

**DETAILED PROPOSAL FOR PRELIMINARY EXPLORATION (G3 STAGE)
OF GRAPHITE IN KANDEGAON BLOCK, KALAHANDI DISTRICT,
ODISHA UNDER NMEDT.**

Commodity: Graphite

BY



Maheshwari
Global Technologies. Ecological Mining.

**MMPL PRIVATE LIMITED
FR 07 SHILPANGAN, PLOT NO – LB 1,
SECTOR III, SALT LAKE, KOLKATA-700091**

Place: Kolkata

Date: 18.05.2026

Summary of the Block in G3 Stage Exploration

Sl.no	Features	Details
A.	Block ID	Kandegaon Block
B.	Current Exploration Agency	MMPL Private Limited (Formerly Maheshwari Mining Private Limited)
C.	G4 stage Geological Report (Previous stage Geological Report)	“Report on The Graphite Investigation in Parts of Bolangir, Kalahandi and Phulbani Districts of Orissa” & “Report on the Investigation for Graphite in Parts of Sambalpur; Bolangir and Kalahandi Districts, Orissa”
D.	Commodity	Graphite
E.	Mineral Belt	Eastern Ghats Mobile Belt (EGMB)
F.	Completion Period with entire Time schedule to complete the project	12 Months
G.	Objectives	The present exploration programme (G3) has been formulated on the basis of the outcomes of previous work to fulfil the following objectives: • Geological mapping on 1:2000 scale to delineate graphite bands and other lithological units in the area. • Topographical Contouring on 1:2000 scale, by means of surface contouring at 2 m interval. • Delineation of the potential subsurface mineralized zones by Geophysical Survey (SP survey). • Trenching will be carried out to expose the graphite bands. • Exploratory drilling with 100-200 m strike spacing for 1st level (30 m vertical depth of intersection) and 2nd level (60 m vertical depth of intersection). • Assessment of quality of the resources (333) as per UNFC norms & Minerals (Evidence of Mineral Contents) Rules- 2015.
H.	Whether the work will be carried out by the proposed agency or through out-sourcing and details thereof. Components to be outsourced and name of the out-sourced agency	The work will be carried out by proposed agency.
I.	Name/Number of Geoscientists	Field Geologist: Two numbers HQ Geologist: Two numbers
J.	Expected Field days (Geology) Geological Party Days	180

1.	Location	Cardinal points	latitude	longitude
		A	20.2838	83.5480
		B	20.2835	83.5595
		C	20.1994	83.5800
		D	20.1976	83.5670
	Villages	Kandegaon, Bakbera		
	Tehsil	--		
	District	Kalahandi		
	State	Odisha		
2.	Area (hectares/square kilometres)			
	Block Area	12.24 sq km		
	Forest Area			
	Government Land Area			
	Private Land Area			
3.	Accessibility			
	Nearest Rail Head	Rupra Road Railway station		
	Road	NH-59		
	Airport	Jharsuguda		
4.	Hydrography			
	Local Surface Drainage Pattern (Channels)	Dendritic pattern		
	Rivers/Streams			
5.	Climate			
	Mean Annual Rainfall	1,340.30 mm		
	Temperatures (December)(Minimum)	15°C (59°F)		
	Temperatures (June)(Maximum)	32.6°C (90.7°F)		
6.	Topography			
	Toposheet Number	64P/11, 64P/12		
	Morphology of the Area	The area is predominantly rugged with an average elevation of 400 meters and hills that rise up to 900 meters above sea level. Most of the area is covered by a chain of hills and mounds. The drainage pattern follows a dendritic layout with two perennial nala-the Pedda Nala, flowing from northwest to south and the Balandeli Nala, flowing from north to south. The general slope, as indicated by the drainage pattern, is from the northern to the southern side of the region. The alignment of the hill ranges and the drainage system is primarily influenced by the underlying lithology and structure. The higher elevations are dominated by khondalite, while other lithological units are found at lower altitudes.		
7.	Availability of base line geoscience data			
	Geological Map (1:50000/1:25000)	Available		
	Geochemical Map (1:50000)	Available		

	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps)	Gravity and Magnetic data are available																														
8.	Justification for taking up Preliminary Regional Exploration	Justification for taking up the investigation in G3 stage: - Graphite bodies of economic importance occur in the Eastern Ghats migmatite complex of Odisha, India, which consist of sillimanite-rich gneiss (khondalite), calc-silicate granulite, basic (pyroxene) granulite and acidic gneiss, a variety of quartzo feldspathic veins. Graphite mineralization is noticed within khondalite, granite gneiss and calc-silicate rocks of the block. In order to delineate the graphite mineralised zone and to investigate the mineral potentiality of the area, a preliminary exploration in this block has been proposed. - Based on the surface evidence, a total four number of graphite bearing samples were collected by MMPL Pvt Ltd within the block area. The value of FC% for the samples are given below: <table><tr><th>SAMPLE ID</th><th>Moisture (ARB)</th><th>VM (DB)</th><th>Ash (DB)</th><th>Sulphur (DB)</th><th>FC (DB)</th></tr><tr><td>OKR - 01</td><td>1.39</td><td>4.12</td><td>92.53</td><td>0.09</td><td>3.26</td></tr><tr><td>OKR - 02</td><td>0.25</td><td>0.62</td><td>82.11</td><td>0.17</td><td>17.10</td></tr><tr><td>OKR - 03</td><td>2.50</td><td>2.43</td><td>94.37</td><td>0.14</td><td>3.06</td></tr><tr><td>OKR - 04</td><td>1.54</td><td>1.90</td><td>94.73</td><td>0.13</td><td>3.24</td></tr></table> - Based on the results, MMPL has recommended a block of 12.24 sq. km area for G3 stage of investigation.	SAMPLE ID	Moisture (ARB)	VM (DB)	Ash (DB)	Sulphur (DB)	FC (DB)	OKR - 01	1.39	4.12	92.53	0.09	3.26	OKR - 02	0.25	0.62	82.11	0.17	17.10	OKR - 03	2.50	2.43	94.37	0.14	3.06	OKR - 04	1.54	1.90	94.73	0.13	3.24
SAMPLE ID	Moisture (ARB)	VM (DB)	Ash (DB)	Sulphur (DB)	FC (DB)																											
OKR - 01	1.39	4.12	92.53	0.09	3.26																											
OKR - 02	0.25	0.62	82.11	0.17	17.10																											
OKR - 03	2.50	2.43	94.37	0.14	3.06																											
OKR - 04	1.54	1.90	94.73	0.13	3.24																											

Detailed description of the following proposal.

