PROPOSAL FOR RECONNAISSANCE SURVEY (G-4 STAGE EXPLORATION) FOR ,REE AND PHOSPHORITE IN PROPOSED SUMARASAR BLOCK, DISTRICTS:KACHCHH, STATE: GUJARAT

COMMODITY: REE, AND PHOSPHORITE

BY

MINERAL EXPLORATION AND CONSULTANCY LIMITED

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SEMINARY HILLS

PLACE: NAGPUR

DATE: 15th FEBRUARY,2025

Summary of the Block for Reconnaissance Survey (G-4 Stage)
GENERAL INFORMATION ABOUT THE BLOCK

	Features	Details
	Block ID	Sumarasar Block
	Exploration Agency	Mineral Exploration and Consultancy Limited (MECL)
	Commodity	REE & Phosphorite
	Mineral Belt	-
	Completion Period with entire Time schedule to complete the project	10 months
	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 mapping on 1:12,500 scale. ii. To collect surface (BRS/Soil/Stream Sediment) and pit samples for analyses of REE and Phosphorite to decide further course of exploration program. iii. To drill auger boreholes for REE and scout boreholes for REE and phosphorite in case, analytical results of surface/pit/trench samples are positive.The future course of exploration program will be decided after reconnaissance survey (G-4) outcome to G-3/G-2 level of exploration. iv. To estimate reconnaissance resources of REE bearing minerals as per UNFC norms and Minerals (Evidence of Mineral Contents) Amendment Rules, 2021 at G-4 level mineral 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	Two
	Expected Field days (Geology) Geological Party Days	Geologist Party Days: 180 (Field)+60 Days (HQ)

1.	**Location**	

CP	Easting	Northing	Latitude	Longitude
A	551960.5355	2591728.302	23° 26' 4.735" N	69° 30' 31.183" E
B	558341.296	2591637.907	23° 26' 1.018" N	69° 34' 16.032" E
C	558405.4118	2582380.951	23° 21' 0.000" N	69° 34' 17.000" E
D	563902.4004	2582361.805	23° 20' 58.638" N	69° 37' 30.589" E
E	563942.9057	2578292.67	23° 18' 46.315" N	69° 37' 31.396" E
F	552113.9786	2578294.41	23° 18' 47.880" N	69° 30' 34.920" E

	Villages	Sumarasar, Kamaguna, Tankanasar
	Tehsil/ Taluk	Nakhataran
	District	Kachchh
	State	Gujarat
2.	**Area (hectares/ square kilometers)**	
	Block Area	107.46 Sq.km
	Forest Area	Part of the block partially falls in Forestarea as per PMGati Shakti Portal
	Government Land Area	Data Not Available
	Private Land Area	Data Not Available
3.	**Accessibility**	
	Nearest Rail Head	Bhuj Railway Station
	Road	National Highway No. 341 passes outside the proposed block
	Airport	The nearest airport to proposed block is Bhuj (BHJ) Airport which is 20 km away
4.	**Hydrography**	

	Local Surface Drainage Pattern (Channels)	The overall drainage pattern of the area is of dendritic pattern
	Rivers/ Streams	
5.	**Climate**	
	Mean Annual Rainfall	Annual rainfall: The average annual rainfall is around 400 millimeters (16 inches), but it varies widely.
	Temperature	Temperature during summer can reach 40°C (104°F) from mid-March to mid-June, during Monsoon temperatures can exceed 34°C (93.2°F) with high humidity. Temperatures are cool in the mornings from December to February.
6.	**Topography**	
	Toposheet Number	Part of Toposheet Nos. 41E/11
	Morphology of the Area	Physio-graphically the Sumarasar block belongs to the central part of the Kachchh Mainland. Further south, near the southern margin of the topo-sheet 41 E/11, are the hill ranges east and west of Warar Donger. The area has an uneven topography although at the centre of the block hill features are present. Terrain is generally plain with a dome type structure in between the block area. Dendritic and Rectangular drainage withlocalized radial orientations
7	**Availability of baseline geosciences data**	
	Geological Map (1:50K/ 25K)	1:50,000 (NGDR Portal)
	Geochemical Map	NGCM (raw) data from NGDR Portal was downloaded, stream sediment sample results from NGCM was used to compute total REE's, LREE, HREE and accordingly geochemical anomaly map were prepared for TREE and presented as plates in this proposal.
	Geophysical Map	NGPM data of Toposheet 41E/11 is available in NGDR portal.

8.	**Justification for taking up Reconnaissance Survey / Regional Exploration**	1) The enrichment of Rare Earth Elements (REEs) in the Kutch Sedimentary Basin is likely due to various geological and geochemical processes. These processes involve the leaching, transportation, and re-concentration of REEs through weathering, groundwater movement, and hydrothermal activity. The basin, consisting of Mesozoic to Cenozoic sedimentary rocks, contains REE-bearing minerals potentially derived from the surrounding Deccan traps, Precambrian granites, and metamorphic rocks. Weathering of these igneous and metamorphic rocks releases REEs, which accumulate in sediments. Fluvial and marine processes transport these REEs to the basin, where they are adsorbed onto clay minerals and Fe-Mn oxides. Additionally, multiple sea-level fluctuations since the Mesozoic era have caused marine transgressions, introducing REE-rich sediments and promoting the chemical precipitation of phosphates, like monazites. Regression phases further expose these deposits to weathering and secondary concentration, contributing to the REE enrichment in the Kutch basin. 2) The NGCM data, shows the total REE value of stream sediment samples in the proposed Sumarasar block exceeds 1000 ppm, which is considered anomalous for REE mineralization. Notably, the elements Lanthanum (La) reaches up to 363.50 ppm, Cerium (Ce) up to 745.6 ppm, and Neodymium (Nd) up to 356 ppm in this area. 3) According to a journal published in Elsevier, trace elements such as Scandium (Sc), Yttrium (Y), Zirconium (Zr), Niobium (Nb), Hafnium (Hf), Thorium (Th), and Rare Earth Elements (REE) are considered immobile during weathering, diagenesis, and low to moderate levels of metamorphism. As a result, their geochemical signatures are commonly preserved in sedimentary rocks. These trace elements are significant in evaluating tectonic environments and source rock composition, as they are quantitatively transferred into clastic sediments during weathering and transportation, reflecting the signatures of the parent material and paleoenvironmental conditions. 4) The proposed Sumarasar block predominantly features gypseous

		shale, calcareous sandstone containing Belemnites, and feldspathic sandstone shale with ammonite fossils. The REE content in these sediments is likely influenced by the reducing conditions of carbonaceous members, which are enriched in organic matter. During sedimentation, REE-bearing minerals can become selectively concentrated in specific environments, such as beach or fluvial systems. Factors like pH, redox conditions, and the presence of organic matter significantly affect the distribution and preservation of REEs in sedimentary rocks.Phosphorite occurrences have been reported in the Kutch basin, with limestones and mudstones commonly serving as phosphate-bearing rocks. Phosphatic sedimentary rocks are often associated with or interbedded with shales, cherts, limestones, dolomites, and sometimes sandstones. Given that these lithologies are prevalent in the proposed block, exploration for phosphorite is also planned.The unique lithological composition and depositional conditions of the Sumarasar block have contributed to the enrichment of REEs and the presence of phosphorite deposits, making it a significant area for further exploration.

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1.1.0 INTRODUCTION

1.1.1 Development of renewable energy infrastructure requires critical raw materials, such as the rare earth elements (REEs, including scandium) and niobium, and is driving expansion and diversification in their supply chains. Although alternative sources are being explored, the majority of the world's resources of these elements are found in alkaline-silicate rocks and carbonatites. These magmatic systems also represent major sources of fluorine and phosphorus. Exploration models for critical raw materials are comparatively less well developed than those for major and precious metals, such as iron, copper, and gold, where most of the mineral exploration industry continues to focus. The diversity of lithologic relationships and a complex nomenclature for many alkaline rock types represent further barriers to the exploration and exploitation of REE-high field strength element (HFSE) resources that will facilitate the green revolution.

1.1.2 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.

1.1.3 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).

1.1.4 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 62(La, Ce, Pr, Nd, Pm, Sm) and the heavy rare earth elements (HREE) are those with atomicnumbers from 63 to 71 (Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu) and Y, Sc. However, because of their geochemicalproperties, rare earth elements are typically dispersed and not often found concentrated as rareearth minerals in economically exploitable ore deposits.

1.1.5 Generally the light rare earth elements (LREE) are more abundant in the earth's crustand 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.

1.1.6 In the other hand, 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.

1.1.7 Considering important parameters such as resource/ reserve position in the country, production, import dependency, use for future technology/ clean energy, requirement of fertilizer minerals in an agrarian economy, the Committee has identified a set of 30 critical minerals. These are Antimony, Beryllium, Bismuth, Cobalt, Copper, Gallium, Germanium, Graphite, Hafnium, Indium, Lithium, Molybdenum, Niobium, Nickel, PGE, Phosphorous, Potash, REE, Rhenium, Silicon, Strontium, Tantalum, Tellurium, Tin, Titanium, Tungsten, Vanadium, Zirconium, Selenium and Cadmium. (Critical Minerals for India, Report of the Committee on Identification of Critical Minerals, Ministry of Mines, June 2023)

1.1.8 A study, conducted by the Council on Energy Environment and Water, identified 12 minerals out of 49 that were evaluated as **'**most critical**'** for India's manufacturing sector by Vision 2030 which makes more thrust for exploration in Strategic Mineral, Precious Metals, Platinum Group of Elements by Government of India.

1.2.0 **BACKGROUND**

1.2.1 The Commissioner of Geology and Mining (CGM), Gujarat has identified several blocks for exploration of Strategic Mineral based on their previous works. They published the information of these blocks in Gujarat's Mineral Wealth. CGM, Gujarat (via official email dated 14/11/2024) sent MECL a NOC approval to take up exploration investigation in those blocks. The proposed Sumarasar Block (G-4 stage) is carved out from Bhuj Nirona Alkaline Block as this blockis one of the block given to MECL by CGM Gujarat.

1.2.2 Moreover, emphasis has been given to explore the more numbers of blocks for strategic minerals in Gujarat. Keeping this in view, the present proposal Reconnaissance Survey (G-4 stage exploration) for REE and Phosphoritei n Sumarasar block in Kachchh district, Gujarat is being put up for evaluation under NMET funding and execution.

1.3.0 **LOCATION AND ACCESSIBILITY**

1.3.1 The Sumarasar Block falls in T.S. Nos. i.e. 41E/11 andbounded by latitude 23º18'46.315''N to 23º26'4.735''N and Longitude 69º30'31.183''E to 69º37'31.396''E. It lies in the South western partof Kachchh District, and towards South eastern side from the block is the Bhuj city (approximately 20km).The block falls in Nakhataran tehsil.

