GUIDELINE FOR LEASING MINES

For implementation till the MM Bill is enacted and MMMR is revised

AUGUST 12, 2019 12/9/19

DEPARTMENT OF GEOLOGY AND MINES
Ministry of Economic Affairs

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Introduction

The guideline for leasing mines is prepared in line with the provisions of the Mineral Development Policy 2017, Mines and Minerals Management Act 1995 and the Mines and Minerals Management Regulations 2002. The guideline is adopted to streamline and fast track the mine leasing processes in line with international best practices. The guideline shall delineate the role of Mineral Development Division, Mining Division and the Geological Survey Division in the mine leasing process. The lease of mines shall be carried out stringently in line with this guideline.

Eligibility

As per section 17 of the MMMA, "any individual or organization may apply for a mining lease to the head of the department". The applicant, however, shall fulfill the following eligibility requirements:

1. The applicant shall be a Bhutanese individual, licensed firm or a company (Section 13 of the MMMR 2002) and shall produce a valid security clearance and the most recent tax clearance certificate.
2. An individual, licensed firm or a company shall be eligible to obtain only two mining lease at any given instance (Section 17 of the MMMR 2002) and therefore an application for the lease of third mine shall not be entertained. Further, application in the name of relatives, company employees and any other person shall be a breach of law and considered a fraud.
3. The applicant has operated the earlier mining leases satisfactorily (Section 23.2 of the MMMR 2002) and rated average and above in the performance evaluation of the mine operated (section 73.3 of the MMMR 2002).
4. The applicant should not have been disqualified to apply for a mining lease (section 21 (iii) of the MMMA 1995) by the Department or a court of law.
5. The applicant has adequate financial resources, technical competence and experience to carry out the mining operations effectively (section 21 (ii) of the MMMA 1995):
   i. Financial Eligibility – Produce a bank statement or a bank guarantee of the applicable amount based on mine class (Annexure III).
   ii. Technical Manpower – Submit the list of technical manpower to be employed as required in the MMMR 2002 and defined based on mine class (Annexure III).
   iii. The work order for operation of mine shall be issued after employment of required technical manpower under 5(ii).

