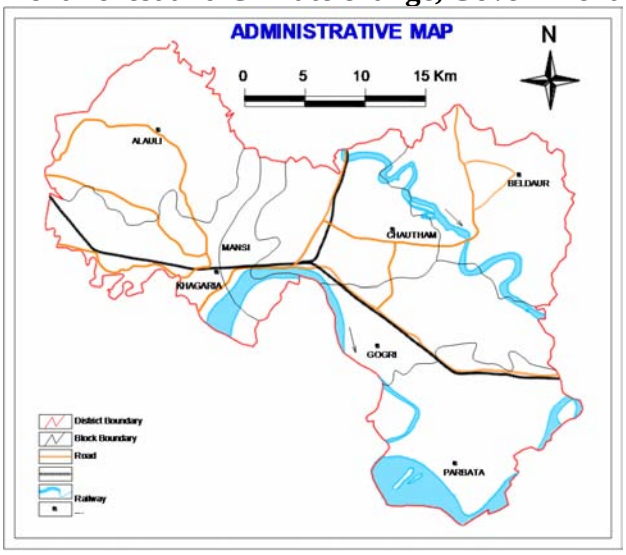
DISTRICT SURVEY REPORT OF KHAGARIA

12/21/2017

Sand and Brick Kilns Mining

As per Notification No. S.O.141 (E) New Delhi, the 15th January, 2016 of Ministry of Environment Forest and Climate change, Government of India



Submitted to

Under Secretary
Mines & Geology Department, Government of Bihar

Prepared by

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PREFACE

The Ministry of Environment, Forests & Climate Change (MoEF&CC), Government of India, made Environmental Clearance (EC) for mining of minerals mandatory through its Notification of 27th January, 1994 under the provisions of Environment Protection Act, 1986. Keeping in view the experience gained in environmental clearance process over a period of one decade, the MoEFCC came out with Environmental Impact Notification, SO 1533 (E), dated 14th September 2006. It has been made mandatory to obtain environmental clearance for different kinds of development projects as listed in Schedule-1 of the Notification.

Further, In pursuance to the order of Hon'ble Supreme Court dated the 27th February, 2012 in I.A. No.12- 13 of 2011 in Special Leave Petition (C) No.19628-19629 of 2009, in the matter of Deepak Kumar etc. Vs. State of Haryana and Others etc., prior environmental clearance has now become mandatory for mining of minor minerals irrespective of the area of mining lease; And also in view of the Hon'ble National Green Tribunal, order dated the 13th January, 2015 in the matter regarding sand mining has directed for making a policy on environmental clearance for mining leases in cluster for minor Minerals, The Ministry of Environment, Forest and Climate Change in consultation with State governments has prepared Guidelines on Sustainable Sand Mining detailing the provisions on environmental clearance for cluster, creation of District Environment Impact Assessment Authority and proper monitoring of minor mineral mining using information technology and information technology enabled services to track the mined out material from source to destination.

The DEIAA and DEAC will scrutinize and recommend the prior environmental clearance of mining of minor minerals on the basis of District Survey Report. This will a model and guiding document which is a compendium of available mineral resources, geographical set up, environmental and ecological set up of the district and replenishment of minerals and is based on data of various departments, published reports, journals and websites. The District Survey Report will form the basis for application for environmental clearance, preparation of reports and appraisal of projects. The Report will be updated once every five years.

OBJECTIVES

The main objective of the preparation of District Survey Report (as per the Sustainable Sand Mining Guideline, 2016) is to ensure the following –

- Identification of areas of aggradations or deposition where mining can be allowed; and
- Identification of areas of erosion and proximity to infrastructural structures and installations where mining should be prohibited and calculation of annual rate of replenishment and allowing time for replenishment after mining in that area.
- Identification of mineral wealth in the district.

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CHPATER-1

Introduction

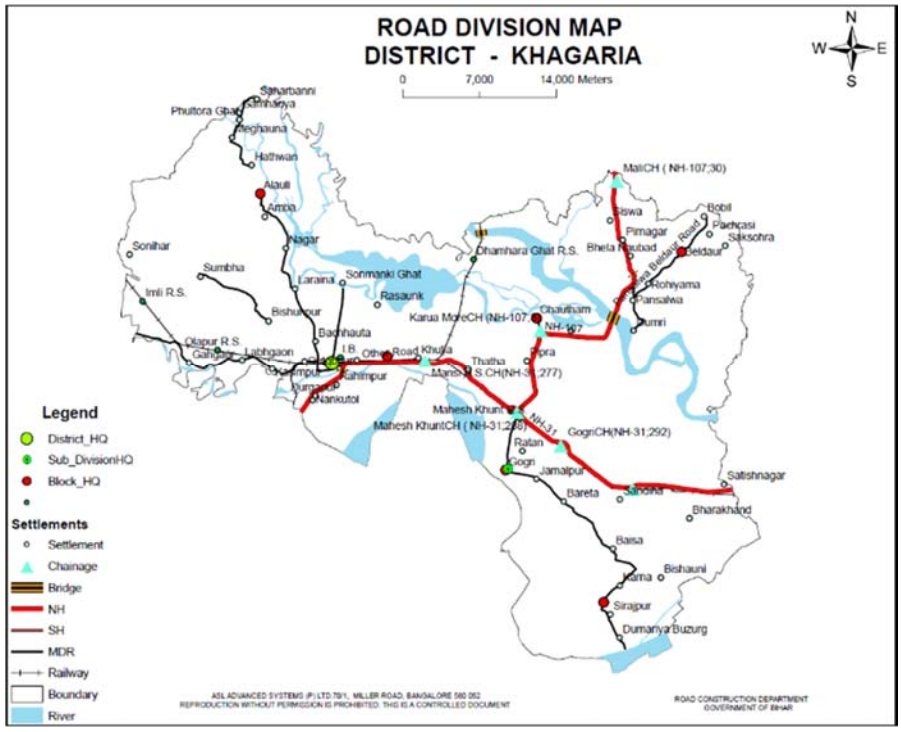
As per Gazette Notification of 15th January, 2016 of Ministry of Environment, Forest and Climate Change a survey shall be carried out by the District Environment Impact Assessment Authority (DEIAA) with assistance of Irrigation Department, Drainage Department, Forest Department, Mining Department and Revenue Department in district of preparation of District Survey Report as per the sustainable sand mining guidelines to ensure identification of area of aggradations or deposition where mining can be allowed, and identification of areas of erosion and proximity to infrastructural structures and installation where mining should be prohibited and calculation of annual rate of replenishment and allowing time for replenishment after mining in that area.

Every effort has been made to cover sand mining locations, areas and overviews of mining activity in the district with all the relevant features pertaining to geology and mineral wealth in replenish-able and non-replenish-able areas of rivers, stream and other sources. The mineral potential is calculated based on field investigation taking coordinates of the area and gather all relevant information and geology of the catchment area of the river or stream. Also gather all data for bricks mining, taking area coordinates with local soil quality, availability of soil etc. Also as per the site condition and location depth of mineable mineral is defined. The area of removal of mineral in the river and stream is decided on geomorphology and other factors, it can be 50% to 60% of the area of a particular river or stream. Similarly for bricks and soil mining all data will be gathered. Other constituents like clay and slit are excluded as waste while calculating the mineral potential of particular river or stream. This District Survey Report shall form the basis of application for environmental, preparation of reports and appraisal of projects. The report shall be updated once every 5 years.

1.1 Historical Perspective:

Khagaria district occupies a very important place in the medieval as well as modern history of Bihar. Khagaria is also known as **Farakiya** in local region. There is an interesting story behind it. Five centuries ago Akbar, the Mugal empire directed his revenue minister Todarmal to map his entire empire. But he could not map this region now known as Khagaria due to difficult terrain, rivers and dense forests. So, he named it **Farakiya** (*Farak* in Urdu means separate). The district of Khagaria is unfortunate in the sense that very little has been recorded regarding the social and cultural history of this area. Whatever account of the old district of Monger has been unearthed covers mainly the southern Munger and to some extent Northwest Munger i.e. the present Begusarai district. All the ancient remains and inscriptions have been discovered south of the Ganga, and some in Northwest, namely in Jaimanglagarh (Begusarai). Description of cultural heritage of old district of Monger, in contemporary literature, is found both in the writings of Bengali and English writers

1.2 Geography:



Khagaria as a district is only 20 years old. It was a part of district of Munger as a sub division. It was upgraded as district, effective from 10th May, 1981. The Khagaria district, has been sub-divided into two sub-divisions viz. Khagaria and Gogari. There are seven blocks in the Khagaria District-1.Allouli, 2.Beldaur, 3.Chautham, 4.Gogari, 5.Khagaria 6.Manasi and 7.Parbatta

Khagaria is located at 25°30'N 86°29'E25.5°N 86.48°E. The district is included in the Survey of India toposheets no's 72 K. Its geographical area is 1485 Sq. Km. This district is well connected to other parts of Bihar and the country through railways as well as roads. New Delhi - Gauwahati railway lines passes through Khagaria, other important stations are Mansi, Maheshkhunt and Pasraha, From Mansi, one branch line goes towards Saharsa, while from Khagaria, one branch line goes towards Samstipur, and both these branch lines

are still meter- gauge. Between Khagaria and Mansi, both broad gauge and meter gauge railway lines run parallel. Mansi had been an important place from the point of view of railways, since it used to be the headquarters of an engineering district of railway but now most of important offices of railways have shifted from this place to other places, and mostly to Khagaria or Barauni, which falls in Begusarai district. National Highway No. 31 passes through the district almost parallel to the railway line in west-east direction, the intersection of the two existing at a place called Chukati. The total population of district is 1,657,599 of which male and female where 880, 065 and 777,534 respectively. (2011 census)

1.3 Basin/sub-basin, Drainage

The district is an extensive plain formed by the rich alluvial soil brought down by a number of rivers and streams. The principal rivers of the district are the Ganga, the Burhi Gandak, the Bagmati, the Kamla and the Ghaghri (the mainstream of Koshi). The Ganga collects Burhi Gandak, Bagmati, Kosi and many smaller streams. These rivers have their catchment basins in Great Himalayas. They bring enormous load during the rainy season not only to spread the new sheets of fertile sediments but also alter their beds and their channel courses. The Ganga forms the southern boundary of the district in its entire length. This river has severe shifting tendencies resulting in a vast tract of diara land, on the northern side and several hamlets of the present Munger district have resettled on the north of the Ganga due to erosion caused by the shifting of the river. Due to vast tract of diara land, during rainy season, at some places, the breadth of the river runs into miles. The Burhi Gandak, runs a Zig-zag course through the district of Begusarai and enters Khagaria for a short while, running by the side of the town of Khagaria, and flows in to the Ganga, It forms the western boundary of the Khagaria town and a protection embankment built along the eastern side of this river, protects Khagaria town from the floods of Burhi Gandak. The Bagmati enters the district from the western side, through the district of Begusarai. It then pursues a winding but generally easterly direction, till it flows into the Tilijuga or the Kamla near Chautham.

