

**PROPOSAL FOR RECONNAISSANCE SURVEY (G4) FOR GLAUCONITIC
SANDSTONE IN PINDRA SW EXTENSION BLOCK, DIST.- SATNA, MADHYA
PRADESH (AREA 40.00 Sq. Km)**

COMMODITY: GLAUCONITIC SANDSTONE

BY

**MINERAL EXPLORATION AND CONSULTANCY LIMITED
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PLACE: NAGPUR

DATE: 24.08.2022

SUMMARY OF THE BLOCK FOR RECONNAISSANCE SURVEY (G4) FOR GLAUCONITIC SANDSTONE IN PINDRA SW EXTENSION BLOCK, DIST.- SATNA, MADHYA PRADESH

Features	Details
Block ID	PINDRA SW EXTENSION
Exploration Agency	Mineral Exploration and Consultancy Limited (MECL)
Commodity	GLAUCONITIC SANDSTONE
Mineral Belt	Pindra SW Extension block is a part of Majhgawan-Paharikhera Potash Belt is situated in the northern part of the Satna Distt., Madhya Pradesh and falls in the Survey of India toposheet nos. 63D/09 and 63D/13.
Completion period with entire Time schedule to complete the project	12 Months
Objectives	i. Geological mapping in the SW Extension part of the GSI's Pindra North block in 1:12500 scale. ii. To expose the concealed glauconitic sandstone and check the K₂O content at shallow depth, trenching/pitting will be done. iii. To check the extension of Glauconitic sandstone in the Gap area as well as SW extension part of GSI's Pindra North block, up to the panna shale below ground level, by drilling scout boreholes at 1600m grid. iv. To estimate the Reconnaissance Mineral Resources and grade for glauconite in the block as per UNFC and MEMC-2015
Whether the work will be carried out by the proposed agency or through outsourcing and details thereof. Components to be outsourced and name of the outsource agency	Work will be carried out by the proposed agency.
Name/Number of Geoscientists	Nos. of Geoscientists: 2
Expected Field days (Geology, Geophysics, surveyor)	Geologist Party days: 120 (At field) & 60 at HQ Survey Party days: 0

1.	Location					
	Latitude - Longitude	Block Corner points	UTM Zone-44 (m)		Geographic Co-ordinate WGS-84	
			Easting (m)	Northing (m)	LATITUDE	LONGITUDE
		A	474380.478	2761956.806	24° 58' 21.98" N	80° 44' 46.215" E
		B	474740.048	2761955.298	24° 58' 21.953" N	80° 44' 59.04" E
		C	476464.003	2759097.932	24° 56' 49.154" N	80° 46' 0.704" E
		D	477254.367	2759097.932	24° 56' 49.198" N	80° 46' 28.888" E
		E	479164.699	2760508.072	24° 57' 35.143" N	80° 47' 36.934" E
		F	479595.140	2759849.749	24° 57' 13.76" N	80° 47' 52.32" E
		G	479934.350	2754419.570	24° 54' 17.23" N	80° 48' 4.7" E

		H	474292.959	2752876.310	24° 53' 26.75" N	80° 44' 43.7" E
		I	472041.358	2754735.405	24° 54' 27.05" N	80° 43' 23.31" E
		J	472040.979	2757304.003	24° 55' 50.56" N	80° 43' 23.11" E
		K	472921.348	2757299.162	24° 55' 50.46" N	80° 43' 54.5" E
		L	472925.880	2756610.482	24° 55' 28.07" N	80° 43' 54.71" E
		M	473439.687	2756594.714	24° 55' 27.59" N	80° 44' 13.03" E
		N	473475.410	2756065.920	24° 55' 10.401" N	80° 44' 14.34" E
		O	473827.687	2756057.551	24° 55' 10.15" N	80° 44' 26.9" E
		P	475383.303	2756850.688	24° 55' 36.03" N	80° 45' 22.31" E
		Q	475884.120	2756786.750	24° 55' 33.981" N	80° 45' 40.17" E
		R	476205.540	2757593.580	24° 56' 0.23" N	80° 45' 51.58" E
		S	476123.430	2757632.480	24° 56' 1.49" N	80° 45' 48.65" E
		T	474362.516	2757674.409	24° 56' 2.75" N	80° 44' 45.86" E
	Villages	Pindra, Kallaspura, Majhgawan				
	Tehsil/Taluk	Majhgawan				
	District	Satna				
	State	Madhya Pradesh				
2.	Area (hectares/ square kilometres)					
	Block Area	4000 ha /40 sq.km				
	Forest Area	The block co-ordinates were subjected in the Decision Support System (DSS) of Forest department, Ministry of Environment, Forest and Climate Change (MOEFCC). It has been found that the block area is under “not inviolate”. (Go)-Non-Forest area.				
	Government Land Area (Bilanam)	Data not available				
	Charagaha	Data not available				
	Private Land Area	Part of the area is private, cultivated land				
3.	Accessibility					
	Nearest Rail Head	Majhgaon 10km				
	Road	NH 11 passes near the block connecting Satna and Chitrakoot				
	Airport	Khajuraho 150km				
4.	Hydrography					
	Local Surface Drainage Pattern (Channels)	The dendritic drainage.				
	Rivers/ Streams					
5.	Climate					
	Mean Annual Rainfall	Average annual rainfall is 100 mm				
	Temperatures (December) (Minimum) Temperatures (June) (Maximum)	Minimum temperatures 5°C (Jan), Maximum temperatures up to 45°C (May)				
6.	Topography					
	Toposheet Number	63D/09 & 63D/13				
	Morphology of the Area	The terrain is represented by a number of gently sloping table lands and north facing escarpments and inter-montance valleys. The table lands are capped				

