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A Mini Ratna Company

SCIENTIFIC REPLENISHMENT STUDY

FOR BAJRI/SAND MINE LEASES
IN
THE STATE OF RAJASTHAN

[Phase-I Report]

Job No. 091017026

December, 2017

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CHAPTER-I
Introduction

1. Sand Mining

Sand Mining is a process of the actual removal of sand from the foreshore including rivers, streams and lakes. Sand is mined from beaches and inland dunes and dredged from river bed. The sand is dug up, the valuable minerals are separated in water by using their different density, and the remaining ordinary sand is re-deposited. River sand is vital for human well-being and for sustenance of rivers. River sand is one of the world's most plentiful resources (perhaps as much as 20% of the Earth's crust is sand) and has the ability to replenish itself. As a resource, sand by definition is 'a loose, incoherent mass of mineral materials and is a product of natural processes. These processes are the disintegration of rocks and corals under the influence of weathering and abrasion.

Sand has become a very important mineral for society due to its many uses mainly in infrastructural activities. Sand and gravel have long been used as aggregate for construction of roads and buildings. Today, the demand for these materials continues to rise. In India, the main source of sand is from river flood plain sand mining, in-stream mining, coastal sand mining, paleo channel sand mining, and sand mining from agricultural fields.

River sand mining is a common practice as habitation concentrates along the rivers and the mining locations are preferred near the markets or along the transportation route, for reducing the transportation cost. River sand mining can damage private and public properties as well as aquatic habitats. Excessive removal of sand may significantly distort the natural equilibrium of a stream channel. The role of sand is very vital with regards to the protection of the coastal environment. It acts as a buffer against strong tidal waves and storm surges by reducing their impacts as they reach the shoreline. Sand is also a habitat for crustacean species and other related marine organisms.

1.1 Sand Mining in the State of Rajasthan

According to clause (e) of Section 3 of the Mines and Minerals (Development & Regulation) Act (MMDR) Act, 1957 and as per Rule 70 of the Mineral Conservation Rules (MCR), 1960; **sand is classified as minor mineral based on the end use**. Mines and Minerals (Development & Regulation) Act, 1957, under section 15, **empowers the State Government to make rules in respect of minor mineral**. Mining Leases for the mineral Bajri are granted as provided in Rajasthan Minor Mineral Concession (Amendments) Rules, 2012 notified vide Department Notification No. F.14 (1) Mines/ Gr. II/ 2011 dated 23-05-2012 *i.e.* RMMCR, 1986.

In exercise of the powers conferred by Section 15 of the Mines and Minerals (Development & Regulation) Act, 1957 (Central Act No. 67 of 1957), the State Government of Rajasthan made rules for regulating the grant of quarry license, mining lease and other mineral concessions in respect of minor minerals. As per the Notification of Government of Rajasthan dated 28 February, 2017, "Bajri" means weathered detritus consisting of graded particles of varying sizes obtained from

loose weathered rock material from the provenance, usually found in river beds or basins or paleo channels, also covers river sand.

The following provisions *interalia* for the mining of Bajri/sand is applicable that:

i. As per Rule 18 (Amended Rules, 2012) of RMMCR, 1986 clause 32 stipulates "*In case of mining lease of mineral Bajri, the lease/ leases shall abstain from mining beyond depth of 3.0 m from the surface and below the water in such a manner that natural path of river/ nallah is not altered*".

ii. As per notification no. F-14(1)Mines/Gr11/2012 dated 21 June, 2012 from Dy. Secretary to Government of Rajasthan clause 3 "*No person shall excavate Bajri beyond the depth of 3.0 m from the surface below the water level of river/nallah and within 45 m of any rail/ road bridge.*"

The value of particle size (d_{mm}) for various types of alluvial materials are described as under:

Table-1.1: Value of particle size (dmm) for various types of alluvial materials

Type of material	Sub-type	Average Grain size in mm
Silt	Very fine	0.05-0.08
	Fine	0.12
	Medium	0.16
	Standard	0.32
Sand	Medium	0.51
	Coarse	0.73
Bajri & Sand	Fine	0.89
	Medium	1.29
	Coarse	2.42
Gravel	Medium	7.28
	Heavy	26.10
Boulders	Small	50.10
	Medium	72.50
	Large	188.80

(*Source: Irrigation Engineering & Hydraulic Structures by S.K. Garg)*

1.2 Impact of Sand Mining

Bajri/sand mining has many positive impacts on the economy and on the quality of life of people. However, if extracted in excess amount beyond the replenishment rate, it has an adverse and destructive impact, on the river system, making it unsustainable. The impacts of sand mining are as under:

A. Positive Impacts

Sand deposition eventually leads to reduction in conveyance capacity of river leading to flood in rivers. Proper dredging of sand keeps the bed at the desired level. Thus if dredging is not done, due to continuous deposition of sand, the depth of river may get reduced. This will result in flooding of water and loss of properties. It also facilitates the navigation in the channel. Sand is the main fine aggregate in concrete. Riverbeds are major sources of clean sand. There is a change in traditional housing of people in India and sand has become one of the essential material for construction.

B. Negative Impacts

Taking into consideration the places of occurrences of the adverse environmental impacts of river sand mining, Kitetu and Rowan (1997) classified the impacts broadly into two categories namely off-site impacts and on-site impacts. The off-site impacts are, primarily, transport related, whereas, the on-site impacts are generally channel related. The on-site impacts are classified into excavation impacts and water supply impacts. The impacts associated with excavation are channel bed lowering, migration of excavated pits and undermining of structures, bank collapse, caving, bank erosion and valley widening and channel instability. The impacts on water supply are reduced ground water recharge to local aquifers, reduction in storage of water for people and livestock especially during drought periods, contamination of water by oil, gasoline and conflicts between miners and local communities. Many reports show that depletion of sand in the streambed and along coastal areas causes the deepening of rivers and estuaries, and the enlargement of river mouths and coastal inlets. It may also lead to saline-water intrusion from the nearby sea. Thus in-stream sand mining results in the destruction of aquatic and riparian habitat through large changes in the channel morphology. Impacts include bed degradation, bed coarsening, lowered water tables near the streambed, and channel instability.

It is well understood that mining changes the physical characteristics of the river basin, disturbs the closely linked flora and fauna, and alters the local hydrology, soil structure as well as the socio-economic condition of the basin. In general, it was reported that in-stream mining resulted in channel degradation and erosion, head cutting, increased turbidity, stream bank erosion *etc.* All these changes adversely affect fish and other aquatic organisms either directly by damage to organisms or through habitat degradation or indirectly through disruption of food web.

Ministry of Environment, Forests & Climate Change (MoEFCC), Government of India, in the *Sustainable Sand Mining Management Guidelines, 2015* has identified the following impacts on account of sand and gravel mining:

i. Extraction of bed material in excess of replenishment by transport from upstream causes the bed to lower (degrade) upstream and downstream of the site of removal.
ii. In-stream habitat is impacted by increase in river gradient, suspended load, sediment transport, sediment deposition. Excessive sediment deposition for replenishment increases turbidity which prevents penetration of light required for photosynthesis and reduces food availability of aquatic fauna.
iii. Riparian habitat including vegetative cover on and adjacent to the river banks controls erosion, provide nutrient inputs into the stream and prevents intrusion of pollutants in the

stream through runoff. Bank erosion and change of morphology of the river can destroy the riparian vegetative cover.

iv. Bed degradation are responsible for channel shifting, causing loss of properties and degradation of landscape, it can also undermine bridge supports, pipe lines or other structures.

v. Degradation may change the morphology of the river bed, which constitutes one aspect of the aquatic habitat.

vi. Degradation can deplete the entire depth of gravelly bed material, exposing other substrates that may underlie the gravel, which could in turn affect the quality of aquatic habitat. Lowering of ground water table in the flood plain because of lowering of riverbed level as well as river water level takes place because of extraction and draining out of excessive ground water from the adjacent areas. So, if a floodplain aquifer drains to the stream, groundwater levels can be lowered as a result of bed degradation.

vii. Lowering of the water table can destroy riparian vegetation.

viii. Excessive pumping of ground water in the process of mining in abandoned channels depletes ground water causing scarcity of irrigation and drinking water. In extreme cases it may create ground fissures and subsidence in adjacent areas.

ix. Flooding is reduced as bed elevations and flood heights decrease, reducing hazard for human occupancy of floodplains and the possibility of damage to engineering works.

x. The supply of overbank sediments to floodplains is reduced as flood heights decrease.

xi. Rapid bed degradation may induce bank collapse and erosion by increasing the heights of banks.

xii. Polluting ground water by reducing the thickness of the filter material especially if mining is taking place at top of recharge fissures.

xiii. Choking of filter materials for ingress of ground water from river by dumping of finer material, compaction of filter zone due to movement of heavy vehicles. It also reduces the permeability and porosity of the filter material.

xiv. Removal of gravel from bars may cause downstream bars to erode if they subsequently receive less bed material than is carried downstream from them by fluvial transport.

xv. Ecological effects on bird nesting, fish migration, angling, etc.

xvi. Direct destruction from heavy equipment operation; discharges from equipment and refueling.

xvii. Bio-security and pest risks.

xviii. Impacts on coastal processes.

The other deleterious impacts of indiscrete mining include-

Loss of riparian habitat resulting from direct removal of vegetation along the stream bank to facilitate the use of a dragline or through the process of lowering the water table, bank undercutting, and channel incision.

The physical composition and stability of substrates are altered as a result of in-stream mining and most of these physical effects may exacerbate sediment entrainment in the channel.

1.3 Sustainable Sand Mining Guidelines - MoEFCC

Sand is naturally occurring granular material composed of finely divided rock and mineral particles between 0.06 mm to 2 mm in diameter. Sand is formed due to weathering of rocks due to mechanical forces. In the process the weathered rocks forms gravel and then to sand.

Sand and gravel together known as aggregate, represent the highest volume of raw material used on earth. The mining of aggregate has been continuing for many years. Now the mining of aggregates has reached a level threatening the environment and ecosystem besides also reaching a level of scarcity that would threaten the economy. It is recommended that sand & aggregate mining, and quarrying should be done only after sound scientific assessment and adopting best practices to limit the impact on the environment.

It is also felt that the greater use of substitute material (manufactured sand) & construction technology, and sustainable use of the resource could drastically reduce adverse impact of mining on the environment.

The Guidelines has been based on the following principles:

- Uncontrolled sand mining is not sustainable.
- Compliance with present and future legislation and regulations on the subject is mandatory and not voluntary.
- Each lease holder should be given the opportunity to self-regulate to the extent that it can demonstrate compliance with legislation and regulations.
- Where self- regulation fails to deliver compliance with legislation and regulations, increased formal enforcement and monitoring should be implemented with punitive measures applied in line with the legal framework.
- There is a need to protect the environment and the right of the population to live in clean and safe surroundings, with the need to use natural resources in a way that will make a positive and sustainable contribution to the economy.

The main objectives of the Guidelines are:

- To ensure that sand and gravel mining is done in environmentally sustainable and socially responsible manner.
- To ensure availability of adequate quantity of aggregate in sustainable manner.
- To apply river model studies in identifying the aggradation zones and quantities suitable for mining.
- To improve the effectiveness of monitoring of mining and transportation of mined out material.
- Ensure conservation of the river equilibrium and its natural environment by protection and restoration of the ecological system.
- Avoid aggradation at the downstream reach especially those with hydraulic structures such as jetties, water intakes etc.
- Ensure the rivers are protected from bank and bed erosion beyond its stable profile.
- No obstruction to the river flow, water transport and restoring the riparian rights and in-stream habitats.

- Avoid pollution of river water leading to water quality deterioration.
- To prevent depletion of ground water reserves due to excessive draining out of ground water.
- To prevent ground water pollution by prohibiting sand mining on fissures where it works as filter prior to ground water recharge.
- To maintain the river equilibrium with the application of sediment transport principles in determining the locations, period and quantity to be extracted.
- Streamlining and simplifying the process for grant of environmental clearance (EC) for sustainable mining.

1.4 Genesis of the present study

Government of Rajasthan has issued Letters of Intent to successful bidders for dry mining of mineral Bajri/River Sand from various rivers and their tributaries tehsil-wise in various districts of the State of Rajasthan in the year 2013. As per the conditions of Letter of Intent, it was mandatory to obtain environmental clearance (EC) from MoEFCC, Government of India. Presentations were given in the Expert Appraisal Committee of MoEFCC and MoEFCC has recommended for the environmental clearance to the competent authority. However, all the sand mining project of Rajasthan was deliberated again in 11th Meeting held at October 24-25, 2016. The EAC opined that "*the proposals of sand mining from Rajasthan are not in perennial rivers. These are, in effect, paleo sand deposits and are not replenished annually during monsoon season. The mined out areas are not replenished adequately and may turn into permanent depressions*." It was decided by MoEFCC to advise all applicants to carry out scientific replenishment study and submit the report before EAC for the consideration of quantity of production for mining of Bajri/River Sand on yearly basis, as the rivers in Rajasthan are seasonal and not perennial.

In view of the above requirement, Bajri Lease/LoI Holder's Welfare Samiti, Jaipur approached CMPDI for undertaking the scientific replenishment study of their various mines spread across the State of Rajasthan.

CHAPTER-II
Project Description

2. General

The scientific replenishment study of the mines of Bajri Lease/LoI Holder's Welfare Samiti, Jaipur in being undertaken in phases. In the 1st phase of the study, the following mines have been considered:

Table-2.1: List of the mines to be taken up for study in 1st Phase

Sl. No.	Name of leaseholder	Name of Lease Area	District	Area (in Ha)
1	M/s Shekhawat Associates	Jahajpur	Bhilwara	1299.00
2	Shri Abhishek Choudhary	Asind	Bhilwara	1207.60
3	Shri Sanjay Kumar Garg	Bhilwara	Bhilwara	1947.12
4	Shri Sanjay Kumar Garg	Bijolia Mandalgarh	Bhilwara	1675.85
5	Rajasthan FORT& PAL	Kapasan	Chittorgarh	335.03
6	Shri Himmat Singh Shekhawat	Nathdwara	Rajsamand	773.28
7	Shri Narottam Singh Jadaun	Raj Samand	Rajsamand	489.40
8	Shri Mangal Singh	Chouth ka Barwara	Sawai Madhopur	278.67
9	Shri Rahul Panwar	Malpura	Tonk	316.58
10	Shri Mangal Singh Solanki	Niwai	Tonk	104.78
11	M/s Shekhawat Associates	Peplu Masi	Tonk	889.93
12	Shri Som Prakash	Peplu Banas	Tonk	3342.10
13	Shri Pradeep Kumar Sethi	Tonk	Tonk	2389.36
14	Shri Jaswant Singh	Raipur (Pali)	Pali	1677.00
15	M/s S.R. Associates	Deoli	Tonk	1667.78
16	Shri Mahendra Singh	Kotri	Bhilwara	1191.37
17	Shri Vikramaditya Rathore	Hurda & Masuda	Bhilwara	544.03
18	Shri Rajendra Singh	Deogarh	Rajsamand	339.62
19	Shri Mahender Singh Ratnawat	Udaipurvati	Jhunjhunu	2932.92

A brief description of the above mines is provided hereunder:

2.1 M/s Shekhawat Associates

Name of the Mine: **Bajri (Minor Mineral) Mine of M/s Shekhawat Associates**
Lease area: 1299.00 ha
Name of the river: Banas River
Length of the river under lease: Approx. 50 kms
Tehsil: Jahajpur
District: Bhilwara

Capacity of Production: 4.2 million tonnes per year
State: Rajasthan

Location: The lease area is located in Banas River, Tehsil-Jahajpur of district Bhilwara, covering an area of 1299 ha in the 26 villages falling along the Banas River and is approached from metalled road. The nearest railway station is Bhilwara station about 55 km from Jahajpur. The key plan is prepared on toposheet 45K O/2, 45O/3, 45 O/6, and 45O/7 on a scale of 1:50,000.Area is located between following Latitude and Longitudes:

Latitude – 25°45'00.00" N to 25°29'00.00" N
Longitude - 75°06'00.00" E to 75°19'00.00" E

Physiography & Drainage:

The area is marked by flat topography of igneous formation, which are surrounded by fine to coarse grained sandy soil overlying the river sand deposit. The elevation level of 308 mRL is lowest and 340m RL is the highest RL in the River Banas, Tehsil- Jahajpur of dist. Bhilwara. The Banas River flows from SW to NE direction in the Tehsil Jahajpur. Banas River is non perennial and runs only in during rainy season and almost dry in summer. In some parts of the river boulder and exposure of basement rock is also available.

