

**Preliminary Exploration(G3) for Vanadium, Scandium, Gallium and associated minerals in and around Satoli village, Bidar district, Karnataka (Satoli block)**  
**To**



**National Mineral Exploration & Development Trust**  
**Ministry of Mines,**  
**Room No. 325 & 326, Wing-F,**  
**Udyog Bhawan, Rafi Ahmed Kidwai Marg, Rajpath Area,**  
**Central Secretariat, New Delhi-110011**

**By**



**Geo Marine Solutions Pvt. Ltd.**  
**15-17-909/9, Leslie Haven, 5<sup>th</sup> Cross,**  
**Shivabagh, Mangalore-575005, Karnataka**

**May 2026**

**Reconnaissance (G4) for Base metals and associated minerals in the area between  
Preliminary Exploration(G3) for Vanadium, Scandium, Gallium and associated  
minerals in and around Satoli village, Bidar district, Karnataka (Satoli block)  
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**Geo Marine Solutions Pvt. Ltd.  
15-17-909/9, Leslie Haven, 5th Cross,  
Shivabagh, Mangalore-575005, Karnataka**

**Mangalore  
May 2026**

Summary of the Proposal for  
**“Preliminary Exploration(G3) for Vanadium, Scandium, Gallium and associated minerals in and around Satoli village, Bidar district, Karnataka (Satoli block).”**

| Features                                                                                                | Details                                                                                                                                                                                                                                                                              |
|---------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Block ID                                                                                                | GEMS_KA _02                                                                                                                                                                                                                                                                          |
| Current Exploration Agency                                                                              | Geo Marine Solutions Pvt. Ltd., Mangalore for Reconnaissance survey of G3 level                                                                                                                                                                                                      |
| Previous Exploration Agency                                                                             | Geological Survey of India                                                                                                                                                                                                                                                           |
| G4 stage Geological Report & G3 stage Exploration report                                                | <ul style="list-style-type: none"> <li>Report on Critical Mineral Assessment Programme for Vanadium and associated critical minerals in lateritic rocks of Sindol Tanda block, Bidar district, Karnataka by Dr. Deepu T.R. &amp; Dr. M Bawanhun Mawthoh, GSI (FS:2024-25)</li> </ul> |
| Commodity                                                                                               | Vanadium, Scandium, Gallium and associated minerals                                                                                                                                                                                                                                  |
| Mineral Belt                                                                                            | Laterite /Bauxite of Deccan basalt                                                                                                                                                                                                                                                   |
| Completion Period with entire Time schedule to complete the project                                     | <p><b>Mobilization: 1 month</b></p> <p><b>Mapping: 2 months</b></p> <p><b>Drilling months: 4 months</b></p> <p><b>Sample &amp; Data Processing &amp; Analysis:3 months</b></p> <p><b>Report: 2 months</b></p> <p><b>Total:12</b></p>                                                 |
| Objectives                                                                                              | Preliminary Exploration(G3) for Vanadium, Scandium, Gallium and associated minerals in and around Satoli village, Bidar district, Karnataka (Satoli block).                                                                                                                          |
| Whether the work will be carried out by the proposed agency or through outsourcing and details thereof. | The NABET accredited exploration agency (Geo Marine Solutions Pvt Ltd., Mangalore) will be carrying out all the components of the proposed exploration.                                                                                                                              |
| Number of Geoscientists                                                                                 | 2 Geologists                                                                                                                                                                                                                                                                         |

|  |                                 |                                                                                                          |
|--|---------------------------------|----------------------------------------------------------------------------------------------------------|
|  | Expected Field Months (Geology) | Field work: <b>Mobilization: 1 month</b><br><b>Mapping: 2 months</b><br><b>Drilling months: 4 months</b> |
|--|---------------------------------|----------------------------------------------------------------------------------------------------------|

| <b>1.</b> | <b>Location</b>                          | Satoli village, Bidar district, Karnataka                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
|-----------|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------|--------------------------|---|----------|----------|---|----------|----------|---|----------|----------|---|----------|--------|---|----------|----------|---|----------|----------|---|----------|----------|---|----------|----------|
|           |                                          | <table> <tr> <th></th><th><b>LONGITUDE<br/>(DD)</b></th><th><b>LATITUDE<br/>(DD)</b></th></tr> <tr> <td>A</td><td>77.44805</td><td>17.79932</td></tr> <tr> <td>B</td><td>77.45056</td><td>17.77276</td></tr> <tr> <td>C</td><td>77.47875</td><td>17.76529</td></tr> <tr> <td>D</td><td>77.47743</td><td>17.785</td></tr> <tr> <td>E</td><td>77.46874</td><td>17.78472</td></tr> <tr> <td>F</td><td>77.46902</td><td>17.79284</td></tr> <tr> <td>G</td><td>77.47627</td><td>17.79301</td></tr> <tr> <td>H</td><td>77.47646</td><td>17.79843</td></tr> </table> |  | <b>LONGITUDE<br/>(DD)</b> | <b>LATITUDE<br/>(DD)</b> | A | 77.44805 | 17.79932 | B | 77.45056 | 17.77276 | C | 77.47875 | 17.76529 | D | 77.47743 | 17.785 | E | 77.46874 | 17.78472 | F | 77.46902 | 17.79284 | G | 77.47627 | 17.79301 | H | 77.47646 | 17.79843 |
|           | <b>LONGITUDE<br/>(DD)</b>                | <b>LATITUDE<br/>(DD)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
| A         | 77.44805                                 | 17.79932                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
| B         | 77.45056                                 | 17.77276                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
| C         | 77.47875                                 | 17.76529                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
| D         | 77.47743                                 | 17.785                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
| E         | 77.46874                                 | 17.78472                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
| F         | 77.46902                                 | 17.79284                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
| G         | 77.47627                                 | 17.79301                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
| H         | 77.47646                                 | 17.79843                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
|           | Villages                                 | Satoli                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
|           | Tehsil/Taluk                             | Bidar                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
|           | District                                 | Bidar                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
|           | State                                    | Karnataka                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
| <b>2.</b> | <b>Area (hectares/square kilometers)</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
|           | Block Area                               | 9 sq.km.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
|           | Forest Area                              | Nil                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
|           | Government Land Area                     | ~1.3 sq km                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
|           | Private Land Area                        | ~7.7 sq km                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
| <b>3.</b> | <b>Accessibility</b>                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
|           | Nearest Rail Head                        | Bidar railway station                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
|           | Road                                     | SH-15 & Bidar-Chincholi Road                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
|           | Airport                                  | Bidar domestic airport (17 km from study area) & Kalaburagi Airport (100 km)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |
| <b>4.</b> | <b>Hydrology</b>                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |                           |                          |   |          |          |   |          |          |   |          |          |   |          |        |   |          |          |   |          |          |   |          |          |   |          |          |

|           |                                                                                                 |                                                                                                                                                                                                                                                                                                                                   |
|-----------|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           | Local Surface Drainage Pattern (Channels)                                                       | Sub-dendritic to dendritic                                                                                                                                                                                                                                                                                                        |
|           | Rivers/Streams                                                                                  | Karanja River                                                                                                                                                                                                                                                                                                                     |
| <b>5.</b> | <b>Climate</b>                                                                                  |                                                                                                                                                                                                                                                                                                                                   |
|           | Mean/Average Annual Rainfall                                                                    | Approximately 840 mm                                                                                                                                                                                                                                                                                                              |
|           | Temperatures                                                                                    | Tropical semi-arid climate, characterized by hot summers, moderate to low rainfall, and mild winters. Summers, from March to May, are typically hot with temperatures often exceeding 40°C. Winters, spanning November to February, are relatively mild and pleasant, with minimum temperatures occasionally dropping below 15°C. |
| <b>6.</b> | <b>Topography</b>                                                                               |                                                                                                                                                                                                                                                                                                                                   |
|           | Toposheet Number                                                                                | Toposheet No. 56G/5                                                                                                                                                                                                                                                                                                               |
|           | Morphology of the area                                                                          | The study area is a part of the Deccan Plateau and shows a gently undulating terrain formed over basaltic rocks. The region is mainly characterized by pediplains and pediments, with occasional residual hills and rock outcrops. Drainage is dendritic with seasonal streams forming shallow valleys.                           |
| <b>7</b>  | <b>Availability of baseline geoscience data</b>                                                 |                                                                                                                                                                                                                                                                                                                                   |
|           | Geological Map (1:50K&25K)                                                                      | The proposal is based on the published literatures mentioned in the reference. Geological inputs pertaining to the area falling in 56G/5 is available (1:50K) and referred while preparing the write up.                                                                                                                          |
|           | Geochemical Map                                                                                 | Geochemical inputs pertaining to the area falling in 56G/5 is available                                                                                                                                                                                                                                                           |
|           | Geophysical Map (Aero-geophysical, Ground geophysical, Regional as well as local scale GP maps) | Geophysical inputs (Ground magnetic & gravity) pertaining to the area falling in 56G/5 is available.                                                                                                                                                                                                                              |
| <b>8</b>  | <b>Justification for taking up G4 stage mineral exploration</b>                                 | <ul style="list-style-type: none"> <li>• <b>GSI,2024-25:</b> This study was taken up in the Sindol Tanda block to assess the potentiality of</li> </ul>                                                                                                                                                                           |

