

**PROPOSAL OF RECONNAISSANCE SURVEY (G-4 STAGE) FOR  
IRON, MANGANESE AND ASSOCIATED MINERALS IN TALWA  
BLOCK (92.70 SQ. KM)  
DISTRICTS- JABALPUR AND KATNI , MADHYAPRADESH**

**COMMODITY: IRON, MANGANESE AND ASSOCIATED MINERALS**

**BY  
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**PLACE: NAGPUR**

**DATE: 15.03.2023**

**Summary of the Block for Reconnaissance Survey (G4 Stage)**  
**GENERAL INFORMATION ABOUT THE BLOCK**

<b>Features</b>	<b>Details</b>
Block ID	TALWA G4 BLOCK
Exploration Agency	Mineral Exploration and Consultancy Limited (MECL)
Commodity	Iron, Manganese and Associated Minerals
Mineral Belt	The area belongs to the Mahakoshal Group of rocks. Mineralisation of Iron is occurring around the area associated with Banded Iron Formation (BIF) while Manganese is associated with BIF and Phyllites.
Completion period with entire Time schedule to complete the project	Time Line for Exploration work with Drilling is 14 months.
Objectives	<p>The block area falls in the vicinity of old quarries, pits and several lease hold area for Iron and Manganese.</p> <p>The presence of supporting lithology for Iron and Manganese mineralization viz. BIF and Phyllites. encourages to take up the G4 Exploration in the area.</p> <p>Evaluation of previous work, work done by pvt mines and exploration agencies and field investigation done by MECL has indicated occurrence of Iron and Manganese in and around the proposed block. On the basis of these evidences of mineralisation, the present exploration program has been formulated to fulfill the following objectives.</p> <p>i) To carry out Geological &amp; structural mapping on 1:12,500 scale for demarcation of Iron and Manganese bearing host rock for these mineralisation with the structural features to identify the surface manifestations and lateral disposition of the mineralized zones.</p> <p>ii) To collect bedrock samples, Channel samples and Trench samples &amp; to analyze for Iron &amp; Manganese for further course of Exploration program.</p> <p>iii) Pitting / trenching will be done to expose the concealed host rock and mineralisation.</p>

		<p>iv) If phase-I exploration data will give positive results, 5 Nos. of scout boreholes shall be drilled which in turn will decide the future course of Exploration program at G-3 category of UNFC.</p> <p>v) To estimate reconnaissance resources (334) along with accessory elements as per UNFC norms and Minerals (Evidence of Mineral Content) Rules-2015 at G-4 level.</p>
	<p>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</p>	<p>Work will be carried out by the proposed agency (MECL).</p>
	Number of Geoscientists	Nos. of Geoscientists: 2 (1Field + 1HQ)
	Expected Field days( Geology, Surveyor)	Geologist Party days:150 field + 60 HQ Survey Party days : Nil

<b>1.</b>	<b>Location</b>	
	Longitude-Latitude	Refer Block Description
	Villages	Bargi, Talwa, Darshini, Ponda etc.
	Tehsil/Taluk	Majhoul, Sihora, Dhimarkheda
	District	Jabalpur, Katni
	State	Madhya Pradesh
<b>2.</b>	<b>Area (hectares/ square kilometres)</b>	
	Block Area	92.70 sq km
	Forest Area	Part of Amoch Reserve Forest falls in the Block area
	Government Land Area	Data not available
	Charagaha	Data not available
	Private Land Area	Part of the area is private cultivated land
	Study of DSS	Area Not Inviolate
<b>3.</b>	<b>Accessibility</b>	
	Nearest Rail Head	Sihora of West Central Railway Main line falls in the 3 km south of the Proposed block.
	Road	The proposed block is well connected via NH-30 connecting Sihora to Sleemanabad and via Majholi-Darshini-Sihora State Highway.
	Airport	Jabalpur in SW Direction, about 50 km from the block area

<b>4.</b>	<b>Hydrography</b>	
	Local Surface Drainage Pattern (Channels)	The drainage pattern in the block is dendritic. General flow direction of the area is towards south west and South in the northern part of the proposed block. Kanari Nadi, a tributary of River Narmada flows from the central part of the block towards south west direction.
	Rivers/ Streams	Kanari Nadi , a tributary of Narmada
<b>5.</b>	<b>Climate</b>	
	Mean Annual Rainfall	Average annual rainfall is 900 mm The climate of the area is mainly tropical with clearly defined dry and rainy seasons. The humidity is generally low except during the monsoons.
	Temperatures (December) (Minimum) Temperatures (May-June) (Maximum)	Minimum temperatures 10°C Maximum temperatures up to 45°C
<b>6.</b>	<b>Topography</b>	
	ToposheetNumber	64 A/02 and 64 A/03
	Morphology of the Area	The topography in the proposed block is moderate to flat with occasional undulation indicating an overall slope towards south.
<b>7.</b>	<b>Availability of baseline geoscience data</b>	
	Geological Map (1:50K/25K)	Bhukosh ( 1:50,000)
	Geochemical Map	-
	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps)	
<b>8.</b>	<b>Justification for taking up Reconnaissance Survey/ Regional Exploration</b>	<p>i) The area belongs to the Mahakoshal Group which is well known for various mineral resources including Iron and Manganese.</p> <p>ii) Mineralisation of Iron is occurring around the area associated with Banded Iron Formation (BIF) while Manganese is associated with BIF and Phyllites.</p> <p>iii) Several active Mines of Iron and Manganese are there in the close vicinity of the block including an exploration block of NMDC in south of the proposed block for Fe-Mn.</p> <p>iv) MECL has conducted field visit in the proposed block. During geological traverses, MECL has identified BIF and Phyllites at</p>

		<p>several places, collected 4 nos. of samples and analysed them through handheld XRF and in MECL Chemical Lab. Samples are showing upto 51 % Fe and Mn upto 33.09%.</p> <p>v) Based on the mineralization evidences of Iron and Manganese in and around the block, the present Reconnaissance Survey exploration program at G-4 level has been prepared. Geological mapping, surface sampling and pitting/trenching will be helpful in assessing the lithology, disposition and grade of the mineralized zones, structural features etc.</p> <p>v) The Exploration will be helpful in estimation of reconnaissance resources of Iron and Manganese and associated minerals in the block area. Geochemical sampling of BRS/CS/ Pitting/trenching and the drilling of scout boreholes will be helpful in assessing the disposition and grade of mineralization.</p> <p>vi) The Reconnaissance Survey (G4) will eventually help in planning of detailed exploration program (incase upgraded to G-3 level) which in turn will facilitate the state Government for action of block.</p>
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# **PROPOSAL OF RECONNAISSANCE SURVEY (G-4 STAGE) FOR IRON, MANGANESE AND ASSOCIATED MINERALS IN TALWA BLOCK (92.70 SQ.KM.), DISTRICTS- JABALPUR AND KATNI, MADHYA PRADESH**

