GOVT. OF MADHYA PRADESH,
MINERAL RESOURCES DEPARTMENT

A REPORT ON THE PROSPECTING OF SAGMANIA LIMESTONE BLOCK

TAHSIL- RAGHURAJNAGAR DISTRICT- SATNA

FIELD SEASON
2019-21

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GEOLOGICAL REPORT ON RECCONNAISSANCE SURVEY (EXPLORATION)G-4 LEVEL LIMESTONE BLOCK IN SAGMANIAAREA

TEHSIL-RAGHURAJNAGAR, DIST- SATNA

Abstract:

Limestone is an important industrial raw material and used in cement, iron and steel industries. It is also consumed in chemical industries like calcium carbide, bleaching powder, soda-ash, precipitated carbonate etc.

As per recommendation and approval of TCC of NMET, mineral exploration project of Sagmania Limestone was to be executed by the MPSMC, thus as per the Director of Geology and Mining M. P. (DGM) order no. 10848/Geol-1/F.No./2020-21 Bhopal dated 3.10.2020,the G-4 level prospecting of Limestone in village- Sagmania, tehsil-Raghurajnagar, district- Satna was taken up in Field Season2019-2021.

Total 4 modules were approved by the committee and executed by the DGM. These were Reco. survey on 1:12,500, Detailed geological mapping on 1:12,500, Reconnaissance drilling of 240M (6 Boreholes) and sampling to confirm the availability of limestone in the approved area.

The prospecting work fulfils the G-4 level of UNFC and readily available for Auction under *Mineral (Auction)second Amendment Rules 2021*. The Indian Bureau of Mines specifications (wide *The Gazette of India Extraordinary, Part I-Section 1, 25 April 2018*) were considered for categorization of mineral resources. The total resources of limestone in prospected area in all A, B, and C block are **274.64** Million tonnes based on G4 level investigation, in the area, and is available for Auction on Composite Licence basis.

CHAPTER -1

1.0 Details of the Project / Introduction: -

The area is bounded by Latitudes $24^0$36'09": $24^0$40'05" and Longitude $80^0$53`56" to $80^0$55'28" and included in Survey of India Toposheet No. 63-D/14. The areais comprises of parts of six villages namelyBari, Baraj, Nimi, Pureni, Bathiakhurd, Naina. The area of investigation is located at about 12 kms. from the divisional H.Q. Satna and can be approaches by metalled road from Satna. Satna is well connected bothby rail and Road. Satna –Semaria road passes through South-Eastern part of the area (PLATE 1). The nearest railhead is Satna of WCR which is at about 20 km from the area. The prospected block can also be approached by Satna-Semaria road. The prospectedarea subdivided into three blocks. The details are given below.

Details of Block Area

Name of block	villages	Area (in hect.)
A	Bari,Baraj,Nimi,Pureni	601.059
B	Bathia	103.282
C	Naina,	238.837
	Total	943.178

1.1 Investigating Agency: -The Directorate of Geology and Mining M.P.

1.2 Objectives of Present Exploration: -

The present Exploration was carried out with the following objectives.

1. To demarcate the Limestone occurrences in the study area by drilling boreholes at G4level investigation. The G-4 level investigation was taken up to confirm the availability of limestone in Sagmania block.

2. The TCC and NMET approved the following items under G-4 investigation in the area.

A. Reconnaissance survey: (1: 12500 scale)
B. Detailed mapping: (1: 12500 scale)
C. Drilling: (6 boreholes/ Total Meterage 240.00M)
D. Sampling: (As required)

1.3 Basis of taking up of Exploration: -

The area was surrendered by M/s Birla Corporation limited. As per information available, initial prospecting and exploration by diamond core drilling was carried out during the year from 1957 to 1959 upto a depth of 20M at grid interval of 800M in the area. Total 06 numbers of boreholes were drilled in the area. Unfortunately, the boreholes positions and core samples along with analysis could not be available and neither found in records. The purpose of taking up this project is to confirm the availability of limestone in the area for auctioning of mineral block. It is situated in Puraini, Barikala, Baraj, Bhatia, Nimi and Naina villages of Raghurajnagar Tahsil of Satna district. It lies in Survey of India toposheet no. 63 D/14.

1.4 Details of work done: -

S.no.	Nature Of Work	Achievement	Remark
1	Reconnaissance Survey (1:125000)scale	943.178 Hect	--
2	Detailed Geological Mapping(1:12500)	943.178 Hect	--
3	Drilling	239.00M	Total 06 nos. boreholes (SG-01 to SG-06)
4	Sampling (As required)	117 nos.	-

1.5 Personal involved: -

S.no.	Person and Designation	Work
1.	Pramod K. Dhoke (Assistant Geologist & Camp-in-charge)	Execution of work along with preparation of Geological report
2.	Ram Murty Singh (Topo surveyor)	Topographical work
3.	Shri Dadan Prasad Pandey (Assistant Driller)	Drill –in charge , Drill no. 55
4.	Shri R.P. Sondhiya (Helper)	Drill in charge , Drill no. 41
5.	Shri Munnalal Sen	Truck Driver

1.6 Mode of operation of different work component and associated agency: -

All the approved modules of the project were done by the investigation agency (The Directorate of Geology and Mining M. P. Govt. of Madhya Pradesh).

1.7 Acknowledgement: -

The author is thankful to NMET for approving the project funding for taking up the investigation. The author is also thankful to The Director, Geology and mining M. P. and the M. P. State Mining Corporation Ltd. for giving me the opportunity to carry out the investigation. Thanks, are also to all those who are directly or indirectly involved and provided handheld support.

CHAPTER -2

2.0 Description of the investigated area: -

2.1 Details of the area

1.Village name -Bari, Baraj, Nimi, Pureni,Bathia,Naina,

2.Tahsil - Raghurajnager

3.District – Satna

4.State – Madhya Pradesh

5.Toposheet no. – 63D/14

6.Geo-coordinates with the corner points of the investigated area:

Latitudes $24^0$36'09": $24^0$40'05" and Longitude $80^0$53`56`` to $80^0$55'28"

7.Land use/cover –Private land/Govt. Land

8.Forest with type: .No. The area is partly private and govt. Revenue land.

9.Free hold/Lease hold details-943.178 Hect.

2.2 Block Location and Accessibility: -

It is situated in Puraini, Barikala, Baraj, Bhatia, Nimi and Naina villages of Raghurajnagar Tahsil of Satna district. It lies adjacent to section mining lease of M/s Birla Corporation limited (Plate-1). The area of investigation is situated at about 12 kms. from the divisional H.Q. Satna and can be approached by Semi metalled road from Satna. The nearest railhead is Satna of WCR which is about 20 km.

2.3 Climate: -

The climate of the area is characterized by extremes of temperature and dryness, except during the monsoon months. The cold season is from December to February. The hot season is from March to about middle of June. The period from mid-June to September constitute the south western monsoon season. October and November form the post monsoon season.

Temperatures begin to drop in November-December and January is the coldest month with the mean daily minimum at about 9^0 C. From March temperature rise rapidly till May, this is the hottest month. Temperature in May and June sometimes rises to upto 47^0 C.

The average annual rain fall in the area is 1074.7 mm. The rain fall generally decreases from the south west to North West. The period from June to September is the main rainy season, July being the rainiest month. The rain fall during the south west monsoon season constitutes about 88% of the annual rainfall. In January and February some rain fall occurs in association with passing western disturbances.

2.4 Fauna and Flora: -

Fauna: - The wild life population in the district is not large. The animals found in the area are Goat, Rabbit, Dear, Cow etc. Reptiles of the area are Dhaman or rat snake occurs in and around habitation. Cobra is the most poisonous snake of the area which has sharp fangs and is most swift. Goh (Monitor Lizards) lives on insect and smaller animals. Important species of birds met within the forest are owl, crow, parrots and sparrow. Black partridge, panted partridge and grey partridge are found in the scrub and grasses.

Flora: -The investigated area is mainly private agriculture land. As per the revised classification of Indian Forest by H.G. Champion and B.K. Seth, the forest included in the area fall primarily in the group 5A i.e. Tropical dry deciduous forest. The occurrence of teak as the most prevalent species at some places and edaphic type of vegetation like sarai and kardhai met with in the dry deciduous mixed forest. In mix type forest in the area,there is large variety of tree species.

It is found in small area apart from the mix type the only other conspicuous type met with is salai forest. Another feature of forest, is the sparse growth of high trees most of which are young and middle age. This gives rise to heavy growth of shrubs, herbs, weeds and climbers. The Botanical species found in the area are achar, aounla, arjun, bahera, bamboo, saja, bel, bija, dhawra, haldu, harra, jamun, mahua, sal, salai etc. Shrubs and herbs found in the area amaltas, baranga, kuda, makor, reunjha, thuar etc. Weeds and grasses of the area are dhurbhusi, kans, kusal, phuli, panwar, gursakri, harsingaretc.Amarbel, keoti.ber, mahul, palasbel are the conspicuous climbers of the area

2.5 Geomorphology (Physiography and Drainage)-

The area is an almost flat terrain with a general slope towards NE direction,the topography of the area is simple with a plain land. The district is mainly drained by Tamas river and their tributaries. There are numerous nalas traversing the area and which provide drainage to the area. All the small nalas gets dry during the summer season.