		by the gently dipping sandstone. The highest elevation of the area is 440 m in the eastern and southern western side of the Block.
7.	Availability of baseline geoscience data	
	Geological Map (1:50K/25K)	Geological Map of GSI FS 1986-88 is available at 1:12500 scale
	Geochemical Map	Available
	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps)	Not Available
8.	Justification for taking up Reconnaissance Survey/ Regional Exploration	1. Today most of the potash demand is met through bedded marine evaporite deposits such as sylvite, carnalite, kainite, polyhalite, surface and sub-surface potash-rich brines. In absence of mineable evaporite potash deposit in India, it was considered necessary to look for non-traditional source of potash such as glauconitic sandstone and potash rich shales. Hence, potash recovery from low grade glauconitic sandstone is essential, as its high grade deposits are limited in our country. 2. Previous exploration work by GSI in about 12 sq km of Pindra North Block indicates 'proved category' reserves of about 266 million tones with 4.90% K₂O a large portion of the horizon carrying more than 5% K₂O. Towards West of the GSI's Pindra North block, there are two 10a2b cancelled lease block, having exploration work done for glauconitic sandstone. The two blocks, namely, Chitrakoot-2 explored by M/s Nagur Minerals Pvt. Ltd. and Chitrakoot-3 explored by M/s Mobile Trading & Investment Pvt. Ltd having proved mineable reserve estimated viz. 50.46 mT and 85.51 mT respectively. The present Reconnaissance survey in Pindra SW Extension block has been proposed in the gap area between the GSI's Pindra North block and Chitrakoot-2 10a2b cancelled lease block, as well as in the SW extension of GSI's Pindra North block. 3. Considering the consistency of glauconitic sandstone in the GSI's Pindra North block, the present exploration programme is planned to prove the continuity of the glauconitic sandstone in the SW extension part.

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1. INTRODUCTION

- 1.1. Along with nitrogen and phosphorus, potassium is one of the most essential macronutrients and is required in agriculture in relatively large amounts for plant's healthy growth. After the growing recognition of potassium as one of the key nutrient in plant growth, subsequent development of potash industry was resulted. Reaching an estimated value of one million tonnes in 1921, production of potassium continues to increase consistently and reach to almost 34.6 million tonnes in 2013 (United State Geological Survey, 2013a, 2013b) expecting to raise 37.8 million tons in 2022 with the growth rate of about 2.9% annually (Rawashdeh et al., 2016).
- 1.2. Today most of the potash demand is met through bedded marine evaporite deposits such as sylvite, carnalite, kainite, polyhalite, surface and sub-surface potash-rich brines. These minerals are mixture of soluble salts, mainly potassium chloride or sulfates. More than 90% of these deposits are mainly concentrated in countries like Canada, Russia, Belarus, Brazil, China, Chile, Germany and USA (Anderson, 1985; The New York Times Editorial Board, 2013; Rawashdeh and Maxwell, 2014) on which rest of the world is dependent for supply of potash fertilizer.
- 1.3. In order to sustain crop production and to ensure self-sufficiency, exploration and investigation of alternative resource for potassium such as K-bearing silicates could be one of the options to meet the future demand (Manning, 2010; Manning, 2012; Ciceri et al., 2015).
- 1.4. In absence of mineable evaporite potash deposit in India, it was considered necessary to look for non-traditional source of potash such as glauconitic sandstone and potash rich shales. In many countries deficient in the conventional evaporite deposits insoluble potash used 'to be extracted out of silicate and non silicate minerals. Thus alunite in Bulla dealah in New castle, (Australia) containing 5% to 10%. K₂O was commercially exploited. Extraction of potassium from shales has also been discussed by Everest et al. (1964),

Similarly glauconite has been used in USSR as a source of potassium fertilizer's (GSI, CGPB report, 1978 p. 94).

1.5. Out of different non-conventional sources, glauconitic sandstones deposits are available in plenty and are considered as one of the indigenous resources for potassium in India. India has vast reserves of more than 3,000 million tonnes of glauconitic sandstone containing 4 to 8% K₂O occurring in States like Madhya Pradesh, Uttar Pradesh, Rajasthan and Gujrat (Kumar and Bakliwal, 2005).

2. BACKGROUND

2.1. Exploration for strategic, critical, precious, rare earths and PGE are given top priority by Govt. of India, after amendment of MMDR act 2015. Keeping in view, the present proposal has been prepared and being put up for Reconnaissance Survey for NMET funding and execution.

3. LOCATION AND ACCESSABILITY

3.1. Pindra SW Extension block is a part of Majhgawan-Paharikhera Potash Belt is situated in the northern part of the Satna Distt., Madhya Pradesh and falls in the Survey of India toposheet nos. 63D/09 and 63D/13. Majhgawan railway station is located on Bombay-Jabalpur-Allahabad line and lies between Satna and Manakpur stations. It also falls on State highway no. 11 and is about 44 km from Satna on Satna -Chitrakoot road. Khajuraho and Allahabad are nearest airports. Block boundary corner points of Pindra SW Extension block is given below:

Block Corner points	UTM Zone-44 (m)		Geographic Co-ordinate WGS-84	
	Easting (m)	Northing (m)	LATITUDE	LONGITUDE
A	474380.478	2761956.806	24° 58' 21.98" N	80° 44' 46.215" E
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4. PHYSIOGRAPHY AND DRAINAGE

4.1. The block lies in the Majhgawan range which is bordering Indo-gangetic alluvial plains in the north. The terrain is represented by a number of gently sloping table lands and north facing escarpments and inter-montane valleys. The table lands are capped by the gently dipping sandstone. The Glauconitic Banbiha sandstone forms an erosion surface.

4.2. The drainage pattern in the area is of dendritic type. The regional slope of the area is towards north and northeast and so most of the rivers flows towards north and northeast. Palsuni River (also named Badha Nala in toposheet), the only significant stream in the area forms tributary of river Yamuna. The highest elevation of the area is 440 m in the eastern and southern western side of the Block-B. In the Block -A the highest elevation is 448 m in the eastern side of the proposed Block.

5. CLIMATE

5.1. The climate is tropical monsoon type. The maximum temperature recorded is 45°C and in winter temperature drops down to 5°C. Average annual rainfall is 100 cm with maximum precipitation during July and August.

6. REGIONAL GEOLOGY

6.1. The rock types of the region, district- Satna, ranges in age from Archaean to Cainozoic. The Archaean rocks comprise of granites & gneisses and are exposed only in northern part of the Satna district. The rocks of Vindhyan Super group comprised of Semri, Kaimur, Rewa & Bhandar groups. The Semri Group of rocks is represented by an alternating sequence of Sandstone and shale along with porcellanite and limestone. The Semri Group of rocks mainly exposed in the southern and northern part of the district. The Rohtas Limestone of Semri Group is light to grey in colour, fine grained compact and well bedded. The Kaimur Group comprising mainly sandstone which is fine

grained; massive and thickly bedded is exposed in the northern and southern part. The Rewa Group of rocks comprises mainly of sandstone, shale and conglomerate.