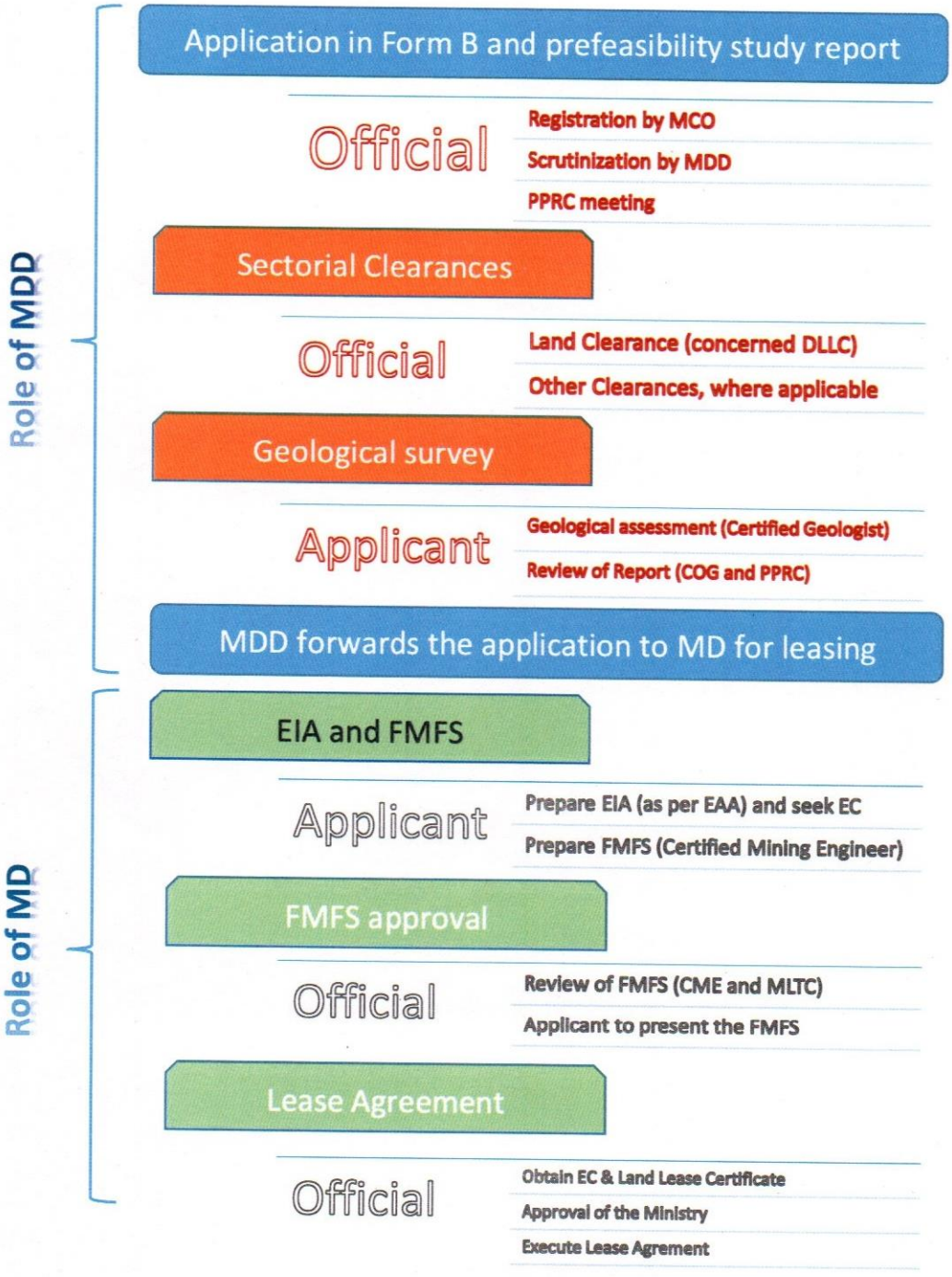
Lease processing

STEP 1: Submission of application for the lease of mine

Application for the lease of a mine shall be made in Form B of annex 1 of the Mines and Minerals Management Regulations 2002 (MMMR 2002). The Form shall be filled in accordance to the "guide to fill Form B" (Annexure I). The application shall be accompanied by a prefeasibility study

report prepared by a professional Mining Engineer and geologist certified for carrying out such activity by the Department. In the case of minerals which are technically viable for value addition, a conceptual plan for industry development shall be required to be submitted to enable lease as captive mine.

Flowchart for the lease of mines



The description on the geology of the area shall be carried out by a professional geologist certified by the Department. The prefeasibility study shall be carried out as per the standard requirement

provided (Annexure II). The applicant shall also submit the list of active mines and application under process in his name.

1.1. The application for the lease of mine shall be submitted in person to the Mineral Cadastre Officer under Mineral Development Division (MDD) of the Department and the person shall countersign the register authenticating the submission of the application. In the case of company, an authorized officer may deliver the application. Only complete application shall be received and registered.

1.2. The application shall be acknowledged in writing by the Mineral Cadastre Officer and an application identification number shall be designated against the application which shall be used as a reference throughout the lease processes and mining tenure. The application identification number shall be unique, in sequential order and non-repeatable.

1.3. The registered application shall be submitted to the Head of the Department for review and then forward to the MDD for processing.

1.4. The register for recording the application shall be closed at the end of every day countersigned by the Mineral Cadastre Officer and the Head of the Mineral Development Division.

STEP 2: Scrutinization of application

Application for the lease of mine shall be entertained to only qualified applicant and the qualification shall be stringently verified to ensure responsible, scientific and environmentally cautious mining operation in the country. The MDD shall study the application and scrutinize in line with the requirement under MMMA 1995 and MMMR 2002 based on the eligibility requirements spelled out under eligibility above.

The Prefeasibility study report shall be scrutinized with reference to the standard requirement provided (Annexure II). A Mining Engineer and a geologist (if need to validate the report submitted) of the Department may visit the proposed site to validate the prefeasibility study report submitted. All expenses (travel and DSA of the officials) incurred in the site visit shall be borne by the applicant. A Mining Engineer and the geologist shall submit the verification report to the Head of the MDD.

The MDD may directly reject the application in writing under the following cases:

2.1. If the documents are incomplete;
2.2. If the applicant has more than 2 mines/applications in hand;
2.3. If the prefeasibility report is substandard and is not in line with the requirements or if it is not carried out by certified professionals;
2.4. If there is evidence of fraud practices, mis-declaration; and
2.5. Any other reason required by the MMMA 1995 and the MMMR 2002.

The written letter shall indicate the reason for rejection.

STEP 3: Committee meeting

The MDD shall organize a Project Proposal Review Committee (PPRC) meeting to discuss the application. The MDD shall present the application and the proposed site, and explain the prefeasibility report submitted by the applicant along with the site validation report, if applicable.

The PPRC shall review and accord in principle approval to further process the lease of mine if everything is observed to be in order and the proposed site is feasible for mining.

For those application accorded in principle approval to further process the lease of quarry, the Head of the Department shall write to the concerned Dzongkhag Land Leasing Committee seeking Land Lease Certificate. The Head of the Department shall also seek other clearances considered required by the PPRC.

For those application not accorded in principle approval to further process the lease of quarry, the MDD shall issue a regret letter in writing and copy the Head of the Department.

If the mineral applied befits the definition of strategic mineral in the MDP, the department shall not accept application for lease of such minerals till the MM Bill is enacted and the MMMR is revised.

STEP 4: Sectorial Clearances

The concerned DLLC shall process the Land Lease Certificate as per the requirement under chapter 5 of the Land Lease Rules and Regulations 2018. The required public consultation shall be carried out as per the approved Public Consultation Guidelines and shall record the meeting in the form of minutes with signature of attendees. The proposed mine shall be demarcated during the field verification by the DLLC involving a Mining Engineer from the DGM to guide the area requirement.