The Tilijuga or the Kamla enters the district from Darbhnga, near Mohraghat, It then flows south east to Chautham, merges into the Bagmati, and the united stream flows into the district of Bhagalpur under the name of the Ghaghri,'which is known as one of the main branches of the Koshi. The main drainage pattern observed in these rivers are dendritic, rectangular to parallel etc. The river Ganga forming an antecedent drainage and flowing as a meandering and oscillating channel, traverses the district from the west to east.

1.4 Irrigation Practices Map

Wheat is the prominent rabi crop in the district. Due to floods and water logging, the paddy production is very low, except in the southern part of the district. Maize is grown abundantly almost throughout the district, while banana cultivation as a cash crop, has grown into a profitable business. Banana cultivation is most common in Gogari and Parvatta blocks of the district. The Rabbi Crops are paddy, maize, oil seeds. The main Khariff crops are paddy maize, pulses. Apart from these crops mangoes, Lichis are also grown in some areas. According to the Directorate of Statistics Govt. of Bihar there is no area under forest cover in 9 the district.

As per the variable statistics the net area irrigated by different sources constitutes only 33% of total cultivable area. As there is no canal command are in the district, the assured irrigation is possible only by ground water. The rivers in the district forms comparatively very meagre surface flow during summer. That is why ground water is the main resource for socio economic uplifting of the area

1.5 Connectivity:

This district is well connected to other parts of Bihar and the country through railways as well as roads. New Delhi – Gauhati railway lines passes through Khagaria. Other prominent stations are Mansi, Maheshkhunt and Pasraha. From Mansi, one branch line goes towards Saharsa, while from Khagaria, one branch line goes towards Samastipur. Both these branch lines are still meter-gauge. Between Khagaria and Mansi, both broad gauge and meter gauge railway lines run parallel. Mansi had been an important place from the point of view of railways, since it used to be the headquarters of an Engineering district of railway but now most of important offices of railways have shifted from this place to other places, and mostly to Khagaria or Barauni, which falls in Begusarai district. National Highway-31 passes through the district almost parallel to the railway line in west-east direction, the intersection of the two existing at a place called Chukati, eight kilometers eastward from Khagaria. Almost 46 Km. of NH- 31 falls within the jurisdiction of Khagaria district. NH-31 goes right up to Gauhati and is an important road link of Bihar to the north – eastern part of the country and to Northern Bengal. From Maheshkhunt, on NH-31, branches off one road to Saharsa district. It is maintained by Road Construction Department of Government of Bihar.

Apart from National highway, the condition of other roads in the district is not very good. Historically also the situation had been the same. Excessive rains and water logging coupled with

poor maintenance account for this. Prominent roads of the district, which are maintained by Road Construction department are Maheshkhunt- Chautham- Beldaur Road (26 Km.), Maheshkhunt – Gogari- Parvatta- sultanganj ghat Road (32 Km.), Khagaria- Alauli Road (18 Km.), Khagaria – Parihara- Bakhri Road (19 Km.), Khagaria-Munger ghat Road (6.5 Km.) , Khagaria- Sonmankhi Road (6.5 Km.) and Pansalwa – Baijnathpur Road (11 Km.).The condition of other roads, some maintained by Rural Engineering organisation and some by Block and Panchayats are also worse . Due to existence of several rivers and rivulets, all weather communication in the interiors of the district would require huge investment in bridges and culverts, the lack of which makes large part of country side accessible by boats only during the rainy season.

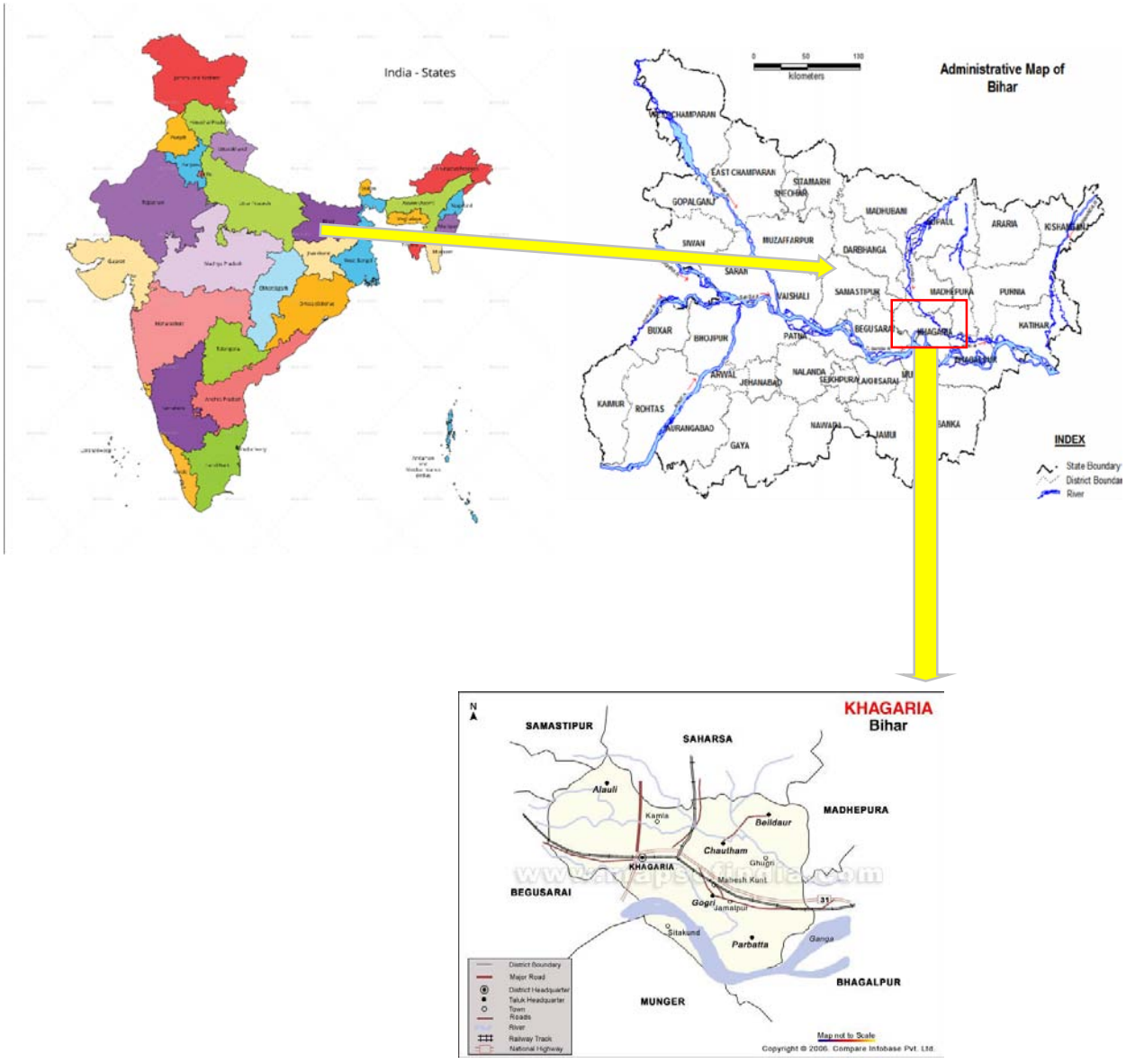


Figure: 1.1 Present Locations / Subdivision / Block wise Map of Khagaria District

Headquarter of Khagaria : Khagaria

Rivers in Khagaria : Ganga, Burhi Gandak, Bagmati, Kamla and Ghaghri

Area of Khagaria : 1486 Sq. km

Latitude of Khagaria : 25° to 30° North

Longitude of Khagaria : 84° to 85° East

There are seven blocks in the Khagaria District-1. Allouli, 2. Beldaur, 3. Chautham, 4. Gogari, 5. Khagaria. 6. Manasi and 7. Parbatta. Khagaria is located at 25°30′N 86°29′E25.5°N 86.48°E.

An official Census 2011 detail of Khagaria, a district of Bihar has been released by Directorate of Census Operations in Bihar. Enumeration of key persons was also done by census officials in Khagaria District of Bihar.

In 2011, Khagaria had population of 1,666,886 of which male and female were 883,786 and 783,100 respectively. In 2001 census, Khagaria had a population of 1,280,354 of which males were 679,267 and remaining 601,087 were females. Khagaria District population constituted 1.60 percent of total Maharashtra population. In 2001 census, this figure for Khagaria District was at 1.54 percent of Maharashtra population.

There was change of 30.19 percent in the population compared to population as per 2001. In the previous census of India 2001, Khagaria District recorded increase of 29.32 percent to its population compared to 1991.

