PROPOSAL FOR RECONNAISSANCE SURVEY (G-4 STAGE) FOR REE IN CHATRAI-NARASAPURAM BLOCK (AREA: 164 SQ KM)

DISTRICT- NTR & ELURU, ANDHRA PRADESH

COMMODITY: REE

MINEREAL EXPLORATION AND CONSULTANCY LIMITED

DR. BABASAHAB AMBEDKAR BHAWAN

SEMINARY HILLS

PLACE: NAGPUR

DATE: APRIL, 2026

Summary of the Block for Reconnaissance Survey (G-4 Stage)

GENERAL INFORMATION ABOUT THE BLOCK

	Features	Details
	Block ID	Chatrai-Narasapuram Block
	Exploration Agency	Mineral Exploration and Consultancy Limited (MECL)
	Commodity	REE
	Mineral Belt	Eastern Ghat Mobile Belt (EGMB), Peninsular Gneissic Complex (PGC-II) and Gondwana Supergroup (Pranhita Godavari Valley)
	Completion Period with entire Time schedule to complete the project & Estimated Cost	10 months with about 102.33 Lakhs rupees.
	Objectives	Based on the evaluation of geological data available, the present exploration program has been formulated to fulfill the following objectives: i. To carry out Geological & Structural mapping on 1:12500 scale for identification of REE mineral bearing formation with the structural features to identify the surface manifestation (if any) and lateral disposition of the mineralized zones. ii. To collect bedrock, stream sediment samples (from positive catchment area) for analyses of REEs. iii. To identify the REE enriched soil horizon, 05 nos of orientation pitting will be carried out. Soil samples will be collected from all the soil horizon and bedrock separately by panning for heavy mineral separation. iv. To further determine the REE mineralised zone in the proposed block, auger drilling will be carried out and samples will be
		collected from targeted soil horizon established by orientation survey. v. To establish the reconnaissance resources for REE bearing minerals as per UNFC norms & Minerals (Evidence of Mineral Contents) Rules- 2015. vi. The outcome of this exploration will decide further exploration strategy for upgradation of block to Preliminary (G-3)

		Exploration.
	Whether the work will be carried out by the proposed agency or through outsourcing and details thereof. Components to be outsourced and name of the outsource agency	Work will be carried out by the proposed agency.
	Name/ Number of Geoscientists	Three nos. of Geoscientist (2 Field + 1 HQ)
	Expected Field days (Geology) Geological Party Days	Geologist Party Days: 157 Days (Field) Geologist Party Days: 45 Days (HQ)
1	**Location**	
	The coordinates of corner points of proposed Chatrai-Narasapuram Area are as follows:	

POINTS	Latitude	Longitude
A	16° 53' 46.77" N	080° 53' 58.43" E
B	16° 53' 45.66" N	080° 48' 18.4" E
C	16° 59' 50.9" N	080° 48' 16.2" E
D	17° 03' 28.55" N	080° 51' 34.32" E
E	17° 03' 25.69" N	080° 54' 7.9" E

	Villages	Chatrai, Narasapuram, Burugugudem
	Tehsil/ Taluk	Tiruvuru (old)
	District	Ntr and Eluru
	State	Andhra Pradesh
2.	**Area (hectares/ square kilometers)**	
	Block Area	164 sq km
	Forest Area	The proposed area is free from Eco sensitive Zone and Wildlife Sanctuary.
	Government Land Area	Data Not Available
	Private Land Area	Data Not Available
3	**Accessibility**	
	Nearest Rail Head	Eluru (58 km SE of the block)
	Road	The National Highway no. 44 passes through the toposheet area which

		connects Sattupalli with Khammam, Ashwaraopeta, Chintalapudi and Eluru. The interior places are mostly approachable by fair weather roads. Jeepable roads and foot tracts serve rest of the area.
	Airport	Vijayawada International Airport (75 km south of the block)
4	**Hydrography**	
	Local Surface Drainage Pattern (Channels)	The hill ranges exhibit sub-dendritic to dendritic drainage pattern is prevalent in the area whereas in the plains and isolated hillocks it shows sub-dendritic and sub-parallel drainage pattern.
	Rivers/ Streams	The main drainage in the area is Tammileru River originating from the southern flanks of Gavalagutta range near Annapureddipalli, and flows towards south traversing the area between Sattupalli and Gangavaram villages, then flows towards south and finally enters in Krishna-Godavari delta plains near Eluru.
5	**Climate**	
	Mean Annual Rainfall	The Southwest monsoon brings plenty of rainfall from June to September. Maximum Rainfall: About 900 mm
	Temperatures	Maximum Temperature: 40°C (May) Minimum Temperature: 13°C (January) Maximum Rainfall: 900 mm (July to September)
6	**Topography**	
	Toposheet Number	65C16 & 65D13
	Physiography of the Area	Physiography of area show more or less flat terrain with few isolated small hills and ridges.
7	**Availability of baseline geosciences data**	

	Geological Map (1:50K/ 25K)	1:50000 (NGDR) 1:25000 (Part) (NGDR)
	Geochemical Map	Stream sediment sample results from NGCM, NGDR, GSI for TS 65C16 & 65D13 have been used to compute LREE, HREE & Total REE geochemical anomaly maps presented as plates in the proposal.
	Geophysical Map	Available
8	**Justification for taking up Reconnaissance Survey / Regional Exploration**	i) 42 (30 from TS 65D13 & 12 from TS 65C16) NGCM Stream Sediment Sample data points fall in the proposed Chatrai-Narasapuram area. The total REE, LREE and HREE values have been calculated and the geochemical anomaly map for the same has been prepared. The proposed area has a maximum TREE+Sc+Y value of 2608.53 ppm followed by 2435.74 ppm. A total of 25 sample out of 42 (60% samples>1000PPM) shows TREE+Sc+Y value more than 1000 PPM. The maximum total HREE value in proposed Chatrai-Narasapuram area is 113.49 ppm of which the major contributing element is Gadolinium (maximum 50.31 ppm). The maximum LREE value in Chatrai-Narasapuram block is 2439.27 ppm and the major contributing element is Cerium (maximum 1184.58 ppm) followed by Lanthanum (maximum 609.2 ppm). The NGCM (FS 2016-17 & 2017-18) stream sediment samples carried out by GSI show highly anomalous values for REE in toposheets 65C16 & 65D13, therefore the Chatrai-Narasapuram Area is proposed for reconnaissance survey for REE.

