EXPLORATION PROPOSAL (G-3 AND G2) FOR LIMESTONE IN UDAGI BLOCK, TALUK - CHITTAPUR, DISTRICT - KALABURAGI, KARNATAKA

SYNOPSIS

1. Mineral	**Limestone**
2. Location	The Block Udagi located about 12km East of Chittapur, the Taluka town and about 50km South–East of Kalaburagi (Gulbarga), the district head quarter in Karnataka state. The proposed block falls in the jurisdiction of Diggaon, Udagi, Benakanahalli villages of Chitapur Taluk, Kalaburagi District and lies about 3.1 km North east of Diggaon village. Digaon village is located about 12km East of Chitapur on single lane village road leading to Benakanahalli village. The Composite Block area falls within the Survey of India Toposheet No. 56 G/4.
3. Total Area	6.11 sq.km
4.Exploration Agency	MECL
5. Background	Directorate of Mining & Geology (DMG), Karnataka explored the adjoining area towards west of Block area in detail in the year 1976 with the purpose of proving cement grade limestone in the area. The exploration could establish the occurrence of large reserves of cement grade limestone in the area. The results of investigation are given in the report entitled "Limestone Deposits immediately to the East of Chittapur, gulbarga District, Karnataka". GSI carried out preliminary investigation for Flux grade Limestone around Wadi, Gulbarga district Karnataka during the year 1974-75. The area is occupied by Shahabad limestone formation of Bhima Group, chip samples were collected from vertical faces of the quarries existing in the area. Chemical analysis shows that the MgO content is always very low. A few beds of grey to dark grey soft limestone are of blast furnace grade and the rest are of cement grade. Flaggy to slabby variegated limestones are always siliceous in composition with the insolubles around 15%. An area of about 16.75 sq. km. on 1:7,910 scale using the village maps as base map was covered by mapping. A total of 150 samples also collected and analysed. The formations met with here are Rabanapalli shale and flaggy limestone, stylolitic limestone and variegated limestone units of Shahabad Limestone Formation. All those formations are remarkably horizontal and undisturbed. Generally stylolitic limestone contains CaO 48% and above and insolubles around 10%. Hence it is categorized as Blast Furnace Grade. The other two units can be utilised in cement manufacture if suitably blended with high grade limestone. During the F.S. 1977-78, GSI carried out preliminary investigation for Flux grade, Cement grade Limestone in Bhima Basin, Gulbarga district, Karnataka an area of 50.5 sq.km area was mapped on 1:10,000 scale using tape and compass and a total of 125 samples were collected, around Wadi and Chittapur. The limestone met with in this area has been classified as fissile limestone stylolitic limestone and variegated limestone. Stylolitic limestone is of Flux grade (Blast Furnace grade) and occupies over an area of 8.5sq.km. Total inferred reserve of B.F. grade limestone has been calculated as 153 million tons for the area under investigation. Mining activities are currently ongoing in surrounding areas and limestone being excavated for manufacturing of cement. The nearest cement plants located are Orient cement (3 km), Ultratech cement (3 km) and Vasavadatta cement (within 10 km).

6.Regional Geology

The rocks exposed in the block belong to the Shahabad formation of Sedum sub group of Bhima Group. The stratigraphic sequence of the litho units exposed in and around the block area based on field observations and available data/literature from nearby mine. Recent classification (1991) of revised litho stratigraphy of the Bhima Group is furnished below:

Formation	Maximum Thickness	Member	Main Lithological components
2. Shahabad limestone	< 75m		• Grey, argillaceous micritic limestones. • Dark, bluish grey, massive limestones. • Variegated, siliceous and cherty limestones. • Blue- grey, blacky micritic limestones. • Flaggy (Partly impure argillaceous and cherty) limestones.
---------- Gradational and transitional contact ----------			
1. Rabanpalli Clastics	< 70m	4. Ekmai shale member	Ferrugenous shales, with calcareous shales at top.
		1. Kasturpalli-Glauconitic member	Green, glauconitic bearing fine grained sandstones and siltstones.
		2. Kundrapalli quartz arenite member	Quatzitic sandstones (medium to fine grained).
		1. Adki Hill conglomerate member	Polymictic conglomerates and arkosic, gritty sandstones.

7. Objective

The exploration is proposed with the following objectives

I. To delineate the strike and depth continuity of limestone by drilling 800m X 800m grid interval at G-3 level.

II. In case the results of G-3 level are encouraging boreholes shall be drilled at gap areas in consideration with G-4 and G-3 level exploration and cover the entire block at 400m x 400m grid interval to bring the deposit at G-2 level.

III. To estimate grade wise Limestone resources in the Block area as per UNFC norms at G-3 / G-2 level of exploration.

IV. To carry out exploration as per Minerals (Evidence of Mineral Contents) Rule-2015, Mineral (Auction) Rules-2015 and MMDR Amendment Act-2015 in turn to facilitate the State Govt. (Karnataka) in Auctioning of the Block.

8. QUANTUM OF EXPLORATORY WORK

Sl. No.	Item of Work	Unit	Quantum (G-3)	Quantum (G-2)	Total
1	Topographic Survey & Geological Mapping on 1:2000 scale.	Sq. Km.	6.11 Sq. Km	6.11 Sq. Km	6.11 Sq. Km
2	Drilling	m.	600 (10 holes)	1380 (23 holes)	1980 (33 holes)
3	Laboratory Studies				
	i) Chemical Analysis; Primary samples for 6 radicals i.e. CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3 and LOI	Nos.	600	1380	1980
	ii) For SO_3 & P_2O_5	Nos.	60	138	198
	iii) Check sample for analysis of 6 radicals i.e. CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3 and LOI	Nos.	60	138	198
	iv) External Check (NABL) samples for analysis of for 6 radicals i.e. CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3 and LOI	Nos.	30	69	99
4	Composite Samples a) For 12 radicals (CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3, SO_3, P_2O_5 , LOI, MnO_2, K_2O, Na_2O and Cl.)	Nos.	100	230	330
5	Physical Studies				
	a)Spectroscopic Studies (10 elements)	Nos.	20	40	60
	b)XRD studies	Nos.	20	40	60
6	Petrological Studies (Petrographic Studies)	Nos.	20	40	60
7	Specific Gravity Determinations	Nos	20	40	60
8	Report Preparation (Digital format) with Peer Review of Report	Nos	1 No	1 No	2 Nos.