1 Block Summary

Background Geology (Regional Geology, Geology of the Block):

1.1 Physiography

The area is predominantly rugged with an average elevation of 400 meters. Most of the area is covered by a chain of hills and mounds. The drainage pattern follows a dendritic layout with two perennial nala-the Pedda Nala, flowing from northwest to south and the Balandeli Nala, flowing from north to south.

The general slope, as indicated by the drainage pattern, is from the northern to the southern side of the region. The alignment of the hill ranges and the drainage system is primarily influenced by the underlying lithology and structure. The higher elevations are dominated by khondalite, while other lithological units are found at lower altitudes.

1.2 Background Geology

1.2.1 Regional Geology

The rugged country with discontinuous hill ranges occurring along the coast of the Bay of Bengal is known as the Eastern Ghats. The average altitude is 610 m and the tallest peak Mahendragiri is 1501 m high. The highly deformed rocks that experienced ultrahigh-temperature granulite facies metamorphism and several generations of magmas of varied compositional types are recognized as the **Eastern Ghats Mobile Belt (EGMB)** which is extending from Brahmani River in Odisha to Ongole in south-eastern Andhra Pradesh. The 1000-km-long terrain is nearly 300 km wide in the northern part (Mahalik 1996), but tapers to merely 30 km in the south, the average width being 100 km. The Gondwana in two Phanerozoic rift valleys, the Mahanadi Graben in the north and the Godavari Graben in the south, break the continuity. It is a Mesoproterozoic terrain that has a very long history of tectono-thermal evolution including migmatization and charnockitization of supra-crustal rocks.

The EGMB was referred to as a convergent orogeny that evolved under NW–SE-directed sub horizontal compression resulting from oblique collision of continental plates (Chetty and Murthy 1994; Ramakrishnan et al. 1998; Bhattacharya 2002). Gravity modelling constrained by seismic information suggests that the eastward-inclined 38 to 40km-thick column of cratonic crust lies 35 km below this mobile belt (Kumar et al. 2004). It will be apparent that the EGMB displays high-gravity anomaly compared to the cratons, implying denser rocks underlying it (Subramanyam and Verma 1986). Building the bulk of the EGMB, the exposed charnockite–khondalite succession represents the thrust-

up lower crustal material. The basement archaean rocks are seen nowhere, but the material forming them occurs in the framework of the mobile belt in a drastically remobilized and reconstituted forms.

Four lithological zones were recognized in the EGMB on the basis of ages of protoliths and constituent minerals (Ramakrishnan et al. 1998). The fifth unit is the zone of transition. The brief descriptions are as follow-

The **Western Charnockite Zone** comprises dominant charnockites and enderbites with lenses of basic and ultrabasic rocks and minor intercalations of metapelite (khondalite) and basic granulites. There are several generations of charnockites, the oldest being deformed and gneissose, garnet bearing and concordant in disposition with the khondalite.

The **Western Khondalite Zone** is dominated by metapelitic khondalite with intercalations of quartzite, calc silicate gneiss, marble and minor though very significant high Mg–Al granulite characterized by sapphirine. Intrusive bodies of charnockites and massif-type anorthosite, as seen at Bolangir, Turrkel and Jugsaipatna are also present. Metamorphosed basic sills and lava flows are represented by concordant bodies of basic granulites within the khondalite succession. In many cases, there are plutonic intrusives.

The **Central Migmatite Zone** is made up of dominant migmatites, garnet-bearing diatexites with leptynites, high Mg–Al granulite and calc silicate rock intruded by charnockites and porphyritic granites. There are bodies of massif-type anorthosite within the zone. The migmatites owe their origin to high-grade metamorphism with differential melting of siliceous granulites, like the khondalite. The charnockites also show a composition that reveals affinity to tholeiitic to calc-alkaline basalts of the protoliths (Rao et al. 1995). There are patches of charnockite developed incipiently on the granulitic gneisses and migmatites. They were supposed to have formed as a result of activity of CO₂-rich fluids and/or through a process of charnockitization of metasediments of appropriate bulk composition (Nanda and Pati 1989; Paul et al. 1990; Rajesham et al. 1992; Mohan et al. 2003).

The **Eastern Khondalite Zone** consists of a lithology not different from that of the Western Khondalite Zone, but is devoid of anorthosite bodies. The leptynites that are interlayered with khondalites in the Chilka Lake area represent the granitoids produced by dehydration melting in the metapelites of different composition (Sen and Bhattacharya 1997). The presence of sillimanite trails within garnets suggests that the khondalites were indeed subjected to partial melting. In the Rengali domain in the northern part of the EGMB, the multiple shear zones seem to have not only served as places for intrusion of alkaline rocks but also provided pathways to fluids that brought about charnockitization and migmatization of granulitic rocks (Mahalik 1994). Understandably, the ultrabasic intrusives occur as boundinaged bodies in the highly deformed masses of khondalites of

shear zones. Closely associated in space, the co-magmatic anorthosite occurs as metamorphosed and tectonized layers in the EGMB.

Transition Zone is present on the western and south-western margins of the EGMB. It consists of a mixture of litho-types belonging to the craton and the Western Charnockite Zone. The granulites show retrogression to amphibolite facies of metamorphism along the shear zone.

On the basis of different geological investigation and evidences tentative stratigraphic column (Table 1) was proposed by Ramakrishnan et al., (1994).

