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Appendix 3

ENVIRONMENTAL MNAGEMENT PLAN (EMP)

Accompanying Application for Large Scale Mining Licence (LML)

Over

Area under Prospecting Licence No. 19622-HQ-LPL at Mwachilinga, Shantumbu Area, Kafue District.

By

Lu Hang Stone Mining Company Limited

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LUSAKA

3.1 Environmental Project Brief

In pursuant to the Environmental Impact Assessment (EIA) Regulations, Statutory Instrument No. 28 of 1997, an Environmental Project Brief (EPB) for the Dolomitic / Limestone Quarry project at Mwachilinga / Shantumbu Area in Kafue District of Lusaka Province was submitted to Zambia Environmental Management Agency (ZEMA). Approval and issuance of Decision Letter is awaited.

3.2 Project Location and Access

The proposed project site of extent area approximately 79 hectares is located at Mwachilinga Village, Shantumbu Area in Kafue District of Lusaka Province of the Republic of Zambia. Location of the site is as described in Appendix 1 (1.2).

3.2 Relevant Legislation

3.2.1 Environmental Protection and Pollution Control Act, Chapter 204 (EPPCA)

The primary environmental legislation in Zambia is the "Environmental Protection and Pollution Control Act" (EPPCA) of 1990 and the Environmental Protection and Pollution Control (Amendment) Act of 1999. This legislation sets out a framework for Environmental Impact Assessments (EIAs) as well as establishing the Environmental Council of Zambia as a regulatory body charged with the responsibility of overseeing the implementation of the requirements of the environmental legislation.

Under the EPPCA, regulations have been issued setting out detailed requirements for environmental reporting in relation to new developmental projects like the one being proposed by Lu Hang Stone Mining Company Limited.

3.2.1.1 The Environmental Protection and Pollution Control (Environmental Impact Assessment) Regulations, 1997.

Relevance and Compliance

The legislation requires that any project developer for any new developmental project prepares an Environmental Project Brief (EPB), which is a report that includes preliminary predictions of possible impacts of a proposed project on the environment and constitutes the first stage of environmental impact assessment process. Once completed, the project brief should be submitted to the relevant authority for their review and assessment.

The preparation of this Environmental Project Brief (EPB) by the developer is in compliance with the requirements of the Environmental Impact Assessment (EIA) Regulations of 1997. Negative environmental aspects arising from project implementation have been identified and these will have to be mitigated. The mitigation measures for the identified impacts are tackled in the management plan included herein.

3.2.1.2 The Water Pollution Control (Effluent & Waste Water) Regulations, 1993

Relevance and Compliance

Under these regulations, the term "pollutant" is defined as any substance or energy which if it enters or is discharged into water may cause discomfort to, or endanger the health, safety and welfare of persons, or may cause injury or damage to plant or animal life or property, or which may interfere unreasonably with normal enjoyment of life or property or use of property or conduct of business and those objects or substances as may inadvertently obstruct or divert the natural flow of a water course when discharged or dumped into it.

The proposed site does not communicate with the regional or local drainage system.

3.2.1.3 The Air Pollution Control (Licencing & Emissions Standards) Regulations, 1996.

Relevance and Compliance

Air pollution is usually a major environmental issue for any quarrying operation. It is for this reason that these Regulations sets emission limit levels, rates, amounts or concentrations of a given substance discharged in the air that must not be exceeded by an operator.

As a way of complying with the requirements of these regulations, the developer shall apply for permits to discharge any air pollutants that would arise as a result of the proposed quarrying operations at the site so as to ensure that the limits would be within the specified limits by the inspectorate.

3.2.1.4 The Hazardous Waste Management Regulations (S.I No. 125 of 2001)

Relevance and Compliance

The proposed operations will strive to comply with the term "environmentally sound management of hazardaous waste". This means taking all reasonable and practical steps to ensure that hazardous waste is managed in a manner, which will protect human health, animals, plants or the environment against adverse effects which may result from such waste. The possible sources of such waste at the proposed site will include medical waste. Incineration of medical waste will be one way of managing waste as it renders them harmless or inert.

3.2.2 The Mines and Minerals Development Act, 2008, Chapter 213.

The Mines and Minerals Development Act No.7 of 2008 regulates mining activities and operations for the protection of the environment from prospecting through up to closure of mine. Under the Act, several regulations have been issued that are specific to operations relating to mining / quarrying which will have to be complied with by the developer.

3.2.2.1 Mines and Minerals (Environmental) Regulations, 1997, (SI 29 of 1997)

Relevance and Compliance

These regulations establish the requirement for any mining operation to submit an Environmental Project Brief as part of any new development. This legislation places the initial responsibility for assessing any new mining application with the Mines Safety Department (MSD). It however, recognizes the pre-eminence of the EPPCA of 1990 and the role of the Environmental Council of Zambia as the lead agency on all issues relating to environmental protection in the country. Therefore, the preparation of this project brief by the developer is in fulfillment and complying with this requirement.

3.2.2.2 Mining Regulations, 1971

Relevance and Compliance

Any mining / quarrying operation in Zambia has to be conducted in accordance with the requirements of these regulations, which is enforced by the Mines Safety Department (MSD). Under these regulations, there shall be a miner Owner and a mine Holder, as well as competent persons appointed to execute a mining operation. The mine Holder, who in most cases is a Mine Manager, is responsible for the day to day running of mining operations while the Owner provides necessary means to enable the Holder run the operations smoothly.