## **1.0.0 INTRODUCTION**

### **1.1.0 Preamble**

- 1.1.1 Iron and Manganese being important constituent in steel manufacture has played a vital role in the industrial growth of a nation. Both Iron and Manganese are one of the most common elements in the Earth's crust and is widely distributed across the planet's surface. Iron, the metal of common man has its use in every sphere of life, since the Iron Age 800 BC and there on, it forms the backbone for the industrial growth of a nation. The stage of growth in iron and steel industry of a nation is a measure of its economic status among the world communities. Manganese is very hard, brittle, gray-white transition metal that is found in variety of minerals, but never as free element in nature and it is often found in the form of minerals in combination with iron.
- 1.1.2 It is well known fact that India is endowed with rich deposits of iron ore both quality and quantity wise. Indian iron ores are good demand in the international market especially in Asian markets. India could further explore markets in the Middle East and Europe as it is well placed geographically to these regions in comparison to other leading iron ore exporting countries in the world.
- 1.1.3 To cope with the increasing demands, mining activities have to be accelerated. Mechanisation of iron ore mines is imperative not only to increase production but also to reduce production cost. The leading iron producing countries like Brazil, South Africa and Australia have increased their iron ore production by adopting cost-effective and technologically advanced schemes of mining.
- 1.1.4 Beneficiation of low grade iron ore and fines that are in abundance in India could be another viable prospect. This will fetch good export value to the indigenous iron ore and create job opportunities in the sector. The Regional Research Laboratory(RRL), Bhubaneshwar, Ore Dressing Division of IBM and National Metallurgical Laboratory (NML), Jamshedpur, have developed techniques of iron ore beneficiation of iron ore on pilot scale.

- 1.1.5 Although India is endowed with substantial resources of iron ore, many prospective areas in the country have still not been explored. Detailed exploration may result in further augmentation of iron ore resources. With increased use of iron ore with around 50% Fe in globe steel plants there is a need to reassess the iron ore resources of the country. Banded Iron Formation, namely, Banded Haematite-Quartzite (BHQ)/Jasper and Banded Magnetite Quartzite (BMQ) are other potential sources of iron ore and need exploration for assessment of technology to beneficiate BHQ/BMQ to extract iron ore from these sources.
- 1.1.6 On the other hand, increasing demand of manganese in the country in recent years can be eased with the exploration of new manganese deposits of economic importance.
- 1.1.7 The Govt. of India enacted the MMDR Amendment Act, 2015 duly introducing the system of auction for allocation of Mineral Concessions. Manganese has been categorized in the Fourth Schedule which needs prospecting and exploration by the State Govt. before auctioning of the blocks.
- 1.1.8 MECL in association with DMG, Madhya Pradesh has looked up for the freehold area for investigation of Iron and Manganese and associated minerals around the explored Iron and Manganese blocks in Jabalpur, Katni etc districts of Madhya Pradesh.
- 1.1.9 Subsequently, after receipt of consent from DMG, Madhya Pradesh to take up exploration work, MECL has prepared an exploration proposal for reconnaissance survey (G-4) for iron and manganese and associated minerals in Talwa Block in Jabalpur and Katni District of Madhya Pradesh and submitted to NMET for taking up for discussion in the upcoming TCC.

### **1.2.0 Location and Accessibility**

- 1.2.1 The block is located in the Jabalpur and Katni Districts of Madhya Pradesh. The proposed block is well connected via NH-30 connecting Sihora to Sleemanabad and via Majholi-Darshini-Sihora State Highway. Sihora Railway Station of West Central Railway Main line falls in 3 km south of the Proposed block. The nearest airport Jabalpur, is 50 km away from the block in SW direction. The area falls in Survey of India Toposheet No. 64A/02 and 64 A/03.

### **1.3.0 Physiography & Drainage**

- 1.3.1 The topography in the proposed block is moderate to flat with occasional undulation indicating an overall slope towards south west.

1.3.2 The drainage pattern in the block is dendritic. General flow direction of the area is towards south west and South in the northern part of the proposed block. Kanari Nadi, a tributary of River Narmada flows from the central part of the block towards south west direction.

#### **1.4.0 Climate**

1.4.1 The Average annual rainfall is 900 mm The climate of the area is mainly tropical with clearly defined dry and rainy seasons. The humidity is generally low except during the monsoons. The area comes within the semi arid zone with temperature ranging from 10°C (Dec-Feb) to 45°C (Apr-Jun).

#### **1.5.0 Flora Fauna**

The Block falls in the part of Amoch Reserve Forest. Main flora of the area are Mangoes, Neem (Margosa), Tendu, Mahua, Palas, Pipal, Barakar and Sagaun and main fauna are boars, Cheetal, Sambar, Rabbits, Snakes and Foxes. Large size scorpions are commonly found here which are almost jet black to brownish black in colour.

#### **1.6.0 Regional Geology**

1.6.1 The Proposed block falls in the Mahakoshal Group of rocks which is famous for various mineral assemblages. Mahakoshal Group of rocks are represented by the volcano-sedimentary sequence occurring as ENE-WSW trending linear belt extending from Narsinghpur district in M.P. to Palamau district in Jharkhand. The sediments include quartzite, conglomerate, phyllite, chert, stromatolitic dolomite, limestone and Banded Iron Formation inter-layered with metabasics of basaltic composition. The narrow belt of high grade gneisses which occur to the north and south of this belt in the area have been considered to be the basement for Mahakoshal Group of rocks. The Mahakoshal Supracrustals are intruded by serpentinitised ultramafic bodies of dunite-peridotite and pyroxenite composition. Syn to post kinematic granitoids have intruded this sequence which are 1800 Ma and 2400 Ma old (Rb-Sr age dating, Bandyopadhyay et al, 1990). The Supracrustal rocks have been subjected to three phases of deformations, the first two phases are more pronounced (Roy & Bandyopadhyay, 1990). Green schist facies of metamorphism is seen in the entire belt, however, locally higher grade minerals also occur.