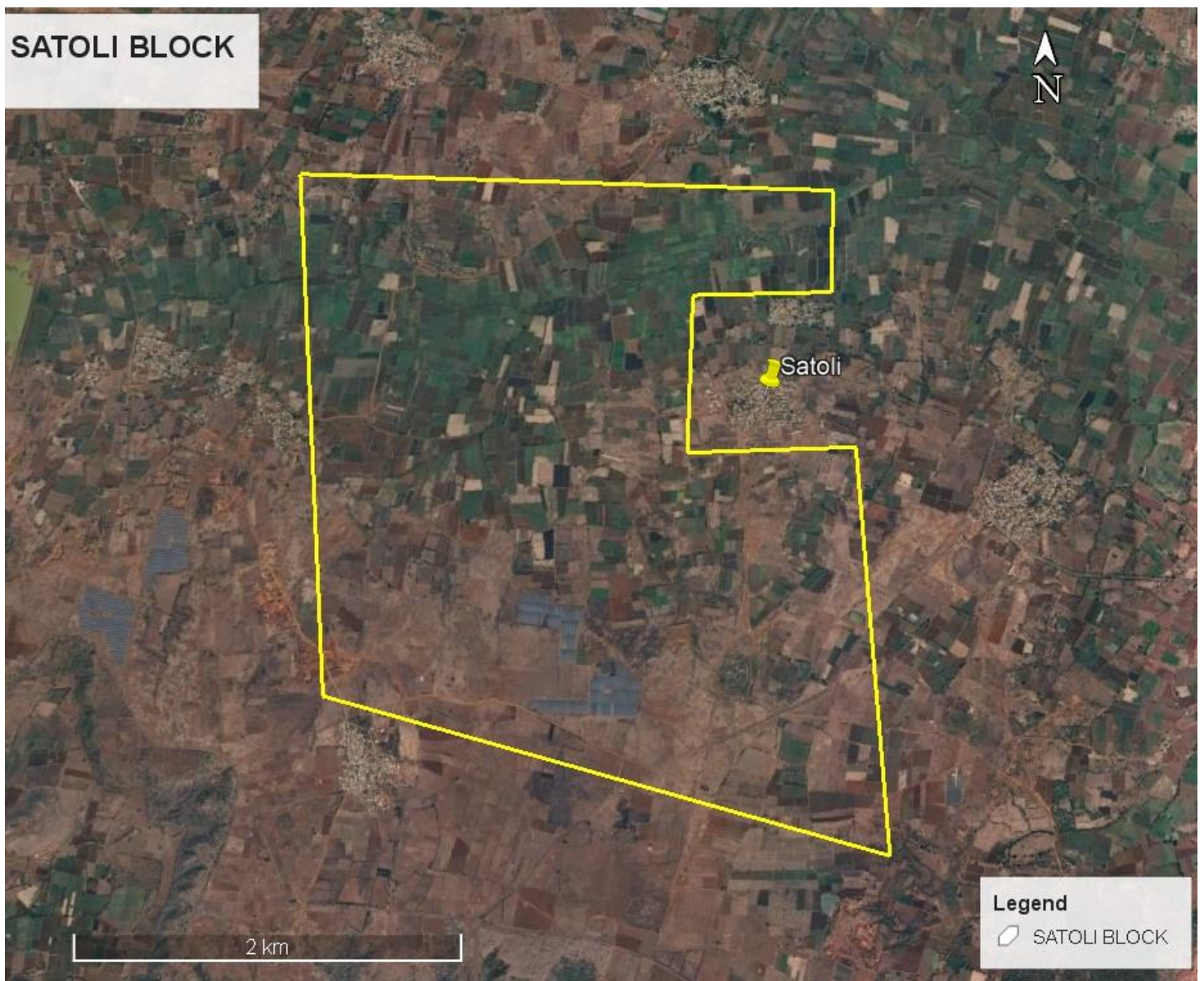
|  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | <p>vanadium (V) and scandium (Sc) and associated mineralization. The integrated geological, geochemical, and subsurface investigations in this area, including bedrock (BRS), trench, profile, and borehole sampling revealed a systematic enrichment of Fe-Ti-V-Sc oxides within lateritic horizons. So, in order to delineate the continuity and lateral extent of the mineralized horizon, further exploration is recommended in this area including Ground geophysical surveys, along with drilling.</p> <ul style="list-style-type: none"> <li>• There are no CL/ML for major minerals within the proposed block</li> <li>• The area is not falling within the buffer zone of International Boundary, Wildlife sanctuary, no-go zone, Biodiversity Park etc.</li> </ul> |
|--|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## DETAILED DESCRIPTION OF THE PROPOSAL

### 1. Block Summary:

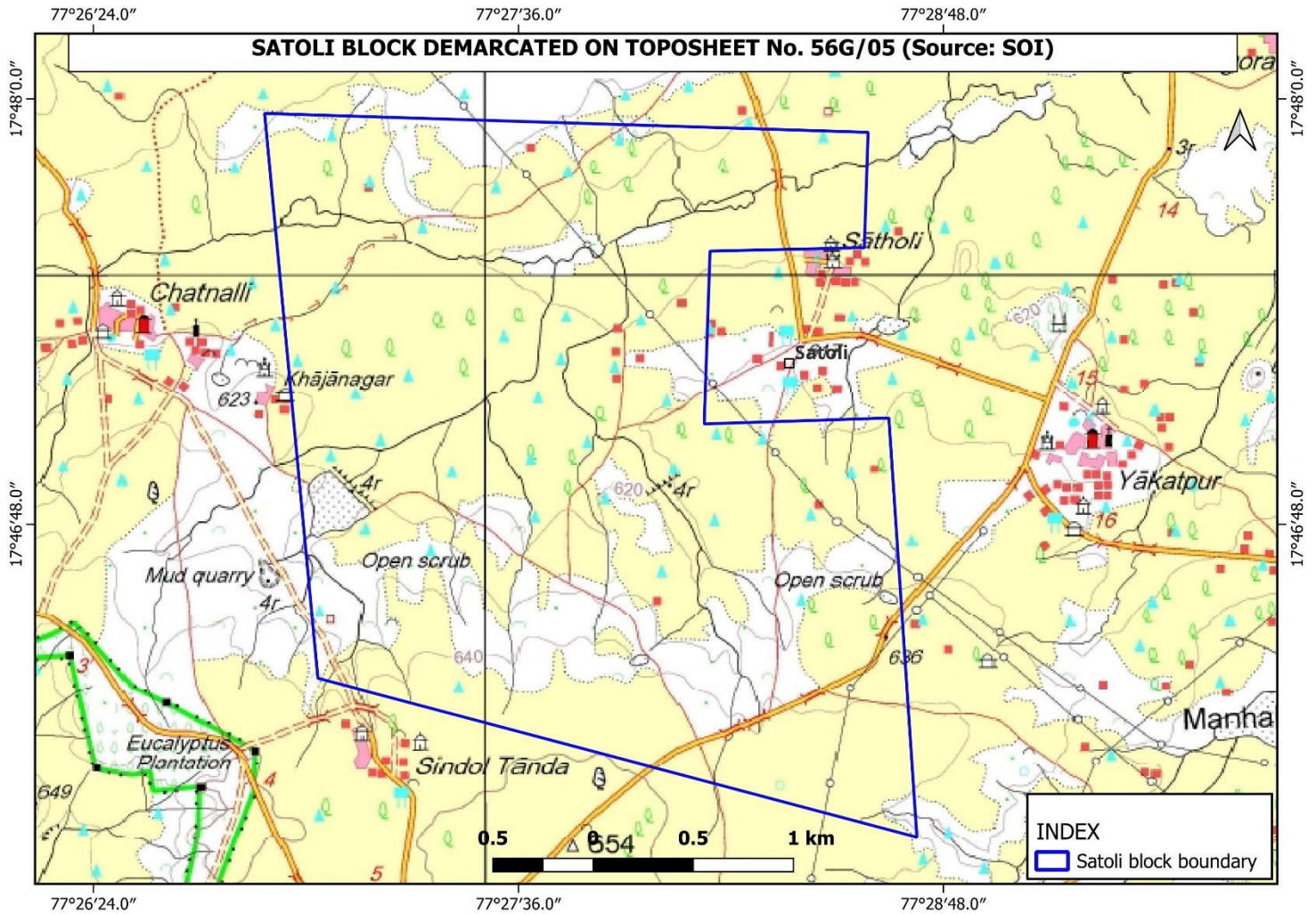
#### a) Physiography

The study area comes under Pediment Pediplain complex, with a small water body in the SW portion of the block. The elevation of study area varies in between 622m to 665m.



**Fig 1: Proposed Satoli block boundary on Google Earth Imagery**





**Fig 2: Proposed Satoli block boundary on Toposheet no. 56G/5**

## b) Background Geology

The study area is a part of Deccan Plateau within toposheet 56G/05, which is predominantly characterized by lateritic outcrops/cover of Cenozoic age. Laterite completely covers the proposed area and it covers few scattered mounds in the surrounding area, which form plateaus of various sizes having irregular outlines, linear ridges, and conical and flat-topped blocks of small size. The top part of the laterite formed duricrust due to weathering/chemical leaching and this part is very hard, followed by fericrete with the rubble of laterite. From duricrust to this part specific gravity of the rock samples is high may be due to the high specific gravity of elements/minerals, which are highly oxidized. Laterite is yellowish to reddish brown, limonitic and highly porous with vermicular openings. The contact between the underlying flow and laterite is gradational.



| Age                            | Supergroup  | Group    | Formation | Lithology          |
|--------------------------------|-------------|----------|-----------|--------------------|
| Cenozoic                       |             |          |           | Laterite           |
| Upper Cretaceous to Palaeocene | Deccan Trap | Sahyadri | Ambaneli  | Basalt flow 13     |
|                                |             |          |           | Basalt flow 11, 12 |
|                                |             |          |           | Intertrappean      |
|                                |             |          |           | Basalt flow 10     |
|                                |             |          |           | Basalt flow 9,10   |