9. **Cost Estimate:** The total estimated cost is Rs. 393.83 Lakhs

10. Time Schedule:

G-3 Exploration: 9 Months
G-2 Exploration: 9 Months

11. Justification

I. Proposed G-3 level of exploration will be a systematic exploration on 800x800 m grid Interval in the Block area based on outcome of proposed G-4 level exploration in the Composite block (Diggaon & Udagi).

II. In case the result of G-3 level are encouraging boreholes shall be drilled at

400m x 400m grid interval in gap areas along the sections to bring the deposit at G-2 level.

III. The proposed exploration programme will be helpful in demarcating zone of various grades of limestone in the block as per UNFC norms and estimation of limestone resources/reserves.

IV. In view of MMDR Amendment Act and Minerals Auction Rule 2015 DMG Government of Karnataka has requested MECL to prepare and submit Exploration proposal for this Block under NMET funding through DMG Karnataka letter No.DMG-17013/6/2018-19/2393 dated 7/7/2018.

EXPLORATION PROPOSAL (G-3 AND G-2) FOR LIMESTONE IN UDAGI BLOCK, TALUK-CHITTAPUR, DISTRICT- KALABURAGI, KARNATAKA

1.0.0. INTRODUCTION

1.1.0. On enactment of MMDR Amendment Act 2015, Minerals (Evidence of Mineral Contents) Rules 2015 and Mineral Auction Rules 2015, Govt. of India directed State Governments to speed up exploration work for different Mineral Commodities in the respective states. Accordingly, State Government of Karnataka requested MECL to prepare and submit exploration proposal for two newly identified limestone blocks in Chittapur taluk, Kalaburagai District of Karnataka through DMG, Karnataka letter No.DMG-17013/6/2018-19/2393 dated 7/7/2018. For ease of exploration convenience, identified limestone blocks have been designated as Digaon Block (7.01 sq.km) and Udagi Block (6.11 sq.km). Udagi Limestone Block (6.11 sq.km/611.08 ha) is one of the blocks identified by DMG, Karnataka. Keeping in view regional perspective, both blocks have been clubbed together to form a composite block (13.12 sq.km) for carrying out regional exploration for limestone at G-4 level. Accordingly, Regional Exploration proposal for limestone at G-4 level has been prepared for the composite block separately. Subsequent to G-4 level exploration, G-3 and G-2 level exploration proposals for each Block have been prepared seamlessly.

1.1.1 Accordingly, MECL has prepared the detailed exploration proposal involving 1980m in 33 Boreholes at G-3 and G-2 level exploration seamlessly in Udagi Block. Total 10 Boreholes with 600 m of drilling proposed at G-3 level and 23 Boreholes involving 1380 m of drilling proposed at G-2 level for the systematic exploration of the deposit. The proposal is being put up for approval of Technical Committee of NMET.

1.2.0 LOCATION AND COMMUNICATION

1.2.1 The Block area is located at about 12km East of Chitapur, the Taluka town and about 52km South –East of Kalaburagi (Gulbarga), the district head quarter in Karnataka state.

1.2.2 The proposed block falls in the jurisdiction of Udagi, Diggaon and Benakanahalli villages of Chitapur Taluk, Kalaburagi District and lies about 4 km South of Udagi Village and at about 4 km East of Diggaon Village. The Block area can be accessed from Udagi village and Malkhed through signle lane village road. Diggaon village is

1.4.0 CLIMATE

1.4.1 The The climate of the area has semi arid type climate. Dry climate prevails for most part of the year. December is the coldest month with mean daily maximum and minimum temperatures being 29.5^0 C and 10^0 C respectively. During peak summer, temperature rises upto 45^0 C. The climatic information of the area is as given below:

Temperature	Max.	45°C in May- June
	Min.	10 °C in December
Rainfall	Max.	70 mm in 24 hours

The average annual rainfall is 770 - 880 mm and the relative humidity varies from 26% in summer to 62% in winter.

1.5.0 FLORA & FAUNA

1.5.1 No forest, sanctuaries, national park, etc., exist in the vicinity of the Block area.

2.0.0 PREVIOUS WORK

2.1.1 In the past the area under reference was covered under regional geological mapping by Geological Survey of India with an aim to establish the geology and stratigraphy of the area.

2.1.2 Directorate of Mining & Geology (DMG), Karnataka explored the adjoining area towards west of Block area in detail in the year 1976 with the purpose of proving cement grade limestone in the area. The exploration could establish the occurrence of large reserves of cement grade limestone in the area. The results of investigation are given in the report entitled "Limestone Deposits immediately to the East of Chittapur, Gulbarga District of Karnataka.

2.1.3 GSI carried out preliminary investigation for Flux grade Limestone around Wadi, Gulbarga district Karnataka during the year 1974-75. The area is occupied by Shahabad limestone formation of Bhima Group, chip samples were collected from vertical faces of the quarries existing in the area. Chemical analysis shows that the MgO content is always very low. A few beds of grey to dark grey soft limestone are of blast furnace grade and the rest are of cement grade. Flaggy to slabby variegated limestones are always siliceous in composition with the insolubles around 15%.

2.1.4 During the field season 1976-77, GSI carried out preliminary investigation for Flux grade Limestone near Wadi Gulbarga district Karnataka. An area of about 16.75 sq. km. on 1:7,910 scale using the village maps as base map was covered by mapping. A total of 150 samples also collected and analysed. The formations met with here are Rabanapalli shale and flaggy limestone, stylolitic limestone

and variegated limestone units of Shahabad Limestone Formation. All those formations are remarkably horizontal and undisturbed. Generally stylolitic limestone contains CaO 48% and above and insolubles around 10%. Hence it is categorised as Blast Furnace Grade. The other two units can be utilised in cement manufacture if suitably blended with high grade limestone. An inferred reserve of 96 million tonnes of Blast Furnace grade limestone has been estimated over an area of 4.00 sq.km to a depth of 12 m. Drilling can be taken up to explore the depth-wise persistence and lateral extension of the B.F. grade limestone.

2.1.5 During the F.S. 1977-78, GSI carried out preliminary investigation for Flux grade Cement grade Limestone in Bhima Basin, Gulbarga district, Karnataka. Preliminary investigation for flux grade and cement grade limestone in parts of Bhima Basin, Gulbarga district, Karnataka was taken up an area of 50.5 sq.km area was mapped on 1:10,000 scale using tape and compass and a total of 125 samples were collected, around Wadi and Chitapur. The limestone met with in this area has been classified as fissile limestone stylolitic limestone and variegated limestone. Stylolitic limestone is of Flux grade (Blast Furnace grade) and occupies over an area of 8.5sq.km. Total inferred reserve of B.F. grade limestone has been calculated as 153 million tonnes for the area under investigation.