The National Land Commission Secretariat shall accord Preliminary Approval to the DGM. The concerned agency may issue relevant clearance sought to the DGM.

The MDD shall process the lease by skipping STEP 5 if an application has been approved for mining resulting from detailed geological exploration.

STEP 5: Geological assessment

The MDD shall communicate to the applicant to carry out detailed geological assessment of the proposed site. The geological mapping shall be carried out by a professional geologist certified by the DGM and shall prepare the report as per the requirement (annexure IV). The applicant shall submit the geological report to the Head of the MDD.

The MDD shall request the GSD to review the geological report. A geologist under the GSD shall review the report as per the approved Standards for detail Geological Assessment and ToR of Committee of Geologist (CoG) and present the findings to the CoG. The geologist may visit the site for verification, if necessary. Accordingly, the CoG shall approve or reject the report and forward a copy of the report to the Head of MDD. All decisions taken by the CoG shall be recorded in writing.

STEP 6: Forward to Mining Division to issue mining lease

For those deposit recommended for leasing, the MDD shall issue an interoffice memo to the Mining Division to further process the lease and execute the mining lease agreement.

STEP 7: Final Mine Feasibility Study and Environmental Clearance

The Mining Division shall ask the applicant to prepare and submit a Final Mine Feasibility Study (FMFS) and TOR for the Environmental Impact Assessment (EIA) of the proposed mine. The FMFS shall be carried out by a professional Mining Engineer certified by the DGM. The FMFS report shall be prepared as required in Annex 2 of the MMMR 2002.

The Mining Division shall forward the TOR to the NECS for approval and ask the applicant to undertake EIA of the proposed mine as per the approved TOR.

The applicant shall submit the FMFS to the Mining Division of the Department. A mining engineer under the Mining Division shall review the report upon visiting the site and present the findings to the CoME for review and accord in principle approval. A copy of the FMFS report shall be submitted to the National Environment Commission Secretariat and seek Environmental Clearance.

Upon receipt of the Environmental Clearance, the Mining Division shall schedule Mines Leasing Technical Committee meeting to approve the FMFS report. The Mining Engineer who prepared the FMFS report shall be asked to present the report to the MLTC. The Committee of Mining Engineers shall supplement the presentation based on their findings.

STEP 8: Land Lease Certificate

The Mining Division shall forward a copy of the Environmental Clearance and the FMFS approval letter to the National Land Commission Secretariat (NLCS) and request for issuance of Land Lease Certificate (LLC).

The NLCS shall issue LLC to the applicant through the concerned Dzongkhag.

STEP 9: Lease Agreement

The Department shall seek approval from the Ministry for lease of the mine (section 10 of the MMMA 1995).

Upon approval, the Department shall execute Mining Lease Agreement with the applicant as per the format prescribed under Form E of Annex 1 of MMMR 2002.

STEP 10: Commission of Mining

10.1. The Department shall open a joint account with the Bank of Bhutan, Thimphu to deposit the Environmental Restoration Bond (ERB) and the Lessee shall deposit the upfront payment as per the Mining Lease Agreement.

10.2. The Lessee shall fulfill the following requirements prior to operation of the mine:
10.2.1. produce evidence of the upfront ERB payment;

10.2.2. produce a Trade License from the Regional Trade and Industry Office and submit the TPN number; and

10.2.3. notify the Department on the employment of the required technical manpower.

10.3. The Mining Division shall issue work order for commissioning of mining operation.

Area Extension

The Lessee shall apply to the Mineral Cadastre Officer of the MDD for any extension of area contiguous to the approved boundary. The application shall be accompanied by a prefeasibility study report carried out by a professional Mining Engineer and geologist certified for carrying out such activity by the Department or an accredited firm employing the certified professionals.

The MDD shall process the application following all the steps discussed above.

Renewal of Mining Lease

An application for renewal of a mining rights shall be made to the Mineral Cadastre Officer of the MDD at least one year prior to expiry of the lease in Form J of Annex 1 of MMMR 2002 along with geological reassessment and mining operation report to further extract the mineral prepared by a certified mining engineer and a geologist or an accredited firm employing the certified professionals. The renewal of the mining lease shall be subject to feasibility and the outcome of the Performance Evaluation report of the mine required under section 73.1 and 73.2 of MMMR 2002.

The MDD shall scrutinize the application and convene a PPRC meeting for approval to further process the lease. The rejection of lease renewal in whole or in part of the area applied for shall be communicated in writing stating the decision of the PPRC.

For those proposals accorded approval to further process, the Department shall write to the Dzongkhag Land Lease Committee of the concerned Dzongkhag for the renewal of the Land Lease Certificate in line with the Land Lease Rules and Regulations. The rest of the requirements shall be processed as per the steps for the lease of mine discussed above.