6.2. The Rewa Group has been subdivided into the Panna Shale, the Itwa Sandstone, the Jhiri Shale and the Gahadra Sandstone. The Panna Shale conformably overlies the Baghain Sandstone. It mainly comprises purple to olive green (khaki), thinly laminated flaggy shale with thin siltstone and fine sandstone. Itwa Sandstone conformably overlies the Panna Shale with a gradational contact. It forms a prominent stratigraphic division between the Panna Shale and the overlying Gahadra Sandstone. The Asan Sandstone comprises dirty green, greenish grey and variously coloured medium to fine grained sandstone with thin shale and siltstone partings. The Jhiri Shale is purple, greenish grey, khaki and chocolate coloured, thinly laminated with wavy to lenticular bedding. Sedimentary structures such as halite casts, load casts, flute casts, bounce marks, small scale cross bedding and ripple marks are commonly exhibited by silty and sandy units. The Gahadram Sandstone comprises a thickly bedded, current bedded and massive sandstone succession. It is compact and pink, light reddish brown and purple coloured, medium to fine grained, rarely gritty. A conglomerate (oligomictic type), comprising pebbles, cobbles and even boulder size fragments of vein quartz and sandstone, has yielded diamonds in the Sakaria area.

VINDHYAN SUPER GROUP	Recent to sub recent	Alluvium with diamond ferrous gravel beds	
	Rewa Group	Gahadra Sandstone with white & pink medium grained sandstone	
		Jhiri Shale Formation	
		Itwa Sandstone Formation and Banbiha sandstone member with Glauconitic sandstone	
		Panna Shale	
	Kaimur Group	Baghain Sandstone	
	Semri Group	Palkawan Shale with a dolomitic limestone bed at its base	
			Bansakar Sandstone (Upper Glauconite Boarding

			Sandstone
		Pandwa Sandstone	Fall Kohari Chert (Dolomitic Limitation Chert & Chert Breccia
			Kudwari Sandstone (Lower Glauconite Bearing Sandstone.
.....UNCONFORMITY.....			
BUNDELKHAND GRANITE COMPLEX			Medium to coarse grained granites generally traversed by quartz reef dolerite dyke.

7. GEOLOGY OF THE STUDY AREA

- 7.1. The geological formations ranging in age from Archaeans to Recent are occurring in different part of area. Vindhyan are main rock units of the area, covering more than 95 % of geographical area of the district. Among Vindhyan rocks both Lower and Upper Vindhyan are representing the area, but Lower Vindhyan are mostly occupying in southern part of the area in Son Sub-basin. The proposed area comprises the rock formations belonging to the Vindhyan Supergroup and is represented by Kaimur and Rewa Groups.
- 7.2. In this area Rewa Group of rocks exhibit their best development in the entire Vindhyan basin (Soni, et al 1987) and could be considered as type area for Rewa Group of rocks. The rocks are characterized by lateral and vertical facies variation, multiplication of rock units and depositional environment which is different from the rest of the basin. The Group is represented by four formations.
- 7.3. Panna shale is exposed in the form of a band around table lands formed by overlying Banbiha sandstone (plate-1). Best exposures are seen along Badha nala and in the scarp sections of the Pindra North Block, The thickness of the-shale-horizon varies from 15to 25 meters. The formation is represented by red, purple, green, yellow, grey and greyish black argillaceous shales. The shales are thinly bedded to laminated. In its upper parts the shales are calcareous with alternating beds of greyish calcareous shales and thin bluish grey argillaceous limestone. The limestone inter beds show veins of sparite. The limestone could be called argillaceous sparite limestone or calcilutite.

Uppermost horizon of Panna shale is also rich in K₂O which ranges upto 5.33% in some cases.

- 7.4. Being the lowest member of the Itwa Sandstone Formation, Banbiha sandstone overlies Panna Shale Formation with a sharp break in grain size and mineral constituents although bands of shale are recorded in the basal part of glauconitic sandstone. The sandstone is exposed in the form of ENE-WSW trending table land on either sides of the Badha nala. The thickness varies from 8 to 20 meters. The formation pinches out towards west and to the west of Kisanpur it is less than 5 meters thick and low in glauconite content. The sandstone consists of highly cross bedded units of glauconitic sandstone with alternating beds of quartz rich sandstone. In its upper part the sandstone carries thin bands and pellets of chert and in the lower part thin bands of shale. Upper 5 to 6 meters of sandstone is highly ferruginous due to oxidation of iron oxide. The lower portion consists of bluish-green sandstone, Glauconite, quartz, feldspars, mica and ferro-mangnesian minerals are main mineral constituents. The cement is generally glauconite mud but at places siliceous and ferruginous cement is also observed.
- 7.5. Bhulwa limestone member consists of a lower chert breccia/brecciated chert horizon and an upper limestone horizon. The chert breccia unit overlies Banbiha sandstone and the contact between the two is rather gradational in the sense that, the upper horizons of glauconite sandstone carries thin bands of chert (bedded) which, in its upper portions, changes into a chert breccias with, fragments of chert and glauconitic sandstone and finally into a thick bed of chert. The chert horizon varies in thickness from 50 cm to 2.5 meters and show considerable pinching and swelling but persistency in its occurrence. The limestone unit overlies chert and varies in thickness from 1 to 3 meters. The limestone is yellowish, brown fine grained, compact and thickly bedded. It contains spherical to irregular shaped nodules as big 4 cm in diameter and 10 cm in length. The nodules are of magnetite commonly limonitised internally showing radiating fibrous structure.
- 7.6. The Pindra shale member represents transitional facies from underlying limestone to overlying Rohania sandstone. In the basal part the shale is greenish and calcareous with thin interbeds of limestone. In its upper part the shale is non- calcareous, pink and is interbedded with overlying sandstone.

The shale varies in thickness from 3 to 15 metres and pinches out west of Bhatawa.

7.7. Rohania Sandstone is the topmost member of Itwa Sandston Formation. It is about 4 to 5 meters thick and exhibit uniform thickness throughout the area. Rohania sandstone is represented by thinly bedded to thickly bedded, white and dirty yellow, fine and medium grained sandstone interbedded with shale.

