RECONNAISSANCE SURVEY (G-4 EXPLORATION) FOR GRAPHITE AND ASSOCIATED MINERALISATION IN PHANDKA-GATAKHERA AREA, BETUL DISTRICT, MADHYA PRADESH

RECONNAISSANCE SURVEY (G-4 EXPLORATION)
NMEDT FUNDED

COMMODITY:
GRAPHITE AND ASSOCIATED MINERALS

BY

VARDAN ENVIRONET LLP
PLOT NO 82A, SECTOR-5 IMT MANESAR, GURGAON, HARYANA

PLACE:-GURUGRAM
DATE:-29.10.2025

Block Summary

General Information about the block

Table-1.1 Summary of the Phandka-Gatakhera Block, Betul District, Madhya Pradesh

S. No.	Features	Details
	Block ID	VAR/NMET/ME/MP/Graphite/PG/2025/01
	Exploration Agency	Vardan Environet LLP
	Commodity	Graphite and associated mineralization
	Mineral Belt	Betul Belt
	Completion Period with entire Time schedule to complete the project	10 Months
	Objective	The Present Exploration Program (G-4) is formulated based on the available regional geological data on the work carried out by GSI in and around the area; the program has the following objectives vis-à-vis proposed field components. 1) To carry out Geological mapping on 1:12,500 scale of the block (Area: 23.14 Sq.km) to delineate various litho-units and their linear/planar structural features with special attention to identify potential host rocks of Graphite and associated mineralization. 2) To carry out systematic grab/channel/grove sampling of bed rocks from the potential mineralized zones. 3) XRD, XRF, proximate analysis for graphite (i.e., moisture content, volatile matter, ash, and fixed carbon) and ICP-MS analysis of major and Trace elements of selected samples. 4) Petrographic and ore microscopic studies of possible host rock. 5) Pitting-trenching to know the continuity of host rock of selected zones and sampling. 6) Geophysical studies are to identify drilling targets

		based on preliminary reconnaissance studies and an understanding of the area's structural and lithological characteristics using Ground Magnetic, Electrical Resistivity Imaging, SP and Resistivity surveys. 7) Core Drilling, Drill Core Logging and Drill Core Sampling 8) Specific Gravity Determination of selected core samples from the mineralized zones intersected in the boreholes. 9) To assess G4 category (334) resource if any, in the Block, as per UNFC norms and Minerals (Evidence of Mineral Contents) Rules (IBM, 2003).
	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	The large-scale geological mapping (1:12,500 scale), pitting, trenching, location of boreholes, core logging, sampling and report writing will be carried out by Vardan Environet LLP. However, the Vardan Environet LLP would outsource some of specialized works viz. Geophysical work, topographic survey will be outsourced. • Chemical analysis, petrological work and geotechnical studies will be out sourced as company has MOUs with Shiva analytic Lab, Bengaluru, SCS Enviro services, Jaipur, Radhey Testing Lab, Tundla and GSI chemical lab Western region, Jaipur, Rajasthan. • Drilling work will be out sourced as company has MOUs with Khanna Associates, Delhi
	Name/ Number of Geoscientists	9 (5 in house, 2 empanelled, 2 team member)
	Expected Field days (Geology) Geological Party Days	Geologist: 180 man days for Geological Party Days: Approximately 3 months Total man days for surveyor- 50 man days
1.	**Location**	
	Latitude (N)	22°03'08.80"N

	Longitude (E)	78°07'22.80"E
	Localities	Phandka and Gatakhera villages
	Tehsil/ Taluk	Ghora Dongri
	District	Betul
	State/UT	Madhya Pradesh
2.	**Area (hectares/ square kilometers)**	
	Block Area	23.14 sq. km.
	Forest Area	14.48 sq. km (Ranipur RF) 3.32 sq. km (Ranipur PF)
	Government Land Area	Not Specified
	Private Land Area	Not Specified
3.	**Accessibility**	
	Nearest Rail Head	Ghora Dongri Station
	Road	SH 19B
	Airport	Domestic airport Bhopal
4.	**Hydrography**	
	Local Surface Drainage Pattern	Dendritic
	Rivers/ Streams	Ampani and Bhatkal
5.	**Climate**	
	Mean Annual Rainfall	1085 mm
	Temperatures	Min Temperature (December): 11˚C Max Temperature (June) : 41˚C
6.	**Topography**	
	Toposheet Number	55J/04
	Morphology of the Area	Area is represented by rugged terrain with strike ridges and valleys trending ENE- WSW to E-W
7.	**Availability of baseline geoscience data**	
	Geological Map (1:50K/25K)	Included
	Geochemical Map	Included
	Geophysical Map (Aeromagnetic, ground geophysical, Regional/local	Included

	scale GP maps)	
8.	Justification for taking up reconnaissance survey / Regional Exploration	a) The old workings for graphite from the area north of Betul, Tikari – Gauthana and Chiklar were first reported by J. Narayanmurthy (1958). The occurrence of graphite schist is confined within a narrow belt of muscovite-quartz schist, which is about 2 miles (3.2 km) x 100 ft (30 to 35 m). During FS 2012-13 prospecting for graphite was carried out in Tikari – Gauthana, and Chiklar areas and it was found that the graphite mineralisation is exposed discontinuously in the form of 3 lenticular bands disposed in en-echelon pattern over a strike length of more than 3.5 km trending ENE- WSW to NNESSW (Lenka. B & Ahmad. S A, 2012-13). b) During FS 2012-13, Lenka B and Ahmad S.A. (GSI), have carried out large scale mapping followed by detailed mapping in parts of Chiklar, Gauthana and Tikari areas. Delineated the graphite bands for a cumulative strike length of 3.5 km and the bands were divided into three segments viz, the southern (1450 m strike length), the central (550 m strike length) and the northern band (1350 m strike length). Further, Lenka B (FS 2013-14) has carried out exploration by drilling in the above said area by means of 07 boreholes in the area covering parts of the southern and central graphite bands, proving the 1.25 km strike length and estimated graphite resource of 4.73 MT. **<u>Ratipur-Chikhli-Bhopali block (GSI, FS: 2017-18)</u>** **Graphite band –I** Extends for about 1.2 Km with width varying from 4m-12m and disposed in N75E-S75W direction. **Graphite band – II** Extends for 2 km in strike length with width varying from 2m to 40 m. and disposed in N70E-S70W direction. **Graphite band- III**. Rather small but thick band

		extends for only 300m with width varying from 25 to 30m disposed with the similar strike orientation. **<u>Justification of the proposed block (Phandka-Gatakhera block)-</u>** • Proposed block lies in the strike continuity of the Explored block Rathipur-Bhopali by Geological survey of India where three bands of graphite mineralisation of 1.2 km, 2.0 km and 300 m have been established. This is important to note that the band Number One of the Rathipur block which has a strike length of 1.2 km is continuing up to the NE boundary of the GSI explored Rathipur block, hence a very high chance of the same being continuous in the proposed block exists as the same geological set up exists in the proposed area. • The same Geological milieu is continuing in the adjacent area; hence the possibility of existing graphite mineralisation exists in the proposed block. • The nature of the host; which is supra-crystals occur as lensoid enclaves within the Betul granite gneisses and the older gneisses hence always there are possibilities of the enclaves of supra crystals exists in the other areas.

Detailed Description of the block

1. Block Summary

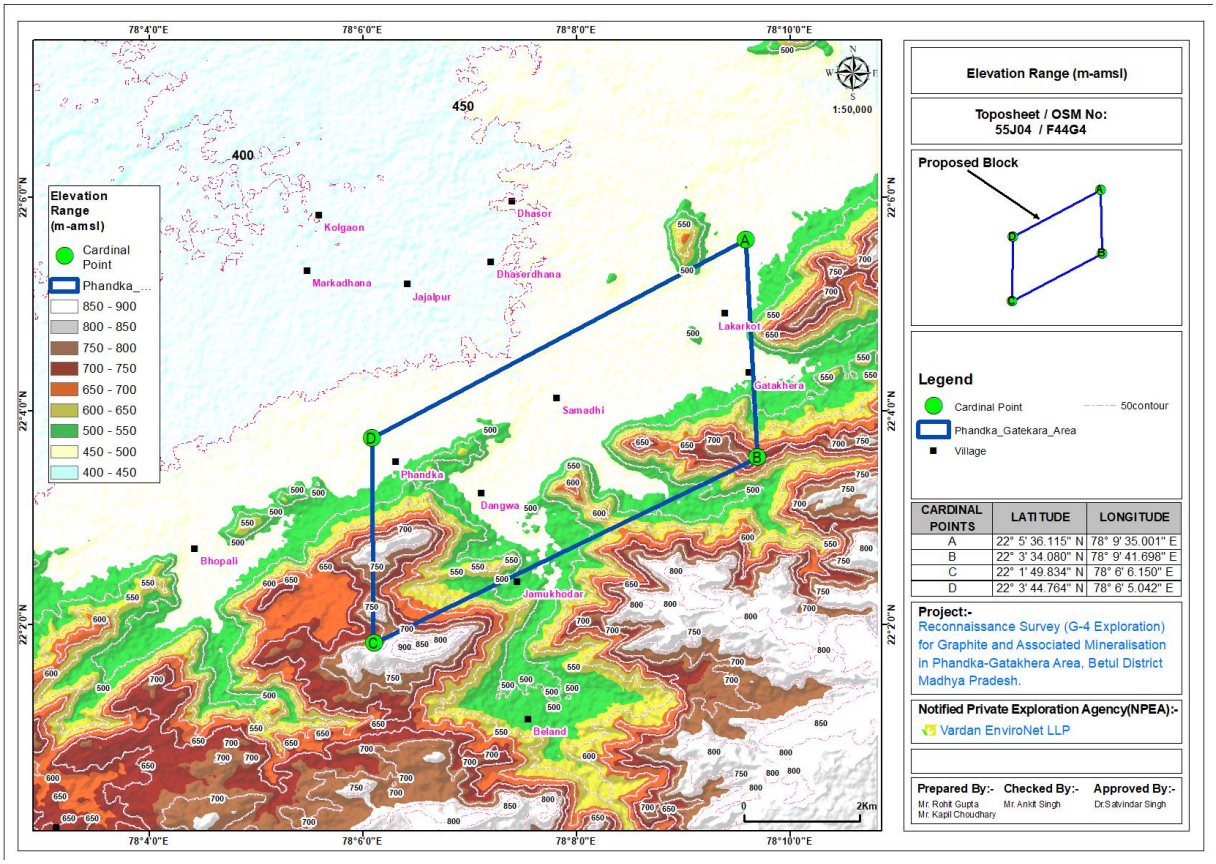
1.1 PHYSIOGRAPHY

The area represents part of Satpura Plateau touching southwestern margin of Satpura ranges which gradually acquire greater heights in the adjoining north-eastern part. The entire area, barring north central part, is represented by rugged terrain with strike ridges and valleys trending ENE-WSW to E-W. The area in the immediate vicinity of Betul town is by and large plain with some hummocks of granite/granite gneisses. The area to the north, NE & NW of Betul town is under reserve forest. The highest elevation of the study area is above 800 m near Jamukhodar village (Fig.1.1). A NE-SW trending steep linear quartzite ridge known as Sonaghati ridge forms the most prominent physiographic feature in the area. It is flanked on both sides by low lying areas with quartz-mica schist, amphibolites and gneisses. Ampani and Bhatkal are the main streams draining the area of investigation. These are tributaries of Narmada River. The drainage is mostly dendritic.

1.2 CLIMATE

The climate of Betul is fairly good. Its height above the plains and the neighbourhood of extensive forests moderates the heat and render pleasant temperature most part of the year. The area experiences a dry and temperate climate except during the south-west monsoon which sets in June and continues up to September. The summer is between March and June with maximum temperature rising up to 41˚C with May and June being the hottest months. The nights in the hot season are comparatively cool and pleasant. The average rainfall in the area is 1085 mm with heavy rain in July and August. The winter prevails from November to February with fairly cold weather with maximum temperature of 27˚C and minimum 11˚C. December and January are the coldest months when sometimes at nights mercury dips below the minimum temperature.

Fig. 1.1. DEM of the Study Area

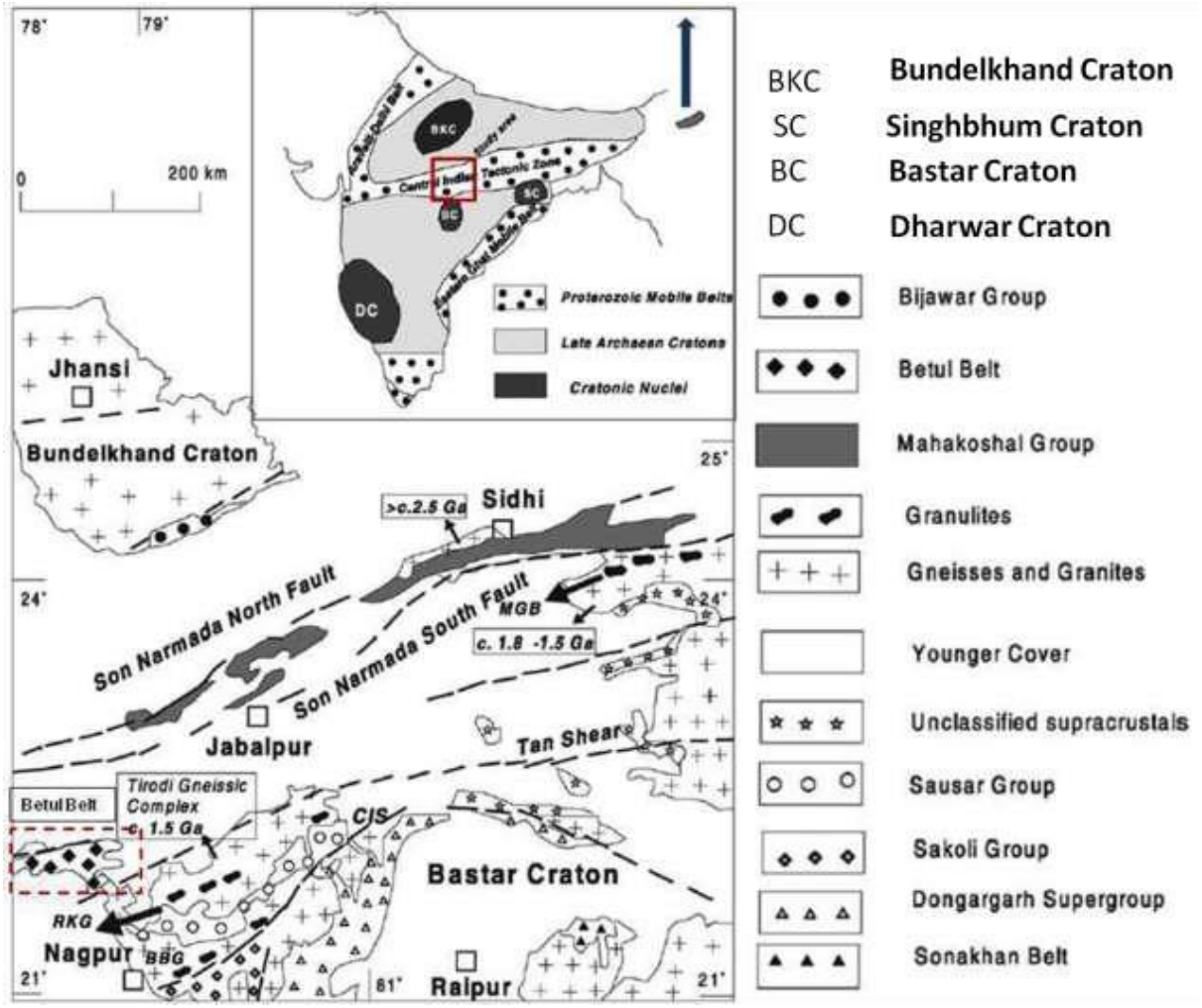


1.3 BACKGROUND GEOLOGY:-

1.3.1 REGIONAL GEOLOGY

Phandka-Gatakhera proposed block is located in the Betul-Chhindwara belt, which extends from Chhindwara in the east to Chicholi in the west in the ENE-WSW direction. The Betul belt forms a part of Central Indian Tectonic Zone (CITZ), and represents a Proterozoic mobile belt (Roy and Prasad, 2001). The Betul belt is of late Archean to Neo Proterozoic age which is bounded by two scale fault/ductile shear zones-the Son-Narmada South Fault (SNSF) in the north and Goviligarh Tan shear zone in the south. The ENE-WSW trending Betul supracrustal belt forms a conspicuous litho-tectonic unit lying between Mahakoshal belt in the north and Sausar supracrustal belt in the south, (Fig-1.2).

Fig. 1.2. Geological map showing different components of CITZ. Bundelkhand and Bastar Craton and geological setup within and near CITZ, Data from various published geological maps, after Roy et al. 2002.

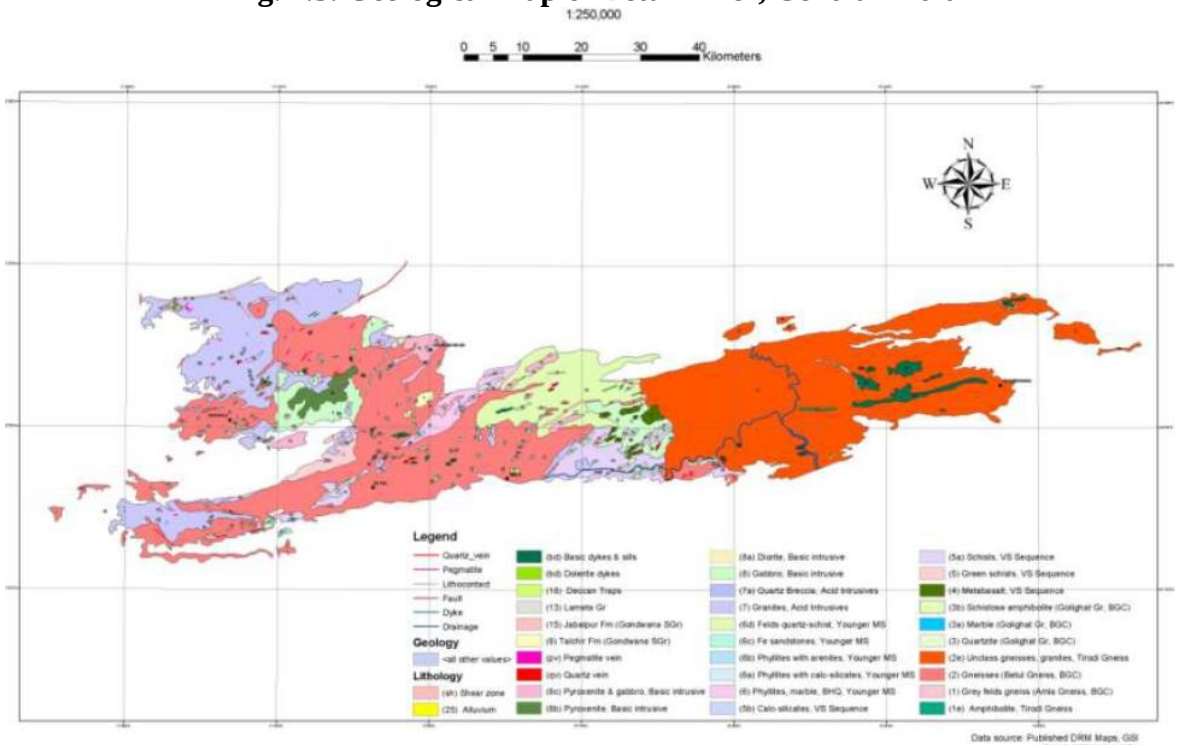


This belt extends for a length of about 135 km with an average width of 15 km from Chhindwara town in the east to Chicholi village in Betul district in the west and is composed of volcano-sedimentary rocks, intruded by mafic-ultramafic and granitic suite of rocks in that order (Srivastava and Chellani, 1995). Lithologically, the belt is more similar to the Mahakoshal supracrustals in having large volume of volcanic rocks than to the volcanic free Sausar belt. The Betul belt is surrounded by younger Gondwana sediments and Deccan Trap from three directions and through a narrow NW-SE trending corridor along Kanhan. The gneissic complex of Betul belt shows tectonic contact with the gneisses of Sausar Belt of Chhindwara district.

