV IV orebody	900~810	565.6	576547	0.65	211962
	810~742.5	565.6	125907	0.65	46288
Orebody V V orebody	900~840	565.6	170544	0.65	62699
	840~780	565.6	94353	0.65	34688

(III) Engineering geology

The engineering geology of the rock mass within the mining area can be divided into two types: loose and hard. Loose rock formations mainly consist of Quaternary eluvial and alluvial-proluvial deposits, fully weathered, and strongly weathered bedrocks. The Quaternary loose soft rock formations are distributed on the slope surfaces, at the bottom of valleys, and in gently sloping areas. They have a loose to slightly dense structure, high porosity, and poor stability. The strongly weathered bedrock rock masses are extremely fragmented, with cores mostly in fragmented shapes and poor stability. They are the surrounding rocks of the shallow surface ore bodies and have a certain impact on mining. Hard rock formations can be divided into two types: granite pegmatite and mica (quartz) schist. Granite pegmatite is distributed in the northern, eastern, and southern parts of the mining area and is the host rock of the ore deposit. It has a massive structure, with cores mostly in columnar and short columnar shapes. The rock mass is complete to relatively complete, with good stability. The uniaxial natural compressive strength of the rock is 110.1 to 155.6 MPa, the saturated compressive strength is 108.9 to 151.2 MPa, the tensile strength is 8.07 to 14.03 MPa, the saturated shear cohesion is 9.98 to 14.11 MPa, the saturated shear internal friction angle is 46.1 to 53.2°, the saturated elastic modulus is 7.83 to 9.65×104 MPa, and the saturated Poisson's ratio is 0.11 to 0.21u. Mica (quartz) schist is distributed in the western, northeastern, and southeastern parts of the mining area. The cores are mostly in long columnar and short columnar shapes, with a few in fragmented shapes. The rock mass is complete to relatively complete, with relatively developed joints. It is the surrounding rock of the ore body roof and floor, with a uniaxial natural compressive strength of 62.3 to 94.6 MPa, a saturated compressive

strength of 56.2 to 89.7 MPa, a tensile strength of 2.64 to 7.64 MPa, a saturated shear cohesion of 6.02 to 9.26 MPa, a saturated shear internal friction angle of 41.9 to 48.9°, a saturated elastic modulus of 4.02 to 7.23×104 MPa, and a saturated Poisson's ratio of 0.14 to 0.25u.

The primary structural planes in the mining area are mainly interfaces between different lithological strata and rock-soil contact interfaces. The strata in the area have distinct bedding, mostly straight and widely extending. The surface of mica schist is often filled with soil after weathering. The shallow surface is mostly distributed with Quaternary eluvial-deluvial layers, with a general thickness ranging from 2.04 to 5.41 meters and a maximum thickness of 8.54 meters. They are in angular unconformable contact with the underlying bedrock. The soil-rock interface is undulating, and the contact interface tends to be irregular. The secondary structural planes are mainly fractures and faults. Faults are distributed in the western and northern areas of the mining area, and the fault fracture zones are concealed by colluvial deposits. There are mainly two groups of fractures developed in the mining area, with strikes of northeast and northwest respectively.

The mine has been in operation for a long time, with numerous underground mining tunnels and large areas of mined-out areas. Most of these tunnels have been essentially filled with water, and cleaning them would pose varying degrees of engineering geological problems, posing significant safety hazards to future mining operations. The engineering geological issues of historical mine tunnels mainly manifest as: ①tunnel collapses; ②tunnel water inrush (roof collapses connecting to water-bearing fractures, or even directly connecting to surface water systems during the rainy season); ③ground collapses, with a 20m×8m×10m ground subsidence occurring at DH10 point in the mining area. Due to the majority of underground tunnels being filled with water, it is impossible to enter and carry out related work, making it impossible to ascertain the spatial location, shape, and characteristics of the underground mined-out areas. Mining within the affected area poses certain safety hazards.

In summary: The engineering geological types of rock masses in the mining area are divided into loose rock formations, metamorphic hard rock formations, and magmatic hard rock formations. The rocks within the strata are fragmented along bedding and fracture surfaces, with poor rock integrity. The surface and shallow parts of the strata and rock masses are strongly weathered, resulting in relatively fragmented rocks in the shallow part and more intact rocks in the deep part. Historical underground mining has caused surrounding engineering geological problems. Therefore, the complexity of the engineering geology is classified as medium.

(IV) Geological characteristics of ore body

This ore deposit belongs to the granite pegmatite type of lithium-polymetallic deposits.

1. Ore body characteristics

Within the mining area, a total of five industrial ore bodies have been delineated, numbered IV-1, IV-2, IV-3, IV-4, and V. Among them, Ore Body IV-1 is the main ore body, while the others are secondary ore bodies. All ore bodies occur within the Precambrian Paleoproterozoic granite pegmatite. The morphology of the ore bodies is controlled by the ore-bearing granite pegmatite veins and short-axis dome-shaped concealed anticlines, mainly in layered and stratoid forms. Some smaller-scale ore bodies are in vein and lenticular shapes. The occurrence of the ore bodies is basically consistent with that of the ore-bearing pegmatite.

Orebody IV-1 is distributed between lines P15 and P16 in the mining area. The orebody is layered and layer-like, with a strike of northwest to southeast, a strike extension of about 1537m, a dip towards the northeast, a dip angle of 0 to 20°, a dip depth of 140 to 1040m, an occurrence elevation of +667 to +915m, and a burial depth of 0 to 244m.

Orebody V is distributed between lines P02 and P26 in the mining area. The orebody is layered and layer-like, with a strike of northwest to southeast, a strike extension of about 1038m, a dip to the northeast, a dip angle of 7 to 37 degrees, a dip depth of 290 to 450m, an occurrence elevation of +700 to +919m, and a burial depth of 0 to 212m. The middle part of the orebody is thick and rich in grade, while the orebody becomes thinner and poorer towards the ends at lines P02 and P26.

Orebodies IV-2, IV-3, and IV-4 are all concealed orebodies located beneath Orebodies IV-1. They occur in vein-like formations and are of small scale. Orebodies IV-2: Located between lines P05 and P02, the orebody generally dips towards the northeast at an angle of 0 to 17°, with a strike extension of approximately 429m and a maximum dip extension of 286m. The occurrence elevation ranges from +756 to +810m, and the orebody is buried at a depth of 70 to 156m. Orebodies IV-3: Located at line P07, the orebody generally dips towards the northeast at an angle of 0 to 9°, with a strike extension of approximately 153m and a maximum dip extension of 78m. The occurrence elevation ranges from +759m to +793m, and the orebody is buried at a depth of 61 to 120m. Orebodies IV-4: Located between lines P07 and P04, the orebody generally dips towards the northeast at an angle of 0 to 10°, with a strike extension of approximately 405m and a maximum dip extension of 191m. The occurrence elevation ranges from +719 to +774m, and the orebody is buried at a depth of 134 to 192m.

2. Ore quality

1) Ore mineral composition

The lithium minerals in the ore are primarily spodumene, followed by lepidolite and lithium chlorite, with trace amounts of perovskite; the tin minerals are cassiterite; the niobium-tantalum minerals are primarily columbite, followed by tantalite. Other minerals mainly include albite and quartz, followed by potassium feldspar and muscovite, with minor amounts of apatite, chlorite, limonite, beryl, kaolinite, etc.

2) Chemical composition of ore

The chemical composition of the ore is primarily SiO2, followed by Al2O3, Fe2O3, Na2O, K2O, Li2O, etc., with lower contents of CaO, MgO, MnO, P2O5, etc. The main beneficial component in the ore is Li2O. According to the survey report by the Fifth Brigade, the associated tin, niobium, tantalum, and beryllium mineralization within the mining area is limited in scope and low in grade, lacking economic development value.

3) Ore structure and tectonics

Ore structure: According to the characteristics of mineral grains in the ore, it can be divided into fine-grained structure, uneven-grained structure, porphyritic-like structure, and porphyritic structure; according to the degree of crystallization of the ore, it can be divided into euhedral, subhedral, and allotriomorphic crystal structures.

Ore structure: The main types are massive (ore-bearing pegmatite) and banded (ore-bearing two-mica schist), followed by porphyritic and disseminated structures, etc.

4) Ore type

Natural type of ore: Based on the main mineral composition of the ore, it is classified as albite granite pegmatite type spodumene ore.

Ore industry type: granite pegmatite type lithium polymetallic ore.

III. Socio-economic Overview of the Mining Area

The region is primarily agricultural, with sorghum and corn being the main food crops. Due to climatic constraints, the yield is low and there are fewer cash crops. The nearby areas are mainly focused on the production of meat products, livestock breeding, and food processing, with few industries and an underdeveloped economy. Local people have fewer job opportunities.

IV. Current status of land use in the mining area

The mining area covers an area of 38km^2. The land use types include grassland, shrub land, road land, pond water surface, residential area (including scattered houses), and mining land (originally used for tin mining)**.**

5 Table of Current Land Use Status within the Mining Area

project scope	Name of land use	Area / 10,000 m^2
Kamativi Polymetallic Lithium Mine in Zimbabwe	grassland	132.81
	shrubland	3,131.36
	Land for kilometers	0.91
	Pond water surface	41.34
	settlement	93.36

	Land for mining	447.71
total		3800.00 (38 km^2)

The land types surrounding the mining area and industrial sites are primarily shrubland and mining land. The mining land is located in the open-pit mining areas of Orebody IV and Orebody V. The area is dominated by grayish-brown residual soil (with no transport, composition consistent with the parent rock, and loose structure) that remains on the original site after the parent rock has weathered. The thickness ranges from 0.5 to 3 meters. Some areas are distributed with yellowish-gray plain fill, composed of gravelly soil, silty soil, etc., containing a small amount of plant roots, with a loose structure. The thinnest part is 0.40 meters; the thickest part is 4.80 meters; the average thickness is 1.75 meters. The lower part of the residual soil is grayish-brown and has a phanerocrystalline structure. The fractures are well-developed, and the rock core is extremely fragmented, mainly in blocky form, with locally soil-clamped (rock-clamped) strongly weathered granite. The thinnest part is 0.10 meters; the thickest part is 3.20 meters; the average thickness is 0.54 meters. The land in this area is barren, with crops such as sorghum and corn, which are drought-resistant plants. Other forest land is mainly located on the slopes of the mining area and its surroundings, with low shrubs and weeds.

V. Mining and other major human engineering activities in and around the surrounding areas

Upon investigation, there are no scenic spots, historic sites, important buildings or facilities, or rare animals and plants within a 300-meter radius of the mining area. Additionally, no telecommunications lines, cables, or railways pass through the area. There are other enterprises in the mining area that use tailings from the original tin mine as raw materials, but their boundaries are clearly defined and there are no disputes over mining rights.

VI. Case analysis of geological environment governance and land reclamation in mines and surrounding areas

This mine is a proposed mine. Currently, the mining area is in its original topography and landform, and no resource extraction has been carried out. According to the development and utilization plan, the surface of the mining area is dominated by sloping land. The distance between the residential areas and the open-pit mining site in the mining area has exceeded 1.1km, which has no impact on mining operations in the area. There are no permanent buildings or structures, no cultural relic protection areas, and no other mining rights set up around the mining area.

Currently, no mine or neighboring mine has carried out the compilation and reporting of mine geological environment governance and land reclamation plans. Therefore, mines that have implemented and completed mine geological environment governance and land reclamation do not provide reference and lessons for the compilation of this plan.

Chapter 3 Assessment of Geological Environmental Impact and Land Degradation in Mines

I. Overview of mine geological environment and land resource survey

The survey was conducted on June 10, 2023, employing a survey method that involved alternating routes and focusing on geological environmental points. We ensured that every person was interviewed and every ditch was inspected, combining interview surveys with practical investigations. A 1:2000 topographic map was used as the field survey hand map, and GPS and topographic and geomorphic verification were used for positioning of survey points. We conducted a focused investigation on areas that may be affected by mining activities, and took detailed records and photos of disaster sites and important geological phenomena, ensuring the quality of the survey.

The scope of geological environmental survey for mines encompasses both the registered mining area and the areas potentially affected by mining activities. Therefore, the field survey scope is based on the delineated mining area. Taking into account the geographical location of the mine and the characteristics of the surrounding environment, as well as the integrity of existing road facilities and the design of mining engineering and other facilities, the survey area is determined based on the scope of open-pit mining activities and other mining impacts.

The on-site investigation primarily focused on key surface buildings and facilities, residential areas, drinking water sources, and rivers within the investigated site. It mainly examined the transportation network, mine construction status, residents' drinking water wells, residential areas, rivers, vegetation coverage, topographical and geomorphic landscapes, and potential geological hazards within the area. The current state of the mine geological environment and land use issues within the scope of the mine production impact have been basically identified.

The survey covered soil, hydrology, water resources, biodiversity, land use, and land damage in the mining area. The survey area was approximately 11.64 km^2, the survey route was about 8,000 m long, with 54 survey points, 4 residential areas, and 34 geological points. A total of 100 photos were taken. The workload of the field survey is shown in Table 3-1.

1 Field survey workload table

serial number	Project Name	unit	workload
1	1:2000 hydrogeological, environmental	km^2	11.64
2	Survey route	km	8.0
3	Survey site	a	54

4	settlement	place	4
5	visitor count	person	25
6	Geological point	place	34
7	Take relevant photos	Zhang	100

According to the "Technical Specification for Feasibility Study of the Kamativi Polymetallic Lithium Mine Project in Zimbabwe" (China Nerin Engineering Technology Co., Ltd., June 2023), the mining operation will result in the formation of two open-pit mining areas, namely the IV orebody open-pit mining area and the V orebody open-pit mining area; two topsoil stockpile areas, three waste dump areas, three tailings ponds, two mineral processing industrial squares, one camp, one explosives magazine, one warehouse, one gas station, and mine roads. During the survey, no geological disasters such as landslides, collapses, or mudslides were found within the mining area. The mine production may slightly pollute the groundwater, surface water bodies, soil, noise, and air around the mining area; the minimum mining elevation of the mine is higher than the local minimum erosion datum, and atmospheric rainfall has a certain impact on future mining operations; mining may slightly damage the aquifers, but no impact on groundwater level dewatering or decline has been observed, nor has there been any occurrence of wells or springs drying up or water level decline around the mine due to other mining activities. The stripping of the surface overburden layer before ore production and subsequent ore mining will damage land resources.

II. Assessment of the impact on the geological environment of mines

(I) Scope and level of assessment

1. Scope of evaluation

The scope of the assessment area should be determined based on the analysis of the geological environment survey results of the mine. The scope of this assessment is larger than the mining area, which is centered around the mining area and extends to the watershed in the south, north, west, and east, as well as the boundary line that may be affected by the geological environment, constituting the mining area and the area affected by mine production, covering an area of approximately 11.77 km^2,

2. Evaluation level

It is comprehensively determined based on the importance of the assessment area, the scale of mine production and construction, and the complexity of the mine geological environment.

1) Evaluate the importance of the area

The scattered residential areas, commercial districts, churches, schools, cemeteries, etc. within the assessment area serve as supporting facilities for the mining area, all located more than 1.1km away from the mining area; there is no

permanent population in the mining area, and there are no water systems, important traffic arteries, or building facilities within the assessment area; there are relatively important surface water bodies such as reservoirs and rivers within the assessment area, and the rivers are dry except during the rainy season. The land types in the assessment area are mainly forest land, grassland, and garden land. The importance level of the assessment area is classified as relatively **important** (see Table 3-2).

2 Classification of importance levels in the assessment area

Important area	**More important area** √	General Area
Residential areas with a population of over 500 people	**Residential areas with a population of 200 to 500 people concentrated in one place** √	**The residents are scattered, and the population in the concentrated residential areas is less than 200**
There are highways, first-class highways, railways, medium-sized or larger water conservancy and electric power projects, or other important construction facilities	There are second-class highways, small-scale water conservancy projects, electric power projects, or other relatively important construction facilities distributed	**No major traffic arteries or building facilities** √
The mining area is located adjacent to national nature reserves (including geological parks, scenic spots, etc.) or important tourist attractions (sites)	Close to provincial or county-level nature reserves or relatively important tourist attractions (sites)	**Keep away from all levels of nature reserves and tourist attractions (spots)** √
There are important water sources	**There are relatively important water sources** √	No significant water source
Damage to cultivated land and garden land	Damage to forest land and grassland	**Damage to other types of land** √
Note: The principle of giving priority to the next higher level is adopted for determining the importance level of the evaluation area. As long as one criterion is met, it is considered to be at that level.		

2) Production and construction scale of the mine

The designed annual production capacity of spodumene ore for this mine is 2.3 million tons per year (open-pit mining). Referring to Appendix D of the "Compilation Specifications for Mine Geological Environment Protection and Restoration and Rehabilitation Plan" (DZ/T223-2011) in China, specifically the "Classification Schedule of Mine Production and Construction Scale" (see Table 3-3 for details), this mine is classified as a **large-scale mine**.

3 Classification Schedule of Mine Production and Construction Scale (Excerpt)

Ore type		Annual production volume	Remarks

	unit of measurement	**large-scale**	medium-sized	small	
Sandstone, clay mine	"Wan t"	**≥100**	100~30	⩽30	ore

3) Complexity of geological environmental conditions in mines

The central part of the mining area is slightly higher, and the gentle terrain is eroded and dissected into dendritic monadnock. The elevation difference between the ridges and valleys is not significant, and the natural slopes (except for the west side where the cliffs are hand-climbed) are generally less than 45°, with stable internal terrain natural slopes. The ore body is partially exposed, with an overall strike of northwest to southeast, generally at 120 to 150°. East of the axis of this concealed anticline, the ore body dips to the northeast, with a general inclination of 0 to 10°, and locally up to 20°, showing a trend of steepening towards the east as it goes deeper; west of the axis of this anticline, the ore body dips to the southwest, with an inclination of 0 to 15°, and locally up to 30°, showing a trend of dipping towards the northwest as it goes deeper. The concealed anticline controls the occurrence of granite pegmatite and lithium-polymetallic ore bodies, and is one of the important ore-controlling structures. It is difficult to fully mine by open-pit mining, although the ore body has developed joints (fissures), the rock mass integrity is relatively good. The stope engineering slopes formed by mining the mine from top to bottom change the original living environment landscape of animals and plants in the mining area; they change and damage the surface structure, ground stress, and rock mass structure, especially in the slope sections composed of sandy residual soil and strongly weathered rock, which are prone to collapse or erosion and loss with rainwater, leading to slope instability. Therefore, during the mining process, attention should be paid to drainage and slope monitoring to ensure safe production. The slope evaluation of the mining area is basically stable, but with the artificial slopes formed by mining, the self-stress release of the rock mass causes deformation, leading to slope instability.

Taking into account the aforementioned factors and indicators, and referring to the classification table for the complexity of geological environmental conditions in open-pit mines (see Table 3-4) outlined in China's "Compilation Specifications for Mine Geological Environment Protection and Restoration Treatment Plan" (DZ/T223-2011), it is determined that the complexity of the geological environmental conditions in the mine is **moderate**.

4 Classification Table of Complexity Levels of Geological Environmental Conditions in Open-Pit Mines

Complexity	**Medium** √	Simple
1. The mining layer (body) is located below the groundwater level, with a large catchment area and complex water inflow boundary conditions. It is closely related to regional	1. The mining layer (body) is located below the groundwater level, with a large catchment area and close connection to regional aquifers or surface water. The	**1. The mining layer (body) is located above the groundwater level, with a small catchment area and not closely related to regional**

aquifers or surface water, with good groundwater recharge and runoff conditions. The normal water inflow of the mining site is more than 10,000 m^3/d. Mining activities and dewatering drainage can easily damage the main aquifers in the area.	water inflow into the mining area ranges from 3,000 to 10,000 m^3/d. Mining and dewatering activities are relatively prone to affecting or damaging the main aquifers around the mining area.	**aquifers or surface water. The normal water inflow of the mining site is less than 3000 m^3/d; mining and dewatering drainage are unlikely to cause impact or damage to the main aquifers around the mining area.** √
2. The rock mass structure of the surrounding rocks of the ore deposit is primarily characterized by cataclastic and loose structures, with the development of weak structural planes and unfavorable engineering geological layers. There are water-saturated weak rock layers or loose weak rock layers, with numerous and widely distributed water-bearing sand layers. The thickness of the eluvial-deluvial layer and bedrock weathering fracture zone is greater than 10 meters, with poor stability. The rock slopes in the mining area are weathered and fractured, or the soil layers are soft. The outer slope has weak structural planes or dangerous rocks, which are prone to slope instability.	2. The rock mass structure of the surrounding rocks of the ore deposit is primarily characterized by thin to thick layered structures. Weak structural planes and unfavorable engineering geological layers are moderately developed, with the presence of water-saturated weak rock layers and water-bearing sand layers. The thickness of the eluvial-deluvial layer and the weathered and fractured zone of the bedrock ranges from 5 to 10 meters, with poor stability. The rock slopes of the stope are weathered and relatively fractured, with outward-inclined weak structural planes or dangerous rocks on the slopes, which may locally lead to slope instability.	**2. The rock mass structure of the surrounding rocks of the ore deposit is primarily characterized by a massive thick layered-blocky overall structure. Weak structural planes and unfavorable engineering geological layers are not developed. The thickness of the eluvial-deluvial layer and the weathered and fractured zone of the bedrock is less than 5m, with good stability. The rocks on the stope slope are relatively complete to completely intact. The soil layer is thin, and there are basically no outwardly inclined weak structural planes or dangerous rocks on the slope, making it relatively stable.** √
3. Complex geological structure. The occurrence of the surrounding rock strata of the ore deposit varies greatly, with the development of fault structures or Holocene active faults. The water-conducting faults cut through the surrounding rock, overlying strata, and main aquifers (zones) of the ore bed (body) or connect surface water bodies, exhibiting strong water	3. The geological structure is relatively complex. The occurrence of the surrounding rock strata of the ore deposit varies greatly, and the fault structure is relatively developed, cutting through the surrounding rock, overburden, and water-bearing strata (zones) of the ore bed (body). The water conductivity is poor, which	**3. The geological structure is relatively simple. The occurrence of the surrounding rock strata of the ore deposit varies little, and the fault structure is less developed. The faults do not cut through the surrounding rock and overburden of the ore bed (body), thus having a**

conductivity and having a significant impact on water filling in the mining area.	has a significant impact on the water filling of the stope.	**small impact on water filling in the stope.** √
4. Under the current conditions, there is a high incidence of primary geological disasters, or a wide range of geological environmental issues in mines, posing significant hazards.	4. Under the current conditions, there are various types of geological environmental issues in mines, posing significant hazards.	**4. Under the current conditions, there are few types of geological environmental issues in mines, and the hazards are minor.** √
5. Due to the large area of the mining site and the depth of the mining pit, the unstable slope is prone to geological disasters.	**5. The stope area and the depth of the mining pit are relatively large, and the slope is relatively unstable, making it prone to geological disasters.** √	5. With a small stope area and shallow mining pit depth, the slope is relatively stable, making it less prone to geological disasters.
6. There are various types of geomorphic units, with complex microtopography and significant topographic relief variations, which are not conducive to natural drainage. The topographic slope is generally greater than 35°, with a large relative elevation difference. The inclination of the rock strata in the direction of the high slope is mostly in the same direction as the slope of the mining pit.	6. There are various types of geomorphic units, with relatively complex microtopography. The topographic relief varies moderately, and the natural drainage conditions are average. The terrain slope generally ranges from 20° to 35°, with a significant relative elevation difference. The rock strata inclination in the direction of the steep slope is mostly oblique to the slope of the mining pit.	**6. The geomorphic unit type is single, the micro-geomorphic form is simple, and the terrain is relatively flat, which is conducive to natural drainage. The terrain slope is generally less than 20°, and the relative elevation difference is small. The rock strata inclination in the direction of high slopes is mostly opposite to the slope of the mining pit.** √
Note: Adopt the principle of "if one meets the criteria, it should be classified as that level".		

4) Evaluation level

Based on the analysis of the aforementioned evaluation indicators, the importance level of the mine assessment area is classified as **"relatively important"**, the complexity of geological environmental conditions is **"medium"**, and the scale of mine production and construction is **"large"**. Therefore, it is determined that the level of this mine geological environmental impact assessment is **"Level I"** (see Table 3-5).

5 Classification Table of Mine Geological Environmental Impact Assessment

		The complexity of geological environmental conditions

Assess the importance of the area	Mine production and construction scale	complex	**Moderate** √	simple
Important area	large-scale	Level 1	Level 1	Level 1
	medium-sized	Level 1	Level 1	Level 1
	small	Level 1	Level 1	Level 2
Important area √	**Large** √	Level 1	**Level 1** √	Level 1
	medium-sized	Level 1	Level 2	Level 2
	small	Level 1	Level 2	Level 3
General Area	large-scale	Level 1	Level 2	Level 2
	medium-sized	Level 1	Level 2	Level 3
	small	Level 2	Level 3	Level 3

(II) Analysis and prediction of the current situation of geological disasters in mines

1. Analysis of the current status of geological disasters in mines

Geological disasters encompass a range of hazards related to geological processes, such as mountain collapses, landslides, mudflows, ground collapses, ground fissures, and ground subsidence, which can threaten people's lives and property safety due to either natural factors or human activities. The types of geological disasters subject to risk assessment include collapses, landslides, mudflows, ground collapses, ground fissures, and ground subsidence.

Upon on-site investigation, it was found that the mine is a proposed mine. The infrastructure construction of the mine is being carried out in accordance with the mining design requirements. No large-scale geological disasters such as landslides, collapses, mudslides, and ground fissures were found in the assessment area. Currently, there is no geological disaster development.

According to Appendix E of the "Compilation Specifications for Mine Geological Environment Protection and Restoration Treatment Plan" (DZ/T0223-2011), the impact of geological disasters under current conditions is **relatively minor**.

2. Prediction of geological disasters in mines

Based on the current situation assessment and in accordance with the "safety facility design", potential geological disaster issues arising from future mining activities are predicted. The geological disasters primarily include instability of

potentially unstable slopes in open-pit mining areas, environmental geological issues caused by temporary surface soil in mines, and hydrogeological issues.

(1) Slope stability analysis

The stability analysis of the slope is as follows:

1) Design parameters related to the final slope of open-pit mining

Step height: 15m

The height of the final connecting step: 30m

End step slope angle: 70°

Width of safety platform: 5m, 7m

Sweeping platform width: 11, 13, 15m

The final slope angle is 50°

The design mining elevation for this project is as follows: 945m-742.5m for the open-pit of Orebody IV, and 950m-780m for the open-pit of Orebody V.

Final slope height: 202.5m for the open-pit of Orebody IV, and 170m for the open-pit of Orebody V.

2) Slope safety grade

According to the grading standards for open-pit slope height, the final slope height is 202.5m for the open-pit stope of Orebody IV and 170m for the open-pit stope of Orebody V. Slope heights greater than 100m are classified as high slopes. Slope instability may cause personal injury and property damage, with potential direct economic losses less than $100,000 and potential indirect economic losses less than $1 million. The hazards of slope instability are severe, and the hazard level of the mine slope is classified as Level II, with a corresponding safety level of Level III.

6 Slope Hazard Classification Table

Slope hazard level		I	II★	III
Possible casualties	Personal injury or death	There are casualties	Some personnel were injured★	No casualties
Potential economic losses	direct	≥1 million	500,000 to 1,000,000★	≤500,000
	indirect	≥10 million	5 million to 10 million★	≤5 million
Comprehensive evaluation		very serious	Severe★	Not serious

7 Classification Table of Safety Levels for Slope Engineering

Safety level of slope engineering	Slope height H (m)	Slope hazard level
I	>500	I, II, III

Safety level of slope engineering	Slope height H (m)	Slope hazard level
	500≥H >300	I, II
	300≥H >100	I
II★	500≥H >300	III
	300≥H >100★	II, III★
	≤100	I
III	300≥H >100	III
	≤100	II, III

3) Determination of slope safety factor

The range of safety factor values for slopes under different load combinations is shown in Table 3-9. For bench slopes and temporary working slopes, a certain degree of damage is allowed, and the design safety factor can be appropriately reduced. The overall safety level of slope engineering is Grade II, and the comprehensive safety factor values for slopes are shown in Table 3-8.

8 Table of value ranges for slope safety factors

Safety level of slope engineering	Safety factor in slope engineering design	
	Load combination I Self-weight + groundwater (rainstorm)	Load Combination II Self-weight + groundwater (rainstorm) + seismic force
I	1.25～1.20	1.20～1.15
II★	1.20～1.15	1.15～1.10
III	1.15～1.10	1.10～1.05

9 Table of safety factor values for slopes

Load combination I (Self-weight + groundwater (rainstorm))	Load combination II (Self-weight + groundwater (rainstorm) + seismic force)
1.20	1.15

4) Stability calculation of open-pit slope

computational method

The design utilizes the GEO-SLOPE/W limit equilibrium analysis software and employs the conventional slice method to calculate the safety factor of the designed slope in this mine. The calculation scenarios include: self-weight + rainstorm condition, and self-weight + rainstorm + earthquake condition.

5) Analysis of calculation results

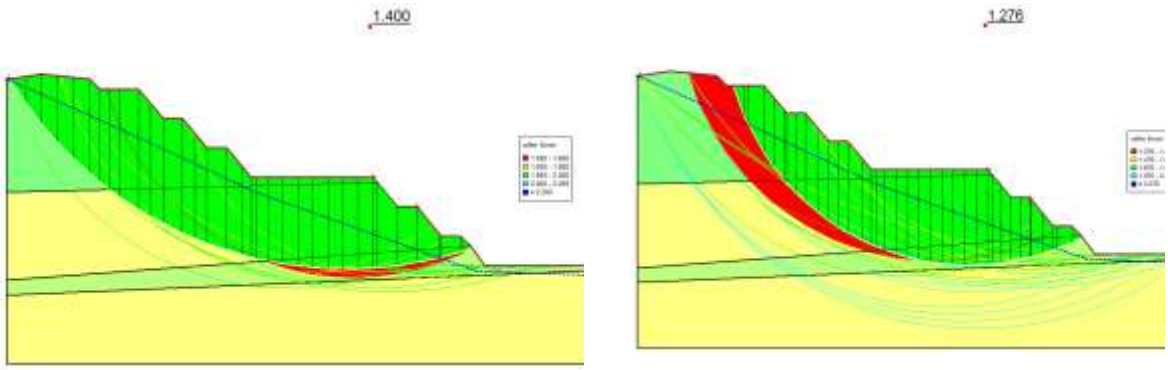
Models were established for profiles A-A', B-B', and C-C', respectively. By automatically searching for the most dangerous slip surface, the stability of internal sliding within the slope was calculated. The calculation models are illustrated in Figures 3-5 to 3-7. After calculation, the summary of slope stability coefficients for the three profiles under different working conditions is presented in Table 3-13.

10 Summary Table of Slope Stability Coefficients

section	operating condition	Stability coefficient (calculated value)	Determination of the safety factor for slope	Stability evaluation
A-A' section	Load combination I	1.400	1.15	stable
	Load combination II	1.276	1.10	stable
B-B' section	Load combination I	1.365	1.15	stable
	Load Combination II	1.247	1.10	stable
C-C' section	Load combination I	1.338	1.15	stable
	Load combination II	1.241	1.10	stable

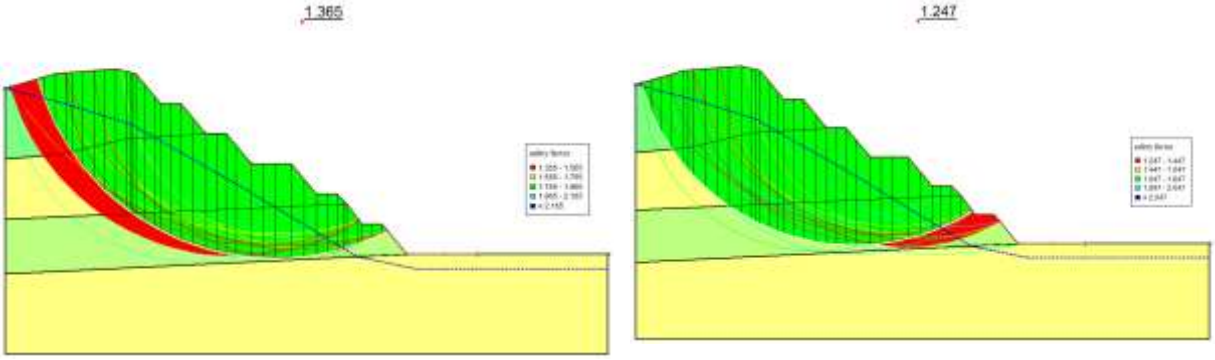
Note: Load combination I: self-weight + rainstorm; Load combination II: self-weight + rainstorm + earthquake.

In summary, the stability coefficients of the slope under both conditions of self-weight + rainstorm (load combination I) and self-weight + rainstorm + earthquake (load combination II) are greater than the design safety coefficient, indicating that the slope is stable.

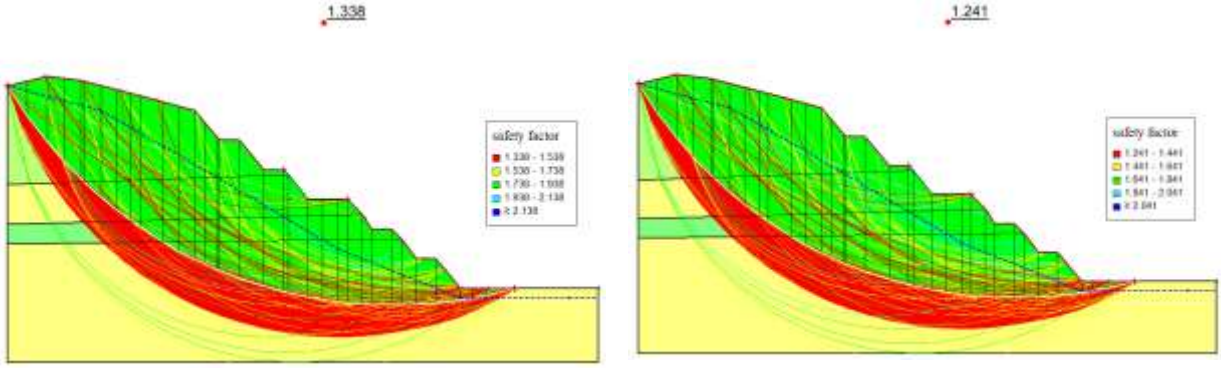


1 A' Profile (Left: Self-weight + Rainstorm Condition, Right: Self-weight + Rainstorm

+ Earthquake Condition)



2 B-B' profile (left: self-weight + rainstorm condition, right: self-weight + rainstorm + earthquake condition)



3 C-C' section (left: self-weight + rainstorm condition, right: self-weight + rainstorm + earthquake condition)

In summary, the mine slope is stable, but the joint fissures in the ore body of the mine are relatively developed, posing a potential for local failure. The potential energy of the overlying rock mass is large, and once the slope becomes unstable, it has the conditions for potential energy to be converted into kinetic energy, leading to geological disasters. Therefore, during the mining process, slope monitoring should be strengthened to prevent geological disasters.

(2) Environmental geological issues caused by temporary topsoil on mines

During mine production, the stripped topsoil is stored nearby on a flat area of the open-pit. In accordance with the principle of "reclaiming while mining", the stripped topsoil is promptly used for mine reclamation. Retaining and drainage measures are set up around the temporary topsoil stockpile. Based on the topographical and geological conditions of the mine, mudslide geological disasters will not occur due to mine production, but monitoring of the temporary stockpile is necessary.

(3) Hydrogeological issues

The terrain of the mining area is flat and open, with developed valleys that facilitate the natural drainage of atmospheric precipitation. The mining elevation (975-795m) is higher than the local erosion datum elevation of 660m, and the mine is an open-pit mining operation. Temporary water accumulation in the mining area will not pose a threat to the construction and mining operations of the mine.

The rocks within the mine do not contain harmful or toxic elements. The main chemical components of the rocks include P_2O_5, Al_2O_3, CaO, TiO_2, Li_2O, SiO_2, FeO, K_2O, Na_2O, Cs_2O, SnO_2, Nb, Ta, etc. Mining operations will not cause pollution to groundwater. The mine adopts mechanized mining methods and rarely uses chemical products. The wastewater, after being treated in sedimentation tanks to remove pollutants, is non-toxic and harmless, and can be naturally discharged along the trenches. The production water in the mineral processing industrial site is recycled internally and not discharged externally. No production wastewater flows into the groundwater system. It is only necessary to strengthen the management of domestic and industrial waste to prevent it from leaching into the groundwater system through atmospheric precipitation after being exposed on the surface, which could cause pollution and affect groundwater quality.