Rainfall and Climate:

The district experiences arid dry type of climate except during short rainy season. On an average, the district recorded 277 mm of rainfall. Almost 90% of the total rainfall is received during the southwest monsoon, which enters the district in the first week of July and withdraws in the mid of September. The district lies in the desert area and extreme heat recorded during summer and cold during winter season which is the characteristic of the desert. The winter extends from December to March and summer from March end to June third week, followed by rainy season which lasts up to third week of September. The temperature varies between 46°C to 48 °C in summer and 3 °C in winter season. The maximum humidity recorded in the month of August with mean daily relative humidity value of 46 %.

Estimated Reserve and Production Envisaged:

A) PROVED RESERVES AS PER UNFC CODE (111)
Total Reserves = 51717060.5 m^3

B) BLOCKED RESERVES AS PER UNFC CODE (211 & 222)

a) Safety zone for bridge = 5,77,000 m^3
b) Roads (1 nos) = 4,72,500 m^3
c) Wells (29 nos) = 22,09,800 m^3
d) Offset against bank and lease boundary (40.0 m) = 59,22,672 m^3
TOTAL BLOCKED RESERVES = 91,71,972 m^3
e) MINEABLE RESERVES = A-B
= 51717060.5 – 9171972 = 4,25,45,088.5 cu.m
= 42.54 million m^3

C) TARGETED PRODUCTION
During the 5 year period of lease total extraction is = 21.0 million m^3

D) Balance reserves will be = 42.45 – 21.00 =21.54 million m^3

Details of Production & Dispatches of Five Years

This is a new lease area being allotted to the applicant. Future production programme has been planned as per the details given below:

Production Programme

Proposed lease will be allotted for a period of 5 years only. Proposed lease consist of 1299.00 ha area in 26 villages falling along the Banas River. It is proposed to work as per the details given earlier.

Daily production planned: 15,000 tonnes
Yearly production planned: 42,00,000 tonnes

Working days have been taken as 280 days per annum which can be increased depending on the conditions prevailing at the time of execution.

Projected Production Per Year = 280 x 15,000 = 42,00,000 tonnes
Specific Density = 1.40 tonne/ cu.m
Volumetric Production = 3.0 million m^3

2.2 Shri Abhishek Choudhary

Name of the Mine: **Bajri (Minor Mineral) Mining Lease of Shri Abhishek Choudhary**
Lease area: 1207.60 ha
Name of the river: Mansi and Kothari
Length of the river under lease: 35.00 kms
Tehsil: Asind
District: Bhilwara
Capacity of Production: 28,00,000 tonnes/year
State: Rajasthan

Location: The lease area is located in River Mansi and Kothari, tehsil-Asind of district Bhilwara, covering an area of 1207.61 ha in the 38 villages falling along the Mansi and Kothari River and is approached from metalled road. The nearest railway station is Vijaynagar station about 50 kms from district Bhilwara. The key plan is prepared on topo-sheet 45K/1, 45K/2, 45K/5, 45K/6, 45K/9, 45K/10 on a scale of 1:50,000.Area is located between following latitude and longitudes:

Latitude - 25°38'00.00" N to 25°25'00.00" N
Longitude - 74°10'00.00" E to 74°33'00.00" E

Physiography & Drainage:

The area is marked by flat topography of igneous formation, which is surrounded by fine to coarse grained sandy soil overlying the river sand deposit. The recorded elevation of 412 mRL is lowest and 525 mRL is the highest RL in the River Mansi and Kothari, Tehsil Asind. The Mansi and Kothari rivers flow from SW to NE direction in this Tehsil Asind. Bothe the rivers are non-perennial and runs only in during rainy season and almost dry in summer. In some parts of the river boulder and exposure of basement rock is also available.

Rainfall and Climate:

The district experiences arid dry type of climate except during short rainy season. The mean annual rainfall (1971 - 2005) in the district is 281.8 mm whereas normal rainfall (1901-1971) is lower than average rainfall and placed at 277.5 mm. As district lies in the desert area and extreme heat recorded during summer, and cold during winter season which is the characteristic of the desert. The winter extends from December to March and summer from March end to June third week, followed by rainy season which lasts up to third week of September. The temperature varies from 48 °C in summer to 2 °C in winter season. The maximum humidity recorded in the month of August with mean daily relative humidity value of 43 %.

Estimated Reserve and Production Envisaged:

A) PROVED RESERVES AS PER UNFC CODE (111)
Total Reserves = 4,71,84,719.4 m^3

B) BLOCKED RESERVES AS PER UNFC CODE (211 & 222)
a) Safety zone for bridge = 51,97,500 m^3
b) Roads (2 nos) = 5,15,970 m^3
c) Wells (77 nos) = 58,67,400 m^3
d) Offset against bank and lease boundary (20.0 m) = 3677772 m^3
TOTAL BLOCKED RESERVES = 1,52,58,642 m^3
e) MINEABLE RESERVES = A-B
= 47184719.4 – 15258642 = 3,19,26077.4 cu.m
= 31.92 million m^3

C) TARGETED PRODUCTION

During the 5 year period of lease total extraction is = 14.0 million m^3
D) Balance reserves will be = 31.92 – 14.00 =17.92 million m^3

Details of Production & Dispatches of Five Years

This is a new lease area being allotted to the applicant. Future production programme has been planned as per the details given below:

Production Programme

Proposed lease will be allotted for a period of 5 years only. Proposed lease consist of 1207.60 ha area in 38 villages falling along the Mansi and Kothari River in a stretch of 35.00 kms. It is proposed to work in blocks as per the details given earlier. Production programme is 10,000 tonnes/day. Working days have been taken as 280 days per annum which can be increased depending on the conditions prevailing at the time of execution.

Projected Production Per Year = 280 x 10,000 = 28,00,000 tonnes/year
Specific Density = 1.40 tonnes/ cu.m
Volumetric Production = 2.0 million m^3 per year

2.3 Shri Sanjay Kumar Garg, Bhilwara

Name of the Mine: **Bajri (Minor Mineral) Mining Lease of Shri Sanjay Kumar Garg**
Lease area: 1947.12 ha
Name of the river: **River Banas and Kothari**
Length of the river under lease: 67.40 (38.60 km in Banas River and 28.80 km in Kothari River)
Tehsil: Bhilwara
District: Bhilwara
Capacity of Production: 22,40,000 tonnes/Year
State: Rajasthan

Location:

Proposed lease area (1947.12 ha) is located in the River Banas and Kothari Rivers, Tehsil-Bhilwara of District Bhilwara. The lease area has been divided into two zones, lease area situated in the Banas River is zone-I and part of the Kothari River is zone-II. Total length of the allotted area (inclusive of prohibited area) is 67.40 km (38.60 km in Banas River and 28.80 km in Kothari River). Effective length of the mine lease area, where mining activities will be carried out is 55.85 km (32.35 km in Banas River and 23.50 km in Kothari River).

The lease area of Zone-I can be approached from north side via NH-79 near Biliya Kalan and also near Solankiyon ka Kheda whereas, Zone-II can be approached via NH-79 near village Raneegpura. It can be approached from Akola on north and Sawar road from South direction. It forms a part of G. T. Sheet No's – 45 K/6, 45 K/7, 45 K/8, 45 K/10, 45 K/11, 45 K/12, 45 K/14, 45 K/15, and 45 K/16 on a scale of 1:50,000. Toposheet is enclosed with the report. Area is of both the lease are located between following latitude and longitudes:

Zone	Latitude	Longitude
Zone-I	25°12'6.98" N to 25°15'45.11"N	74°29'47.83" E to 74°47'27.15" E
Zone-II	25°24'5.52" N to 25°20'47.33"N	74°34'36.54" E to 74°46'.40" E

Physiography & Drainage:

The lease area is marked by flat topography of igneous formation, which are surrounded by fine to coarse grained sand soil overlying the river sand deposition. The lease area is gently dipping towards East side indicating the flow direction of river.

Elevation	**Zone - I**	**Zone - II**
Highest	429 mRL	430 mRL
Lowest	383.45 mRL	389.15 mRL

No work shall be carried out below the water level. As such there shall be no need for any pumping operations. A drain on the up-slop side of pit will be made so that rainwater does not go into pit during mining. No water problems are envisaged during the five years of lease period since the workings will not go deep.

Climate and Rainfall:

The district experiences arid dry type of climate except during short rainy season. The mean annual rainfall (1971-2005) in the district is 281.8 mm whereas normal rainfall (1901-1971) is lower than average rainfall and placed at 277.5 mm. As district lies in the desert area and extreme heat recorded during summer and cold during winter season which is the characteristic of the desert. The winter extends from December to March and summer from March end to June third week, followed by rainy season which lasts up to third week of September. The maximum temperature varies from 48°C in summer to 3°C in winter season. The maximum humidity recorded in the month of August with mean daily relative humidity value of 43%.

Estimated Reserve and Production Envisaged:

A) PROVED RESERVES AS PER UNFC CODE (111)
Total Reserves = 2,21,98,350 m^3

B) BLOCKED RESERVES AS PER UNFC CODE (211 & 222)
a) Safety zone for bridge (3) = 6,69,000 m^3
b) Roads (3 nos) = 3,24,000 m^3
c) Wells (30 nos) = 5,72,220 m^3
d) Offset against bank (7.5 m) and lease boundary (7.5) = 14,55,750 m^3
TOTAL BLOCKED RESERVES = 30,20,970 m^3

C) MINEABLE RESERVES = A – B
= 2,21,98,350 –30,20,970 = 1, 91, 77, 380 cu.m
= 19.17 MM^3

D) PROVED RESERVED AS PER UNFC CODE (211 & 222)
Total Reserves = 1,12,10,700 m^3

E) BLOCKED RESERVES AS PER UNCF CODE (211 & 222)
a) Bridges (4 nos.) = 4,32,000 m^3
b Roads (5 nos.) = 5, 40,000 m^3
c) Wells (6 nos.) = 1,14,444 m^3
d) Offset against bank/lease boundary (7.5 m each side) = 10,57,500 m^3
TOTAL BLOCKED RESERVES = 21,43,944 m^3

F) MINEBLE RESERVES = D – E
= 1,12,10,700 – 21,43,944 = 90,66,756 cu.m
= 9.06 million m^3

TOTAL MINEABLE RESERVES = C + F = 19.17 + 9.06 = 28.23 million m^3

G) TARGETED PRODUCTION

During the 5 year period of lease total extraction is = 8.0 million m^3

H) BALANCE RESERVES WILL BE = 28.23 – 8.0 = 20.23 million m^3

Details of Production & Dispatches of Five Years

This is a new lease area being allotted to the applicant. Future production programme has been planned as per the details given below:

Production Programme

Proposed lease will be allotted for a period of 5 years only. Proposed lease consist of 1947.12 ha area in a stretch of 67.40 kms. It is proposed to work in 5 blocks as per the details given in the mining plan. Production programme is 8000 tonnes/day. Working days have been taken as 280 days per annum which can be increased depending on the conditions prevailing at the time of execution.

Projected Production Per Year = 280 x 8000 = 22,40,000 Tons
Specific Density = 1.40 tonne/ cu.m
Annual Volumetric Production = 1.60 million m^3

2.4 Shri Sanjay Kumar Garg, Bijolia Mandalgarh

Name of the Mine: **Bajri (Minor Mineral) Mining Lease of Shri Sanjay Kumar Garg**
Lease area: 1675.85 ha
Name of the river: **River Banas, Beerach and Menali**
Length of the river under lease: 36.00 kms
Tehsil: Bijoliya and Mandalgarh
District: Bhilwara
Capacity of Production: 28,05,000 tonnes/year
State: Rajasthan

Location:

Proposed lease area (1675.85 ha) is located in the River Banas, Tehsil- Bijoliya and Mandalgarh of District Bhilwara. The proposed lease area falls on survey of India Toposheet No.–45 O/3, 45 O/4, 45 O/7, and 45 O/8.

Physiography & Drainage:

The district Bhilwara consist of fairly open plains in the north and south east with a few hillocks and undulating plains & hills in the south and northeastern part. Occasional inselberge, low lying hillocks and chains of ridges break the monotony of peneplained tract. The area of the district is generally slopes gently except on western & northwestern part where it is high.

Major River of the district is Banas, which flows in northwest to easterly direction. It enters near village Doodiya in Bhilwara tehsil in west following towards east and take an abrupt turn towards north-north eastern direction near Bigod downstream of the confluence with Beerach River and again takes an easterly turn near Kanti and finally flows towards northeast till it enters Tonk district. Total length of the Banas River is 142 km in Bhilwara district. Channel pattern of Banas is sinuous and changes to more of less straight between Bigod and Rajamahal indicating structural control on the drainage pattern. Important tributaries are Beerach, Kothari, Unli, Mendi, Nakadi, Chandrabhaga and Khari River. All these rivers are ephemeral.

Climate and Rainfall:

The district experiences arid dry type of climate except during short rainy season. The mean annual rainfall (1986-2005) in the district is 633.9 mm whereas normal rainfall (1901-1970) is lower than average rainfall and placed at 603.3 mm. Almost 95% of the total rainfall is received during the southwest monsoon, which enters in the district in the last month of June and withdraws in the middle of September. Probability of average annual rainfall exceeding 900 mm is only 10%. However, there is 90% probability that the average rainfall will be more than 400 mm. the probability of occurrence of mean annual rainfall is 45%. Drought analysis based on agriculture criteria indicates that the district is prone to mild and normal type of droughts. Occurrence of severe and very severe type of drought is very rare.

The winter extends from December to March and summer from March end to June third week, followed by rainy season which lasts up to third week of September. The temperature varies from 46°C in summer to 7.3°C in winter season. The maximum humidity recorded in the month of August with mean daily relative humidity value of 80%. (**Source:** *District Groundwater Brochure*).

Estimated Reserve and Production Envisaged:

A) PROVED RESERVES AS PER UNFC CODE (111)
Total Reserves = 62418981.12 Tons

C) NET MINEBLE RESERVES

Net mineable reserve = Demand reserves (Proved) – 10% Reserves locked in the boundary buffer zone, other Physical features such as Annicut, Bridges, Tar roads *etc.*

Net minable reserves = 62418981.12 Tons – 6241898 tonnes= 5,61,77,083 tonnes

F) TARGETED PRODUCTION

Total working days in a year would be 330 days assuming target production@ 8500 TPA. Annual targeted production will be @ 28,05,000 tonnes per annum. Depending upon demand, supply position of the market actual production may vary $\pm$ 20% of the targeted production.

Details of Production & Dispatches of Five Years

This is a new lease area being allotted to the applicant. Future production programme has been planned as per the details given below:

Production Programme

Proposed lease will be allotted for a period of 5 years only. Proposed lease consist of 1675.85 ha area in a stretch of 36.00 kms. It is proposed to work in 5 blocks as per the details given in mining plan. Production programme is to the tune of 8500 tonnes/day. Working days have been taken as 330 days per annum which can be increased depending on the conditions prevailing at the time of execution.

Projected Production Per Year = 330 days x 8500 = 28,05,000 TPA
Specific Density = 1.40 tonne/ cu.m
Annual Volumetric Production = 2.00 million m^3

2.5 M/s RAJASTHAN FORT & PAL

Name of the Mine: Bajri (Minor Mineral) Mine of M/s RAJASTHAN FORT & PAL.
Lease area: 335.03 ha
Name of the river: Berach
Length of the river under lease: 35.00 kms
Tehsil: Kapasan
District: Chittorgarh
Capacity of Production: 1.40 lakh tonnes per annum
State: Rajasthan

Location:

The mining area is located in revenue villages of Tehsil: Kapasan, District: Chittorgarh, State: Rajasthan. The mining lease / proposed project area falls in Survey of India Toposheet No. 45L/1, 45L/2, 45L/5, 45L/6 & 45L/9 and the area falls between $24^0$44'13.1" to $24^0$47'29.06" N Latitudes & $74^0$07'11.3" to $74^0$26'22.04"E Longitude. The elevation of the ML area varies from 457-419 m above MSL. The area is located in River Berach covering the 21 villages falling along the Berach River. The land form is river bed and non-forest land.

Physiography & Drainage:

The proposed area is a river bed which is flat. The land profile adjoining the river bank is also flat. The difference of the highest & the lowest elevation of the area is about 40 m. The natural drainage of the river bed is not disturbed as the mining is undertaken up to a depth of 1-3 m and safety zone of 45.0 m radius will be earmarked for the wells located in the river bed.

Topographically the district is undulating with scattered hills of the Aravalli ranges. The western-southern and northern parts of the district are somewhat plain. A series of hills run North-South forming parallel valleys to the east of Chittorgarh. Bhainsrorgarh area is practically hilly. The main rivers flowing through this district are Chambal, Banas, Berach, Gambhiri, Jakham with smaller rivers like Wagon, Gungali *etc.* The district comprises rocks of Bhilwara Supergroup, Vindhyan Supergroup and Deccan Traps.