2.1.6 Mining activities are currently ongoing in surrounding areas and limestone being excavated for manufacturing of cement. The nearest cement plants located are Orient cement (6.5km), Ultratech cement (4km) and Vasavadatta cement (within 10km).

3.0.0 GENERAL GEOLOGY

3.1.0 REGIONAL GEOLOGY OF THE AREA

3.1.1 Bhima basin is the smallest of all Proterozoic basins of India. They do not actually come in contact with the Kaladgi group and are believed to be younger. They are in close resemblance to the Kurnool group of the Cuddapah super group. The Bhima basin is covered by latitude N 16°20' to 17°35' and longitude N 76°15' to 77°40'E. The Bhima basin sediments stretch linearly in N -S for about 160 km with varying width and the maximum being 40 km. It extends over an area of 5200 Sq.km. and is situated to the North West of Cuddapah basin and North east of Kaladgi basin.

3.1.2 Captain New Bold (1842 – 1845) was first to record the Talikote flaggy limestone and Muddebihal red sandstone. R. Bruce Foote (1876) had divided the Bhima Group (mainly of limestone) into lower clastic represented by sandstone and shale and upper mainly of limestone and shales. Further, Mahadevan (1947), Janardhana Rao et.al (1973), Mathur (1977), Mudholkar and Kale (1982) and Mishra et.al (1987) classify Bhima Group. However, Vivek S. Kale, V.G. Phansalkar

et.al (1991) classify Bhima Group into Rabanapalli (clastic) formation and Shahabad (limestone) formations.

3.1.3 The Stratigraphic Column of the Bhima Group (after GSI) is furnished in **Table 3.1** below:

Table - 3.1

The Stratigraphic Column of the Bhima Group (after GSI)

Group	Sub-Group	Formation	Member	Thicknes
Bhima Group (upper Proterozoic) (93-273 m.y)		Harwal-Gogi		5-10m
	Andola Sub-group in Pulsating basin environment (31-68 m.y)	Katamdevar-halli	Fossil shale member ortho-quartzite chert + pebble conglomerate	10-40m 16-18m
		Halkal		
	-------Para – unconformity --------			
			Flaggy dark grey and argillaceous	4-6m
			Massive dark grey and bluish grey	8-20m
		Shahabad	Variegated and siliceous/cherty	20-80m
	Sedam Sub-group with quiescent basin regime (62-2.5 m.y)		Blackish, light grey to bluish grey L.st	10-15m
			Slabby and flaggy Lst	4-8m
			Purple shale	2-40m
			Green/yellow shale	5-15m
		Rabanapalli	Siltstone	3-4m
			Quartzite / Intercalated Sand stone	5-15m
			Conglomerate / grit	1-2m

3.1.4 Recent classification (1991) of revised litho stratigraphy of the Bhima Group is furnished below in **Table 3.2.**

Table - 3.2

Revised litho stratigraphy of the Bhima Group
(after Vivek S. Kale, V.G. Phansalkar et.al 1991)

Formation	Maximum Thickness	Member	Main Lithological components
2. Shahabad limestone	< 75m		• Grey, argillaceous micritic limestones. • Dark, bluish grey, massive limestones. • Variegated, siliceous and cherty limestones. • Blue- grey, blacky micritic limestones. • Flaggy (Partly impure argillaceous and cherty) limestones.
---------- gradational and transitional contact ----------			
1. Rabanpalli Clastics	< 70m	4. Ekmai shale member	Ferrugenous shales, with calcareous shales at top.
		1. Kasturpalli-Glauconitic member	Green, glauconitic bearing fine grained sandstones and siltstones.
		2. Kundrapalli quartz arenite member	Quatzitic sandstones (medium to fine grained).
		1. Adki Hill conglomerate member	Polymictic conglomerates and arkosic, gritty sandstones.

3.1.0 REGIONAL STRUCTURE

3.2.1 The general trend of all formations is North - South. The rectilinear East - West (EW) to North West (NW) - South East (SE) trending boundaries are faulted while the N-S and NNE-SSW linear trends show unconformable relation with the underlying gneisses.

3.2.2 Sediments of Bhima Group are structurally least disturbed and preserve their horizontal bedded character originally impressed at the time of deposition. Deformation is observed only in the vicinity of faults. The faults encountered have

continued into the basement that has exercised control upon the basin configuration.

3.2.3 The basin is well known for its huge reserves of limestone and the newly discovered Uranium occurrence near Gogi. Regional Geological map of Bhima basin is shown as **PLATE NO.2.**

3.2.0 GEOLOGY OF THE BLOCK

3.3.1 The rocks exposed in the block belong to the Shahabad formation of Sedum sub group of Bhima Group. The stratigraphic sequence of the litho units exposed in and around the block area based on field observations and available data/literature from nearby mine/areas is given below **Table No.3.3.**

Table No-3.3
Stratigraphic Sequence of Litho-units exposed in and around The Block area

Age	Group	Sub Group	Formation	Litho Units
Quaternary	-	-	Recent	Top soil
Upper proterozoic	Bhima	Sedam	Shahabad	Siliceous/flaggy limestone Massive grey limestone Shaly limestone

3.4.0 DESCRIPTION OF ROCK TYPES

3.4.1 Almost entire area of the block is concealed under quaternary sediments i.e. soil cover. Scanty scattered limestone outcrops are seen at places. The beds are horizontally disposed as noticed in nearby areas. Since most of the area is concealed under soil cover the strike and dip of the limestone beds is not observed in the block. Mining activities are currently ongoing in surrounding areas and limestone being excavated for manufacturing of cement. The lithological description of litho units from top to bottom as obtained from available data from nearby mines is given below.

3.4.2 **Top Soil**

The overburden top soil is black in colour, fine to silty, friable when dry and sticky when wet. The Over burden soil covers almost the entire Block area. The thickness of the soil varies from 0.10 m to about 19.00 m at places. Top soil cover thickness is expected to vary from 0.10 m to 2.00 in the area based on available mining data from nearby areas.