Table 1: Stratigraphic Sequence of Eastern Ghats [Ramakrishnan et al., (1994)]	
Age	Lithological Units
800-900 Ma	Alkaline rocks, granitoids
1000-1100 Ma	-----Eastern Ghats orogeny-----
	Development of eastern Ghats front of upgraded cratonic rocks.
	Incipient and massive charnockite and garnetiferous gneiss with biotite and sillimanite
1300-1400 Ma	Emplacement of alkaline rocks (Feldspathoid gneiss and anorthosite)
Khondalite Group (WKZ, CMZ, EKZ)	Garnet-sillimanite-Quartzo-feldspathic graphite gneiss
	Cordierite-sapphirine-spinel rocks
	Calc silicate rocks and rare marbles
	Quartzite rich in garnet
1600-1800 Ma (WCZ)	Evolution of purana basin
2600-2800 Ma	Charnockite with enclaves of basic granulite, high grade schists including BIF and layered basic complexes, representing original cratonic basement (?) in migmatitic amphibolite facies
3000 Ma	Vestigial events (?)

1.2.2 Geology of the area at G3 stage of investigation

The outcrop map of the proposed area consists of mappable lithological units of charnockite, granite gneiss, khondalite, leptynite and calc-silicate gneiss. The khondalite occurs along the higher altitude where as other lithological units are restricted to the hill slopes and valley portions.

Description of the lithological units

Charnockite

This is the dominant lithology of the area. Large continuous dome shaped exposures of charnockite are well exposed in central, eastern and south western parts; small outcrops of charnockite are also encountered in the north western and western part of the area.

Charnockite is a medium to coarse grained greasy looking rock that is typically greenish grey to dark grey in color. It is composed of plagioclase, quartz, prismatic pyroxene and occasionally garnet. The rock is very hard, compact and massive in nature. In some locations charnockite suffer some sort of migmatization evidenced by formation of well-developed flow folding.

Granite gneiss

Granite gneiss is extensively exposed in the northwestern, western, and southeastern parts of the study area. This rock is characterized by pinkish white color and is primarily composed of quartz, feldspar, biotite and garnet. The gneissosity is well-developed with distinct layering: light-colored bands rich in quartz and feldspar, alternate with darker layers dominated by biotite. In certain areas, larger augen-shaped porphyroblasts of quartz and feldspar are observed. The granite gneiss is foliated in nature, with a general trend NW-SE dipping towards southwest. Small graphite flakes occur in granite gneiss scattered in a disseminated form, aligned parallel to the foliation plane.

Khondalite

Khondalite in the area is hard, highly weathered, foliated, and migmatized, occurring predominantly at high elevations in the northeastern, southern and western parts of the region. The khondalite exhibits gradational boundaries with the surrounding granite gneiss. The rock is leucocratic, ranging in color from reddish-brown to buff-red and is medium to coarse-grained consisting primarily of garnet, quartz, feldspar, and sillimanite with or without graphite. Some of the khondalite units display coarse garnet grains. The general strike of the lithounit ranges from N50°W to N30°W, with dips between 40° and 60° towards southwest.

Leptynite

Leptynite occurs as small bodies within khondalite in areas near Palupai, Barhisola, Dhepagurha and Kalingaguda villages. The lithological units are light-colored and consist primarily of quartz, feldspar, staurolite, and garnet. A distinctive feature of the unit is the presence of well-developed quartz blades, which are oriented parallel to the foliation plane.

Calc granulite

Calc granulite has limited distribution and occurs within the granite gneiss in the area. Calc-silicate granulite bodies are encountered in the southern part of Tenupulisi village and northwestern part of Rangamati village. The rock is fine grained, greenish white in colour composed of wollastonite, diopside, plagioclase and quartz; shows ridge and furrow structure due to differential weathering of alternate compositional banding.

Quartzite

A narrow band of quartzite is located in the southwestern part of Palupai village, where it is associated with khondalite. The quartzite is brownish-white in colour, medium to fine grained, hard and compact composed predominantly of quartz with small proportions of garnet.

Basic Granulite

Basic granulite occurs as narrow bands within the granite gneiss near Bankili village. Patches of basic granulite occur within granite gneiss and leptynite in the northern part of chakrigurha village.

1.3 Geology of the proposed block area

Granite gneiss

Granite gneiss is characterized by pinkish white color and is primarily composed of quartz, feldspar, biotite and garnet. The gneissosity is well-developed with distinct layering: light-colored bands rich in quartz and feldspar, alternate with darker layers dominated by biotite. In certain areas, larger augen-shaped porphyroblasts of quartz and feldspar are observed. The granite gneiss is foliated in nature, with a general trend NW-SE dipping towards southwest. Small graphite flakes occur in granite gneiss scattered in a disseminated form, aligned parallel to the foliation plane.

Charnockite

Charnockite is a medium to coarse grained greasy looking rock that is typically greenish grey to dark grey in color. It is composed of plagioclase, quartz, prismatic pyroxene and occasionally garnet. The rock is very hard, compact and massive in nature. In some locations charnockite suffer some sort of migmatization evidenced by formation of well-developed flow folding.

Quartzo-feldspathic graphite gneiss

The quartzo-feldspathic graphite gneiss occurs along the nala sections and characterized by alternative bands of quart-feldspar rich band and graphite rich bands. The graphite flakes are parallel to the plane of gneissosity.

1.4 Mineral potentiality based on geology, geophysics, ground geochemistry etc.

- Based on the surface evidences, a total four number of graphite bearing samples were collected by MMPL within the block area. The value of FC% for the samples are given below:

SAMPLE ID	Moisture (ARB)	VM (DB)	Ash (DB)	Sulphur (DB)	FC (DB)
OKR - 01	1.39	4.12	92.53	0.09	3.26
OKR - 02	0.25	0.62	82.11	0.17	17.10
OKR - 03	2.50	2.43	94.37	0.14	3.06
OKR - 04	1.54	1.90	94.73	0.13	3.24

1.5 Recommendations of previous G4 stage mineral exploration report

The recommendations of previous G4 stage mineral exploration report are as follow-

- Reconnaissance studies and quarry observations indicate that workable graphite concentrations are mainly associated with **migmatized khondalite zones**, where **migmatization and nearby granitic intrusions** play a major role in graphite enrichment.
- In Bakbera, four bands contain about 19,993 tonnes of graphite (5.36–6.90% F.C.) to 10 m depth on the basis of 12 no of trenches length from 2m to 12m, depth varying between 1m to 2.5m.
- Graphite schist (20–25% F.C. visual estimation) exposed on eastern hill slope; **3–5 m width** over **20 m strike length** towards NW of Lamer village.

