



# **Geological Report on Preliminary Exploration (G-3 Stage) for Limestone in Sawalhira East Block, Korpana Tehsil, District-Chandrapur, Maharashtra (Toposheet No-56I/14)**

Under

1. National Mineral Exploration Trust  
Ministry of Mines,  
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EC-OM No- F. No. 23/461/2024-NMET/124 dated 10-06-2024

**Commodity – Limestone**

By

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Limestone outcrop in Sawalhira East Block



Outcrop of massive limestone in Sawalhira East Block

**GK/GR/2025/LIMESTONE/SAWALHIRA-EAST/NMET/14**

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## CHAPTER-1

### EXECUTIVE SUMMARY (HINDI & ENGLISH)

सावलहिरा ईस्ट ब्लॉक में प्राथमिक अन्वेषण (G-3 स्टेज) का उद्देश्य महाराष्ट्र के चंद्रपुर जिले के कोरपना तहसील में 5 वर्ग किलोमीटर क्षेत्र में चूना पत्थर की खोज करना है। यह परियोजना राष्ट्रीय खनिज अन्वेषण न्यास (NMET) द्वारा स्वीकृत है, जिसका उद्देश्य खनन पट्टों की नीलामी हेतु चूना पत्थर संसाधनों का सीमांकन करना है। इस परियोजना को जेम्को काटी एक्सप्लोरेशन प्राइवेट लिमिटेड द्वारा निष्पादित किया गया, जिसकी स्वीकृत बजट राशि ₹87.71 लाख है और कार्य की अवधि 10 महीने तय की गई है। भौगोलिक रूप से अध्ययन क्षेत्र पेंगंगा समूह से संबंधित है, जिसमें स्तरित चूना पत्थर, डोलोमाइटिक चूना पत्थर, डोलोमाइट और शेल प्रमुख चट्टानें हैं। क्षेत्रीय भू-संरचना की प्रवृत्ति NW-SE से लेकर NNW-SSE दिशा तक पाई गई है, और चट्टानों की ढलान समतल से लेकर अधिकतम 23° तक है।

1:4,000 पैमाने पर विस्तृत भूवैज्ञानिक मानचित्रण (DM) किया गया, जिससे संभावित चूना पत्थर क्षेत्रों का सीमांकन किया जा सके। कुल 45 बेडरॉक सैंपल (BRS) और 6 गड़ढा सैंपल एकत्र किए गए और इनका प्रमुख ऑक्साइड्स के लिए विश्लेषण किया गया। चट्टान की अधिक जानकारी के लिए 5 BRS नमूनों पर पेट्रोग्राफिक अध्ययन भी किया गया। अन्वेषण गतिविधियों के अंतर्गत 2 बोरहोल की ड्रिलिंग की गई, जिनकी कुल गहराई 120 मीटर (प्रत्येक 60 मीटर) रही।

शेष तीन बोरहोल समय पर वन स्वीकृति न मिलने के कारण नहीं खोदे जा सके और अब तक किए गए कार्य के आधार पर जाँच पूरी करने का निर्णय लिया गया। 79.4.20 की मीटिंग मिनट्स के अनुसार, इस मद को बंद करने के लिए 79th टीसीसी-एक और ईसी, एनएमईटी से अनुमोदन प्राप्त कर लिया गया है। तीन बोरहोल बंद करने के मद्देनजर, मद की लागत को मूल बजट 86.71 लाख रुपये से संशोधित कर 57.22 लाख रुपये कर दिया गया है, जिसमें (-) 29.49 लाख रुपये की राशि में परिवर्तन (अर्थात् 34% कमी) किया गया है।

जांच में यह पुष्टि हुई कि सतही गहराई पर चूना पत्थर (सीमेंट उद्योग के लिए मिश्रण/लाभदायक ग्रेड) की उपस्थिति है। चूना पत्थर एक बोरहोल (SW-BH-02) में मिला, जिसमें CaO की मात्रा 35.08% (गहराई: सतह से 6 मीटर) रही, जो भारतीय खान ब्यूरो (IBM) द्वारा निर्धारित 34% थ्रेशोल्ड से अधिक है। दूसरा बोरहोल सिलिका युक्त चूना पत्थर दर्शाता है, जिसकी CaO मात्रा 19.60% पाई गई।

बोरहोल SW-BH-02 (ज़ोन 1) में पाए गए चूना पत्थर में औसतन CaO की मात्रा 35.08% और MgO की मात्रा 1.82% है, जो कि सीमेंट ब्लेंडिंग के लिए उपयुक्त है (भारतीय खान ब्यूरो [IBM] के वर्गीकरण के अनुसार,



34% से अधिक और 42% से कम CaO युक्त चूना पत्थर उपयुक्त माना जाता है। यह अनुमान 400 मीटर प्रभाव क्षेत्र, 6 मीटर मोटाई, और 2.68 ग्राम प्रति घन सेंटीमीटर की बल्क डेंसिटी के आधार पर लगाया गया है। 5 वर्ग किलोमीटर के क्षेत्र में की गई प्रारंभिक जांच में, बोरहोल SW-BH-02 (ज़ोन 1) से 5.87 मिलियन टन ब्लेंडेबल/बेनिफिशिएबल ग्रेड चूना पत्थर की पहचान की गई है। यह अनुमानित संसाधनों को संयुक्त राष्ट्र रूपरेखा वर्गीकरण (UNFC) और खनिज साक्ष्य एवं खनिज सामग्री (MEMC) नियम, 2015 के अंतर्गत “प्रारंभिक अन्वेषण खनिज संसाधन” (334) के रूप में घटा दिया गया है, क्योंकि केवल दो ही बोरहोल ड्रिल किए जा सके।



## EXECUTIVE SUMMARY

The Preliminary exploration (G-3 Stage) in Sawalhira East block is aimed at assessing limestone potentiality over an area of 5 sq. km in Korpana Tehsil, Chandrapur District, Maharashtra being approved by the National Mineral Exploration Trust (NMET), to delineate limestone resources. The project, executed by Gemco Kati Exploration Pvt. Ltd., was sanctioned with a budget of ₹86.71 lakhs and a completion timeline of 10 months. Geologically, the study area belongs to the Penganga Group, characterized by bedded limestone, dolomitic limestone, dolomite, and shale. The regional strike of the beds varies from NW-SE to NNW-SSE, with dips ranging from sub-horizontal to 23°.

Detailed geological mapping (DM) at a scale of 1:4,000 was carried out to delineate potential limestone zones. A total of 45 bedrock samples (BRS) and 6 pit samples were collected and analyzed for major oxides. Petrographic study on 5 samples of BRS were carried out to characterize the rock in more detail. Exploration activities included the drilling of 2 boreholes, with a cumulative depth of 120 meters, each having depths of 60 meters.

Remaining 3 boreholes couldn't be drilled due to non-receipt of forest clearance in time and decided to conclude the investigation based on work carried out so far. The approval from TCC and EC, NMET have been obtained for closure of the item vide Minutes of the meeting 79.4.20. In view of dropping three boreholes, the cost of item is revised to Rs. 57.22 Lakh from original budget of Rs. 86.71 Lakh with a change in amount of (-) Rs. 29.49 Lakh (i.e. 34% de-escalation).

The investigation confirmed limestone (Blendable/beneficiable grade for cement industry based on end user classification of IBM) occurrences at shallow depth. Limestone deposits were identified in one borehole, with CaO concentrations (CaO higher than 34% threshold value of Indian Bureau of Mines) appropriate for blending or beneficiation in the cement industry.

Limestone resources (appropriate for blending/beneficiation in the cement industry) were found in one borehole: SW-BH-02 (CaO: 35.08%, MgO: 1.82%, depth: surface to 6 meters depth). Another borehole yielded siliceous limestone having CaO content of 19.60.

The borehole SW-BH-02 (zone 1) contains blendable/beneficiable grade limestone with an average CaO content of 35.08%, MgO-1.82% suitable for cement blending (34%–<42% CaO as per IBM classification). The resource estimate is based on a 400m area of influence, 6m thickness, and a bulk density of 2.68 g/cc. Preliminary exploration within 5 sq. km block has identified 5.87 million tons of blendable/beneficiable grade limestone from Borehole SW-BH-02 (Zone 1). The estimated resources have been downgraded to “Reconnaissance Mineral Resource” (334) under the United Nations Framework Classification (UNFC) and the Mineral Evidence and Mineral Content (MEMC) Rules, 2015, as two boreholes only could be drilled.

## CHAPTER-2 INTRODUCTION

### 2.1 Details of project:

The Sawalhira East Block project is a Preliminary investigation (G-3) project focused on exploring limestone resources over an area of 5 sq. km in Korpana Taluka, Chandrapur District, Maharashtra State. It is undertaken as part of the National Mineral Exploration Trust (NMET), Ministry of Mines initiatives and was approved at a cost of ₹86.71 lakhs, with a completion timeline of 10 months. The project involves geological survey, topographic survey, pitting, core drilling, and geochemical analysis to assess limestone quality and continuity in block area. Project challenges include rugged terrain, accessibility constraints in forest areas and forest clearance. Executed by M/s GEMCO KATI Exploration Pvt. Ltd., this project supports the auctioning process for mineral resources and contributes to sustainable resource development in Maharashtra. **Figure 1 (Refer list of figures)**, shows the Sawalhira East Block on Toposheet No. 56I/14 of Survey of India (1:50,000 scale).

### 2.2 Chronology of the project activities:

| Chronology of the project activities |  |   |
|--------------------------------------|--|---|
| S.N.                                 | Date   | Project related activities  |
| 1                                    | 22, 26 and 27 <sup>th</sup> March 2024                             | Project proposal presentation: 63 <sup>rd</sup> meeting of TCC, NMET. TCC recommended the project for approval to EC, NMET.   |
| 2                                    | 16 <sup>th</sup> May 2024  | Approval by 35 <sup>th</sup> EC, NMET.  |
| 3                                    | 10 <sup>th</sup> June 2024   | Date of receipt of sanction order of the project.   |
| 4                                    | 13 <sup>th</sup> August 2024                                       | Application on Parivesh portal for seeking permission regarding drilling.   |
| 5                                    | 10 <sup>th</sup> April 2024  | Date of initiation of project work.   |
| 6                                    | 18 <sup>th</sup> October 2024                                      | Site inspection visit of Deputy Conservator of Forest (DCF), Chandrapur.  |
| 7                                    | 25 <sup>th</sup> and 26 <sup>th</sup> November 2024                | First review: 71 <sup>th</sup> TCC I.   |
| 8                                    | 30 <sup>th</sup> and 31 <sup>st</sup> January 2025                 | Second review: 73 <sup>th</sup> TCC I.  |
| 9                                    | 21 <sup>st</sup> February 2025                                     | Site inspection visit of Chief Conservator of Forest (CCF), Chandrapur.   |
| 10                                   | 27 <sup>th</sup> and 28 <sup>th</sup> March 2025                   | Third review: 75 <sup>th</sup> TCC I.   |
| 11                                   | 30 <sup>th</sup> April and 1 <sup>st</sup> May 2025                | Fourth review: 76 <sup>th</sup> TCC I.  |
| 12                                   | 26 <sup>th</sup> , 27 <sup>th</sup> and 30 <sup>th</sup> June 2025 | Fifth review: 78 <sup>th</sup> TCC I. Reviewed the project and suggested to submit a technical report stating the status of the work to NMET Secretariat.   |
| 13                                   | 30 <sup>th</sup> June 2025   | A communication regarding the same has been made with the NMET secretariat.   |
| 14                                   | 8 <sup>th</sup> July 2025  | Forest permission status: Drilling application pending with the Forest Department.  |
| 15                                   | 26 <sup>th</sup> , 27 <sup>th</sup> and 30 <sup>th</sup> June 2025 | The 78 <sup>th</sup> TCC I recommended the pre-closure of project to EC for approval and advised Gemcokati for submission of revised cost sheet in the next TCC-1 of NMET due to delay and uncertainty in forest permission for drilling 3 boreholes.         |
| 16                                   | 28-30 <sup>th</sup> July 2025                                      | The 79 <sup>th</sup> TCC I revised the cost sheet of the Sawalhira East block project and recommended for peer review of the final geological report (GR) with time extension.  |
| 17                                   | 12 <sup>th</sup> August 2025                                       | The NMET nominated Dr. G. Lakshminarayana, Director (Rtd.), Geological Survey of India as a peer-reviewer.  |
| 18                                   | Peer Review  | On 14 <sup>th</sup> August GR soft sent to peer reviewer by email and hard copy by speed post on 16 <sup>th</sup> August. On 20 <sup>th</sup> August received soft copy with email from peer reviewer and hard copy by speed post on 26 <sup>th</sup> August. |

|    |                                 |   |
|----|---------------------------------|---|
| 19 | 28-30 <sup>th</sup> August 2025 | The 80 <sup>th</sup> TCC I reviewed the peer review compliance and permitted for final submission of GR.  |
| 20 | 30 <sup>th</sup> August 2025    | The approval granted by the committee members of 80 <sup>th</sup> I on 30 <sup>th</sup> August 2025, for submission of final GR with a suggestion to downgrade the resources under 334 (G4) category, as only 2 boreholes could be drilled out of proposed 5 boreholes, due to non-availability of forest permission in time. The report submission date was within 31 <sup>st</sup> August' 2025, therefore the minutes of the meeting couldn't be included under Annexure part. |

## 2.3 Investigation Agency:

The investigation for the preliminary exploration (G3 stage) in the Sawalhira East Block is being carried out by M/s **Gemco Kati Exploration Private Limited**, a reputed agency headquartered in Chandrapur, Maharashtra. The company is entrusted with executing detailed geological and geochemical studies in the 5 sq. km project area. As a notified private exploration agency, Gemco Kati is actively involved in mineral exploration under India's National Mineral Exploration Trust (NMET).

| Name and Address of the Investigating agency  |  |
|---|--|
| (a) Name of NPEA                              | Gemco Kati Exploration Private Limited               |
| (b) Name of Authorized Signatory              | Subrata Sarkar, Vice President (Projects & Planning) |
| (c) Postal address:                           | E-77, MIDC Road, Chandrapur-442406.                  |
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| (f) Mobile No & Telephone Number (Residence): | (+) 91 7044208900                                    |
| (g) E-mail address:                           | subrata.sarkar@gemcokati.com                         |

## 2.4 Objectives of investigation:

The primary objective of the Sawalhira East Block Limestone Exploration Project is to delineate the potential limestone resources within the 5 sq. km area and demarcate mineralized zones through detailed surface and subsurface exploration. Specific goals include:

1. **Surface Outcrop Delineation:** To identify and map limestone outcrops using BRS/Pit sampling and detailed geological mapping & topographic survey at a 1:4000 scale.
2. **Subsurface Continuity:** To establish the depth and subsurface extent of limestone deposits by drilling five boreholes in a polygonal pattern (800m x 800m) down to 60m, adhering to MEMC Rules 2015.
3. **Petrological and Chemical Analysis:** To analyze host rock samples for cement-grade limestone properties, ensuring the quality and consistency of the resource.
4. **Resource Estimation:** To estimate in-situ resources of different grades of limestone using exploration data, enabling classification under the UNFC guidelines.

5. **Facilitating Auctions:** To provide the Government of Maharashtra with sufficient data and evidence for the auctioning of the block for mining purposes.

## 2.5 Basis for taking up investigation:

The investigation of the Sawalhira East Block Limestone was undertaken based on the following factors:

1. **Field Evidence of Mineralization:** Preliminary field visits, by Geologists of Gemco Kati Exploration Pvt. Ltd., conducted on August 4th, 8th, and 18th, 2023, revealed promising indications of cement-grade limestone deposits. Grab samples collected during these visits showed calcium oxide (CaO) content ranging between 46.01% and 50.46%, confirming the presence of high-quality limestone.
2. **Proximity to Industrial Units:** The Sawalhira East block is located near cement factories and dolomite mines, further indicating the area's industrial potential and geological continuity.
3. **Previous Exploration Results:** Adjacent areas, such as Sawalhira West, were recently explored under G3 norms by DGM, Maharashtra, yielding favorable results for limestone with CaO content between 46% and 50%, strengthening the case for further investigation in the Sawalhira East block.
4. **Auction Potential:** Under prevailing conditions, the investigation aimed to identify and classify limestone deposits to make the block auction-ready for mining leases within 10 months, adhering to G3 norms under UNFC classification.

## 2.6 Details and nature and quantum of work proposed vs achievement:

**Table 1. Nature and quantum of work proposed and achieved.**

| Sl. No. | Nature of work  | Target assigned                     | Target achieved   |
|---------|---|-------------------------------------|---|
| 1       | a) Geological Mapping (DM) (Sq. km.) on 1:4000 scale<br>b) Topographic survey on 1:4000 scale   | 5 sq.km<br>5 sq. km                 | 5 sq. km<br>5 sq. km  |
| 2       | Technological   |                                     |   |
|         | a) Surface exploration-BRS samples  | 30 nos.                             | 45 nos.   |
|         | b) Drilling   | 300m                                | 120m [180m is dropped as per approval of the TCC, NMET]         |
|         | C) Pitting  | 6 Nos.                              | 6   |
| 3       | Petrographic Studies (Nos.)   | 5 nos.                              | 5   |
| 4       | Chemical analysis (Nos.)  |                                     |   |
|         | a) Sampling BRS (Primary+ Check) for 6 radicals Fe%, SiO <sub>2</sub> %, P <sub>2</sub> O <sub>5</sub> , CaO, Al <sub>2</sub> O <sub>3</sub> % & Acid Insoluble | 33 BRS (Including 3 check samples)  | 54 (45 nos. - BRS + 3 Check + 6 Pit Samples Analyzed)           |
|         | b) Drill core Samples   | 220 CS (Including 20 check samples) | 86 CS geochemical analysis completed including-8 check samples. |
|         | c) Bulk density   | 2                                   | 2   |

## 2.7 Personnel involved:

The Sawalhira East Block Project involved a dedicated team of professionals who contributed their expertise across various stages of the investigation. The key personnel included:

1. **Subrata Sarkar** (Project Coordinator of QCI-NABET): Vice President (Project & Planning) served as the leader & guiding authority and supervised each phase of the project execution, ensuring adherence to the proposed timeline and objectives.
2. **Dr. Vinay Sahay** (Technical Area Expert: QCI-NABET): Senior Manager (Geology), assisted in data analysis, core drilling, draft report preparation and forest permission for drilling in forest lands.
3. **Junior Geologists:** Chinmay Rout, Ravikant Sinha, Suraj Vidhate, Tejeswar Barik, Nitin, Devika Ishwardas Nagpure and Ramraj Patel actively participated in geological mapping, sampling, core drilling, core logging and core splitting programs for composite sample preparation.
4. **Surveying:** In-house surveying teams Sandip Singh & Satyam Singh conducted topographic surveys at a detailed scale.
5. **Chemical Analysis:** Analysis was performed by Shiva Analytical (India) Pvt. Ltd., Bengaluru, and JNRRDC, Nagpur.
6. **Petrographic Study:** Petrographic sample processing and studies were conducted by the Geological Survey of India, CR, Nagpur.
7. **Topographic, outcrop & sample location map:** These maps were prepared by Shri. M. Vishnu Kumar (Retd, Surveyor, GSI), Mescon Survey Services, Secunderabad.

This team worked collaboratively to achieve the project's goals, combining their diverse skills to ensure the successful completion of the exploration.

## 2.8 Acknowledgement:

We express our sincere gratitude to Shri. Jijo George, Director & CEO, for his leadership support, motivation and encouragement, and to Shri. Nigel Job, Director & CFO, for his unwavering administrative and financial support. We also thank Shri. Lijin Sunil, MIS. We are also thankful to the members of the Technical-cum-Cost Committee (TCC) & Executive Committee (EC), National Mineral Exploration Trust (NMET), Ministry of Mines for providing us the opportunity to successfully complete a G3 stage project and geological report from Chandrapur District, Maharashtra. Our thanks extend to the Director General, Director & Deputy Director, Directorate of Geology and Mining (DGM), Maharashtra, and geologists of DGM, Nagpur & Chandrapur, Maharashtra. We deeply appreciate the help and cooperation extended by all individuals, whether in the office or the laboratory. Finally, we express our sincere thanks to all the members of the Gemco Kati family for their tremendous support throughout the entire period of investigation.

## CHAPTER-3

### PROPERTY DESCRIPTION

#### 3.1 A brief description of details of the area (village name, district, state, Toposheet number, Geo-coordinate with the aid of DGPS/Total Station of all the corner points of the investigated area:

The Sawalhira East Limestone Exploration Block is located in Sawalhira East Village, within Korpana Tehsil, in the Chandrapur District of Maharashtra State (**Table 2**). The area falls under Toposheet No. 56I/14, which provides detailed geographical and topographical information about the block.

**Table 2. Block related location and accessibility information.**

| Block related location and accessibility information |  |
|--|--|
| Tehsil/Taluk   | Korpana  |
| District   | Chandrapur   |
| State  | Maharashtra  |
| Toposheet Number                                     | 56 I/14  |
| Nearest Rail Head                                    | The nearest railway station is Balharshah, approximately 50 km away, providing a vital rail link for transporting goods and personnel.   |
| Road   | The block is connected through a network of all-weather metalled and tar roads. It is accessible from Korpana (around 10 km), Chandrapur (around 60 km), and Nagpur (around 200 km) via State Highway MH SH 264. |
| Airport  | The nearest airport is Nagpur Airport, located around 200 km from the block, serving as the primary hub for air travel.  |

#### 3.2 Geo-Coordinates of Corner Points:

**Table 3. The block's boundary coordinates.**

| S.N. | Latitude      | Longitude     |
|------|---------------|---------------|
| (A)  | 19°41'43.83"N | 78°58'36.67"E |
| (B)  | 19°41'42.35"N | 79° 0'0.00"E  |
| (C)  | 19°40'48.92"N | 79° 0'0.00"E  |
| (D)  | 19°40'47.20"N | 78°59'14.25"E |
| (E)  | 19°40'6.90"N  | 78°58'56.32"E |
| (F)  | 19°40'27.61"N | 78°58'36.79"E |

### **3.3 Land use/ cover, forest with type of forests, free hold/lease hold details:**

The Sawalhira East limestone block is situated in part of Pardi Reserved Forest region, characterized by open land and cultivated areas with some shrubs and bushes present in certain locations. The area contains mango and mahua trees, and is used for seasonal agriculture. The primary crops grown in the area are cotton, soybean, jowar, and various pulses. The terrain of the region is generally flat, with clayey soil prevalent throughout.

### **3.4 Location:**

The Sawalhira East Limestone Exploration Block spans an area of 5 sq. km within Korpana Tehsil, Chandrapur District, Maharashtra. The block is situated northeast of Sawalhira East village, approximately 5 km from Korpana and about 55 km from the district headquarters, Chandrapur. It is easily accessible via metaled and fair-weather roads connecting nearby towns and villages. The nearest railway station is Balharshah, approximately 45 km from the block, and the nearest airport is in Nagpur, located around 200 km away. This well-connected location ensures convenient access for exploration and future mining operations.

### **3.5 Accessibility:**

The Sawalhira East Limestone Exploration Block is well-connected and accessible via multiple transportation routes, ensuring smooth operational logistics. Key details about accessibility are as follows:

1. Road Connectivity: The block is connected through a network of all-weather metaled and tar roads. It is accessible from Korpana (5 km away), Chandrapur (55 km), and Nagpur (295 km) via State Highway MH SH 264.
2. Rail Connectivity: The nearest railway station is Balharshah, approximately 50 km away, providing a vital rail link for transporting goods and personnel.
3. Air Connectivity: The nearest airport is Nagpur Airport, located around 200 km from the block, serving as the primary hub for air travel.
4. Local Infrastructure: Villages like Sawalhira situated less than 1 km from the block, offer basic amenities, including water sources from dug wells, bore wells, and perennial streams. The local area is also well-connected by telephone lines and mobile networks, facilitating seamless communication.

### **3.6 Climate: (Source: Indian Meteorological Department)**

The Sawalhira East Limestone Exploration Block, located in Korpana Tehsil of Chandrapur District, Maharashtra, experiences a tropical climate with three distinct seasons:

1. **Summer:**

- Duration: March to June
- Temperature Range: 28°C to 42°C
- Characteristics: Hot and dry weather conditions dominate this period.

2. **Monsoon:**

- Duration: July to September
- Rainfall: Heavy rainfall with an average annual precipitation of 1200-1400 mm
- Characteristics: The region experiences lush greenery and increased humidity due to monsoonal showers.

3. **Winter:**

- Duration: October to February
- Temperature Range: 10°C to 28°C
- Characteristics: Cool and pleasant weather, ideal for outdoor activities and agricultural operations.

### 3.7 Flora and fauna (Source: Chandrapur Forest Publications):

Flora – In Korpana Tehsil of Chandrapur District, several species of flora can be found. Some notable plant species observed in this region include:

- Teak (*Tectona grandis*): Teak trees are commonly found in the forests of Korpana Tehsil. They are known for their high-quality timber and are often harvested for commercial purposes.
- Sal (*Shorea robusta*): Sal trees contribute to the region's biodiversity and provide important ecosystem services.
- Bamboo (*Bambusoideae*): Various species of bamboo, such as *Dendrocalamus strictus* and *Bambusa bambos*, are present. These versatile plants serve multiple purposes and contribute to the local ecology.
- Tendu (*Diospyros melanoxylon*): Tendu trees, native to the region, are likely to be found here. The leaves of this tree are used in the production of beedis, a traditional Indian cigarette.
- Mahua (*Madhuca longifolia*): Mahua trees may be found in Korpana Tehsil, offering edible flowers that have culinary and medicinal uses.
- Neem (*Azadirachta indica*): Neem trees, known for their medicinal properties, are likely to be found in Korpana Tehsil, providing various benefits to the local community.
- Palash (*Butea monosperma*): Palash trees, also known as the flame of the forest, may be present in Korpana Tehsil. They are known for their vibrant red flowers and cultural significance.

These are some of the flora species that can be found in Korpana Tehsil of Chandrapur District. The specific distribution and abundance of these plant species may vary within the tehsil due to local ecological factors.

Fauna – The Chandrapur district in Maharashtra encompasses a large expanse of undisturbed forests with a sparse human population, predominantly comprising aboriginal communities. These forests exhibit lush vegetation, providing a favorable habitat for diverse wildlife species adapted to such environments. In Korpana Tehsil near the Sawalhira East limestone block, the wild dog (*Cuon alpinus*) population is abundant. Other carnivorous species, including the jackal (*Canis aureus*), hyena (*Hyaena hyaena*), wild cat (*Felis chaus*), and jungle cat (*Felis chaus*), are less commonly found in this Tehsil.

A variety of herbivorous animals inhabit this Tehsil. Deer species are mostly localized to the plain forests north of the Penganga River. The blue bull (*Boselaphus tragocamelus*) is fairly common in open grassy forest areas. Barking deer (*Muntiacus muntjak*), Indian gazelle (*Gazella*), small deer species, and antelope are also present in nearby open forests. Indian wild boars (*Sus cristatus*) are widespread throughout the forested areas and adjacent cultivated tracts. Langur monkeys (*Semnopithecus entellus*) are found in large numbers. Other notable species include hares (*Lepus nigricollis ruficaudatus*), flying squirrels (*Petromys fimbrialus*), porcupines (*Hystrix leucura*), pangolins (*Manis crassicaudata*), and Indian ratels (*Mellivora capensis*). Among the bird species, the peafowl (*Pavo cristatus*) is conspicuous but less abundant in the area. Grey jungle fowl (*Gallus sonneratii*), grey partridges (*Francolinus spp.*), painted partridges (*Francolinus spp.*), and various quail species (*Coturnix spp.*) are commonly found in the open grassy areas.

### **3.8 Geomorphology, Physiographic and drainage (Source: Satellite and SOI topographic maps):**

The Sawalhira East limestone prospecting area is characterized by low-level plateaus with minimal relief, except for the limestone belts, which exhibit slightly higher relief. The overall slope of the area is towards the north, with the lowest contour at 282 meters and the highest contour at 393 meters. The drainage of the area is predominantly controlled by the Penganga River and its tributaries, which flows perennially in an east-west direction. The drainage pattern observed in the area is dendritic.

Near the Sawalhira East limestone block in Korpana Tehsil, there are several major rivers and streams. To the north, the prominent water bodies include the Penganga River and Wardha River. These rivers and their tributaries play a significant role in the region's water resources, supporting various activities such as irrigation, drinking water supply, and ecological balance.

### **3.9 Infrastructural facilities, Population and Socio-economic condition (Source: District socio-economic review by District Collectorate Office):**

The main source of income for the villagers is agriculture. However, there is still ample manpower available in the area. The nearby Dalmia Cement Manufacturing Plant is a significant private employment generator.

Nearest Village: Sawalhira (< 1 km)

Nearest Town: Korpana (5 km)

Nearest Headquarter: Chandrapur (55 km)



Nearest Railway Station: Balharshah (50 km)

Nearest Airport: Nagpur (200 km)

Sawalhiri is a medium-sized village in Korpana Taluka of Chandrapur district, Maharashtra, with a total of 161 families. According to the 2011 Population Census, the village has a population of 693, comprising 348 males and 345 females.

Children aged 0-6 years constitute 75 individuals, making up 10.82% of the total population. The average sex ratio of Sawalhiri is 991, which is higher than Maharashtra's state average of 929. The child sex ratio in the village stands at 1,344, significantly above the state average of 894.

Sawalhiri has a lower literacy rate compared to Maharashtra. In 2011, the village's literacy rate was 73.30%, whereas the state average was 82.34%. Male literacy in Sawalhiri was recorded at 82.28%, while female literacy stood at 63.91%.

The village offers a peaceful environment and has an ample supply of manpower.

### **3.10 Archaeological/historical sites, National parks etc. (Source: Chandrapur tourism website):**

The Sawalhiri village in Chandrapur district is surrounded by several historical sites. The ancient Buddhist caves in Bhadravati, dating back to the 1st century BC, contain stunning sculptures and paintings depicting Buddhist teachings and mythology. The Ballarpur Fort, located about 45 km from Sawalhiri village, was an important military stronghold during the Bahmani and Nizam Shahi dynasties. The fortifications and ruins of Ballarpur provide a glimpse into the rich history and culture of the region. The Manikgarh Fort, located in the nearby town of Gadchandur, is a hill fort situated 507 meters above sea level. These historical sites are a testament to the region's rich and diverse cultural heritage.