Kachchh district is not having any railways station however the nearest city from the block is bhuj.Bhuj railway station is a Class-A railway station in Bhuj, Gujarat, India, on the Western line of the Western Railway network. It is the last station on the Western Railway line in the area.

1.4.0 **PHYSIOGRAPHY, DRAINAGEAND CLIMATE:**

1.4.1 Physio-graphically the Sumarasar block belongs to the central part of the Kachchh Mainland. Further south, near the southern margin of the topo-sheet 41 E/11, are the hill ranges east and west of Warar Donger. The area has an uneven topography although at the centre of the block hill features are present. Terrain is generally plain with a dome type structure in between the block area. Dendritic and Rectangular drainage withlocalized radial orientations

1.4.2 The area has a hot semi-desert climate with short, hot summers and short, mild winters. The bhujcity is mostly clear and dry year-round. Temperature during summer can reach 40°C (104°F) from mid-March to mid-June, during Monsoon temperatures can exceed 34°C (93.2°F) with high humidity and temperatures are cool in the mornings from December to February.

Annual rainfall: The average annual rainfall is around 400 millimeters (16 inches), but it varies widely.

1.5.0 FLORA & FAUNA:

1.5.1 Area falls into the arid and semi-arid area so vegetation in areais found accordingly. As block is near to the desert area (Rann of Kutch) and is also in close proximity with the sea, it shows bio-diversity in terms of flora and fauna. Varieties of vegetation are found here. The area has vegetation like Saru, Neem, Ber, Neem, coconut etc. The dry and hilly zone has trees of Pipal, Imli, Gugal, Vad, and varieties of Cactus. Varieties of reptiles, mammals and fishes are found in Bhuj and its adjoining areas. Crocodile, spiny tailed lizard, monitor lizard, Kutch Rock Gecho, Black Cobra, Black Krait, Sand Boa, Royal Snake, Sand Boa, Python etc. are some of the reptiles found here. Varieties of toads and frogs are found in area.The mammals in area are Neelgai, Wild Boar, Chinkara, Indian wolf, Jackal, pangolin. Kutch area is also famous for huge population of White Ass.

1.6.0 REGIONAL GEOLOGYAND STRUCTURE

1.6.1 The Proposed Sumarasar Block is in Kachchh Basin. The Kachchh basin which is a peri-cratonic rift basin is composed of Mesozoic,Tertiary and Quaternary sediments. The Mesozoics, which are mainly rift fill sediments, are comprised of Late Triassic continental, Middle to Late Jurassic marine and late Jurassic to Early Cretaceous fluvio-deltaic sediments. The Mesozoic rocks are overlain bybasic lava flows with intertrappean beds, dykes and sills of the Deccan Volcanics. The Tertiary sediments are mostly shallowmarine shelf sediments in the peripheral and intervening structural lows bordering Mesozoic uplift areas. The Quaternarysediments are composed of sediments ranging from marine, fluvial, lacustrine and aeolian sediments.

1.6.2 The Kachchh basin is located in the Western margin of India and is an importantPericratonic Mesozoic-Tertiary sedimentary basin (Biswas, 1980). It is bounded by the

Nagar Parkar Fault (NPF) to the North, the Radhanpur–Barmer arch to the East, theArabian Sea to the west and the Kathiawar uplift to the south. The development of severalfaults in the Kachchh region is related to the separation of Eastern Gondwanaland and theWestern Gondwanaland in the late Triassic/early Jurassic resulted by a subsidenceprocess between the Nagar Parkar fault and the Kathiawar fault. The rifting in theKachchh basin was aborted along Kutch Mainland Fault (KMF) during the lateCretaceous due to uplift processes and then became a shear zone with strike-slipmovements (Biswas, 1987, 1992).

The basin is predominantly filled with Mesozoic,Tertiary and Quaternary sediments. In the North, the Precambrian granitic basement isexposed in the Nagar Parkar Hills and in the South there lies the Saurashtra platform,covered by late Cretaceous sediments and the Deccan traps. In the East, the basin extendsup to northern Gujarat plains where the Precambrian rocks are covered by alluvium and inthe west; it extends up to the continental shelf (Bansal et. al., 2016). The Kachchh basin isstill under compressional stress, due to collision of Indian and Eurasian plates (Gupta et.al., 2001).The Geology of Kachchh Peninsula is very intriguing as itcomprises rocks ranging in age from Jurassic to Recent. The area exposes a completesection of Mesozoic sediments viz, the Pachchham, Chari, Katrol and the Bhuj formationsoverlain by lava flows and intruded by Deccan volcanic represented by sills, dykes andplugs. The Matanomadh, Khari Nadi, Gaj and Sandhan formations represent the TertiaryCenozoic rocks and are overlain by Holocene sediments belonging to Millolite, Varahi,Mahuva and the Rann formations.

1.6.3 **DESCRIPTION OF FORMATIONS**

The Chari and Katrol formations represent the upper Jurassic in Kutch. The Chari beds are exposed in the Jhura hills and to the south of the Katrol Fault south of Nangiari. In the former, it is represented by limestones and marls with thin interbeds of golden oolite, Shales, calcareous sandstone, fossil-bearing argillaceous limestone and oolitic limestone. The Chari Series attain a total thickness of 400 metres. An elliptical inlier of the Charts is found south of the Katrol Fault. It comprises gypseous shales and cream coloured fossiliferous oolitic limestones.

The golden oolite is a rather coarse-grained limestone composed of calcareous grains coated with a very thin ferruginous layer and surrounded by a matrix of carbonate of lime. The golden oolite band has an average thickness of about 12 m. There is considerable variation in the colour of the bands, The marls above the golden oolite have yielded the ammonite Indocephalites apart from the brachiopods Bhynchonellaconcinna and Terebratula of acutiplicata. The calcareous sandstone is pebbly and forms a marker horizon. Ripple marks are characteristic of this formation. The Dhosa oolite is essentially an oolitic,limestone . The oolites are upto 0.5 mm in diameter and are canted with thin films of ferruginous matter. They are embedded in a calcareous matrix. The Dhosa oolite is a highly fossiliferous horizon. It has yielded a rich variety of ammonites, Belemnoidea, are represented by Belemnopsis of gerardi, Belemnopsisorientalis and Belemnopsissubhastata. Among the brachiopodes, terebratulids and Rhychonellids are abundant. Terebratula euryptycha is common. Astarte and Ostrea are common among lamellibrachs. The Echinoids are represented by Pygorhytis tumulus and Collyrites dorsalis. Pleurotomaria is the only genus representing the class gastropoda,

Katrol Series:

The Katrol beds conformably overlie the Chari series. They are represented by shales and sandstones. To the north of the Katrol fault, the katrol formations are met with from north of Tankanasar to the south uptoKodki where it is fallowed by the sandstones of Bhuj series.The shales are gray to ash grey in colour and they have intercalations of jasper tabloids and pyrite nodules. Fossil wood is also not uncommon. The sandstones are of various hues, white grey, pinkish end brown. The brown sandstone are medium-grained with sub-angular grains of quarts and are calcareous. These sandstones have well-developed vertical joints; the major set of joints strike in NNW-SSE, NNE-SSW and ESE-WNW directions.

Bhuj Series:

The rocks of this series are not exposed in areas represented by toposheets 41 E/11/1.Overlying the Katrol, the Bhuj formations are seen extending from Makhana upto the Katrol fault, south of Nangiari. Towards the south of the Kotral Fault, the Bhuj sandstones are exposed from north of Godparupto 1 km north of Chunadi where they are unconformably overlain by the Deccan trup lava flows.

The rocks of this series are essentially coarse-grained, current-bedded felspathic sandstones, with ferruginous, pink coloured sandstones towards the bottom. The sandstone occurring close to the contact with the overlying formations reveals a few intercalations of pebbly conglomerate, comprising rounded pebbles of shale, quart site and porphyritic and amygdaloidaltratps.

The Deccan trap overlies both the felspathic sandstone and the pebbly conglomerate. The lava flows compiles fine-grained amygdaloidal basalt with dense, hard, porphyritic basalt occurring as sills within them.

Connected with the Deccan trap igneous activity are the basic dykes which traverse the area. A majority of the dykes trend in a more or less NE-SW direction find a few in east-west direction, these dykes are generally emplaced along faults of the bubs trend and it is likely that the basic welled up along south-west trending fissure.

Supra-trappeans: These consist of laterites and aluminous laterites resting on either the Bhuj formations or the Deccan traps.

The marls have yielded fossils of gastropods and lamellibranches with spines of echinoderm. Turritella is the most abundant gastropod.

Miliolite limestone:

This Recent to Sub-Recent formation is generally seen in the upper ranches of the nala courses draining the hill-range to the north of Chunadi and also in the highlands. The Bhuj sandstones to too north of the Jhura hill are also covered by Miliolite limestone. At a few places the contact is disconformable. The Miliolite formation consists of angular fragments of limestone and sandstone set in a calcareous matrix at the base, and is overlain by limestone carrying stray boulders of other rocks.