Actual Population	1,666,886	1,280,354
Male	883,786	679,267
Female	783,100	601,087
Population Growth	30.19%	29.32%
Area Sq. Km	1,486	1,486
Density/km2	1,122	862
Sex Ratio (Per 1000)	886	885
Average Literacy	57.92	41.35
Male Literacy	65.25	51.82
Female Literacy	49.56	29.35
Literates	768,028	414,174
Male Literates	461,153	277,226
Female Literates	306,875	136,948

Sl. No	Particular	Year	Unit	Statistics
1		**Geographical features**		
(A)	Geographical Data			
	i) Latitude		Degree. minute	25.15 -25.44 N
	ii) Longitude	- do-	-do-	86.17-86.52 E
	iii) Geographical Area		Sq.km	1485.8
(B)	Administrative Units			
	i) Sub divisions	2011	Nos.	3
	ii) Tehsils	2011	Nos.	7
	iii) Sub-Tehsil	-	-do-	-
	iv) Patwar Circle	2010-11	-do-	-
	v) Panchayat	2010-11	-do-	-
	vi)Nagar nigam	-	-	-
	vii) Nagar Palika	2009-10	Nos.	2
	viii) Gram Panchayat	2010-11	Nos.	129
	xi) Revenue villages			306
2.	**Agriculture**			
A.	Land utilization			
	i) Total Area	2009-10	Hectare	104000
	ii) Forest cover	-do-	"	-
	iii) Non Agriculture Land	-do-	"	13694
	v) cultivable Barren land	-do-	"	19690

1.6 Demography of Khagaria District

In 2011, Khagaria had population of **1,666,886** of which male and female were 883,786 and 783,100 respectively. In 2001 census, Khagaria had a population of 1,280,354 of which males were 679,267 and remaining 601,087 were females. Khagaria District population constituted 1.60 percent of total Maharashtra population. In 2001 census, this figure for Khagaria District was at 1.54 percent of Maharashtra population.

1.7 Natural Divisions

Before the construction of embankments along the River Ganga, Bagmati, Burhi Gandak and Kosi, namely Karachi Badlaghat embankment, Badla- Nagarpara embankment, Burhi Gandak protection embankment and Gogri- Narayanpur embankment, the vast tract of present Khagaria

district was flat alluvial plain and was abound in marshy and swampy land. The characteristics of this part, north of the Ganga has been described as follows by a former collector of Munger, Mr. E. Lockwood in "Natural History, Sports and Travel"- "The northern part is an extensive plain formed by the rich alluvial soil brought down by the ever changing river. In the north, nine tenths of the trees are cultivated mangoes, whilst wheat, Indian corn, various kinds of millet peas, Masur, Rahar, Oats, Indigo, Mustard, Linseed and Castor oil, are the principal crops which the land holders find profitable to grow." He further describes that in contrast, "the southern portion (south of the Ganga) consists of vast rice tracts and forests, which cover the metamorphic hills extending far away into central India from the town of Monghyr. In the forest of the south are found the ebony tree, the sal and the mahua. The south also yields vast quantities of rice and a hundred and fifty tons of opium, grown on twenty five thousand acres of land, whilst, after crossing the Ganges, little rice and not a single poppy will be seen." The major part of the alluvial plain comprising this district, at present, is mainly a saucer- shaped depression, the center of which was inundated during the rains by the over flow of the rivers and for the rest of the year was full of marshy hollows. The inundation has decreased after construction of embankments but still a large part in the north eastern part of the district, contained in west by Gogari- Maheshkhunt – Saharsa Road, in the north by the Koshi and in the south by the Ganga is completely inundated during rainy season except for the National Highway and the New Delhi – Gauhati Railway line.

1.8 Rivers

The principal rivers of the district are Ganga, Burhi Gandak, Bagmati, Kamla and Ghaghri (the mainstream of Koshi). The Ganga forms the southern boundary of the district in its entire length. This river has severe shifting tendencies resulting in a vast tract of diara land, on the northern side and several hamlets of the present Munger district have resettled on the north of the Ganga due to erosion caused by the shifting of the river. Due to vast tract of diara land, during rainy season, at some places, the breadth of the river runs into miles.

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winding but generally easterly direction, till it flows into the Tilijuga or the Kamla near Chautham. The Tilijuga or the Kamla enters the district from Darbhnga near Mohraghat, It then flows south east to Chautham, merges into the Bagmati, and the united stream flows into the district of Bhagalpur under the name of the Ghaghri, which is known as one of the main branches of the Koshi.

1.9 Climatic conditions

The climate of the district may be said to form a medium between the dry, parching heat of the up country and the close moist atmosphere of the south valley of Bengal. The heat is often intense but is very favorable during the rains because of law humidity. The seasons are the same as in the other parts of Bihar. The summer begins towards the middle of March and continues up to till end of June, when the rainy season begins, the months of April and May combine heat with high humidity relieved by intermittent rain falls. The rainy season continues up to October, while the water logging due to rain water continues in some areas up to the end of December. The winters are quite pleasant in this area. The district enjoys an average rainfall of 962.00 mm (2012). The maximum amount of rain occurs from July to September, through the south west monsoon, where as some downpour is also through north east monsoon in winter days. Ground water is mainly replenished by percolating rain water during the monsoon.

CHAPTER - 2

Overview of Mining Activity of District

Topography and General Geology:

The river Kosi flows through the district. Its major tributaries are Tilyuga, Chhamira, Kali, Tilawe, Bhenga, Mirchaiya,, sursar. The mostly sandy soil type is found here. Some where it is acidic and some where it is basic in nature. The average elevation is 34 meters. Geomorphologically, the area consists entirely of fluvial depositional landscape divisible into three genetically significant and well defined units viz., the Khagaria terrace, Ganaga –Kosi plain and the Diara plain. The main soil types found in the district are - Vertisols, inceptisols, entisols.

Approach to Sand Mining:

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.

Main objectives of Sustainable Sand Mining:

- 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 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 aggradations at the downstream reach especially those with hydraulic structures such as jetties, water intakes etc.
- Ensure that 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

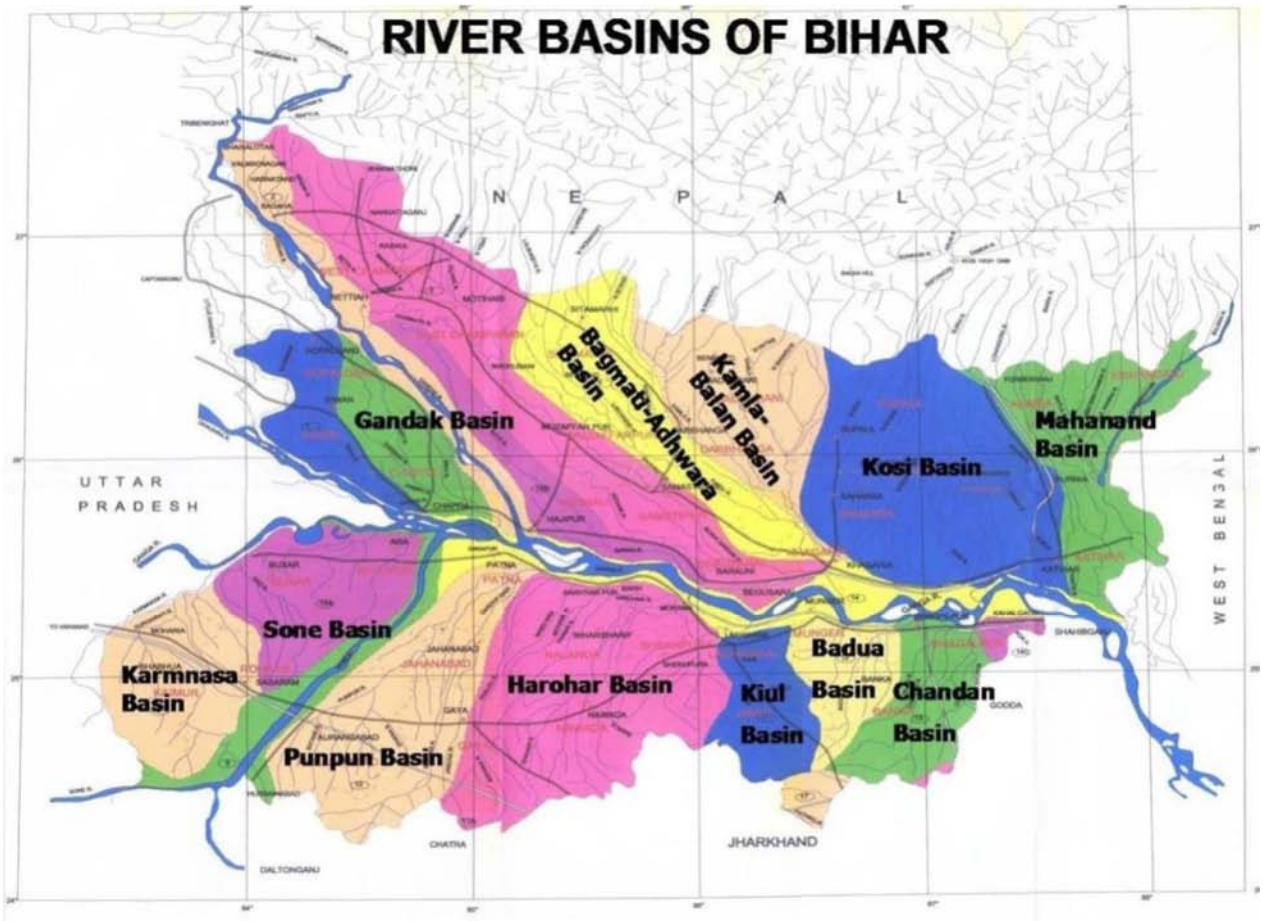


Figure 2.1 River Basin Map of Bihar

River	Catchment area km^2
Bagmati River	1.50
Balamjan River	0.40
Burhi Gandak	3.60
Chanha River	1.80
Ganga	6.00
Gumti Dhar	1.80
Kareha	11.00
Koshi	47.00
Malti River	0.60
Satras Dhar	0.42
	74.12

Mode of grant of mineral concession

i) Before giving details of actual sites/number of sites or mineral concessions it would be appropriate to explain that the mineral concession respect of minor minerals area granted as per provisions of the state rules, Framed by the respective state Government in Exercise of power under section 15 of the Mines and Minerals (D&R) Act,1957

ii) The state of Bihar at the time of bifurcation opted Prevailing Rule Namely "Bihar Minor Minerals Concession Rules 1972" and amended by 2014.These Rule were amended form time to time as per policy of the state government for minor minerals. The Hon'ble Supreme Court vide its order dated 27.02.2012 directed all state Government to revise their state rule making provisions in accordance with various recommendations contained in the report of the group of MOEF&CC, on mining of minor and the model draft guidelines issued by Ministry of Mines, Gol

iii) Accordingly, the state of Bihar Comprehensively revised its State Rules namely the "Bihar Minors Minerals Concession, Stocking, Transportation of Minerals and Prevention of illegal Mining Rule, 2014" repealing the Prevailing Rules namely Bihar Minors Minerals concession Rules 1972".

iv) The Mineral concession in the Bihar are being Granted in the form of "Mining Contract" or Mining Lease" through competitive bidding process. In district Khagaria minerals Concessions are/were granted in the form of mining contact for the period for 05 years.