2.6 Previous Work: -

The area was surrendered by M/s Birla Corporation limited. As per information available, initial prospecting and exploration by diamond core drilling was carried out during the year from 1957 to 1959 uptoa depth of 20M at grid interval of 800M in the area. Total16 numbers of boreholes were drilled in the area.Sincelong, TheDGM is actively engaged in the regular field programmes of survey and prospecting various mineral deposits of the state. The DGM had already undertaken and completed preliminaryand detailed assessment of high grade Limestone block in the nearby area. Pandey and Dhopeshwar (2016) investigated Cement grade limestone in the Nagod area.Bajpai and Parmar(2016) investigated Cement grade limestone in Ramsthan area.These areas were

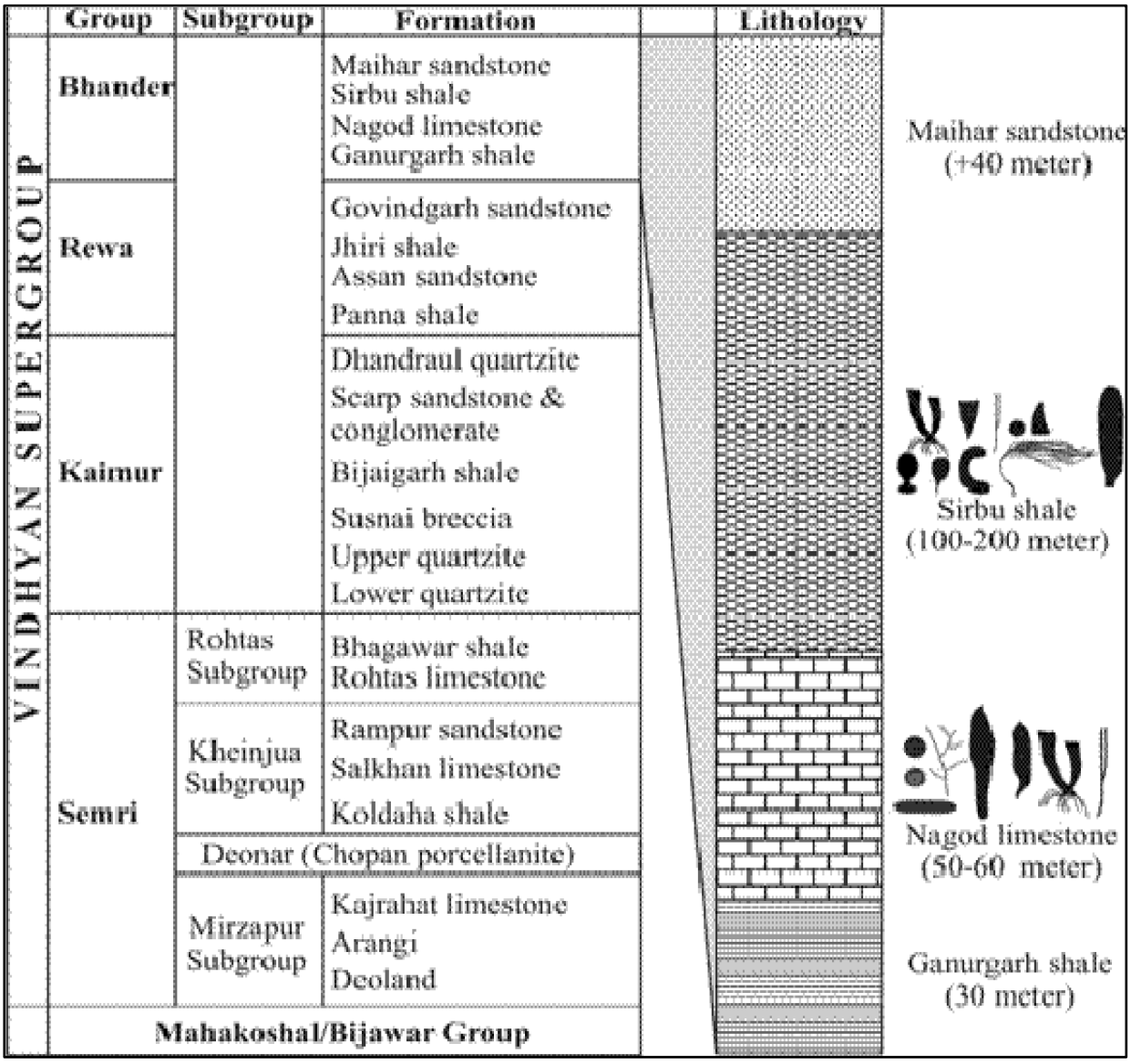
handed over to MECL for further prospecting. Subsequently these areas are put on auction in year 2021.

CHAPTER -3

3.0 Geology of the Area: -

3.1 Regional Geology:

Lithostratigraphically, Vindhyan Supergroup has been subdivided into four successive groups namely the Semri Group (Lower Vindhyan), Kaimur, Rewa and Bhander groups (Upper Vindhyan) in ascending order and detailed work on geology and its allied disciplines given by pioneer earth. The Semri and Bhander groups include a heterogeneous assemblage (sandstone, shale and limestone) whereas the Kaimur and Rewa groups are predominantly arenaceous in nature.



After Journal of Evolutionary Biology Research Vol. 1 (1), pp. 001-017, December, 2009

Available online at http://www.academicjournals.org/jebr © 2009 Academic Journals: ***Discovery of carbonaceous remains from the Neoproterozoic shales of Vindhyan Supergroup, India"Singh V. K. et. al. (2009).***

Structural Set up:

The Lithounits trend in NE-SW direction with very low northerly dipping to almost horizontal strata. Local warping and slumps in shaly horizons are common features noted in the area. Shales are highly weathered and the limestone is capped by varyingly thick soil cover. The limestone is exposed in small pits, at places. The sandy horizons in shales exhibit higher contours.

3.2 Geology of the investigation Block: -

An area of about 943.178Hect.has been covered by reconnaissance survey, along with collection of outcrop samples and marking of outcrop on 1: 12500 on SOI Toposheet No. 63D/14.

An area of about 943.178 Hect. was surveyed along with recording of stratigraphic units given in lithology. The rock formation of Limestone (Nagod) belong to the Bhander group of upper Vindhyan is exposed in the area. The main lithological formation, which were encountered in the area are Nagod Limestone and Sirbu shales in patches at places. They are mostly capped by varyingly thick soil and calcareous shaly horizons. These rock formations are almost horizontally bedded, howeverat places northerly dips varing from 2^0 to 4^0 due North were observed. Thegrey to bluish grey limestone was seen as forming a sickle within Sirbu and Ganurgarhshale. (Plate 2)

Sirbu Shale:-

This shale is purple in colour. Below this shale occurs another horizon of olive green shale. The prominent outcrops of the Sirbu shales are encountered on the high land area around villages Bhati that is on the half way between Cement factory and Sagmania Limestone mines. Also another prominent exposure of Sirbu shales within surrendered area is encountered in North-Western part both in Puraini, Barikala and Baraj villages. Olive green shale area also found at places superimposed by purple shale. Small isolated occurrences of Sirbu shales with sandy partings were also seen.

Bhander (Nagod) limestone:–

It is light to dark grey in colour, fine grained, massive to bedded.At places,it shows stromatolitic structure.The limestone deposits in the area show fairly frequent variation in quality and thickness both laterally and vertically. In several localities, the good quality limestone beds are inter-bedded by low grade limestone and shale. Therefore at some places, it is highly siliceous and argillaceous in nature.

The limestone is well bedded, fine to medium grained, grey to dark grey in colour. Overall, it is heterogeneous with lateral end vertical variation in respect of lithology and chemical content.

3.3 Mode of occurrence: -

In the investigated area, the limestone is erratic in nature. It doesn't exhibit a homogenous nature. The relief of limestone area is undulating. It is stratified with a very gentle dip due north at places. The local warp was also seen. In the area limestone beds are generally found to be covered by varying thick black cotton soil. The limestone is horizontal with dip varying from 2^0 to 5^0 in the direction varying from $N10^0E$ to $SN10^0W$.

3.4 Mineral Prospect: -

The limestone is principalraw material for manufacture of cement. The investigated area is in close proximity to sanctioned captive Mining leases of M/s Birla Corporations Pvt. Ltd and thus it is highly probable that once it available for auction will readily be sold out and may provide mineral revenue to the state exchequer.

CHAPTER-4

4.0 Geoscience Investigation: -

4.1 Geological Mapping: -

The area was proposed for G-4 level prospecting in Puraini, Barai,Nimi,Bathia and Naina area in the field season 2019-20,and 2020-21. The Reconnaissance survey was done in an around the block area. Major geographical feature and litho logical units were marked. The area is ubiquitous Vindhyan terrain. The outcrops are far and few and mostly covered by varying thick soil. These are briefed in previous chapter. The assigned block area was mapped in detail mapping on 12500 scale. All the geographical features (road, nalla, habited, tank, high-tension line, pit, school etc.) and outcrops were marked on the map. The general geological succession can be represented as below:

Age	Supergroup	Group	Lithology
Recent to Sub Recent	-	-	Soil/Alluvium
Proterozoic	Vindhyan	Bhander	Sirbu Shale Nagod Limestone

The area is cultivated land and lithounits area covered with varyingly thick soil. Soil is generally black cotton type. Thin capping of brown to grey shale was observed in pits and nalla cuttings. In the adjoining area, large pits of mining lease of M/s Birla corp. exhibit presense of limestone beneath shales. Limestone generally trends NE-SW direction with a minute dip of 2^0 to 5^0 towards North. Local warping was also observed. The detached outcrops were seen in all the three blocks. (PLATE-3)

4.2 Surveying: -

The assignment was initiated in field season 2019-20 and subsequently continues in field season 2020-21.The work was hampered due to COVID-19 lockdown. The report presents the G-4 level investigation work in Sagmania area and incorporates detailed mapping, topographical survey and prospecting by drilling in the potential area. All the geographic features like road, nala, electric lines, habitat and ponds etc. were marked on 1:12,500 scale. There is no broad physiographic features, because the area is characterised by a flat terrain. The main lithological formation, which have been encountered in the area, Nagod limestone and sirbu shale in patches. No major structural features are encountered in the area, except some localized warps and joints. The nature of the mineralisation of the limestone in the area is found to be in the form of thick horizontal sedimentary bedded deposit. In the area, limestone beds are generally found to be covered by black cotton soil. The limestone is horizontal to sub-horizontal with dip vary

from 2^0 to 5^0due North. The discontinuous of limestone were seen in all three blocks and initial reconnaitory drilling confirmed presence of cement grade limestone.

4.3 Exploratory Drilling: -

Two heavy drill machines were engaged for drilling work. The area is mainly a cultivated land where crops were standing. Thus, the accessibility of the area to engage rigs was difficult task due to standing crops and muddy fields. The Limestone, in the area, is of simple type and horizontal stratified deposit. Initially, an interval of 800M was taken into the consideration to get good result in respect of horizontal and vertical variation of limestone as per G-3 level of UNFC. But TCC committee approved only 06 no. Boreholes (03 no. in A block, 02 no. in C block, and 01 no. in B block) to confirm the resources of limestone and its general behaviour. A maximum drilling depth of 41.00M in borehole no.SG-01 and minimum drilling 36.80M in borehole no. SG-05. The area is bounded by Latitudes $24^0$36'09": $24^0$40'05" and Longitude $80^0$53`56`` to $80^0$55'28" included in Survey of India Toposheet No. 63-D/14.The pilot drilling was initiated in the area to decipher the continuity of limestone beneath the soil cover/younger formation. It was performed in areas namely village Bari, Baraj, Nimi, Pureni, Bathia and Naina. The depth of boreholes varies between 41.00M (SG-01) to 36.80M (SG-05). In this way, total 239.00M drilling was done in 06 nos. boreholes. Borehole no. SG-05 had to be closed due to occurrence of clay and could not be drilled further (Annexure -2). A succinct description of drilled boreholes is given below.