**Figure 3: Regional Stratigraphy of the area (Source: Compiled 50 K Geological Map, GSI)**

**c) Mineral potentiality based on geology, geophysics, ground geochemistry etc.**

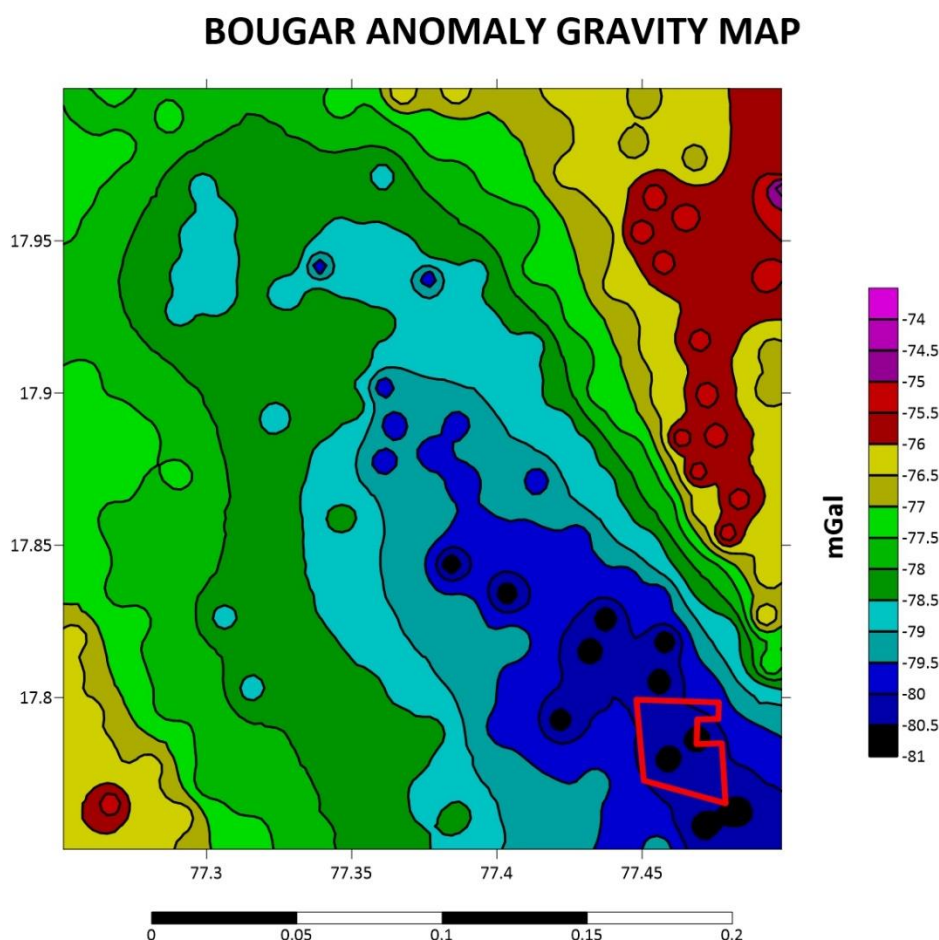
- Based on the data accumulated by the **GSI-G4,2024-25** study, the geochemical and mineralogical data collectively point to a residual supergene genesis, involving intense tropical weathering, leaching of mobile cations (Ca, Mg, Na, K), and residual enrichment of immobile oxides (Fe, Ti, V, Sc). The duricrust and ferruginous laterite represent the upper enrichment zones, while the saprolitic horizon acts as a secondary trap for REE and transition metals. The enrichment of V, Sc, and TiO<sub>2</sub> substantially exceeding crustal averages highlights strong potential for Fe–Ti–V–Sc oxide mineralization in lateritized Deccan basalt terrains. The duricrust–saprolite couplet identified in boreholes KBST-1 and KBST-3 represents the prime exploration target for critical metal resources under supergene conditions.
- Based on NGPM data accessed through the NGDR portal, the observation density for ground gravity and magnetic surveys is approximately one station per 2.5 km<sup>2</sup>. The Bouguer gravity data (Fig. 4) within the Satoli block show noticeable variations compared to the surrounding areas of the toposheet. A negative Bouguer anomaly is identified within the block, which is showing 1mGal variation from the adjacent points/stations and it is extending towards North. It indicates the presence of relatively low-density rocks. In the study area, laterite is the major exposed rock type which is underlain by basalt. On the basis of density, Laterite is less dense than basalt, and the density further decreases when the laterite is intensely weathered. Therefore, the pronounced negative anomaly within the Satoli block may indicate the presence of a thick lateritic cover overlying massive basalt, which is exposed at the surface in the northern and northwestern parts of the toposheet. The anomaly pattern also suggests intense weathering and prolonged tropical alteration in the area.

Meanwhile, the magnetic data of this area doesn't show any anomaly. It indicates a uniform magnetic field without any structural deformations.

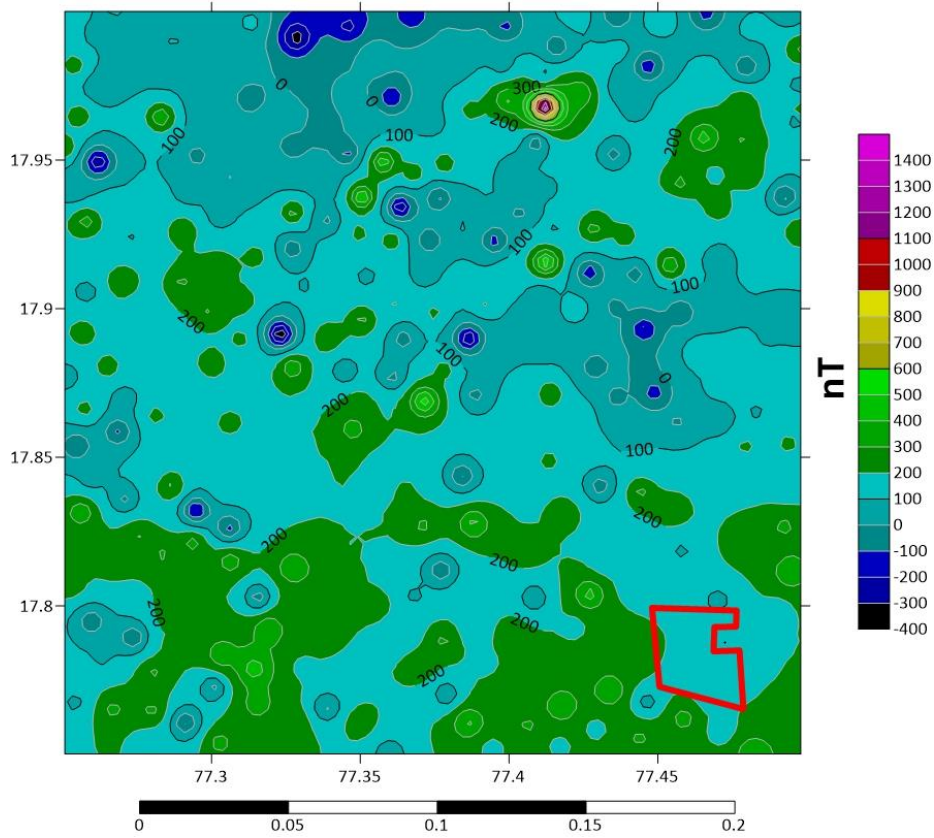
- GSI has conducted the G4 (2024-25) study in Sindol Tanda block based on the high V values reported in the toposheet no. 56G/05 during the NGCM project, FS 2021-22. Geochemical contour maps of Toposheet No. 56G/05 indicate an E-W trending anomaly within the B3 and C3 quadrants. The NGCM data (stream sediments) within the proposed Satoli block is given below:

| Sample No           | Longitude | Latitude | Ga | Sc | V   | V <sub>2</sub> O <sub>5</sub> | TREE   |
|---------------------|-----------|----------|----|----|-----|-------------------------------|--------|
| 56G05/039/S/2021-22 | 77.4481   | 17.7952  | 26 | 41 | 330 | 590.7                         | 228.74 |
| 56G05/040/S/2021-22 | 77.4669   | 17.7952  | 22 | 27 | 195 | 349.05                        | 201.7  |
| 56G05/026/S/2021-22 | 77.4669   | 17.7771  | 33 | 37 | 391 | 699.89                        | 253.83 |

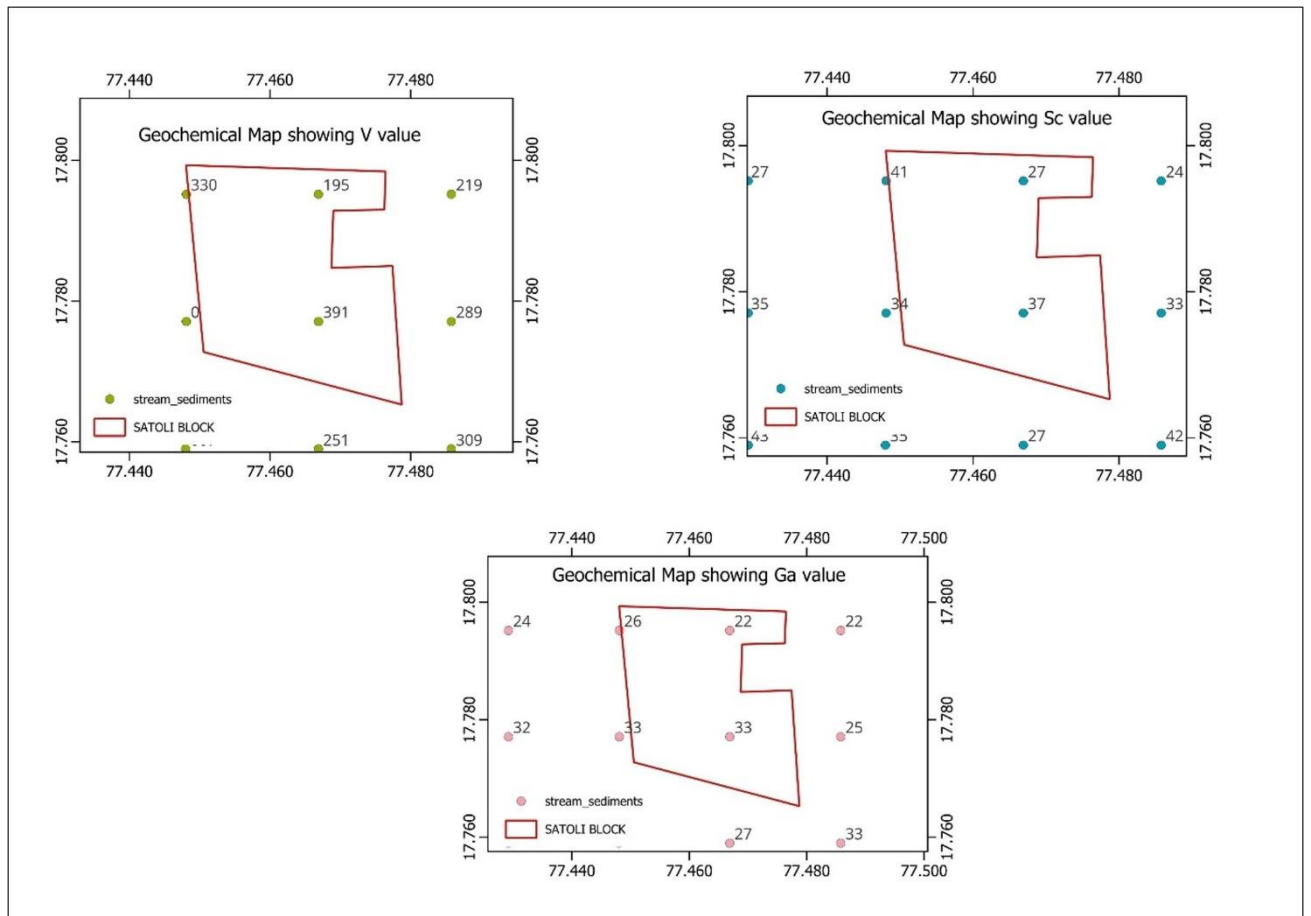
**Table 1: The NGCM data (stream sediments) within the proposed Satoli block (Source : NGDR)**