The contracts are been granted through open auction mode. The Mineral concession are being granted subject to condition that actual mining operation shall be allowed only after Environment Clearance is/are obtained from the competent authority as per requirement of EIA Notification dated 14.09.2206 of the MoEF&CC, GoI.

v) The Mineral concession holder are required to prepare detailed " **Mining Plan"** for their specific project through Registered Qualified Person and get in approved from authorized officer of Mines and Geology Department of the State Government. The exhaustive mining plan are prepared by RQP giving details of minerals reserves, method of mining, progressive closure plan, extent of proposed mining and other related details. These are the project specific details are based on these details itself the project proponents/minerals concession holder obtains environmental clearances.

Method of Mining and Condition in Which Mining in River Bed Areas is to be allowed

i. The river bed area apart from other related condition for mining are allowed to excavate minerals (sand) to ensure safety of river bed structures and the adjoining area on the following specific conditions:

a. No mining would be permissible in a river bed up to a distance of five times of the span of a bridge on up stream side and ten times the span of such bridge on down-stream side, subject to a minimum of 250 meters on the downstream side:

b. There shall be maintained an un-mined block of 150 meter width after every block of 1000 meters over which mining in undertaken or at such distance as may be directed by the Director or any officer authorized by him.

c. The Maximum depth of mining in the river-bed shall not exceed three meters measured form the un-mined bed level at any point in time with proper bench formation.

d. Mining shall be restricted within the central 3/4th width of the river rivulet:

e. Note: The above said conditions have been decided after detailed discussions and recommendations of the concerned Department, Government of Bihar.

ii. As the mining river bed remains restricted in the in the central 3/4th part of the river bed, the area left on both on side of the river bank not only ensures the safety of banks (bank cutting due to water stream) but also ensures that in the central part of river, water stream flows smoothly during rains and process of river and process of river meandering does not occur.

iii. The light weight excavator/JCBs are being deployed to remove mineral form river bed up to maximum depth of 03 meter layer form general level of the bed. The mining in the river bed are undertaken in mechanized manner. At times the RQPs do refers the excavation in river bed mining through excavators as "Semi Mechanized Mining".

iv. The mineral excavated is directly loaded in the vehicles/dumpers and the vehicles owners and driver take away the minerals directly to the stone crushers or screening plants or consumers. In certain cases minerals concession holder stacks mineral on the river bank in case are not able to sell the material on actual mining itself.

Method of Mining in Areas outside River Bed Areas:

i. As the mineral (sand) are around river beds area also to ensure that mining from outside do not effect river. No mining is being permitted in an area up to a width of 500 meters form the active edges of embankments in case of river, 250 meter in case of bridge and 100 meter on either side of all other rivers/rivulets.

ii. The mineral from outside area river bed is being permitted subject to condition a safety margin of two meter (2m) shall be maintained above the ground water table while undertaking mining operation shall be permissible below this level unless a specific permission is obtained from the competent authority in this behalf further the depth of excavation of minerals shall not exceed nine meter (9m) at any point of time.

iii. The method of excavation is such that the mining contractors deploys earth moving machineries and after removing the top layer of original soil, varying between 1 to 1.5 meter stacks the same separately. Thereafter removes the minor minerals deposits. After undertaking the mining i.e. removing of minerals layer up to a maximum depth of 9 meter, the top stacked soil is again spread back into the pit. The mined out area/land in put to reuse for cultivation after spreading the top soil. The landowners/famers give their land to the contractors for mining after getting compensation, mutually settled between the landowner and the mining contractor.

Method of Mining in river bed area (semi mechanized/or manual)

i. The Hon'ble NGT with regards to rivers bed mining has specifically desired to examine the mode of mining- shall the same be semi mechanized/mechanized or manual.

ii. There is no specific definition of Semi- Mechanized Mining. The team Semi-mechanized mining in general is used were method of working in general are undertaken mechanically. However, some operation are also undertaken manually. Therefore the

semi mechanized mining or mechanized mining is the method of working sometime mechanized mining with light machines are also referred as semi –mechanized mining. The term semi mechanized mining is being used in general parlance where in the very same mining area in part area as per requirement manual mining is also under taken along with mechanized mining of sand/river bed mining.

iii. Where Manual mining operation are undertaken using conventional hand tools only like chisel, hammer and crowbar etc. and operation are only labour intensive. As per requirement manual lifting of sand and directly loading intensive, as per requirement manual lifting of sand and directly loading the sand in tractor trolleys etc. through labours itself.

iv. The Mechanized mining operation in respect of sand mining are undertaken with help of excavator-cum–loaders. In this process sand is lifted/excavated form the river bed through excavator-cum loader and directly loaded in dumpers or other mode of transport. The vehicles carrying the minerals form mines to site of use/site of construction or sale stocks outside lease hold area (an independent business than that of mining).

v. In the current scenario it is impractical to undertake manual mining because:-

i. The labour are not easily available.

ii. Manual mining cannot be under taken in systematic and scientific manner as compared to mechanical mining which can be undertaken systematic/scientific and controlled mining.

iii. In case of manual mining to achieve desired level of production more number of manpower would be required meaning thereby human interface within river bed area would increase and more ecological damage would be caused.

vi. The method of mining even otherwise can be uniform even for same area and all the methods have their own pros and cons, however, considering the current scenario wherever feasible mechanized (semi-Mechanized or mechanized is same thing) mining should be preferred over manual method.

General Regulation relating to Mining

I. As per prevailing state rules the mineral concession holder are required to get a mining plan for the area prepared form a “Recognized Qualified Person’. The mining plan includes the area specific details along with the mine closure plan (progressive & Final) taking into consideration the details of the geology and lithology of the area including the estimated mineral reserve of the area. Proposed method of mining/development of mines, use of explosives and blasting operation. If any stacking and disposal of minerals, mine-

drainage pattern, handing of the overburden, location of weight bridge, and minerals processing ,if any .The extant of manual mining or mining with the use of machinery and mechanical device along level of production (production form year-to year for a period of five years), Mechanization, Type of Machinery to be used, nature and extent of the minerals body/spot or spots where the mining operation area proposed to be undertaken, natural water occurs, limits of minerals reserve and other forest area and density of trees, if any assessment of impact of mining activity on land environment management plans, In addition to this mining plan also suggests the details of area of restoration/ rehabilitation of the area through afforestation, land reclamation, use of pollution control devices and such other measure as may be directed by the state Government from time to time.

II. The Mining plan area to be got approved from the authorized officer of the state Government, Based on mining plan prior environment clearance from the competent authority as per provisions of EIA Notification dated 14.09.2006 of MoEF& CC Gol.

III. After obtaining the Environment clearance as Further, to comply with requirement of Air Act, 1981, the consent to establish and consent to operate, from State pollution Control Board are also obtained before actual mining.

IV. The above said provision mainly related to mineral conservation and environmental protection with regard to provisions related to safety in mines and welfare of labours provisions under mines acts 1952 are ensured by the Directorate General Mines Safety De Ministry of Labour, Government of India.

Area Selected for Mining in District Khagaria:

I. As per rough estimate total area of river beds (Ganga, Burhi Gandak, Bagmati, Kamla and Ghaghri and tributaries/rivulets) passing through district Khagaria is about 72.14 Sq. Km., area outside river bed is also having mineral deposits. A large part of which is otherwise under various uses including agriculture. As regards selection of area for mining it may be pointed out that:-

i. Earlier, (about 16-18 years back) mineral concession / mining contracts were being granted on revenue estate basis (without giving any specific details of areas) subject to various restrictions. The minerals concession holder used to undertake mining in area after living restricted area.

ii. Needless to state that such material concession area use to have even the area having no mineral deposit the area otherwise not permissible for mining activity. The Mineral concession holders were under obligation to undertake mining only in the area free from all restriction and as per prevailing all rules and regulation. Mineral Concession for minor Mineral prior to 14.09.2006 were not required to obtain environmental clearance.

The EIA notification dated 14.09.2006 became applicable for fresh contacts/ leases and in the year 2008 for grant of mineral concessions in respect of other area in the state fresh auction was notified subject to condition that will be allowed to be undertaken only after prior environment clearance to obtained as per requirement of EIA notification dated 14.09.2006 of MoEF,CC, Gol. However, said condition was challenged by some prospective bidders on the plea that the notification date 14.09.2006 was not applicable for mining minerals

Area Selected for Mining in District: Khagaria

iii. The EIA notification dated 14.09.2006 became applicable for fresh contacts/ leases and in the year 2008 for grant of mineral concessions in respect of other area in the state fresh auction was notified subject to condition that will be allowed to be undertaken only after prior environment clearance to obtained as per requirement of EIA notification dated 14.09.2006 of MoEF&CC, Gol. However, said condition was challenged by some prospective bidders on the plea that the notification date 14.09.2006 was not applicable for mining minerals.