Drill wise description:-

S. No.	Drill Machine	Total Borehole Drilled	Block	Total Borehole	Meterage achieved
1	D. No. 41	SG-01	C	01 no.	41.00
2	D. No. 41	SG-02	B	01 no	40.20
3	D. No. 41	SG-03	A	01 no.	40.20
4	D. No. 41	SG-04	A	01 no.	40.60
5	D. No. 55	SG-05	C	01 no.	36.80
6	D. No. 41	SG-06	A	01 no.	40.20
Total				**06 nos.**	**239.00M**

4.3.1 Drilled Area Description: -

The drilling operations were begun in village Naina and Bathia area on 14/02/2020. The drilling was done at a distance 800M in block A, B and C block. This was done in order to determine the continuity of limestone beneath the soil cover in both blocks.

Further this might enable us to know the grade of deposit. The work was hampered due to pandemic and total lockdown. Block wise details of the operations are briefed as below:

A BLOCK (Bari, Baraj, Nimi, Pureni):-

The area is located on the North of Satna and can be approached by Satna-Semaria road highway is roughly 14 kms. from city Satna. The proposed block area is covered with soil and maximum area is cultivated land Here Boreholes SG-03 was on Western line whereas the Eastern line has SG-04 and SG-06. Here in this area in total 03 nos. of boreholes were drilled and meterage achieved was 121.00M. in the area the shales are thinly bedded ard purple to olive green color The prominent outcrop of the top Sirbu shales was encountered on the high land area around village Puraini, Barikala and Barajviilages (in the southern side of the block area adjoining working pit of M/s Birla cement).

B BLOCK (Bathia): -

The area is located on the North of Satna and can be approached by Satna-Semaria road highway is roughly 11 kms. from city Satna. The proposed block area is covered with soil and maximum area is cultivated land Here in this area in total 01 nos. of boreholes SG-02 were drilled and meterage achieved was 40.20M.. In the area, outcrop of the Limestone was seen in viiageBathia. The general trend of Limestone is almost E-W. The limestone is sub horizontal with dips varying from 2^0 to 5^0 towards North. The area is occupied by black cotton soil and scattered outcrops were seen at places.The limestone is mainly grey to dark grey in colour with argillaceous intercalations in the northern part of the block area, (adjoining the working pit of Birla cement).

C BLOCK :- (Naina and Bathia)

The area is located on the North of Satna and can be approached by Satna-Semaria road and is roughly 11 kms. from Satna city. The proposed block area is covered with soil and maximum area is cultivated land. Here, in this area, in total 02 nos. of boreholes SG-01and SG-05 were drilled and meterage achieved was 77.80M. In the area, limestone outcrop was recorded in viiage Naina. The general trend of limestone is almost E-W . The limestone is sub horizontal with dip varying from 2^0 to 5^0 towards North. The area is occupied by black cotton soil and small outcrops of shale were seen at places.The limestone is mainly grey to dark grey in colour with clay and shale.

4.4 Core Logging: -

Detailed core logging was done run wise and their physical characteristics were recorded. The average core recovery was on the low side due to presence of soft clayey

horizons and cavities. The limestone core portion was identified by putting drops of dilute HCl (Please see Annexure 2 for details).

4.5 Sampling: -

Meter wise core sampling was done. Individual core samples were split longitudinally into two halves. One half was preserved and the other half was powdered to 100 mash size and 100 to 200 gm of sample was prepared after repeated coning and quartering. A duplicate sample is packed for future reference. The samples were analyzed for CaO, MgO, Sio_2, Fe_2O_3, Al_2O_3 and LOI in departmental lab at Jabalpur. The band with Cao% (+34%) was considered while below this Cao% (-34%) is treated as waste and not Included in making bands. (Annexure-2).

4.6 Chemical analysis of samples: -

The samples were analyzed for CaO, MgO, Sio_2, Fe_2O_3, Al_2O_3 and LOI in departmental lab at Jabalpur. The IBM specification was considered for prospective Limestone band for resources estimation, thus after analyzing the borehole data, two categories (i) +34% to -42% Cao (beneficial grade)and (ii) above +42% CaO(Cement grade) were considered for assessment.

Average analysis results of all boreholes

S. No.	Boreholes No.	Depth in M.	SiO_2%	Fe_2O_3%	Al_2O_3%	CaO%	MgO%
1	SG-01	41.00	17.15	0.88	1.28	40.46	1.66
2	SG-02	40.20	21.33	0.85	1.86	38.34	5.48
3	SG-03	40.20	21.34	1.32	1.98	37.78	3.69
4	SG-04	40.60	14.83	0.90	1.21	42.38	3.76
5	SG-05	36.80	23.79	1.26	2.71	36.30	3.26
6	SG-06	40.20	17.84	0.95	4.47	38.74	3.26

As per chemical results of all six boreholes, Limestone was encountered in all (A, B, C) blocks.

4.7 Specific Gravity Determination on Drill core Samples: -

The specific gravity of 2.5 has been taken for limestone. The same specific gravity has been considered in the prospecting operations in the surrounding areas and literature available in the department.

4.8 Details of Cement grade Limestone zones of the Block:-

The TCC committee approved only 06 no. Boreholes (03 no. in A block, 02 no. in C block, and 01 no. in B block) to confirm the presence of the limestone and its general behaviour. The prospected area falls in Naina, Nimi, Puraini, Bari, Baraj, Bathiakhurd

villages. The quality and degree of exploration activity is adequate for G-4 level. The chemical analysis results reveal presence of Blendable and Cement grade Limestone in all (A,B and C) blocks.

The core logging, sampling, and chemical analysis of borehole cores revealed presence of limestone. Those boreholes which yielded + 34% to -42% CaO and +42% Cao bearing limestone, are tabulated below:

Boreholes Showing cement grade Limestone bands (+42 % CaO)

		Run			Core	Chemical Analysis				
S. NO.	BH No.	from	to	Total		SiO_2%	Fe_2O_3%	Al_2O_3%	CaO%	MgO%
1	SG-01	2.00	7.60	5.60	5.15	5.27	0.58	0.76	47.89	1.77
		11.60	14.00	2.40	2.05	14.49	0.83	1.34	44.71	1.55
2	SG-02	7.10	14.00	6.90	4.15	21.33	0.80	1.86	42.02	2.53
3	SG-03	20.00	21.00	1.00	0.80	8.28	0.80	0.80	49.13	0.97
		28.00	29.00	1.00	0.90	11.22	0.80	0.96	43.07	5.48
		30.00	31.00	1.00	0.60	5.12	0.60	0.54	48.90	3.90
4	SG-04	11.00	17.00	6.00	2.20	12.93	0.60	0.94	45.94	1.50
		21.00	22.00	1.00	0.80	14.00	1.20	1.14	42.40	3.87
5	SG-05	9.15	13.20	4.05	3.70	4.22	0.60	1.08	50.92	1.33
6	SG-06	14.00	22.00	8.00	3.90	10.53	0.66	3.60	45.05	1.97
		24.00	26.00	2.00	1.40	10.35	1.20	4.01	43.18	3.14
		28.00	29.00	1.00	0.95	11.10	1.00	4.70	43.07	2.60

Boreholes Showing Blendable grade Limestone bands (+34 to -42% CaO)

		Run			Core	Chemical Analysis				
S. NO.	BH No.	from	to	Total		SiO_2%	Fe_2O_3%	Al_2O_3%	CaO%	MgO%
1	SG-01	8.10	9.10	1.00	.1.00	28.24	1.00	1.60	35.89	2.26
		10.15	11.20	1.05	1.00	21.26	1.50	2.36	37.01	4.19
		14.60	20.10	5.50	4.80	22.24	1.12	2.15	39.95	1.54
2	SG-02	5.10	6.10	1.00	0.80	12.48	1.70	1.28	39.26	6.77
		17.00	18.00	1.00	0.75	20.30	0.40	2.94	39.93	2.10
		19.00	21.00	2.00	1.45	21.04	0.50	3.02	38.22	3.10
		25.00	27.00	2.00	1.60	17.56	0.25	3.54	39.37	3.79
3	SG-03	19.00	20.00	1.00	0.70	27.98	2.00	2.20	37.46	0.16
		21.00	22.00	1.00	0.90	32.12	2.00	2.34	34.55	0.81
		26.00	28.00	2.00	1.40	10.74	0.95	1.21	40.82	6.45
		29.00	30.00	1.00	0.90	15.54	1.00	1.30	41.05	4.52
		31.00	35.00	4.00	2.40	20.73	1.22	1.86	37.01	4.95
4	SG-04	13.00	14.00	1.00	0.50	20.10	0.80	1.38	40.83	2.42
		17.00	21.00	4.00	3.40	13.28	1.00	1.43	40.49	6.21
		22.00	23.00	1.00	0.80	17.48	1.30	2.08	39.26	5.00

5	SG-05	13.20	17.45	4.25	3.65	26.67	1.20	1.32	37.57	1.53
		22.50	23.55	1.05	0.95	24.12	0.80	3.52	37.46	2.10
		24.55	28.60	4.05	3.95	21.66	0.72	3.77	38.07	2.58
6	SG-06	22.00	24.00	2.00	1.75	17.69	1.20	5.30	35.89	5.89
		26.00	28.00	2.00	1.85	13.74	0.95	4.44	41.38	2.74
		29.00	31.00	2.00	1.70	18.28	1.04	5.25	36.90	3.87
		32.00	33.00	1.00	0.80	14.84	1.50	4.28	34.10	8.07

Besides above, Three samples were also collected from outcrops and their chemical analysis results are tabulated below:

Result of surface samples points

		Chemical Analysis					**Grade**
S. NO.	**Surface samples**	**SiO_2%**	**Fe_2O_3%**	**Al_2O_3%**	**CaO%**	**MgO%**	
1	S-01	12.20	1.00	3.70	45.09	0.65	Cement
2	S-02	15.40	1.40	4.60	39.26	3.39	Blendable
3	S-03	33.28	1.00	4.60	31.85	1.45	----

CHAPTER-5

5.0 Resource Estimation and Grade

5.1 Sampling Procedure: -

The area contains numerous intercalated / interbedded clay horizons. Thus, while doing the calculation all these having a thickness of ≥ 1M were taken into consideration, so that any economic entity shouldn't be left out. At times, the thin bands of marginal grade were clubbed into the +42% CaO horizons for calculation. The resources estimation has been done by adopting procedure of the inclusive block area method. For the boreholes lying on the boundary of the block, the area of influence has been taken for only up to the boundaries of the block.

5.2 Chemical Analysis: - total 117 no of samples were prepared from 6 no. of boreholes and were analyzed in Departmental Chemical Laboratory at Jabalpur. The results are given in Annexure 2.

5.3 Limestone specification cut-off grade: -

The specifications were considered as per notification wide **The Gazette of India Extraordinary, Part 1-Section 1, Ministry of Mines, Indian Bureau of Mines, Nagpur, Dated 25 April 2018**.

5.4 Bulk Density (In-situ)/ Specific Gravity: -

The specific gravity of 2.5 has been taken for limestone. The same specific gravity has been considered in the prospecting operation in the surrounding areas and literature available in the department.