Annexures

Annexure I: Guide to fill Form B

Annexure II: Standards for prefeasibility study

Annexure III: Eligibility requirements for the lease of mines (technical and financial)

Annexure IV: Standards of geological assessment of mineral deposit for mining

Annexure I: Guide to Fill Form B

For Official Use			
DGM		Application No:	
Other:		Date received:	
Other		Responsible Officer:	

Guide to fill
Form B: Application for Mining Lease (Section 20)

PARTICULARS OF APPLICANT			
Name of applicant:	**Individual, Firm or a Company** (Application by multiple investors (shareholding) and registered mining company is encouraged)		
Postal Address:	**Proper postal address (inform the department on any change in postal address subsequently)**		
Telephone number:	**Fixed and or Mobile No.**	**Fax number:**	**Provide (if available)**
		e-mail address:	**Mandatory**

SHORT DESCRIPTION OF THE PROPOSED MINING ACTIVITY	
Type of Mineral and products for selling	Mention the mineral(s) and the products after beneficiation processes. Indicate if the applicant intends to come up mineral based industry (submit standard conceptual industrial proposal plan)
Production Capacity	Lay down the approximate annual production capacity of the mine. Mention the proposed size of the mine (large, medium of small) in this section.
Period of Lease requested	Provide the proposed lease period (should not be more than the life of mine calculated based on the estimated reserve and annual production target)
Market for the product	The proposal should indicate the intended market to sell the product(s). Market should be specific and not just mentioning the name of Dzongkhags.
Socio-economic benefits	Benefit sharing is an important policy objective. Project the realistic benefit sharing amongst community and nation, including intended CSR activities.
Investment required	Project the approximate investment required derived from the PFS report.
Financing sources	Provide evidence of the source of funding required based on mine class – Bank statement or bank guarantee.
Technical Competence and Experience	The technical competence must be specified based on the proposed mine class and in line with the requirements under Chapter 8 of the MMMR, 2002. Provide evidence of the past performance, where relevant.
Current Land Use in the proposed area	Mention if the site falls under private or government reserved forest land or under any protected areas.
Workforce requirement and recruitment	Mention the workforce requirement based on the mine class. Attach the list of existing employee or an organogram of the company.

LOCATION OF PROPOSED MINING ACTIVITY (all fields are mandatory)			
Village:	**Specific location and Village**	**Gewog:**	
Dzongkhag:			
Geographical Co-ordinates:	**Geographical coordinates of the centre of the proposed mining area**		

DECLARATION
I hereby declare that I am fully aware of my responsibilities in terms of the Mines and Minerals Management Act, 1995 and that failure to comply fully may constitute an offence in terms of the said Acts.

SIGNATURE		
	Applicant	**Witness**
Signature:	**(Original applicant or an authorized representative of the company/firm with authorization letter). Affix legal stamp**	**Witness cannot be relatives of the applicant with CID No. Affix legal stamp**
Date:		
Place:		

Annexure I: Guide to Fill Form B

Appendices forwarded with the Application:

Note: Indicate appendix numbers (e.g. A, B, C, etc.) with a tick (√) mark if enclosed;

Location map in scale of 1:50,000 (preferably 1:10,000 scale) **A**
(showing land-use and infrastructure in and around the proposed mining area and 1 KM zone around it on a google map)

Endorsement on use of land from land owner **B**
- In case of the proposed site being in the private land, provide evidence of the written consent obtained from the private landowner.

Copy of the project promoter's Citizenship Card **C**

A list of all other businesses owned in part of in whole **D**

Copy of any other business/industrial license held **E**
- Required as evidence of the businesses owned

Mineral Deposit Assessment Report (if available) **F**
- Prospecting and Exploration report

Organisation structure of the company **G**

Others:
- Any other documents or evidences to support the application and eligibility of the applicant.

Standards for prefeasibility study

1. Introduction

The standards for the Prefeasibility Study (PFS) is established to facilitate uniform assessment of the intended mining site by the professionals before lodging the application for mining to the Department. The PFS will provide an analytical information on the technical, environmental and socio-economic viability of the intended site for mining that can enable the Department to make decision. The PFS report should be able to provide confidence to the applicant to invest on the site for a viable and profitable mining business.

2. Requirement in the Prefeasibility Study Report

The PFS conduct and the report shall contain information including but not limited to the following:

a. Applicant's details

i. Name of the applicant or firm, mention if it is a registered company
ii. Valid postal address
iii. Contact details and email address

b. Salient features

i. A brief summary of the intended mining site
- Location of the proposed mine (Name of the area, Village, Gewog and Dzongkhag).
- Land use type
- The geo-coordinates of the proposed mine.

ii. Local community

The report shall contain brief description of the local community and their primary economic activities and livelihood. It shall also mention the number of households and land use type within 500 m radius from the periphery of the proposed site and along the access road construction. The report shall also mention any spiritual or culturally important heritages and areas that are likely to be affected by the operation of mine and transportation of minerals.

iii. Market analysis
- Size and specification of the market
  a. Projection for local demand
  b. Potential for export
  c. Opportunity for import substitution
  d. Potential for value addition etc.
- Number of other mines within 5 km radius

iv. Expected socio-economic benefits
- Local benefit
  a. Employment
  b. Business opportunity
  c. Raw material
  d. Infrastructure
  e. Projected CSR etc.
- National benefit

a. Projected revenue
b. Value addition and the benefit
c. Projected employment number in the mine as well as in the mineral based industry
d. Other benefit to the nation.