Alluvium:

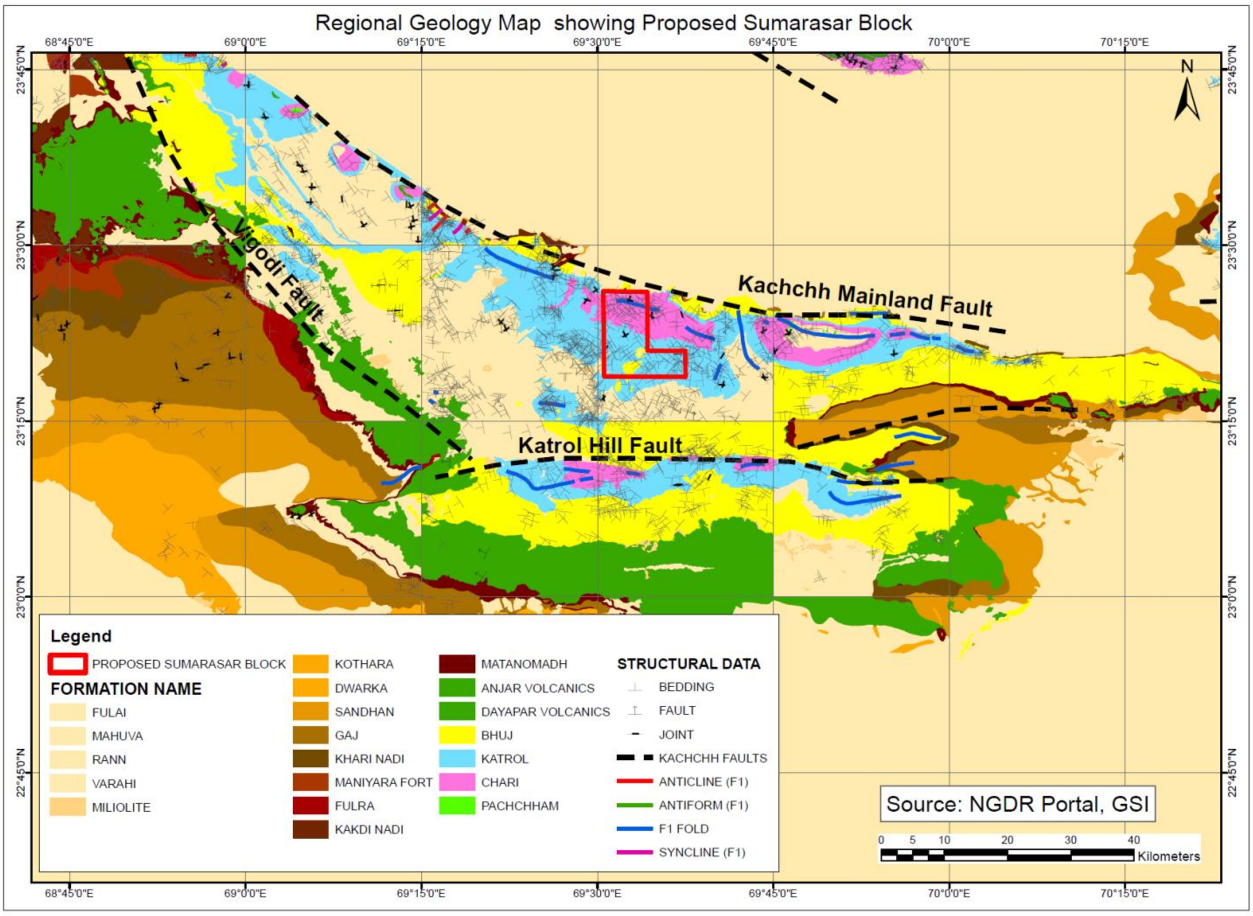
Alluvium occurs to the north of the Banni Fault, where it occupies the Banni area north of Jhuna. It consists of loose sand with clayey in the trap country, the soil is brown, to red in colour. The soil on the Bhuj formations consists generally of wind-brown loose sand.

The Mesozoic sediments of Kachchh are represented by Pachchham, Chari, Katrol and Umia Formations (after Krishnan, 1982). Krishnan (1982) classified the Mesozoic succession of Kachchh as presented in the below table-

Regional Stratigraphic sequence of Litho units (after Krishnan, 1982)

Age	Unit	Sub-division	Lithology
Post-Aptian	UMIA	Bhuj beds (Umia Plant beds)	Sandstone and shale
Aptian		Ukra beds	Marine calcareous shale
Upper Neocomial		Umia beds	Barren sandstone and shale
Valanginian		Trigonia beds	Barren sandstone
Upper Tithonian		Umia ammonite beds	Shale and sandstone
Middle Tithonian	KATROL	Upper Katrol Shales	Shale
Middle Tithonian		Gajansar beds	Shale
Lower Tithonian		Upper Katrol (Barren)	Sandstone
Middle Kimmeridgian		Middle Katrol	Red sandstone
Upper Oxfordian		Lower Katrol	Sandstone, shale, marl
Oxfordian	CHARI	Dhosa Oolite	Green and brownoolitic limestone
U. Callovian		Athleta beds	Marl and gypseous shale

Age	Unit	Sub-division	Lithology
Middle Callovian		Anceps beds	Limestone and marl
Middle Callovian		Rehmani beds	Yellow limestone
Lower Callovian		Macrocephalus beds	Shales with calcareous bands and golden oolites
Lower Callovian	PATCHAM	Coral bed	Shale and limestone
Lower Callovian to Bathonian		Patcham shell limestone Patcham basal beds (Kuar Bet beds)	Limestone, shale and marl



Geological map of the Kachchh Basin along with the proposed Sumarasar block

1.7.0 GEOLOGY OF THE BLOCK AREA

1.7.1 The proposed Sumarasar block is covered by Katrol and Chari formation. Predominantly composed of dark grey to black shale in the lower part, interbedded with ferruginous sandstone and micaceous siltstone and shale.

1.8.0 PREVIOUS WORK - OBSERVATION AND RECOMMENDATIONS

1.8.1 In the FSP year 1966-67 geological Mapping has been carried out in parts of Kachchh district, Gujarat by GSI. On the basis of mapping in Toposheet no 41E/11. It has shown that the oldest formations are the Chari series of Upper Jurassic age. The golden oolites, which occur in the Lower Charis, are restricted to the Jhura Dome only, and are not exposed in the Chari formations to the south of the Katrol Fault. There are at least 26 different lava flows as counted from the top of the Bhuj series and occurring within the area limited by the southern margin of the toposheet. The Chari formations are exposed due to the upthrow caused by the Banni fault in the Jhura area and the Katrol Fault in the south. The Jhura Dome is essentially doubly plunging asymmetrical anticline. The Banni and Katrol Faults are the extensions of the faults known by the same name and traced in the adjoining area to the west. Rhynchonella concinna, a characteristic brachiopod of Upper pa cham, persists the Charis also. Minor phosphorus bearing horizons are found within the ferruginous sandstone of Bhuj series, and in the nodular horizons in the Chari series. Only the concretions and nodules show values upto 15 to 20% of P_2O_5. No primary phosphorite has been encountered.

1.8.2 Geophysical Mapping has been covered by GSI in Toposheet no 41E/11 in FSP year 2019-20. The gravity and magnetic (TF) surveys have provided both qualitative and quantitative information regarding subsurface structure, basement depth and variation of crustal thickness having different density and magnetic susceptibility in the area under the investigation. The following conclusions were drawn:-The Bouguer anomaly map indicated a concentric gravity high anomaly towards north of Sumrasar village under soil cover in Toposheet41E/11. This gravity high has been marked as the zone of interest (Z1) and is corroborated by circular magnetic high anomaly near Kadol village. Thiscircular contour pattern indicates an intrusive vertical/sub-verticalcylindrical body underneath. The root of this feature seems to haveshallower extension as it is visible in both regional and residual maps up to adepth of about 1000m. Similarly, limited depth extent of this anomaly has been observed in the upward continued magnetic map of the area. Thislimited gravity high feature attributed to the sudden change in thedepositionary pattern of the sandstone and shale belonging to the Sandhanand Khari Nadi formation having surface geology - clay, marl, conglomeraterocks and aeolian sand.

1.8.3 Phosphorite, phosphate rock or rock phosphate is a non-detritalsedimentary rock which contains high amounts of phosphate minerals. The amount of phosphorus in clastic rocks depends ontheir origin and grain size, with phosphorus content generally increasing with decreasing grain size. Limestones and mudstonesare common phosphate-bearing rocks (Prothero, Donald R.; Schwab, Fred 2003). Phosphatic sedimentary rocks are commonly accompanied by or interbedded with shales, cherts, limestone, dolomites and sometimes sandstone (Prothero, Donald R.; Schwab,Fred 2003). During the field season 1966-67, Desikenet. al., (Report circulation year 1968) had reported phosphorite occurrences at a number of places in Bhuj and Mandvi taluka with P_2O_5 content upto 20%. During 1976-77, R.S. Kathiara(Report circulation year1977) checked the entireoccurrence reported by Desikenet. al. (Report circulation year 1966) to ascertain the possibility oflocating anysizable phosphorite deposit. During the course of that investigation it was found that in all the localities only a fewscattered nodules are seen, which have no economic other than the cherty limestone of Chari Formation.R.S. Kathiara (1984)hascovered an area of 220 sq. km. Fallingin toposheets 41E/4 7, 8, &12 on 1: 63, 360 scale by traverse mapping and the bands ofphosphatic cherty limestone of Chari Formation were tested and sampled for determinations of P2O5 content.The cherty limestoneof Mesozoic of Kachchh were examined in 30 kms long belt between Lerin the east and Wandhaya in the west and in the Habohill,about 20kms north of Bhuj for the presence of any rich rocks of phosphorite.More than 1500 samples were tested for P_2O_5 inthe field by Shapiro s method, out of this a total of 275 sample were selected for analysis in the laboratory. Katharia (Reportcirculation year 1984) estimated a reserve of 9 million tonnes. IBM in April 2018 published the threshold values of minerals in whichthreshold value for phosphate is revised to P2O5minimum content of 5%. N. Kumar and N.Das (Report circulation year 2021)carried out field work under FSP 19-20 in and around Bhasar, Samtra, deshalpar, and Vandhay in search of phosphatic rock andmapped 100 sq.km. Area in 1:12,500 scale. They found two horizons of rock units viz. cherty limestone (Dhosaoolite: 1-2mthickness) and pisolitic/fossiliferous calcareous conglomerate (10-15 cm thickness) which yielded positive result in Shapiro test. The bed rock samples collected from different phosphorite bearing rock over the area show P_2O_5 value ranging from 0.05% to2.07%. The pit 7 trench samples (PTS) show P_2O_5 value ranging from 0.12% to 2.49% and channel sampling P_2O_5 value ranging from 0.435 to 1.79%. Cherty Limestone/Dhosaoolite of Chari Formation has been reported from throughout the Kachchh andconsidered as marker horizon of Oxfordian- Colluvian time (Ramkumar, 2015). F rsichet.Al. 2013and Patel et. Al. (2009) had worked

in the eastern and southern part of the Jhura dome respectively and reported similar lithological and Geological setting as theworking area of FSP 19-20 as per available literature, Phosphatic rocks also found to host significant amount of REEs (Emsbo et.