3.4.3 **Flaggy/Siliceous Limestone**

This unit overlying massive grey limestone and is grey in color, fine grain, hard and flaggy/flaky in nature. The thickness of this formation varies from 2.00 m to 65.00 m

regionally. However, the thickness of this lihto unit is expected to vary from 2.00 m to 6.00 m in the area based on available mining data from nearby areas. The average CaO% and SiO_2% is about 38% and 27% respectively.

3.4.4 **Massive Grey Limestone**

Massive grey Limestone formation is dark grey in color, micritic, fine grained and compact. At places color varies from dark grey to ligh grey. Stylolite structures are often noticed in this unit. The thickness of this lithounit varies from 7.00 m to 78.00 m regionally. However, the thickness of this litho unit is expected to vary from 40.00 m to 50.00 m in the area based on available mining data from nearby areas. The average CaO% and SiO_2% is about 46% and 13% respectively. Massive grey limestone is cement grade to high grade and being excavated for manufacturing of cement in nearby areas.

3.4.5 **Shaly Limestone**

Shaly limestone is underlying formation of Massive grey limestone and is fine grained, thinly bedded and associated with thin shale bands/partings. Massive limestone to Shaly limestone transition zone is marked with frequency of shale partings. The frequency of shale parting/bands increases with depth. This litho unit forms the bottom most horizon and extends more than 70m depth from ground surface based on available data from nearby areas. The average CaO% and SiO_2% is about 39% and 23% respectively.

3.4.0 Structure:

The rock formations of the Block area are horizontally disposed and mostly concealed under top soil. At places, limestone beds dip 1^0 to 2^0 due East. The area is geologically undisturbed. Schematic geological cross section of the area envisaged based on available data from mining area nearby is given as **Fig. No.1.**

Fig.No.1 : Schematic Geological Cross section of the area

4.0.0 OBJECTIVE: -

4.1.0. The exploration is proposed with the following objectives

i) To delineate the strike and depth continuity of limestone by drilling 800m x 800m grid interval at G-3 level.

ii) In case the results of G-3 level are encouraging boreholes shall be drilled at gap areas in consideration with G-4 and G-3 level exploration and cover the entire block at 400m x 400m grid interval to bring the deposit at G-2 level.

iii) To estimate grade wise Limestone resources in the Block area as per UNFC norms at G-3 / G-2 level of exploration.

iv) To carry out exploration as per Minerals (Evidence of Mineral Contents) Rule-2015, Mineral (Auction) Rules-2015 and MMDR Amendment Act-2015 in turn to facilitate the State Govt. (Karnataka) in Auctioning of the Block.

5.0.0. METHODOLOGY OF EXPLORATION

5.1.0 Topographic Survey & Geological Mapping.

5.1.1 The Block boundary will be surveyed by DGPS and total station in WGS-84 datum for demarcation of block boundary/corner points. Triangulation network will be laid down in the proposed study area of 6.11 Sq. Km (611.08 ha). Contouring will be done on 1:2000 scale at 1m contour intervals along with survey of surface features. Borehole will be fixed on the ground. RL's and co-ordinates of survey and exploration points will be determined. Detailed Geological Mapping will be done in the proposed block on 1:2000 scale. All the geological features will be recorded and litho contacts will be plotted for finalization of Geological map. This map will be used as base map for future work.

5.2.0 Surface Drilling

5.2.1 The present exploration scheme is prepared by proposing total drilling of 1980 m in 33 boreholes (G-3 & G-2 level) seamlessly on a regular grid pattern 800 m X 800 m for G-3 level and 400 m X 400 m for G-2 level apart from geological mapping on 1:2000 scale with a view to firm up the grade and resources of limestone at G-3 and G-2 level of exploration across the length & breadth of proposed 6.11 Sq. Km Limestone bearing Block area.

For G-3 Level of Exploration: Total 10 boreholes involving 600m proposed at G-3 level exploration at 800m x 800m grid interval. The borehole depth is planned up to 60m or up to intersection of shaly limestone (underlying formation of Massive grey limestone) tentatively based on available mining data from nearby areas. However, proposed borehole depth may vary and subject to outcome of proposed G-4 level exploration in the block area. The borehole location map is enclosed as **PLATE NO.3** and the details of proposed boreholes at G-3 level are given in below **Table No. 5-I.**

Table No. 5- I

Details of Proposed Boreholes (G-3 Level of Exploration)

In Udagi Block

Sl.No.	Proposed BH Id	Northing (m)	Easting (m)	Angle & Azimuth	Proposed Depth to be drilled (m)
1	PBH-1	1893342	733705	Vertical	60
2	PBH-2	1892542	733705	Vertical	60
3	PBH-3	1892542	734505	Vertical	60
4	PBH-4	1892542	735305	Vertical	60
5	PBH-5	1892542	736105	Vertical	60
6	PBH-6	1891742	733705	Vertical	60
7	PBH-7	1891742	734505	Vertical	60
8	PBH-8	1891742	735305	Vertical	60
9	PBH-9	1890942	734505	Vertical	60
10	PBH-10	1890942	735305	Vertical	60
Total					**600**

For G-2 Level of Exploration: Total 23 boreholes involving 1380m proposed at G-2 level exploration mostly aimed at to fill up the gaps of previously drilled boreholes at G-4 & G-3 level of exploration on section lines in order to cover the entire limestone bearing area/block on 400m x 400m grid interval. The borehole depth is planned up to 60m or up to intersection of shaly limestone (underlying formation of Massive grey limestone) based on available mining data from nearby mines. However, proposed borehole depth may vary and subject to outcome of G-4 and G-3 level of exploration. The borehole location map is enclosed as **PLATE NO.3** and the details of proposed boreholes at G-2 level are given in below **Table No. 5-II**.