- Any other

v. If the proposed mine is applied as captive, a conceptual plan for the intended mineral based industry shall accompany the report.

c. Project feasibility parameters

i. Description of the landscape

- Topography and gradient of the slope
- Mineability of the site
- Direction of terrain
- Perineal river or stream and its orientation and location with respect to the proposed site.

ii. Area requirement and availability

The report shall contain the following area requirement and availability:

- Mining area
- Overburden dump yard
- Office space
- Labour camps
- Stockyard
- Beneficiation plants
- Any other

d. Surroundings of the project site

i. Information on infrastructures and structures

- National Highway
- Secondary Highway
- Feeder/farm road
- Telecommunication/Transmission towers
- Irrigational channels
- Drinking water source
- Public infrastructures
- Cultural sites, schools, health facilities etc.

ii. Information on environment

- Climatic condition
- Vegetation and presence of wildlife (flora and fauna) in the area, mention if it is a habitat of any endangered species
- Presence of waterbodies, their orientation and type
- Drainage system: Details on the drainage (major, minor and seasonal) and its usage.
- Does it fall within protected area or FMU or a Community Forest?
- Describe the likely impact on the environment and the possible mitigation measures

e. Regional Geology

The report shall contain description on the regional geology of the intended site.

f. Geology and mineralisation of the proposed site

The report shall provide where relevant, the geological information based on physical examination of the deposit including but not limited to:

i. Lithological description such as colour, texture, mineralogy, degree of weathering, mode of occurrence, specific gravity, and name of the target rock;
ii. Mineralogical description such as colour, lustre, forms and shape, cleavage, hardness, fracture, magnetism, tenacity, streak, specific gravity etc. of the target mineral;
iii. Geological structures such as bedding, foliation, folds, faults, joints, unconformities with collection of structural data such as strike and dip of bedding or foliation; bedding thickness, foliation spacing; strike and dip of joint sets; spacing of joint sets etc.;
iv. Approximate reserve of the targeted mineral (geology and mineable reserve);
v. Representative chip/grab samples and their lab analytical results, where necessary;
vi. Geological map prepared on topographic map scale of 1:50000 or larger or google image showing the target rock types or mineral bands, underlying and overlying rock types; host rock of mineralization, and sample locations;
vii. Stability of the land in and around the periphery based on the topographic and landslides information collected and observations made under f. i, f. ii. and f. iii.; and
viii. Any other related information.

g. Mining methodology

The report shall briefly describe, but not limited to:

i. Proposed method of mining for extracting the intended mineral
ii. Annual production target
iii. Transportation and machineries to be used
iv. Quantity and type of overburden
v. Access road construction and cost
vi. Topsoil preservation and waste dump sites

h. Preliminary Impact Assessment

The report may briefly describe the likely significant impact and the mitigation measures to be adopted:

i. Maps

The report shall contain the following maps:

i. Map showing the intended mining site boundary and the surrounding areas (min of 1 km radius) showing all important features. Soft copy of the kmz file of the mine showing all the mine features.
ii. Map showing the access road alignment and all important mining features such as office space, labour camp, beneficiation plant, waste dump sites, workshop, magazine etc.

j. Conclusion and Recommendation

The conclusion of the report shall also include the recommendation for mining or not.

k. Name of Mining Engineer and Geologist

Provide the name of professional Mining Engineer and the Geologist engaged in the PFS and report writing. The report shall be duly signed by the professionals to authenticate their study and role.

l. Declaration

Both the applicant and the professionals preparing the report shall declare that the information provided are true and are liable for penalties if found otherwise in accordance to the MMMA 1995.

Annexure III: Eligibility requirement for the lease of mines

Eligibility requirements for the lease of mines (technical and financial)

Mining is a capital intensive activity and requires technical knowledge to operate profitably and professionally. The mining activity involves many different activities in addition to much more than excavation of minerals and selling. The miners should know what, where and how to excavate and this involves understanding the geology and accordingly planning to extract it profitably and cautiously.

To build professionalism, the Department shall entertain mining to only those who have the capacity to mine. For that, the application for the lease of a mine shall include declaration of financial capacity and requirement of a set of technical manpower for the proposed mine as part of the eligibility requirement. The set of technical manpower requirement shall be made available after executing the mining lease agreement and before the start of mining operation, and the same shall be authenticated in writing to the Department.

For the purpose of determining the technical and manpower requirement, mines shall be classified as under:

i. Large Mine: A mine employing over 100 persons or having more than 50 numbers of heavy earth moving machineries such as loaders, dumpers, drill machines, excavators etc.
ii. Medium Mine: A mine employing 40-99 persons or having more than 25-49 numbers of heavy earth moving machineries such as loaders, dumpers, drill machines, excavators etc.
iii. Small Mine: A mine employing over less than 40 persons or having less than 25 numbers of heavy earth moving machineries such as loaders, dumpers, drill machines, excavators etc.