8. PREVIOUS WORK

8.1. Regional geological mapping of the area was done by Sanyal and Chakraborty (1982). Adjoining parts were mapped by Mehta (1942), Mathur (1954), Rao (1972) and Soni (1981) Rao(1980) and Rao and Soni (1985). Aspects related to stratigraphy of glauconite bearing horizons and associated rocks were discussed in the report. Adjoining area towards east, falling in the state of Uttar Pradesh, was studied by Kedar Karayan (1960), Safaya (1963-66), Hukku (1971) and Srivastava et al (1977). Kalsotra and Sheo Prasad (1980), while drilling for testing in ASMARA lineament in the adjoining area of Uttar Pradesh intersected the glauconitic horizon. They analysed samples of glauconitic sandstone. Detailed exploration of glauconitic sandstone in the area was carried out by Geological Survey of India, Uttar Pradesh Circle in 1980-82.

8.2. In the study area, a total of 23 drill holes were drilled in Pindra North Block for the calculation of reserve of glauconite by GSI in 1987 and also 2 boreholes (GMP-22 & GMP-23) were drilled to study the regional distribution of glauconite sandstone and potash content and the total quantum of drilling in 23 drill holes was 456.90 m. The drilling results show that the glauconitic sandstone varies from 10 m to 19.40 m with an average thickness of 15.89 metres and thickness of 10 to 15 m are recorded in holes where the upper part of sandstone is eroded away. The actual thickness varies from 15 to 19.40 meters. The drilling result shows that the upper 5 meters of glauconite sandstone is ferruginous and brown in colour which confirms the oxidation of iron and the lower portion is bluish-green and non-ferruginous. Also the sandstone contains thin bands and laminae and fragments of chert in its upper part and thin grey shale bands in its lower part. And the thickness of bands varies from 2 mm to 2 cms. Thin bands of quartz rich sandstone (2 cm to 14 cm) also occur within the sandstone and have diluted K₂O content.

8.3. Detailed exploration of about 12 sq km of Pindra North Block indicates 'proved category' reserves of about 266 million tones with 4.90% K₂O a large portion of the horizon carrying more than 5% K₂O.

8.4. M/s Nagur Minerals Pvt. Ltd. had executed exploration work in the Chitrakoot-2 prospecting lease block, with geological mapping, surface sampling, pitting/trenching and drilling of 16 boreholes to estimate proved mineable resource of 50.46 mT.

9. OBJECTIVE

9.1. The exploration is proposed with the following objectives

9.1.1. Geological mapping in the SW Extension part of the GSI's Pindra North block in 1:12500 scale.

9.1.2. To check the extension of Glauconitic sandstone To expose the concealed glauconitic sandstone and check the K₂O content at shallow depth, trenching/pitting will be done.

9.1.3. in the Gap area as well as SW extension part of GSI's Pindra North block, up to the panna shale below ground level, by drilling scout boreholes at 1600m grid.

9.1.4. To estimate the Reconnaissance Mineral Resources and grade for glauconite in the block as per UNFC and MEMC-2015

10. PROPOSED SCHEME OF EXPLORATION

10.1. **Geological mapping:** geological mapping will be conducted in the proposed block of 40 Sq. Km area, in 1:12500 scale.

10.2. **Survey:** DGPS survey will be done for the block boundary demarcation and for all the borehole locations.

10.3. **Trenching/Pitting:** To expose the concealed glauconitic sandstone and check the K₂O content at shallow depth, trenching/pitting will be done. Around, 200 nos. of samples will be drawn from the exposed Banbiha sandstone, for analysis of 4 radicals (K₂O, SiO₂, Al₂O₃ & Fe₂O₃), for this 500 Cu.m excavation is required.

10.4. **Drilling:** The present exploration scheme is prepared by proposing 10 nos. of scout boreholes in the gap area between the GSI's Pindra North block and Chitrakoot-2 10a2b cancelled lease block, as well as in the SW extension of GSI's Pindra North block at 1600m grid, with proposed borehole depth of 50m. The vertical boreholes are planned to establish the continuity of

glauconite zones encountered in the GSI boreholes from GMP-1 to GMP-23. The boreholes will be closed judiciously by the field geologist, after encountering the panna shale formation, so that entire glauconitic sandstone is drilled. The proposed location & depth of the borehole is tentative and the final decision regarding taking up borehole, borehole location and closing of borehole will be ascertained by field geologist. Tentative location and depth of borehole have been provided for each block. Proposed Borehole parameters are tentative and may vary subject to the geological and drilling conditions in the study area.

10.5. Drill core logging: Geological core logging will be carried out systematically by recording carefully the minute details and physical/lithological characters of the rock formations including colour, core recovery, grain size, weathered zone, texture, banding, mineralogical composition, micro-structural/structural details, lithological variations along with visual estimate in respect of Potash content encountered in boreholes. As per the requirement the Rock quality designation (RQD) shall also be carried out, while logging drill cores. On the basis of these parameters, grade of glauconite can be broadly assessed and it will also be helpful in sampling/demarcating the Phosphorite zones.

10.6. Drill core sampling: For preparation of samples, the borehole core will be splitted 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 gram 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. It will generate about 200 Nos **primary samples** and 10 Nos **Internal Check samples** (5% of Primary samples). In addition to this, 10% of primary samples i.e. 20 nos **External Check samples** will be prepared as External Check samples that will be sent to NABL Lab for analysis. **Composite samples** will be prepared borehole wise based on the analytical results of primary sample at every 8m interval (8m bench height). Composite samples shall be prepared from the entire borehole in which glauconitic sandstone bands will be intersected. This will generate about 100 nos. of composite samples. Each sample should be marked at every 1m length in case of continuance of similar mineralogical

composition down the borehole. The sample length towards the floor marked by non-ore zone needs also to be adjusted as per variations of the litho-units. Even if the floor is distinctly differentiated by the presence of non-mineralized zone, at least two nos. samples after the Glauconite zone need to be drawn to mark the floor of the Glauconite zone decisively.