Estimated Reserve and Production Envisaged:

Lease area consists of 335.03 Ha in khasra of 21 villages in a stretch of 35.0 kms. It is proposed to work in 05 blocks with maximum working depth 3.0 m from the river beds.

A) PROVED RESERVES AS PER UNFC CODE (111)

Total Reserves = 14071260 tonnes

B) MINEABLE RESERVES = 14071260 - 3131310= 10939950 tonnes

C) TARGETED PRODUCTION

During the 5 year period of lease the extraction will be = 1.40 Lakh TPA

Volume of production = 1 lakh m^3 per year or 0.1 million m^3

2.6 Shri Himmat Singh Shekhawat

Name of the Mine: **Bajri (Minor Mineral) Mine of Shri Himmat Singh Shekhawat**
Lease area: 773.2797 ha
Name of the river: Banas & Lapli
Length of the river under lease: 50 kms
Tehsil: Nathdwara
District: Raj Samand
Capacity of Production: 2.80 LTPA
State: Rajasthan

Location: The proposed project is located at Tehsil: Nathdwara, District: Rajsamand. The lease area lies on the river of 26 Revenue villages situated in Tehsil: Nathdwara, District Rajsamand falling along the rivers. The land form is river bed and non-forest land. The river bed area belongs to Government land as per revenue records. The area of mining lease fall in Survey of India Toposheet no. 45H/9, 45H/13, 45G/12, 45G/16. The lease area comprises of Govt. land and is located between following Latitude and Longitudes:

Latitude – 24°54‘48.6”N to 25°01‘12.9”N
Longitude - 73°37‘18.9”E to 73°56‘09.7”

Physiography & Drainage:

The area is marked by flat topography of igneous formation, which are surrounded by fine to coarse grained sandy soil overlying the river sand deposit 520 m (above MSL) is the lowest and 635 m (above MSL) is the highest RL in the rivers in Tehsil: Nathdwara of District: Rajsamand. The surrounding area is devoid of any thick vegetation except for patched agricultural lands. The River Banas & Lapli flow from West to East direction in tehsil Nathdwara. The alluvial ground surface overlying river sand some distance away from the river bed is under cultivation. River is Non-perennial River and it turns only in rainy season and almost dry in summer. The characteristics of the river are as under:

i. Highest elevation : 635 mRL
ii. Lowest elevation : 520 mRL
iii. Difference in RL : 115 m
iv. Length of river : 50 kms
v. Bed slope of river : 2.30 m/km

Rajsamand district is drained by Banas river and its tributaries *i.e.* Khari, Chandrabhaga, Gomti, Kothari and Ahar *etc.* The river as well as tributaries are ephemeral and flow only in response to heavy precipitation. The Banas or the hope of the forest rises in Aravalli hills about 5 km. from Kumbhalgarh fort and flowing southwards meets the Gogunda plateau. Hence it burst east and cutting through the outlying ridges of Aravalli that bursts into open country. Here on its right banks is situated the famous Vaishnava shrine of Nathdwara. It flows through Rajsamand and Railmagea tehsils and then crosses into Chittaurgarh and Bhilwara district. Chandrabhaga originates from northern and the Gomti River, from the north-west part of the areas. The Chandrabhaga and Gomti rivers trend NNW-SSE to NW-SE. The predominant drainage pattern in the western hill ranges is rectangular to sub-rectangular and it is dendritic to sub-dendritic in rest of the area. Drainage pattern in the western hill region is controlled by fractures & joints and in rest of the area by subsurface liniments. The district has a dry climate except during short raining season. The winter extends

from December to March and summer from March end to June 3rd week, followed by rainy season which lasts upto third week of September.

Estimated Reserve and Production Envisaged

River sediments (River Sand) have been deposited/mineralized in the form of stratified deposit. Mineralization is found in the entire river bed. The river sand is brought by flood waters from upstream side and naturally deposited when the water current in the river slows down. Following parameters were considered for reserve estimation in the mining plan:

a) Shape, size, width and depth extension of mineral as conceived on the geological plan and section.
b) Bulk density of the Bajri (River Sand) is taken as 1.40 (as per MMCR, 1986).
c) Based on geological cross section the actual width and thickness is taken in to consideration.
d) Reserves only in proved category are calculated to a depth of 3.0 m in river bed since mining has been restricted to 3.0 m deep only for safety reasons.

Volumetric method is adopted for calculating reserves of River Sand. Reserves are estimation on the basis of established width, thickness, and stoke length based on influence of the mineralized formation in the river bed and where good inferences are available only such area are considered for reserve estimation. The depth is considered upto 3.0 m as although working is permitted upto 3.0 m depth in the riverbed.

Therefore reserves are: Cross sectional area (average length*average width)*depth*Bulk density. The reserves in the river bed shall be replenished by flood waters during rainy season.

Mineable reserves have been taken as 95% of geological reserves.

Proved reserves as per UNFC code (111)
Total reserves = 32477340 Tonnes

A) **Blocked reserves as per UNFC code (211 & 122)**

- Water bodies = 4.00 Ha.
- Roads (18 nos) = 37.2510 Ha.
- Railway line = 8.80 Ha.
- Bridge = 3.510 Ha.

Total blocked Area = 53.56 Ha.
Total blocked reserve =2249520 tonnes

B) Minable Reserves = A - B

= 32477340 - 2249520 = 302.27 lakh tonnes

Production Capacity = 2.8 lakh tones per year or 0.2 million m^3 per year

The size of sediments varies from 1.0 mm to about 3.0 mm and is not uniform. The grains in the all size, small or large are rounded to sub rounded in shape. The colour of river sand is grayish fine to course grained. River sand weathered particles of feldspethic rocks of granitic composition with mixture of silica and other accessories minerals. The sand is composed of loose rounded silica grains of varying size with minor clay and sand particle with pebbles and is being used for preparing

of pieces which are used as building materials. The River Sand is of two grades *i.e.* fine and coarse River Sand and used for different purposes.

2.7 Shri Narottam Singh Jadaun

Name of the Mine: **Bajri (Minor Mineral) Mine of Shri Narottam SinghJadaun**
Lease area: 489.3965 ha
Name of the river: Banas, Gomti and Taleri
Length of the river under lease: 50 kms
Tehsil: Raj Samand
District: Raj Samand
State: Rajasthan
Capacity of Production: 2.80 LTPA

Location: The proposed project is located at Tehsil & District Rajsamand. The lease area lies on the river of 14 revenue villages situated in Tehsil & district Rajsamand. The area of mining lease fall in Survey of India Toposheet no. 45G/15, 16, 45K/4, 45H/13. The lease area comprises of Govt. land. The geographical location of the project is-

Longitude - $73^0$49’26.6”E to $74^0$00’28.2”E
Latitude - $250^0$0’20.6” N to $25^0$13’33.7”N

Physiography & Drainage:

The proposed area is a river bed which is gently sloping. The elevation in the area varies from 610 mRL to 512 mRL. The surrounding area is devoid of any thick vegetation except for patched agricultural lands. The alluvial ground surface and overlying river sand some distance away from the river bed is under cultivation. River is Non-perennial River and it turns only in rainy season and almost dry in summer. The characteristics of the river are as under:

i. Highest elevation : 610 mRL
ii. Lowest elevation : 512 mRL
iii. Difference in RL : 98 m
iv. Length of river : 50 kms
v. Bed slope of river : 1.96 m/km (Slope ratio)

Rajsamand district consists of monotonously rolling topography interacted by shallow valleys. Towards the western part of the district, Aravalli hills, a series of ridges run diagonally in the direction of NE and SW. The highest portion of Aravallis occurs south of Kailwara near Kumbhalgarh fort (25°08’ & 73°35’) with an altitude of 1293 m above msl. A typical gneissic plain bearing irregularly carved of gneisses and granites without any alluvium cover is observed to the highest altitude of above 600 m above msl. The central and eastern part of the district is relatively plain area forming the foot hill part of Aravalli ranges. This plain gently slopes towards the East and North East. In the higher and more rugged part towards the Western side alluvium is scanty where as in the Eastern flank the alluvium is more continuous and reasonably thick.

The ground water in this area gets intersected at a depth of more than 25m bgl in riverbed. No work shall be carried out below the water level. As such there shall be no need for any pumping operations. A drain on the up- slope side of pit will be made so that rainwater does not go into pit

during mining. No water problems are envisaged during the five years of lease period since the workings will not go deep.

Estimated Reserve and Production Envisaged:

River sediments (river sand) have been deposited/mineralized in the form of stratified deposit. Mineralization is found in the entire river bed. The River Sand is brought by flood waters from upstream side and naturally deposited when the water current in the river slows down. Following parameters were considered for reserve estimation:

a) Shape, size, width and depth extension of mineral as conceived on the geological plan and section.
b) Bulk density of the Bajri (River Sand) is taken as 1.40.
c) Based on geological cross section the actual width and thickness is taken in to consideration.
d) Reserves only in proved category are calculated to a depth of 3.0 m in river bed since mining has been restricted to 3.0m deep only for safety reasons.

Volumetric method is adopted for calculating reserves of River Sand. Reserves are estimation on the basis of established width, thickness, and stoke length based on influence of the mineralized formation in the river bed and where good inferences are available only such area are considered for reserve estimation. The depth is considered upto 3.0m as although working is permitted upto 3.0 m depth in the riverbed.

Reserve calculation- Area in sq. mt. x Thickness of Sand x Bulk Density

Proved Reserve as per UNFC code (111)
Total reserve = 32477340 Tonnes

(a) **Blocked reserve as per UNFC code (211 & 122)**

- Total mining lease area – 489.3965 Ha.
- Water bodies- 2 Ha.
- Mining Prohibited area (Shamsan, Anicut, open well, roads, bridge) =17 Ha.
- Exposure of basement rock- 60 Ha.

(b) Total mineable area- 410 Ha

(c) Total Estimated Minable reserves- 172.20 Lac Tonnes

Lease has been allotted for a period of 5 years. Lease area consists of 489.3965 hectare in khasra of 14 villages in a stretch of 50.0 kms. It is proposed to work 05 Blocks as per the detail given as below:

- Production programmed = 50 trucks/day
- Capacity of Truck is 20 tons/day
- Total production= 50 x 20 = 1000 tonnes/day
- Production capacity = 2.80 lakh tones per year or 0.2 million m^3 per year

2.8 Shri Mangal Singh

Name of the Mine: **Bajri (Minor Mineral) Mine of Shri Mangal Singh Solanki**
Lease area: 278.67 ha
Name of the river: Banas
Length of the river under lease: 30.40 kms
Tehsil: Chauth ka Barwara
District: Sawai Madhopur
Capacity of Production: 4000 Tonnes per day
State: Rajasthan

Location: Lease area can be approached both from Chauth ka Barwara on south side of the river and Baonli on north side of the river Banas. Distance of lease area from Chauth ka Barwara side is approximately 11.0 kms. Various link roads on the river course stretch, merges with the tar road which connects Chauth ka Barwa and Baonli. The lease extends upto Village Trilopkpura. It forms a part of Survey of India Topo-sheet No. 54B/3, 54B/4, 54B/7 and 54B/8. Area is located between following Latitude and Longitudes:

Latitude – 28°08'11.75" N to 26°11'15.6" N
Longitude - 76°05'33.78" E to 76°16'18.8" E

Physiography & Drainage:

Lease area is gently dipping towards east side indicating the flow direction of river. Highest elevation is 250.0 m above MSL and the lowest elevation is 235 m above MSL.

The district Sawai Madhopur has a dry climate except during short raining season. The winter extends from December to March and summer from March end to June 3rd week, followed by rainy season which lasts upto third week of September. The normal actual rainfall in the district is 689.2 mm. On an average, there are 35 raining days in a year. The mean maximum temperature is about 40° C and means minimum temperature is about 3° C. ***(source: Mining Plan)***

Estimated Reserve and Production Envisaged:

As per the mining plan, for reserve estimation and systematic operation, river stretch was divided into3 blocks, as per the details given below:

Total blocks = 3
Total area = 278.67 ha (excluding prohibited area)

A. Proved Reserve as per UNFC Code (111)

Total reserve = 83,98,000 m^3

B. Blocked reserve as per UNFC Code (211 and 222)

a. Safety zone for bridges = Charagah (grazing land)
b. Roads (2 nos.) = Charagah (grazing land)

c. Wells (2 nos.)= 1,52,400.0 m^3
d. Offset against bank (7.5 m and lease boundary (7.5 m) = 2,07,000 m^3

Total blocked reserves = 3,59,400 m^3

C. Mineable Reserve = A-B
= 83,98,000 - 3,59,400
= 80,38,600 m^3 or 8.03 million m^3

D. Targeted production

During the five year period of lease, total extraction is 4.0 million m^3.

E. Balance Reserve

It will be (8.03-4.0) *i.e.* 4.03 million m^3.

Details of Production and Dispatches in five years

This is a new lease area. Lease is proposed to be allotted for a period of 5 years only. Lease area consists of 278.67 ha of land in 15 villages in river stretch of 30.40 kms. As per mining plan, it is proposed to work in three blocks as per details hereunder:

i. Working days has been kept as 280 days per annum which can be increased or decreased depending upon the situation prevailing at the time of extraction.
ii. Production programme is 200 trips per day.
iii. Projected production per year = 280 x 4000 = 11,20,000 m^3
= 1.12 million MT per year
iv. Specific gravity = 1.40 tonne/m^3
v. Volumetric production = 0.80 million m^3

2.9 Shri Rahul Panwar

Name of the Mine: **Bajri (Minor Mineral) Mine of Shri Rahul Panwar**
Lease area: 316.575 ha
Name of the river: Masi
Length of the river under lease: 40.40 kms
Tehsil: Malpura
District: Tonk
Capacity of Production: 4,000 tonnes/day
State: Rajasthan

Location:
Proposed lease area can be approached both from Malpura on North side of the river and Tonk and Deoli on East South side and East side respectively of the river. Distance of lease area on Malpura side is approximately at a distance of 6 kms. Various link roads on the river course stretch, merges with the tar road. It forms a part of G.T. Sheet nos. 45N/7, 45N/8, 45N/11, 45N/12. Area is located between following Latitude and longitude:

Latitude – 26°16'00.00" N to 26°11'00.00" N
Longitude - 75°26'00.00" E to 75°46'00.00" E

Physiography & Drainage:

Lease area is gently dipping towards south side indicating the flow direction of river. Highest surface elevation is 343.0 m above MSL and lowest surface elevation is 265.0 m above MSL. The climate of the area is semi-arid type. The average mean annual rainfall (1979-2008) is 622 mm. The potential evapotranspiration is highest (55.0 mm) in the month of May and lowest (68.0 mm) in the month of December (district *Groundwater Boucher, Jaipur).* In summers temperature goes as high as 45°C while in winters it remains at 22°C.

Estimated Reserve and Production Envisaged:

A) PROVED RESERVES AS PER UNFC CODE (111)
Total Reserves = 1,26,84,678 m^3

B) BLOCKED RESERVES AS PER UNFC CODE (211 & 222)

TOTAL BLOCKED RESERVES = 69,55,800 m^3

e) MINEABLE RESERVES = A – B

= 1,26,84,678 –69,55,800 = 57,28,878 m^3 *i.e.* 5.72 million m^3

C) TARGETED PRODUCTION

During the 5 year period of lease total extraction will be = 5.60 million m^3
D) Balance reserves will be = 5.72 – 5.6 = 0.12 million m^3

Details of Production & Dispatches of Five Years

This is a new lease area being allotted to the applicant. Future production programme has been planned as per the details given below:

Production Programme

Proposed lease will be allotted for a period of 5 years only. Proposed lease consist of 316.575 ha area in (including bridge safety area of 12.6 ha in 17 villages (Khasara) in a stretch of 40.400 km. It is proposed to work in 5blocks in the leasehold. Production programme is 200 trucks/ day. Working days have been taken as 280 days per annum which can be increased depending on the conditions prevailing at the time of execution. Capacity of each truck is 20 tonnes.