Table No. 5- II

Details of Proposed Boreholes (G-2 Level of Exploration)

In Udagi Block

Sl.No.	Proposed BH Id	Northing (m)	Easting (m)	Angle & Azimuth	Proposed Depth to be drilled (m)
1	PBH-1	1893342	733305	Vertical	60
2	PBH-2	1893342	734105	Vertical	60
3	PBH-3	1892942	733705	Vertical	60
4	PBH-4	1892942	734105	Vertical	60
5	PBH-5	1892942	734505	Vertical	60
6	PBH-6	1892942	734905	Vertical	60
7	PBH-7	1892942	735305	Vertical	60
8	PBH-8	1892942	735705	Vertical	60

9	PBH-9	1892542	734105	Vertical	60
10	PBH-10	1892542	734905	Vertical	60
11	PBH-11	1892142	733705	Vertical	60
12	PBH-12	1892142	734505	Vertical	60
13	PBH-13	1892142	734905	Vertical	60
14	PBH-14	1892142	735305	Vertical	60
15	PBH-15	1892142	735705	Vertical	60
16	PBH-16	1891742	734105	Vertical	60
17	PBH-17	1891742	734905	Vertical	60
18	PBH-18	1891742	735705	Vertical	60
19	PBH-19	1891342	733705	Vertical	60
20	PBH-20	1891342	734105	Vertical	60
21	PBH-21	1891342	734505	Vertical	60
22	PBH-22	1891342	734905	Vertical	60
23	PBH-23	1891342	735705	Vertical	60
TOTAL					**1380**

Note: Proposed Borehole depth is tentative only and may vary subject to outcome of proposed G-4/G-3 level exploration in the Block area and also depending upon the geological and drilling conditions in the study area.

5.2.2 The combined proposed Borehole location map of Udagi Block for G-3 and G-2 level exploration is given in **PLATE NO.3.**

5.3.0 Drill Core Logging and Sampling

5.3.1 Detailed drill core logging will be done with consideration of weathering, grain size, fossil contents, and color of various formations, intercalation / parting of shale, stylolite, and structure. On the basis of these parameters, grade of limestone can be broadly presented and it will also be helpful in sampling.

Primary samples will be drawn at 1 m interval subject to change in lithology and core recovery. The following parameters shall be considered while sampling the drill cores.

1) Colour, grain size.
2) Fossil variation.
3) Thin intercalations of shale/siltstone.
4) Partially weathered zone.

For preparation of samples the borehole core will be longitudinally split into two equal halves by using core splitter. One half will be powdered to -100 mesh size and the other half will be kept for future studies. The powdered material will be mixed thoroughly and about 100 gm of samples will be taken for chemical analysis by successive coning and quartering as primary samples and rest of the material (-100 mesh size) will be kept as duplicate half for future reference.

For G-3 Level of Exploration, total number of samples shall likely to generate about 600 Nos primary samples and 60 Nos check samples (10% of primary

samples) totaling 660 Nos. In addition 5% of primary samples i.e. 30 Nos. Check samples will be prepared as External Check samples and will be sent to NABL accredited Labs for analysis of 6 radicals. Around 60 numbers of primary samples will be prepared for analysis of two radicals i.e. SO_3 & P_2O_5.

For G-2 Level of Exploration, total number of samples shall likely generate about 1380 Nos primary samples and 138 Nos check samples (10% of primary samples) totaling 1580 Nos. In addition 5% of primary samples i.e. 69 Nos. Check samples will be prepared as External Check samples and will be sent to NABL accredited Labs for analysis of 6 radicals.

Composite samples will be prepared borehole wise based on primary sample data at every 6-m interval (6 m bench height). Composite samples will be prepared only from all the limestone zone demarcated at 42% CaO cut off. This will generate about 100 nos. of composite samples. **(For G-3 Level of Exploration)**

Composite samples will be prepared borehole wise based on primary sample data at every 6-m interval (6 m bench height). Composite samples will be prepared only from all the, limestone zone demarcated at 42% CaO cut off. This will generate about 230 nos. of composite samples. **(For G-2 Level of Exploration)**

5.4.0 Laboratory Studies

5.4.1 Chemical Analysis: All the Primary samples (600 Nos.) will be analyzed for 6 radicals, CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3 and LOI. 48 Nos. of primary samples will be analyzed for additional two radicals i.e. SO_3 & P_2O_5. 10% of primary samples around 60 Nos. will be analyzed as internal check for 6 radicals CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3 and LOI. 5% of primary samples (30 Nos.) will be sent to NABL external labs as external check samples for analysis of 6 radicals CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3 and LOI. **(For G-3 Level of Exploration)**

All the Primary samples (1380 Nos.) will be analyzed for 6 radicals, CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3 and LOI. 138 Nos. of primary samples will be analyzed for additional two radicals i.e. SO_3 & P_2O_5. 10% of primary samples around 138 Nos. will be analyzed as internal check for 6 radicals CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3 and LOI. 5% of primary samples (69 Nos.) will be sent to NABL external labs as external check samples for analysis of 6 radicals CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3 and LOI. **(For G-2 Level of Exploration)**

5.4.2 Composite Samples: Around 100Nos. of composite samples generated from borehole cores shall be subjected to analysis of 12 radicals, CaO, MgO, Fe_2O_3, SiO_2, Al_2O_3, SO_3,P_2O_5, MnO_2, K_2O, Na_2O, Cl &,LOI. Spectroscopic studies will be

done on 20 nos. of composite samples each for presence of trace elements and mineral phase studies respectively. 20 Nos. composite samples shall be subjected to XRD studies for mineral phase studies. **(For G-3 Level of Exploration)**

Around 230 Nos. of composite samples generated from borehole cores shall be subjected to analysis of 12 radicals, CaO, MgO, Fe2O3, SiO_2, Al_2O_3, SO_3,P_2O_5, MnO_2, K_2O, Na_2O, Cl &,LOI. Spectroscopic studies will be done on 40 nos. of composite samples each for presence of trace elements and mineral phase studies respectively. 40 Nos. composite samples shall be subjected to XRD studies for mineral phase studies. **(For G-3 Level of Exploration)**

5.4.3 **Petrological Studies**: Petrological studies will be done on 20 nos. of core specimen. **(For G-3 Level of Exploration)**

Petrological studies will be done on 40 nos. of core specimen. **(For G-2 Level of Exploration)**

5.4.4 **Specific Gravity Determination:** Specific Gravity will be determined on 20 nos. drill core specimen. **(For G-3 Level of Exploration)**

Specific Gravity will be determined on 40 nos. drill core specimen. **(For G-2 Level of Exploration)**