**Fig. 4: Bouguer anomaly gravity map of the area (NGPM data, GSI)**



**Fig. 5: Magnetic map of the area (NGPM data, GSI)**



**Fig 6: Stream Sediments Geochemical Map of the Proposed Satoli block (G3) Source: NGDR**

#### d) Scope for proposed exploration

- The study area situated in the southeastern part of the Deccan Plateau which is predominantly characterized by lateritic outcrops of Cenozoic age.
- The basaltic flows of the Deccan Traps are present in the western part of the block
- The top part of the laterite formed duricrust in the study area due to weathering/chemical leaching and this part is very hard, followed by fericrete with the rubble of laterite
- The duricrust and ferruginous laterite represent the upper enrichment zones, while the Saprolitic horizon acts as a secondary trap for REE and transition metals.
- The bedrock samples (BRS) within the block exhibit broad compositional variation, with SiO<sub>2</sub> (18.24-34.68%), Fe<sub>2</sub>O<sub>3</sub> (25.88-52.34%), Al<sub>2</sub>O<sub>3</sub> (10.22-26.47%), and TiO<sub>2</sub> (1.11-4.34%), indicating variable alteration intensity
- The Sc, Ga, V<sub>2</sub>O<sub>5</sub> and  $\Sigma$ REE values of these samples range between <4ppm-81ppm (Avg-39.64 ppm), 24ppm-42ppm (Avg-32.47ppm), 757.17ppm-3338.35ppm (Avg-1915ppm) and 75.014ppm-475.949 ppm (Avg-171.90 ppm) respectively.
- In PTS, Fe<sub>2</sub>O<sub>3</sub> shows value in a range of 43.3%-49.67% with an average of 45.05%.
- The Ga and V<sub>2</sub>O<sub>5</sub> values in PTS samples range between 35ppm-43ppm (avg-39.5ppm) and 2164.11ppm-2532.85ppm (Avg-2302.656ppm) respectively. Sc is less than 4 ppm in these samples.
- The boreholes KBST-1 and KBST-3, drilled through lateritic profiles developed over Deccan Trap basalts, exhibit broadly similar lithological and geochemical characteristics, indicating a continuous weathering system of supergene origin
- In both profiles, vanadium (V) enrichment is observed predominantly within the ferruginous duricrust and upper lateritic horizons, reflecting partitioning into Fe–Ti oxides under oxidizing supergene conditions.
- The KBST-3 (within the proposed block) exhibits higher concentrations of up to 1647 ppm near the surface, suggesting stronger residual enrichment and possibly a thicker weathering profile at the latter site.
- Scandium (Sc) shows enrichment in the upper oxidized horizons of both boreholes, although the depth and intensity vary.
- In KBST-3, the Sc enrichment extends to greater depths, averaging 157 ppm over 18 m, indicating a more developed saprolitic enrichment zone.
- In KBST-3, the  $\Sigma$ REE+Y+Sc concentrations vary from 133.73 to 2378.88 ppm, with an overall average of 398.67 ppm. The saprolite unit alone records a higher average  $\Sigma$ REE+Y+Sc concentration of 595.33 ppm.

- Across the different lithological units, the laterite unit records Sc concentrations ranging from 19 to 109 ppm, with an average of approximately 64 ppm, while V concentrations vary between 120 and 1647 ppm, averaging about 883.5 ppm, and Y concentrations range from 9 to 24 ppm, with an average of nearly 16.5 ppm. In the clay-rich laterite unit, Sc concentrations range from 93 to 177 ppm, averaging around 135 ppm; V concentrations vary from 425 to 625 ppm, with an average of approximately 525 ppm; and Y concentrations range between 8 and 20 ppm, averaging about 14 ppm. The saprolite unit exhibits comparatively wider variations, with Sc concentrations ranging from 23 to 305 ppm and averaging around 164 ppm, V concentrations between 295 and 899 ppm with an average of approximately 597 ppm, and Y concentrations varying from 8 to 520 ppm, averaging nearly 264 ppm.
- The enrichment of V, Sc, and TiO<sub>2</sub> substantially exceeding crustal averages highlights strong potential for Fe–Ti–V–Sc oxide mineralization in lateritized Deccan basalt terrains.
- The report has been concluded by recommending further exploration in this area including Ground geophysical surveys, along with drilling, to delineate the continuity and lateral extent of the mineralized horizon.
- In KBST-3, the laterite horizon has a thickness of 8.3 m, the clay laterite horizon measures 4.9 m, and the saprolite horizon extends to 19.4 m.

**e) Recommendations of G4 Stage Mineral Exploration Report**

- **GSI (2024-25)** G4 level exploration reveals that, lateritic profiles developed over Deccan basalt exhibit strong geochemical enrichment of V–Sc–Ti, particularly within the ferruginous duricrust and laterite–saprolite horizons. Profiles P4, P5, P7, and P11 and boreholes KBST-1 and KBST-3 demonstrate significant concentrations of vanadium, scandium, TiO<sub>2</sub> and associated REE enrichment, indicating oxide-type secondary mineralization derived from Fe–Ti-rich mafic parent rocks. The identified mineralized zones show vertical continuity and promising thickness, especially in KBST-3 (within Satoli block), where extended Sc and Ti enrichment zones occur. These characteristics suggest potential for economically viable extraction of vanadium, scandium, and titanium-bearing phases. It is recommended that systematic ground geophysical surveys (magnetic and resistivity methods) be conducted to delineate the lateral continuity and geometry of Fe–Ti-rich horizons, followed by closely spaced drilling to define grade, thickness, and resource continuity. Additionally, detailed mineralogical and metallurgical studies should be undertaken to assess recoverability and processing characteristics of V–Sc–Ti-bearing phases.

**f) Objectives**

- Topographic survey using drone
- Geological mapping (1:4000 scale)
- Core drilling

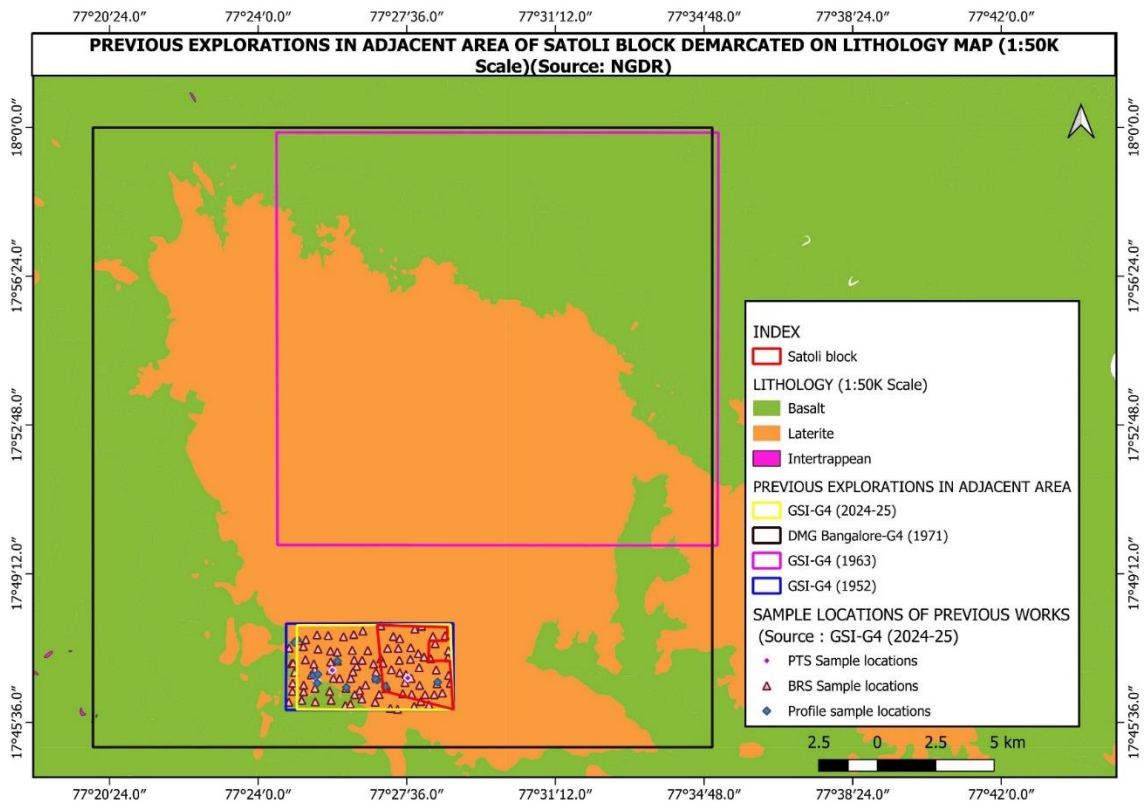
**2. Previous work**

**a) Previous Geological Report (G4 Stage)**

- Report on Critical Mineral Assessment Programme for Vanadium and associated critical minerals in lateritic rocks of Sindol Tanda block, Bidar district, Karnataka by Dr. Deepu T.R. & Dr. M Bawanhun Mawthoh, GSI (FS:2024-25)

**b) Previous exploration in adjoining area (Regional area)**

- Geological Features and Mineral Resources of Each Districts of Hyderabad State, GSI (G4) (FS:1952)
- A note on the preliminary investigation for clay at Kamthana, Bidar Taluk, Bidar district, Mysore state, GSI (G4) (FS:1963) Mineral resourcesMineral resources of Laterite belt in Bidar Taluk, Bidar district, DMG Bangalore (G4) (FS:1971)
- Mineral resources of Laterite belt in Bidar Taluk, Bidar district, DMG Bangalore (G4) (FS:1971)



**Fig 7: Previous exploration blocks in adjacent area of Satoli block, demarcated on Lithological Map (1:50000 scale) of GSI (Source: GSI-NGDR)**