1.6 Objectives

The present exploration program (G3) has been formulated on the basis of the outcome of previous work as well as sampling data to fulfil the following objectives:

- Geological mapping on 1:2000 scale to delineate graphite bands and other lithological units in the area.
- Topographical Contouring on 1:2000 scales, by means of surface contouring at 2 m interval.
- Delineation of the potential subsurface mineralized zones by Geophysical Surveys (SP survey).
- Trenching will be carried out to expose the graphite bands.

- Exploratory drilling with 100-200 m strike spacing for 1st level (30 m vertical depth of intersection) and 2nd level (60 m vertical depth of intersection).
- Assessment of quality of the resources (333) as per UNFC norms & Minerals (Evidence of Mineral Contents) Rules- 2015.

2 Previous Work in adjoining area:

“Report on The Investigation for Graphite in Turekela and Bakbera Areas of Bolangir and Kalahandi Districts, Orissa” (Progress Report for the Field Season 1982-83) by S. D. Mohanty, P.Chakrabarti, M. Renganathan, Geologists & V.Ankanna, Asstt. Geologist, (Toposheets No: 64 L/11,14,15 and 64P/11 & 12) the mapped area in Bolangir district forms part of the Sargipali graphite belt and comprises graphite-bearing gneiss/schist, granulite, quartzite, granite gneiss, and pegmatite/quartz veins, overlain by thin laterite cover. Litho-units trend NNW–SSE to NNE–SSW with gentle easterly dips and show tight folding. Graphite mineralisation is confined to the migmatite zone.

In the Bakbera area, Kalahandi district, similar litho-units occur with steep easterly dips, and graphite is present as low-grade bands within the migmatites.

Graphite mineralisation is confined to sheared and hydrothermally altered migmatite zones and is affected by erosion. In Bakbera, two continuous bands contain about 19,993 tonnes of graphite (5.33–6.9% F.C.) to 10 m depth, while Turekela reserves await drilling results.

“Report on The Graphite Investigation in Parts of Bolangir, Kalahandi And Phulbani Districts of Orissa” (Progress Report for the Field Season 1983-84) by S. D. Mohanty, S. C. Kanungo, K. N. Nanda, Geologist (Sr.) and V. Ankanna, Asst. Geologist (Toposheets No: 64 L/14 and 64P/8 & 11), Graphite mineralisation in Bolangir and Kalahandi districts occurs mainly within **quartz–garnet–sillimanite ± graphite schist, migmatites and quartzite**, mostly as **low-grade band-type bodies**, with some medium-grade vein deposits along foliation joints and fold hinges. Seven linear zones were identified (five in Bolangir and two in Kalahandi), and reserves have been estimated down to **10 m depth**, indicating potential for large tonnage despite low grade.

Trenching suggests good continuity, and drilling of geophysical anomalies at **Turekela** confirmed subsurface graphite bodies (0.2–4.7 m thick). Further geophysical surveys and drilling are recommended, along with sulphide investigation near **Barcharan** due to associated sulphide mineralisation.

“Report on the Investigation for Graphite in Parts of Sambalpur; Bolangir and Kalahandi Districts, Orissa” (Progress Report for 1979-80 Field Season) by S. D. Mohanty and B. Sarangi Geologists, (Jr.) Geological Survey of India, Reconnaissance studies and quarry observations indicate that workable graphite concentrations are mainly associated with **migmatized khondalite zones**, where **migmatization and nearby granitic intrusions** play a major role in graphite enrichment. Both **syngenetic and epigenetic** graphite occurrences are present, with epigenetic bodies controlled by **shearing and fracturing**. Band-type graphite bodies are generally **low grade but high tonnage** due to long strike continuity, whereas vein/lensoid bodies are **higher grade but limited tonnage**.

Based on surface exposures, a minimum reserve of about **75,348 tonnes** of graphite is anticipated down to **40 m depth** (except Sargipali mine). Further work is recommended through continued inventory and reconnaissance surveys. Geophysical surveys are suggested for the soil-covered **Bijamal–Dahigaon zone** (potential ~4 km strike), the **Badi forest belt (Fatamunda–Jhikidangar)** (~5.6 km strike), and detailed exploration between **Fatamunda and Kandegan** (~2.4 km strike), which may yield large tonnage despite low fixed carbon values (1.05–12.17% F.C.).

3 Block description

The detailed co-ordinate of the proposed block is given below-

Table 2: Co-ordinates of corner points		
Cardinal points	latitude	longitude
A	20.2838	83.5480
B	20.2835	83.5595
C	20.1994	83.5800
D	20.1976	83.5670

4 Planned Methodology

In accordance with the objectives set for Preliminary exploration (G3 Stage) of Graphite in Kandegaon Block, Kalahandi District, Odisha geological mapping in 1:2,000 scale, trenching, geophysical SP survey, scout drilling, chemical analysis of the samples (BRS, PT and core samples), petrological and mineralogical studies are proposed in the block. The exploration will be carried out as per Minerals (Evidence of Mineral contents) Rules-Amended in 2021. Accordingly, the details of different activities to be carried out are presented in subsequent columns.

4.1 Topographic Surveying

Topography survey will be carried in the area (12.24 sq. km) and all the surface features will be marked in the 1:2000 scale. The block boundary will be surveyed by DGPS / total station in WGS-84 Datum and demarcation of the boundary pillars to enable the block auctionable. The reduced level and coordinate of the boreholes would be surveyed by DGPS/ total station.

4.2 Geological Mapping

Detailed geological mapping on 1:2000 scale in the area (12.24 sq. km) will be carried out by taking geological traverses. The contacts of different lithounits, surficial lithology, structural features, etc. will be noted in detail. The detailed geological map on 1:2,000 scale will be generated based on the details gathered during the field visit.