5.5 Assumptions :-

1. The UNFC guidelines and the Mines (Evidence of mineral) Content Rules 2015), were the principal criteria for resources estimation. The quality and degree of exploration activity in present report qualify for G-4 level. The prospected area falls in - Bari, Baraj, Nimi, Pureni, Bathiakhurd and Naina villages. The following criteria have been employed for the estimation of resources.

2. The IBM specification (as above) was considered for prospective Limestone band for resources estimation, thus after analyzing the borehole data, two categories (i) +34% to - 42% Cao (benificiable grade) and (ii) above +42% CaO (Cement grade) were considered for assessment. The Sagmania limestone block has been divided into three blocks; namely A, B and C. In the whole block +34 to 42% CaO (blendable grade) and +42 % CaO (cement grade), were considered for limestone.

3. The thickness of cement grade limestone measured in each borehole has been considered to be uniform throughout the area of influence of that particular borehole.

4. The grade of limestone measured in each block has been considered to be uniform throughout the area of influence of boreholes in the block. These were then averaged to get average thickness and grade of limestone in that block. Thus, the limestone resources were assessed upto a depth of 35 M from surface RL. Resources of all three blocks were combined to get total resources of limestone of Sagmania block.

5. The whole block was subdivided into three blocks (namely A, B and C) for convenience of resource estimation. These blocks are irregular in shape and dimensions. Thus, it was difficult to assess the area of influence of boreholes and vary greatly. Therefore, inclusive block area method was employed for resource estimation. Here, the area of each block was multiplied by average thickness of limestone band to arrive at the volume. This, then, was multiplied by specific gravity to arrive at the total resources of limestone in that particular block.

6. The specific gravity of 2.5 has been taken for limestone. The same specific gravity has been considered in the prospecting operation in the surrounding areas and literature available in the department.

7. The thin (<1M) intrabanded clay /argillaceous horizons were clubbed into potential nearby CaO bands. i.e. +34% to - 42% CaO and +42% CaO.

8. The restricted areas per prevailing rules were left out and not considered in the process. Further, the areas of sanctioned mining leases were also carved out.

5.6 Methodology adopted in cross section method: -

The whole block was subdivided into three blocks (namely A, B and C) for convenience of resource estimation. These blocks are irregular in shape and dimensions.

Thus, it was difficult to assess the area of influence of boreholes and vary greatly. Therefore, inclusive block area method was employed for resource estimation. The prospected area falls in six villages. Their khasra maps were procured, mosaiced and georeferenced. Here, the area of each block was multiplied by average thickness of limestone band to arrive at the volume. This, then, was multiplied by specific gravity to arrive at the total resources of limestone in that particular block.

5.7 Calculation of Average grade: -

Meter wise sampling of cores of six scout boreholes were done and analysed for their chemical constituents. The weighted average of CaO, SiO_2, Fe_2O_3, Al_2O_3, MgO and LOI were determined. The potential bands were further averaged to arrive at the grade.

5.8 Category of Resource: -

RESOURCES OF CEMENT GRADE LIMESTONE

S. No.	Block name	Drilled Borehole	Area (In Hect.)	Average Thickness (in M)		Volume (in cu.M)		Resources	
				As per run	As per core	As per run	As per core	As per run	As per core
1	A	3 Nos. (SG-03,04 and 06)	601.059	4.68	2.97	2812.95	1785.15	7032.375	4462.875
2	B	1 No. (SG- 02)	103.282	3.9	3.35	402.79	345.99	1006.975	864.975
3	C	2 Nos. (SG-01and 05)	238.837	6.02	5.53	1437.79	1320.76	3594.475	3301.9
Total		6	9431780000 or say **943.178 Hect.**	**TOTAL RESOURCES**				11633.825 or say **116.33 Million tonnes**	8629.75 or say **86.29 Million tonnes**

RESOURCES OF BLENDABLE GRADE LIMESTONE

S. No.	Block name	Drilled Borehole	Area (In Hect.)	Average Thickness (in M)		Volume (in cu. M)		Resources	
				As per run	As per core	As per run	As per core	As per run	As per core
1	A	(SG-03,04 and 06)	601.059	6.1	4.9	3666.4599	2945.1891	9166.14975	7362.97275
2	B	1(SG-02)	103.282	6.85	4.95	707.4817	511.2459	1768.70425	1278.11475
3	C	2 (SG-01and 05)	238.837	8.2	7.2	1958.4634	1719.6264	4896.1585	4299.066
Total		**6 Nos.**	**9431780000 or say 943.178 Hect.**	**TOTAL RESOURCES**				**15831.0125**	**12940.1535**
								or say 158.31 Million Tonnes	**or say 129.40 Million tonnes**

SUMMARY OF LIMESTONERESOURCES: -

The total resources of Sagmania Limestone Block are summarized below:

Table-showing Limestone Resources of the total block area

S. No.	Block	Grade	Resources (In tonnes)	Resources (in Million Tonnes) (as per run)
1	A, B and C	CEMENT	11633.825	116.33
2	A, B and C	BLENDABLE	15831.0125	158.31
TOTAL				274.64

CHAPTER-6

6.1 Conclusion: -

The work contained in this report was performed in Field Season 2019 to 2021. The prospected G-4 level work falls in parts of Puraini, Bari, Baraj, Nimi, Naina, Bathia villagesof Tahsil- Raghurajnagar, District Satna (M.P.). The limestone belongs to Nagod limestone member of Bhander group of upper Vindhyans. It is light to dark in colour and bedded. It trends in NE-SW with a shallow northerly dip. It is intercalated and interbedded with thin argillaceous and siliceous horizons. The exposures are far and few and mostly covered by thin and thick soil cover. The area is principally a cultivated land. In this area, Detailed Mapping of about 9.43 Sq.Km. and drilling of 239.00M (06 nos. boreholes) and 117 nos. of samples were prepared and analyzed. The prospected area was divided into three blocks namely A, B and C. On the basis of chemical results of samples in Sagmania block, presence of Limestone in all three (A, B and C) is affirmed. The total area of Sagmania Limestone block is **943.178 hectares.** The total resources of Blendable and Cement Grade limestone in prospected area are in all A, B, and C block is **274.64 Million tonnes based on G-4 level investigation.** The information regarding available area for mineral concession is to be sort out from mining section Satna.

6.2 Recommendation: -

Based on this G-4 level work, Sagmania limestone block with a total limestone resource of the tune of **274.64 Million Tonnes** is available for auction as composite licence.

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LIST OF ABBREVIATIONS

1. DGM: The Directorate of Geology and Mining, Govt. of Madhya Pradesh, Mineral Resources Department, Bhopal, M. P.

2. GSI: The Geological Survey of India, Govt. of India.

3. UNFC: United Nations Framework of Classification of Mineral Deposits.

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Annuxure-1

Locality index

S.NO.	NAME OF VILLAGE	LATTIUDE	LONGITUDE
1	Puraini	24^0 38’ 51”	80^0 52’ 42”
2	Barikhurd	24^0 37’ 38”	80^0 52’ 25”
3	Naina,	24^0 37’ 19”	80^0 52’ 46”
4	Baraj	24^0 38’ 40”	80^0 54’ 42”
5	Bathia	24^0 36’ 53”	80^0 52’ 18”
6	Nimi,	24^0 38’ 46”	80^0 54’ 48”
7	Satna	24^0 34’ 52”	80^0 50’ 40”

Annexure 2

BOREHOLE NO. SG-01

Reduce Level: 316.00 meter											**Date of Commencement: 14.02.2020**								
Drill No. D-41											**Date of completion: 15.03.2020**								
Block: SAGMANIA BLOCK											**Total Depth: 41.00 meter**								
Depth (meter)									**Lithology**		**Analysis result in percentage**								
From	**To**	**Run**	**Core**	**From**	**To**	**Run**	**Core**	**% of Recovery**		**sample no.**	**SiO2**	**R2O3**	**CaO**	**MgO**	**Fe2O3**	**Al2O3**	**LOI**	**Total**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
0	1	1	0						Surface soil									
1	2	1.00	0.00					0%	Surface soil									
2	3.05	1.05	0.90					86%	Greyish White Limestone	1	3.98	1.2	49.8	2.42	0.7	0.5	41.62	99.02
3.05	4.05	1.00	0.95					95%	Greyish White Limestone	2	4.04	1.24	49.13	3.06	0.7	0.54	41.68	99.15
4.05	5.05	1.00	0.95					95%	Greyish White Limestone	3	7.18	1.02	49.57	1.29	0.4	0.62	40.12	99.18
5.05	6.1	1.05	1.00					95%	Greyish White siliceous Limestone	4	17.26	1.48	43.74	1.45	0.6	0.88	35.78	99.71
6.1	7.6	1.50	1.40															
				6.1	7.1	1	1	100%	Greyish White siliceous Limestone	5	11.18	1.76	46.88	1.29	0.5	1.26	38.12	99.23
				7.1	7.6	0.5	0.4	90%										
7.6	8.6	1.00	0.95					95%	Greyish White Limestone	6	9.78	1.22	48.23	1.13	0.5	0.72	38.82	99.18
8.6	9.6	1.00	0.90					90%	Greyish White siliceous Limestone	7	28.24	2.6	35.89	2.26	1	1.6	30.6	99.59
9.6	10.6	1.00	0.70					70%	Greyish White shale fractured	8	34	2.42	33.2	1.94	0.9	1.52	28.11	99.67
10.6	11.6	1.00	0.85					85%	Greyish White siliceous Limestone	9	21.26	3.86	37.01	4.19	1.5	2.36	32.85	99.17
11.6	12.6	1.00	0.90					90%	Greyish White siliceous Limestone	10	13.3	2.36	45.54	1.61	0.9	1.46	36.4	99.21
12.6	13.6	1.00	0.95					95%	Greyish White siliceous Limestone	11	16.3	2	43.07	1.45	0.8	1.2	36.94	99.76
13.6	14	0.40	0.40					100%	Greyish White siliceous Limestone	12	13.88	2.18	45.54	1.61	0.8	1.38	36.59	99.81
14	15	1.00	0.80					80%	Greyish White siliceous Limestone	13	25.18	3.34	37.91	1.61	1.3	2.04	31.29	99.33
15	16	1.00	0.85					85%	Greyish White siliceous Limestone	14	23.14	3.18	39.48	1.61	1.1	2.08	31.95	99.36
16	17.05	1.05	0.90					86%	Greyish White siliceous Limestone	15	23.36	3.84	39.36	1.45	1.4	2.44	31.57	99.58
17.05	18.1	1.05	0.95					90%	Greyish White siliceous Limestone	16	20.46	3.18	41.05	1.2	1.98	1.77	32.89	99.35
18.1	19.1	1.00	0.85					85%	Greyish White siliceous Limestone	17	19.1	2.84	41.95	2.84	0.6	1.29	34.07	99.25
19.1	20.1	1.00	0.90					90%	Greyish White shale									
20.1	21.1	1.00	0.90					90%	Greyish White shale									
21.1	21.8	0.70	0.70					100%	Greyish White shale									
21.8	22.8	1.00	0.95					95%	Greyish White shale									
22.8	23.35	0.55	0.40					73%	Greyish White shale									
23.35	24.85	0.50	0.50					100%	Greyish White shale									
24.85	25.85	1.00	0.50					50%	Greyish White shale									
25.85	26.4	0.55	0.30					55%	Greyish White shale									
26.4	27.4	1.00	0.95					95%	Greyish White shale									
27.4	28.4	1.00	0.80					80%	Greyish White shale									
28.4	29.45	1.05	0.95					90%	Greyish White shale									
29.45	30.45	1.00	0.95					95%	Greyish White shale									
30.45	31.45	1.00	0.95					95%	Greyish White shale									
31.45	32.5	1.05	0.95					90%	Greyish White shale									
32.5	33.5	1.00	0.95					95%	Greyish White shale									
33.5	34.5	1.00	1.00					100%	Greyish White shale									
34.5	35.55	1.05	1.00					95%	Greyish White shale									
35.55	36.55	1.00	0.95					95%	Greyish White shale									
36.55	37.55	1.00	0.95					95%	Greyish White shale									
37.55	38.6	1.05	0.95					90%	Greyish White shale									
38.6	39.8	1.20	1.00					83%	Greyish White shale									
39.8	41	1.20	1.00					83%	Greyish White shale									
								Borehole closed at depth 41.00 mts.										