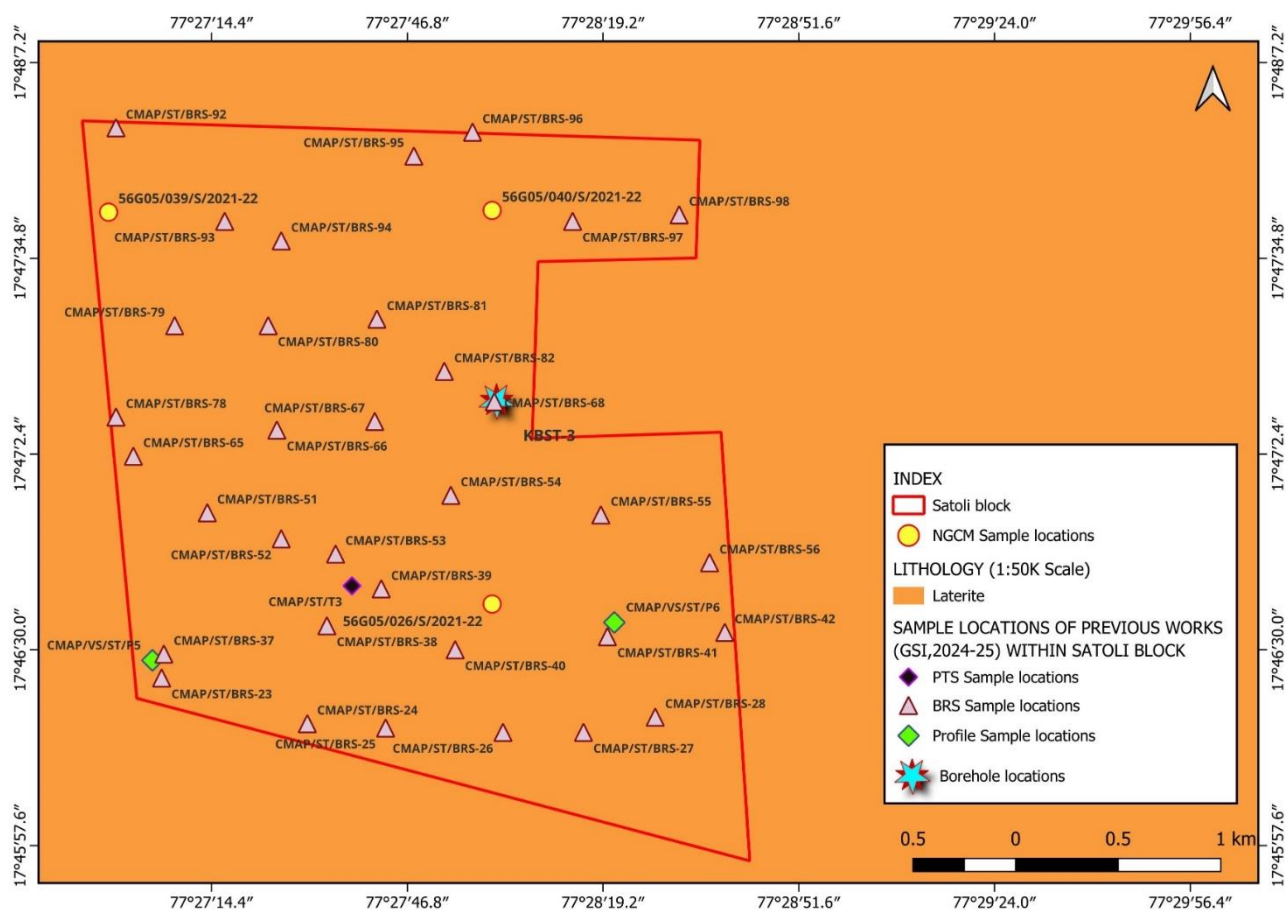


### c) Previous Exploration details in the proposed block area

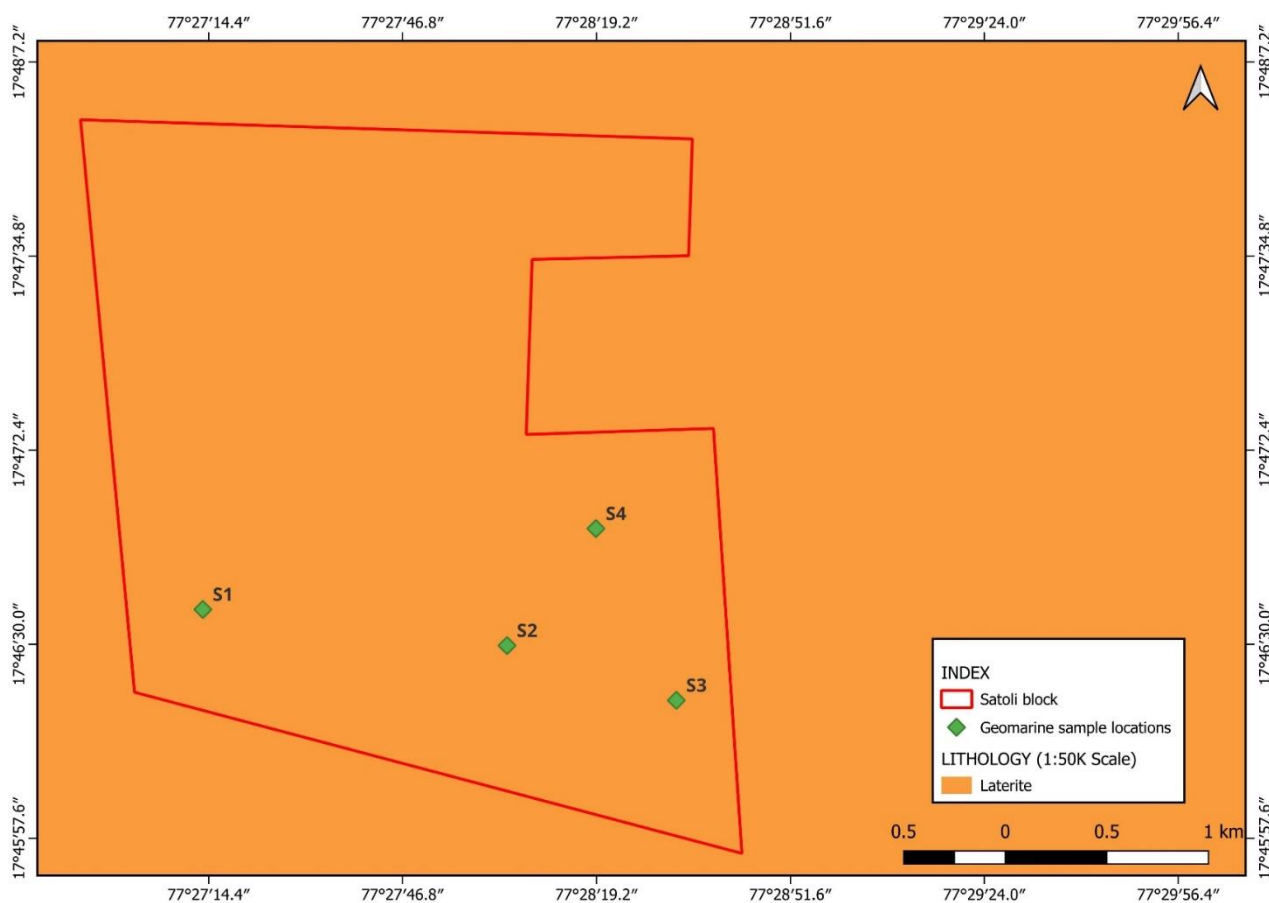
- **GSI,2024-25:** The G4 study in the Sindol Tanda block evaluates the potential for vanadium (V), scandium (Sc), and associated mineralization through integrated geological, geochemical, and subsurface investigations. Results indicate systematic enrichment of Fe–Ti–V–Sc oxides within lateritic horizons developed over Deccan Trap basalts. Bedrock samples show significant compositional variation, reflecting varying alteration intensity, with notable concentrations of  $V_2O_5$  (avg ~1915 ppm), Sc (avg ~39.6 ppm), Ga, and REE. Pit/trench samples exhibit consistently high  $Fe_2O_3$  (~45%) and  $V_2O_5$  (~2300 ppm), though Sc is low (<4 ppm). The duricrust and ferruginous laterite form the main enrichment zones, while the saprolite acts as a secondary host for REE and transition metals. Boreholes KBST-1 and KBST-3 confirm a continuous supergene weathering profile. KBST-3 (within Satoli block) shows stronger enrichment, with vanadium up to 1647 ppm near the surface and scandium averaging 157 ppm over 18 m depth. REE values are also significant, averaging ~228 pp. Further exploration is recommended, including geophysical surveys (magnetic and resistivity), closer-spaced drilling, and detailed mineralogical and metallurgical studies to assess resource continuity and recovery potential.
- As a part of the preparation of the DPR, Geo Marine has conducted preliminary sampling in the proposed Satoli block during February 2026.
- 4 grab samples have been collected from the Satoli block and out of that, 3 samples analyzed through ICP MS and XRF.
- The  $Al_2O_3$  values of these samples range between 13.58 % to 16.37% and  $Fe_2O_3$  ranges between 24.63% to 46.80%. The  $SiO_2$  values between 22.18% to 44.56%. The  $Fe_2O_3/Al_2O_3$  ratio is consistently greater than 1, indicating iron enrichment. Most samples also satisfy the  $SiO_2/Fe_2O_3$  criterion for ferruginous laterite, although a few silica-rich samples may slightly deviate. Therefore, these samples can generally be classified as ferruginous laterite, indicating a strongly iron-rich lateritic profile developed under intense tropical weathering conditions.
- The analyzed laterite samples also show enrichment of critical metals such as vanadium, scandium, and gallium.  $V_2O_5$  values range from 0.154–0.285 mass%, Sc from 27.59–50.55 ppm, and Ga from 31.67–43.62 ppm. Sample S1 records the highest concentration of all three elements, indicating stronger residual enrichment within the lateritic profile. The association of V, Sc, and Ga reflects enrichment under intense tropical weathering and
- lateritization processes, suggesting potential for critical metal mineralization within ferruginous laterites.