CHAPTER – 3

List of Mining Leases in the District with location, area and period of validity

List of Mining Leases in the District with location, area and period of validity is attached as Annexure-1

Sl. No.	Mining Unit Block Location	Area (In Hec.)	Period (In Yrs)	Name of Minor Minerals	Name of Granted of Minerals Concession	Annual Capacity as per E.C./Mining Plants/T or in MT.	Present Status
There is no previous EC approved ghat in Khagaria district of Bihar							

CHAPTER - 4

Details of Royalty or Revenue received in last three years

Sr.	Year	Revenue (In Lakh Rs.)
1	2014-15	
2	2015-16	
3	2016-17	

CHAPTER - 5

Detail of Production of Sand or minor mineral in last three years

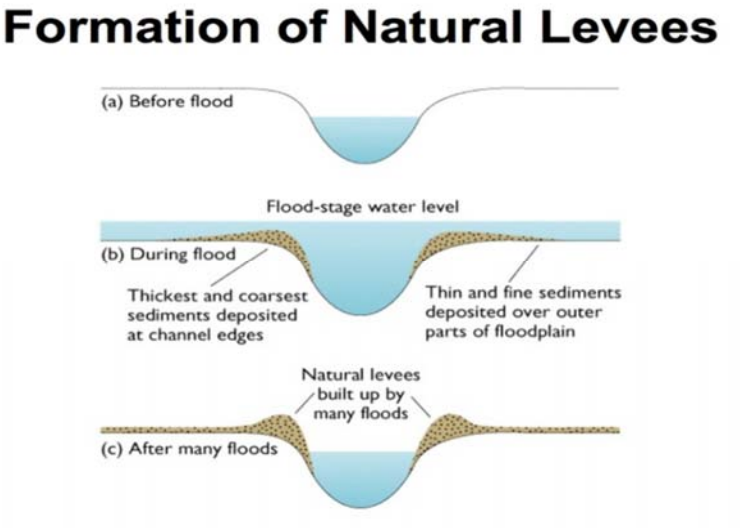
Sr.	Year	Production
1	2014-15	NIL
2	2015-16	NIL
3	2016-17	NIL

CHAPTER - 6

Process of Deposition of Sediments in the rivers of the District

Process- Sediment is a naturally occurring material that is broken down by processes of weathering and erosion, and is subsequently transported by the action of wind, water and/or by the force of gravity acting on the particles. Sediments are most often transported by water. Sediment is transported based on the strength of the flow that carries it and its own size, volume, density, and shape. Stronger flows will increase the lift and drag on the particle, causing it to rise, while larger or denser particles will be more likely to fall through the flow.

Deposition is the processes where material being transported by a river is deposited. Deposition occurs when a river loses energy. This can be when a river enters a shallow area (this could be when it floods and comes into contact with the flood plain) or towards its mouth where it meets another body of water.



Rivers flood on a regular basis. The area over which they flood is known as the flood plain and this often coincides with regions where meanders form. Meanders support the formation of flood plains through lateral erosion.

When rivers flood the velocity of water slows. As the result of this the river's capacity to transport material is reduced and deposition occurs. This deposition leaves a layer of sediment across the whole floodplain. After a series of floods layers of sediment form along the flood plain. Larger material and the majority of deposition occurs next to the river channel. This is the result of increased friction (with the flood plain) causing the velocity of the river to slow and therefore rapidly reduce its ability to transport material. This leaves a ridge of higher material next to the river channel on both banks of the river known as a levee. If the upwards velocity approximately equal to the settling velocity, sediment will be transported Downstream entirely as suspended load. If the upwards velocity is much less than the settling velocity, but still high enough for the sediment to move, it will move along the bed as bed load by rolling, sliding, and saltation (jumping up into the flow, being transported a short distance then settling again). If the upwards velocity is higher than the settling velocity, the sediment will be transported high in the

flow as wash load. As there are generally a range of different particle sizes in the flow, it is common for material of different sizes to move through all areas of the flow for given stream conditions.

The various factors governing the occurrence and deposition of sand is country rock i.e. geological disposition, climate, and rainfall, water load physical parameters of river and velocity of water current. Rivers have a lot of energy and because they have energy, they do stuff. The obvious things rivers do with their energy is flow but, besides this, they also transport load, erode load and erode the channel through which they flow. Erosion is the breaking down of material by an agent. In the case of a river, the agent is water. The water can erode the river's channel and the river's load. A river's load is bits of eroded material, generally rocks, which the river transports until it deposits its load.

Capacity & Competence Rivers can only carry so many loads depending on their energy. The maximum volume of load that a river can carry at a specific point in its course is called the age river's capacity. The biggest sized particle that a river could carry at a specific point is called the river's competence. Deposition to transport load a river needs to have energy so when a river loses energy it is forced to deposit its load. There's several reasons why a river could lose energy. If the river's discharge is reduced then the river will lose energy because it isn't flowing as quickly anymore. This could happen because of a lack of precipitation or an increase in evaporation. Increased human use (abstraction) of a river could also reduce its discharge forcing it deposit its load. If the gradient of the river's course flattens out, the river will deposit its load because it will be travelling a lot slower. When a river meets the sea a river will deposit its load because the gradient is generally reduced at sea level and the sea will absorb a lot of energy. As rivers get nearer to their mouths they flow in increasingly wide, gentle sided valleys. The channel increases in size to hold the extra water which the river has to receive from its tributaries. As the river gets bigger it can carry larger amounts of material. This material will be small in size, as larger rocks will have broken up on their way from the mountains. Much of the material will be carried in suspension and will erode the river banks by abrasion. When rivers flow over flatter land, they develop large bends called meanders. As a river goes around a bend most of the water is pushed towards the outside causing increased erosion. The river is now eroding sideways into its banks rather than downwards into its bed, a process called lateral erosion. On the inside of the bend, in contrast, there is much less water. The river will therefore be shallow and slow-flowing. It cannot carry as much material and so sand and shingle will be deposited.

This is called a point bar or slip off slope Due to erosion on the outside of a bend and deposition on the inside, the shape of a meander will change over a period of time. Notice how erosion narrows the neck of the land within the meander. In time, and usually during a flood, the river will cut right through the neck. The river will then take the new, shorter route. The fastest current, called the Thalweg, will now tend to be in the center of the river, and so deposition is likely to occur in gentler water next to the banks. Eventually deposition will block off the old meander to leave an oxbow lake. The oxbow lake will slowly dry up, only refilling after heavy rain or during a flood. Streams lose velocity and make deposits when their gradient decreases, when the volume of water decreases, when there is an increase in cross section, when they encounter obstructions, or when they enter still water. They deposit alluvial fans, alluvial cones, piedmont alluvial plains, channel fill, bars, flood plains and deltas.

Rivers in the Gangetic plains have a habit of meandering, i.e., changing course. In India this is a prominent feature of rivers which swell in the monsoon, occasionally suddenly, and the torrential movement carves out a new course in the soft alluvial plain. The Ganga River, in Patna, has meandered and migrated northwards in the Patliputra area. This migration has resulted in deposition of earth on the south [right] bank of the river and created a massive space of a few hundred hectares between the urban development line and the active river channel.

A river system can be divided into three sub-systems:

- ✓ **Collecting system** (branches) -- consisting of a network of tributaries in the headwater region, collects and funnels water and sediment to the main stream.
- ✓ **Transporting system** (trunk) -- the main trunk stream, which functions as a channel way through which water and sediment move from the collecting area toward the ocean. (Erosion and deposition also occur in a river's transporting system)
- ✓ **Dispersing system** (roots) -- consists of a network of distributaries at the mouth of a river (delta), where sediment and water are dispersed into an ocean, a lake, or a dry basin
- ✓

Removal of washed in Silt Load

Geologically, the district forms part of the vast Indo-Gangetic alluvial tract. The origin of the Indo Gangetic tract as a whole is now attributed to the sag in the earth crust formed in the upper Eocene times between Gondwana land and the raising of Himalaya belt. The economic minerals found in the district are Sand and Soil.

The sand deposits being an integral part of the dynamic river system to which it belongs. Therefore, as a part of natural cycle, the monsoon flow of every river carries with it replenishment of silt and washed out soil and clay from upstream areas in the catchment. This silt shall be removed during the sieving of sand before it is loaded into truck/tipper/trailer to carry to the consumers.

Sand mining is critical to infrastructure development around the globe. Sand is an essential minor mineral used extensively across the country as a useful construction constituent and variety of other uses in sports, agriculture, glass making (a form of sand with high silica content) etc. The rivers are the most important source of Sand. It acts as source of transportation and deposition of sand etc.

Local Geology of the Area

The river sand exposed in the river beds of Ganga, Burhi Gandak, Bagmati, Koshi etc. and surrounding areas is the product of the deposition of the sediments brought and deposited in the flood plains of River Ganga. These sediments are of recent geological formation. The litho-units exposed within the river and surrounding areas have formed as water borne sediments brought by flood water during rainy season every year and deposited in riverbed. The litho units encountered in the riverbed and surrounding areas belongs to the Shiwalik super groups. The size of the sediments towards the source i.e. host rock is course and at the tail end of the river the grain size is reduced to smaller sizes resulted in the formation of clay beds. The following sequences have been observed in the area, i.e. Top soil/ Alluvium followed by sand deposition

Sand and silt are deposited in the middle of the river whereas fine sand and soil are deposited at the fringe of the riverbanks. Soil/ alluvium varying in thickness from 0.20m to 0.60m constitute the top horizons in the area suitable for agriculture. River Ganga meanders through the area exposing the alluvium and soil at the banks. Sand is found in the river bed up to a depth of more than 3.0 m. The major part of bed remains dry as water flows in a single stream during the non-monsoon seasons. Only during rainy seasons the entire flood plain has water, when there will be no mining done.

Origin & Control of Mineralization (Annual Replenishment of Mineral in River Bed Area/Sedimentation)

Sedimentation, in the geological sciences, is a process of deposition of a solid material from a state of suspension or solution in a fluid (usually air or water). Broadly defined it also includes deposits from glacial ice and those materials collected under the impetus of gravity alone, as in talus deposits, or accumulations of rock debris at the base of cliffs. The term is commonly used as a synonym for sedimentary petrology and sedimentology.