BOREHOLE NO. SG-02

Reduce Level: 316.20.00 meter											**Date of Commencement: 19.03.2020**								
Drill No. D-41											**Date of completion: 14.04.2020**								
Block: SAGMANIA BLOCK											**Total Depth: 40.20 meter**								
Depth (meter)									**Lithology**		**Analysis result in percentage**								
From	**To**	**Run**	**Core**	**From**	**To**	**Run**	**Core**	**% of Recovery**		**sample no.**	**SiO2**	**R2O3**	**CaO**	**MgO**	**Fe2O3**	**Al2O3**	**LOI**	**Total**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
0	1	1	0						Surface soil									
1	2	1.00	0.50					50%	yellwoish white shale fractured	1	24.14	11.68	26.02	7.9	6.9	4.78	29.85	99.59
2	3.05	1.05	1.00					95%	yellwoish white shale fractured	2	35.1	5.24	23.55	7.42	3.1	2.14	27.93	99.24
3.05	4.05	1.00	0.30					95%	yellwoish white shale fractured	3	51.14	5.76	15.25	7.26	3	2.76	20.07	99.48
4.05	5.1	1.05	0.60					57%	yellwoish white shale fractured									
5.1	6.1	1.00	0.80					80%	Greyish White siliceous Limestone	4	12.48	2.98	39.36	6.77	1.7	1.28	37.81	99.3
6.1	7.1	1.00	0.70					70%	Greyish white shale fractured	5	39.31	4.74	24.68	5.16	2.2	2.51	38.33	99.23
7.1	8.15	1.05	0.7					100%	Greyish White siliceous Limestone	6	12.06	1.78	45.99	1.29	0.8	2.54	25.21	99.1
8.15	9	0.85	0.70					82%	Greyish White siliceous Limestone	7	11.16	1.8	45.99	2.1	1	0.98	37.98	99.18
9	10	1.00	0.80					80%	Greyish White Limestone	8	6.76	1.52	48	2.74	0.8	0.8	38.21	99.59
10	11	1.00	0.90					90%	Greyish White shale	9	38.46	2.7	27.82	4.05	0.1	0.72	40.25	99.67
11	12	1.00	0.70					70%	Greyish White shale	10	36.48	3.74	28.26	4.03	0.4	3.34	26.23	99.17
12	13	1.00	1.00					100%	Greyish White siliceous Limestone	11	17.2	2.44	45.54	1.45	0.1	2.34	26.88	99.21
13	14	1.00	0.95					95%	Greyish White siliceous Limestone	12	18.06	2.32	41.72	2.1	0.1	2.22	35.34	99.76
14	15	1.00	0.55															
				14	14.2	0.2	0.1	50%	Greyish white shale fractured	13	32.78	3.26	33.65	1.13	0.5	2.76	35.14	
				14.2	15	0.8	0.45	56%										
15	16	1.00	0.70					70%	Greyish White shale	14	32.74	3.62	32.08	2.26	0.3	3.32	28.5	99.33
16	17	1.00	0.85					85%	Greyish White shale	15	41.59	4.34	26.47	2.58	0.3	4.04	28.52	99.36
17	18	1.00	0.75					75%	Greyish White siliceous Limestone	16	20.3	3.34	39.93	2.1	0.4	2.94	24.49	99.58
18	19	1.05	0.60					57%	Greyish White shale	17	29.72	5.02	30.96	4.03	0.6	4.42	33.42	99.35
19	20	1.00	0.70					70%	Greyish White shale	18	26.88	3.28	34.99	3.29	0.5	2.78	29.48	99.25
20	21	1.00	0.75															
				20	20.6	0.6	0.5	83%	Greyish White siliceous Limestone	19	15.2	3.76	41.95	2.92	0.5	3.26	31.27	99.63
				20.6	21	0.4	0.25	62%										
21	22	1.00	0.60					60%	Greyish White shale	20	32.02	4.26	26.92	7.85	0.8	3.46	35.68	99.68
22	23	1.00	0.95					95%	Greyish White shale	21	45.08	5.5	23.53	3.23	0.9	5	28.53	99.47
23	24	1.00	0.50															
				23	23.5	0.5	0.2	40%	Greyish White shale	22	34.32	6.56	29.83	2.42	0.8	6.16	21.93	99.66
				23.5	24	0.5	0.3	60%	Greyish White shale									
24	25	1.00	0.60					60%	Greyish White shale	23	35.86	6.86	28.49	2.9	0.8	6.08	25.9	99.15
25	26	1.00	0.80					80%	Greyish White siliceous Limestone	24	19.64	4.76	37.69	3.55	0.3	4.46	25.11	99.78
26	27	1.00	0.80					80%	Greyish White siliceous Limestone	25	15.48	2.82	41.05	4.03	0.2	2.62	36.24	99.31
27	28	1.00	0.50					50%	Greyish White shale									
28	29	1.00	0.60					60%	Greyish White shale									
29	30	1.00	0.60					60%	Greyish White shale									
30	31	1.00	0.45					45%	Greyish White shale									
31	32	1.00	0.55					55%	Greyish White shale									
32	33	1.00	0.55					55%	Greyish White shale									
33	34	1.00	0.60					60%	Greyish White shale									
34	35	1.00	0.55					55%	Greyish White shale									
35	36	1.00	0.50					50%	Greyish White shale									
36	37	1.00	0.60					60%	Greyish White shale									

37	38	1.00	0.40					40%	Greyish White shale										
38	39	1.00	0.60					60%	Greyish White shale										
39	40.2	1.20	0.60					50%	Greyish White shale										
								Borehole closed at depth 40.20 mts.											

BOREHOLE NO. SG-03

Reduce Level: 308.50 meter											**Date of Commencement: 21.10.2020**								
Drill No. D-41											**Date of completion: 30.11.2020**								
Block: SAGMANIA BLOCK											**Total Depth: 40.20 meter**								
Depth (meter)									**Lithology**		**Analysis result in percentage**								
From	**To**	**Run**	**Core**	**From**	**To**	**Run**	**Core**	**% of Recovery**		**sample no.**	**SiO2**	**R2O3**	**CaO**	**MgO**	**Fe2O3**	**Al2O3**	**LOI**	**Total**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
0	1	1	0						Surface soil									
1	2	1.00	0.50					50%	Pinkish white shale fractured									
2	3	1.05	0.40					38%	Pinkish white shale fractured									
3	4	1.00	0.45					95%	Pinkish white shale fractured									
4	5	1.00	0.40					40%	Pinkish white shale fractured									
5	6	1.00	0.80					80%	Pinkish white shale fractured									
6	7	1.00	0.80					70%	Pinkish white shale fractured									
7	8	1	0.6					100%	Pinkish white shale fractured									
8	9	1.00	0.90					90%	Pinkish white shale fractured									
9	10	1.00	0.70					70%	Pinkish white shale fractured									
10	11	1.00	0.70					70%	Pinkish white shale fractured									
11	12	1.00	0.90					90%	Pinkish white shale fractured									
12	13	1.00	0.80					80%	Greyish White shale fractured									
13	14	1.00	0.95					95%	Greyish White shale fractured									
14	15	1.00	0.90					90%	Greyish White shale fractured									
15	16	1.00	0.90					90%	Greyish White shale fractured									
16	17	1.00	nil					0%	sludge									
17	18	1.00	0.40					40%	Greyish White shale fractured									
18	19	1.00	0.40															
				18	18.6	0.6	0.2	33%	Pinkish white shale fractured									
				18.6	19	0.4	0.2	50%	Greyish White Limestone									
19	20	1.00	0.70					70%	Greyish White siliceous Limestone	1	27.98	4.2	37.46	0.16	2	2.2	29.73	99.53
20	21	1.00	0.80					80%	Greyish White Limestone	2	8.28	1.6	49.13	0.97	0.8	0.8	39.23	99.21
21	22	1.00	0.90					90%	Greyish White siliceous Limestone	3	32.12	4.34	34.55	0.81	2	2.34	27.8	99.62
22	23	1.00	0.90					90%	Greyish White shale fractured	4	47.76	7.72	21.53	2.1	2.7	5.02	20.16	99.27
23	24	1.00	0.90					90%	Greyish White shale fractured	5	46.52	6.58	23.55	1.94	1.8	4.78	21	99.59
24	25	1.00	0.90					90%	Greyish White siliceous Limestone	6	11.96	2.56	41.72	4.84	1.1	1.46	37.96	99.04
25	26	1.00	0.50					50%	Greyish White Limestone	7	9.52	1.76	39.93	8.07	0.8	0.96	39.87	99.15
26	27	1.00	0.70					70%	Greyish White siliceous Limestone	8	11.22	1.76	43.07	5.48	1.76	0.8	38.18	99.71
27	28	1.00	0.70					70%	Greyish White siliceous Limestone	9	15.54	2.3	41.05	4.52	1	1.3	36.16	99.57
28	29	1.00	0.90					90%	Greyish White Limestone	10	5.12	1.14	48.9	3.06	1.14	0.6	41.28	99.5
29	30	1.00	0.90					90%	Greyish White siliceous Limestone	11	18.96	3.3	37.01	5.32	1.3	2	34.9	99.49
30	31	1.00	0.60					60%	Greyish White siliceous Limestone	12	19.12	4.12	35.22	6.45	1.4	2.72	34.63	99.54
31	32	1.00	0.60					60%	Greyish White siliceous Limestone	13	21.68	3	39.06	3.06	0.9	2.1	33.03	99.8
32	33	1.00	0.70					70%	Greyish White siliceous Limestone	14	23.18	1.94	36.79	5	1.3	0.64	32.78	99.69
33	34	1.00	0.50					50%	Greyish White shale fractured									
34	35	1.00	0.50					50%	Greyish White shale fractured									
35	36	1.00	0.45					45%	Greyish White shale fractured									
36	37	1.00	0.40					40%	Greyish White shale fractured									
37	38	1.00	0.40					40%	Greyish White shale fractured									
38	39	1.00	0.20					20%	Greyish White shale and clay									
39	40.2	1.20	0.45					38%	Greyish White shale fractured									
								Borehole closed at depth 40.20 mts.										