| --<br>Sample<br>locations | Longitude  | Latitude   | Al <sub>2</sub> O <sub>3</sub><br>(mass%) | Fe <sub>2</sub> O <sub>3</sub> (mass%) | SiO <sub>2</sub> (mass%) | V <sub>2</sub> O <sub>5</sub><br>(mass%) | Sc<br>(ppm) | Ga<br>(ppm) |
|---------------------------|------------|------------|-------------------------------------------|----------------------------------------|--------------------------|------------------------------------------|-------------|-------------|
| S1                        | 77.451283° | 17.774703° | 16.25                                     | 46.80                                  | 22.27                    | 0.285                                    | 50.55       | 43.62       |
| S3                        | 77.472141° | 17.774897° | 16.37                                     | 45.17                                  | 22.18                    | 0.176                                    | 45.77       | 31.67       |
| S4                        | 77.472755° | 17.776092° | 13.58                                     | 24.63                                  | 44.56                    | 0.154                                    | 27.59       | 38.66       |

**Table 2: The ICP MS and XRF data of the samples collected by GEOMARINE within the proposed Satoli block**



**Fig 8: Sample locations of previous works (GSI, 2024-25) within Satoli block, demarcated on Lithological Map (1:50000 scale) (Source: GSI-NGDR)**



**Fig 9: Sample locations by Geomarine within Satoli block, demarcated on Lithological Map (1:50000 scale)**

### 3. Block description

#### a) Boundary coordinates of the proposed block

|   | LONGITUDE (DD) | LATITUDE (DD) |
|---|----------------|---------------|
| A | 77.44805       | 17.79932      |
| B | 77.45056       | 17.77276      |
| C | 77.47875       | 17.76529      |
| D | 77.47743       | 17.785        |
| E | 77.46874       | 17.78472      |
| F | 77.46902       | 17.79284      |
| G | 77.47627       | 17.79301      |
| H | 77.47646       | 17.79843      |

**Table 2: Boundary coordinates of Satoli block**

b) **Coordinates of Proposed Borehole Locations:** Geographical coordinates of the proposed borehole locations are given below.

| <b>Borehole No.</b> | <b>Longitude (DD)</b> | <b>Latitude (DD)</b> | <b>Borehole No.</b> | <b>Longitude (DD)</b> | <b>Latitude (DD)</b> |
|---------------------|-----------------------|----------------------|---------------------|-----------------------|----------------------|
| <b>BH-01</b>        | 77.450878             | 17.796432            | <b>BH-28</b>        | 77.469532             | 17.781747            |
| <b>BH-02</b>        | 77.454648             | 17.796385            | <b>BH-29</b>        | 77.473303             | 17.781699            |
| <b>BH-03</b>        | 77.458419             | 17.796338            | <b>BH-30</b>        | 77.477073             | 17.781651            |
| <b>BH-04</b>        | 77.462190             | 17.796290            | <b>BH-31</b>        | 77.450631             | 17.778371            |
| <b>BH-05</b>        | 77.465960             | 17.796243            | <b>BH-32</b>        | 77.454401             | 17.778324            |
| <b>BH-06</b>        | 77.469731             | 17.796195            | <b>BH-33</b>        | 77.458172             | 17.778277            |
| <b>BH-07</b>        | 77.473502             | 17.796148            | <b>BH-34</b>        | 77.461942             | 17.778229            |
| <b>BH-08</b>        | 77.450828             | 17.792820            | <b>BH-35</b>        | 77.465712             | 17.778182            |
| <b>BH-09</b>        | 77.454599             | 17.792773            | <b>BH-36</b>        | 77.469483             | 17.778134            |
| <b>BH-10</b>        | 77.458370             | 17.792726            | <b>BH-37</b>        | 77.473253             | 17.778087            |
| <b>BH-11</b>        | 77.462140             | 17.792678            | <b>BH-38</b>        | 77.477023             | 17.778039            |
| <b>BH-12</b>        | 77.465911             | 17.792631            | <b>BH-39</b>        | 77.450582             | 17.774759            |
| <b>BH-13</b>        | 77.450779             | 17.789208            | <b>BH-40</b>        | 77.454352             | 17.774712            |
| <b>BH-14</b>        | 77.454550             | 17.789161            | <b>BH-41</b>        | 77.458122             | 17.774665            |
| <b>BH-15</b>        | 77.458320             | 17.789113            | <b>BH-42</b>        | 77.461893             | 17.774617            |
| <b>BH-16</b>        | 77.462091             | 17.789066            | <b>BH-43</b>        | 77.465663             | 17.774570            |
| <b>BH-17</b>        | 77.465861             | 17.789019            | <b>BH-44</b>        | 77.469433             | 17.774522            |
| <b>BH-18</b>        | 77.450730             | 17.785596            | <b>BH-45</b>        | 77.473203             | 17.774475            |
| <b>BH-19</b>        | 77.454500             | 17.785549            | <b>BH-46</b>        | 77.476973             | 17.774427            |
| <b>BH-20</b>        | 77.458271             | 17.785501            | <b>BH-47</b>        | 77.458073             | 17.771052            |
| <b>BH-21</b>        | 77.462041             | 17.785454            | <b>BH-48</b>        | 77.461843             | 17.771005            |
| <b>BH-22</b>        | 77.465811             | 17.785406            | <b>BH-49</b>        | 77.465613             | 17.770958            |
| <b>BH-23</b>        | 77.450680             | 17.781984            | <b>BH-50</b>        | 77.469383             | 17.770910            |
| <b>BH-24</b>        | 77.454451             | 17.781936            | <b>BH-51</b>        | 77.473153             | 17.770863            |
| <b>BH-25</b>        | 77.458221             | 17.781889            | <b>BH-52</b>        | 77.476924             | 17.770815            |
| <b>BH-26</b>        | 77.461992             | 17.781842            | <b>BH-53</b>        | 77.473104             | 17.767250            |
| <b>BH-27</b>        | 77.465762             | 17.781794            | <b>BH-54</b>        | 77.476874             | 17.767203            |

**Table 3: Coordinates of Proposed Boreholes, Satoli block**

#### 4. Planned Methodology

- a) **Topographical survey & Geological mapping:** - Reference points will be established within the mapping area by level transferring of SoI (Survey of India) benchmark point or through SOI CORS network based TBM establishment. The total area of 9 sq km will be mapped on 1:4000 scale using drone method to bring out different geological and geomorphological units. All the mapped units will be linked (geo-referenced) to the toposheet 56G/5 pertaining to the area.
- b) **Core drilling:** The collection of sub-samples at 1.0 m interval in 54 boreholes drilled up to 36m or up to bedrock whichever is occurring earlier, at 400 by 400m grid pattern covering the entire block. This will ensure to drill through Laterite, Clay and Saprolite, which area bearing critical minerals like V, Sc, Ga, REE etc.

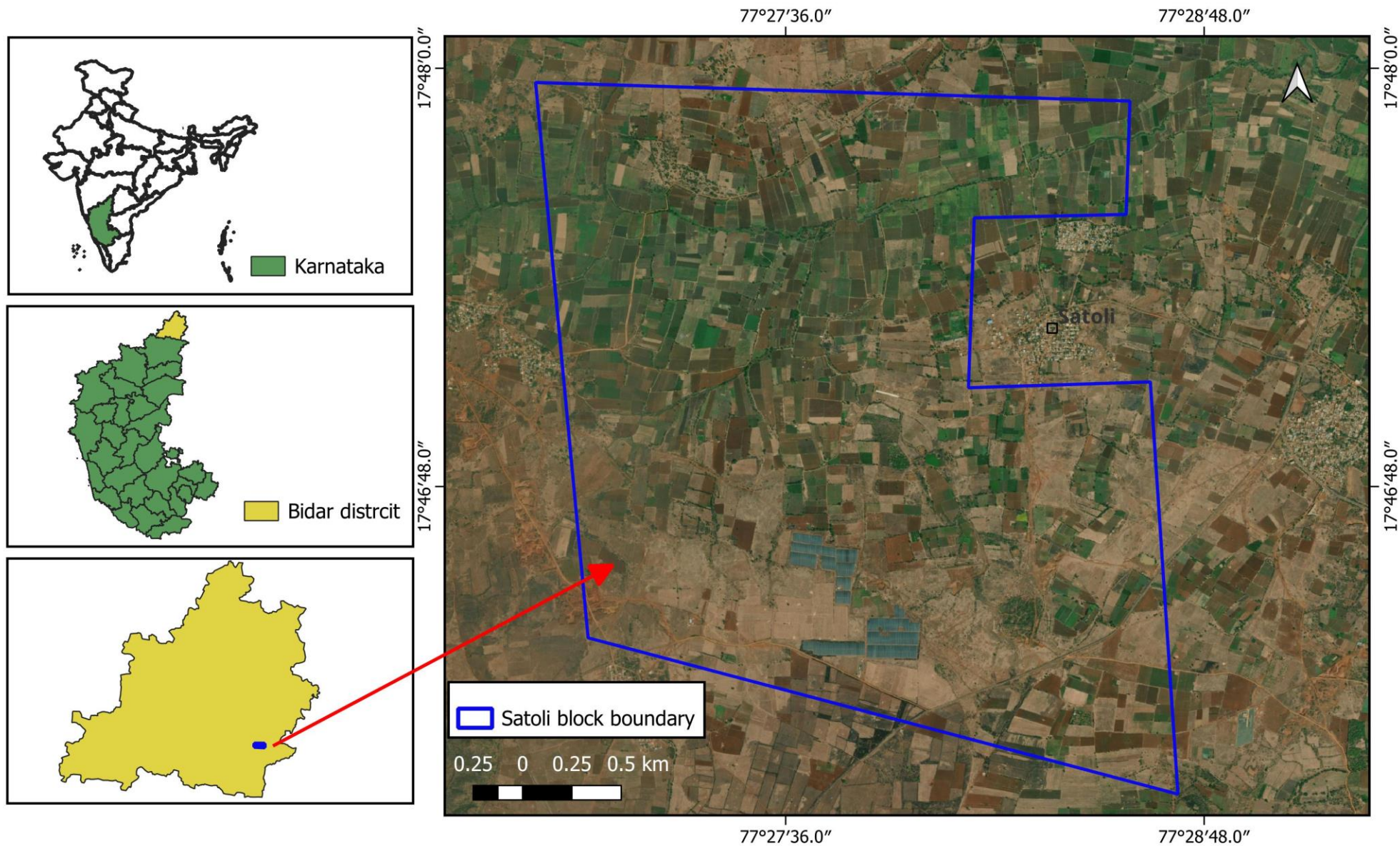
#### 5 Nature Quantum and Target

| Sl. No. | Description of Work                                                                             | Unit         | Time line |
|---------|-------------------------------------------------------------------------------------------------|--------------|-----------|
| 1.      | Topographical drone survey                                                                      | 9.0 sq km    | 1 month   |
| 2.      | Geological mapping in 1: 4000 scale                                                             | 9.0 sq km    | 2 months  |
| 3.      | Core drilling 400mX400m grid- up to 36.0m depth or up to bedrock whichever is occurring earlier | 54 BH; 1944m | 4 months  |
| 5.      | Primary + 10 % Check Sample (1m sample length) for major oxides and LOI by XRF; (583+58)        | 641 Nos      | 3 months  |
| 6.      | Primary +check samples for REE, Ga, V and other Trace elements: by ICPMS; (583+58)              | 641 Nos      | 3 months  |
| 7.      | Preparation & study of thin section (5+5)                                                       | 10           | 4 months  |
| 8.      | XRD                                                                                             | 20           | 4 months  |
| 9.      | Report writing (soft copy)                                                                      | 1            | 2 months  |