10.7. Chemical Analysis: All the primary samples and 5% of the Primary samples as check samples will be analyzed for 4 radicals (K_2O , SiO_2 , Al_2O_3 & Fe_2O_3). About 10% of primary samples will be sent to NABL external laboratory as check samples for analysis of 4 radicals i.e. K_2O , SiO_2 , Al_2O_3 & Fe_2O_3 . Around 20 composite samples will be analyzed for 12 radicals i.e. K_2O , Na_2O , CaO , MgO , Al_2O_3 , SiO_2 , Fe_2O_3 , SO_3 , P_2O_5 , Mn_2O_3 , TiO_2 , and LOI.

10.8. XRD Study: To know the different mineral phases, for recovery of potash, XRD study will be performed in 20 samples of glauconitic sandstone.

10.9. Determination of specific gravity: To calculate the resource, volume of the ore body need to be multiplied with a density factor. Hence, 20 nos. of samples will be drawn from the glauconitic sandstone for determination of specific gravity.

11. QUANTUM OF WORK

11.1. The following quantum of work have been proposed for preliminary level exploration for glauconitic sandstone in Pindra SW Extension block:

Sl. No.	Item of Work	Unit	Target
1	Geological Mapping (1:12500 scale)	Sq. Km	40
2	DGPS Survey for Borehole and Block Boundary fixation	Nos.	34
3	Trenching/Pitting	Cu. M	500
4	Drilling (Core)	m.	500
5	Trench Sample	Nos.	200
6	Drill core sample (Primary)	Nos.	200
7	Drill core sample (Check)	Nos.	30
8	Chemical Analysis (Trench + Primary + Check) for 4 radicals viz. K_2O , SiO_2 , Al_2O_3 & Fe_2O_3	Nos.	430
9	Chemical Analysis (Composite) for 12 radicals viz. K_2O , Na_2O , CaO , MgO , Al_2O_3 , SiO_2 , Fe_2O_3 , SO_3 , P_2O_5 , Mn_2O_3 , TiO_2 , and LOI.	Nos.	20
10	XRD Study	Nos.	20
11	Determination of Specific Gravity	Nos.	20
12	Geological Report preparaton	Nos.	1

12. TIME SCHEDULE AND ESTIMATED COST

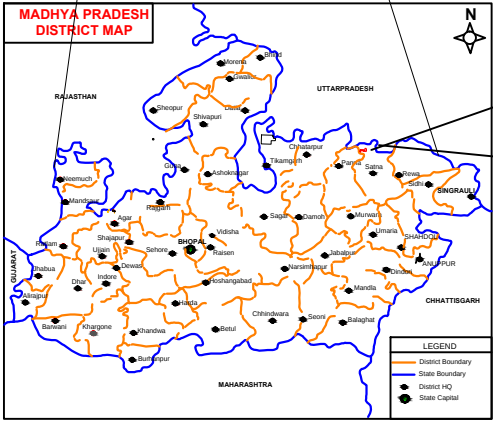
12.1. The proposed exploration programme envisages geological mapping, core drilling, sample preparation and laboratory studies, which will be completed within 10 months, geological report preparation and peer review, will take 4 months with two month overlapping with lab works. Therefore, a total of 12 months is planned for completion of the entire proposed programme.

Time Schedule for Reconnaissance Survey (G4) for Glauconitic Sandstone in Pindra SW Extension Block, Satna District, Madhya Pradesh													
S.No.	Activities	MONTHS											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Camp setting												
2	Geological mapping (1:12500 scale)												
3	Trenching/Pitting												
4	Drilling												
5	Sample preparation (Trench + Drill Core)												
6	Camp winding												
7	Analysis work												
8	Geological report												
9	Peer Review												
* Commencement of project will be reckoned from the day the exploration acreage is available along with all statutory clearances													
*Time loss on account of monsoon/agricultural activity/forest clearance/ local law & order problems will be addition to above time line.													

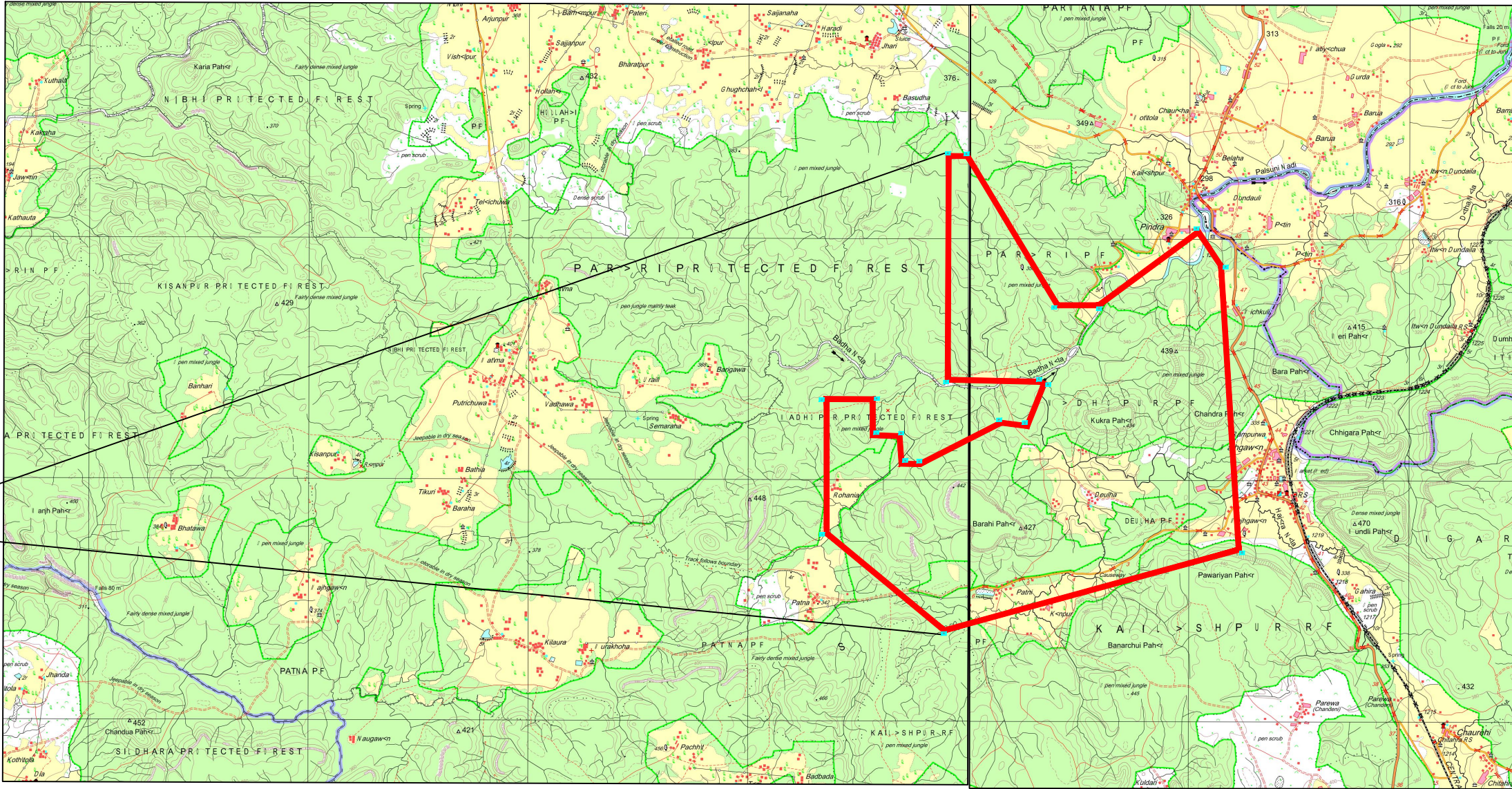
12.2. Cost has been estimated based on actual schedule of rates mandated in the circular OM No. 61/1/2018/NMET dated 31st March 2020 for NMET funded Projects. The total estimated cost is Rs. 164.27 Lakhs. The summary of cost estimates for this reconnaissance survey (G4) is given below:

Sl. No.	Item	Total Estimated Cost (Rs.)
1	Geological Mapping, Other Geological Work	1,832,880
2	Trenching/Pitting	1,665,000
3	Drilling	6,391,300
4	Labrotary studies	1,286,700
5	Geologist at HQ	540,000
	Sub Total (1 to 7)	11,715,880
6	Exploration Report Preparation	585,794
7	Proposal Preparation	246,033
8	Peer review charges	10,000
9	Sub Total (1 to 9)	12,557,707
10	GST 18%	2,260,387

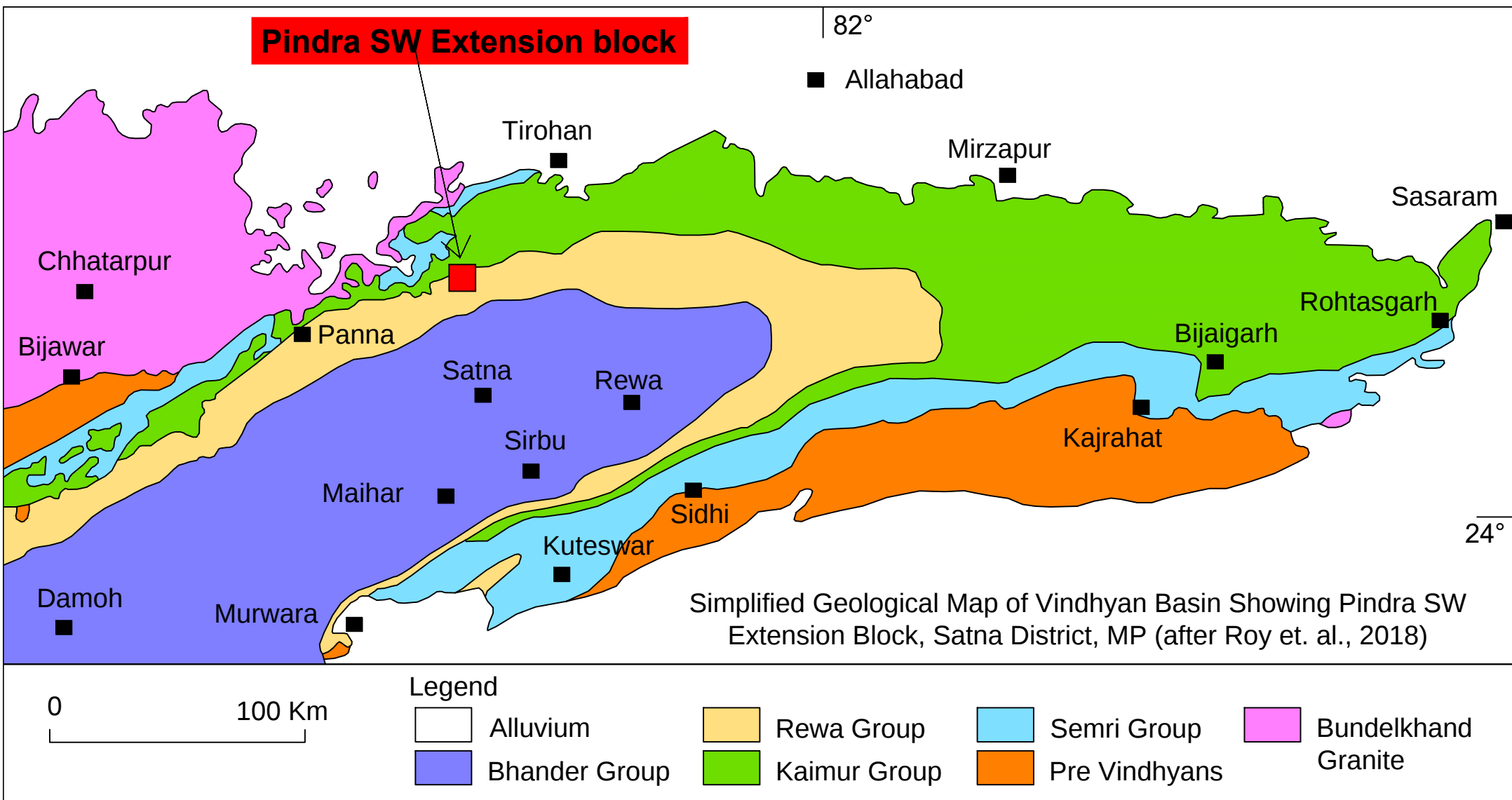
	Total:	14,818,095
	Say Rs. In Lakh	148.18