Projected Production per Year = 20 x 200 = 4,000 Tons/day x 280

= 1120000 tonnes *i.e.* 0.80 million m3

2.10 Shri Mangal Singh Solanki

Name of the Mine: **Bajri (Minor Mineral) Mine of Shri Rahul Panwar**
Name of the river: Bandi and Mansi
Length of the river under lease:
Tehsil: Niwai
District: Tonk
Capacity of Production: 0.504 MTPA
State: Rajasthan

Location:

Proposed lease area can be approached from Churada which is connected to Madhorajpura-Bhojpura Road. NH 12 runs almost parallel to the lease area on the East side at a distance of about 16 km from Jodhpura and SH-12 runs parallel to the lease area on wester side at a distance of about 25 km from Tantanpura. The lease area is also accessible through various link roads which approach the lease area from Northern and Southern side. Lease area forms a part of G.T. Sheet nos. 45N/10, 45N/1, 45N/14, 45N/15. Area is located between following Latitude and longitude:

Latitude – 26°29'02.00" N to 26°22'45.16" N
Longitude - 75°46'18.81" E to 75°44'35.49" E

Physiography & Drainage:

Lease area is gently dipping towards South side indicating the flow direction of river. Highest surface elevation is 287.626 MSL and lowest surface elevation is 275.262 MSL. The climate of the area is semi-arid type. The average mean annual rainfall (1979-2008) is 622 mm. The potential evapotranspiration is highest (255.0 mm) in the month of May and lowest (68.0 mm) in the month of December (Source; *India Water Portal).*

Estimated Reserve and Production Envisaged:

A) PROVED RESERVES AS PER UNFC CODE (111)
Total Reserves =27,43,122 m^3

B) BLOCKED RESERVES AS PER UNFC CODE (211 & 222)

TOTAL BLOCKED RESERVES = 4,96,701 m^3

e) MINEABLE RESERVES = A – B

= 27,43,122 –4,96,701 = 22,46,421 m^3
= 2.46 million m^3

C) TARGETED PRODUCTION

During the 5 year period of lease total extraction is = 1.8 million m^3
D) Balance reserves will be = 2.46 – 1.8 = 0.45 million m^3

Details of Production & Dispatches of Five Years

This is a new lease area being allotted to the applicant. Future production programme has been planned as per the details given below:

Production Programme

Proposed lease is for a period of 5 years only. Lease area consists of 104.777 ha area in 7 villages (Khasara) in a stretch of 14.8 km. Daily production proposed is 1800 tons. Production programme is 90 trips/ day with 20 tons per trip. Working days have been taken as 280 days per annum which can be increased depending on the conditions prevailing at the time of execution.

Projected Production Per Year = 280 x 1800 = 5,04,000 Tons= 0.504 MTPA

2.11 M/S Shekhawat Associates

Name of the Mine: Bajri (Minor Mineral) Mine of M/S Shekhawat Associates
Lease area: 889.925 ha
Name of the river: Mansi
Length of the river under lease: 45 kms
Tehsil: Piplu
District: Tonk
Capacity of Production: 10,000 tons per day
State: Rajasthan

Location:
The lease area is located in River Mansi, Tehsil Piplu, district- Tonk covering the 20 villages falling along the Mansi and is approached from metalled roads. The nearest railway station is Banasthali Niwai station about 35 km from district Tonk. The nearest airport is Jaipur about 100 km from the Tonk area. The key plan is prepared on Toposheets 45N/7, 45N/8, 45N/16, 45N/15 on a scale of 1: 50,000. Area is located between following latitude and longitude:

Latitude – 26°12’00.00” N to 26°29’00.00” N
Longitude - 75°41’00.00” E to 75°48’00.00” E

Physiography & Drainage:

The district experiences arid type of climate. Mean annual rainfall (1971-2005) of the district is 281.8 mm whereas normal rainfall (1901-1971) is lower than average rainfall placed at 277.5 mm. Almost 90% of the total annual rainfall is received during the southwest monsoon, which enters the district in the first week of July and withdraws in the mid-September. As the district lies in the desert, extreme of heat and extreme of cold is the climatic condition in the region.

Estimated Reserve and Production Envisaged:

A) PROVED RESERVES AS PER UNFC CODE (111)
Total Reserves = 3,73,38,840 m^3

B) BLOCKED RESERVES AS PER UNFC CODE (211 & 222)

TOTAL BLOCKED RESERVES = 98,20,647 m^3

e) MINEABLE RESERVES = A – B
= 3,73,38,840 –98,20,647 = 2, 75,18,193 m^3
= 27.51 million m^3

C) TARGETED PRODUCTION
During the 5 year period of lease total extraction is = 14.00 million m^3
D) Balance reserves will be = 27.51 – 14.00 = 13.51 million m^3

Details of Production & Dispatches of Five Years
This is a new lease area being allotted to the applicant. Future production programme has been planned as per the details given below:

Production Programme

Proposed lease is for a period of 5 years only. Lease area consists of 889.925 ha area in 20 villages (Khasara). Daily production proposed is 10,000 tonnes and yearly production proposed is 28,00,000 tonnes. This is 2.0 million m^3 per year.

2.12 Shri Som Prakash

Name of the Mine: **Bajri (Minor Mineral) Mine of Shri Som Prakash**
Lease area: 3342.10 ha
Name of the river: Banas
Length of the river under lease: 24.40 kms
Tehsil: Piplu
District: Tonk
Capacity of Production: 5.6 MTPA
State: Rajasthan

Location:

Proposed lease area can be approached from both Piplu on North side of the river and Tonk on South side of the river. Distance of lease area from Piplu side is approximately 6.0 km. Various link roads on the river course stretch, merges with the tar road. South part of the lease area towards Tonk side is located on the North side of NH 12 (Jaipur–Jabalpur) and is around 1.0 km from Megh Gaon. Lease extends upto village Borkhandi Khurd. This can be approached by tar road which bifurcates from NH-12 on the West side before the bridge over river. Lease area forms a part of G.T. Sheet nos. 45N/11, 45N/12, 45N/15 and 45N/16. Area is located between following latitude and longitude:

Latitude – 26°08’11.2” N to 26°13’03.8” N
Longitude - 75°39’37.5” E to 75°50’12.47” E

Physiography & Drainage:

Lease area is gently dipping towards East side indicating the flow direction of river. Highest surface elevation is 271.0 m above MSL and lowest surface elevation is 260.0 m above MSL. The climate of the area is semi-arid type. The average mean annual rainfall (1979 - 2008) is 622mm. The

potential evapotranspiration is highest (255.0 mm) in the month of May and lowest (68.0 mm) in the month of December (Source; District Groundwater Boucher, Tonk*).* In summers temperature goes as high as 45°C while in winters it remains at 22°C.

Estimated Reserve and Production Envisaged:

A) PROVED RESERVES AS PER UNFC CODE (111)
Total Reserves = 281,23,928 m^3

B) BLOCKED RESERVES AS PER UNFC CODE (211 & 222)

TOTAL BLOCKED RESERVES = 34,91,688 m^3

e) MINEABLE RESERVES = A – B
= 281,23,928 –34,91,688 = 246,32,240 m^3
= 24.63 million m^3

C) TARGETED PRODUCTION

During the 5 year period of lease total extraction will be = 20.0 million m^3

D) Balance reserves after 5 years period will be = 24.63 – 20.0 = 4.63 million m^3

Details of Production & Dispatches of Five Years

This is a new lease area being allotted to the applicant. Future production programme has been planned as per the details given below:

Production Programme

Proposed lease is for a period of 5 years only. Lease area consists of 3342.10 ha area in 7 villages (Khasara) in a stretch of 24.4 km. Production programme is 1000 trips/ day with 20 tons of trucks per trip. Working days have been taken as 280 days per annum which can be increased depending on the conditions prevailing at the time of execution.

Projected Production Per Year = 1000 x20 x 280= 56,00,000 tonnes= 5.6 million tonnes i.e. 4.0 million m^3 per year

2.13 Shri Pradeep Kumar Sethi

Name of the Mine: **Bajri (Minor Mineral) Mine of Shri Pradeep Kumar Sethi**
Lease area: 2389.36 ha
Name of the river: Banas
Length of the river under lease: 63.20 kms
Tehsil: Tonk
District: Tonk
Capacity of Production: 5.6 MTPA
State: Rajasthan

Location:

Proposed lease area can be approached from Piplu on North side. Distance of starting point of lease area from Chann is approximately 4.5 km. Various link roads on the river course stretch, merges with the tar road. Lease area end point is at approximately 1.0 km distance from village Raipura. This can be approached by tar road which connects Isarda and Banetha. Proposed lease area forms a part of G.T. Sheet nos. 55N/11, 55N/12, 55N/15, 55N/16, 54B/3, 54B/4, 45O/9, 45O/13 & 54C/1.Area is located between following latitude and longitude:

Latitude – 25°59'18.45" N to 26°06'46.46" N
Longitude - 75°38'39.12" E to 76°00'05.57" E

Physiography & Drainage:

Proposed lease area is gently dipping towards East side indicating the flow direction of river. Highest surface elevation is 283.0 m above MSL and lowest surface elevation is 249.0 m above MSL. The climate of the area is semi-arid type. The average mean annual rainfall (1979-2008) is 622 mm. The potential evapotranspiration is highest (255.0 mm) in the month of May and lowest (68.0 mm) in the month of December (District *Groundwater Boucher, Tonk). In summers temperature goes as high as 45*°C while in winters it remains at around *22*°C.

Estimated Reserve and Production Envisaged:

A) PROVED RESERVES AS PER UNFC CODE (111)
Total Reserves = 6,32,36,604 m^3

B) BLOCKED RESERVES AS PER UNFC CODE (211 & 222)

TOTAL BLOCKED RESERVES = 401,99,700 m^3

e) MINEABLE RESERVES = A – B
= 6,32,36,604–401,99,700 = **2,30,36,904 m^3**
= 23.03 million m^3

C) TARGETED PRODUCTION

During the 5 year period of lease total extraction will be = 20.0 million m^3
D) Balance reserves will be = 23.04–7.80 = 3.03 million m^3

Details of Production & Dispatches of Five Years

This is a new lease area being allotted to the applicant. Future production programme has been planned as per the details given below:

Production Programme

Proposed lease will be allotted for a period of 5 years only. Proposed lease consist of 2389.36 ha area in villages (Khasara) of tehsil and district Tonk in a stretch of 63.20 km. It is proposed to work in 7 blocks as per the details given earlier. Production programme is 20000 tonnes/ day. Working

days have been taken as 280 days per annum which can be increased depending on the conditions prevailing at the time of execution.

Projected Production Per Year = 280 x 20000 = 56,00,000 Tons *i.e.* 5.6 MTPA
Specific Density = 1.40 ton/ cu.m
Volumetric Production = 4.0 million m^3 per year

2.14 Shri Jaswant Singh

Name of the Mine: **Bajri (Minor Mineral) Mine of Shri Jaswant Singh**
Lease area: 1677 ha
Name of the river: Raipur, Luni & Sukri
Length of the river under lease: 56.00 kms
Tehsil: Raipur
District: Pali
Capacity of Production: 12.00 Lakh TPA
State: Rajasthan

Location:

The lease area of river sand is located 1 km to 14 km away from district headquarters Raipur. It is located both sides of Raipur and is around 17 km in length. Tar roads are available from 0.5 to 1 km distance. Jhuntha Block is located western side of the Raipur around 2.5 km away connected by tar road. The lease area is part of survey of India G. T. Sheet Numbers 45F/16, 45J/04, 45K/1 and 45 G/13. The mine lease area is between $26^0$01'26.39"N, to $26^0$16'21.5"N and $73^0$54'30"E to $74^0$03'28.15"E.

Physiography & Drainage:

The lease area comprises flat cum undulating terrain. The highest contour is of 340 m RL and lowest contour is of 304 mRL. No forest land is observed in the lease area. Part of road between Bar and Pali passes through a part of the area. The drainage of the area is by Nadi and Nallah. General flow of rivers is north-westernly. The trees mainly of *Juli flora & Acacia arabica* are found along the banks of the river with the density of around 2% to 3%. The flora is not disturbed by river sand mining. The general slope of the rivers is western to northwestern side.

Water table is around 70m to 80m in depth from the lowest altitude. Thus water table varies from 220 mRL to 230 mRL. The level of river remains up towards inlet side and decreased towards outlet side. However, in the river bed the water level remains on upper side during monsoon. The area has semi-arid zone type climate. Average rainfall remains between 330mm to 350mm per year. The maximum, minimum and mean temperature of the area is 45^0C, 3^0C and 24^0C respectively.

Estimated Reserve and Production Envisaged:

A) PROVED RESERVES AS PER UNFC CODE (111)
Total Reserves = 4,44,03,860 Tonnes

B) MINEABLE RESERVES = 1,90,23,350 Tonnes

C) TARGETED PRODUCTION

During the 5 year period of lease total extraction is = 12.00 Lakh TPA

2.15 M/S SR Associates

Name of the Mine: **Bajri (Minor Mineral) Mine of M/S SR Associates**
Lease area: 1667.78 ha
Name of the river: Banas
Length of the river under lease: 36.10 kms
Tehsil: Deoli
District: Tonk
Capacity of Production: Average 6.6 million tonnes
State: Rajasthan

Location:

The lease area is located from Rajmahal to village Jaguriya of Deoli Tehsil. Total area is around 30 km in length and is of Z shape. There are many approach roads to reach up to the river. The approach from NH 11 is from eastern side of Rajmahal through village Santhali. From district headquarters Tonk, the approach road starts after 23 km and available upto 43 km. The part of the area is located between following latitude and longitude:

Latitude – 25°52'13.66"N to 25°59'19.75"N
Longitude - 75°28'3.6"E to 75°38'51.6" E

Physiography & Drainage:

Lease area comprises flat cum undulated terrain. The highest contour is of 297mRL and lowest contour is of 27mRL. No forest land is observed in the area. No PWD road passes through the applied lease area. The slope of the area is easterly to northerly. General drainage is easterly to northerly by Banas river. The flow of the nallahs which submersed in the river Banas is towards the flow direction of river Banas.

Estimated Reserve and Production Envisaged:

A) PROVED RESERVES AS PER UNFC CODE (111)
Total Reserves = 4,43,17,730 tonnes

B) TARGETED PRODUCTION
During the 5 year period of lease total extraction is = 3,31,17,000 tonnes

Details of Production & Dispatches of Five Years
This is a new lease area being allotted to the applicant. Future production programme has been planned as per the details given below:

Year of Production	Bajari (River Sand) in tonnes
1st Year	6004950
2nd Year	6463800
3rd Year	6623400
4th Year	6822900

Year of Production	Bajari (River Sand) in tonnes
5th Year	7201950
Total	**33117000**

2.16 Shri Mahendra Singh

Name of the Mine: **Bajri (Minor Mineral) Mining Lease of Shri Mahendra Singh**
Lease area: 1191.37 ha
Name of the river: **River Banas and River Kothari**
Length of the river under lease: 76.56 km (22.76 km in Banas River and 53.80 km in Kothari River)
Tehsil: Kotri
District: Bhilwara
Capacity of Production: 11330 Tonnes/day (33,99,500 tonnes per year)
State: Rajasthan

Location: Proposed lease area (1191.37 ha) is located in the River Banas and KothariRiver, Tehsil-Kotri of District Bhilwara. The applied lease area of river sand (Kothari) is located southern side and eastern side of tehsil Kotri. River Kothari is located from southwester side to southeaster side of Kotri. Towards southern side the river Kothari is about 7 kilometers near village Rerwas. River Banas observed towards southwester side of Kotri about 18 kilometers fom Kotri to southeaster side near village Biliya around 18 kilometers by crow flight. Towards eastern side this river Banas is from village Biliya to the eastern side & Kotri up to village Paroli. State Highway between Mandalgarh to Bhilwara is in between both rivers towards southern side of Kotri. National Highway is near Bhilwara towards western side of the applied area.

Lease area forms a part of topo-sheet no. – 45 K/14, 45 K/15, 45 K/16, 45 O/2, 45 O/3, and 45 O/4 on a scale of 1:50,000. Area is of both the lease are located between following Latitude and Longitudes:

Latitude : 74°45'00" E to 74°04'00" E
Longitude : 25°14'30" N to 25°30'30"N

Physiography & Drainage: The lease area comprises flat cum undulated terrain. The highest altitude in the river Kothari is 390 mRL towards western side near village Lasariya and lowest is 334 mRL towards northern side near village Paroli. The, drainage of the area is by Nadi and Nalah. General flow of rivers is easterly to northernly. No work shall be carried out below the water level. As such there shall be no need for any pumping operations. A drain on the up-slop side of pit will be made so that rainwater does not go into pit during mining. No water problems are envisaged during the five years of lease period since the workings will not go deep.

Climate and Rainfall: The district experiences semi-arid zone type of climate. The average annual rainfall remains between 300 mm to 350 mm. As district lies in the desert area and extreme heat recorded during summer and cold during winter season which is the characteristic of the desert. The maximum temperature varies from 45°C in summer to 3°C in winter season. The winter extends from December to March and summer from March end to June third week, followed by rainy season which lasts up to third week of September. The sandy winds are common during the day hours in hot season.