#### 6 Break-up of expenditure and Time schedule: Attached as Excel

1. Manpower deployment
2. Break-up of expenditure
3. References





**Fig 10. Location map of Satoli block**



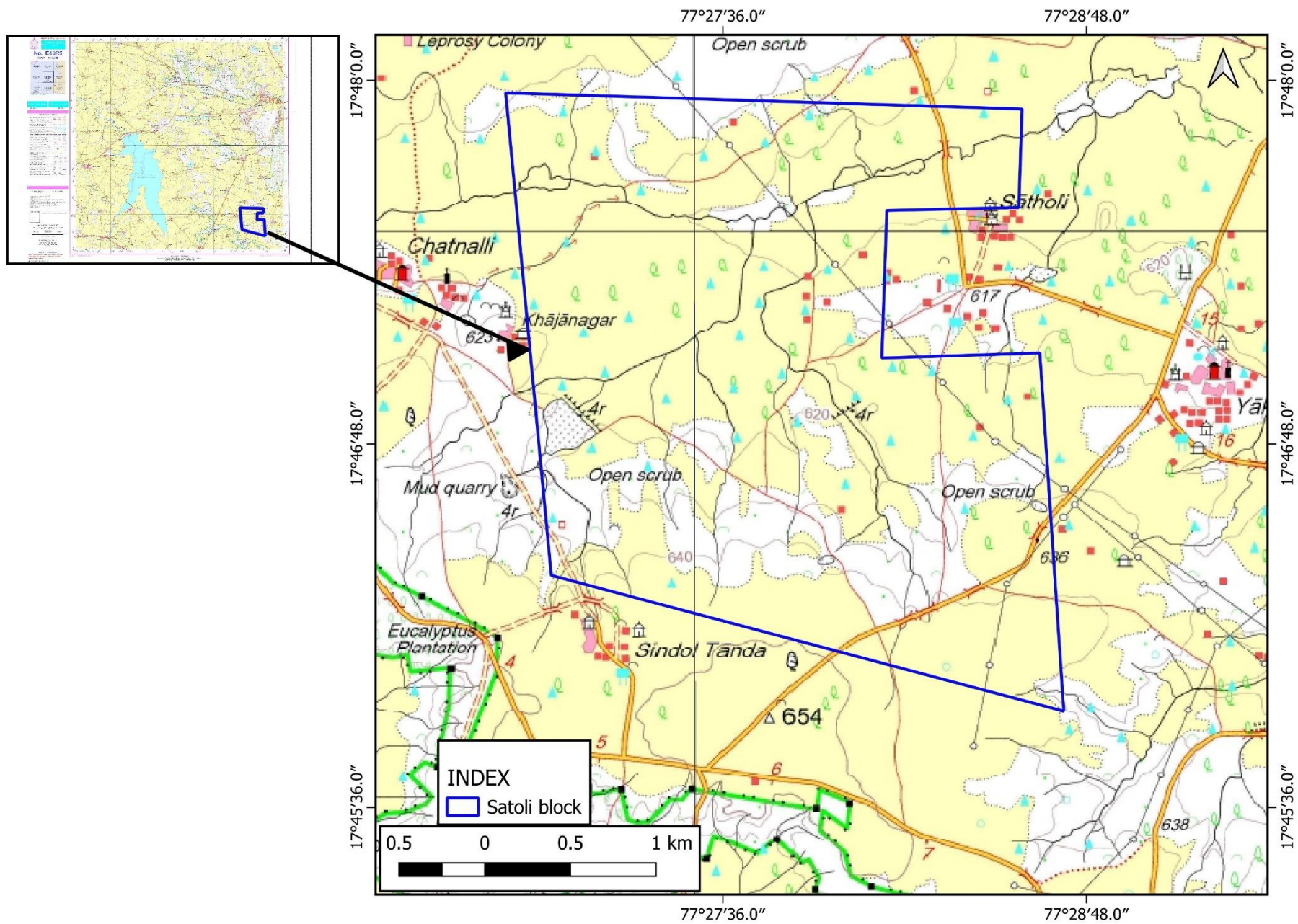
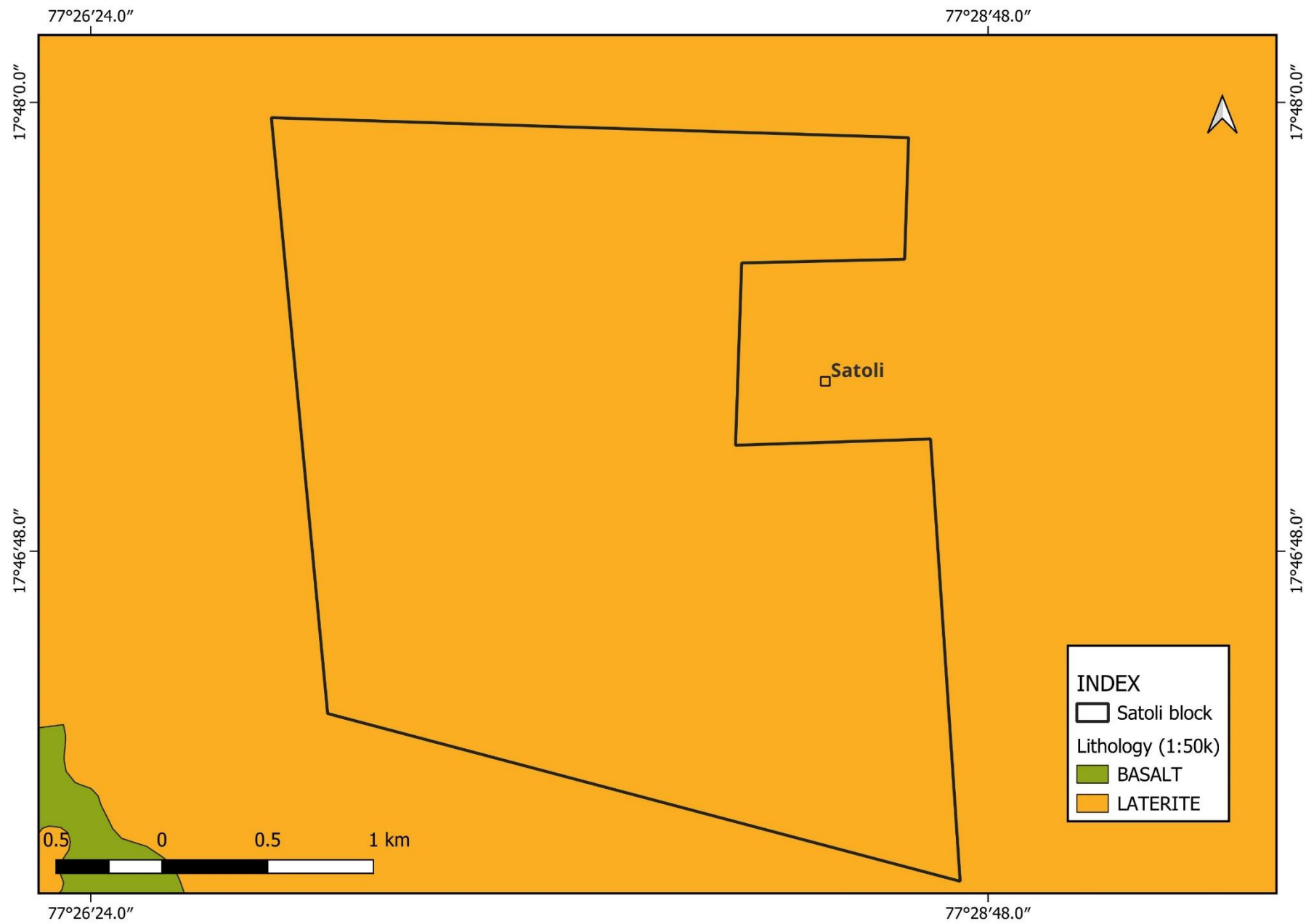
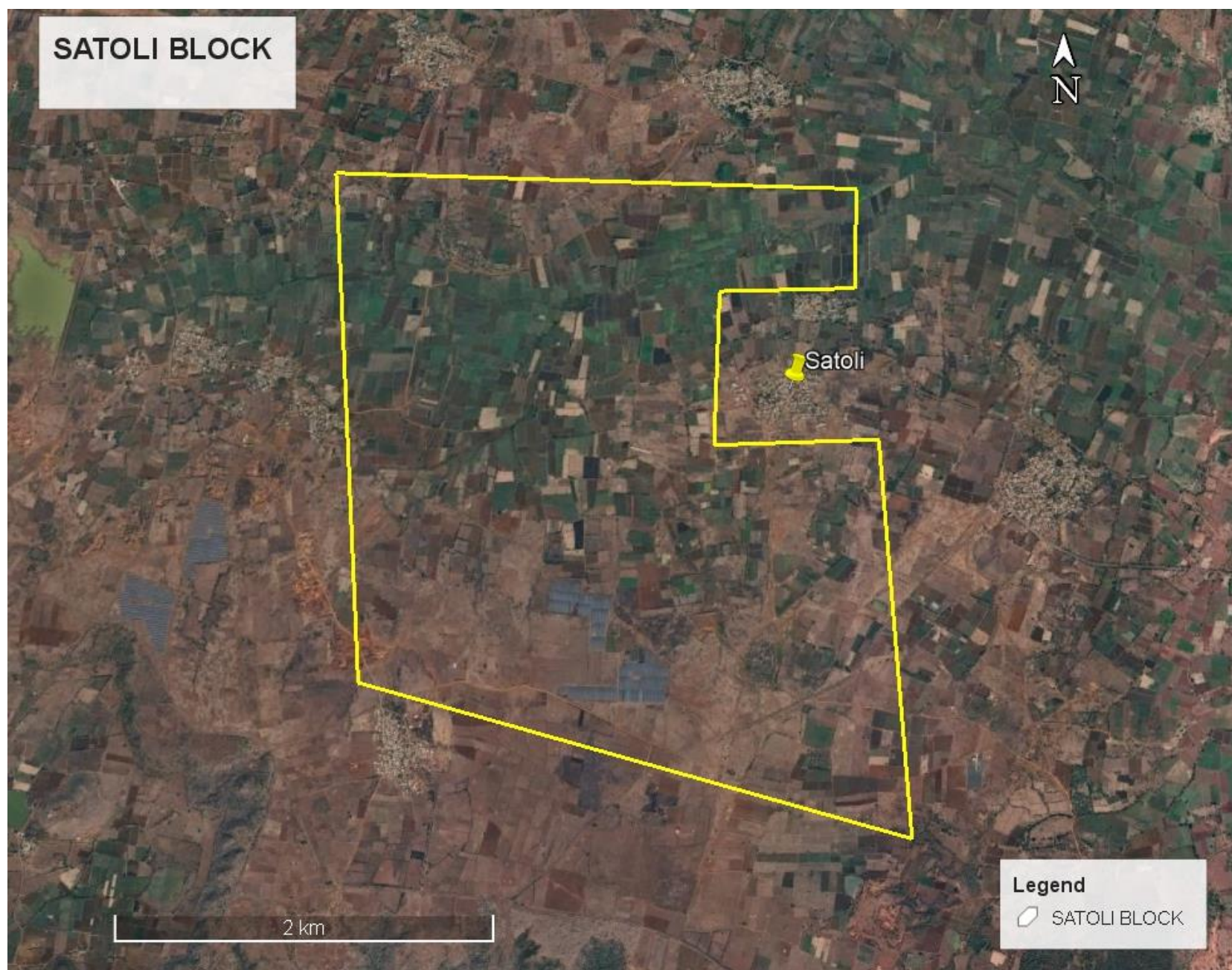