5.5.0 The Quantum of work proposed

The Quantum of work proposed is given in **Table No.5-III.**

Table No.5-III - Quantum of Work Proposed For (G-3) / (G-2) Level of Exploration

Sl. No.	Item of Work	Unit	Quantum (G-3)	Quantum (G-2)	Total
1	Topographic Survey & Geological Mapping on 1:2000 scale.	Sq. Km.	6.11 Sq. Km	6.11 Sq. Km	6.11 Sq. Km
2	Drilling	m.	600 (10 holes)	1380 (23 holes)	1980 (33 holes)
3	Laboratory Studies				
	i) Chemical Analysis; Primary samples for 6 radicals i.e. CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3 and LOI	Nos.	600	1380	1980
	ii) For SO_3 & P_2O_5	Nos.	60	138	198
	iii) Check sample for analysis of 6 radicals i.e. CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3 and LOI	Nos.	60	138	198
	iv) External Check (NABL) samples for analysis of for 6 radicals i.e. CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3 and LOI	Nos.	30	69	99
4	Composite Samples a) For 12 radicals (CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3, SO_3, P_2O_5 , LOI, MnO_2, K_2O, Na_2O and Cl.)	Nos.	100	230	330
5	Physical Studies				
	a)Spectroscopic Studies (10 elements)	Nos.	20	40	60
	b)XRD studies	Nos.	20	40	60
6	Petrological Studies (Petrographic Studies)	Nos.	20	40	60
7	Specific Gravity Determinations	Nos	20	40	60
8	Report Preparation (Digital format) with Peer Review of Report	Nos	1 No	1 No	2 Nos.

5.6.0 Exploration Report:

Data generated from present seamless exploration at G-3 and G-2 level, proposed G-4 exploration data and earlier data if any shall be utilized in Report preparation.

5.7.0 Peer Review of Report:

After finalization of report it will be sent for Peer Review to the member of Peer Review Committee.

6.0.0 TIME SCHEDULE AND COST ESTIMATES:

6.1.0 Time Schedule:

The proposed exploration programme work activities like Drilling, Geology, including camp setting, winding, Laboratory studies, will be completed in 6 months' time. Report writing will take additional 3 months with one month overlapping of laboratory studies. Thus, the total time proposed for completion of work is 9 months. The bar chart showing Action Plan/time schedule is given in Table-6.1. **(For G-3 Level of Exploration)**

Table:6.1 Time schedule (in months) for G-3 level Exploration for Limestone in Udagi Block, Chittapur Taluka, Kalaburagi District, Karnataka

Sl. No.	Activities	Unit	MONTHS									Total
			1	2	3	4	5	6	7	8	9	
1	Camp Setting	Month	←	→								1 month
2	Surface Drilling (2 rig)	m.		←	→							600 m (in 10 BHs)
3	Survey Party days (1 Party)	day	←		→							6.11 sq.km.
4	Geologist Party days (1 Party)	day		←		→						120
5	Sampling Party days, Core Sampling (2 party)	day		←		→						90
6	Laboratory Studies	Nos.				←	→					
7	Camp Winding	Month				←	→					1 month
8	Geological Report Writing	Month						←	→			4 month

The proposed exploration programme work like Drilling, Geology, including camp setting, winding, Laboratory studies, will be completed in 9 months' time. Report writing will take additional 2 months with two month overlapping of laboratory studies. Thus, the total time proposed for completion of work is 8 months. The bar chart showing Action Plan/time schedule is given in Table-6.2. **(For G-2 Level of Exploration)**

Table:6.2 Time schedule (in months) for G-2 level Exploration for Limestone in Udagi Block, Taluka, Kalaburagi District, Karnataka Chitapur

Sl. No.	Activities	Unit	MONTHS									Total
			1	2	3	4	5	6	7	8	9	
1	Camp Setting	Month	←	→								1 month
2	Surface Drilling (3 rig)	m.		←			→					1380 m (in 23 BHs)
3	Survey Party days (1 Party)	day		←			→					6.11 sq.km.
4	Geologist Party days (1 Party)	day		←			→					120
5	Sampling Party days, Core Sampling (2 party)	day		←			→					120
6	Laboratory Studies	Nos.				←			→			
7	Camp Winding	Month						←	→			1 month
8	Geological Report Writing	Month						←			→	4 month

6.2.0 Cost Estimate:

Cost has been estimated based on actual and provisional escalation as per RBI indices as on 31-03-18 and provisional escalation of @ 15% points for drilling work and 25% points for Geological and Laboratory Studies for the subsequent years. The total estimated cost is **Rs. 105.63 Lakhs.** The summary of cost estimates is given in **Table 6.3** and details of cost estimates are given in **Table 6.5 (For G-3 Level of Exploration)**

Table 6.3
Summary of Cost Estimates for G-3 Level of Exploration

Sl. No.	Item	Estimated Cost (Rs.)
1	Drilling	6683584
2	Geology	1776450
3	Laboratory	2721200
4	Exploration Report	111812
	Total	**11293046/-**

Say Rs. 112.93 Lakhs

Cost has been estimated based on actual and provisional escalation as per RBI indices as on 31-03-17 and provisional escalation of @ 15% points for drilling work and 25% points for Geological and Laboratory Studies for the subsequent years. The total estimated cost is **Rs. 247.74 Lakhs.** The summary of cost estimates is given in **Table 6.4** and details of cost estimates are given in **Table 6.5. (For G-2 Level of Exploration)**

Table 6.4
Summary of Cost Estimates for G-2 Level of Exploration

Sl. No.	Item	Estimated Cost (Rs.)
1	Drilling	13630566
2	Geology	2045280
3	Laboratory	6168178
4	Exploration Report	218440
	Total	**22062464/-**

Say Rs. 220.62 Lakhs

7.0.0 JUSTIFICATION

i) Proposed G-3 level of exploration will be a systematic exploration on 800x800 m grid interval in the Block area based on outcome of proposed G-4 level exploration in the Composite block (Diggaon & Udagi).

ii) In case the result of G-3 level are encouraging boreholes shall be drilled at

400m x 400m grid interval in gap areas along the sections to bring the deposit at G-2 level.

iii) The proposed exploration programme will be helpful in demarcating zone of various grades of limestone in the block as per UNFC norms and estimation of limestone resources/reserves.

iv) In view of MMDR Amendment Act and Minerals Auction Rule 2015 DMG Government of Karnataka has requested MECL to prepare and submit Exploration proposal for this Block under NMET funding through DMG Karnataka letter No.DMG-17013/6/2018-19/2393 dated 7/7/2018.