The Jatpura Gate, Anchareshwar Temple and Fort, Mahakali Temple, and Pathanpura Gate are some other historical sites located in and around Chandrapur city, which is about 37 km from the Sawalhira East block.

Among the national parks, tiger reserves, and wildlife sanctuaries, the following are notable:

- Tadoba Andhari Tiger Reserve: Approximately 85 km from Sawalhira East block
- Pench Tiger Reserve: Approximately 285 km from Sawalhira East block
- Nagzira Wildlife Sanctuary: Approximately 265 km from Sawalhira East block
- Halda-Pauni Wildlife Sanctuary: Approximately 205 km from Sawalhira East block
- Ghodajhari Wildlife Sanctuary: Approximately 155 km from Sawalhira East block



The Sawalhira East limestone block area is surrounded by a number of small-scale limestone mines, along with a prominent cement manufacturing plant belonging to M/s Dalmia Bharat Group. Additionally, other major cement manufacturing plants, such as Ultratech, Ambuja, and Manikgarh, are located within a 25 km radius of the area.

## CHAPTER-4

### PREVIOUS WORK

#### 4.1 A very brief note on previous work:

The earliest reference to the geology of the area was made by Hughes (1877), who mapped the limestone bands of the Penganga beds in the southern part of Yavatmal district as part of the Vindhyan Supergroup. Later researchers, including Sinha (1946-47) in Toposheet No. 56 I/13 also correlated the Penganga beds with the Vindhyan. However, other geologists, such as King (1881), Heron (1949), Gajbhiye (1964-65), Patil (1966-67) in Toposheet No. 56 I/9, and Jain (1976-77), considered these beds equivalent to the Pakhal Group (Cuddapah Group). Hemmady (1964-65) in Toposheet No. 56 M/2 suggested that the Penganga beds represented a transitional stage between the Cuddapah and Vindhyan formations. In the overlying Deccan Traps, Hemmady (1964-65) reported more than six lava flows in Toposheet No. 56 M/2. Kazim and Reddy (1983-84) also mapped the Penganga beds in Toposheet No. 56 M/1 and classified them as equivalent to the Pakhal Group (~Cuddapah Group). Penganga Group comprises of shales, limestones and dolomitic limestones. Shales are the oldest in the area mapped resting over an unknown basement and have gradational relationship with the overlying limestone.

#### 4.2 Details of previous exploration/investigation:

An area of 1000 sq. km was mapped jointly by R.K. Agarwal and V. Subba Rao, Geologists (Jr), of the Geological Survey of India, in parts of Toposheets No. 56 I/9, I/13, and I/14, on a scale of 1:50,000. Of this, 527 sq. km was mapped by R.K. Agarwal and 473 sq km by V. Subba Rao. Approximately 210 sq. km of the total mapped area falls in Toposheet No. 56 I/9, bounded by the Maharashtra State boundary in the southern part of the toposheet, between latitudes 19°20' and longitudes 78°40' to 78°45'; 580 sq km falls in Toposheet No. 56 I/13, between the Maharashtra State boundary in the southwestern part of the toposheet, and latitudes 19°45' to 20°00', 19°45' to 19°50', and 19°50' to 19°55', with longitudes 78°45' to 78°55', 78°55' to 79°00', and 78°55' to 78°50', respectively; and 210 sq. km falls in Toposheet No. 56 I/14, between latitudes 19°32'25" to 19°45'00", and the western part of the toposheet, along the boundary of the state of Maharashtra, at longitude 79°00'. The Directorate of Geology and Mining, Maharashtra, has carried out detailed investigations of the limestone deposits occurring southwest of Mukatban in Toposheet No. 56 I/13.

#### 4.3 In case the area forms part of the area covered earlier by exploration then same should be shown in the map with proper scale and a brief description:

No prior studies had been conducted in the Sawalhira East Block area, as discussed in above sub-section. As a result, there was no available information on the quality and quantity of limestone present or its extension into the Sawalhira East Block. This knowledge gap led to the selection of this area for preliminary limestone



exploration, following a field visit and sampling of outcrops by geologists from the Exploration Division of Gemco Kati Exploration Pvt. Ltd. Preliminary field visits, by Geologists of Gemco Kati Exploration Pvt. Ltd., conducted on August 4th, 8th, and 18th, 2023, revealed promising indications of cement-grade limestone deposits. Grab samples collected during these visits showed calcium oxide (CaO) content ranging between 46.01% and 50.46%, confirming the presence of high-quality limestone.

## CHAPTER-5

### GEOLOGY OF THE AREA

#### 5.1 Aerial reconnaissance:

The satellite photograph (**Figure 2: Refer list of Figures**) indicates that the terrain of the Sawalhira East block is mostly flat to gently undulating. Drainage patterns reveal the influence of the underlying lithology, and moderate surface water flow is visible through local channel networks. The topography shows a gentle slope and a more dissected northward area due to erosion, while accessibility is good to moderate with visible roads along the boundaries and nearby areas.

#### 5.2 Regional geological set up of the area:

Geological investigations in Chandrapur district have identified a diverse range of stratigraphic units, spanning from the Archean to recent alluvium and laterites. The middle to late Proterozoic sedimentary formations of the Pranhita-Godavari Valley occurs in two narrow, linear strips along the margins of a NW-SE trending belt of the Gondwana Supergroup, extending across parts of Telangana, Maharashtra, and Madhya Pradesh (Heron, 1949). The succession along the northern part of the outcrop belt, situated on the southwestern flank of the valley, was initially termed the Penganga Series (Heron, 1949) and later redefined as the Penganga Group by Chaudhuri et al. (1989), who also established its stratigraphic succession in the type area near Adilabad (**Table 4**).

The pre-Proterozoic rocks extend for approximately 400 km, following the general trend of the river valley, and are bordered by the Archean Basement Complex (Chaudhuri et al., 1989). The Penganga Group is divided into three formations, listed in ascending order: the Pranhita Sandstone, the Chanda Limestone, and the Sat Nala Shale (Chaudhuri et al., 1989). Rb-Sr dating of glauconitic minerals from the lower part of the succession yielded ages of  $770 \pm 30$  Ma and  $790 \pm 30$  Ma (Chaudhuri et al., 1989). The investigation area is primarily composed of the Chanda Limestone and Satnala Shale of the Penganga Group. The Chanda Limestone is a bedded lithographic limestone that was deposited in a deep-water ramp, below the wave base. It contains intercalated beds of intraformational lime-clast conglomerates and calcarenites, which were deposited as debris flows at different intervals (Chaudhuri et al., 1989). This limestone gradually transitions upward into the thinly laminated brown shale of the Satnala Shale through a limestone-shale heterolithic horizon. The shale is devoid of siliciclastics coarser than mud and lacks wave- or current-generated structures, indicating its deposition in a deep basinal environment.

**Table 4. A lithostratigraphic classification (Chaudhuri et al., 1989) is given below.**

| Group/supergroup | Formation           | Member                | Lithology  | Geological Age          |
|------------------|---------------------|-----------------------|--|-------------------------|
| Alluvium         | Alluvium            | -                     | Gravels, sand, silt and clay   | Quaternary              |
| Deccan Trap      | Basaltic Lava Flows | -                     | Dark grey to grey, fine grained, amygdaloidal, massive hard compact basalt   | Cretaceous to Paleogene |
| Penganga group   | Satnala Shale       | Chocolate brown shale | Thin-bedded, monotonous chocolate brown shale, intercalated off-white layers   | Meso to Neo-Proterozoic |
|                  | Chanda Limestone    | Bilari Member         | Massive, medium to thick bedded steel grey lime mudstone with stratiform Stylolites  |                         |
|                  |                     | Ramai Member          | Massive, medium to thick-bedded pink, dolomitic lime mudstone with stratiform stylolites. Stratiform dolomites formed locally.   |                         |
|                  |                     | Bhimsari Member       | Massive, medium to thick-bedded Lime mudstone, brown limestone- shale. A few beds of mass-flow conglomerates. A lenticular body of glauconitic sandstone of mass-flow origin at the lower part |                         |
|                  | Pranhita sandstone  | Shale member          | Thin laminated green mudstone grading upwards to brown shale.  |                         |

### 5.3 Surface indication of mineralization:

The present G3 stage project investigates the Chanda Limestone Formation of the Penganga Group in Sawalhira East block area. The Penganga limestone deposits in block area exhibit distinct surface indications in the form of limestone outcrops, which are more prominently seen along channel/nala beds as well as channel/nala cuttings indicating the lateral continuity of the deposit. The Penganga limestone also exhibits low vegetation cover in exposed zones, which is a common characteristic of carbonate-rich terrains due to poor soil development. Limestone deposits in block area occur as stratified sedimentary formations within the Proterozoic Penganga Group. The limestone is predominantly bedded, massive to thickly bedded, and extends laterally over a significant area, forming continuous bands. The block area also contain dolomite. The dolomitic limestone unit consists of pinkish-grey to greyish-white rocks that exhibit elephant skin weathering. These rocks are hard, compact, and massive, breaking with a conchoidal fracture. The limestone occurs interbedded with shale and minor siliceous layers, indicating periodic changes in depositional conditions.

## CHAPTER-6

### ACTIVITY DURING THE PERIOD (GEOSCIENCE INVESTIGATION)

#### 6.1 Detailed Geological mapping on 1: 4,000 scale:

Systematic geological mapping at a 1:4,000 scale was carried out in the block. The objective of the geological mapping was to conduct detailed geological mapping of the block to identify limestone having industrial grade. During the geological mapping, the following lithologies were identified in the block area: limestone, siliceous limestone, and shales, all belonging to the Penganga Group.

#### 6.2 Outcrop maps on 1: 4,000 scale:

The geological map illustrates the distribution of different lithologies in the mapped area. Further details are provided in the description of rock types section. A considerable portion of the area is relatively flat. The geological map at a 1:4,000 scale has been prepared by plotting lithological outcrops and litho-contacts. The outcrop map is given in (Figure 3: Refer list of Figures).

#### 6.3 Topographical survey on 1: 4,000 scale:

The Sawalhira East block area comprises an area of 5 sq. km or 500 hectares and falls in Survey of India Toposheet No. 56I/14. Establishment of block corner coordinates by DGPS and preparation of Topographical map of the block was carried out by inhouse surveyor. The block boundary has been demarcated with the help of DGPS. The base line was fixed considering the topographical features. The entire block was surveyed with the help of DGPS instrument using the UTM co-ordinates (UTM Zone 44Q North) of the block. The features like drainage, hut, cart tracks, foot tracks, borewell, power line and road were delineated. The block boundary coordinates and core drilling borehole coordinates were fixed using DGPS. The surface contour plan of 1:4000 scale has been prepared. Topographic map was prepared with the contour interval of 1m (Figure 4: Refer list of Figures).

#### 6.4 Description of Rock Types:

Geologically, the study area consists of several rock units, including limestone, dolomitic limestone, dolomite, and shales, all belonging to the Penganga Group. These units are described as follows:

##### Limestone

Limestones are thinly to thickly bedded in nature and vary from light grey to dark grey, white to pinkish white and buff in colour, fine grained, compact and contain partings of calcareous shale along the bedding planes. However, at places massive limestone with indistinct bedding planet has also been noted. The Chanda Limestone of the Penganga Group is a micritic limestone characterized by laterally continuous rhythmites. It exhibits a variety of colors, ranging from grey to greenish grey, brown and pink to fawn. This limestone is

siliceous, fine-grained, massive, and compact, with a conchoidal fracture. It is primarily thickly bedded, with individual beds varying in thickness, and shows the development of stylolitic structures.

### **Shale**

The lithounit occupying the mapped area is characterized by a reddish-brown to purple color, with occasional greenish to olive-green hues. These shales are thinly bedded, fissile, hard, and compact, exhibiting discoidal and splintery fragmentation. Intercalations of limestone, sometimes argillaceous, transition gradually into the shales. Thin chert intercalations are also present within the shale. Additionally, calcite veins have intruded both the shales and limestones along joint planes.

### **Dolomite/Dolomitic Limestone**

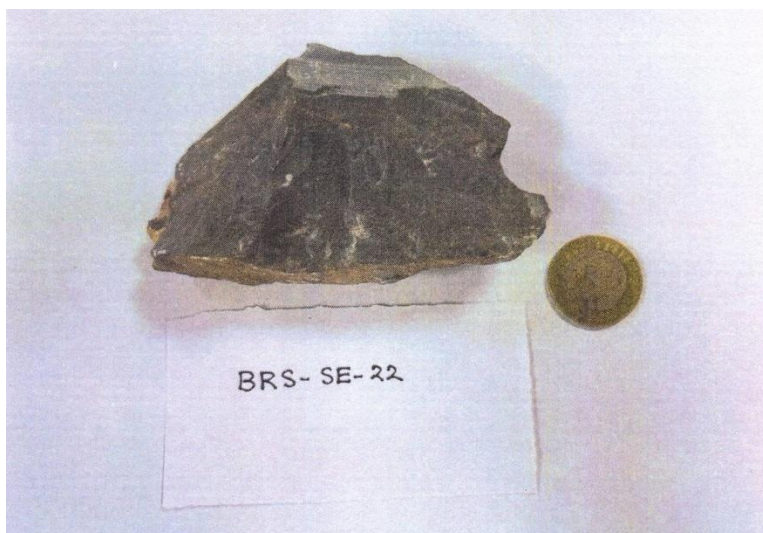
The dolomitic limestone unit consists of pinkish-grey to greyish-white rocks that exhibit elephant skin weathering. These rocks are hard, compact, and massive, breaking with a conchoidal fracture.

### **Soil/Alluvium**

The region is also covered by a thick layer of alluvium. The alluvial layer varies in thickness. The soil cover also varies in thickness, ranging from few cm to 3 meters.

### **6.5 Petrological study:**

The petrographic study was carried out on 5 samples selected from different parts of the block area as shown in **Figure 5 (Refer List of Figures)**.

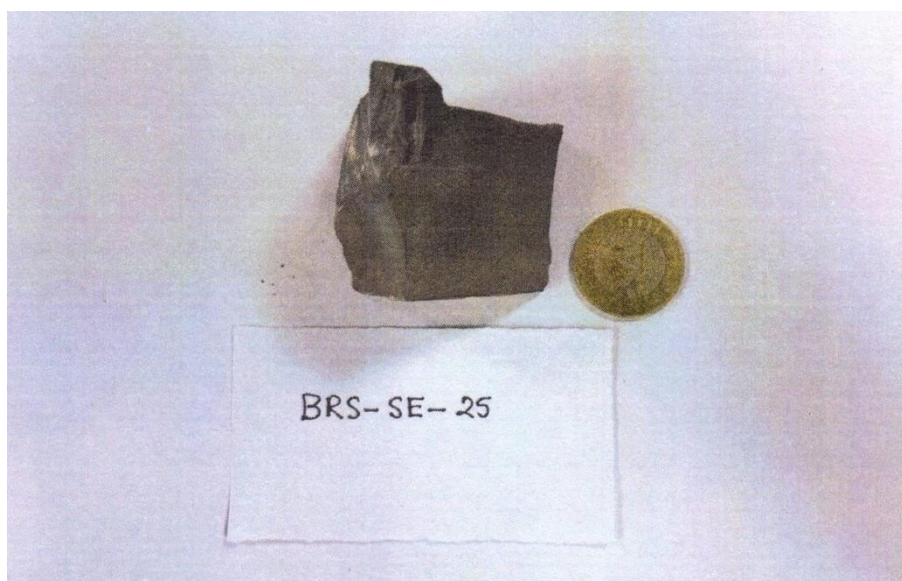


**Figure 6.** Sample number BRS-SE-22. The rock appears very fine -grained and dark in colour. In hand specimen the rock is fine grained, dark grey colored. The rock shows strong effervescence when treated with hydrochloric acid indicating the presence of calcite rich carbonates.



**Figure 7.** Photomicrograph of sample number BRS-SE-22. Photomicrograph reveals very fine-grained microcrystalline carbonates embedded in muddy matrix. Under XPL (2.5X).

The petrographic study reveals an assemblage of very fine-grained, microcrystalline carbonate grains predominantly embedded in a muddy carbonate matrix. Grain size is extremely fine to identify individual carbonate grains even under high magnification in cross polar condition. Strong effervescence and very fine-grained nature indicate that the rock is a carbonate rich limestone. Above all features indicate that the rock is limestone (Microcrystalline carbonate rock).

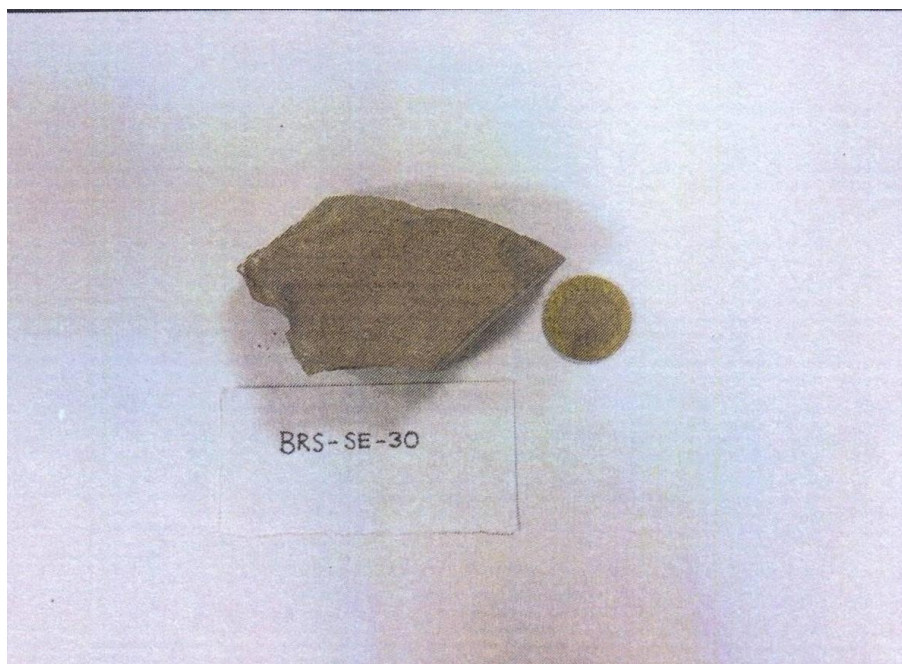


**Figure 8.** Sample number BRS-SE-25. The rock appears fine grained and dark grey in colour. In hand specimen the rock is fine grained, dark grey colored. The rock shows strong effervescence when treated with hydrochloric acid indicating the presence of calcite rich carbonates.

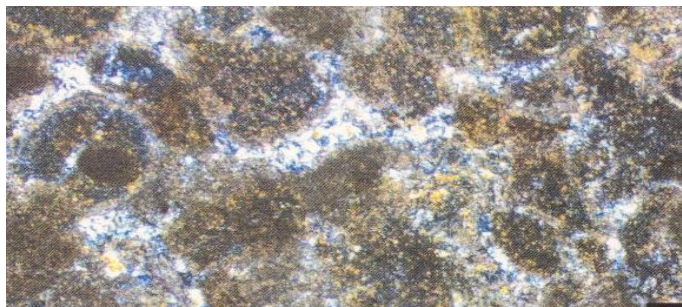


**Figure 9.** Photomicrograph of BRS-SE-25. Photomicrograph reveals fine grained microcrystalline carbonates embedded in micritic matrix. Under XPL.

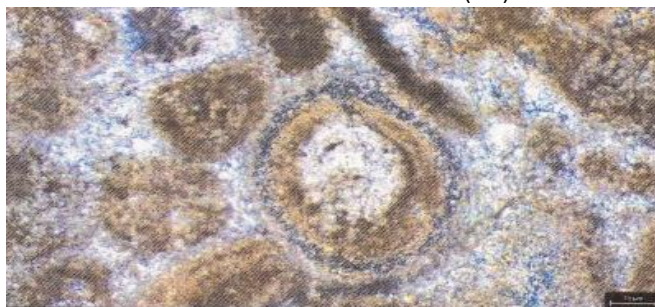
The petrographic study identifies fine-grained, microcrystalline carbonate grains embedded in a micritic matrix. When examined under high magnification in cross-polarized light, the carbonate grains exhibit significant anisotropy and higher-order interference colors. Above all features indicate the rock is limestone (Micritic).



**Figure 10.** Sample number BRS-SE-30. The rock appears fine grained and grey in colour. In hand specimen the rock is fine grained, dark grey colored. The rock shows strong effervescence when treated with hydrochloric acid indicating the presence of calcite rich carbonates.



**Figure 11.** Photomicrograph of BRS-SE-30. Photomicrograph showing oval and sub oval pelloids within micritic matrix. Under XPL (5X).

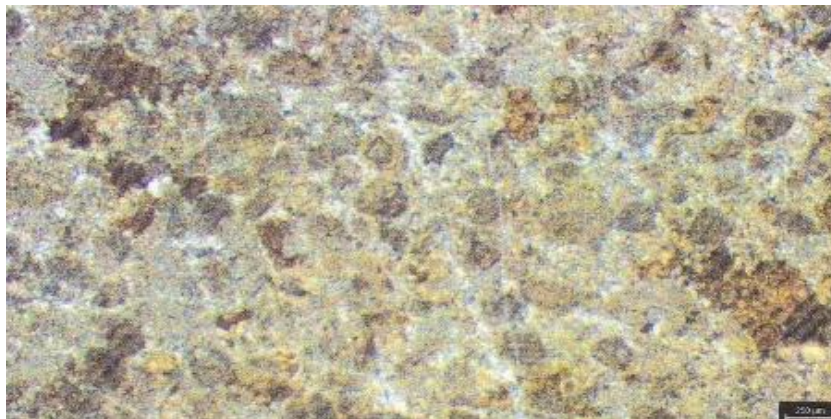


**Figure 12.** Photomicrograph of BRS-SE-30. Photomicrograph showing spherical ooids under XPL (10X). The petrographic studies show presence of oval to sub oval grains of pelloids. However, some of grains are spherical in shape with concentric rings resembling ooids. Pelloids and ooids are embedded in extremely fine-grained carbonate matrix. Extremely fine-grained iron oxide dusts are noticed at places. All above features indicate the rock is limestone (Pelmicritic).

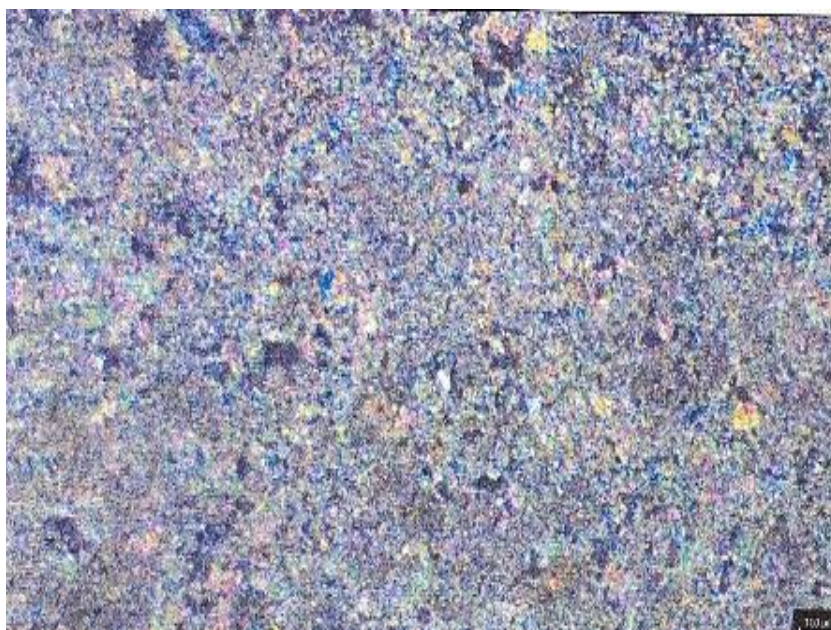


**Figure 13.** Sample number BRS-SE-35. The rock appears fine grained dark grey in colour with stringers.

In hand specimen the rock is fine grained, dark grey colored with very fine veinlets. The rock shows strong effervescence when treated with hydrochloric acid indicating the presence of calcite rich carbonates.

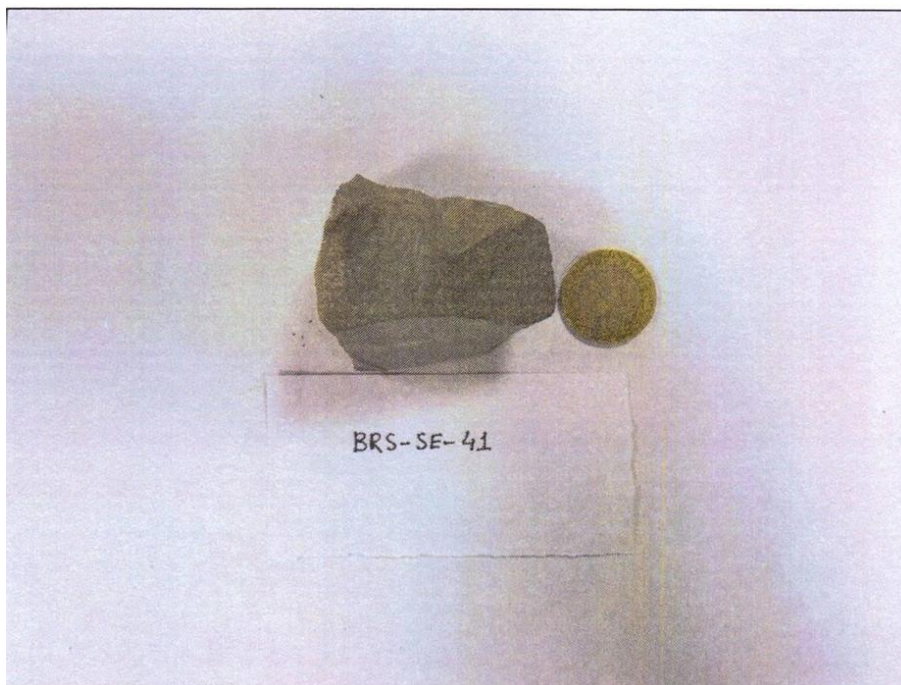


**Figure 14.** Photomicrograph of BRS-SE-35. Photomicrograph showing pelloids within micritic matrix under XPL (2.5X).



**Figure 15.** Photomicrograph of BRS-SE-30. Photomicrograph showing fine grained calcite grains with a variegated higher-order interference colour, set within a micritic matrix. Under XPL (5X).

The petrographic studies show presence of oval to sub oval grains of pelloids. However, some of pelloids are spherical in shape. Pelloids are embedded on micritic matrix. Under high magnification and cross polarized light, micritic carbonate grains (calcite) are anisotropic and show higher order interference colors. Extremely thin veinlets of carbonate are also observed in the rock. All above characteristics indicate the rock is limestone (Pelmicritic).



**Figure 16.** Sample number BRS-SE-41. The rock appears fine-grained and dark grey in colour.

In hand specimen the rock is fine grained, dark grey colored. The rock shows strong effervescence when treated with hydrochloric acid indicating the presence of calcite rich carbonates.



**Figure 17.** Sample number BRS-SE-41. Photomicrograph illustrates a calcite-quartz rich veins traversing through a medium-fine grained carbonate rich micritic matrix, predominantly composed of calcite. Under XPL (2.5X).

The petrographic analysis indicates that the rock is medium to fine grained and the carbonate grains are embedded within the micritic matrix. The rock is traversed by relatively coarser carbonate veins that are predominantly made of carbonate. Under high magnification and cross polarized light, micritic carbonate

grains (calcite) are anisotropic and show higher order interference colors. All above characteristics indicate the rock is limestone (Micritic).

### **6.6 Whole rock analysis (Major oxides)/Bed rock samples (BRS):**

The whole rock analysis was carried out on 45 bed rock samples selected from different parts of the block area as shown in **Figure 18 (Refer list of figures)**. The results of major oxides of BRS samples are provided in the table of **Annexure 1**. The major oxides results show significant values of CaO indicating presence of limestone in Sawalhira East block area. The significant CaO content indicates shallow occurrence of cement grade limestone. SiO<sub>2</sub> content is relatively high in analyzed BRS samples from the block area. Sulphur and phosphorus content is negligible. Among 45 bed rock samples about 24 BRS samples yielded CaO content of more than 40%. About 21 BRS samples yielded CaO content of less than 40%.

### **6.7 Structure:**

The following structural elements associated with the limestone in the Sawalhira East Block are observed in the area:

**Bedding:** The limestone in the Sawalhira East Block exhibits distinct bedding characteristics, primarily thickly bedded, except, where intercalated with argillaceous limestone. The shales are typically thinly bedded intercalated with argillaceous limestone. The regional strike of the beds varies from NW-SE to NNW-SSE. The beds display dips, ranging from sub-horizontal to 23°.

**Joints:** The limestone exhibits multiple sets of vertical to sub-vertical joints, influencing its structural integrity and potential fragmentation.

The dipping beds cutting across the contours indicates the orientation and inclination of limestone beds relative to the topography of the land. In the studied area as observed in the field limestone beds have sub-horizontal to 23° dip which are resulting in cutting across the contours which are lines of equal elevations.