The litho-assemblage of the Betul belt comprises three distinct suite of rocks namely, **1) supracrustal rocks,** which include quartzites, metapelite, bimodal volcanics (basalt-rhyolite) metaexalhites, calc-silicates and BIF which show evidence for shallow water sedimentation. **2) ultramafic- mafic suite**, represented by pyroxenite– hornblende, pyroxenite – gabbro – diorite - quartz diorite association and 3**) syn to post tectonic granitic suites** (**Fig. 1.3).** The

supracrustals are hosted within the gneissic complex considered to be the basement. Due to shearing and copious granite magmatism the supracrustal rocks are disposed as disturbed sequence. The Betul belt presents a unique lithopackage in CITZ containing bimodal volcanics in general and abundant felsic volcanics in particular. The belt is traversed by a number of ENE-WSW ductile shear zones having sub vertical to steep dips towards north which were developed during deformation and shows low to medium grade metamorphism.

Fig. 1.3. Geological map of Betul Inlier, Central India



The metasedimentary / supracrustal litho association dominate the western and north western part of the belt around Sonaghati and Chicholi areas whereas the volcano sedimentary sequence dominates the eastern and central parts. The mafic-ultramafic complex crops out mainly in the western and north western part of the belt around Padhar and in the eastern part of the belt around Mordongri where it occurs in association with bimodal volcanics. Apart from these mafic-ultramafic complexes, there are several other mapable units of gabbro, pyroxenite and hornblendite which also occur in association with bimodal volcanics. Granitoids show both intrusive and tectonic contact relationship with the supracrustals and mafic-ultramafics. Several ENE-WSW trending ductile shear zones have often served as avenues for emplacement of granitic rocks.

The Palaeo-Proterozoic older metasediments/supracrustals comprising graphite schist, marble, calc- silicates, tremolite- actinolite schist and quartzites are seen only in the western and north-western part of the belt around Sonaghati and Chicholi forming high ridges. These rocks are very well foliated and occur as enclaves within older granite gneisses. Older metasediments show intense shearing and mesoscopic fold closures with axial planes trending ENE-WSW.

Granite gneisses are seen around west of Betul, Amla and Morkha. Morkha granite gneiss has been dated as 1550 ± 50 Ma by Rb-Sr method (Barganje, AMD, Nagpur-personnel communication quoted by Mahakhud et al., 2001a).

ENE-WSW trending bimodal volcano-sedimentary sequence is very well exposed in the central and eastern part of the belt stretching from Kherli Bazar in the WSW to east of Bhuyari in the ENE. In the bimodal suite of volcanics, the felsic volcanics are proportionately much more abundant than their basic counterpart. Impersistent bands of metasediments interlayered with siliceous and lithic tuff occur within these felsic volcanics. Basic volcanics in the area are represented by pillowed and non-pillowed, vesicular and amygdular metalavas.

Younger metasediments comprising phyllites, quartz-mica schist, ferruginous quartzite and banded haematite quartzite are confined in the northwestern part of the belt around Bhopali, Ranipur, Ghodadongri etc. Mafic and ultramafic suite of rocks of possible Neo- Proterozoic age occurs in the western part of Betul Belt around Padhar which comprises gabbro, pyroxenite, dunite, peridotite, serpentinite etc. The lower to middle Proterozoic metasediments have developed on a sparse scale in the area and are represented by quartzites and schist. The metasedimentaries include quartzites, calcareous quartzites, quartz mica schist, graphite schist, carbon phyllite and marble. These metasedimentaries occur as enclaves within the granite gneisses and are continuous litho units in the northern and western part of the Sonaghati ridge.

The older metasedimentaries are confined to the western part of the belt around Betul town. The granite gneiss is exposed to the west of Betul town around Amla and Morkha. The volcano-sedimentary sequence comprising bimodal volcanics and intercalations of impersistent metasediments are mainly found in Kherli Bazar-Bargaon-Banskhapa areas in central and eastern parts of the Betul belt. Younger metasediments are formed near Ghoradongri. Mafic and acid intrusives comprising gabbro/pyroxinite and granites are found throughout the belt. Younger granites from Navegaon area have been dated 850±15 ma by Rb-Sr method (Barganje, AMD, Nagpur-personnel communication quoted by Mahakhud et al., 2001 a).

Deccan Traps are exposed towards south and east, while Gondwanas border the Precambrian inliers towards west and north. Later on, the basis of the litho assemblage Chaturvedi (2001) has proposed a tectno lithostratigraphic succession of Betul belt (Table 1.2). It is as follows.

Table. 1.1. Stratigraphic succession of Betul belt (after Mahakud et al., 2000)

	Formation	Lithology
Cretaceous	Deccan Traps	Basaltic flows
Late Proterozoic	Basic intrusive/Ultrabasic	Hornbiendite/gabbro/pyroxenite
	Acid intrusives	Granites/aplite/pegmatite/quartz vein
Middle Proterozoic	Younger meta sediments	Phyllites/quartz-mica schist, ferruginous quartzite/BHQ
	Volcano sedimentary Sequence	Acid volcanics, meta rhyolite, tuff with intercalation of meta sediments like anthophyllite schist, calc silicate etc.
		Basic volcanics, pillowed and non-pillowed meta basalt
Early Proterozoic	Granitoid complex	Granite gneiss, porphyritic gneiss, pillowed meta basalt
	Older meta sediments	Graphite schist, marble, calc silicate, tremolite-actinolite schist and quartzite.
Basement not seen		

The argillaceous and arenaceous metasedimentary sequence termed as “Golighat group” which has three distinct lithological packages, i.e., the Kosmi Formation which comprises quratz mica schist, garnetiferous mica schist and interbands of actinolite tremolite-chlorite dominated basic schist and amphibolites, with a regional spread. The Temni Formation includes impure marble and calc silicates which occur as small lensoid bodies and the Sonaghati Formation representing linear ENE-WSW trending arenaceous rocks which passes through Sonaghati, 4 Km north of Betul. The rocks of Golighat Group are seen only in the western and northern part of the Betul belt around Sonaghati and Chhicholi forming high ridges.

A sequence in the Kherli Bazar area comprising metabasalt, pillow lava, komatiite, acid volcanics, rare ultramafics, intercalated thin lenses of metasediments including gamet-staurolite- fibrolite/sillimanite-gahnite bearing schist and micro granite has been termed as the Bargaon Group by Shrivastava and Chellani, 1995. Pillow lava, is best exposed between Bargaon and Tarora. Geochemically and petrographically the basic rocks are theolitic attaining spilitic character in altered zones. The acid volcanics have a sheeted appearance and occur as distinct bands. They are highly recrystallized and are massive.

In the volcaniclastics large grains of amphiboles, garnets and staurolites developed locally. At Bhawra Tekra and other places, the acid volcanics are intimately associated with anthophyllite bearing schist, which host massive lead-zinc mineralisation. The dominant metasediment is quartz-mica schist with or without garnet and staurolite. These rocks have

been intruded by hornblende rich granite, pyroxinite/gabbro, dolerite bodies occurring as sills and dykes, pegmatites and quartz veins.

Table 1.2 Tectano-litho stratigraphy of Betul belt (after Chaturvedi 2001)

DECCAN TRAPS	Basaltic lava flows and dolerite dykes
GONDWANA SUPERGROUP	Mainly sandstone, shale and conglomerates with coal seams in some areas.
Tectonic /Unconformable	
INTRUSIVES	Quartz veins, quartzofelspathic veins, Pegmatite veins. Aplitic veins pink and grey granite
PADHAR MAFIC COMPLEX	Pyroxinite, gabbro and metabasics
BHOPALI GROUP	Dolomitic limestone, Phyllitic/calc-phyllites Frruginous quartzite
INTRUSIVES	Crudely foliated granite Porphyroblastic/augen gneiss
BARGAON GROUP	Pillowed lava, basalt/apillitic/Komatite Chert rhyolite and associated volcano-clastics
GOLIGHAT GROUP	Kosmi Formation-quartz mica schist, actinolite-tremolite-chlorite schist, garnetiferrous mica schist and linear bands of graphite schist Temni Formation-Lenses of calcsilicate, marble and carbonates Sonaghati Formation- quartz calcarious quartzite, micaceous quartizites
BETUL GNEISSIC COMPLEX	Amla gneiss with interbands of schists and amphibolites representing basement

The low-grade metasediments of the Bhopali Group comprising of phyllites, dolomitic limestone, banded hematite quartzite, have a tectonic contact with Golighat Group towards south and Gondwana Supergroup towards north. The rocks of the Bhopali Group are very well exposed in Bhopali, Ranipur and Khamalpur (Raut and Mahakud, 2004). The Padhar Mafic Complex mainly comprises olivine websterite, clinopyroxenite, peridotite, norite, gabbro and varying quartz diorite with pyroxenite, being the dominant constituent.

The central and eastern part of the Betul belt, consists of a typical bimodal volcanosedimentary sequence, which includes acid and basic volcanic and impersistent metasedimentary intercalations comprising anthophyllite-cummingtonite-talc schist, calc silicates and garnetiferrous biotite-chlorite-gahnite-staurolite schist and hosts base metal minerlization

(Mahakhud 2001). However, some later workers (Praveen et.al, 2005, 2007) interpreted these metasedimentary bands as metamorphosed hydrothermally altered zones in felsic volcanic rocks. Chakraborthy et al (2009) provides a tectnostratigraphic succession of Betul belt and is as follows (Table 1.3).

According to Chakraborthy et al (2009), the basement of Betul belt is occupied by banded migmatitic gneisses termed as Amla gneiss that extends from east of Betul through Kosmi and Bhadus towards further west, along Betul-Ranipur road and south of Sonaghati ridge. They have proposed a three-fold lithostratigraphic subdivision of the Betul supracrustal rocks. The basal sequence of calc-arenite, marble, B.I.F. phyllite, metabasalt and carbonaceous phyllite being best exposed in Ranipur and Bhopali areas is termed as "Ranipur Formation". These rocks have undergone low degree of regional metamorphism with development of low-grade metamorphic minerals. This litho-assemblage, earlier shown as "Bhopali Group" as younger metasediments (Chaturvedi, 2001), was in fact exposed continuously towards WSW in Sonaghati ridge area and forms the basal sequence.

The southern margin of the basal supracrustal sequence (i.e. in the area south of Sonaghati ridge) is marked by the presence of calcareous, gritty, feldspathic quartzite (earlier termed as Temni Formation of 'Golighat Group' by Chaturvedi' 2001) which is highly tectonised and is in juxtaposition with the basement migmatitic gneiss, thereby indicating the tectonised unconformity. The migmatitic gneiss occurring as basement to the supracrustals of the Betul Group is termed as "Amla gneiss". Unconformable basement - cover relation is best exposed in the Machna River sections, NW of Bhadus. Here, the basal calcareous gritty quartzite preserve well developed graded bedding and cross-stratification, suggesting shallow water sedimentation on a sialic crust basement. The contact between Ranipur Formation and the basement gneiss is unconformable at places and faulted at other.

The lithounits of the basal "Ranipur Formation" are co-folded together and conformably overlained by the interbanded sequence of micaceous ferruginous quartzite + magnetite and quartz-mica schist/ phyllite and graphitic schist and is being termed as "Sonaghati Formation". In rest of the area, basement migmatitic gneiss i.e. Amla gneiss is having a tectonic contact with different litho units of Betul supracrustal sequence. Due to intense tectonism and profuse granitic activity along the prominent shear zones, it is difficult to work out the original lithostratigraphic succession of the Betul belt.

Table-1.3: Tectonostratigraphic succession of Betul belt
(modified after *Chakraborty et al., 2009)*

DECCAN TRAPS	Basaltic lava flows and dolerite dykes	
Intrusive contact / Disconformity		
GONDWANA SUPERGROUP	Conglomerate, sandstones, and shales	
Unconformable / Tectonic Contact		
BETUL GROUP	INTRUSIVES	Basic dykes, pegmatites, quartz veins, homophanous amphibole-mica granite, porphyritic granite
	Intrusive / Tectonic contact	
	PADHAR MAFIC – ULTRAMAFIC SUITE	Diorite, epidiorite, gabbro, norite, pyroxenite, hornblendite, websterite, harzburgite, anorthosite, diorite, talc – serpentinite rock, quartz – epidote rock
	Intrusive / Tectonic contact	
	SONAGHATI FORMATION	Intercalated sequence of quartzite, quartz-mica schist and graphite schist
	Conformable / Tectonic contact	
	BARGAON FORMATION	Meta-sediments (mica schists), meta-rhyolite and felsic metatuff, metabasalt and amphibole – chlorite schist
	Conformable / Tectonic contact	
	RANIPUR FORMATION	Phyllite, banded hematite / magnetite quartzite, BIF, granulite, meta-basalt, amphibolites, carbonaceous phyllites, calcareous quartzite, calc-silicates, marble
Un-conformable / Tectonic contact		
AMLA GNEISS	BASEMENT ROCK	Banded migmatite gneiss, quartzofeldspathic mica schist /gneiss

In the central part of Betul Belt around Bargaon, Muariya and Kherlibazar, bimodal volcanosedimentary lithoassemblage of meta-rhyollite and meta basalt as volcanic components with minor intercalations of meta tuff and metapelite known as “Bargaon Formation” are exposed. The litho-assemblage of Bargaon Formation is not in contact with the lithounits of Ranipur Formation and Sonaghati Formation but are separated from each other by syn to post kinematic intrusive granites along prominent ductile shear zones. They have tentatively kept the stratigraphic position of Bargaon Formaton in between the Ranipur Formation and Sonaghati Formation. The impersistent intercalations of metafelsic and metabasic tuff along with the metapelites are noted within the bimodal litho-assemblage of Bargaon Formation. Metamorphic minerals like garnet, staurolite, andalusite and sillimanite are also developed in metafelsic tuff. Amphibole and garnet bearing rocks in the mineralised zone is interpreted as metamorphosed exhalites. It is presumed that zinc-copper mineralization in this belt is syngenetic exhalative

type. Basic volcanics in the area are represented by pillowed and non-pillowed, vesicular and amygdular metabasalt and the acid volcanic rocks are represented by metarhyolite and felsic metatuff. In addition, metasediments are also associated with the Bargaon Formation. Metabasalt occurs as elliptical outcrops, often standing out as ridges with the long axis of the ellipse parallel to the direction of dominant foliation of the area.

The metabasalt shows well developed pillow structure at several locations but best developed in the hill near Tarora. The pillows have semicircular to elliptical cross section and are stacked one above the other. Megascopically, the acid volcanic rocks are medium grained, intensely deformed and metamorphosed. The dominant constituent minerals are quartz, feldspar, muscovite and occasionally garnet. The rock is generally massive but with the increase of muscovite, it becomes schistose at places. Pyroclastic material of varying sizes is often noticed in the acid volcanics. The bimodal volcano- sedimentary sequence is traversed by intrusives viz, quartz- vein, gabbro and amphibolite dykes.

The Sonaghati Formation extends as a linear ridge in NE-SW direction from SW of Pangra via Sonaghati towards Ranipur. Another major outcrop of the formation extends in a NNE direction from east of Padhar through south of Arjongondi. Isolated outcrops are also seen as patches resting over the basement Amla gneiss. The continuation of these has been disrupted at places by a major fault occurring in the area. Quartzite being a resistant and dominant rock forms a prominent strike ridge all along.

Apart from these major metasedimentary litho units, several small detached exposures of granulitic B.I.F., calc-silicate marble and amphibolite (possibly belonging to the basal Ranipur Formation) along with basement migmatitic gneiss occur as enclaves in the mafic-ultramafic complex and intrusive granites.

Large intrusive bodies of pyroxenite, gabbro, diorite and foliated mafic-ultramafics exposed around Padhar, Gajpur and at several places within the Betul belt have been termed as Padhar Mafic Complex. The mafic-Ultramafic complex, which covers an area of about 160 sq.km, occurs in the western and north western parts of the Betul belt (Roy and Chakraborti, 2008). A number of amphibolites to granulite facies supracrustal enclaves are recorded within the complex. Another mafic-ultramafic complex is also seen within the bimodal litho-assemblage of Bargaon Formation in the eastern part of the Betul belt. The mafic-ultramafic complex outcrop in an area of nearly 5 X 4 km towards south of Mordongri village. Several dykes related to this complex are also found towards west. Besides these, small exposures of gabbro,

pyroxenite and hornblendite are also seen within the bimodal lithoassemblage of Bargaon Formation.

Granitoid rocks in the area show both intrusive as well as tectonic contact relationship with the basement gneiss, supracrustal rocks and the mafic-ultramafic rocks. Syn-to post tectonic, prophyritic to homophanous granites were emplaced along several ENE-WSW trending ductile shear zones. Due to intense shearing and copious granitic magmatism, the supracrustal litho-assemblage of Betul belt occur as dismembered sequences within the granitic host. Two major varieties of granitoid rocks are recognized viz., coarsely crystalline porphyritic granite which is mostly porphyroclastic, strongly foliated and mylonitic along the shear zones and homophanous amphibole mica granite (± garnet ± allanite). Apart from these granitoids, tourmaline mica pegmatite, quartz veins and dolerites of different generations intrudes almost all the rock types of Betul belt.

1.3.2 GEOLOGY & PETROLOGY OF PROPOSED BLOCK

Geologically, the area exposes graphite bearing quartz – muscovite-biotite-sericite chlorite schist, flanked on the east by discontinuously exposed quartzite and amphibolites whereas the western contact is defined by continuous occurrence of granite gneiss. In the southern part, the western contact of quartz-sericite-muscovite schist and granite gneisses are marked by discontinuously exposed various small and large pegmatite bodies. Besides, a number of silicified zones are found within the quartz- sericite- muscovite schist

1.3.2.1 Granite gneisses

Granite gneisses occur as a major litho unit along the western contact of quartz – sericite-muscovite-schist. The variants include pink porphyroblastic gneisses, homophanous pink biotite gneisses and quartzo feldspathic gneisses. The rocks are medium to coarse grained, grey, whitish grey, pinkish grey and well foliated which is defined by parallel arrangement of feldspars and flakes of biotite. At places, the gneissosity is highly obliterated due to the effect of shearing otherwise showing development of strong foliation. The foliation in the rocks is NE-SW with 50^{o} to sub vertical dips due NW or SE.

1.3.2.2 Quartz- sericite- muscovite- biotite-chlorite schist

Quartz-sericite-muscovite-biotite-chlorite schist is a prominent unit among the older metasediments and occurs as a continuous band in the mapped area for the entire strike length. Quartz-mica-schist, the host lithology for graphite rests over the gneisses roughly aligned in ENE-WSW, with dips varying in amount and direction due to intense folding in the area. The

western contact of quartz sericite-muscovite-biotite schist is largely defined by discontinuously exposed small and large pegmatite bodies. The contact between schist and gneisses is largely defined by intrusion of pegmatite.

1.3.2.3 Graphite schist

Graphite schist occurs within the quartz-sericite-muscovite-biotite schist in the form of 3 lenticular bodies disposed in en-echelon pattern over a strike length of 3.5 km. The width of the graphite bearing zone varies from 5 m to 135 m as depicted in the detailed map of the southern graphite band. The graphite schist mainly comprises of small flakes of steel grey graphite mixed intimately with muscovite flakes and ash grey powdery material. The foliation planes are well defined by compactly packed flakes of mica and graphite. Prominent concordant veinlets of quartzo-felspathic material and siliceous partings are well recorded in graphite-schist. The graphite bodies are mostly sub vertical to vertical, however shallower dips are also observed in the area of folding.

1.3.2.4 Quartzite

Quartzite helps in building the structural history of the metasedimentaries, primary and secondary structures are well preserved within the quartzites. In the northeastern part, at places the sheared quartzite occurs as caught up patch within schists. This sheared quartzite band is exposed as a discontinuous lithounit in the southern band and as more or less continuous lithounit in the central band with an exposed width of less than 5 m to a maximum of 20 m. Thick bedded quartzite is particularly the characteristic of the top linear part of the entire Sonaghati ridge.