As a way of complying with these regulations, the developer shall appoint a mine Owner and a Holder once the proposed operations are up and running. The Holder will be responsible for all operations at the Quarry including the reporting of incidences and accidents to the Director of Mines Safety Department.

3.2.2.3 Environmental Protection Fund (EPF) Regulations (SI No. 102 of 1998)

Relevance and Compliance

The legislation requires all holders of mining licences to make cash contributions to the Environmental Protection Fund whose objectives are:

(a) To provide assurance to the Director of Mines Safety Department (MSD) that a person who holds such licence or permit shall execute the Environmental Management Plan in accordance with the Mines and Minerals (Environmental) Regulations of 1997; and

(b) To provide protection to the Government against risk of having the obligation to undertake the rehabilitation of a mining area where the holder of a licence or permit fails to do so.

As a requirement under these regulations, the developer will commence the deposition of monies into the EPF after the first environmental audit that will be performed by an independent consultant.

3.2.3 Forestry Act, Chapter 199

The Forestry Act of 1974 provides for the management, conservation and protection of forests and trees. The Act prohibits the felling, collection or injuring of forest products in protected forest areas or forest reserves, unless a licence has been obtained to do so. The Act also prohibits excavations, conservation, and operation of machinery which the forest reserves or protected areas.

Relevance and Compliance

The extent area of the proposed Large Scale Mining Licence is only 79 hectares, and the actual Quarry and crushing plant will be confined in a very small area of less than 10 hectares. The felling of trees or forest and disturbance of vegetation will be almost negligible especially that the quarrying operations will be on the site previously cultivated. The nearest designated forest, Lusaka South Extension Local Forest No. 55 is about 2.7km north and would not be affected by the operations.

3.2.4 Town and Country Planning Act, Chapter 283

The Town and Country Planning Act provides for the control, use and change of land use zones and reservations for various purposes e.g. citing of work sites. It also provides for the compensation of affected communities by planning decisions and regulated developments.

Relevance and Compliance

The proposed site falls under Kafue District Council and according to the office of the Director of Works at the Council, it was advised that the Mwachilinga / Shantumbu Quarry site falls within titled farmland owned by the developer.

3.2.5 The Local Government Act of 1991

The Act provides for the establishment of Councils in the Districts, the functions of local authorities and local government system.

Relevance and Compliance

Some of these functions which will be of relevance to this particular project being proposed by the developer relate to pollution control and the protection of the environment in general within their locality. Since the proposed project is located in the Kafue District, the Kafue District Council will be responsible for the particular aspect at the proposed project.

3.2.6 The Water Act of 1949

The Act establishes the Department of Water Affairs (DWA) and the Water Board with the responsibility of looking after the water resources of the country. The Department of

Water Affairs is responsible for the hydrology (surface water), hydrogeology (groundwater) as well as quality aspects of these water resources in the country.

Relevance and Compliance

The project will have to comply with this Act on aspects of underground water in view of accessing the water resource through the aquifer.

3.2.7 The National Heritage Conservation Act of 1989

The Act provides for the protection and conservation of heritage resources, cultural and historical sites, and the Act enforced by the National Heritage Conservation Commission (NHCC).

Relevance and Compliance

If any such site within the proposed project area is found, the NHCC shall be informed and such a site should be preserved.

3.2.8 The Lands Act of 1995 and the Land Acquisition Act of 1995.

The Act provides for the alienation, transfer and change of land. It also provides for the compulsory acquisition of land by the President whenever he is of the opinion that it is desirable or expedient to do so in the interest of the public.

Relevance and Compliance

The land is divided into state, private and traditional land. The proposed project falls under traditional land in Senior Chief Nkhomeshya Mukamambo II of the Soli people of Lusaka Province. The area Chief would be consulted whenever need arise.

3.2.9 The Public Health Act of 1996.

The Act provides for the prevention of diseases, drainage, latrine and disposal of sewerage and treatment systems.

Relevance and Compliance

The proposed project site will have to comply with these aspects and measures will include proper disposal of wastes generated on site so as to prevent outbreak and spreading of diseases.

3.2.10 The Explosives Act of 1971.

The Act gives guidance on the purchase, transportation, storage and usage of explosives. The Mines Safety Department (MSD) through the Explosives Section enforces this Act.

Relevance and Compliance

The proposed project shall comply with this Act by getting permits from MSD prior to construction of explosive magazines, and purchase of any explosives that will be used for blasting operations. The purchase, transportation, usage as well as storage of the explosives will be under the guidance of a holder of a valid Zambian Blasting Licence.

3.2.11 The Zambia Wildlife Authority Act, 1989.

The Act provides for the conservation and management of ecosystems to preserve them from impacts of modern man. The Act also regulates the type and extent of tourism activities that may be permitted in the national park or game management area settings.

Relevance and Compliance

The proposed quarrying site is very far from the nearest Game Management Area (GMA), Chiawa GMA which is 27km SE of the proposed quarry site. Despite the proposed physically being far from the National Park or GMA, environmental and ecological considerations shall be taken into account by the developer to avoid environmental impacts on any wildlife.

In addition, the developer will comply with any other conditions that would be set out in any decision letter regarding wildlife in general.

3.3 PROJECT DESCRIPTION

3.3.1 Project Objectives

- To utilize the Mwachilinga / ShantumbuQuarry site and commence sustainable quarrying operations under a mining right.

- To produce various stone aggregates and quarry dust to meet the huge demand of quarry products by the construction industry through various developmental projects in Kafue District, and Lusaka Province in general.

- To create meaningful employment to the local community and contribute to the local and regional economic growth.