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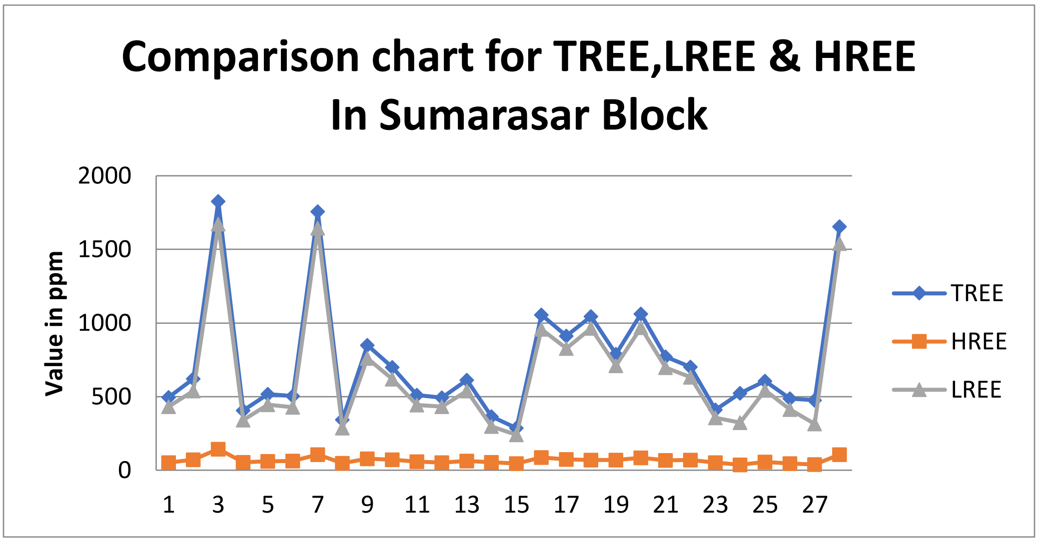
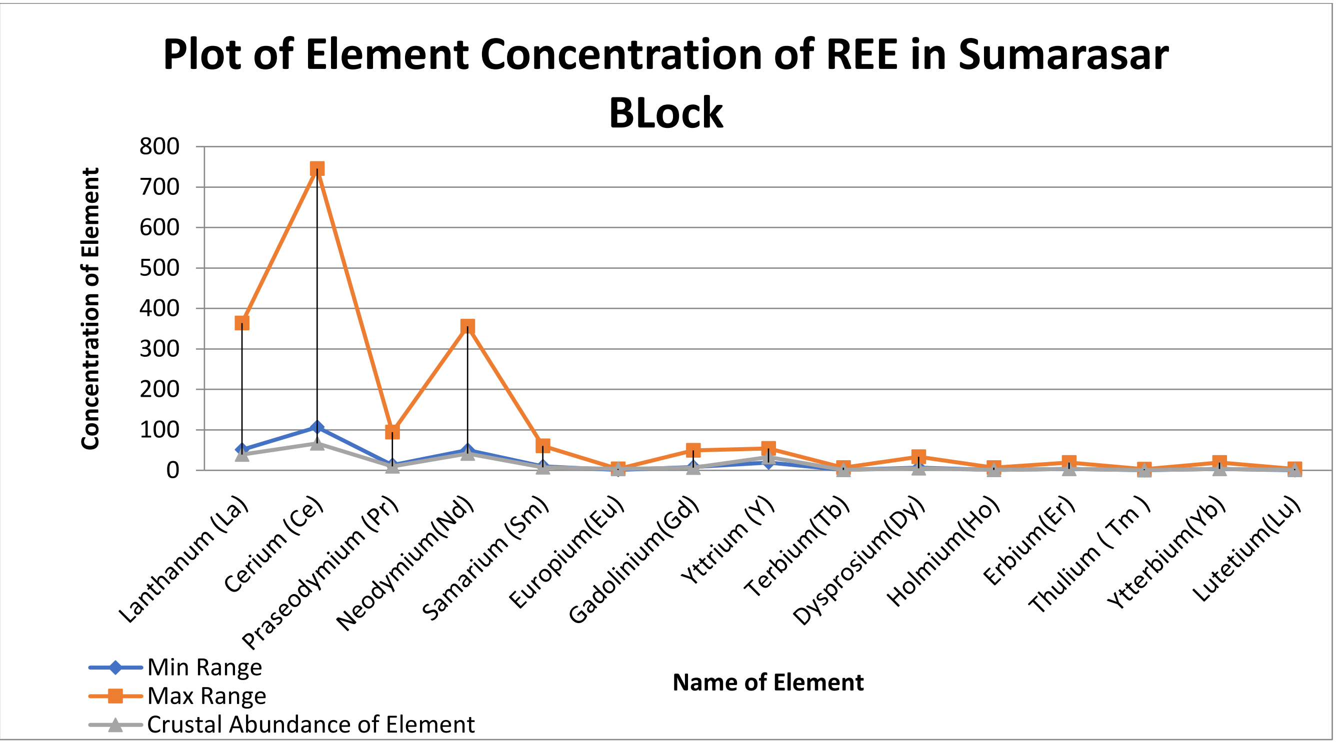
Table-1.3

Data showing NGCM (LREE & HREE) Stream Sediment results for proposed Sumarasar BlockToposhhet No. 41E/11 (NGDR, GSI)

Item	Sl. No.	Element	RANGE (PPM)		Average crustal abundance values are from Lide (2004, p.17); REE, rare earth element
			MIN	MAX	
LREE	1	Lanthanum(La)	51.2	363.50	39
	2	Cerium(Ce)	106.6	745.6	66.5
	3	Praseodymium (Pr)	12.89	93.98	9.2
	4	Neodymium(Nd)	50.13	356.0	41.5
	5	Samarium (Sm)	9.52	60.25	7.05
	6	Europium(Eu)	1.26	3.60	2
	7	Gadolinium(Gd)	8.06	48.89	6.2
		LREE	**240.06**	**1671.99**	
HREE	8	Yttrium (Y)	19	54	33
	9	Terbium(Tb)	1.30	6.36	1.2
	10	Dysprosium(Dy)	6.50	33.21	5.2
	11	Holmium(Ho)	1.29	6.31	1.3
	12	Erbium(Er)	3.70	18.98	3.5
	13	Thulium (Tm)	0.49	2.77	0.52
	14	Ytterbium(Yb)	3.12	19.35	3.2
	15	Lutetium(Lu)	0.5	3.18	0.8
		HREE	**37.02**	**144.19**	





1.8.0 SCOPE FOR PROPOSED EXPLORATION.

a) The Reconnaissance survey at G-4 stage exploration program proposed comprises of Large ScaleGeological mapping (1:12,500 scale), Surface Sampling (Bedrock, Soil &Stream Sediments), Pitting/Trenching, Drilling, chemical analysis, physical analysis and geological report preparation.

1.9.0 JUSTIFICATION

1) The enrichment of Rare Earth Elements (REEs) in the Kutch Sedimentary Basin is likely due to various geological and geochemical processes. These processes involve the leaching, transportation, and re-concentration of REEs through weathering, groundwater movement, and hydrothermal activity. The basin, consisting of Mesozoic to Cenozoic sedimentary rocks, contains REE-bearing minerals potentially derived from the surrounding Deccan traps, Precambrian granites, and metamorphic rocks. Weathering of these igneous and metamorphic rocks releases REEs, which accumulate in sediments. Fluvial and marine processes transport these REEs to the basin, where they are adsorbed onto clay minerals and Fe-Mn oxides. Additionally, multiple sea-level fluctuations since the Mesozoic era have caused marine transgressions, introducing REE-rich sediments and promoting the chemical precipitation of phosphates, like monazites. Regression phases further expose

these deposits to weathering and secondary concentration, contributing to the REE enrichment in the Kutch basin.

2) The NGCM data, shows the total REE value of stream sediment samples in the proposed Sumarasar block exceeds 1000 ppm, which is considered anomalous for REE mineralization. Notably, the elements Lanthanum (La) reaches up to 363.50 ppm, Cerium (Ce) up to 745.60 ppm, and Neodymium (Nd) up to 356.0 ppm in this area.

3) According to a journal published in Elsevier, trace elements such as Scandium (Sc), Yttrium (Y), Zirconium (Zr), Niobium (Nb), Hafnium (Hf), Thorium (Th), and Rare Earth Elements (REE) are considered immobile during weathering, diagenesis, and low to moderate levels of metamorphism. As a result, their geochemical signatures are commonly preserved in sedimentary rocks. These trace elements are significant in evaluating tectonic environments and source rock composition, as they are quantitatively transferred into clastic sediments during weathering and transportation, reflecting the signatures of the parent material and paleoenvironmental conditions.

4) The proposed Sumarasar block predominantly features gypseous shale, calcareous sandstone containing Belemnites, and feldspathic sandstone shale with ammonite fossils. The REE content in these sediments is likely influenced by the reducing conditions of carbonaceous members, which are enriched in organic matter. During sedimentation, REE-bearing minerals can become selectively concentrated in specific environments, such as beach or fluvial systems. Factors like pH, redox conditions, and the presence of organic matter significantly affect the distribution and preservation of REEs in sedimentary rocks.

5) Phosphorite occurrences have been reported in the Kutch basin, with limestones and mudstones commonly serving as phosphate-bearing rocks. Phosphatic sedimentary rocks are often associated with or interbedded with shales, cherts, limestones, dolomites, and sometimes sandstones. Given that these lithologies are prevalent in the proposed block, exploration for phosphorite is also planned.The unique lithological composition and depositional conditions of the Sumarasar block have contributed to the enrichment of REEs and the presence of phosphorite deposits, making it a significant area for further exploration.

BLOCK DESCRIPTION

1.10.1 The Sumarasar blockfalls in Survey of India Toposheet No.41E/11 covering a total area of 107.46.00 sq.km in Nakhataran Tehsil, Kachchh District, State-Gujarat. The location map of the block area is given in **Plate-I.** The Co-ordinates of the corner points of the block area both geodetic and UTM are given in **Table No.-1.4**.

Table- 1.4

Co-ordinates of the Corner points of the Sumarasar Block

CP	Easting	Northing	Latitude	Longitude
A	551960.5355	2591728.302	23° 26' 4.735" N	69° 30' 31.183" E
B	558341.296	2591637.907	23° 26' 1.018" N	69° 34' 16.032" E
C	558405.4118	2582380.951	23° 21' 0.000" N	69° 34' 17.000" E
D	563902.4004	2582361.805	23° 20' 58.638" N	69° 37' 30.589" E
E	563942.9057	2578292.67	23° 18' 46.315" N	69° 37' 31.396" E
F	552113.9786	2578294.41	23° 18' 47.880" N	69° 30' 34.920" E

1.10.1 PLANNED METHODOLOGY

1.10.2 The exploration program is proposed in accordance to the objective set for reconnaissance survey (G-4) of the block. The Exploration shall be carried out as per Minerals (Evidence of Mineral Contents) Amendment Rules, 2021. 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.

1.10.3 GEOLOGICAL MAPPING

Geological mapping will be done in the entire 107.46 sq. km area on 1:12,500 scale. Rock types, their contact, structural features will be mapped. Surface manifestations of the mineralisation available along with their surface disposition will be marked on map.

1.10.4 SURFACE GEOCHEMICAL SAMPLING

Bed Rock Sample: During the course of Sampling, around 50 nos. of bed rock samples shall be collected from the suitable surface locale for REE and 50 nos. of bed rock samples shall be collected from the suitable surface locale for Phosphorite. A total of 100 nos. of primary and 10 nos. of external check surface samples will be analysed for 34 elements for REE and 8 radicals (K_2O, SiO_2, MgO, CaO, Na_2O, P_2O5, Al_2O_3& Fe_2O_3) for Phosphorite.