Crustal abundance (ppm) of rare earth elements (After Mason and Moore 1982)			**Summary of Stream sediment sample data falling in Proposed Block (NGCM)**		
Group	**Element**	**Crustal abundance (ppm)**	**Minimum (ppm)**	**Maximum (ppm)**	**Average (ppm)**
LREE	Lanthanum (La)	30	131.96	609.20	265.16
	Cerium (Ce)	60	255.59	1184.58	500.90
	Praseodymium (Pr)	8.2	30.04	124.93	57.20
	Neodymium (Nd)	28	116.30	453.45	207.19
	Samarium (Sm)	6	1.45	69.67	30.19
	Europium (Eu)	1.2	1.93	39.12	6.22
	Gadolinium (Gd)	5.4	1.80	28.70	5.76

HREE	Terbium (Tb)	0.9	2.89	50.31	21.77
	Dysprosium (Dy)	3	6.73	26.54	11.62
	Holmium (Ho)	1.2	0.96	3.76	1.80
	Erbium (Er)	2.8	2.69	10.29	4.91
	Thulium (Tm)	0.5	0.36	1.50	0.72
	Ytterbium (Yb)	3.4	2.71	9.58	4.79
	Lutetium (Lu)	0.5	0.39	1.44	0.73
	Scandium (Sc)	22	3.50	56.39	16.45
	Yttrium (Y)	23	17.10	59.97	31.93
Total LREE			583.13	2439.27	1060.63
Total HREE			32.86	113.49	58.31
TREE+Sc+Y			672.72	2608.53	1167.32

iii. Geological Exploration of REE was successfully carried out by GSI (FS 2021-24) for secondary REE enrichment in the EGMB and Pranhita Godavari Valley which gave encouraging results. The enrichment of REE in the present area was first pointed out by high concentration of total REE values in the composite stream sediment samples during the NGCM works. It is further observed that the concentration of the REE bearing minerals is mainly high in stream sediments and less in soil. The REE mineralization in the study area occurs in the form of heavy minerals in stream sediments. The REE bearing mineral phases identified by SEM study are monazite, zircon and allanite. It was also inferred from the reconnaissance surveys by GSI (FS 2021-24 in AP and Telangana) that **the REE mainly occurs as secondary enrichment of the REE bearing mineral phases in stream sediment derived from the weathering and erosion of heavy mineral rich layers of the garnet-sillimanite gneiss, quartzites of Eastern Ghat Belt and sandstones of Gondwana i.e. alluvial placer type deposit.** GSI recommended studying these areas in details for REE mineralization.

The new findings of alluvial placer type of REE enrichment may create huge potential area for secondary REE mineralization. This may considerably augment the REE resource in India particularly from the Garnet-sillimanite gneiss of EGMB and Gondwana rocks. It will be a potential game changer in terms of REE exploration in

		India and significantly help to mitigate the crucial REE demand. Litho units belonging to Khondalite group of rocks, Lower and Upper Gondwana is present in the present proposed area. Similar investigation in the proposed area might yield encouraging results of REE.

PROPOSAL FOR RECONNAISSANCE SURVEY (G-4 STAGE) FOR REE IN CHATRAI-NARASAPURAM AREA, DISTRICT –NTR & ELURU, STATE -ANDHRA PRADESH (AREA 164 SQ. KM.)

1.0.0 INTRODUCTION:

1.0.1 Rare earth elements are characterized by high density, high melting point, high conductivity and high thermal conductance with distinctive electrical, metallurgical, catalytic, nuclear, magnetic and luminescent properties make them indispensable for a variety of emerging high end and critical technology applications which are relevant to India's energy security i.e., clean energy, defense, civilian application, environment and economic areas. REE demand is expected to continue its growth, especially for their use in low carbon technology. The ever-increasing demand for these REE necessitates a concerted effort to augment the resource position of our country.

1.0.2 The Rare earth elements (REE) are a collection of 17elements in the periodic table , namely scandium, yttrium and lanthanides (15 elements in the periodic table with atomic numbers 57 to 71 namely: lanthanum (La), cerium (Ce), praseodymium(Pr), neodymium (Nd), promethium (Pm), samarium (Sm), europium (Eu), gadolinium (Gd), terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb) and lutetium (Lu). In spite of its low atomic weight Yttrium (atomic no. 39) has properties more similar to the heavy lanthanides and is included with this group. Scandium (atomic no. 21) is found in a number of minerals although it may also occur with other rare earth elements (REE).

1.0.3 Although these elements tend to occur together, the lanthanide elements are divided into two groups. The light rare earth elements (LREE) are those with atomic numbers 57 through 63(La, Ce, Pr, Nd, Pm, Sm, Eu) and the heavy rare earth elements (HREE) are those with atomicnumbers from 64 to 71 (Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu). However, because of their geochemical properties, rare earth elements are typically dispersed and not often found concentrated as rare earth minerals in economically exploitable ore deposits.

1.0.4 Generally, the light rare earth elements (LREE) are more abundant in the earth's crust and easily extracted than heavy rare earth elements (HREE). It was the very scarcity of these minerals (previously called "earths") that led to the term "rare earth". The first such mineral discovered was gadolinite, a compound of cerium, yttrium, iron, silicon and other elements. This mineral was extracted from a mine in the village of Ytterby in Sweden; several of the rare earth elements bear names derived from this location.

1.0.5 Critical minerals are those minerals that are essential for economic development and national security. The lack of availability of these minerals or concentration of extraction or

processing in a few geographical locations may lead to supply chain vulnerabilities and even disruption of supplies. The future global economy will be underpinned by technologies that depend on minerals such as lithium, graphite, cobalt, titanium, and rare earth elements. These are essential for the advancement of many sectors, including high-tech electronics, telecommunications, transport, and defence. They are also vital to power the global transition to a low carbon emissions economy, and the renewable energy technologies that will be required to meet the 'Net Zero' commitments of an increasing number of countries around the world. Hence, it has become imperative to identify and develop value chains for the minerals which are critical to our country.

1.2.0 BACKGROUND

1.2.1 On enactment of MMDR Amendment Act- 2015, Minerals (Evidence of Mineral Contents) Rule 2015 and Mineral Auction Rules 2015, Govt. of India directed State Government to speed up exploration work for different Mineral Commodities in the respective states. Accordingly, MECL has prepared the proposal for Reconnaissance (G4) level involving identification of mineralized areas worthy of further investigation towards deposit identification.

1.2.2 The Exploration for strategic, critical, rare metals, rare earths elements, PGE and precious metals is given top priority by Govt. of India after amendment of MMDR act 2015. Keeping this in view, the present proposal is being put up for Reconnaissance Survey (G-4) for REEs and associated minerals in Chatrai-Narasapuram Block, Ntr & Eluru district, Andhra Pradesh.

1.2.3 MECL has prepared the proposal for G-4 level exploration for REE in Chatrai- Narasapuram Block, Ntr & Eluru district, Andhra Pradesh to put up for approval in the forthcoming meeting of Technical cum Cost Committee (TCC-I) of NMET.

1.3.0 LOCATION AND ACCESSIBILITY

1.3.1 The proposed Chatrai-Narasapuram Block comprises of 164 sq km area and lies Ntr & Eluru district (Toposheet No. 65C16 & 65D13), Andhra Pradesh. The major villages falling within the proposed block are Chatrai, Narasapuram and Burugugudem. All the villages in the area are well connected to each other and to the highways by motorable roads and tracks. The district headquarters Eluru and Vijayawada is about 58 km and 75 km from the block respectively. The nearest railway station is at Eluru which is about 58 km south east of the proposed block. The nearest airport is at Vijayawada which is about 78 km south of the proposed block. The location map of the proposed block is provided as Plate No- I. The detailed location of the boundary points are given in Table 1.

Table 1: Coordinates of Corner Points of Proposed Chatrai-Narasapuram Block, NTR & Eluru district, Andhra Pradesh

POINTS	Latitude	Longitude
	° 53' 46.77" N	0° 53' 58.43" E
	° 53' 45.66" N	0° 48' 18.4" E
	° 59' 50.9" N	0° 48' 16.2" E
	° 03' 28.55" N	0° 51' 34.32" E
	° 03' 25.69" N	0° 54' 7.9" E

1.4.0 PHYSIOGRAPHY

1.4.1 Physiography of area show more or less flat terrain with few isolated small hills and ridges in the northeastern and southeastern parts. The area is gently undulating with residual hills of Khondalite seen in a vast Pediment-Pediplain complex. The entire area is of denudation origin.