3.3.2 Main Activities

The proposed project will have four major phases namely Site Preparation; Construction Phase; Operation Phase; and Closure Phase.

3.3.2.1 Site Preparation Phase

The main activities that will be carried out include:-

- siting of quarrying layout taking into account information generated during the prospecting stage.
- Clearing and preparation of the site within the designated quarry boundaries falling in the mining licence area; and
- Preparation of site access roads to the quarry to be used by vehicles.

3.3.2.2 Construction Phase

The construction Phase will involve the mobilization, installation and assembling of the crushing plant on site. Other activities during this phase will include the development of the quarry which will be the source of stone, the raw material for the aggregate and quarry dust products. The construction of the office block, ablution, magazines, fencing, workshop and storerooms will be done during this phase.

3.3.2.3 Operational Phase

The operational phase will proceed after overburden removal, which is negligible, formation of terraces on the identified dolomitic / limestone hill. This operational phase will involve the actual production of the required products, and most of the impacts that will require mitigation will take place during this phase. The major activities at the quarry site will be:-

- Drilling
  Drilling of vertical 90mm – 145mm Ø by ~12m deep blast hole in a specific drill pattern will be done by a crawler mounted pneumatic drill rig.

- Blasting
  After drilling sufficient blast holes in a specific pattern, light charge primary blasting will be carried out whenever necessary using light charge of emulsions with Cordtex and sand stemming. Lighter charging will be used to avoid fly rocks and reduce sound and dust emissions beyond acceptable levels. All primary and secondary blasting will be carried out during day time between 08:00hrs to 17:00hrs. In addition to audible warning, warning signs as per requirement of the Explosives Regulations will also be posted on all approaches prior to blasting time.

  To minimize on blasting activities, a CAT 320D Hydraulic Breaker will also be used to break bigger boulders into smaller manageable pieces.

  A qualified BLH will be used to conduct all blasting operations.
- Loading
  An Excavator (CAT 320D2) will be used to load the blasted material from the Quarry face onto a dump truck which will then transport the material to the

Crushing plant. The Excavator-Dump truck-Crusher combination will also be alternated by using LHD equipment, especially during initial stages.

- Crushing
  At the crushing plant, quarry material will be off loaded directly into the feeder, which will feed into the Primary Jaw Crusher (PJC). From the PJC, the crushed material will be conveyed via a conveyor belt into a Secondary Jaw Crusher (SJC) where the three different quarry products will be produced i.e. 0-5mm, 5.1-10mm, and 10.1-25mm will then be conveyed using three conveyor belts to storage areas awaiting collection by clients. The oversize rocks in the vibrating screen will be routed to the impact crusher and sent back to the Jaw Crusher for further crushing.

- Transportation
  Once the material has been broken down into correct sizes in the crushing plant, it will be put into various stockpiles, according to the sizes. From these stockpiles the material will be loaded onto trucks and transported to clients.

- Stock piling
  Stockpiling will be automatic by conveyor belts sited on different quarry aggregates sizes and quarry dust stockpiles. However, a diesel propelled LHD will be used on the stockpiles to handle quarry products spillage and maintenance of stockpile profiles.

3.3.2.4 Decommissioning and Closure

The decommissioning and closure phase will come at the end of quarrying operations when all the quarry stone reserves would have been exhausted within the area under mining licence. At closure, the site will be rehabilitated so that some other sustainable land use other than quarrying could be permitted. To ensure that this is achieved, progressive rehabilitation of the area shall start on commencement of the operations at the Quarry and will be integral part of the entire project cycle at the Quarry. All disturbed areas will be progressively rehabilitated once the operations cease in the particular area.

Closure phase activities will include:-

- Site rehabilitation and remediation;
- Preparing the area for other sustainable post quarrying land use;
- Writing and submitting of a closure report to the Director of Mines Safety as required under the Mines and Minerals Environmental Regulations of 1997; and
- Surrendering of the licence area to the Ministry of Mines and Minerals Development.

3.3.3 Raw Materials and Other equipments

The main raw materials of the proposed project are the quarry stone which is in abundance within the mining licence area. Equipment and plant that will be required on site for smooth running of operations will include:-

- Drilling rigs;
- Excavators;
- Front-End-Loaders (LHDs);
- Dump trucks;
- Gen-sets
- Crushing plant (with pollution control kit); and
- Utility trucks
- Weigh Bridge

3.3.4 Products and by-products

The following will be the products at the proposed project:-

- -6mm Quarry Dust;
- 9.5mm Quarry Aggregates;
- 13.2mm Quarry Aggregates; and
- 19mm Quarry Aggregates.

3.3.5 Alternatives

3.3.5.1 Project alternatives

Project Option

The "Project Option" will mean allowing the developer to go ahead with the continued quarrying at the proposed quarry site at proposed Mwachilinga / Shantumbu. The proposed project will create employment opportunities and positively contribute to the local and national economic growth. With a multiplier effect of about 10-15 people in Zambian rural setting, an estimated 750 people will directly benefit from the proposed project by the developer.

Although the project will have some negative impacts such as noise, dust emissions and vibrations, they can be contained with the implementation of a proper Environmental Management Plan (EMP). In addition, the human settlements are quite away from the actual quarrying sites to have serious adverse impacts.

No Project Option

The "No Project Option" will mean not going ahead with the proposed project. This option must be weighed against the loss of a multi-million dollar investment that the project developer intends to invest in the rural local economy. The proposed project will employ a lot of people and the majority of this staff complement will come from the

local area. The project will have numerous knock-on effects for the local and regional economy.