Depending on the mine class, the minimum technical manpower and financial requirements shall be as provided in the tables below:

Technical Manpower:

Criteria	Technical Manpower Requirements		
	Large Mine	**Medium Mine**	**Small Mine**
Manager	1. Qualification: - Minimum of Bachelor's Degree in Mining Engineering with two years of work experience in a mine; 2. Requirement: - One mines/ production manager - One marketing manager - One	1. Qualification: - Diploma in mining engineering with one year of work experience; or - Minimum of Class XII with five years of work experience; or - Certificate holder in mining/related subject from DGM or other recognized institutions 2. Requirement: - One mines/production manager	1. Qualification - Minimum of Class XII with 2 years work experience in mining; or - Certificate course in mining/related subject from DGM or other recognized institutions 2. Requirement: - One mines/production manager

Annexure III: Eligibility requirement for the lease of mines

Mining Engineer (Minimum of Bachelor's Degree in Mining Engineering)	Requirement: The manager shall fulfill the basic requirement	Requirement: A minimum of one Mining Engineer working on part time and visiting the site at least *twice* a month	Requirement: One Mining Engineer working on part time and visiting the site at least *once* a month
Foreman/Supervisor (Certified or trained by DGM)	Requirement: A minimum of three	Requirement: A minimum of one	Requirement: A minimum of one
Blaster (Certified under Explosives Regulations)	Requirement: A minimum of one Blaster and one assistant	Requirement: One Blaster	Requirement: One Blaster

Apart from the above mentioned basic manpower requirements, the Department may subject the mine to other professional requirements based on complication and type of mining.

Financial Requirements:

Requirement	**A Minimum Financial Requirements**		
	Large Quarry	**Medium Quarry**	**Small Quarry**
Evidence of access to financial resources	Nu. 20 million or equivalent	Nu. 10 million or equivalent	Nu. 2.5 million or equivalent

The financial eligibility shall be established during the application stage and shall be one of the basis to qualify the applicant.

Standards for geological assessment of mineral deposit for mining

The mineral and rock resources form an important input for economic growth and construction industry in the country. The abundance and grade of the mineral is critical to time, cost, suitability and sustainability of the mineral based industry and infrastructural development. In exercise of the power conferred by Section 15 of the MMMA 1995 and in line with the Economic Development Policy 2016 and Mineral Development Policy 2017, the DGM is establishing standards for geological assessment of mineral deposit for mining to guide and ensure standard approach for conducting such activities.

The standards shall provide the requirements and specifications to carry out detailed geological assessment of mineral deposits that can ascertain the reserve and grade of the deposit and facilitate decision making for mining business. The so produced geological assessment report shall also facilitate preparation of mine plan for extraction of the mineral. Therefore, a well-planned and managed geological assessment of the mineral deposit with high confidence level of geological knowledge is imperative to determine the economic feasibility and profitability of the mine.

1. Standards of Detailed Geological Assessment

Detailed geological assessment involves the three-dimensional delineation of a known deposit. The size, shape, structure, grade, and other characteristics of the deposit will have to be established with high degree of accuracy. The reserve (Quantity) and grade (quality) of the mineral deposit shall be estimated using acceptable geological methods and extrapolation. The estimation of reserve and grade of the mineral deposit should be done in conjunction with interpretation of geological and chemical or geotechnical laboratory results.

The following requirements, specifications and standards of detailed geological assessment should be fulfilled for approval of the geological reports and maps by the DGM:

1.1. Topographical Surveying

Topographical surveying forms a key part of geological assessment of mineral deposits for generating base information. The following standards shall be followed while conducting the topographical survey:

a. Topographical survey shall be carried out by a professional or certified surveyor or survey engineer.

b. The topographical survey must be carried out using appropriate technology and instrument, serving accurate base map and data for geological maps and cross sections. Modern technology or equipment such as Total Station, LiDAR, GNSS, Remote Sensing etc. are recommended for use.

c. Topographical survey must be carried out on a scale of 1:500 to 1:5000 (depending on the area of the proposed site and the type of mineral/rock of interest) giving moderately precise (x,y,z) coordinates of the locations. The contour interval shall range between 0.5 to 5m.

d. The topographical survey or any kind of data collection must be carried out using National Coordinate Reference System (DRUKREF-03), selecting the correct projection system and datum for the area.

e. For map production and construction of cross sections, state of the art technology in data input, GIS and other relevant software are recommended. However, for digital data processing techniques, CAD-CAM software is recommended.

f. The GIS layers shall contain required attributes with proper field names and standards.

g. The topographical map may feature areas beyond the mining demarcation boundary to facilitate interpretation of the geology and topography.

h. The final maps should contain, inset of location map, scale, orientation, grid, coordinate reference system, legend with standardized symbols, line works, information of the mapper and lettering in legible size.

i. Base Map/Fundamental Datasets may include but not limited to the following layers/features:

- Contour
- Drainage
- Infrastructures
- Land Use

1.2. Geological Mapping

The following are the standards for geological mapping:

a. Geological mapping must be carried out by a certified geologist.

b. The geological mapping must be carried out on 1:500 to 1:5000 scale (depending on the area of the proposed site and type of the mineral/rock of interest) using topographic survey data and geological tools.

c. Location of data may be collected using Total Station, RTK GPS and other sub-cm accuracy instruments in Drukref 03 coordinate reference system.

d. The quantity and quality of the data must be collected and maintained based on the scale of mapping and purpose.