(4) Tailings pond

Based on the current total amount of tailings and the preliminary production schedule, it is proposed to construct two tailings ponds. The 1# tailings pond is located near the concentrator, which can basically meet the storage needs for the first three years. The 2# tailings pond is situated within the northwest area of the mining area to accommodate the storage of tailings during later production stages. The 1# tailings pond is located in a valley to the south of the concentrator, with a straight-line distance of approximately 550m. It is proposed to use mining waste rock for one-time dam construction on the west side of the valley, and to use geomembrane for full-pond seepage prevention. The tailings will be transported via pipelines, with uniform ore drawing in front of the tailings dam and water return at the tail end of the pond. The 1# tailings pond covers an area of approximately 0.298km^2, with a total storage capacity of approximately 4.9878 million m^3. The design dam crest elevation of the tailings pond is 936.00m, and the dam height is 64.00m. The main dam is a rockfill dam constructed using waste rock as the dam material, with a compressive strength of not less than 40MPa. The maximum dam height of the main dam is 64m, with a dam crest width of 6m, an upstream dam slope gradient of 1:2.25, and a 5m wide berm provided every 15m elevation difference; the downstream slope gradient is 1:2.0, with a 3m wide berm provided every 15m elevation difference. The geomorphic unit of the 1# tailings pond site belongs to the low mountain and hilly area, with ground elevations ranging from 860.14m to 945.53m during the survey period. The 2# tailings pond is a dry-piled tailings pond located to the northwest of the concentrator, with a straight-line distance of approximately 3.2km from the concentrator. The 2# tailings dam is constructed in one stage, and the dam material can be soil borrowed from within the pond or mining waste rock. Full-pond seepage prevention is implemented within the pond. This plan proposes to implement the construction of the 2# tailings pond in three phases, with geomembrane used for full-pond seepage prevention during each phase, and spillways used as flood discharge facilities for the tailings pond.

According to the subsoil revealed in the engineering geological survey report, the surface layer of the foundation soil of the tailings pond is composed of Quaternary silty clay containing gravel, while the lower part is primarily composed of granite, which is of igneous rock origin. At the site of the tailings pond and its vicinity, no major adverse geological processes such as landslides and collapses have been observed, and no obvious faults, fracture zones, or other adverse geological processes have been detected. The site is stable. In summary, the possibility of geological disasters caused by the construction of the tailings pond is low.

In summary, the predicted impact of mining activities on geological disasters is **"relatively minor"**.

(III) Analysis and prediction of the current status of aquifer damage in mining areas

1. Analysis of the current status of aquifer damage in the mining area

The mine is a proposed mine, with an area of damaged land of 0 million square meters· Under the current conditions, the impact of mining activities on the aquifer is "**relatively minor**".

2. Prediction and analysis of aquifer damage in mining areas

After the mine commences production, the lowest elevation will be 795m. The mining plan involves open-pit mining, with bench mining from top to bottom. The local erosion base level is at an elevation of 660m. According to the safety facility design, during the later stages of mining, there will be intermittent slopes on all four sides (north, south, east, and west). Atmospheric precipitation will converge in the low-lying areas of the mining site, and water will be pumped out through a pumping station. The slopes formed during the mining process will alter the discharge channels of groundwater and surface water, with surface water flowing down the slopes to open valleys for natural discharge. Since the mine began production, it has not been affected by groundwater. When the rainy season arrives, there will be a small amount of water accumulation at the bottom of the pit due to surface water influence. The region's rainy season is short, and the water is pumped out in a timely manner, so the water accumulation at the bottom of the pit is short-lived. The water that seeps into the groundwater system is minimal. In summary, mining has a small impact on groundwater. The predicted impact assessment of mining activities on aquifers is "**relatively minor**".

(IV) Analysis and prediction of the current damage status of the topographical and geomorphic landscapes (geological relics, cultural landscapes) in the mining area

1. Analysis of the current status of damage to the topographical and geomorphic landscapes (geological relics, cultural landscapes) in the mining area

The mine is a proposed mine, with an area of damaged land of 0 million square meters· Under the current conditions, the degree of damage to the original topography and landscape caused by the mining production activities is "**relatively minor**".

2. Prediction and analysis of the damage to topographical and geomorphic landscapes (geological relics, cultural landscapes) in mining areas

According to the design of mine safety facilities, the final land area damaged by mine production will be 3.601234 million square meters· The mining area formed after mining will further alter the original topography and landform of the mine, resulting in further damage to the mountain, exposure of rocks, and destruction of vegetation, which will have a serious impact on and damage to the topographical and geomorphological landscape. The dump site will change the original gentle slope and gully morphology, causing a more serious impact on the topographical and geomorphological landscape. There are no geological relics, scenic spots, natural protected areas, geological relics, or cultural landscape distribution areas in the assessment area.

In summary, mining activities have a significant impact on and damage to the original topography, landform, and landscape; there are no major transportation routes or natural scenic spots around the mining area, and human activities are infrequent; there are cultural relics protection units within the mining area, and the mine design incorporates protection measures, ensuring no damage to the area. The predicted impact of mining activities on the topography, landform, and landscape is "**severe**".

(V) Analysis and prediction of the current situation of soil and water environmental pollution in the mining area

1. Analysis of the current status of soil and water pollution

The mine is a proposed mine, and production has not yet begun. Under the current conditions, the degree of damage to land resources is "relatively minor".

2. Prediction, assessment, and analysis of water and soil pollution

According to the "Technical Specification for Feasibility Study of the Kamati Vido Polymetallic Lithium Mine Project in Zimbabwe" compiled by China Nerin Engineering Technology Co., Ltd. in June 2023, during the production period of the

mine, all initial rainwater collected in the beneficiation plant area will be directed into the production water pool for use in the beneficiation process, achieving resource utilization. The beneficiation wastewater (including return water from the tailings pond) will be fully reused in production through a closed-loop system, with no wastewater discharged externally under normal circumstances. Domestic sewage is treated using an integrated MBR sewage treatment device. After the effluent water quality meets relevant standards, part of it is used for plant greening irrigation and dust suppression, while the remaining part is safely discharged into surrounding water bodies, adhering to strict water quality control standards.

The mine adopts open-pit mining, and all ore bodies are located above the local groundwater level. The recharge of regional groundwater mainly relies on atmospheric precipitation. Due to the fragmented and steep terrain, most of the precipitation quickly flows into the valleys in the form of slope runoff, with only a small portion infiltrating to recharge groundwater.

The ore mined from the mine is spodumene, which has a stable composition and does not contain toxic or harmful substances (such as heavy metals or radioactive elements). This ensures that the risk of pollution to water bodies and soil is extremely low from the source. Comprehensive anti-seepage projects will be implemented for tailings ponds and solid waste landfills. Specific measures include site leveling, laying 600g/m² non-woven geotextile as a protective layer, and covering with 1.50mm thick HDPE geomembrane to meet safety isolation requirements.

After the closure of the mine, the groundwater level will gradually rise and approach a new dynamic equilibrium. Since the ore body does not contain toxic or harmful elements, and the wastewater is fully reused without external discharge during mining, the groundwater quality will not deteriorate significantly, and the main ion concentrations will gradually approach background levels. Regarding surface water, due to the harmless nature of the ore and the absence of pollution accumulation during mining, the pit lake water is expected to be neutral or weakly alkaline, with main ions being conventional minerals and heavy metal content far below environmental standard limits. The overall water body is neutral or weakly alkaline. To ensure safety, it is recommended to implement a long-term water environment monitoring plan after the closure of the mine, tracking indicators such as pH, turbidity, TDS, and specific ion concentrations.

In summary, the assessment concludes that the degree of damage to land resources caused by mining production is "relatively minor".

(VI) Summary of environmental impact assessment of the mining area

Based on the above analysis and prediction of the current status of the geological environment of the Kamativi polymetallic lithium mine in Zimbabwe from four aspects, the assessment results of the geological environmental impact of the mine are

summarized in Tables 3-11 and 3-12, following the principle of "choosing the higher rather than the lower".

11 Summary Table of Assessment on the Current Status of Geological Environmental Impact of Mines

serial number	evaluation object	Area (10,000 m^2)	Current status of geological disasters	Current status of aquifer	Current status of topography and geomorphological landscape	Current status of water and soil pollution	Overall evaluation
1	Open-pit mining area of Orebody V	27.0488	Lighter	Lighter	Lighter	Lighter	Lighter
2	Open-pit mining area of Orebody IV	51.8674	Lighter	Lighter	Lighter	Lighter	Lighter
3	1# Topsoil Storage Yard	7.3941	Lighter	Lighter	Lighter	Lighter	Lighter
4	2# Topsoil Stockpile Area	9.1133	Lighter	Lighter	Lighter	Lighter	Lighter
5	Lean ore stockyard	14.8071	Lighter	Lighter	Lighter	Lighter	Lighter
6	Wet-discharged tailings pond	36.2452	Lighter	Lighter	Lighter	Lighter	Lighter
7	Dry-piled tailings pond	27.4295	Lighter	Lighter	Lighter	Lighter	Lighter
8	1# waste dump	9.2352	Lighter	Lighter	Lighter	Lighter	Lighter
9	3# waste dump	29.1209	Lighter	Lighter	Lighter	Lighter	Lighter
10	2# dump site	78.9786	Lighter	Lighter	Lighter	Lighter	Lighter
11	Mine road	7.6464	Lighter	Lighter	Lighter	Lighter	Lighter
12	Industrial site for mineral processing in workshop 1	4.9723	Lighter	Lighter	Lighter	Lighter	Lighter

serial number	evaluation object	Area (10,000 m^2)	Current status of geological disasters	Current status of aquifer	Current status of topography and geomorphological landscape	Current status of water and soil pollution	Overall evaluation
13	Industrial site for mineral processing in Workshop 2	37.0692	Lighter	Lighter	Lighter	Lighter	Lighter
14	gas station	0.6046	Lighter	Lighter	Lighter	Lighter	Lighter
15	warehouse	2.2964	Lighter	Lighter	Lighter	Lighter	Lighter
16	explosives depot	4.0303	Lighter	Lighter	Lighter	Lighter	Lighter
17	campsite	12.2640	Lighter	Lighter	Lighter	Lighter	Lighter
total		360.1234	/	/	/	/	/

12 Summary Table of Prediction and Assessment of Impact on Mine Geological Environment

serial number	evaluation object	Area (10,000 m^2)	Geological disaster prediction	Aquifer prediction	Topographic and geomorphic landscape prediction	Prediction of soil and water environmental pollution	Overall evaluation	
1	Open-pit mining area of Orebody V	27.0488	Lighter	Lighter	serious	relatively serious	serious	
2	Open-pit mining area of Orebody IV	51.8674	Lighter	Lighter	serious	relatively serious	serious	

3	1# Topsoil Storage Yard	7.3941	Lighter	Lighter	relatively serious	Lighter	relatively serious	
4	2# Topsoil Storage Yard	9.1133	Lighter	Lighter	relatively serious	Lighter	relatively serious	
5	Lean ore stockyard	14.8071	Lighter	Lighter	serious	relatively serious	serious	
6	Wet-discharged tailings pond	36.2452	Lighter	Lighter	serious	relatively serious	serious	
7	Dry-piled tailings pond	27.4295	Lighter	Lighter	serious	relatively serious	serious	
8	1# waste dump	9.2352	Lighter	Lighter	serious	Lighter	serious	
9	3# waste dump	29.1209	Lighter	Lighter	serious	Lighter	serious	
10	2# waste dump	78.9786	Lighter	Lighter	serious	Lighter	serious	
11	Mine road	7.6464	Lighter	Lighter	Lighter	Lighter	Lighter	
12	Industrial site for mineral processing in workshop 1	4.9723	Lighter	Lighter	relatively serious	relatively serious	relatively serious	
13	Beneficiation industrial site of workshop 2	37.0692	Lighter	Lighter	relatively serious	relatively serious	relatively serious	
14	gas station	0.6046	Lighter	Lighter	Lighter	relatively serious	relatively serious	
15	warehouse	2.2964	Lighter	Lighter	Lighter	Lighter	Lighter	
16	explosives depot	4.0303	Lighter	Lighter	Lighter	Lighter	Lighter	
17	campsite	12.2640	Lighter	Lighter	relatively serious	relatively serious	relatively serious	

total	360.1234	/	/	/	/	/	

III. Prediction and assessment of mine land damage

(I) Land damage link and time sequence

1. Land damage and destruction process

(1) Open-pit mining: During the production process of mines, blasting, excavation, and other procedures cause damage, and at the same time, the land is compacted, resulting in soil compaction and changes in physicochemical properties. The type of damage is classified as destruction.

The land damage in open-pit mining mainly manifests as direct excavation damage, encompassing processes such as topsoil stripping, blasting, ore extraction, and slope formation. These activities thoroughly disrupt the soil structure, alter the topography and landform, exacerbate soil erosion, and completely remove native vegetation and ecosystems.

(2) Industrial sites (beneficiation industrial site of workshop 1, beneficiation industrial site of workshop 2)

The land damage at industrial sites is primarily due to occupation, where the occupation of buildings and equipment foundations leads to soil compaction and deterioration of physical structure. Production activities (such as ore spillage and wastewater leakage) may introduce pollutants such as oils, heavy metals, or mineral processing chemicals, further damaging the physicochemical properties of the soil.

(3) Topsoil stockpile areas (1# Topsoil Stockpile Area, 2# Topsoil Stockpile Area)

The main damage to the yard area is primarily due to the occupation of topsoil. The accumulation of a large amount of topsoil deteriorates soil permeability, disrupts nutrient cycling, and prevents natural vegetation growth. If the pile is not managed properly, it may lead to slope collapse or soil erosion, such as the risk of mudslides in waste dump sites under rainwater erosion.

(4) Tailings pond (wet-discharge tailings pond, dry-stockpile tailings pond, lean ore stockpile yard)

The land damage caused by tailings ponds primarily involves the occupation of land by tailings. Wet-discharged tailings ponds may contaminate soil and groundwater (such as heavy metals and mineral processing chemicals) due to leakage, while dry-stacked tailings ponds mainly cause physical occupation, leading to the destruction of soil structure. Both types of ponds pose geological disaster risks such as

dam breaches and landslides, necessitating strict monitoring of anti-leakage measures and dam stability.

(5) Dump sites (Dump Site 1, Dump Site 2, Dump Site 3)

The damage to the waste dump is primarily caused by the occupation and compaction of waste rock and soil piles, accompanied by the risks of landslides and mudslides triggered by rainwater erosion. The placement of waste rock piles disrupts the original terrain and vegetation, leading to deterioration of the soil's physical structure and exacerbation of soil erosion.

(6) Mining area roads

The damage to mining roads includes repeated rolling by vehicles and machinery, as well as surface hardening (road paving). Rolling causes severe soil compaction and loss of permeability; excavating slopes may lead to soil erosion or small landslides. The road network also fragments ecological landscapes and hinders the restoration of natural vegetation.

(7) Auxiliary facilities (gas stations, warehouses, explosives magazines)

The land damage of auxiliary facilities is primarily caused by the occupation of buildings, with potential chemical pollution risks. Gas stations may pollute the soil due to oil leakage, explosive magazines may have residual explosives or chemicals, and warehouse material storage may also introduce pollutants.

(8) Office and living area (camp)

The damage to the office and living areas primarily manifests as the occupation of buildings and spaces, leading to the destruction of the soil's physical structure. Domestic sewage and garbage may cause pollution such as organic matter and heavy metals, further deteriorating soil quality.

2. Timing of land damage

Land damage prediction mainly includes land damage and occupation.

Based on the characteristics of ore mining in the mine and the construction and operation conditions of this project, the activities that may cause land damage during the construction and operation periods mainly include engineering damage and occupation, which will result in varying degrees of disturbance and damage to the surface. These are described as follows:

1) Damage to land caused by project occupation

Various land occupations will alter, bury, or damage the existing vegetation and landform, causing varying degrees of damage to the original land.

2) Damage to land caused by mining excavation

Construction excavation and filling will disturb and damage the original surface vegetation, ground composition, and topography, resulting in exposed surface soil or the formation of loose accumulations. This will deprive the soil of its original anti-scouring and soil-stabilizing capabilities, and disrupt its natural stable state. Under the influence of rainfall and surface runoff, scouring and collapse may occur, leading to increased soil erosion.

3) Impact of mine industrial square, mine roads, and temporary storage yard on land

Upon completion of the construction phase, the construction site will undergo rehabilitation. Taking into account factors such as transportation distance and cost, the primary source of topsoil for reclamation will be the overburden from the original construction site. The temporary storage area is located within the platform section of the mining area. The temporary piling of topsoil will result in a loose accumulation. Without appropriate temporary protective measures, the unstable soil slope formed is highly susceptible to disturbances from external factors like precipitation, leading to erosion.

Pre-preparation stage (2023-2024): Before the official commencement of construction, the main tasks in the pre-preparation stage are to gradually complete land leasing and site development. Firstly, the topsoil is removed, followed by the construction and installation of infrastructure. The main methods of land damage are excavation and occupation.

Production stage (2024-2030): After production begins, the surface layer will be stripped first. After the topsoil is removed, open-pit mining of spodumene ore within the project area will commence. The main form of land damage will be excavation damage.

Post-production stage (2030-2034): This stage mainly involves the demolition and removal of structures and construction equipment built in the earlier stages. No new land resources will be damaged during this stage. After the demolition and removal, reclamation will be carried out to restore the ecological environment.

(II) Current status of various damaged lands

The mine is a proposed mine, and the land damaged by its current production totals 0 million square meters.

(III) Prediction and assessment of land to be damaged

1. Prediction basis

The destruction of land during the construction and production process of open-pit mining is direct destruction. Direct destruction mainly occurs during the production period, and its manifestations include direct occupation of land, large-scale excavation and compaction of the ground, and fundamental changes in the surface

morphology and function, such as stope, industrial square, mine roads, ancillary facilities, etc. The scope of destruction can be determined through on-site survey and land acquisition agreements.

This mine is a proposed mine, and the damage to land in the future will mainly vary with the expansion of the mining scope.

2. Prediction unit and prediction period

(1) Prediction unit division

Based on the characteristics and timing of mineral extraction, combined with the local natural environment, socio-economic conditions, and land reclamation strategies, the mining area is divided into a prediction unit. The division of the prediction unit should adhere to the following principles:

1) Principle of similarity in topography and land use status;

2) Principle of consistency in the methods of engineering damage and land occupation;

3) Principle of similarity in original land site conditions;

4) Principle of consistency in reclamation direction;

5) Facilitate the overall arrangement of reclamation measures, adhering to the principle of integrity in zoning.

(2) Prediction time period

Based on the characteristics of land resources damaged during mining, the prediction period is divided into two stages: the mining stage and the natural recovery stage.

Mining period: Due to the existence of mining production and other activities during the mining period, mining slag, tailings, artificial solid accumulations, and unstable slopes are formed, inevitably damaging and occupying land. This is a high-risk period for land destruction. Therefore, the mining period is a key time period for land destruction prediction.

Restoration period: During the restoration period, there is no new damage. The land damage is only the expansion of the land damaged during the mining period through various forms of soil erosion. With the implementation of various land reclamation and soil and water conservation measures, the land damage will be gradually contained, and the land ecological environment of the mining area will be restored and improved until reaching a new equilibrium state.

3. Prediction content and method

(1) Predicted content

Based on the development and utilization plan as well as the design of safety facilities, the prediction of land damage includes the following aspects:

1) The methods of land destruction in each prediction period and prediction zone;

2) The area of land damaged in each forecast period and forecast zone;

3) Types of land damaged in each prediction period and prediction zone;

4) The degree of land destruction in each prediction period and prediction zone.

(2) Prediction method

The terrain of the mining area is moderately complex, and the types of land damage are relatively homogenous. The prediction of land damage is conducted by combining quantitative statistics and qualitative description, as detailed below:

1) Prediction method for land destruction patterns: Based on the characteristics of the project, land destruction patterns exhibit diversity. In addition to the two obvious ways caused by engineering construction, namely damage and occupation, there is also land destruction caused by soil erosion during mining production. The prediction method employs qualitative description.

2) Prediction method for the area of damaged land: By analyzing and statistically assessing the land occupation in each prediction zone, combined with the methods of land damage, a quantitative statistical approach is adopted.

3) Prediction method for damaged land types: Based on field survey data, determine the types of land damaged due to the construction of the processing zone.

4) Prediction method for land damage degree: The degree of land damage caused by mining production varies depending on the purpose of land use, directly altering the direction of land utilization. Once damaged, the land becomes irreversible and experiences strong disturbance on the surface. The main method of land damage in mining areas is primarily through destruction, making land reclamation challenging and the degree of land damage relatively significant.

4. Partition prediction results

Based on the design plan and on-site investigation, it is known that additional land will be damaged during the later stages of mining. The proposed area of land to be damaged is 3,601,234 square meters.

(IV) Degree of land damage

The analysis of the degree of land destruction in mines reveals the scope of land use and its available capacity. The destruction of mine land manifests in mining development activities, causing the indicators of land quality control factors to change in a direction that is detrimental to land use, based on the original background values of land quality in mines. This includes two aspects:

Firstly, the destruction of mine land refers to the change in land quality relative to the original background value before development activities. Secondly, the change in mine land quality is directly or indirectly caused by mining development activities.

The evaluation of the degree of land destruction in mines is actually an assessment of the extent of changes in land quality caused by mining development activities. The prediction levels for land destruction are set at three levels: Level 1 (mild destruction), Level 2 (moderate destruction), and Level 3 (severe destruction). Currently, there is no precise division value for the specific grade standards of evaluation factors both domestically and internationally. The plan is to evaluate and classify the grades using the dominant factor method, based on the investigation of land destruction factors in similar projects and referring to practical empirical data from various related disciplines. The specific standards are shown in Tables 3-13 and 3-14.

13 Table of evaluation factors and grade standards for the degree of damage

Evaluation factors	Evaluation factor	Rating Level		
		Mild damage	Moderate damage	Severe damage
Surface deformation	mining depth	<6 meters	6-10 meters	"Over 10 meters"
	Excavation area	<1 million m^2	1-10 million m^2	>10 million m^2

14 Evaluation Factors and Grade Standards Table for the Degree of Damage Caused by Occupied Land

Evaluation factors	Evaluation factor	Rating Level		
		Mild damage	Moderate damage	Severe damage
Surface deformation	Occupied area	<100,000 m^2	100,000 to 1,000,000 square meters	>1 million m^2
	Dump height	<10 meters	10-30 meters	>30 meters

Based on the predictive analysis of previously damaged land and land proposed for damage, the total area of land proposed for damage is 3,601,234 square meters. Referring to the above evaluation index system, the evaluation results are shown in Table 3-15.

15 Table of total damaged land area

serial number	Land use unit	Damage timing sequence	Damage type	Degree of damage	Area of damage (10,000 m²)
1	Open-pit mining area of Orebody V	Proposed destruction	Excavation damage	severe	27.0488
2	Open-pit mining area of Orebody IV	Proposed destruction	Excavation damage	severe	51.8674
3	1# Topsoil Storage Yard	Proposed destruction	Damage from excavation, occupation and encroachment	moderate	7.3941
4	2# Topsoil Storage Yard	Intended to be damaged	Damage from excavation, occupation and encroachment	moderate	9.1133
5	Lean ore stockyard	Intend to damage	Damage from excavation, occupation and encroachment	severe	14.8071
6	Wet-discharged tailings pond	Intended to be damaged	Damage from excavation, occupation and encroachment	severe	36.2452
7	Dry-piled tailings pond	Proposed destruction	Damage from excavation, occupation and encroachment	severe	27.4295
8	Waste dump site 1#	Proposed destruction	Damage due to excavation, occupation and encroachment	severe	9.2352
9	Waste dump 3#	Intended to be damaged	Damage due to excavation, occupation or encroachment	severe	29.1209
10	Waste dump 2#	Proposed destruction	Damage from excavation, occupation and encroachment	severe	78.9786

serial number	Land use unit	Damage timing sequence	Damage type	Degree of damage	Area of damage (10,000 m²)
11	Mine road	Intend to destroy	Damage from excavation, occupation and encroachment	moderate	7.6464
12	Industrial site for mineral processing in workshop 1	Proposed destruction	Damage due to excavation, occupation and encroachment	moderate	4.9723
13	Industrial site for mineral processing in workshop 2	Proposed destruction	Damage from excavation, occupation and encroachment	moderate	37.0692
14	gas station	Intended to be damaged	Damage from excavation, occupation and encroachment	moderate	0.6046
15	warehouse	Intended to be damaged	Damage from excavation, occupation or encroachment	moderate	2.2964
16	explosives depot	Proposed destruction	Damage due to excavation, occupation or encroachment	moderate	4.0303
17	campsite	Proposed destruction	Damage from excavation, occupation or encroachment	moderate	12.2640
Total:					360.1234

IV. Zoning for mine geological environment governance and scope of land reclamation

(I) Zoning for mine geological environment protection and restoration and management

1. Partitioning principle

The geological environment of mines possesses triple attributes: natural, social, and economic. Therefore, we adhere to the principle of "people-oriented, engineering construction-centered, and sustainable development-oriented". The mining sequence, mining method, working face advancement speed, and service life of the plan are determined according to the mineral resource development and utilization plan. At the same time, we consider the hazards caused or exacerbated by infrastructure construction and mining that deteriorate the geological environment of mines, and strive to minimize the damage caused by human engineering activities such as engineering construction and mine production to the geological environment, as well as to restore and manage the damaged geological environment as much as possible.

Based on the current assessment results and predictive assessment results, we will adopt the principle of "upgrading rather than downgrading" for zoning.

2. Partitioning method

Based on the assessment and predictive evaluation of the impact and damage on geological disasters, aquifers, topographical landscapes, and land resources, the protection and restoration of mine geological environment are zoned according to the potential losses and the difficulty of prevention and control. The current status and predictive evaluation results of geological disasters, aquifers, topographical landscapes, and land resources are selected as zoning indicators. The overlay method is used for zoning, and the zoning criteria are based on the provisions of Appendix Table F.1: "Mine Geological Environment Protection and Restoration Zoning Table" (Table 3-16) in the "Compilation Standards for Mine Geological Environment Protection and Restoration Plan".

16 **Zoning Table for Mine Geological Environment Protection and Restoration**

Situation assessment	Prediction and evaluation		
	serious	relatively serious	Lighter
serious	key area	key area	key area
relatively serious	key area	Secondary key	Secondary key area
Lighter	key area	Secondary key	General Area

3. Commentary by zones

Based on the aforementioned zoning principles and methods, and taking into account the actual situation of the mine, we adhere to the "people-oriented" principle. On the basis of the current assessment and predictive assessment of the impact on the mine's geological environment, and fully considering the importance of the construction project itself, the assessment area is divided into key prevention and control zones. The zoning is described as follows:

(1) Key prevention and control area (A)

The area comprises open-pit mining sites, industrial mining sites, waste dump sites, and tailings ponds, covering a total area of 2.7473 million square meters. Its main characteristics are: a relatively minor impact on geological disasters, severe damage to topography and landscape, and considerable destruction of land resources.

In the event of a geological disaster in this area, it would cause damage to the mine geological environment, potentially leading to harm to people, property, and resources. Furthermore, it would severely damage the topographical and geomorphic landscapes. Therefore, it is classified as a key prevention and control area for mine geological environment protection and restoration. Based on the existing geological environmental issues in the area, the degree of impact on the topographical and geomorphic landscapes, and the extent of damage to land resources, comprehensive measures will be taken to manage this key prevention and control area.

(2) Secondary key area (A)

The area includes topsoil stockpile sites, mineral processing industrial sites, and camps, covering a total area of 714,200 square meters. Its main characteristics are: relatively minor impact on geological disasters, severe damage to topography and landscape, and significant destruction of land resources.

Monitoring of the mine geological environment should be conducted in this area to promptly understand and grasp the scope of impact and degree of damage caused by mining activities on the original topography and landform landscape. Engineering measures should be taken to promptly eliminate potential geological hazards identified through monitoring.

(3) General area (A)

To assess areas within the region other than those mentioned above, which are indirectly impacted by mining activities, the general prevention and control area covers an area of 8,316,266 square meters. The mining activities within this area have a relatively minor impact on the topography and landscape; they also have a minor impact on the aquifers and land resources; and the potential for inducing geological disasters is low. The main prevention and control targets are other potential impacts that mining activities may have on the surrounding environment. The main prevention and control measures include setting up warning signs and conducting manual inspections to promptly rectify any hidden dangers and other geological environmental issues discovered during inspections.

17 Characteristics Table of Zoning for Mine Geological Environment Protection and Restoration

Classification of impact degree	Partition code	Area (10,000 m^2)	proportion
serious	A	274.7327	23.33%
relatively serious	B	71.4175	6.06%

Lighter	C	831.6266	70.61%
Total:		1177.777	100%

(II) Land reclamation area and scope of reclamation responsibility

The land reclamation area consists of land damaged by production and construction projects and permanent construction land. The scope of reclamation responsibility encompasses the damaged land and permanent construction land that is no longer in use within the reclamation area.

Based on this, the reclamation area of this mine comprises 17 sections, including the open-pit mining area of Orebody V, the open-pit mining area of Orebody IV, 1# overburden yard, 2# overburden yard, lean ore yard, 1# waste dump, 2# waste dump, 3# waste dump, gas station, warehouse area, industrial site for ore beneficiation in Workshop 2, industrial site for ore beneficiation in Workshop 1, wet tailings pond, dry tailings pond, explosives magazine, Chinese camp, and mine roads, covering a total area of 3,601,234 square meters· Among them, the Chinese camp, mine roads, industrial site for ore beneficiation in Workshop 2, industrial site for ore beneficiation in Workshop 1, explosives magazine, gas station, and warehouse are designated as permanent construction land after communication with the community. Therefore, the reclamation responsibility scope is defined as the 10 sections excluding the Chinese land, covering a total area of 2,912,400 square meters· The reclamation responsibility scope is entirely located within the mining area, and there is no reclamation responsibility obligation outside the mining area.

(III) Land type and ownership

The mining land belongs to KAMATIVI, and the ownership of the mining land is vested in Kamativi Mining Company (Private) Limited. The mining boundaries are clear, and there are no disputes over the right to use.

Chapter 4 Feasibility Analysis of Mine Geological Environment Treatment and Land Reclamation

I. Communication on the preservation of facilities in the reclamation area and the reclamation method

To scientifically determine the direction for land reclamation and facility reuse after the closure of mines, avoid blind investment and resource waste, and ensure that land use after mine closure truly meets the needs of local sustainable development, the project conducted extensive, multi-level, and wide-ranging communication and research during the planning process. Several forums and seminars were held with local governments, community representatives, and the general public to deeply listen to the demands of all parties, and field investigations were conducted on the regional socio-economic status and development planning. Based on a comprehensive consideration of the long-term development of local society and economy, resource endowments, and the actual needs of the community, a comprehensive utilization plan for the post-closure of mining facilities was finally jointly determined with all parties, as follows:

(1) Chinese camp: After communication with the community, it was found that the building structure is relatively good and has certain utilization value, so it will not be bulldozed and reclaimed. After the mine is closed, it will be fully handed over to the local community for use to support community development.

(2) Supporting facilities in the mining area (including gas stations, explosives magazines, warehouse areas, mining industrial site warehouses and office buildings, mineral processing industrial site office buildings and laboratories): These facilities have been assessed to be structurally safe and functionally convertible, and will be handed over to the local community simultaneously after the closure of the mine. Their reuse can significantly reduce the initial investment in community public services and industrial development, with specific uses to be determined by the community based on its development needs.

(3) Main roads in the mining area: Due to their strong connectivity, after consultation with the local government and community, it has been decided to retain their traffic function and not to reclaim them. In the future, they will serve as community commuter roads and regional connecting lines, continuously providing convenient transportation for the local area.

(4) The sunken part of the open pit: Based on the reality of local drought and water shortage, as well as the needs of agricultural irrigation and aquaculture, after multiple demonstrations, it has been decided to adopt the "pit lake" method for reclamation. The lake will be mainly used to collect surface runoff during the rainy season, alleviate the problem of water shortage, and is planned to support ecological

industries such as fish farming, aiming to bring long-term economic and environmental benefits to the local area.

(5) Other areas: Strictly adhere to relevant national and local standards and regulations, aiming to restore the ecology and prevent soil erosion. Primarily utilize artificial pasture for reclamation, while considering both ecological benefits and the potential for sustainable land use in the future.

The above plan is the result of repeated negotiations and consensus-building, aiming to ensure that the re-use of land after the closure of mines can not only effectively improve the ecological environment but also truly benefit local communities and promote coordinated socio-economic development in the region.

II. Feasibility analysis of mine geological environment governance

Based on the scale, characteristics, distribution, and hazards of geological disasters, aquifer damage, topographical and geomorphological landscape (geological relics, cultural landscapes) damage, and water and soil environmental pollution caused by mining activities and those predicted to occur in the future, the feasibility and difficulty of implementing prevention and control measures are elaborated according to the types of problems.

(I) Technical feasibility analysis

The complexity of the terrain in this mining area is simple. The mining method is recommended based on the occurrence conditions of the ore body and the terrain conditions of the deposit. The mining plan is to adopt a top-down bench mining method, with safety platforms set at 5m and 7m, and cleaning platforms at 11m, 13m, and 5m. The bench height is 15m, and the height of the bench after breaking is 30m, ensuring stable final mining benches. After the tailings pond, waste dump, and other industrial sites are closed according to the design, the terrain becomes gentle and the slopes are stable. The mine restoration and management adhere to the principles of "developing while protecting, protecting while developing" and "adapting to local conditions, mining while managing". By constructing a small number of drainage channels around the mining boundary, building a small number of retaining walls in the ore stockpile area, constructing drainage facilities in the tailings pond, waste dump, and other industrial sites, conducting daily patrol monitoring, using vegetation concrete ecological slope protection technology, and planting trees and grass, the geological environment of the mining area can be restored. Therefore, the prevention and control of geological environment management engineering in this mine is necessary and technically feasible. The measures taken in the management engineering have basically no adverse impact on the environment. After the completion of the prevention and control engineering, it can play a role in protecting the environment, promoting local social stability, and accelerating economic development.

(II) Economic feasibility analysis

If the slopes of mines or other facilities are not properly treated and managed, landslides, collapses, and other disasters may occur, posing threats to the safety of mining equipment and facilities, and even endangering the lives of mining workers. Once a geological disaster occurs, it can lead to significant direct economic losses. By implementing engineering measures to manage the disaster-prone areas, the basic stability of the open-pit mining area can be ensured, thereby ensuring the safety of the entire mining area and achieving remarkable economic benefits. Therefore, the prevention and control of geological environmental governance projects for this mine are necessary and economically feasible.

(III) Analysis of ecological environment coordination

Mine development is a complex systematic project that follows its own laws. The mine development process is divided into five stages: pre-design stage, design stage, construction stage, production stage, and closure stage. Mine construction should follow the principle of "prioritizing ecological and social benefits". Mine development disrupts and damages the geological environment, leading to the complexity of the ecological environment and determining the diversity of mine geological environment protection and ecological restoration and management. Based on the geological environmental characteristics of the mine project and the pressure of mine engineering activities on the geological environment, resulting in mine environmental geological issues, mine geological environment protection and ecological restoration and management should be planned and zoned according to different types. In view of different engineering characteristics and geological environmental features, comprehensive planning and comprehensive remediation of mine geological environment restoration and ecological restoration and management should be carried out from the perspective of sustainable development strategy and "green mine" construction requirements. Mine development and environmental protection and remediation should be regarded as a composite system, carried out simultaneously, and developed in a coordinated manner.

The mining area features complex terrain, with some steep slopes, and focuses on vegetation restoration and pit-lake projects to prevent geological disasters such as collapses and landslides caused by unreasonable artificial slopes and waste residue piling. In addition to engineering measures, dust-retaining trees should be planted to mitigate the pollution caused by ore dust and fugitive dust. The ecological restoration and management of deep concave mining sites are challenging. Therefore, mine design and mining should consider development and comprehensive management after the closure of the pit. This plan systematically analyzes the geological structure and ore composition of the mining area, confirming that the ore body does not contain toxic or harmful elements, and the heavy metal content of the ore and surrounding rocks is below the international environmental protection standard limits. This provides an important environmental foundation for the reclamation of pit lakes and

grasslands. Based on the above, the risk of water pollution in the project area is controllable, and the concentration of heavy metal leachate is below the limits set by the World Health Organization's Drinking Water Standards, which will not significantly pollute the pit lake water body. Furthermore, the hydrogeological conditions in the project area are suitable, with the catchment area of the pit lake dominated by inert rock formations with low permeability, which can effectively prevent groundwater cross-layer pollution. At the same time, regional rainfall runoff can be diverted through a drainage system to reduce the risk of acidic water generation. Therefore, the reclamation of pit lakes in this mine is feasible in terms of environmental conditions, technical measures, and risk control. After reclamation, it can be used as a water resource reserve or ecological landscape land, providing long-term benefits to the local community. In summary, after the implementation of the project, it will increase topsoil vegetation, manage soil erosion, and create a good ecological environment. Therefore, the prevention and control of mine geological environment management projects are necessary and feasible from an ecological perspective.

(IV) Pre-analysis of the feasibility of reclamation of tailings pond

To ensure the safety and effectiveness of land reclamation work after the closure of the tailings pond, this plan conducts a systematic pre-analysis of the feasibility of reclamation for the tailings pond, as follows:

Environmental safety analysis of tailings components: The ore type mined in this project is spodumene, and its ore and the tailings generated after mineral processing do not contain toxic or harmful heavy metal elements (such as arsenic, cadmium, mercury, lead, etc.), and have stable physicochemical properties. According to the tailings component testing report, its pH value is neutral, and the leaching concentration of heavy metals is far below the regulatory limit, thus avoiding the risk of soil and water pollution after reclamation from the source, laying the most important material foundation for safe reclamation.