4.3 Core Drilling

4.3.1 Borehole plan:

In phase I, 1st level boreholes will be planned to investigate the depth persistence of graphite mineralization (lenticular body) up to 30 m vertical depths of intersection. The borehole spacing will be 100 m to 200 m. In phase II, 2nd level boreholes will be planned based on the reference of 1st level boreholes with positive outcome to investigate the depth persistence of the graphite mineralization at 60 m vertical depth of intersection.

4.3.2 Core Logging

The drill cores would be logged systematically viz. details of litho-units, colour, structural feature, texture, mineralization, besides the recovery, rock quality designation and type of ore deposit would be recorded.

4.3.3 Core Sampling

The drill core will be split into two equal halves and one part would be preserved in the core box. The other half will be powdered to 70 micron (200 mesh size) and the same would be divided into four parts (250 g each) through coning and quartering. One part of the sample will be sent to chemical laboratory for proximate analysis, second part to be preserved in the camp as duplicate sample, third part to be sent for chemical analysis of minor and trace elements by ICPMS and the fourth part would keep as either check sample or sample to be used for any other specific purpose.

The length of each sample will be kept 0.50 m-1.0 m depending upon the width of the graphite zone. 44 nos. would be analysed by ICPMS to ascertain the presence of other trace elements.

4.4 Petrographic and petrochemical Studies

Thin and polished section studies of the outcrop samples and the core samples will be studied for detailed petrographic and mineralogical characteristics. These samples will be collected from ore zones and associated rocks. A provision of 10 nos. specimens for both petrographic and petrochemical studies will be kept for the proposed area.

4.5 Bulk Density Determination

In addition, bulk density determination of 5 nos. samples will be carried out for the proposed block.

5 Nature Quantum and Target for G3 stage

Table no. 3: Nature and quantum of work for Preliminary exploration (G3 Stage) of Graphite in Kandegaon Block, Kalahandi District, Odisha			
Sl. no	Item of work	Unit	Quantum
1	Detailed Geological mapping (on 1:2,000)	Sq. Km	12.24
2	Geochemical sampling (Bedrock sampling)	Nos.	100
4	SP survey	L.km	10
6	Trenching	Cubic meter	300
7	Drilling (number of 1st level borehole = 10 @100m interval, number of 2nd level borehole = 10 @100m interval)	Meter	600+900= 1,500
8	Proximate analysis for graphite (BRS=100 (Groove line sampling); PT samples =200; core samples = 300)	Nos.	100+200+300=600
9	Proximate analysis for graphite 10% external check	Nos.	60
10	Analysis for 34 elements by ICP-AES / ICPMS (34 elements along with Cu, Pb, Zn, Fe, Ni, Co, Cr, Al, S, Bi etc)	Nos.	44
11	Petrographic studies	Nos.	10
12	Preparation of thin sections	Nos.	10
13	Study of thin section	Nos.	10
14	Bulk density/ specific gravity determination	Nos.	5
15	Drill core preservation	Meter	400

6 Manpower deployment

Two geologists, two geophysicists, one surveyor with required labourers and two drilling rigs with drilling crew will be deployed as per the requirement of the time schedule chart (Table: 4).

Table 4: Time Schedule/Action Plan for Preliminary exploration (G3) in Kandegaon Block, Kalahandi District, Odisha under NMEDT													
Item of work	Months												
	1	2	3	4	5	REVIEW	6	7	8	9	10	11	12
Camp Setup													
Detailed Geological Mapping (1:2,000)													
Topographic survey (2m contour interval)													
Bed Rock Sampling and trenching													
Chemical analysis of surface samples													
Geophysical SP survey													
Interpretation of SP data													
Drilling													
Sampling of drill cores													
Analysis of drill core samples													
Preparation of Geological Model													
Geological report preparation													

7 BREAK UP OF EXPENDITURE

The breakup of expenditure is given in table 5.

Estimated Cost for Preliminary exploration (G3) for Graphite in Kandegaon Block, Kalahandi District, Odisha							
Total area - 12.24 Sq.km; number of 1st level borehole = 10 @100m interval, number of 2nd level borehole = 10 @100m interval; Meterage - 600+900= 1,500m, Period of completion - 12 months, Review - After 5 months (after mapping, trenching and SP survey)							
SL.No	Item Of Work*	Unit*	Rate As Per NMEDT SOC 2025		Estimated Cost of the Proposal		Remarks
			SOC. Item No	Rate As Per revised SOC* (a)	Qty. (b)	Total Amount (Rs) (a*b)	
A	Detailed Geological Mapping Other Geological Work & Surveying						
i	Geological mapping (1:2,000), Trenching & Drilling work	Per Sq. km	1.1	18300	12.24	₹ 2,23,992.00	
ii	a. Charges for 2 Geologist per day (Field) for Geological mapping & Trenching work, drilling activity (without labour)	day	1.2.1a	₹ 14,500.00	150	₹ 21,75,000.00	

Estimated Cost for Preliminary exploration (G3) for Graphite in Kandegaon Block, Kalahandi District, Odisha							
Total area - 12.24 Sq.km; number of 1st level borehole = 10 @100m interval, number of 2nd level borehole = 10 @100m interval; Meterage - 600+900= 1,500m, Period of completion - 12 months, Review - After 5 months (after mapping, trenching and SP survey)							
SL.No	Item Of Work*	Unit*	Rate As Per NMEDT SOC 2025		Estimated Cost of the Proposal		Remarks
			SOC. Item No	Rate As Per revised SOC* (a)	Qty. (b)	Total Amount (Rs) (a*b)	
iii	b. Labours charges; Base rate (for 2 labours per geologists)	day	5.8	₹ 541.00	300	₹ 1,62,300.00	Amount will be reimbursed as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher.
iv	c. Charges for Geologist per day (HQ)	day	1.2.1a	₹ 10,500.00	30	₹ 3,15,000.00	
	Sub Total- A					₹ 28,76,292.00	
B	Trenching/Pitting						
i	Trenching	per cu.m	2.1.1	₹ 4,125.00	300	₹ 12,37,500.00	
	Sub Total- B					₹ 12,37,500.00	
C	Survey work						
i	Charges for one qualified surveyor	day	1.3.1	₹ 10,500.00	30	₹ 3,15,000.00	
ii	DGPS Survey for BH fixation & RL determination	Per Point of observation of observation	1.3.2	₹ 24,000.00	24	₹ 5,76,000.00	