The "No Project Option" will therefore be a major setback for the local, regional and national economic development as it would deny the much required materials for the construction industry which has great potential of growing at a fast rate. Current most suitable quarry products coming from RDA Quarry is not adequate.

Of the above two options, the most favourable one is the "Project Option". Its advantages for outweigh those of the "No Project Option". The " Project Option" will reduce the high levels of unemployment in the area, and also curb unlicenced quarrying activities.

Mining Process

There is one option for the mining of quarry stone, which is the raw material in the whole production process, and this :-

- Open pit (terracing)mining

The quarry stone deposits at Mwachilinga / Shantumbu forms a hill as rock dolomitic / limestone outcrop and are therefore amenable only to open pit mining method. In Phase I, initial stage of Quarrying, for about 28 years, terracing of the hill will be done

Open Pit mining method will be used, with terracing techniques.

3.4 SITE DESCRIPTION

3.4.1 Topography

The Mwachilinga / Shantumbu has a flat and gentle rolling terrain and typical of the Lusaka plateau characterize most of the area of Lusaka Province. The geomorphology of the area is typical of the Central African plateau and closely follows the geology of the area.

3.4.2 Climate

The climate of the Kafue District, Mwachilinga / Shantumbuarea where the proposed project site will be located is characterized by three distinct seasons determined the movement across the region of the Inter-Tropical Convergence Zone (ITCZ) and is typical for much of the Central African Plateau. The region experiences a cool dry season from mid-April to August, a hot season from September to October and rainy season from November to April.

The proposed project area receives an annual rainfall in the region of around 600mm to 700mm with mean annual rainfall days of 70-80 days i.e. between December, January and February receiving over 70% of annual rainfall.

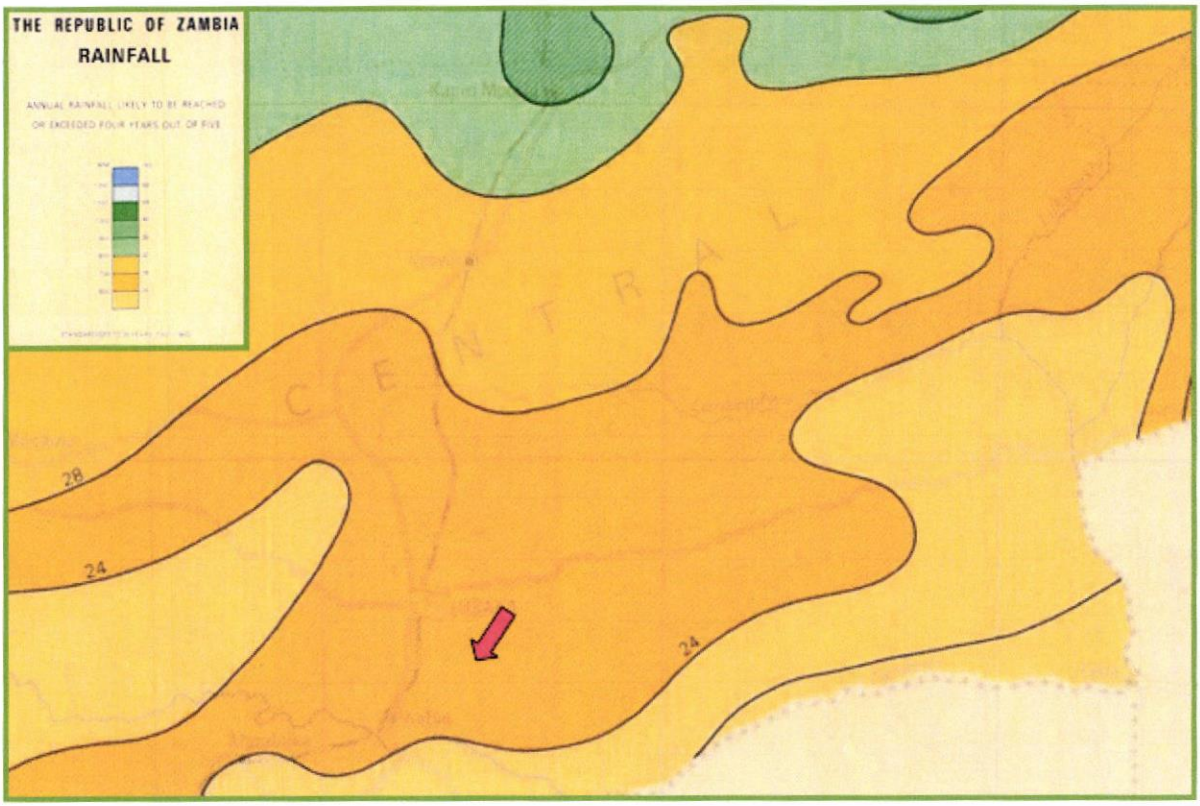

Figure 3.4.2 (1): Showing rainfall for project area

3.4.3 Flora and Fauna

The natural type of vegetation occurring at Mwachilinga / Shantumbu mainly comprise of munga woodlands on heavy soils. Mainly clay soils with bad workability, 17°C - 18°C min. and 22°C - 23°C max. temperature. The proposed quarry site has mainly short grass and shrubs supported on thin layer of lateritic soils underlain by dolomitic / limestone rock formation which is/was exploited for quarry stone.

No much fauna exist within the mining licence area and quarry site due to increased human activities, as much of the area is used for subsistence farming by the local community. The few fauna life just include species rodents, reptiles, insects and grassland bird species which find habitat in beneath surface, in rocks, anthills, grass and shrubs.