Geological Stability and Engineering Feasibility Analysis: The dam structure of the tailings pond is stable, and anti-seepage measures (such as laying HDPE impermeable membrane) are strictly implemented in accordance with specifications. The final stability reinforcement will be completed before the closure of the pond. Preliminary analysis suggests that no geological disasters (such as landslides and collapses) will occur after the closure of the tailings pond. The site is overall stable and possesses the engineering conditions for landform reconstruction, soil restructuring, and vegetation restoration.

Suitability analysis of reclamation direction: Based on the characteristics of the tailings pond and the surrounding environment, the priority for the reclamation direction of the tailings pond is determined to be ecological restoration. Through the technical process of "geomorphological reshaping - soil reconstruction - vegetation restoration", vegetation can be effectively restored. Considering the local climate and

soil conditions in Zimbabwe, the reclamation project will prioritize the selection of herbaceous plants that are resistant to infertility and have strong capabilities for initial coverage, gradually guiding the ecosystem to evolve towards a self-sustaining state.

Key technical support for reclamation: Given the poor water retention and nutrient retention capacity of the tailings pond, a comprehensive drainage system will be established to prevent soil erosion and consolidate the reclamation achievements.

In summary, the tailings pond of this mine fully meets the reclamation conditions due to its low environmental risk from contained substances and high site stability. After reclamation, it can effectively control dust, restore the ecology, and coordinate with the surrounding land use planning, achieving sustainable land use.

II. Feasibility analysis of land reclamation in mining areas

(I) Current land use status in the reclamation area

The land in the reclamation area is primarily grassland, accompanied by a small amount of shrubland.

(II) Suitability evaluation of land reclamation

Based on the survey of the current status of mine land and the analysis of land slated for destruction, the scope of reclamation responsibility for the mine is defined as the open-pit mining area, various industrial sites, tailings pond, waste dump, and other damaged land areas, with a total area of 3,601,234 square meters. The reclamation area covers 2,912,400 square meters, while the other planned land use area is 688,834 square meters, resulting in a land reclamation rate of 80.88%.

1. Evaluation principles

(1) It shall comply with the overall land use planning and be coordinated with other planning.

When determining the suitability of land for reclamation, it is necessary to consider not only the natural conditions and damage status of the evaluated land, but also the regional overall land use planning and agricultural and pastoral planning. Overall consideration should be given to the socio-economic development of the region and the production and construction development of the mining area, to avoid blind investment and excessive waste of land resources.

(2) The principle of adapting to local conditions.

Land use is constrained by surrounding environmental conditions, and land use patterns must have supporting facilities that are compatible with environmental characteristics. Based on the infrastructure that the land possesses before and after being damaged, we should adjust measures to local conditions, leverage strengths and circumvent weaknesses, and determine a reasonable utilization direction. After

reclamation, according to the overall land use planning and ecological construction planning, and on the basis of respecting the wishes of the right holders, the land should be used for agriculture if suitable, for forestry if suitable, for animal husbandry if suitable, for fishing if suitable, or for grassland if suitable.

(3) Principle of combining natural factors with socio-economic factors.

For the suitability evaluation of reclamation of damaged land in reclamation areas, it is necessary to consider both its natural attributes (such as soil, climate, landform, degree of damage, etc.) and its social attributes (such as the willingness of the construction unit, social demand, and funding). The combination of the two determines the direction of reclamation and utilization.

(4) Dominant limiting factors and the principle of comprehensive balance.

There are numerous factors that influence the reclamation and utilization of damaged land, such as soil source, slope, soil fertility, and irrigation and drainage conditions. Based on the natural environment, land use, and land damage situation in mining areas, it is essential to analyze the dominant limiting factors affecting the reclamation and utilization of damaged land, while also taking into account other limiting factors.

(5) Principle of optimal comprehensive benefits.

When determining the direction of land reclamation, priority should be given to considering its optimal comprehensive benefits and selecting the best utilization direction. This should be based on whether the land condition is suitable for reclamation into a certain type of land, or whether the minimum cost investment can achieve the best economic, social, and ecological environmental benefits. At the same time, attention should be paid to maximizing overall benefits.

(6) Principle of dynamic and sustainable land use.

The degradation of reclaimed land is a dynamic process, and the suitability of reclaimed land also varies with the level and process of degradation, exhibiting dynamism. When evaluating the suitability of reclaimed land, it is necessary to consider the prospects for industrial and agricultural development in mining areas, technological progress, and changes in social demand brought about by production and living standards, in order to determine the direction of development and utilization of reclaimed land. The reclaimed land should not only meet the needs of protecting biodiversity and the ecological environment but also satisfy human demands for land. It is essential to ensure ecological security and sustainable development of human society.

(7) Principle of economic feasibility and technical rationality.

The cost required for land reclamation should be determined under the premise of ensuring the integrity of reclamation objectives and achieving reclamation standards, while taking into account the cost of land reclamation and minimizing the

burden on enterprises. The reclamation technology should be able to meet the requirements for the smooth implementation of reclamation work and achieving reclamation quality.

2. Evaluation basis

Based on a detailed analysis of the natural conditions, socio-economic factors, and land use status of the mining area, the suitability evaluation of land reclamation takes into comprehensive consideration the analysis results of land damage, public participation opinions, and reclamation experience from similar projects in the surrounding areas. Practical and feasible methods are adopted to determine the direction of reclamation and utilization.

3. Suitability evaluation

Based on the characteristics of this project, the following technical route for suitability evaluation has been formulated according to local conditions, in the hope of obtaining the most optimal and reasonable land reclamation plan.

1) Definition of reclamation scope

Based on the survey of the current status of the damaged land in the mine area and the analysis of the land proposed to be damaged, the total area of damaged land in the mine is within the scope of reclamation responsibility. After communication with the public and the local government, some areas have been closed, and 688,834 square meters have been designated as other planning land, where no reclamation work will be carried out. Therefore, the total area of reclamation scope is 2,912,400 square meters.

2) Division of reclamation evaluation units

Based on the overall land use planning and relevant plans, and following the principle of adapting to local conditions, while fully respecting the wishes of landowners, the optimal utilization direction of the land to be reclaimed is determined based on the original land use type, land damage situation, public participation opinions, etc., under economically feasible and technically reasonable conditions. The land reclamation evaluation units are then divided accordingly.

Evaluation units are generally defined as damaged plots with the same damage method and degree, as well as identical or similar internal and external characteristics. This facilitates the reasonable determination of the assignment of evaluation factors for each evaluation unit, making the determined reclamation direction more closely aligned with reality.

Through on-site inspection and investigation, it was found that the main types of land damage caused during the mining process in the mine are the destruction of the regional surface during the construction of open-pit mining areas, mine roads, tailings ponds, camps, and industrial sites. Among them, two open-pit mining pits were formed after the final mining was completed, with the boundary being defined by the enclosed circle of the open-pit. The concave part below the enclosed circle of the open-pit mining area of Orebody IV is 157.5 meters deep, and the elevation difference

of the slope is 45 meters. The concave part below the enclosed circle of the open-pit mining area of Orebody V is 120 meters deep, and the elevation difference of the slope is 50 meters. After mining, corresponding safety platforms, cleaning platforms, final slope angles, and bench slope angles were formed according to the design. The waste dump was strictly piled to the design elevation in a bench-like shape according to the design. The tailings pond was drained to the dam crest height according to the design, forming a flat area with the dam crest as the reference plane. The industrial sites in the mine are mainly production or supporting production buildings; the living camp is mainly composed of living and office buildings, with some supporting green areas; various stockpiles are used for production or pending production of pegmatite; the mine roads are relatively flat and are all compacted mud-gravel roads; various facilities are connected to each other through mine roads. However, the roads, camps, and some supporting facilities still have social value after being closed. Therefore, based on the different characteristics of land damage in each block, 10 evaluation units were divided: Open-pit mining area of Orebody V, open-pit mining area of Orebody IV, 1# topsoil stockpile, 2# topsoil stockpile, lean ore stockpile, 1# waste dump, 2# waste dump, 3# waste dump, wet-piled tailings pond, and dry-piled tailings pond.

3. Analysis of characteristics before and after the construction of evaluation units

The characteristics of evaluation units before and after construction are predicted based on the current survey data of each evaluation unit, combined with the construction plan of the mine. The analysis of the characteristics of each evaluation unit before and after mining is presented in Table 4-1.

1 Characteristic analysis of each evaluation unit before and after construction

Evaluation unit	**Area (10,000 m^2)**	**Characteristics before construction**	**Characteristics after construction**
Open-pit mining area of Orebody V	27.0488	The reclamation area is primarily hilly, with a relatively flat terrain and well-developed vegetation. Vegetation covers 80% of the area, mainly consisting of shrubs, miscellaneous trees, and weeds.	The land has been excavated and damaged, with vegetation destroyed. The terrain of the pit bottom and platform is relatively flat. The rocks are exposed, with a slope of about 0° to 5°. Below the enclosed area is a concave part, which is prone to water accumulation.
Open-pit mining area of Orebody IV	51.8674		The land has been stripped and damaged, with vegetation destroyed. The terrain at the bottom of the pit and on the platform is relatively flat. The rocks are exposed, with a slope of about 0° to 5°. Below the enclosed area is a concave part, which is prone to water accumulation
1# Topsoil Storage Yard	7.3941		The land has been occupied and the vegetation has been destroyed. The surface

Evaluation unit	Area (10,000 m^2)	Characteristics before construction	Characteristics after construction
			layer of the site is primarily composed of stripped sandy soil, with a slope of approximately 15° to 25°.
2# Topsoil Storage Yard	9.1133		The land has been occupied and the vegetation has been destroyed. The surface layer of the site is mainly composed of stripped sandy soil, with a slope of about 15° to 25°.
Lean ore stockyard	14.8071		The land has been damaged due to excavation and occupation, with vegetation destroyed. Most of the site is occupied by abandoned ore, with a slope of about 15° to 35°.
Wet-discharged tailings pond	36.2452		The land has been damaged by excavation and occupation, with vegetation destroyed. Most of the site is occupied by abandoned ore, with a slope of about 15° to 35°.
Dry-piled tailings pond	27.4295		The land has been damaged by excavation and occupation, the vegetation has been destroyed, and most of the site is occupied by abandoned ore, with a slope of about 15° to 35°.
1# Dump site	9.2352		The land has been occupied and the vegetation has been destroyed. The surface layer of the site is mainly composed of stripped sandy soil, with a slope of about 15°~25°.
Waste dump No. 3	29.1209		The land has been occupied and the vegetation has been destroyed. The surface layer of the site is mainly composed of stripped sandy soil, with a slope of about 15° to 25°.
2# waste dump	78.9786		The land has been occupied and the vegetation has been destroyed. The surface layer of the site is mainly composed of stripped sandy soil, with a slope of about 15° to 25°.
Total:	291.2401		

4. Selection of reclamation directions for evaluation units

The selection of reclamation directions for the evaluation unit is determined based on the actual situation of the mine-damaged land parcels and the main land use patterns in the local area, which include potholes, grasslands, shrublands, and other grasslands.

5. Determination of evaluation grades for various reclamation directions

Based on the actual situation of the project area and the land use after reclamation, factors such as soil texture, topographic slope, soil organic matter content, land use status, geological disasters, irrigation conditions, drainage conditions, rock and soil pollution, and effective soil layer thickness are determined as factors for suitability evaluation to assess the reclamation suitability of the land to be reclaimed in this project. Scores above 90 indicate suitable for paddy fields, scores between 60 and 90 indicate suitable for grasslands, and scores between 40 and 60 indicate suitable for both grasslands and forests.

The evaluation criteria and their weights are shown in the table below (Table 4-3):

2 List of Suitability Evaluations for Various Participating Units Based on the Grade Standards of Main Limiting Factors for Reclaimed Land

Factor and full score	indicator	Weight index
soil texture (10)	loam	10
	Clay, sandy loam	7
	Heavy clay, sandy soil	5
	Sandy soil, gravelly soil	2
	Stone quality	0
Terrain slope (°) (12)	< 2	12
	2～5	10
	5～8	8
	8～15	6
	15～25	3
	>25	0
Soil organic matter content ($g \cdot kg^{-1}$) (15)	>4%	15
	4%～3%	13
	3%～2%	11
	2%～1%	5
	0.6～1%	2

	< 0.6%	1
Current land use status (15)	Hirata	15
	Terraced fields, flat land, vegetable fields	13
	Terraced fields	11
	Slope land, open field	9
	garden plot	8
	woodland	5
	Pasture land, grassland	2
	Bare land, bare rock and gravel land	0
Degree of geological disaster risk (8)	good	8
	mild	4
	serious	0
Irrigation conditions (10)	Having stable irrigation conditions	10
	The guarantee of irrigation water source is generally adequate	8
	The guarantee of irrigation water sources is poor	5
	No guarantee of irrigation water source	0
Drainage conditions (10)	Good drainage	10
	Drainage is average	8
	Poor drainage	5
	none	0
Geotechnical pollution (10)	no	10
	mild	8
	moderate	5
	severe	0
Effective soil layer thickness (cm) (10)	>150	10
	100～150	8

	60～100	5
	30～60	2
	<30	0
total score		100

6. Suitability evaluation results of land to be reclaimed

After consolidation, the reclaimed land from the mining project will possess a certain level of productivity. However, due to varying conditions across different evaluation units, their suitability differs. Since the public has reached a consensus on using pit lakes for reclamation in the concave areas below the enclosed boundary of the open-pit, these areas will not be evaluated. Only the hillside open-pit section above the enclosed boundary will be assessed. By comparing the land quality of the evaluation units with the evaluation grade standards for agriculture, forestry, and animal husbandry, which represent the main limiting factors for land to be reclaimed, the suitability evaluation results of the reclaimed land from the mining project are presented in the table below.

3 Table of scores for various indicators of land quality to be reclaimed

partition	soil texture	terrain slope	organic matter content	Current land use status	Degree of geological disaster risk	Irrigation conditions	Drainage conditions	Geotechnical pollution	Effective soil layer thickness	score	Suitability
1# Topsoil Storage Yard	5	3	2	2	8	5	8	10	10	53	Suitable for grassland
2# Topsoil Stockpile Area	5	3	2	2	8	5	8	10	10	53	Suitable for grassland
Lean ore stockyard	2	3	2	2	8	5	8	10	0	40	Suitable for grassland
Wet-discharged tailings pond	2	3	2	2	8	5	8	10	0	40	Suitable for grassland

partition	soil texture	terrain slope	organic matter content	Current land use status	Degree of geological disaster risk	Irrigation conditions	Drainage conditions	Geotechnical pollution	Effective soil layer thickness	score	Suitability
Dry-piled tailings pond	2	3	2	2	8	5	8	10	0	40	Suitable for grassland
Waste dump 1#	2	3	2	2	8	5	8	10	10	50	Suitable for grassland
Waste dump 3#	2	3	2	2	8	5	8	10	10	50	Suitable for grassland
Waste dump 2#	2	3	2	2	8	5	8	10	10	50	Suitable for grassland

7. Objective of land reclamation in mining areas

The evaluation results table for the suitability of land reclamation in the mining project clearly indicates that the main focus of mine reclamation is on other grasslands. In order to harmonize with the surrounding environment and in consideration of the actual situation, the open-pit mining area adopts pit lake reclamation, while the reclamation direction for the waste dump, tailings pond, and topsoil yard is set towards other grasslands.

The reclamation responsibility area of the mining area covers an area of 3,601,234 square meters, of which the Chinese camp, mine roads, industrial site for ore dressing in Workshop 2, industrial site for ore dressing in Workshop 1, explosive magazine, gas station, and warehouse are permanently designated as construction land after communication with the community. Therefore, the reclamation responsibility area is divided into 10 sections, with a total area of 2,912,400 square meters. The area proposed for reclamation into a pit lake is 789,161 square meters, and the area of other grassland is 2,123,239 square meters.

(III) Analysis of water and soil resource balance

1) Water resource balance

A) Water supply analysis

①Atmospheric precipitation

Based on the meteorological characteristics introduced earlier, the project area has an average annual rainfall of 867mm. According to the terrain and land types within the reclamation area, rainfall generates abundant surface runoff, with a catchment area of approximately 2,912,400 m² and a runoff coefficient of 0.50. Using the following formula, the total annual surface water volume can be calculated as approximately 126.25×10^4 m³.

$Q=S\times h\times\varphi=291.2400\times867\times10^{-3}\times0.50\approx1,262,500$ m³

In the formula: Q - total surface water volume of the whole year (10,000 m^3);

S - Catchment area of the reclamation scope (m^2);

h - Multi-year average runoff depth in the reclamation area (mm);

φ - runoff coefficient, taken as 0.50.

Based on the above analysis, it can be seen that the total amount of surface water resources in the project area is abundant, with a rich supply of usable water. The total annual surface water volume is approximately 1.2625 million cubic meters.

②Surface water storage

The surface water body near the mining area is the Kamativi Reservoir. Located in the central part of the mining area, the reservoir covers an area of approximately 0.37km², with a circumference of about 5.0km, a length of 1.2km from east to west, and a length of 0.78km from north to south. The reservoir's water mainly comes from rainwater, with a maximum depth of about 30m and an average depth of about 4.7m. Based on the above analysis, the total available water resources in the project area amount to 3,001,500 cubic meters.

B) Water demand analysis

After reclamation, the grassland requires irrigation. Based on the rainfall characteristics within the region, the grassland needs to be irrigated for 8 months throughout the year, while the remaining 4 months rely on natural replenishment from atmospheric precipitation.

Key influencing factors and calculation logic

1) Water requirement differences during the growth stages

The growth stages of drought-tolerant grass throughout the dry season can be divided into:

Greening period (August to November): Root system recovery requires maintaining soil moisture (with a water content of 60%-70% of the field capacity),

and the water demand accounts for 70%-80% of the total demand during the dry season.

Pre-dormant period (April to July): Temperature drops, growth slows down, and water demand decreases (accounting for 20%-30% of the total demand during the dry season).

2) Climate and evaporation

During the dry season (April to November), there is no natural precipitation, and water replenishment relies solely on irrigation. The key climatic parameter is the reference crop evapotranspiration (ET_0), which represents the water evaporation potential of the soil-plant-atmosphere continuum. Based on the climate of the reference region, ET_0 is set at 8mm/day

3) Water requirement characteristics of grass seeds

The crop coefficient (Kc) of drought-tolerant grasses, which reflects the ratio of actual water demand to potential evapotranspiration, varies with the growth stage as shown in the following table:

growth stage	Kc range	Instructions
Greening period (August to November)	0.8-1.0	The root system is shallow, requiring a lot of water but exhibiting strong drought tolerance
Growth period (December to March)	1.0-1.2	It grows vigorously and requires the most water (Kc slightly decreases at high temperatures)
Pre-dormant period (April to July)	0.6-0.8	Growth slows down, and water demand decreases

4) Soil water retention capacity

Sandy soil: Low water-holding capacity, with an effective water content of about 50-80mm/m, requiring frequent but small amounts of irrigation (5-10mm per irrigation).

5) Irrigation efficiency (η)

Drip irrigation: $\eta \approx 0.9$ (high water use efficiency, suitable for sandy soil);

Sprinkler irrigation: $\eta \approx 0.7$-0.8 (good uniformity, suitable for clay soil);

Flood irrigation: $\eta \approx 0.5$-0.6 (serious wastage, not recommended).

②Water demand calculation

To calculate, it is necessary to first estimate crop evapotranspiration (ETc), which is typically approximately equal to the reference evapotranspiration (ET_0) multiplied by the crop coefficient (Kc).

Reference evapotranspiration: ET_0 averages 5mm per day, with a monthly average of 150mm;

Crop coefficient: Taking perennial ryegrass as an example (growth period Kc=1.0, regrowth period Kc=0.9, dormant period Kc=0.7);

Soil: Sandy soil (effective water content 60mm/m, irrigation efficiency η=0.8);

Objective: Maintain soil moisture content at 60%-70% of field capacity.

1) Calculation of monthly average water demand

Growth period (December to March, 4 months): naturally replenished by atmospheric precipitation,

Greening period (August to November, 4 months):

$ETc=Kc\times ET_o=0.9\times 5mm/day\times 30\ days=135mm/month$

Net irrigation water requirement IN=ETc−Pe=135−0=135mm/month (without rainwater)

The irrigation water requirement for furrow irrigation is calculated as IR=IN/η=135/0.8≈168.75mm/month (approximately 0.17m³/㎡·month).

Pre-dormant period (April - July, 4 months):

$ETc=Kc\times ET_o=0.7\times 5mm/day\times 30\ days=105mm/month$

Net irrigation water requirement IN=ETc−Pe=105−0=105mm/month (without rainwater)

The irrigation water requirement for gross irrigation is IR=IN/η=105/0.8≈131.25mm/month (approximately 0.13m³/㎡·month).

2) Total water demand during the full dry season

168.75×4+131.25×4≈675+525≈1200mm/dry season (approximately 1.2m³/㎡·dry season).

The area of reclaimed grassland in the project area is 2,123,239 m^2. Based on the gross irrigation water demand of 1.2 m³/m2 during the full dry season, the calculated water demand is approximately 2,547,900 m³.

④Water balance analysis

Through analysis, it can be concluded that the total water supply in the project area (3,001,500 m³) exceeds the water demand (2,547,900 m³), which can meet the water needs for agricultural planting in the project area. In the reclamation project, water reservoirs, sand basins, channels, and other hydraulic engineering structures will be constructed to regulate the balance of water resources in time and space, ensuring sufficient irrigation water within the area.

⑤Analysis of reservoir water storage restoration in mining areas

The reclamation direction for the open-pit mining areas of Orebody IV and

Orebody V is towards the pit lake. The pit lake has a large water demand, which can be met by utilizing surface water. The open-pit mining area of Orebody IV is adjacent to the KAMATIVI River, which flows into KAMATIVI Lake along the northern border of the mining area. The reclamation of the pit lake in the open-pit mining area of Orebody IV can utilize the river to introduce surface water into the mining pit, accelerating the reclamation work of the pit lake (the original reservoir water volume will decrease, affecting the ecology of downstream reservoirs during the reclamation period). To collect surface water, a diversion canal with a length of 40 meters, a width of 10 meters, and a depth of 2 meters needs to be built. The open-pit mining area of Orebody V has no river passing through it. Water from the mountain catchment areas is collected by building flood intercepting ditches on the west and north sides of the mining area and diverted into the pit. Water is also introduced into the pit from the east side by utilizing natural valleys. A total of 1.2 kilometers of flood intercepting ditches need to be built.

Analysis of water storage capacity of reclaimed reservoirs

main structure of the project	Restoration area (10,000 m²)	Average height (m)	Reservoir capacity (10,000 m3)
Open-pit mining area of Orebody IV	51.8674	116	6017
Open-pit mining area of Orebody V	27.0488	60	1623
total	78.9162	—	7640

According to the table above, the recoverable water storage capacity of the reservoir area in this project is 76.4 million m^3. The water storage in the project area mainly relies on nearby rivers and natural channels. The annual average rainfall in the project area is 867mm, and the construction of diversion channels in the restoration project has increased the rainfall utilization rate to 80%. Based on the annual rainfall, it is estimated that the annual water storage capacity in the area is 928,960 m^3. For detailed analysis, please refer to the table below:

4 Annual water storage capacity of reclaimed reservoir

Rainwater harvesting area (10,000 m²)	Annual average precipitation (mm)	Runoff coefficient	Surface runoff (10,000 m3)	Utilization rate	Annual water supply (10,000 m3)	Water storage plan (year)
155.6022	867	0.6	80.94	80%	64.752	93
67.622			35.18		28.144	58
223.2242	—	—	116.12	—	92.896	151

Based on this analysis, it can be seen that the restoration of reservoir water storage dates back to a long time ago, and the restoration measures have been supplemented with greening measures. Specifically, replanting and greening involves scientifically selecting suitable tree species and herbaceous plants to gradually restore vegetation cover in the reservoir area and surrounding areas, effectively curbing soil erosion, while providing habitats for aquatic organisms and promoting the restoration of biodiversity.

3) Soil resource balance

A) Soil analysis is required

Based on the reclamation suitability evaluation of the evaluation unit, the reclamation direction of this project is pit lakes and other grasslands. The area reclaimed as pit lakes is 789,161 m^2, and the area reclaimed as other grasslands is 2,123,239 m^2. For the area reclaimed as pit lakes, spillway facilities need to be constructed; for the area reclaimed as other grasslands, the standard for backfilling topsoil in areas with a slope of ≤35° is to cover with soil at a depth of 0.2 m. Due to the steep slopes in the final mining slope area and the dump slope area, approximately 124,000 m2 cannot be covered with soil. After removing the pumice in this area, bougainvillea will be planted at the slope toe. Based on the above analysis, the amount of topsoil covered in the project area is 399,800 m^3.

B) Analysis of soil supply quantity

According to the preliminary design plan for the mine, during the later stage of mining, the main area where shrub forests are present can have an area of approximately 1.9507 million m^2 for topsoil stripping. Based on a stripping thickness of 0.3m, a total of 585,200 m^3 of topsoil can be stripped.

The stripped topsoil is designed to be stockpiled in designated areas, and part of it is reclaimed according to the mine production schedule, following the principle of "reclaiming while mining". This ensures that the amount of topsoil in the stockpile is relatively small and the storage is relatively safe. To prevent dust during the stacking process in the soil yard and erosion caused by rainfall on the surface of the loose accumulation, dustproof nets are laid on the surface of the accumulation for protection. Additionally, to maintain soil fertility, ryegrass seeds are sown on the surface of the topsoil accumulation for greening and maintenance.

C) Analysis of supply and demand balance

After statistical analysis, the required soil volume for the project is 399,800 m^3, while the available soil supply is 58.52 m^3, which is greater than the amount of topsoil required for covering. However, considering losses during the transportation of topsoil, the amount of topsoil for covering is slightly larger than the actual demand. Therefore, it is recommended to collect as much topsoil as possible during the collection process to prevent shortages. Based on the analysis of the required and available soil volumes, the soil source for reclamation can be guaranteed to meet the reclamation needs.

(IV) Quality requirements for land reclamation

1) Overall requirements

1. The type of reclamation and utilization should be coordinated with the local terrain, landform, and surrounding environment;

2. The stability and safety of the reclamation site should be reliably guaranteed;

3. Different standards should be applied for different types of damage;

4. The reclamation site must be equipped with irrigation facilities that meet the required standards to fulfill irrigation needs;

5. The reclamation site must be equipped with drainage facilities that meet the required standards, and the flood control standards must comply with local regulations;

6. Measures to control soil erosion are in place at the reclamation site;

7. Measures to control pollution are in place at the reclamation site, encompassing air, surface water, and groundwater;

8. The layout of roads and transportation trunk lines on the reclamation site is reasonable;

9. The materials used for covering should be non-toxic and harmless. If the materials contain harmful components, they should be treated in advance, and if necessary, an isolation layer should be set up before reclamation.

2) Quality requirements for land reclamation in various reclamation directions

The quality requirements for land reclamation are based on the land reclamation quality control standards, as shown in Table 4-5.

5 Quality control standards for reclamation of potholes and lakes

category	indicator item	Specific standards and requirements
water quality safety	Physicochemical indicators	The pH value, transparency, dissolved oxygen, heavy metals (such as lead, cadmium, mercury, arsenic, etc.) and characteristic pollutant concentrations should comply with the surface water environmental quality standards. If used for aquaculture, the water quality must also meet the fishery water standards.
	Eutrophication risk	The concentrations of nutrients such as total nitrogen and total phosphorus should be controlled within reasonable limits to prevent eutrophication (such as algal blooms) in water bodies.
Water body morphology and safety	Water depth and shoreline	The water depth in different areas of the lake should meet the design safety and functional requirements. The shoreline should be naturally gentle or reinforced to prevent collapse and soil erosion.
	safety protection	Conspicuous safety warning signs must be set up in dangerous areas such as areas near lakes and steep slopes. In areas with heavy pedestrian traffic, protective

category	indicator item	Specific standards and requirements
		railings or isolation nets should be installed when necessary.
Ecosystem Construction	Aquatic vegetation	Plant aquatic plants suitable for the local conditions to purify water quality and provide habitats for aquatic organisms. The survival rate and coverage should meet the design goals of the plan.
	Aquatic animals (if planned)	If one intends to develop aquaculture, the fish fry and other aquatic species introduced should comply with local ecological requirements and avoid introducing invasive species.
supporting facilities	Flood control and drainage	The constructed drainage facilities should meet the regional flood control standards, ensure effective response to rainstorms, and smoothly connect with the surrounding drainage system.
	monitoring point	Water quality monitoring points that are convenient for sampling and observation should be established.

6 Reclamation quality control standards for exploration areas

Reclamation object	key steps	Technical points and quality standards
Exploratory hole	Orifice treatment	After backfilling the hole, ensure that it blends naturally with the surrounding area.
	ecological restoration	Perform backfilling in the sealed hole area, ensuring that the thickness of the backfill meets the requirements for subsequent vegetation growth and seamlessly blends with the surrounding terrain.
Exploration platform	Clearing and leveling Topsoil restoration	The stripped and stored topsoil shall be returned to the leveled platform, with a post-leveling slope not exceeding 10° and a covering soil thickness of not less than 20 centimeters.
	vegetation restoration	After vegetation restoration, its coverage, biomass, and other indicators should reach the level of similar surrounding land within a certain period of time.

7 Quality control standards for grassland land reclamation

Reclamation direction		indicator type	Basic indicators	control standard
grassland	Other grasslands	soil quality	Effective soil layer thickness (in cm)	≥20

			Soil bulk density / (g/cm^3)	≤1.45
			soil texture	sandy loam
			Gravel content/%	≤50
			pH value	5.5-8.0
			Organic matter /%	≥1
			Yield / (kg/10,000 m^2)	Reach the same level of land use type as the surrounding areas in four years
		supporting facilities	irrigation	Achieve the same level of land use type as the surrounding areas in four years
			road	
		Productivity level	Coverage/%	≥40
			Yield / (kg/10,000 m^2)	Reach the same level of land use type as the surrounding areas in four years

Chapter 5: Mine Geological Environment Treatment and Land Reclamation Project

I. Protection of mine geological environment and prevention of land reclamation

(I) Objective and Task

1. Preventive objectives and tasks for mine geological environment protection

The goal of mine geological environment governance is to establish a relatively comprehensive prevention and control system, as well as a supervision and management system, for mine geological environment governance, based on a thorough understanding of the distribution and severity of geological environmental issues in mines. This aims to achieve coordinated development between mineral resource exploitation and mine geological environment protection, and to enhance the efficiency of mineral resource exploitation and utilization. Practical and feasible methods will be adopted to avoid and reduce the damage caused by mining activities to the geological environment in mining areas, thereby significantly improving the geological environment in mining areas and their surrounding areas.

Within the planning period of the governance plan, focus on geological disasters caused by mining activities and the damage to land and vegetation resources, carry out mine geological environment governance projects, ensure safe production in mines, and improve and restore the mine geological environment. Specific objectives for the governance of the mine geological environment are as follows:

a) Minimize the occurrence of geological environmental issues in mines, avoid and mitigate losses caused by geological disasters, effectively curb the impact and damage of mine production on topography and landscape, protect the geological environment of mining areas, achieve coordinated development between the exploitation and utilization of mineral resources and geological environmental protection, and realize sustainable economic development in mining areas.

b) Effectively manage the high and steep slopes formed by mining activities and the waste slag slopes, to avoid and mitigate the losses caused by potential landslides, waste slag debris flows, and associated geological disasters; prevent and reduce unnecessary economic losses and casualties; ensure the safety of construction sites, roads, and personnel.

c) Reduce the impact of mining production activities on the damage to aquifers.

d) Timely implement governance and land reclamation engineering measures to avoid and mitigate the impact of mine development on the topography and landscape,

and restore the surrounding vegetation. After the mine is closed, the geological environment of the mine should be coordinated with the surrounding ecological environment, achieving environmental functions that are compatible with the local conditions.

e) For damaged land, land reclamation measures shall be taken to restore it to its original appearance or suitable use. This will minimize the damage caused by mining activities to the land, ensure reasonable recovery and utilization of the damaged land, and improve land use efficiency.

Based on the objectives of geological environment governance for mines and in consideration of the actual situation of this mine, the tasks for geological environment governance are as follows:

1) Clear the dangerous rocks around the open-pit and on the slopes in a timely manner, strengthen slope management, and reduce or avoid personnel and property losses caused by unstable dangerous rocks and slopes.

2) Strengthen the comprehensive utilization of waste rocks and reduce the amount of waste rock stockpiling. Build retaining walls for the waste dump site according to relevant technical requirements, and stack waste rocks and waste residues in layers to avoid geological disasters such as collapses and landslides.

3) Optimize the mining plan and reduce the scope of damage.

4) Carry out geological disaster early warning and monitoring projects, including monitoring of disaster hidden danger points, deformation monitoring of stope slopes, dynamic monitoring of water environment and water volume, etc.

5) Promptly repair damaged land and vegetation during the production process. After the mine is closed, carry out reclamation work on the occupied and damaged land and restore vegetation.

2. Principle of prevention and control for land reclamation

In view of the characteristics of surface ecological damage caused by open-pit mines, the planning for land reclamation and ecological reconstruction in the project should adhere to the following principles:

1) We should attach equal importance to the development of mineral resources and environmental protection, adhering to the principles of "prioritizing prevention and combining prevention with control" and "developing within protection and protecting within development";

2) Adhere to the principle of "the one who causes the damage should take responsibility for remediation; the one who destroys should restore what was damaged",

3) The principle of "relying on technological progress, developing circular economy, and building green mining industry";

4) Adhere to the principle of "safety first, adapting to local conditions, and subordinating economic benefits to social and environmental benefits";

5) The principle of "overall planning, highlighting key points, and implementing in stages";

6) The principle of "technically feasible and economically reasonable";

7) Comprehensive utilization, economic rationality, and the mutual enhancement of economic, social, and environmental benefits;

8) Seek truth from facts and adjust measures to local conditions to maximize the restoration of the ecological environment.

(II) Main technical measures

1. Preventive measures for geological environmental protection

1) Preventive measures for geological disasters in mines

Based on the results of the geological environmental impact assessment of the mine, the potential geological disasters caused by mining operations include landslides and collapses. To address these potential risks, the following preventive measures are primarily taken: When mining in areas with hidden dangers of landslides and collapses, measures such as clearing, risk mitigation, or slope cutting should be taken to promptly eliminate these hazards. Solid waste should be stacked in an orderly and reasonable manner, with stable slope angles designed. Reinforcement or construction of retaining walls, drainage, and waterproofing projects should be implemented. Special attention should be paid to the prevention of geological disaster risks (such as landslides and mudslides) in the tailings pond area, especially the potential threat of flood invasion. The following targeted measures are recommended: (1) Constructing a comprehensive flood interception system: Set up flood intercepting ditches or drainage channels on the slopes surrounding the tailings pond to effectively guide mountain flood runoff away from the pond area, preventing floodwater from directly scouring the dam or entering the pond, thereby ensuring the stability of the dam and the safety of the pond area (the main project already includes a comprehensive flood interception system, so this plan does not repeat the design); (2) Regularly inspect and analyze the stability of the tailings dam slope to ensure it meets safety requirements (the workload has been included in the mine geological environmental monitoring section). (3) Before the official closure of the tailings pond, a qualified third-party organization will be entrusted to conduct comprehensive soil and environmental special inspections, assess the soil environmental quality of the tailings pond and surrounding areas, confirm the presence and migration and diffusion of characteristic pollutants (such as heavy metals), and provide scientific basis and benchmark data for ecological restoration after closure, ensuring that the site meets environmental protection requirements and has no remaining environmental risks

after closure (the workload has been included in the mining area land reclamation monitoring).

2) Aquifer protection measures

The mine is designed as a large-scale open-pit mine for lithium spodumene extraction. Based on the aquifer structure and groundwater occurrence conditions, combined with mining engineering, measures such as constructing flood intercepting ditches and drainage channels are taken to prevent pollution of groundwater by toxic and harmful wastewater and solid waste leachate.

3) Protection measures for topographical and geomorphological landscapes (geological relics, cultural landscapes)

The following measures should be taken to avoid or reduce the damage to the topography and landscape of the mining area caused by mining activities: optimize the mining plan to minimize or avoid damaging farmland; reasonably stack solid waste, select appropriate comprehensive utilization technologies, increase the amount of comprehensive utilization, and reduce the damage to the topography and landscape; carry out treatment while mining and restore vegetation in a timely manner; take measures such as fencing, warning signs, avoidance, and reinforcement to protect geological relics and cultural landscapes with significant scientific and cultural value.