1.5.0 DRAINAGE

1.5.1 The area is drained by the river Tammileru and its drainage network with subdendritic to subparallel in the western and west central part and subangular pattern in the eastern and east central part of the Toposheet 65D13.

1.6.0 CLIMATE

1.6.1 The area lies on 112m above sea level. The area experiences tropical climate. Winter season between November and February is pleasant. Temperature drops to 15° - 18°C during the night. Summer season between March and May is very hot and dry. Temperature goes upto 48°C during the day. Precipitation here is about 1019mm. 10 inch of precipitation between the driest and wettest months. The area receives its rainfall chiefly by southwest monsoon between June and September.

1.7.0 FLORA AND FAUNA

1.7.1 The terrain has thick fertile soil cover and alluvial cover in its south eastern part and is extensively cultivated. Paddy, cotton and chilly are the main crops of the area. Mango plantation is common.

1.7.2 Deer (Odocoileus virginianus), wild boar (sus scrofa), Monkey (Macaca fassicularis), Peacock (Pavo cristatus) wild pig (Sus cristatus), Snakes constitute the main fauna of the area.

2.0.0 REGIONAL GEOLOGY

2.1.0 Litho ensemble belonging to three different tectonic, domains with contrasting structural styles and metamorphic imprints is exposed in this proposed area viz. Khondalite Group of Archaean age, Penninsular Gneissic Complex (PGC- II) of Archaean to Palaeo-Proterozoic age with Talchir, Barakar, Kamthi, Kota, Gangpur formations of Lower to Upper Gondwana Supergroup of Upper Carboniferous to Lower Triassic age exposed in the area.

2.2.0 The general lithological sequence of the study area mainly comprises of garnet-sillimanite gneiss and magnetite quartzites of Khondalite Group of Eastern Ghat Supergroup which is overlained by granite gneiss of PGC II. PGC II is mostly consists of grey hornblende granite and grey hornblende biotite granite gneiss. PGC II unconformably overlained by Lower Gondwana Supergroup. Bedding and cross bedding are recorded in Gondwana sediments. The general trend of the Gondwana sediments varies from NW-SE to WNW-ESE directions with sub horizontal to gentle dips.

2.3.0 Based upon the mode of occurrence and inter-relationship of various litho-units the following stratigraphic sequence is tentatively suggested by G. Lakshminarayana et. al., (1993).

Table No. 2.1: Stratigraphic succession After G. Lakshminarayana et. al. (1993)

SUPERGROUP	GROUP	FORMATION	LITHOLOGY	AGE
GONDWANA SUPER GROUP	Upper Gondwana	Gangpur	Coarse grained white Sand stone, buff Siltstone & Claystone.	Early Permian to Lower Cretaceous
		^^^^^^^^^Unconformity^^^^^^^^^^^^		
		Kota	Conglomeratic Sandstone, Clay, Siltstone And indurated red Claystone	
	Lower Gondwana	Kamthi	Conglomeratic Sandstone, Ferruginous Sandstone, Siltstone and indurated Claystone	
		^^^^^^^^^Unconformity^^^^^^^^^^^^		
		Barakar	Gritty, felspathic Sandstone-siltstone-carbonaceous shale and coal	
		^^^^^^^^^Unconformity^^^^^^^^^^^^		
		Talchir	Green Sandstone olive green needle Shale and Siltstone	
^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^Unconformity^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^				
PENNINSULAR GNEISSIC COMPLEX II	Intrusives		Quartz veins	Archaean To Palaeo Proterozoic
			Grey Hornblende-Biotite Granite Gneiss	
			Grey Hornblende-Granite Gneiss	
	-----------------------------------Deformation------------------------------------			
	Basic intrusive		Amphibolite	Archaean
EASTERN GHAT SUPER GROUP	-----------Deformation, metamorphism and migmatisation------			
	Khondalite Group		Garnet-sillimanite gneiss,Graphite	
			Calc-granulite/Calc silicate /Schist	
			Quartzites/Magnetite Quartzites	
^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^Unconformity^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^				
Basement – as yet undifferentiated from migmatitic complex.				

3.0.0 GEOLOGY OF THE BLOCK

3.1.0 The study area demonstrates majorly Khonadalite Group of rocks of Neo-archaean age, Penninsular Gneissic Complex II (PGC-II) of Archean to Palaeo-proterozoic age, sedimentary assemblage of Lower Gondwana to Upper Gondwana Supergroup (Upper Carboniferous to Triassic). Sedimentary rocks of Gondwana Supergroup are observed in the South-eastern part of the proposed area, the basement rock i.e. granitic gneisses of Penninsular Gneissic Complex (PGC-II) in the North-western part and the rest (majority) of the area comprised of the Khondalite Group of rocks of the Eastern Ghat Mobile Belt.

3.2.0 Grey hornblende granite, grey hornblende biotite granite, grey hornblende biotite gneiss of PGC-II and garnetiferrous sillimanite gneiss of EGMB is exposed majorly at eastern, central and southern part of the study area respectively and predominantly occupies the low lying areas. In the south eastern part of the proposed area Shale, sandstone belonging to Lower Gondwana and sandstone-clay intercalation of Upper Gondwana are exposed. Quartz reefs/vein occurs as intrusive bodies in gneisses. The stratigraphic succession of the area is given in Table 2.2.

Table- 2.2: The generalized stratigraphic succession of the proposed block (After GSI)

SUPERGROUP	GROUP	FORMATION	LITHOLOGY	AGE
GONDWANA	Upper Gondwana	Gollapalle	Sandstone	Upper Carboniferrous to Cretaceous
	Lower Gondwana	Kamthi	Argilllaceous Sandstone	
------ Unconformity ------				
PENNINSULAR GNEISSIC COMPLEX	Intrusives		Quartz veins & Reefs	Archaean To Paleo-proterozoic
			Grey hornblende biotite granite	
			Grey hornblende	

SUPERGROUP	GROUP	FORMATION	LITHOLOGY	AGE
			granite gneiss	
------ Deformation, metamorphism and migmatisation ------				
EASTERN GHAT SUPERGROUP	Khondalite Group		Garnet-sillimanite gneiss	Archaean
------ Unconformity ------				
Basement – as yet undifferentiated from migmatitic complex				

3.3.0 Description of the Litho units

3.4.0 The geological formations and a brief description of the lithology observed in the area are mostly belong to Penninsular Gneissic Complex II, Khondalite Group of Eastern Ghat Supergroup, Gondwana Supergroup and described in details is as given below:

3.5.0 Eastern Ghat Supergroup

Khondalite Group

The majority of the proposed area comprises of Khondalite suite of rocks; the rock types include garnet sillimanite gneiss, quartzite/ magnetite quartzite. The quartzite occurs as small enclaves within garnet sillimanite gneiss.

Quartzites

Quartzites are the oldest rock type of the study area. This unit represents Khondalite group rocks exposed as small enclaves within garnetiferrous sillimanite gneiss. It is felsic, medium coarse grained rock. Quartzite is hard, compact and consists of quartz and feldspar.

Garnet sillimanite gneiss

The major part of the proposed area is covered by Garnet sillimanite gneiss. The reddish brown Garnet sillimanite gneiss is highly weathered. It is composed of garnet, sillimanite, biotite, quartz and plagioclase with accessory magnetite. Graphite occurs as flaky type along the general foliation of quartzite.