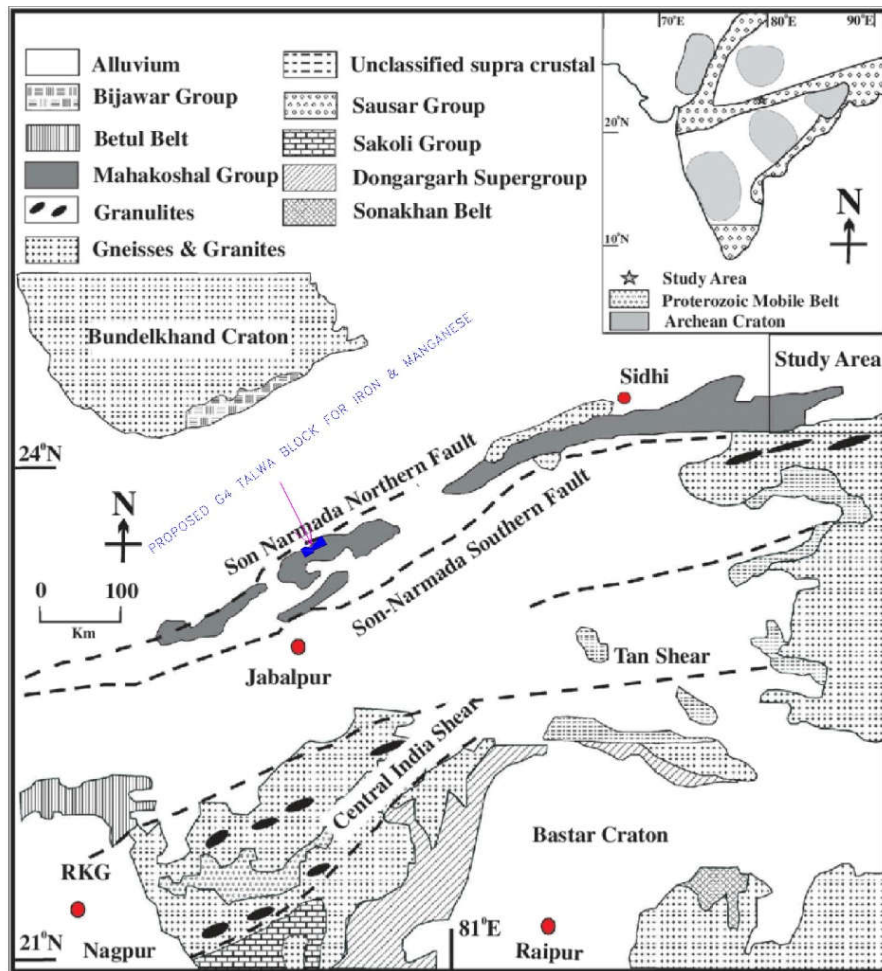


Fig- Map showing Proterozoic Mobile belt, Mahakoshal Group and the proposed G4 block

- 1.6.2 Nair et al. (1995) have advocated a threefold classification of Mahakoshal Group. The lower part comprises ultramafic flows and plugs constituting Chitrangi Formation, while the middle part named as Agori Formation, comprises chemogenic sediments viz. meta carbonates, chert and BIF with thin mafic flows. The upper part named as Parsoi Formation comprises thick sequence of argillites and greywacke.
- 1.6.3 Regional stratigraphic succession of the litho-units after GSI is illustrated in the Table I.A. Regional geological map with the proposed Block is given in PLATE-II.

**Table I.A**  
**Regional Stratigraphic sequence of Litho units (After GSI)**

Age	Supergroup	Formation/Beds	Lithology
Lower Cretaceous	Gondwana	Chandia	Fine to medium grained Sandstone
-----Faulted Contact-----			
Proterozoic	Vindhyan		Sandstone, Shale, Conglomerate
-----Unconformity-----			
Early Proterozoic to Archaean	Mahakoshal	Intrusives	Quartz veins, Quartz porphyre veins Mafic and Ultramafic intrusives
		Bhitrigarh Formation	Phyllite with bands of quartzite, Conglomerate
		-----Unconformity-----	
		Slemanabad Formation	Dolomite, Limestone with bands of BIF, Manganiferous chert, quartzite and metabasalts, pyroclasts

### 1.7.0 Regional Structure

- 1.7.1 **Diastrophic Structures** The overall structural framework of the Mahakoshal belt is represented by a series of upright to slightly overturned folds on southerly dipping axial planes and the folds developed during the initial stage of deformation were refolded into nearly vertical to reclined folds during the course of the progressive deformation, especially in the vicinity of the shear zones. According to Roy and Bandyopadhyay (1990), the Supracrustal rocks of the Mahakoshal belt have been involved in folding of at least three generations (D1, D2 & D3) and the present day ENE-WSW disposition of the belt is due to the development of D1 and D2 structures. The shear zone rocks include as part of the Mahakoshal Supracrustal and the granitoids occurring further on the southern margin. The mylonitic foliation within the shear zone is parallel to the schistosity of the dominant folds (D1) and sheath like folds are found in the mylonites. The North to NNW subhorizontal shortening across a large terrain of the deformed rocks and a shearing movement superimposed over the regional strain along the steep southerly dipping slip/shear planes represented by slip faults (Abhinaba Roy and M. K. Devarajan).
- 1.7.2 The regional strike of the Mahakoshal Group of rocks is ENE-WSW to East-West with dips ranging from 55° to 80°. Presence of isoclinal folds, asymmetrical folds and

cross folds, reflect the deformational events. The earliest recognized folding which has generated tight, isoclinal, reclined folds with sub vertical axial planes is represented by a closure at Pan Umariya village located at south west of the Imaliya village. The pervasive foliation in the volcano sedimentary sequence, which strikes in ENE-WSW direction and was generated during this deformation, is seen in this part of the Mahakoshal belt. The plunge of the folds is towards SSE. The second event of the deformation has developed folds with sub vertical axial planes with axis plunging very gently either ENE or WSW. Both of these events have developed folds which are co-axial but one has a gentle plunge whereas the other has steep plunge of axis. Topography in this part is also representing ENE-WSW trending alternate hills and valleys. The third event, which has NNW-SSE axial trend with open warps where cross faults are present, has caused discontinuity or gap in these ridges. This particular activity is most important in the Mahakoshal belt for localization of mineralisation. The above mentioned diastrophic structures like foliation, mesoscopic and minor folds, are reflecting the deformational history of the supracrustals in the present area. In the central part of Mahakoshal belt fold closures of the major folds as such are not well preserved, however, some of the F2 fold closures seen in the central part are at Pan Umariya, Sihora and Tindni which also represent the large scale folds of the Mahakoshal belt. The map scale folds and minor folds have varying plunges which are either plane cylindrical or non-planar and non-cylindrical, tight to isoclinal, upright to reclined folds. These may overall represent sheath geometry. These are seen in the Sarada area (23°28'31" : 80°08'41", 64A/3) in the central part of the Mahakoshal belt (Singhai and Keshava Prasad, 1997-98). Plunge in the minor fold of Tindni closure, which is plane, cylindrical, upright to reclined fold, varies from 15° to 80° both towards ENE and WSW as observed in this part of the Mahakoshal belt. Such variations have been attributed to inhomogeneous nature of the strata in the area (Roy and Bandyopadhyay, 1990).