### **6.8 Metamorphism:**

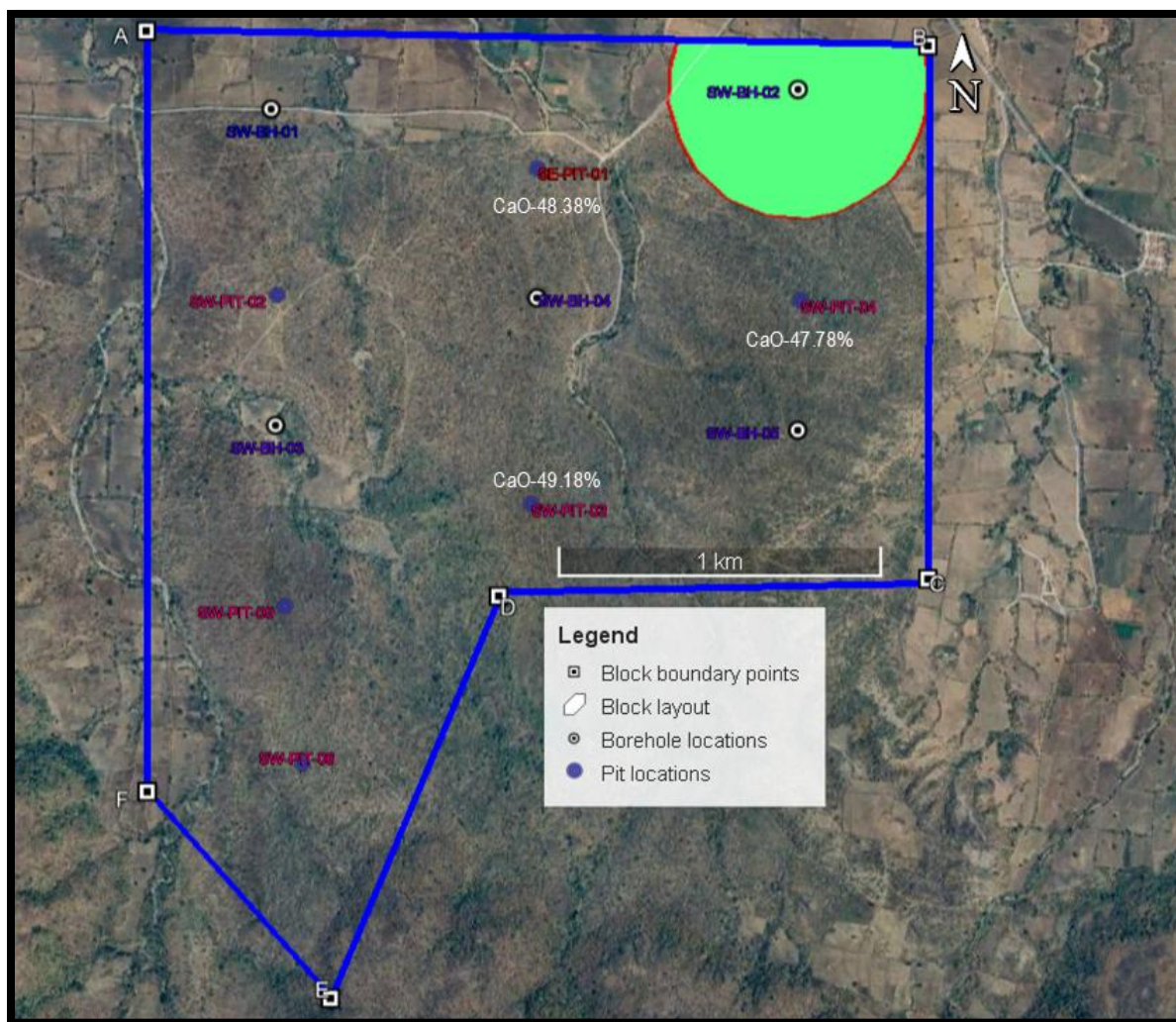
The Penganga Limestone has undergone low-grade regional metamorphism due to tectonic activity and burial processes. The degree of metamorphism varies across the region, with localized recrystallization observed in some areas. The primary effects include the development of compact and crystalline textures, dolomitization, and the presence of silicified zones.

## 6.9 Pitting:

To fill the gap in drilling spacing, approximately 6 pits were excavated in the Sawalhira East Block to characterize the limestone (**Figure 19**). The dimensions of the pits were 1m × 1m × 1m. The results of analysis of major oxides of pits samples are shown in table of **Annexure 2**. The bed rock samples of limestone beds were collected from the pits to analyze their grade.

The results of 6 pits having 1-meter depths yielded good results in 3 pits. Pit number 1, 3 and 4 yielded CaO values of 48.38%, 49.18% and 47.78% (**Annexure 2**). The three pits yielded relatively lower CaO content.

**Figure 19.** Location map of pits in Sawalhira East Block. Map also shows identified potential area having resources is in green shaded colour.





## CHAPTER-7

### MINERAL PROSPECT

#### 7.1 Surface indication:

The Penganga limestone deposits in block area exhibit distinct surface indications that signal the presence of limestone. The most prominent feature is the extensive limestone outcrops, which appear as light grey to buff-colored, massive to thick-bedded exposures. These outcrops are more prominently seen along channel beds as well as channel cuttings indicating the lateral continuity of the deposit.

In certain areas, iron oxide staining along fractures and joints points to minor secondary alteration, likely due to groundwater interaction. The Penganga limestone also exhibits low vegetation cover in exposed zones, which is a common characteristic of carbonate-rich terrains due to poor soil development.

#### 7.2 Mode of occurrence:

The Penganga limestone deposits in block area occur as stratified sedimentary formations within the Proterozoic Penganga Group. The limestone is predominantly bedded, massive to thickly bedded, and extends laterally over a significant area, forming continuous bands. The limestone occurs interbedded with shale and minor siliceous layers, indicating periodic changes in depositional conditions.

Structurally, the limestone beds exhibit gentle dips influenced by regional tectonic activity. In some areas, dolomitization and recrystallization have altered the primary carbonate texture. The limestone bed is largely exposed at the surface with occurrences extending to subsurface depths as indicated by drilling studies.

#### 7.3 Strike length and width of anomalies:

Regional trend of the litho-units is variable from NW-SE to NNW-SSE and at places becomes almost N-S with dips varying from 7° to 23°.

#### 7.4 Alteration zones:

Calcite veins have intruded both the shales and limestones along joint planes. No prominent zone of alteration was observed during the investigation of the block area.

#### 7.5 Genesis of mineralization:

The Penganga Limestone of block area is part of the Proterozoic Penganga Group. The genesis of mineralization of this limestone is primarily attributed to marine sedimentation under shallow-water conditions during the Proterozoic era. The deposition occurred in a stable shelf environment, where calcium carbonate precipitation was dominant. Periodic fluctuations in sea level and environmental conditions led to the development of argillaceous and siliceous intercalations, which influenced the purity and texture of the limestone. The presence of stromatolitic structures indicates biogenic activity, suggesting microbial precipitation played a role in its formation.



Post-depositional processes such as diagenesis and secondary enrichment further influenced the mineralization. The limestone underwent compaction, recrystallization, and pressure solution, leading to textural and mineralogical modifications. In some areas, hydrothermal activity and groundwater circulation contributed to dolomitization and secondary calcite veining, enhancing the carbonate content. Overall, the genesis of the Penganga Limestone is a result of primary sedimentary deposition modified by subsequent diagenetic and hydrothermal processes.

## CHAPTER-8

### EXPLORATION SYSTEMATIC DRILLING

#### 8.1 Spacing of boreholes should be as per MEMC, 2015:

A total of five boreholes were planned for drilling in the Sawalhira East Block to study the subsurface continuity of limestone formations (**Figure 20: Refer list of figures**). The drilling was designed in a polygonal pattern, with borehole spacing of 400 meters as per MEMC, 2015. From five approved boreholes only two boreholes were drilled up to a depth of 60 meters each, due to delay in permission from the Forest Department.

The drilling was conducted to intersect the limestone formations and understand their lateral and vertical continuity. The borehole cores logged. Logging was conducted run-wise, and the data for each drill hole were systematically recorded in a register. Based on the collected data, lithologies of the boreholes were prepared.

#### 8.2 Methodology of drilling with details of type of drilling:

Core drilling for limestone was carried out using inhouse the **Voltas-60** (KC 30) model drill rig, ensuring good core recovery for geological and stratigraphic analysis. The drilling methodology followed a systematic approach, including site preparation, drill rig setup, and core recovery. Two boreholes were drilled up to 60 meters each accordingly. Drilling was terminated upon reaching the planned depth.

#### 8.3 Borehole planning, co-ordinates, RL of collar, borehole logging:

The drilling was designed in a polygonal pattern, with borehole spacing of 400 meters as per MEMC 2015. Each borehole was geologically logged to record textural, mineralogical, and structural details. The lithologies encountered in the boreholes were identified using accepted nomenclature. Since the drilling commodity was limestone, core samples were collected after macroscopic examination and acid testing. The samples were arranged in a book pattern and appropriately marked with a marker for identification. The borehole coordinates and RL of the borehole collars are given in **Table 5**.

| Table 5. Borehole Co-ordinates and RL of collar. |              |               |               |                       |
|--|--------------|---------------|---------------|-----------------------|
| S.N.   | Borehole No. | Latitude      | Longitude     | RL of borehole collar |
| 1  | SW-BH-01     | 19°41'36.00"N | 78°58'50.00"E | 268.834m              |
| 2  | SW-BH-02     | 19°41'37.97"N | 78°59'46.16"E | 278.59m               |

#### 8.4 Mineralogy of limestone zone:

The mineralogy of the limestone ore zone primarily consists of calcite ( $\text{CaCO}_3$ ) as the dominant mineral, with varying proportions of siliceous limestone in majority of zones. Impurities such as quartz, clay minerals, and iron oxides are also present. The texture and composition of the limestone vary across the boreholes, reflecting depositional and diagenetic processes. The geochemical analysis of borehole core samples indicates that the limestone present in the Sawalhira East Block is siliceous in nature, as evidenced by its relatively high  $\text{SiO}_2$  content.

#### 8.5 Methodology of limestone zone sampling and composite sample preparation:

Ore zone sampling for limestone was conducted systematically to ensure representative sample collection for analysis. Samples were collected at 1.5-meter intervals from the drill cores. Based on the drilling depths, samples were prepared for boreholes extending up to 60 meters accordingly. Based on the drilling depths, 40 samples were collected from two boreholes of 60 meters each, resulting in a total of 80 samples. Core samples were split using a diamond saw (**Figure 21**), with one half retained for submitting to Central Core Library, GSI, Nagpur and the other half used for geochemical analysis. Few intact core samples were used for bulk density analysis. The prepared samples were securely packed in labeled sample bags for geochemical analysis. The graphic lithologs, of 2 drilled boreholes in Sawalhira East block, based on composite sample analysis results were prepared and shown in **Figure 22 (Refer list of figures)** and in **Annexures 4 & 5 tables**.



**Figure 21.** Core Cutting Laboratory of Gemco Kati Exploration Pvt Ltd.

### 8.6 Composite samples analysis [Primary and check samples]:

The **annexure-3 table** presents the geochemical analysis of 8 composite core samples collected from 2 boreholes. These samples were initially analyzed at Shiva Lab, Bangalore, and subsequently, check samples were analyzed at JNARDDC, Nagpur, for validation and correlation of results. There is a good correlation between CaO, MgO, Fe<sub>2</sub>O<sub>3</sub> and other values in primary and check samples, validating the accuracy of the results. The correlation between the primary and check sample results indicates consistency and reliability in the analysis, ensuring accurate geochemical data analysis. **(Refer annexure-3)**

### 8.7 Details of intersected zones of the boreholes drilled and their correlation:

The borehole SW-BH-02 composite sample analysis shows presence of limestone (Blendable/beneficial for cement) from the depth of 0m to 6m having thickness of 6 meters.

1. Borehole SW-BH-02 Zone 1 (Depth: Surface to 6m) (Average CaO – 35.08%) (MgO – 1.82%)

Limestone zones (Blendable/beneficial for cement) are separated based on 34% to less than 42% CaO based on End User Classification of Indian Bureau of Mines.



## CHAPTER-9

### RESOURCE ESTIMATION

#### 9.1 Detailed description of ore zones:

Exploration at G-3 level was carried out by Gemco Kati Exploration to establish strike extent, depth continuity, grade and thickness of limestone horizon in Sawalhira East block. A total of 2 vertical boreholes could have been drilled out of proposed 5 BHs, within an area of 5 sq. km. Therefore the resources is downgraded and categorised under 334.

#### 9.2 Cutoff grade and industrial utilities:

The specifications of limestone for industrial uses are as follows: Cement Industry

CaO: 42% (minimum)

MgO: 4% (max.)

Silica: 16% (max.)

Al<sub>2</sub>O<sub>3</sub>: 2 (max.)

Fe<sub>2</sub>O<sub>3</sub>: 2% (max.)

SO<sub>3</sub>: 1.75% (max.)

Separation of cement grade limestone zones is based on cut-off i.e. minimum 42% CaO, 4% MgO (Max.) and 16% SiO<sub>2</sub> (Max.).

#### Indian Bureau of Mines has threshold value of limestone as mentioned below:

Limestone zones (Blendable/beneficiable for cement) have also been separated based on CaO content, ranging from 34% to 42%. For limestone deposits in Chhattisgarh, Gujarat, Himachal Pradesh, Madhya Pradesh, Maharashtra, Rajasthan, Uttarakhand & Uttar Pradesh - CaO - 34% (min), MgO - 4% (max).

“Threshold Value of minerals” means limit prescribed by the Indian Bureau of Mines based on the beneficiability and marketability of a mineral for a given region and a given time, below which a mineral obtained after mining can be discarded as waste.

#### 9.3 Specific gravity/bulk density calculation:

Bulk density analysis was conducted to determine the physical properties of the limestone. Two core samples from two boreholes were analyzed at Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC), Nagpur, to obtain bulk density measurements. The average of the two bulk density values was considered for resource calculation.

1. SW-BH-01 : 2.67

2. SW-BH-02 : 2.68

Average bulk density : 2.68

#### 9.4 Assumption for resource estimation:

The following assumptions are made while estimating the resources of limestone:

1. The radius of an area of influence of a borehole is taken as 400meters for determining an area containing limestone resources. The area is in Sq. m.
2. Since limestone are of bedded nature, they are assumed to have the same thickness and quality within their area of influence of the boreholes.
3. The bulk density value is 2.68 g/cc is taken as the average of two core samples which were analyzed from JNARDDC, Nagpur.
4. 5 boreholes were planned in an 800m × 800m polygon pattern, as per MEMC 2015, within the block. However, due to forest permission issues, only two boreholes are drilled up to now.
5. The interpretation of exploration data is based on the assumption of a gradual change between borehole observation points.

#### 9.5 Resource estimation:

1. Borehole SW-BH-02 Zone 1 (Depth: Surface to 6m) (Average CaO – 35.08%) (MgO – 1.82%) Limestone zones (Blendable/beneficial for cement) are separated based on 34% to less than 42% CaO based on End User Classification of Indian Bureau of Mines. Potential area of blendable grade limestone based on end user classification of IBM:

- Potential area – 37 hectare
- Average CaO% - 35.08%
- Depth range – From surface to 6-meter depth.
- Bulk density value -2.68.
- Resources based on influence area (400 m based on MEMC rule 2015) of borehole within block –  
Area × Thickness × Bulk density
- Resources = 365661×6×2.68
- Resources = 5.87 million tons

Blendable/beneficial Grade Limestone Resources: 5.87 million tons having average CaO% of 35.08%, MgO-1.82%.

#### 9.6 Category of resources as per MEMC, 2015 along with UNFC classification:

The estimated resources are downgraded as Reconnaissance Mineral Resource (334) under the United Nations Framework Classification (UNFC) and the Mineral Evidence and Mineral Content (MEMC) Rules, 2015, as only two boreholes could have been drilled out of proposed 5 BHs, due to forest constraint.

Blendable/beneficial grade limestone having an average CaO content of 35.08%, MgO-1.82% from the surface to 6-meter depth.



## **CHAPTER-10**

### **CORE PRESERVATION**

The two boreholes in non forest area have been drilled out of proposed 5 BHs. There are three BHs falling within forest area have been dropped due to enormous delay in getting forest clearance and more over the grade as evident in two drilled BHs are poor, therefore it is decided not to preserve any drill cores (120 m).

## CHAPTER-11

### CONCLUSION AND RECOMMENDATION

#### 11.1 Conclusion:

1. The G3 stage preliminary exploration in the Sawalhira East Block has identified one potential area containing limestone in bedded form through the boreholes
2. This study identifies the presence of 5.87 million tonnes of limestone resources.
3. The limestone, found between 0 meters and 6 meters depths, has average CaO content of 35.08% and is classified as blendable/beneficial for cement manufacturing.
4. The limestone (Blendable/beneficial for cement manufacturing) bearing potential area is about 37 hectares.
5. Surface values of CaO [Bed rock samples as well as pit samples down to 1 m depth] is of cement grade limestone, but in depth the limestone bands are highly splitted with reduced CaO values.
6. The estimated resources have been downgraded to “Reconnaissance Mineral Resource” (334) under the United Nations Framework Classification (UNFC) and the Mineral Evidence and Mineral Content (MEMC) Rules, 2015, as only two boreholes could be drilled due to non-receipt of forest clearance in time.

#### 11.2 Recommendation:

1. The identified blocks can be considered for auctioning under composite license (CL) for limestone (**Figure 23: Refer list of figures**).

Based on this study, it is suggested that although the resource is presently meager, the block can be further investigated because:

- Borehole-2 geochemical data indicates Blendable/beneficial cement grade limestone at shallower depth from surface to 6-meter depth.
- Scope exists for delineation of additional resources having similar grade with further drilling along the strike direction of the borehole number SW-BH-02. Particularly in shallow depth.

| S.N. | CL block  | Area in hectare | Depth     | BH. No.           | Resources | Grade                        |
|------|-----------|-----------------|-----------|-------------------|-----------|------------------------------|
| 1.   | Limestone | 37              | 0-6 meter | SW-BH-02 (Zone 1) | 5.87 MT   | CaO – 35.08%,<br>MgO – 1.82% |

## CHAPTER-12 EXPENDITURE

| S. No.   | Item of Work *  | Unit *                   | Rates as per SoC * | Approved Qty. | Approved Amount (Rs) | Revised Qty. | Revised Amount (Rs.) |
|----------|---|--------------------------|--------------------|---------------|----------------------|--------------|----------------------|
| <b>A</b> | <b>Geological Mapping Other Geological Work &amp; Surveying</b>                                 |                          |                    |               |                      |              |                      |
|          | Geological mapping, (1:4,000 scale) & Trenching , drilling work                                 |                          |                    |               |                      |              |                      |
| i        | a. Charges for Geologist per day (Field) for geological mapping & trenching work, drilling work | day                      | 11000              | 120           | 1320000              | 100          | 1100000              |
| ii       | b. Labours Charges; Base rate   | day                      | 504                | 240           | 120960               | 200          | 108200               |
|          | c. Charges for Geologist per day (HQ)   | day                      | 9000               | 50            | 450000               | 50           | 450000               |
|          | d. Charges for one Sampler per day (1 Party)  | one sampler per day      | 5100               | 32            | 163200               | 32           | 163200               |
|          | e. Labours (4 Nos)  | day                      | 504                | 128           | 64512                | 128          | 64512                |
|          |   |                          |                    |               | <b>21,18,672</b>     |              | <b>18,90,648</b>     |
| <b>B</b> | <b>Survey work</b>  |                          |                    |               |                      |              |                      |
| a        | DGPS Survey for BH fixation & RL determination  | Per Point of observation | 19,200             | 11            | 211200               | 8            | 1,53,600             |
| b        | Charges of Surveyor (1 party) for Geophysical survey layout work & Block boundary demarcation   | one surveyor per day     | 8,300              | 30            | 249000               | 30           | 249000               |
| c        | Labours Charges for survey work;  | day                      | 504                | 120           | 60480                | 120          | 60480                |
|          | <b>Sub-Total C</b>  |                          |                    |               | <b>5,20,680</b>      |              | <b>4,67,520</b>      |
| <b>C</b> | <b>Trenching/Pitting</b>  |                          |                    |               |                      |              |                      |
|          | a) Excavation of Pit  | per cu.m                 | 3,800              | -             | 0                    | 6            | 22,800               |
| <b>D</b> | <b>DRILLING</b>   |                          |                    |               |                      |              |                      |
| 1        | Drilling up to 300m (Hard Rock)   | m                        | 6,775              | 300           | 2032500              | 120          | 8,13,000             |
| 2        | Borehole deviation Survey by Multishot Camera   | m                        |                    |               |                      |              |                      |
| 3        | Land / Crop Compansation (in case the BH falls in agricultural Land)                            | per BH                   | 20,000             | -             | 0                    |              |                      |
| 4        | Construction of concrete Pillar (12"x12"x30")   | per borehole             | 2,000              | 5             | 10000                | 2            | 4,000 (3 BH dropped) |
| 5        | Borehole plugging by cement   | per borehole             | 150                | -             | 0                    |              |                      |
| 6        | Transportation of Drill Rig & Truck associated per drill (2 rigs)                               | Km                       | 36                 | 400           | 14400                | 400          | 14400                |
| 7        | Monthly Accomodation Charges for drilling Camp (up to 2 Rigs)                                   | month                    | 50,000             | 2             | 1,00,000             | 2            | 1,00,000             |
| 8        | Drilling Camp Setting Cost  | Nos                      | 2,50,000           | 1             | 2,50,000             | 1            | 2,50,000             |

| S. No.   | Item of Work *   | Unit *                                | Rates as per SoC *                                       | Approved Qty. | Approved Amount (Rs) | Revised Qty. | Revised Amount (Rs.) |
|----------|--|---------------------------------------|--|---------------|----------------------|--------------|----------------------|
| 9        | Drilling Camp Winding up Cost  | Nos                                   | 2,50,000   | 1             | 2,50,000             | 1            | 2,50,000             |
| 10       | Road Making (Flat Terrain)   | Km                                    | 22,020   | 2             | 44,040               | 2            | 44,040               |
| 11       | Drill Core Preservation  | per m                                 | 1,590  | 250           | 3,97,500             | -            | -                    |
|          | <b>Sub Total E</b>   |                                       |  |               | <b>30,98,440</b>     |              | <b>14,75,440</b>     |
| <b>E</b> | <b>LABORATORY STUDIES</b>  |                                       |  |               |                      |              |                      |
| 1        | <b>Chemical Analysis</b>   |                                       |  |               |                      |              |                      |
| i)       | <b>Major Oxide Analysis</b>  |                                       |  |               |                      |              |                      |
|          | a) Estimation of major oxides by XRF/whole rock analysis for primary samples (CaO, MgO, SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , LOI, Na <sub>2</sub> O, Fe <sub>2</sub> O <sub>3</sub> , MnO, K <sub>2</sub> O, TiO <sub>2</sub> , SO <sub>3</sub> , P <sub>2</sub> O <sub>5</sub> , Cr <sub>2</sub> O <sub>3</sub> , ZnO, V <sub>2</sub> O <sub>5</sub> ) | per sample                            | 4200   | 230           | 9,66,000             | 131          | 5,50,200             |
|          | Estimation of major oxides by XRF/whole rock analysis for check samples  | per sample                            | 4200   | 23            | 96,600               | 14           | 58,800               |
|          | Determination of insitu Bulk Density   |                                       | 3,540  | 2             | 7,080                | 2            | 7,080                |
| 2        | <b>Physical &amp; Petrological Studies</b>   |                                       |  |               |                      |              |                      |
| i        | Preparation of thin section  | Nos                                   |  |               |                      |              |                      |
| ii       | Study of thin section  | Nos                                   |  |               |                      |              |                      |
| iii      | Preparation of polish section  | Nos                                   | 1,549  | 5             | 7,745                | 5            | 7,745                |
| iv       | study of polished section  | Nos                                   | 4,232  | 5             | 21,160               | 5            | 21,160               |
| v        | Digital Photographs  | Nos                                   | 280  | 10            | 2,800                | 10           | 2,800                |
| vi       | Whole Rock Analysis  | Nos                                   |  |               |                      |              |                      |
| vii      | Sp. Gravity  | Nos                                   |  |               |                      |              |                      |
|          | SEM Studies  | per hour                              |  |               |                      |              |                      |
| viii     | EPMA studies   | per hour                              |  |               |                      |              |                      |
|          | <b>Sub total</b>   |                                       |  |               | <b>11,01,385</b>     |              | <b>6,47,785</b>      |
|          | <b>Total</b>   |                                       |  |               | <b>68,39,177</b>     |              | <b>45,04,193</b>     |
| <b>G</b> | <b>Geological Report Preparation</b>   | <b>5 Hard copies with a soft copy</b> | <b>5.2 (i/ii/iii/iv)</b>                                 |               | <b>3,41,959</b>      |              | <b>2,25,210</b>      |
| <b>H</b> | <b>Peer review Charges</b>   |                                       |  |               | <b>30,000</b>        |              | <b>30,000</b>        |
| <b>I</b> | <b>Preparation of Exploration Proposal (5 Hard copies with a soft copy)</b>  | <b>5 Hard copies with a soft copy</b> | <b>2% of the Cost or Rs. 5.0 Lakhs whichever is less</b> |               | <b>1,36,784</b>      |              | <b>90,084</b>        |
|          |  |                                       |  |               | <b>73,47,919</b>     |              | <b>48,49,487</b>     |
|          |  |                                       |  |               | <b>13,22,625</b>     |              | <b>8,72,908</b>      |
|          |  |                                       |  |               | <b>86,70,545</b>     |              | <b>57,22,394</b>     |
|          |  |                                       | <b>or Say Rs. In Lakhs</b>                               |               | <b>86.71</b>         |              | <b>57.22</b>         |



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## CHAPTER-14 LOCALITY INDEX

| S.N. | Locality  | Latitude       | Longitude      |
|------|-----------|----------------|----------------|
| 1    | Pardi     | 19° 44' 20.00" | 78° 55' 05.00" |
| 2    | Khadki    | 19° 49' 30.00" | 78° 52' 30.00" |
| 3    | Chopan    | 19° 43' 30.00" | 78° 57' 10.00" |
| 4    | Sawalhiri | 19°41'42.00"   | 78°58'18.88"   |

## LIST OF FIGURES

Figure 1. Sawalhira East block on Toposheet No. 56I/14 of SOI (1:50,000 scale). (Source: SOI Toposheet).

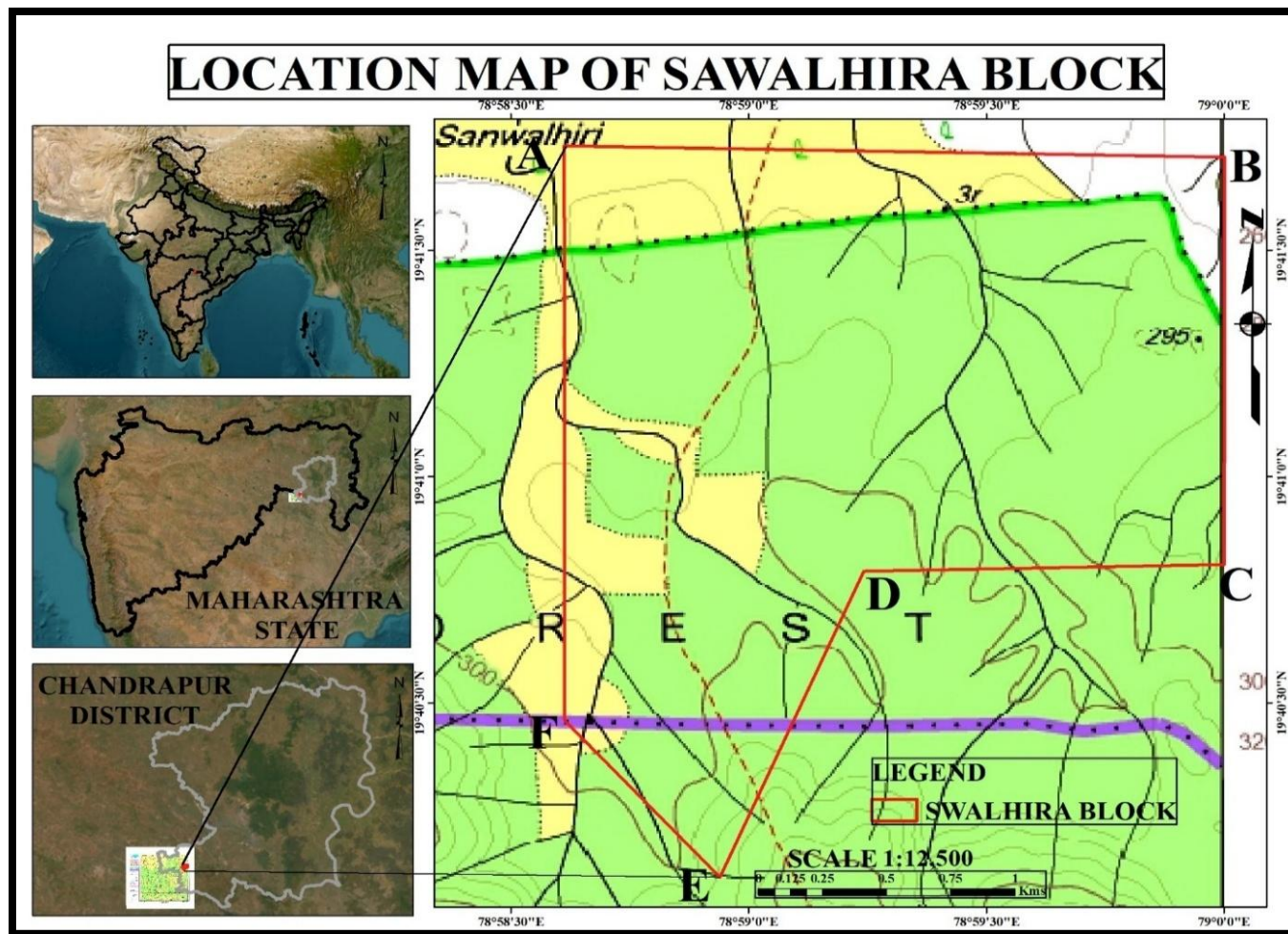
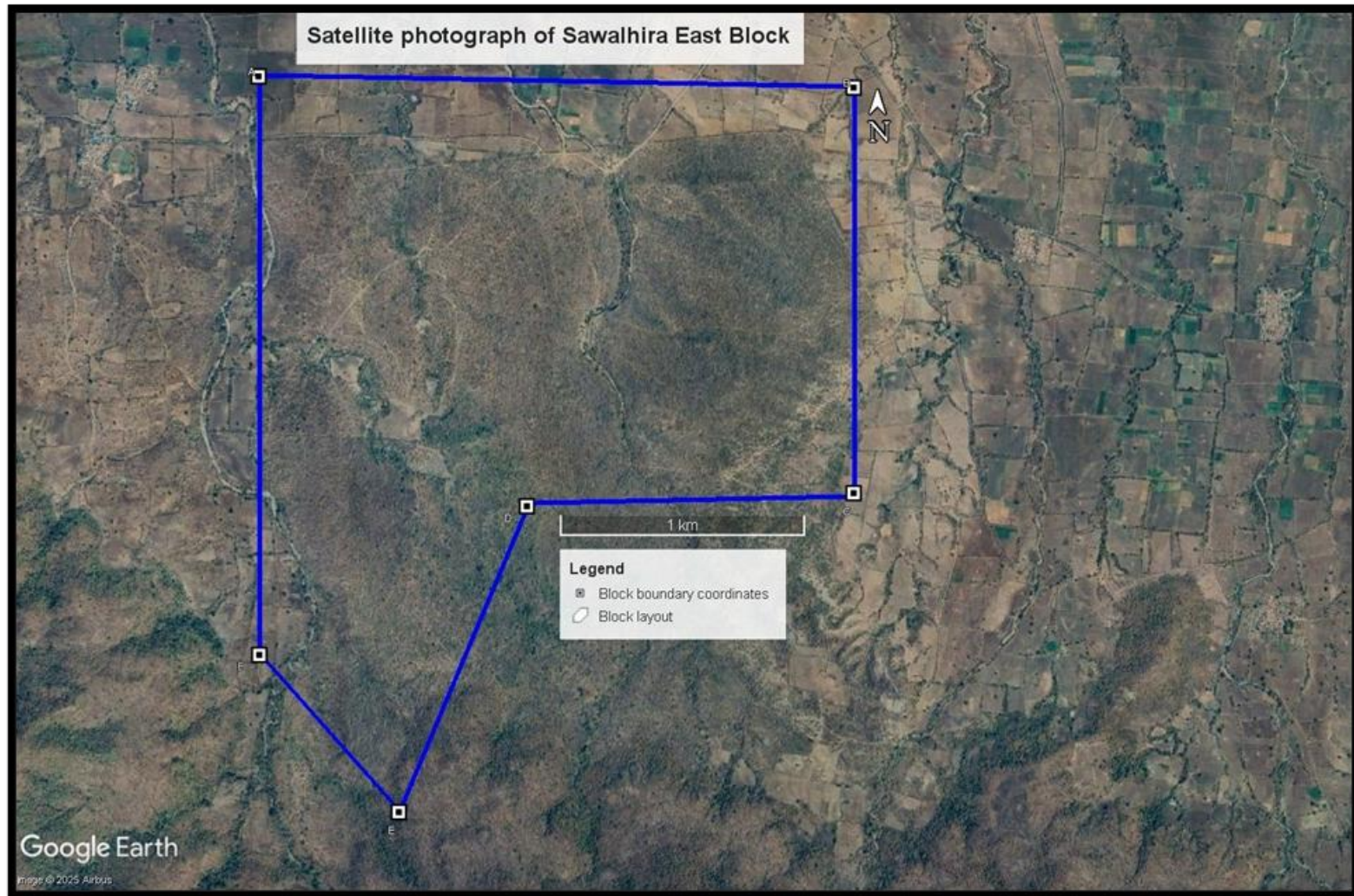