Peninsular Gneissic Complex (PGC-II)

Peninsular Gneiss is a term coined to highlight the older gneissic complex of the metamorphics found all over the Indian Peninsula (**Smeeth, 1916**). PGC-II is represented by

the Grey hornblende biotite granite covering the north-western corner of the area and characteristic mineralogy are quartz, plagioclase, biotite and hornblende.

Grey Hornblende Biotite Granite

Dark greyish to greyish green, medium grained mostly composed of granular hornblende, flakes of biotite with quartz, potash feldspar, plagioclase and some mafic opaque minerals shows foliation trending at NE-SW direction. Gneissosity is described through alternate mafic layer of hornblende and biotite with felsic layer of quartz and feldspar.

Grey Hornblende Granite Gneiss

The rock is mainly dark green/greyish green, medium to coarse grained mostly composed of granular hornblende, quartz, plagioclase feldspar, epidote with some biotite minerals. Grey Hornblende Granite gneiss is medium to coarse grained, well foliated and shows gneissic banding. The felsic and mafic constituents are quartz, potash feldspar, plagioclase and biotite and hornblende respectively.

Gondwana Supergroup

The different members of the Gondwana Supergroup exposed in the area are Kamthi formation of Lower Gondwana Group and Gollapalli formation of Upper Gondwana Group. Kamthi Formation is denoted by sandstones and shale observed in the SE part of the area. Kamthi sandstone is buff creamy to light pink colour with medium to coarse grains. Gollapalli Formation is characterized by the sandstone of upper Gondwana. This Sandstone is yellowish in colour with ferruginous and gritty nature trending NE-SW with shallow dip due easterly.

Soil and Alluvium

A grey to reddish brown coloured soil is present in large part of the areas. The thickness of soil cover varies but generally 0.5 m – 1 m thick soil cover is common in area. The proposed area is mostly covered by thick soil.

3.6.0 Structure

3.6.1 The rocks of Easternghat mobile belt, i.e., Garnet sillimanite gneiss are showing well developed gneissosity. The regional trend of gneissosity plane is NE-SW with steep dip of 68°-78° towards southeast. The gneissic rock is showing 2-sets of nearly perpendicular joints which are again emplaced by sillimanite bearing quartz veins and pegmatite veins comprising mainly quartz, feldspar and mica. The foliation is considered to have developed because of first phase of folding and uniformly shows parallelism with the primary layering **(Moitra, 1996).** Rocks of Lower Gondwana are represented by Kamthi sandstone and Upper Gondwana by Gollapalle sandstone. Kamthi sandstone is showing subhorizontal bedding (S0) planes trending NW-SE. Gollapalle sandstone is also showing subhorizontal beds trending

NNE-SSW with shallow dip towards easterly. It is highly weathered with preservation of cross beddings showing paleocurrent direction towards NW.

4.0.0 PREVIOUS WORK

4.0.1 The pioneering geological work was carried out by W.T Blanford (1870-1872) about one and a half century ago. The earliest account on the geology of the Chintalapudi sub-basin was given by him who stated that this part of the Gondwana basin contains Chintalapudi Sandstone (Kamthi Sandstone).

4.0.2 Huges (1877) and King (1881) are the two pioneer workers who carried out an extensive geological mapping of the entire Godavari Valley Coalfield. Raja Rao (1982) who carried out geological mapping of the Godavari coal field broadly agrees with the geological map of King and identified a small patch of the Talchir Formation near Chintalapudi. He divided the Pranahita- Godavari valley basin into four sub-basins namely (1) Godavari, (2) Kothagudem (3) Chintalpudi and (4) Krishna-Godavari coastal tracks. Exploratory drilling for Coal in Sattupalli and Chintalapudi and Aswaraopeta areas was carried out by Ramanamurthy (1979) for sedimentary stratigraphic sequence and coal horizons. Raviverman et.al. (1985) also considered that the Chintalapudi sub-basin is represented by the 'Kamthi Group' of rocks of Lower Gondwana affinity.

4.0.3 As a part of geological mapping programme of the southern region of Geological Survey of India, the Chandrugonda-Mulakalapalli-Amaravarm area of the Chintalapudi sub-basin was system- atically mapped by Lakshminarayana and Md. Burhanuddin (1986-88) and Lakshminarayana and Kutumba Rao (1989) who reported the occurrence of the Talchir, Barker, Kamthi (Lower Gondwana) and Kota and Gangapur Formation (Upper Gondwana) in the earlier considered Kamthi of Sattupalli- Chintalapudi-Dammapeta area of the Chintalapudi sub-basin. The newly identified Barakar Formation was recommended for drilling to determine the presence of the coal seams.

4.0.4 Gaonkar et.al. (1989) carried out geophysical investigation for exploration of coal in Sattupalli- Ayyannapalem areas and studies to augment the geological data. Gravity lows are recorded to the north and south of this feature which indicate the existence of deep sub-basins located near Bugapadu in the north and Diddavaram in the south. Seismic surveys have indicated that the sediment thickness to be about 500 m near Gangavaram, 700 m near Sattupalli and more near Pakalagudem.

4.0.5 V. Singaraju and K.S. Bhaskara Rao (2001-2002) have taken regional traverses on 1:50,000 scale to understand the geological set up of the reported diamond occurrences. They have examined the diamond mines documented in the Mallavalli area by previous workers and

demarcated their extensions. They have carried out Sedimentological, Geomorphological and heavy mineral studies around Mallavalli area to identify the target areas for diamond exploration. According to their study, both the terraces of Ramileru vagu consist of silty sand only. Study of heavy minerals from few stream sediment samples collected from streams draining the transition zone between EGMB and Dharwar craton, did not reveal the presence of any Kimberlite specific minerals.

4.0.6 A Specialised Thematic Mapping In Eastern Ghats Mobile Belt On The Southern Bank Of The Godavari River In Parts Of Krishna And Khammam Districts of Andhra Pradesh was under taken during FS-1997-98 by J. Srihari, S.M.J Bashs, D.N Charyulu, S.T Narahari. They identified a presence of three different lihto-tectonic domains with contrasting structural and metamorphic imprint is exposed in the area. The domains include parts of Dharwar Craton, Khammam Schist Belt with associated biotite gneiss and Eastern Ghats Mobile Belt. Shear zones mark the domain boundaries. Litho assemblage representing the Dharwar Craton of the area includes granite with bands of amphibolite and younger dolerite dykes. Cratonic assemblage of the area shows evidences for one phase of deformation and shows imprints of chlorite or green schist facies of metamorphism. Khammam Schist Belt is represented by meta-psammo-pelites, metamorphosed calcareous sediments and meta-igneous rocks. The litho types of KSB are intimately associated with and occur as conformable bands within deformed granitic gneiss. These, along with the associated granitic gneiss are successively emplaced by pink granite, anorthosite gabbro complex, meta- gabbro and younger dolerite/gabbro dykes. In association with biotite gneiss, they show evidences for two phases of deformation and upper amphibolite to granulite facies of metamoiphism. While gneissic granite forms part of PGC of Dharwar Craton, KSB litho types along with the associated biotite gneiss may represent a more deformed segment of Dharwar Craton now in tectonic contact with PGC. Lithounits representing the EGMB include quartzite, khondalitc, pyroxene granulite, charnockite and migmatite. Litho ensemble of EGMB shows evidences for two phases of deformation and granulite grade of metamorphism. Metamorphic transitions are not present across the different litho tectonic domains viz., Dharwar Craton, Khammam Schist Belt and Eastern Ghats Mobile Belt. Granitic gneiss east of Chimalpad area, bears imprint of Eastern Ghats orogeny. The EGMB and KSB form basement for Gondwana Sediments. Basement-cover relationship is undisturbed. They also reported Brccciated iron ore and slag occurrence near Rangapuram and Ramanakkapeta; old workings for chromite occurence near Dendukuru near Madhira. Ultramafite in the west of Shantinagar analysed anomalous values of Cr 1709 ppm, Ni 1206

ppm, Cu 8635 ppm and Ag 6.5 ppm.