1.3.2.5 Amphibolite

Amphibolite occurs as thin linear bodies almost throughout the area and disposed parallel or sub parallel to regional foliation assuming concordant relationship with the rocks, exposed over a length of nearly 3.5 km with width varying from 80-120 m in NE SW direction. In general, these amphibolites are greenish to dark green in colour, medium grained and show development of foliation parallel to the foliation of the host rock. Two sets of foliations are prominent in amphibolites, one ENE-WSW and another in NE-SW direction, with varying dips both towards NW & SE.

1.3.2.6 Quartz veins

Quartz veins of various generations are emplaced in NNE-SSW direction. These veins are emplaced parallel to S1 as well as S2 foliations and also cutting across these two. The thinner quartz veins are emplaced parallel to the foliations, and the thicker quartz veins are confined to a very well-defined zone.

1.3.2.6 Pegmatites

Pegmatites are composed of quartz, feldspar, muscovite and biotite with little development of garnet in the pegmatite within the schist. Numerous large and small pegmatite bodies have been emplaced in the southwestern part of the area, mainly in the mica schists and granite gneisses with sharp contacts. The pegmatite veins/bodies occur more or less parallel to the regional strike of the rocks in NE-SW direction with a concordant relationship with the granitic and schistose rocks.

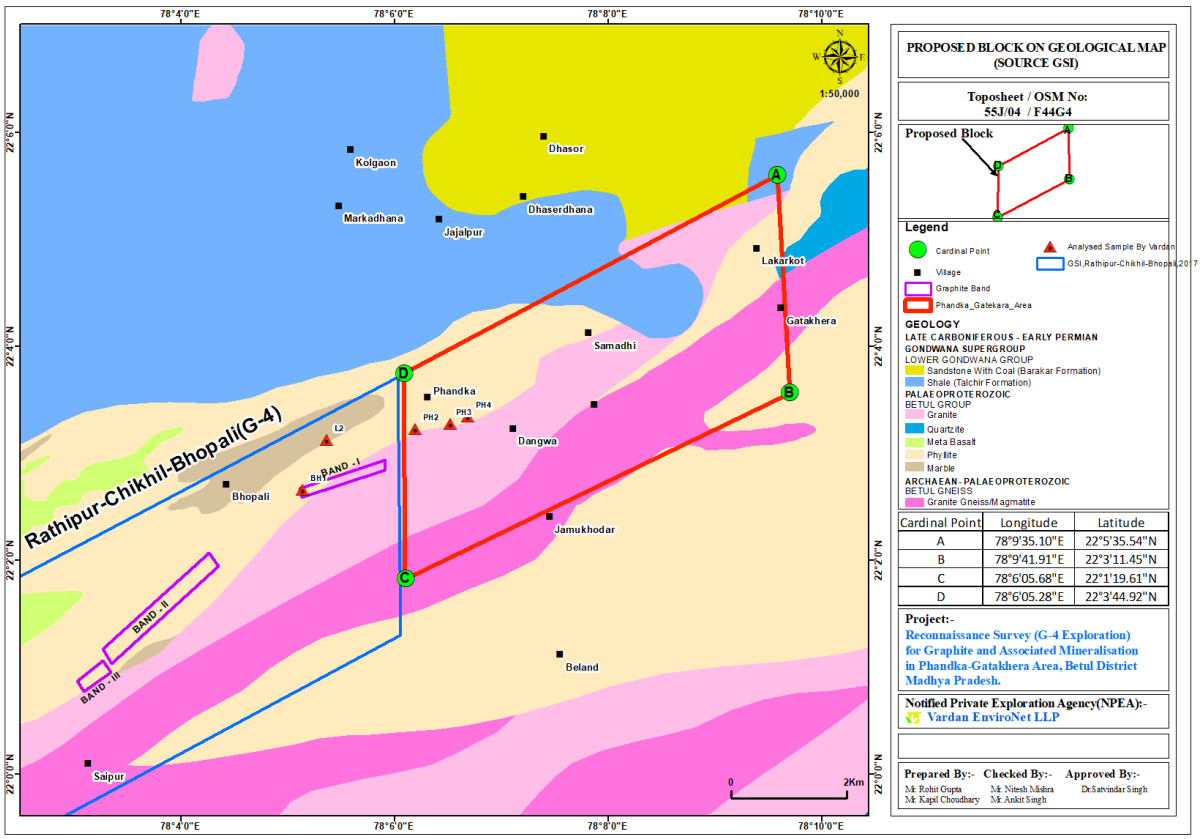
1.3.3 Metamorphism and structural fabric in the area

Polyphase deformation in the Betul supracrustal rocks has been accompanied by corresponding metamorphism in order to make adjustment of mineral assemblages with changed temperature and pressure conditions. Metasedimentary rocks of the area represent the western part of the Betul inlier, which is highly deformed and regionally metamorphosed. Presence of various mineral assemblages suggest that the rocks have experienced regional metamorphism which is syn-tectonic to F1 deformation and is confined to upper green schist facies except in marginal areas, where calcareous metasediments close to granitoid/shear zones are thermally metamorphosed to calc silicate hornfelses. Widespread occurrence of Quartz + Orthoclase + Microcline + Muscovite + Biotite + Plagioclase + Perthite + Apatite + Zircon in the basement banded migmatite gneisses, Quartz + Plagioclase +Muscovite + Sericite + Chlorite + Feldspar + Calcite + Diopside + Epidote + Garnet + Sphene + Apatite Tremolite + Wollastonite + Opaques and Carbonate in the metasedimetaries of the Ranipur Formation and Quartz + Muscovite + Sericite + Opaques + Feldspar + Garnet+ Calcite+ Graphite in the meta-sedimentaries of the Sonaghati Formations is an indicative of a regional metamorphism of upper green schist facies to amphibolite facies Betul belt in Central India is located between Son-Narmada and Tapti lineaments which trend roughly ENE-WSW. Primary structures in the area are well preserved by quartzites and are represented by colour banding defined by alternate pink, grey and greyish white bands and compositional banding defined by alternate siliceous and ferruginous bands. Bedding is preserved at few places but schistosity (S1) is prominent in quartz-mica schist, where S1 is defined by the parallel alignment of the mica flakes, developed due to tight, isoclinal folding of the first generation (F1). The rocks of the area show NNE-SSW strike and dips towards WNW in the northern part and ESE in the southern part.

The predominant dip direction is northerly except in the southern part, which is probably due to development of a regional antiformal structure. The supracrustal of Betul belt show evidences of polyphase deformation producing folds of at least three generations (F1, F2 & F3) with contemporaneous shearing of gradually decreasing intensity accompanied by a gradual shift in the direction of compressive strain from ENE-WSW to N-S.

On the basis of the attitude F1 folds can be categorised as moderately plunging, vertical to steeply inclined and upright folds (Parihar, et.al 1992). In macroscopic scale the Sonaghati ridge actually comprises two coalesced limbs of an almost upright synformal structure of this generation. In mesoscopic scale F1 folds are observed on either limb of this macroscopic fold in quartz-micaschist. The second generation (F2) folds are not common in this area and are developed locally. They are observed only on mesoscopic scale with folding up to S2 foliation. The F2 folds are tight isoclinals and chevron hinged.

Fig.:-1.4 Proposed block on Geological map



The axial plane of these folds shows variation in trend from NE SW to NW-SE. Large numbers of shear zones, ranging in magnitude from few meters to several km long and few cms to about 200 m wide have been observed in the area. These shear zones are strike parallel to regional schistocity / gneissocity and are related to more than one episode of deformation, i.e. related to progressive stages of deformations.

1.4.0 MINERAL POTENTIALITY OF THE BLOCK

The Betul belt is a known geological milieu for its volcanic hosted massive sulphides, to the geological community. Due to its complex tectono lithostratigraphy, structure and potentiality for mineralization related to acid magmatism in the western part, tungsten mineralization and molybdenum, niobium and tantalum anomalous values have been reported whereas in the northern part Padhar mafic-ultramfic and in the eastern part Mordongri ultramafic complex show promise for PGE, Ni, Co, Cr and Cu mineralization as there are reports of occurrence of the mineralization by various workers in this suite of rocks.

1.4.0 SCOPE OF THE PRESENT EXPLORATION:-

Phase I (Approximately 3 to 4 months):

For the total block area, fertility assessment will be performed by geological mapping (1:12,500 scale) and identification of host rock and surface evidence of mineralisation. This will lead to an area reduction.

Phase II (Approximately 4 to 8 months):

This phase will consist of 600 m core drilling in 6 boreholes and thereafter the chemical and petrographic analysis of the core samples. Core drilling will help to identify and characterise potential mineralized zones/ore bodies.

Decision points:

The exploration strategy incorporates the GO-NO GO milestones to be collaboratively decided between the Vardan Environet LLP, State of Rajasthan and the NMET based on the results of the on-going phases. Total duration of the work plan is 10 months. The exploration plan incorporates one decision point.

2. PREVIOUS WORK

The occurrence of Graphite dated back to 1958 but no subsequent prospecting/exploration was ever planned till Shri Lenka B. and S. A. Ahmad carried out prospecting for Graphite in Chiklar-Gauthana-Tikari areas, Betul district, M.P. The prospecting work has revealed the presence of significant mineralisation of Graphite contained in the supra crustal rocks of proterozoic age. P.K. Raut and Meherotra (FS 1991-92) has reported the presence of graphite in the supracrustal of Betul belt in Golighat and Junewani area. Based on the reported occurrence, Lenka while carrying out the G2 stage investigation for graphite has carried out recconoitery traverse in Golighat and Junewani area for generation of G4 stage proposal. The surface manifestations of graphite mineralization in the area are in the form of few old pits and mine dumps. It has also been observed that graphite being hosted within the quartz mica schist has a contrast in the appearance of soil colour than the surrounding areas. In Golighat area, the surface manifestation occurs only in the form of few insect burrowings with limited surface exposures and blackening of the surface soil.

2.1.0 Geophysical Exploration

Geophysical mapping on 1:50,000 scale in toposheet no. 55 G/13, have been carried out by Prasad, K.N. et.al during FS 2013-14. Elliptical shaped gravity high aligned in the NE SW direction has been observed. This moderate gravity indicates presence of medium density bodies and two elliptical shape gravity lows has been observed on either side of moderate gravity values. These may be due to felsic intrusion of granitic rock within the Betul group of rocks. GSI during 2015-16 carried out integrated geophysical surveys employing SP, magnetic (VF) and IP cum resistivity methods in Tikari-Gauthana-Chiklar area, Betul district, MP for delineation of graphite mineralization in the area and to indicate the continuity and to provide an initial estimate of size, shape, structure in the area. Geophysical surveys are carried out for the southern and central graphite band and the geological, geophysical corners and borehole points were covered by DGPS survey by the geophysicist. Traverses were laid on the baseline which was at an angle of N55^{o}E at 200 m interval.

SP surveys have brought out low variation which may be attributed to formational/ compositional changes/near surface exposure of graphite. High SP values are seen in the southern side which may be due to exposed pegmatites / gneisses. Magnetic survey has delineated structural / lithological contacts which are significant to understand lithological disposition and sub-surface structures in the study area. The southern zone shows a bipolar body which indicates a lithological contact (amphibolites/pegmatite) and the prominent

magnetic low on eastern side may be due to shallow causative body. Magnetic survey has delineated structural / lithological contacts which are significant to understand lithological disposition and sub-surface structures in the study area.

The southern zone shows a bipolar body which indicate a lithological contact (amphibolites/pegmatite) and the prominent magnetic low on eastern side may be due to shallow causative body. While, IP / resistivity surveys have delineated host rock and graphite on the basis of resistivity and chargeability and well corroborated with magnetic contour patterns.

3. BLOCK DESCRIPTION WITH BOUNDARY COORDINATES / FIELD VISIT LOCATIONS WITH COORDINATES

Table-3.1. Block boundary coordinates

CARDINAL POINTS	LATITUDE	LONGITUDE
A	22° 5' 36.115" N	78° 9' 35.001" E
B	22° 3' 34.080" N	78° 9' 41.698" E
C	22° 1' 49.834" N	78° 6' 6.150" E
D	22° 3' 44.764" N	78° 6' 5.042" E

3.0.1 RECONNOITRE WORK

The reconnoitre field work for two days has been carried out in the proposed block area by Vardan Environet LLP. The litho units observed in the area are Granite, Gneiss, Phyllite, Graphite Schist, Carbonaceous Phyllite, Dolomite and Marble of Betul group. Bed rock samples from different litho units were collected. Collected bed rock samples were submitted to Vardan Envirolab LLP, Gurgram for chemical analysis. The results are appended in Annexure-IV. Out of four Samples collected by Vardan Environet LLP team (June, 2025) from the area sample indicated encouraging value of 7-9% FC and 500 to 1400 ppm of Pb.

Table-3.2. Field visit Co-ordinates of Reconnoitre Survey

Point	Sample	Location	Longitude	Latitude	Analysis	Lithology
L1	BH-1	Near Bhopali, Along the nala section	78°05'08.10" E	22°02'39.30"N	Proximate analysis, base metal & La Series	N80°E, vertical dip due to intense folding, graphite band exposed in nala Lithology- Top of hill-Granite and Gneiss, Foothill- Phyllite, Graphite schist, Carbonaceous Phyllite
L2	-	Near Bhopali	78°05'21.50" E	22°03'07.20" N		Quartz Vein exposed, Dolomite, Marble
L3	PH-2	In Between Bhopali & Phandka, along the nala section	78°05'45.40" E	22°03'10.50"N	Proximate analysis, base metal & La Series	Boulders of Graphite were observed
L4	PH-3	Near Phandka	78°06'31.00" E	22°03'16.30"N	Proximate analysis, base metal & La Series	Small boulder of Carbonaceous Schist in Nala Section
L5	PH-4	Near Phandka	78°06'34.70" E	22° 3' 17.10" N	Proximate analysis, base metal & La Series	Graphite boulder on road cuttings, thin bands of 3 – 4 m, N30°W/S30°E, nearly vertical dipping

4. PLANNED METHODOLOGY AND EXPLORATION TASK FLOW

The proposed exploration program is meticulously designed in accordance with the objectives outlined for Preliminary surveys (G-4) as stipulated in the Minerals (Evidence of Mineral Contents) Rule-2015 and Minerals (Evidence of Mineral Contents) Amendment Rules-2021. This comprehensive methodology encompasses several interrelated components; each aimed at establishing a detailed understanding of the geological and mineral potential of the area under investigation.

4.1.0 Detailed Geological Mapping

Geological mapping is a foundational need of any exploration program. Mapping will be conducted over a specified area of 23.14 km² on 1:12,500 scale. The detailed mapping will involve:

Litho-unit Identification: The identification and characterization of various litho-units present in the area will be a key focus. This will include noting their mineralogical composition, physical properties, and distribution patterns.

Contact Relationships: The relationships between different litho-units, including their contacts and interactions, will be meticulously documented. Understanding these relationships is crucial for assessing mineralization potential.

Textural and Structural Analysis: The textural characteristics (e.g., grain size, shape, and arrangement) and structural features (e.g., folding, faulting) of the geological formations will be mapped. These elements are significant in understanding the geological history and potential for mineral deposits.

Surface Manifestations: Any visible surface manifestations of mineralization, such as veins, outcrops, and other geological indicators, will be carefully marked on the geological map. Their spatial disposition and distribution patterns will be analysed to identify prospective areas for further investigation.

4.2.0 Sampling and Analysis

4.2.1 Bed Rock:

During the geological mapping phase, a targeted approach will be employed to collect bed rock samples from outcrops that exhibit signs of mineralization. Key indicators include the presence of metal-oxides/sulphides, shearing, brecciation, oxidation, silicification, ferruginization, and other alteration features. Samples analysed for assay of Graphite and associated mineralization in the area. A total of 25 bed rock samples will be collected systematically from identified locations using chip, groove or channel sampling techniques. These samples will be prepared for laboratory analysis for **Graphite and associated mineralization** in the area. Additionally, to ensure the reliability and accuracy of the results, 3 check samples will be included in the analytical batch. These will consist of both internal duplicates and external standards.

4.2.2 Trench/Pit Sampling:

To further investigate mineralized zones, a total of 200 cubic meters of trenching will be executed across approximately 10 trenches (dimensions: 10m x 1m x 2m) strategically located identified Mineralised zones. In conjunction with trenching, a total of 20 cubic meters of pitting will be executed, involving 10 pits with dimensions of 2m x 1m x 1m each. The trench walls will be mapped on 1:200 scale.

From this trenching/pit activity, approximately 100 Graphite samples will be generated and analysed, which is well-established for determining mineral content. To bolster the reliability of these results, 10 samples will be designated as check samples.

4.2.3 Core Sampling:

200 core samples (0.50 m length) will be collected from mineralised part from drilled boreholes. The 200 nos. of samples will be analysed by XRD, AAS & ICPMS for base metal & REE

analysis and proximate analysis of Graphite. To ensure the quality and accuracy of the results, 20 additional check samples will also be collected. About 15 core samples collected for specific gravity determination.

4.2.4 Geochemical and Lab Analysis

At the G4 level of mineral exploration, we're undertaking an extensive program involving approximately 358 samples (including check samples). The aim is to analyse these samples for their Graphite content and associated minerals and selected samples for Au. This will help identifying the mineralised zone and resource estimation.

4.3.0 Surveying:

The block boundary will be surveyed by DGPS and total station in WGS-84 datum for demarcation of proposed area boundary points. Survey party will also carry out surface features, contouring in the proposed area and associated with Geological/Geophysical activities for taking up locations of Geophysical station/line marking, outcrop, Pitting/ Trenching, channel sample collection for taking up the location of sample points and plotting it on the map for proper interpretation of the sample data. Further, during the drilling programme, the survey party will carry out borehole fixation and determination of reduced level and co-ordinates of the boreholes.

4.4.0 Ground Geophysical Survey:

Ground geophysical surveys like Self-Potential (SP), Magnetic, Induced polarization and Electromagnetic methods are the best tools to delineate graphite deposits. Initially, SP and Magnetic methods surveys are the best methods for delineation of graphite deposits. Based on the results of SP and Magnetic surveys IP surveys can be carried out in the potential zones.

Proposing SP surveys of 30lkm with 10m/20m station interval, Magnetic survey in 30lkm totalling about 1500 stations (200m line interval and 20m station interval) and 20line km of IP survey. Approximate time period to conduct the survey will be around 3 months (2 months for acquiring data and 1 month for processing and interpretation).

4.5.0 Core drilling:

Based on the results of surface exploration such as geological mapping, geophysical & geochemical survey and pitting/ trenching in an area of 23.14 sq.km., scout boreholes shall be drilled in targeted mineralized zone to find out the continuity of mineralized zones in strike & dip direction and to assess the attitude of the subsurface disposition of the Graphite bodies. To find out the continuity of mineralized zones in strike & dip direction, six (6 nos.) boreholes shall

be drilled over the mineralised zone along the strike and dip direction to prove the mineralization if any. Total drilling meterage of 600m, taking the average depth of borehole as 100 m. The azimuth and angle of inclination of the proposed boreholes will be decided once the attitude (strike & dip) of mineralized zones (host rock) is deciphered after geological mapping.

4.6.0. Petrological Studies

Petrological studies are integral to understanding the mineralogical characteristics of the litho-units. During the geological mapping phase:

- A total of 10 samples will be selected from various litho-units for detailed petrographic analysis. This will involve examining thin sections under a microscope to ascertain the mineral composition and texture.

- Additionally, 10 samples will undergo polished section analysis (Mineralographic studies) to explore the assemblages of metal oxide/sulphide minerals present. The focus will be on understanding their distribution, alteration processes, and potential for economic mineralization.

4.7.0. Remote Sensing and Data Analysis

Remote sensing techniques will be leveraged to augment the geological mapping efforts:

- A comprehensive remote sensing study will be conducted over the entire 23.14 sq. km area to identify key geological features such as lineaments, lithological contacts, and other structural elements. This analysis will help in delineating mineral potential zones.

- Multispectral imaging and Digital Elevation Model (DEM) data will be utilized to enhance geological interpretations and provide a spatial context for surface and subsurface features.