Figure 2. Satellite photograph of Sawalhira East Block. (Source: Google Earth)



**Figure 3. Outcrop map of Sawalhira East block on 1:4,000 scale.**

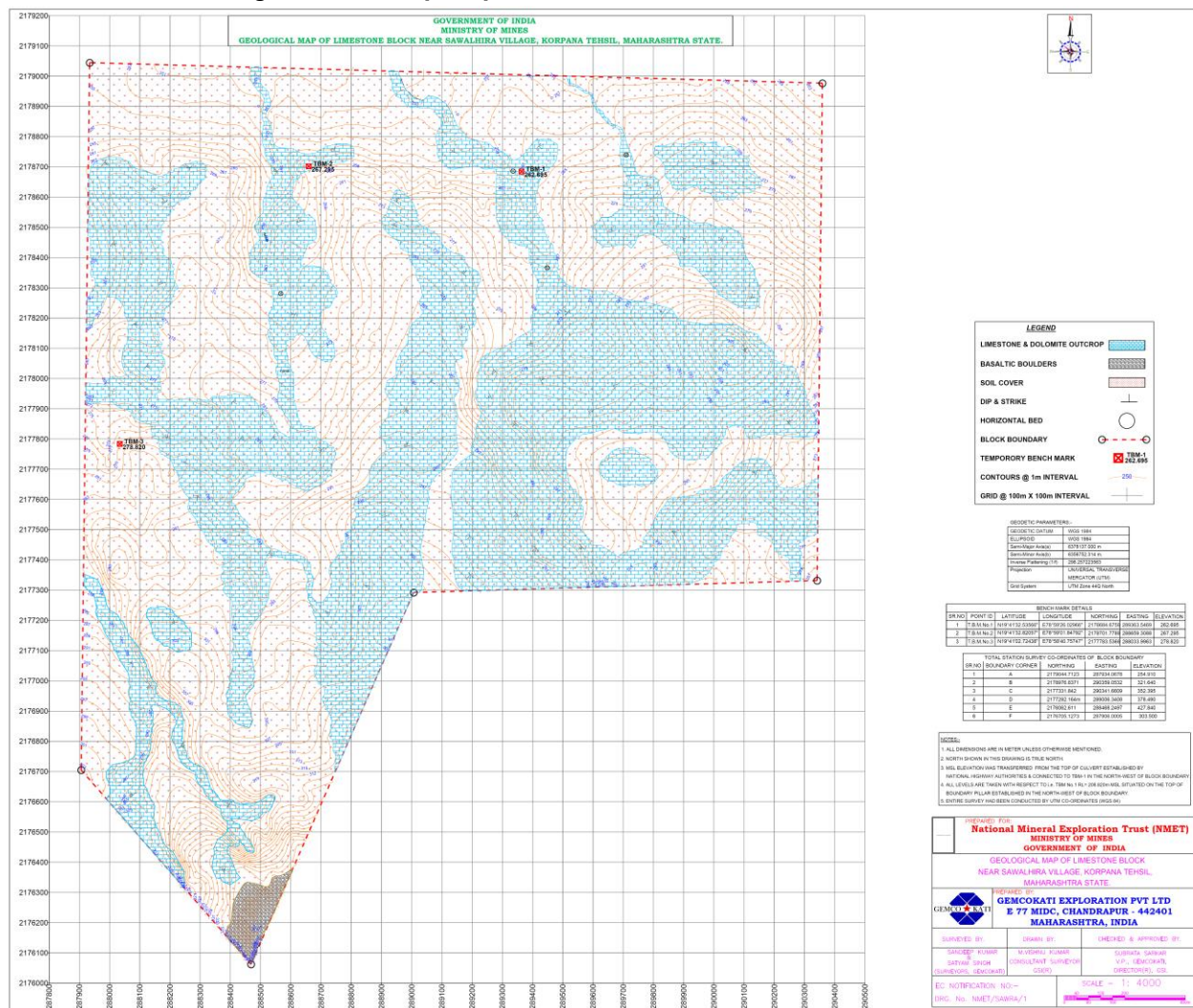
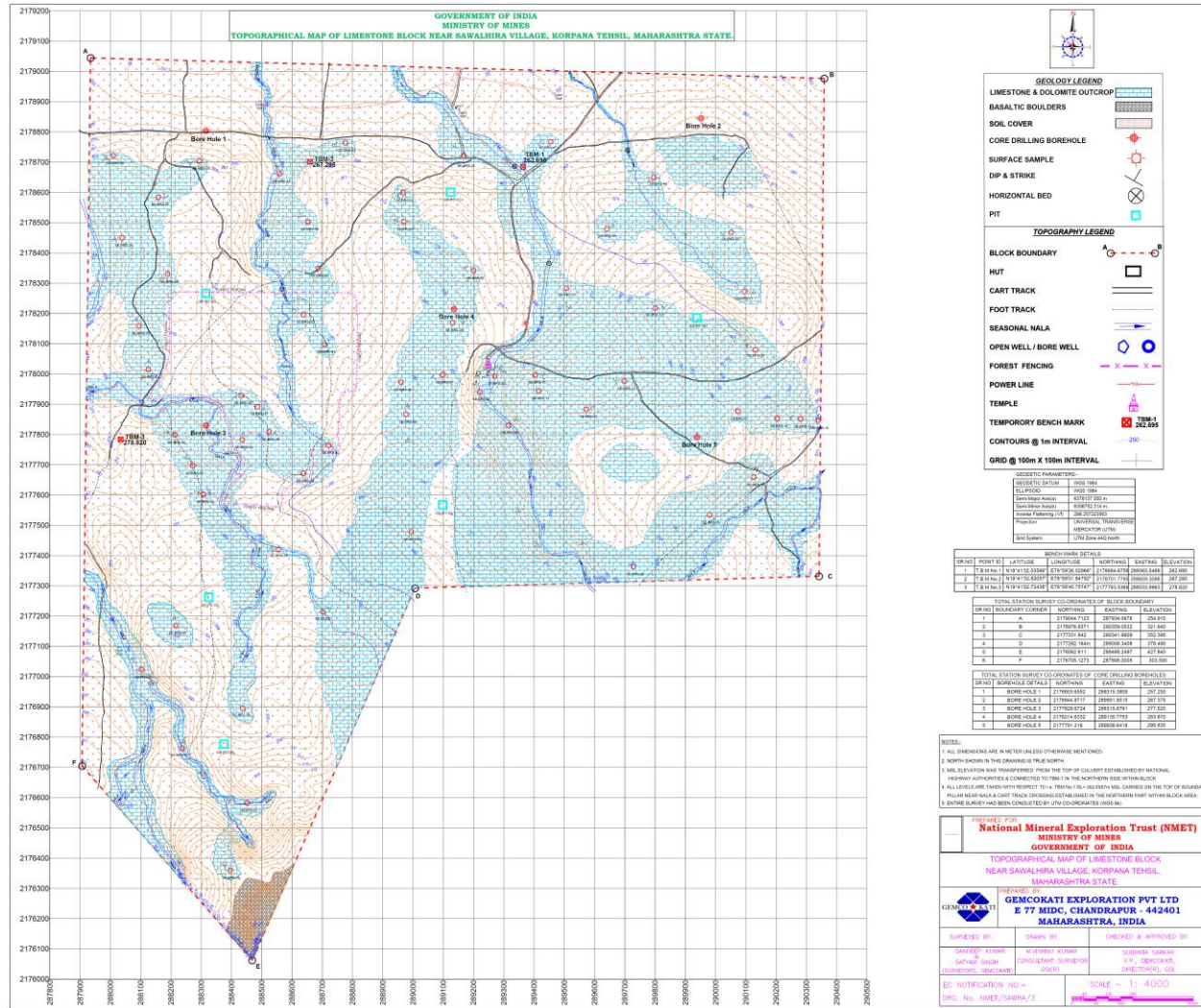
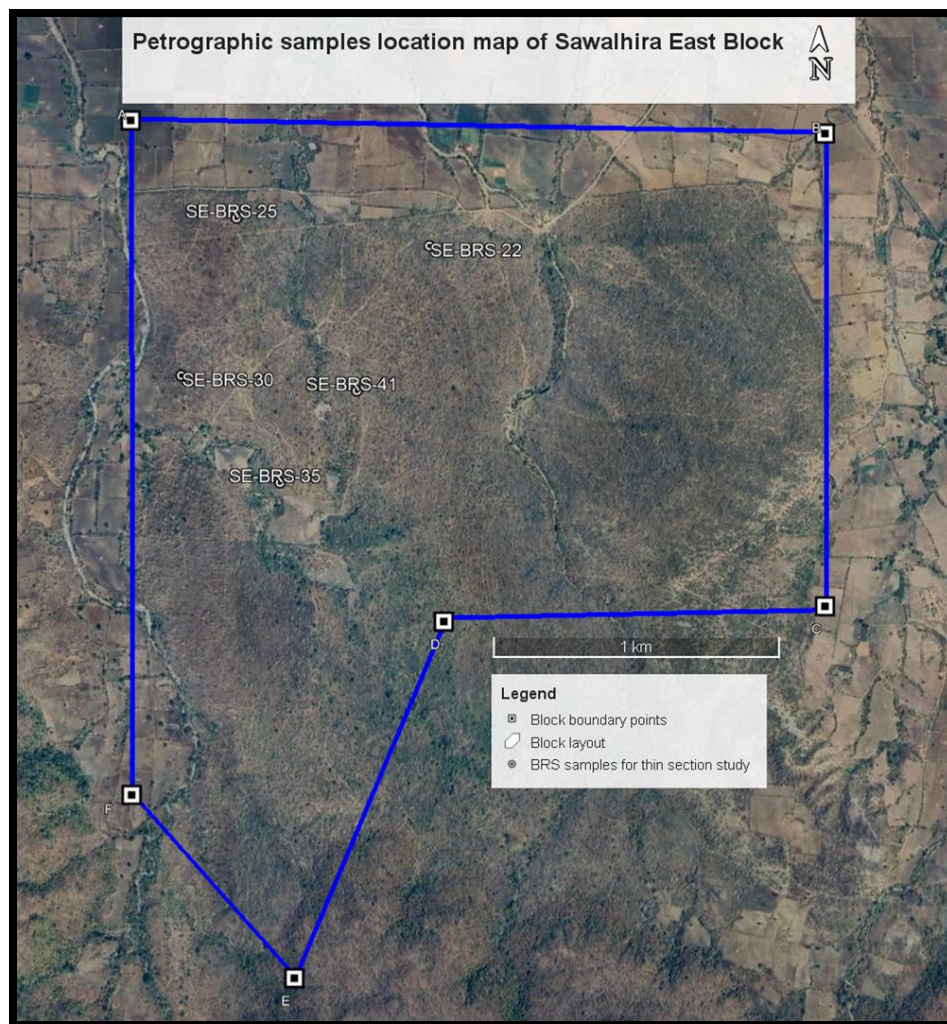


Figure 4: Topographic survey map of Sawalhira East block on 1:4,000 scale.



**Figure 5. Location map of 5 petrographic BRS samples.**



**Figure 18. Sample locations map of Sawalhira East block.**

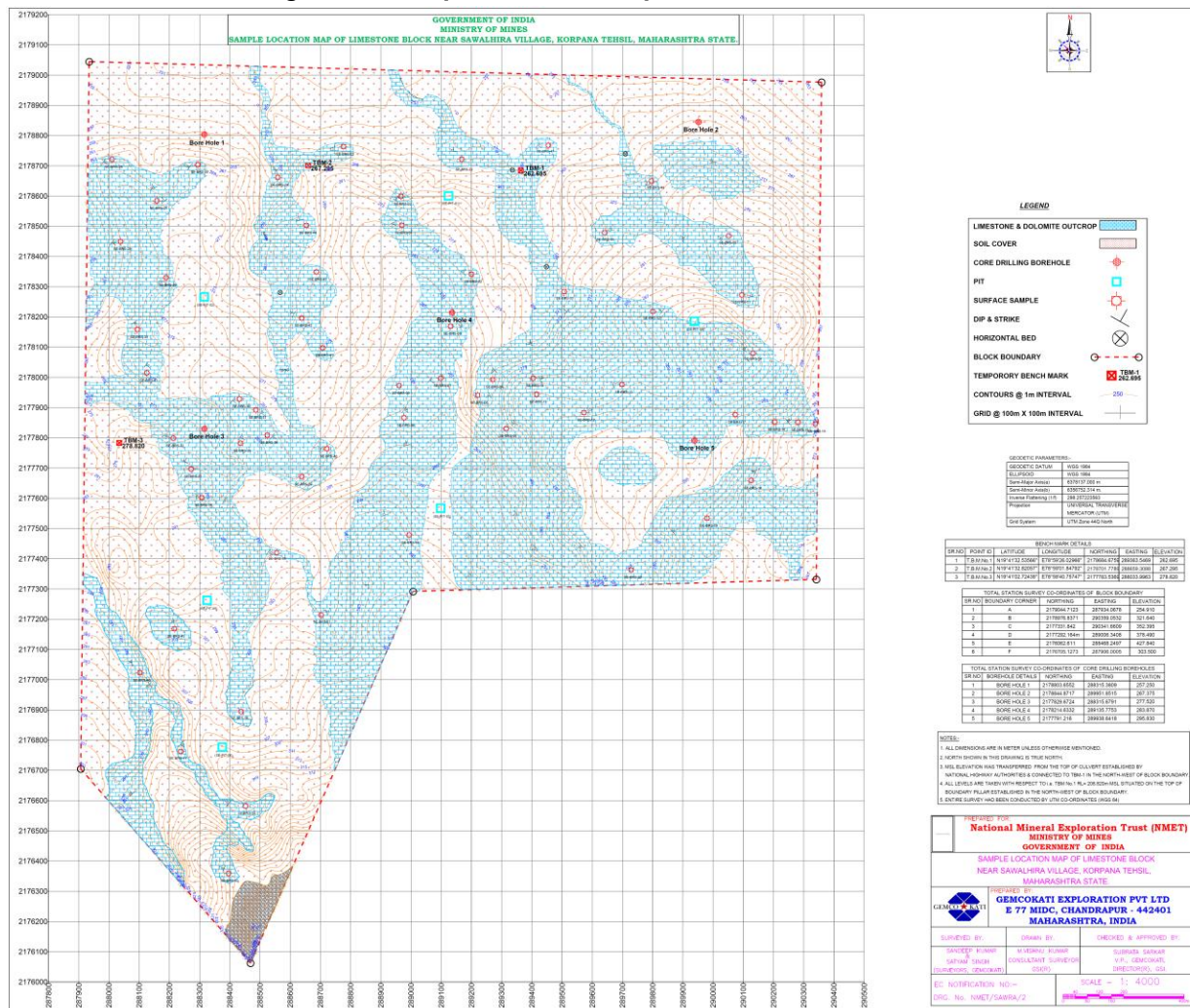


Figure 20. Block map showing locations of boreholes. Map shows that 3 boreholes are in forest land.

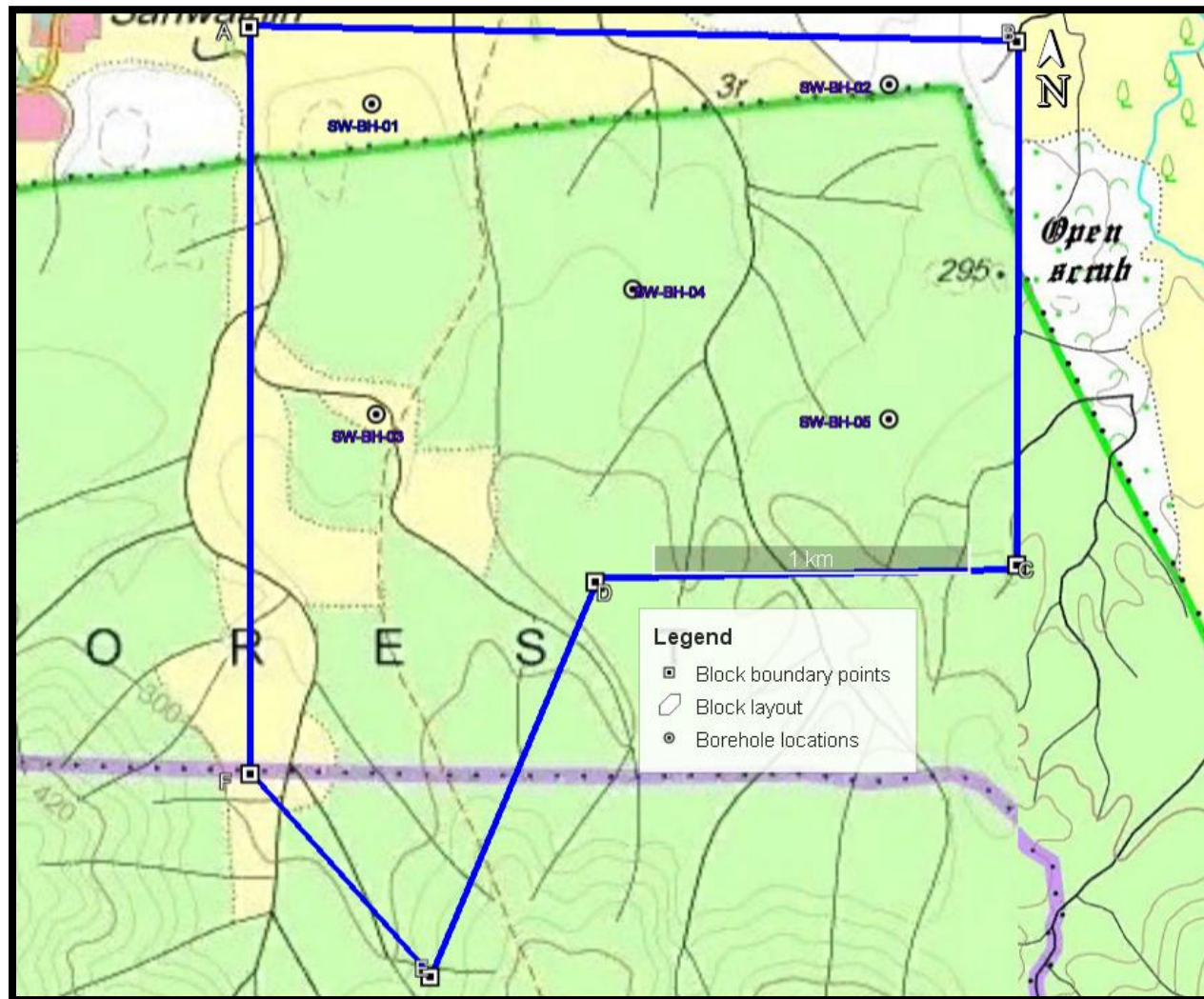


Figure 22. Graphic litholog of two boreholes with based on results of compositional sample analysis.

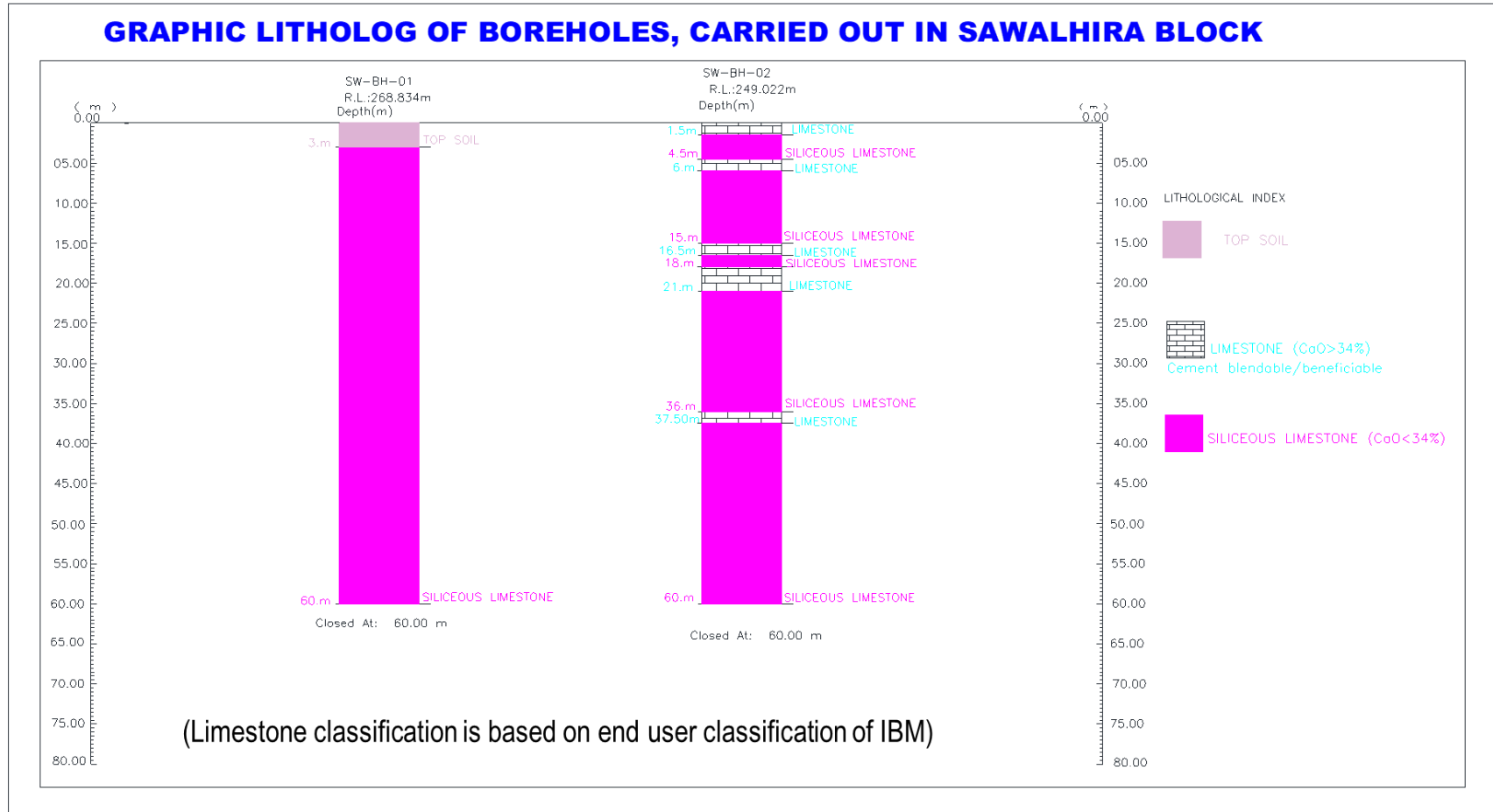
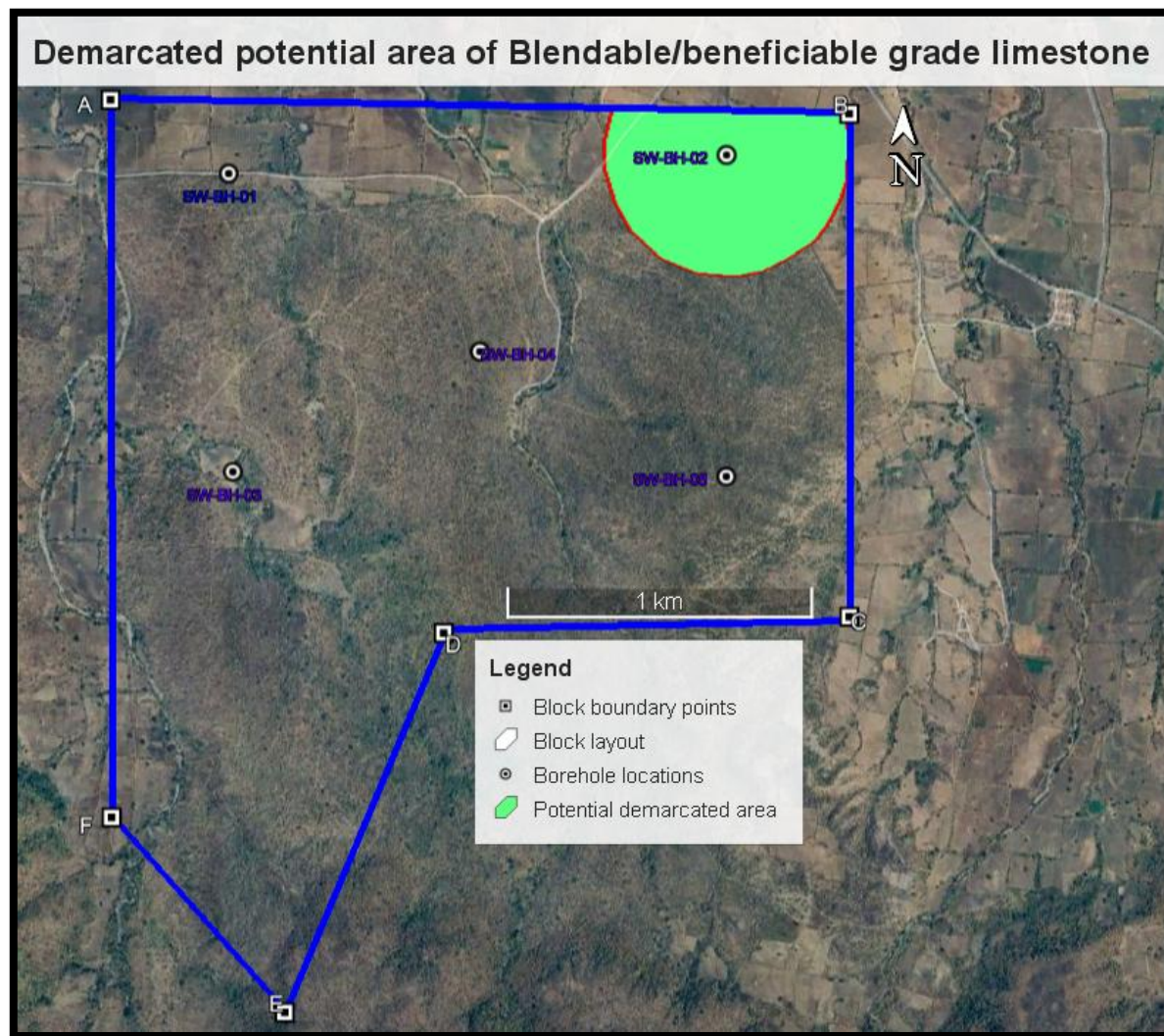


Figure 23. Potential demarcated area (37 hectares) of blendable grade limestone in Sawalhira East block.