Mineral Reserved:

The mineral reserves as per UNFC are as follows:

Total mineable reserves = Demonstrated reserves (Proved + probable) – Reserves in boundary barrier, 7.5 meter barrier etc. (Proved + probable)

Reserves of Bajari

Total Mineral Resources (A + B)	Code	Reserve
A. Mineral Reserve- Bajari, River sand 1. Proved Reserves 2. Probable Reserves	 111 121	 4,55,65,800 tonnes 4,34,22,150 tonnes
B. Remaining Mineral-Bajari, River sand 1. Feasibility Mineral Reserves 2. Prefeasibility Mineral Reserves 3.Inferred Mineral Reserves	 211 222 333	Lease barrier +Locked in UPL Nil Nil Nil

MINEABLE RESERVES= 8,89,87,950 tonnes

Details of Production & Dispatches of Five Years

This is a new lease area being allotted to the applicant. Future production programme has been planned as per the details given below:

Production Programme

Proposed lease will be allotted for a period of 5 years only @11330 tonnes per day thus 33,99,500 tonnes per year. Proposed lease consist of 1191.37 ha area. Production programme is through trip of 250 trips/ day for trucks/tippers and 400 trips/ day for tractor with trolleys. Working days have been taken as 300 days per annum.

Projected Production Per Year = 33,99,500 tonnes
Specific Density = 1.40 ton/ cu.m
Annual Volumetric Production = 2.43 million m^3

2.17 Shri Vikramaditya Rathore

Name of the Mine: **Bajri (Minor Mineral) Mining Lease of Shri Vikramaditya Rathore**
Lease area: 544.03 ha
Name of the river: Khari and Mansi
Length of the river under lease: 33 kms
Tehsil: Hurda of Bhilwaradistrict and Masuda of Ajmerdistrict
District: Bhilwara and Ajmer
Capacity of Production: 4530 tonne per day in first year to 9300 tonne per day in fifth year
State: Rajasthan

Location: The lease area is located in River Mansi and Khari, Tehsil- Hurda of Bhilwara district and Masuda of Ajmer district, covering an area of 544.03 ha in the 38 villages falling along the Mansi and Khari River and is approached from metalled road. The lease area is part of survey of India G. T. Sheet number 45 K/3, 45K4, 45 K/9, 45 K/ 10, 45 K/13 and 45 K/14 on a scale of 1:50,000.

Physiography & Drainage: The area is comprises of River Mansi and Khari. The height is high towards inlet side and decreases towards outlet side. General drainage is towards northeast to eastern side. The drainage of the area is drain by Nadi and Nallah. The Mansi and Khari River flows from North east to Eastern direction. Both the rivers are non-perennial and runs only in during rainy season and almost dry in summer. In some parts of the river boulder and exposure of basement rock is also available.

The general ground level in the study area is 380 mRL. The ground water table is 320 mRL to 330 mRL within the applied lease area. The water table rise in monsoon as water flows in the river. The water level decreased towards outlet side.

Rainfall and Climate: The district experiences semi-arid dry type of climate except during short rainy season. The average rainfall remains between 300 mm to 350 mm. As district lies in the desert area and extreme heat recorded during summer and cold during winter season which is the characteristic of the desert. The winter extends from December to March and summer from March end to June third week, followed by rainy season which lasts up to third week of September. The maximum temperature varies from 45 °C in summer to 3 °C in winter season.

Mineral Reserved:

The mineral reserves as per UNFC are as follows:
Total mineable reserves = Demonstrated reserves (Proved + probable) – Reserves in boundary barrier, 7.5 meter barrier etc. (Proved + probable)

Mineral Reserved:

Total Mineral Resource (A + B)	UNFC Code	Reserve
A. Mineral Reserve- Bajari, River sand 1. Proved Reserves 2. Probable Reserves	 111 121	 1,89,90,800 2,28,81,110
B. Remaining Mineral-Bajari, River sand 1. Feasibility Mineral Reserves 2. Prefeasibility Mineral Reserves 3.Inferred Mineral Reserves	 121 222 333	Lease barrier +Locked in UPL Nil Nil 52,47,650 tonnes

MINEABLE RESERVES= 4,38,71,910 tonnes

TARGETED PRODUCTION

The production target is around 4530tonnes per day in first year and 9300 tonnes per day in fifth year**.**

Details of Production & Dispatches of Five Years

This is a new lease area being allotted to the applicant. Future production programme has been planned as per the details given below:

Production Programme

Proposed lease will be allotted for a period of 5 years only. Proposed lease consist of 544.03 ha area falling along the Khari and Mansi River.

2.18 Shri Rajendra Singh

Name of the Mine: **Bajri (Minor Mineral) Mine of Shri Rajendra Singh**
Lease area: 339.62 ha
Name of the river: Khari
Length of the river under lease: 23.57 kms
Tehsil: Deogarh
Capacity of Production: 1.50 LTPA
State: Rajasthan

Location: The proposed project is located at Tehsil: Deogarh, District: Rajsamand. The applied lease area located in the Khari river, Tehsil Deogarh, District Rajsamand covering the eight village falling along the Khari river and is approachable from Deogarh- Anjana Choraya – Amet tar road. The area of mining lease fall in Survey of India Topo sheet no. 45G/14 & 45K/2. The lease area comprises of Govt. land and is located between following Latitude and Longitudes:

Latitude – 25°33’ 58”N to 25°36’25”N
Longitude – 73°55’ 57”E to 73°07’13”E

Physiography & Drainage:

River Khari originates in the hills near Deogarh in Rajsamand District. It flows northeast about 192 km through Udaipur, Bhilwara and Ajmer Districts before joining the Banas river near Chosala village in Ajmer District. The proposed lease area is having flat topography, which are surrounded by the fine to coarse grained sandy soil overlying the river sand deposit. The maximum height in this area is 620 mRL and the lower most 560 mRL in the Khari river. The water is flowing in the northeast direction. River is non-perennial and is almost dry in summer season. Water bodies are very few in number, scattered and shallow in depth. They are mostly visible near the check dams and other natural obstacles such as basement rocks. In some part of the river bed boulders of weathered rocks and exposed basement rock can be seen.

The characteristics of the river is as under:

vi. Highest elevation : 620 mRL
vii. Lowest elevation : 560 mRL

viii. Difference in RL : 60 m
ix. Length of river : 192 kms
x. Bed slope of river : 0.31 m/km

There is no other village in the near vicinity of the area however Lasani, Kalalon ki Aanti, Sopari, Isharmand, Malkamaliya, Malkot, Kakrod and Pushalon Ka Khera villages are situated surrounding applied area. The applied area does not fall in any forest or reserve forest area. Soil and agricultural land is available nearby river area. Few scattered trees and shrubs are found in the surrounding area. The temporary benchmark has been shown on surface plan *i.e.* 620 mRL.

The climate of the region is semi-arid type. Temperature of the area in peak summer varies from 40^{o}C to 45^{o}C and minimum varies from 5^{o}C to 10^{o}C in winter. The average rainfall of the applied area is about 500-600 mm per year (average).

Estimated Reserve and Production Envisaged:

River sediments (River Sand) have been deposited/mineralized in the form of stratified deposit. Mineralization is found in the entire river bed. The River Sand is brought by flood waters from upstream side and naturally deposited when the water current in the river slows down. Following parameters are considered for reserve estimation:

a) Shape, size, width and depth extension of mineral as conceived on the geological plan and section.
b) Bulk density of the Bajri (River Sand) is taken as 1.40 (as per MMCR, 1986).
c) Based on geological cross section the actual width and thickness is taken in to consideration.
d) Reserves only in proved category are calculated to a depth of 3.0 Mt. in river bed since mining has been restricted to 3.0m deep only for safety reasons.

Volumetric method is adopted for calculating reserves of River Sand. Reserves are estimation on the basis of established width, thickness, and stoke length based on influence of the mineralized formation in the river bed and where good inferences are available only such area are considered for reserve estimation. The depth is considered upto 3.0 m as although working is permitted upto 3.0 m depth in the riverbed.

Therefore reserves are: Cross sectional area (average length*average width)*depth*Bulk density. The reserves in the river bed shall be replenished by flood waters during rainy season.

Mineable reserves have been taken as 95% of geological reserves.

Proved reserves as per UNFC code (111)

Total reserves = 9984828 Tonnes

A) **Blocked reserves as per UNFC code (211 & 122) :**

Reserves blocked in water filled areas in river and 45 m radius from each water well/funeral ground, upto 45 m from either side side of existing culverts =1033251 Tonne

B) Minable Reserves = A - B

= 9984828 - 1033251 = 8951577 Ton

Production of sand each year = 1,50,000 tonnes per year for five years.

The size of sediments varies from 1.0 mm to about 3.0 mm and is not uniform. The grains in the all size, small or large are rounded to sub rounded in shape. The colour of river sand is pinkish/light and the form is fine to coarse grained. River sand weathered particles of feldspathic rocks of metamorphic composition with mixture of silica and other accessories minerals. The sand is composed of loose rounded silica grains of varying size with minor clay and sand particle with pebbles and is being used for preparing civil construction activities. The river sand is of two grades *i.e.* fine and coarse river sand and used for different purposes.

2.19 Shri Mahendra Singh Ratnawat

Name of the Mine: Bajri (Minor Mineral) Mine of Shri Mahendra Singh Ratnawat
Lease area: 2932.92 ha
Name of the river: Kantli and Lohagarh
Length of the river under lease: 62.00 kms
Tehsil: Udaipurwati and Nawalgarh
District: Jhunjhunu
Capacity of Production: 75.9 Lakh TPA
State: Rajasthan

Location:

The lease area lies on Kantli Nadi, and Udaipur-Lohargarh Nadi. The mine lease area is between $28^0$02'9.2784"N, to $27^0$40'36.6288"N and $75^0$33'8.8912"E to $75^0$23'9.4259"E. The project is located in Seismic Zone-II. Total mine lease area of the project is 2932.924 ha. Total River stretches allotted for mining is about 79.0km comprises Kantli Nadi (39.0km), Udaipur-Lohargarh Nadi (40.0km)

Physiography & Drainage:

The hilly area in South Eastern part of district is characterized by hills of Aravalli range, running in North Easterly direction. The highest peak, 1051 m high is in the south of Lohagarh village bordering Sikar district. Hills are almost barren of vegetation except a few bushes of *Acacia* and *Cactus*. The undulating area with small isolated hills having steep slope lies in the South Western part of district. The general elevation above mean sea level range between 300 and 450m

Jhunjhunu district is covered under mainly Sekhawati basin and North Western part falls outside the basin *i.e.* having inland drainage. The area is drained mainly by Kantli River. The area in the South Eastern part is drained by Singhana River and a small area in south western corner of district is drained by Budhi nala. The South and East of hill ranges in Khetri area is drained by Dohana River. All the rivers/nalas are ephemeral in nature and flows in response to heavy precipitation during monsoon. Being a desertic terrain particularly in North Eastern and North western part of district has inland drainage.

Estimated Reserve and Production Envisaged:

A) PROVED RESERVES AS PER UNFC CODE (111)
Total Reserves 136380966 Tonne

B) MINEABLE RESERVES = 81828579.6 Tonnes

C) TARGETED PRODUCTION:
During the 5 year period of lease total extraction is = 75.9 Lakh TPA

CHAPTER-III
Literature Survey & Methodology

3.1 Estimation of Surface Runoff / River Flow

The importance of estimating the water availability from the available hydrological data for estimating the runoff is quite important for determination of replenishment. Many engineers in the past has developed empirical run off estimation formulae. These formulae are essentially rainfall-runoff relations with additional third or fourth parameters to account for climatic or catchment characteristics. Some of the empirical formulae used in various parts of India are as under:

Binnie's Percentages

Sir Alexander Binnie measures the runoff from a small catchment near Nagpur (area of 16 km^2) during 1869 and 1872 and developed curves of cumulative runoff against cumulative rainfall. The two curves are found to be similar. From these, he established percentage of runoff from the rainfall data. These percentages have been used in Madhya Pradesh and Vidarbha Region of Maharashtra for the estimation of yield.

Barlows Tables

Barlow, the first Chief Engineer of the Hydro-electric Survey of India (1915), on the basis of his study in small catchments (area–130 km^2) in Uttar Pradesh expressed runoff R as:

$$R = K_b P$$

Where K_b is the runoff coefficient which depends upon the type of catchment and nature of monsoon rainfall.

Table-3.1: Barlow's Runoff coefficient Kb in percentage (Developed for use in UP)

Class	Description of catchment	Value of K_b (Percentage)		
		Season I	Season II	Season III
A	Flat, cultivated and absorbent soils	7	10	15
B	Flat, partly cultivated and stiff soils	12	15	18
C	Average catchment	16	20	32
D	Hills and plains with little cultivation	28	35	60
E	Very hilly, steep and hardly any cultivation	36	45	81

Season I: Light rain, no heavy downpour
Season II: Average or varying rainfall, no continuous downpour
Season III: Continuous downpour

Strange's Tables

Strange (1928) studies the available data on rainfall and runoff on the border areas of present day Maharashtra and Karnataka and obtained the values of runoff coefficient as,

$$Ks = R/P$$

as a function of the catchment character. For purpose of calculating the yield from the total monsoon rainfall, the catchments were characterized as "good", "average" and "bad". Value of the Ks for these catchments is shown in Table-3.2. Strange also gave a table for calculating the daily runoff from daily rainfall. In this, the run-off coefficient depends not only on the amount of rainfall but also on the state of the ground. Three categories of the original ground state as "dry", "damp" and "wet" are used by him.

Table-3.2: Extract of Strange's table of Run-off Co-efficient Ks in percent

Total monsoon rainfall (cm)	Run-off Co-efficient Ks in percent		
	Good catchment	Average catchment	Bad catchment
25	4.3	3.2	2.1
50	15.0	11.3	7.5
75	26.3	19.7	13.1
100	37.5	28.0	18.7
125	47.6	35.7	23.8
150	58.9	44.1	29.4

Inglis and De'Souza Formula

As a result of careful stream gauging in 53 sites in Western India, Inglis and De'Souza (1929) evolved two regional formulae between annual runoff R in cm and annual rainfall P in cm as follows:

i. For Ghat regions of western India, $R= 0.85 P – 30.5$
ii. For Deccan plateau, $R = (1/254) P (P-17.8)$

Khosla formula

Khosla (1960) analyzed the rainfall, runoff and temperature data for various catchment in India and USA to arrive at an empirical relationship between runoff and rainfall. The time period is taken as a month. His relationship for monthly runoff is

$$R_m = P_m - L_m$$

and $L_m= 0.48T_m$ for $T_m>4.5^oC$
where R_m= monthly runoff in cm and $R_m \geq 0$
P_m= monthly rainfall in cm
L_m= monthly losses in cm
T_m= Mean monthly temperature of the catchment in ^oC

For $T_m \leq 4.5^oC$, the loss L_m may provisionally be assumed as:

T °C	4.5	-1	-6.5
L_m (cm)	2.17	1.78	1.52

Annual run-off = $\sum R_m$

Khosla's formula is indirectly based on the water balance concept and the mean monthly catchment temperature is used to reflect the losses due to evapotranspiration. The formula has been tested on a number of catchments in India and is found to give fairly god results for the annual yield for use in preliminary studies. This formula can also be used to generate synthetic run-off data from historical rainfall and temperature data.

All of the above empirical formulae have been developed for a particular region of India and have their own limitations. For the present study, the area of the watershed for the river has been estimated using remote sensing satellite data. This estimation has also helped in determining the river parameters and soil erosion from the catchment area.

Computing Run-off by using Run-off Coefficient

The volume of run-off can be directly computed approximately, by using an equation of the form;

$$Q = K.P$$

Where Q = Run-off
P = Precipitation, and
K = is a constant, depending upon imperviousness of the drainage area.

Various values of K, which are commonly used, are shown in Table-3.3 below.