4.8.0. Final Report Submission

Upon completion of the exploration activities, a detailed final report will be compiled, encompassing the following key components:

- **Identification of Targets for G3 Stage**: The report will outline specific targets for further exploration at the G3 stage, focusing on additional ore bodies that show potential for economic viability. -

Comprehensive Data Analysis: A thorough analysis and interpretation of the geochemical, geological, and petrological data collected during the survey will be presented, highlighting significant findings and implications.

- **Recommendations for Further Exploration**: Based on the findings, the report will provide actionable recommendations for subsequent exploration phases, ensuring a strategic approach to resource assessment and potential development.

This structured and multifaceted methodology aims to ensure a comprehensive understanding of the mineral potential of the area, paving the way for informed decision-making in future exploration and development initiatives.

Fig.-4. Planned Methodology and Exploration task flow

1.Lithological Mapping (1:12,500), Sampling, Mineralogy, Geochemistry

Outcome:- Identification of Mineralisation, Structural framework study, Lithology and Ore Minerals and zeroing down the area for detailed Geophysical studies.

2. Geophysical Survey

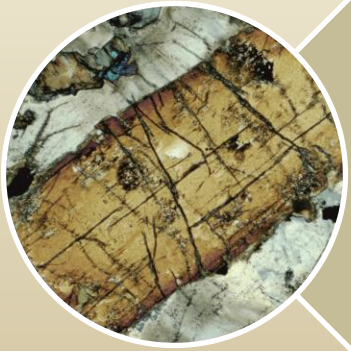
[SP, Magnetic, IP & Imaging]

Outcome:- Identification of prospective zones for detail studies, defining drilling targets.

3. Drilling, Core Sampling, Metal assay

[6 BH, Each BH 100 m depth]

Outcome:- Identification Of Mineralized Zone, evaluation of mineral resources



4. Petrography and Whole rock and Trace Element Assay

Outcome: -

- 1.Vector to additional target.
- 2. Identification Mineralisation Zone
- 3. Characterisation of Mineralised zones and Report with recommendation

5. NATURE QUANTUM AND TARGET

A table containing the NQT is given in Annexure I.

6. MANPOWER DEPLOYMENT

A table containing the manpower deployment table is given in Annexure II.

7. SUMMARY EXPENDITURE

The summary expenditure for each phase is given in Annexure III.

8. BREAKUP OF EXPENDITURE

The breakup expenditure for each phase is given in Annexure IV.

9. TIMELINE

TIME SCHEDULE/ACTION PLAN													
S.N.	Activities	Unit	Months										
			1	2	3	4	Review	5	6	7	8	9	10	Total
1.	Geologist Party days (HQ)	day												50
2.	Geologist Party days (Field)	day												180
3.	Sampling Party days	day												60
4.	Geophysical work	day												50
5.	Drilling	day												90
6.	Petrographic Studies	Nos.												15
7.	Geochemical Studies	Nos.												358
8.	Geological Work (pitting, trenching,	m^3												220
9.	Report Writing	day												30
10.	Peer Review	day												30

NOTE	
A.	Commencement of project may be reckoned from the day the exploration acreage is available along with all statutory clearances.
B.	Time loss on account of monsoon/agricultural activity/forest clearance / local law & order problem/ lockdown etc will be additional to above time line.

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ANNEXURE -I

NQT TABLE FOR RECONNAISSANCE SURVEY (G-4 EXPLORATION) FOR GRAPHITE AND ASSOCIATED MINERALISATION IN PHANDKA-GATAKHERA AREA, BETUL DISTRICT, MADHYA PRADESH				
Area: 23.14 sq. km		**No. of BH: 6** **Each Borehole depth range- 100 m**		**Schedule timeline- 10 Months** **Review: After: 4 & 8 Months**
S.N.	**Item of Work**	**Quantum**	**Target**	**Remarks**
1.	**Geological Work**			
A.	**Geological Mapping (Scale 1:12,500) & sampling**			
a	Satellite Imageries	Per imageries		As per actuals
b.	Geologists (HQ) days (1 No)	60 days		Report writing, Multispectral and DEM data analysis, etc.
d.	Geologist field-days (2 No. geologists)	180 days	Identification of anomalous mineralized zones for detailed characterization	Geological Mapping on 1:12,500 Scale, core logging, sampling, supervision of trenching and pitting
e.	Labour (Field days) (2 workers per geologist, i.e. Total 4 No.)	360 days		
B.	**Survey work**			
a.	Surveyor	10 day		For Topographic Survey, geophysical station marking, BH fixation and Boundary Point Marking
b.	Labours (Field days) (4 workers per survey, i.e. Total 4 No.)	0 days		
c	Demarcation of block boundary & Boreholes	10		
C.	**Trenching/Pitting**			
a.	Trenching	100 cu.m		
b.	Pitting	0		
D	**Sample preparation**			
a	Sampler charges	66 man day		
b	Labour charges for sampling (4 labour per sampler)	264 man days		

2.	**Geochemical Sampling**			
a.	Bed rock sampling (Nos.)	30		
b.	Trench/pit sampling (Nos.)	110		
c.	Core sampling (Nos.)	220		
3.	**Geophysical Survey-Outsource**			
a.	Magnetic Surveys (10-30 line km)	0		Profile Interval of 200m with 20m station interval of 30-line km totalling to 1500 stations
b.	Self-Potential (SP) survey (8-20 line km)	30 Line Km		
c.	Induced Polarisation (Dople-Dipole) (10-20 Line Km) n=10	0		Cover thickness map, predictive geological and predictive structural map to be generated after IP survey
d.	Borehole Geophysical logging	600 m		
e.	Expert Geophysicist (HQ)	10 day		
f.	Expert Geophysicist (Field Monitoring)	0		
4	**Core Drilling (600 m/ 6 BH)-Outsource**			
a.	Drilling (600 m / 6 BH)	600 m	To identify subsurface lithology	No. of samples = 220
b.	Borehole deviation survey by Multi shot camera	600 m		
	Sub Total :- 6			
5.	**Laboratory Study-Outsource**			
a.	XRF for whole rock analysis major oxides(including check sample)	248 Nos.	Fertility assessment and target selection	BRS (25), Core (100), Trench (100), Check (23)
b.	REE by ICPMS (including check sample)	28 Nos.		BRS (5), Core (10), Trench/pit (10), Check (3)
c.	Proximate Analysis of Graphite (including check sample)	248 Nos.		BRS (25), Core (100), Trench (100)
d.	XRD (including check sample)	28 Nos.		BRS (5), Core (10), Trench (10)
6.	**Petrological studies**			
a.	Study of polished section for petrography	10 Nos	Fertility assessment and target selection	
7.	**Exploration Proposal**	**5 hard copy**		
8.	**Geological Report Preparation**	**5 hard copy**		

ANNEXURE -II

SUMMARY EXPENDITURE FOR RECONNAISSANCE SURVEY (G-4 EXPLORATION) FOR GRAPHITE AND ASSOCIATED MINERALISATION IN PHANDKA-GATAKHERA AREA, BETUL DISTRICT, MADHYA PRADESH		
Sl. No	**Item**	**Estimated Cost in INR**
1.	Geological Mapping (1:12,500) and Other Geological Work	₹ 26,24,760
2.	Survey work	₹ 7,15,200
3.	Trenching/Pitting	₹ 7,42,000
4.	Sample Preparation	₹ 3,70,920
5.	Geophysical Survey-Outsource	₹ 63,75,941
6.	Core Drilling- Outsource	₹ 77,71,500
7.	Laboratory Study- Outsource	₹ 26,25,815
8.	Petrological studies- Outsource	₹ 98,955
9	**Total (Sno.1 to 8)**	**₹ 2,13,25,091**
10.	Preparation of Exploration Proposal	₹ 3,80,000
11.	Geological Report Preparation	₹ 7,50,000
12.	Tender Processing Cost	₹ 4,26,502
13.	Operation Charges	₹ 12,18,611
14.	Peer Review charge	₹ 30,000
15.	**Total (Sno.9 to 14)**	**₹ 2,41,30,204**
16.	Add GST @ 18%	₹ 43,43,437
17.	**Grand Total Including GST**	**₹ 2,84,73,641**
	Say Rs. In Lakh	**₹ Two Hundred Eighty-Four Lakh Seventy-Three Thousand Six Hundred Forty One only**

ANNEXURE -III

Annexure 8A

Estimated Cost for Reconnaissance Survey (G-4 Exploration) for Graphite and Associated Mineralisation in Phandka-Gatakhera Area, Betul District, Madhya Pradesh Area: 23.17 sq. km, No.of BH: 6, Each Borehole depth range- 100 m, Schedule timeline- 10 Months , Review: After: 4 & 8 Months

Exploration Agnecy : Vardan Environet Llp

Sl.No.	Item of Work	SoC Sr. No.	Units	Qty	Cost per unit/ per day/ manday (In Rs.)	Total Amount (In Rs.)	Remarks
1	**Geological Mapping (Scale 1:12,500)**						
a.	Satellite Imageries	1.1a	Per Imageries				As per Actuals
b.	Geologists (HQ) days (1 No) [Multispectral and DEM data analysis]	1.1b	Per day	0	9,000.00	0.00	
c.	Geologists (HQ) days(1 No)	1.2a	Mandays	60	9,000.00	5,40,000.00	
d.	Charges of Geologist (field)	1.2b	Mandays	180	11,000.00	19,80,000.00	Geological Mapping on 1:12,500 Scale, core logging, sampling (BRS & Core), supervision of trenching and pitting
e.	Labour Charges (2 Helper for each geo)	5.7	Mandays	360	541.00	1,94,760.00	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
	Sub Total :- 1					**27,14,760.00**	
2	**Survey work**						

a.	Charges of Surveyor	1.6.1b	Per day	10	8,300.00	83,000.00	For Toporaphic Survey, geophysical station marking, BH fixation and Boundary Point Marking
b.	Labours Charges for survey work	5.7	Per day	0	541.00	0.00	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
c.	Demarcation of block boundary & boreholes	1.6.2	Per point	10	19,200.00	1,92,000.00	6 BHs and 4 boundary coordinates
	Sub Total :- 2					**2,75,000.00**	
3	**Trenching/Pitting**						
a.	Trenching	2.1.1	cu.m	100	3,330.00	3,33,000.00	
b.	Pitting	2.1.2	cu.m	0	3,800.00	0.00	
	Sub Total :- 3					**3,33,000.00**	
4	**Sample Preparation**						
a.	Sampler charges for Sample processing work	1.5.2	Mandays	66	5,100.00	3,36,600.00	
b.	Labour(Field days)(2workers per sampler)	5.7	Mandays	264	541.00	1,42,824.00	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
	Sub Total :- 4					**4,79,424.00**	
5	**Geophysical Survey-Outsource**						
a.	Magnetic Surveys (10-30 line km)	3.2a	Per station	0	0.00	0.00	Profile Interval of 200m with 20m station interval of 30 line km totalling to 1500 stations

b.	Self-Potential (SP) survey (8-20 line km)	3.3a	Line Km	30	29,600.00	8,88,000.00	
c.	Induced Polarisation (Dople-Dipole) (10-20 Line Km) n=10	3.4a	Line Km	0	0.00	0.00	Cover thickness map , predictive geological and predictive structural map to be generated after IP survey
d.	Borehole Geophysical logging	3.12	m	1	10,88,941.00	10,88,941.00	
e.	Expert Charges for Geophysicist (HQ)	3.18	Per day	10	9,000.00	90,000.00	
f.	Expert Charges for Geophysicist (Field Monitoring)	3.19	Per day	0	11,000.00	0.00	
	Sub Total :- 5					**20,66,941.00**	
6	**Core Drilling (600 m/ 6 BH)-Outsource**						
a.	Drilling (HQ Size Core) (6 BH)(Hard Rock), 120m	2.2.4a	Per m	0	13,800.00	0.00	
b.	Drilling (NQ Size Core) (6 BH)(Hard Rock of <300m), 600 m	2.2.1.4a	Per m	600	11,500.00	69,00,000.00	
c.	Drill Core Preservation	5.3	Per m	250	1,590.00	3,97,500.00	This amount will be reimbursed after successful delivery of the cores to concerned libraries/authorities
d.	Borehole deviation survey by Multi shot camera	2.2.6	Per m	600	330.00	1,98,000.00	
	Sub Total :- 6					**74,95,500.00**	
7	**Laboratory Study**						
a.	Bed Rock samples+ Core Samples+ trench samples by XRF for whole rock analysis- Major Oxides	4.1.15a	Nos	225	4,200.00	9,45,000.00	BRS - 25. Trench- 100 Core - 100
	External Check 10%	4.1.15a	Nos	23	4,200.00	96,600.00	

b.	Bed Rock samples by ICPMS- REE (14 REE elements package) {Bed Rock samples+ Core Samples+ trench samples}	4.1.13	Nos	25	5,380.00	1,34,500.00	Trench-10, BRS-05, CORE- 10
	External Check 10%	4.1.13	Nos	3	5,380.00	16,140.00	
c.	Proximate Analysis of Graphite	4.1.16	Nos.	225	3,000.00	6,75,000.00	BRS - 25. Trench- 100 Core - 100
	External Check 10%	4.1.16	Nos.	23	3,000.00	69,000.00	
d.	Bed Rock samples by XRD	4.5.1	Nos.	25	4,000.00	1,00,000.00	Trench-10, BRS-05, CORE- 10
7.2	**Drill Core Samples**						
b.	Drill core samples by AAS (Cu, Pb, Zn, Ni, Co)	4.1.7a	Nos	100	2,506.00	2,50,600.00	
	External Check 10%	4.1.7a	Nos	10	2,506.00	25,060.00	
c.	Drill core samples by AAS (V)	4.1.7b	Nos	100	335.00	33,500.00	
	External Check 10%	4.1.7b	Nos	10	335.00	3,350.00	
h.	Density	4.8.3	Nos	10	1,568.00	15,680.00	
	Sub Total :- 7					**23,64,430.00**	
8	**Petrological studies- Outsource**						
c.	Preparation of polished section	4.3.2	Nos	10	1,549.00	15,490.00	
d.	Complete petrographic /ore microscopic study/mineragraphic report of rock sample	4.3.4	Nos	10	4,232.00	42,320.00	
e.	Digital photomicrograph of thin polished	4.3.7	Nos	15	280.00	4,200.00	
	Sub Total :-8					**62,010.00**	

	Total (Sno.1 to 8)					**1,57,91,065.00**	
9	**Preparation of Exploration Proposal**	**5.1**	One Number (5 Hard copies) along with soft copy	**2% of approval project cost or 5 Lakh whichever is lower**		**3,15,821.30**	
a.	**Geological Report Preparation**	**5.2(ii)**	Cost per 5 Hard copies of report along with soft copy	iii) Reconnaissance Survey/ Preliminary exploration/General exploration/Detailed exploration exceeding ₹150 lakh but less than 300 lakh: A Minimum of ₹7.5 lakh or 3% of the work whichever is more and ₹3000/- per each additional copy.		**7,89,553.25**	
b.	**Tender Processing Cost**	**2.3**	One time, in case of outsourced component(s) of project work	2% of the approved project cost or 5 lakh whichever is lower will be paid one time to Exploration Agency		1,77,538.82	For the outsourced component (Rs.8,88,000+Rs.10,88941+Rs.69,00,000/= 88,76,941)

c.	**Operational Charges**	**6(iii)**				**7,90,770.58**	In case of total outsourced cost more than ₹50 lakh up to ₹1 crore: Cost for outsourced component(s) of project work will be reimbursed as per actuals. In addition, ₹5 lakh plus 7.5 percent on the balance amount of outsourced cost in excess of ₹50 lakh will be paid to Exploration Agency towards operational charges. The operational charges will be calculated on the cost of total outsourced component or certified actual payment made by the Exploration Agency, whichever is lower.
10	**Peer Review charge**	**As per EC**				**₹ 30,000**	
	Grand Total					**₹ 1,78,94,749**	
	Add GST @ 18%				**18%**	**₹ 32,21,055**	
	Grand Total Including GST					**₹ 2,11,15,804**	
	Rs in Lakh					**₹ 211**	
Note:							
1	**Strict adherence to the Ministry of Finance's and GFR guidelines is mandatory. Every transaction must adhere to GFR rule 21.**						
2	**In case of delay/non- performance, the appropriate action will be taken by competent authority against delinquent agency as per prevailing govt. of India rules/guidelines on procurement.**						
3	**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 NEA on its own, a Certificate regarding non outsourcing of any component/project is required.**						
4	**Necessary efforts should be made to minimize any adverse impact on the environment during exploration activities.**						
5	**Any item of work not mentioned above shall be added as per SoC.**						
6	**All the Geological Reports and data are to be uploaded on NGDR as per MERT template by the agency.**						

ANNEXURE -IV

Vardan Envirolab LLP
Laboratory: Plot No. 82A, Sector - 5, IMT Manesar, Gurugram - 122051 (HR)
ISO 9001 | ISO 14001 | ISO 45001

Test Report

Sample Number : VEL/OM/01
Name & Address of the Party : M/s Vardan Environet LLP
Department Mineral Exploration, Plot No. 82A, Sec-5, IMT Manesar, Gurugram-122051, Haryana.

Report No. : VEL/OM/2506120001
Format No : 7.8 F-03
Party Reference No : By mail
Reporting Date : 17/06/2025
Period of Analysis : 12/06/2025-17/06/2025
Receipt Date : 12/06/2025
Sampling Date : 12/06/2025
Sampling Quantity : 25 Gram
Sampling Type : Grab
Packing Status : Temp. Sealed

Name of Sample : Graphite Ore
Sample Group : Ores & Minerals
Location : BH-1
Sample Given By : Mineral Exploration Department
Environmental Condition : 25±2°C
Parameter Required : As Per Work Order
Sampling and Analysis Protocol : IS & STP

S.No	Test Parameters	Test Method	Results	Units
Discipline : Chemical				
1	Ash	IS:1350(P-1)RA:2007	86.86	%
2	Fixed Carbon	IS:1350(P-I)RA:2007	7.97	%
3	Nickel (as Ni)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	41.59	mg/kg
4	Zinc (as Zn)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	401.18	mg/kg
5	Lead (as Pb)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	1417.04	mg/kg
6	Arsenic (as As)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	43.19	mg/kg
7	Cadmium (as Cd)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	BLQ(LOQ-0.1)	mg/kg
8	Mercury (as Hg)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	BLQ(LOQ-0.1)	mg/kg
9	Moisture	IS:1350(P-I)RA:2007	0.64	%
10	Volatile Matter	IS:1350(P-I)RA:2007	4.53	%
11	Lanthanum	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	19.47	mg/kg

Reviewed By

Authorized Signatory

Vardan Envirolab LLP
Laboratory: Plot No. 82A, Sector - 5, IMT Manesar, Gurugram - 122051 (HR)
ISO 9001 | ISO 14001 | ISO 45001

Test Report

Sample Number : VEL/OM/01 Report No. : VEL/OM/2506120001

S.No	Test Parameters	Test Method	Results	Units
12	Cerium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	26.80	mg/kg
13	Praseodymium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	3.72	mg/kg
14	Neodymium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	13.47	mg/kg
15	Gold (as Au)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	BLQ(LOQ-0.1)	mg/kg
16	Samarium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	2.80	mg/kg
17	Europium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	0.59	mg/kg
18	Gadolinium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	3.51	mg/kg
19	Terbium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	0.64	mg/kg
20	Dysprosium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	4.84	mg/kg
21	Holmium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	1.15	mg/kg
22	Erbium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	3.51	mg/kg
23	Thulium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	0.45	mg/kg
24	Ytterbium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	2.76	mg/kg
25	Lutetium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	0.42	mg/kg
26	Vanadium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	480.35	mg/kg

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• Laboratory is not responsible for the authenticity of photocopied test report. The test samples will be retained only for specific period
• The report no. with Suffix A-Amended Report.
• This test report will not be used for publicity or advertising or media purpose without prior written permission on the laboratory.
• Giving opinions does not imply endorsement of the tested sample by the lab. Under no circumstances, the lab accepts any liability caused by the use or misuse of the test report.