## Annexure 1

### Whole rock analysis (Major oxides)/Bed rock samples (BRS).

| S.N. | Sample ID | Latitude         | Longitude        | Al <sub>2</sub> O <sub>3</sub> | BaO   | CaO   | Fe <sub>2</sub> O <sub>3</sub> | Fe (Total) | K <sub>2</sub> O | MgO   | MnO   | Na <sub>2</sub> O | SiO <sub>2</sub> | P <sub>2</sub> O <sub>5</sub> | SO <sub>3</sub> | P     | S    | SrO   | TiO <sub>2</sub> | V <sub>2</sub> O <sub>5</sub> | LOI   |
|------|-----------|------------------|------------------|--------------------------------|-------|-------|--------------------------------|------------|------------------|-------|-------|-------------------|------------------|-------------------------------|-----------------|-------|------|-------|------------------|-------------------------------|-------|
| 1    | SE-BRS-01 | 19° 41' 26.49" N | 78° 59' 12.59" E | 1.91                           | <0.01 | 47.07 | 1.09                           | 0.76       | 0.59             | 1.25  | 0.01  | 0.05              | 9.6              | 0.03                          | 0.46            | 0.01  | 0.18 | <0.01 | 0.09             | <0.01                         | 37.78 |
| 2    | SE-BRS-02 | 19° 41' 21.32" N | 78° 59' 20.55" E | 0.85                           | <0.01 | 50.24 | 0.8                            | 0.56       | 0.34             | 0.93  | <0.01 | 0.05              | 6.46             | <0.01                         | 0.49            | <0.01 | 0.2  | 0.02  | 0.06             | <0.01                         | 39.73 |
| 3    | SE-BRS-03 | 19° 41' 15.69" N | 78° 59' 18.24" E | 2.08                           | <0.01 | 45.35 | 1.02                           | 0.71       | 0.69             | 1.56  | <0.01 | 0.05              | 11.75            | <0.01                         | 0.42            | <0.01 | 0.17 | <0.01 | 0.11             | <0.01                         | 36.9  |
| 4    | SE-BRS-04 | 19° 41' 10.01" N | 78° 59' 23.12" E | 2.12                           | <0.01 | 48.06 | 0.89                           | 0.62       | 0.36             | 0.86  | 0.05  | 0.05              | 9.51             | <0.01                         | 0.04            | <0.01 | 0.02 | <0.01 | 0.11             | <0.01                         | 37.88 |
| 5    | SE-BRS-05 | 19° 41' 8.30" N  | 78° 59' 21.41" E | 2.03                           | <0.01 | 48.53 | 0.94                           | 0.66       | 0.3              | 0.96  | 0.08  | 0.05              | 8.54             | <0.01                         | 0.04            | <0.01 | 0.02 | <0.01 | 0.1              | <0.01                         | 38.38 |
| 6    | SE-BRS-06 | 19° 41' 4.75" N  | 78° 59' 24.71" E | 1.72                           | <0.01 | 49.07 | 0.85                           | 0.59       | 0.28             | 0.88  | 0.07  | 0.05              | 8.2              | <0.01                         | 0.03            | <0.01 | 0.01 | 0.01  | 0.09             | <0.01                         | 38.7  |
| 7    | SE-BRS-07 | 19° 41' 10.08" N | 78° 59' 17.20" E | 2.12                           | <0.01 | 48    | 0.98                           | 0.68       | 0.39             | 0.88  | 0.07  | 0.05              | 10.57            | <0.01                         | 0.04            | <0.01 | 0.02 | 0.01  | 0.13             | <0.01                         | 36.72 |
| 8    | SE-BRS-08 | 19° 41' 9.24" N  | 78° 59' 12.48" E | 1.7                            | <0.01 | 49.08 | 0.88                           | 0.61       | 0.33             | 0.87  | 0.1   | 0.05              | 9.18             | <0.01                         | 0.04            | <0.01 | 0.01 | 0.01  | 0.1              | <0.01                         | 37.61 |
| 9    | SE-BRS-09 | 19° 41' 5.79" N  | 78° 59' 13.09" E | 0.84                           | <0.01 | 29.36 | 0.87                           | 0.61       | 0.14             | 19.19 | <0.01 | 0.05              | 6.23             | 0.01                          | 0.04            | <0.01 | 0.02 | <0.01 | 0.04             | <0.01                         | 43.16 |
| 10   | SE-BRS-10 | 19° 41' 10.20" N | 78° 59' 27.69" E | 1.83                           | <0.01 | 33.94 | 1.44                           | 1          | 0.33             | 5.96  | <0.01 | 0.05              | 22.87            | 0.02                          | 0.07            | <0.01 | 0.03 | <0.01 | 0.12             | <0.01                         | 33.33 |
| 11   | SE-BRS-11 | 19° 41' 8.45" N  | 78° 59' 28.15" E | 3.34                           | <0.01 | 22.17 | 1.57                           | 1.1        | 0.73             | 13.86 | <0.01 | 0.05              | 25.02            | 0.04                          | 0.08            | 0.02  | 0.03 | <0.01 | 0.2              | <0.01                         | 32.89 |
| 12   | SE-BRS-12 | 19° 41' 6.57" N  | 78° 59' 33.60" E | 1.1                            | <0.01 | 49.96 | 0.63                           | 0.44       | 0.15             | 0.58  | 0.05  | 0.05              | 6.89             | <0.01                         | 0.06            | <0.01 | 0.02 | 0.06  | 0.08             | <0.01                         | 40.35 |
| 13   | SE-BRS-13 | 19° 41' 9.61" N  | 78° 59' 37.84" E | 2.64                           | <0.01 | 23.66 | 1.41                           | 0.99       | 0.8              | 13.14 | <0.01 | 0.05              | 24.56            | 0.04                          | 0.08            | 0.02  | 0.03 | <0.01 | 0.18             | <0.01                         | 33.38 |
| 14   | SE-BRS-14 | 19° 41' 5.63" N  | 78° 59' 59.85" E | 1.73                           | <0.01 | 39.02 | 1.36                           | 0.95       | 0.21             | 4.11  | <0.01 | 0.05              | 17.63            | 0.01                          | 0.06            | <0.01 | 0.02 | <0.01 | 0.08             | <0.01                         | 35.69 |
| 15   | SE-BRS-15 | 19° 41' 5.77" N  | 78° 59' 57.89" E | 1.09                           | 0.04  | 51.42 | 0.68                           | 0.48       | 0.12             | 0.59  | 0.08  | 0.05              | 4.24             | <0.01                         | 0.05            | <0.01 | 0.02 | <0.01 | 0.05             | <0.01                         | 41.53 |
| 16   | SE-BRS-16 | 19° 41' 5.79" N  | 78° 59' 55.23" E | 3.33                           | <0.01 | 29.19 | 1.8                            | 1.26       | 0.91             | 7.8   | <0.01 | 0.06              | 24.84            | 0.03                          | 0.05            | 0.01  | 0.02 | <0.01 | 0.19             | <0.01                         | 31.72 |
| 17   | SE-BRS-17 | 19° 41' 6.51" N  | 78° 59' 50.75" E | 3.26                           | <0.01 | 28.82 | 1.71                           | 1.19       | 1.01             | 8.01  | <0.01 | 0.06              | 25.24            | 0.03                          | 0.05            | 0.01  | 0.02 | <0.01 | 0.21             | <0.01                         | 31.55 |
| 18   | SE-BRS-18 | 19° 40' 59.48" N | 78° 59' 52.61" E | 0.97                           | <0.01 | 51.76 | 0.62                           | 0.44       | 0.11             | 0.53  | 0.06  | 0.05              | 4.14             | <0.01                         | 0.03            | <0.01 | 0.01 | 0.01  | 0.05             | <0.01                         | 41.61 |
| 19   | SE-BRS-19 | 19° 40' 55.37" N | 78° 59' 47.65" E | 0.9                            | <0.01 | 27.61 | 1.29                           | 0.9        | 0.18             | 17.72 | <0.01 | 0.05              | 10.57            | 0.04                          | 0.05            | 0.02  | 0.02 | <0.01 | 0.04             | <0.01                         | 41.5  |
| 20   | SE-BRS-20 | 19° 40' 49.72" N | 78° 59' 39.09" E | 2.3                            | <0.01 | 34.68 | 1.4                            | 0.98       | 0.72             | 9.06  | 0.01  | 0.05              | 13.54            | 0.04                          | 0.11            | 0.02  | 0.04 | <0.01 | 0.15             | <0.01                         | 37.87 |
| 21   | SE-BRS-21 | 19° 41' 33.68" N | 78° 59' 19.18" E | 8.72                           | 0.02  | 22.16 | 3.73                           | 2.62       | 2.45             | 1.59  | 0.03  | 0.07              | 40.40            | 0.09                          | 0.04            | 0.04  | 0.02 | <0.01 | 0.49             | <0.01                         | 20.16 |
| 22   | SE-BRS-22 | 19° 41' 29.59" N | 78° 59' 12.45" E | 1.86                           | <0.01 | 35.21 | 1.64                           | 1.15       | 0.27             | 5.07  | <0.01 | 0.05              | 21.72            | 0.02                          | 0.06            | <0.01 | 0.02 | <0.01 | 0.11             | <0.01                         | 33.95 |
| 23   | SE-BRS-23 | 19° 41' 34.87" N | 78° 59' 5.83" E  | 4.30                           | 0.05  | 36.22 | 1.81                           | 1.27       | 0.95             | 1.06  | 0.11  | 0.18              | 24.74            | 0.04                          | 0.08            | 0.02  | 0.03 | 0.01  | 0.25             | <0.01                         | 30.13 |
| 24   | SE-BRS-24 | 19° 41' 31.48" N | 78° 58' 58.40" E | 2.65                           | <0.01 | 30.55 | 1.53                           | 1.07       | 0.72             | 12.32 | <0.01 | 0.05              | 13.29            | 0.05                          | 0.14            | 0.02  | 0.06 | <0.01 | 0.16             | <0.01                         | 38.48 |
| 25   | SE-BRS-25 | 19° 41' 32.74" N | 78° 58' 49.31" E | 1.18                           | <0.01 | 51.01 | 0.65                           | 0.45       | 0.19             | 0.76  | 0.07  | 0.05              | 5.57             | <0.01                         | 0.04            | <0.01 | 0.01 | 0.01  | 0.06             | <0.01                         | 40.36 |
| 26   | SE-BRS-27 | 19° 41' 28.82" N | 78° 58' 44.69" E | 1.20                           | <0.01 | 48.37 | 0.65                           | 0.46       | 0.41             | 0.95  | <0.01 | 0.05              | 9.44             | <0.01                         | 0.19            | <0.01 | 0.08 | <0.01 | 0.07             | <0.01                         | 38.60 |
| 27   | SE-BRS-30 | 19° 41' 14.94" N | 78° 58' 42.67" E | 2.05                           | <0.01 | 46.80 | 0.97                           | 0.68       | 0.40             | 0.64  | 0.04  | 0.05              | 11.03            | <0.01                         | 0.04            | <0.01 | 0.01 | 0.03  | 0.12             | <0.01                         | 37.77 |
| 28   | SE-BRS-35 | 19° 41' 2.83" N  | 78° 58' 54.53" E | 3.21                           | 0.04  | 42.26 | 1.63                           | 1.14       | 0.66             | 1.19  | 0.05  | 0.09              | 16.06            | 0.02                          | 0.09            | <0.01 | 0.03 | 0.01  | 0.20             | <0.01                         | 34.44 |
| 29   | SE-BRS-41 | 19° 41' 13.21" N | 78° 59' 3.75" E  | 3.02                           | <0.01 | 27.89 | 1.90                           | 1.33       | 0.87             | 8.63  | <0.01 | 0.06              | 25.54            | 0.03                          | 0.05            | 0.01  | 0.02 | <0.01 | 0.19             | <0.01                         | 31.76 |



| S.N. | Sample_ID | Latitude         | Longitude       | Al2O3 | BaO   | CaO    | Fe2O3 | Fe (Total) | K2O   | MgO    | MnO   | Na2O  | SiO2   | P2O5  | SO3   | P     | S     | SrO   | TiO2  | V2O5  | LOI   |
|------|-----------|------------------|-----------------|-------|-------|--------|-------|------------|-------|--------|-------|-------|--------|-------|-------|-------|-------|-------|-------|-------|-------|
| 30   | SE-BRS-43 | 19° 41' 21.36" N | 78° 59' 2.92" E | 0.99  | <0.05 | 28.21  | 0.83  | 0.58       | 0.26  | 20.33  | <0.05 | <0.08 | 6.30   | <0.05 | <0.05 | <0.05 | <0.05 |       | <0.05 | <0.05 | 42.84 |
| 31   | SE-BRS-47 | 19°41'31.70"N    | 78°59'29.18"E   | 0.87  | <0.05 | 50.795 | 0.833 | 0.58       | 0.217 | 1.035  | <0.05 | <0.08 | 4.201  | <0.05 | 0.418 | <0.05 | 0.167 | <0.05 | <0.05 | <0.05 | 41.45 |
| 32   | SE-BRS-48 | 19°41'31.56"N    | 78°59'40.88"E   | 1.607 | <0.05 | 47.136 | 1.218 | 0.85       | 0.435 | 1.167  | <0.05 | <0.08 | 9.251  | <0.05 | 0.42  | <0.05 | 0.168 | 0.107 | 0.105 | <0.05 | 38.44 |
| 33   | SE-BRS-49 | 19°41'25.96"N    | 78°59'35.62"E   | 1.2   | 0.92  | 48.528 | 1.569 | 1.10       | 0.409 | 0.668  | <0.05 | <0.08 | 6.247  | <0.05 | 0.825 | <0.05 | 0.33  | 0.067 | 0.069 | <0.05 | 39.2  |
| 34   | SE-BRS-50 | 19°41'25.76"N    | 78°59'49.74"E   | 1.442 | <0.05 | 46.764 | 1.131 | 0.79       | 0.35  | 1.22   | <0.05 | <0.08 | 10.217 | <0.05 | 0.201 | <0.05 | 0.08  | 0.111 | 0.095 | <0.05 | 38.33 |
| 35   | SE-BRS-51 | 19°41'19.56"N    | 78°59'31.11"E   | 3.04  | <0.05 | 38.222 | 1.885 | 1.32       | 1.301 | 1.202  | <0.05 | <0.08 | 21.68  | <0.05 | 0.383 | <0.05 | 0.153 | <0.05 | 0.214 | <0.05 | 31.93 |
| 36   | SE-BRS-52 | 19°41'17.52"N    | 78°59'41.22"E   | 1.55  | <0.05 | 41.188 | 0.787 | 0.55       | 0.621 | 1.141  | <0.05 | <0.08 | 20.753 | <0.05 | 0.199 | <0.05 | 0.08  | <0.05 | 0.113 | <0.05 | 33.53 |
| 37   | SE-BRS-53 | 19°41'19.43"N    | 78°59'51.32"E   | 1.588 | <0.05 | 48.014 | 0.908 | 0.64       | 0.477 | 1.066  | <0.05 | <0.08 | 8.45   | <0.05 | 0.316 | <0.05 | 0.127 | 0.126 | 0.104 | <0.05 | 38.8  |
| 38   | SE-BRS-54 | 19°41'13.16"N    | 78°59'52.65"E   | 1.596 | 0.135 | 47.888 | 0.87  | 0.61       | 0.688 | 0.8    | <0.05 | <0.08 | 8.977  | <0.05 | 0.312 | <0.05 | 0.125 | <0.05 | 0.1   | <0.05 | 38.45 |
| 39   | SE-BRS-55 | 19°40'51.11"N    | 78°58'58.80"E   | 1.153 | <0.05 | 28.338 | 1.287 | 0.90       | 0.355 | 15.54  | <0.05 | <0.08 | 13.381 | 0.055 | 0.055 | <0.05 | <0.05 | <0.05 | 0.06  | <0.05 | 39.67 |
| 40   | SE-BRS-56 | 19°40'53.19"N    | 78°59'13.82"E   | 1.153 | <0.05 | 49.465 | 0.704 | 0.49       | 0.486 | 0.71   | <0.05 | <0.08 | 7.368  | <0.05 | 0.163 | <0.05 | 0.065 | <0.05 | 0.066 | <0.05 | 39.83 |
| 41   | SE-BRS-57 | 19°40'44.46"N    | 78°59'3.94"E    | 1.681 | <0.05 | 43.248 | 0.824 | 0.58       | 0.719 | 3.93   | <0.05 | <0.08 | 11.037 | <0.05 | 0.151 | <0.05 | 0.06  | <0.05 | 0.098 | <0.05 | 38.18 |
| 42   | SE-BRS-58 | 19°40'33.98"N    | 78°58'54.96"E   | 1.455 | <0.05 | 25.357 | 0.985 | 0.69       | 0.5   | 14.965 | <0.05 | <0.08 | 19.788 | <0.05 | 0.066 | <0.05 | <0.05 | <0.05 | 0.106 | <0.05 | 36.66 |
| 43   | SE-BRS-59 | 19°40'23.81"N    | 78°58'55.60"E   | 1.689 | <0.05 | 25.945 | 1.319 | 0.92       | 0.494 | 17.012 | <0.05 | <0.08 | 14.011 | <0.05 | 0.052 | <0.05 | <0.05 | <0.05 | 0.094 | <0.05 | 39.21 |
| 44   | SE-BRS-60 | 19°40'16.54"N    | 78°58'53.76"E   | 1.205 | <0.05 | 28.825 | 1.029 | 0.72       | 0.467 | 18.552 | <0.05 | <0.08 | 6.963  | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | 0.062 | <0.05 | 42.7  |
| 45   | SE-BRS-61 | 19°40'29.63"N    | 78°58'48.17"E   | 1.404 | 0.509 | 27.759 | 1.391 | 0.97       | 0.285 | 18.449 | <0.05 | <0.08 | 6.487  | <0.05 | 0.325 | <0.05 | 0.13  | <0.05 | 0.064 | <0.05 | 42.86 |



## Annexure 2

### Major oxide analysis results of pit samples from Sawalhira East Block.

| S.No. | Sample ID | Latitude      | Longitude     | Al <sub>2</sub> O <sub>3</sub> | BaO   | CaO   | Fe   | Fe <sub>2</sub> O <sub>3</sub> | K <sub>2</sub> O | MgO   | MnO   | Na <sub>2</sub> O | P     | S     | P <sub>2</sub> O <sub>5</sub> | SO <sub>3</sub> | SrO   | SiO <sub>2</sub> | TiO <sub>2</sub> | V <sub>2</sub> O <sub>5</sub> | LOI   |
|-------|-----------|---------------|---------------|--------------------------------|-------|-------|------|--------------------------------|------------------|-------|-------|-------------------|-------|-------|-------------------------------|-----------------|-------|------------------|------------------|-------------------------------|-------|
| 1     | SE-PIT-01 | 19°41'29.92"N | 78°59'18.31"E | 1.10                           | <0.05 | 48.38 | 0.54 | 0.77                           | 0.29             | 1.12  | <0.05 | <0.08             | <0.05 | <0.05 | <0.05                         | 0.08            | <0.05 | 8.36             | 0.06             | <0.05                         | 39.71 |
| 2     | SE-PIT-02 | 19°41'17.22"N | 78°58'50.51"E | 1.99                           | <0.05 | 24.59 | 0.87 | 1.24                           | 0.55             | 16.17 | <0.05 | <0.08             | <0.05 | <0.05 | <0.05                         | <0.05           | <0.05 | 17.56            | 0.12             | <0.05                         | 37.60 |
| 3     | SE-PIT-03 | 19°40'56.29"N | 78°59'17.60"E | 0.74                           | <0.05 | 49.18 | 0.68 | 0.97                           | 0.28             | 1.25  | <0.05 | <0.08             | <0.05 | 0.15  | <0.05                         | 0.39            | <0.05 | 6.88             | <0.05            | <0.05                         | 40.14 |
| 4     | SE-PIT-04 | 19°41'16.67"N | 78°59'46.32"E | 1.33                           | <0.05 | 47.78 | 0.42 | 0.60                           | 0.59             | 0.74  | <0.05 | <0.08             | <0.05 | <0.05 | <0.05                         | 0.09            | <0.05 | 9.98             | 0.10             | <0.05                         | 38.67 |
| 5     | SE-PIT-05 | 19°40'46.06"N | 78°58'51.36"E | 3.76                           | <0.05 | 21.84 | 1.15 | 1.64                           | 1.32             | 15.23 | <0.05 | <0.08             | <0.05 | <0.05 | <0.05                         | <0.05           | <0.05 | 21.91            | 0.24             | <0.05                         | 33.86 |
| 6     | SE-PIT-06 | 19°40'30.30"N | 78°58'53.21"E | 1.35                           | 0.05  | 25.72 | 0.94 | 1.35                           | 0.37             | 16.09 | <0.05 | <0.08             | <0.05 | <0.05 | <0.05                         | 0.07            | <0.05 | 16.14            | 0.07             | <0.05                         | 38.66 |

### Annexure 3

#### Check sample analysis of two borehole cores.

| S.No. | Sample ID   | Lab ID               | Al <sub>2</sub> O <sub>3</sub> | BaO   | CaO   | Fe   | Fe <sub>2</sub> O <sub>3</sub> | K <sub>2</sub> O | MgO  | MnO   | Na <sub>2</sub> O | P     | S     | P <sub>2</sub> O <sub>5</sub> | SO <sub>3</sub> | SrO   | SiO <sub>2</sub> | TiO <sub>2</sub> | V <sub>2</sub> O <sub>5</sub> | LOI   |
|-------|-------------|----------------------|--------------------------------|-------|-------|------|--------------------------------|------------------|------|-------|-------------------|-------|-------|-------------------------------|-----------------|-------|------------------|------------------|-------------------------------|-------|
| 1     | SW-BH-01/03 | G460-1               | 9.86                           | 0.12  | 19.60 | 2.77 | 3.96                           | 2.72             | 1.53 | 0.08  | <0.08             | <0.05 | <0.05 | 0.09                          | 0.08            | <0.05 | 42.37            | 0.52             | <0.05                         | 18.94 |
|       |             | JNA/24-25/NAB/MAR/3  | 10.79                          |       | 19.31 |      | 3.62                           | 2.65             | 1.96 |       |                   |       |       | 0.13                          | 0.07            |       | 42.53            |                  |                               |       |
| 2     | SW-BH-01/04 | G460-2               | 10.50                          | <0.05 | 17.41 | 2.85 | 4.07                           | 2.83             | 1.76 | <0.05 | <0.08             | <0.05 | <0.05 | 0.11                          | <0.05           | <0.05 | 45.12            | 0.56             | <0.05                         | 17.42 |
|       |             | JNA/24-25/NAB/MAR/4  | 11.56                          |       | 16.89 |      | 3.96                           | 2.81             | 2.19 |       |                   |       |       | 0.11                          | 0.06            |       | 45.09            |                  |                               |       |
| 3     | SW-BH-01/05 | G460-3               | 11.05                          | <0.05 | 16.67 | 2.79 | 3.99                           | 2.97             | 1.78 | 0.05  | <0.08             | <0.05 | <0.05 | 0.11                          | <0.05           | <0.05 | 45.67            | 0.57             | <0.05                         | 16.94 |
|       |             | JNA/24-25/NAB/MAR/5  | 11.77                          |       | 16.63 |      | 3.92                           | 2.94             | 2.16 |       |                   |       |       | 0.15                          | 0.10            |       | 45.50            |                  |                               |       |
| 4     | SW-BH-01/06 | G460-4               | 11.14                          | 0.07  | 15.71 | 2.87 | 4.10                           | 3.15             | 1.94 | <0.05 | <0.08             | <0.05 | <0.05 | 0.11                          | 0.05            | <0.05 | 47.04            | 0.61             | <0.05                         | 15.91 |
|       |             | JNA/24-25/NAB/MAR/6  | 12.35                          |       | 15.32 |      | 3.84                           | 3.12             | 2.32 |       |                   |       |       | 0.13                          | 0.09            |       | 46.77            |                  |                               |       |
| 5     | SW-BH-02/01 | G460-39              | 4.46                           | <0.05 | 36.85 | 1.39 | 1.99                           | 1.35             | 1.72 | <0.05 | <0.08             | <0.05 | 0.06  | <0.05                         | 0.16            | <0.05 | 21.70            | 0.29             | <0.05                         | 31.28 |
|       |             | JNA/24-25/NAB/MAR/7  | 5.13                           |       | 36.39 |      | 1.79                           | 1.40             | 2.14 |       |                   |       |       | 0.08                          | 0.11            |       | 21.51            |                  |                               |       |
| 6     | SW-BH-02/02 | G460-40              | 5.17                           | <0.05 | 33.76 | 1.70 | 2.44                           | 1.50             | 1.94 | <0.05 | <0.08             | <0.05 | 0.09  | <0.05                         | 0.21            | <0.05 | 25.26            | 0.33             | <0.05                         | 29.18 |
|       |             | JNA/24-25/NAB/MAR/8  | 5.72                           |       | 33.87 |      | 2.17                           | 1.52             | 2.30 |       |                   |       |       | 0.07                          | 0.15            |       | 24.65            |                  |                               |       |
| 7     | SW-BH-02/03 | G460-41              | 5.35                           | <0.05 | 33.25 | 1.81 | 2.58                           | 1.64             | 1.90 | <0.05 | <0.08             | <0.05 | 0.18  | <0.05                         | 0.46            | <0.05 | 26.19            | 0.35             | <0.05                         | 28.06 |
|       |             | JNA/24-25/NAB/MAR/9  | 6.26                           |       | 33.77 |      | 2.21                           | 1.59             | 2.34 |       |                   |       |       | 0.06                          | 0.19            |       | 25.12            |                  |                               |       |
| 8     | SW-BH-02/04 | G460-42              | 4.69                           | <0.05 | 36.48 | 1.40 | 2.00                           | 1.51             | 1.73 | <0.05 | <0.08             | <0.05 | 0.13  | <0.05                         | 0.33            | <0.05 | 21.95            | 0.30             | <0.05                         | 30.80 |
|       |             | JNA/24-25/NAB/MAR/10 | 5.32                           |       | 37.06 |      | 1.85                           | 1.45             | 2.05 |       |                   |       |       | 0.06                          | 0.22            |       | 20.87            |                  |                               |       |

Primary samples from Shiva Lab, Bangalore

Check sample from JNARDDC, Nagpur



## Annexure 4

### Composite sample analysis of Borehole SW-BH-01

|      | BOREHOLE SW-BH-01 COMPOSITE SAMPLE ANALYSIS                      |                         |        |                   |       |       |       |      |       |      |      |                         |       |       |       |      |       |       |       |      |       |       |                     |
|------|--|-------------------------|--------|-------------------|-------|-------|-------|------|-------|------|------|-------------------------|-------|-------|-------|------|-------|-------|-------|------|-------|-------|---------------------|
|      | CO-ORDINATE: LATITUDE- N 19°41'36.00", LONGITUDE- E 78°58'50.00" |                         |        |                   |       |       |       |      |       |      |      | REDUCED LEVEL: 268.834m |       |       |       |      |       |       |       |      |       |       |                     |
|      |  |                         |        |                   | %     | %     | %     | %    | %     | %    | %    | %                       | %     | %     | %     | %    | %     | %     | %     | %    | %     |       |                     |
| S.N. | Borehole sample numbers  | Borehole depth from (M) | To (M) | Sample length (M) | Al2O3 | BaO   | CaO   | Fe   | Fe2O3 | K2O  | MgO  | MnO                     | Na2O  | P     | S     | P2O5 | SO3   | SrO   | SiO2  | TiO2 | V2O5  | LOI   | Lithology           |
| 1    | SW-BH-01/01  | 0.00                    | 3.00   | 3.00              | -     | -     | -     | -    | -     | -    | -    | -                       | -     | -     | -     | -    | -     | -     | -     | -    | -     | -     | Top soil            |
| 2    | SW-BH-01/03  | 3.00                    | 4.50   | 1.50              | 9.86  | 0.12  | 19.60 | 2.77 | 3.96  | 2.72 | 1.53 | 0.08                    | <0.08 | <0.05 | <0.05 | 0.09 | 0.08  | <0.05 | 42.37 | 0.52 | <0.05 | 18.94 | Siliceous Limestone |
| 3    | SW-BH-01/04  | 4.50                    | 6.00   | 1.50              | 10.50 | <0.05 | 17.41 | 2.85 | 4.07  | 2.83 | 1.76 | <0.05                   | <0.08 | <0.05 | <0.05 | 0.11 | <0.05 | <0.05 | 45.12 | 0.56 | <0.05 | 17.42 | Siliceous Limestone |
| 4    | SW-BH-01/05  | 6.00                    | 7.50   | 1.50              | 11.05 | <0.05 | 16.67 | 2.79 | 3.99  | 2.97 | 1.78 | 0.05                    | <0.08 | <0.05 | <0.05 | 0.11 | <0.05 | <0.05 | 45.67 | 0.57 | <0.05 | 16.94 | Siliceous Limestone |
| 5    | SW-BH-01/06  | 7.50                    | 9.00   | 1.50              | 11.14 | 0.07  | 15.71 | 2.87 | 4.10  | 3.15 | 1.94 | <0.05                   | <0.08 | <0.05 | <0.05 | 0.11 | 0.05  | <0.05 | 47.04 | 0.61 | <0.05 | 15.91 | Siliceous Limestone |
| 6    | SW-BH-01/07  | 9.00                    | 10.50  | 1.50              | 9.73  | 0.09  | 20.97 | 2.66 | 3.80  | 2.64 | 1.81 | <0.05                   | <0.08 | <0.05 | <0.05 | 0.10 | 0.08  | <0.05 | 40.43 | 0.53 | <0.05 | 19.63 | Siliceous Limestone |
| 7    | SW-BH-01/08  | 10.50                   | 12.00  | 1.50              | 9.74  | 0.08  | 20.38 | 3.06 | 4.37  | 2.59 | 1.80 | <0.05                   | <0.08 | <0.05 | <0.05 | 0.11 | 0.09  | <0.05 | 41.03 | 0.52 | <0.05 | 19.12 | Siliceous Limestone |
| 8    | SW-BH-01/09  | 12.00                   | 13.50  | 1.50              | 10.61 | 0.07  | 17.33 | 3.51 | 5.02  | 2.93 | 1.84 | <0.05                   | <0.08 | <0.05 | <0.05 | 0.11 | 0.06  | <0.05 | 44.31 | 0.57 | <0.05 | 16.97 | Siliceous Limestone |
| 9    | SW-BH-01/10  | 13.50                   | 15.00  | 1.50              | 10.04 | 0.08  | 19.35 | 3.08 | 4.40  | 2.62 | 1.81 | <0.05                   | <0.08 | <0.05 | <0.05 | 0.11 | 0.07  | <0.05 | 42.42 | 0.53 | <0.05 | 18.40 | Siliceous Limestone |
| 10   | SW-BH-01/11  | 15.00                   | 16.50  | 1.50              | 10.61 | 0.07  | 17.20 | 3.42 | 4.90  | 2.90 | 1.92 | <0.05                   | <0.08 | <0.05 | <0.05 | 0.11 | 0.07  | <0.05 | 44.57 | 0.55 | <0.05 | 16.93 | Siliceous Limestone |
| 11   | SW-BH-01/12  | 16.50                   | 18.00  | 1.50              | 11.50 | 0.07  | 14.13 | 3.70 | 5.29  | 3.12 | 1.96 | <0.05                   | <0.08 | 0.05  | <0.05 | 0.12 | 0.06  | <0.05 | 48.29 | 0.59 | <0.05 | 14.62 | Siliceous Limestone |
| 12   | SW-BH-01/13  | 18.00                   | 19.50  | 1.50              | 10.96 | 0.07  | 15.95 | 2.88 | 4.11  | 2.96 | 1.84 | <0.05                   | <0.08 | 0.06  | <0.05 | 0.13 | 0.09  | <0.05 | 47.31 | 0.54 | <0.05 | 15.87 | Siliceous Limestone |
| 13   | SW-BH-01/14  | 19.50                   | 21.00  | 1.50              | 8.94  | 0.08  | 22.14 | 2.88 | 4.12  | 2.30 | 1.71 | 0.07                    | <0.08 | <0.05 | <0.05 | 0.09 | 0.10  | <0.05 | 39.51 | 0.49 | <0.05 | 20.31 | Siliceous Limestone |
| 14   | SW-BH-01/15  | 21.00                   | 22.50  | 1.50              | 9.94  | 0.08  | 19.46 | 3.17 | 4.53  | 2.55 | 1.89 | 0.07                    | <0.08 | <0.05 | <0.05 | 0.10 | 0.10  | <0.05 | 41.99 | 0.52 | <0.05 | 18.54 | Siliceous Limestone |
| 15   | SW-BH-01/16  | 22.50                   | 24.00  | 1.50              | 9.88  | 0.07  | 20.20 | 3.13 | 4.48  | 2.50 | 1.82 | <0.05                   | 0.10  | <0.05 | <0.05 | 0.10 | 0.09  | <0.05 | 41.14 | 0.52 | <0.05 | 18.98 | Siliceous Limestone |
| 16   | SW-BH-01/17  | 24.00                   | 25.50  | 1.50              | 10.59 | 0.18  | 17.98 | 3.30 | 4.71  | 2.83 | 1.87 | <0.05                   | 0.14  | <0.05 | 0.05  | 0.11 | 0.14  | <0.05 | 43.71 | 0.54 | <0.05 | 17.11 | Siliceous Limestone |
| 17   | SW-BH-01/18  | 25.50                   | 27.00  | 1.50              | 10.35 | 0.09  | 18.68 | 3.28 | 4.68  | 2.65 | 1.79 | 0.07                    | 0.24  | <0.05 | <0.05 | 0.10 | 0.10  | <0.05 | 43.01 | 0.54 | <0.05 | 17.62 | Siliceous Limestone |
| 18   | SW-BH-01/19  | 27.00                   | 28.50  | 1.50              | 10.92 | 0.11  | 16.95 | 3.46 | 4.94  | 2.89 | 1.80 | <0.05                   | 0.27  | <0.05 | <0.05 | 0.11 | 0.10  | <0.05 | 44.99 | 0.57 | <0.05 | 16.26 | Siliceous Limestone |
| 19   | SW-BH-01/20  | 28.50                   | 30.00  | 1.50              | 10.89 | 0.09  | 16.46 | 3.47 | 4.97  | 2.82 | 1.83 | <0.05                   | 0.33  | <0.05 | <0.05 | 0.11 | 0.09  | <0.05 | 45.77 | 0.58 | <0.05 | 15.97 | Siliceous Limestone |