1.3. Sampling

a. The sampling must be carried out by a professional or certified geologist or under the guidance of the geologist.

b. Depending on the purpose and scope of work, an appropriate sampling method must be used. For industrial and metallic mineral assessment, the recommended sampling method are groove, channel or core sampling and for construction materials (stone and aggregates) gridded grab sampling is recommended.

c. The samples collected shall be used for the purpose of chemical or geotechnical analysis only.

i. The sample collected shall meet the following requirements:

- appropriate spacing (between 5 and 50 meters) based on the scale of mapping;
- be representative of the area of interest;
- free of weathering and contamination;
- recorded with geo-coordinates;
- packed properly with proper labeling;
- in appropriate size weighing 1-2 kg for petrological or mineralogical studies and chemical tests for non-metallic minerals, 5-10 kg for metallic minerals, and 3-5 kg for geotechnical tests;

1.4. Pitting and Trenching

1.4.1. Pitting

a. Pitting, if required, shall be carried out under the guidance of professional or certified geologist.

b. In pitting, the number and spacing of the pits may be determined by the geologist depending on the topography and mineral/rock occurrence. The spacing of the pits may range from 5-50m.

c. Pitting may be carried out by excavating about 1 X 1 m^2 or 0.5 m radius using handheld tools only.

d. The depth of the pits may vary depending on the extent of weathering and location of mineral/rock of interest.

e. The pitting may be carried out in a systematic manner, preferably in grid system.

f. The representative material recovered from every meter of pit is stacked separately to collect samples for analysis to determine the variations across the mineralization.

g. The mucks/waste excavated from the pits must be dumped properly on a stable ground for use to backfill the pits upon completion of the work.

h. The pits must be backfilled after completion of the work.

1.4.2. Trenching

a. Trenching, if required, must be carried out under the guidance of professional or certified geologist.

b. Systematic trenching may be carried out by excavating appropriate dimensions.

c. The numbers and spacing of the trenches may differ depending on the topography and mineral/rock occurrence. The spacing may range from 5 - 50m.

d. The representative material recovered from each meter of trench is stacked separately to collect samples for analysis to determine the variations across the mineralization.

e. The mucks/waste excavated from the trenches must be dumped properly on a stable ground for use to backfill the trenches upon completion of the work.

f. The trenches must be backfilled after completion of the work.

1.4.3. Drilling

a. Drilling, if required, must be carried out under the recommendation or guidance of professional or certified geologist and must be performed by professional drilling engineer or technician.

b. Diamond rotary drilling or other drilling methods may be used.

c. The spacing, depth and orientation of the boreholes may be determined by the geologist concerned depending on the type and nature of the mineral deposit and topography of the area.

d. All borehole locations must be indicated on a geological map and cross sections with proper geo-coordinates.

1.5. Petrological and Mineralogical Studies, Laboratory Analysis

a. The standard sample preparation for thin section analysis must be ensured.

b. Thin section analysis may be carried out using appropriate equipment such as Petrological Microscope, Scanning Electron Microscopy (SEM) and Wavelength Dispersive Spectroscopy (WDS) depending on the type of mineral/rock and purpose of study.

c. Samples collected must be tested or analyzed in a standard licensed firm or certified laboratory.

d. The parameters, radicals or elements to be determined will depend on the type of mineral/rock and purpose. Samples for testing minerology shall be tested in chemical laboratory and for testing compatibility in the construction industry in geotechnical laboratory.

e. The methods used for the analysis of samples must be documented properly and justified.

f. The analyzed samples must be Quality Controlled and shall satisfy Quality Assurance. The samples tested outside the DGM laboratory shall be verified by the Head of the Chemical Laboratory and Head of the Engineering Geology Section, where relevant.

1.6. Reserve Estimation

a. The reserve of the mineral deposit must be estimated using appropriate method (e.g. cross-sectional, polygonal, geostatistical etc.) depending on the type and nature of topography and mineral/rock deposits.

b. The reserve estimation based on 3-D modeling and geo-statistical technique with use of standard software is highly recommended.

c. The estimated mineral reserve must be in "Proven" category providing high level of geological confidence.

d. The error of the estimated reserve should not exceed 20%.

e. The reserve estimate is based on detailed geological, chemical, and/or geophysical information.