BOREHOLE NO. SG-04

Reduce Level: 304.20 meter											**Date of Commencement: 16.12.2020**								
Drill No. D-41											**Date of completion: 08.01.2021**								
Block: SAGMANIA BLOCK											**Total Depth: 40.60 meter**								
Depth (meter)									**Lithology**		**Analysis result in percentage**								
From	**To**	**Run**	**Core**	**From**	**To**	**Run**	**Core**	**% of Recovery**		**sample no.**	**SiO2**	**R2O3**	**CaO**	**MgO**	**Fe2O3**	**Al2O3**	**LOI**	**Total**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
0	1	1	0						Surface soil									
1	2	1.00	0.00					0%	Sandy soil									
2	3	1.05	0.00					0%	Sandy soil									
3	4	1.00	0.00					95%	Sandy soil									
4	5	1.00	0.25					25%	yellowishh white shale fractured									
5	6	1.00	0.50					50%	Pinkish white shale fractured									
6	7	1.00	0.60															
				6	6.4	0.4	0.25	62%	Pinkish white shale fractured									
				6.4	7	0.6	0.45	75%	Pinkish white shale fractured									
7	8	1	0					0%	Sandy sludge									
8	9	1.00	0.00					0%	Sandy sludge									
9	10	1.00	0.00					0%	Sandy sludge									
10	11	1.00	0.40															
				10	10.6	0.6	0.1	16%	Pinkish white shale fractured									
				10.6	11	0.4	0.3	75%	Pinkish white shale fractured									
11	12	1.00	0.20					20%	Greyish White Limestone	1	6.76	1.16	50.25	1.45	0.6	0.56	39.53	99.15
12	13	1.00	0.40					40%	Greyish White Limestone	2	16.3	2.06	44.19	1.61	0.8	1.26	35.07	99.23
13	14	1.00	0.50					50%	Greyish White siliceous Limestone	3	20.1	2.18	40.83	2.42	0.8	1.38	33.54	99.07
14	15	1.00	0.30					30%	Greyish White siliceous Limestone	4	12.13	1.68	45.76	2.42	0.7	0.98	37.03	99.07
15	16	1.00	0.40					40%	Greyish White siliceous Limestone	5	14.86	1.5	46.21	0.97	0.7	0.8	35.94	99.48
16	17	1.00	0.40															
				16	16.6	0.6	0.2	33%	Greyish White Limestone	6	7.42	1.18	48.45	2.58	0.5	0.68	39.65	99.28
				16.6	17	0.4	0.2	50%										
17	18	1.00	0.90					90%	Greyish White Limestone	7	9.76	2.3	40.15	8.07	1	1.3	39.5	99.78
18	19	1.00	0.90															
				18	18.6	0.6	0.6	100%	Greyish White siliceous Limestone	8	11.6	1.54	40.38	7.74	0.7	0.84	38.07	99.33
				18.6	19	0.4	0.3	75%										
19	20	1.00	0.80					80%	Greyish White siliceous Limestone	9	14.46	2.26	41.05	5.32	1	1.26	36.7	99.79
20	21	1.00	0.80					80%	Greyish White siliceous Limestone	10	17.32	3.64	40.38	3.71	1.3	2.34	34.78	99.83
21	22	1.00	0.80					80%	Greyish White siliceous Limestone	11	14	2.34	42.4	3.87	1.2	1.14	36.89	99.5
22	23	1.00	0.80					80%	Greyish White siliceous Limestone	12	17.48	3.38	39.26	5	1.3	2.08	34.71	99.83
23	24	1.00	0.80					80%	Greyish White shale fractured	13	30.58	5.44	31.85	3.55	3.1	2.34	28.41	99.83
24	25	1.00	0.60					60%										
25	26	1.00	0.40															
				25	25.5	0.5	0.2	40%	Greyish White shale fractured									
				25.5	26	0.5	0.2	40%	Greyish White shale fractured									
26	27	1.00	0.40					40%	Greyish White shale fractured									
27	28	1.00	0.60					60%	Greyish White shale fractured									
28	29	1.00	0.60															
				28	28.6	0.6	0.5	83%	Dirty white shale fractured									
				28.6	29	0.4	0.1	25%	Dirty white shale fractured									
29	30	1.00	0.90					90%	Dirty white shale fractured									
30	31	1.00	0.60					60%	Dirty white shale fractured									
31	32	1.00	0.60					60%	Dirty white shale fractured									

32	33	1.00	0.70					70%	Dirty white shale fractured										
33		1.00	0.50					50%	clay										
34	35	1.00	0.50					50%	Greyish White shale fractured										
35	36	1.00	0.45					45%	Greyish White shale fractured										
36	37	1.00	0.40					40%	Greyish White shale fractured										
37	38	1.00	0.40					40%	Clay with boulders										
38	39	1.00	0.20					20%	Clay with boulders										
39	40.6	1.60	0.50					31%	Greyish White shale fractured										
								Borehole closed at depth 40.60 mts.											

BOREHOLE NO. SG-05

Reduce Level: 310.22meter											**Date of Commencement: 31.12.2020**								
Drill No. D/N-55											**Date of completion: 18.01.2021**								
Block: SAGMANIA BLOCK											**Total Depth: 36.60 meter**								
Depth (meter)									**Lithology**		**Analysis result in percentage**								
From	**To**	**Run**	**Core**	**From**	**To**	**Run**	**Core**	**% of Recovery**		**sample no.**	**SiO2**	**R2O3**	**CaO**	**MgO**	**Fe2O3**	**Al2O3**	**LOI**	**Total**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
0	3.05	3.05	0						Surface soil									
3.05	4.55	1.55	1.00															
				3.05	3.75	0.7	0.2	28%	yellowish white shale fractured									
				3.75	4.55	0.8	0.8	100%	Greyish White shale fractured									
4.55	6.1	1.55	1.00															
				4.55	5.8	1.25	0.9	72%	Greyish White shale fractured	1	27.16	5.34	23.55	11.94	2.6	2.74	31.55	99.54
				5.8	6.1	0.3	0.1	30%										
6.1	9.15	3.05	2.60															
				6.1	6.7	0.5	0.25	50%	Greyish White shale fractured	2	27.32	5.14	23.78	11.77	2.8	2.34	31.41	99.42
				6.7	7.65	0.95	0.75	78%										
				7.65	7.8	0.15	0.15	100%										
				7.8	9.15	1.45	1.45	100%	Greyish White shale fractured	3	23.04	4.38	28.26	10.32	2.4	1.98	33.31	99.31
9.15	12.2	3.05	2.75															
				9.15	10.15	1	0.95	95%	Greyish White Limestone	4	4.26	1.24	51.82	0.65	0.5	0.74	41.55	99.52
				10.15	11.15	1	0.85	85%	Greyish White Limestone	5	5.56	1.84	48.45	2.74	0.7	1.14	40.87	99.46
				11.15	12.2	1.05	0.85	80%	Greyish White Limestone	6	3.82	1.78	51.59	0.97	0.6	1.18	41.33	99.49
12.2	15.25	3.05	2.80															
				12.2	13.2	1	0.95	95%	Greyish White Limestone	7	3.26	1.86	51.82	0.97	0.6	1.26	41.54	99.45
				13.2	14.2	1	0.95	95%	Greyish White siliceous Limestone	8	24.78	2.07	40.15	0.65	0.8	1.24	31.8	99.42
				14.2	15.25	1.05	0.9	85%	Greyish White siliceous Limestone	9	29.8	2.8	35.67	1.29	1	1.8	29.62	99.18
15.25	17.45	2.20	1.80															
				15.25	16.25	1	0.95	95%	Greyish White siliceous Limestone	10	23.74	2.84	38.13	2.42	1	1.84	32.53	99.66
				16.25	17.45	1.2	0.85	70%	Greyish White siliceous Limestone	11	28.38	2.4	36.34	1.77	2	0.4	30.47	99.36
17.45	20.5	305	2.9															
				17.45	18.45	1	0.95	95%	Greyish White shale fractured	12	38.46	3.96	29.83	1.94	1.4	2.56	25.37	99.56
				18.45	19.45	1	0.95	95%	Greyish White shale fractured	13	31.76	5.5	31.63	2.9	2	3.5	27.93	99.72
				19.45	20.5	1.05	1	95%	Greyish White shale fractured	14	27.6	6.08	32.08	3.55	2.2	3.88	29.84	99.15
20.5	23.55	3.05	2.95															
				20.5	21.5	1	1	100%	Greyish White shale fractured	15	31.58	6.02	32.3	2.1	1.5	4.52	27.51	99.51
				21.5	22.5	1	1	100%	Greyish White shale fractured	16	41.08	6.46	26.25	2.26	1.8	4.66	22.99	99.04
				22.5	23.55	1.05	0.95	90%	Greyish White siliceous Limestone	17	24.12	4.32	37.46	2.1	0.8	3.52	31.74	99.74
23.55	26.6	3.05	2.90															
				23.55	24.55	1	0.95	95%	Greyish White shale fractured	18	37.26	4.6	30.28	1.61	0.8	3.8	25.51	99.26
				24.55	25.55	1	0.95	95%	Greyish White siliceous Limestone	19	24.58	4	36.79	2.58	0.6	3.4	31.61	99.56
				25.55	26.6	1.05	1	95%	Greyish White siliceous Limestone	20	22.58	4.1	37.01	3.23	0.5	3.6	32.71	99.63
26.6	29.65	3.05	2.85															
				26.6	27.6	1	1	100%	Greyish White siliceous Limestone	21	22.03	6.36	37.24	2.26	1.2	5.16	31.65	99.54
				27.6	28.6	1	1	100%	Greyish White siliceous Limestone	22	17.48	3.54	41.27	2.61	0.6	2.94	34.57	99.12
				28.6	29.65	1.05	0.85	80%	Greyish White shale fractured	23	27.6	4.98	33.42	2.9	0.8	4.18	30.61	99.51
29.65	31.75	2.10	1.85															
				29.65	30.65	1	0.9	90%	Greyish White shale fractured									
				30.65	31.75	1.1	0.9	81%	Greyish White shale fractured									
31.75	33.75	2.00	0.50															
				31.75	32.75	1	0.5	50%	Greyish White shale fractured									