| S.N. | Borehole sample numbers | Borehole depth from (M) | To (M) | Sample length (M) | Al2O3 | BaO  | CaO   | Fe   | Fe2O3 | K2O  | MgO  | MnO   | Na2O | P     | S     | P2O5 | SO3  | SrO   | SiO2  | TiO2 | V2O5  | LOI   | Lithology           |
|------|-------------------------|-------------------------|--------|-------------------|-------|------|-------|------|-------|------|------|-------|------|-------|-------|------|------|-------|-------|------|-------|-------|---------------------|
| 20   | SW-BH-01/21             | 30.00                   | 31.50  | 1.50              | 10.23 | 0.08 | 19.32 | 3.21 | 4.59  | 2.65 | 1.76 | <0.05 | 0.32 | <0.05 | <0.05 | 0.10 | 0.10 | <0.05 | 42.38 | 0.53 | <0.05 | 17.84 | Siliceous Limestone |
| 21   | SW-BH-01/22             | 31.50                   | 33.00  | 1.50              | 9.82  | 0.09 | 18.99 | 3.23 | 4.62  | 2.55 | 1.71 | 0.05  | 0.35 | <0.05 | <0.05 | 0.10 | 0.09 | <0.05 | 42.05 | 0.52 | <0.05 | 18.99 | Siliceous Limestone |
| 22   | SW-BH-01/23             | 33.00                   | 34.50  | 1.50              | 9.84  | 0.09 | 19.58 | 3.20 | 4.58  | 2.57 | 1.70 | 0.05  | 0.37 | <0.05 | <0.05 | 0.10 | 0.10 | <0.05 | 42.56 | 0.53 | <0.05 | 17.85 | Siliceous Limestone |
| 23   | SW-BH-01/24             | 34.50                   | 36.00  | 1.50              | 9.71  | 0.09 | 20.21 | 3.15 | 4.50  | 2.52 | 1.68 | <0.05 | 0.39 | <0.05 | <0.05 | 0.10 | 0.10 | <0.05 | 41.66 | 0.53 | <0.05 | 18.39 | Siliceous Limestone |
| 24   | SW-BH-01/25             | 36.00                   | 37.50  | 1.50              | 9.66  | 0.08 | 21.29 | 2.97 | 4.24  | 2.38 | 1.64 | <0.05 | 0.38 | <0.05 | <0.05 | 0.10 | 0.10 | <0.05 | 40.22 | 0.51 | <0.05 | 19.28 | Siliceous Limestone |
| 25   | SW-BH-01/26             | 37.50                   | 39.00  | 1.50              | 10.13 | 0.10 | 19.90 | 3.17 | 4.53  | 2.55 | 1.64 | 0.06  | 0.37 | <0.05 | <0.05 | 0.10 | 0.10 | <0.05 | 41.72 | 0.52 | <0.05 | 18.18 | Siliceous Limestone |
| 26   | SW-BH-01/27             | 39.00                   | 40.50  | 1.50              | 9.95  | 0.07 | 20.30 | 3.12 | 4.46  | 2.49 | 1.66 | 0.06  | 0.36 | <0.05 | <0.05 | 0.10 | 0.09 | <0.05 | 41.39 | 0.52 | <0.05 | 18.48 | Siliceous Limestone |
| 27   | SW-BH-01/28             | 40.50                   | 42.00  | 1.50              | 10.25 | 0.09 | 18.95 | 3.33 | 4.76  | 2.69 | 1.69 | <0.05 | 0.39 | <0.05 | <0.05 | 0.11 | 0.09 | <0.05 | 42.81 | 0.55 | <0.05 | 17.52 | Siliceous Limestone |
| 28   | SW-BH-01/29             | 42.00                   | 43.50  | 1.50              | 9.51  | 0.07 | 21.13 | 3.07 | 4.40  | 2.48 | 1.60 | 0.06  | 0.41 | <0.05 | <0.05 | 0.10 | 0.08 | <0.05 | 40.42 | 0.51 | <0.05 | 19.16 | Siliceous Limestone |
| 29   | SW-BH-01/30             | 43.50                   | 45.00  | 1.50              | 10.05 | 0.06 | 19.48 | 3.21 | 4.59  | 2.64 | 1.66 | <0.05 | 0.43 | <0.05 | <0.05 | 0.11 | 0.07 | <0.05 | 42.27 | 0.54 | <0.05 | 17.98 | Siliceous Limestone |
| 30   | SW-BH-01/31             | 45.00                   | 46.50  | 1.50              | 9.78  | 0.20 | 20.22 | 3.06 | 4.37  | 2.62 | 1.57 | <0.05 | 0.40 | <0.05 | 0.06  | 0.10 | 0.15 | <0.05 | 41.40 | 0.51 | <0.05 | 18.56 | Siliceous Limestone |
| 31   | SW-BH-01/32             | 46.50                   | 48.00  | 1.50              | 9.36  | 0.12 | 21.55 | 2.87 | 4.10  | 2.41 | 1.53 | 0.07  | 0.44 | <0.05 | <0.05 | 0.10 | 0.12 | <0.05 | 40.26 | 0.49 | <0.05 | 19.38 | Siliceous Limestone |
| 32   | SW-BH-01/33             | 48.00                   | 49.50  | 1.50              | 9.43  | 0.12 | 21.57 | 3.04 | 4.35  | 2.41 | 1.56 | <0.05 | 0.45 | <0.05 | 0.05  | 0.10 | 0.13 | <0.05 | 39.83 | 0.49 | <0.05 | 19.46 | Siliceous Limestone |
| 33   | SW-BH-01/34             | 49.50                   | 51.00  | 1.50              | 9.23  | 0.11 | 22.24 | 3.03 | 4.33  | 2.36 | 1.55 | 0.06  | 0.44 | <0.05 | <0.05 | 0.10 | 0.12 | <0.05 | 38.89 | 0.49 | <0.05 | 20.00 | Siliceous Limestone |
| 34   | SW-BH-01/35             | 51.00                   | 52.50  | 1.50              | 9.74  | 0.11 | 21.06 | 3.06 | 4.38  | 2.43 | 1.61 | 0.05  | 0.48 | <0.05 | <0.05 | 0.10 | 0.12 | <0.05 | 39.96 | 0.51 | <0.05 | 19.39 | Siliceous Limestone |
| 35   | SW-BH-01/36             | 52.50                   | 54.00  | 1.50              | 9.38  | 0.09 | 22.60 | 2.93 | 4.20  | 2.28 | 1.58 | <0.05 | 0.42 | <0.05 | <0.05 | 0.10 | 0.12 | <0.05 | 38.24 | 0.49 | <0.05 | 20.36 | Siliceous Limestone |
| 36   | SW-BH-01/37             | 54.00                   | 55.50  | 1.50              | 9.37  | 0.09 | 22.17 | 2.91 | 4.16  | 2.30 | 1.58 | 0.07  | 0.46 | <0.05 | <0.05 | 0.10 | 0.11 | <0.05 | 38.90 | 0.50 | <0.05 | 20.11 | Siliceous Limestone |
| 37   | SW-BH-01/38             | 55.50                   | 57.00  | 1.50              | 10.37 | 0.08 | 18.92 | 3.41 | 4.88  | 2.70 | 1.70 | 0.06  | 0.47 | <0.05 | <0.05 | 0.10 | 0.10 | <0.05 | 42.38 | 0.54 | <0.05 | 17.63 | Siliceous Limestone |
| 38   | SW-BH-01/39             | 57.00                   | 58.50  | 1.50              | 9.52  | 0.09 | 22.00 | 2.98 | 4.26  | 2.37 | 1.59 | 0.07  | 0.47 | <0.05 | <0.05 | 0.09 | 0.10 | <0.05 | 39.05 | 0.49 | <0.05 | 19.81 | Siliceous Limestone |
| 39   | SW-BH-01/40             | 58.50                   | 60.00  | 1.50              | 10.52 | 0.09 | 17.40 | 3.37 | 4.82  | 2.71 | 1.67 | <0.05 | 0.49 | <0.05 | <0.05 | 0.10 | 0.10 | <0.05 | 44.92 | 0.55 | <0.05 | 16.52 | Siliceous Limestone |

## Annexure 5

### Composite sample analysis of Borehole SW-BH-02

|      | BOREHOLE SW-BH-02 COMPOSITE SAMPLE ANALYSIS                        |                         |        |                   |       |                        |       |      |       |      |      |       |       |       |       |       |      |       |       |      |       |       |                     |
|------|--|-------------------------|--------|-------------------|-------|------------------------|-------|------|-------|------|------|-------|-------|-------|-------|-------|------|-------|-------|------|-------|-------|---------------------|
|      | CO-ORDINATE:      LATITUDE-N 19°41'37.97" LONGITUDE-E 78°59'46.16" |                         |        |                   |       | REDUCED LEVEL: 278.59m |       |      |       |      |      |       |       |       |       |       |      |       |       |      |       |       |                     |
|      |  |                         |        |                   | %     | %                      | %     | %    | %     | %    | %    | %     | %     | %     | %     | %     | %    | %     | %     | %    | %     | %     |                     |
| S.N. | Borehole sample numbers  | Borehole depth from (M) | To (M) | Sample length (M) | Al2O3 | BaO                    | CaO   | Fe   | Fe2O3 | K2O  | MgO  | MnO   | Na2O  | P     | S     | P2O5  | SO3  | SrO   | SiO2  | TiO2 | V2O5  | LOI   | Lithology           |
| 1    | SW-BH-02/01  | 0.00                    | 1.50   | 1.50              | 4.46  | <0.05                  | 36.85 | 1.39 | 1.99  | 1.35 | 1.72 | <0.05 | <0.08 | <0.05 | 0.06  | <0.05 | 0.16 | <0.05 | 21.70 | 0.29 | <0.05 | 31.28 | Limestone           |
| 2    | SW-BH-02/02  | 1.50                    | 3.00   | 1.50              | 5.17  | <0.05                  | 33.76 | 1.70 | 2.44  | 1.50 | 1.94 | <0.05 | <0.08 | <0.05 | 0.09  | <0.05 | 0.21 | <0.05 | 25.26 | 0.33 | <0.05 | 29.18 | Siliceous limestone |
| 3    | SW-BH-02/03  | 3.00                    | 4.50   | 1.50              | 5.35  | <0.05                  | 33.25 | 1.81 | 2.58  | 1.64 | 1.90 | <0.05 | <0.08 | <0.05 | 0.18  | <0.05 | 0.46 | <0.05 | 26.19 | 0.35 | <0.05 | 28.06 | Siliceous limestone |
| 4    | SW-BH-02/04  | 4.50                    | 6.00   | 1.50              | 4.69  | <0.05                  | 36.48 | 1.40 | 2.00  | 1.51 | 1.73 | <0.05 | <0.08 | <0.05 | 0.13  | <0.05 | 0.33 | <0.05 | 21.95 | 0.30 | <0.05 | 30.80 | Limestone           |
| 5    | SW-BH-02/05  | 6.00                    | 7.50   | 1.50              | 6.46  | <0.05                  | 29.80 | 1.96 | 2.80  | 2.06 | 2.10 | <0.05 | <0.08 | <0.05 | <0.05 | 0.06  | 0.12 | <0.05 | 30.12 | 0.42 | <0.05 | 25.88 | Siliceous limestone |
| 6    | SW-BH-02/06  | 7.50                    | 9.00   | 1.50              | 6.87  | <0.05                  | 27.96 | 2.48 | 3.54  | 2.02 | 2.53 | <0.05 | <0.08 | <0.05 | <0.05 | 0.06  | 0.07 | <0.05 | 31.28 | 0.43 | <0.05 | 25.10 | Siliceous limestone |
| 7    | SW-BH-02/07  | 9.00                    | 10.50  | 1.50              | 7.53  | <0.05                  | 25.47 | 2.48 | 3.55  | 2.33 | 3.00 | <0.05 | <0.08 | <0.05 | <0.05 | 0.07  | 0.09 | <0.05 | 33.72 | 0.47 | <0.05 | 23.62 | Siliceous limestone |
| 8    | SW-BH-02/08  | 10.50                   | 12.00  | 1.50              | 7.48  | <0.05                  | 26.95 | 2.45 | 3.50  | 2.24 | 2.47 | <0.05 | <0.08 | <0.05 | <0.05 | 0.07  | 0.06 | <0.05 | 33.02 | 0.47 | <0.05 | 23.58 | Siliceous limestone |
| 9    | SW-BH-02/09  | 12.00                   | 13.50  | 1.50              | 6.16  | <0.05                  | 31.41 | 2.02 | 2.90  | 1.84 | 2.20 | <0.05 | <0.08 | <0.05 | 0.08  | 0.06  | 0.21 | <0.05 | 27.49 | 0.40 | <0.05 | 27.18 | Siliceous limestone |
| 10   | SW-BH-02/10  | 13.50                   | 15.00  | 1.50              | 6.94  | <0.05                  | 28.15 | 2.61 | 3.73  | 2.09 | 2.48 | <0.05 | <0.08 | <0.05 | 0.13  | 0.06  | 0.34 | <0.05 | 30.70 | 0.44 | <0.05 | 24.92 | Siliceous limestone |
| 11   | SW-BH-02/11  | 15.00                   | 16.50  | 1.50              | 5.00  | <0.05                  | 35.72 | 1.62 | 2.31  | 1.49 | 2.03 | <0.05 | <0.08 | <0.05 | <0.05 | <0.05 | 0.10 | <0.05 | 22.31 | 0.32 | <0.05 | 30.54 | Limestone           |
| 12   | SW-BH-02/12  | 16.50                   | 18.00  | 1.50              | 5.74  | <0.05                  | 33.67 | 1.98 | 2.83  | 1.67 | 2.62 | <0.05 | <0.08 | <0.05 | <0.05 | <0.05 | 0.08 | <0.05 | 23.02 | 0.33 | <0.05 | 29.84 | Siliceous limestone |
| 13   | SW-BH-02/13  | 18.00                   | 19.50  | 1.50              | 3.63  | <0.05                  | 41.43 | 1.15 | 1.65  | 0.99 | 1.68 | <0.05 | <0.08 | <0.05 | 0.07  | <0.05 | 0.18 | <0.05 | 15.60 | 0.21 | <0.05 | 34.43 | Limestone           |
| 14   | SW-BH-02/14  | 19.50                   | 21.00  | 1.50              | 3.85  | <0.05                  | 39.94 | 1.28 | 1.84  | 1.10 | 2.31 | <0.05 | <0.08 | <0.05 | <0.05 | <0.05 | 0.12 | <0.05 | 16.29 | 0.24 | <0.05 | 34.14 | Limestone           |
| 15   | SW-BH-02/15  | 21.00                   | 22.50  | 1.50              | 5.78  | <0.05                  | 31.97 | 1.96 | 2.81  | 1.77 | 2.85 | <0.05 | <0.08 | <0.05 | <0.05 | <0.05 | 0.11 | <0.05 | 25.73 | 0.35 | <0.05 | 28.43 | Siliceous limestone |
| 16   | SW-BH-02/16  | 22.50                   | 24.00  | 1.50              | 6.42  | <0.05                  | 29.53 | 2.22 | 3.18  | 1.96 | 2.74 | <0.05 | <0.08 | <0.05 | 0.15  | 0.06  | 0.37 | <0.05 | 28.93 | 0.41 | <0.05 | 26.24 | Siliceous limestone |
| 17   | SW-BH-02/17  | 24.00                   | 25.50  | 1.50              | 6.86  | <0.05                  | 28.59 | 2.34 | 3.34  | 2.02 | 2.62 | <0.05 | <0.08 | <0.05 | 0.09  | 0.06  | 0.24 | <0.05 | 30.26 | 0.44 | <0.05 | 25.41 | Siliceous limestone |
| 18   | SW-BH-02/18  | 25.50                   | 27.00  | 1.50              | 7.67  | <0.05                  | 25.42 | 2.60 | 3.72  | 2.35 | 2.81 | <0.05 | <0.08 | <0.05 | <0.05 | 0.07  | 0.10 | <0.05 | 33.97 | 0.48 | <0.05 | 23.27 | Siliceous limestone |



| S.N. | Borehole sample numbers | Borehole depth from (M) | To (M) | Sample length (M) | Al2O3 | BaO   | CaO   | Fe   | Fe2O3 | K2O  | MgO  | MnO   | Na2O  | P     | S     | P2O5  | SO3   | SrO   | SiO2  | TiO2 | V2O5  | LOI   | Lithology           |
|------|-------------------------|-------------------------|--------|-------------------|-------|-------|-------|------|-------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|---------------------|
| 19   | SW-BH-02/19             | 27.00                   | 28.50  | 1.50              | 8.53  | 0.10  | 21.71 | 2.83 | 4.05  | 2.66 | 3.81 | <0.05 | <0.08 | <0.05 | 0.16  | 0.08  | 0.40  | <0.05 | 36.61 | 0.51 | <0.05 | 21.41 | Siliceous limestone |
| 20   | SW-BH-02/20             | 28.50                   | 30.00  | 1.50              | 5.99  | <0.05 | 31.67 | 1.78 | 2.54  | 1.95 | 2.15 | <0.05 | <0.08 | <0.05 | 0.39  | 0.05  | 0.97  | <0.05 | 27.07 | 0.40 | <0.05 | 27.04 | Siliceous limestone |
| 21   | SW-BH-02/21             | 30.00                   | 31.50  | 1.50              | 6.29  | 0.09  | 30.52 | 1.91 | 2.74  | 2.01 | 2.48 | <0.05 | <0.08 | <0.05 | 0.22  | 0.06  | 0.55  | <0.05 | 28.06 | 0.41 | <0.05 | 26.60 | Siliceous limestone |
| 22   | SW-BH-02/22             | 31.50                   | 33.00  | 1.50              | 8.25  | <0.05 | 23.93 | 2.83 | 4.05  | 2.50 | 3.01 | <0.05 | <0.08 | <0.05 | <0.05 | 0.07  | 0.05  | <0.05 | 34.99 | 0.50 | <0.05 | 22.51 | Siliceous limestone |
| 23   | SW-BH-02/23             | 33.00                   | 34.50  | 1.50              | 7.79  | 0.16  | 24.57 | 2.72 | 3.90  | 2.52 | 2.63 | <0.05 | <0.08 | <0.05 | 0.05  | 0.07  | 0.14  | <0.05 | 35.01 | 0.51 | <0.05 | 22.57 | Siliceous limestone |
| 24   | SW-BH-02/24             | 34.50                   | 36.00  | 1.50              | 7.59  | <0.05 | 26.89 | 2.28 | 3.25  | 2.34 | 2.43 | <0.05 | <0.08 | <0.05 | <0.05 | 0.06  | 0.05  | <0.05 | 32.47 | 0.49 | <0.05 | 24.26 | Siliceous limestone |
| 25   | SW-BH-02/25             | 36.00                   | 37.50  | 1.50              | 3.74  | 0.16  | 40.99 | 1.30 | 1.86  | 1.14 | 1.35 | 0.06  | <0.08 | <0.05 | <0.05 | <0.05 | 0.11  | <0.05 | 16.62 | 0.24 | <0.05 | 33.58 | Limestone           |
| 26   | SW-BH-02/26             | 37.50                   | 39.00  | 1.50              | 7.50  | <0.05 | 26.59 | 2.53 | 3.61  | 2.41 | 2.32 | <0.05 | <0.08 | <0.05 | <0.05 | 0.07  | <0.05 | <0.05 | 32.92 | 0.48 | <0.05 | 23.91 | Siliceous limestone |
| 27   | SW-BH-02/27             | 39.00                   | 40.50  | 1.50              | 5.03  | <0.05 | 36.60 | 1.63 | 2.33  | 1.57 | 1.66 | <0.05 | <0.08 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | 21.71 | 0.32 | <0.05 | 30.55 | Siliceous limestone |
| 28   | SW-BH-02/28             | 40.50                   | 42.00  | 1.50              | 5.92  | <0.05 | 33.60 | 1.93 | 2.76  | 1.83 | 2.13 | <0.05 | <0.08 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | 24.17 | 0.35 | <0.05 | 28.99 | Siliceous limestone |
| 29   | SW-BH-02/29             | 42.00                   | 43.50  | 1.50              | 5.79  | <0.05 | 33.38 | 1.98 | 2.84  | 1.85 | 2.32 | <0.05 | <0.08 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | 24.21 | 0.35 | <0.05 | 29.04 | Siliceous limestone |
| 30   | SW-BH-02/30             | 43.50                   | 45.00  | 1.50              | 6.24  | <0.05 | 30.83 | 2.17 | 3.10  | 2.11 | 2.64 | <0.05 | <0.08 | <0.05 | <0.05 | 0.06  | <0.05 | <0.05 | 26.88 | 0.39 | <0.05 | 27.55 | Siliceous limestone |
| 31   | SW-BH-02/31             | 45.00                   | 46.50  | 1.50              | 6.68  | <0.05 | 29.59 | 2.41 | 3.45  | 2.26 | 2.25 | <0.05 | <0.08 | <0.05 | <0.05 | 0.07  | <0.05 | <0.05 | 28.87 | 0.43 | <0.05 | 26.23 | Siliceous limestone |
| 32   | SW-BH-02/32             | 46.50                   | 48.00  | 1.50              | 7.23  | <0.05 | 27.43 | 2.43 | 3.48  | 2.38 | 2.93 | <0.05 | <0.08 | <0.05 | <0.05 | 0.07  | <0.05 | <0.05 | 30.47 | 0.43 | <0.05 | 25.39 | Siliceous limestone |
| 33   | SW-BH-02/33             | 48.00                   | 49.50  | 1.50              | 8.97  | <0.05 | 19.19 | 3.11 | 4.45  | 3.09 | 4.33 | <0.05 | <0.08 | <0.05 | <0.05 | 0.09  | <0.05 | <0.05 | 38.39 | 0.55 | <0.05 | 20.73 | Siliceous limestone |
| 34   | SW-BH-02/34             | 49.50                   | 51.00  | 1.50              | 7.12  | <0.05 | 26.69 | 2.42 | 3.46  | 2.37 | 3.70 | <0.05 | <0.08 | <0.05 | <0.05 | 0.07  | <0.05 | <0.05 | 30.19 | 0.41 | <0.05 | 25.77 | Siliceous limestone |
| 35   | SW-BH-02/35             | 51.00                   | 52.50  | 1.50              | 7.28  | <0.05 | 26.74 | 2.41 | 3.45  | 2.40 | 2.99 | <0.05 | <0.08 | <0.05 | <0.05 | 0.08  | <0.05 | <0.05 | 31.39 | 0.43 | <0.05 | 25.04 | Siliceous limestone |
| 36   | SW-BH-02/36             | 52.50                   | 54.00  | 1.50              | 8.79  | <0.05 | 22.26 | 2.79 | 3.98  | 2.82 | 2.65 | <0.05 | <0.08 | <0.05 | <0.05 | 0.08  | <0.05 | <0.05 | 37.37 | 0.49 | <0.05 | 21.38 | Siliceous limestone |
| 37   | SW-BH-02/37             | 54.00                   | 55.50  | 1.50              | 9.65  | <0.05 | 18.79 | 3.21 | 4.59  | 3.14 | 3.39 | <0.05 | <0.08 | <0.05 | <0.05 | 0.09  | <0.05 | <0.05 | 39.90 | 0.52 | <0.05 | 19.72 | Siliceous limestone |
| 38   | SW-BH-02/38             | 55.50                   | 57.00  | 1.50              | 8.82  | <0.05 | 21.36 | 2.73 | 3.90  | 2.80 | 2.78 | <0.05 | <0.08 | <0.05 | <0.05 | 0.09  | <0.05 | <0.05 | 38.74 | 0.51 | <0.05 | 20.78 | Siliceous limestone |
| 39   | SW-BH-02/39             | 57.00                   | 58.50  | 1.50              | 10.13 | <0.05 | 16.69 | 3.05 | 4.36  | 3.24 | 3.22 | <0.05 | <0.08 | <0.05 | <0.05 | 0.10  | <0.05 | <0.05 | 43.73 | 0.56 | <0.05 | 17.72 | Siliceous limestone |
| 40   | SW-BH-02/40             | 58.50                   | 60.00  | 1.50              | 8.90  | <0.05 | 21.02 | 2.80 | 4.00  | 2.71 | 2.62 | <0.05 | <0.08 | <0.05 | <0.05 | 0.08  | <0.05 | <0.05 | 39.41 | 0.49 | <0.05 | 20.56 | Siliceous limestone |

## Annexure 6 Core Photographs

### 1. Borehole SW-BH-01



## 2. Borehole SW-BH-02



### Annexure 7

Photograph of Voltas-60 (KC-30) drilling machine utilized in core drilling in Sawalhira East Block