4) Preventive measures for environmental pollution of land resources

Regular maintenance and repair of machinery and equipment required for mining in the mining area should be carried out to prevent soil and water pollution caused by oil leaks from machinery and equipment, such as gasoline and engine oil. Professional organizations should be entrusted to recycle and dispose of waste liquids. Meanwhile, the stripped topsoil should be collected and stacked in a safe location, and grass seeds should be sown for backfilling and utilization during reclamation.

2. Preventive and control measures for land reclamation

Based on the principles of "unified planning, source control, and prevention and restoration integration", preventive control measures for engineering land reclamation are formulated according to project characteristics, construction methods, and processes.

The prevention and control measures primarily encompass the following aspects:

1) The soil used in this project is sourced from mature soil in mining areas. Since soil extraction is the most severe form of land damage, it completely alters the natural structure of the original soil body. Therefore, to avoid adding new damaged land, this project adopts mature soil from mining areas, which can completely avoid this form of land damage and reduce the area of land damaged.

2) Selection of land occupation. To minimize the damage to land resources caused by the project, the project should strive to choose unused land as much as

possible. The concept of protecting land, especially arable land resources, should be effectively incorporated into the project's route and site selection, so as to reduce and avoid the damage to land resources from the source.

3) Consider reasonably optimizing the construction plan and facility layout, such as utilizing existing rural roads or rural residential facilities as close as possible for construction access roads and construction living camps, in order to reduce the amount of temporary land occupation and minimize the damage to the land.

4) Due to the destructive nature of mining production, land reclamation can only be carried out after the mine closure period. However, during the construction period, corresponding engineering and vegetation protection measures were taken for various sites to reduce and avoid soil erosion. In particular, the topsoil and arable soil of the original land were separately stored properly to provide usable soil sources for future land reclamation.

5) The preparation of land reclamation plans should be based on the principles of economic rationality, natural conditions, and the state of land damage, and the land use after reclamation should be determined according to local conditions. Land reclamation planning should be consistent with the overall land use planning of the project location and coordinated with other relevant planning.

6) The mine geological environment protection and land reclamation plan of this project should be submitted to relevant departments for review. After approval, it should be implemented simultaneously with the construction. The tasks determined in the land reclamation planning and design scheme should be included in the construction plan and investment budget.

(III) Quantities of preventive measures for land reclamation

The project area is designated for open-pit mining. In future mining operations, the mine will need to strip the topsoil resources within the mining area and store them in a centralized manner, serving as the source of cover soil for land reclamation work. According to the mine's feasibility study design, during the later stages of mining, approximately 1,950,700 square meters of topsoil can be stripped from the shrub forest area. Based on a stripping thickness of 0.3 meters, 585,200 cubic meters of topsoil can be removed. The stripped topsoil will be stored in a flat area within the mining site. Management and protection of the stripped topsoil should be strengthened to maintain soil fertility. **The quantity of topsoil stripping work has already been included in the mining costs during production, and this quantity of topsoil stripping work will not be included in the quantities specified in this design plan.**

II. Management of geological disasters in mines

(I) Objective and Task

The purpose of mine geological disaster mitigation is to comprehensively manage geological disasters caused and induced by mining activities through various

engineering measures. The goal is to control or eliminate potential geological hazards in mines, mitigate the risks posed by these disasters to personnel and equipment, and restore mine production and construction to a safe state.

Based on the actual situation of this mine, the main tasks of mine geological disaster mitigation include:

1. For unstable slopes, it is necessary to promptly remove dangerous rocks and eliminate dangerous rock masses that pose a risk of collapse or landslide. Gradually adjust the mining platform and mining sequence to ensure that mining activities are carried out according to the design of the development and utilization plan, thereby avoiding the occurrence or induction of new geological disasters due to improper mining practices.

2. Strengthen research on the comprehensive utilization of waste rock, reduce the amount of waste rock piling, construct retaining walls in accordance with relevant technical requirements, and stack waste rock and waste slag in layers to avoid geological disasters such as collapses and landslides.

(II) Engineering design

Based on the preliminary design plan combined with on-site investigations, the geological disasters in the mining area are primarily due to the potential formation of unstable slopes during open-pit mining

Upon investigation, no geological disasters of significant scale have occurred within the mining area. Through the current status assessment and predictive analysis of geological disasters, it is found that during mining operations, the surface movement and deformation caused by mining activities are relatively minor. Based on the combined results of the current status assessment and predictive analysis of geological disasters, the overall stability of the high and steep rock slopes formed by mining is relatively good, and there will be no severe collapses, ground fissures, or water-logged areas in the mining area. During the mining process, it is crucial to conduct thorough monitoring and set up warning signs. Any geological disaster issues identified should be promptly addressed.

1 Mine Geological Environment Protection and Land Reclamation Prevention Engineering Table

serial number	Project Name	unit	workload	Remarks
one	Warning sign			
1	Warning sign	block	20	

The design of the corresponding geological disaster monitoring project is detailed in Section 6 "Mine Geological Environment Monitoring" of this chapter.

III and reclamation in mining areas

(I) Target tasks

1. The area of the reclamation responsibility scope is 360.1234 square meters. The other permanent planning area is 688,834 square meters, and the actual reclamation area is 2,912,400 square meters

2. The reclamation rate of this plan is 80.88%.

Based on the results of land reclamation suitability evaluation and public participation opinions, the proposed reclamation area for this project is 2,912,400 m2, including 789,161 m2 of land reclaimed as pits and lakes, and 2,123,239 m2 of other grassland areas. The land use structure before and after reclamation is shown in Table 5-2.

2 Table of land use structure before and after reclamation

Secondary land type		Before reclamation	After reclamation	increase and decrease
encoding	name	Ten thousand m^2	Ten thousand m^2	Ten thousand m^2
1	shrubland	260.1220	0.0000	-260.1220
2	Other grasslands	97.7314	212.3239	114.5925
3	Land for highway use	0.9100	7.6465	6.7365
4	Pond water surface	0.0000	78.9161	78.9161
6	settlement	1.3600	61.2369	59.8769
		360.1234	360.1234	/

(II) Engineering design

Based on the evaluation results of reclamation suitability, the land reclamation in the mining area can be divided into two major reclamation units. The land types after reclamation are mainly potholes, lakes, and other grasslands. The description of different reclamation units is as follows:

1. **Reclamation exploration area unit**

1) Exploratory hole

Within the mining area, there are a total of 252 exploration holes. This restoration is only targeted at 92 exploration holes outside the planned reclamation area of the mining area. The opening size of the exploration holes is 95mm, with an average depth of 3 meters. Below 3 meters, a 74 drill bit is used, with a hole diameter

of 75mm and an average depth of about 200 meters. A construction method combining mechanical and manual assistance is adopted to directly backfill soil for sealing. After sealing, reclamation is carried out according to the land type. A total of 80.65m³ of backfill soil is used.

2) Exploration platform

During the preliminary exploration, a total of 92 exploration platforms were formed, covering an area of 3,500 m². The topography, landform, and vegetation of these platforms were not severely damaged. It is proposed to use a combination of mechanical and manual assistance for land leveling, followed by sowing grass seeds for reclamation. The area of land to be leveled is 3,500 m², and the area for sowing grass seeds is also 3,500 m².

2. **Reclamation pit and lake unit (the area below the enclosed boundary of two open-pit mines is 789,161 m^2)**

As a reclamation unit within the overall reclamation efforts, the total reclamation area of Kenghu is 789,161 square meters, including 518,674 square meters for the open-pit mining area of Orebody IV and 200,487 square meters for the open-pit mining area of Orebody IV.

(1) Water diversion project

Open-pit mining area of Orebody IV

The reclamation direction for the open-pit of Orebody IV is a pit lake. The water demand for the pit lake is relatively large, and surface water can be used. The open-pit of Orebody IV is adjacent to the KAMATIVI River, which flows into KAMATIVI Lake along the northern border of the pit. The reclamation of the pit lake in the open-pit of Orebody IV can utilize the river to introduce surface water into the mining pit, accelerating the reclamation work of the pit lake (the original water volume of the reservoir will decrease, affecting the ecology of downstream reservoirs during the reclamation period). To collect surface water, a diversion canal with a length of 40m, width of 10m, and depth of 2m needs to be constructed.

②Open-pit mining area of Orebody V

There are no rivers passing through the open-pit mining area of Orebody V. Water from the mountains is collected by building flood intercepting ditches on the west and north sides of the mining area and directed into the pit. On the east side, natural valleys are used to guide water resources into the pit. A total of 1.2 kilometers of flood intercepting ditches need to be built.

3. **Reclamation of arbor + grassland unit (area excluding pits and lakes: 2,123,239 m^2)**

(1) Leveling works

The reclamation unit requires site leveling. The specific approach involves a combination of mechanical and manual construction methods. For areas that need to be leveled locally, the higher parts are removed and the lower parts are filled in, ensuring that the local elevation difference is less than 0.1m. For areas with significant local soil layer backfilling, appropriate compaction is carried out to ensure that no pits form after soil settlement. The thickness of the leveled soil layer is 20cm, with a slope area of 124,000 m² removed and a leveled area of 1,999,293 m².

(2) Backfilling project

The soil covering project follows the reclamation standards. The soil source is the soil stripped and stored in the mining area in advance, which is transported to the reclamation area by dump trucks from the storage site. The reclamation direction in the project area is towards other grasslands, covering an area of 1,999,293 square meters. The reclamation standard for other grasslands is that the effective soil layer thickness after soil covering should reach 20 centimeters. During soil covering, attention should be paid to reserving working surfaces for drainage and irrigation ditches to facilitate the discharge of surface water. Finally, manual fine leveling is carried out, with a soil covering volume of 399,800 cubic meters.

(3) Slope trimming

The design involves manually clearing loose pumice and other hazardous falling rock areas from the slope surface, and transporting the excavated earth and stone to the mined-out area of the mine for backfilling. The cumulative area of slope to be cleared in the stope, waste dump, and tailings pond is approximately 124,000 m^2. Assuming a clearance thickness of 0.2 m, the cumulative amount of stone to be cleared is 24,800 m^3. **This part of the work quantity has been included in the main work quantity, and will not be separately calculated in this plan.**

(4) Plant red willow and locust tree at the platform, and plant bougainvillea at the slope toe

Engineering site preparation: The site preparation specifications are 20cm×20cm×15cm. The spacing between planting holes is 5m×5m, with one seedling planted in each hole (pit). A total of 84,930 red willow and locust trees are required.

Afforestation requirements: Cuttings of lignified branches shall be used for planting, with a specification of 30cm per plant and a planting density of 1m. Pueraria lobata shall be planted on the final harvest slope, with a slope bottom line length of approximately 9.9km, requiring a total of 9,900 Bougainvillea spectabilis plants.

(5) Sow grass seeds (Eulaliopsis binata)

In areas designated for reclamation as other grasslands, grass seeds are sown at a density of 225kg per 10,000 m^2. The sown area covers 1,999,293 m^2, requiring a total of 44,984kg of grass seeds.

(III) Technical Measures

1. Technical measures for reclamation in exploration areas

1) Technical requirements for reclamation of exploration holes

For the reclamation of exploration holes, surrounding soil should be used to fully block the holes to prevent them from becoming vertical channels for groundwater or posing a risk of falls for people and livestock. After backfilling, the soil should be compacted in layers to ensure the compactness of the backfill. After backfilling, the hole opening area needs to be covered with soil and leveled, with the thickness of the covering soil not less than 20 centimeters. In addition, before reclamation, stripped topsoil should be collected and stored for soil reconstruction after backfilling; vegetation restoration should choose native grass species that are adapted to the local climate, ensuring that vegetation coverage, biomass, and other indicators after reclamation gradually reach the level of the surrounding natural environment.

2) Technical requirements for reclamation of exploration platforms

The reclamation of exploration platforms requires the immediate removal of on-site waste after the completion of operations, followed by land leveling to eliminate potential safety hazards. After the platform is leveled, topsoil should be replaced to ensure a thickness of no less than 20 centimeters. During the vegetation restoration phase, grass seeds that are resistant to infertility and have strong soil-fixing capabilities should be selected for sowing. The vegetation coverage after reclamation should not be less than 40%, and a cultivation and management plan, including measures such as reseeding and fertilization, should be formulated. For platforms located on slopes, simple drainage ditches or soil retaining facilities should be constructed to control soil erosion.

2. Technical measures for artificial grassland reclamation

1) Chemical measures

The ore produced in the mine is spodumene, and there is no pollution during the production process. Therefore, this plan does not include the design of contaminated land remediation. The main consideration is that after reclamation, the soil fertility may be insufficient, and it is necessary to increase soil organic matter and nutrient content, improve soil properties, and enhance soil fertility. Organic fertilizer and farmyard green manure can be combined to enrich the soil.

In this plan, organic and inorganic fertilizers are applied in combination during the soil improvement process, with organic fertilizers being the mainstay. The organic fertilizer meets the following requirements: total nutrient content (N+P2O5+K2O) (on a dry basis) / (%) ≥ 30, total nutrient content (nitrogen + phosphorus pentoxide + potassium oxide) (on a dry basis) / (%) ≥ 4.0, moisture (free water) content / (%) ≤ 20, and pH value ranging from 5.5 to 8.0. It is designed to apply an additional 1000kg of nitrogen, phosphorus, and potassium inorganic compound fertilizer per 10,000 m^2, and to apply commercial organic fertilizer at a rate of 3000kg per 10,000 m^2 to enrich the soil.

2) Biological measures

Construction preparation: mainly includes the preparation of nursery stock and

seeds, equipment, and materials (fertilizer).

Soil amendment: For small plots with a slope of less than 30 degrees (no steeper than 1:1.8), and with thin soil layers, high soil gravel content (difficult to clean) or all composed of gravel, soil amendment should be carried out before reforestation. The source of soil amendment can be nearby excavation with low soil gravel content. If the soil thickness is less than 30 centimeters, it should reach more than 30 centimeters after soil amendment, and the thickness of the planting hole should not be less than 50 centimeters, with uniform paving.

Site preparation:

(1) Site preparation for arbor forest: Remove stones and debris from the topsoil layer. Adopt the horizontal strip site preparation method, with a bench width of 50cm, depth of 30cm, and bench spacing of 100cm. Build earth ridges outside the benches to intercept water. It is advisable to prepare the site in advance, excavate the soil and place it beside the benches to allow it to fully mature. Sunlight can play a role in disinfection. Raw soil and topsoil should be stacked separately. See Figure 8-6 for details.

Planting: For arbor forest planting, manual seedling planting is adopted, and all seedlings must be qualified and robust. During planting, firstly, 10-15cm of topsoil should be placed at the bottom of the trench, then the seedlings should be placed, ensuring that the seedlings are upright and the roots are straight. Soil should be covered in layers, with deep planting and compaction. After planting, root-setting water should be immediately poured. When covering soil, topsoil should be filled first, followed by subsoil, and each layer should be compacted to ensure a tight bond between the roots and the soil. The planting spacing for arbors is 5m×5m. Grass seeds should be sown in the blank spaces between terraces.

Young forest tending: After afforestation is completed, promptly assign tending and management personnel, and arrange for professional technical personnel to guide the tending techniques.

(1) Tending content: including soil cultivation and seedling support, replanting and reseeding, watering and fertilizing, weeding and pruning, etc.

(2) Rearing method: Comprehensive rearing.

(3) Tending period: May to June each year, for three consecutive years.

(4) Nurturing techniques and measures: Nurturing soil and supporting seedlings: As the purpose of planting is to restore forest and grass vegetation, the frequency of loosening and weeding should be reduced, and only crooked seedlings should be supported with soil. Replanting and replanting: According to the design density, replanting should be carried out on the forest stands with missing plants during the young forest stage. For seedlings and grass seeds that have poor growth or died due to drought, freezing damage, mechanical damage, pests and diseases, replanting and replanting should be carried out according to the original design standards and designed tree species and grass seeds, or replanting and replanting should be carried out on a flat crop basis. Planting seedlings of the same age with specifications similar to those of the original afforestation seedlings. Simultaneously replant the target tree species in sparse areas. Pruning: Removing competing, diseased, and dead branches that affect tree growth. The plot for planting landscape tree species should be timely

plastered with buds, fixed poles, shaped and trimmed. Watering: The season should be chosen when trees begin to grow in spring, when trees enter their peak growth period in summer, and when trees are about to stop growing in autumn and winter. The amount and frequency of irrigation should be determined based on specific conditions such as weather and soil quality. The soil moisture content should be maintained at no less than 60% of the field capacity (with sandy loam soil having a moisture content of no less than 11%). After irrigation, hoes should be promptly used to maintain soil moisture. Fertilization: Afforestation is determined based on the fertility of the forest land, and fertilization is generally applied to soils with medium to high physical properties and low fertility. Fertilization should be carried out once in the year of planting, and technicians can increase the frequency of fertilization according to the actual growth of seedlings. Fertilize from late April to early May every year after afforestation. Adopt trench or hole application, and water promptly after application.

 Selection of plants

Red Willow-leafed Sophora: Conditions: Dry open woodland; tolerant of sandy or rocky soil, drought, and frost after planting. Uses: Can be used for shade, firewood, and firebreaks - slow to medium growth rate.

Eragrostis curvula, also known as "Lovegrass," belongs to the genus Eragrostis in the family Poaceae. The name "Lovegrass" is derived from the Greek words "eros" (love) and "agrostis" (grass). It is drought-resistant and tolerant of infertility, capable of growing in sandy, saline-alkali soils and along roadsides, and adapts to a wide temperature range from -7℃ to above 30℃

 Planting technology

Plant red willow and locust tree at the platform with a plant spacing of 5m×5m per plant, and plant bougainvillea at the slope toe with a plant spacing of 1m per plant. At the edge of the planting points, insert climbing branches to ensure that the oil branches climb up along the branches. Sow grass seeds between the rows of bougainvillea. After planting the grass seeds, rake the topsoil to ensure that the sown grass seeds are located more than 2cm below the surface layer. The planting technology configuration table is shown in Table 5-3.

3 **Planting Technology Configuration Table**

Tree (grass) species	plant spacing (m, kg/10,000 $m^{2)}$	Technical Specifications	Requirements for nursery stock
Red willow-leaf locust tree	5×5	During planting, the spacing between arbor trees should be 5m×5m. A shrub should be planted between every two arbor trees. Grass seeds should be sown in the blank spaces between the terraces.	High-quality seedlings (over 1.5 meters)
Bougainvillea	1	Plant climbing plants at the foot of the slope, apply 0.1kg of compound fertilizer to each hole, mix it evenly with the loose old soil, plant the seedlings in the center of the tree hole, and water them to establish roots	Ground diameter 50cm
Eulaliopsis	225	Evenly sow the processed grass seeds on the cleared land, Cover with fine shallow soil and spray with clear water	Grade Excellence

		simultaneously	

(IV) Main quantities

The main quantities of the reclamation project are shown in Tables 5-4 to 5-6.

4 Statistical Table of Diversion Canal Engineering Quantities

main structure of the project	Project Name	long	wide	deep	Rock excavation	Earth filling	M7.5	M10
							Masonry	Mortar plastering
		m	m	m	m^3	m^3	m^3	m^2
Open-pit mining area No. IV	Diversion canal	72	10	2	574.6	433.4	237.6	792.0
Open-pit mining area No. V	Intercepting ditch	2435	2	1.5	2565.0	1935.0	2520.0	8400.0

5 Statistical Table of Spillway Engineering Quantities

main structure of the project	Project Name	long	wide	deep	Excavation of stonework	Fill earthwork	M7.5	M10
							Masonry	Mortar plastering
		m	m	m	m^3	m^3	m^3	m^2
Open-pit mining area No. IV	spillway	42	10	3	667.8	592.2	255.0	510.0
Open-pit mining area No. V	spillway	39	10	3	620.1	549.9	236.8	473.6

6 Statistical Table of Reclamation Quantities in the Project Area

serial number	Project Name	unit	workload	Remarks
one	Reclamation of exploration area			
1	land leveling	m^2	3500	
2	Sow grass seeds	m^2	3500	
3	Topsoil backfilling	m^3	80.65	
two	Soil reconstruction project			

1	land leveling	10,000 m^2	199.9293	
2	Topsoil backfilling	10,000 cubic meters	39.98	
3	Fertilization to enhance soil fertility	Ten thousand m^2	199.9293	
three	Vegetation restoration project			
1	Planting red willow and locust tree	strain	84930	
2	Planting Bougainvillea spectabilis	strain	9900	
3	Sow grass seeds (Eulaliopsis binata)	Ten thousand m^2	199.9293	

IV. Aquifer damage repair

(I) Target tasks

The damage to the aquifer caused by mining production is relatively minor, and there is no need for damage repair at this stage. The goal of aquifer damage repair is to strengthen monitoring, take preventive measures, and minimize the damage to the aquifer caused by mining activities.

(II) Engineering design

Based on the current status and forecast of aquifer damage in the mine, only monitoring and preventive engineering measures will be taken in the future, without specific remedial engineering measures to repair the aquifer damage.

The design of the corresponding monitoring project is detailed in Section 6 "Mine Geological Environment Monitoring" of this chapter.

(III) Technical measures

At the current stage of mining, the damage to the aquifer is relatively minor and does not require repair, hence there are no technical measures in place.

(IV) Main quantities of works

The current mining operations at the mine have caused minimal damage to the aquifer, thus no repair is necessary, and therefore, there is no associated engineering workload.

V. Remediation of soil and water pollution

(I) Target tasks

Based on the nature and degree of contamination of water and soil pollutants, physical, chemical, or biological measures can be taken to remove or inactivate the pollutants. For severely contaminated water and soil where the pollutants cannot be eliminated or their activity cannot be suppressed to the target level through the aforementioned measures, engineering measures can be taken for isolation. During isolation, it is necessary to analyze the toxic and harmful components of the isolation materials to avoid introducing pollution from the isolation materials.

Through the implementation of engineering and technical measures for soil and water environmental pollution remediation, the pollution of the soil and water environment caused by mining production is restored, so that the polluted soil and water environment can return to normal indicators and restore its ecological functions, including various ecological functions such as drinking water, irrigation, fishery, and land cultivation. Alternatively, the degree of soil and water environmental pollution can be reduced, and the ecological functions of the soil and water environment can be appropriately restored. For example, although drinking water pollution cannot be restored to its original function through remediation measures, it can meet agricultural irrigation water standards through remediation.

(II) Engineering design

1. Water environmental pollution remediation project

The product produced by the mine is spodumene. During the ore production process, the tailings have been discharged into a tailings pond that has undergone anti-seepage treatment in accordance with environmental protection requirements. Both wastewater and production return water are collected and recycled, with no external discharge. Furthermore, the designed mining floor elevation is much higher than the lowest erosion datum elevation of groundwater in the area. The drainage conditions of the mining site are good, and the ore contains essentially no harmful components or radioactive elements, posing minimal risk of groundwater pollution. Therefore, this plan does not include engineering design for water environmental pollution remediation.

2. Soil environmental remediation project

Ore mining has a relatively severe impact on the surface soil environment. However, through the implementation of land reclamation, the damaged land can basically recover its productivity. According to the land reclamation measures outlined in this plan, all the soil for land reclamation in this project comes from the topsoil stripped during ore mining, eliminating the need to purchase external soil. Therefore, no soil environmental remediation project is designed in this plan.

(III) Technical measures

The pollution level of the water and soil environment during the production process of this mine is minor. The pollution to the water environment is only due to sediment and ore dust pollution, and since the ore does not contain toxic or harmful components, the pollution to the water environment is slight. At the same time, the mine production causes damage to the land; the type is damage and occupation, and no pollution occurs. Therefore, the implementation of the project has a minor impact on the pollution of the water and soil environment. This plan does not design physical, chemical, or biological measures to repair the pollution of the water and soil environment.

(IV) Main quantities

Due to the slight degree of pollution to the water and soil environment during the actual mining process, the plan did not design specialized remediation projects and technical measures, hence there is no quantity of water and soil environmental pollution remediation work.

VI. Mine geological environment monitoring

(I) Target tasks

1. Monitoring objectives

(1) Through monitoring the geological environment of this mine, we can timely grasp the dynamic changes in the geological environment of the mining area caused by mining activities, identify problems, and take corresponding prevention and control measures in a timely manner;

(2) By monitoring the geological environmental issues in the mining area and the effectiveness of prevention and control measures, provide a basis for the completion acceptance of the geological environmental protection, restoration, and management project of this mine;

(3) By monitoring the geological environmental issues in mining areas and the effectiveness of prevention and control measures, provide a basis for government departments' supervision and management.

2. Monitoring tasks

Comprehensive construction engineering involves monitoring the distribution of geological disasters in the project area, geological disasters induced by mining production, the potential and characteristics of geological environmental damage, as well as monitoring geological disasters, water resources, landforms, and land resources in different parts of the project. Additionally, it entails monitoring the effectiveness of control measures to provide a basis for the supervision and management of the land department.

(II) Monitoring design

1. Design of geological disaster monitoring engineering

1) Monitoring method

This plan proposes to primarily rely on geological macro-inspection, with the mine entrusting a professional surveying and mapping agency or purchasing monitoring equipment to conduct regular surveys, measurements, and monitoring of the slopes in the open-pit mining area. This will enable timely detection of macro-deformation phenomena such as cracking and collapse of the slopes in the open-pit mining area. In conjunction with large-scale deformation measurement methods, the dynamics of surface displacement changes can be timely grasped, adhering to the principle of obtaining observational data.

2) Monitoring frequency

Once every quarter, that's four times a year. If there are significant abnormal changes, the frequency of observation should be increased, possibly up to once a week. There are 18 geological disaster monitoring points set up, including 6 at the mining site, 6 at the waste dump, and 6 at the tailings pond.

3) Monitoring records

Observation records should be listed systematically and comprehensively. During observations, if there is rainfall, the start and end time of the rainfall should be recorded, and its intensity (light, moderate, heavy, or heavy rainstorm) should be estimated. Monitoring points located near surface water bodies should also observe and record changes in surface water levels. As the observation progresses, observation curves can be drawn, with time as the horizontal axis and observation data as the vertical axis, to illustrate curves such as water level changes and crack changes, providing a basis for analysis and judgment.

4) Danger alert

When anomalies occur and are confirmed as dangerous situations, they should be reported to the danger alarm system in a timely manner. In places where a danger alarm system has not been established, local governments can establish corresponding organizations based on local specific conditions to facilitate the smooth implementation of disaster prevention and mitigation work. During the observation process, if anomalies are found to suddenly intensify and the danger situation is determined to be urgent, it should be reported immediately and emergency measures should be decisively taken.

5) Monitoring duration: 11 years.

2. Water quality monitoring

The water quality monitoring in mining areas primarily targets surface water and groundwater.

Firstly, we monitor water quality and water level; secondly, we monitor groundwater pollution to understand whether it meets the discharge standards.

1) Monitoring content

Changes in water quantity and quality during the dry season, as well as the whereabouts of water; pollution projects related to ore, and other projects reflecting major water quality issues in the region.

2) Monitoring method

The monitoring methods for water quantity can be achieved through water metering and water volume measurement. Water quality should be sent to a professional laboratory for testing.

3) Monitoring frequency

Monitor once each during the dry season and wet season every year;

4) Monitoring duration: 11 years (Systematic verification is required for water quality monitoring every five years. If the water quality fails to meet the requirements, the monitoring duration needs to be extended to 25 years, and the corresponding workload should be revised or this plan should be re-prepared).

3. Topography and landform landscape monitoring

Based on the monitoring of surface vegetation in the affected area due to mining activities on the ore body.

1) Monitoring content: Monitor the non-natural death and degradation of vegetation.

2) Arrangement of monitoring points: Each mining area shall have at least 2 dynamic monitoring points.

3) Monitoring method: Conduct regular inspections and surveys on the damage to vegetation and soil within the damaged area.

4) Monitoring frequency: once per month.

5) Monitoring duration: 11 years.

(III) Technical measures

1. Establish a specialized agency (department) for mine geological environment monitoring or entrust the monitoring work to a professional monitoring agency. The specialized agency or the entrusted party shall be fully responsible for the daily management of mine geological environment monitoring.

2. Establish a monitoring system for the geological environment of mines, and ensure effective monitoring, early warning, and forecasting.

3. On-site records must be kept for each inspection and monitoring session, and the monitoring data must be analyzed and compared. Any abnormalities should be immediately reported to the mine leaders and relevant departments, so that prompt measures can be taken.

4. Establish monitoring data archives and promptly archive monitoring data.

5. Regularly organize full-time monitoring personnel to learn relevant professional technical knowledge of monitoring, in order to improve the quality of monitoring.

(IV) Main quantities

Based on the geological environment monitoring engineering design, the service life of the mine, and the implementation and monitoring duration of land reclamation in the later stage, the main quantities of geological environment monitoring for the mine in this project are calculated and are shown in Table 5-7.

7 Main workload of mine geological environment monitoring

serial number	Project Name	frequency	quantity
1	geological disaster monitoring		
⑴	Set up monitoring points	a	18
⑵	Deformation monitoring	once per quarter	792
2	water quality monitoring		
⑴	Surface water monitoring	Twice a year	22
⑵	groundwater monitoring	Twice a year	22
3	Topographical and geomorphic landscape monitoring		
⑴	Patrol monitoring	once a month	132

VII. Monitoring, management, and protection of land reclamation in mining areas

(I) Target tasks

1. Monitoring target tasks

Monitor all damaged objects within the scope of reclamation responsibility, track the land damage situation in a timely manner, ascertain the damaged land area, land type, and degree of damage, and monitor the soil quality status. Take preventive

measures before soil quality declines to ensure the provision of high-quality soil sources for reclamation. Monitor the vegetation and supporting facilities of reclamation to facilitate the timely detection of areas where the reclamation quality does not meet standards, and take remedial measures to improve the reclamation effect and quality.

2. Management and protection objectives and tasks

Management and protection is the final procedure of reclamation, which involves managing and protecting reclaimed pits, lakes, and grasslands. It aims to prevent long-term drought, rodent infestation, and insect pests on the reclaimed grasslands. Through the management and protection of the grasslands, it ensures that the reclaimed grasslands meet the quality requirements of reclamation, improves the survival rate of vegetation, and enhances the growth trend of vegetation, thereby ensuring the overall goal of reclamation is achieved.

(II) Measures and Contents

1. Monitoring engineering measures

This project primarily utilizes remote sensing interpretation, ground observation, surveys, and inspections for land reclamation monitoring. Based on the prediction results, the monitoring scope of the project mainly encompasses the impact area of mining activities in the mining area, and the monitoring content spans the entire reclamation process.

1) Land damage monitoring

Based on the land damage situation of the project, during the construction and production process of the mine, the damaged and occupied land should be monitored. This includes monitoring the location, area, and form of damage to the land. If the production process changes, resulting in changes to the timing and location of land damage, the land reclamation plan should be revised. During the monitoring process, for areas involving topsoil stripping, it is necessary to monitor whether the topsoil has been stripped. For occupied and damaged objects, it is necessary to monitor changes in the area of occupied and damaged land, land type, soil, etc. The monitoring of land damage should be conducted throughout the entire 11-year production service life of the mine, with monitoring conducted once a year, a total of 11 times.

2) Soil quality monitoring

Monitoring is conducted on the reclaimed grassland soil using the random sampling method, with a sample size generally ranging from 5% to 10%. In this plan, a sample size of 10% is adopted. The monitoring content includes soil pH, organic matter, total nitrogen, available phosphorus, available potassium, soil salinity, soil erosion, etc. A total of 5 monitoring points are designed, and the monitoring period is 11 years after reclamation, with two monitoring sessions per year, for a total of 110 monitoring sessions.

3) Vegetation restoration monitoring

Conduct a survey on the vegetation recovery rate of the reclaimed vegetation, with the monitoring scope covering the reclaimed grassland area.

The monitoring method employed is the random quadrat survey method. Representative plots are selected as standard plots, and quadrats are randomly determined within these plots. The area of each quadrat is the projected area, with 10m×10m for forest land and 20m×20m for grassland. The canopy density of forest land is calculated using the observed values of the quadrats. For the survey and monitoring content, a comprehensive survey should be conducted at the initial stage of reclamation, followed by a monitoring frequency of twice per year. A total of 80 surveys are conducted.

4) Water quality monitoring of ponds and lakes

Monitoring indicator system

Lithium mining may lead to an increase in alkaline substances (such as lithium carbonate and lithium hydroxide), and may be accompanied by the precipitation of fluoride (F^-) and radioactive elements (such as uranium and thorium). Therefore, on the basis of general indicators, it is necessary to increase the monitoring of characteristic pollutants.

②Arrangement of monitoring points

According to the site layout, two pit lake areas are set up, with two points each, for a total of four points.

③Monitoring methods and techniques

Method category	**Applicable indicators**	**Technical Points**
On-site rapid detection	PH, DO, turbidity, temperature, conductivity	Utilize a portable instrument, such as the YSI ProDSS, for real-time measurements, ensuring the error is maintained within ±5%.
Laboratory analysis	Lithium (Li), fluoride (F^-), total radioactive alpha/beta	It is recommended to use inductively coupled plasma mass spectrometry (ICP-MS) for the determination of lithium and other heavy metals, and ion chromatography (IC) for the determination of fluoride. This is the core for obtaining accurate data.

		Professional equipment such as low-background alpha/beta measuring instruments is required.
biological monitoring	Plankton, benthic animals	Sampling and identification should be conducted in accordance with the "Technical Guidelines for Biodiversity Observation". Monitoring of attached algae can be added as an indicator of the nutritional status of the water body.

④Monitoring frequency and cycle

Make dynamic adjustments based on the changing risks associated with different stages of lithium mining (such as infrastructure construction, operation, and closure), including nutrient salts and characteristic pollutants (Li, F^-, TN, TP, etc.).

 Data management and quality control

A warning threshold system for lithium pollution characteristics needs to be established to ensure the visualization of collected data. The quality and quantity of samples should be guaranteed during the collection process, and abnormal data should be corrected.

5) Biodiversity monitoring

Biodiversity monitoring is a crucial means of assessing ecosystem health by regularly observing and recording the composition and changes of biodiversity. In the mining sector, its core monitoring content encompasses three levels: species, ecosystems, and landscapes, necessitating systematic assessments that integrate both traditional and modern technologies.

At the species level: Focus on the population dynamics of endangered species, economically important species, and indicator species, as well as the impact of dust and heavy metal pollution from mining areas on vegetation communities. For instance, infrared cameras can be used to capture wildlife activities, and environmental DNA technology can be employed to analyze changes in biodiversity in soil and water bodies.

 Ecosystem level: Establish long-term fixed monitoring plots in typical areas to assess the impact of mining on soil pH, organic matter content, and hydrological conditions. For example, by monitoring changes in pH and heavy metal content of surface water bodies, ecological risks can be reflected.

 Landscape level: Utilize remote sensing technology and geographic information systems to analyze changes in the landscape pattern of mining areas, including the impact of disruptions in biological corridors on species migration. For

instance, through drone aerial photography and GIS analysis, assess the occupation of surrounding vegetation by slag accumulation areas.

6) Soil quality testing of tailings pond

Before the official closure of the tailings pond, a qualified third-party organization will be entrusted to conduct a comprehensive special inspection of the soil and environment of the tailings pond, accurately assess the soil and environmental quality of the tailings pond and surrounding areas, and provide scientific basis and benchmark data for ecological restoration after closure.

Testing content: including but not limited to key indicators such as soil physicochemical properties, heavy metal content (such as lead, cadmium, mercury, arsenic, etc.), and pH value.

Detection locations: Sampling points will be set up within the reservoir area, upstream and downstream of the dam, as well as in key areas that may be affected.

Follow-up actions: Based on the test results, if local contamination is found, a soil remediation plan (such as soil replacement, chemical stabilization, phytoremediation, etc.) will be formulated and implemented to ensure that the site meets environmental protection requirements and poses no residual environmental risks after closure.

2. Management and protection engineering measures

This plan aims to reclaim damaged land into pits, lakes, and other grasslands. In order to facilitate the rapid recovery of land resources after reclamation, it is necessary to manage and protect the reclaimed land and vegetation. The scope of management and protection covers the area where vegetation restoration measures are taken, with an area of 2,123,239 square meters.

Design of grassland management and protection project: The management and protection target is other reclaimed grasslands, covering an area of 2,123,239 m². The specific management and protection works mainly include the following points:

After sowing and before seedling emergence, a hardened layer often forms on the soil surface, which hinders the seeds from pushing through the soil and emerging. It is necessary to break up this hardened layer.

②Replenishing seedlings

If severe seedling shortage is found after emergence, measures such as reseeding or transplanting should be taken to replenish the seedlings. To accelerate emergence, seeds should be soaked to promote germination during reseeding. It is necessary to ensure sufficient soil moisture during seedling replenishment.

③Nutrient management

When nutrient deficiency symptoms appear on reclaimed grassland, timely topdressing should be carried out according to the symptoms.

④Pest, disease, and weed management

Pests, diseases, and weeds are major threats to grassland establishment and management. It is necessary to timely apply pesticides and other effective measures to control grassland pests and diseases.

⑤Maintenance time

The management and protection period should be no less than 3 years. Based on the climatic characteristics and vegetation growth conditions of the project area, the management and protection period in this plan is set at 3 years, starting from the completion of the vegetation reclamation project for the reclamation objects.