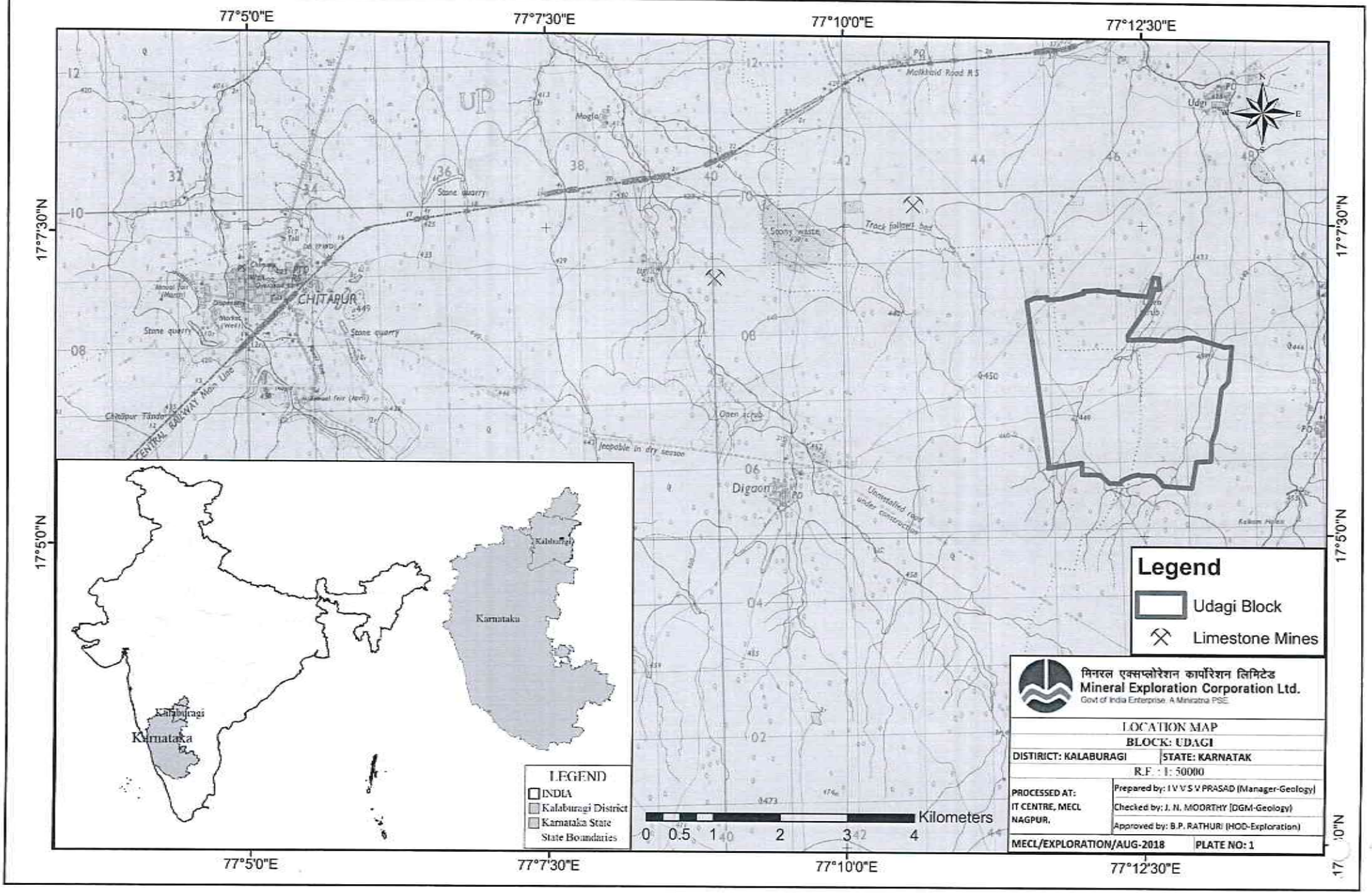
Table: 6.4 Cost Estimate for G-3 / G-2 level of Exploration of Limestone in Udagi Block, Taluka-Chitapur, Distt. Chitapur, Karnataka

S.N	Item of Work	Unit	Base Rate as on 01-04-1990	Escalated rates (2018-19) G-3 Level of Exploration			Escalated rates (2018-19) G-2 Level of Exploration			Total Quantity	Total Amount (Rs.)
				Rate	Quantity	Amount (Rs)	Rate	Quantity	Amount (Rs)		
A	DRILLING										
1	Surface Drilling (2/3 Rigs)*	m.	1714	7028	600	4216800	7028	1380	9698640	1980	13915440
2	Transportation	Km.	8.8	33	2000	66000	33	3000	99000	5000	165000
3	Accomodation	One time/ Drill	185925	690693	2	1381386	690693	3	2072079	5	3453465
4	Camp Setting / Winding	Drill/month	68606	254864	2	509728	254864	3	764592	5	1274320
5	Road Making (Flat Terrain)	Km	5200	19317	10	193170	19317	15	289755	25	482925
6	GI Core Boxes	Nos.	Lumpsum	2000	150	300000	2000	345	690000	495	990000
7	Transportation charges of Core Boxes	Km	8.8	33	500	16500	33	500	16500	1000	33000
	Sub Total A					**6683584**			**13630566**		**20314150**
B	GEOLOGICAL WORK										
1	Survey Party Days (1 party)	day	1180	6056	90	545040	6056	120	726720	210	1271760
2	Geologist Party days (1 party)	day	1541	8083	120	969960	8083	120	969960	240	1939920
3	Core Sampling Party days(1 party)	day	525	2905	90	261450	2905	120	348600	210	610050
	Sub-Total B					**1776450**			**2045280**		**3821730**
C	LABORATORY STUDIES										
a	Chemical Analysis										
1	Primary + Check Samples										
	i) for 6 radicals i.e. CaO, MgO, Al2O3, SiO2, Fe2O3 and LOI	Nos	490 '(110+76x5)	2670	600	1602000	2670	1380	3684600	1980	5286600
	ii) for additional 2 radicals SO3 & P2O5	Nos	186 '(76+110)	1006	60	60360	1006	138	138828	198	199188
	iii) Check samples for analysis of for 6 radicals i.e. CaO, MgO, Al2O3, SiO2, Fe2O3 and LOI	Nos	490 '(76x5+110)	2670	60	160200	2670	138	368460	198	528660
	iv) External Check (NABL) samples for analysis of for 6 radicals i.e. CaO, MgO, Al2O3, SiO2, Fe2O3 and LOI	Nos	490 '(76x5+110)	2670	30	80100	2670	69	184230	99	264330
2	Composite Samples										
	i) for 12 radicals (CaO, MgO, Al2O3, SiO2, Fe2O3, SO3, P2O5 , LOI, MnO2, K2O, Na2O and Cl.)	Nos	946 '(76x11+110)	5166	100	516600	5166	230	1188180	330	1704780
b	Physical Analysis										
1	X-RD Studies on composite	Nos	1137	5813	20	116260	5813	40	232520	60	348780
2	Spectroscopic Studies (Trace element)***	Nos	1173	6861	20	137220	6861	40	274440	60	411660
3	Preparation of thin section	Nos	100	556	20	11120	556	40	22240	60	33360
4	Petrographic Studies	Nos	228	1478	20	29560	1478	40	59120	60	88680
5	Specific Gravity determination	Nos	64	389	20	7780	389	40	15560	60	23340
	Sub-Total C					**2721200**			**6168178**		**8889378**
	Total A+B+C					**11181234**			**21844024**		**33025258**
D	**EXPLORATION REPORT - 1% of (A+B+C)**					**111812**			**218440**		**330253**
E	**Peer Review of Reports****	**Nos**	**10000***	10000	1	**10000**	10000	1	**10000**	2	**20000**
	GRAND TOTAL A to E					**11303046**			**22072464**		**33375511**
	GST 18%										**6007592**
	Grand Total : with GST 18%										**39383102**
											Say Rs 393.83 Lakh