4.0.7 Snigdharani Mishra and Mahima k. (2016-17) carried out Geochemical Mapping in Toposheet no. 65D13 and 65K02. During their course of investigation a total of 836 stream sediment samples from each sq.km grid, 40 Nos. of duplicate samples, 10 nos. of regolith and C-horizon samples each, 10 nos. of water samples in every 5' x 5' grid quadrants were collected. The total REE value ranges between 34.37 to 2001.60 ppm. Total LREE values ranges from 32.08 to 1940.15 ppm with median of 672.251 ppm. Highest value of LREE is observed in composite no. 071 over Garnet sillimanite gneiss in the south of Annaraopeta reserve forest. The very high value of LREE in Garnet sillimanite gneiss is indicating felsic source rock due to larger ionic radii of LREEs.

4.0.8 Jayshree S. Meshram, Shweta A. Gawhade (2017-18) carried out Geochemical Mapping in Toposheet no. 65C16. Overall the analytical results are in coherence with the lithounits present in the area. The major oxides are showing higher values where the underlying lithology is grey hornblend biotite gneiss or grey hornblende granite gneiss. Analytical results of values of Zirconium (Zr) vary from 143 ppm to 1891.48 ppm. Enriched values observed near Gudipadu and Mankolu villages where the underlying rocks are grey hornblende biotite granite and grey hornblende granite gneiss. About 90% of samples are showing higher value of Zirconium (Zr). The highest value of Nickel (Ni) is 83.3 ppm shows the values varying from 10 ppm to 83.3 ppm. The values observed near Raghavpuram, Chanubanda, Kalagura and Vemsuru villages where underlying rocks are grey hornblende granite gneiss and grey hornblende biotite granite. Highest value of Chromium in the area is 160.97 ppm near Krishnaraopalem and Namavaram village SW part of wtudy area where the underlying rocks are grey hornblende biotite granite gneiss with shale and ferrugenous sandstone at some places. Base metals (Cu-Pb-Zn) value in area ranges from 49 ppm to 218 ppm. Threshold value is 167.48 ppm. Highest value of Cu-Pb-Zn which is 218 ppm is recorded. High concentration value is observed in south western part of the area near Bethupalli village. The TREE value in area ranges from 236.44 ppm to 2552.75 ppm. Threshold value of combined TREE is 1303.27 ppm. About 08 sample recorded value more than threshold value. Highest value 1303.27 ppm is recorded in sample no. 036 in rock type Grey hornblende biotite granite. . The LREE value varries from 223.37 ppm to 2492.68 ppm.The highest value of LREE is 1269.86 ppm recorded in sample no. 036 near in rock type Grey hornblende biotite granite. Anomalous zone of REE is noticed in Barrikonda Reserve Forest, southwest of Pattayagudem and in and arround part of the area near Burugagudem village where underlying geology is dominant with grey

hornblende biotite granite,garnet sillimanite gneiss, Ferrugenous sandstone with chert/siltstone.The HREE value values varries from 10.96 ppm to 60.07 ppm. High value of HREE is 60.07 ppm observed in unit cell 036 in grey hornblende biotite granite, garnet sillimanite gneiss, in and arround of Burugagudem village and south of Marlapadu village. The 'R' and 'C' horizon soil samples, high concentration of major oxides such as silica and aluminium shows higher values in the regolith than C-horizon, may be due to its intense weathering leaching pattern of the insitu soil. Most of the trace elements and REEs shows increasing high value in C horizon from Regolith may be due to non development of soil profile except in two samples. It was recommended to study the area in detail to assess the potentiality of the area. Cerium (Ce), Zircon (Zr) values in the area have been recorded highest i.e. 1184.57 ppm and 1891.48 ppm respectively in grey hornblende biotite granite. Authors also recommended studying the Garnetiferrous sillmanite from the area.

4.0.9 Yadav, Kumar, Maurya and Rao undertook Regional Gravity and Magnetic (Total Field) survey in Toposheet no. 65C/13, 65C/16, 65D/13, 65G/02 & 65G/03 in parts of Khammam District in Telangana and Krishna& West Godavari Districts in Andhra Pradesh under NGPM programme. The Bouguer gravity anomaly has brought out the low over the Gondwana sediments and moderate to high over EGMB group of rocks and PGC. The major trends in this area are NW-SE to N-S. The contact of Gondwana is marked by high gradient zone with pinching and swelling of contours due to basement aberrations. The faults are observed within the Gondwana near Sathupally and Chintalpaudi. The nosing towards low near Tatilanka and high near Modikunta is major feature. Magnetic total field anomaly map shows similar anomaly over PGC and EGMB group of rocks, which indicates absence of susceptibility contrast. The Gondwana is seen as moderate anomaly zone with few bipolar anomalies near Vemsoor and Chintalpaudi. The high and low near Damarcherla and Arlagudem respectively over same PGC is an interesting feature. The shear zone in NE-SW direction near Gummadipalli is seen as sparse contour in Bouguer gravity anomaly and high zone in magnetic total field anomaly. Along this zone Nephaline syenite is exposed.

4.0.10 Geological Exploration of REE was successfully carried out by GSI(2021-24) for REE in the Gondwana sediments of Pranhita Godavari Valley which gave encouraging results. GSI recommended studying those areas in details for REE mineralization. The findings of those Geological Reports area summarized below.

Table-3: Table for Various analytical results for REE in the blocks over Gondwana Sediments by GSI

Sr no	Block	TS	FSP	State	Outcome
1	Kottapalle Area (G-4)	65G04 & 65H1	2022-23	Andhra Pradesh	TREE values: BRS- 293-596 PPM SSS- 450-2174 PPM PTS- 329-1540 PPM SS- 415-1854 PPM
2	Kamalapuram-Jagannadhapuram Area (G-4)	65C15	2021-22	Telangana	TREE values: BRS- 105.79-10216.57 PPM SSS- 0.248-3.118% Regolith- 126.88-13249.96 PPM Clay- 318.84-2602.19 PPM
3	Velagapadu Area (G-4)	65G04	2021-22	Andhra Pradesh	TREE values: BRS- 137-1508 PPM SSS-294-10673 PPM PTS- 294-4348 PPM SS- 232-4245 PPM
4	Mulagalampalli Area (G-4)	65G04	2023-24	Andhra Pradesh	TREE values: BRS- 105-1681 PPM SSS- 290-1797 PPM PTS- 227-16770 PPM SS- 284-3665 PPM
5	Annapureddipalli Area (G-4)	65C15	2023-24	Telangana	TREE values: SSS- 339.957-40428.642 PPM Regolith- 243.34-8780.12 PPM
6	Patrwarugudem Area (G-4)	65C15	2022-23	Telangana	TREE values: BRS- 161.51-2187 PPM SSS- 0.1-2.03% Regolith- 0.42-6.98% PPM Clay- 313.46-984.36 PPM
7	Pata-Gangaram	65C15	2021-23	Telangana	Reconnaissance Resource (334) in : Soil/Alluvium- 2.57 million tonnes
					Stream Placers- 0.13 million tonnes Inferred Mineral Resource (333): TREE- 8.15 million tonnes TREO- 12.38 million tonnes