3.4.4 Geology

The general geology of the area mainly consist of meta-carbonate rocks of various types. Refer also to Appendix 1 (1.5).

3.4.5 Soils

The soil types correspond closely to the geology, topography and climate of the area. Generally the Mwachilinga / Shantumbu area soils are clay. However, most of the portions at the quarry site is lateritic underlain by dolomitic limestone. The soil types of the area is shown in Figure 3.4.5(1) as described under F.A.O /UNISCO classification.

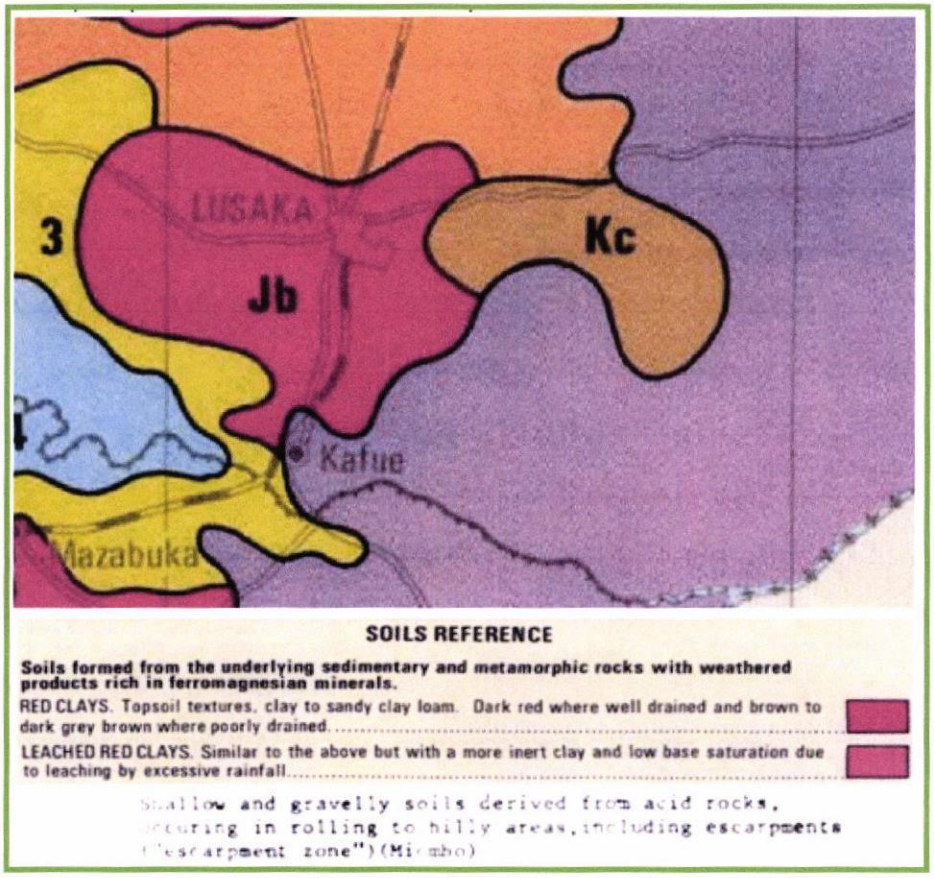

Figure 3.4.5 (1): Soil type of the proposed project area.

3.4.6 Hydrology

3.4.6.1 Surface Water Features and Drainage

The proposed quarry site does not communicate with either local or regional drainage system.

3.4.6.2 Underground Water Resources

The proposed quarry site is underlain by dolomitic limestone with low permeability. However, due to fissures and joints characterized by the some rock formation, underground water may communicate with quarrying operations.

The underground water source within the area underlain by the dolomitic limestone may not be useful for human consumption.

3.4.7 Existing Land use

Apart from quarrying, the land at the proposed site is not used for any other social-economic activity due to the underlain dolomitic limestone which support little vegetation growth. However, some portions are used for the grazing of live stock, especially goats which feed of leaves from the shrubs.

3.4.8 Human Settlements

The proposed quarry site falls within the developer's property, and there is no other settlement within the property. However, the property shares boundary with other properties.

3.4.9 Cultural Characteristics

The site reconnaissance survey conducted and information gathered revealed no presence of sensitive sites.

3.5 POTENTIAL ENVIRONMENTAL IMPACTS

Table 3.5.1 – Environmental Impact Matrix for proposed Mwachilinga / ShantumbuQuarry Project

Impact target	Impact Source	Impact Source Description	Significance of Impact	Mitigation
Environmental Impacts				
3.5.1.1 Water Sources	Maintenance of Machinery	Fuels and oil leakages and spills from machinery during maintenance onto ground may find way to surface and ground water sources	Very Low Negative	Maintenance of machinery except in case of breakdown will only be carried on in designated areas. Machinery will be maintained in good order
	Pit Dewatering	Water table When the water table is reached in the pit, the pit dewatering will lower the water table in the vicinity of the quarry area, thereby affecting boreholes used for portable water within the licence area.	Very Low Negative	For initial 28 years, no Open Pit expected. Resource will be exploited from hill by terracing. Nearest bore hole about 1km from pit location.
3.5.1.2 Landscape	Pit Excavation	Open Pit Excavation of pit and removal of quarry stone will create a permanent open pit of about 15m deep and 120m wide.	Moderate to low negative	Open pit area will be fenced off to restrict access by the public. Pit and WRD areas will be rehabilitated progressively.
	Stockpile & Dumps	Stock piles (Quarry products) Stockpiles of quarry products awaiting disposal , and overburden materials at Waste Rock Dumps(WRD) may protrude above the natural surface topography of the area thereby detracting away from the natural scenic beauty of the area.		