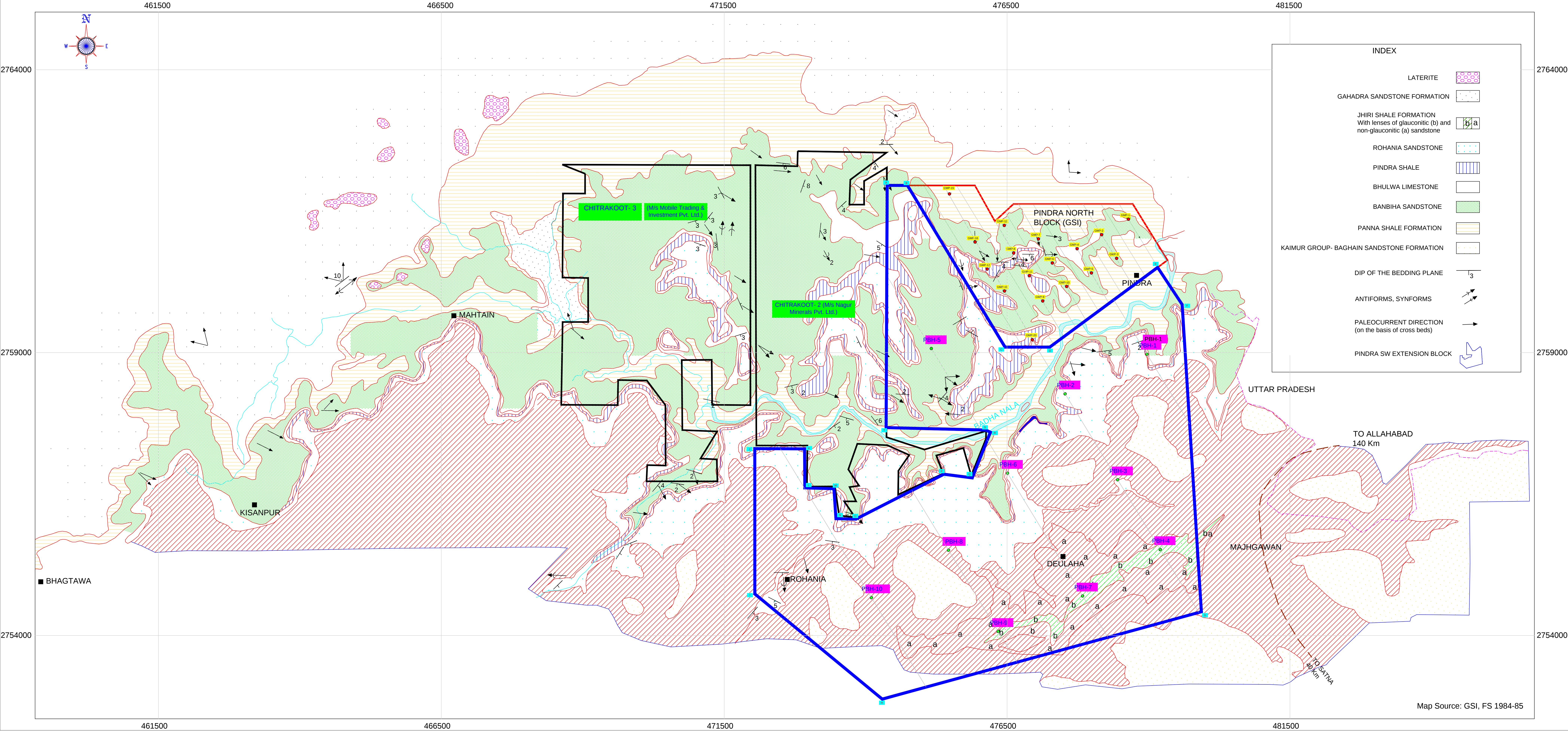
Block Corner points	UTM Zone-44 (m)		Geographic Co-ordinate WGS-84	
	Easting (m)	Northing (m)	LATITUDE	LONGITUDE
A	474380.478	2761956.806	24° 58' 21.98" N	80° 44' 46.215" E
B	474740.048	2761955.298	24° 58' 21.953" N	80° 44' 59.04" E
C	476464.003	2759097.932	24° 56' 49.154" N	80° 46' 0.704" E
D	477254.367	2759097.932	24° 56' 49.198" N	80° 46' 28.888" E
E	479164.699	2760508.072	24° 57' 35.143" N	80° 47' 36.934" E
F	479595.140	2759849.749	24° 57' 13.76" N	80° 47' 52.32" E
G	479934.350	2754419.570	24° 54' 17.23" N	80° 48' 4.7" E
H	474292.959	2752876.310	24° 53' 26.75" N	80° 44' 43.7" E
I	472041.358	2754735.405	24° 54' 27.05" N	80° 43' 23.31" E
J	472040.979	2757304.003	24° 55' 50.56" N	80° 43' 23.11" E
K	472921.348	2757299.162	24° 55' 50.46" N	80° 43' 54.5" E
L	472925.880	2756610.482	24° 55' 28.07" N	80° 43' 54.71" E
M	473439.687	2756594.714	24° 55' 27.59" N	80° 44' 13.03" E
N	473475.410	2756065.920	24° 55' 10.401" N	80° 44' 14.34" E
O	473827.687	2756057.551	24° 55' 10.15" N	80° 44' 26.9" E
P	475383.303	2756850.688	24° 55' 36.03" N	80° 45' 22.31" E
Q	475884.120	2756786.750	24° 55' 33.981" N	80° 45' 40.17" E
R	476205.540	2757593.580	24° 56' 0.23" N	80° 45' 51.58" E
S	476123.430	2757632.480	24° 56' 1.49" N	80° 45' 48.65" E
T	474362.516	2757674.409	24° 56' 2.75" N	80° 44' 45.86" E

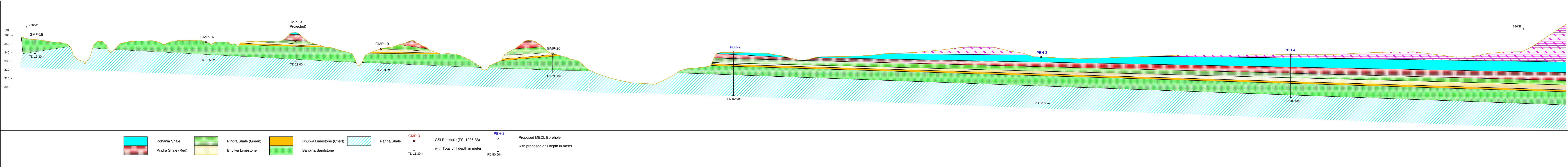


MINERAL EXPLORATION & CONSULTANCY LIMITED		
LOCATION MAP		
G4 EXPLORATION FOR GLAUCONITIC SANDSTONE IN PINDRA SW EXTENSION BLOCK		
(PART OF TOPOSHEET NO. 63D/09 and 63D/13)		
DISTRICT : SATNA	STATE : MADHYA PRADESH	
Prepared by : Exploration Division, MECL, Nagpur.	Processed at : Survey & Map section, MECL, Nagpur.	
MECL / EXPLORATION / SEP-2022	PLATE NO - I	1