Estimated Cost for Preliminary exploration (G3) for Graphite in Kandegaon Block, Kalahandi District, Odisha							
Total area - 12.24 Sq.km; number of 1st level borehole = 10 @100m interval, number of 2nd level borehole = 10 @100m interval; Meterage - 600+900= 1,500m, Period of completion - 12 months, Review - After 5 months (after mapping, trenching and SP survey)							
SL.No	Item Of Work*	Unit*	Rate As Per NMEDT SOC 2025		Estimated Cost of the Proposal		Remarks
			SOC. Item No	Rate As Per revised SOC* (a)	Qty. (b)	Total Amount (Rs) (a*b)	
iii	Labours Charges for survey work; Base rate	day	5.8	₹ 541.00	30	₹ 16,230.00	
Sub Total- C						₹ 9,07,230.00	
D	Ground Geophysical Survey (in- house)						
i	Charge for SP survey	Line km	3.3a	₹ 62,140.00	10	₹ 6,21,400.00	
ii	Charges for Geophysicist per day (HQ)	day	3.18	₹ 10,500.00	15	₹ 1,57,500.00	
Sub Total- D						₹ 7,78,900.00	
E	Drilling (after review) (in-house)						
i	Systematic Drilling (Hard rock) (HQ) in first Level	per m	2.2.1.1d	₹ 10,000.00	1500	₹ 1,50,00,000.00	1st level borehole = 10 @100m interval, number of 2nd level borehole = 10 @100m interval; Meterage - 600+900= 1,500m
ii	Borehole deviation by multi shot camera	per m	2.2.5	₹ 330.00	250	₹ 82,500.00	

Estimated Cost for Preliminary exploration (G3) for Graphite in Kandegaon Block, Kalahandi District, Odisha							
Total area - 12.24 Sq.km; number of 1st level borehole = 10 @100m interval, number of 2nd level borehole = 10 @100m interval; Meterage - 600+900= 1,500m, Period of completion - 12 months, Review - After 5 months (after mapping, trenching and SP survey)							
SL.No	Item Of Work*	Unit*	Rate As Per NMEDT SOC 2025		Estimated Cost of the Proposal		Remarks
			SOC. Item No	Rate As Per revised SOC* (a)	Qty. (b)	Total Amount (Rs) (a*b)	
iii	Land / Crop Compansation (in case the BH falls in agricultural Land)	per borehole	5.6	₹ 30,000.00	20	₹ 6,00,000.00	
iv	Construction of concrete Pillar (12"x12"x30")	per borehole	2.2.7	₹ 2,000.00	20	₹ 40,000.00	
v	Miscellaneous charges (Transportation of drilling rigs, accomodation for drilling camp, camp setting and winding construction of approach road making and drill core preservation)	Lumpsum	2.2.9	Drilling cost more than 50 lakhs and less than 1 crore: 20% of the drilling cost with a maximum ceiling of Rs. 15 lakh		₹ 30,00,000.00	For drilling cost more than 1 Cr and less than 2 Cr: 15% of the drilling cost with a maximum ceiling of 20 lakhs.

Estimated Cost for Preliminary exploration (G3) for Graphite in Kandegaon Block, Kalahandi District, Odisha							
Total area - 12.24 Sq.km; number of 1st level borehole = 10 @100m interval, number of 2nd level borehole = 10 @100m interval; Meterage - 600+900= 1,500m, Period of completion - 12 months, Review - After 5 months (after mapping, trenching and SP survey)							
SL.No	Item Of Work*	Unit*	Rate As Per NMEDT SOC 2025		Estimated Cost of the Proposal		Remarks
			SOC. Item No	Rate As Per revised SOC* (a)	Qty. (b)	Total Amount (Rs) (a*b)	
vi	Drill core preservation	per m	X	₹ 1,590.00	400	₹ 6,36,000.00	
vii	Charges for one Sampler per day (1 Party)	one sampler per day	1.2.1b	₹ 7,850.00	60	₹ 4,71,000.00	
viii	Charges for Labour	day	5.8	₹ 541.00	240	₹ 1,29,840.00	
	Sub Total- E					₹ 1,99,59,340.00	
F	Laboratory Studies						
1	Chemical Analysis						
i)	Surface Samples+ Trench samples+ BH Core samples						
a	Proximate analysis for graphite	Nos	4.1.18	₹ 3,614.00	600	₹ 21,68,400.00	BRS/ Grooveline sampling=100, Trench sample=200, BH Core sample=300

Estimated Cost for Preliminary exploration (G3) for Graphite in Kandegaon Block, Kalahandi District, Odisha							
Total area - 12.24 Sq.km; number of 1st level borehole = 10 @100m interval, number of 2nd level borehole = 10 @100m interval; Meterage - 600+900= 1,500m, Period of completion - 12 months, Review - After 5 months (after mapping, trenching and SP survey)							
SL.No	Item Of Work*	Unit*	Rate As Per NMEDT SOC 2025		Estimated Cost of the Proposal		Remarks
			SOC. Item No	Rate As Per revised SOC* (a)	Qty. (b)	Total Amount (Rs) (a*b)	
b	Proximate analysis for graphite (10% external check)	Nos	4.1.18	₹ 3,614.00	60	₹ 2,16,840.00	
c	Analysis of one rock/ soil sample for quantitative analysis of 14 REE elements+9 Trace elements (U, Ta, Ge, Be, Hf, Sn, As, Rb, Th) by ICP-MS (sequential technique)	Nos	4.1.15	₹ 7,400.00	40	₹ 2,96,000.00	Trench=20, BH Core sample=20
d	Analysis of one rock/ soil sample for quantitative analysis of 14 REE elements+9 Trace elements (U, Ta, Ge, Be, Hf, Sn, As, Rb, Th) by ICP-MS (sequential technique)	Nos	4.1.15	₹ 7,400.00	4	₹ 29,600.00	
2	Physical & Petrological Studies						
i	Preparation of Standard thin section of rock	Nos	4.3.2	₹ 800.00	10	₹ 8,000.00	