### 1.7.3 Non Diastrophic Structures

The non-diastrorphic structures and planar features like bedding is represented by compositional layering within the BIF, colour banding in the chert and jasper bands

and alternate silica rich and mica rich layers within the metapelites of the Mahakoshal belt. The colour banding in the dolomite and chert, which is a dominant unit in this part, is exhibited by light to dark greyish tone and pink to pinkish & purple impurities in chert bands. Intercalations of phyllite within the dolomite and calcareous intercalations in argillaceous rocks are reflecting the depositional characters. Thin sedimentary units, which are of arenaceous nature, are also found in the calcareous and argillaceous rocks. The variation in grain size, fineness and coarseness are characteristic of these units. Presence of intra-formational conglomerate and its gradation towards coarseness or fineness is indicative of its depositional nature. In this part, the regional stratification is ENE-WSW to WNW-ESE with sub vertical dips varying from 70° to 80° due south. Meta basaltic flows, which occur in Shahdar and Madhana area upto east of Pan Umaria show flow structures like vesicles filled with secondary materials or minerals. Flows may contain Pahaehoe like features and these may have development of pillow structure as has been suspected from the north eastern part of Dungaria in Sleemanabad area.

#### 1.8.0 Geology of the Block

The area mostly exposes lithounits belonging to Early Proterozoic to Archaean aged Mahakoshal Group of Rocks comprising Quartz veins, Quartz porphyre veins, Mafic and Ultramafic intrusive, Phyllite with bands of quartzite, Conglomerate Dolomite, Limestone with bands of BIF, Manganiferous chert, quartzite and metabasalts, pyroclasts. The tentative stratigraphic sequence of litho units exposed in the Block area (After GSI) is given in Table I.B.

**Table I.B**  
**Stratigraphic sequence of the Talwa G4 Block**  
(After GSI)

Age	Supergroup	Formation/Beds	Lithology
Early Proterozoic to Archaean	Mahakoshal	Intrusives	Quartz veins, Quartz porphyre veins Mafic and Ultramafic intrusives
		Bhitrigarh Formation	Phyllite with bands of quartzite, Conglomerate
		-----Unconformity-----	
		Sleemanabad Formation	Dolomite, Limestone with bands of BIF, Manganiferous chert, quartzite and metabasalts, pyroclasts

## **1.9.0 Mineral Potentiality based on geology and ground geochemistry**

1.9.1 Iron and Manganese mineralization associated with the Early Proterozoic aged Mahakoshal Group of rocks has been present in the area marked by the presence of BIF and Mn bearing Phyllites etc. Previous agencies have also observed the presence of Iron and Manganese and several old working pits are present in the area. Banded Hematite Jasper (BHJ) in the area occurs mainly as a simultaneous layering of hematite and jasper. Hematite is in dark reddish-black colored and Jasper is in dark pinkish colored. Banded Hematite Quartzite (BHQ) are present in the area with an alternate layering of hematite and quartz bands. Hematite layer is having a dark reddish black colour and quartz is white in colour.

1.9.2 Phyllites are exposed in the moderate to low lying areas. In general, it represents low-grade metamorphic activities. At places, they are grey to yellow in colour but near the contact of manganese body, they are in whitish or greyish in colour. As far as a mineral constituent of manganese ore is concerned, psilomelane and pyrolusite are the dominant manganese bearing minerals in the area. Psilomelane is greyish in colour with a brownish tint and occurs as finely crystalline aggregate and colloidal form. It is strongly anisotropic with high birefractance due to variable hardness. Pyrolusite shows greyish coloured with blueish tint and occur as fine grains colloidal and stalactitic forms. It has also very high anisotropism and reflectance. Shrinkage cracks are also very common which are formed due to the loss of water possible at the time of formation.

## **2.0.0 Previous Work**

2.1.0 The southern limit of Mahakoshal Group has been a matter of debate as most of the mappers had shown granite, granite gneiss, schist and metamorphics occurring to the south as basement for Mahakoshal Group. In the “Field Workshop” on Mahakoshal Group (10 & 11 April 2004), it was well established that most of the granites are of intrusive nature and the enclaves of schist/phyllite within them are part of Mahakoshal Group.