(III) Main quantities

1. Monitoring and measurement of engineering quantities

1. Monitoring and measurement of engineering quantities

1) Land damage monitoring

The land within the scope of reclamation responsibility is monitored according to the damage situation. The damaged land is surveyed and demarcated annually, and the degree of damage is recorded. The total monitoring area is 2,912,400 square meters, and the monitoring period spans the entire production process, covering 11 years and 11 monitoring times in total.

2) Soil quality monitoring

Monitoring is conducted on the reclaimed grassland soil using the random sampling method, with a sample size typically ranging from 5% to 10%. In this plan, a sample size of 10% is adopted. The monitoring content includes soil pH, organic matter, total nitrogen, available phosphorus, available potassium, soil salinity, soil erosion, etc. A total of 8 monitoring points are designed, with a monitoring period of 4 years and two monitoring sessions per year, for a total of 64 monitoring sessions.

3) Monitoring during vegetation restoration period

The monitoring area for reclamation vegetation is 2,123,239 square meters, with two monitoring sessions per year. A total of eight monitoring points are designed, and the monitoring is conducted for three years, amounting to 48 times in total.

4) Water quality monitoring of ponds and lakes

Water quality monitoring of the pit lake is conducted twice a year, during the rainy season and the dry season respectively. A total of four monitoring points are designed, and the monitoring has been carried out for four years, with a total of 32 times.

5) Biodiversity monitoring

Biodiversity monitoring is a crucial means of assessing ecosystem health by regularly observing and recording the composition and changes of biodiversity. In the mining sector, its core monitoring content encompasses three levels: species, ecosystems, and landscapes, requiring systematic assessment through a combination of traditional and modern technologies. Biodiversity monitoring employs patrol monitoring methods, with a monitoring period spanning the entire production process, totaling 11 years and 11 monitoring sessions.

monitoring content

At the species level: Focus on the population dynamics of endangered species, economically important species, and indicator species, as well as the impact of dust and heavy metal pollution in mining areas on vegetation communities. For example, infrared cameras can be used to capture wildlife activities, combined with environmental DNA technology to analyze changes in biodiversity in soil and water bodies.

At the ecosystem level: Establish long-term fixed monitoring plots in typical areas to assess the impact of mining activities on soil pH, organic matter content, and hydrological conditions. For instance, by monitoring changes in pH and heavy metal content of surface water bodies, ecological risks can be reflected.

Landscape level: Utilize remote sensing technology and geographic information systems to analyze changes in the landscape pattern of mining areas, including the impact of biological corridor disruptions on species migration. For instance, through drone aerial photography and GIS analysis, assess the occupation of surrounding vegetation by slag accumulation areas.

2. Measurement and calculation of maintenance workload

- .

3. Summary of monitoring and management workload

The summary of the workload for monitoring, management, and protection of land reclamation in mining areas is shown in Table 5-8.

8 Summary Table of Reclamation Monitoring, Management, and Protection Workload

Name of monitoring project		Number of monitoring points	monitoring frequency	Monitoring period	quantity of work	unit
Land reclamation monitori	Land damage monitoring	Patrol monitoring	once a year	11	11	time
	Soil quality monitoring	8	Twice a year	4	64	time

ng project	Monitoring of vegetation restoration	8	Twice a year	3	48	time
	Pit lake water quality monitoring	4	Twice a year	4	32	time
	Biodiversity monitoring	Patrol monitoring	once a year	11	11	time
	Soil quality testing of tailings pond	/	/	/	1	time
Management and maintenance project	Pit lake management and protection (4 years)		1	4	78.9161	10,000 m^2·year
	Grassland management and protection (3 years)		1	3	212.3239	10,000 m^2·year

Chapter 6: Deployment of Mine Geological Environment Treatment and Land Reclamation Work

I. Overall Work Deployment

The protection of mine geological environment and land reclamation work should not only be comprehensively planned and deployed, but also be tailored to reality, highlighting key points, and adopting scientific, economical, and reasonable methods to complete them gradually according to their importance and urgency. In terms of timing, the protection, restoration, and management of the mine geological environment and land reclamation should be synchronized with the mine production and construction as much as possible. In terms of spatial layout, different measures should be taken to address different types of mine geological environmental issues.

The service life of the mine is approximately 7 years. This plan envisions a 1-year construction period for post-closure restoration and land reclamation, followed by a 3-year monitoring and maintenance period for subsequent projects. The total service life of this plan is determined to be 11 years (from 2023 to 2030).

Due to the potential changes in various indicators during the construction process of production projects, as production progresses, the existing plan may no longer be able to guide the later reclamation due to changes in the production and construction scale, land use scale and location, and the adopted production process. The mining rights holder should prepare a new plan, and the implementation plan will also be adjusted accordingly. If there are no significant changes in production scale and production process, but due to the long service life of the plan, there may be some differences in the damaged land area and location compared to the originally prepared plan. The mining rights holder should promptly adjust the implementation plan of the plan.

Based on the prediction and assessment results of the damage to land resources caused by mining production, this work, under the conditions of technical feasibility and economic rationality, adopts engineering control measures such as land leveling and land tillage to restore and manage the land in the assessment area according to the specific situation of land damage. Monitoring projects are set up to timely grasp the situation of geological disasters, surface water quality, groundwater level and quality in the assessment area.

II. Phase Implementation Plan

Based on the land reclamation plan compilation procedures and in combination with the actual situation of the mine, the restoration and management of the mine's geological environment will be deployed in stages. The service life of this plan is 11 years. To ensure the safety of residents' lives and production in the mining area and surrounding areas, and to restore and manage its ecological environment as soon as

possible, in accordance with the principle of planning first, combined with the land planning of the area, a geological environment protection and restoration management plan suitable for this mine will be compiled. Based on the "development and utilization plan" and "safety facility design" of the mine, the order of mine development, and the types of geological environmental issues in the mine, the restoration work of the mine's geological environment will be deployed in stages according to the principle of prioritizing and implementing step by step.

Phase I: 1 year (short-term), from July 2023 to June 2024: The main focus is to address existing issues in the geological environment of the mine. In response to the impact of mining activities, efforts will be made to protect the geological environment of the mine during the mining development process, including proper topsoil stripping and management. Prevention and control measures will be taken for potential disasters such as collapses, landslides, ground collapses, and ground fissures, with daily monitoring and warning systems in place. Comprehensive utilization of water resources in the mine and monitoring of surface water will be carried out to eliminate potential disasters, reduce dust pollution, and partially restore the ecological environment. Meanwhile, the exploration holes and platforms formed during early exploration will be reclaimed.

Phase 2: 6 years (mid-term), from July 2024 to June 2030. The main focus is to address existing issues in the mine's geological environment. In response to the impacts of mining activities, efforts will be made to protect the mine's geological environment during the mining development process. Prevention and control measures will be taken for potential disasters such as collapses, landslides, ground collapses, and ground fissures, and daily monitoring and warning systems will be established. Comprehensive utilization of mine water resources and surface water monitoring will be conducted to eliminate potential disasters, reduce dust pollution, locally restore the ecological environment, and manage damaged and unused land. The mine production engineering will implement mining and restoration simultaneously. During this phase, the main tasks include cleaning up the mined steps, covering temporarily exposed areas, and restoring vegetation.

Phase III: 4 years (long-term), from July 2030 to June 2034, during which the reclaimed potholes, lakes, and grassland areas will be managed and protected, the projects in the project area will be maintained, and monitoring will be conducted on the reclamation projects, mining area slopes, and reclamation project areas. Details are provided in Table 6-1.

Table 6-1 Work Schedule for Mine Geological Environment Treatment and Monitoring Engineering at Each Stage

Phase I: Short-term (July 2023 - June 2024)				
1. Prevention engineering				
Governance target	**Content of measures**	**Project content**	**unit**	**quantity**

Protective engineering	Regularly check the integrity of warning signs	Warning sign	a	10
II. Governance Project				
Governance target		Scale of governance measures		
		The content of the measures	unit	quanti ty
/	/	/	/	/
III. Quantities of geological environment monitoring works in mines				
monitoring target		monitoring elements	unit	quanti ty
Infrastructure construction stage	geological disaster monitoring	Stope slope, tailings pond slope, etc	Point • times	72
	water quality monitoring	Surface water, groundwater	Point • times	2
	Topography and geomorphology monitoring	Surface vegetation in the area affected by mining activities of ore bodies	Point • Time	12
Phase 2: Mid-term (July 2024 - June 2030)				
1. Prevention engineering				
Protective engineering	Regularly check the integrity of warning signs	Warning sign	a	/
II. Governance Project				
Governance target		Scale of governance measures		
		Content of measures	unit	quanti ty
/	/	/	/	/
III. Quantities of mine geological environment monitoring works				
monitoring target		monitoring elements	unit	quanti ty
production phase	geological disaster monitoring	Stope slope, tailings pond slope, etc	Point • times	432
	water quality monitoring	Surface water, groundwater	Point • times	12

	Topography and geomorphology monitoring	Surface vegetation in the area affected by mining activities of ore bodies	Point • Time	72
Phase III: Long-term (July 2030 - June 2034)				
1. Prevention engineering				
Protective engineering	Regularly check the integrity of warning signs	Warning sign	a	/
II. Quantity of governance works				
none				
III. Monitoring of engineering quantities				
monitoring target		monitoring elements	unit	quanti ty
Land reclamation stage	geological disaster monitoring	Stope slope, tailings pond slope, etc	Point • times	288
	water quality monitoring	Surface water, groundwater	Point • Time	8
	Topography and geomorphology monitoring	Surface vegetation in the area affected by mining activities of ore bodies	Point • times	48

Table 6-2 Work Schedule for Land Reclamation Projects at Each Stage

serial number	**Name of project or expense**	**unit of measurement**	**quantity of work**
Phase I: Short-term (July 2023 to June 2024)			
one	**Reclamation project in exploration area**		
(I)	Reclamation of exploration area		
1	Reclamation of exploration holes		
⑴	Topsoil backfilling	m^3	80.65
2	Reclamation of exploration area		

serial number	Name of project or expense	unit of measurement	quantity of work
(1)	land leveling	m^2	3500
(2)	Sow grass seeds	m^2	3500
two	**Monitoring and maintenance project**		
(I)	Monitoring project		
1	Land damage monitoring	Point • times	1
(II)	Management and maintenance project		
1	Topsoil conservation	Ten thousand m^2	2.3578
Phase 2: Mid-term (July 2024 - June 2030)			
one	**Monitoring and maintenance project**		
(I)	Monitoring project		
1	Land damage monitoring	Point • Time	6
(II)	Management and maintenance project		
1	Topsoil conservation	hm^2	14.1496
Phase III: Long-term (July 2030 - June 2034)			
one	**Reclamation project**		
(1)	Soil reconstruction project		
1	Topsoil management and protection	Ten thousand m^2	16.5074
2	land leveling	Ten thousand m^2	199.9293
3	Topsoil backfilling	Ten thousand cubic meters	39.98
4	Fertilization of soil	Ten thousand m^2	199.9293
(II)	Vegetation restoration project		
1	Planting red willow and locust tree	strain	84930
2	Planting Bougainvillea spectabilis	strain	9900

serial number	Name of project or expense	unit of measurement	quantity of work
3	Sow grass seeds (Eulaliopsis binata)	Ten thousand square meters	199.9293
(III)	water diversion project		
1	Diversion canal	m	72
2	Intercepting ditch	m	2435
3	spillway	m	81
two	**Monitoring and maintenance project**		
(I)	Monitoring project		
1	Land damage monitoring	Point • times	4
2	Soil quality monitoring	Point • times	64
3	Reclamation vegetation monitoring	Point • times	48
4	water quality monitoring	Point • times	32
(II)	Management and maintenance project		
1	Grassland management and protection	Ten thousand square meters	78.9161
2	Pit lake management and protection	Ten thousand m^2	212.3239

III. Recent annual work arrangement

This mine is a proposed mine with a designed production and construction service life of 7 years. The restoration project is detailed based on the principle of no more than three years per phase. Therefore, this plan details the annual task grading and work deployment by phase. According to the regulatory requirements and the engineering measures of this design, the main tasks for mine geological environment protection and land reclamation from 2023 to 2025 are as follows: (see Table 6-2 for details)

(I) Mine geological environment governance project:

1. Set up safety warning signs;

2. Establish geological disaster monitoring points for geological disaster monitoring, land damage monitoring, soil and water pollution monitoring, topography and landscape monitoring, etc. Repair the slopes of the stope, dump site, and tailings pond (this part of the work quantity has been included in the main work quantity, and will not be separately calculated in this plan).

(II) Reclamation project in exploration area:

Leveling of exploration platform and backfilling of topsoil in exploration holes;

(III) In terms of land reclamation projects:

1. Topsoil stripping;

2. Topsoil management and protection;

3. Monitoring of land damage, etc.

Table 6-3: Annual Workload Schedule for Mine Geological Environment Protection and Land Reclamation in the Near Future

annual	Main engineering measures	unit	quantity of work
Infrastructure construction period (July 2023 - June 2024)	**Mine geological environment remediation project**		
	Set up warning signs	block	10
	geological disaster monitoring	time	72
	Topography and geomorphology monitoring	time	12
	water quality monitoring	time	2
	Reclamation project in exploration area		
	Backfilling of exploration holes	m^3	80.65
	Land leveling for exploration platform	m^2	3500
	Sowing grass seeds on the exploration platform	m^2	3500
	Land reclamation project		
	Land damage monitoring	time	1

	Topsoil stripping	Ten thousand cubic meters	8.36
	Topsoil management and protection	Ten thousand m^2	2.3578
Production period (July 2024 - June 2025)	**Mine geological environment remediation project**		
	geological disaster monitoring	time	72
	Topography and landform monitoring	time	12
	water quality monitoring	time	2
	Land reclamation project		
	Land degradation monitoring	time	1
	Topsoil stripping	Ten thousand cubic meters	8.36
	Topsoil management and protection	Ten thousand m^2	4.7156
Production period (July 2025 - June 2026)	**Mine geological environment remediation project**		
	geological disaster monitoring	time	72
	Topography and landform monitoring	time	12
	water quality monitoring	time	2
	Land reclamation project		
	Land damage monitoring	time	1
	Topsoil stripping	Ten thousand cubic meters	8.36
	Topsoil management and protection	Ten thousand m^2	7.0734

Chapter 7 Funding estimation and schedule arrangement

I. Basis for funding estimation

The estimation is based on relevant international laws, regulations, systems, and procedures. It is compiled on the basis of statistics of the quantities of individual projects, combined with the actual conditions on site, and in accordance with corresponding quotas, fee standards, and prices of labor, machinery, and materials.

(I) Basis for estimating the cost of funds for the restoration and management of the geological environment of mines

Engineering governance calculates engineering costs based on a fixed base price as the basis for fee determination. The estimated costs consist of construction costs, independent costs, and basic Contingency.

(1) Construction cost

The engineering cost consists of direct costs, indirect costs, corporate profits, price differences, and taxes.

Direct engineering cost: It consists of direct cost, other direct costs, and on-site expenses.

The direct costs include labor costs, material costs, and machinery usage fees. According to the mining industry wage standards in Zimbabwe, labor costs are calculated as follows: $1.88/hour for foremen and $2.16/hour for skilled workers. The machinery usage fee for geological environment remediation is calculated as follows: machinery usage (machine-hours) × construction machinery machine-hour fee.

Other direct costs (including additional costs for construction during winter and rainy seasons, additional costs for nighttime construction, and other expenses);

②Indirect cost: Direct engineering cost × Indirect cost rate

Indirect costs include enterprise management fees and regulatory fees.

③Corporate profit: (Direct engineering cost + Indirect cost) × 7%.

④Taxes: (Direct engineering cost + Indirect cost + Corporate profit) × 9%.

1 Statistical Table of Mine Geological Environment Protection and Management Fee Rates

Engineering Category	Temporary facility cost (%)	Cost of safe and civilized production measures (%)	Other fees (%)	Enterprise management fee (%)	Regulatory fee (%)	Interest rate (%)	Tax rate (%)
Earthwork	4.2	2	0.7	7.8	2.7	7	9

Stonework engineering	4.2	2	0.7	7.8	2.7	7	9
Masonry works	3.0	2	0.7	7.6	2.6	7	9
Concrete engineering	4.0	2	0.7	7.5	2.6	7	9
Template project	4.2	2	0.7	8.4	2.8	7	9
greening project	3.0	2	0.7	8.4	2.6	7	9
other	3.0	2	0.7	8.4	2.6	7	9

(2) Temporary facility fees: This includes the lump-sum fees allocated to construction enterprises for temporary facilities in accordance with regulations, as well as the actual expenses incurred by enterprises for constructing temporary facilities on their own.

(4) Basis for monitoring fee collection

The monitoring content of the mine geological environment monitoring project includes mine geological environmental issues and major environmental factors such as ground collapse, ground fissures, avalanches, landslides, mudslides, aquifer damage, and topographical and geomorphic landscape damage caused or potentially caused by mine construction and mining activities. The monitoring fee standard is as follows:

Geohazard monitoring

-- Embedding of monitoring piles

Self-construction, calculated at 80 USD per unit (only including time-consuming wages for self-inspection).

-- Absolute displacement monitoring of slope landslide, collapse, and deformation.

②Water quality monitoring

Water quality monitoring encompasses both surface water and groundwater monitoring, with a reference cost of $100 per instance (self-conducted patrols, only accounting for time-consuming wages).

③Topography and landform landscape monitoring

Topography and landform monitoring involves patrol monitoring, with a reference cost of $50 per instance (self-conducted patrols, only time-consuming wages are calculated).

(5) Contingency

The basic contingency fund is calculated at 5%.

(6) Contingency for price increase

The contingency for price differences is calculated at 6% of the static investment.

(II) Basis for estimating land reclamation costs

The project budget consists of construction costs, equipment costs, other expenses (including preliminary work costs, engineering supervision fees, demolition compensation fees, completion inspection fees, and owner management fees), and unforeseen expenses. In the calculation, it is expressed in US dollars, rounded to two decimal places to the nearest cent, and then summarized to the nearest yuan.

(1) Construction cost

The construction cost of the project consists of direct costs, indirect costs, profits, and taxes.

1) Direct cost

Direct costs consist of direct engineering costs and measure costs.

Direct engineering cost

Direct engineering costs consist of labor costs, material costs, and construction machinery usage fees.

The calculation table for the artificial budget unit price is shown in Table 7-2 below.

2 Labor Wage Calculation Table (Monthly Work 280 Hours)

serial number	project	formula	Engineering Category
1	basic salary	391.39÷208×8═15.05	General worker
		452.4÷208×8═17.4	skilled worker
Unit price of labor cost			
General worker			$15.05
skilled worker			$17.40

The labor unit price in the labor cost is calculated according to the relevant provisions of the Zimbabwean mining wage standard, which is USD 15.05/man-day for Grade A workers and USD 17.40/man-day for Grade B workers.

The material cost is determined based on the actual consumption of materials and the actual prices of project materials.

The usage fee of construction machinery is determined by reference to the machine-shift cost of equipment of the same type during the project production process

②Measure cost

Measure cost = direct engineering cost (or labor cost) × measure cost rate

The measure fees include temporary facility fees, additional fees for construction during winter and rainy seasons, additional fees for nighttime construction, construction auxiliary fees, additional fees for safe and civilized construction, and additional fees for construction in special areas.

The calculation method for the additional cost of construction during the winter and rainy season is based on different regions and calculated as a percentage of the direct engineering cost, with a rate of 0.9%.

The night construction fee is calculated as a percentage of the direct engineering cost, with installation engineering at 0.5% and construction engineering at 0.2%.

Construction auxiliary costs are calculated as a percentage of direct engineering costs, with installation engineering accounting for 1% and building engineering accounting for 0.7%.

The additional cost for safe and civilized construction is calculated as a percentage of the direct engineering cost, with 0.5% for installation works and 0.3% for building works.

According to different engineering properties, the rates for temporary facility fees are listed in the table below.

3 Temporary facility fee rate table

Engineering Category	Computing foundation	Temporary facility fee
Earthwork	Direct engineering cost	3.7%
Stonework engineering	Direct engineering cost	3.7%
Masonry engineering	Direct engineering cost	3.7%
Concrete engineering	Direct engineering cost	4.7%
Agricultural well engineering	Direct engineering cost	4.7%
other engineering	Direct engineering cost	3.7%

installation engineering	Direct engineering cost	5.2%

2) Indirect costs. The rates of indirect costs vary according to the nature of the project, as shown in the table below

4 Indirect cost rate table

Engineering Category	Computing foundation	Indirect cost (%)
Earthwork	Direct engineering cost	6
Stonework	Direct engineering cost	7
Masonry works	Direct engineering cost	6
Concrete engineering	Direct engineering cost	6
Agricultural well engineering	Direct engineering cost	9
other engineering	Direct engineering cost	6
installation engineering	labor cost	65

3) Profit

The profit margin is set at 5%, calculated based on the sum of direct and indirect costs.

4) Taxes

Based on the actual tax rate of 15% in Zimbabwe, the calculation is based on the sum of direct costs, indirect costs, and profits.

(2) Equipment purchase cost

The cost incurred by purchasing equipment during the construction process of land reclamation and consolidation projects.

(3) Other expenses

Other expenses consist of preliminary work costs, engineering supervision fees, completion inspection fees, and owner management fees.

a. Preliminary work expenses

The preliminary work expenses include: land survey fee, project feasibility study fee, project survey fee, project design and budget preparation fee, project bidding fee, etc. The land survey fee rate is 0.50%. The project feasibility study fee is calculated based on the sum of construction cost and equipment purchase cost, using a tiered fixed fee calculation method, with each interval determined by interpolation. The project survey fee rate is 1.5%. The project design and budget preparation fee is calculated based on the sum of construction cost and equipment purchase cost, using a tiered fixed fee calculation method, with each interval determined by interpolation.

The project bidding fee is calculated based on the sum of construction cost and equipment purchase cost, using a differential fixed rate calculation method, with each interval determined by interpolation.

b. Engineering supervision fee

The engineering supervision fee is calculated based on the sum of the construction cost and equipment purchase cost, using a tiered quota billing method, with each interval determined by interpolation.

c. Completion inspection fee

The completion inspection fee encompasses various expenses such as project engineering review fees, engineering inspection fees, project final settlement preparation and audit fees, post-settlement land revaluation and registration fees, and signage setup fees. All these fees are calculated using the sum of construction costs and equipment purchase costs as the billing base, employing a differential rating system.

d. Management fee

The management fee is calculated based on the construction cost, equipment purchase cost, preliminary work cost, engineering supervision fee, demolition compensation fee, and completion inspection fee, using a differential fixed rate billing method.

(4) Monitoring and maintenance costs

It is calculated based on the monitoring and maintenance workload, as well as the prices of labor and material costs.

The land reclamation monitoring of this project primarily comprises four components: land damage monitoring, soil quality monitoring, reclamation effect monitoring, and monitoring of reclamation supporting facilities.

The monitoring fees are charged based on the previous inquiries for various monitoring projects in Zimbabwe. See the table below:

5 Reference table for estimated unit price of mine land reclamation monitoring project

Test Item	unit	cost
Monitoring of land damage	USD/time	50
Soil quality monitoring	USD/time	100
Monitoring of vegetation restoration effect	USD/time	25
water quality monitoring	USD/time	100
Biodiversity monitoring	USD/time	25

Soil quality testing of tailings pond	USD/time	800

The maintenance project mainly includes the maintenance of vegetation on reclaimed land and the maintenance of pit and lake projects. The main content involves reseeding artificial grasslands, preventing and controlling pests and diseases, irrigation and fertilization, as well as the maintenance of irrigation and drainage facilities for pit and lake projects.

6 Reference Table for Estimated Unit Prices of Maintenance and Protection Works

Management and maintenance costs	unit	cost
Pit lake management and protection	US dollar per hectare	200
Grassland management and protection	USD/ha	100

(5) Contingency

 Basic contingency fund

Basic contingency funds: calculated at 8% of the total of construction engineering installation costs and independent costs.

 Price contingency

Calculate the contingency for price differences based on a price index of 6%.

 Risk premium

The calculation base is the sum of construction costs and other expenses, excluding monitoring and maintenance costs, with a rate of 10%.

II. Fund Estimation for Mine Geological Environment Treatment Project

(I) Total engineering quantity and investment estimation

1. Total engineering quantity of mine geological environment governance

The quantities of the geological environment remediation engineering design for the polymetallic lithium mine in the Kamativi mining area, Matabeleland North Province, Zimbabwe, are detailed in Table 7-7 below.

Table 7-7 Workload of Mine Geological Environment Treatment Project

serial number	**Project name/method**		**unit**	**workload**	**Remarks**
1	Mine geological environment protection and land reclamation	Warning sign	Zhang	20	The engineering quantity is included in the geological environm

	preventio n				ent restoratio n project
2	Geologica l disaster monitorin g	Deformation monitoring	time	792	
		water quality monitoring	time	22	
		Topography and landform monitoring	time	132	

2. Investment estimation for mine geological environment governance

The estimated total investment for the geological environment protection project of this project is USD 88,000. This includes USD 3,000 for the main construction works, USD 72,000 for the mine geological environment monitoring project, and USD 6,000 for basic Contingency. All funds will be raised by the land reclamation obligor. The cost estimate is shown in Table 7-7.

7 Summary Table of Investment Estimation for Mine Geological Environment Treatment Project

serial number	**Name of project or expense**	**Construction and installation costs**	**Independent cost**	**Total (USD)**	**Account for 1-5% of investment**
I	Part 1: Main Building Construction Works	3000.00		3000.00	3.65%
II	Part II Temporary Construction Works				
III	Part III: Engineering cost for mine geological environment monitoring	72160.00		72160.00	87.76%
IV	Part IV: Independent fee		7066.90	7066.90	8.59%
V	Part V: Contingency				
	Investment in parts one to three	75160.00	7066.90	82226.90	
	Basic contingency fund			6578.15	
	static total investment			88805.05	
	Price contingency				
	total investment			88805.05	

(II) Individual project quantities and investment estimation

The investment estimates for each individual project of the polymetallic lithium mine in the Kamativi mining area, Matabeleland North Province, Zimbabwe, are detailed in Table 7-8 below.

8 Estimation Table for Main Building Works

serial number	Name of project or expense	unit	quantity	Unit price (USD)	Total price (USD)
	Part 1: Main building works				3000.00
1	Prevention of mine geological environment protection				3000.00
1.1	Warning sign				3000.00
1.1.1	Warning sign	a	20	150.00	3000.00

III. Estimation of funds for land reclamation projects

(I) Total engineering quantity and investment estimation

1. Total engineering quantity of land reclamation in the mining area

The area of responsibility for mine reclamation is 3,601,234 square meters, with a land reclamation rate of 80.88%. It primarily involves engineering measures such as soil reconstruction, vegetation restoration, monitoring, and management and protection projects. Details are provided in Table 7-9.

9 Summary Table of Land Reclamation Quantities in the Exploration Area

serial number	Name of project or expense	unit	quantity
one	Reclamation of exploration area		
1	Reclamation of exploration holes		
⑴	Topsoil backfilling	m^3	80.65
2	Reclamation of exploration platform		
⑴	land leveling	m^2	3500
⑵	Sow grass seeds	m^2	3500

10 Summary Table of Land Reclamation Quantities in Mining Areas

serial number	Name of project or expense	unit	quantity
one	Pit lake drainage and irrigation		
1	Construction of water diversion canal		
(1)	Earth excavation	$100m^3$	4.33
(2)	Stonework excavation	$100m^3$	5.74
(3)	M7.5 mortar rubble	$100m^3$	2.37
(4)	M10 mortar plastering	m^2	7.92
2	Construction of intercepting ditch		
(1)	Earth excavation	$100m^3$	5.92
(2)	Stonework excavation	$100m^3$	2.56
(3)	M7.5 mortar rubble	$100m^3$	2.55
(4)	M10 mortar plastering	m^2	5.1
3	Spillway construction		
(1)	Earth excavation	$100m^3$	11.42
(2)	Stonework excavation	$100m^3$	12.87
(3)	M7.5 mortar rubble	$100m^3$	4.91
(4)	M10 mortar plastering	m^2	9.83
two	Soil reconstruction project		
1	land leveling		
2	Leveling project	$100m^2$	19992.93
three	Vegetation restoration project		
1	Planting red willow and locust tree	strain	84930
2	Planting Bougainvillea spectabilis	strain	9900
3	Sow grass seeds	Ten thousand m^2	199.9293

2. Investment estimation for land reclamation

The estimated total dynamic investment for land reclamation in this project is USD 2.8411 million, with a static investment of USD 2.7306 million. This includes USD 2.0533 million for engineering measures, construction, and biochemical measures, USD 528,000 for other expenses, USD 49,400 for monitoring and management fees, and USD 210,400 for Contingency (USD 100,000 for basic Contingency and USD 110,400 for price contingency Contingency). All funds are to be raised by the land reclamation obligor. See Table 7-10.

11 Land reclamation investment estimation table

serial number	Name of project or expense	cost	Rate (%)
	(1)	(2)	(3)
one	Construction cost	2053254.71	
two	Equipment procurement cost		
three	Other fees	527976.85	
four	Reclamation monitoring and management fees	49440.61	
1	Reclamation monitoring fee	12425.00	
2	Management and maintenance fee	37015.61	
five	contingency fund	210393.88	
1	Basic contingency fund	99969.62	5.00
2	Price contingency	110424.26	6.00
3	risk reserve		
six	static total investment	2730641.79	
seven	Dynamic total investment	2841066.05	

(II) Individual project quantities and investment estimation

The construction investment for the mine land reclamation project is approximately US$2.0533 million. The estimated quantities and engineering investment for the reclamation work in the exploration area are shown in Table 7-11, while the estimated quantities and engineering investment for the land reclamation work are shown in Table 7-12.

12 Investment Estimation Table for Reclamation Project in Exploration Area

serial number	Name of project or expense	unit of measurement	quantity of work	comprehensive unit price	total
1	Reclamation of exploration area				970.36
1.1	Reclamation of exploration holes				199.21
1.1.1	Topsoil backfilling	m^3	80.65	2.47	199.21
1.2	Reclamation of exploration platform				771.15
1.2.1	Leveling project	$100m^2$	35	2.57	89.95
1.2.2	Sow grass seeds	Ten thousand m^2	0.35	1946.28	681.20

13 Investment Estimation Table for Land Reclamation Project

serial number	Name of project or expense	unit of measurement	quantity of work	comprehensive unit price	total
2	Pit lake water diversion and drainage				28052.75
2.1	Construction of diversion canal				8782.36
2.1.1	Earth excavation	$100m^3$	4.33	14.81	64.13
2.1.2	Stonework excavation	$100m^3$	5.74	35.68	204.80
2.1.3	M7.5 mortar rubble	$100m^3$	2.37	715.70	1696.21
2.1.4	M10 mortar plastering	$100m^2$	7.92	860.76	6817.22
2.2	Construction of intercepting ditch				6487.11
2.2.2	Earth excavation	$100m^3$	5.92	14.81	87.68
2.2.1	Stonework excavation	$100m^3$	2.56	35.68	91.34
2.2.3	M7.5 mortar rubble	$100m^3$	2.55	715.70	1825.04
2.2.4	M10 mortar plastering	$100m^2$	5.1	879.03	4483.05

2.3	Spillway construction				12783.28
2.3.2	Earth excavation	100m^3	11.42	14.81	169.13
2.3.1	Stonework excavation	100m^3	12.87	35.68	459.20
2.3.3	M7.5 mortar rubble	100m^3	4.91	715.70	3514.09
2.3.4	M10 mortar plastering	100m^2	9.83	879.03	8640.86
3	Soil reconstruction project				1054170.31
3.1	land leveling				51381.83
3.1.1	Leveling project	100m^2	19992.93	2.57	51381.83
3.2	Backfilling project				988305.60
3.2.1	Topsoil backfilling	100m3	3998		988305.60
3.3	Fertilization to enhance soil fertility				14482.88
3.3.1	Fertilization of soil	Ten thousand square meters	199.9293		14482.88
4	Vegetation restoration project				
4.1	Planting Bougainvillea spectabilis	100 plants	99	6.31	624.69
4.2	Sow grass seeds	Ten thousand m2	199.9293	1946.28	389118.40
4.3	shrub	100 plants	849.30	683.29	580318.20

IV. Summary of Total Expenses and Annual Arrangement

1. Composition of total expenses

The total cost of this project consists of two parts: the cost for mine geological environment governance and the cost for land reclamation. The cost for mine geological environment governance includes: the cost for prevention of mine geological environment protection, the cost for governance of mine geological disasters, the cost for aquifer restoration, the cost for restoration of water and soil environmental pollution, and the cost for monitoring of mine geological environment. The cost for land reclamation includes the cost for land reclamation in mining areas and the cost for monitoring and management of land reclamation in mining areas.

2. Summary of total expenses

The total dynamic investment for the mine environmental governance project and land reclamation project in this project amounts to USD 2,929,100, while the total static investment stands at USD 2,819,400. Specifically, the investment in the mine environmental governance project amounts to USD 88,000, while the dynamic investment in the land reclamation project amounts to USD 2,841,100, with a static investment of USD 2,730,600. The reclamation responsibility area in the project area covers an area of 3,601,234 square meters, with an investment per unit area of USD 0.8 per square meter. Please refer to Table 7-13 for details.

The total investment for the geological environment remediation and land reclamation projects at the mine is estimated to be USD 2,929,100, and the mining enterprise also needs to raise a total of USD 2,929,900 for the geological environment remediation and restoration fund.

14 **Summary Table of Estimates for Mine Environmental Treatment and Land Reclamation Projects**

serial number	Individual item name	estimated amount	The proportion (%) of various expenses in the construction cost of the project
	(1)	(2)	(3)
1	Mine environmental governance project	8.8	3.00%
2	Mine land reclamation project	284.11	97.00%
Total:	——	292.91	100.00%

3. The cost arrangement for mine geological environment protection and land reclamation is shown in Table 7-19.

15 Schedule of expenses for mine geological environment protection and land reclamation (in 10,000 US dollars)

expense name	Annual arrangement			total
	2023～2024	2024～2030	2030～2034	
Mine geological environment protection and restoration	1.6	6.3	0.9	8.8
land reclamation	13.05	64.00	207.07	284.11

total	14.65	70.30	207.97	292.91

4. Recent annual funding arrangement

16 Recent annual funding arrangement

years	Main engineering measures	main engineering quantity	Fund arrangement (USD 10,000)
July 2023 ~ June 2024	Reclamation of exploration holes, reclamation of exploration platforms, geological environment monitoring, land damage monitoring, installation of warning signs, stripping of topsoil, and maintenance, etc	Backfilling of topsoil for exploration holes: 80.65m³; land leveling for exploration platforms: 3500㎡; sowing of grass seeds: 3500㎡; installation of 10 warning signs; land damage monitoring: 1 time; topsoil maintenance: 11.52hm2	14.65
July 2024 ~ June 2025	Geological environment monitoring, land damage monitoring, topsoil stripping and maintenance, etc	72 times of geological disaster monitoring, 1 time of land damage monitoring, and 23.04 hm2 of topsoil conservation	11.72
July 2025 to June 2026	Geological environment monitoring, land damage monitoring, topsoil stripping, and maintenance, etc	72 times of geological disaster monitoring, 1 time of land damage monitoring, and 34.56 hm2 of topsoil conservation	11.72
July 2026 ~ June 2027	Geological environment monitoring, land damage monitoring, topsoil stripping and maintenance, etc	72 times of geological disaster monitoring, 1 time of land damage monitoring, and 46.09 hm2 of topsoil conservation	11.72
July 2027 ~ June 2028	Geological environment monitoring, land damage monitoring, stripping of topsoil, and maintenance, etc	72 times of geological disaster monitoring, 1 time of land damage monitoring, and 57.61 hm2 of topsoil conservation.	11.72
July 2028 ~ June 2029	Geological environment monitoring, land damage monitoring, topsoil stripping, and maintenance, etc	72 times of geological disaster monitoring, 1 time of land damage monitoring, and 69.13 hm2 of topsoil conservation	11.72
July 2029 to June 2030	Geological environment monitoring, land damage monitoring, topsoil stripping, and maintenance, etc	72 times of geological disaster monitoring, 1 time of land damage monitoring, and 80.65 hm2 of topsoil conservation	11.72
July 2030 ~ June 2031	Geological environment monitoring, land damage monitoring, construction of pit and lake drainage and irrigation projects, soil reconstruction projects, and vegetation restoration projects	The construction of the pit lake drainage project is 2507m long, the soil reconstruction project covers an area of 1,999,293 m², the vegetation restoration project covers an area of 2,123,200 m², and there are 72 geological disaster monitoring activities and 12 topographical and geomorphic monitoring activities. The pit lake management and protection covers an area of 789,161 m² and is inspected and monitored annually, while the grassland management and protection covers an area of 212.32 m² and is inspected	175.75

		and monitored annually. There are also two water quality monitoring activities.	
July 2031 to June 2032	Geological environment monitoring, land damage monitoring, stripping of topsoil, and maintenance, etc	Geological disaster monitoring was conducted 72 times, topography and landform monitoring 12 times, inspection and monitoring of pits and lakes covering 789,161 square meters per year, inspection and monitoring of grassland management and protection covering 212.32 square meters per year, and water quality monitoring was conducted twice.	10.84
July 2032 to June 2033	Geological environment monitoring, land damage monitoring, topsoil stripping, and maintenance, etc	Geological disaster monitoring was conducted 72 times, topography and landform monitoring 12 times, and inspection and monitoring of pits and lakes covering an area of 789,161 square meters per year, as well as inspection and monitoring of grassland management covering an area of 212.32 square meters per year, and water quality monitoring was conducted twice.	10.84
July 2033 - June 2034	Geological environment monitoring, land damage monitoring, topsoil stripping, and maintenance, etc	Geological disaster monitoring was conducted 72 times, topography and landform monitoring 12 times, inspection and monitoring of pits and lakes covering 789,161 square meters per year, inspection and monitoring of grassland management and protection covering 212.32 square meters per year, and water quality monitoring was conducted twice.	10.54

Chapter 8: Safeguard Measures and Benefit Analysis

I. Organizational guarantee

1. Management guarantee measures

To ensure the smooth implementation of the plan, effective control of damaged land, and the healthy development of the ecological environment in and around the mining area, as well as to guarantee the implementation and fulfillment of all measures proposed in the plan, the obligor of the plan shall undertake the self-governance and reclamation. A project leadership team shall be established to be responsible for the project management and implementation during the construction process. Strict requirements shall be imposed on the implementation unit in accordance with the engineering measures, schedule arrangements, technical standards, etc. of the implementation plan, to ensure the completion of all measures with quality and quantity guaranteed.