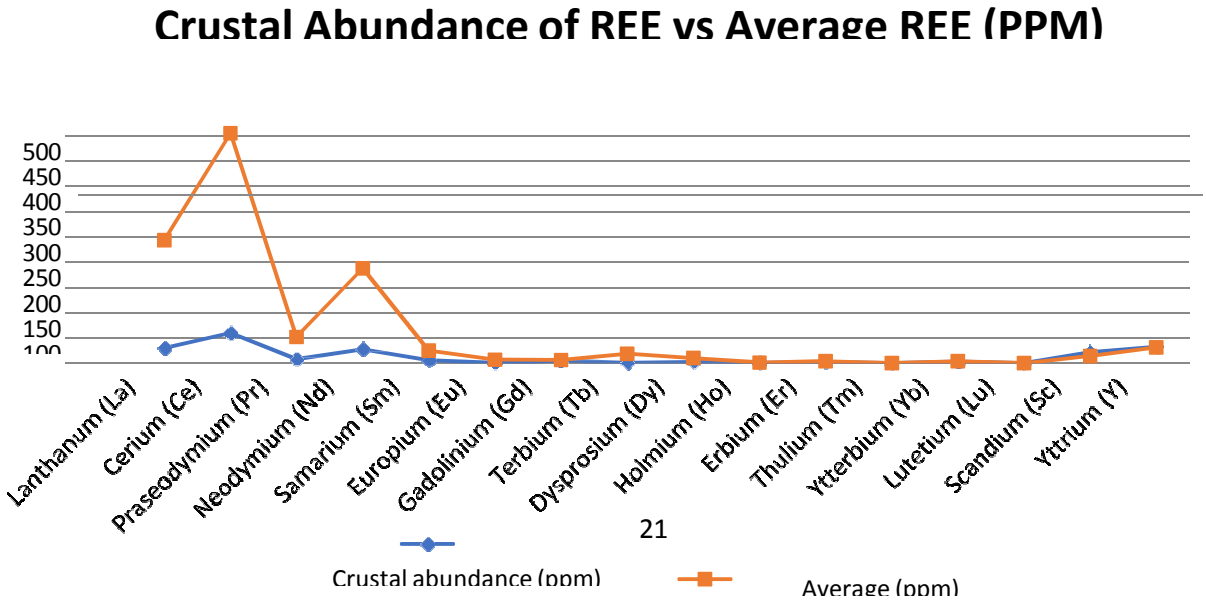
4.0.11 MECL used the NGCM data from NGDR portal, GSI of Toposheet No. 65C16 & 65D13. The total REE, LREE, HREE values in stream sediments falling in the proposed block was calculated and it was observed that the maximum total REE value in the proposed block is

2608.53 ppm. The maximum and minimum range for each element is given in below table. On the basis of anomalous stream sediment values in NGCM data the block is proposed for Reconnaissance Survey for REE.

Table-4:

Data showing NGCM Stream Sediment results for Proposed Chatrai-Narasapuram Block (44 numbers of samples) (Source: NGDR portal GSI)

Crustal abundance (ppm) of rare earth elements (After Mason and Moore 1982)			**Summary of Stream sediment sample data falling in Proposed Block (NGCM)**		
Group	**Element**	**Crustal abundance (ppm)**	**Minimum (ppm)**	**Maximum (ppm)**	**Average (ppm)**
LREE	Lanthanum (La)	30	131.96	609.20	265.16
	Cerium (Ce)	60	255.59	1184.58	500.90
	Praseodymium (Pr)	8.2	30.04	124.93	57.20
	Neodymium (Nd)	28	116.30	453.45	207.19
	Samarium (Sm)	6	1.45	69.67	30.19
HREE	Europium (Eu)	1.2	1.93	39.12	6.22
	Gadolinium (Gd)	5.4	1.80	28.70	5.76
	Terbium (Tb)	0.9	2.89	50.31	21.77
	Dysprosium (Dy)	3	6.73	26.54	11.62
	Holmium (Ho)	1.2	0.96	3.76	1.80
	Erbium (Er)	2.8	2.69	10.29	4.91
	Thulium (Tm)	0.5	0.36	1.50	0.72
	Ytterbium (Yb)	3.4	2.71	9.58	4.79
	Lutetium (Lu)	0.5	0.39	1.44	0.73
	Scandium (Sc)	22	3.50	56.39	16.45
	Yttrium (Y)	23	17.10	59.97	31.93
Total LREE			583.13	2439.27	1060.63
Total HREE			32.86	113.49	58.31
TREE+Sc+Y			672.72	2608.53	1167.32



5.0.0 PLANNED METHODOLOGY

5.1.1 Based on the evaluation of geological data available, the present exploration program has been formulated to fulfill the following objectives:

i. To carry out Geological & Structural mapping on 1:12500 scale for identification of REE mineral bearing formation with the structural features to identify the surface manifestation (if any) and lateral disposition of the mineralized zones.

ii. To collect bedrock, stream sediment samples (from positive catchment area) for analyses of REEs.

iii. To identify the REE enriched soil horizon, 05 nos of orientation pitting will be carried out. Soil samples will be collected from all the soil horizon and bedrock separately by panning for heavy mineral separation.

iv. To further determine the REE mineralised zone in the proposed block, auger drilling will be carried out and samples will be collected from targeted soil horizon established by orientation survey.

v. To establish the reconnaissance resources for REE bearing minerals as per UNFC norms & Minerals (Evidence of Mineral Contents) Rules- 2015.

5.1.2 The outcome of this exploration will decide further exploration strategy for upgradation of block to Preliminary (G-3) Exploration.

5.1.3 The details of different activities to be carried out are presented in subsequent paragraphs.

5.2.0 GEOLOGICAL MAPPING

5.2.1 Geological mapping will be carried out in the entire 164sq.km area on 1:12,500 scale. Rock types, their contact, structural features will be mapped. Surface manifestations of the mineralization (REE) if available along with their surface disposition will be marked on map.

5.2.2 50 nos. of bedrock samples will be collected from the various lithounits present in the area, to identify the host REE bearing formation. Bedrock samples will be collected from the fresh part of the rock by making chips. 34 element ICPMS studies will be carried out for the 50 bedrock samples collected from various lithounits, 10% of primary samples i.e. 05 external check samples will be sent to NABL External Labs for analysis.

5.2.3 10 nos. of surface samples from various lithounits will be studied for petrography and minerography.

5.3.0 GEOCHEMICAL SAMPLING (Stream Sediment Sampling)

5.3.1 During the course of Geological mapping stream sediment samples will be collected from 1st, 2nd and higher order streams to identify the positive catchment area for REE mineralization. The stream sediment sample will be commenced from the positive catchment area identified by NGCM samples having total REE value greater than 1000 ppm. Stream sediment samples will be collected in two factions i.e. raw SSS and heavy mineral (HMS) concentrated samples from the same location. The raw samples will be collected directly by sieving (-120 mesh) of naturally homogenous material and the HMS will be collected in the same spot around 20-30 kg from suitable trap site.

5.3.2 Total 65 raw stream sediment samples and 15 HMS will be collected from the proposed area. The final samples (both raw and HM) collected will be powdered and sent to laboratory for 34 element ICPMS analysis of REE. 07 external check samples will be analyzed for assay of 34 elemental analysis includes Nb, Sr, Ta, W, Mo, Sn, Rb, Be, Ba, Cs, Li & REE.