Fig 11: Toposheet map of Satoli block



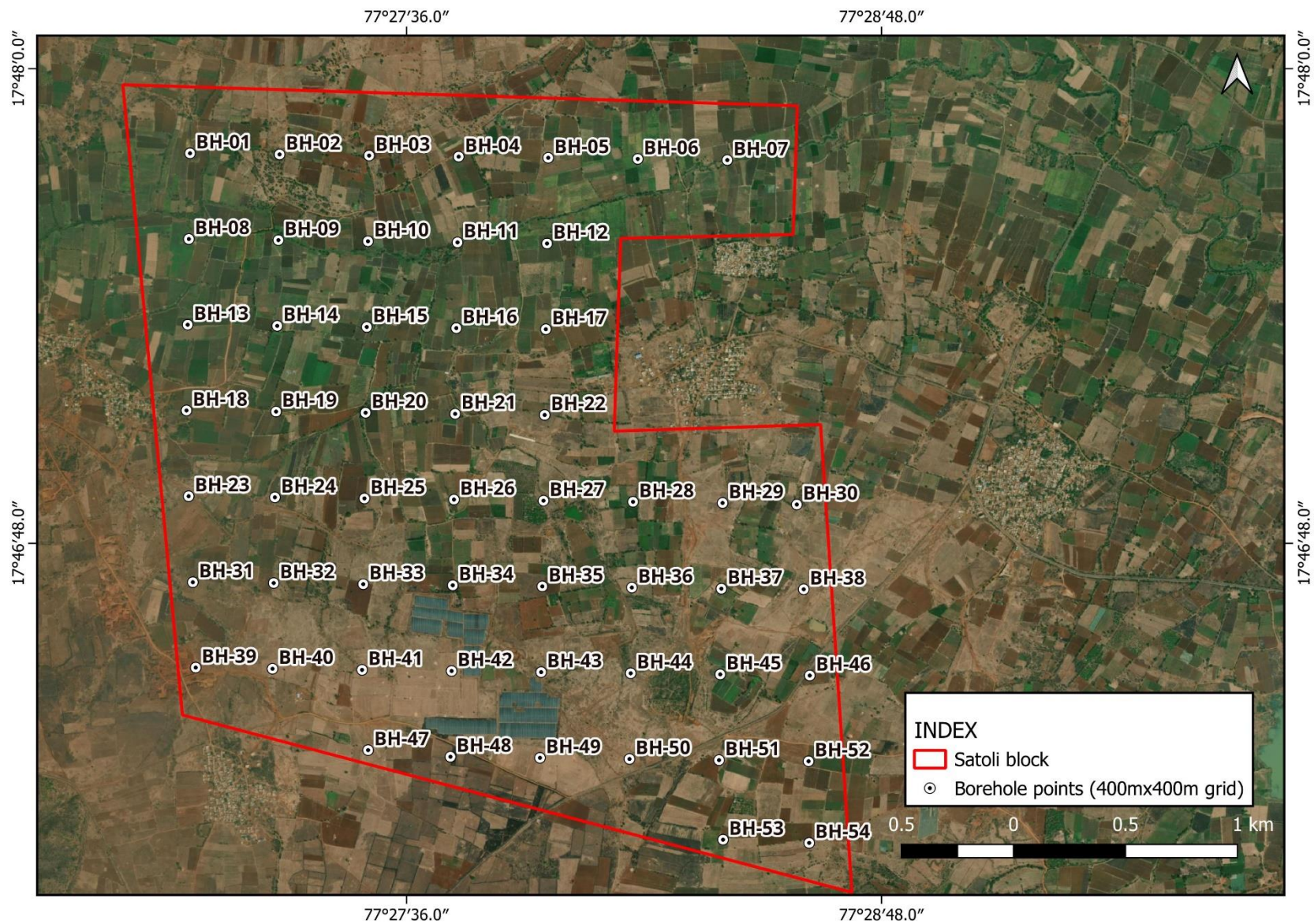
**Fig 12. Satoli block demarcated on Lithological map (1:50,000) (Source: GSI-NGDR)**





**Fig 13. Satoli block demarcated on Google earth imagery**





**Fig 14: Proposed borehole locations (400x400m grid) in Satoli block in 9.0 sq.km.**

## CHECKLIST FOR EXPLORATION AGENCIES FOR SUBMISSION OF EXPLORATION PROJECT PROPOSALS

**Name of Project/Block:** Preliminary Exploration(G3) for Vanadium, Scandium, Gallium and associated minerals in and around Satoli village, Bidar district, Karnataka (Satoli block)

**Agency:** GEO MARINE SOLUTIONS PRIVATE LIMITED

**Nodal Personnel (Agency):** P Praveen Kumar

**Date:** 28/05/2026

| Sl. No. | Items to be Verified by Agency                                                                                                                                                                                                 | Yes/No | Page Number in submitted Document                                                   |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------------------------------------------------------------------------|
| 1       | Geospatial scrutiny completed using KML/coordinate dataset and AOI assessed (including exploration activities, mining areas, eco zones, dependencies).                                                                         | Yes    | Page no. 15 (boundary coordinates)                                                  |
| 2       | Total Forest area in proposed block - with pic from PM Gatishakti portal.<br>Type of forest (RF/PF/Sanctuary/National Reserve Forest) to be mentioned.                                                                         | No     | There is no forest area within the proposed block as per toposheet and google earth |
| 3       | Overlap study of previous exploration work carried out in any exploration agencies/departments, or ongoing/proposed exploration work by any agencies/departments done                                                          | Yes    | No overlap                                                                          |
| 4       | Baseline data availability (NGCM, NGPM, Geological Maps, Airborne geophysical data etc.) on NGDR confirmed and reflected in comments.                                                                                          | Yes    | NGCM map on Page 9<br>NGPM on page 9 and<br>Geological map on page 20               |
| 5       | Processing of Baseline Geoscience data (NGCM, NGPM, Geological Maps, Airborne geophysical data etc.), legacy exploration data of proposed area, integration, analysis and interpretation presented in the project proposal/DPR | Yes    | NGCM map on Page 9<br>NGPM on page 9 and<br>Geological map on page 20               |
| 6       | Existing leases (ML/CL/EL etc.) in and around project area verified through NGDR/State DGM/Ministry of Mines                                                                                                                   | No     | No ML/CL/EL for major minerals .Page No. 4                                          |
| 7       | Whether the area falling within the buffer zone of International Boundary, Wildlife sanctuary, no-go zone, Biodiversity Park etc.                                                                                              | No     | Page No. 4                                                                          |
| 8       | Literature review and previous findings submitted by agency verified and reflected in DPR/In-principle<br>( <i>Page number of the particular to be mentioned in Reference / Bibliography</i> )                                 | Yes    | Page 11-12                                                                          |
| 9       | Whether the agency has carried out field work in the proposed area, collected samples and presented their findings with analytical data in project proposal/DPR                                                                | Yes    | Page 13-14                                                                          |
| 10      | Justification for proposed commodities and details of previous work included in DPR/In-principle.<br>Reference to NMEDT's ongoing/completed projects verified and included in comments.                                        | Yes    | Page 4                                                                              |

### Other Information

Accreditation of Agency:

Date: 13.08.2025

Valid Upto: 17.08.2028

Notification of Agency:

Date: 19.03.2025

Valid Upto: 18.03.2028

**Personnel Deployed**

As per QCI NABET – 2-Geophysicist + 1 Geologist

Current strength -27 (21- Geologist + 3- Geophysicist + 2- RS & GIS + 1- Hydrogeologist)

Total no. of Projects funded by NMEDT: 10

Approved - 10

Completed - 3

Ongoing - 7

**Comments of Nodal Personnel (Agency), if any:**

**Certification**

I hereby certify that the above checklist has been duly completed and all verifications have been carried out as per the guidelines.



Signature of Nodal Personnel (Agency):

Name: P. Praveen Kumar

Designation: Director

Date: 28/05/2026