The project involves the establishment of a leading group for mine geological environment protection and land reclamation by the mining company, which will coordinate and lead the work of mine geological environment protection and land reclamation in a unified manner. The head of the leading group will be a deputy general manager-level leader in charge of the mine, and two full-time personnel will be assigned to handle daily work such as organization and coordination. Specific responsibilities are as follows:

(1) Implement relevant policies and guidelines from local governments and relevant departments, and formulate management regulations for mine geological environment protection and land reclamation work;

(2) Strengthen the study and promotion of relevant laws, regulations, and ordinances, organize technical training for relevant staff on environmental protection and reclamation knowledge, and ensure that everyone consciously establishes awareness of mine environmental protection;

(3) Coordinate the relationship between mine geological environment protection and land reclamation work with mine production, ensure the fundraising for mine geological environment protection and land reclamation, and guarantee the normal implementation of engineering measures;

(4) Regularly conduct in-depth inspections at the project site to grasp the situation of geological environment damage in mines, land destruction, and the implementation of measures for geological environment protection and land reclamation in mines;

(5) Regularly report to the supervisory leaders on the progress of the reclamation project, the status of land damage, and the protection of mine geological environment and land reclamation;

(6) During the production of mines and the construction of mine geological environment protection and land reclamation projects, regularly or irregularly inspect the ongoing or completed projects to keep abreast of their construction progress, carry out daily maintenance, establish and improve various archives and materials. Actively accumulate, analyze, and compile mine geological environment protection and land reclamation data to provide relevant information for project acceptance.

2. Policy and measure guarantee

(1) The local government fully applies relevant laws and regulations to formulate preferential policies conducive to the protection of mine geological environment and land reclamation, encourages and mobilizes the enthusiasm of all aspects of mining enterprises, and does a good job in promoting and mobilizing the protection of mine geological environment and land reclamation. This not only enables mining enterprises to fully understand the position and role of mine geological environment protection and land reclamation in economic construction, enhance their sense of urgency and responsibility, and obtain the understanding and support of cadres and the masses, but also encourages local villagers and grassroots organizations to actively participate, providing enthusiastic and thoughtful cooperation and services to mining enterprises, making them feel the warmth of local cadres and the masses and the strong support of governments at all levels.

(2) Carry out geological environmental protection and land reclamation work in mining areas in accordance with the principle of "the one who damages shall be responsible for reclamation".

II. Technical Support

1. Mining enterprises should introduce professional and technical personnel, especially those skilled in environmental engineering management and vegetation restoration. By recruiting technical personnel who are professionally matched and adaptable to the mining work environment, they can compensate for the lack of technical talent and provide technical support for mine geological environmental protection and land reclamation work. At the same time, mining enterprises should also increase the equipment and instruments required for mine geological environmental protection and land reclamation work, providing technical and material support for improving these efforts.

2. Strengthen the publicity and education of environmental and ecological knowledge and regulations for enterprise employees, enhance their awareness and sense of responsibility, ensure that various governance projects are implemented by individuals, and strengthen internal self-inspection within the enterprise.

3. In terms of the technical aspects of mine geological environment protection and land reclamation plans, qualified design units shall be entrusted to prepare implementation plans, design construction drawings, etc. for the project, ensuring the scientific and operable nature of the mine geological environment protection and land reclamation plans.

4. During the project implementation stage, scientifically formulate the implementation plan and annual implementation plan for mine geological environment governance and land reclamation at each stage, timely summarize the practical experience of phased governance and reclamation, and revise this plan based on relevant regulations.

5. Mining enterprises should regularly or irregularly engage relevant experts to provide professional consultation on mine geological environment protection and land reclamation projects, and promptly adjust unreasonable plans and measures to ensure the effectiveness of mine geological environment protection and land reclamation projects.

6. Establish a technical supervision system, focusing on supervising obligors to implement the separation and protection of hazardous substances, not to use toxic and hazardous substances as backfill or filling materials, and not to use land contaminated by heavy metals and other toxic and hazardous substances for planting edible crops.

III. Fund guarantee

Funding availability is crucial to the success of mine geological environment protection and land reclamation work. To ensure the effectiveness of these efforts, it is imperative to devise practical and feasible measures for funding guarantee. This plan will implement funding guarantee measures covering various aspects such as funding sources, deposit, management, utilization, and audit.

1. Source of funds

As the obligor for mine geological environment protection and land reclamation, the company shall fully incorporate funds for these purposes into production and construction costs, earmarking them exclusively for the implementation of mine geological environment protection and land reclamation work. The invested funds shall be fully disbursed, safe, and effective.

2. Fund guarantee and management

(1) Establish a financial guarantee mechanism for bank guarantees: According to the annual funding schedule for mine geological environmental protection and land reclamation, set up bank guarantees with equal amounts of funds at the beginning of the year to ensure the safety and security of funds.

(2) Specific job responsibilities of management staff: Financial personnel are responsible for urging the mine to apply for and update bank guarantees according to the annual expense budget determined by the total dynamic investment of funds for mine geological environment protection and land reclamation at the end of each year; they are also in charge of compiling statistics on the expenditure amount of funds for geological environment protection and land reclamation over the years.

3. Use of funds

(1) Curb the extensive use of project funds. The protection of mine geological environment and land reclamation work are closely related to the safety of people's lives and property. Every cent of reclamation funds should be allocated to mine geological environment protection and land reclamation projects, and the extensive use of project funds should be strictly prohibited. In the use of reclamation funds, the system of in-process supervision and post-check should be implemented simultaneously to maximize the benefits of reclamation funds.

(2) Strictly prohibit any alteration of the intended use of project funds. Given the significant amount of funds allocated for mine geological environment protection and land reclamation, no individual or department is allowed to divert these funds for other purposes in disguised forms, such as supporting projects or comprehensive development, during the implementation of the project.

(3) Strictly enforce the fund allocation system. Upon completion of the project, the construction unit shall submit an application for fund allocation based on the project progress. After review and signature by the competent department, the application shall be submitted to the financial department for approval. Prior to the allocation of funds, the use of funds from the previous period must be inspected and accepted. Only after passing the inspection can the funds be allocated.

4. Fund supervision and audit

The audit work for the special funds for mine geological environment protection and land reclamation is applied for and entrusted to accounting firms by the management agency for mine geological environment protection and land reclamation. The accounting firms undertake and perform audit services through bidding, adhere to audit standards and professional ethics norms, and strictly fulfill their obligations in accordance with the engagement letter. The specific audit contents are as follows:

(1) Ensure that the internal control system for funds exists, is effective, and is consistently implemented;

(2) Confirm the authenticity of the amounts listed in the accounting statements;

(3) Ensure that the accounting records of funds are accurate, the amounts are correct, the measurements are accurate, the subsidiary ledgers are consistent with the general ledger, and there is no embezzlement or misappropriation;

(4) Ensure the authenticity of fund revenue and expenditure, and the correctness of currency valuation;

(5) Ensure the appropriate disclosure of funds in the accounting statements.

IV. Supervision and Guarantee

1. The obligor for geological environmental protection and land reclamation of this mine, namely the construction unit, promises to strictly implement the plan and carry out work in stages, and will disclose relevant information to the public through

local television, newspapers, and the internet, accepting supervision from relevant government departments and the public.

2. The implementation of the project must be organized and implemented by qualified units, with the establishment of dedicated institutions, specific management responsibility system by full-time personnel, detailed exploration, design, and construction plans, establishment of quality monitoring and acceptance procedures, and consciously accepting supervision and inspection by local government departments.

3. Units involved in project exploration, design, construction, and management must possess the required qualifications and obtain corresponding qualification certificates. Project quality management must be strictly implemented in accordance with relevant specifications and procedures, ensuring clear responsibilities and distinct rewards and punishments. Materials required for construction must be inspected and accepted by the quality inspection department before use.

V. Benefit analysis

1. Social benefits

The investment in mine geological environment protection and land reclamation will effectively control the adverse environmental impacts generated by project construction and operation, protect the environmental resources of the project, and play a positive role in maintaining and improving the environmental quality of the project. After reclamation, the forest land can continue to be used by local villagers, which is conducive to promoting rational land use, increasing agricultural income, and improving the local ecological environment. This is beneficial to the physical and mental health of local people and promotes social stability and unity. Therefore, mine geological environment protection and land reclamation are major issues concerning the national economy and people's livelihood. They are not only of great significance for the development of production and coal mining, but also for the stability, unity, and sustainable development of the entire society. It is also an important component of ensuring sustainable development in the project area, thus having significant social benefits.

2. Environmental benefits

Land is a comprehensive entity encompassing nature, economy, and society, and it also constitutes a vast ecosystem. The protection of mine geological environment and land reclamation are large-scale projects closely integrated with ecological reconstruction. Conducting land reclamation and ecological reconstruction in this region to address land damage caused by mining holds immense ecological significance.

The mine geological environment protection and land reclamation plan, adhering to the principle of "rational layout and adapting to local conditions," aims to comprehensively manage the land damaged during production. It aims to establish a

new land use ecosystem, create new artificial and natural green landscapes, and play a role in water storage and soil conservation, reducing land damage. This will restore the original good ecological environment of the project area, maintain the virtuous cycle of the local vegetation ecosystem, and regulate the regional microclimate.

Through specific measures such as land leveling, improving soil physicochemical properties, and tree planting, land quality can be effectively improved, leading to a balanced ecological environment and yielding good ecological benefits.

3. Economic benefits

Economic benefits encompass both direct and indirect economic benefits. The expenses for mine geological environmental protection and land reclamation are primarily allocated towards monitoring geological disasters, water and soil pollution, as well as the restoration and management of occupied and damaged land, in order to prevent geological disasters such as collapses and ground fissures, as well as the continuous deterioration of the human living environment. If these geological issues are not addressed and restored, it will, on one hand, severely impact the safety of lives and property within the area, thereby increasing corporate compensation costs and imposing a persistent economic burden on the enterprise. On the other hand, it will cause severe damage to the water, soil, and vegetation environments, downgrade the land use grade, diminish the land use value, and the losses incurred are immeasurable.

Therefore, monitoring and managing issues related to the geological environment of mines and land damage is beneficial to the production and life of people in mining areas, as well as to ecological balance and sustainable development, and can generate good economic benefits.

VI. Public Participation

The purpose of public participation in land reclamation is to gather opinions and suggestions from local land resource authorities, land users, and the surrounding public regarding the project land occupation and the subsequent reclamation work.

According to the requirements for compiling land reclamation plans, it is necessary to inform the local residents around the project site about the relevant content of the reclamation plan, such as the reclamation period, direction, and engineering measures. Based on this, they should be encouraged to fully express their opinions and suggestions, and put forward corresponding constructive suggestions, so that they can be implemented in specific land reclamation activities. This ensures that the reclamation plan is feasible and meets relevant requirements.

In the early stages of plan preparation, the construction unit and plan preparers visited local residents near the mining area, fully solicited opinions from government departments, communicated with them about the objectives and contents of the plan, clarified the direction of land reclamation, the standards for reclamation management,

and implementation measures, and received their assistance and strong support. The reclamation work has a good social foundation.

During the project construction process, we emphasize deep engagement with the local community: (1) Establishing a dedicated community liaison mechanism: Forming a "reclamation supervision group" composed of community representatives, holding regular meetings, providing feedback on community opinions, and participating in decision-making. (2) Prioritizing local employment and skills training: In the reclamation project, priority is given to hiring local residents and providing technical training to enhance their ability to participate in reclamation work, while creating long-term employment opportunities for the community. (3) Conducting reclamation in conjunction with community needs: For example, part of the reclaimed land can be used for community agriculture or animal husbandry, benefiting local residents; the water and soil conservation facilities (such as drainage ditches and reservoirs) built during the reclamation project can also be used by the community. (4) Continuous communication and benefit sharing: Regularly publishing reclamation progress reports to the community to ensure transparency; exploring future mechanisms for sharing the benefits of reclaimed land, so that the community can benefit in the long run.

After the completion of the project implementation, in addition to organizing relevant experts, some public representatives will also be invited to participate, ensuring that the acceptance inspection is fair, just, and open.

Overall, the public has a high level of concern regarding mining activities in the mining area, indicating a solid social foundation. However, they are not well-informed about the objectives, measures, and goals of land reclamation in the mines. After gaining an early understanding of the direction and measures of mine land reclamation, most people have great confidence in it, believing that the implementation of this plan can effectively improve the local ecological environment. The local government hopes that the implementation of this plan will fully consider the local natural conditions, select locally advantageous plants, and ensure that the land reclamation rate and reclamation effect meet the acceptance requirements. At the same time, it hopes that the construction unit will strengthen the management, protection, and cultivation work after reclamation to consolidate the achievements of land reclamation.

Chapter 9 Conclusion and Suggestions

I. Conclusion

1) The Kamativi polymetallic lithium mine in Zimbabwe adopts open-pit mining, with the ore type being spodumene. The designed production capacity is 2.3 million tons per year. The mine has a service life of 7 years. After the mine is closed, the construction period for mine geological protection and land reclamation projects will be 1 year, and the monitoring and maintenance period will be 3 years. Therefore, the applicable period of this plan is 11 years (from 2023 to 2034).

The base year for the preparation of this plan **is 2023**, and it should be revised every 5 years during its implementation. When the mine expands its production scale, expands its mining area, or changes its mining method, the mine geological environment protection and land reclamation plan should be re-prepared or revised.

2) The Kamativi polymetallic lithium mine in Zimbabwe is classified as a **"large-scale mine"**, with an assessment area importance level of **"important"**, and a mine geological environment complexity level of **"medium"**. The assessment level is determined as **"level one"**.

3) The current assessment indicates that the impact of geological disasters is relatively minor, with minor impacts on aquifers, topography and landscape, and water and soil environment. The predictive assessment also suggests that the impact of geological disasters is relatively minor, with minor impacts on aquifers; however, the damage to the landscape is more severe, and the impact on the water and soil environment is more serious.

4) Based on the assessment and predictive evaluation results of the current impact of the mine's geological environment, fully considering the impact of mine production on the human living environment, and following the principle of similarity within the area and difference between areas, the mine geological environment protection and restoration and management areas are divided into three zones according to the zoning principle that when multiple geological environmental issues coexist within the same area, the impact degree should be considered as the greater rather than the lesser, and the higher rather than the lower. These zones are the key prevention and control zone, the secondary key prevention and control zone, and the general prevention and control zone.

5) After the implementation of this plan, mine geological environmental issues such as mine geological disasters and landscape destruction have been effectively prevented and controlled. The damaged land has been reclaimed. After the implementation of the reclamation project, 789,161 square meters of pit lakes, 2,123,239 square meters of tree and grass land, and 688,834 square meters of other planned land use will be obtained. This will enable the mine geological environment to achieve benign, harmonious, and sustainable development, and both social and environmental benefits can be achieved.

II. Suggestions

1. This plan does not replace engineering survey work, environmental impact assessment, or other related work. It also does not replace the final construction drawing design for the mine geological environment remediation project and land reclamation project. It is recommended that mining enterprises, when carrying out geological environment remediation projects and land reclamation projects, entrust relevant units to conduct special engineering surveys and designs for the mine geological environment impact areas and land reclamation areas.

2. Due to the long production lifespan of this mine, there are numerous factors that could affect mine production, the geological environment, and land reclamation during future mining processes. It is recommended to promptly revise this plan based on actual changes in mine production and adjust governance measures to achieve the best results.

3. During the process of mine environmental governance and land reclamation according to this plan, the mining party should continuously accumulate data and experience to provide reliable data for the preparation of the next planning period plan, so as to better serve the mine construction.

4. It is recommended that the mine strengthen engineering geological exploration during production to prevent mining collapse, landslides, avalanches, and mudslide disasters. At the same time, an emergency command group should be established, with clear division of responsibilities and a liaison mechanism defined. An emergency response plan should be prepared, and it should be activated immediately in case of major accidents. To ensure the safe and smooth implementation of land reclamation projects, the following emergency response measures are specifically formulated for potential emergencies such as landslides and collapses: Firstly, full-time monitors should be equipped for 24-hour patrols. Secondly, an early warning mechanism should be established, and emergency procedures should be activated immediately once the standards are exceeded. In the event of a landslide or collapse, personnel in the dangerous area should be evacuated immediately, warning lines should be set up, and sandbags, wooden piles, or gabions should be used for temporary reinforcement. At the same time, drainage ditches should be excavated to prevent continuous water flow scouring. In addition, emergency supplies should be kept on site, and a linkage mechanism should be established with local rescue teams and environmental protection departments to ensure support.

5. To ensure the effectiveness of the land reclamation project, for the destroyed grassland, dustproof nets should be quickly covered to reduce soil erosion, and after the weather stabilizes, resistant grass seeds should be quickly reseeded.

6. It is recommended to strengthen the inspection, comprehensive treatment, and utilization of mine drainage and wastewater. During the operation of this project, monitoring of surface water and aquifers should be enhanced to prevent potential water quality pollution in aquifers.

7. During the implementation of mine geological environment remediation projects and land reclamation projects, it is necessary to continuously accumulate data to provide basic information for the comprehensive restoration of the mine geological environment and land reclamation in the future.

8. It is recommended that the design unit, construction unit, monitoring unit, supervision unit, etc. strictly adhere to relevant laws, regulations, specifications, procedures, and other requirements to ensure the effective implementation of this plan.

Due to the difficulties in land acquisition for the mine, the mine owner should revise this plan based on the actual situation during the later stages of mine production.

10. This plan is formulated based on the existing development plan and mine safety facility design. If there are any changes to the development and utilization plan or the mine safety facility design, this plan should be revised or re-formulated.

11. The impact of mining on the environment is dynamic. In the process of implementing environmental governance and land reclamation for mines, the budget estimation for funds is based on industry-specific engineering fee standards and local labor costs. According to current market prices and socio-economic development trends, the estimated funds in this plan are for known parts of environmental governance and land reclamation for mines. The economic estimation is temporarily reasonable in the near future. If there are significant changes such as new mining areas or changes in mining methods during this period, this plan will be revised.

APPENDIX 3: CULTURAL HERITAGE REPORT

Cultural Heritage Assessment Report -KMC

SECTION 1

PROJECT BACKGROUND AND OVERVIEW

This report provides details of the archaeological field survey exercise that was conducted in August 2025 as part of the Kamativi Mining Company Growth Project Environmental Impact Assessment. One of the broad aims of this undertaking was to assess the Archaeological significance of the area and to come up with informed recommendations and mitigation measures for the project. Whenever development is taking place, archaeological, cultural and natural heritage components also require protection through the Archaeological Impact Assessment (AIA) under the Environmental and Social Impact Assessment (ESIA). All heritage sites in Zimbabwe receive equal protection from the National Museums and Monuments of Zimbabwe Act Chapter 25: 11. This archaeological study for Kamativi Mining Company was therefore carried out to help the developer to comply with the legal requirements of the National Museums and Monuments of Zimbabwe Act 25: 11. Of importance is Section 24 (1a) which states that, 'No person shall without the written consent of the Executive Director, excavate any ancient monument or national monument', hence justification for carrying out this baseline study.

Part IV of the Act, Section 21 provides for the notification of discovery of ancient monuments and relics to the National Museum and Monuments of Zimbabwe.

The Act and the subsequent surveys derive their validation and relevance from the preposition that all land in Zimbabwe is anthropogenic, that is, it was once occupied and used by mankind and therefore the evidence of that period and cultural remains of pre-historic people deserve protection.

SECTION 2

LEGAL AND POLICY BASIS

A number of legislative protocols relevant to this assessment were identified and analysed with key sections being referred to. A synopsis of each key policy instrument is provided below showing how it is of relevance to this study.

Constitution of Zimbabwe (2013) - provides for the fundamental rights of the citizens, including rights related to access and use of the environment and natural resources. Section 73 provides for the right towards a clean and safe environment free from pollution and ecological degradation with the promotion of environmental conservation to ensure intergeneration equity.

National Museums and Monuments Act (CAP 25:11) - provides for the protection and safeguarding of archaeological, historical, architectural, geological, and paleontological sites. This Act prohibits the alteration or removal of cultural materials without the written consent of the Director from any development project site.

Traditional Leaders Act (CAP 29:17) - stipulates provisions for the appointment of village heads, headmen's and chiefs, as well as their functions including land and natural resources management within their jurisdiction. Their

responsibilities include making sure community members receive benefits from any development projects within their area, in a fair and equitable manner.

The Environmental Management Act (CAP 20:27) - mandates the disclosure of information to ensure that key decisions reflect stakeholder needs, by providing project information in a timely manner that permits review and feedback amongst interested and affected stakeholders.

Environmental Management (Environmental Impact Assessment and Ecosystems Protection) Regulations (SI 7 of 2007) - sets procedures for conducting EIAs, the registration of persons engaged in EIA consultation and the conditions for the awarding, amendment, suspension or cancellation of an EIA certificate, all which include community consultations as part of the AIA.

Environment and Social Safeguards Policy of EMA (2019) - fosters full respect for Indigenous Peoples dignity, human rights, and cultural uniqueness through understanding local conditions, including indigenous knowledge systems and practices by consulting local leadership and marginalized groups.

UNESCO Convention for the Safeguarding of Intangible Cultural Heritage, adopted in 2003, shines a spotlight on the significance of intangible cultural elements. This convention goes beyond the tangible and emphasizes practices, expressions, knowledge, and skills that communities transmit to subsequent generations. In doing so, it underscores the crucial need to protect living cultural heritage, giving rise to the active involvement of communities in its preservation. By fostering heightened awareness regarding the value of intangible heritage,

this convention cultivates deep-seated respect for cultural diversity, consequently catalyzing sustainable development. It therefore places emphasis on the significance of intangible cultural elements including practices, expressions, knowledge, and skills that communities transmit to subsequent generations. It underscores the crucial need to protect living cultural heritage, placing value on the active involvement of communities in its preservation.

One of the cornerstones of international efforts to protect cultural heritage is the **UNESCO World Heritage Convention. Adopted in 1972**, this landmark treaty seeks to identify and safeguard sites of outstanding cultural and natural value. Under this convention, member states nominate sites for inclusion on the World Heritage List, thereby committing to their protection and preservation. The convention's significance lies not only in the protection of physical sites but also in raising awareness about the value of cultural heritage on a global scale.

Beyond tangible heritage, the concept of intangible cultural heritage gained prominence with the adoption of the UNESCO Convention for the Safeguarding of Intangible Cultural Heritage in 2003. This convention recognizes the importance of oral traditions, performing arts, rituals, and other forms of intangible heritage that shape identities and build communities. It emphasizes the need to ensure the viability of these living traditions for future generations. International law also seeks to prevent the illicit trafficking of cultural artefacts, a grave concern that fuels the loss and destruction of heritage. **The 1970 UNESCO Convention on the Means of Prohibiting and Preventing the Illicit Import, Export, and Transfer of Ownership of Cultural Property** aims to halt

the illegal trade in cultural artefacts. It obligates states to implement measures to prevent the transfer of stolen or unlawfully exported cultural items. In times of conflict, cultural heritage often finds itself at risk of destruction and looting. **The 1954 Hague Convention for the Protection of Cultural Property in the Event of Armed Conflict** and its two Protocols offer protection for cultural heritage during armed conflicts. They establish rules to safeguard cultural property from deliberate destruction, and they advocate for respect for such property even amid warfare. Another notable development in cultural heritage protection is the emergence of customary international law. Over time, certain practices and principles have become accepted as binding norms among states, even without a formal treaty. These customary norms contribute to the broader legal framework for the protection of cultural heritage. Moreover, the preservation of cultural heritage is a paramount concern within international law. The concerted efforts of nations, facilitated by various treaties and conventions, reflect the commitment to safeguarding the diverse tapestry of human civilization. While challenges persist, the global recognition of the value of cultural heritage serves as a foundation for building a more inclusive and respectful world. Through these legal instruments, communities around the world strive to ensure that their cultural legacy endures for generations to come.

Indigenous People of the area under study.

The indigenous people of Hwange district after Khoisan are the Nambya , Tongas in the Zambezi Valley around Msuna area in Vic Falls there were Lozi people who gave it the name Mosi Oa Tunya now the lozi are in Zambia

southern province. Social and Culturally the people practised subsistence farming , African Traditional religion and polygamy. They reared livestock and game hunting. Due to global trends inter cultural exchanges have prevailed due to economic activities in the district such as mining and tourism. People from other regions in Zimbabwe have come to seek a living such as Shona and Ndebele causing cultural diffusion .In the pre independence days common were migrants from neighbouring countries such as Zambia, Malawi and Zambia , Mozambique and Angola .

Wankie colliery brought in some cultural influences in types of marriages and food types and the locals adopted some of their vocabulary from their languages. Different festivals and dances are common i.e. When one dies a year after they have a ceremony to unite him or her with his ancestors umbuyiso in Ndebele and Malila in Nambya. The most common indigenous group is the Nambya.

SECTION 3

Research Aims and Objectives

Earth moving activities have impacts on the bio-physical and socio-economic environment including cultural and natural heritage resources. This study was therefore carried out to investigate and document all archaeological remains, places of cultural and intangible heritage, immovable archaeological settlements and palaeontological remains that may be affected by the proposed project.

The following are the objectives of the Archaeological Impact Assessment.

1. To document and preserve any existing cultural material before destruction due to development for scientific, educational, social and political values for future generations.
2. To ensure that development proponents consider Archaeological resource values and concerns during project planning and implementation.
3. To allow for the implementation of any monitoring and review mechanisms in the process of development to mitigate Archaeological resources.
4. To ensure where decisions are made to develop the land, the proponents adopt one of the following actions,

a. *Avoid Archaeological resources where possible; or*
b. *Implement measures which will mitigate project impacts on Archaeological resources.*

The role of National Museums and Monuments of Zimbabwe is to administer, preserve and protect relics and monuments not to prohibit or impede land use and development. When proper impact management practices are implemented, it is usually possible to minimize the loss of Archaeological resource values in a cost-effective manner.

SECTION 4

Assessment/Research Methodology

The assessment has followed the criteria and guidelines for evaluating and assessing impacts on sites of Archaeological value as set out by the NMMZ Act. To assess potential direct and indirect impacts on the sites of Archaeological value, the study area covering Kamativi Mining Company claims was comprehensively surveyed.

The assessment comprises the tasks described in the following sections:

Identification of Baseline Archaeological Conditions

Desktop Study: A thorough investigation was conducted to check whether any archaeological, cultural, historical, palaeontological or natural heritage features have been recorded within the proposed mining area by Kamativi Mining Company. The search included the review of; List of declared monuments protected by the NMMZ Act [Chapter 25:11], deemed monuments recorded in the Archaeological Survey Database, published and unpublished papers, records, archival and historical documents and old maps and aerial photographs. The National Archaeological Survey Database indicated that no sites are known to exist within a 10 km radius of North Hill mining area. The National Index Map (2006) from the Surveyor Generals offices in Harare was also consulted to understand the geology and vegetation of the area. The existence of Kamativi mine in the region also validates lack of any substantial archaeological remains as mining developments commenced way before these current proposed projects.

***Field Survey*:** An archaeological survey was undertaken to obtain field data to evaluate the archaeological interest and the extent to which it is potentially

impacted by the project. Emphasis was placed on the visible ground attributes for archaeological resources as identification of such resources would determine the positive or negative recommendation thereafter. During the field walk, artefacts such as stone tools and clay pots were on the lookout, as well as possible marking of graves buried beneath the visible landscape. Making use of the recovery theory by Sullivan (1978), principles of site discovery, visibility and obtrusiveness were overcome by adopting intensive cluster sampling technique which entailed visual site inspection. Places of intangible significance were also assessed during the field walk to comprehend the archaeology of the area.

Documentation: During the field walk, archaeological recording sheets were used to capture essential details of sites observed while conducting the field survey. Photographs were also captured to ensure visual representation of the identified archaeological sites would be used as part of this report compilation. Mapping of archaeological resources is also essential as part of records keeping, hence coordinates for identified sites were captured using a handheld GPS, which were used to create a map of the project area (*appendix 1*).

Community Consultations: Interviews were held with the traditional leadership including respective Village Heads and local community members (*appendix 2*) to gather their valuable insights on the presence of any archaeological resources or places of intangible significance. This was done to complement the field surveys, especially validating any questionable findings, specifically the demarcations of some identified grave sites.

SECTION 5

Major Findings

Grave Sites

A total of 84 graves were identified within the core area proposed for mining development projects by Kamativi Mining Company posing severe risk towards the destruction of this tangible heritage. Site number 1 had a total of 14 graves whilst site number 2 had a total of 70 graves, which were documented and mapped during the field walk (*appendix 3*).To validate the grave findings, local communities including Village Heads confirmed the existence of these human remains during consultations and interviews, as they participated in the burial ceremonies of most of the individuals. One of the Village Heads highlighted that these graves are important to the local Nambya people who often conduct some cultural rituals periodically indicating the significance of the graves.

Chingahari Sacred Mountain Ranges

Traditional practices including rain making ceremonies are conducted as the elders go and plead for good rains and good harvests to the Chingahari ancestors. Ritual practices are done when elders appeal to ancestors when there is calamity, need protection, and introduction of new investors in the community. To indicate the likelihood of risk on the identified heritage sites, a severity matrix approach was adopted as indicated in figure 1.0 below.

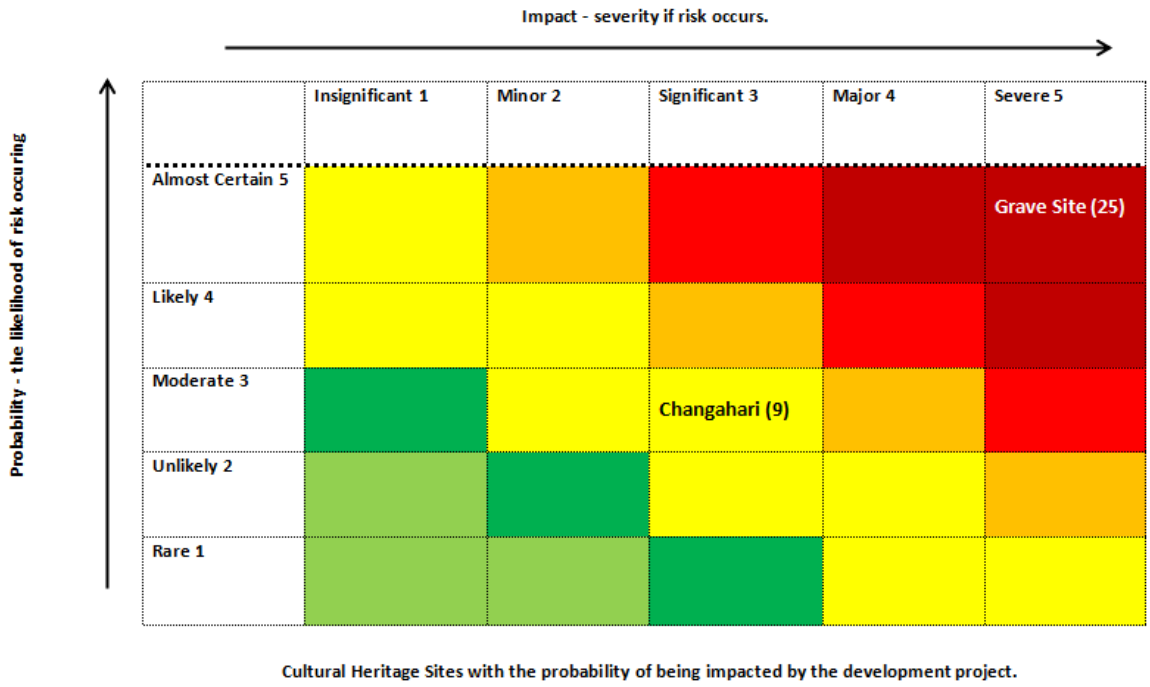


Figure 1.0 - Identified Heritage Sites and their risk severity.

Horizontal axis (Impact): Measure the severity if the risk occurs, from insignificant (1) to severe (5). vertical axis (Probability): measures the likelihood of the risk occurring, from rare (1) to almost certain (5). The color shading (green>yellow>orange>red>dark red) shows the risk level (low, moderate, high, extreme). The risk score is calculated by: risk score = probability multiplied by impact. Grave Site (25) is located in the 'almost certain' (5) row and the 'severe' (5) column. Multiplying probability and impact; 5 (almost certain) x 5 (severe) = 25 (grave site), hence it is in the dark red zone showing highest risk. Changahari (9) is located in the 'moderate' (3) row and the 'significant' (3) column. Multiplying probability and impact; 3 (moderate) x 3 (significant) = 9 (Changahari). It is situated in the yellow zone showing moderate risk. .

As indicated in figure 1.0 above, the project has a very high impact on the physical/tangible heritage, i.e., graves situated within the core area of the development project. Cultural Heritage buried underneath should be excavated/exhumed before commencement of any mining activities as part of compliance with the cultural tradition of the local landscape. The impact of mining on heritage graves is a profound and multi-faceted issue, pitting economic development against cultural preservation and spiritual beliefs, thus it involves legal, ethical, and community-level conflicts.

Direct Physical Impacts (The Most Immediate Destruction)

These are the most visible and irreversible consequences of mining operations.

· Complete Excavation and Removal: Graves can be directly dug up by heavy machinery to access the mineral resources beneath them. This results in the total destruction of the burial site, scattering and damaging human remains and grave goods.

· Vibration and Subsidence: Blasting and the use of heavy equipment cause ground vibrations. This can lead to the cracking and collapse of grave markers, headstones, and burial chambers. For underground mines, subsidence (the sinking of the ground) can completely distort and destroy cemetery landscapes.

· Erosion and Sedimentation: Clearing land for mining removes vegetation that holds soil in place. Subsequent rainfall can cause severe erosion, washing away topsoil and potentially exposing or carrying away shallow graves.

· Alteration of the Landscape: The entire topography is changed—hills are leveled, pits are dug, and waste rock is piled into new mountains. This not only destroys the graves but also erases the cultural and spiritual landscape that gave the burial site its context and meaning.

2. Cultural and Spiritual Impacts

The damage often goes far beyond the physical.

· Severing Cultural Connection: For many cultures, particularly Indigenous communities, ancestors are not simply in the past; they are a living part of identity and community. Disturbing graves severs a vital link to history, tradition, and cultural continuity.

· Violation of Spiritual Beliefs: Many belief systems hold that graves are sacred, final resting places that must not be disturbed. Mining activity is seen as a profound desecration, causing spiritual harm to both the deceased and the living community.

· Loss of Intangible Heritage: Graves are not just bones and objects. They are part of a larger cultural landscape that includes stories, songs, ceremonies, and traditional knowledge associated with the place. Destroying the site can irrevocably damage this intangible heritage.

3. Archaeological and Historical Loss

Even if remains are "rescued" through excavation, significant information is lost.

· Loss of Context: In archaeology, context is everything. The position of a body, the orientation of a grave, the artefacts placed with it, and its relationship to other graves and features provide invaluable information about a culture's beliefs, social structure, diet, and health. Mechanical excavation destroys this context forever.

· Inadequate Salvage Archaeology: While salvage or rescue archaeology is often a condition of mining permits, it is typically done under significant time pressure. This can lead to rushed work, potentially missing subtle features and details that a more meticulous research-driven excavation would find.

Mitigation and Best Practices

To minimize harm, a proactive and respectful approach is essential:

1. Early and Thorough Surveys: Conduct comprehensive cultural heritage assessments, using techniques like LIDAR, ground-penetrating radar, and extensive consultation with local and Indigenous communities before any ground is broken.

2. Genuine Community Consultation and Consent: Engagement must be more than a box-ticking exercise. It must involve genuine dialogue, respect for traditional knowledge, and a commitment to obtaining FPIC.