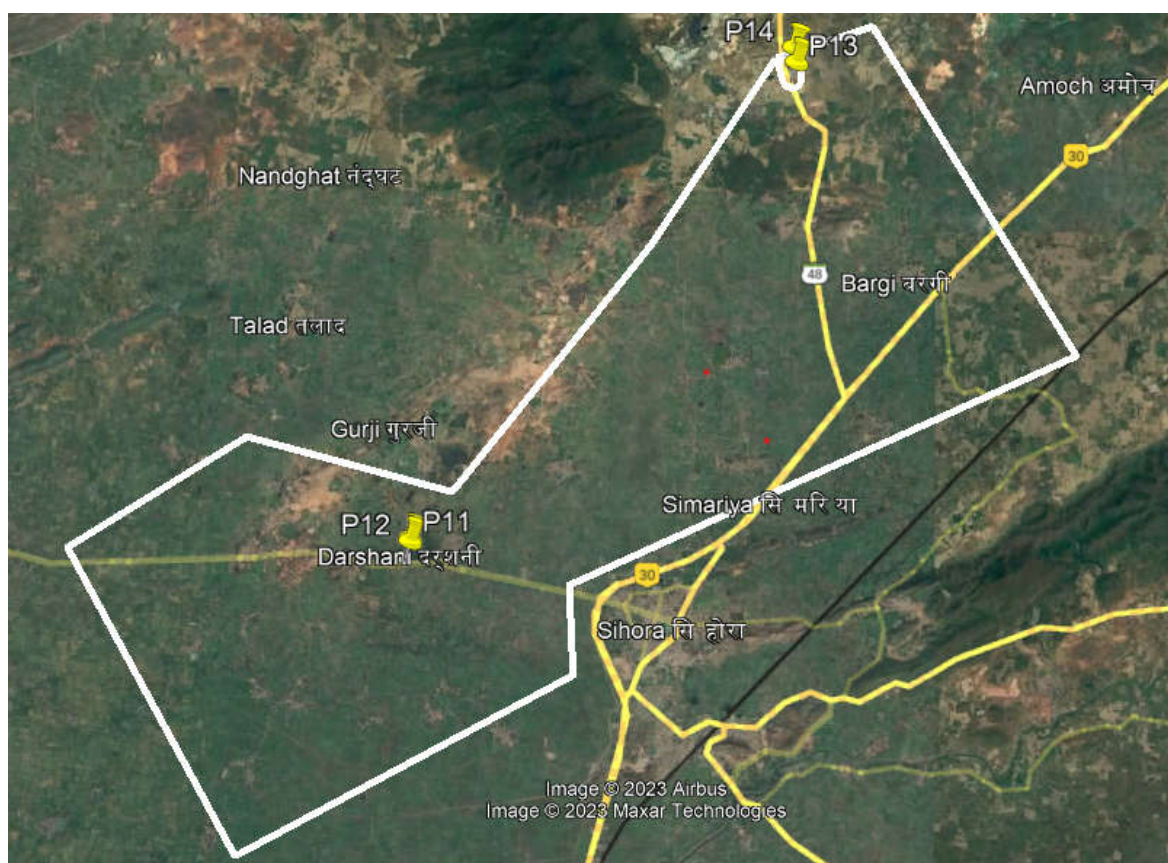
- 2.2.0** The F.R. Mallet & Huges in 1833 surveyed the parts of Jabalpur District. and identified iron ore deposits associated with BIF and laterites in the area. He mentioned the presence of iron ore bands of varying thickness in the area. Earlier workers (Fermor, 1990; Krishnan, 1939) have described these gneisses and metasedimentary rocks equivalent to Dharwar Group of rocks.
- 2.3.0** Then, G.R. Rao of the DGM, MP in 1959, examined this area and referred the iron ore reserve to be low to medium grade. S.S. Mishra of the DGM, MP in 1961 established that the iron ore bands continue has vast continuation in the area.
- 2.4.0** Sharma R.K. (1962 - 63) and Tiwari R.K (1964- 65) mapped in and around the area and has shown banded quartzite, dolomite, phyllite and epidiorite as unclassified unit. In the basin clastic sediments were deposited first, followed by chemogenic sediments; the chert and dolomites and the intermittently basic lavas.
- 2.5.0** Subsequent compilation of Quadrangle Geological Map (QGM)by GSI has shown these rocks as unclassified Mahakoshal and older granite gneisses. Previous exploration was conducted by Geological Survey of India, Jabalpur at G4 stage having titled “Investigation for Iron Ore in Sihora and Gosalpur area in Jabalpur district” during FSP 2015-2017.
- 2.6.0** Active Mines and Exploration blocks of Iron and Manganese are there in the close vicinity of the block.

### **3.0.0 FIELD VISIT BY MECL**

MECL has conducted field visit in the proposed block. During geological traverses, MECL has identified the host rocks viz. BIF and Phyllites at several places. 4 no. of Samples are collected and analysed through handheld XRF and in MECL Chemical Lab. Samples are showing upto 51 % Fe and up to 33.09% Mn value in XRF Analysis. Further, these samples are analysed in MECL Chemical Lab, Nagpur. The analytical results shown in hand held XRF are mentioned below:

**Table III.A – Analysis Results of Samples by Hand held XRF**

Sample ID	Latitude	Longitude	Hand held XRF Result in %			
			Fe%	Al%	Si%	Mn%
P-11	23.4983262°	80.05998284°	16.30	1.26	1.078	33.09
P-12	23.49786284°	80.05995501°	50.92	3.25	3.76	-
P-13	23.57446352°	80.12732673°	30.26	9.36	7.86	-
P-14	23.60811101°	80.22541042°	37.61	9.05	5.43	-



**A. Location of the sample collected from the mineralization area in the Proposed Talwa G4-Block for Iron-Manganese**



B. Field photograph of exposure showing Manganese mineralisation near Darshini in the Proposed Talwa G-4 Block





C. Field photograph of showing BIF near Darshini in the Proposed Block



D. Photographs of Hand specimen samples collected and analysed from the proposed block

#### 4.0.0 Block description

4.1.0 The proposed G-4 block for Iron and Manganese and associated minerals falls in Survey of India Toposheet No. 64A/02 and 64A/03 and covers an area of 92.70 sq km in and around villages Bargi, Talwa, Darshini, Ponda etc. of Jabalpur and Katni Districts, Madhya Pradesh. The block location is given in **PLATE-I**. The Coordinates of the corner points of the block area both geodetic and UTM are given in **Table No.-IV.A**.

<b>Table-IV.A Coordinates of cardinal points of Talwa Iron-Manganese G4 Block (92.70 Sq Km)</b>					
<b>Sl. No.</b>	<b>Corner</b>	<b>DD° MM' SS" (WGS 84)</b>		<b>UTM 44N</b>	
	<b>Points</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>Easting(X)</b>	<b>Northing(Y)</b>
1	A	23° 29' 59.3"	80° 00' 03.9"	398007.76	2599202.89
2	B	23° 31' 03.2"	80° 01' 56.7"	401219.58	2601147.56
3	C	23° 30' 31.5"	80° 04' 05.9"	404876.38	2600149.26
4	D	23° 32' 53.5"	80° 06' 10.4"	408436.43	2604492.78
5	E	23° 34' 41.4"	80° 07' 29.0"	410684.41	2607796.93
6	F	23° 34' 59.5"	80° 08' 29.6"	412406.07	2608344.34
7	G	23° 31' 50.0"	80° 10' 37.8"	416006.79	2602494.7
8	H	23° 29' 37.9"	80° 05' 19.4"	406951.47	2598487.24
9	I	23° 28' 46.0"	80° 05' 21.8"	407010.65	2596891.02
10	J	23° 27' 01.5"	80° 01' 49.5"	400964.36	2593715.3

#### 5.0.0 Planned Methodology

In accordance to the objective set for reconnaissance survey (G-4) of the block, the exploration programme is proposed. The Exploration shall be carried out as per Minerals (Evidence of Mineral Contents) Rule-2015. Accordingly, the following scheme of exploration is formulated in order to achieve the objectives. The details of different activities to be carried out are presented in subsequent paragraphs.