Sedimentation is generally considered by geologically, in terms of the textures, structures, and fossil content of the deposits lay down in different geographic and geomorphic environments. The factors which affects the "Computation of Sediment":

a) Geomorphology & Drainage Pattern: The following geomorphic units plays important role:

- Structural Plain
- Structural Hill
- Structural Ridge
- Denudation Ridge & Valley
- Plain & Plateau of Gangetic plane
- Highly Dissected pediment
- Un-dissected pediment

b) Distribution of Basin Area River wise

c) Drainage System/Pattern of the area, Rainfall & Climate: Year wise Rainfall data for previous 10 years of Gangetic Basin/River

e) As per Dandy & Bolton study "Sediment Yield" can be related to

- Catchment Area and
- Mean Annual Run-off

Sand is an essential minor mineral used extensively across the country as a useful construction constituent and variety of other uses in sports, agriculture, glass making (a form of sand with high silica content) etc. It is common knowledge that minerals are non-renewable but this form of mineral naturally gets replenished from time to time in a given river system and is very much interrelated to the hydrological cycle in a river basin.

Sand mining has become a widely spread activity and does not require a huge set up or technology, the number of ventures has increased extensively and it has become a footloose industry in itself but the backward-forward linkages are becoming stronger as many are getting employed as well as the construction activity / industry requires this mineral at consistent rates. Riverine environmental systems are unique in themselves and provide environmental services, natural resources to meet variety of needs of urban and rural communities. The Rivers originating from the Himalayas bring with them lots of aggregate materials whereas as they move downstream, only finer elements / minerals like sand are found in abundance.

CHPATER-7

General Profile of the District

Sl. No.		Statistics
1.	**GENERAL INFORMATION**	
	I. Geographical Area (Sq. Km.)	1486
	Administrative Divisions	2
	No. of Panchayats/Villages	129/309
	Nos. of blocks	7
	II. Population (As per 2011 Census)	Rural: 1579727
		Urban: 87159
	III. Average Annual Rainfall (mm)	1170.2
2	**GEOMORPHOLOGY**	
	Major Physiographic Units	Gangetic Alluvium
	Major Drainages	Ganga, Kosi, Bhuri Gandak, Kamla
3	**LAND USE**	
	a) Forest Area	Nil
	b) Net Area Sown	924.95 sq.km
	c) Cultivable Area	1306.06 sq. km
4	**MAJOR SOIL TYPES**	Vertisols, inceptisols, entisols.
5	**PRINCIPAL CROPS**	Potato, Gram, Masoor, Kesari, Chillies, Peas
6	**IRRIGATION BY DIFFERENT SOURCES**	
	(Area in hectares)	
	Dugwells	2244
	Tubewells/Borewells (STW)	10598
	Tanks/ponds	6
	Canals	3
	Other Sources	3 - 15
	Net Irrigated Area	666 sq. km (35 % of net sown area)
	Gross Irrigated Area	790 sq. km
7.	**PREDOMINANT GEOLOGICAL**	1. Quaternary Formations
	FORMATIONS	2. Basement Pre-cambrian Granitic Gneiss with few Exposures as Inliers.
9	**HYDROGEOLOGY**	
	Major water bearing formations	Alluvium
	Pre-monsoon Depth to water level during 2011	5.4 – 8.95 m bgl
	Post-monsoon Depth to water level during 2011	2 – 5.3 m bgl
	Long term water level trend in last 10 yrs(2002 – 2011) in m/yr	No significant decline
11	**GROUND WATER QUALITY**	
	Presence of Chemical constituents more than the permissible limit (e.g.EC, F, As, F)	As in patches affecting the shallow aquifer
	Type of Water	Potable
12	**DYNAMIC GROUND WATER RESOURCES**	

	(as on 31st March 2009) in mcm.	
	Annual Replenishible Ground Water Resources	69583
	Net Annual Ground Water Draft	22941
	Projected Demand for Domestic and Industrial Uses up to 2025	7665
	Stage of Ground Water Development	38 %
	Note: Latest available data may be incorporated	

Source: Centre for Ground Water Board (CGWB))

CHPATER-8

Land Utilization Pattern in the district: Forest, Agriculture, Horticulture, Mining

In the whole district, there is no hill and no mineral is found in this district. As far as the land use pattern is concerned, wheat is the prominent rabi crop in the district. Due to floods and water logging, the paddy production is very low, except in the southern part of the district. Maize is grown abundantly almost throughout the district, while banana cultivation as a cash crop, has grown into prominence in last two decades. Banana cultivation is done mostly in Choutham, Gogari and Parvatta blocks. Apart from these mango and litchi orchards are abundant in this district and are found almost throughout the entire area. The study of old gazetteers show that these orchards have been in existence since long

1	**LAND USE (ha)**	
	a) Forest area:	Nil
	b) Net area sown:	924.95 sq.km
	c) Total Cropped area:	1306.06 sq. km
2	**MAJOR SOIL TYPES**	Vertisols, inceptisols, entisols.
3	**PRINCIPAL CROPS**	Potato, Maize, Gram, Masoor, Kesari, Chillies, Peas
4	**AREA UNDER PRINCIPAL CROPS**	
	Dug wells	2244
	Tube wells / Bore wells (STW)	10598
	Tanks/ponds	6
	Canals	3
	Other Sources	3 - 15
	Net Irrigated Area	666 sq. km (35 % of net sown area)
	Gross Irrigated Area	790 sq. km

CHAPTER-9

Physiography of the District

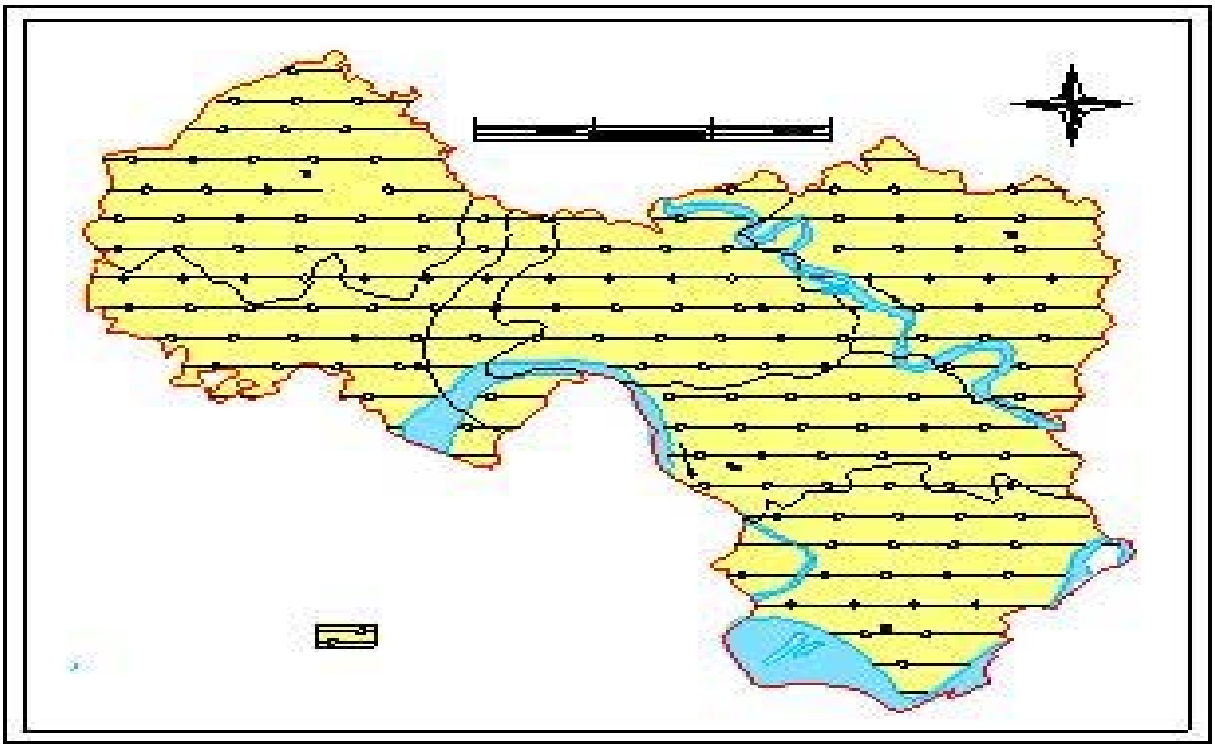
Hydrogeology

The district forms a part of alluvial flat underlain by unconsolidated sediments having considerable thickness. The entire area is overlain by recent alluvium of Quaternary age. Lithologically, the entire alluvial is composed of clay, silt, sand and gravel with occasional kankar. The Gangetic alluvial deposits can be subdivided into two types viz (a) the older alluvium (b) newer alluvium. The older alluvium forms slightly elevated terraces generally above the flood level. The newer alluvium is light coloured and poor in calcareous matter.

The vast stretch of alluvial tract of Ganga plain in Khagaria district possesses ideal hydro geological conditions for ground water development.

The main province of ground water is formed by quaternary alluvial sequence in the district. Ground water occurs under water table or unconfined conditions as well as locally in deeper zone under semi-confined conditions. The aquifer geometry and its physical characters control the occurrence and movement of ground water in different segments of district. The morphology as well influences movement and storage of ground water in different segments of the district. The thickness of aquifer ranges from 50 to 70 metre. In most of the boreholes thin clays lenses are underlain by continuous granular materials from ground level to maximum depth showing aquifers under water table conditions. In some of the bore holes clay is encountered below the granular zones which show that deeper aquifers may come under semi confined condition. A view of Hydrogeological map of the area reveals that the lowest contour value in the area is in the south eastern corner of the district and maximum value of the water table contour is found in the north western corner of the district. The ground water table slope in the district is little undulating and generally follows the topographic condition of the area. The average hydraulic gradient in the area is 0.14m /km.