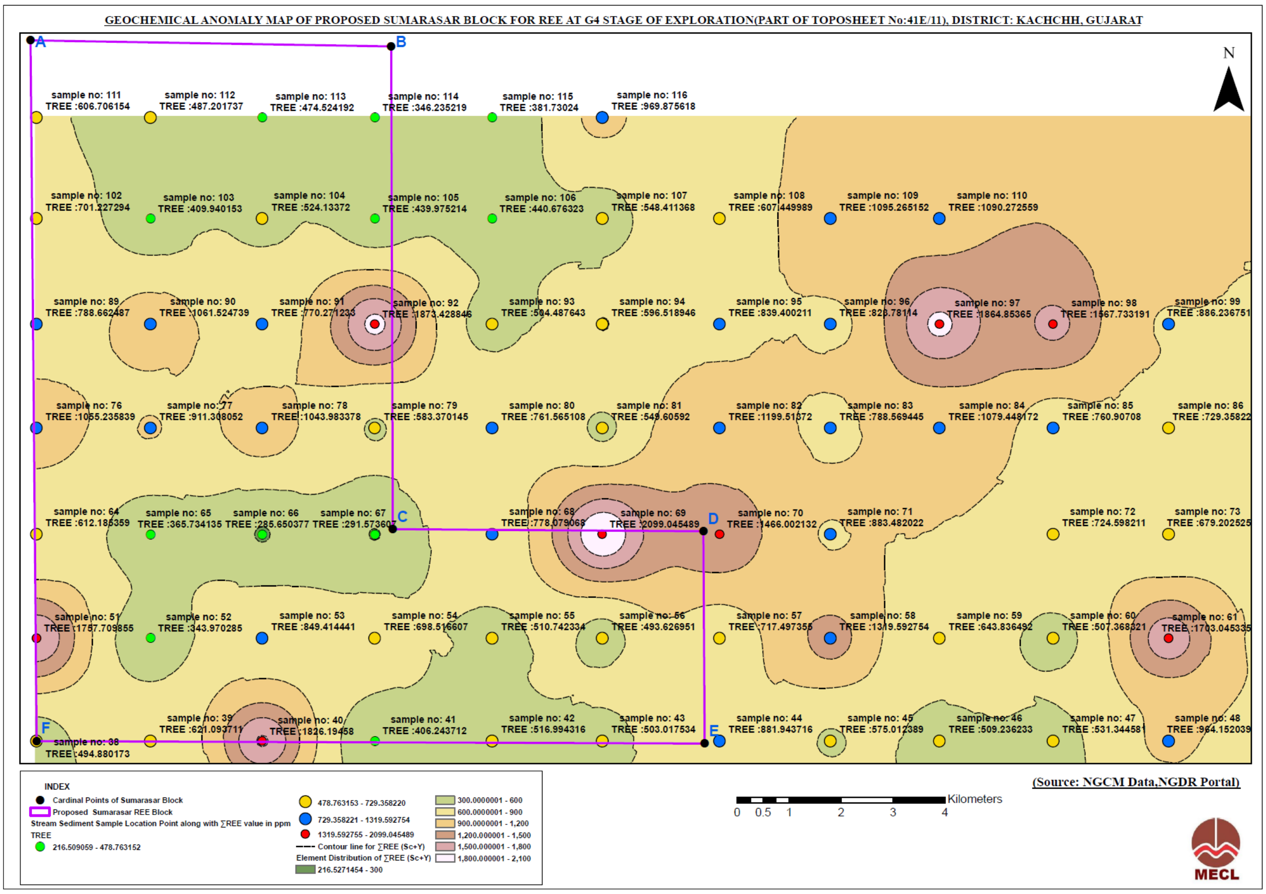
Further,60 Nos of follow up stream sediments samples shall be collected from 1st order and 2nd order streamaround the samples within two potential area identified for REE to identify the provenance of the mineralisation. The collected stream sediment samples shall be sun dried and pass to -120 mesh sieve to collect -120 mesh natural fraction samples as a follow up stream sediment sample.

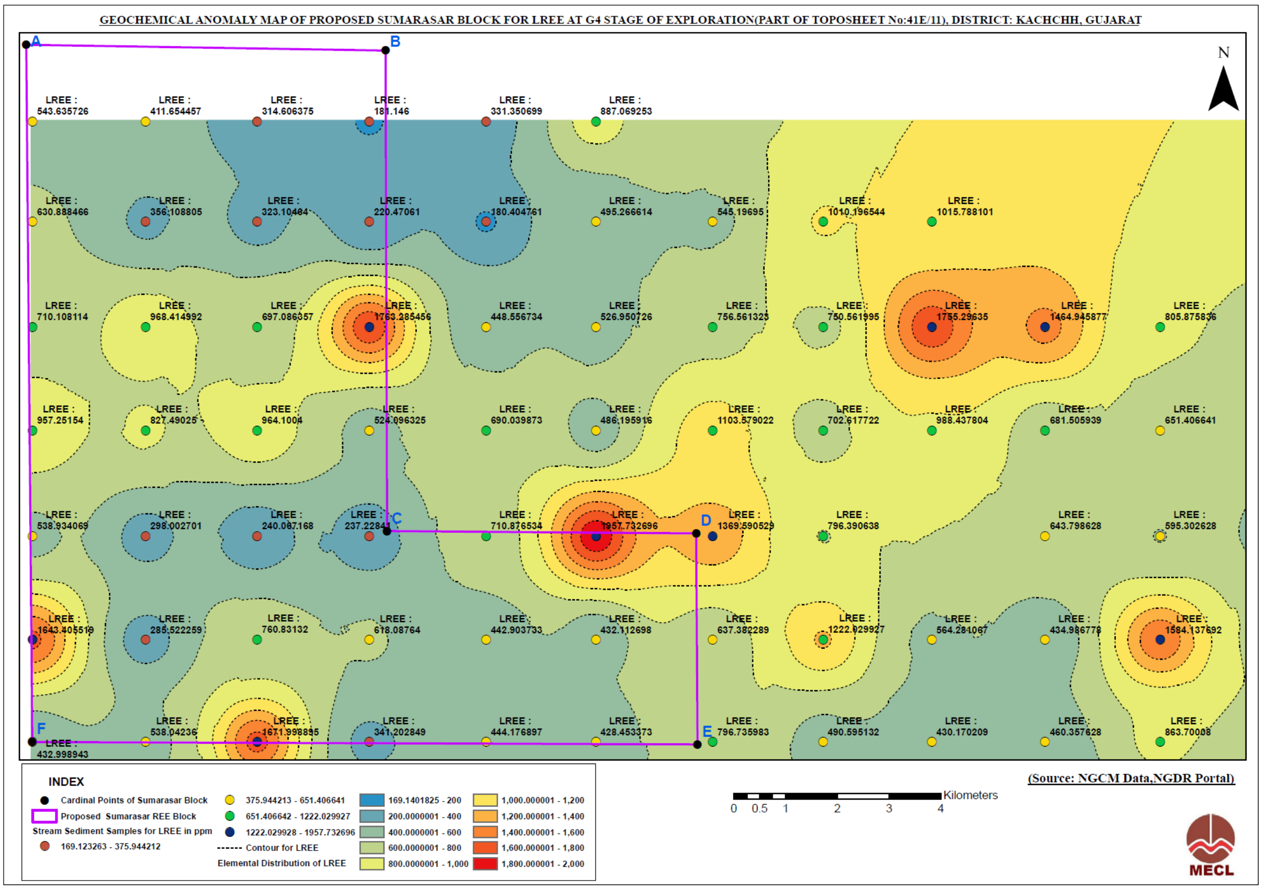
Around 5 Nos of pit may be dug with cumulative 10cu.m of excavation for orientation sampling. All the soil horizons from orientation pit and the enriched horizon from the other pits may only be sampled. Heavy mineral separation shall be carried out for each samples. Thus a total 30 Nos of samples generated heavy mineral separation and natural fraction shall be analysed for 34 elements by ICPMSanalysis includes Sn, Hf, Nb, Ta, U, Th, Be, Ba, Ge, As, Rb, Sr, W, Mo, Ti, Zr, Cs, Y, Sc, Pb, Zn and REE. The weight percentage of heavy fraction shall also be calculated.

1.11.3 Exploratory Mining (Trenching): Trenching (Excavation) shall be carried out in the potential zones identified based on the results of geological mapping and geochemical sampling for Phosphorite mineralization. A provision of trenching/pitting of 100 cubic meter has been planned. Trenching work will be carried out by excavating trenches of 1m width and up to 2m depth in the area to expose the source rock and mineralization. Around 50 nos. of trenchsamples shall be collected. A total of 50 no of primary and 5 no of external check trench samples will be analysed for 8 radicals (K_2O, SiO_2, MgO, CaO, Na_2O, P_2O_5, Al_2O_3 & Fe_2O_3) and 34 elements by ICPMS analysis includes Sn, Hf, Nb, Ta, U, Th, Be, Ba, Ge, As, Rb, Sr, W, Mo, Ti, Zr, Cs, Y, Sc, Pb, Zn and REE.