#### 5.1.0 Geological Mapping

Geological mapping will be done in the entire 92.70 sq km area on 1:12,500 scale. Rock types, their contact, structural features will be mapped. Surface manifestations of the ore bodies available along with their surface disposition will be marked on map.

#### **5.2.0 Surveying:**

During exploratory drilling of scout borehole, fixation and determination of reduced level and co-ordinates of the boreholes will be undertaken by DGPS/ Total station.

**5.3.0 Surface Geochemical sampling (Bed Rock/Channel Sample):** During the course of Geochemical Sampling the bed rock /channel samples shall be collected from the outcrops.

**5.4.0 Exploratory Mining (Trenching/Pitting)** Trenching/pitting (Excavation) shall be carried out in the potential zones identified based on the results of geological mapping and geochemical sampling. A provision of trenching/pitting of 100 cubic meter has been planned. Trenching work will be carried out by cutting trenches of 1m width and 2 m depth directly on the fresh outcrop/rock exposures across the Fe and Mn ore bearing formation, Locations of pits/trenches on ground will be decided by field geologist based on field observations. Trench walls will be geologically mapped.

**5.5.0 Bed Rock/Channel Sample/Trench Samples:** A total of 300 no of primary, 15 no of internal check and 30 no of external check Bedrock/Channel/Trench samples will be collected. Sample taken will be analysed for Total Fe, Total Mn, Al<sub>2</sub>O<sub>3</sub>, P<sub>2</sub>O<sub>5</sub>, Cao, SiO<sub>2</sub> and Acid insolubles. A total of 23 Nos. (20 Primary + 3 Check) of samples may be collected and analysed fo Au by fire Assay method.

**Note: Sample analysis for Gold will be done from the powdered samples of -100mesh. Other sample analysis will be done from the powdered samples of -200mesh.**

#### **5.6.0 Core Drilling:**

5.6.1. Based on Geological mapping, Geochemical studies and trenching/pitting (Excavation), the extension of the mineralized zones (ore bodies) will be marked. To find out the potentiality of mineralized zones in strike & dip direction, 5 Nos of scout boreholes involving 500m of drilling will be carried out for upper level of intersection of mineralized zones.

5.6.2. **Drill Core Logging:** The borehole cores would be logged systematically. Details of the litho units, colour, structural feature, texture, mineralization, % recovery of core, rock quality designation (RQD) etc. would be recorded.

**5.7.0 Drill Core Sampling:**

**5.8.0** The mineralized (Iron and Manganese) part of drill core will be sampled as Primary sample. The length of each sample will be kept 1.00 m within the ore zone depending upon the thickness of particular type of manganese ore and its physical character. The primary core samples will be analysed for Total Fe, Total Mn, Al<sub>2</sub>O<sub>3</sub>, P<sub>2</sub>O<sub>5</sub>, Cao, SiO<sub>2</sub> and Acid insolubles. The cores of rocks 3m immediate on footwall and 3m immediate on hanging wall of mineralized zones would be sampled at 1.0 m interval, as far as possible, depending upon the intensity of mineralization, change in lithology and core recovery etc.

**5.9.0** A total of 115 no of core samples (100 no Primary & 15 no Check samples) shall be generated from the mineralized zones to be intersected in the boreholes. Samples will be analysed for Total Fe, Total Mn, Al<sub>2</sub>O<sub>3</sub>, P<sub>2</sub>O<sub>5</sub>, Cao, SiO<sub>2</sub> and Acid insolubles. Internal check samples (5% of Primary samples) will be analyzed in Chemical Laboratory of MECL and 10% of Primary samples will be sent as External Check Samples to NABL External Labs. A total of 23 Nos. (20 Primary + 3 Check) of samples may be collected and analysed for Au by fire Assay method.

**Note: Sample analysis for Gold will be done from the powdered samples of 100mesh. Other sample analysis will be done from the powdered samples of 200mesh.**

**5.10.0** Total 20 Nos of composite samples will be analysed for Total Fe, Total Mn, Al<sub>2</sub>O<sub>3</sub>, P<sub>2</sub>O<sub>5</sub>, Cao, SiO<sub>2</sub> and Acid insolubles

**5.11.0 Whole Rock Analysis:**

5.11.1. Whole Rock analysis for SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, TiO<sub>2</sub>, MnO, CaO, Na<sub>2</sub>O, K<sub>2</sub>O+H<sub>2</sub>O, MgO, P<sub>2</sub>O<sub>5</sub>, CO<sub>2</sub>, S and LOI will be carried out on 10 Nos samples to check the rock types, their variation in chemical composition.

**5.12.0 Petrological & Mineralogical Studies:**

5.12.1. During the course of Geological mapping and core logging 10 samples from various litho units from surface, Pit/Trench/Channels and lithounits intersected in boreholes will be studied for petrography and 10 samples from mineralized zones will be studied for the ore mineral assemblages and their distribution, alteration, enrichment etc in polished sections.

**5.13.0 Trace element Studies:** Trace element Studies will be done on 20 nos. for 34 elements

**5.14.0 Justification :**

5.14.1. The area belongs to the Mahakoshal Group which is well known for various mineral resources including Iron and Manganese. Mineralisation of Iron is occurring around the area associated with Banded Iron Formation (BIF) while Manganese is associated with BIF and Phyllites. Several active Mines of Iron and Manganese are there in the close vicinity of the block including an exploration block of NMDC in south of the proposed block for Fe-Mn. MECL has conducted field visit in the proposed block. During geological traverses, MECL has identified BIF and Phyllites at several places, collected 4 nos. of samples and analysed them through handheld XRF and in MECL Chemical Lab. Samples are showing upto 51 % Fe and Mn upto 33.09%. Based on the mineralization evidences of Iron and Manganese in and around the block, the present Reconnaissance Survey exploration program at G-4 level has been proposed. Geological mapping, surface sampling and pitting/trenching will be helpful in assessing the disposition of the mineralized zones, structural features etc. The Exploration will be helpful in estimation of reconnaissance resources of Iron and Manganese and associated minerals in the block area. Geochemical sampling of BRS/CS/ Pitting/trenching and the drilling of scout boreholes will be helpful in assessing the disposition and grade of mineralisation. The Reconnaissance Survey (G4) will eventually help in planning of detailed exploration program (incase upgraded to G-3 level) which in turn will facilitate the state Government for action of block.