Annexure 8

Photographs Showing Boundary Line (BL) Survey Pillars in Sawalhira East Block





## Annexure 9

### Log sheet prepared by drill site geologist

| NAME OF THE PROJECT: SAWALHIRA (E) BLOCK PRELIMINARY EXPLORATION |                  |       |                |                     | BORE HOLE NO.: SW-BH-01                                 |  |
|--|------------------|-------|----------------|---------------------|---|--|
| DATE OF COMENCEMENT: 21/12/2024                                  |                  |       |                |                     | CO-ORDINATE: LATITUDE-19°41'36.7" LONGITUDE-78°58'50.5" |  |
| DATE OF COMPLITION: 24/12/2024                                   |                  |       |                |                     | REDUCED LEVEL: 268.834m                                 |  |
| Serial number  | Drilling run (m) |       | Run length (m) | Recovery length (m) | Recovery percentage (%)                                 | Lithology  |
|  | FROM             | TO    |                |                     |   |  |
| 1  | 0.00             | 0.50  | 0.50           | 0.48                | 96.00   | 0 - 0.5m, Top brownish soil  |
| 2  | 0.50             | 1.00  | 0.50           | 0.48                | 96.00   | 0.5 - 1m, Top brownish soil  |
| 3  | 1.00             | 1.50  | 0.50           | 0.50                | 100.00  | 1 - 1.5m, Top brownish soil  |
| 4  | 1.50             | 2.00  | 0.50           | 0.48                | 96.00   | 1.5 - 2m, Top brownish soil  |
| 5  | 2.00             | 2.50  | 0.50           | 0.50                | 100.00  | 2 - 2.5m, Top brownish soil  |
| 6  | 2.50             | 3.00  | 0.50           | 0.50                | 100.00  | 2.5 - 3m, Top brownish soil  |
| 7  | 3.00             | 3.50  | 0.50           | 0.50                | 100.00  | 3 - 3.5m, Top brownish soil  |
| 8  | 3.50             | 4.00  | 0.50           | 0.48                | 96.00   | 3.5 - 4m, Pebbles of bedrock brownish grey, fine grain, hard, compact, limestone, showing high effervescence,  |
| 9  | 4.00             | 5.00  | 1.00           | 0.99                | 99.00   | 4 - 5m, Brownish grey, fine grain, hard, compact, fractured, weathered, dolomitic limestone, showing slow effervescence  |
| 10   | 5.00             | 6.00  | 1.00           | 0.98                | 98.00   | 5 - 6m, Brownish grey, fine grain, hard, compact, fractured, weathered, dolomitic limestone, showing slow effervescence.   |
| 11   | 6.00             | 7.00  | 1.00           | 0.98                | 98.00   | 6 - 7m, Brownish grey, fine grain, hard, compact, fractured, weathered, dolomitic limestone, showing slow effervescence.   |
| 12   | 7.00             | 10.00 | 3.00           | 2.98                | 99.33   | 7 - 10m, Greenish grey, fine grain, hard, compact, fractured, thin calcite vein, light grey band, showing slow effervescence in greenish part compare to lighter part, Intercalation of shale & Intercalation of shale & limestone |
| 13   | 10.00            | 13.00 | 3.00           | 2.98                | 99.33   | 10 - 13m, Alternate light grey & brownish colour band, fine grain, hard, compact, showing slow effervescence at brown part compare to lighter part, Intercalation of shale & limestone   |

|    |       |       |      |      |        |   |
|----|-------|-------|------|------|--------|---|
| 14 | 13.00 | 16.00 | 3.00 | 3.00 | 100.00 | 13 - 16m, Alternate light grey & brownish colour band, fine grain, hard, compact, showing slow effervescence at brown part compare to lighter part, Intercalation of shale & limestone  |
| 15 | 16.00 | 19.00 | 3.00 | 3.00 | 100.00 | 16 - 18.50m, Alternate light grey & brownish colour band, fine grain, hard, compact, showing slow effervescence at brown part compare to lighter part, Intercalation of shale & limestone.<br>18.50-19.00m greenish, fine grain, hard, compact, dolomitic limestone, showing slow effervescence |
| 16 | 19.00 | 22.00 | 3.00 | 3.00 | 100.00 | 19 - 22m, Alternate light grey & brownish colour band, fine grain, hard, compact, showing slow effervescence at brown part compare to lighter part, Intercalation of shale & limestone  |
| 17 | 22.00 | 25.00 | 3.00 | 3.00 | 100.00 | 22 - 25m, Alternate light grey & brownish colour band, fine grain, hard, compact, fractured, showing slow effervescence, Intercalation of shale & limestone   |
| 18 | 25.00 | 28.00 | 3.00 | 3.00 | 100.00 | 25 - 28m, Alternate light grey & brownish colour band, fine grain, hard, compact, fractured, showing slow effervescence, Intercalation of shale & limestone   |
| 19 | 28.00 | 31.00 | 3.00 | 3.00 | 100.00 | 28 - 31m, Alternate light grey & brownish colour band, fine grain, hard, compact, fractured, showing slow effervescence, Intercalation of shale & limestone   |
| 20 | 31.00 | 34.00 | 3.00 | 3.00 | 100.00 | 31 - 34m, Alternate light grey & brownish colour band, fine grain, hard, compact, fractured, showing slow effervescence, Intercalation of shale & limestone   |
| 21 | 34.00 | 37.00 | 3.00 | 3.00 | 100.00 | 34 - 37m, Alternate light grey & brownish colour band, fine grain, hard, compact, fractured, showing slow effervescence, Intercalation of shale & limestone   |
| 22 | 37.00 | 40.00 | 3.00 | 3.00 | 100.00 | 37 - 40m, Alternate light grey & brownish colour band, fine grain, hard, compact, fractured, showing slow effervescence in brown part related to lighter part, Intercalation of shale & limestone   |
| 23 | 40.00 | 43.00 | 3.00 | 3.00 | 100.00 | 40 - 43m, Alternate light grey & brownish colour band, fine grain, hard, compact, fractured, calcite venation, showing slow effervescence in brown part related to lighter part, Intercalation of shale & limestone   |



|    |       |       |      |      |        |   |
|----|-------|-------|------|------|--------|---|
| 24 | 43.00 | 46.00 | 3.00 | 3.00 | 100.00 | 43 - 46m, Alternate light grey & brownish colour band, fine grain, hard, compact, fractured, calcite venation, showing slow effervescence in brown part related to lighter part, Intercalation of shale & limestone |
| 25 | 46.00 | 49.00 | 3.00 | 3.00 | 100.00 | 46 - 49m, Alternate light grey & brownish colour band, fine grain, hard, compact, showing slow effervescence in brown part related to lighter part, Intercalation of shale & limestone                              |
| 26 | 49.00 | 52.00 | 3.00 | 3.00 | 100.00 | 49 - 52m, Alternate light grey & brownish colour band, fine grain, hard, compact, showing slow effervescence in brown part related to lighter part, Intercalation of shale & limestone                              |
| 27 | 52.00 | 55.00 | 3.00 | 3.00 | 100.00 | 52 - 55m, Alternate light grey & brownish colour band, fine grain, hard, compact, showing slow effervescence in brown part related to lighter part, Intercalation of shale & limestone                              |
| 28 | 55.00 | 58.00 | 3.00 | 3.00 | 100.00 | 55 - 58m, Alternate light grey & brownish colour band, fine grain, hard, compact, showing slow effervescence in brown part related to lighter part, Intercalation of shale & limestone                              |
| 29 | 58.00 | 60.00 | 2.00 | 2.00 | 100.00 | 58 - 60m, Alternate light grey & brownish colour band, fine grain, hard, compact, showing slow effervescence in brown part related to lighter part, Intercalation of shale & limestone                              |



## Annexure 10

| NAME OF THE PROJECT: SAWALHIRA BLOCK PRELIMINARY EXPLORATION |                  |      |   |                     | BORE HOLE NO.: SW-BH-02 |   |
|--|------------------|------|---|---------------------|-------------------------|---|
| DATE OF COMENCEMENT: 22-12-2024                              |                  |      | CO-ORDINATE: LATITUDE-19°41'36.8" LONGITUDE-78°59'46.6" |                     |                         |   |
| DATE OF COMPLITION: 25-12-2024                               |                  |      | REDUCED LEVEL: 278.59m                                  |                     |                         |   |
| Serial number  | Drilling run (m) |      | Run length (m)  | Recovery length (m) | Recovery percentage (%) | Lithology   |
|  | FROM             | TO   |   |                     |                         |   |
| 1  | 0.00             | 0.50 | 0.50  | 0.45                | 90.00                   | 0-0.5m, Dark grey in colour, fine grain, hard and compact, limestone, showing high effervescence  |
| 2  | 0.50             | 1.00 | 0.50  | 0.45                | 90.00                   | 0.5-1m, Dark grey in colour, fine grain, hard and compact, limestone, showing high effervescence.   |
| 3  | 1.00             | 1.50 | 0.50  | 0.48                | 96.00                   | 1-1.5m, Dark grey in colour, fine grain, hard and compact, limestone, showing high effervescence.   |
| 4  | 1.50             | 2.00 | 0.50  | 0.48                | 96.00                   | 1.5-2m, Dark grey in colour, fine grain, hard and compact, limestone, showing high effervescence some parts are weathered.  |
| 5  | 2.00             | 2.50 | 0.50  | 0.48                | 96.00                   | 2-2.5m, Alternate bands of light grey and dark grey, fine grained, hard and compact showing high effervescence in light grey band than dark grey band, intercalation of shale & limestone.  |
| 6  | 2.50             | 3.00 | 0.50  | 0.45                | 90.00                   | 2.5-3m, Alternate bands of light grey and dark grey with yellowish colour along the fracture, fine grained, hard and compact showing high effervescence in light grey band than dark grey band, intercalation of shale & limestone. |
| 7  | 3.00             | 6.00 | 3.00  | 2.92                | 97.33                   | 3-6m, Alternate bands of light grey and dark grey, fine grained, hard and compact showing high effervescence in light grey band than dark grey band, intercalation of shale & limestone.  |

|    |       |       |      |      |        |  |
|----|-------|-------|------|------|--------|--|
| 8  | 6.00  | 9.00  | 3.00 | 3.00 | 100.00 | 6-9m, Thick Alternate bands of light grey and dark grey, fine grained, hard and compact showing high effervescence in light grey band than dark grey band, intercalation of shale & limestone.   |
| 9  | 9.00  | 12.00 | 3.00 | 2.95 | 98.33  | 9-12m, Thick Alternate bands of light grey and dark grey, fine grained, hard and compact showing high effervescence in light grey band than dark grey band, intercalation of shale & limestone.  |
| 10 | 12.00 | 15.00 | 3.00 | 2.95 | 98.33  | 12-15m, Thick Alternate bands of light grey and dark grey, fine grained, hard and compact showing high effervescence in light grey band than dark grey band, intercalation of shale & limestone.   |
| 11 | 15.00 | 18.00 | 3.00 | 3.00 | 100.00 | 15-18m, Thick Alternate bands of light grey and dark grey with calcite veins vertical to bands, fine grained, hard and compact showing high effervescence in light grey band than dark grey band, intercalation of shale & limestone.  |
| 12 | 18.00 | 21.00 | 3.00 | 3.00 | 100.00 | 18-21m, Thick Alternate bands of light grey and dark grey with calcite veins vertical to bands appears in some parts of the core sample, fine grained, hard and compact showing high effervescence in light grey band than dark grey band, intercalation of shale & limestone. |
| 13 | 21.00 | 24.00 | 3.00 | 2.96 | 98.67  | 21-24m, Alternate bands of light grey and dark grey, fine grained, hard and compact showing high effervescence in light grey band than dark grey band, intercalation of shale & limestone.   |
| 14 | 24.00 | 27.00 | 3.00 | 2.97 | 99.00  | 24-27m, Alternate bands of light grey and dark brown, light grey band showing high effervescence in light grey band than dark grey band and the dark brown showing the slow effervescence, fine grained, hard and compact, intercalation of shale & limestone.                 |

|    |       |       |      |      |        |  |
|----|-------|-------|------|------|--------|--|
| 15 | 27.00 | 30.00 | 3.00 | 3.00 | 100.00 | 27-30m, Alternate bands of light grey and dark grey with calcite veins vertical to bands, fine grained, hard and compact showing high effervescence in light grey band than dark grey band, intercalation of shale & limestone.  |
| 16 | 30.00 | 33.00 | 3.00 | 2.91 | 97.00  | 30.0 to 31.5m, alternate bands of light grey and dark grey with calcite veins vertical to bands, from 31.5m to 33.0 m alternate bands of light grey and dark brown also appear. light grey band showing high effervescence and the dark brown and dark grey, some parts are fractured, along the fracture brownish colour also appears, fine grained, hard and compact, intercalation of shale & limestone.  |
| 17 | 33.00 | 36.00 | 3.00 | 3.00 | 100.00 | From 33 to 34m alternate bands of light grey and dark brown with calcite veins vertical to bands, from 34 m to 35 m alternate bands of light grey and dark brown appearance. and again from 35 m to 36 m alternate bands of light grey and dark brown appearance, light grey band showing high effervescence than the dark brown and dark grey, some parts are fractured, along the fracture brownish colour also appears, fine grained, hard and compact, intercalation of shale & limestone. |
| 18 | 36.00 | 39.00 | 3.00 | 2.94 | 98.00  | 36-39m, Alternate bands of light grey and dark brown, light grey band showing high effervescence and the dark brown showing the slow effervescence, fine grained, hard and compact, intercalation of shale & limestone.  |
| 19 | 39.00 | 42.00 | 3.00 | 3.00 | 100.00 | 39-42m, Alternate bands of light grey and dark brown, light grey band showing high effervescence and the dark brown showing the slow effervescence, fine grained, hard and compact, intercalation of shale & limestone.  |
| 20 | 42.00 | 45.00 | 3.00 | 3.00 | 100.00 | 42-45m, Alternate bands of light grey and dark brown, light grey band showing high effervescence and the dark brown showing the slow effervescence, fine grained, hard and compact, intercalation of shale & limestone.  |



|    |       |       |      |      |        |   |
|----|-------|-------|------|------|--------|---|
| 21 | 45.00 | 48.00 | 3.00 | 3.00 | 100.00 | 45-48m, Alternate bands of light grey and dark brown, light grey band showing high effervescence and the dark brown showing the slow effervescence, fine grained, hard and compact, intercalation of shale & limestone. |
| 22 | 48.00 | 51.00 | 3.00 | 3.00 | 100.00 | 48-51m, Alternate bands of light grey and dark brown, light grey band showing high effervescence and the dark brown showing the slow effervescence, fine grained, hard and compact, intercalation of shale & limestone. |
| 23 | 51.00 | 54.00 | 3.00 | 3.00 | 100.00 | 51-54m, Alternate bands of light grey and dark brown, light grey band showing high effervescence and the dark brown showing the slow effervescence, fine grained, hard and compact, intercalation of shale & limestone. |
| 24 | 54.00 | 57.00 | 3.00 | 3.00 | 100.00 | 54-57m, Alternate bands of light grey and dark brown, light grey band showing high effervescence and the dark brown showing the slow effervescence, fine grained, hard and compact, intercalation of shale & limestone. |
| 25 | 57.00 | 60.00 | 3.00 | 3.00 | 100.00 | 57-60m, Alternate bands of light grey and dark brown, light grey band showing high effervescence and the dark brown showing the slow effervescence, fine grained, hard and compact, intercalation of shale & limestone. |

## Annexure 11

### Comments/suggestions of peer reviewer and compliance

| Peer reviewer comments/suggestions   | Compliance   |
|--|--|
| 1. Last paragraph in the executive summary may be recast. It may also be specified that the estimated resource category is whether 'inferred' or 'reconnoitary'. | Compliance: Recasted as<br>"The estimated resources are classified as "Inferred Mineral Resources" (333) under the United Nations Framework Classification (UNFC) and the Mineral Evidence and Mineral Content (MEMC) Rules, 2015.<br>Page number 3.   |
| 2) Matter presented in pages 3 to 12 is broadly okay.  | Compliance: No action as such.   |
| 3) Whether the matter presented in Chapter 4.3 is included in Chapter 4.2 or not it may be clearly mentioned as per the subject matter of Chapter 4.3            | Compliance: It is clarified that Chapter 4.3 contains additional details not covered in 4.2.<br>No prior studies had been conducted in the Sawalhira East Block area, as discussed in above sub-section. As a result, there was no available information on the quality and quantity of limestone present or its extension into the Sawalhira East Block. This knowledge gap led to the selection of this area for preliminary limestone exploration, following a field visit and sampling of outcrops by geologists from the Exploration Division of Gemco Kati Exploration Pvt. Ltd. Preliminary field visits, by Geologists of Gemco Kati Exploration Pvt. Ltd., conducted on August 4th, 8th, and 18th, 2023, revealed promising indications of cement-grade limestone deposits. Grab samples collected during these visits showed calcium oxide (CaO) content ranging between 46.01% and 50.46%, confirming the presence of high-quality limestone.<br>Page number 14-15. |
| 4) Please see Page no.16 Table-4 please specify the Formation or Member which is explored on 1:4000 Scale in the present investigation.                          | Compliance: It has now been specified that the Chanda Limestone Formation of the Penganga Group has been explored at 1:4000 scale in the present investigation.<br>The present G3 stage project investigates the Chanda Limestone Formation of the Penganga Group in Sawalhira East block area.<br>Page 17.  |
| 5) Clarity may be improved in the specimen photographs shown in the figures 6 to 10, 13 & 16.  | Compliance: Higher clarity photographs have been inserted to replace the earlier photographs.<br>Page 19-24.   |

|  |   |
|--|---|
| 6) Photomicrographs shown in Figure-7, Figure-9, Figure-14, 15 & 17 are not clear. If better photographs are available the same may be replaced.   | Compliance: The higher-resolution thin section photomicrographs have been replaced.<br>Page 20-24.  |
| 7) Figure-19 may be given in Page-24 for better presentation.  | Compliance: Figure-19 has been shifted to Page-26 for improved continuity and presentation as per comment of the peer reviewer.   |
| 8) What is the figure number shown in Page-28  | Compliance: Figure on Page-28 has been labeled as Figure-21 with page number 30.  |
| 9) Bedrock sample?: whether the samples collected in pits are Bedrock samples. If so specify   | Compliance: Yes, the samples collected from the pits represent bedrock samples and have been marked as such in the revised text.<br>The bed rock samples of limestone beds were collected from the pits to analyze their grade.<br>Page 26.   |
| 10) There is variation between Pit samples and Drill core sample results, please comment.  | Compliance: The variation is attributed to variation in thickness of samples in limestone beds at depth. In drill core samples thickness was of 1.5 meter in which siliceous bands are also included as has been observed in core data logging as well as geochemical results having relatively higher values of SiO <sub>2</sub> .<br><br>The geochemical analysis of borehole core samples indicates that the limestone present in the Sawalhira East Block is siliceous in nature, as evidenced by its relatively high SiO <sub>2</sub> content.<br>Page 30. |
| 11) Clarity of Figures-3 & 4 may be improved.  | Compliance: the clarity was improved for Figures 3 and 4.<br>Page number 42 and 43.   |
| 12) Resource block deciphered from Borehole-2 may be shown in Figure-19. Linear scale of the map may be clearly mentioned in Fig-19. Please see the Sample location map of limestone block large copy. Please check the same figure in which dipping beds cut across the contours, please checkup such | Compliance: Resource block deciphered from Borehole-2 is shown in Figure- 19 on page number 26. A linear bar scale has been added in Figure 19.<br>The dipping beds cutting across the contours indicates the orientation and inclination of limestone beds relative to the topography of the land. In the studied area as observed in the field limestone beds have sub-horizontal to 23° dip which  |

|   |  |
|---|--|
| significance as per any standard Field Geological text book.  | are resulting in cutting across the contours which are lines of equal elevations, duly described in Page number 25.  |
| 13) It is confusing to see the CaO contents mentioned in Fig-19 and contents mentioned in Chapter 9.4   | Compliance: Clarification- CaO contents in Fig-19 are of pits results (Thickness 1 meter) where as those presented in Chapter 9.4, are based on borehole core geochemical analysis results (Thickness 1.5 meter).  |
| 14) The resource concluded in Page-33 is meagre. The Exploration agency may also mention with its experience; the block is whether 'go' or 'no go' for further investigation/proceedings. | Compliance: Based on this study, it is suggested that although the resource is presently meager, the block can be further investigated because: <ul style="list-style-type: none"> <li>• Borehole-2 geochemical data indicates Blendable/beneficial cement grade limestone at shallower depth from surface to 6-meter depth.</li> <li>• Scope exists for delineation of additional resources having similar grade with further drilling along the strike direction of the borehole number SW-BH-02. But forest clearance is an issue.</li> </ul> Page number 35. |
| 15) The authorities may approve the report subject to reconciliation of the annotations mentioned in the hard copy of the report.   | Compliance: All annotations in the hard copy have been reconciled.   |



## Annexure 12

### TCC NMET Minutes of meetings

1. 63<sup>rd</sup> TCC

**Agenda 63.3.17. Preliminary Exploration (G-3) for Limestone in Sanwalhiri (East) Block, Chandrapur, District: Maharashtra**  
**[Implementing Agency: DGM Maharashtra (Gemcokati Exploration Pvt. Ltd)]**

- a) The proposed area belongs to, Penganga Group Limestone Pranhita-Godavari valley and it fall in toposheet no 56I/14. The area lies towards west of Sanwalhiri block which has recently been explored by DGM, MS.
- b) Geological Survey of India had mapped the area during FS:1984-85 and reported the presence of cement grade limestone near Chopan, Sanwalhiri, area of T.S. 56I/14.
- c) The Geologists of the Exploration Wing of Gemcokati Exploration Pvt Ltd. have recently conducted field visit in the area, confirmed the presence of dolomitic limestone and collected samples which yielded 34.74% to 51.98% Cao in with average of 43.71% CaO in 7 samples.
- d) In view of this, Sanwalhiri (East) Block has been proposed for G3 stage exploration.
- e) The committee suggested to keep only 5BHs in polygon method and individual borehole drilling depth should be 60m only. No stratigraphic borehole required in the block.

**Recommendation of TCC:**

The committee recommends the proposal for the approval of EC for "Preliminary Exploration (G-3) for Limestone in Sawalhira (East) Block, Chandrapur, District: Maharashtra" with an estimated cost of Rs. 86.71 lakh (including GST) within time schedule of 10 months and submission of report as per Annexures 7A & 7B. The item will be reviewed after 04 months.

*Santhi*  
8/14/2024

32 | Page  
*An.*  
08/04/2024

## 2. 71<sup>st</sup> TCC I

### **Agenda 71.3.16. Preliminary Exploration (G-3) for Limestone in Sawalhira (East) Block, Chandrapur District, Maharashtra.**

**[Implementing Agency: DGM Maharashtra (M/s Gemcokati Exploration Pvt)]**

- a) M/s Gemcokati Exploration Pvt. Ltd. informed that the project was approved in the 35<sup>th</sup> EC Meeting held on 16<sup>th</sup> May, 2024. The sanction order was issued on 10<sup>th</sup> June, 2024 with timeline of 10 months (Up to 09.04.2025) and approved cost was INR 86,70,545/-
- b) The M/s Gemcokati Exploration Pvt.Ltd presented the progress and informed the committee that all the targets in the item have been achieved and drilling is to be initiated after obtaining FC.
- c) Upon review, the committee advised Gemcokati Exploration Pvt.Ltd to pursue FC and expedite drilling and complete the target within approved timeline.

#### **Recommendation TCC**

***The committee recommended Gemcokati Exploration Pvt.Ltd to pursue with the Dept. of Forests for FC and expedite drilling***

## 3. 73<sup>rd</sup> TCC I

### **Agenda 73.2.6. Preliminary Exploration (G3) for Limestone in Sawalhira (East) Block, District Chandrapur, Maharashtra.**

**[Implementing Agency: Gemcokati Exploration Pvt. Ltd.]**

- a) Gemcokati Exploration Pvt. Ltd. informed that the project was approved in the 35<sup>th</sup> EC Meeting held on 16<sup>th</sup> May, 2024. The sanction order was issued on 10<sup>th</sup> June, 2024 with timeline of 10 months (up to 09.04.2025) and approved cost was INR 86,70,545/-.
- b) Gemcokati presented the progress of the project and informed that 3 out of 5 BHs were pending due to non- receipt of forest permission. Gemcokati informed that the agency is regularly pursuing with concerned offices for forest permission. The analytical results are yet to be received. Timeline for completion of the project exists upto 9<sup>th</sup> April, 2025.

#### **Recommendation of TCC-1**

***The TCC-1 noted the progress of the project and advised Geomcokati to expedite the work.***



#### 4. 75<sup>th</sup> TCC I

**Agenda 75.3.19. Preliminary Exploration (G3) for Limestone in Sawalhiri (East) Block,  
District Chandrapur, Maharashtra.**

**[Implementing Agency: GemcoKati Exploration Pvt. Ltd.]**

- a) Gemcokati Exploration Pvt. Ltd. informed that the project was approved in the 35<sup>th</sup> EC Meeting held on 16<sup>th</sup> May, 2024. The sanction order was issued on 10<sup>th</sup> June, 2024 with timeline of 10 months (up to 09.04.2025) and approved cost was INR 86,70,545/-.
- b) TCC-1 was informed that the exploration work has been completed and draft GR is being prepared.
- c) Gemcokati informed that the progress was presented in the 73rd TCC-1 and committee had advised GemcoKati to expedite the work.
- d) GemcoKati informed that 3 out of 5 BHs were pending due to non-receipt of forest permission. Since, timeline project is being exhausted on 09.04.2025, GemcoKati requested for extension up to 30<sup>th</sup> June 2025.

**Recommendation TCC-1:**

**The TCC-1 approved timeline extension upto 30<sup>th</sup> June 2025 for GR submission due to FC pending and completion of two boreholes.**

  
16/04/25

  
16/04/2025 16

5. 76<sup>th</sup> TCC I

**Agenda 76.5.10. Preliminary Exploration (G3) for Limestone in Sawalhira (East) Block, Chandrapur District, Maharashtra**

**[Implementing Agency: Gemcokati]**

- a) Gemcokati informed that the project was approved in the 35<sup>th</sup> EC Meeting held on 16<sup>th</sup> May, 2024. The sanction order was issued on 10<sup>th</sup> June, 2024 with timeline of 10 months (up to 09.04.2025) and approved cost was INR 86,70,545/-.
- b) Gemcokati apprised the house, that all the work quantum except for drilling and drill core analysis have been achieved. Due to delay in forest clearance, drilling of the remaining 3 BH (180 m) could not be completed. A total of 54 samples (45 nos. - BRS + 3 Check + 6 Pit samples) are analyzed for six radicals against assigned quantum of 33 samples.
- c) Gemcokati apprised the house that BRS and Pit samples (1meter depth) results are providing relatively good CaO values and hence requested for 1meter length of sampling instead of 1.5 m thickness sampling. This will cause an additional analysis of 60 core samples (for remaining 180 m drilling) with additional cost of Rs, 2,77,200/- (Rs. Two lakh seventy seven thousand two hundred only).
- d) The tem was reviewed in 73rd TCC-1 meeting. The map prepared is not proper and concept of geological mapping should be understood thoroughly.
- e) Analytical results of BRS and Core Samples shown is not supporting the presence of limestone in the block.
- f) Gemcokati has to improve the map and properly elucidate the rock types and plan further work judiciously.

**Recommendations of TCC-1:**

*The TCC-1 suggested that quality of map may be improved and presented in upcoming 77<sup>th</sup> TCC-I.*

A handwritten signature in blue ink, appearing to read "Subrata Sarkar", with the date "19/05/2024" written below it.

19

A handwritten signature in blue ink, appearing to read "Subrata Sarkar", with the date "19/05/2024" written below it.



6. 78<sup>th</sup> TCC I

**Agenda 78.4.20. Preliminary Exploration (G3) for Limestone in Sawalhira (East) Block,  
District Chandrapur, Maharashtra.  
[Implementing Agency: Gemco Kati Exploration Private Limited]**

- a) GemcoKati Exploration Private Limited informed that the project was approved in the 35th EC Meeting held on 16th May, 2024. The Sanction Order was issued on 10th June, 2024 with timeline of 10 months (up to 09.04.2025) and approved cost was INR 86,70,545/-. Time extension upto 30.06.2025 was approved in 75th TCC-I meeting
- b) The agency apprises the committee about progress of work and informed that part of drilling component could not be initiated as Forest clearance permission is still pending with competent authorities (APCCF/Nodal Officer, Nagpur).
- c) The analytical results from the completed Borehole yielded CaO % from 14 to 41%, while MgO varied from 1.3 to 4.3%. The committee opined that while the surface sample results are encouraging, the subsurface samples do not show promising CaO values. Accordingly, it was advised to conclude the exploration and submit a revised cost sheet for approval.
- d) The committee instructed the agency to give formal request to NMET for pre closure of project, citing technical reasons.

**Recommendations of TCC-1:**

*The TCC recommended the pre-closure of project to EC for approval and advised Gemcokati for submission of revised cost sheet in the next TCC-1 of NMET.*

**Agenda 78.4.21. Preliminary Exploration (G3) for Ramghad Iron and Manganese mineralization near Ramghad Village, District Ballari, Karnataka.  
[Implementing Agency: Ecomen Mining Pvt Ltd.]**

  
16/7/25

  
16/07/2025



7. 79<sup>th</sup> TCC I

**79.4.20 Preliminary Exploration (G-3) for Limestone in Sawalhira (East) Block, Chandrapur District, Maharashtra  
[Implementing Agency: Gemcokati Exploration Pvt. Ltd.]**

- a) GemcoKati Exploration Private Limited informed that the project was approved in the 35<sup>th</sup> EC Meeting held on 16<sup>th</sup> May, 2024. The Sanction Order was issued on 10<sup>th</sup> June, 2024 with timeline of 10 months (up to 09.04.2025) and approved cost was INR 86,70,545/-. Time extension upto 30.06.2025 was approved in 75<sup>th</sup> TCC-I meeting.
- b) The item was reviewed in 78<sup>th</sup> TCC-I meeting and fore-closure of item was recommended due to forest clearance issue and non-promising values of CaO in subsurface samples.
- c) The agency presented the revised costsheet.

*Parathi*  
09/08/2025

*San*  
09/08/2025

Page 19 of 71

**Recommendations of TCC-1:**

*The committee recommended closure of item titled "Preliminary Exploration (G-3) for Limestone in Sawalhira (East) Block, Chandrapur District, Maharashtra" and extension of timeline upto 31.08.2025 for GR submission for approval of EC. The cost of item is revised from Rs. 86.71 lakh to Rs. 57.22 lakh with a change in amount of (-) Rs 29.49 lakhs (~34.00 % de-escalation) as per Annexure 10.*



**Annexure 13**  
EC NMET Minutes of meetings

1. 35<sup>th</sup> EC minutes

*Only through e-mail*

Government of India  
Ministry of Mines  
National Mineral Exploration Trust


F.No.6/2/2015-NMET/88

New Delhi, 29<sup>th</sup> May, 2024

**Subject: Circulation of minutes of 35<sup>th</sup> meeting of Executive Committee (EC) of National Mineral Exploration Trust (NMET) held on 16<sup>th</sup> May, 2024.**

Please find enclosed the minutes of 35<sup>th</sup> meeting of Executive Committee of NMET held on 16<sup>th</sup> May, 2024 for your kind perusal.

Action Taken Report on relevant Para may kindly be forwarded to this office.

  
[Maneesh Kumar]  
Deputy Secretary & HoD, NMET

| D. Implementing Agency: DGM, Maharashtra (M/s Gemcokati Exploration Pvt. Ltd.) |   |           |    |    |       |          |
|--|---|-----------|----|----|-------|----------|
| 9  | Preliminary Exploration (G-3) for Limestone in Sawalhira (East) Block, Chandrapur District, Maharashtra | Limestone | G3 | 10 | 86.71 | Approved |
| 10   | Preliminary exploration for Limestone in Rupapeth Block, Chandrapur district, Maharashtra               | Limestone | G3 | 10 | 96.00 | Approved |



## 2. Sanction Order with approved cost sheet, OM EC, NMET

**Government of India  
Ministry of Mines  
National Mineral Exploration Trust  
Sanction Order**  
\*\*\*\*\*

F.No.23/461/2024-NMET/124

New Delhi, 10<sup>th</sup> June, 2024

**Subject: Approval of mineral exploration project and release of 1st 40% Advance of Grant-in-Aid (General) for Preliminary Exploration (G-3) for Limestone in Sawalhira (East) Block, Chandrapur District, Maharashtra.**

On the recommendation of Technical-cum-Cost Committee (TCC) of NMET, the Executive Committee (EC) in its 35<sup>th</sup> EC meeting held on 16<sup>th</sup> May, 2024 approved mineral exploration project to be executed by DGM Maharashtra (NPEA: M/s. Gemcokati Exploration Pvt. Ltd.) The details of the block are given below:

| S. No. | Project/Block Name  | Commodity | Stage | Duration (Months)         | Approved Cost (Including GST). |
|--------|---|-----------|-------|---------------------------|--------------------------------|
| 1      | Preliminary Exploration (G-3) for Limestone in Sawalhira (East) Block, Chandrapur District, Maharashtra | Limestone | G3    | 10<br>Up to<br>09.04.2025 | ₹ 86,70,545 /-                 |


2. The mineral exploration project will be funded by NMET as per the cost recommended by the TCC and approved by the EC. The Implementing Agency shall complete the same as per the approved cost estimates and time schedule, enclosed in **Annexure**, as summarized below:-

- **Field Mobilization** : 1<sup>st</sup> month (up to 09.07.2024).
- **Exploration** : 2<sup>nd</sup> to 8<sup>th</sup> month (up to 09.02.2024).  
(Mapping, Sampling, Survey, Pitting/Trenching & Drilling, Camp winding)
- **Laboratory Studies** : 2<sup>nd</sup> month to 09<sup>th</sup> month (up to 09.03.2025)
- **Report Writing with Peer Review and submission to NMET** : 8<sup>th</sup> to 10<sup>th</sup> month (up to 09.04.2025)

3. NMET has approved a scheme for engagement of notified Private Exploration agencies (PEAs) in mineral exploration vide Office Memorandum no.6/3/2015-NMET/28 dated 10<sup>th</sup> May, 2022 regarding "Scheme for engagement of Notified Private Exploration Agencies in Mineral Exploration". As per scheme the notified agencies shall be eligible for funding from National Mineral Exploration Trust as per provision under sub-section 5 of section 9C of the Act.