5.4.0 EXPLORATORY MINING (Pitting):

5.4.1 Orientation pitting will be carried out in positive catchment area identified on the basis of total REE NGCM values of GSI and analysis of stream sediment samples collected during proposed exploration. A provision of 05 nos of pitting on the identified anomalous zone (2.0 m wide X 2.0 m deep) with 20 cubic meters is kept. Pitting will be carried from surface up to a depth of 2 m. Locations of pits will be decided by field geologist based on field observations.

5.4.2 10 orientation soil samples will be collected from 05 pits where separate samples would be collected from all the soil horizon (Soil Regolith and Soil C) and bedrock (if exposed) of each pit. The collected soil samples will be subjected to both heavy mineral separations by panning and by natural faction method. The orientation soil samples would help to decide the target soil horizon best suitable for REE mineralization. All samples (both raw and HM) generated would be powdered and analysed for 34 elemental analysis including Nb, Sr, Ta, W, Mo, Sn, Rb, Be, Cs, Li & REE by ICPMS method. 10% of Primary Samples will be sent for external check in NABL External Labs by ICPMS method.

5.5.0 EXPLORATORY DRILLING

5.5.1 Auger Drilling will be carried out in the REE anomaly area. The REE anomaly area will be redefined on the basis of geological mapping, bedrock sampling and stream sediment sampling carried out by MECL. Auger drilling will be carried out in a grid pattern of 1 km X 1 km.

5.5.2 Total 45 numbers of auger drilling boreholes have been proposed in the block each having a depth of 4 m. The total auger drilling carried out in the block will be 180 m. Based on the

result of orientation pitting, samples from auger drilling will be collected from targeted soil horizon and bedrock.

5.5.3 Auger samples will be collected in two modes i.e raw soil faction and HM faction. A total 90 auger samples will be generated in raw faction and 50 nos will be collected in HM faction from the same locations. All the samples will be processed and submitted for analysis for REE by 34 element ICPMS method. 10% of Primary Samples will be sent for external check in NABL External Labs by ICPMS method.

5.6.0 WHOLE ROCK ANALYSIS

5.6.1 10 Nos of samples shall be subjected to determination of major oxides by XRF.

5.7.0 PETROLOGICAL & MINERAGRAPHIC STUDIES:

5.7.1 During the course of Geological mapping and sampling 10 nos. of samples from outcrops of various lithounits will be collected to carry out Petrography and Minerography. These samples would be drawn from ore zones and host rocks.

5.8.0 XRD & EPMA STUDY

5.8.1 To know the different mineral phases which can possibly host REE, 10 samples will be studied by XRD method. The samples for XRD will be selected from the samples which will analyze anomalous values of REE in bedrock, stream sediment and auger drilling.

5.8.2 A provision of 10 hours of EPMA study is also kept.

6.0.0 PROPOSED QUANTUM OF WORK

6.1.0 Details of the particular, Quantum and the targets are tabulated in **Table No.-5**

Table No- 5.1
Envisaged Quantum of proposed work

Sl. No.	Item of Work	Unit	Target
1	**Geological Mapping** (on 1:12,500 Scale)	Sq km	157.50
2	**Geochemical Sampling**		
i	Bedrock samples for REE (34 elemental analysis By ICPMS includes Nb, Sr, Ta, W, Mo, Sn, Rb, Be, Cs, Li& REE)	Nos	50
ii	Stream Sediment samples for REE (34 elemental analysis by ICPMS includes Nb, Sr, Ta, W, Mo, Sn, Rb, Be, Cs, Li & REE)	Nos	65
3	**Exploratory Mining**		
i	Orientation Pitting (5 pits) (1m*2m*2m)	Cu.m	20
ii	Pit samples for 34 elemental analysis includes Nb, Sr, Ta, W, Mo, Sn, Rb, Be, Cs, Li & REE	Nos	10
4	**Auger Drilling for REE**		
i	Auger Drilling in 45 boreholes (4m/BH)	m	180
ii	Auger Drilling samples for 34 elemental analysis includes Nb, Sr, Ta, W, Mo, Sn, Rb, Be, Cs, Li & REE	Nos	90

5	**Laboratory Studies**		
	i) Orientation Pit samples for REE in raw faction	Nos	10
	ii) Orientation Pit samples for REE in heavy mineral faction	Nos	10
	iii) Bedrock samples for REE	Nos	50
	iv) Stream sediment samples for REE in raw faction	Nos	65
	v) Stream sediment samples for REE in heavy mineral faction (NGCM anomaly zones)	Nos	15
	vi) Auger Drilling Samples for REE in raw faction	Nos	90
	vii) Auger Drilling Samples for REE in heavy mineral faction	Nos	50
	viii) Heavy Mineral Seperation by isodynamic seperators (10 orientation pit sample+ 15 Stream Sediment Samples + 50 Auger Drilling Samples)	Nos	75
	ix) 10% external check samples for REE	Nos	29
7	Whole Rock Analysis for Major Oxides by XRF technique	Nos	10
8	Petrological Samples (Surface Samples)	Nos	10
9	Mineragraphic Studies (Surface Samples)	Nos	10
10	XRD Mineral phase analysis	Nos	10
11	EPMA studies	Hrs	10
12	Report Preparation (5 Hard copies with a soft copy)	Nos.	1
13	Preparation of Exploration Proposal (5 Hard copies with a soft copy)	Nos.	1

6.1.0 BREAK-UP OF EXPENDITURE

6.1.1 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. 102.33 Lakhs.** The summary of cost estimates for Reconnaissance Survey (G-4 Level) is given in

Table No. - 5.2. The detailed cost sheet is given as Annexure-I.

Table No. 5.2

Summary of cost estimates for Reconnaissance survey (G-4) in Chatrai-Narasapuram Block, District- Ntr & Eluru, Andhra Pradesh

Sl. No.	Item	Total Estimated Cost (Rs.)
1	Geological Mapping (LSM), Other Geological Work	44,66,514
2	Trenching	94,500
3	Drilling	8,56,800
4	Laboratory Studies	27,09,200
	Sub Total (1 to 4)	**81,27,014**
5	Exploration Report Preparation	2,50,000
6	Proposal Preparation	1,62,540
7	Peer review charges	30,000
8	**Sub Total (1 to 7)**	**86,72,370**
9	GST 18%	15,61,027
10	**Total:**	**90,20,629**
	Say Rs. In Lakh	**90.21**

6.2.0 TIMELINE

6.2.1 The entire project is planned tentatively for 10 months. Initially, geological mapping and surface bedrock sampling along with soil sampling shall be carried out followed by auger drilling provided positive results are obtained in the first phase of sampling.