Table-3.3: Values of Run-off Coefficient K

Sl. No.	Type of Area	Value of K		
		Flat land 0-5% slope	Rolling land 5-10% slope	Hilly land 10-30% slope
1. (a)	**Urban areas**			
	30% area impervious (paved)	0.40	0.50	--
	50% area impervious (paved)	0.55	0.65	--
	70% area impervious (paved)	0.65	0.80	--
(b)	**Single family residence in urban areas**	0.30		
2.	**Cultivated areas**			
	Open sandy loam	0.30	0.40	0.52
	Clay and silt loam	0.50	0.60	0.72
	Tight clay	0.60	0.70	0.82
3.	**Pastures**			
	Open sandy loam	0.10	0.16	0.22
	Clay and silt loam	0.30	0.36	0.42
	Tight clay	0.40	0.55	0.60
4.	**Wooded land or Forested Areas**			
	Open sandy loam	0.10	0.25	0.30
	Clay and silt loam	0.30	0.35	0.50
	Tight clay	0.40	0.55	0.60

(Source: Irrigation Engineering & Hydraulic Structures by S.K. Garg)

3.2 Estimation of Bed Load

The transport of sediment by rivers has been studied extensively by engineers and earth scientists for more than a century. The use of Bed load transport is a famous one for this analytical type of approach. The first bed load equation was developed by Du Boys in 1879. Since then several equations have been proposed for the prediction of bed load transport. One of the major models among them was Mayer- Peters and Muller model (1948) which is still being hold good for the prediction of bed load transport. The other models include schoklitsch model (1962), Chang model (1939) and Shamove (1962). Each model fit into different scenario. Bagnold (1980), Parker et.al. (1982) were the major works carried out for the Mayer- Peter equations giving an empirical correlation of bed load transport rates in flumes and natural rivers. There were different reported studies which use the same model indifferent types of rivers. Dietrich and Smith (1984) studied the behaviour of bed load transport in meandering river.

Another scientist Bathurst and Graf (1987) developed a bed load discharge equation for steep mountain rivers which are appropriate for course sediment. Carson and Griffiths (1987) had given a review on the behaviour of the bed load transport in gravel channels. Meade *et.al.*(1990) has made a detailed study on movement and storage of sediment of the rivers of United States and Canada. Parker (1990) made a study of bed load transport of Gravel Rivers. The study indicates that the bed load transport rate of mixtures should be based on the availability of the each size range in the surface layer. Parker (1991) put forward a theory on selective sorting and abrasion of river gravel.

Recent studies on bed load transport incorporated the stochastic nature of the river sand inflow. Habibi *et.al.* (1994) developed a new formulation for estimation of bed load transport. Zhilin Sun and Donahue (2000) developed a statistical based bed load formula for non-uniform sediment. Maarten Klienhans and Rijn (2002) introduced another stochastic model for bed load transport prediction. Nian-Sheng Cheng (2002) developed another exponential formula for the bed load transport which does not involve the concept of critical shear stress. Jaber Almedeij and Diplas (2003) worked on bed load transport in gravel bed streams with uni-model sediment. Strom et.al (2004) studied about the cluster formation and evolution by tackling the aspects associated with micro- topography and the bed load transport. Yantao and Parker (2005) presented a new numerical model for the simulation of gravel bed load transport and pulse evolution in Mountain Rivers.

The study of Darren *et al.*(2005) is an important one in the model study of bed load transport, which gave more attention and increases the applicability of Meyer–Peter‘s equation. Hyung et.al (2008) reported a study on sediment transport processes over a sand bank in macro tidal Garolim Bay, West coast of Korea. In India there are only a few studies on sand mining. Chandrakanth *et.al* (2005) studied the effect of sand mining on ground water depletion in Karnataka by investigating the field data and comparing it with a non-sand bearing area. Rajendra *et.al.*(2008) reported a detailed study on sand extraction from agricultural fields around Bangalore. Several such studies related to river sand mining have been reported for the rivers of Kerala also.

For a clear direction for the local bodies, for the limit for safe sand mining from different stretches, an analytical study based on bed load transport model combined with actual sand flow measurement is necessary. This study develops a reach wise assessment of actual sand inflow and the optimal removal from rivers.

3.3 Methodology for Estimation of Sediment Load

The scientific solution for the crisis of sand mining needs an optimization of sand removal. Knowledge of sand inflow is the key part of determination of optimal sand removal. To determine this sand inflow an analytical study is carried out by using bed load transport model. The bed load transport can be estimated using different analytical model such as Meyer-Peter's, Einstein's Model, Shield's Formula, Du-Boy's Formula etc. However, in the present study, the most scientifically accepted Meyer-Peter's equation for estimation of bed load transport was used.

The monsoon in the state of Rajasthan is not regular. Thus, the actual observation of flow and silt which is essential for determination of replenishment is difficult. With this situation in mind, a three stage sand replenishment study, described hereunder, was undertaken.

***In stage one**, preliminary study with field data collection was done. During the field visit, the installation of marked observation rods was undertaken in every leasehold area in the pre-monsoon period. The rise of river bed level in the post monsoon season was then ascertained. While installing the marked observation rods, it was also kept in mind that depending upon the rainfall intensity and duration, there may not be actual discharge in this particular year of 2017 and therefore data from secondary sources might be required. In view of this, CMPDI has approached Central Water Commission (CWC), Ministry of Water Resources, Government of India, for getting the hydrological data from the observation stations CWC has in the study area of the State of Rajasthan. In addition to this CMPDI has also approached state agencies in Jaipur for getting the hydrological data for those rivers that are not covered by CWC.*

***The second stage** includes, **use of remote sensing technology** for identification of watershed area relevant to each mine lease. In addition to this, the grain size analysis i.e. d_{10}, d_{30}, d_{50} and d_{60}, uniformity coefficient and coefficient of curvature was also determined as an input for estimation of bajri/sand replenishment of rivers under study. Use of **Universal Soil Erosion Equation** was also done to have an idea of the soil erosion from the river catchment area.*

***The final stage** of this study comprises of use of analytical model study of bed load transport from the non-perennial rivers flowing through the mining lease areas. The data for this study was taken from field survey, Central Water Commission and approved mine plans of leases. The real time data of major rivers flowing in the state of Rajasthan is collected by CWC periodically through its well established hydrological network stations at critical observation points. This data along with field data was used in the **Meyer Peter's equation** for calculation of bed load transport.*

Meyer – Peter's equation:

The present study used the Meyer-Peterson's model for the estimation of bed load transport because of its wide acceptance and simplicity in computation. Other models give reliable estimates for manmade channels like canals. But the present study considered with river body, in which the former equation is relevant.

Meyer-Peter's equation is based on experimental work carried out at Federal Institute of Technology, Zurich. Mayer-Peter gave a dimensionless equation based, for the first time, on rational laws. The simplified Meyer Peter's equation (*Source: Irrigation Engineering & Hydraulic Structures by S.K. Garg)* is as follows:

$$g_b = 0.417[\tau_0 (\eta'/ \eta)^{1.5} - \tau_c]^{1.5}$$

where,

g_b = Rate of bed load transport (by weight) in N per m width of channel per second

η' = Manning's coefficient pertaining to grain size on an unrippled bed and Strickler formula *i.e.* $\eta' = (1/24) \times d^{1/6}$ where d is the median size (d_{50}) of the bed sediment in m.

η = The actual observed value of the *rugosity coefficient* on rippled channels. Its value is generally taken as 0.020 for discharges of more than 11cumecs, and 0.0225 for lower discharges.

τ_c = Critical shear stress required to move the grain in N/m^2 and given by equation $\tau_c = 0.687 d_a$, where d_a is mean or average size of the sediment in mm. This arithmetic average size is usually found to vary between d_{50} and d_{60}.

τ_0= Unit tractive force produced by flowing water *i.e.* $\gamma_w RS$. Truly speaking, its value should be taken as the unit tractive force produced by the flowing water on bed = $0.97\gamma_w RS$. R is the hydraulic mean depth of the channel (depth of flow for wider channel) and S is the bed slope

The value of Manning's coefficient (η) depends upon channel condition and also upon discharges. The recommended values are provided in Table-3.3 and Table-3.4.

Table-3.4: Recommended values of Manning's coefficient (η) for unlined channels

Sl. No.	Condition of Channel	Value of η
1	Very good	0.0225
2	Good	0.025
3	Indifferent	0.0275
4	Poor	0.030

Central Board of Irrigation has recommended the following values of η for different discharges:

Table-3.5: Recommended values of Manning's coefficient (η) for Different Discharges

Sl. No.	Discharge in Cumecs	Value of η
1	14 to 140	0.025
2	140 to 280	0.0225
3	280 and above	0.020

Figure 3.1: Field Survey in the Mine leases

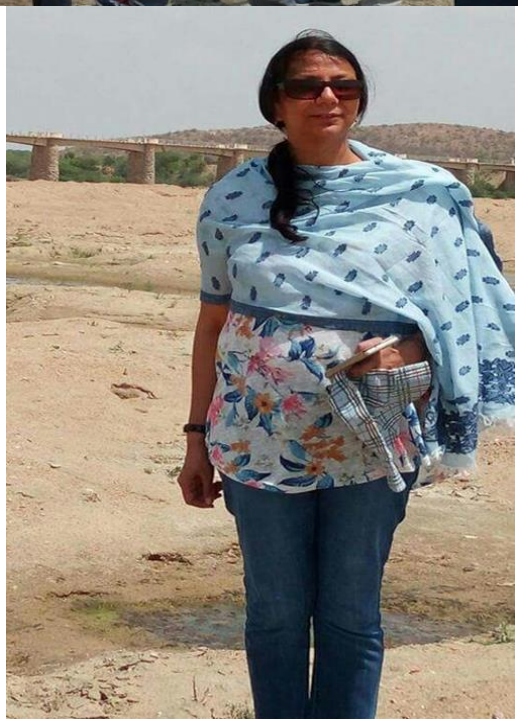

Figure 3.2: Installation of Observation Points in Mine leases

Figure 3.3: A view of the Sand Mining Lease

Universal Soil Erosion Equation:

Soil Erosion Equation is defined as, A = K R (LS) C

Where,

A = Estimate of soil loss rate in tons/hectare/year
K = Soil erodibility factor
R = Rainfall factor
LS = Slope factor
C = Crop management factor

This will help us to determine the soil loss from the catchment area that finds place in the rivers.

CHAPTER-IV
Data Collection, Analyses and Estimation of Replenishment

4. General

As described in Chapter-II, there are following 19 mining leases that has been considered for replenishment study in the 1st phase of this assignment. The list of concerned rivers for each of the mining leases is provided in Table-4.1.

Table-4.1: List of the mines to be taken up for study in 1st Phase and concerned rivers

Sl. No.	Name of leaseholder	District	Name of the River
1	M/s Shekhawat Associates	Bhilwara	Banas
2	Shri Abhishek Choudhary	Bhilwara	Nekadi, Khari & Masi
3	Shri Sanjay Kumar Garg	Bhilwara	Banas & Kothari
4	Shri Sanjay Kumar Garg	Bhilwara	Banas, Beerach & Menali
5	Rajasthan FORT& PAL	Chittorgarh	Beerach
6	Shri Himmat Singh Shekhawat	Rajsamand	Banas& Lapli
7	Shri Narottam Singh Jadaun	Rajsamand	Banas, Gomti& Taleri
8	Shri Mangal Singh	Sawai Madhopur	Banas
9	Shri Rahul Panwar	Tonk	Masi
10	Shri Mangal Singh Solanki	Tonk	Mansi & Bandi
11	M/s Shekhawat Associates	Tonk	Mansi
12	Shri Som Prakash	Tonk	Banas
13	Shri Pradeep Kumar Sethi	Tonk	Banas
14	Shri Jaswant Singh	Pali	Raipur, Luni, Sukri
15	M/s S.R. Associates	Tonk	Banas
16	Shri Mahendra Singh	Bhilwara	Banas & Kothari
17	Shri Vikramaditya Rathore	Bhilwara	Khari & Mansi
18	Shri Rajendra Singh	Rajsamand	Khari
19	Shri Mahender Singh Ratnawat	Jhunjhunu	Kantli & Lohagarh

The size of the lease hold including their average length and width is provided in Table-4.2 below:

Table-4.2: Dimensional Parameters of the mines to be taken up for study in 1st Phase

Sl. No.	Name of leaseholder	Area (in Ha)	Dimension of the Lease		
			Average length (in kms)	Average Effective width (in kms)	Bed slope
1	M/s Shekhawat Associates	1299.00	50.00	0.260	1:1560
2	Shri Abhishek Choudhary	1207.00	35.00	0.220	1:310

Sl. No.	Name of leaseholder	Area (in Ha)	Dimension of the Lease		
			Average length (in kms)	Average Effective width (in kms)	Bed slope
3	Shri Sanjay Kumar Garg	1947.00	55.85	0.230	1:1728
4	Shri Sanjay Kumar Garg	1675.85	36.00	0.210	1:1114
5	Rajasthan FORT & PAL	335.03	35.00	0.150	1:921
6	Shri Himmat Singh Shekhawat	773.28	50.00	0.212	1:115
7	Shri Narottam Singh Jadaun	489.40	50.00	0.150	1:510
8	Shri Mangal Singh	278.67	30.40	0.140	1:2026
9	Shri Rahul Panwar	316.58	40.40	0.090	1:512
10	Shri Mangal Singh Solanki	104.78	13.30	0.110	1:1210
11	M/s Shekhawat Associates	889.93	45.00	0.175	1:720
12	Shri Som Prakash	3342.10	24.40	0.310	1:2218
13	Shri Pradeep Kumar Sethi	2389.36	63.20	0.295	1:1915
14	Shri Jaswant Singh	1677.00	56.00	0.250	1:1555
15	M/s S.R. Associates	1667.78	36.10	0.260	1:2123
16	Shri Mahendra Singh	1191.37	42.00	0.170	1:554
17	Shri Vikramaditya Rathore	544.03	33.00	0.105	1:1018
18	Shri Rajendra Singh	396.20	23.57	0.090	1:393
19	Shri Mahender Singh Ratnawat	2392.00	79.00	0.300	1:414

From the above, it may be seen that major rivers for the above mining leases are Banas, Mansi, Khari, Kothari and Gomti. These rivers have been considered for replenishment study in the 1st phase.

4.1 Banas River

The Banas is a river of Rajasthan state in western India. It is a tributary of the Chambal River, which in turn flows into the Yamuna, a tributary of the Ganges. The Banas is approximately 512 kilometres in length. It is also known as 'Van Ki Asha' (Hope of forest).

The Banas originates in the Veron ka Math situated in Khamnor Hills of the Aravalli Range, about 5 kms from Kumbhalgarh in Rajsamand district. It flows northeast through the Mewar region of Rajasthan, and meets the Chambal near the village of Rameshwar in Sawai Madhopur District. The cities of Nathdwara, Jahazpur, and Tonk lie on the river. Major tributaries include the right bank tributaries of Berach and Menali and the left bank tributaries of Kothari, Khari, Dai, Dheel River, Sohadara, Morel and Kalisil.

The Banas drains a basin of 45,833 km², and lies entirely within Rajasthan. It is a seasonal river that dries up during the summer, but it is nonetheless used for irrigation. The Bisalpur-Jaipur project completed by the Government of Rajasthan in 2009 provides drinking water from the Banas to Jaipur city. Banas drains the east slope of the central portion of the Aravalli Range, and the basin includes all or part of Ajmer, Bhilwara, Bundi, Chittorgarh, Dausa, Jaipur, Pali, Rajsamand, Sawai Madhopur, Sirohi, Tonk, and Udaipur districts.

Tributaries: Berach and Menali on the right, and Kothari, Khari, Dai, Dheel, Sohadara, Morel and Kalisil on the left.