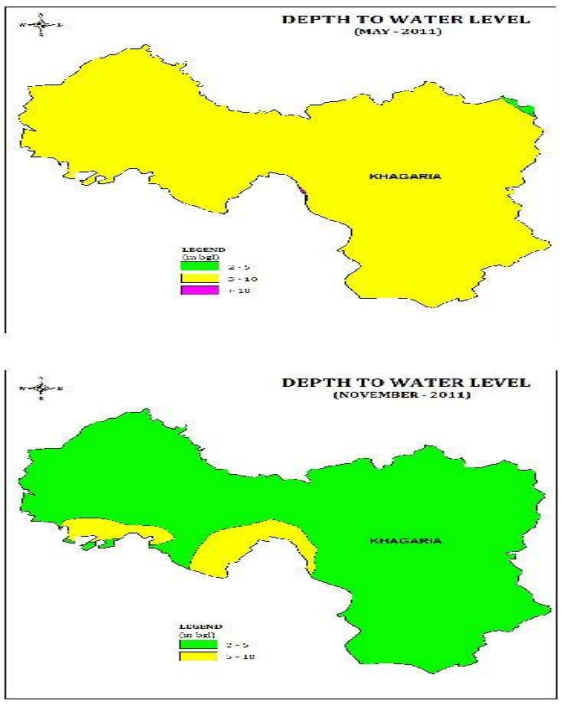
Hydrogeological map of Khagaria district

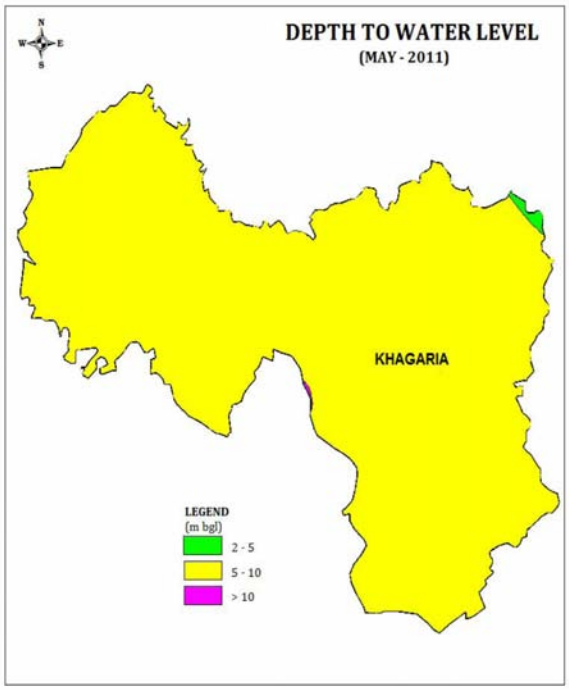


The pre-monsoon (May 2011) depth to water level generally varies from 5.40 to 8.95m bgl in major part of the district. The post-monsoon water level generally varies from 2 to 10m bgl in major part of the district. The seasonal water level show rise of 1.39 to 5.69m. The May 2011 (Pre-monsoon) water level fluctuation with respect to May 2010 show rise from 0.3 to 0.94m. The November 2011 (Post monsoon) water level fluctuation with respect to November 2010 show rise from 0.52 to 2.05 m. The long-term decadal (2001-2011) water level fluctuation shows variation between 0.14 to 1.76 m. The Number of well monitored, categorization of well and water level range of 2011 for different monitoring periods are given in Table 2.

Table 1: Number of well monitored, categorization of well and water level range of 2011) for different monitoring periods

	No. of wells		**Categorization**			**Water level**
	monitored					range
Period		0 - 2	2 - 5	5 - 10	10-20	(mbgl)
May – 11	6	0	0	6	0	5.40 – 8.95
Aug – 11	8	2	6	0	-	1.26 – 3.70





Pre-monsoon (May 2011) water level map of Khagaria district and Post-monsoon (November 2011) water level map of Khagaria district

Ground Water Resources:

The net annual replenish able ground water resource as on 31st March 2009 works out to be 53121 ha/m. The gross annual draft for all uses works out to be 23282 ha/m. Allocation of ground water for domestic and industrial use for 25 years works out to be 3959 ha/m. The stage of ground water development is 43.8%. The stage of ground water development is highest in Parbatta (50.5%) and lowest in Alauli (35%). As stages of ground water development in all the blocks are less than 70%, and there is no long-term decline in water levels, all the blocks are under safe category.

Geomorphology

Geomorphology and Soil types

Geomorphlogically the area consists entirely of fluvial depositional landscape divisible into three genetically significant and well defined units viz., the Khagaria terrace, Ganaga –Kosi plain and the Diara plain. The main soil types found in the district are -- Vertisols, inceptisols, entisols.

CHPATER-10

Climate and Rainfall

The climate of the district may be said to form a medium between the dry, parching heat of the up country and the close moist atmosphere of the south valley of Bengal. The heat is often intense but is very favorable during the rains because of law humidity. The seasons are the same as in the other parts of Bihar. The summer begins towards the middle of March and continues up to tile end of June, when the rainy season begins, the months of April and May combine heat with high humidity relieved by intermittent rain falls. The rainy season continues up to October, while the water logging due to rain water continues in some areas up to the end of December. The winters are quite pleasant in this area.

The district enjoys an average rainfall of 962.00 mm (2012). The maximum amount of rain occurs from July to September, through the south west monsoon, where as some downpour is also through north east monsoon in winter days. Ground water is mainly replenished by percolating rain water during the monsoon.

CHPATER-11

Geology and Mineral Wealth

Geology

(i) Regional Geology

Regionally, the area constitutes a part of the Ganga River Basin. The north-eastern part is predominantly characterized by sedimentary lithology in the Sub-Himalayan zone comprising Subathus, Dagshais, Kasaulis and Siwaliks. A general Regional stratigraphic sequence of the area is given below

Geological Succession and their geographic distribution

The Tertiaries are exposed in Masan area of North Champaran District, as series of low hillocks. They represent Upper Siwaliks of the Sub-Himalayas and consist of sandstone and clay stone, disturbed by folding and thrust faulting. The entire sequence here occurs as an inlier in the alluvial terrain. The Quaternary of North Bihar Plains, between the tortuous course of Ganga and Himalayan foothills, are represented by Older Alluvium Group (OAG) (Bhangar) and Newer Alluvium Group (NAG) (Khader).The OAG is represented by Mirganj Formation, Khajauli Formation and Madhubani Formation in Gandak basin, Gandak- Kosi interfluve and Kosi basin, respectively. The NAG includes the Vaishali Formation, the Jainagar Formation and Purnea Formation in Gandak basin, Gandak-Kosi interfluve and Ganga-Kosi-Mahananda interfluve. In the whole region the uppermost formation is the Present Flood Plains, Diara formation, Channel Bars and Sand Dunnes. In central Bihar Plains the OAG forming the highest terrace, in the Son-Ganga alluvial tract, and NAG forming younger terraces, as Older Flood Plains, are exposed all along the Alluvial Upland. The Present Flood Plain deposits are confined with then channels. The Vindhyans, in Bihar, are exposed in Rohtas and Bhabhua districts as scarps and plateau. They comprises gritty to fine cemented sandstones, shales, flagstones, quartzites, sandy siltstones, limestone breccias and porcellanites, the shales often being pyritiferous. The Gondwana rocks occur as sporadic outlier basins, in the parts of Nalanda district. The main rock types are sandstones, fine to coarse or gritty sandstone, ironstone, shales, Carbonaceousshales, coal seams and boulder beds. They are largely cemented, jointed, fractured, faulted and intruded by dykes and sills. Along the northern fringe of the Chotanagpur Granite Gneiss Complex are low-grade supracrustals covering the Kharagpur hills, Rajgir hills and Gaya hills referred to as the Satpura Range, comprises schists, ferruginous phyllite, quartzite and phylliticshales. The

Bihar Mica belt comprises a sequence of folded hornblende schists, amphibolite, mica-schist, quartzite and calc-silicates intruded by circular to oval shaped granitic plutons, dolerites, pegmatites and quartz veins. There are many old mines of mica in this belt. The Archaeans are the oldest rock formation in the state. The most predominant rock type is mainly of gneisses and granitic rocks with lesser amount of schists, quartzites, basic intrusives and pegmatoides. They are exposed in Aurangabad, Gaya, Nawada, Jamui, Bhagalpur and Banka districts.

Source: Centre for Ground Water Board (CGWB)