3. Avoidance: The best mitigation is to avoid the site entirely. Mining plans should be redesigned to work around significant heritage areas whenever possible.

4. Respectful Salvage Archaeology: If disturbance is unavoidable, a well-funded, carefully planned salvage operation must be conducted with the full involvement and consent of descendant communities. This includes the respectful handling of remains and grave goods.

5. Repatriation and Reburial: Any remains and artefacts that are removed should be repatriated to the community for reburial in a respectful manner, according to their traditions.

6. Long-Term Monitoring and Protection: Protecting nearby graves from vibrations, subsidence, and erosion should be an ongoing part of the mine's environmental management plan.

SECTION 6

Conclusions and Recommendations

The mining phases of any proposed project by Kamativi Mining Company cannot commence without the proper exhumation and reburial process of all the identified and documented grave sites. This is in compliance with the NMMZ Act as well as the Cemeteries Act which both prohibit the destruction of graves. As indicated by local community members, there should be respectful relocation/reburial of the exhumed graves as part of their traditional customs. Where possible and in adherence to professional conduct, community members especially relatives must be allowed to participate in the exhumation and reburial process through conducting their ritual ceremonies or taking part in the actual exhumation exercise. With regards to Chingahari Sacred Mountain

ranges, consulted community members recommended the need to establish a buffer zone that will continue to prohibit illegal access and maintain the sacredness of the mountains. Such recommendations should be adopted as they ensure the local traditional practices are maintained, ensuring good relations are attained between the investor and the local communities. Constant consultation with the stakeholders, especially communities should be maintained as any chance finds may require participation from the communities, especially within Chingahari Sacred Mountain ranges.

Indirect and Cumulative Impacts

Extension of the project scope can result in the destruction of religious and ceremonial activities that are currently at the heart of activities being conducted by the local communities. Close consultation with the local leadership should always be maintained in the event that any of the projects scope may extend towards the sacred mountain. The impact of mining on intangible cultural heritage (ICH) is profound and often overlooked, as it is less visible than the destruction of physical sites like graves. While tangible heritage can be documented or even moved, the loss of ICH is frequently irreversible, representing the extinction of living cultural practices, knowledge and identity. Mining impacts on ICH are rarely a simple case of direct destruction. It operates through a cascade of interconnected environmental, social, and economic changes as follows:

1. Displacement and Community Disintegration

This is the single greatest threat posed by the mining project as it often requires the physical relocation of communities. When people are moved from their ancestral lands, they are severed from the very landscape that gives meaning to their rituals, stories, and social practices. A ritual performed at a specific sacred mountain cannot be replicated in a government resettlement village. The social fabric of the community-the elders, knowledge holders, and apprentices all living together is torn apart, halting the inter-generational transmission of knowledge, which is the anchor of survival of traditional practices.

2. Environmental Degradation.

The natural environment is not just a resource; it is the foundation of most intangible heritage, especially for Indigenous peoples.

Knowledge Systems: Traditional ecological knowledge about plants (for medicine, food, crafts), animal behavior, and seasonal cycles becomes obsolete when the rivers are polluted, the forests are cleared, and the animals leave. This knowledge, accumulated over millennia, is rendered useless.

Sacred Landscapes: Mountains, rivers, caves, and groves are often sacred sites where rituals must be performed. Their destruction or contamination through mining waste (e.g., acid mine drainage) renders these rituals impossible or meaningless. A "purification" ritual in a polluted river is a contradiction.

Raw Materials: Traditional craftsmanship relies on specific materials (e.g for pottery, certain plants for weaving, sacred woods for carving). If these materials are destroyed by mining operations, the craft itself dies.

3. Social and Cultural Disruption

The influx of outside workers, rapid urbanization around mine sites, and shifting economic priorities create profound social change.

Cultural Dilution: An influx of a large, transient workforce can overwhelm local communities, leading to the marginalization of local languages, customs, and social norms.

Shift in Values: Mining jobs can shift the economic focus from traditional subsistence activities (farming, fishing, crafting) to wage labor. Younger generations may devalue the "old ways," seeing them as less economically viable than working for the mine. This breaks the chain of knowledge transmission from elders to youth.

Loss of Languages: Indigenous languages, often already endangered, are repositories of unique concepts and knowledge about the local environment. Community disintegration and cultural dilution accelerate their decline towards extinction.

4. Psychological and Spiritual Harm

The act of destroying a sacred landscape is not just a physical event; it is a spiritual and psychological trauma.

Loss of Identity: A people's identity is deeply tied to their land and their heritage. When these are damaged, it leads to a collective sense of loss, grief, and identity crisis, contributing to social ills like substance abuse and depression.

Desecration: The very presence of a mine on a sacred landscape can be experienced as an ongoing act of desecration, making it impossible for community members to practice their rituals or even feel a sense of spiritual well-being in their own home.

Compliance Assessment

Principles Governing Public Consultation were adopted to ensure a comprehensive stakeholder engagement was attained. The following crucial principles for an effective stakeholder engagement process were maintained;

i) **Inclusive:** The public consultation process covered representation of all relevant stakeholders including government departments, local communities and employees**. i.e** Zimbabwe Republic Police, Ministry of Health, Chief Nekatambe, Headman Galuza, See Annexure- Questionnaires.

ii) **Openness and transparency:** In order to enhance this principle, the consultant ensured that all consulted stakeholders, including the grievance redress mechanism, understood all steps and activities of the public consultation.

iii) **Relevancy:** Relevance was also key in this EIA and this was achieved through remaining focused on the project issues that matter. The consultation

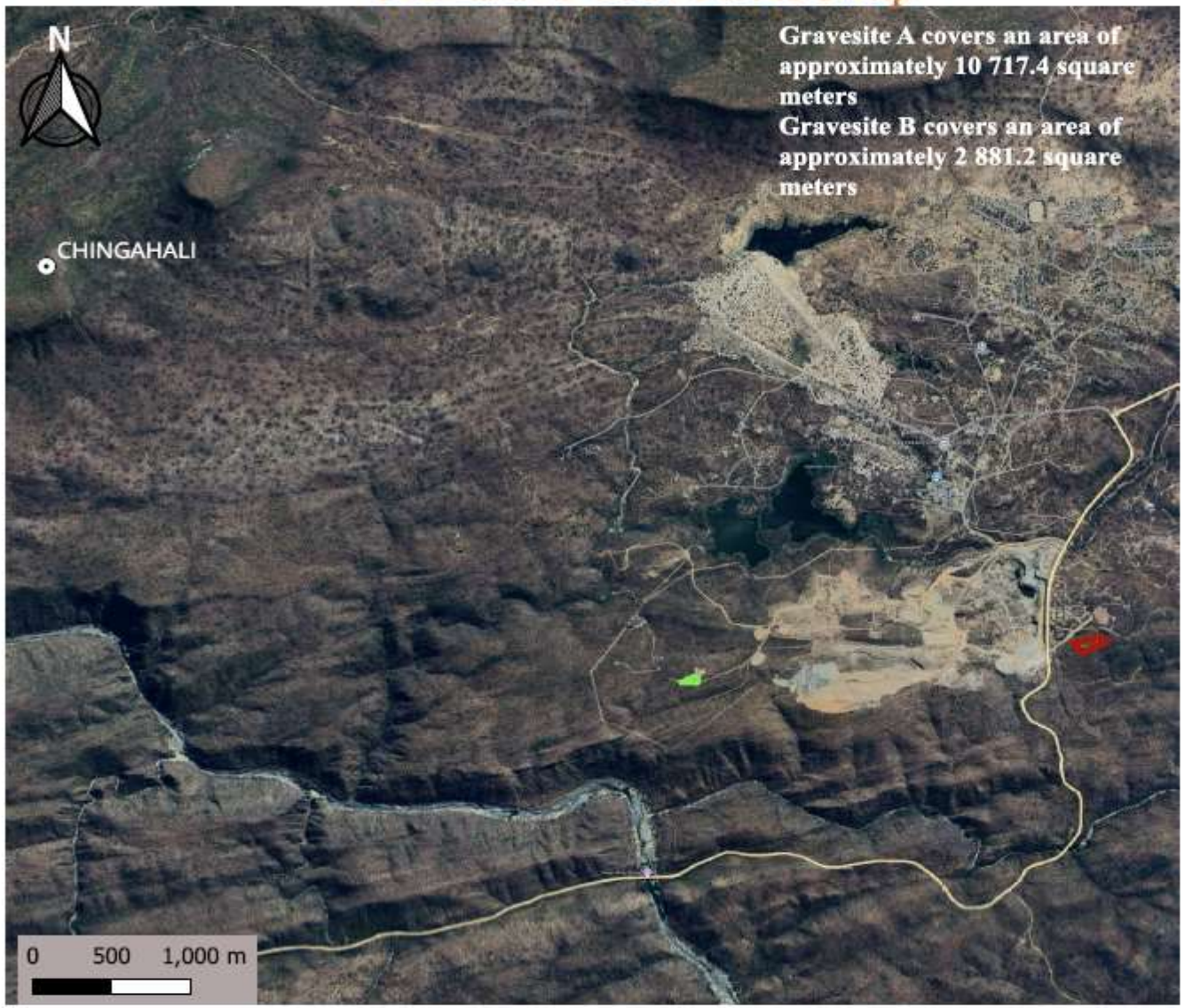
boundaries also ensured that the consultation process remains relevant to the proposed activities.

iv) **Fairness and responsiveness:** To achieve the objectives of the stakeholder consultation process there was a need to ensure that the consultation was conducted impartially. All stakeholders were empowered with project information first then solicited their informed input.

APPENDICES

APPENDIX 1: Heritage Sites Distribution Map

Kamativi Gravesites Map









Legend

- Gravesite A
- Gravesite B
- Chingahali Mountain Range

Google Satellite Hybrid

APPENDIX 2: Consultation with the Headman



APPENXIX 3: Documented Graves during Field Walk

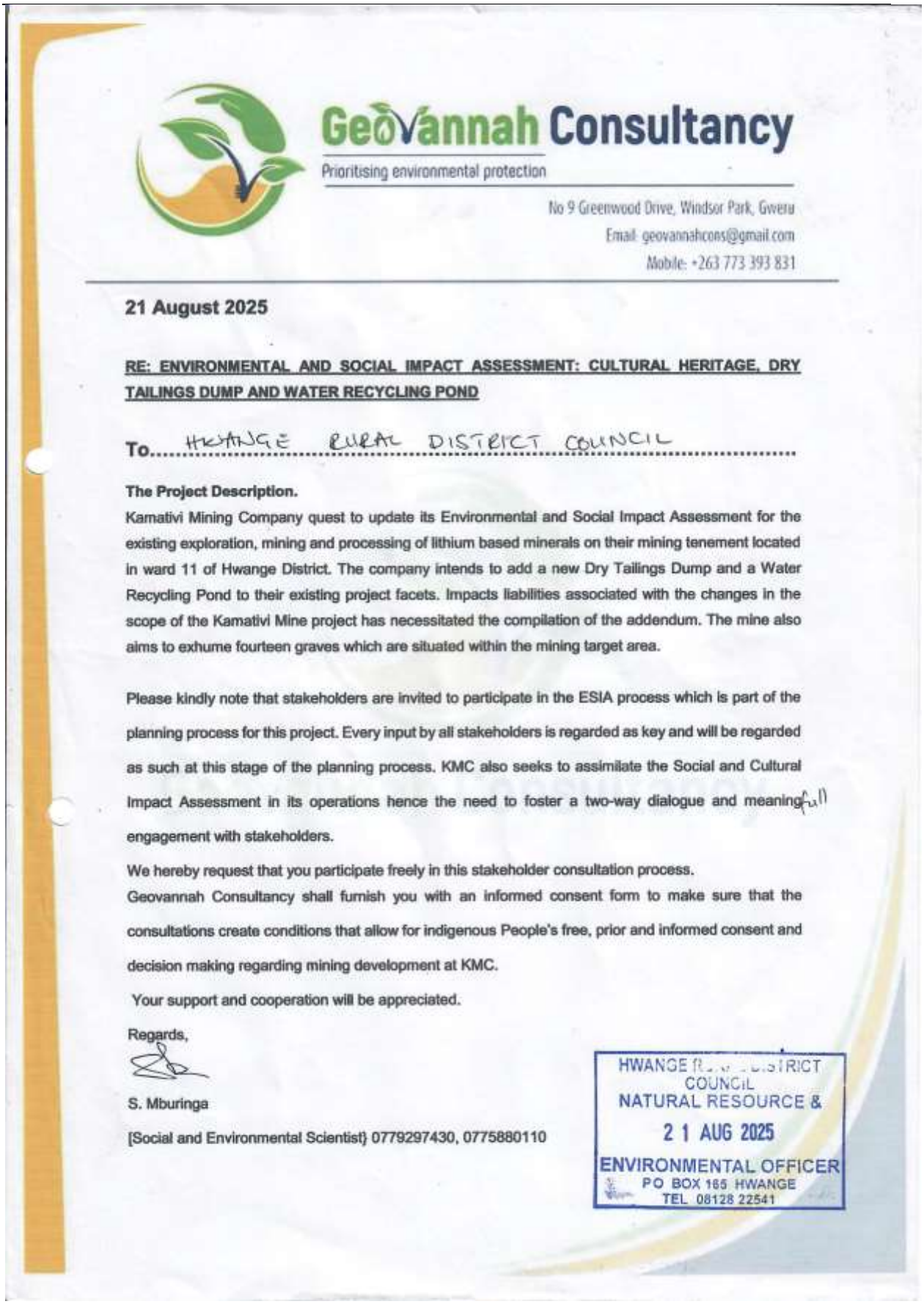








APPENDIX 4: STAKEHOLDER CONSULTATION NOTIFICATIONS



Geovannah Consultancy

Prioritising environmental protection

No 9 Greenwood Drive, Windsor Park, Gweru
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Mobile: +263 773 393 831

21 August 2025

RE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: CULTURAL HERITAGE, DRY TAILINGS DUMP AND WATER RECYCLING POND

To..... HWANGE RURAL DISTRICT COUNCIL .....

The Project Description.

Kamativi Mining Company quest to update its Environmental and Social Impact Assessment for the existing exploration, mining and processing of lithium based minerals on their mining tenement located in ward 11 of Hwange District. The company intends to add a new Dry Tailings Dump and a Water Recycling Pond to their existing project facets. Impacts liabilities associated with the changes in the scope of the Kamativi Mine project has necessitated the compilation of the addendum. The mine also aims to exhume fourteen graves which are situated within the mining target area.

Please kindly note that stakeholders are invited to participate in the ESIA process which is part of the planning process for this project. Every input by all stakeholders is regarded as key and will be regarded as such at this stage of the planning process. KMC also seeks to assimilate the Social and Cultural Impact Assessment in its operations hence the need to foster a two-way dialogue and meaningfull engagement with stakeholders.

We hereby request that you participate freely in this stakeholder consultation process.

Geovannah Consultancy shall furnish you with an informed consent form to make sure that the consultations create conditions that allow for indigenous People's free, prior and informed consent and decision making regarding mining development at KMC.

Your support and cooperation will be appreciated.

Regards,

S. Mburinga

[Social and Environmental Scientist} 0779297430, 0775880110

HWANGE RURAL DISTRICT COUNCIL
NATURAL RESOURCE &
21 AUG 2025
ENVIRONMENTAL OFFICER
PO BOX 165 HWANGE
TEL 08128 22541

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Prioritising environmental protection
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Mobile: +263 773 393 831

21 August 2025

RE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: CULTURAL HERITAGE, DRY TAILINGS DUMP AND WATER RECYCLING POND

To.... Z.INKSA LOWER GWAYI SUBCATCHMENT COUNCIL

The Project Description.

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Regards,

LOWER GWAYI SUB CATCHMENT COUNCIL BOX 84 HWANGE

S. Mburinga

[Social and Environmental Scientist] 0779297430, 0775880110

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21 August 2025

RE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: CULTURAL HERITAGE, DRY TAILINGS DUMP AND WATER RECYCLING POND

To...CHIEF MASWDA (IRIRA LOWER).....

The Project Description.

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S. Mburinga

[Social and Environmental Scientist] 0779297430, 0775880110

M/gerwa 0778104983

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21 August 2025

RE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: CULTURAL HERITAGE, DRY TAILINGS DUMP AND WATER RECYCLING POND

To. KAMATIVI MISSION HOSPITAL

The Project Description.

Kamativi Mining Company quest to update its Environmental and Social Impact Assessment for the existing exploration, mining and processing of lithium based minerals on their mining tenement located in ward 11 of Hwange District. The company intends to add a new Dry Tailings Dump and a Water Recycling Pond to their existing project facets. Impacts liabilities associated with the changes in the scope of the Kamativi Mine project has necessitated the compilation of the addendum. The mine also aims to exhume and rebury fourteen graves which are situated within the mining target area.

Please kindly note that stakeholders are invited to participate in the ESIA process which is part of the planning process for this project. Every input by all stakeholders is regarded as key and will be regarded as such at this stage of the planning process. KMC also seeks to assimilate the Social and Cultural Impact Assessment in its operations hence the need to foster a two-way dialogue and meaningful engagement with stakeholders.

We hereby request that you participate freely in this stakeholder consultation process. Geovannah Consultancy shall furnish you with an informed consent form to make sure that the consultations create conditions that allow for indigenous People's free, prior and informed consent and decision making regarding mining development at KMC.

Your support and cooperation will be appreciated.

Regards,

S. Mburinga

[Social and Environmental Scientist] 0779297430, 0775880110

0773667302

Geovannah Consultancy
Prioritising environmental protection
No 9 Greenwood Drive, Windsor Park, Gweru
Email: geovannahcons@gmail.com
Mobile: +263 773 393 831

21 August 2025

RE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: CULTURAL HERITAGE, DRY TAILINGS DUMP AND WATER RECYCLING POND

To... KDMCTN AFFAIRS .....

The Project Description.

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S. Mburinga

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Mobile: +263 773 393 831

21 August 2025

RE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: CULTURAL HERITAGE, DRY TAILINGS DUMP AND WATER RECYCLING POND

To...AGRITEX.....

The Project Description.

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[Social and Environmental Scientist} 0779297430, 0775880110

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Mobile: +263 773 393 831

21 August 2025

RE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: CULTURAL HERITAGE, DRY TAILINGS DUMP AND WATER RECYCLING POND

To..... RESIDENTS CHAIRMAN .....

The Project Description.

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Regards,

S. Mburinga

[Social and Environmental Scientist] 0779297430, 0775880110

MTULA. 0782089895

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Prioritising environmental protection
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Mobile: +263 773 393 831

21 August 2025

RE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: CULTURAL HERITAGE, DRY TAILINGS DUMP AND WATER RECYCLING POND

To..... HEADMAN GALUZA .....

The Project Description.

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Regards,

HEADMAN GALUZA
HWANGE DISTRICT
CHIEF NEKATAMBE
DATE: 22/08/2025
SIGN: GALUZA

S. Mburinga

[Social and Environmental Scientist] 0779297430, 0775880110

Geovannah Consultancy
Prioritising environmental protection
No 9 Greenwood Drive, Windsor Park, Gweru
Email: geovannahcons@gmail.com
Mobile: +263 773 393 831

21 August 2025

RE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: CULTURAL HERITAGE, DRY TAILINGS DUMP AND WATER RECYCLING POND

To... BAWC ABC .....

The Project Description.

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Regards,

S. Mburinga

[Social and Environmental Scientist} 0779297430, 0775880110

0777743126

Geovannah Consultancy
Prioritising environmental protection
No 9 Greenwood Drive, Windsor Park, Gweru
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Mobile: +263 773 393 831

21 August 2025

RE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: CULTURAL HERITAGE, DRY TAILINGS DUMP AND WATER RECYCLING POND

To...ZRP.....

The Project Description.

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Regards,

S. Mburinga

[Social and Environmental Scientist] 0779297430, 0775880110

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Mobile: +263 773 393 831

21 August 2025

RE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: CULTURAL HERITAGE, DRY TAILINGS DUMP AND WATER RECYCLING POND

To.....DPT OF VETERINARY SERVICES.....

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Regards,

S. Mburinga

[Social and Environmental Scientist) 0779297430, 0775880110

0776531348

APPENDIX 5: PROOF OF STAKEHOLDER CONSULTATIONS.

GeoVannah Consultancy
Prioritising environmental protection
No 9 Greenwood Drive, Windsor Park, Gweru
Email: geovannahcons@gmail.com
Mobile: +263 773 393 831

Informed Consent

TITLE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: CULTURAL HERITAGE, DRY TAILINGS DUMP. TSF AND WATER RECYCLING POND

Purpose of study:

To update the KMC Social and Environmental Impact Assessment through the comprehensive stakeholder consultation to create conditions that allow for indigenous people's free, prior and informed consent and decision making regarding mining development at KMC.

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Voluntary Participation:

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CONSENT

I have read and I understand the provided information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this study.

Participant's signature _____ Date 22/09/25

Investigator's signature _____ Date 22/09/25

Participant's Initials. STEPHEN. SIBANDA

GeoVannah Consultancy
Prioritising environmental protection
No 9 Greenwood Drive, Windsor Park, Gweru
Email: geovannahcons@gmail.com
Mobile: +263 773 393 831

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Participant's signature _____ Date 17/09/2025

Investigator's signature _____ Date 17/09/25

Participant's Initials.....

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Name..... ID Number.....

Contact Numbers..... Organization CHIEF NEKATAMBE

1.) What are the negative environmental and sociocultural impacts associated with the project?

EFFECT ON THE LOCAL CULTURE

SOCIAL MISCHIEFS LIKE PROSTITUTION AND DRUG ABUSE

2.) How can the impacts cited above be addressed in your view?

THE PROTECTION OF ALL AREAS OF CULTURAL SIGNIFICANCE

POLICE PRESENCE IN THE AREA HELPS MINIMISING THE SELLING OF DRUGS

3.) What are the likely benefits of the project to the community and the nation at large?

EMPLOYEMENT FOR THE LOCAL PEOPLE

PROVISION OF WATER FACILITIES TO THE LOCAL COMMUNITY

Signature.....

Geovannah Consultancy
Prioritising environmental protection
No 9 Greenwood Drive, Windsor Park, Gweru
Email: geovannahcons@gmail.com
Mobile: +263 773 393 831

Cultural Heritage related Issues.

1. Do you know of any cultural heritage sites within the proposed project area? If so please list them.....
Chinge hari Mountain Range

2. How important are these cultural heritage sites?
Yes for rain making ceremonies

3. Do you conduct any traditional, ritual practices in the project area? If so please list them.....
Rain making Ceremonies

4. Which cultural heritage are likely to be affected by the project?
NONE

5. How best can we address and or mitigate the impacts?
NONE.

Signature.....

CHIEF NEKATAMBE
HWANGE DISTRICT
17 SEP 2025
SIGNATURE:
TEL: 0772 338 247

GeoVannah Consultancy
Prioritising environmental protection
No 9 Greenwood Drive, Windsor Park, Gweru
Email: geovannahcons@gmail.com
Mobile: +263 773 393 831

Informed Consent

TITLE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: CULTURAL HERITAGE, DRY TAILINGS DUMP. TSF AND WATER RECYCLING POND

Purpose of study:

To update the KMC Social and Environmental Impact Assessment through the comprehensive stakeholder consultation to create conditions that allow for indigenous people's free, prior and informed consent and decision making regarding mining development at KMC.

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Participant's signature L. [redacted] CHUMA Date 17/09/25

Investigator's signature _____ Date 19/09/25

Participant's Initials 79/050167-T-79

HEADMAN GALUZA
HWANGE DISTRICT
CHIEF NEKATAMBE
DATE 17/09/2025
SIGN Galuza

GeoVannah Consultancy
Prioritising environmental protection
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Name. LION M. CHUMA ID Number. 79-050167-T79

Contact Numbers. 0775402521 Organization. K.M.C.

1.) What are the negative environmental and sociocultural impacts associated with the project?

On this issue they use traditional spirits e.g. to ask to the idol spirits and on the same point People were not going to the work. They were gathering to-gether and making beer for those who drink and also they were dancing using drums not radios. They use going up at the mountain "Chingehari" to talk to elders.

2.) How can the impacts cited above be addressed in your view?

To gather all people in the community e.g. Traditional Leaders, and so on.

3.) What are the likely benefits of the project to the community and the nation at large?

We are looking for better lyfe in future e.g. Jobs, So that porert can be casted to us in our community. Dams, Boreholes, we have much difficulties of water. People are starving too much.

Signature. K.Chuma

HEADMAN GALUZA
HWANGE DISTRICT
CHIEF NEKATAMBE
DATE 17/09/2025
SIGN: GALUZA

Geovannah Consultancy
Prioritising environmental protection
No 9 Greenwood Drive, Windsor Park, Gweru
Email: geovannahcons@gmail.com
Mobile: +263 773 393 831

Cultural Heritage related Issues.

1. Do you know of any cultural heritage sites within the proposed project area? If so please list them.
Kamativi Tin Mine
Katope mine
ward 15 Binga

2. How important are these cultural heritage sites?
We are looking for a better life for tommorow. At leaat some of us are working. And to help those who are still not working in the community. To help our livestock for water. Also and us people to have better life for tomorrow.

3. Do you conduct any traditional, ritual practices in the project area? If so please list them.
Yes I do

4. Which cultural heritage are likely to be affected by the project?
Irrigation
Dams
Boreholes
Schools
Mining

5. How best can we address and or mitigate the impacts?
Community gathering, Traditional leaders

Signature. L. Chung

HEADMAN GALUZA
HWANGE DISTRICT
CHIEF NEKATAMBE
DATE 17/09/2025
SIGN.

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Informed Consent

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Participant's signature _____ Date 17/09/25

Investigator's signature _____ Date 17/09/25

Participant's Initials.....N.....

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Name. Ngwenya Ntabiso ID Number. 08-599687K35

Contact Numbers. 0774756462 Organization. Kamativi Sec School

1.) What are the negative environmental and sociocultural impacts associated with the project?

Unfilled drilling holes on the ground

2.) How can the impacts cited above be addressed in your view?

They can be filled where possible

3.) What are the likely benefits of the project to the community and the nation at large?

It provides employment to people, especially the community ones

Signature. Mngwenya

Geovannah Consultancy
Prioritising environmental protection
No 9 Greenwood Drive, Windsor Park, Gweru
Email: geovannahcons@gmail.com
Mobile: +263 773 393 831

Cultural Heritage related Issues.

1. Do you know of any cultural heritage sites within the proposed project area? If so please list them...No.....

2. How important are these cultural heritage sites?

Not Applicable.....

3. Do you conduct any traditional, ritual practices in the project area? If so please list them.....

No.....

4. Which cultural heritage are likely to be affected by the project?

Not applicable.....

5. How best can we address and or mitigate the impacts?

Not applicable.....

Signature...mageya.....

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Prioritising environmental protection
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Informed Consent

TITLE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: CULTURAL HERITAGE, DRY TAILINGS DUMP. TSF AND WATER RECYCLING POND

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Participant's signature _____ Date 17/09/25

Investigator's signature _____ Date 17/09/25

Participant's Initials....T. T.....

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Name..... ID Number.....

Contact Numbers..... Organization.....

1.) What are the negative environmental and sociocultural impacts associated with the project?

=> Dust.
=> Noise
=> Air Pollution
=> We might have Animals lands within
=> Erroding of the local practices

2.) How can the impacts cited above be addressed in your view?

=> Suppress dust by spraying water.
=>

3.) What are the likely benefits of the project to the community and the nation at large?

=> Employment
=> Skills training
=> Paying of fees to less Previlegde Children. => Adds to GDP.

Signature.....

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Email: geovannahcons@gmail.com
Mobile: +263 773 393 831

Cultural Heritage related Issues.

1. Do you know of any cultural heritage sites within the proposed project area? If so please list them.....
=) Chigehali

2. How important are these cultural heritage sites?

=) Rain making sites
=) to appease the ancestors

3. Do you conduct any traditional, ritual practices in the project area? If so please list them.....
=) Rain making ceremony at Chigehali

4. Which cultural heritage are likely to be affected by the project?

=) maybe in the long run, the operations might affect Chigehali sites.

5. How best can we address and or mitigate the impacts?

=) Doing underground mining affects less of the environment and sites..

Signature.....

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Mobile: +263 773 393 831

Informed Consent

TITLE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: CULTURAL HERITAGE, DRY TAILINGS DUMP, TSF AND WATER RECYCLING POND

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CONSENT

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Participant's signature _____ Date 17/09/25

Investigator's signature _____ Date 17/09/25

Participant's Initials....M.P.....

GeoVannah Consultancy
Prioritising environmental protection
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Name. MWLWDA PHINEAS ID Number. 06-038759 S06

Contact Numbers. 0773667302 Organization. MOHCC

1.) What are the negative environmental and sociocultural impacts associated with the project?
- Landscape Alteration eg Creation of pits
- Habitant destruction ie displacing wildlife
- Deforestation leading to loss of biodiversity
- Soil erosion and pollution
- Social impacts ! Increased health risks
- Water depletion

2.) How can the impacts cited above be addressed in your view?
- Sustainable mining practices ie reduce waste
- Rehabilitation and restore mined land
- Implement water management Systems to prevent pollution
- Fair compensation and relocation
- Community development eg health, Schools
- Transparency and accountability in mining operations

3.) What are the likely benefits of the project to the community and the nation at large?
- Job creation, Infrastructure development, Community development programs, Improved living standards

Nation: Foreign exchange earnings, Increased govt revenue, Diversification of economy

Signature. PM Chi

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Cultural Heritage related Issues.

1. Do you know of any cultural heritage sites within the proposed project area? If so please list them.....Traditions & customs - rituals
Chingahari ie Senatyabankombwe

2. How important are these cultural heritage sites?
- Identity and belonging - helps connect individuals and community with their past
- Preserve history
- Tourism and economic benefits through tourism

3. Do you conduct any traditional, ritual practices in the project area? If so please list them....Yes - Appeasing of ancestral Spirits when need arises

4. Which cultural heritage are likely to be affected by the project?
CHINGAHARI CULTURAL HERITAGE SITE - CHINGAHARI MOUNTAIN

5. How best can we address and or mitigate the impacts?
- Document cultural heritage Sites, artifacts and traditions
- Conserve cultural heritage sites
- Restore damaged or deteriorated cultural heritage sites

Signature.....

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Informed Consent

TITLE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: CULTURAL HERITAGE, DRY TAILINGS DUMP. TSF AND WATER RECYCLING POND

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Participant's signature _____ Date 16/09/25

Investigator's signature _____ Date 16/09/25

Participant's Initials G.S

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Name... SAMUEL SIBANDA... ID Number 19-0180755 D79

Contact Numbers. 0774 354194 Organization. SENA VILLAGE HEAD

1.) What are the negative environmental and sociocultural impacts associated with the project?

MAKOMBA
KURVISWA KWEMAKWIJA
DUST

2.) How can the impacts cited above be addressed in your view?

ZIMAKUVA ANOFAREKWA KUBVISWA
ZVIRIPAMUTEMO VAKURU VENZWIMBO
VARIPO

3.) What are the likely benefits of the project to the community and the nation at large?

MABASA
MABASA NGAAPIWE KUVANA
VEMUNDO MUKAMATIJI

Signature.....

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Cultural Heritage related Issues.

1. Do you know of any cultural heritage sites within the proposed project area? If so please list them.....
CHINGEZHARI MOUNTAIN

2. How important are these cultural heritage sites?
TINOKUMBIRA MUDZIMU KANA TICHIDA KUITA ZVECHIGHEZHA

3. Do you conduct any traditional, ritual practices in the project area? If so please list them.....
TINOKUMBIRIRA MUORA
MAKWENDE KANA MAOKI

4. Which cultural heritage are likely to be affected by the project?
CHINGEZHARI IRI KURE NEKWE MINE PARIZVINO HATISATI TAKUNA KUKAVHANYWA KUNE GOMO REDU

5. How best can we address and or mitigate the impacts?

Signature.....

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Participant's signature M. Nyoni Date 17-9-25

Investigator's signature _____ Date 18/09/25

Participant's Initials..... M N

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Name MOSES NYONI ID Number 79-122267-N-79

Contact Numbers 0787328211 Organization WARD COUNCILLOR

1.) What are the negative environmental and sociocultural impacts associated with the project?

THEY ARE ALL GOOD IN DEVELOPING OUR DISTRICT

2.) How can the impacts cited above be addressed in your view?

THEY ARE LIKELY GOOD AND HELPS US IN IMPROVING OUR WARD.

3.) What are the likely benefits of the project to the community and the nation at large?

EMPLOYMENT - EXPRIENCE IN BOTH ENVIRONMENTAL & SOCIAL IMPACT.

Signature M. NYONI

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Participant's signature _____ Date 15/09/2025

Investigator's signature _____ Date 16/09/25

Participant's Initials P. S.Hamadi

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Name PEACE SIMUMBA ID Number 53-055822 W 03

Contact Numbers 0776452190 Organization ALUMTECH

1.) What are the negative environmental and sociocultural impacts associated with the project?

(i) Dry Tailings Dump – Dust emissions can cause respiratory problems
– Soil and crop contamination
– Loss of land and vegetation

(ii) Tailings Storage Facility – Risk of structural failure – which can contaminate downstream rivers
– Ground water contamination / seepage
– Surface water contamination / ecosystem damage
– Long term land use restrictions and legacy liability

(iii) Water Recycling Pond – Contaminant concentration and evaporation
– Health issues and local nuisance

(iv) Sociocultural impact – Displacement and loss of homes, social tension / livelihood benefits
– Loss of livelihoods (agricultural), loss of heritage sites

2.) How can the impacts cited above be addressed in your view?

(i) Dry Tailings Dump – Dust suppression, covering and rehabilitation of inactive dumps
– monitoring and quality

(ii) Tailings Storage Facility – Emergency preparedness plan to be stressed

(iii) Water Recycling Ponds – Seepage control
– Regular water quality monitoring
– Health and safety (Put warning signs)
– Lining and leakage control

(iv) Sociocultural issues – Livelihood restoration, resettlement and compensation
– Community engagement, benefits sharing
Continuous heritage protection

3.) What are the likely benefits of the project to the community and the nation at large?

(i) Community benefits – Environmental protection, improved infrastructures
– Job creation, access to water
– Health and safety

(ii) Nation at large – Economic growth, sustainable mining
– Water conservation, climate change mitigation
– Technology transfer and skills development

Signature

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Cultural Heritage related Issues.

1. Do you know of any cultural heritage sites within the proposed project area? If so please list them.....
CHINGEHARI MOUNTAIN, GRAVES/CEMETERIES

2. How important are these cultural heritage sites?
VERY IMPORTANT

3. Do you conduct any traditional, ritual practices in the project area? If so please list them.....
NO IDEA.

4. Which cultural heritage are likely to be affected by the project?
GRAVES, TRADITIONAL OR SPIRITUAL SITES, SCARED SPOTS, SPRINGS AND TREES

5. How best can we address and or mitigate the impacts?
- DOCUMENTATION OF BUILDINGS AND OTHER STRUCTURES BEFORE DAMAGE
- PLAN FOR RESPECTFUL RELOCATION/REBURIAL
- ESTABLISH BUFFERS TO PROTECT THESE SITES
- CONSULT ELDERS, TRADITIONAL LEADERS, COMMUNITY MEMBERS TO FIND OUT UNRECORDED SITES

Signature.....

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Informed Consent

TITLE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: CULTURAL HERITAGE, DRY TAILINGS DUMP. TSF AND WATER RECYCLING POND

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Participant's signature Qmuma Date 17.09.25

Investigator's signature [signature] Date 18/09/25

Participant's Initials E.C.T

OFFICER-IN-CHARGE
ZIMBABWE REPUBLIC POLICE
KAMATIVI
18 SEP 2025
P.O. BOX 28, KAMATIVI
ZIMBABWE. 0719 386 737

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Name. TAILOR ERNEST C. ID Number 77-0167959-77

Contact Numbers. 0773 819 392 Organization. ZRP

1.) What are the negative environmental and sociocultural impacts associated with the project?

Environmental degradation and pollution.

2.) How can the impacts cited above be addressed in your view?

Enviromental sound mining practices

3.) What are the likely benefits of the project to the community and the nation at large?

- Employment creation and Economic development.

Signature.

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Cultural Heritage related Issues.

1. Do you know of any cultural heritage sites within the proposed project area? If so please list them.

(1) Yes
- Graves.

2. How important are these cultural heritage sites?

These graves are important to the local ronga people who often conduct some cultural rituals periodically highlighting their significance.

3. Do you conduct any traditional, ritual practices in the project area? If so please list them.

No

4. Which cultural heritage are likely to be affected by the project?

Grave yards

5. How best can we address and or mitigate the impacts?

Stakeholder participation with local people and traditional leadership

Signature Qumma

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Participant's signature _____ Date 18/09/2025

Investigator's signature _____ Date 18/09/25

Participant's Initials C.T.M

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Name. Courage T. Mugoni ID Number. 63-204936B 91F

Contact Numbers. 263777493126 Organization. BANCABC

1.) What are the negative environmental and sociocultural impacts associated with the project?