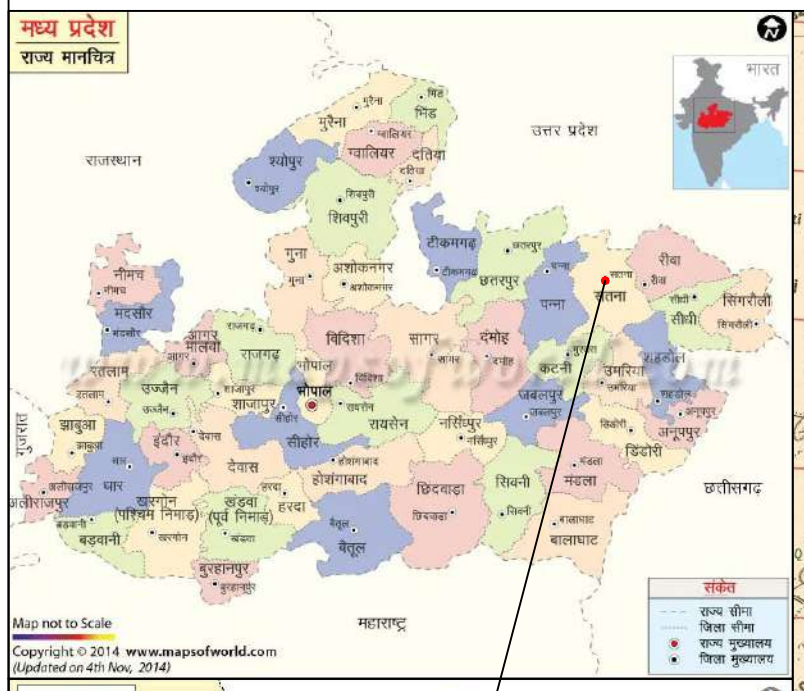
				32.75	33.75	1	0	0%	clay										
33.75	36.8	3.05	0.50																
				33.75	35.75	2	0	0%	clay										
				35.75	36.8	1.05	0.35	33%	Greyish White shale fractured										
								Borehole closed at depth 36.80 mts.											

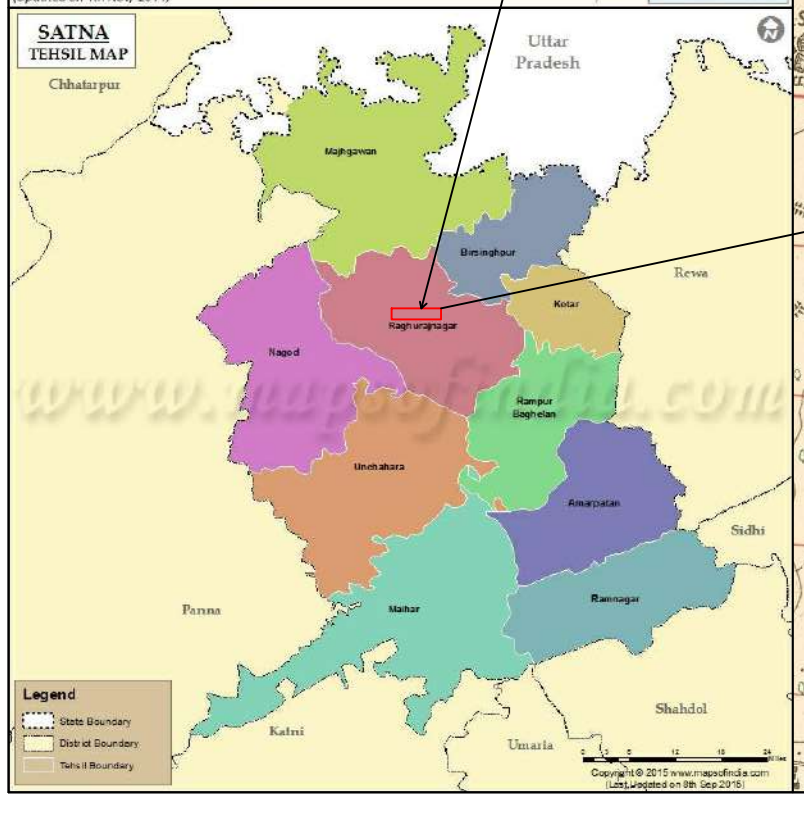
BOREHOLE NO. SG-06

Reduce Level: 307.29 meter											**Date of Commencement: 17.01.2021**							
Drill No. D-41											**Date of completion: 05.02.2021**							
Block: SAGMANIA BLOCK											**Total Depth: 40.20 meter**							
Depth (meter)									**Lithology**		**Analysis result in percentage**							
From	**To**	**Run**	**Core**	**From**	**To**	**Run**	**Core**	**% of Recovery**		**sample no.**	**SiO2**	**R2O3**	**CaO**	**MgO**	**Fe2O3**	**Al2O3**	**LOI**	**Total**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
0	1	1	0					0%	Surface black soil									
1	2	1.00	0.00					0%	Sandy soil									
2	3	1.00	0.00					0%	Sandy soil									
3	4	1.00	0.50					50%	Sandy soil									
4	5	1.00	0.50					50%	yellowishh white shale fractured									
5	6	1.00	0.30					30%	Pinkish white shale fractured									
6	7	1.00	0.30					30%	Pinkish white shale fractured									
7	8	1.00	0.5					50%	Pinkish white shale fractured									
8	9	1.00	0.30					30%										
9	10	1.00	0.20					20%	Pinkish white shale fractured	1	29.24	5.48	33.42	2.1	1.4	4.08	29.3	99.54
10	11	1.00	0.50					50%										
11	12	1.00	0.80					80%	Pinkish white shale fractured	2	38.54	5.96	26.47	3.71	0.9	5.06	24.94	99.6
12	13	1.00	0.90					90%	Greyish White shale fractured	3	41.64	6.66	23.1	4.84	1.1	5.56	22.88	99.12
13	14	1.00	0.95					95%	Greyish White shale fractured	4	28.56	5.78	31.85	4.36	1.2	4.58	29.16	99.71
14	15	1.00	0.80					80%	Greyish White siliceous Limestone	5	12.1	3.7	43.97	1.94	0.8	2.9	37.53	99.24
15	16	1.00	0.80					80%	Greyish White siliceous Limestone	6	11.26	4	41.95	4.52	0.8	3.2	37.97	99.7
16	17	1.00	0.40					40%	Greyish White Limestone	7	4.26	2.66	49.8	1.61	0.4	2.26	41.24	99.57
17	18	1.00	0.30					30%	Greyish White Limestone	8	4.3	2.2	50.92	0.65	0.4	1.8	41.19	99.26
18	19	1.00	0.40					40%	Greyish White siliceous Limestone	9	11.92	4.1	43.97	3.06	0.6	3.5	36.45	99.5
19	20	1.00	0.60					60%	Greyish White siliceous Limestone	10	12.52	5.54	43.52	1.61	0.7	4.84	36.41	99.6
20	21	1.00	0.50					50%	Greyish White siliceous Limestone	11	14.38	5.96	42.17	1.94	0.9	5.06	34.81	99.26
21	22	1.00	0.60					60%	Greyish White siliceous Limestone	12	13.52	5.96	44.42	0.48	0.7	5.26	34.94	99.32
22	23	1.00	0.95					95%	Greyish White siliceous Limestone	13	23.7	4.08	34.32	4.68	1.6	6.48	32.27	99.05
23	24	1.00	0.80					80%	Greyish White siliceous Limestone	14	11.68	4.92	37.46	7.1	0.8	4.12	37.85	99.01
24	25	1.00	0.70					70%	Greyish White siliceous Limestone	15	9.98	5.6	42.62	3.23	1.4	4.2	37.91	99.34
25	26	1.00	0.70					70%	Greyish White siliceous Limestone	16	10.72	4.82	43.74	3.06	1	3.82	37.19	99.53
26	27	1.00	0.90					90%	Greyish White siliceous Limestone	17	14.44	5.2	41.5	2.42	0.8	4.4	36.01	99.57
27	28	1.00	0.95					95%	Greyish White siliceous Limestone	18	13.04	5.48	41.27	3.06	1.1	4.48	36.6	99.45
28	29	1.00	0.95					95%	Greyish White siliceous Limestone	19	11.1	5.7	43.07	2.6	1	4.7	37.07	99.54
29	30	1.00	0.90					90%	Greyish White siliceous Limestone	20	16.24	7.02	38.36	3.39	1	6.02	34.6	99.61
30	31	1.00	0.80					80%	Greyish White siliceous Limestone	21	20.32	6.28	35.44	4.36	1.8	4.48	33.19	99.59
31	32	1.00	0.90					90%	Greyish White shale fractured	22	42.1	9.3	23.78	2.26	1.4	7.9	22.01	99.45
32	33	1.00	0.80					80%	Greyish White siliceous Limestone	23	14.84	5.78	34.1	8.07	1.5	4.28	36.41	99.2
33	34	1.00	0.85					85%	Greyish White shale fractured									
34	35	1.00	0.85					85%	Greyish White shale fractured									
35	36	1.00	0.90					90%	Greyish White shale fractured									
36	37	1.00	0.90					90%	Greyish White shale fractured									
37	38	1.00	0.70					70%	Greyish White shale fractured									
38	39	1.00	0.60					60%	Greyish White shale and clay									
39	40.2	1.20	0.50					60%	Greyish White shale fractured									
								Borehole closed at depth 40.20 mts.										