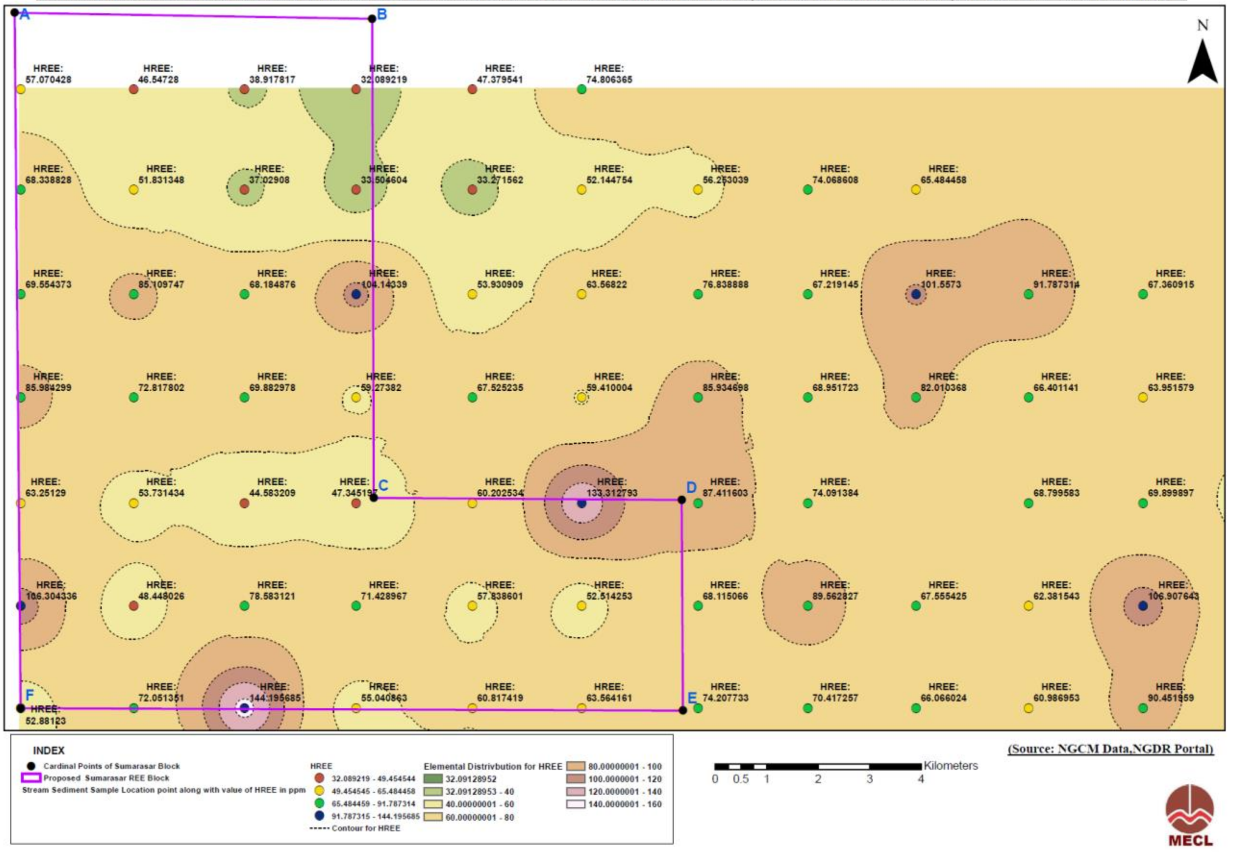
1.11.4 Heavy Mineral Separation

The 15 Nos of soil samples collected from the pit may be subjected to heavy mineral seperation by liquid as well as by gravity and magnetic separation and also 7 Nos of auger sample will be taken to to heavy mineral seperation by liquid as well as by gravity and magnetic separation in laboratory setup, Thus total 22 nos. of sample shall be taken for heavy mineral seperation.

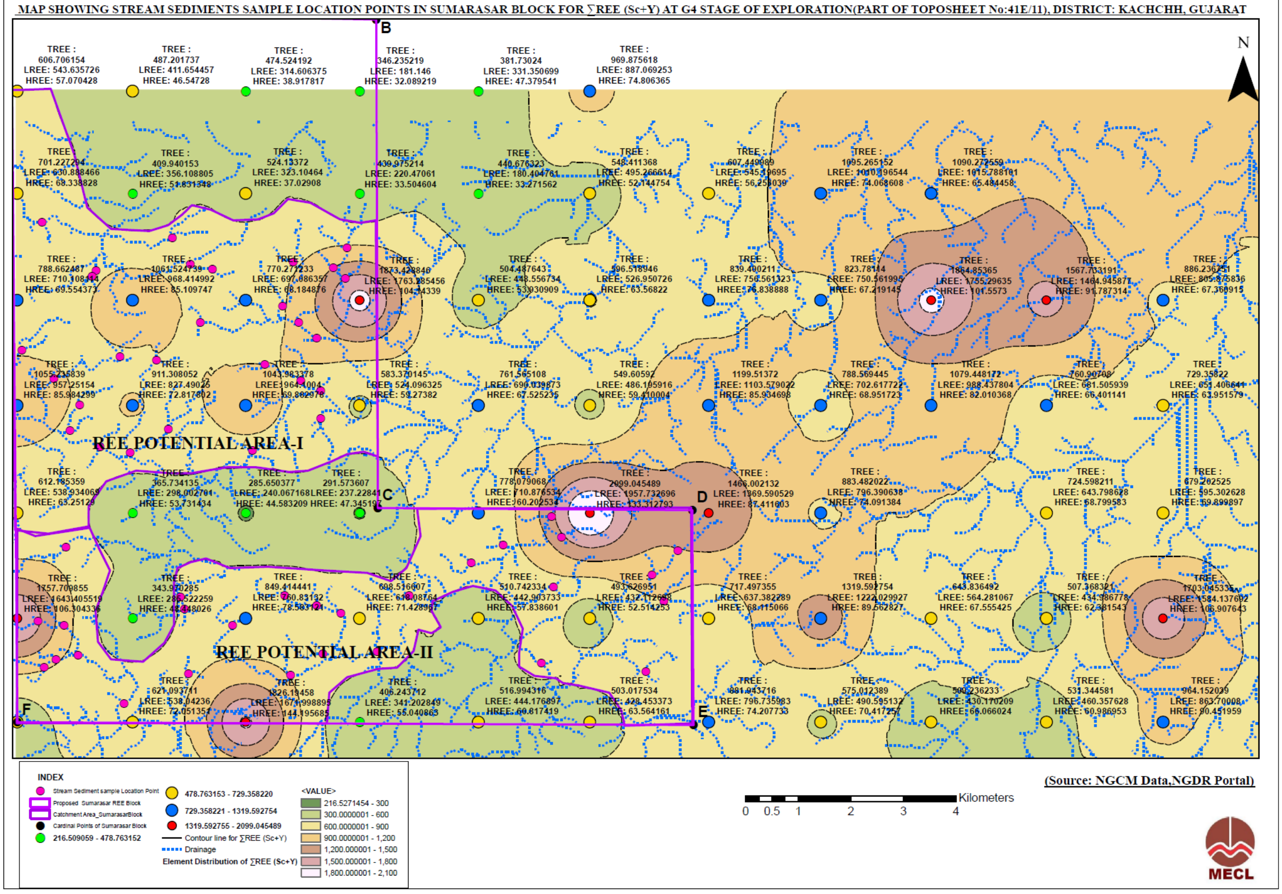

GEOCHEMICAL ANOMALY MAP OF PROPOSED SUMARASAR BLOCK FOR REE AT G4 STAGE OF EXPLORATION(PART OF TOPOSHEET No:41E/11), DISTRICT: KACHCHH, GUJARAT
N
INDEX
Cardinal Points of Sumarasar Block
Proposed Sumarasar REE Block
Stream Sediment Sample Location Point along with ∑REE value in ppm
TREE
216.509059 - 478.763152
478.763153 - 729.358220
729.358221 - 1319.592754
1319.592755 - 2099.045489
Contour line for ∑REE (Sc+Y)
Element Distribution of ∑REE (Sc+Y)
216.5271454 - 300
300.0000001 - 600
600.0000001 - 900
900.0000001 - 1,200
1,200.000001 - 1,500
1,500.000001 - 1,800
1,800.000001 - 2,100
Kilometers
0 0.5 1 2 3 4
(Source: NGCM Data,NGDR Portal)


GEOCHEMICAL ANOMALY MAP OF PROPOSED SUMARASAR BLOCK FOR LREE AT G4 STAGE OF EXPLORATION(PART OF TOPOSHEET No:41E/11), DISTRICT: KACHCHH, GUJARAT
N
INDEX
Cardinal Points of Sumarasar Block
Proposed Sumarasar REE Block
Stream Sediment Samples for LREE in ppm
169.123263 - 375.944212
375.944213 - 651.406641
651.406642 - 1222.029927
1222.029928 - 1957.732696
Contour for LREE
Elemental Distribution of LREE
169.1401825 - 200
200.0000001 - 400
400.0000001 - 600
600.0000001 - 800
800.0000001 - 1,000
1,000.000001 - 1,200
1,200.000001 - 1,400
1,400.000001 - 1,600
1,600.000001 - 1,800
1,800.000001 - 2,000
Kilometers
0 0.5 1 2 3 4
(Source: NGCM Data,NGDR Portal)

GEOCHEMICAL ANOMALY MAP OF PROPOSED SUMARASAR BLOCK FOR HREE AT G4 STAGE OF EXPLORATION(PART OF TOPOSHEET No:41E/11), DISTRICT: KACHCHH, GUJARAT



MAP SHOWING STREAM SEDIMENTS SAMPLE LOCATION POINTS IN SUMARASAR BLOCK FOR ∑REE (Sc+Y) AT G4 STAGE OF EXPLORATION(PART OF TOPOSHEET No:41E/11), DISTRICT: KACHCHH, GUJARAT



1.10.5 DRILLING:

1.10.6 Based on Geological mapping and trenching/pitting, the extension of the mineralized zones (ore bodies) will be marked.

1.10.7 Auger Drilling for REE Mineralisation: Auger drilling shall be carried out in identified two potential zone for REE mineralization. Total 70 number of boreholes shall be drilledof average depth of 7m, thus total auger drilling of 490 m shall be carried out.

1.10.8 Core Sampling: Sample will be collected after the auger drilling,total 210 Nos of primary and 21 check (10% External Check) samples will be analysed for for Sn, Hf, Nb, Ta, U, Th, Be, Ba, Ge, As, Rb, Sr, W, Mo, Ti, Zr, Cs, Y, Sc, Pb, Zn and REE analysis by ICP-AES / ICPMS (sequential technique) assay.

1.10.9 Scout Borehole drilling for REE Mineralisation: Ten (10 nos) of scout borehole shall be drilled each of 30 m thus total 300 meterage shall be drilled in sandstone rock type based on geochemical analysis result for REE mineralization.

1.10.10Drill Core Logging: The drill core will be logged for rock types, structural features, textures, types of mineralization and occurrence of various ore minerals. The logging for determination of Rock Quality Determination/Designation (RQD) will also be undertaken.

1.10.11Core Sampling: During geological logging of drill core, mineralized zones will be marked on basis of concentration and lithology. Sample will be collected from each borehole, thus total 100 Nos of primary and 10 check (10% External Check) samples will be analysed for for Sn, Hf, Nb, Ta, U, Th, Be, Ba, Ge, As, Rb, Sr, W, Mo, Ti, Zr, Cs, Y, Sc, Pb, Zn and REE analysis by ICP-AES / ICPMS (sequential technique) assay.

1.10.12 Scout Borehole drilling for Phosphorite Mineralisation : Ten (10 nos) of scout borehole shall be drilled each of 30 m thus total 300 meterage shall be drilled in limestone rock type based on geochemical analysis result for phosphorite mineralization.

1.10.13Drill Core Logging: The drill core will be logged for rock types, structural features, textures, types of mineralization and occurrence of various ore minerals. The logging for determination of Rock Quality Determination/Designation (RQD) will also be undertaken.