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Laboratory: Plot No. 82A, Sector - 5, IMT Manesar, Gurugram - 122051 (HR)
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Test Report

Sample Number : VEL/OM/02
Name & Address of the Party : M/s Vardan Environet LLP
Department Mineral Exploration, Plot No. 82A, Sec-5, IMT Manesar, Gurugram-122051, Haryana.

Name of Sample : Coal Sample
Sample Group : Ores & Minerals
Location : PH-2
Sample Given By : Mineral Exploration Department
Environmental Condition : 25±2°C
Parameter Required : As Per Work Order
Sampling and Analysis Protocol : IS & STP

Report No. : VEL/OM/2506120002
Format No : 7.8 F-03
Party Reference No : By mail
Reporting Date : 17/06/2025
Period of Analysis : 12/06/2025-17/06/2025
Receipt Date : 12/06/2025
Sampling Date : 12/06/2025
Sampling Quantity : 25 Gram
Sampling Type : Grab
Packing Status : Temp. Sealed

S.No	Test Parameters	Test Method	Results	Units
Discipline : Chemical				
1	Ash	IS:1350(P-1)RA:2007	86.37	%
2	Fixed Carbon	IS:1350(P-I)RA:2007	9.12	%
3	Nickel (as Ni)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	26.90	mg/kg
4	Zinc (as Zn)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	159.75	mg/kg
5	Lead (as Pb)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	523.48	mg/kg
6	Arsenic (as As)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	20.72	mg/kg
7	Cadmium (as Cd)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	BLQ(LOQ-0.1)	mg/kg
8	Mercury (as Hg)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	BLQ(LOQ-0.1)	mg/kg
9	Moisture	IS:1350(P-I)RA:2007	0.73	%
10	Volatile Matter	IS:1350(P-I)RA:2007	3.78	%
11	Lanthanum	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	18.04	mg/kg

Reviewed By

Authorized Signatory

Vardan Envirolab LLP
Laboratory: Plot No. 82A, Sector - 5, IMT Manesar, Gurugram - 122051 (HR)
ISO 9001 | ISO 14001 | ISO 45001

Test Report

Sample Number : VEL/OM/02 **Report No.** : VEL/OM/2506120002

S.No	Test Parameters	Test Method	Results	Units
12	Cerium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	26.43	mg/kg
13	Praseodymium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	3.52	mg/kg
14	Neodymium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	12.58	mg/kg
15	Gold (as Au)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	BLQ(LOQ-0.1)	mg/kg
16	Samarium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	2.53	mg/kg
17	Europium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	0.52	mg/kg
18	Gadolinium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	2.79	mg/kg
19	Terbium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	0.47	mg/kg
20	Dysprosium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	3.02	mg/kg
21	Holmium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	0.68	mg/kg
22	Erbium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	2.01	mg/kg
23	Thulium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	0.27	mg/kg
24	Ytterbium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	1.71	mg/kg
25	Lutetium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	0.26	mg/kg
26	Vanadium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	178.96	mg/kg

Reviewed By

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- The report no. with Suffix A-Amended Report.
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Test Report

Sample Number : VEL/OM/03

Name & Address of the Party : M/s Vardan Environet LLP
Department Mineral Exploration, Plot No. 82A, Sec-5, IMT Manesar, Gurugram-122051, Haryana.

Name of Sample : **Graphite Ore**
Sample Group : Ores & Minerals
Location : PH-3
Sample Given By : Mineral Exploration Department
Environmental Condition : 25±2°C
Parameter Required : As Per Work Order
Sampling and Analysis Protocol : IS & STP

Report No. : VEL/SF/2506120003
Format No : 7.8 F-03
Party Reference No : By mail
Reporting Date : 17/06/2025
Period of Analysis : 12/06/2025-17/06/2025
Receipt Date : 12/06/2025
Sampling Date : 12/06/2025
Sampling Quantity : 25 Gram
Sampling Type : Grab
Packing Status : Temp. Sealed

S.No	Test Parameters	Test Method	Results	Units
Discipline : Chemical				
1	Ash	IS:1350(P-1)RA:2007	86.15	%
2	Fixed Carbon	IS:1350(P-I)RA:2007	8.29	%
3	Nickel (as Ni)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	26.44	mg/kg
4	Zinc (as Zn)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	164.06	mg/kg
5	Lead (as Pb)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	507.86	mg/kg
6	Arsenic (as As)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	20.38	mg/kg
7	Cadmium (as Cd)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	BLQ(LOQ-0.1)	mg/kg
8	Mercury (as Hg)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	BLQ(LOQ-0.1)	mg/kg
9	Moisture	IS:1350(P-I)RA:2007	0.72	%
10	Volatile Matter	IS:1350(P-I)RA:2007	4.84	%
11	Lanthanum	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	17.71	mg/kg

Reviewed By

Authorized Signatory

Vardan Envirolab LLP
Laboratory: Plot No. 82A, Sector - 5, IMT Manesar, Gurugram - 122051 (HR)
ISO 9001 | ISO 14001 | ISO 45001

Test Report

Sample Number : VEL/OM/03 **Report No.** : VEL/SF/2506120003

S.No	Test Parameters	Test Method	Results	Units
12	Cerium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	26.42	mg/kg
13	Praseodymium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	3.53	mg/kg
14	Neodymium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	12.63	mg/kg
15	Gold (as Au)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	BLQ(LOQ-0.1)	mg/kg
16	Samarium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	2.53	mg/kg
17	Europium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	0.53	mg/kg
18	Gadolinium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	2.78	mg/kg
19	Terbium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	0.47	mg/kg
20	Dysprosium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	3.01	mg/kg
21	Holmium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	0.68	mg/kg
22	Erbium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	2.01	mg/kg
23	Thulium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	0.28	mg/kg
24	Ytterbium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	1.72	mg/kg
25	Lutetium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	0.26	mg/kg
26	Vanadium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	201.53	mg/kg

Reviewed By

Authorized Signatory

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- Laboratory is not responsible for the authenticity of photocopied test report. The test samples will be retained only for specific period
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- Giving opinions does not imply endorsement of the tested sample by the lab. Under no circumstances, the lab accepts any liability caused by the use or misuse of the test report.

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Vardan Envirolab LLP
Laboratory: Plot No. 82A, Sector - 5, IMT Manesar, Gurugram - 122051 (HR)
ISO 9001 | ISO 14001 | ISO 45001

Test Report

Sample Number : VEL/OM/04
Name & Address of the Party : M/s Vardan Environet LLP
Department Mineral Exploration, Plot No. 82A, Sec-5, IMT Manesar, Gurugram-122051, Haryana.

Name of Sample : Graphite Ore
Sample Group : Ores & Minerals
Location : PH-4
Sample Given By : Mineral Exploration Department
Environmental Condition : 25±2°C
Parameter Required : As Per Work Order
Sampling and Analysis Protocol : IS & STP

Report No. : VEL/OM/2506120004
Format No : 7.8 F-03
Party Reference No : By mail
Reporting Date : 17/06/2025
Period of Analysis : 12/06/2025-17/06/2025
Receipt Date : 12/06/2025
Sampling Date : 12/06/2025
Sampling Quantity : 25 Gram
Sampling Type : Grab
Packing Status : Temp. Sealed

S.No	Test Parameters	Test Method	Results	Units
Discipline : Chemical				
1	Ash	IS:1350(P-1)RA:2007	86.74	%
2	Fixed Carbon	IS:1350(P-I)RA:2007	8.75	%
3	Nickel (as Ni)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	37.42	mg/kg
4	Zinc (as Zn)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	350.88	mg/kg
5	Lead (as Pb)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	1284.73	mg/kg
6	Arsenic (as As)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	39.01	mg/kg
7	Cadmium (as Cd)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	BLQ(LOQ-0.1)	mg/kg
8	Mercury (as Hg)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	BLQ(LOQ-0.1)	mg/kg
9	Moisture	IS:1350(P-I)RA:2007	0.63	%
10	Volatile Matter	IS:1350(P-I)RA:2007	3.88	%
11	Lanthanum	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	17.85	mg/kg

Reviewed By

Authorized Signatory

Vardan Envirolab LLP
Laboratory: Plot No. 82A, Sector - 5, IMT Manesar, Gurugram - 122051 (HR)
ISO 9001 | ISO 14001 | ISO 45001

Test Report

Sample Number : VEL/OM/04 Report No. : VEL/OM/2506120004

S.No	Test Parameters	Test Method	Results	Units
12	Cerium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	24.38	mg/kg
13	Praseodymium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	3.40	mg/kg
14	Neodymium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	12.33	mg/kg
15	Gold (as Au)	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	BLQ(LOQ-0.1)	mg/kg
16	Samarium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	2.55	mg/kg
17	Europium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	0.54	mg/kg
18	Gadolinium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	3.25	mg/kg
19	Terbium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	0.59	mg/kg
20	Dysprosium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	4.45	mg/kg
21	Holmium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	1.07	mg/kg
22	Erbium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	3.24	mg/kg
23	Thulium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	0.41	mg/kg
24	Ytterbium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	2.50	mg/kg
25	Lutetium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	0.38	mg/kg
26	Vanadium	VEL/HW/STP/03 Issue No:-01 , Issue date 01/11/2023	367.10	mg/kg

Reviewed By

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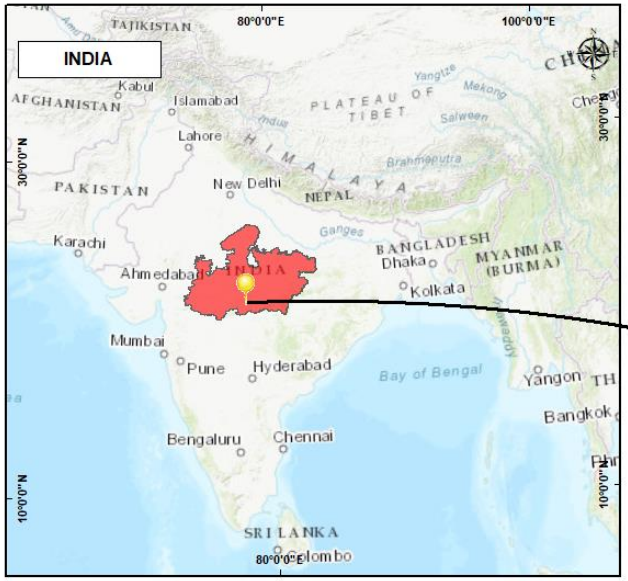
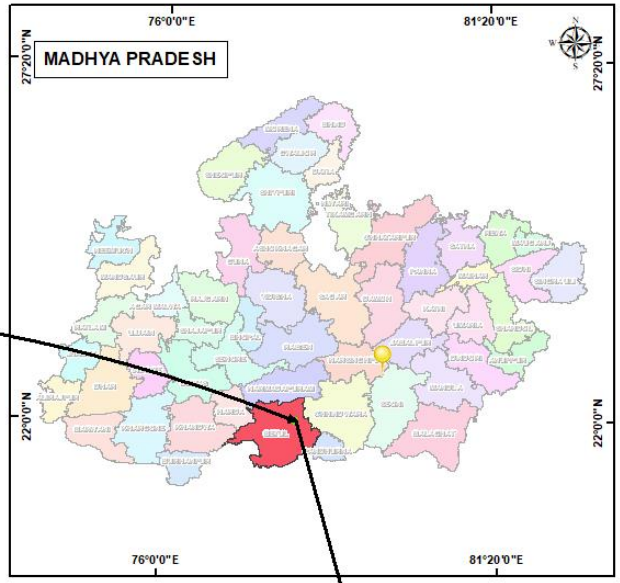
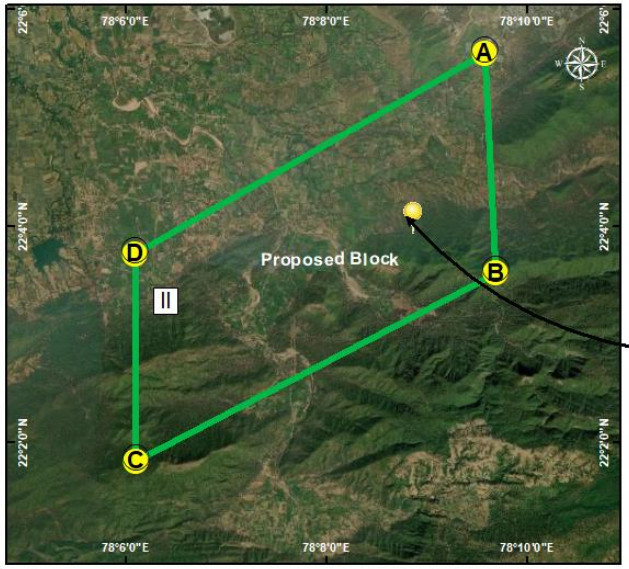
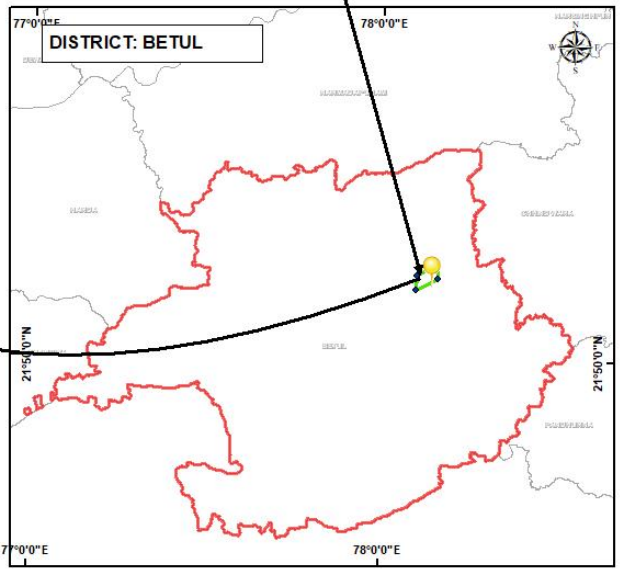
PLATE-I





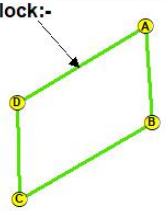




LOCATION MAP OF PROPODED BLOCK

Toposheet / OSM No:
55J04 / F44G4

Proposed Block:-



Legend

Proposed Block

NAME	LATITUDE	LONGITUDE
D	22° 3' 44.764" N	78° 6' 5.042" E
A	22° 5' 36.115" N	78° 9' 35.001" E
B	22° 3' 34.080" N	78° 9' 41.698" E
C	22° 1' 49.834" N	78° 6' 6.150" E

Project:-

Reconnaissance Survey (G-4 Exploration) for Graphite and Associated Mineralisation in Phandka-Gatakhera Area, Betul District Madhya Pradesh.

Notified Private Exploration Agency (NPEA):-

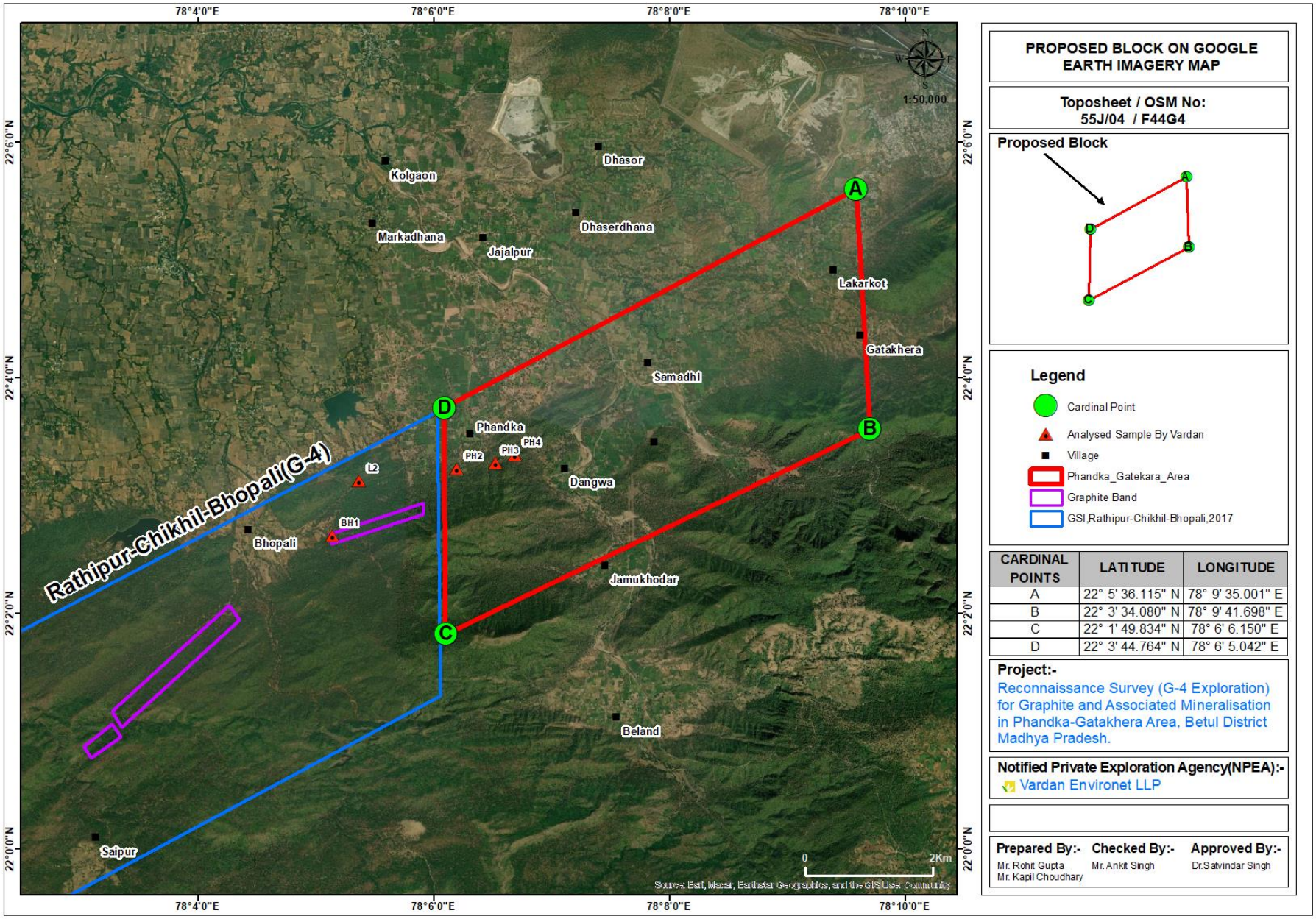
Vardan EnviroNet LLP

Scale:-

0 290 580 1,160 1,740 2,320 Km

Prepared By:-	Checked By:-	Approved By:-
Mr. Rohit Gupta Mr. Kapil Choudhary	Mr. Ankit Singh	Dr.Satvindar Singh

PLATE-II



PROPOSED BLOCK ON GOOGLE EARTH IMAGERY MAP

Toposheet / OSM No:
55J/04 / F44G4

Proposed Block

Legend

- Cardinal Point
- Analysed Sample By Vardan
- Village
- Phandka_Gatekara_Area
- Graphite Band
- GSI,Rathipur-Chikhil-Bhopali,2017