LOCATION MAP OF SAGMANIA LIMESTONE BLOCK

PLATE - 01
NOT TO SCALE





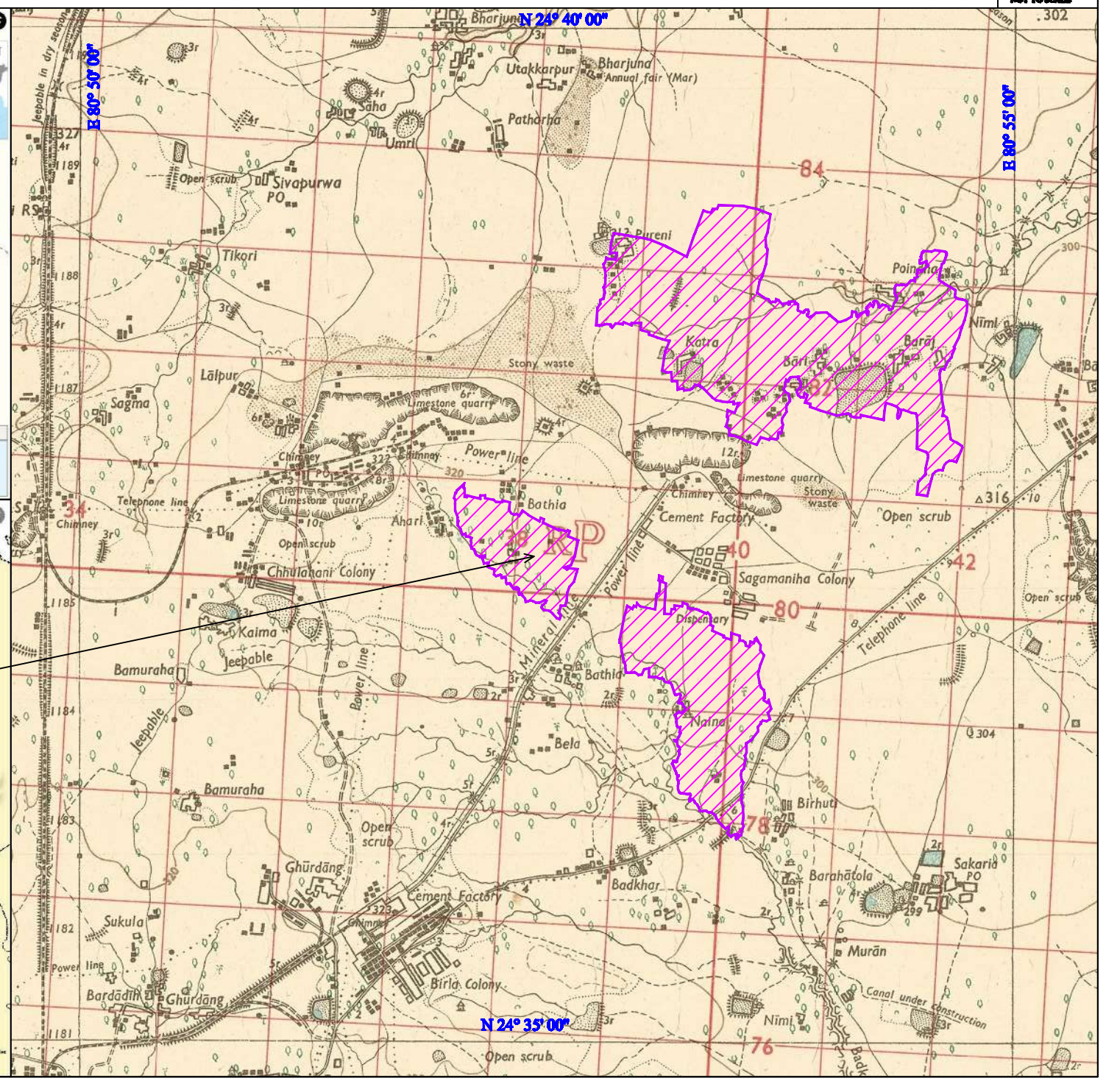


PLATE - 02

80°50'00" 80°51'00" 80°52'00" 80°53'00" 80°54'00" 80°55'00"

24°39'00"

24°38'00"

24°37'00"

24°36'00"

Pureni

SG3

BLOCK -A

Bari

SG6

SG4

Baraj

Nimi

MAIN POWER LINE

Bathia khurd

SG2

BLOCK -B

SG1

Bathia

BLOCK -C

Bela

Naina

SG5

WEST CENTRAL RAILWAY SATNA-REWA

MAIN POWER LINE

TO SATNA

Badkhar

N

W E

S

RECONNAISSANCE SURVEY MAP OF SAGMANIA LIMESTONE BLOCK

TOPOSHEET NO- 63D/14

SCALE 1:12500

INDEX	
VILLAGE	
ROAD	
RAILWAY LINE	
LIMESTONE QUARRY	
POWER LINE	
CONVEYOR BELT	
GRID LINE	
BLOCK BOUNDARY	A,B & C

PLATE - 03

80°52'00" 80°53'00" 80°54'00" 80°55'00"

24°39'00" 24°38'00" 24°37'00" 24°36'00"

N

W E

S

SCALE 1:12500

DETAILED GEOLOGICAL MAP OF SAGMANIA LIMESTONE BLOCK

TOPOSHEET NO- 63D/14

ML SANCTIONED AREA FOR BIRLA CO.

BLOCK -A

BLOCK -B

BLOCK -C

SG1 SG2 SG3 SG4 SG5 SG6

S1 S2 S3

A A' B B' C C' D D' E E' F F'

WEST CENTRAL RAILWAY SATNA-REWA

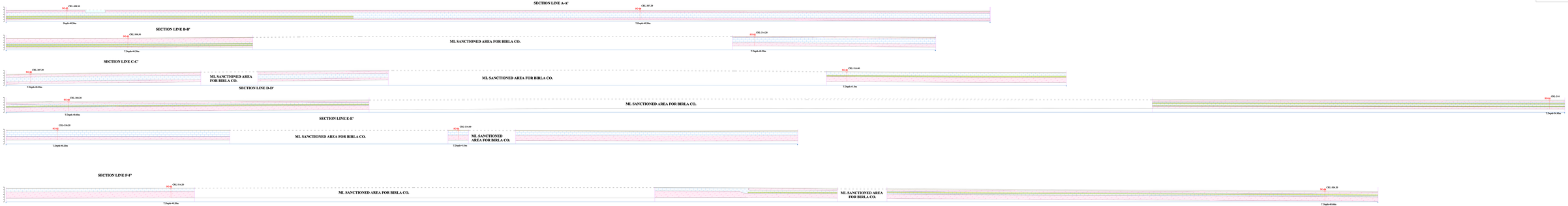
INDEX	
PITS / QUARRY	
BLOCK BOUNDARY	A,B & C
SAMPLE POINT	S2
BORE HOLE	SG5
ROAD	
CONTOUR LINE	
HUMAN SETTLMENT	
WATER BODY	
RAILWAY LINE	
POWER LINE	
CONVEYOR BELT	

LITHOLOGY

ALLUVIUM	
SIRBU SHALE	
NAGOD LIMESTONE	
DIP AND STRIKE	

GEOLOGICAL CROSS SECTIONS MAP OF SAGMANIA LIMESTONE BLOCK

PLATE - 04



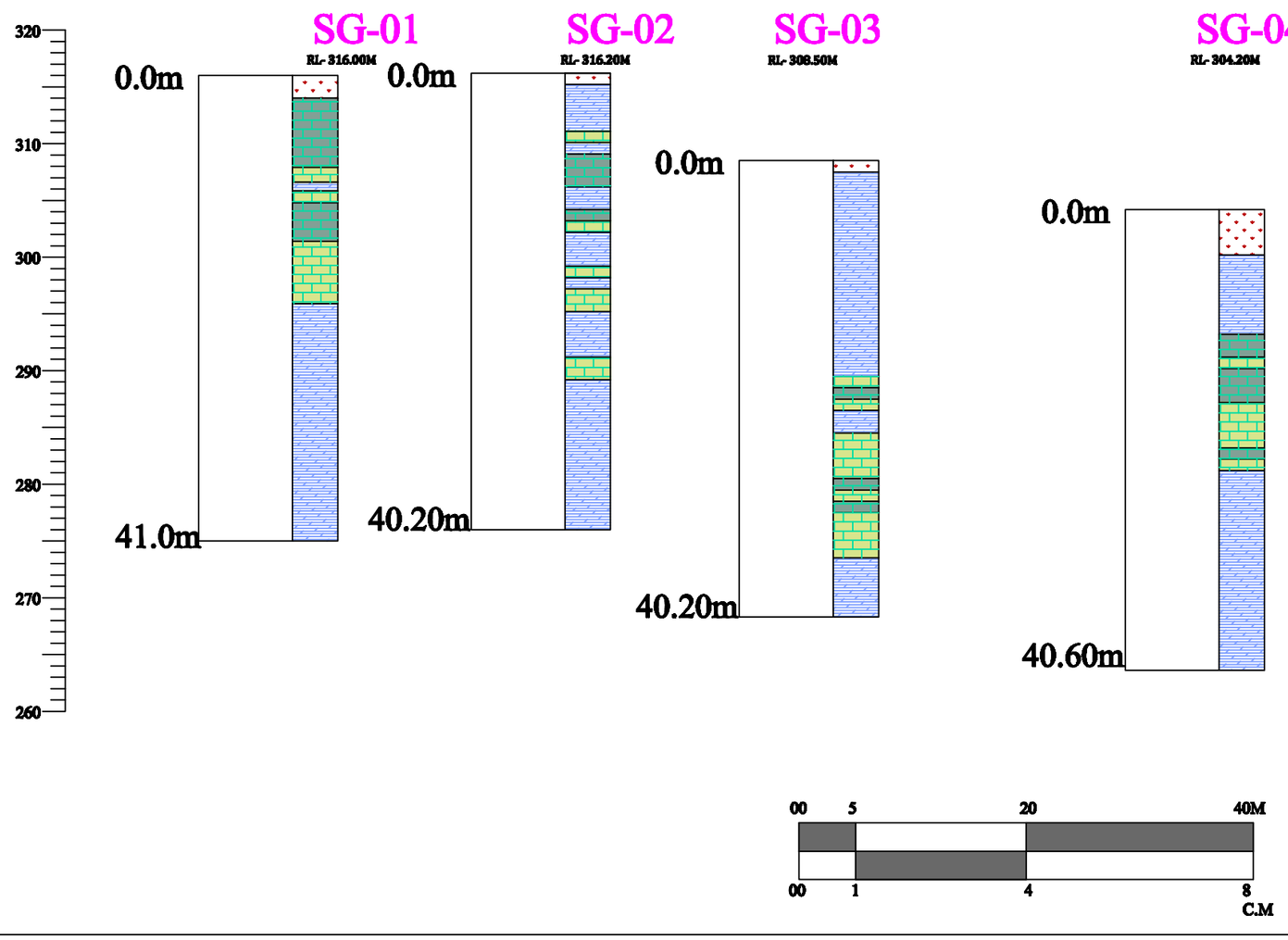
SCALE 1:12500

INDEX

PITS / QUARRY	
BLOCK BOUNDARY	
BORE HOLE	SG-05
WATER BODY	
SECTION LINES	
ALLUVIUM	
SIRBU SHALE	
NAGOD LIMESTONE (LIMESTONE CEMENT GRADE/ BLENDABLE GRADE)	

BORE HOLE LOG OF SAGMANIA LIMESTONE BLOCK

PLATE NO.05



INDEX

- ALLUVIUM
- SIRBU SHALE
- NAGOD LIMESTONE (CEMENT GRADE/BLENDABLE GRADE)