GEOLOGICAL MAP OF PINDRA SW EXTENSION BLOCK, DISTRICT- SATNA, MADHYA PRADESH





Estimated cost for Reconnaissance Survey (G4) for Glauconitic Sandstone in Pindra SW Extension Block, Satna District, Madhya Pradesh Total Area - 40 Sq. Km; Completion Time - 12 Months							
Sl. No.	Item of Work	Unit	Rates as per NMET SoC 2020-21		Total Cost of the Project		Remarks
			SoC- Item- S. No.	Rates as per SoC	Qty.	Total Amount (Rs)	
1.0	Geology & Survey						
1.1	Geologist man days for Geological Mapping in 1:12500 scale (Field)/Sampling	days	1.3	11,000	120	13,20,000	
1.2	Labour Mapping (Field) (2 workers per geologist)	per worker	5.7	431	240	1,03,440	Amount will be reimburse as per the notified rates by the Central Labour Commissioner (Rs. 431/- per day) or respective State Govt. whichever is higher
1.3	Sampling man days - Sampler (Geochemical/Trenching/Pitting) Labour charge not included	day	1.5.2	5,100	60	3,06,000	
1.4	4 labours/ party (Rs 431/day/labour) (As per rates of Central Labour Commissioner) for sampling work	day	5.7	431	240	1,03,440	Amount will be reimburse as per the notified rates by the Central Labour Commissioner (Rs. 431/- per day) or respective State Govt. whichever is higher
Sub-Total 1						18,32,880	
2.0	Trenching/Pitting*						
2.1	Excavation of trenches	per cu m	2.1.1	3,330	500	16,65,000	
Sub-Total 2						16,65,000	
3.0	Drilling						
3.1	Drilling -Medium hard rock (100m to 300m)	m	2.2.1.3a	10,100	500	50,50,000	
3.2	Borehole deviation Survey	m	2.2.6	330	0	-	
3.3	Land / Crop Compansation (in case the BH falls in agreecultural Land)	per BH	5.6	20,000	10	2,00,000	
3.4	Construction of concrete Pillar (12"x12"x30")	per borehole	2.2.7a	2,000	10	20,000	
3.5	Transportation of Drill Rig & Truck associated per drill (for 1 rig)	Km	2.2.8	36	1200	43,200	1200 Km to and fro for one rig
3.6	Monthly Accomodation Charges for drilling Camp (up to 2 Rigs)	month	2.2.9	50,000	3	1,50,000	
3.7	Drilling Camp Setting Cost	Nos	2.2.9a	2,50,000	1	2,50,000	
3.8	Drilling Camp Winding up Cost	Nos	2.2.9b	2,50,000	1	2,50,000	
3.9	Road Making (Flat Terrain)	Km	2.2.10a	22,020	5	1,10,100	
3.10	Drill Core Preservation	per m	5.3	1,590	200	3,18,000	
Sub-Total 3						63,91,300	
4.0	Laboratory Studies						
4.1	Primary + Check + Trench Sample - 4 radicals viz. K ₂ O, SiO ₂ , Al ₂ O ₃ & Fe ₂ O ₃	per sample	4.1.7a	2,506	430	10,77,580	
4.2	Chemical Analysis (Composite) for 12 radicals viz. K ₂ O, Na ₂ O, CaO, MgO, Al ₂ O ₃ , SiO ₂ , Fe ₂ O ₃ , SO ₃ , P ₂ O ₅ , Mn ₂ O ₃ , TiO ₂ , and LOI.	per sample	4.1.7a	4,851	20	97,020	
4.3	Sp. Gravity determination	per sample	4.8.1	1,605	20	32,100	
4.4	XRD Study	per sample	4.5.1	4,000	20	80,000	
Sub-Total 4						12,86,700	
5.0	Geologist man days (1 No.) for geological map & Report (HQ)	days	1.2	9,000	60	5,40,000	
Total (1.0 to 5.0)						1,17,15,880	
6.0	Preparation of Exploration Proposal	Nos	5.1	2% of the cost or Rs. 3.80 lakh - whichever is lower	1	2,46,033	EA has to submit the Hard Copies and the soft copy of the final proposal along with Maps and Plan as suggested by the TCC- NMET in its meeting while clearing the proposal.

7.0	Geological Report Preparation	Nos	5.2	For the projects having cost exceeding Rs. 50 Lakhs but less than Rs. 150 Lakhs: A Minimum of Rs.2.5 lakhs or 5% of the value of work whichever is more and Rs. 3000/- per each additional copy.	1	5,85,794.00	EA has to submit the final Geological Report in Hard Copies (5 Nos) and the soft copy to NMET.
8.0	Report Peer Review Charges	lumpsum	As per EC decision		1	10,000	
Total Estimated Cost without GST						1,25,57,707	
Provision for GST (18%)						22,60,387	GST will be reimburse as per actual and as per notified prescribed rate
Total Estimated Cost with GST						1,48,18,095	
Say Rs. in Lakhs						148.18	
Note - 1. If any part of the project is outsourced, the amount will be reimbursed as per the Paragraph 3 of NMET SoC and Item no. 6 of NMET SoC. In case of execution of the project by EA on its own, a Certificate regarding non outsourcing of any component/project is required.							

Time Schedule for Reconnaissance Survey (G4) for Glauconitic Sandstone in Pindra SW Extension Block, Satna District, Madhya Pradesh

S.No.	Activities	MONTHS											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Camp setting												
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9	Peer Review												

* Commencement of project will be reckoned from the day the exploration acreage is available along with all statutory clearances

*Time loss on account of monsoon/agricultural activity/forest clearance/ local law & order problems will be addition to above time line.