**5.15.0 Nature Quantum and Target**

5.15.1. Details of the particular, Quantum and the targets are tabulated in **Table No.-V.A.**

**Table No-V.A**  
**Envisaged Quantum of proposed work in Talwa G4 Block**

Sl. No.	Item of Work	Unit	Proposed Quantum of work
1	Geological Mapping (on 1:12,500 Scale)	sq km	92.70
2	Survey Work		
	i) Bore Hole Fixation	Nos	5
	ii) RL & Coordinate Determination by DGPS	Nos	15
3	Trenching	cu m	100
4	Core Drilling (5 Scout Boreholes)	m	500.00
5	Sample Preparation & Chemical Analysis		
A.	Primary samples for Iron-Manganese (Bedrock/Channel /Trench/Core Samples)		
	i) Primary samples for Total Fe, Total Mn, Al <sub>2</sub> O <sub>3</sub> , P <sub>2</sub> O <sub>5</sub> , Cao, SiO <sub>2</sub> and Acid insolubles	Nos.	400
	ii) Internal Check samples (5% of Primary samples)	Nos.	20
	iii) External Check sample (10% of Primary samples)	Nos.	40
B.	Primary samples for Gold (Bedrock/Channel /Trench/Core Samples)		
	i) Primary samples for Au by fire Assay	Nos.	40
	ii) Internal Check samples (5% of Primary samples)	Nos.	13
	iii) External Check sample (10% of Primary samples)	Nos.	25
C.	Composite Samples for Iron-Manganese for Total Fe, Total Mn, Al <sub>2</sub> O <sub>3</sub> , P <sub>2</sub> O <sub>5</sub> , Cao, SiO <sub>2</sub> and Acid insolubles	Nos.	20
6	Trace Elements Studies (34 Elements)	Nos.	20
7	Whole Rock Analysis		
	For SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , TiO <sub>2</sub> , MnO, CaO, Na <sub>2</sub> O, K <sub>2</sub> O+H <sub>2</sub> O, MgO, P <sub>2</sub> O <sub>5</sub> , CO <sub>2</sub> , S and LOI.	Nos	10
9	Petrographic Studies	Nos	10
10	Mineragraphic Studies	Nos	10
13	Report Preparation (Digital format)	Nos.	1

**6.0.0 Manpower Deployment**

**6.1.0** Manpower deployment List will be provided later.

### 7.0.0 Break-up of Expenditure

7.1.0 Tentative Cost has been estimated based on Schedule of Charges (SoC) of projects funded by National Mineral Exploration Trust (NMET) w.e.f. 01/04/2020. The total estimated cost is Rs. **168.05 Lakh**. The summary of tentative cost estimates for Reconnaissance Survey (G-4 Level) is given in **Table No.-VII.A** and details of tentative cost estimates is given in **Table No.-VII.B**. Tentative Time schedule/action plan for proposed Reconnaissance Survey (G-4) Block is given in **Table No. VII-C**.

**Table No-VII.A**

**Summary of Tentative Cost Estimates for Reconnaissance Survey (G-4 Level)  
Exploration**

Sl. No.	Item	Total
1	Geological Work	27,18,540
2	Pitting & Trenching	3,33,000
3	Drilling	77,57,100
4	Laboratory Studies	24,79,440
	<b>Sub total</b>	<b>1,32,88,080</b>
5	Report	6,64,404
6	Peer Review	10,000
7	Proposal Prepration	2,79,049.68
	<b>Total</b>	<b>1,42,41,534</b>
8	GST (18%)	25,63,476.06
	<b>Total cost including 18% GST</b>	<b>1,68,05,010</b>
	<b>SAY, in Lakhs</b>	<b>168.05</b>