4. Para 3 of scheme stipulate the Procedure for Engagement of Notified PEAs by State Governments and their Funding and Para 3.2.1: Mode A: Mineral Exploration Projects formulated by Private Exploration agency (PEA) and funding by NMET. For payment Point no (vii) define that NMET shall issue the sanction order to State government and all advances and payments shall be made by NMET to the State Government directly. The State Government, in turn, will get the work executed through the notified PEA for such purpose. The State Government shall submit the utilization certificate to NMET periodically in the manner as specified by NMET.





Public Financial Management System-PFMS  
D/o Controller General of Accounts, Ministry of Finance  
Bharat CPSMS

Welcome: Geetika Sharma  
User Type: PD  
Financial Year: 2024-2025



English

Bill No - 95 of Expenditure Register on Page No - 35

AdhocReports  
SchemeWiseContactDetails  
Home  
CAM Reports  
User Manuals  
Masters  
Users  
Agency  
Sanctions  
PreSanction  
DBT File Tracker  
Sanction Custom Fields  
Printing Templates  
Sanction Templates  
Employee Info. System  
Reports  
Masters  
My Schemes  
Agencies  
My Funds  
Scheme Allocation  
Register/ Track Issue  
Utilisation Certificate  
OLD UC

Sanction Details

Controller: 026-MINES  
Sanction Number: 124  
Sanction Type: Transfer (DDO Bill)  
IPD Number: 23/461/2024-NMET  
Scheme: 3331-EXPLORATION ACTIVITIES UNDER NATIONAL MINERAL EXPLORATION TRUST  
DDO: 236618-JUNIOR SECRETARY,DEPTT.OF MINES,ROOM NO.312,SHASTRI B-HWY,NEW DELHI,TEL.386467.

Sanction Status: Approved  
Sanction Date: 10/06/2024  
Sanction Amount: 3468218  
IPD Date: 06/06/2024  
PAO: 036617-PAO(Mines), New Delhi  
Remarks: Approved

North East Expenditure

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Account Details:

| Grant                   | Department (For U/F Grants Only) | Function Head  | Object Head                | Category  | Amount  | External PAO | Available Budget |
|-------------------------|----------------------------------|--|----------------------------|-----------|---------|--------------|------------------|
| 059 - MINISTRY of Mines |                                  | 2853021022500 - NATIONAL MINERAL EXPLORATION TRUST FUND ACTIVITIES | 31 - GRANTS-IN-AID GENERAL | 5 - VOTED | 3468218 |              | 1811254595       |

Agency Details:

| Sl.No | Agency Name                                    | City   | District | State       | Country | Gross Amount | Deduction Amount | Net Amount | Payee Remarks          |
|-------|--|--------|----------|-------------|---------|--------------|------------------|------------|------------------------|
| 1     | Directorate of Geology and Mining, Maharashtra | Nagpur | NAGPUR   | MAHARASHTRA | INDIA   | 3,468,218    | 0                | 3,468,218  | Payment of 1st Advance |
| Total |  |        |          |             |         | 3468218      | 0                | 3468218    |                        |

Sanction Approved Successfully.

Payee Details

Print Sanction Order

Back

Annexure 7A

Cost Estimate for Preliminary Exploration (G-3) for Limestone in Sawalhira (East) Block, Chandrapur, District: Maharashtra  
6 sq. km; No. of BH: 06; Borehole depth range- 60 m; Schedule timeline- 10 months; Review: After 4 Months]

Area

| S. No. | Item of Work *  | Unit *              | Rates as per NMET SoC 2020-21 |                        | Estimated Cost of the Proposal |                         | Remarks   |
|--------|---|---------------------|-------------------------------|------------------------|--------------------------------|-------------------------|---|
|        |   |                     | SoC-Item No.                  | Rates as per SoC * (a) | Qty. (b)                       | Total Amount (Rs) (a*b) |   |
| A      | Geological Mapping Other Geological Work & Surveying  |                     |                               |                        |                                |                         |   |
|        | Geological mapping, Topographic survey (1:4,000 scale) & Trenching, drilling work               |                     |                               |                        |                                |                         |   |
| i      | a. Charges for Geologist per day (Field) for geological mapping & trenching work, drilling work | day                 | 1.3                           | 11000                  | 120                            | 1320000                 |   |
| ii     | b. Labours Charges: Base rate   | day                 | 5.7                           | 504                    | 240                            | 120960                  | Amount will be reimbursed as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher. |
|        | c. Charges for Geologist per day (HQ)   | day                 | 1.3                           | 9000                   | 50                             | 450000                  |   |
|        | d. Charges for one Sampler per day (1 Party)  | one sampler per day | 1.5.2                         | 5100                   | 32                             | 163200                  |   |
|        | e. Labours (4 Nos)  | day                 | 5.7                           | 504                    | 128                            | 64512                   |   |
|        | Sub Total- A  |                     |                               |                        |                                | 21,18,672               |   |
| B      | Ground Geophysical Survey   |                     |                               |                        |                                |                         |   |
| 1      | IP, Induced Polarization (I.P) cum Resistivity S.P and Magnetic (30 Lkm)                        | 6-10 Line Km        |                               |                        |                                |                         |   |
| 3      | Geophysicist party days (Field)   | per day             |                               |                        |                                |                         |   |
| 4      | c. Labours Charges  | day                 |                               |                        |                                |                         |   |
| 5      | Geophysicist party days (HQ)  | per day             |                               |                        |                                |                         |   |

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|    |  |                          |          |        |     |          |   |
|----|--|--------------------------|----------|--------|-----|----------|---|
|    | Sub Total- B   |                          |          |        |     |          |   |
| C  | Survey work  |                          |          |        |     |          |   |
| a  | DGPS Survey for BH fixation & RL determination                       | Per Point of observation | 1.6.2    | 19,200 | 11  | 211200   |   |
| b  | Charges of Surveyor (1 party)  | one surveyor per day     | 1.6.1a   | 8,800  | 30  | 249000   | Topographical Survey on 1:4000 scale  |
| c  | Labours Charges for survey work;                                     | day                      | 5.7      | 804    | 120 | 60480    | Amount will be reimburse as per the notified rates by the Central Labour Commissioner (Rs. 504/- per day) or respective State Govt. whichever is higher |
|    | Sub-Total C  |                          |          |        |     | 5,20,680 |   |
| D  | Trenching/Pitting  |                          |          |        |     |          |   |
| a) | Excavation of Trenches   | per cu.m                 | 2.1.1    | 3,330  | -   | 0        |   |
| E  | DRILLING (after review)  |                          |          |        |     |          |   |
| 1  | Drilling up to 300m (Soft Rock)                                      | m                        | 2.2.1.1b | 6,775  | 300 | 2032500  | MoC   |
| 2  | Borehole deviation Survey by Multishot Camera                        | m                        |          |        |     |          |   |
| 3  | Land / Crop Compensation (in case the BH falls in agricultural Land) | per BH                   | 5.6      | 20,000 | -   | 0        |   |
| 4  | Construction of concrete Pillar (12"x12"x30")                        | per borehole             | 2.2.7a   | 2,000  | 5   | 10000    |   |
| 5  | Borehole plugging by cement  | per borehole             | 2.2.7b   | -      | 250 | 0        |   |
| 6  | Transportation of Drill Rig & Truck associated per drill             | Km                       | 2.2.8    | 36     | 400 | 14400    | To and Fro  |

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|     |  |            |         |          |     |                  |                        |
|-----|--|------------|---------|----------|-----|------------------|------------------------|
| 7   | Monthly Accomodation Charges for drilling Camp   | month      | 2.2.9   | 50,000   | 2   | 1,00,000         |                        |
| 8   | Drilling Camp Setting Cost   | Nos        | 2.2.9a  | 2,50,000 | 1   | 2,50,000         |                        |
| 9   | Drilling Camp Winding up Cost  | Nos        | 2.2.9b  | 2,50,000 | 1   | 2,50,000         |                        |
| 10  | Road Making (Flat Terrain)   | Km         | 2.2.10a | 22,020   | 2   | 44,040           |                        |
| 11  | Drill Core Preservation  | per m      | 5.3     | 1,690    | 250 | 3,97,500         |                        |
|     | <b>Sub Total E</b>   |            |         |          |     | <b>30,98,440</b> |                        |
| F   | <b>Borehole Geophysical Logging</b>  |            |         |          |     |                  |                        |
| G   | <b>LABORATORY STUDIES</b>  |            |         |          |     |                  |                        |
| 1   | <b>Chemical Analysis</b>   |            |         |          |     |                  |                        |
| (i) | <b>Major Oxide Analysis</b>  |            |         |          |     |                  |                        |
|     | a) Estimation of major oxides by XRF/whole rock analysis for primary samples (CaO, MgO, SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , LOI, Na <sub>2</sub> O, Fe <sub>2</sub> O <sub>3</sub> , MnO, K <sub>2</sub> O, TiO <sub>2</sub> , SO <sub>3</sub> , P <sub>2</sub> O <sub>5</sub> , Cr <sub>2</sub> O <sub>3</sub> , ZnO, V <sub>2</sub> O <sub>5</sub> ) | per sample | 4.1.15a | 4200     | 230 | 9,66,000         | 30BRS +200Core Samples |
|     | Estimation of major oxides by XRF/whole rock analysis for check samples  | per sample | 4.1.15a | 4200     | 23  | 96,600           |                        |
|     | Determination of insitu Bulk Density   |            | 4.10    | 3,540    | 2   | 7,080            |                        |
| 2   | <b>Physical &amp; Petrological Studies</b>   |            |         |          |     |                  |                        |
| i   | Preparation of thin section  | Nos        |         |          |     |                  |                        |
| ii  | Study of thin section  | Nos        |         |          |     |                  |                        |
| iii | Preparation of polish section  | Nos        | 4.3.2   | 1,649    | 5   | 7,745            |                        |
| iv  | study of polished section  | Nos        | 4.3.4   | 4,232    | 5   | 21,160           |                        |
| v   | Digital Photographs  | Nos        | 4.3.7   | 280      | 10  | 2,800            |                        |
| vi  | Whole Rock Analysis  | Nos        |         |          |     |                  |                        |
| vii | Sp. Gravity  | Nos        |         |          |     |                  |                        |
|     | SEM Studies  | per hour   |         |          |     |                  |                        |

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|-------|---|--------------------------------|--------------------|---|--|-----------|---|
| vi    | EPMA studies  | per hour                       |                    |   |  |           |   |
|       |   |                                |                    |   |  | 11,01,386 |   |
| H     | Total A to G  |                                |                    |   |  | 68,39,177 |   |
| I     | Geological Report Preparation   | 5 Hard copies with a soft copy | 5.2                | 5.2 (ii)  |  | 3,41,959  | Reimbursement will be made after submission of the final Geological Report in Hard Copies (5 Nos) and the soft copy to NMET.  |
| J     | Peer review Charges   |                                | As per EC decision |   |  | 30,000    |   |
| K     | Preparation of Exploration Proposal (5 Hard copies with a soft copy)  | 5 Hard copies with a soft copy | 5.1                | 2% of the Cost or Rs. 5.0 Lakhs whichever is less |  | 1,36,764  | EA will be reimbursed after submission of the Hard Copies and the soft copy of the final proposal along with Maps and Plan as suggested by the TCC-NMET in its meeting while clearing the proposal. |
| L     | Total Estimated Cost without GST  |                                |                    |   |  | 73,47,919 |   |
| M     | Provision for GST (18% of J)  |                                |                    |   |  | 13,22,626 | GST will be reimburse as per actual and as per notified prescribed rate   |
| N     | Total Estimated Cost with GST   |                                |                    |   |  | 86,70,546 |   |
|       |   |                                |                    | Rs. In Lakhs                                      |  | 86.71     |   |
| Note: |   |                                |                    |   |  |           |   |
| 1     | Strict adherence to the Ministry of Finance's and GFR guidelines is mandatory. Every transaction must adhere to GFR rule 21.  |                                |                    |   |  |           |   |
| 2     | In case of delay/non- performance, the appropriate action will be taken by competent authority against delinquent agency as per prevailing govt. of India rules/guidelines on procurement.  |                                |                    |   |  |           |   |
| 3     | If any part of the project is outsourced, the amount will be reimbursed as per the Paragraph 3 of NMET SoC and Item no. 6 of NMET SoC. In case of execution of the project by NEA on its own, a Certificate regarding non outsourcing of any component/project is required. |                                |                    |   |  |           |   |
| 4     | Necessary efforts should be made to minimize any adverse impact on the environment during exploration activities.   |                                |                    |   |  |           |   |

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Annexure 7B

| Time Schedule/ Action plan for Preliminary Exploration (G-3) for Limestone in Sawalhora (East) Block, Chandrapur, District: Maharashtra |   |             |   |   |   |   |        |   |   |   |   |   |    |  |
|---|---|-------------|---|---|---|---|--------|---|---|---|---|---|----|--|
| S. No.  |   |             | 1 | 2 | 3 | 4 | Review | 5 | 6 | 7 | 8 | 9 | 10 |  |
| 1   | Camp Setting  | Months/Days |   |   |   |   |        |   |   |   |   |   |    |  |
| 2   | Geological Mapping & Sampling                                 | days        |   |   |   |   |        |   |   |   |   |   |    |  |
| 3   | Geophysical survey  | L.km        |   |   |   |   |        |   |   |   |   |   |    |  |
| 4   | Geophysicist party days (HQ) for data interpretation & Report | Days        |   |   |   |   |        |   |   |   |   |   |    |  |
| 5   | Pitting/Trenching   | cu.m        |   |   |   |   |        |   |   |   |   |   |    |  |
| 6   | Surface Drilling (1 rigs)                                     | m           |   |   |   |   |        |   |   |   |   |   |    |  |
| 7   | Survey Party days   | days        |   |   |   |   |        |   |   |   |   |   |    |  |
| 8   | Geologist Man days  | days        |   |   |   |   |        |   |   |   |   |   |    |  |
| 9   | Sampler Man days  | days        |   |   |   |   |        |   |   |   |   |   |    |  |
| 10  | Camp Winding  | months      |   |   |   |   |        |   |   |   |   |   |    |  |
| 11  | Laboratory Studies  | Nos.        |   |   |   |   |        |   |   |   |   |   |    |  |
| 12  | Report Writing with Peer Review                               | months      |   |   |   |   |        |   |   |   |   |   |    |  |

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### 3. Revised cost sheet

| Annexure 10   |   |                     |                               |                               |                               |                         |                 |                         |   |
|---|---|---------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------|-----------------|-------------------------|---|
| Revised Cost expenditure for Preliminary Exploration (G-3) for Limestone in Sawalhira East Block(G3), Chandrapur, District: Maharashtra |   |                     |                               |                               |                               |                         |                 |                         |   |
| S. No.  | Item of Work *  | Unit *              | Rates as per NMET SoC 2020-21 |                               | Approved Cost of the Proposal |                         | Revised cost of |                         | Remarks   |
|   |   |                     | SoC-Item No. *                | Rates as per NMET SoC 2020-21 | Qty. (b)                      | Total Amount (Rs) (a*b) | Qty. (b)        | Total Amount (Rs) (a*b) |   |
| A   | Geological Mapping Other Geological Work & Surveying  |                     |                               |                               |                               |                         |                 |                         |   |
|   | Geological mapping, (1:4,000 scale) & Trenching , drilling work                                 |                     |                               |                               |                               |                         |                 |                         |   |
| i   | a. Charges for Geologist per day (Field) for geological mapping & trenching work, drilling work | day                 | 1.3                           | 11000                         | 120                           | 1320000                 | 100             | 1100000                 |   |
| ii  | b. Labours Charges; Base rate   | day                 | 5.7                           | 504                           | 240                           | 120960                  | 200             | 108200                  | Amount will be reimbursed as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher. |
|   | c. Charges for Geologist per day (HQ)   | day                 | 1.3                           | 9000                          | 50                            | 450000                  | 50              | 450000                  |   |
|   | d. Charges for one Sampler per day (1 Party)  | one sampler per day | 1.5.2                         | 5100                          | 32                            | 163200                  | 32              | 163200                  |   |
|   | e. Labours (4 Nos)  | day                 | 5.7                           | 504                           | 128                           | 64512                   | 128             | 69248                   | Amount will be reimbursed as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher. |

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|          |   |                          |          |        |            |                  |            |                  |   |
|----------|---|--------------------------|----------|--------|------------|------------------|------------|------------------|---|
|          |   | <b>Sub Total- A</b>      |          |        |            | <b>21,18,672</b> |            | <b>18,90,648</b> |   |
| <b>B</b> | <b>Ground Geophysical Survey</b>  |                          |          |        |            |                  |            |                  |   |
| 1        | IP. Induced Polarization (I.P) cum Resistivity S.P and Magnetic (30 Lkm)                      | 8-10 Line Km             |          |        |            |                  |            |                  |   |
| 3        | Geophysicist party days (Field)   | per day                  |          |        |            |                  |            |                  |   |
| 4        | c. Labours Charges  | day                      |          |        |            |                  |            |                  |   |
| 5        | Geophysicist party days (HQ)  | per day                  |          |        |            |                  |            |                  |   |
|          | <b>Sub Total- B</b>   |                          |          |        |            | <b>-</b>         |            |                  |   |
| <b>C</b> | <b>Survey work</b>  |                          |          |        |            |                  |            |                  |   |
| a        | DGPS Survey for BH fixation & RL determination  | Per Point of observation | 1.6.2    | 19,200 | <b>11</b>  | 211200           | <b>8</b>   | <b>1,53,600</b>  |   |
| b        | Charges of Surveyor (1 party) for Geophysical survey layout work & Block boundary demarcation | one surveyor per day     | 1.6.1a   | 8,300  | 30         | 249000           | 30         | 249000           |   |
| c        | Labours Charges for survey work;  | day                      | 5.7      | 504    | 120        | 60480            | 120        | 64920            | Amount will be reimbursed as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher. |
|          | <b>Sub-Total C</b>  |                          |          |        |            | <b>5,20,680</b>  |            | <b>4,67,520</b>  |   |
| <b>D</b> | <b>Trenching/Pitting</b>  |                          |          |        |            |                  |            |                  |   |
| a)       | Excavation of Pit   | per cu.m                 | 2.1.1    | 3,800  |            | 0                | 6          | 22,800           |   |
|          | <b>Sub-Total D</b>  |                          |          |        |            |                  |            | <b>22,800</b>    |   |
| <b>E</b> | <b>DRILLING (after review)</b>  |                          |          |        |            |                  |            |                  |   |
| 1        | Drilling up to 300m (Hard Rock)   | m                        | 2.2.1.1b | 6,775  | <b>300</b> | 2032500          | <b>120</b> | <b>8,13,000</b>  |   |
| 2        | Borehole deviation Survey by Multishot Camera   | m                        |          |        |            |                  |            |                  |   |
| 3        | Land / Crop Compansation (in case the BH falls in agricultural Land)                          | per BH                   | 5.6      | 20,000 | -          | 0                |            |                  |   |

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|          |   |                   |         |          |     |                  |     |                  |              |
|----------|---|-------------------|---------|----------|-----|------------------|-----|------------------|--------------|
| 4        | Construction of concrete Pillar (12"x12"x30")                                       | per borehole      | 2.2.7a  | 2,000    | 5   | 10000            | 2   | 4,000            | 3 BH dropped |
| 5        | Borehole plugging by cement   | per borehole      | 2.2.7b  | 150      | -   | 0                |     |                  |              |
| 6        | Transportation of Drill Rig & Truck associated per drill (2 rigs)                   | Km                | 2.2.8   | 36       | 400 | 14400            | 400 | 14400            | To and Fro   |
| 7        | Monthly Accomodation Charges for drilling Camp (up to 2 Rigs)                       | month             | 2.2.9   | 50,000   | 2   | 1,00,000         | 2   | 1,00,000         |              |
| 8        | Drilling Camp Setting Cost  | Nos               | 2.2.9a  | 2,50,000 | 1   | 2,50,000         | 1   | 2,50,000         |              |
| 9        | Drilling Camp Winding up Cost   | Nos               | 2.2.9b  | 2,50,000 | 1   | 2,50,000         | 1   | 2,50,000         |              |
| 10       | Road Making (Flat Terrain)  | Km                | 2.2.10a | 22,020   | 2   | 44,040           | 2   | 44,040           |              |
| 11       | Drill Core Preservation   | per m             | 5.3     | 1,590    | 250 | 3,97,500         | -   | -                |              |
|          | <b>Sub Total E</b>  |                   |         |          |     | <b>30,98,440</b> |     | <b>14,75,440</b> |              |
| <b>F</b> | <b>Borehole Geophysical Logging</b>   | 5 Bhs of 60m each |         |          |     |                  |     |                  |              |
| <b>G</b> | <b>LABORATORY STUDIES</b>   |                   |         |          |     |                  |     |                  |              |
| 1        | <b>Chemical Analysis</b>  |                   |         |          |     |                  |     |                  |              |
| i)       | <b>Geochemical Sampling-Surface samples (Bedrock/Channel /Soil/Stream sediment)</b> |                   |         |          |     |                  |     |                  |              |
|          | a. Au by Fire Assay   | Nos               |         |          |     |                  |     |                  |              |
|          | b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by AAS Method                              | Nos               |         |          |     |                  |     |                  |              |
|          | c. For PGE by Fire Assay  | Nos               |         |          |     |                  |     |                  |              |
| ii)      | <b>Surface Check samples (10% External)</b>   |                   |         |          |     |                  |     |                  |              |
|          | a. Au by Fire Assay   | Nos               |         |          |     |                  |     |                  |              |
|          | b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by AAS Method                              | Nos               |         |          |     |                  |     |                  |              |
|          | c. For PGE  | Nos               |         |          |     |                  |     |                  |              |
| iii)     | <b>Trench &amp; Check Samples from Trench</b>                                       |                   |         |          |     |                  |     |                  |              |

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|      |  |            |         |       |     |          |     |          |                      |
|------|--|------------|---------|-------|-----|----------|-----|----------|----------------------|
|      | <b>Trench samples</b>  |            |         |       |     |          |     |          |                      |
|      | a. Au by Fire Assay  | Nos        |         |       |     |          |     |          |                      |
|      | b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by AAS Method   | Nos        |         |       |     |          |     |          |                      |
|      | c. For PGE   | Nos        |         |       |     |          |     |          |                      |
| iv)  | <b>Trench Check samples (10% External)</b>   |            |         |       |     |          |     |          |                      |
|      | a. Au by Fire Assay  | Nos        |         |       |     |          |     |          |                      |
|      | b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by AAS Method   | Nos        |         |       |     |          |     |          |                      |
|      | c. For PGE   | Nos        |         |       |     |          |     |          |                      |
| v)   | <b>BH Core samples</b>   |            |         |       |     |          |     |          |                      |
|      | a. Au by Fire Assay  | Nos        |         |       |     |          |     |          |                      |
|      | b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by ICPMS-34 elements  | Nos        |         |       |     |          |     |          |                      |
|      | c. For PGE   | Nos        |         |       |     |          |     |          |                      |
| vi)  | <b>BH Core samples (10% External)</b>  |            |         |       |     |          |     |          |                      |
|      | a. Au by Fire Assay  | Nos        |         |       |     |          |     |          |                      |
|      | b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by AAS Method   | Nos        |         |       |     |          |     |          |                      |
|      | c. For PGE   | Nos        |         |       |     |          |     |          |                      |
| vii) | <b>Major Oxide Analysis</b>  |            |         |       |     |          |     |          |                      |
|      | a) Estimation of major oxides by XRF/whole rock analysis for primary samples (CaO, MgO, SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , LOI, Na <sub>2</sub> O, Fe <sub>2</sub> O <sub>3</sub> , MnO, K <sub>2</sub> O, TiO <sub>2</sub> , SO <sub>3</sub> , P <sub>2</sub> O <sub>5</sub> , Cr <sub>2</sub> O <sub>3</sub> , ZnO, V <sub>2</sub> O <sub>5</sub> ) | per sample | 4.1.15a | 4200  | 230 | 9,66,000 | 131 | 5,50,200 | 45 BRS+ 80CS + 6 PIT |
|      | Estimation of major oxides by XRF/whole rock analysis for check samples  | per sample | 4.1.15a | 4200  | 23  | 96,600   | 14  | 58,800   | 5 BRS + 8 CS +1 PIT  |
|      | Determination of insitu Bulk Density   |            | 4.10    | 3,540 | 2   | 7,080    | 2   | 7,080    |                      |

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|          |   |                                       |                           |   |    |                  |    |                  |   |
|----------|---|---------------------------------------|---------------------------|---|----|------------------|----|------------------|---|
| 2        | <b>Physical &amp; Petrological Studies</b>                                  |                                       |                           |   |    |                  |    |                  |   |
| i        | Preparation of thin section   | Nos                                   |                           |   |    |                  |    |                  |   |
| ii       | Study of thin section   | Nos                                   |                           |   |    |                  |    |                  |   |
| iii      | Preparation of polish section   | Nos                                   | 4.3.2                     | 1,549   | 5  | 7,745            | 5  | 7,745            |   |
| iv       | study of polished section   | Nos                                   | 4.3.4                     | 4,232   | 5  | 21,160           | 5  | 21,160           |   |
| v        | Digital Photographs   | Nos                                   | 4.3.7                     | 280   | 10 | 2,800            | 10 | 2,800            |   |
| vi       | Whole Rock Analysis   | Nos                                   |                           |   |    |                  |    |                  |   |
| vii      | Sp. Gravity   | Nos                                   |                           |   |    |                  |    |                  |   |
|          | SEM Studies   | per hour                              |                           |   |    |                  |    |                  |   |
| viii     | EPMA studies  | per hour                              |                           |   |    |                  |    |                  |   |
|          | <b>Sub total G</b>  |                                       |                           |   |    | <b>11,01,385</b> |    | <b>6,47,785</b>  |   |
| <b>H</b> | <b>Total A to G</b>   |                                       |                           |   |    | <b>68,39,177</b> |    | <b>45,04,193</b> |   |
| <b>I</b> | <b>Geological Report Preparation</b>  | <b>5 Hard copies with a soft copy</b> | <b>5.2</b>                | <b>5.2 (i)</b>                                    |    | <b>3,41,959</b>  |    | <b>2,25,210</b>  | Reimbursement will be made after submission of the final Geological Report in Hard Copies (5 Nos) and the soft copy to NMET.  |
| <b>J</b> | <b>Peer review Charges</b>  |                                       | <b>As per EC decision</b> |   |    | <b>30,000</b>    |    | <b>30,000</b>    |   |
| <b>K</b> | <b>Preparation of Exploration Proposal (5 Hard copies with a soft copy)</b> | <b>5 Hard copies with a soft copy</b> | <b>5.1</b>                | 2% of the Cost or Rs. 5.0 Lakhs whichever is less |    | <b>1,36,784</b>  |    | <b>90,084</b>    | EA will be reimbursed after submission of the Hard Copies and the soft copy of the final proposal along with Maps and Plan as suggested by the TCC-NMET in its meeting while clearing the proposal. |
| <b>L</b> | <b>Total Estimated Cost without GST</b>                                     |                                       |                           |   |    | <b>73,47,919</b> |    | <b>48,49,487</b> |   |
| <b>M</b> | <b>Provision for GST (18% of J)</b>   |                                       |                           |   |    | <b>13,22,625</b> |    | <b>8,72,908</b>  | GST will be reimburse as per actual and as  |

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|   |   |  |  |                  |           |  |           |  |
|---|---|--|--|------------------|-----------|--|-----------|--|
|   |   |  |  |                  |           |  |           | per notified prescribed rate               |
| N | Total Estimated Cost with GST   |  |  |                  | 86,70,545 |  | 57,22,394 | 29,48,151                                  |
|   |   |  |  | Rs. In Lakhs     | 86.71     |  | 57.22     | 29.48                                      |
|   |   |  |  | Change in amount |           |  |           | (-) Rs 29.69 lakhs (~34.24% de-escalation) |
| 1 | Strict adherence to the Ministry of Finance's and GFR guidelines is mandatory. Every transaction must adhere to GFR rule 21.  |  |  |                  |           |  |           |  |
| 2 | In case of delay/non- performance, the appropriate action will be taken by competent authority against delinquent agency as per prevailing govt. of India rules/guidelines on procurement.  |  |  |                  |           |  |           |  |
| 3 | If any part of the project is outsourced, the amount will be reimbursed as per the Paragraph 3 of NMET SoC and Item no. 6 of NMET SoC. In case of execution of the project by NEA on its own, a Certificate regarding non outsourcing of any component/project is required. |  |  |                  |           |  |           |  |
| 4 | Necessary efforts should be made to minimize any adverse impact on the environment during exploration activities.   |  |  |                  |           |  |           |  |
| 5 | Any item of work not mentioned above shall be added as per SoC.   |  |  |                  |           |  |           |  |
| 6 | All the Geological Reports and data are to be uploaded on NGDR as per MERT template by the agency.  |  |  |                  |           |  |           |  |

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**Annexure 14**  
**Outcrop Photographs of Limestone from Sawalhira East Block**



Exposed outcrop of limestone



Outcrop of limestone with well-developed joints



Outcrop of limestone displaying bedded nature



Outcrop of massive grey colour limestone



Outcrop of limestone showing stratified nature