Estimated Cost for Preliminary exploration (G3) for Graphite in Kandegaon Block, Kalahandi District, Odisha							
Total area - 12.24 Sq.km; number of 1st level borehole = 10 @100m interval, number of 2nd level borehole = 10 @100m interval; Meterage - 600+900= 1,500m, Period of completion - 12 months, Review - After 5 months (after mapping, trenching and SP survey)							
SL.No	Item Of Work*	Unit*	Rate As Per NMEDT SOC 2025		Estimated Cost of the Proposal		Remarks
			SOC. Item No	Rate As Per revised SOC* (a)	Qty. (b)	Total Amount (Rs) (a*b)	
ii	Complete petrographic/ ore microscopic study/ mineragraphic report of rock sample (along with 5 nos. digital photo micrograph)	Nos	4.3.4	₹ 2,800.00	10	₹ 28,000.00	
iii	Petrochemical studies	Nos	4.1.17a	₹ 7,500.00	10	₹ 75,000.00	
iv	Bulk density analysis	Nos	4.8.3	₹ 2,500.00	5	₹ 12,500.00	
v	Raman Spectroscopy	per hour	4.5.1	₹ 2,700.00	24	₹ 64,800.00	
	Sub Total- F					₹ 28,99,140.00	
G	Total A to G					₹ 2,86,58,402.00	
H	Geological Report Preparation	5 Hard copies with soft copy	5.2	total cost of project exceeding 150 lakh		₹ 7,50,000.00	Reimbursement will be made after submission of the Final Geological Report in Hard Copies (5 Nos) and the soft copy to NMET.
I	Peer review Charges	As per EC decision		₹ 30,000.00	1	₹ 30,000.00	

Estimated Cost for Preliminary exploration (G3) for Graphite in Kandegaon Block, Kalahandi District, Odisha							
Total area - 12.24 Sq.km; number of 1st level borehole = 10 @100m interval, number of 2nd level borehole = 10 @100m interval; Meterage - 600+900= 1,500m, Period of completion - 12 months, Review - After 5 months (after mapping, trenching and SP survey)							
SL.No	Item Of Work*	Unit*	Rate As Per NMEDT SOC 2025		Estimated Cost of the Proposal		Remarks
			SOC. Item No	Rate As Per revised SOC* (a)	Qty. (b)	Total Amount (Rs) (a*b)	
J	Preparation of Exploration Proposal (5 Hard copies with a soft copy)	5 Hard copies with a soft copy	5.1	2% of the Cost or Rs. 5 Lakhs whichever is lower		₹ 5,89,168.04	EA will be reimbursed after submission of the Hard Copies and the soft copy of the final proposal along with Maps and Plan as suggested by the TCC-NMEDT in its meeting while clearing the proposal.
K	3D Ore body modeling using compatible software	As per actual/ implementing agency to put the cost based on the market survey	5.4			₹ 8,00,000.00	
L	Total Estimated Cost without GST					₹ 3,08,27,570.04	
M	Provision for GST (18% of L)					₹ 55,48,962.61	GST will be reimbursed as per actual and as per notified prescribed rate

Estimated Cost for Preliminary exploration (G3) for Graphite in Kandegaon Block, Kalahandi District, Odisha							
Total area - 12.24 Sq.km; number of 1st level borehole = 10 @100m interval, number of 2nd level borehole = 10 @100m interval; Meterage - 600+900= 1,500m, Period of completion - 12 months, Review - After 5 months (after mapping, trenching and SP survey)							
SL.No	Item Of Work*	Unit*	Rate As Per NMEDT SOC 2025		Estimated Cost of the Proposal		Remarks
			SOC. Item No	Rate As Per revised SOC* (a)	Qty. (b)	Total Amount (Rs) (a*b)	
N	Total Estimated Cost with GST					₹ 3,63,76,532.65	
				Rs. In Lakhs		₹ 363.77	