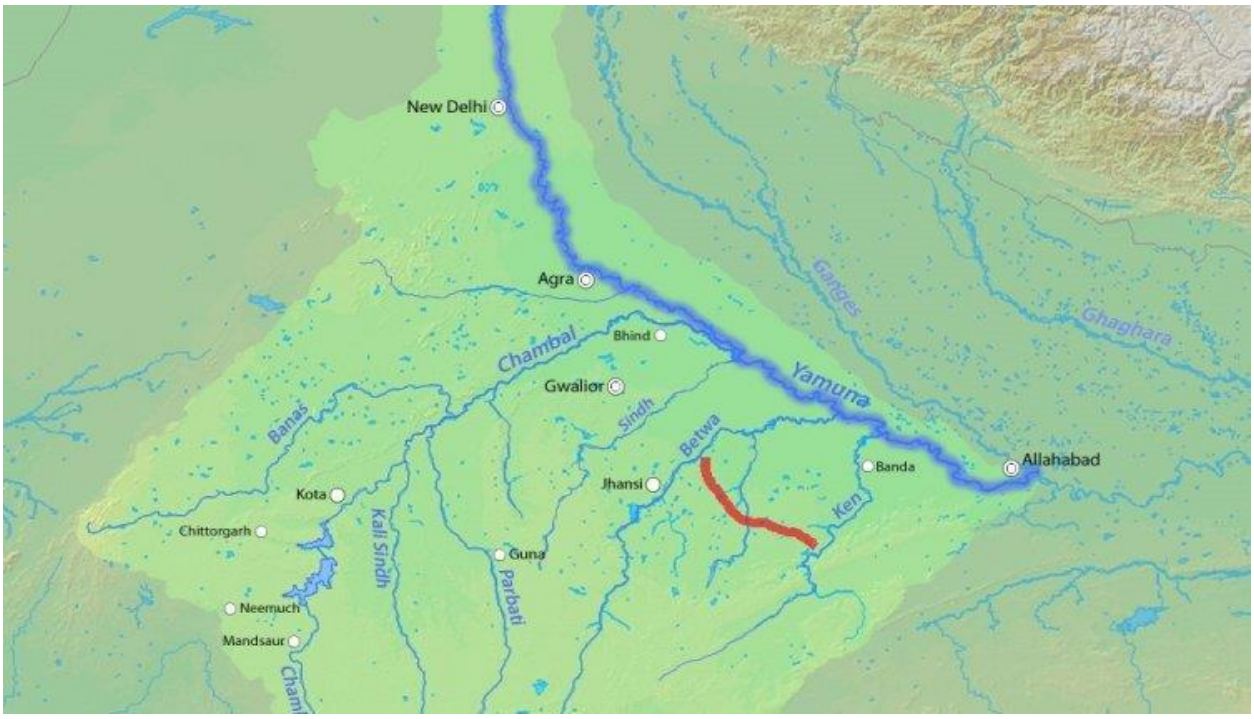

Figure-4.1: Drainage map of study area showing Banas River

Khari: Kahri River rises from Palanpur (B.K. district) and drains into the Banas River through Mehsana district at 80 km downstream of Dantiwada dam. It flows northeast for about 192 km through Rajsamand, Bhilwara and Ajmer Districts before joining the Banas River near Chosala village in Ajmer District. The entry point of the river in the district is village Dhuwala, tehsil Karera and exist point village Gulabpura, tehsil Hurda with the travel length of 62 kms. The catchment area of the river around 6,268 km^2.

Tributaries: Nekhadi and Bara rivers on the left and Mansi River on the right.

Kothari River: Kothari River, another tributary of Banas, originate in the eastern slopes of Aravali ranges, near Horera village in Bhilwara District. The catchment area of the river is 2341 km^2 lying between $73^0$47'30" and $75^0$03'30" East longitudes and $73^0$47'30" & $75^0$03'30" North latitudes. The river flows through Rajsamand and Bhilwara districts for about 51 kms in hilly region and 100 kms through plains before joining the Banas River near Nandrai village in Bhilwara district.

Tributaries: Bahamani

River Berach: River Berach originates in the hills northeast of Udaipur city. It flows northeast for about 157 kms in Udaipur, Chittorgarh and Bhilwara Districts before joining the Banas near Bigod village in Mandalgarh Tehsil of Bhilwara District. The entry point of the river in the Bhilwara district is village Badlias, Tehsil Kotriand whereas exit point is village Bigod near Trivani and it travels 85 km in the district. It flows in a hilly region up to Badgaon reservoir and then through plains. The total catchment area of the river is around 7,502km^2.

Tributaries: Ayar, Wagli Wagon, Gambhiri and Orai, joining from the right.

Figure-4.2: River Raipur, Pali

Figure-4.3: River Banas, Tonk

River Manshi: River Manshi originates near village Karera in Bhilwara District. It flows from south west to north east and then merges in Khari River. The entry point of the river in the district is village Kaserpura, tehsil Karera and exist point is village Sangriya, tehsil Phuliakala with the travel length of 68 km in the district. The total catchment area of the river is around 1500 km^2.

The river Banas, Khari, Mansi, Kothari, and Chandrabhaga are originated from the hills of Delhi Supergroup and enter in the plains of Banded Gniessic Complex in the district Bhilwara. The sand is generated in all the rivers are due to process of erosion of Delhi Super group of rocks and BGC rocks. Among these rivers, Banas River having good quality of sand due to long course of travelling

of the sediments and thickness of deposition of sand is about 3-4 m in all the above rivers as per District Survey Report of Bhilwara District.

Figure-4.4: River Piplu-Banas, Chauth ka Barwara

Figure-4.5: Bajri/sand deposition in River Banas, Tonk

Figure-4.6: River Banas, Jahajpur, Bhilwara

Figure-4.7: River Kotri-Hurda, Bhilwara

4.2 Estimation of Watershed Area through Remote Sensing data

The watershed area of each lease has been worked out based on the topo-sheet and remote sensing data. The data estimated for each of the lease is provided in Table-4.3.

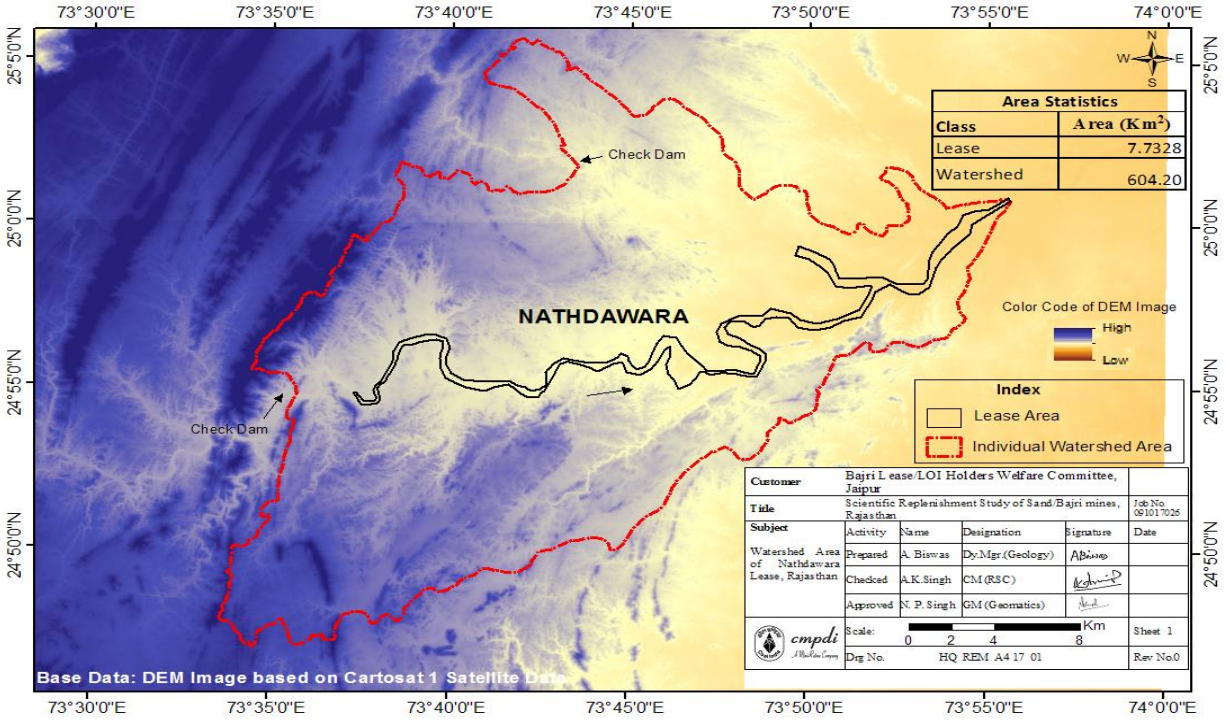

Figure-4.8: Watershed Area determination of Nathdwara Lease through Remote Sensing

Table-4.3: Watershed area of Mine Leases

Sl. No.	Name of leaseholder	Area (in Ha)	Name of Rivers	Watershed Perimeter in Kms	Watershed Area in Sq. Kms.
1	M/s Shekhawat Associates	1299.00	Banas	64.68	83.37
2	Shri Abhishek Choudhary	1207.00	Nekadi, Khari & Masi	194.88	341.02
3	Shri Sanjay Kumar Garg	1947.00	Banas & Kothari	305.84	473.10
4	Shri Sanjay Kumar Garg	1675.85	Banas, Beerach & Menali	450.81	2973.92
5	M/s Rajasthan FORT& PAL	335.03	Beerach	229.09	496.61
6	Shri Himmat Singh Shekhawat	773.28	Banas& Lapli	157.33	604.20
7	Shri Narottam Singh Jadaun	489.40	Banas, Gomti & Taleri	180.92	747.03
8	Shri Mangal Singh	278.67	Banas	401.44	1057.96
9	Shri Rahul Panwar	316.58	Masi	126.70	107.63
10	Shri Mangal Singh Solanki	104.78	Mansi & Bandi	382.11	323.97
11	M/s Shekhawat Associates	889.93	Mansi	106.39	433.70
12	Shri Som Prakash	3342.10	Banas	70.37	372.99
13	Shri Pradeep Kumar Sethi	2389.36	Banas	304.97	608.48

Sl. No.	Name of leaseholder	Area (in Ha)	Name of Rivers	Watershed Perimeter in Kms	Watershed Area in Sq. Kms.
14	Shri Jaswant Singh	1677.00	Raipur, Luni, Sukri	47.17	47.88
15	M/s S.R. Associates	1667.78	Banas	422.47	680.49
16	Shri Mahendra Singh	1191.37	Banas & Kothari	89.51	274.26
17	Shri Vikramaditya Rathore	544.03	Khari & Mansi	106.89	87.92
18	Shri Rajendra Singh	396.20	Khari	120.98	159.41
19	Shri Mahender Singh Ratnawat	2392.00	Kantli & Lohagarh	306.39	904.93

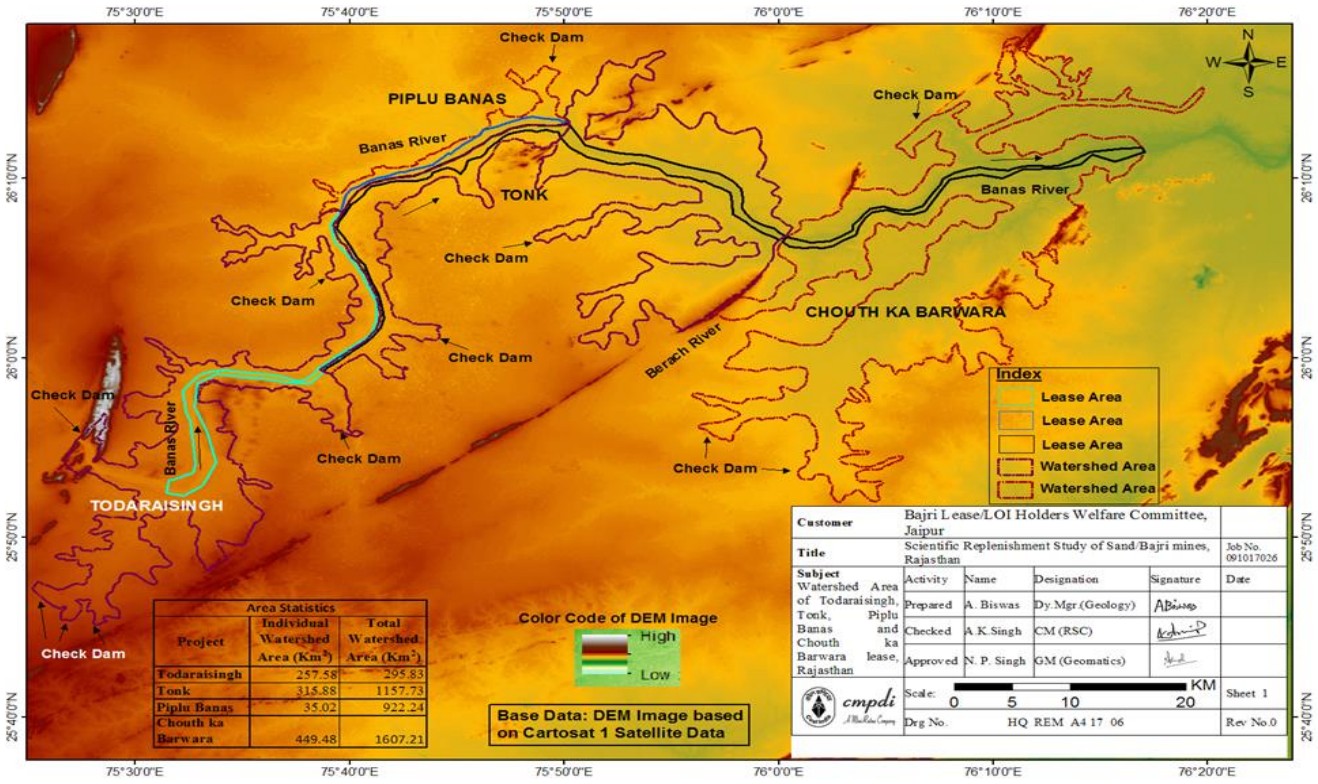

Figure-4.9: Watershed Area determination of Todraising, Piplu Banas and Chauth ka Barwara through Remote Sensing

4.3 Data obtained from Central Water Commission

The data obtained from Central Water Commission from some of their observation stations located in the study area is provided in Table-4.4 and Table-4.5. This data has been utilized for estimation of replenishment of sand mining projects. For determination of the grain size distribution of the Bajri/sand, the sample from each of the mine lease was collected and analyzed. The grain size distribution *i.e.* d_{10}, d_{30}, d_{50}, d_{60}, uniformity coefficient and coefficient of curvature was determined in the laboratory. The analysis result is presented in Table-4.6. From the analysis, it is evident that the sand is well graded.

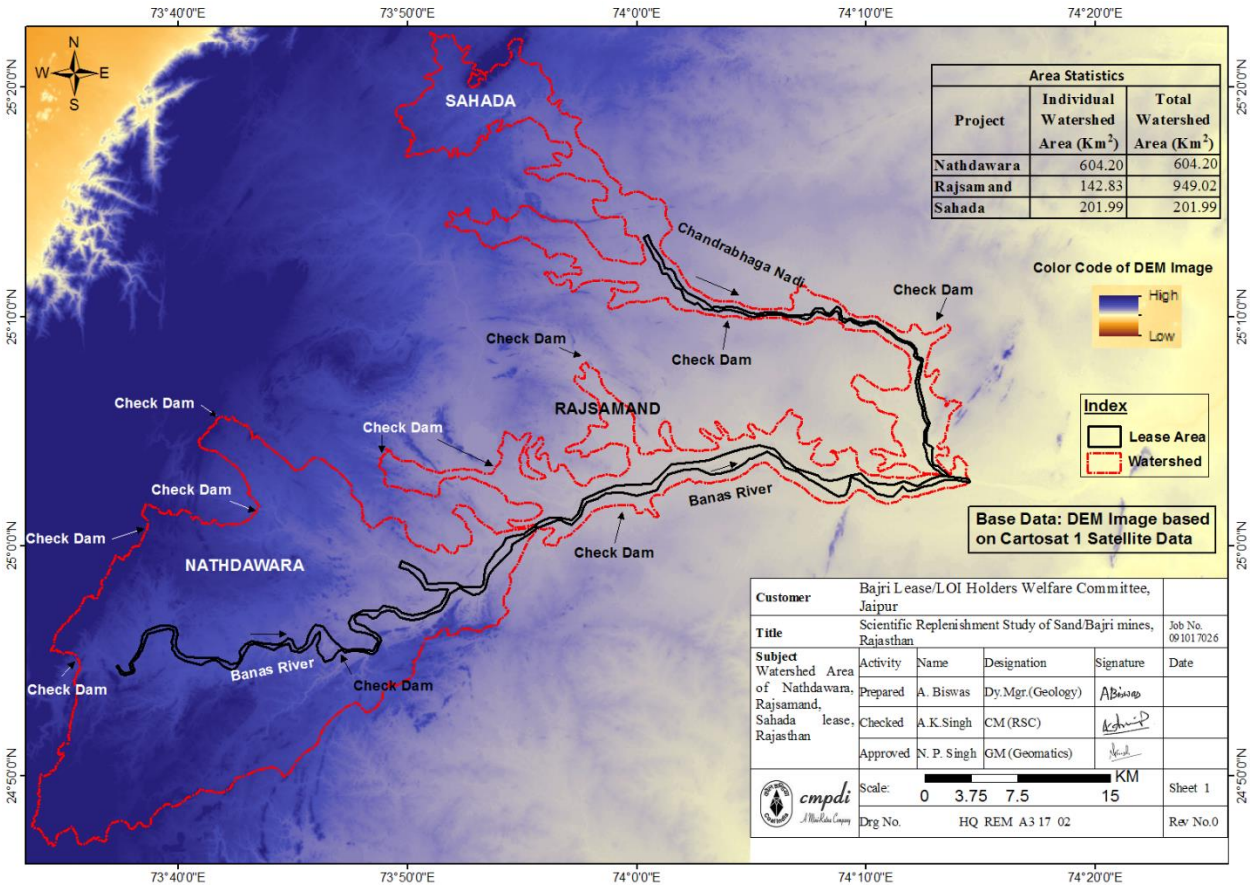

Figure-4.10: Watershed Area determination of Todraising, Piplu Banas and Chauth ka Barwara through Remote Sensing

For estimation of bed load transport, Peyer-Peter's equation was used. The data collected from field, the real time flow data from CWC and grain size distribution was used. For all the tributaries of Banas River, a depth of flow 0.75 m as observed from the field was assumed for estimation of sand replenishment.