Pollution in all its forms
Work related accidents
Job posts to foreigners at the expense of the local community

2.) How can the impacts cited above be addressed in your view?

rehabilitation of degraded areas
addressing health hydration
avoid leakage of water from tailings
Ingraining existing infrastructure

3.) What are the likely benefits of the project to the community and the nation at large?

technological development
Infrastructure development

Signature. [signature]

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Participant's signature _____ Date 17/09/25

Investigator's signature _____ Date 17/09/25

Participant's Initials..... A.M. .....

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Name... MUTIKANI ANNAH ID Number 79-044283 Y79

Contact Numbers... 0772 460 910 Organization... SCHOOL

1.) What are the negative environmental and sociocultural impacts associated with the project?

Emissions of dust.

Destruction of vegetation.

2.) How can the impacts cited above be addressed in your view?

Tree planting in those areas after mining.

3.) What are the likely benefits of the project to the community and the nation at large?

The project has given bread winners some income which has improved our lives

Signature... Mutikani

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Cultural Heritage related Issues.

1. Do you know of any cultural heritage sites within the proposed project area? If so please list them.....
No

2. How important are these cultural heritage sites?

N/A

3. Do you conduct any traditional, ritual practices in the project area? If so please list them.....
No

4. Which cultural heritage are likely to be affected by the project?

None

5. How best can we address and or mitigate the impacts?

Contacting the traditional leaders to explain the procedures to be taken

Signature.....

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Participant's signature _____ Date 18/09/25

Investigator's signature _____ Date 19/09/25

Participant's Initials M.H. Ndoni

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Name. MITCHELLE HELEN NYONI ID Number. 06-078030-D79

Contact Numbers. 0773630157 Organization. WOMEN AFFAIRS

1.) What are the negative environmental and sociocultural impacts associated with the project?

Due to the increase in population due to mining activities there is also a rise in prostitution leading to high rates of STIs and HIV infections. There is also an increase in drug and substance abuse due to more money circulation and employment created which is also contributing to Gender Based Violence issues.

2.) How can the impacts cited above be addressed in your view?

The company should also consider providing accommodation for their workers which also accommodates their families to reduce prostitution and STIs. Give awarenesses on drug and substance abuse and effects of GBV issues on the future of children and families

3.) What are the likely benefits of the project to the community and the nation at large?

- There is employment creation leading to money circulation
- Opening up of businesses and markets improving people's standard of living.
- Improved infrastructure.

Signature. Nyoni

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Cultural Heritage related Issues.

1. Do you know of any cultural heritage sites within the proposed project area? If so please list them.....
1. Chingahan cultural site.

2. How important are these cultural heritage sites?
- They are believed to protect the community as well as preserving local minerals.
- It is also believed to give guidance whenever there are issues which need to be addressed in the community.

3. Do you conduct any traditional, ritual practices in the project area? If so please list them. Traditional practices include rain making ceremonies, where the elders go and plead for good rains and a good harvest to Chingahan ancestors. Ritual practices are done when elders appeal to ancestors when there is calamity, need protection, introduce new investors in the community

4. Which cultural heritage are likely to be affected by the project?
There are ancestral graves which have been there for years which can be exhumed within the targeted mining area.

5. How best can we address and or mitigate the impacts?
- The company should follow all the necessities, rituals and traditions where there is any need to avoid calamity befalling the communities.
- Consult stakeholders as well as the communities whenever they have any activities they intend to carry on our cultural heritage sites.

Signature.....

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I have read and I understand the provided information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this study.

Participant's signature _____ Date 14/09/25

Investigator's signature _____ Date 18/09/25

Participant's Initials.....TMM.....

GeoVannah Consultancy
Prioritising environmental protection
No 9 Greenwood Drive, Windsor Park, Gweru
Email: geovannahcons@gmail.com
Mobile: +263 773 393 831

Kamativi Mining Company intends to update its Environmental and Social Impact Assessment for the existing exploration, mining and processing of lithium based minerals on their mining tenement located in ward 11 of Hwange District. The company intends to add a new Dry Tailings Dump, Tailings Storage Facility and Water Recycling Pond to their existing project facets. The site is located in Ward 11 of Hwange District. This questionnaire is your opportunity to air your views as part of the EIA Addendum.

Name. MUZESA TAZIMANI MANKIWA ID Number. 06-030469D06

Contact Numbers. 0776531344 Organization. VETERINARY SERVICES

1.) What are the negative environmental and sociocultural impacts associated with the project?

If all measures are put in place in regard to protection, accessibility and less risk in Environmental degeneration there will be no negative impacts

2.) How can the impacts cited above be addressed in your view?

As stated above if all factors are put in place, there will be no risk at all

3.) What are the likely benefits of the project to the community and the nation at large?

The benefits are at 100% considering Water usage in the area in terms of Water Recycling Conservation Water usage for production purposes

Signature.....

Geovannah Consultancy
Prioritising environmental protection
No 9 Greenwood Drive, Windsor Park, Gweru
Email: geovannahcons@gmail.com
Mobile: +263 773 393 831

Informed Consent

TITLE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: CULTURAL HERITAGE, DRY TAILINGS DUMP. TSF AND WATER RECYCLING POND

Purpose of study:

To update the KMC Social and Environmental Impact Assessment through the comprehensive stakeholder consultation to create conditions that allow for indigenous people's free, prior and informed consent and decision making regarding mining development at KMC.

Confidentiality

For the purposes of this ESIA, your comments will not be anonymous. However, every effort will be made by the researcher to preserve your confidentiality.

Voluntary Participation:

Your participation in this ESIA is voluntary. It is up to you to decide whether or not to take part in this study. If you decide to take part in this study, you will be asked to sign a consent form. After you sign the consent form, you are still free to withdraw at any time and without giving a reason. Withdrawing from this study will not affect the relationship you have, if any, with the consultant. If you withdraw from the study before data collection is completed, your data will be returned to you or destroyed.

CONSENT

I have read and I understand the provided information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this study.

Participant's signature _____ Date 17/09/2025

Investigator's signature _____ Date 17/09/25

Participant's Initials..... P. M.

GeoVannah Consultancy
Prioritising environmental protection
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Name PHANUEL MILAZI ID Number 79-050721K79

Contact Numbers 0778104983 Organization Local Chief

1.) What are the negative environmental and sociocultural impacts associated with the project?

Mines must protect our heritage and the grounds for the future generations

2.) How can the impacts cited above be addressed in your view?

Consultation to stakeholders

3.) What are the likely benefits of the project to the community and the nation at large?

Employment

Signature

Geovannah Consultancy
Prioritising environmental protection
No 9 Greenwood Drive, Windsor Park, Gweru
Email: geovannahcons@gmail.com
Mobile: +263 773 393 831

Cultural Heritage related Issues.

1. Do you know of any cultural heritage sites within the proposed project area? If so please list them.....
(1) Chigehare (2) Graves which are situated in mining areas

2. How important are these cultural heritage sites?
To protect them not to be destroyed

3. Do you conduct any traditional, ritual practices in the project area? If so please list them.....
N/A
Actually the chiefs and the community do rituals at these sites.

4. Which cultural heritage are likely to be affected by the project?
Once a year we visit these places clean these places and perform rituals

5. How best can we address and or mitigate the impacts?
Priority and protection on these places for the future generations

Signature.....

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We are carrying out an Environmental Impact Assessment Addendum Study for Kamativi Mining Company Pvt Ltd's exploration, mining and processing of lithium based minerals (tin, tantalite and lithium) on their mining tenement at Kamativi Tin Mine. The site is located in Ward 11 of Hwange District. This questionnaire is your opportunity to air your views as part of the EIA Addendum.

Name... NXOLELANI NLUBE ID Number... 63703404 T73

Contact Numbers... +263 778116087 Organization... HWANGE RDC

1.) What do you think are the negative impacts of the proposed project additional components to the environment?

- Land degradation and exposure of the said land to many agents of erosion
- Destruction of flora & fauna
- Closure of wild life corridors

2.) How can the impacts cited above be addressed in your view?

- Mining should be guided by EMA act
- Avoidance of too much tree destruction

3.) What are the likely benefits of the proposed project to the community and the nation at large?

- Employment opportunities
- More minerals being mined hence increasing the GDP of the county

Signature...

HWANGE RURAL DISTRICT COUNCIL
NATURAL RESOURCES
14 APR 2023
ENVIRONMENTAL OFFICER
P.O. BOX 148 HWANGE
TEL: 0[illegible]

GeoVannah Consultancy
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Name: SIMON MUVEYA ID Number: 02-011886 G 02

Contact Numbers: 0777228076 Organization: LOCAL GOVERNMENT

1.) What do you think are the negative impacts of the proposed project additional components to the environment?

The only negative impact is the disturbance of the ecosystem and land degradation that is likely to occur. Cutting of clearing of land will have a negative impact

2.) How can the impacts cited above be addressed in your view?

This can be ~~minised~~ minimised by using environmentally friendly techniques. The company can fill up the pits that they could have dug and plant trees

3.) What are the likely benefits of the proposed project to the community and the nation at large?

The project will contribute to the 12 billion dollars that the nation is looking for under mining. The proposed project will create employment opportunities for locals.

Signature: Muveya

DISTRICT ADMINISTRATOR
HWANGE
MINISTRY OF LOCAL GOVERNMENT PUBLIC WORKS AND NATIONAL HOUSING
29 MAR 2022
P.O. BOX 121, HWANGE
ZIMBABWE TEL: 0281-22245-6

GeoVannah Consultancy
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Name. Obadiene Magauda ID Number. 27-200356K12

Contact Numbers. 0777473007 Organization. Forestry Commission.

1.) What do you think are the negative impacts of the proposed project additional components to the environment?

- Tree destruction during the construction phase
- Dust pollution
- Pollution during the mining phase

2.) How can the impacts cited above be addressed in your view?

- Replace the destroyed trees within and around the project area with trees that are adaptive to the area.
- Dust suppression using water.
- Consider to adopt the management of forests in the area for carbon stocks to counter pollution induced by the mine

3.) What are the likely benefits of the proposed project to the community and the nation at large?

- Employment creation
- Infrastructure development in Kamativi
- Economic development of Kamativi and the nation at large.

Signature. Magauda

FORESTRY COMMISSION
Magauda
11/04/2023
HWANGE DISTRICT

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Prioritising environmental protection
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Mobile: +263 773 393 831

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Name: Maranda Mlotshek ID Number: 26-049241A26

Contact Numbers: 0772785583 Organization: Dept of Lands,

1.) What do you think are the negative impacts of the proposed project additional components to the environment? That is an old mine hence chances of acid Mine drainage is a big issue, Obviously pollution is a challenge.

2.) How can the impacts cited above be addressed in your view? That is need to investigate acid mine drainage levels before any Mining, Old mine dumps, shafts or pits need thorough checking for any dangers

3.) What are the likely benefits of the proposed project to the community and the nation at large? Economic benefits and employment

Signature:

LAND MANAGEMENT AND ADMINISTRATION DEPARTMENT
HWANGE DISTRICT OFFICE
30 MAR 2023
DDC COMPLEX OFFICE No. 4
P.O. BOX 121, HWANGE
TEL: +263 812 820 661

Official communications not to be addressed to individuals

Basch Street/10th Avenue
Bulawayo

Telephone: 263-9-66381-3, 61703

ZIMBABWE

MINISTRY OF MINES & MINING DEVELOPMENT
P.O. Box 386
Bulawayo
Zimbabwe

MIN. OF MINES & MINING DEV.
INSPECTOR OF MINES & EXPLOSIVES
MATABELELAND NORTH
20 APR 2023
P.O. BOX 386, BULAWAYO
ZIMBABWE

STAKEHOLDER'S COMMENTS

COMMENTS

KAMATIVI MINING COMPANY ,

KAMATIVI MINING LEASE # 12

The above mine/mill is legally registered with the Ministry of Mines and Mining Development and it is still current.

Its mining/milling operations are within the confines of the Mining Law and Regulations of the country.

This office has no objections with it continuing operating.

MIN. OF MINES & MINING DEV.
INSPECTOR OF MINES & EXPLOSIVES
MATABELELAND NORTH
20 APR 2023
P.O. BOX 386, BULAWAYO
ZIMBABWE

SIGNATURE .....
For/PROVINCIAL MINING DIRECTOR MAT NORTH

Compensation House
Cnr L. Takawira Ave/J.M.N. Nkomo St
P.O. Box 1294, Bulawayo

Tel: 0292 71013-4, 78904-6,
Fax: 0292 77600

Managing Consultant
Geovannah Consultancy
No 9 Greenwood Drive,
Windsor Park
Gweru

14 April 2023

Dear Sir/Madam

RE: ENVIRONMENTAL IMPACT ASSESSMENT STAKEHOLDER ANALYSIS KAMATIVI MINING COMPANY PVT LTD. EXPLORATION, MINING AND PROCESSING OF LITHIUM BASED MINERALS (TIN, TANTALITE AND LITHIUM).

We acknowledge the receipt of your Environmental Impact Assessment Stakeholder Consultation Questionnaire. Please take note of the points stated in response to your request for an Environmental Impact Assessment Stakeholder Analysis.

If you require further assistance with the issues addressed, please do not hesitate to contact our office. Thank you for your interest in promoting safety and health at work.

Yours Faithfully
N. PHULU
For: **REGIONAL MANAGER**

Environmental Impact Assessment: Stakeholder Consultation

The National Social Security Authority has no objection to the implementation of the above-mentioned project, if all safety and health regulations are followed and these include but not limited to:

- SI 68 of 1990, Accident Prevention and Workers Compensation Scheme.
- Pneumoconiosis Act requirements (applicable where employees will be working in a dusty environment).
- SI 393 of 1990, National Pensions and Other Benefit Scheme, with specific reference to registration of the employer and employee registration and remittance of contributions.

Occupational safety and health precautions

1. On commencement of the project, the site must be barricaded, and access restricted to members of the public.
2. You are required to ensure the safety of equipment iρ use during all operations.
3. The safety of workers should be always ensured. As such workers should be issued with the necessary personal protective clothing and equipment where required and the use of such equipment be enforced.
4. Contractor and sub-contractor employees should be registered with the National Social Security Authority's National Pension Scheme and the Workers Compensation Insurance.
5. Provide adequate first aid facilities and trained first aiders must be available at all the times.
6. Necessary measures to protect workers against hazards such as dust, noise, and others.
7. Ensure adequate and suitable sanitary facilities.
8. The Ministry of Health and Child Care's COVID 19 Guidelines for Non-Medical Workplaces must be implemented.
9. All workers, whether permanent or temporary, must receive a safety orientation and training.
10. Ensure a safe working environment by detecting potential hazards and implementing appropriate management controls.

11. Keep an accident register book on site, where all forms of minor injuries are recorded.
12. Ensure that emergency preparedness and response mechanisms are in place, including firefighting equipment, firefighters, and evacuation procedures.
13. Communicate vital health and safety information through health and safety warning signs.

N PHULU
For: **REGIONAL MANAGER**

GeoVannah Consultancy
Prioritising environmental protection
No 9 Greenwood Drive, Windsor Park, Gweru
Email: geovannahcons@gmail.com
Mobile: +263 773 393 831

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Name CHIEF NEKATAMBE ID Number 08-041339 S 19

Contact Numbers 0772338247 Organization L/GVT

1.) What do you think are the negative impacts of the proposed project additional components to the environment?

LAND DEGRADATION
DEFORESTATION
DESTRUCTION OF HISTORICALLY IMPORTANT PLACES

2.) How can the impacts cited above be addressed in your view?

REFORESTATION
REHABILITATION
PROTECT SUCH HISTORICALLY IMPORTANT PLACES IN THE AREA

3.) What are the likely benefits of the proposed project to the community and the nation at large?

EMPLOYMENT CREATION
LOCAL DEVELOPMENT

Signature

CHIEF NEKATAMBE
HWANGE DISTRICT
21 MAR 2019
SIGN

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Name M. MUNUZI ID Number 08-240692A-08

Contact Numbers 0719784612 Organization Dept of Roads

1.) What do you think are the negative impacts of the proposed project additional components to the environment?

Reduction of vegetation as they open up the mine.

2.) How can the impacts cited above be addressed in your view?

The pits created should be rehabilitated to allow vegetation to grow

3.) What are the likely benefits of the proposed project to the community and the nation at large?

The community should benefit from job creation and activities associated with corporate social responsibility.

Signature

MINISTRY OF TRANSPORT
DEPARTMENT OF ROADS
PROVINCIAL STORES
03 APR 2023
P.O. BOX 3146
BULAWAYO

GeoVannah Consultancy
Prioritising environmental protection
No 9 Greenwood Drive, Windsor Park, Gweru
Email: geovannahcons@gmail.com
Mobile: +263 773 393 831

Kamativi Mining Company Pvt Ltd intends to incorporate exploration and Processing of Tin, Lithium and Tantalite operations on their existing mining operations on the Mining Lease number 12 claims located in Kamativi Stateland, Hwange. The proposed site is in the jurisdiction of Hwange RDC. This questionnaire is your opportunity to air your views as part of the EIA Addendum process being conducted before project implementation.

Name MUZENA TAZIMANI M ID Number 06-036469 D 06

Contact Numbers 0776 531348 Organization DEPT OF VETERINARY SERVICES

1.) What do you think are the negative impacts of the proposed project to the environment?
Systems / BRING RESOURCE monitoring teams / Company (To have proper Research methodologies)

2.) How can the impacts cited above be addressed in your view?
All Stakeholders should be involved In Consultations

3.) What are the likely benefits of the project to the local community and the nation at large?
Community benefit through Industrialisation

Signature

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Name. MARCO TEMBO ID Number. 79-051875A79

Contact Numbers. 0782830214 Organization. HOSPITAL H.C.C

1.) What do you think are the negative impacts of the proposed project to the environment?

AS A HOSPITAL COMMITTEE WE THINK THE PROJECT IS OK

2.) How can the impacts cited above be addressed in your view?

NONE

3.) What are the likely benefits of the project to the local community and the nation at large?

JOBS — SCHOOLS AND COMMUNITY AT LARGE

Signature. TEMBO

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Prioritising environmental protection
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Name. EMMANUEL SIMUKANDA ID Number. 79-036902 A 79

Contact Numbers. 0784772442 Organization. WARD CO-ORDINATOR

1.) What do you think are the negative impacts of the proposed project to the environment?

AT PRESENT WE DONT HAVE THE NEGETIVE IMPACTS

2.) How can the impacts cited above be addressed in your view?

N/A

3.) What are the likely benefits of the project to the local community and the nation at large?

EMPLOYMENT TO THE COMMUNITY
BOREHOLE DRILLING TO THE VILLAGES
AND ROAD REHABILITATION

Signature. [signature]

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Name. GRANDA NYONI **ID Number.** 79-138586 B 79

Contact Numbers. 078 508 8279 **Organization.** MLEYA House

1.) What do you think are the negative impacts of the proposed project to the environment?

Land degradation
fly rocks from blasting might affect my Solar Panels
Open pits endangers the lives of my livestock

2.) How can the impacts cited above be addressed in your view?

fencing
Blasting radius is Supposed to be 500m away from my Solar Panels

3.) What are the likely benefits of the project to the local community and the nation at large?

Creation of Employment
Business development

Signature.

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Name. JACOB NYONI **ID Number.** 79-015504R79

Contact Numbers. 0778626939 **Organization.** HRDC

1.) What do you think are the negative impacts of the proposed project to the environment?

The project has a positive impact in that if successfully it will creat employment and bring cash into circulation thereby improve the welhood of the poor Community

2.) How can the impacts cited above be addressed in your view?

Since it has the positive impact I think in personal capacity, they are no negative aspect of the exploration nor actual mining on the road

3.) What are the likely benefits of the project to the local community and the nation at large?

It will create employement opportunity as thew the Community Co for the Company has already shown Commitment in that they have provided electricity sank borehole locally resuscitating the badly damaged road currently in progress and employing atleast 30+ Labour.

Signature.

RURAL DISTRICT COUNCIL
COUNCILLOR. J. NYONI
WARD KAMATIVI
DATE 28/11/22
SIGNATURE.

0778 626939 / 0715 278 999

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Name. MUSEVENZI LISA T **ID Number.** 79-165417 Q26

Contact Numbers. 0783 421 667 **Organization.** LOCAL COMMUNITY

1.) What do you think are the negative impacts of the proposed project to the environment?

Affect the water balance, wildlife and fishery habitants.
Depletion of forests and the disruption of the ecology.
Soil degradation, loss of soil nutrients.
Affect local climate and impact the pattern of rainfall.

2.) How can the impacts cited above be addressed in your view?

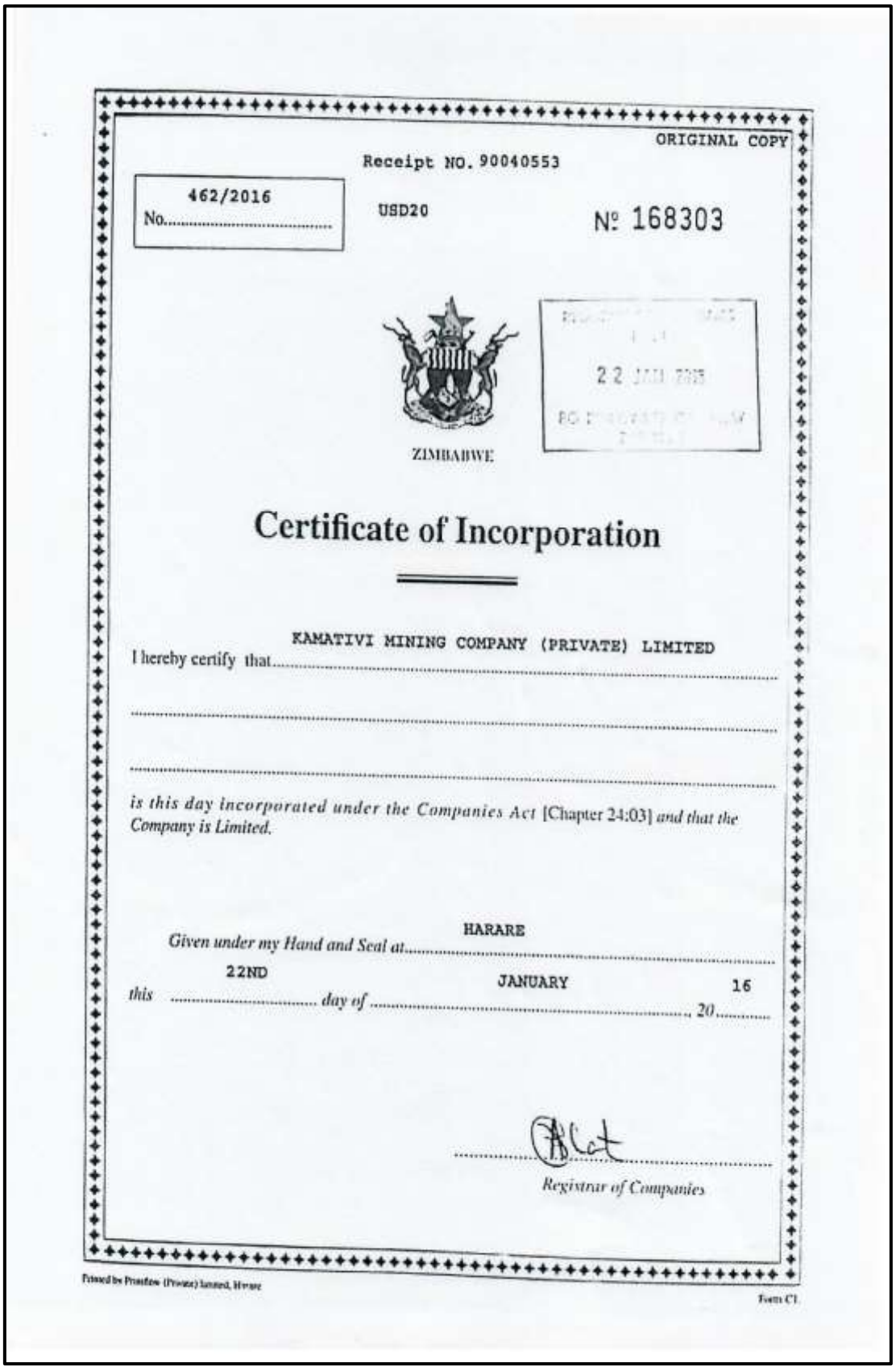
Use of Eco-friendly environment.
Rehabilitation of mining sites, cleaning excess water.
Lower - Impact mining techniques.
Replenishing native soil and grasses, site inspections.
Replanting trees, proper waste removal.

3.) What are the likely benefits of the project to the local community and the nation at large?

Creation of employment.
Contribute to the economy by providing the government with income. Provide materials necessary to modern industry.
Rehabilitation of homes, schools, hospitals, roads, electricity.

Signature. Museveni

APPENDIX 6: THE KMC COMPANY DOCUMENTS



ORIGINAL COPY

Receipt NO. 90040553

462/2016
No.....

USD20

Nº 168303

22 JAN 2016

ZIMBABWE

Certificate of Incorporation

I hereby certify that KAMATIVI MINING COMPANY (PRIVATE) LIMITED

.....

.....

is this day incorporated under the Companies Act [Chapter 24:03] *and that the Company is Limited.*

Given under my Hand and Seal at HARARE

this 22ND *day of* JANUARY 20 16

.....

Registrar of Companies

Printed by Printflow (Private) Limited, Harare

Form C1

ZIMBABWE

Form No. C.R. 6

Sections 217 and 241 of Act
Section 10,11,13,14,15,16,17,18,20 of Regulations
EX 01

No. of Entity:.....462/2016.....

17 FEB 2022
P.O. BOX CY 177, CAUSEWAY
ZIMBABWE

COMPANIES AND OTHER BUSINESS ENTITIES ACT
[CHAPTER 24:31]

.....

PARTICULARS (a) OF REGISTER OF DIRECTORS AND SECRETARIES AND OF ANY CHANGES THEREIN

OR

A LIST (a) OF DIRECTORS AND PRINCIPAL OFFICER OF A FOREIGN ENTITY

Name of Entity: .....KAMATIVI MINING COMPANY (PRIVATE) LIMITED

To the Registrar of Companies:

HARARE

Presented for filing by.....Tatenda Uchena .....

Address ..... No. 191 Drew Road, Chisipite, Harare .....

91355138

Particulars [a] of Directors and Secretaries / Principal Officer
KAMATIVI MINING COMPANY (PRIVATE) LIMITED

1 Date of Appointment	2 Present Forenames and Surname(s) Note any Former Forenames and surnames in Brackets	3 National Identification Number(c) Passport Number and Nationality (b)	4 Full Residential or Business Address and Postal Address	5 Particulars of Other Directorship (d)	6 Nature of Changes (i)	6 Date of change (ii) State in brackets whether date of change the date the company was notified of change (iii)	
	Directors (c)						
26/08/2022	GAO XIN	Chinese Passport No. EG2669973	No. 45 Orange Grove , Highlands Harare , Zimbabwe		Appointed	(26/08/2022)	26/08/2022
26/08/2022	ZHOU JIANQI	Chinese Passport No. EJ4411892	No. 45 Orange Grove , Highlands Harare , Zimbabwe		Appointed	(26/08/2022)	26/08/2022
26/08/2022	YE JIANGUO	Chinese Passport No. E32807730	No. 45 Orange Grove , Highlands Harare , Zimbabwe		Appointed	(26/08/2022)	26/08/2022
13/12/2019	WELLINGTON PASIPAMIRE	Zimbabwean ID No. 29-158280- G- 26	No. 33 Rayden Drive , Borrowdale Harare , Zimbabwe		No Change		
13/12/2019	HANMING WU	Chinese Passport No. E94647895	No. 45 Orange Grove , Highlands Harare , Zimbabwe		No Change		
13/12/2019	YANBIN ZHAI	Chinese Passport No. EB5837260	No. 45 Orange Grove , Highlands Harare , Zimbabwe		No Change		
13/12/2019	CHEN JI	Chinese Passport No. EG4838694	No. 45 Orange Grove , Highlands Harare , Zimbabwe		Resigned	(26/08/2022)	26/08/2022
13/12/2019	YANSHAO CHEN	Canadian Passport No. HP944563	No. 45 Orange Grove , Highlands Harare , Zimbabwe		Resigned	(26/08/2022)	26/08/2022
13/12/2019	YAN SHI	Canadian Passport No. HH372731	No. 45 Orange Grove , Highlands Harare , Zimbabwe		Resigned	(26/08/2022)	26/08/2022
	Secretaries (d) Or Principal Officer (e)						
1/2/2022	TATENDA PROSPER UCHENA	Zimbabwean ID No. 63- 1275562- N- 45	No. 191 Drew Road, Chisipite Harare , Zimbabwe		No Change		

(Signature) Director / Secretary / Principal Officer

This 15th Day of AUGUST 2022

NOTES

(a) Applicable for office holding appointment should always be given.
(b) The date should always be given, whether or not it is in respect of date of the appointment.
(c) Particulars of Directors, for instance of Principal Officer.
(d) National Identity Number or Passport number must be shown in this column.
(e) In the case of a foreign company, if the director is a corporate body, its name and the situation of the principal office must be shown.
(f) In the case of the secretary being a corporate body, the name and the situation of its registered office must be given.
(g) In the case of the principal officer being a corporate body or partnership, the corporate or partnership name must be shown, and if a it is a partnership, all the names of the partners must be given.
(h) In the case of an individual, if he is a director of any other company registered in this country, the name of every such company must be entered. This applies only in respect of new appointees.
(i) State "Resigned", "Retired", "Died" or other such style. In the case of a new appointment since the last list was filed, it must be stated here in what capacity such person will act.
(j) Give the date of the last change notified to the company in the previous column. Both columns 7 and 8 must be completed in the event of a change.
(k) This is required to be signed by a director, secretary or the registrar.

KMC

Kamativi Mining Company (Pvt) Ltd

45 Orange Grove, Highlands, Harare

TO WHOM IT MAY CONCERN

Date: 18 November, 2022

This letter serves to confirm the physical addresses of the following Directors of

KAMATIVI MINING COMPANY (PRIVATE) LIMITED:

NAME	NATIONALITY	PHYSICAL ADDRESS
GAO XIN	Chinese Passport No. EG2669973	No. 45 Orange Grove, Highlands, Harare, Zimbabwe
ZHOU JIANQI	Chinese Passport No. EJ4411892	No. 45 Orange Grove, Highlands, Harare, Zimbabwe
YE JIANGUO	Chinese Passport No. E32807730	No. 45 Orange Grove, Highlands, Harare, Zimbabwe
WELLINGTON PASIPAMIRE	Zimbabwean ID No. 29-158280-G26	No. 33 Rayden Drive, Borrowdale, Harare, Zimbabwe
HANMING WU	Chinese Passport No. E94647895	No. 45 Orange Grove, Highlands, Harare, Zimbabwe
YANBIN ZHAI	Chinese Passport No. EB5837260	No. 45 Orange Grove, Highlands, Harare, Zimbabwe

TATENDA PROSPER UCHENA
LLB (HONS)
17 NOV 2022
LEGAL PRACTITIONER
COMMISSIONER OF OATHS

COMPANY LAWYER

APPENDIX 7: THE KMC MINING LEASE



Printed by Printflow (Private) Limited 68466-0 (Z.645) Form No. 31

Certificate of Registration after Transfer

(Section 254)

PROVINCIAL MINING DIRECTOR
MATABELELAND NORTH
30 JUN 2020
P.O. BOX 386, BULAWAYO
ZIMBABWE

Amount paid $250.00=

Transfer number 36880

Mining Commissioner's Office

30-06, 2020

THIS IS TO CERTIFY THAT KAMATIVI MINING COMPANY (PVT) LTD *is the Registered Holder of* 3848,099 *Claims, named* MINING LEASE

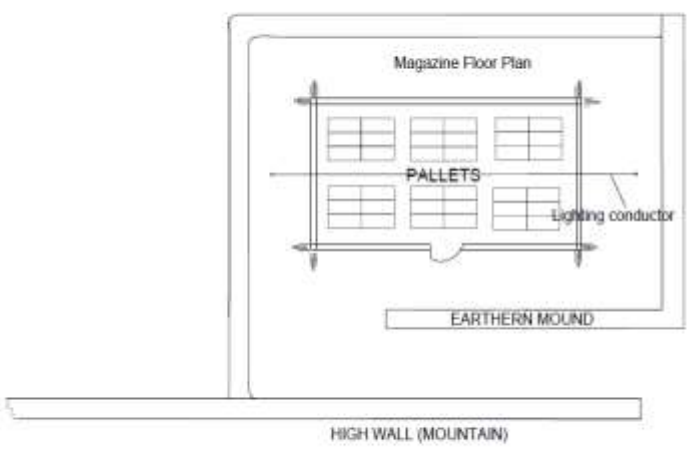
Registered Number MINING LEASE No 12 *and originally registered in my Register on the* 5TH *day of* JANUARY, ~~20~~ 1976 *when the situation was indicated to be* AN AREA SITUATED ON STATELAND IN THE BULAWAYO MINING DISTRICT AND KNOWN AS KAMATIVI MINE AS DETAILED BY SURVEY PLAN S.G. No 251/75

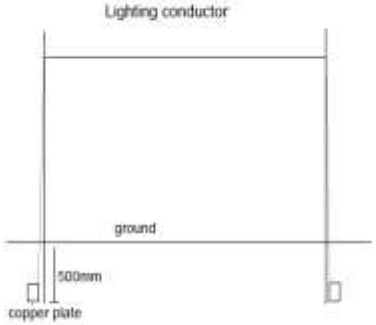
№ 305226

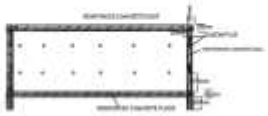
Mining Commissioner

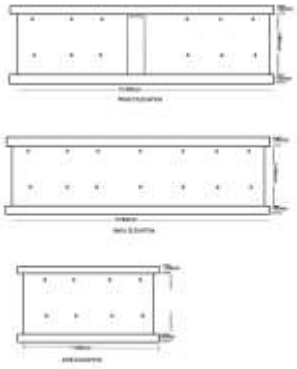
APPENDIX 8: THE EXPLOSIVE MAGAZINE MODEL

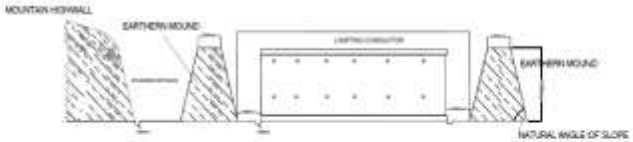
PROPOSED 30 TONNES FRACTURE EXPLOSIVE MAGAZINE AT KAMATIVI MINING COMPANY.

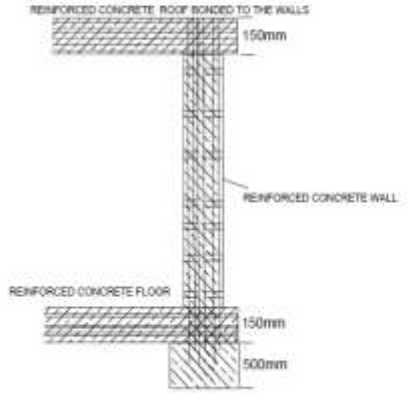












NOTES ON CONSTRUCTION

In the construction of an immovable magazine--

-the walls shall be constructed of reinforced concrete not less 150 millimetres thick;

-no iron or steel used in the construction or in the fittings shall be exposed internally.

-the floor shall consist of reinforced concrete not less than 150 millimetres thick;

-the building shall be covered with a roof of reinforced concrete not less than 150 millimetres thick which shall be securely bonded to the walls;

Ventilation shall be provided by means of elbow flues which are--

-constructed in the thickness of the walls; and fitted with gratings covered with fine wire gauze at both external and internal openings; and not lower than 750 millimetres from the floor and not higher than 250 millimetres below the ceiling.

The door shall--

-be constructed of steel plate not less than 5 millimetres in thickness and lined with wood or similar non-ferrous material so that no iron or steel is exposed to the interior of the magazine;

-be hung in a substantial frame which is securely set in the concrete of the building;

-open outwards, and the hinged edge shall be secured when closed by not less than 5 internal fixed dog-bolts or lugs engaging with the frame;

-be locked by means of 2 or more concealed and protected security dead locks each fitted with at least 5 levers or a bolt mechanism with a concealed and protected dead lock fitted with at least 5 levers and such door and lock or bolt mechanism shall be of a design approved by the Chief Inspector;

The magazine shall be provided with an efficient lightning protection system

The magazine shall be surrounded by a substantial earthern mound which shall be

-at least as high as the eaves of the roof of the building; and not less than 1 metre wide at the top; and at a distance of not more than 1 metre from the magazine, the exterior slope of the mound shall be at the natural slope of the earth with the entrance to the magazine through the mound in a broken line;

provision for the proper drainage shall be made.

-There shall be a 20m vegetation clearance between magazine and perimeter fence.

APPENDIX 9: DIESEL TANKS

APPENDIX 10: TALINGS STRORAGE FACILITY DESIGN REPORT AND DRAWINGS

APPENDIX 11: SITING OF WORKS PLAN