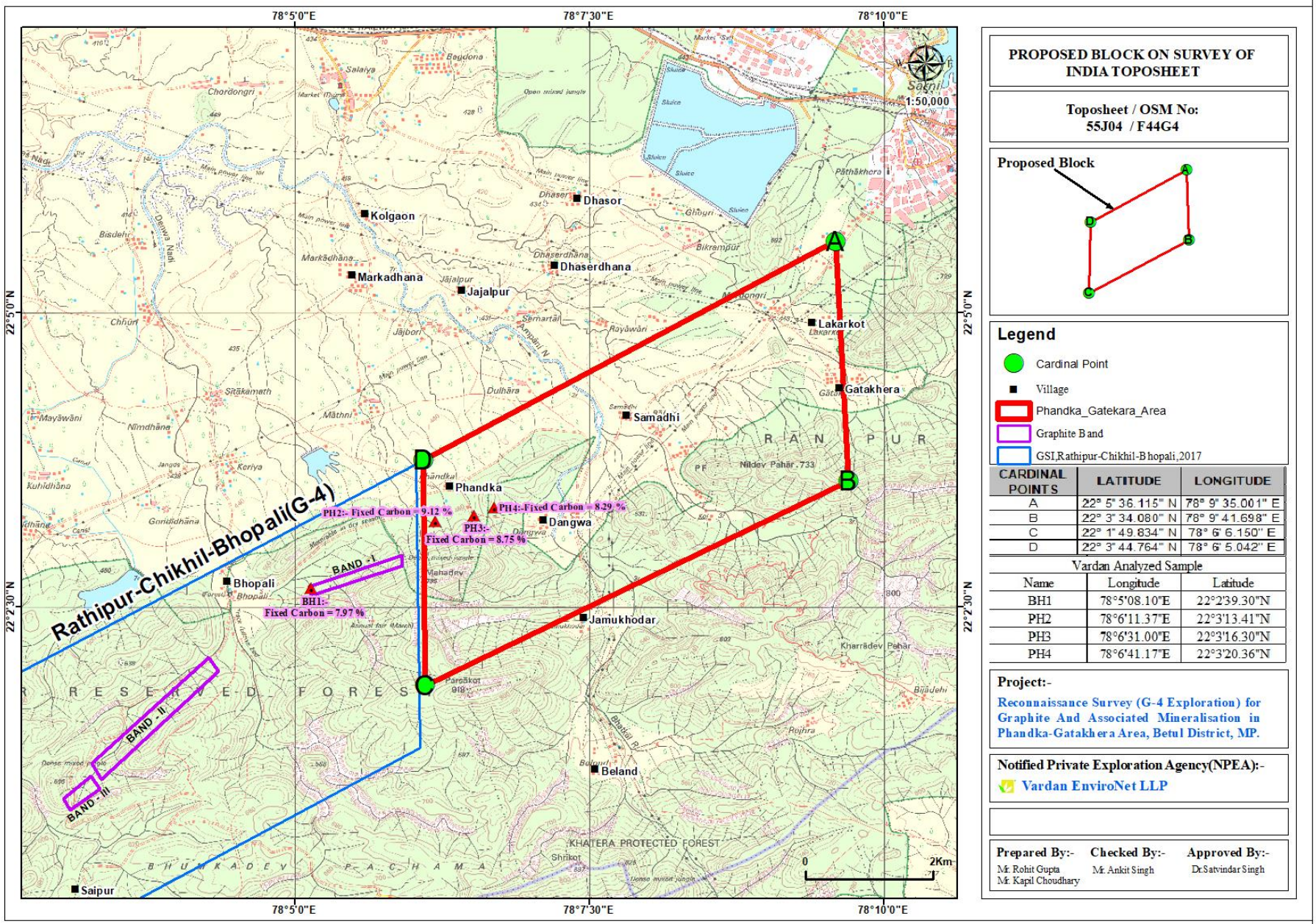
CARDINAL POINTS	LATITUDE	LONGITUDE
A	22° 5' 36.115" N	78° 9' 35.001" E
B	22° 3' 34.080" N	78° 9' 41.698" E
C	22° 1' 49.834" N	78° 6' 6.150" E
D	22° 3' 44.764" N	78° 6' 5.042" E

Project:-
Reconnaissance Survey (G-4 Exploration) for Graphite and Associated Mineralisation in Phandka-Gatakhera Area, Betul District Madhya Pradesh.

Notified Private Exploration Agency(NPEA):-
Vardan Environet LLP

Prepared By:-	Checked By:-	Approved By:-
Mr. Rohit Gupta Mr. Kapil Choudhary	Mr. Ankit Singh	Dr.Satvindar Singh

PLATE-III



PROPOSED BLOCK ON SURVEY OF INDIA TOPOSHEET

Toposheet / OSM No:
55J04 / F44G4

Proposed Block

Legend

- Cardinal Point
- Village
- Phandka_Gatekara_Area
- Graphite Band
- GSI,Rathipur-Chikhil-Bhopali,2017

CARDINAL POINTS	LATITUDE	LONGITUDE
A	22° 5' 36.115" N	78° 9' 35.001" E
B	22° 3' 34.080" N	78° 9' 41.698" E
C	22° 1' 49.834" N	78° 6' 6.150" E
D	22° 3' 44.764" N	78° 6' 5.042" E

Vardan Analyzed Sample

Name	Longitude	Latitude
BH1	78°5'08.10"E	22°2'39.30"N
PH2	78°6'11.37"E	22°3'13.41"N
PH3	78°6'31.00"E	22°3'16.30"N
PH4	78°6'41.17"E	22°3'20.36"N

Project:-

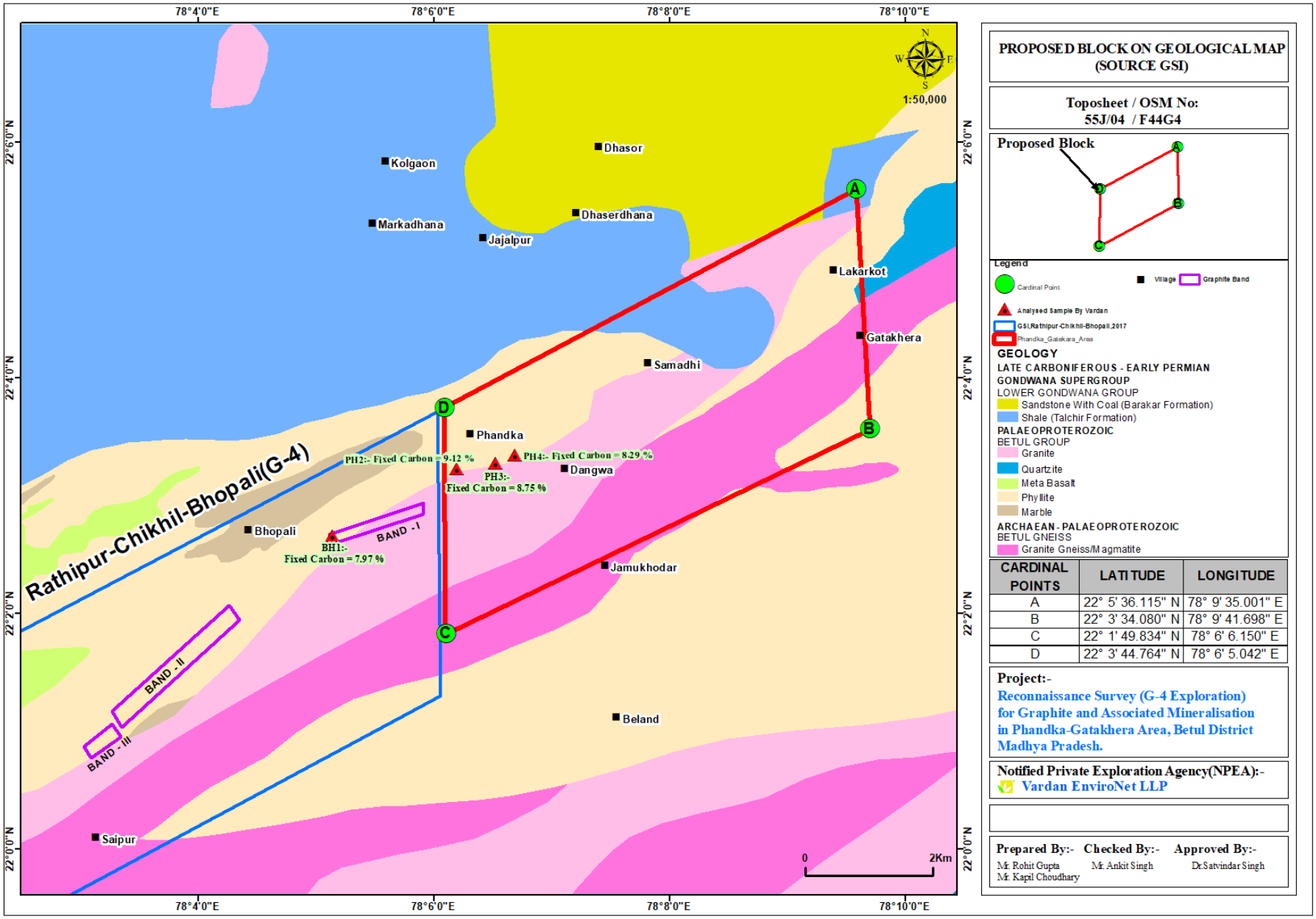
Reconnaissance Survey (G-4 Exploration) for Graphite And Associated Mineralisation in Phandka-Gatakhera Area, Betul District, MP.

Notified Private Exploration Agency(NPEA):-

Vardan EnviroNet LLP

Prepared By:-	Checked By:-	Approved By:-
Mr. Rohit Gupta Mr. Kapil Choudhary	Mr. Ankit Singh	Dr.Satvindar Singh

PLATE-IV



PROPOSED BLOCK ON GEOLOGICAL MAP (SOURCE GSI)

Toposheet / OSM No: 55J/04 / F44G4

Proposed Block

Legend

Cardinal Point
Village
Graphite Band
Analysed Sample By Vardan
GSI,Rathipur-Chikhil-Bhopali,2017
Phandka_Gatekara_Area

GEOLOGY

LATE CARBONIFEROUS - EARLY PERMIAN
GONDWANA SUPERGROUP
LOWER GONDWANA GROUP
Sandstone With Coal (Barakar Formation)
Shale (Talchir Formation)
PALAEOPROTEROZOIC
BETUL GROUP
Granite
Quartzite
Meta Basalt
Phyllite
Marble
ARCHAEAN - PALAEOPROTEROZOIC
BETUL GNEISS
Granite Gneiss/Magmatite

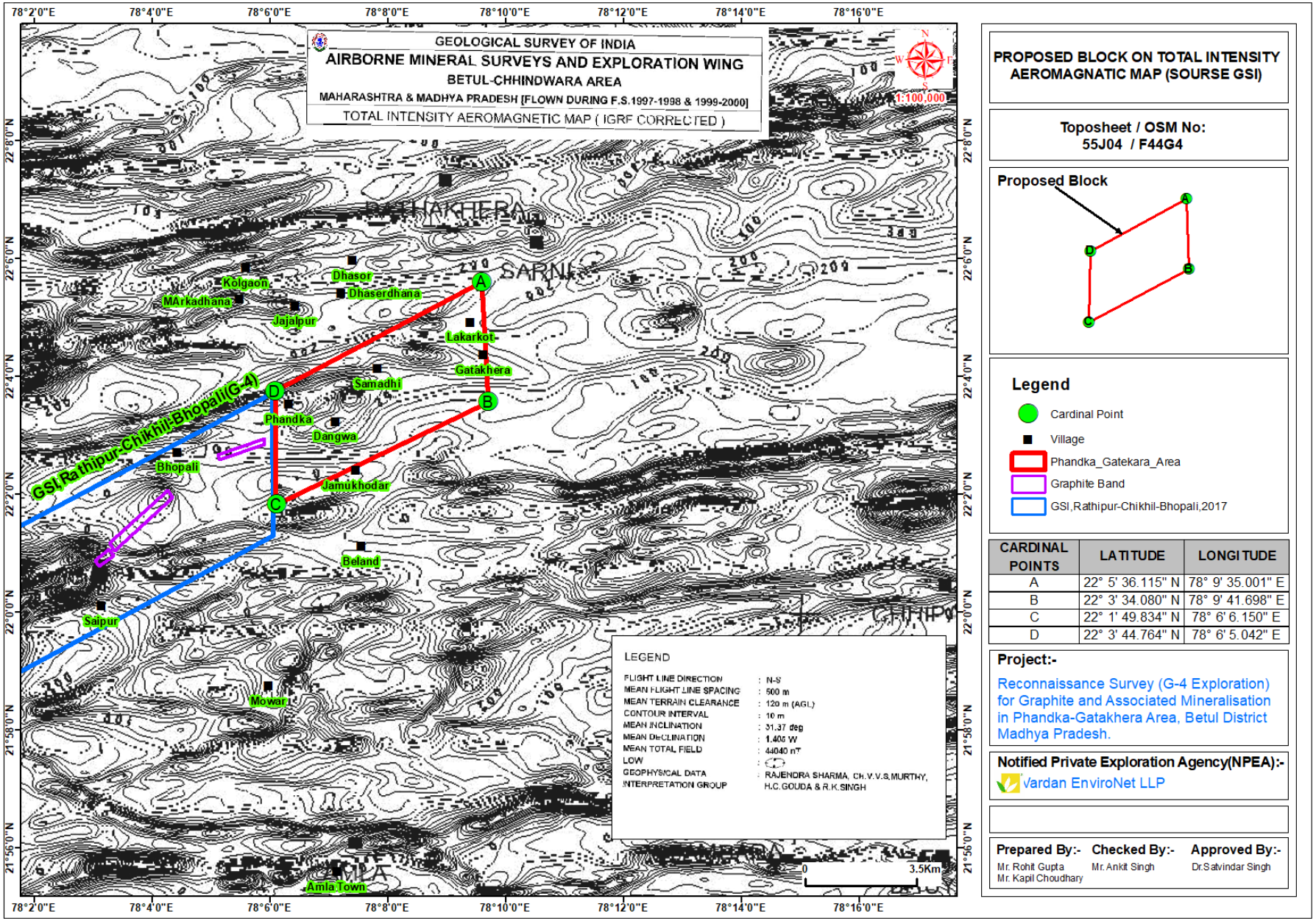
CARDINAL POINTS	LATITUDE	LONGITUDE
A	22° 5' 36.115" N	78° 9' 35.001" E
B	22° 3' 34.080" N	78° 9' 41.698" E
C	22° 1' 49.834" N	78° 6' 6.150" E
D	22° 3' 44.764" N	78° 6' 5.042" E

Project:-
Reconnaissance Survey (G-4 Exploration) for Graphite and Associated Mineralisation in Phandka-Gatakhera Area, Betul District Madhya Pradesh.

Notified Private Exploration Agency(NPEA):-
Vardan EnviroNet LLP

Prepared By:- Mr. Rohit Gupta, Mr. Kapil Choudhary
Checked By:- Mr. Ankit Singh
Approved By:- Dr.Satvindar Singh

PLATE-V



PROPOSED BLOCK ON TOTAL INTENSITY AEROMAGNATIC MAP (SOURSE GSI)

Toposheet / OSM No:
55J04 / F44G4

Proposed Block

Legend

- Cardinal Point
- Village
- Phandka_Gatekara_Area
- Graphite Band
- GSI,Rathipur-Chikhil-Bhopali,2017

CARDINAL POINTS	LATITUDE	LONGITUDE
A	22° 5' 36.115" N	78° 9' 35.001" E
B	22° 3' 34.080" N	78° 9' 41.698" E
C	22° 1' 49.834" N	78° 6' 6.150" E
D	22° 3' 44.764" N	78° 6' 5.042" E

Project:-

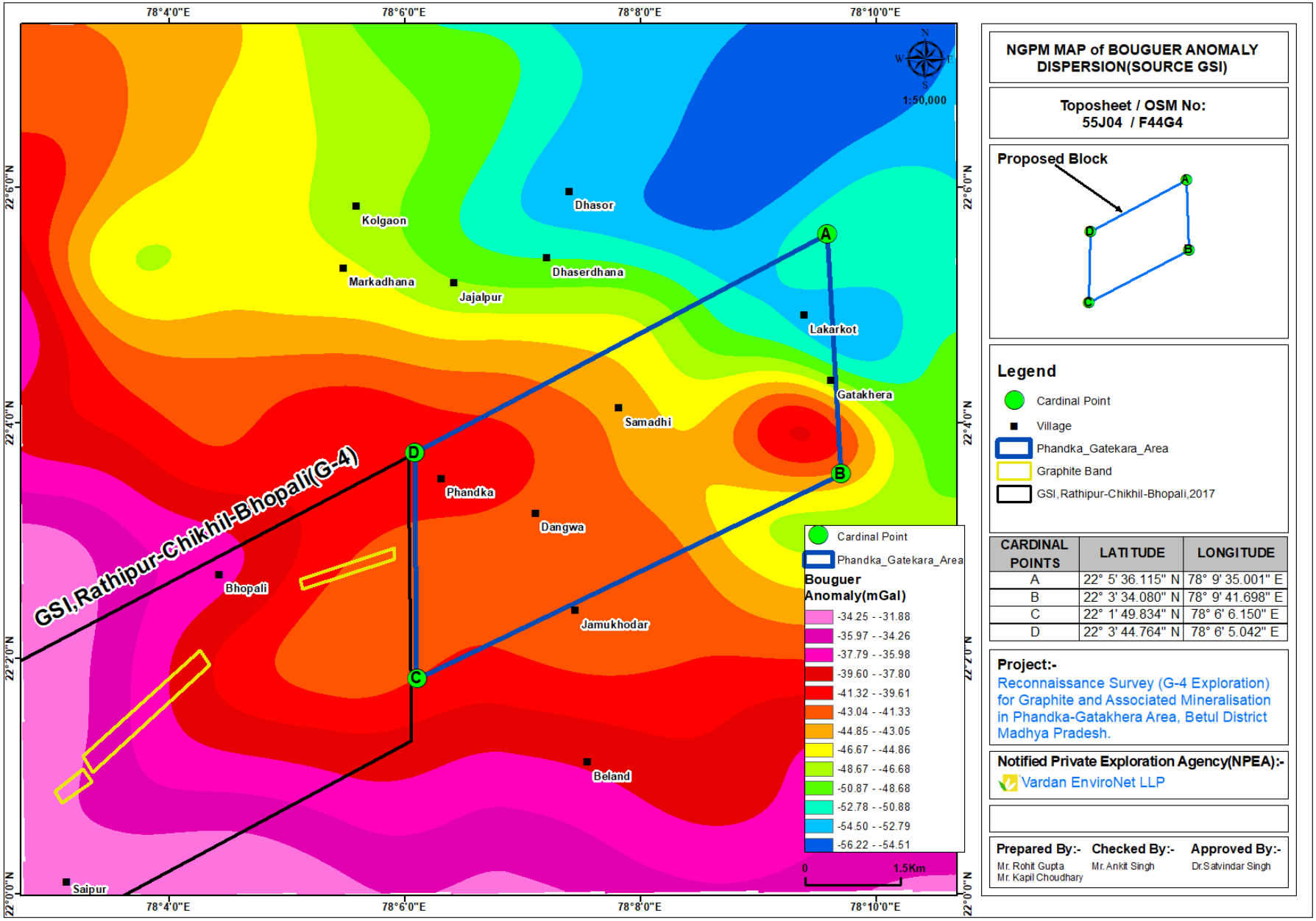
Reconnaissance Survey (G-4 Exploration) for Graphite and Associated Mineralisation in Phandka-Gatakhera Area, Betul District Madhya Pradesh.