(ii) Local Geology of the area

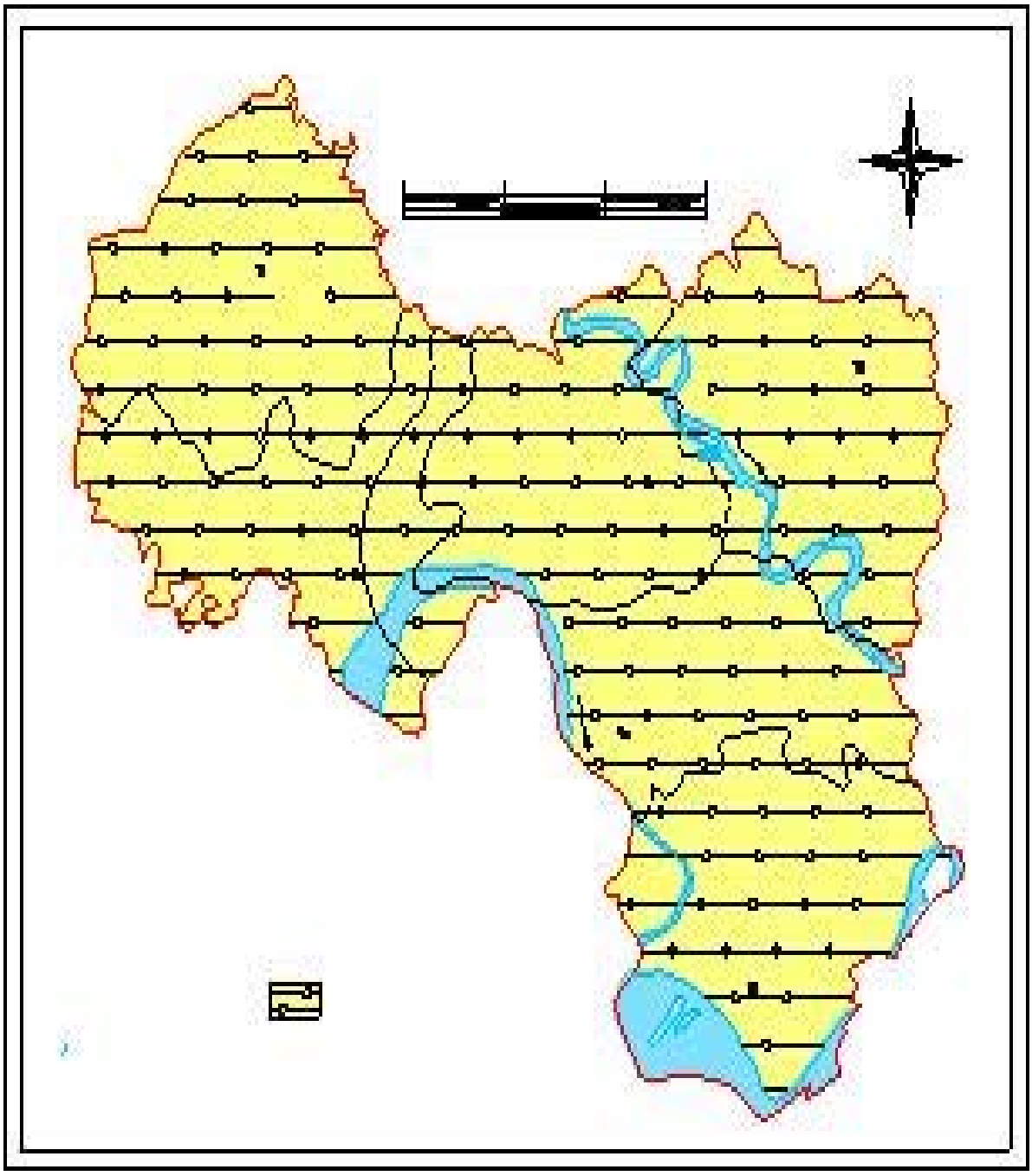
Hydrogeology

The district forms a part of alluvial flat underlain by unconsolidated sediments having considerable thickness. The entire area is overlain by recent alluvium of Quaternary age. Lithologically, the entire alluvial is composed of clay, silt, sand and gravel with occasional kankar. The Gangetic alluvial deposits can be subdivided into two types viz (a) the older alluvium (b) newer alluvium. The older alluvium forms slightly elevated terraces generally above the flood level. The newer alluvium is light coloured and poor in calcareous matter.

The vast stretch of alluvial tract of Ganga plain in Khagaria district possesses ideal hydro geological conditions for ground water development.

The main repository of ground water is formed by quaternary alluvial sequence in the district. Ground water occurs under water table or unconfined conditions as well as locally in deeper zone under semi-confined conditions. The aquifer geometry and its physical characters control the occurrence and movement of ground water in different segments of district. The morphology as well influences movement and storage of ground water in different segments of the district.The thickness of aquifer ranges from 50 to 70 metre. In most of the boreholes thin clays lenses are underlained by continuous granular materials from ground level to maximum depth showing aquifers under water table conditions.In some of the bore holes clay is encountered below the granular zones which show that deeper aquifers may come under semi confined condition.A view of Hydrogeological map of the area reveals that the lowest contour value in the area is in the south eastern corner of the district and maximum value of the water table contour is found in thenorth western corner of the district.The ground water table slope in the district is

little undulating and generally follows the topographic condition of the area.The average hydraulic gradient in the area is 0.14m /km.



CHAPTER-12

Drainage System with description of main rivers.

Drainage Pattern and Sand Source of the Study Area out of total geographical area 1486 Sq. Km

S. No.	Name of the River	Area drained (Sq. Km)	% Area drained in the District
1	Bagmati River	1.5 Sq. Km	0.10%
2	Balamjan River	0.40 Sq. Km	0.03%
3	Burhi Gandak	3.60 Sq. Km	0.24%
4	Chanha River	1.80 Sq. Km	0.12%
5	Ganga	6.0 Sq. Km	0.40%
6	Gumti Dhar	1.80 Sq. Km	0.12%
7	Kareha	11.0 Sq. Km	0.74%
8	Koshi	47.0 Sq. Km	3.16%
9	Malti River	0.60 Sq. Km	0.04%
10	Satras Dhar	0.42 Sq. Km	0.03%
Total		**74.12 Sq. Km**	**4.98%**

CHAPTER-13

Salient Features of Important Rivers and Streams

Total Area of Rivers in Khagaria District: - 74.12 Sq.KM

S. No.	Name of the River	Total Length in the District (in Km)	Place of origin	Altitude at Origin
1	Bagmati River	36	Gaura Chak	44Meters
2	Balamjan River	9	Pattilewa	36 Meters
3	Burhi Gandak	41	Bhela Simri	40 Meters
4	Chanha River	26	Rani Shakarpura	42 Meters
5	Ganga	6	Temtha Patpar	30 Meters
6	Gumti Dhar	9.5	Kingri	40 Meters
7	Kareha	60	Sano Khar	42 Meters
8	Koshi	31	Saharbani	41 Meters
9	Malti River	16	Rasaunk	40 Meters
10	Satras Dhar	8.5	Muzafferpur Sham	40 Meters
Total		**243 KM**		

CHAPTER -14

Methodology Adopted for Calculating of Mineral Potential

The mineral potential is calculated based on field investigation and geology of the catchment area of the river/ streams. As per the policy of the State and location, depth of minable mineral is defined. The area for removal of mineral in a river or stream can be decided depending on geo-morphology and other factors, it can be 50% to 60% of the area of a particular river/stream. Other constituents like clay and silt are excluded as waste while calculating the mineral potential of particular river/ stream.

The specific gravity of each mineral constituent is different. While calculating the mineral potential, the average specific gravity is taken as 2.25.

The quantum of deposition varies from stream to stream depending upon factors like catchment lithology, discharge, river profile and geomorphology of the river course. There are certain geo-morphological features developed in the river beds such as channel bar, point bar etc. where annual deposition is more even two to three meters.

Calculation is based on the methodology given in sustainable guideline of SUSTAINABLE **SAND MINING MANAGEMENT GUIDELINES-2016**.The mineral potential is calculated based on field investigation and geology of the catchment area of the river/ streams. As per the policy of the State and location, depth of minable mineral is defined. The quantum of deposition varies from stream to stream depending upon factors like catchment lithology, discharge, river profile and geomorphology of the river course. There are certain geomorphological features developed in the river beds such as channel bar, point bar etc. where annual deposition is more even two to three meters.

The details are given below:

Name of the River	Portion of the River or stream Recommended for Mineral Concession	Length of area recommended for mineral concession in Kilometer	Average width of area recommended for mineral concession in meter	Area recommended for mineral concession (in Square meter)	Mineable minerals potential (in metric tone (60% of total minerals potential)
Bagmati River	36 KM	36 KM	**42 mtr.**	**15.12 Lakh sq. mtr.**	41.64 Lakh MT
Balamjan River	9 KM	9 KM	**44 mtr.**	**3.96 Lakh sq. mtr.**	10.91 Lakh MT
Burhi Gandak	41 KM	41 KM	**87 mtr**	**35.67 Lakh sq. mtr.**	98.23 Lakh MT
Chanha River	26 KM	26 KM	**69 mtr.**	**17.94 Lakh sq. mtr.**	49.41 Lakh MT
Ganga	6 KM	6 KM	**1000 mtr.**	**60.00 Lakh sq. mtr.**	165.24 Lakh MT
Gumti Dhar	9.5 KM	9.5 KM	**189 mtr.**	**17.95 Lakh sq. mtr.**	49.43 Lakh MT
Kareha	60 KM	60 KM	**183 mtr**	**109.80 Lakh sq. mtr.**	302.39 Lakh MT
Koshi	31 KM	31 KM	**1516 mtr**	**469.96 Lakh sq. mtr.**	1294.27 Lakh MT
Malti River	16 KM	16 KM	**38 mtr**	**6.08 Lakh sq. mtr.**	16.74 Lakh MT
Satras Dhar	8.5 KM	8.5 KM	**49 mtr.**	**4.17 Lakh sq. mtr.**	11.48 Lakh MT
Total	243 KM	243 KM	**321.7 mtr. (Average)**	**740.65 Lakh sq. mtr.**	**2039.74** Lakh MT

Mineral Potential is Calculated in Following Way:

Mineral Potential

Sand (MT)	Total Mineable Mineral Potential(MT)
2039.74 Lakh MT	**2039.74 Lakh MT**
Annual Deposition	
611.92 Lakh MT	**611.92 Lakh MT**

CHAPTER-15

Status of Brick Earth Mining in Khagaria

The state of Bihar is developing rapidly. In the five year period from 2004 to 2009 Bihar's Gross Domestic Product (GDP) has grown by 11.03% and between 2001 and 2011 there has been a significant increase in urbanization with the number of towns increasing from 120 to 213 according to the latest census. This has been possible through investment in various sectors, especially the construction sector. If this growth rate needs to be sustained, the demand for quality building materials will increase manifold. In rural areas too, Bihar faces challenges with the need for over 7.5 billion bricks over the next five years to meet the rural housing gap. A field study was conducted in 5 districts on Bihar to understand the present scenario of the brick industry and to assess the market potential and barriers for introducing energy efficient technologies for walling materials. The major brick producing districts of Bihar is Patna, Nalanda, Siwan, Muzaffarpur, Sitamarhi, East and West Champaran, Darbhanga, Samastipur and Madhubani. With over 5,700 authorized brick kilns the state produces around 17 billion bricks per year. The brick sector in Bihar is growing at a rate of 9%, however it continues to be dominated by traditional technology - the Fixed Chimney Bulls Trench Kiln (FCBTK). Unlike the rest of India (except Punjab, Haryana, Uttar Pradesh and West Bengal) the state of Bihar is the only state which has transformed the brick firing technology from movable to fixed chimney.

A list of Bricks Kilns are attached –Annexure-I

Status of Brick Kilns in Munger District

S No	No of operational Units of Brick Kilns in Munger districts during Financial Year (2016-17)	No of Units of Brick Kilns in Munger Identified by IEED
1	**64**	**71**

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