1.10.14Core Sampling: During geological logging of drill core, mineralized zones will be marked on basis of concentration and lithology. 10 number of Sample will be collected from each borehole, thus total 100 Nos of primary and 10 check (10% External Check) samples will be analysed for (Primary samples for 8 radicals (K_2O, SiO_2, MgO, CaO, Na_2O, P_2O5, Al_2O_3& Fe_2O_3)

1.11CHEMICAL ANALYSIS

1.11.1 A total 464 for REE samples and 50 of check samples generated from Bed rock, Surface,Pit and boreholes will be analysed for 34 elemental analysis includes for Sn, Hf, Nb, Ta, U, Th, Be, Ba, Ge, As, Rb, Sr, W, Mo, Ti, Zr, Cs, Y, Sc, Pb, Zn and REE analysis by ICP-AES / ICPMS (sequential technique).

1.11.2 Within the above samples, 200 sample for Phosphorite samples and 20 check (10% External Check) samples will be analysed for for 8 radicals (K_2O, SiO_2, MgO, CaO, Na_2O, P_2O5, Al_2O_3& Fe_2O_3).

1.11.3 PETROLOGICAL & MINERAGRAPHIC STUDIES:

1.11.4 During the course of Geological mapping and core logging, 15 samples from various litho units from surface and intersected in boreholes will be studied for petrography and mineralized zones will be studied for the ore mineral assemblages and their distribution, alteration, enrichment etc in polished sections.

1.11.5 XRD & EPMA Study

15 nos. of samples from mineralized zones shall be subjected for XRD studies. Moreover, few samples shall also be subjected to EPMA study.

1.11.6 PROPOSED QUANTUM OF WORK

Details of the particular, Quantum and the targets are tabulated in **Table No.-1.5.**

Table –1.5
Envisaged Quantum of proposed work in SumarasarBlock

Sl. No.	Item of Work	Unit	Target
1	**Geological Mapping** (on 1:12,500 Scale)	sq.km	107.46
2	**Sampling**		
	Surface Samples (Stream Sediment Sample for REE)	Nos	60
	Bed Rock Samples (for REE)	Nos	50
	Bed Rock Samples (Phosphorite)	Nos	50
3	**Pitting For Orientation Sampling of REE & Trench Excavation For Phosphorite**		
	a)Pit Excavation (5 Nos) (5 No: 1m X1m X 2m)	Cu.m	10
	b) Collection of different horizon soil sample both Heavy and natural fraction: 22(5 Pit X 3 samples:15+7 no auger samples) X 2 Heavy and natural fraction)	Nos	44

	c)Trenching for Phosphorite (5 No trench: L:10m x D:2m x W: 1m)	Cu.m	100
	d) Collection of Trench Samples for Phosphorite	Nos	50
4	Heavy Mineral Separation by liquid as well as gravity and magnetic	Nos	22
5	**Auger Drilling* (For REE)**		
	a) Auger drilling (70 Boreholes: 5m depth)	m	490
	b) Geological Logging	m	490
	c) Borehole auger samples (70 Boreholes x 3 horizons)	Nos	210
	Scout Drilling* (For REE)		
	a) Core drilling (10 Boreholes: 30m depth)	m	300
	b) Geological Logging	m	300
	c) Borehole core samples (10 Boreholes)	m	100
	Scout Drilling* (For Phosphorite)		
	a) Core drilling (10 Boreholes: 30m depth)	m	300
	b) Geological Logging	m	300
	c) Borehole core samples (10 Boreholes: 10 m of samples)	Nos	100
6	**Laboratory Studies for REE**		
	a)REE associated Trace Elements (34 Element)by ICPMS Bed rock samples (50) Surface samples- (60 Stream Sediment) Orientation Sample-22(5 Pit X 3 samples:15 +7 auger samples) X 2 (Heavy and lighter Fraction)) Core Sample: 210 Samples collected for REE from scout boreholes: 100	Nos	464
	b) External Check Samples	Nos	46
	c) Phosphorite (Primary samples for 8 radicals (K_2O, SiO_2, MgO, CaO, Na_2O, P_2O5, Al_2O_3& Fe_2O_3) : 50 Surface Sample, 50 Trench Sample & 100 Bh Core Samples		200
	d) 10% External check samples for 8 radicals (K_2O, SiO_2, MgO, CaO, Na_2O, P_2O5, Al_2O_3& Fe_2O_3)		20
7	**Physical Study**		
	a)Petrological Study	Nos	15
	b) Mineragraphic Study	Nos	15
	c) XRD Study	Nos	15
	d) EPMA Study	Hours	15
8	**Report Preparation (5 Hard copies with a soft copy)**	Nos.	1

1.11.7 BREAK-UP OF EXPENDITURE

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.246.44 Lakhs.** The summary of tentative cost estimates for Reconnaissance Survey (G-4 Level) is given in **Table – 1.6.**Detailed cost sheet for proposed Reconnaissance Survey (G-4) for REE&Phosphorite is given as Annexure No.**I**

Table-1.6

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

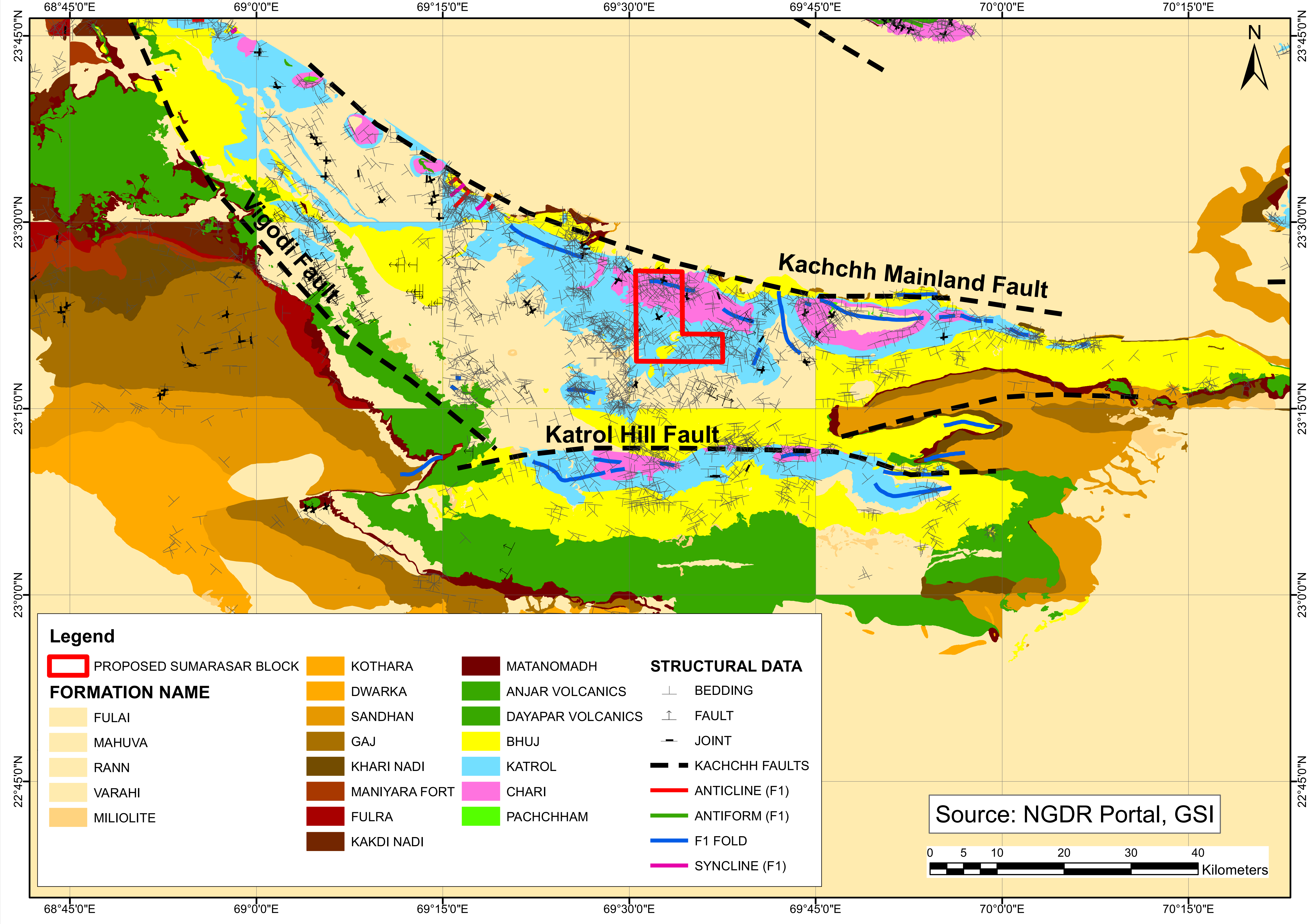
Sl. No.	Item	Total Estimated Cost (Rs.)
1	Geological Work	33,07,292.00
2	Pitting	3,71,000.00
3	Drilling	91,93,352.00
4	**Heavy Mineral Separeation**	**3,56,400.00**
5	Laboratory Studies	64,82,192.40
6	**Sub total**	**1,97,10,236.40**
9	Report	7,50,000.00
10	Peer Review	30,000.00
11	Proposal Preparation	3,94,204.73
12	**Total**	**2,08,84,441.13**
13	GST (18%)	37,59,199.40
Total cost including 18% GST		**2,46,43,640.53**
SAY, in Lakhs		**246.44**