Notified Private Exploration Agency(NPEA):-

Vardan EnviroNet LLP

Prepared By:-	Checked By:-	Approved By:-
Mr. Rohit Gupta Mr. Kapil Choudhary	Mr. Ankit Singh	Dr.Satvindar Singh

PLATE-VI



NGPM MAP of BOUGUER ANOMALY DISPERSION(SOURCE GSI)

Toposheet / OSM No:
55J04 / F44G4

Proposed Block

Legend

- Cardinal Point
- Village
- Phandka_Gatekara_Area
- Graphite Band
- GSI,Rathipur-Chikhil-Bhopali,2017

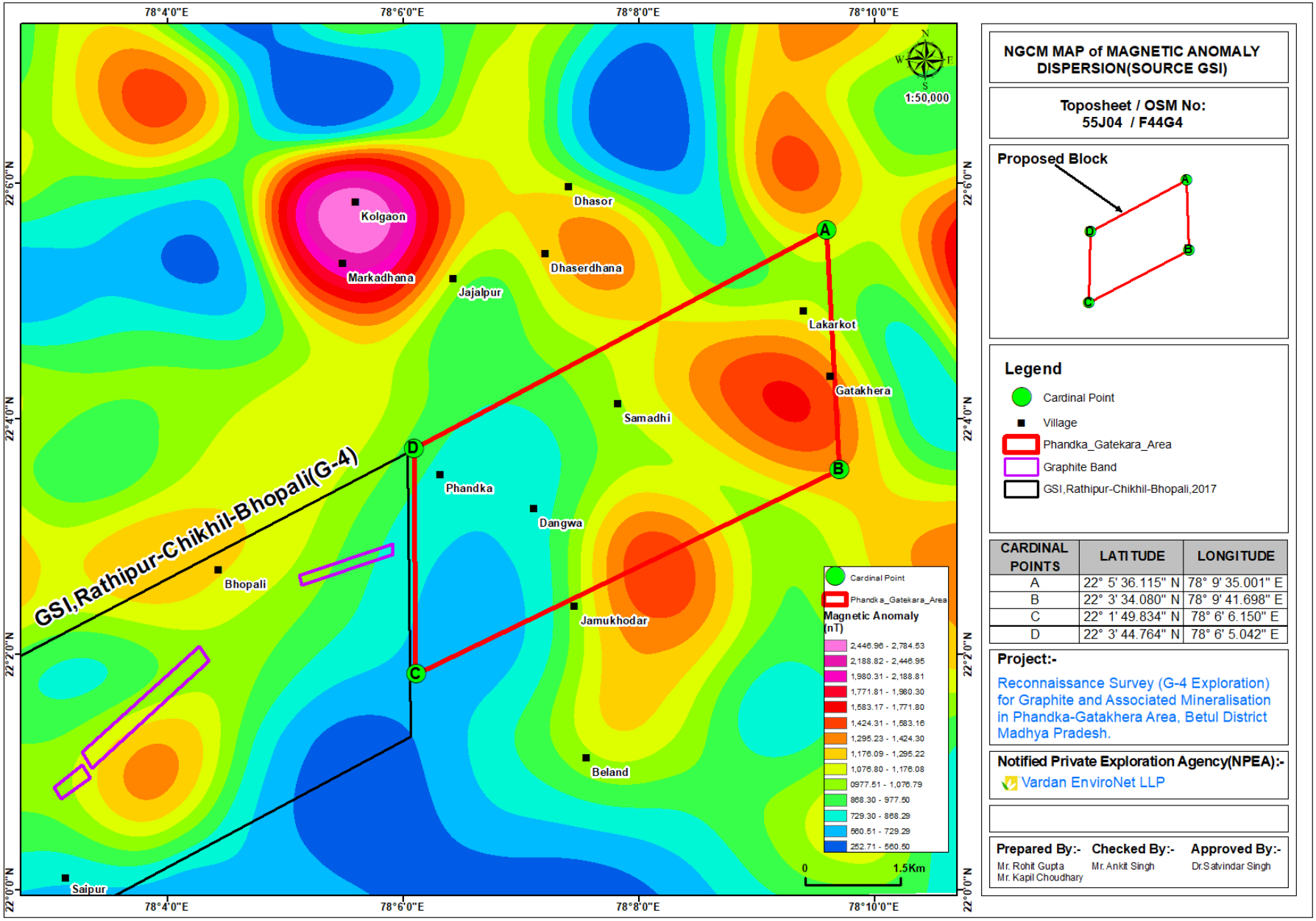
CARDINAL POINTS	LATITUDE	LONGITUDE
A	22° 5' 36.115" N	78° 9' 35.001" E
B	22° 3' 34.080" N	78° 9' 41.698" E
C	22° 1' 49.834" N	78° 6' 6.150" E
D	22° 3' 44.764" N	78° 6' 5.042" E

Project:-
Reconnaissance Survey (G-4 Exploration) for Graphite and Associated Mineralisation in Phandka-Gatakhera Area, Betul District Madhya Pradesh.

Notified Private Exploration Agency(NPEA):-
Vardan EnviroNet LLP

Prepared By:-	Checked By:-	Approved By:-
Mr. Rohit Gupta Mr. Kapil Choudhary	Mr. Ankit Singh	Dr.Satvindar Singh

PLATE-VII



NGCM MAP of MAGNETIC ANOMALY DISPERSION(SOURCE GSI)

Toposheet / OSM No:
55J04 / F44G4

Proposed Block

Legend

- Cardinal Point
- Village
- Phandka_Gatekara_Area
- Graphite Band
- GSI,Rathipur-Chikhil-Bhopali,2017

CARDINAL POINTS	LATITUDE	LONGITUDE
A	22° 5' 36.115" N	78° 9' 35.001" E
B	22° 3' 34.080" N	78° 9' 41.698" E
C	22° 1' 49.834" N	78° 6' 6.150" E
D	22° 3' 44.764" N	78° 6' 5.042" E

Project:-

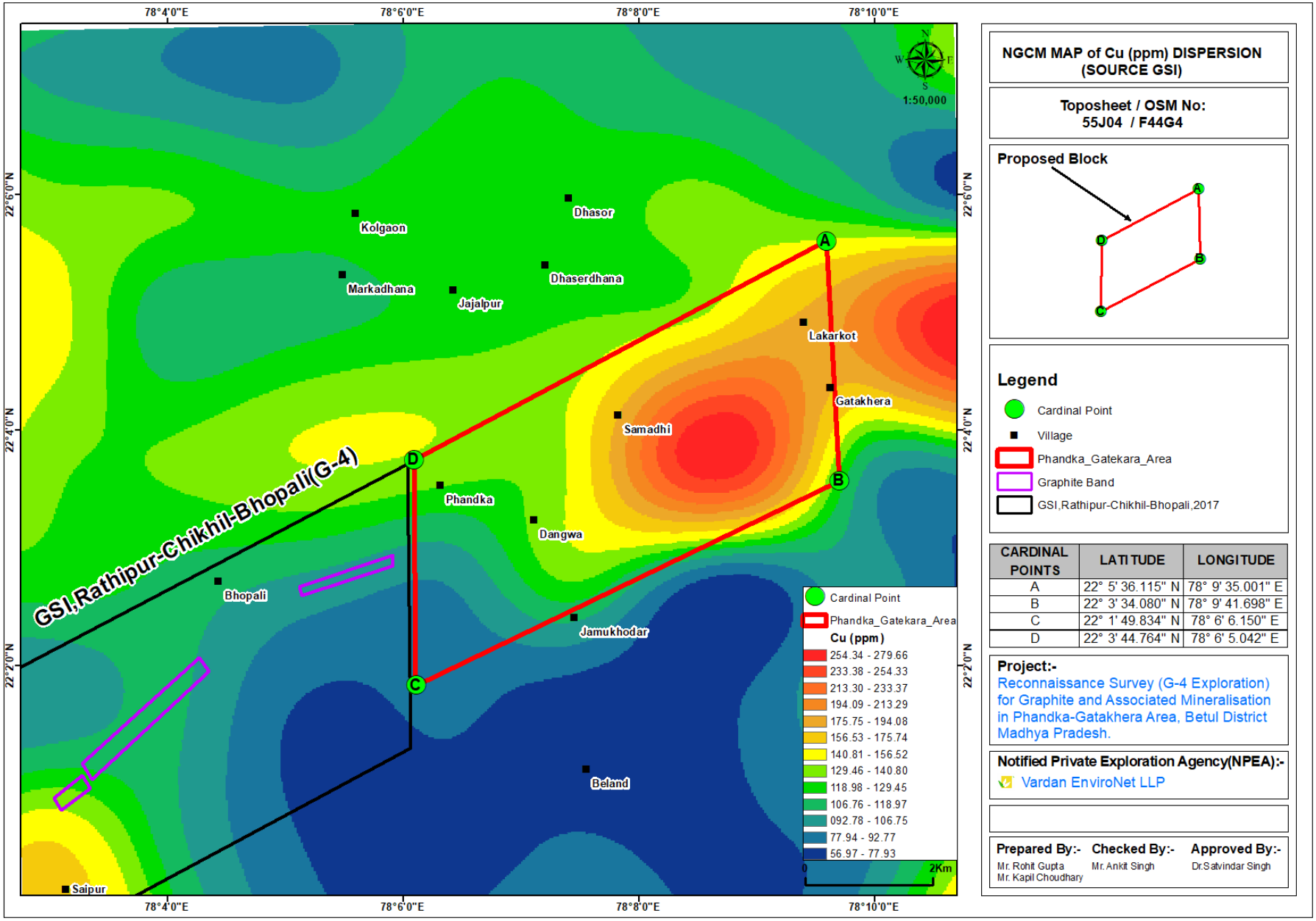
Reconnaissance Survey (G-4 Exploration) for Graphite and Associated Mineralisation in Phandka-Gatakhera Area, Betul District Madhya Pradesh.

Notified Private Exploration Agency(NPEA):-

Vardan EnviroNet LLP

Prepared By:-	Checked By:-	Approved By:-
Mr. Rohit Gupta Mr. Kapil Choudhary	Mr. Ankit Singh	Dr.Satvindar Singh

PLATE-VIII



NGCM MAP of Cu (ppm) DISPERSION (SOURCE GSI)

Toposheet / OSM No: 55J04 / F44G4

Proposed Block

Legend

- Cardinal Point
- Village
- Phandka_Gatekara_Area
- Graphite Band
- GSI,Rathipur-Chikhil-Bhopali,2017

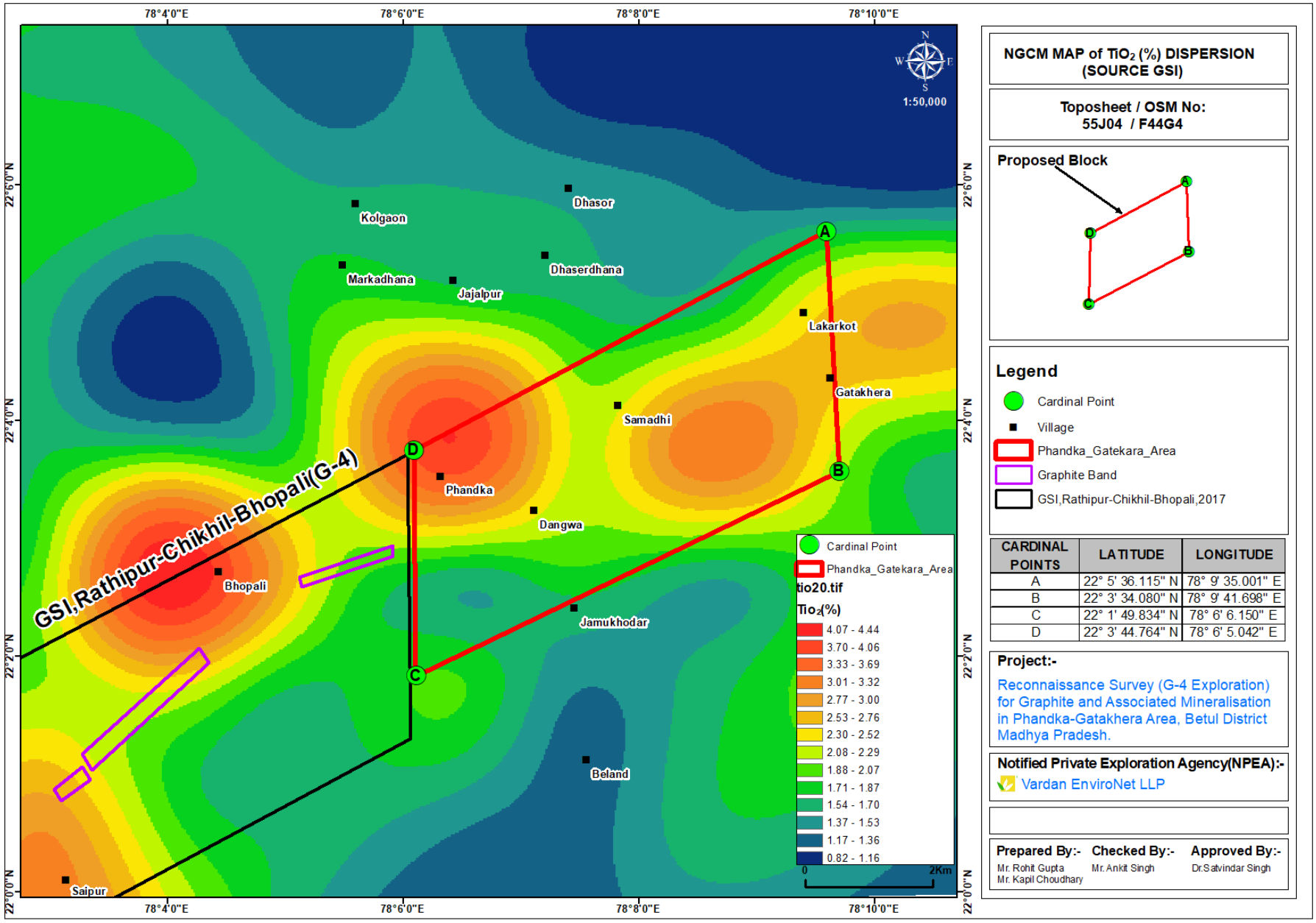
CARDINAL POINTS	LATITUDE	LONGITUDE
A	22° 5' 36.115" N	78° 9' 35.001" E
B	22° 3' 34.080" N	78° 9' 41.698" E
C	22° 1' 49.834" N	78° 6' 6.150" E
D	22° 3' 44.764" N	78° 6' 5.042" E

Project:-
Reconnaissance Survey (G-4 Exploration) for Graphite and Associated Mineralisation in Phandka-Gatakhera Area, Betul District Madhya Pradesh.

Notified Private Exploration Agency(NPEA):-
Vardan EnviroNet LLP

Prepared By:-	Checked By:-	Approved By:-
Mr. Rohit Gupta Mr. Kapil Choudhary	Mr. Ankit Singh	Dr.Satvindar Singh

PLATE-IX



NGCM MAP of TiO_2 (%) DISPERSION (SOURCE GSI)

Toposheet / OSM No: 55J04 / F44G4

Proposed Block

Legend

- Cardinal Point
- Village
- Phandka_Gatekara_Area
- Graphite Band
- GSI,Rathipur-Chikhil-Bhopali,2017

CARDINAL POINTS	LATITUDE	LONGITUDE
A	22° 5' 36.115" N	78° 9' 35.001" E
B	22° 3' 34.080" N	78° 9' 41.698" E
C	22° 1' 49.834" N	78° 6' 6.150" E
D	22° 3' 44.764" N	78° 6' 5.042" E

Project:-

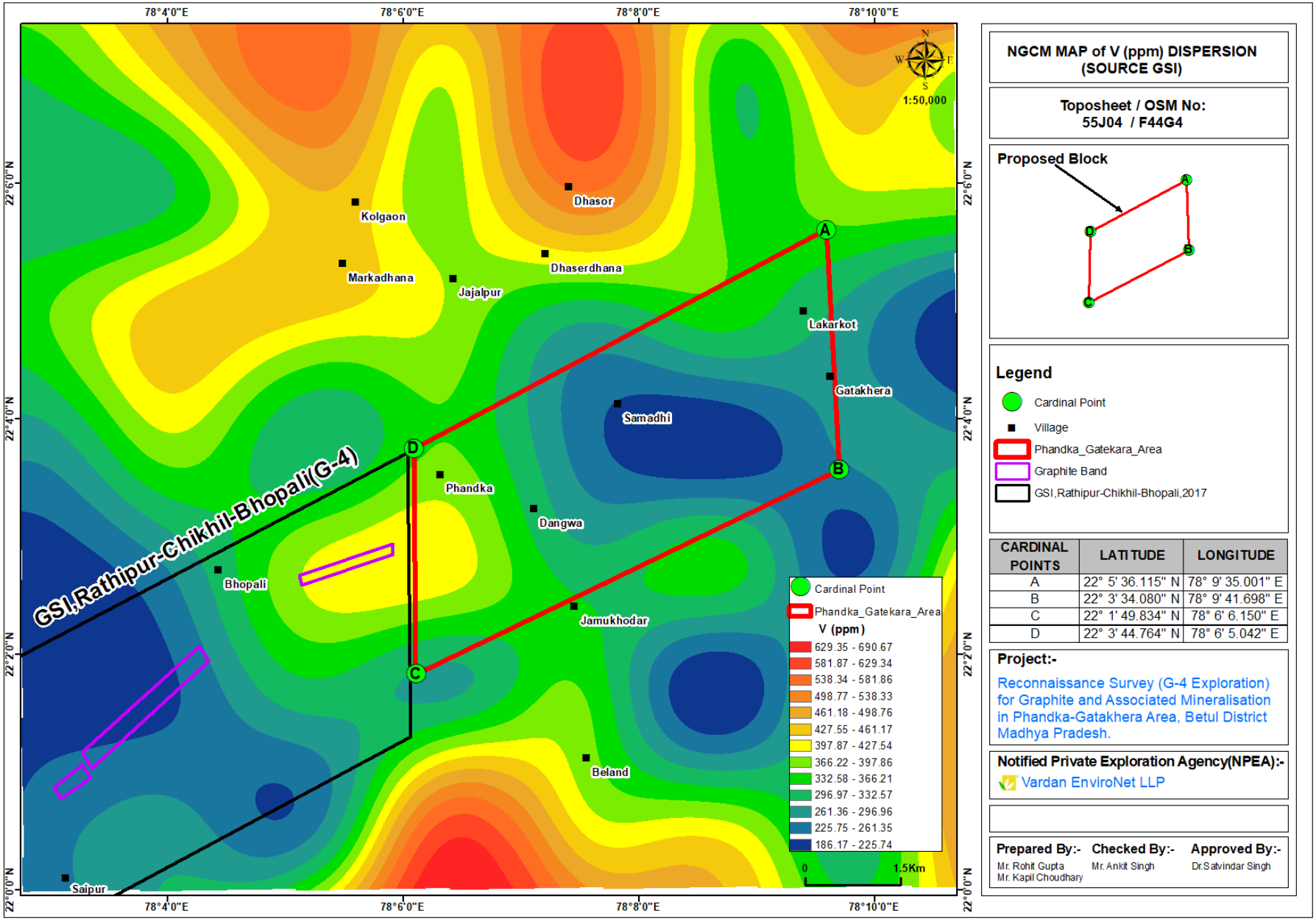
Reconnaissance Survey (G-4 Exploration) for Graphite and Associated Mineralisation in Phandka-Gatakhera Area, Betul District Madhya Pradesh.

Notified Private Exploration Agency(NPEA):-

Vardan EnviroNet LLP

Prepared By:-	Checked By:-	Approved By:-
Mr. Rohit Gupta Mr. Kapil Choudhary	Mr. Ankit Singh	Dr.Satvindar Singh

PLATE-X



NGCM MAP of V (ppm) DISPERSION (SOURCE GSI)

Toposheet / OSM No:
55J04 / F44G4

Proposed Block

Legend

- Cardinal Point
- Village
- Phandka_Gatekara_Area
- Graphite Band
- GSI,Rathipur-Chikhil-Bhopali,2017

CARDINAL POINTS	LATITUDE	LONGITUDE
A	22° 5' 36.115" N	78° 9' 35.001" E
B	22° 3' 34.080" N	78° 9' 41.698" E
C	22° 1' 49.834" N	78° 6' 6.150" E
D	22° 3' 44.764" N	78° 6' 5.042" E

Project:-

Reconnaissance Survey (G-4 Exploration) for Graphite and Associated Mineralisation in Phandka-Gatakhera Area, Betul District Madhya Pradesh.