Table No. 5.3: Tentative Time schedule / Action plan

Estimated timeline for Reconnaissance Survey (G-4) for REE in Chatrai-Narasapuram, District-Ntr & Eluru, Andhra Pradesh

[Block area- 153.46 sq. km; Schedule timeline- 10 months]

S. No.	Particulars	Months/ Days	1	2	3	4		5	6	7	8	9	10
1	Camp Setting	months											
2	Geological Mapping & sampling	months											
3	Pitting	cu.m											
4	Auger Drilling	m											
5	Geologist days	days											
6	Sampling days	days											
8	Camp winding	months											
9	Laboratory Studies	months											
10	Geologist days, HQ	days											
11	Report Writing with Peer Review	months											

7.0.0 JUSTIFICATION

I. 42 (30 from TS 65D13 & 12 from TS 65C16) NGCM Stream Sediment Sample data points fall in the proposed Chatrai-Narasapuram area. The total REE, LREE and HREE values have been calculated and the geochemical anomaly map for the same has been prepared. The proposed area has a maximum TREE+Sc+Y value of 2608.53 ppm followed by 2435.74 ppm. A total of 25 sample out of 42 (60% samples>1000PPM) shows TREE+Sc+Y value more than 1000 PPM. The maximum total HREE value in proposed Chatrai-Narasapuram area is 113.49 ppm of which the major contributing element is Gadolinium (maximum 50.31 ppm). The maximum LREE value in Chatrai-Narasapuram block is 2439.27 ppm and the major contributing element is Cerium (maximum 1184.58 ppm) followed by Lanthanum (maximum 609.2 ppm). The NGCM (FS 2016-17 & 2017-18) stream sediment samples carried out by GSI show highly anomalous values for REE in toposheets 65C16 & 65D13, therefore the Chatrai-Narasapuram Area is proposed for reconnaissance survey for REE.

Crustal abundance (ppm) of rare earth elements (After Mason and Moore 1982)			**Summary of Stream sediment sample data falling in Proposed Block (NGCM)**		
Group	**Element**	**Crustal abundance (ppm)**	**Minimum (ppm)**	**Maximum (ppm)**	**Average (ppm)**
LREE	Lanthanum (La)	30	131.96	609.20	265.16
	Cerium (Ce)	60	255.59	1184.58	500.90
	Praseodymium (Pr)	8.2	30.04	124.93	57.20
	Neodymium (Nd)	28	116.30	453.45	207.19
	Samarium (Sm)	6	1.45	69.67	30.19
HREE	Europium (Eu)	1.2	1.93	39.12	6.22
	Gadolinium (Gd)	5.4	1.80	28.70	5.76
	Terbium (Tb)	0.9	2.89	50.31	21.77
	Dysprosium (Dy)	3	6.73	26.54	11.62
	Holmium (Ho)	1.2	0.96	3.76	1.80
	Erbium (Er)	2.8	2.69	10.29	4.91
	Thulium (Tm)	0.5	0.36	1.50	0.72
	Ytterbium (Yb)	3.4	2.71	9.58	4.79
	Lutetium (Lu)	0.5	0.39	1.44	0.73
	Scandium (Sc)	22	3.50	56.39	16.45
	Yttrium (Y)	23	17.10	59.97	31.93
Total LREE			583.13	2439.27	1060.63
Total HREE			32.86	113.49	58.31
TREE+Sc+Y			672.72	2608.53	1167.32

II. Geological Exploration of REE was successfully carried out by GSI (FS 2021-24) for secondary REE enrichment in the EGMB and Pranhita Godavari Valley which gave encouraging results. The enrichment of REE in the present area was first pointed out by high concentration of total REE values in the composite stream sediment samples during the NGCM works. It is further observed that the concentration of the REE bearing minerals is mainly high in stream sediments and less in soil. The REE mineralization in the study area occurs in the form of heavy minerals in stream sediments. The REE bearing mineral phases identified by SEM study are monazite, zircon and allanite. It was also inferred from the reconnaissance surveys by GSI (FS 2021-24 in AP and Telangana) that **the REE mainly occurs as secondary enrichment of the REE bearing mineral phases in stream sediment derived from the weathering and erosion of heavy mineral rich layers of the garnet-sillimanite gneiss, quartzites of Eastern Ghat Belt and sandstones of Gondwana i.e. alluvial placer type deposit.** GSI recommended studying these areas in details for REE mineralization.The new findings of alluvial placer type of REE enrichment may create huge potential area for secondary REE mineralization. This may considerably augment the REE resource in India particularly from the Garnet-sillimanite gneiss of EGMB and Gondwana rocks. It will be a potential game changer in terms of REE exploration in India and significantly help to mitigate the crucial REE demand. Litho units belonging to Khondalite group of rocks, Lower and Upper Gondwana is present in the present proposed area. Similar investigation in the proposed area might yield encouraging results of REE

Table for Various analytical results for REE in the blocks over Gondwana Sediments by GSI

Sr no	Block	TS	FSP	State	Outcome
1	Kottapalle Area (G-4)	65G04 & 65H1	2022-23	Andhra Pradesh	TREE values: BRS- 293-596 PPM SSS- 450-2174 PPM PTS- 329-1540 PPM SS- 415-1854 PPM
2	Kamalapuram-Jagannadhapuram Area (G-4)	65C15	2021-22	Telangana	TREE values: BRS- 105.79-10216.57 PPM SSS- 0.248-3.118% Regolith- 126.88-13249.96 PPM Clay- 318.84-2602.19 PPM

3	Velagapadu Area (G-4)	65G04	2021-22	Andhra Pradesh	TREE values: BRS- 137-1508 PPM SSS-294-10673 PPM PTS- 294-4348 PPM SS- 232-4245 PPM
4	Mulagalampalli Area (G-4)	65G04	2023-24	Andhra Pradesh	TREE values: BRS- 105-1681 PPM SSS- 290-1797 PPM PTS- 227-16770 PPM SS- 284-3665 PPM
5	Annapureddipalli Area (G-4)	65C15	2023-24	Telangana	TREE values: SSS- 339.957-40428.642 PPM Regolith- 243.34-8780.12 PPM
6	Patrwargudem Area (G-4)	65C15	2022-23	Telangana	TREE values: BRS- 161.51-2187 PPM SSS- 0.1-2.03% Regolith- 0.42-6.98% PPM Clay- 313.46-984.36 PPM
7	Pata-Gangaram	65C15	2021-23	Telangana	Reconnaissance Resource (334) in : Soil/Alluvium- 2.57 million tonnes Stream Placers- 0.13 million tonnes Inferred Mineral Resource (333): TREE- 8.15 million tonnes TREO- 12.38 million tonnes

List of Plates

1. Plate –I: Location Map of Proposed Chatrai-Narasapuram Block (164 sq km), District: Ntr & Eluru, State: Andhra Pradesh.
2. Plate–II: Regional Geological Map showing Proposed Chatrai-Narasapuram Block (164 sq km), District: Ntr & Eluru, State: Andhra Pradesh.
3. Plate–III: Block Geological Map showing Proposed Chatrai-Narasapuram Block (164 sq km), District: Ntr & Eluru, State: Andhra Pradesh (Source: NGDR portal).
4. Plate–IV: Anomaly Map with LREE values in Proposed Chatrai-Narasapuram Block (164 sq km), District: Ntr & Eluru, State: Andhra Pradesh (Source: NGCM data).
5. Plate-V: Anomaly Map with HREE values in Proposed Chatrai-Narasapuram Block (164 sq km), District: Ntr & Eluru, State: Andhra Pradesh (Source: NGCM data).
6. Plate-VI: Anomaly Map with Total REE values in Proposed Chatrai-Narasapuram Block (164 sq km), District: Ntr & Eluru, State: Andhra Pradesh (Source: NGCM data).
7. Plate-VII: Drainage Map with lithology and proposed stream sediment samples and auger drilling location points in Proposed Chatrai-Narasapuram Block (164 sq km), District: Ntr & Eluru, State: Andhra Pradesh.
8. Plate-VIII: Proposed stream sediment samples and auger drilling location points over TREE anomaly zones in Proposed Chatrai-Narasapuram Block (164 sq km), District: Ntr & Eluru, State: Andhra Pradesh.

List of Annexure

I. Detailed Cost sheet of Chatrai-Narasapuram Block, Ntr & Eluru, Andhra Pradesh.