1.12 TIME SCHEDULE

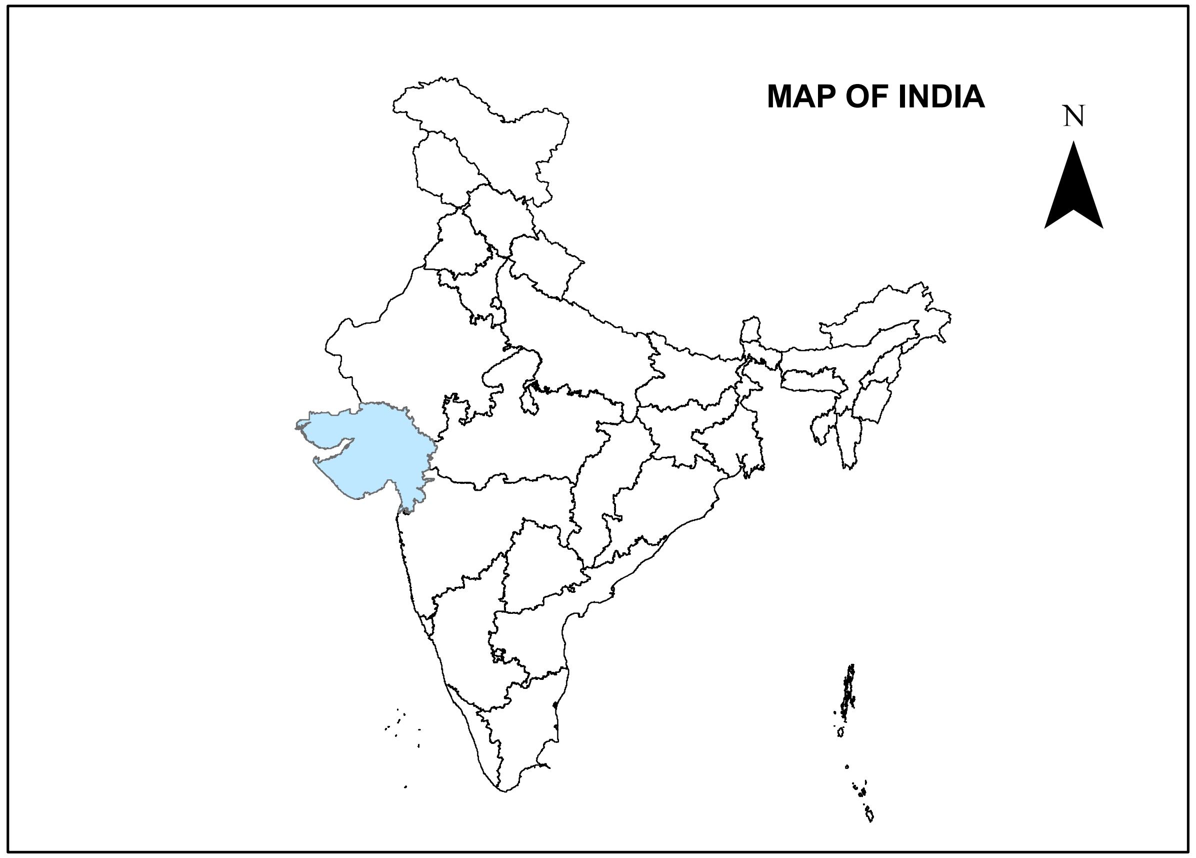
1.12.1 The proposed exploration programme envisages geological mapping, geochemical sampling, exploratory drilling, sample preparation and laboratory studies, which will be completed within 10 months, including geological report preparation. Therefore, a total of 12 months is planned for completion of the entire programme.

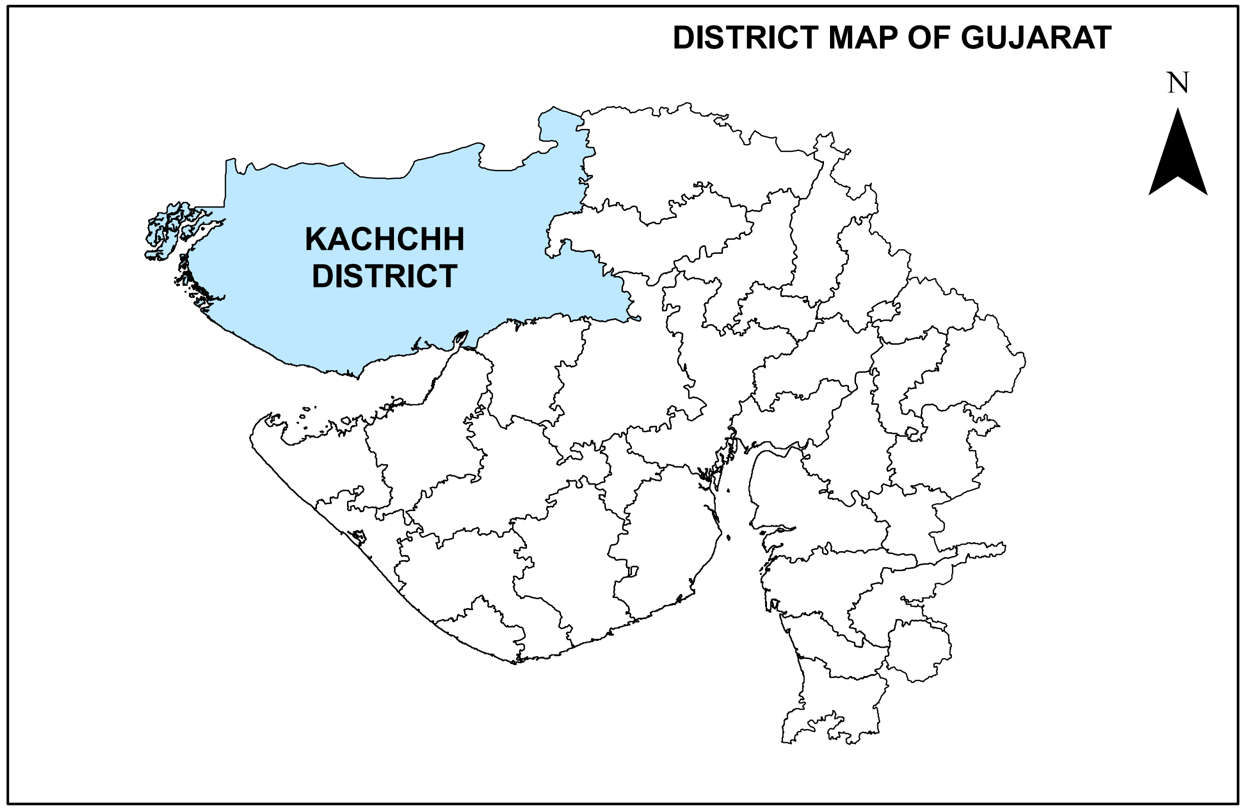
LIST OF PLATES

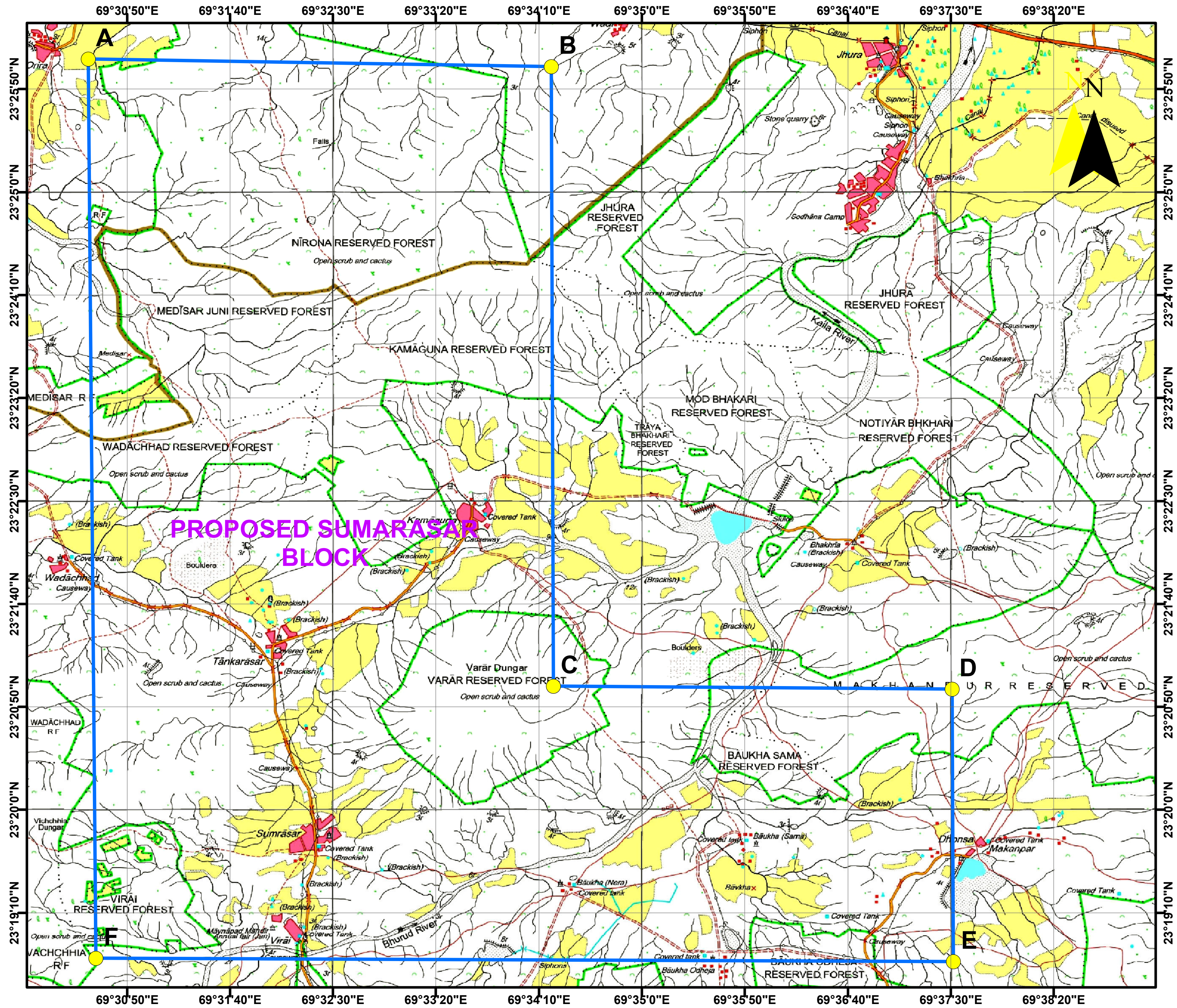
Regional Geology Map showing Proposed Sumarasar Block



LOCATION MAP OF PROPOSED SUMARASAR BLOCK FOR REE AND PHOSPHORITE AT G4 STAGE OF EXPLORATION(PART OF TOPOSHEET No:41E/11), DISTRICT: KACHCHH, GUJARAT







NOT TO SCALE

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- Cardinal Points of Sumarasar Block
- Proposed Sumarasar Block

Coordinates of Proposed Sumarasar REE Block

CP	UTM (In m) Zone 42 N		DMS		Area (Sqkm)
	Easting	Northing	Latitude	Longitude	
A	551960.5355	2591728.302	23° 26' 4.735" N	69° 30' 31.183" E	107.46
B	558341.296	2591637.907	23° 26' 1.018" N	69° 34' 16.032" E	
C	558405.4118	2582380.951	23° 21' 0.000" N	69° 34' 17.000" E	
D	563902.4004	2582361.805	23° 20' 58.638" N	69° 37' 30.589" E	
E	563942.9057	2578292.67	23° 18' 46.315" N	69° 37' 31.396" E	
F	552113.9786	2578294.41	23° 18' 47.880" N	69° 30' 34.920" E	

MECL