Estimated cost for Reconnaissance survey (G4) for Iron, Manganese and associated minerals in Talwa Block, Districts: Jabalpur and Katni , State: Madhya Pradesh. [Block area- 92.70 sq. km; Nos. of Borehole- 5; Schedule timeline- 14 months]							
S. No.	Item of Work	Unit	Rates as per NMET SoC 2020-21		Estimated Cost of the Proposal		Remarks
			SoC-Item -SI No.	Rates as per SoC	Qty.	Amount (Rs)	
<b>A</b>	<b>GEOLOGICAL WORK (1:12,500 scale)</b>						
i	Charges for one Geologist- Field	day	1.2	11,000	150	16,50,000	
ii	Charges for one Geologist per- HQ	day	1.2	9,000	60	5,40,000	
iii	2 labours/ party (Rs 477/day/labour) (As per rates of Central Labour Commissioner)	day	5.7	477	300	1,43,100	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
iv	Core Sampling -1 Samplers Labour charge not included	day	1.5.2	5,100	55	2,80,500	
v	4 labours/ party (Rs 477/day/labour) (As per rates of Central Labour Commissioner)	day	5.7	477	220	1,04,940	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
					<b>Sub Total- A</b>	<b>27,18,540</b>	
<b>B</b>	<b>PITTING AND TRENCHING</b>						
i	Trenching	Cu m	2.1.1	3330	100	3,33,000	
					<b>Sub Total- B</b>	<b>3,33,000</b>	
<b>C</b>	<b>DRILLING</b>						
i	Drilling upto 300m (Hard Rock) (1 rigs )	m	2.2.1.4a	12,650	500	63,25,000	
ii	Borehole deviation Survey	m	2.2.6	-	-	-	
iii	Land / Crop Compansation	per BH	5.6	20,000	5	1,00,000	Amount will be reimburse as per actuals or max. Rs. 20000 per BH with certification from local
iv	Construction of concrete Pillar (12"x12"x30")	per borehole	2.2.7a	2,000	5	10,000	
v	Transportation of Drill Rig & Truck associated per drill	Km	2.2.8	36	800	28,800	Certification in this regard is required to be provided
vi	Monthly Accomodation Charges for drilling Camp (up to 2 Rigs)	month	2.2.9	50,000	5	2,50,000	
vii	Drilling Camp Setting Cost	Nos	2.2.9a	2,50,000	1	2,50,000	
viii	Drilling Camp Winding up Cost	Nos	2.2.9b	2,50,000	1	2,50,000	
ix	Approach Road Making (Flat Terrain)	Km	2.2.10a	22,020	5	1,10,100	Road Making will be considered as per the requirement and Road Making Charges will be
x	Bore Hole Fixation and determination of co-ordinates & Reduced Level of the boreholes and by DGPS	Nos	1.6.2	19,200	6	1,15,200	*5 Boreholes and 1 base station
xi	One complete borehole plus mineralised cores of all the remaining Bhs	m	5.3	1,590	200	3,18,000	This amount will be reimbursed after successful delivery of the cores to concerned libraries/authorities
					<b>Sub Total- C</b>	<b>77,57,100</b>	
<b>D</b>	<b>LABORATORY STUDIES</b>						
<b>1</b>	<b>Chemical Analysis</b>						
i	<b>Primary &amp; Check samples for Iron-Manganese BRS/Channel/Trench/Core samples)</b>						
	a. Primary Samples for Total Fe, Total Mn, Al <sub>2</sub> O <sub>3</sub> , P <sub>2</sub> O <sub>5</sub> , Cao, SiO <sub>2</sub> and Acid insolubles	Nos	4.1.15a	4,200	400	16,80,000	300 nos. sample BRS/Channel/Trench and 100 nos. Core samples
	b. Internal & External (15%) Check samples for 4 Radicals Fe, Al <sub>2</sub> O <sub>3</sub> , P <sub>2</sub> O <sub>5</sub> & SiO <sub>2</sub>	Nos	4.1.9	4,200	60	2,52,000	
ii	<b>Primary &amp; Check samples for gold (BRS/Channel/Core)</b>						
	a. Primary Samples for Au by Fire Assay	Nos	4.1.5a	2,380	40	95,200	20 samples from Dolomite and BIF contact and 20 samples from BIF
	b. Internal & External (15%) Check samples for 4 Radicals Fe, Al <sub>2</sub> O <sub>3</sub> , P <sub>2</sub> O <sub>5</sub> & SiO <sub>2</sub>	Nos	4.1.5a	2,380	6	14,280	
iii	<b>Composite samples for Iron-Manganese</b>						
	a. Composite Samples for Total Fe, Total Mn, Al <sub>2</sub> O <sub>3</sub> , P <sub>2</sub> O <sub>5</sub> , Cao, SiO <sub>2</sub> and Acid insolubles	Nos	4.1.15a	4,200	20	84,000	
iv	Trace element study (34 Elements)	Nos	4.1.14	7,731	20	1,54,620	
<b>2</b>	<b>Physical &amp; Petrological Studies</b>						
i	Preparation of thin section	Nos	4.3.1	2,353	10	23,530	
ii	Complete petrographic study report	Nos	4.3.4	4,232	10	42,320	
iii	Preparation of polished section	Nos	4.3.2	1,549	10	15,490	
iv	Complete mineragraphic study report	Nos	4.3.4	4,232	10	42,320	
v	Digital Photographs	Nos	4.3.7	280	-	-	
vi	Whole Rock Analysis (Major oxide and additional trace elements)	Nos	4.1.15a & b	7,568	10	75,680	
vii	Bulk Density	No.	4.10	3,540	-	-	
viii	Lumps/Fines determination for massive Iron ore	Cu.M.	4.9	6,523	-	-	
ix	Lumps/Fines determination for Float Iron ore	Cu.M.	4.9	6,523	-	-	
					<b>Sub Total- D</b>	<b>24,79,440</b>	
<b>E</b>					<b>Total A to D</b>	<b>1,32,88,080</b>	
<b>F</b>	<b>Geological Report Preparation</b>		<b>5.2</b>	For the projects having cost less than Rs. 150 lakhs - A minimum of Rs. 2.5 lakhs or 5% of the value of work whichever is more		<b>6,64,404</b>	Reimbursement will be made after submission of the final Geological Report in Hard Copies (5 Nos) and the soft copy to NMET.
<b>G</b>	<b>Peer review Charges</b>		<b>As per EC decision</b>			<b>10,000</b>	
<b>H</b>	<b>Preparation of Exploration Proposal (5 Hard copies with a soft copy)</b>	<b>5 Hard copies with a soft copy</b>	<b>5.1</b>	2% of the Cost or Rs. 3.8 Lakhs whichever is lower		<b>2,79,050</b>	EA has to submit the Hard Copies and the soft copy of the final proposal along with Maps and Plan as suggested by the TCC-NMET in its meeting while clearing the proposal.
<b>I</b>	<b>Total Estimated Cost without GST</b>					<b>1,42,41,534</b>	
<b>J</b>	<b>Provision for GST (18% of I)</b>					<b>25,63,476.06</b>	GST will be reimburse as per actual and as per notified prescribed rate
<b>K</b>	<b>Total Estimated Cost with GST</b>					<b>1,68,05,009.74</b>	
					<b>or Say Rs. In Lakhs</b>	<b>168.05</b>	
<b>Note:</b>							
1	If any part of the project is outsourced, the amount will be reimbursed as per the Paragraph 3 of NMET SoC and Item no. 6 of NMET SoC. In case of excusion of the project by NEA on its own, a Certiate regarding non outsourcing of any component/project is required.						



Table No-VII.C

Tentative Time schedule/action plan for proposed Reconnaissance Survey (G-4)

Block

Estimated cost for Reconnaissance survey (G4) for Iron, Manganese and associated minerals in Talwa Block, Districts: Jabalpur and Katni, State: Madhya Pradesh.																
[Block area- 92.70 sq. km; Nos. of Borehole- 5; Borehole depth range- 100m; Schedule timeline- 14 months]																
S. No.		Months /Days	1	2	3	4	5	6	Review	7	8	11	12	13	14	
1	Camp Setting	months	■								■					
2	Geological Mapping	months		■	■	■	■									
3	Trenching	cu.m				■	■	■								
4	Drilling (1 rig)	m									■	■	■			
5	Geologist days	days		■	■	■	■	■			■	■	■			
6	Sampling days, Core Sampling	days				■	■	■			■	■	■	■		
7	Camp winding	months												■		
8	Laboratory Studies	months					■	■					■	■		
9	Geologist days, HQ	days											■	■	■	
10	Report Writing with Peer Review	months										■	■	■	■	

**List of Plates:**

1. Plate-I: Location Map of the Proposed Talwa block, Jabalpur, Katni Distt., State Madhya Pradesh
2. Plate-II: Regional Geological Map with Proposed Talwa block, Jabalpur, Katni, Distt., State Madhya Pradesh