8 List of Plates

SL. No	Description
I	Geological map of Kandegaon block on 1:50,000 scale

II	Boundary of proposed block on toposheet number 64P/11 and 64P/12
----	--

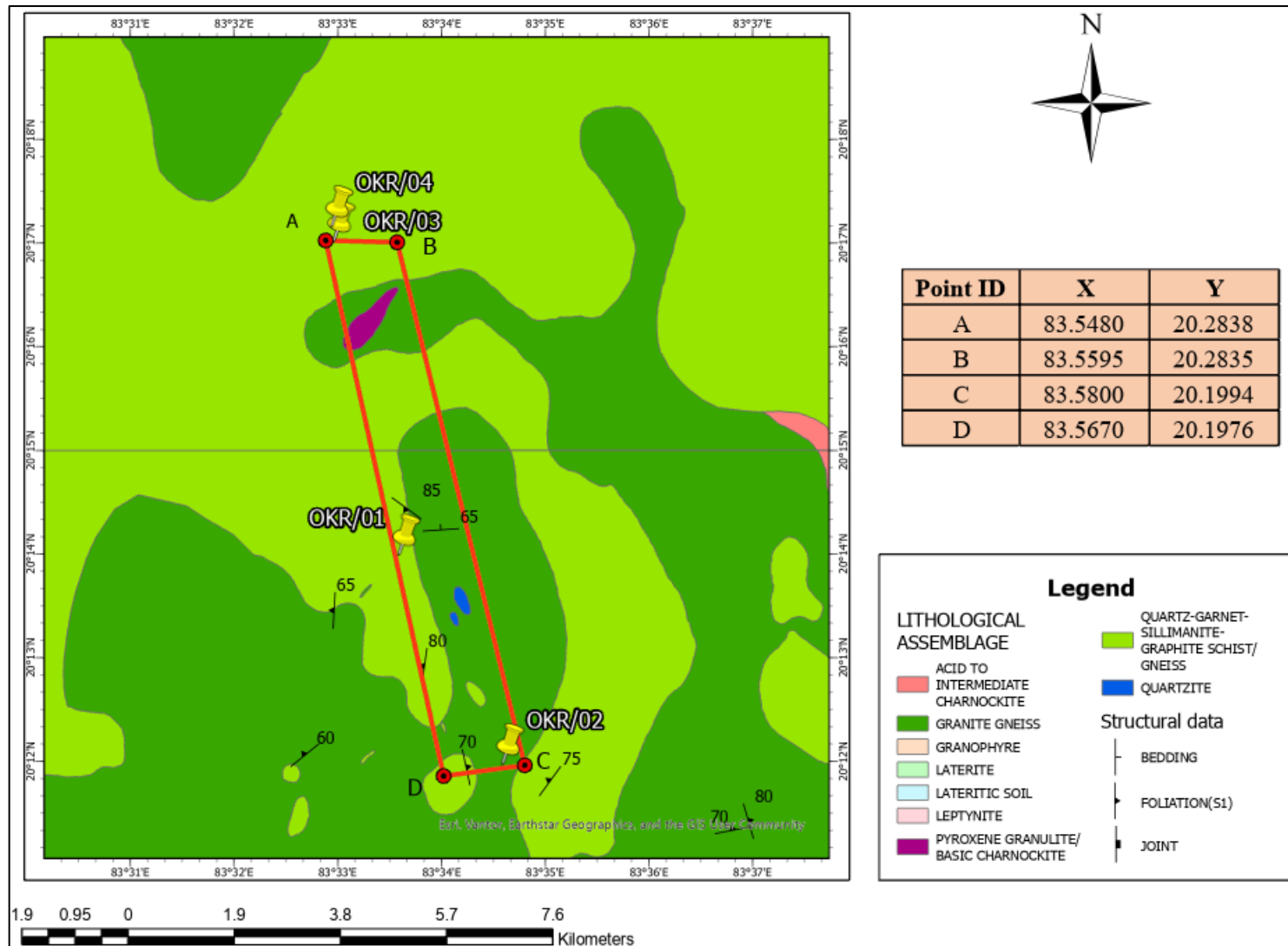


Fig 1: Geological map of Kandegaon block on 1:50,000 scale

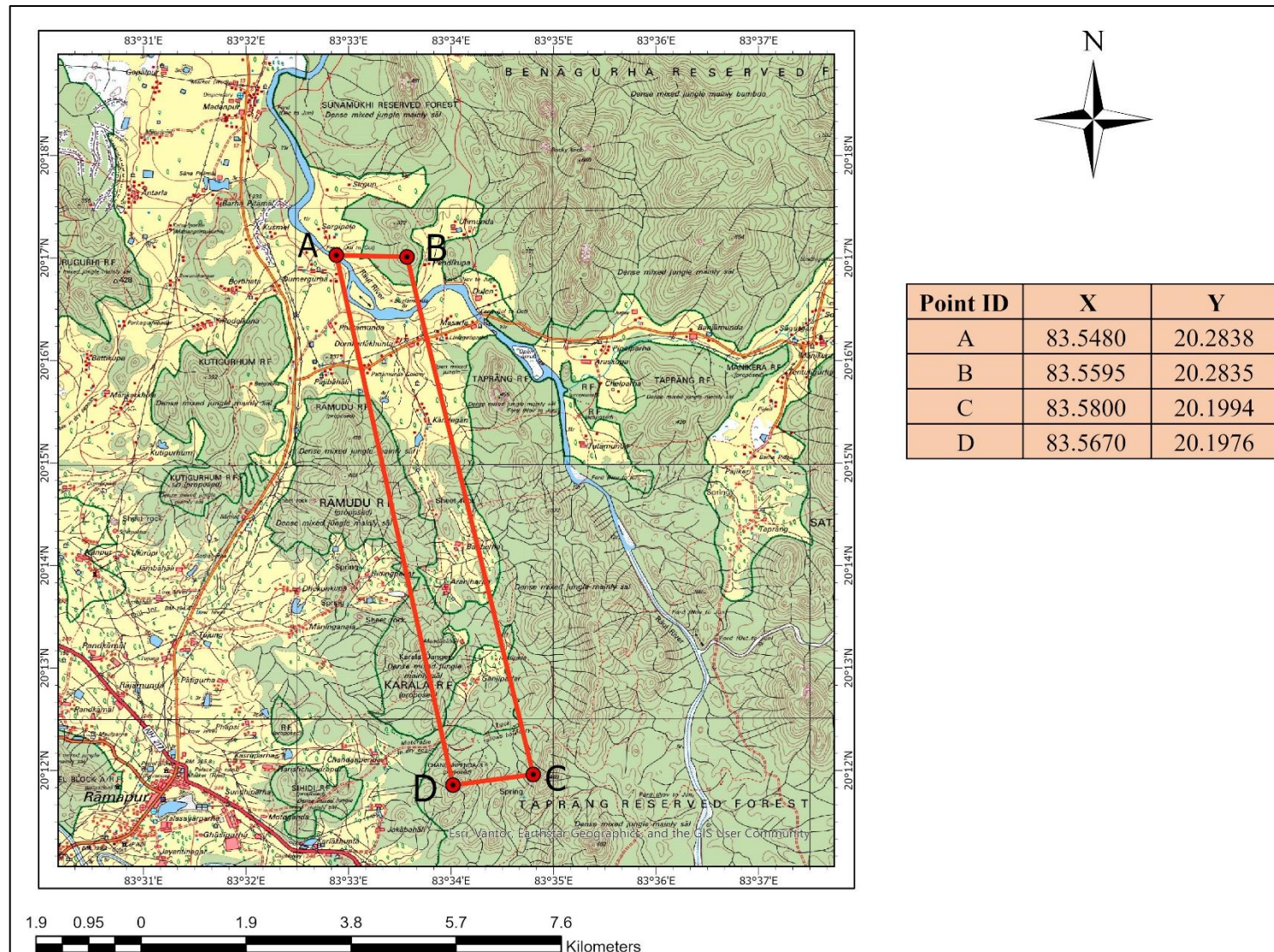


Fig 2: Boundary of proposed block on toposheet number 64P/11 and 64P/12