1.7. Standards for Reports and Maps

The geological assessment report of a mineral/rock is a scientific report and should be written by a professional or certified geologist. The detailed geological assessment report must be submitted to DGM in following standards or format:

- Font size 14-16 for headings, 12 for others.
- Font style must be "Times New Roman".
- Paper size must be A4 for text and appropriate size (not less than A3) for maps and cross sections.
- PDF form and one hard copy.
- Units used must be in SI unit system.
- All pictures and photographs must be in colour with proper annotations.
- Proper captions for tables, figures, annexures, appendices etc.
- All the maps, cross sections, annexure, and appendix and other supporting documents must be enclosed with reports in proper sequence.

Cover page

The cover page design shall include the title, submission date (d/m/y), representative photo, company or firm logo (if relevant), name and address of the promoter and name, sign and seal of the author.

Abstract or Executive Summary

A brief description of background, purpose and objectives, study area, methodology, results, conclusion and recommendations shall be provided in not more than 350-700 words.

Table of Content

The table of content shall be provided with proper categorization of headings, page number and list of figures, tables, pictures, plates and annexure etc.

Introduction

Introduction part shall include: (1) Concise and appropriate background discussion of the problem and the significance, scope, and limits of your work; (2) clear aims, objectives or purpose of the study; (3) Detailed description on study area including locations, accessibility, topography, drainage, climate, flora and fauna; and (4) Outline any previous studies or works in the area by citing pertinent literature.

Regional Geological Setting

Brief description on regional geology using existing information.

Materials and Methods or Technique Applied

The report shall succinctly describe the methods or techniques used to come up with the findings or results. It shall include but not limited to the scale of mapping, sampling methods, analytical techniques with detection limits and name of laboratory, geophysical methods, statistical procedures, drilling methods, surveying methods, data analysis, software used, etc. to ensure replicability of the work.

Results

- Present your findings with respect to methods or techniques used. The findings may include but not limited to: Geology and Structures; Petrological or Mineralogical Studies; Laboratory results; and Geological Reserve.

- Present the digested and condensed data with important trends extracted and described. It is important that your findings be clearly and simply stated as the result comprise new knowledge on the study area. Provide a summarized data collected and their statistical treatment. Include only relevant data but give sufficient detail to justify your conclusions. Use equations, figures or pictures, tables and maps where necessary for clarity and brevity.

Maps, Models, Sample Logs, Annexures

- Maps, cross sections, models, core and sample logs etc. must be attached with the report at the end as plates and annexures and shall be properly numbered and cross referred in the body of the report.

- An appropriate number of cross-sections must be constructed for better understanding and 3D visualization of the tectonostratigraphic setting and enhancing the accuracy of the reserve estimation if cross-sectional method is used for reserve estimation.

- The maps and cross-sections shall contain all the elements of map such as north arrow, title, scale, legend, details of professionals, coordinate system and datum, orientation of the cross-section, detailed litho-structural and topographical data, location inset map; sample, trench, pit, drilling borehole lines or locations; contour interval and base map information etc.

- Any other raw data such as laboratory results must be attached at the end as Appendix and shall be properly numbered.

Discussions

- The purpose of the discussion is to interpret and compare the results. Be objective; point out the features and limitations of the work. Relate your results to current knowledge in the field and to your original purpose in undertaking the project: Have you resolved the problem? What exactly have you contributed? Briefly state the logical implications of your results. Suggest further study or applications if warranted. Present your results and discussion either as two separate Sections or as one combined Section if it is more logical to do so.

- In the context of geological reassessment report, interpretation must be carried out using geological principles or fundamentals, standard charts or diagrams or literature, specifications etc. and the discussions should help in decision making process in terms of taking up the mineral/rock occurrence or deposit for mining or not.

Conclusions and Recommendations

- Include summarized key findings or results.
- Key findings should be based on the evidence(s) presented in the report.

- Include key recommendations based on conclusion and evidence(s) presented in the report.

Acknowledgement

- Brief acknowledgement to individual and/or organization.

References

- The purpose of the reference is to increase the credibility of the report and to help readers find the literature easily.
- The references must be in **APA** Standard Referencing System.
- The reference list must be arranged in alphabetical order using the surname of the main author.
- In-text citation for all the references listed under this Section must be provided in the report.

1.8. Other Reporting Requirement

- DGM may request additional information on the received reports and the work accomplished.
- Survey or Field Raw Data must be submitted to Survey and GIS Section, Geological Survey Division of DGM for archival in the system maintained by DGM.
- All the digital data of GIS (in shapefile) and images (in JPEG or TIFF, GeoTIFF or PNG) shall be submitted to Survey and GIS Section, Geological Survey Division of DGM.
- The confidentiality of the reports and data submitted shall be maintained by DGM until an appropriate time for disclosure or sharing is determined.
- Confidential material may be disclosed or shared with the promoter's written consent. The promotor shall not without good reason withhold such consent.
- DGM may, without restrictions or conditions, make use (including publication) of reports or data that in the opinion of DGM is of public or national interest.
- Any discrepancy(s) that may arise such as the reserve or grade shall be the sole responsibility of the promoter or the consultant.