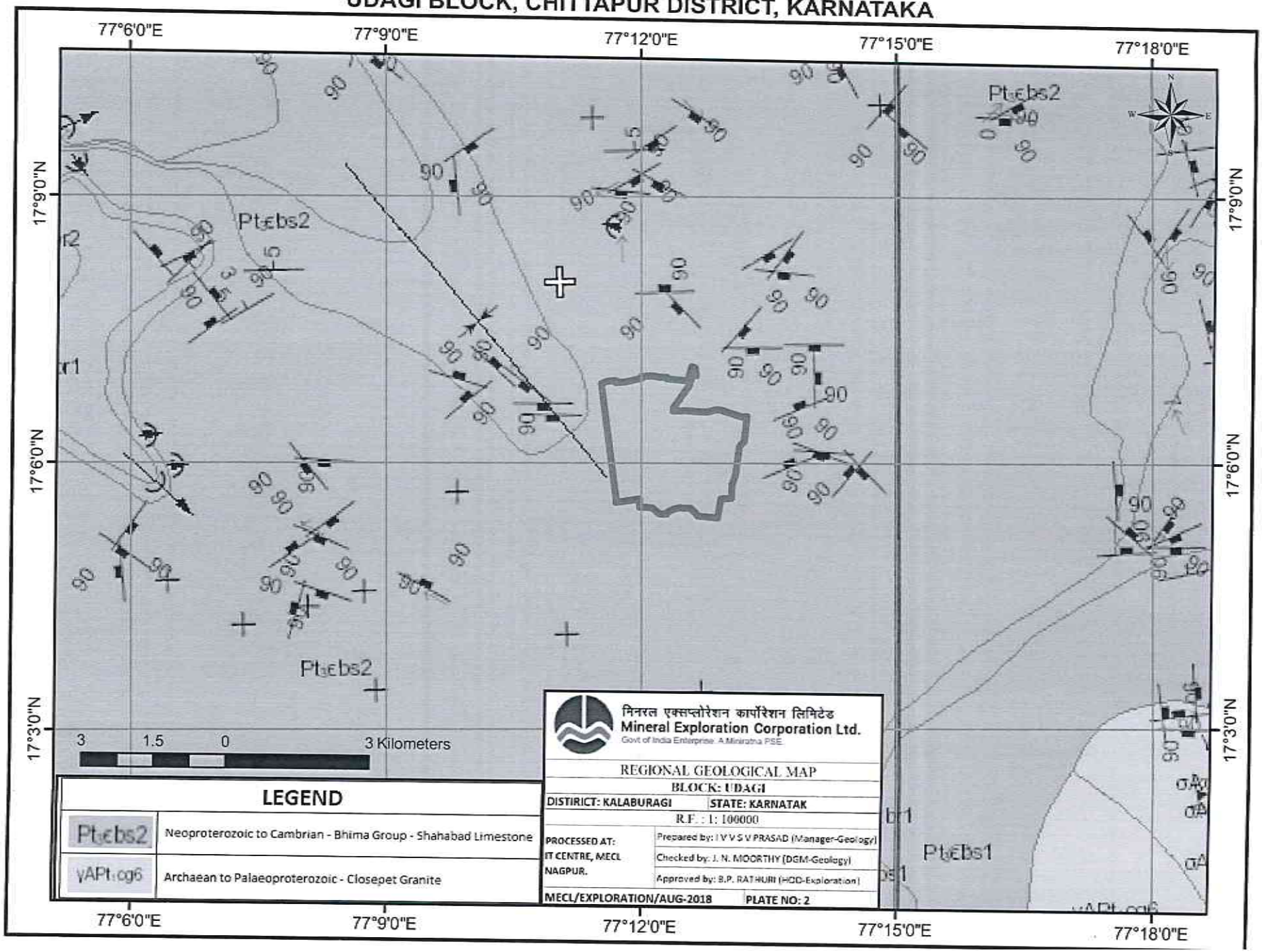
1	Revised Rates of Promotional Work done by MECL on behalf of Govt. of India Vide letter No. 37(I) /2006-M.I. dated- 02-07-2014 and based on actual escalation as per RBI indices as on 31-03-2017 and provisional escalation of @15 %points for drilling and @25% points for Geological & Laboratory studies for subsequent year.
2	Phosphorite rates have been considered as there is no rate for Limestone in Revised Rates of Promotional Work of MoM Schedule of Rates.
3	* Surface Drilling (2/3 Rigs) - 2 Rigs for G-3 level and 3 Rigs for G-2 level estimated based on quantum of work
4	**The Peer Review amount to be paid to the members of Peer Review Committee was finalised by the Executive Committee of NMET
5	*** Rate taken from similar proposal (FY 2017-18) as the same is not available in Committee Report

LOCATION MAP OF UDAGI LIMESTONE BLOCK
TALUK-CHITTAPUR, DISTRICT-KALABURAGI, KARNATAKA

PLATE NO: 1



REGIONAL GEOLOGICAL MAP OF THE AREA
UDAGI BLOCK, CHITTAPUR DISTRICT, KARNATAKA



BORE HOLE LOCATION PLAN (G3 AND G2)
UDAGI BLOCK, TALUK-CHITTAPUR, DISTRICT-KALABURAGI, KARNATAKA