Impact target	Impact Source	Impact Source Description	Significance of Impact	Mitigation
Environmental Impacts				
3.5.1.3 Impact on Soils	Fuel & Oil leakage	Fuels and oil leakages and spills from machinery during maintenance onto ground causing soil contamination.	Very Low Negative	Maintenance of machinery except in case of breakdown will only be carried on in designated areas.
	Soil Compaction	This may be caused by passage of quarry machinery on the roadways, thou this may be extremely limited as much of the area is lateritic and is exposed rock.		Movement of quarry machinery will be restricted to existing roadways.
3.5.1.4 Impact on Vegetation	Pit Excavation Stockpile & Dumps Roadways Stockpile & Dumps Crushing Plant Explosive magazine and other infrastructure	The presence of lateritic soils and extensive rock outcrops with scant vegetation cover comprising of grass and isolated shrubs reduces the possibility of significant negative impacts on vegetation.	Very Low Negative	Absolute minimal vegetation will be allowed.
3.5.1.5 Noise Impact	Quarry vehicles and Machinery Drilling Operations Blasting operations Crushing	The major source of noise impacts will come from drilling, blasting and crushing operations, as well as the site movement of heavy trucks collecting and delivering materials on site haul roadways. The major effect these activities will have will be on project workers on site.	Low to Moderate Negative.	Project vehicles and quarry machinery will be fitted with noise control gargets. Workers will be provided with ear plugs and ear muffs for protection

	Operations	However, given the distance and the buffer zone that will be maintained between the project area and the local communities, the impact will not be significant.		against excessive noise.

Impact target	Impact Source	Impact Source Description	Significance of Impact	Mitigation
Environmental Impacts				
3.5.1.6 Impact on Air **Dust**	Crushing Plant	The generation of dust from the crushing plant, drilling and blasting in the pit, movement of heavy duty equipment on site roadways and wind blowing dust from the stockpiles may have several implications on both human and plant life in the project area and its vicinity. The prolonged exposure to dust emissions and particulate matter may lead to eye and respiratory irritation and chest infections such as asthma. In plants, the deposition of dust on leaves and flowers may interfere with pollination and other functions such as photosynthesis, respiration and transpiration, which are important for plant survival.	Moderate Negative	Water sprays will be used to surprise ducts on major dust sources.
	Drilling operation			Drilling rigs will be fitted with dust collector.
	Blasting operation			Operators will be provided with protective clothing and dust masks.
	Movement of heavy duty equipment			Vegetation will be encouraged to grow on Waste Rock Dumps.
	Wind blowing dust from roadways, stockpiles and Waste Rock Dumps.			

Table 3.5.2 – Social-Economic Impact Matrix for proposed Mwachilinga / Shantumbu Quarry Project

Impact target	Impact Source	Impact Source Description	Significance of Impact	Mitigation
Social-Economic Impacts				
3.5.2.1 Employment Generation		The proposed project will generate employment opportunities for about 50 local Zambians and all this staff complement will be sourced from within Mwachilinga / Shantumbu, Kafue District. The provision of employment will have several multiplier effects at the household level and in the general economy.	Very High Positive	
3.5.2.2 Housing	Workers at the Quarry Immigrant traders	The demand for independent housing units will increase as a result of employment offered. As more are employed business will increase, and demand on goods and services will also increase and therefore attracting immigrant traders resulting in increased demand on housing units.	Very High positive	.
3.5.2.3 Health	Workers Community	The company will have a medical scheme for all its employees and their immediate families at a reputable hospital. The company will operate a First-Aid Clinic within the licence area.	Very High Positive	

3.6 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Impact Aspect	Impact Source	Mitigation Measures	Responsible Person	Timing of Management Actions	
				Start	End
Impacts on Site Vegetation	Very low Negative	The components at the proposed project such as:- Quarry; Crusher; Explosive Magazine area; Stockpiling Areas; and Access Roads will not result in significant loss of vegetation due to little vegetation on site. In addition, the area that these components will occupy will just be about 10% of the mining licence area. However, workers and members of the public will not be allowed to exploit trees and other vegetation within and around the project area.	Quarry Manager	Preparation Phase	Closure Phase
Impact on water sources	Medium / Low Negative	Drums and other materials containing oils and other products will be kept in bonded areas.	Quarry Manager / Developer	Preparation Phase	Closure Phase
		Spillages will be contained and disposed of in line with specifications in national legislation.			
		Dewatering of Open pit is not expected to affect groundwater used as portable within the vicinity of the project area. However, boreholes will be monitored regularly in terms of water levels and if necessary, an alternative clean water supply will be provided to the site work force and local community.			
		Maintenance of machinery will be conducted on a concrete plinth.	Quarry Manager / Developer	Preparation Phase	Closure Phase