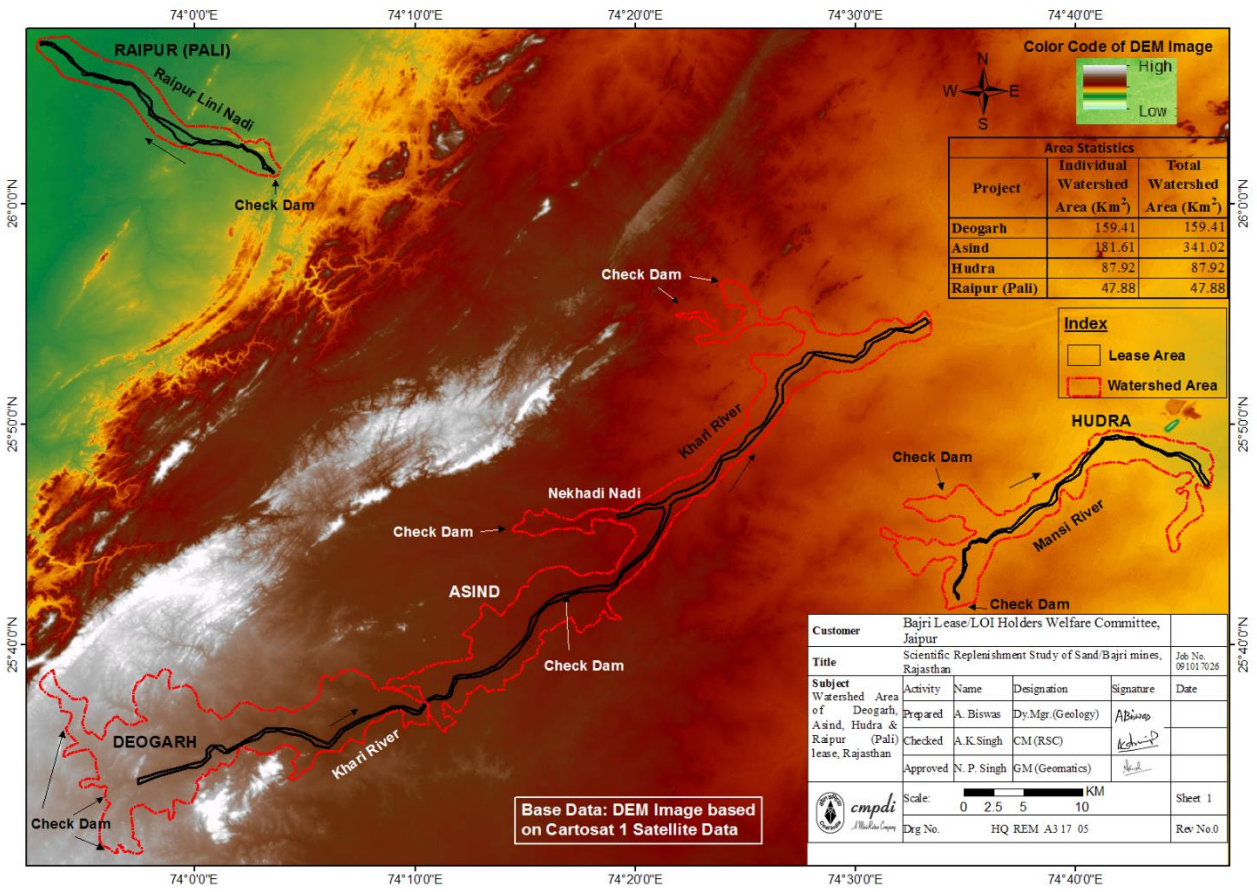

Figure-4.11: Watershed Area determination of Deogarh, Asind and Hudra & Raipur through Remote Sensing

Table-4.4: Hydrological data of the Study Area (Year 2016)

Name of the CWC Observation Stations	Hydrological Data									
	Annual runoff (in MCM)	Annual runoff (in mm)	Peak Observed Discharge (Cumecs)	Corresponding Water Level (in m)	Peak computed Discharge (Cumecs)	Corresponding Water Level (in m)	Lowest Observed Discharge (Cumecs)	Corresponding Water Level (in m)	Lowest Computed Discharge (Cumecs)	Corresponding Water Level (in m)
Baranwada	2809	56	2750	197.70	1650	196.6	0.00	191.0	0.00	191.9
Bigod	2911	203	832.9	423.89	5140	428.20	0.00	420.00	0.70	420.96
Chittorgarh	208	144	183.7	402.71	124.4	402.15	0.00	398.89	0.00	398.89
Khatoli	11112	734	9839	197.38	14400	200.1	0.00	189.61	3.00	189.76
Tonk	495	12	242.9	257.21	587.00	260.06	0.00	253.00	9.00	254.30

(Source: Central Water Commission)

Table-4.5: Annual rainfall data for 2016

Name of the CWC Observation Stations	Rainfall (in mm)						Total Rainfall (in mm)	Total Rainy Days
	May	June	July	August	September	October		
Baranwada	0.00	69.20	415.80	260.00	15.20	18.80	779.00	40
Bigod	Data Not Available							
Chittorgarh	11.00	36.40	283.00	1108.00	36.60	78.00	1553.00	53
Khatoli	0.00	60.00	162.50	463.00	74.80	4.20	764.50	41
Tonk	0.00	5.00	263.00	332.20	8.00	0.00	608.20	34

(Source: Central Water Commission)

Table-4.6: Grain size distribution of the River Sand

Sl. No.	Name of leaseholder	Name of Lease Area	Sand Characteristics							Classification as per Is:1498
			D_{10}(µ)	D_{30}(µ)	D_{50}(µ)	D_{60}(µ)	C_u	C_{cr}	Bulk Density (g/cc)	
1	M/s Shekhawat Associates	Jahajpur	35	250	750	1000	28.57	1.79	1.54	Well graded sand
2	Shri Abhishek Choudhary	Asind	32	260	683	1000	31.04	2.09	1.58	Well graded sand
3	Shri Sanjay Kumar Garg	Bhilwara	39	295	680	980	25.41	2.25	1.59	Well graded sand
4	Shri Sanjay Kumar Garg	Bijolia Mandalgarh	30	290	683	997	33.80	2.84	1.58	Well graded sand
5	Rajasthan FOR & PAL	Kapasan	35	250	690	1000	28.57	1.79	1.60	Well graded sand
6	Shri Himmat Singh Shekhawat	Nathdwara	37	255	690	985	26.95	1.78	1.60	Well graded sand
7	Shri Narottam Singh Jadaun	Raj Samand	40	270	680	983	24.63	1.86	1.57	Well graded sand
8	Shri Mangal Singh	Chouth ka Barwara	40	300	660	960	24.00	2.34	1.60	Well graded sand
9	Shri Rahul Panwar	Malpura	35	280	700	980	27.22	2.55	1.54	Well graded sand
10	Shri Mangal Singh Solanki	Niwai	37	280	680	990	27.75	2.38	1.57	Well graded sand
11	M/s Shekhawat Associates	Peplu Masi	35	320	670	1040	29.71	2.81	1.56	Well graded sand
12	Shri Som Prakash	Peplu Banas	38	290	690	1020	36.43	2.94	1.58	Well graded sand
13	Shri Pradeep Kumar Sethi	Tonk	30	260	710	1040	34.67	2.17	1.62	Well graded sand
14	Shri Jaswant Singh	Raipur (Pali)	33	280	710	1030	31.23	2.33	1.60	Well graded sand
15	M/s S.R. Associates	Deoli	36	270	730	1060	29.44	1.91	1.63	Well graded sand
16	Shri Mahendra Sngh	Kotri	39	285	720	1055	27.07	1.98	1.56	Well graded sand
17	Shri Vikramaditya Singh	Hurda & Masuda	40	265	710	1030	25.80	1.71	1.58	Well graded sand
18	Shri Rajendra Singh	Deogarh	34	270	680	1020	30.00	2.10	1.56	Well graded sand
19	Shri Mahender Singh Ratnawat	Udaipurvati	37	290	705	1055	28.54	2.16	1.59	Well graded sand

Cu= Uniformity Coefficient, Ccr= Coefficient of Curvature

Table-4.7: Estimation of Sand Replenishment

Sl. No.	Name of leaseholder	Lease Area (in Ha)	Estimated Bed Load (Tonnes/day)	Estimated deposition or replenishment (Tonnes/day)	Sediment Load Deposition per month (in Tonnes)	Annual Replenishment (in Tonnes)	Estimated Annual Replenishment (in million m^3)*
1	M/s Shekhawat Associates	1299.00	38977.73	31182.19	935465.70	2806397.10	2.00
2	Shri Abhishek Choudhary	1207.00	29303.97	23443.18	703295.33	2109886.00	1.51
3	Shri Sanjay Kumar Garg	1947.00	33757.01	27005.61	810168.39	2430505.20	1.74
4	Shri Sanjay Kumar Garg	1675.85	61169.15	48935.32	1468059.73	4404179.20	3.15
5	M/s Rajasthan FORT& PAL	335.03	3320.55	2656.44	79693.33	239079.99	0.17
6	Shri Himmat Singh Shekhawat	773.28	72036.46	57629.17	1728875.06	5186625.19	3.70
7	Shri Narottam Singh Jadaun	489.40	50698.48	40558.78	1216763.51	3650290.52	2.61
8	Shri Mangal Singh	278.67	15826.57	12661.26	379837.72	1139513.17	0.81
9	Shri Rahul Panwar	316.58	5414.59	4331.68	129950.38	389851.15	0.28
10	Shri Mangal Singh Solanki	104.78	1484.14	1187.31	35619.36	106858.10	0.08
11	M/s Shekhawat Associates	889.93	5841.78	4673.42	140202.72	420608.18	0.30
12	Shri Som Prakash	3342.10	25754.12	20603.30	618099.09	1854297.28	1.32
13	Shri Pradeep Kumar Sethi	2389.36	31296.24	25037.00	751109.93	2253329.80	1.61
14	Shri Jaswant Singh	1677.00	12799.92	10239.94	307198.22	921594.67	0.66
15	M/s S.R. Associates	1667.78	23590.13	18872.11	566163.28	1698489.86	1.21
16	Shri Mahendra Singh	1191.37	58574.41	46859.52	1405785.80	4217357.39	3.01
17	Shri Vikramaditya Rathore	544.03	1953.11	1562.49	46874.72	140624.17	0.10
18	Shri Rajendra Singh	396.20	8198.25	6558.60	196758.03	590274.11	0.42
19	Shri Mahender Singh Ratnawat	2392.00	5543.10	4434.48	133034.45	399103.36	0.29

**Specific gravity of sand = 1.4 tonne per m^3*

Table-4.8: Status of Sand Replenishment vis-à-vis annual planned production

Sl. No.	Name of the Lessee	*Estimates Reserve (in million m^3)	*Annual Production Capacity envisaged (as per mining plan in million m^3)	Estimated Annual replenishment (in million m^3)	Replenishment Status vis-à-vis planned production
1	M/s Shekhawat Associates	42.54	3.00	2.00	Replenishment less than planned annual production
2	Shri Abhishek Choudhary	31.92	2.00	1.51	Replenishment less than planned annual production
3	Shri Sanjay Kumar Garg	28.23	1.60	1.74	Replenishment more than planned annual production
4	Shri Sanjay Kumar Garg	40.12	2.00	3.15	Replenishment more than planned annual production
5	M/s Rajasthan FORT& PAL	7.81	0.10	0.17	Replenishment more than planned annual production
6	Shri Himmat Singh Shekhawat	30.87	0.20	3.70	Replenishment more than planned annual production
7	Shri Narottam Singh Jadaun	12.30	0.20	2.61	Replenishment more than planned annual production
8	Shri Mangal Singh	8.03	0.80	0.81	Replenishment more than planned annual production
9	Shri Rahul Panwar	5.72	0.80	0.28	Replenishment less than planned annual production
10	Shri Mangal Singh Solanki	2.46	0.36	0.08	Replenishment less than planned annual production
11	M/s Shekhawat Associates	27.51	2.80	0.30	Replenishment less than planned annual production
12	Shri Som Prakash	24.63	4.00	1.32	Replenishment less than planned annual production
13	Shri Pradeep Kumar Sethi	23.03	4.00	1.61	Replenishment less than planned annual production
14	Shri Jaswant Singh	13.58	0.85	0.66	Replenishment less than planned annual production
15	M/s S.R. Associates	23.65	4.73	1.21	Replenishment less than planned annual production
16	Shri Mahendra Singh	63.56	2.43	3.01	Replenishment more than planned annual production
17	Shri Vikramaditya Rathore	31.34	---	0.10	Variable production capacity
18	Shri Rajendra Singh	6.39	0.11	0.42	Replenishment more than planned annual production
19	Shri Mahender Singh Ratnawat	58.45	5.42	0.29	Replenishment less than planned annual production

**** As per Mining Plan approved by Department of Mines and Geology, Government of Rajasthan***

4.4 Summary of the Estimation of Sand Replenishment

The annual Bajri/ sand replacement in mine lease area has been calculated using the Meyer-Peter's equation. It is found that the annual replenishment rate varies from 0.08 million m^3 to 3.70 million m^3 depending on bed load transport rate of rivers. The variation in annual replenishment rate is due to variation in the catchment area size, river slope, annual rainfall, catchment and soil characteristics. It may be mentioned that occurrence of rain in the state of Rajasthan is erratic, unpredictable and comparatively of shorter period. The estimated annual replenishment of mine leases has been provided in the Table-4.7. A comparative analysis of estimated sand replenishment in each lease has been made with the annual planned production of the mine leases in Table 4.8.

CHAPTER-V
Conclusion & Recommendations

i. The EAC, MoEFCC while deliberating the proposal of sand mining in 11th Meeting held at October 24-25, 2016 rightly opined that "*the proposals of sand mining from Rajasthan are not in perennial rivers. These are, in effect, paleo sand deposits and are not replenished annually during monsoon season.* Therefore, the study for replenishment of rivers in the State of Rajasthan have been conducted after giving due consideration to the observations of MoEFCC.

ii. The rivers of Rajasthan are ephemeral in nature and therefore there is need to look at the issue of replenishment of these rivers from different perspective. The rivers are not replenished annually as is the case of perennial rivers and therefore the concept of ***annual replenishment based mine capacity*** does not apply for the rivers of Rajasthan. There is need to consider appropriately for change of the policy applicable for annual replenishment of rivers *vis-à-vis* mine capacity permits in case of Rajasthan.

iii. There may be appreciable variation in the amount of replenishment of the rivers in the State of Rajasthan. This is primarily due to erratic and uncertainty in the occurrence of rainfall in the State. Thus, the replenishment achieved at one point of time may be utilized over more than a year depending upon requirement. This factor needs to be considered while planning for the capacity of mines in the State. Linking to annual production with annual replenishment of the rivers in the State of Rajasthan may not be a practical approach.

iv. In our considered opinion, there is need to consider the concept of ***resource accounting*** of bajri/sand in the rivers of Rajasthan and take the replenishment as a measure for resource augmentation. The permissible level of bajri/sand in each stretch need to be identified and each year, the resource augmentation based on the replenishment of the river need to be added into it for updating the bajri/sand. Based on this estimation, quantum of further permits may be decided by Government.

The system of *Environmental Accounting* has also been propagated by United Nations (UN). UN has come up with the *System of Environmental-Economic Accounting 2012-Central Framework (SEEA-Central Framework)* which is a statistical framework consisting of a comprehensive set of tables and accounts, which guides the compilation of consistent and comparable statistics and indicators for policy making *etc*. It is a tool that helps in tackling natural resource depletion and environmental degradation. For sand mining projects of Rajasthan, physical supply use tables (PSUT) as provided in SEEA-Central Framework of UN may be utilized for sustainable use of sand mining and grant of mining permits. The mining leases in Rajasthan occur in paleo sand deposits and use of PSUT will be appropriate in this case.

v. The installation of observation points may be appropriately considered for determination of replenishment level in each tract of river under consideration. The observation points may be installed at strategic locations and rise in the level of Bajri/sand may be monitored.

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