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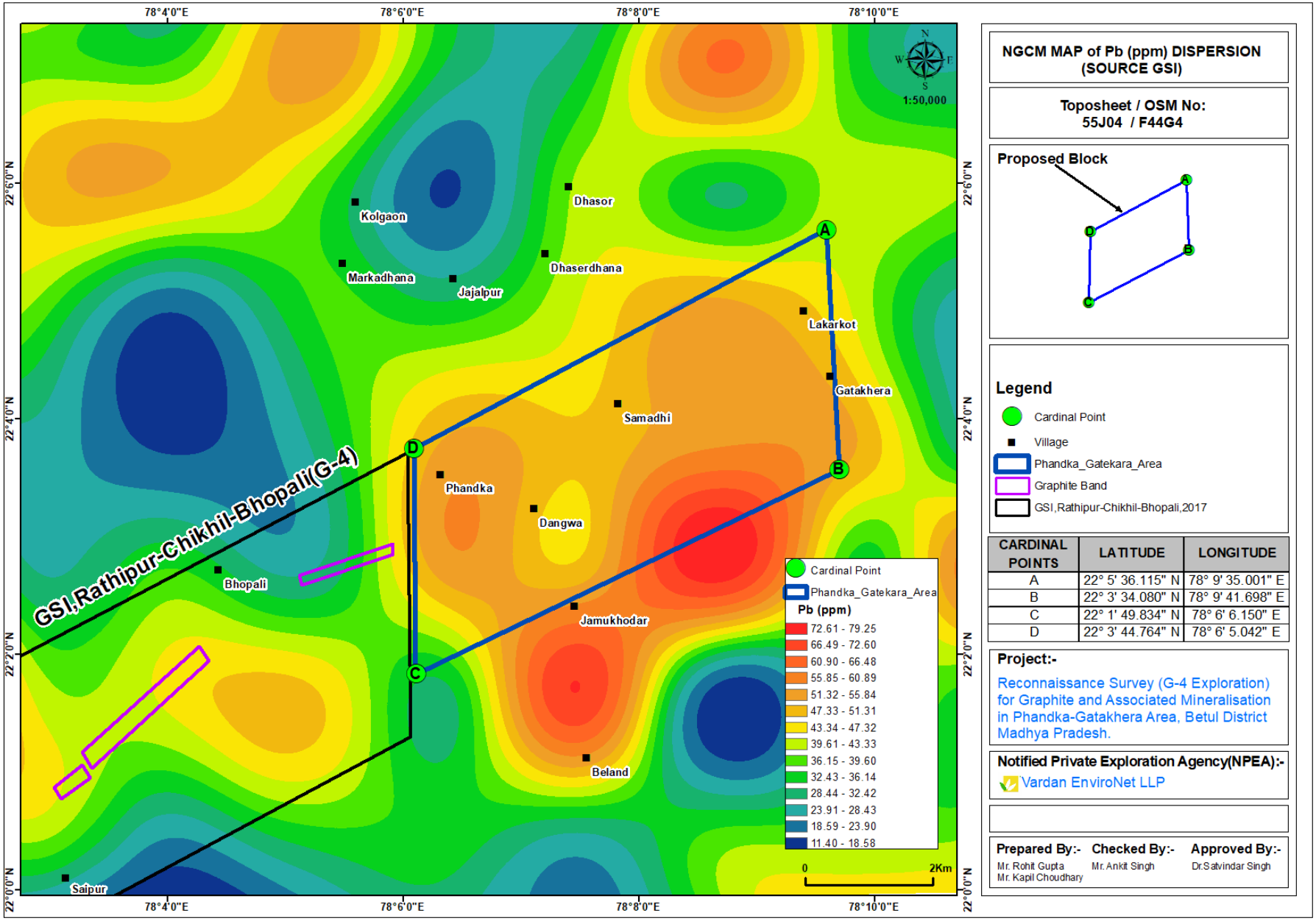
PLATE-XI



NGCM MAP of Pb (ppm) DISPERSION (SOURCE GSI)

Toposheet / OSM No: 55J04 / F44G4

Proposed Block

Legend

- Cardinal Point
- Village
- Phandka_Gatekara_Area
- Graphite Band
- GSI,Rathipur-Chikhil-Bhopali,2017

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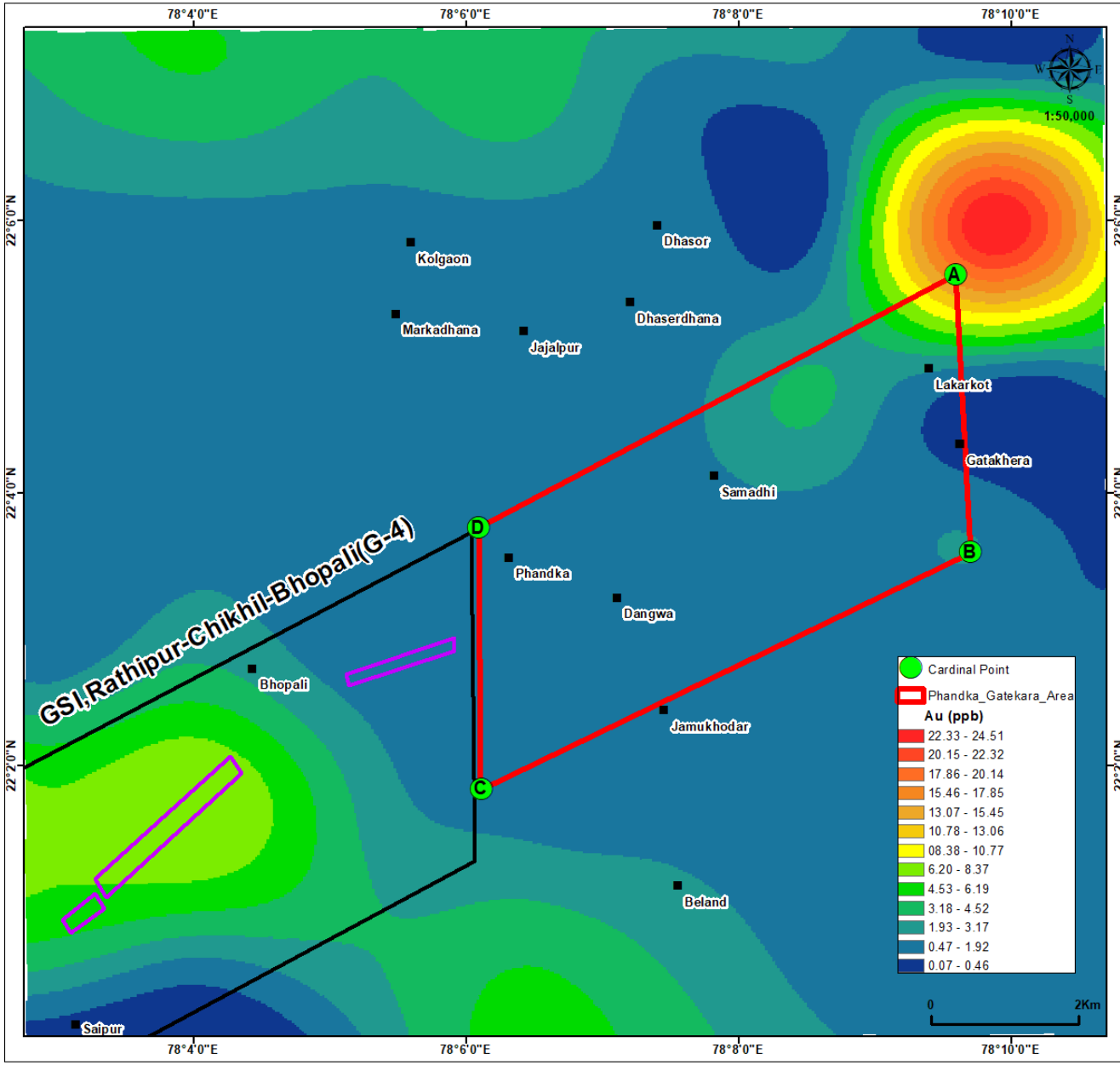
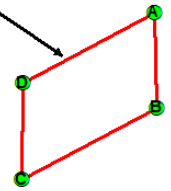
PLATE-XII



NGCM MAP of Au (ppb) DISPERSION (SOURCE GSI)

Toposheet / OSM No: 55J04 / F44G4

Proposed Block



Legend

- Cardinal Point
- Village
- Phandka_Gatekara_Area
- Graphite Band
- GSI,Rathipur-Chikhil-Bhopali,2017

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Project:-
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Notified Private Exploration Agency(NPEA):-
Vardan EnviroNet LLP

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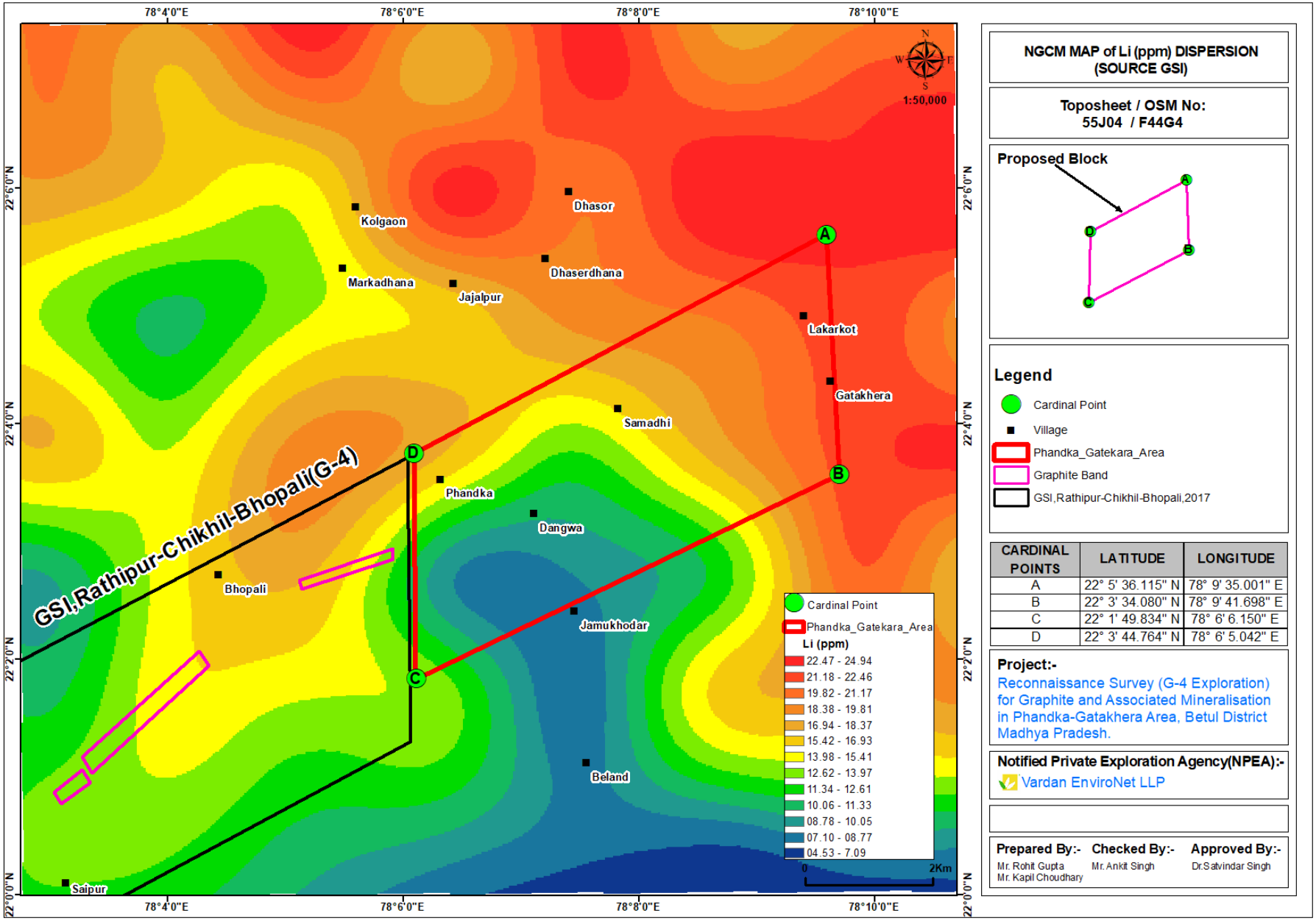
PLATE-XIII



NGCM MAP of Li (ppm) DISPERSION (SOURCE GSI)

Toposheet / OSM No:
55J04 / F44G4

Proposed Block

Legend

- Cardinal Point
- Village
- Phandka_Gatekara_Area
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Project:-
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Notified Private Exploration Agency(NPEA):-
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Prepared By:-	Checked By:-	Approved By:-
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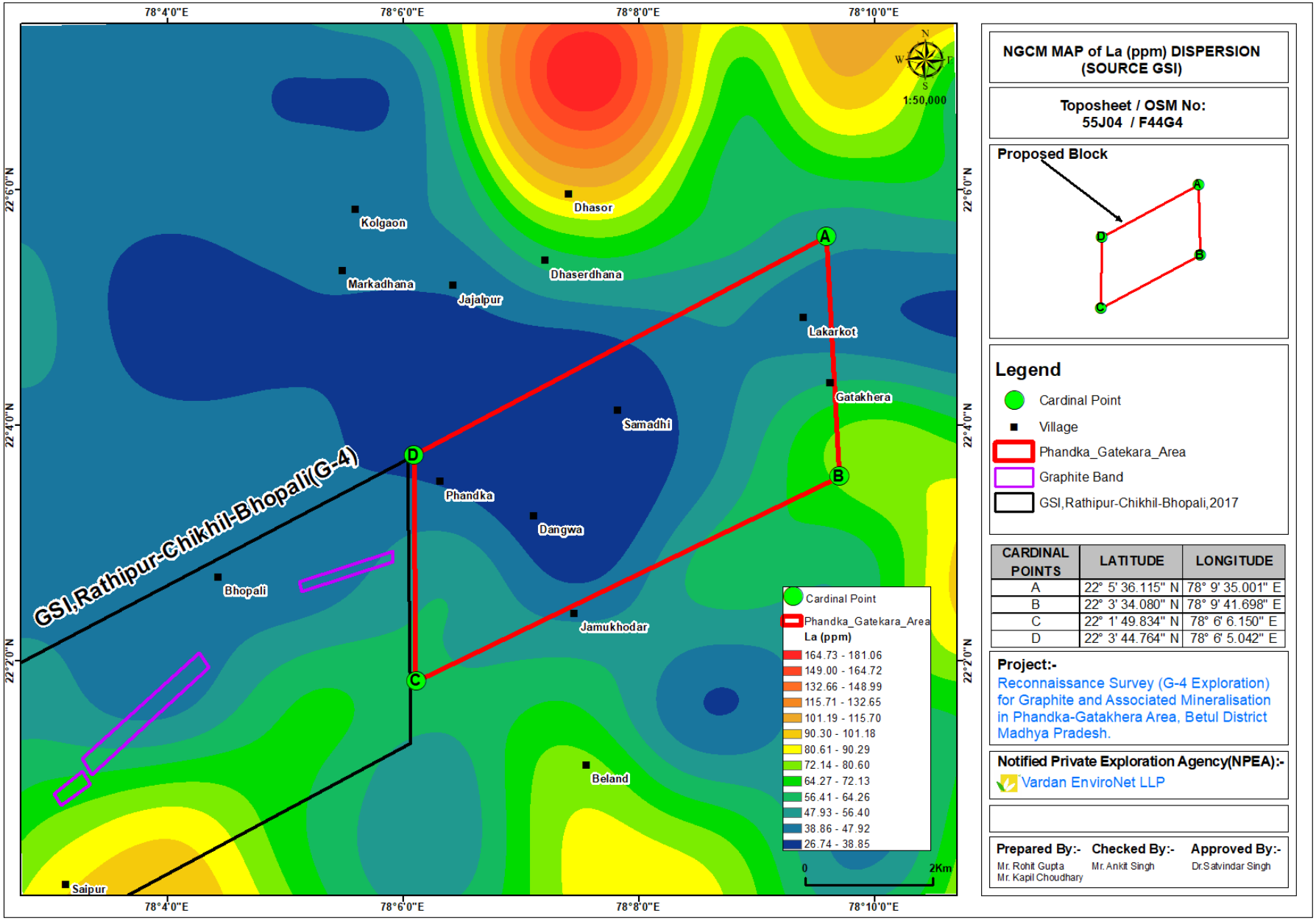
PLATE-IV



NGCM MAP of La (ppm) DISPERSION (SOURCE GSI)

Toposheet / OSM No:
55J04 / F44G4

Proposed Block

Legend

- Cardinal Point
- Village
- Phandka_Gatekara_Area
- Graphite Band
- GSI,Rathipur-Chikhil-Bhopali,2017

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Project:-
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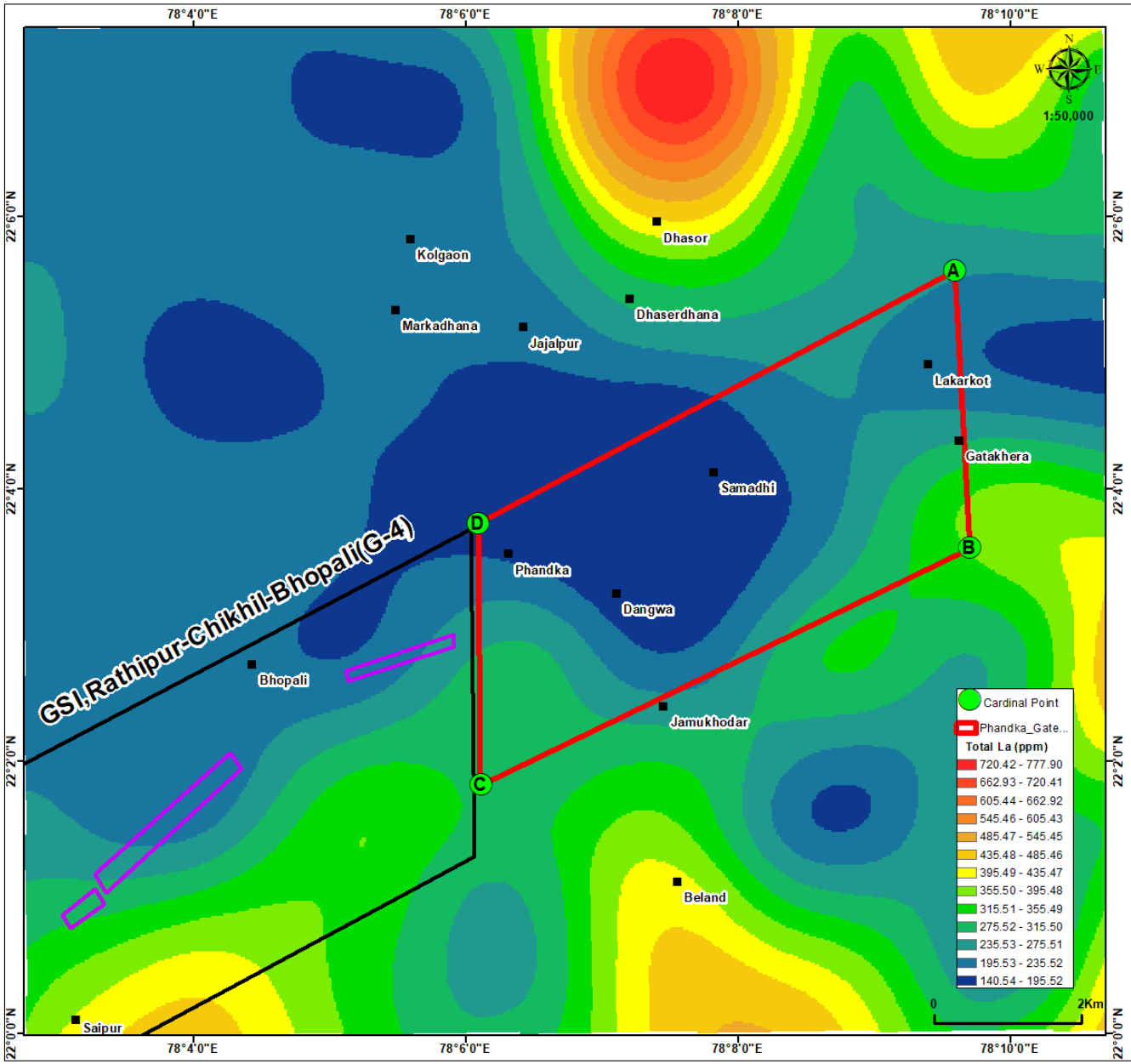
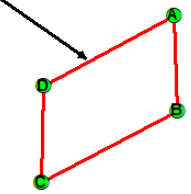
PLATE-XV



NGCM MAP of TOTAL LANTHANIDE SERIES (ppm) DISPERSION(SOURCE GSI)

Toposheet / OSM No:
55J04 / F44G4

Proposed Block



Legend

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Notified Private Exploration Agency(NPEA):-

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