Impacts on Landscape (Visual Intrusion)	Moderate Negative	Trimming of Quarry pit edges to a slope of about 1:3 and reshaping of the quarry pit (landscaping) so as to make stable and suitable for the desired long-term land use and minimise long-term visual impacts.	Quarry Manager	Preparation Phase	Closure Phase
		Leveling (landscaping) of excavated areas, and cleaning of rock boulders.			
		Fencing the area to ensure that only authorized people have access to project area.			
Impacts on Soils	Low Negative	Proper management of lubricants and fuels together with the disposal of domestic waste to designated sites.	Quarry Manager	Preparation Phase	Closure Phase
		Areas used for the maintenance of machinery will be bonded.			
Impact on wildlife	Very Low negative	To prevent generation of high noise that could affect any wildlife if any, use of explosives will be restricted to absolute minimum practically possible during blasting. Cautious blasting techniques will be used during blasting operations, especially with cordtex and ANFEX. However, negligible effect is expected on wildlife as there is no evidence of wildlife within the vicinity of the quarry area.	Quarry Manager	Preparation Phase	Closure Phase
Soil Compaction	Low negative	Landscape (rehabilitate) areas where mining of quarry stone has ceased.	Quarry Manager	Preparation Phase	Closure Phase

Air pollution / Dust nuisance	Moderate Negative	Use of wet process in crushing and screening process at Crushing Plant.	Quarry Manager	Preparation Phase	Closure of Quarry
		Provision of protective wear to workers such as overalls, goggles, safety boots, hard hats and dust masks.			
		Water spraying on roadways and stockpile areas at least twice per day.			
Noise nuisance / Safety	Low negative	Warn residents of surrounding areas before blasting.	Quarry Manager	Preparation Phase	Closure of Quarry
		Blasting will be carried out between 08-17hrs and limited to cautious blasting with lighter explosives.			
		Provide safety tips to workers.			
		Provision of appropriate protective wear to workers within vicinity of strong noise areas such as crusher plant.			
Local Employment	Very High Positive	Ensure that non-skilled jobs were given to members of the local community.	Developer	Preparation Phase	Closure Phase
		Ensure that wages and salaries are competitive.			
Corporate Social Responsibility (CSR)	Very High Positive	Some materials will be used to repair and construct roads that will be used by the general public in Kafue District and other parts of Lusaka Province.	Developer	Optional Phase	Closure Phase
Public Safety	Medium Negative	The company conduct public sensitization on the dangers of trespassing into the Quarrying area through public meeting, and warning signs.	Quarry Manager	Preparation Phase	Closure Phase
Quarry Pit wall stability	Medium Negative	Storm water and erosion management measures will include the construction of diversion channels around the perimeter of the pit and profiling of roadways to re-direct storm water run-off away from the pit and slopes.	Quarry Manager	Preparation Phase	Closure Phase

3.6.1 QUARRY PIT

Operational Phase

Surface Water/Groundwater

Storm water will be collected in sedimentation ponds prior to release into the drainage system of the area. Sedimentation of the water prior to releasing area drainage system will help to check siltation.

The dewatering of the pit will lower the groundwater level in the vicinity of the quarry pit. However, there is no borehole for portable water within a radius of 200m of the pit. As such dewatering of the pit is not expected to affect the deep groundwater used for portable water in the mining licence area. The production borehole will however be monitored regularly in terms of water levels and if necessary, an alternative clean water supply will be provided.

Pit Stability

Storm water and erosion management measures will include the construction of channels around the parameter of the Quarry Pity and profiling of the roadways to re-direct storm water run-off away from the pit and slopes. Sedimentation ponds will be constructed at the bottom of the pit to manage siltation in slope run-off. The pit will be de-watered and de-silted to prevent the accumulation of silt and water, and to ensure the security of the quarry pit and safety of miners. These measures will minimise the risk of pit wall failure and prevent flooding.

Public Safety

Unauthorised persons will be informed of the dangers of the dangers of entering into areas of quarrying / mining operations through public consultation, liaison with surrounding local communities and placement of warning signs. Company security officers will patrol and check for all possible trespassers.

Post-Closure Phase

Surface Water/Groundwater

Pit de-watering will cease at the end of the project at which time the quarry pit will be allowed to flood naturally by groundwater inflow and direct precipitation. This will create a new surface water resource for the surrounding area that could be used for sustainable land uses such as fishing.

The water in the pit will be monitored as part of the 5 years post closure environmental monitoring programme to ensure that there is no deterioration in groundwater quality that could affect its post closure use.

Pit Wall Stability

Final pit walls will be designed with adequate safety factors to ensure long-term pit stability. The pit parameter will be profiled to prevent surface run-off flowing into the pit or saturating the pit walls. Pit wall stability will be monitored as part of the project's post closure environmental monitoring programme.

Public Safety

Warning signs will be placed around the pit perimeter and on approaches to warn the public of the danger of falling into the pit and / or drowning.

3.6.2 CRUSHING PLANT
Operational Phase

Surface Water/Groundwater
The run-off water from the quarry dust and aggregate stockpiles will be collected in drains and directed to silt trap where the solids will settle out. Clean water will be discharged to the main drainage system of the area. The drains and silt trap will be regularly maintained and cleaned out.

Air Emissions, Noise and Vibration
The release of airborne dust from the crushing plant and stockpiles will be suppressed by regular spraying with water sprays and water carts. Water sprinkler systems will be installed in the Crushing Plant and at all bulk transfer points to suppress dust.

3.6.3 TRANSPORT INFRASTRUCTURE
Operational Phase

Accidental Spills / Releases
The contamination of soil, air and water /or water resulting from any spill will be minimized. The developer will implement procedures for the transport of hazardous materials to, from, in and around the project site. These procedures will include but not limited to:-

- Emergency response training for all employees;
- Use of designated transport routes only; and
- Vehicles road worthiness checks and implementation of a preventive maintenance programme.

Site transport infrastructure including roads, weigh bridges, and speed limit signs will be subject to a preventive maintenance programme to ensure that they are kept in a good condition. This will reduce the number of site road accidents / incidents.

Air Emissions
The generation of dust by heavy equipment and vehicles on site roadways will be prevented by frequent water spraying as well as observation of speed limits. Speed limit signs will be hang on all site roads.

Deterioration of Public roads due to heavy traffic
The usage of site access roads by heavy trucks travelling to and from the project area has the potential to cause damage to the roads both internal and outside.

To mitigate this impact, the developer will subject all loaded trucks to a weigh bridge that will be constructed in order to meet the Road s Development Agency (RDA) requirements.

3.6.4 WASTE MANAGEMENT

Operational Phase

Industrial Waste Generation

All the materials that will be generated will be sorted to facilitate re-use / recycling. Re-usable materials such as empty drums will be re-used, sold or given away to employees.

Medical Waste Generation

Medical Waste that will be generated from the site may cause contamination if not handled and disposed properly. All medical waste will be incinerated in an approved incinerator.

3.7 ENVIRONMENTAL MONITORING PLAN (EMoP)

The developer will implement an environmental monitoring programme within the proposed project area. The monitoring plan will include the following:-

- Air Emissions; and
- Quarry Pit Stability

3.7.1 Air Emissions

Air pollution will occur as a result of dust emissions from the blasting operations, crushing operations, movement of vehicles in the project area and dust blow off from various sources across the project area including the stock pile.

Dust Emission Monitoring

Dust levels will be monitored on a monthly basis within the entire project area and the obtained results will determine what mitigation measures to be implemented so as to comply with the Zambian Statutory dust emission limits.

In addition, ambient dust concentrations will be monitored in the entire project area to determine total suspended particles in air (statutory guideline is 120µg/m^3 - average over 24 hours).

Dust concentrations will be monitored using MSD approved monitoring equipment and personal gravimetric samplers worn by operators in critical areas like the crusher plant.

Besides, all employees will be subjected to routine pneumoconiosis examinations conducted by government approved institution.

3.7.2 Quarry Pit Stability

The pit will be monitored for storm water around it in order to prevent erosion and ultimately in-pit mud rush. The pit will be monitored and reviewed for pit slope stability on daily basis using visual means.

3.8 EMERGENCY RESPONSE PLAN (ERP)

The developer will develop an emergency response plan which will outline emergency measures to be undertaken in the event of an accident / incidence. The emergence response plan will detail:-

- Immediate actions to be undertaken;

- Evacuation and / or containment measures; and
- Contact details for persons responsible for implementing emergency measures as well as contact details of relevant authorities such as MSD and ECZ.

The emergency response measures will be communicated to all relevant employees and the measures will be posted at strategic working areas within the quarry site. In addition, a safety and environmental induction will be carried out for new employees. The safety induction will cover; the use of personal protective devices, dangerous areas, appropriated conduct, emergency response procedures and waste management.

3.9 SITE DECOMMISSIONING AND REHABILITATION

The developer will put in place a progressive site reclamation plan. The plan will focus on the reclamation of the Quarry Pit, Crushing Plant, Explosive magazine area, and other disturbed areas within the project area at closure. The main objective of the plan shall be:-

- To return disturbed lands to conditions capable of supporting the former land use and where this is not feasible or practical, the alternative sustainable land use; and
- To prevent potential significant adverse effects on water sources.

3.9.1 Site Reclamation Plan

Quarry Pit

It is not known how large the quarry pit will be at closure of operations. Pit dewatering will however cease and the pit will be left to flood. The potential post closure sustainable uses of the pit will include irrigation for agriculture and fish farming or aquaculture.

Final pit slopes will be checked for long term stability. Danger signs will be posted around the pit and a boom placed across the access ramp to discourage entry.

Crushing Plant

The following plant dismantling and disposal will be applied to the crushing plant at closure of operations:-

- Breaking out and removal of all concrete foundations;
- Dig up and removal of all electrical cables;
- Dismantling of the mobile crusher;
- Removal of all mechanical equipments;
- General site cleanup;
- Site leveling and reprofiling to establish natural drainage patterns across the site; and
- Re-vegetation of the site with indigenous trees and grasses.

3.10 RECLAMATION COSTS

The following costs have been estimated to carry out site reclamation works.

3.10.1 Site Reclamation Costs

The site reclamation works will be associated with the activities highlighted, and related costs in USD.

Decommissioning of Crushing Plant

The estimated dismantling and disposal costs for this component has been estimated to be USD 7,500/ha. The component is expected to cover an area of about 0.5ha. The estimated dismantling and disposal cost is therefore USD 3,750.

Quarry Pit

The post closure uses of the pit are to rehabilitate it progressively and turn it into a fish farm or aquaculture. An estimated amount of USD 4,000 has been included for the rehabilitation of the pit at closure. Progressive rehabilitation of the pit will be on-going during operations.

General Site Clean up

A sum of USD 5,000 has been included for the general site cleanup of the entire area and the erection of warning signs around the pit.

3.10.2 Total Site Reclamation Cost Estimates

The total closure estimates for Lu Hang Stone Mining Company Limited is USD 12,750 as indicated in Table 3.10.2 (1).

Item No.	Description	Closure Costs (USD)
1.	Decommissioning of Crusher Plant	3,000
2.	Quarry Pit	4,000
3.	General Site Clean up	5,000
TOTAL RECLAMATION COST		**12,000**

Lu Hang Stone Mining Company Limited is therefore committed to comply with the conditions of approval within the first year of operation.