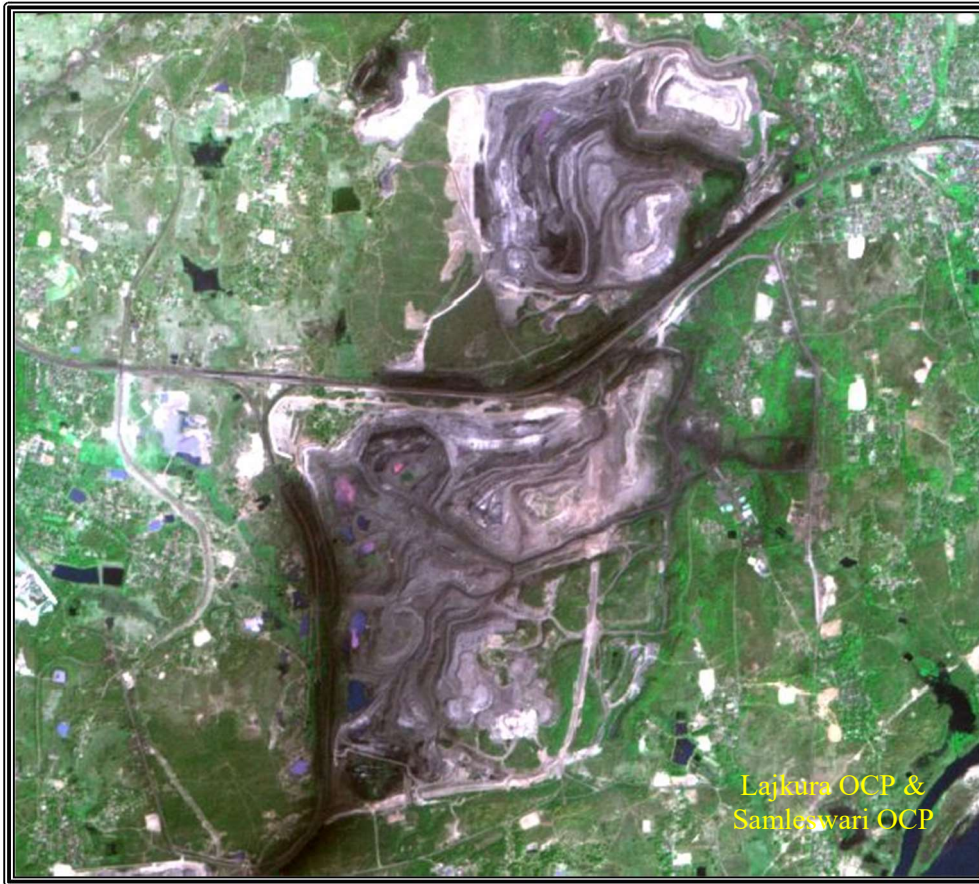


Land Restoration / Reclamation Monitoring of 16 opencast coal mines of Mahanadi Coalfields Ltd. (MCL) producing more than 5 million cu.m. (Coal+OB) per annum based on satellite data of the Year 2022



Submitted to
Mahanadi Coalfields Limited



Land Restoration / Reclamation monitoring of 16 opencast coal mines of Mahanadi Coalfields Ltd. (MCL) producing more than 5 million cu.m. (Coal+OB) per annum based on satellite data of the Year 2022

March 2023



**Remote Sensing Cell
Geomatics Division
CMPDI, Ranchi**

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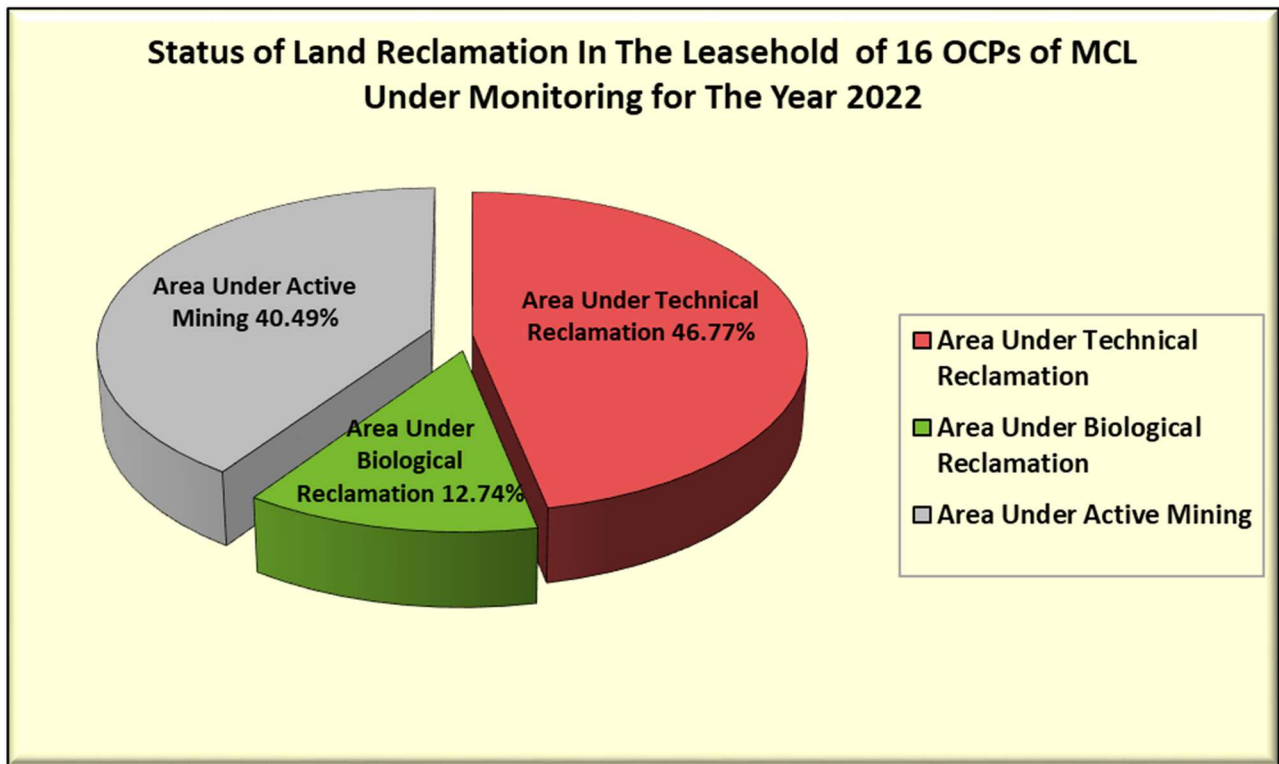
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Executive Summary

- 1.0 Projects** Land restoration / reclamation monitoring of 16 opencast coal mines of Mahanadi Coalfields Ltd. (MCL) producing 5 million cu.m. and more (Coal+OB) per annum based on satellite data on annual basis.
- 2.0 Objective** Objective of the land restoration / reclamation monitoring is to assess the area under backfilling, plantation, social forestry, active mining area, water bodies, distribution of wasteland, agricultural land and forest in the leasehold area of the project. This will help in assessing the progressive status of mined land reclamation and to take up remedial measures, if any, required for environmental protection.
- 3.0 Salient Findings**
- Out of the total mine leasehold area of 179.75 Km² of the 16 opencast projects of MCL viz. Ananta, Balram, Lingaraj, Bharatpur, Bhubaneshwari, Jagannath, Hingula, Belpahar, Lakhanpur, Samleswari, Lajkura, Siarmal, Basundhara W. Extn., Garjanbahal, Kulda and Kahina considered for monitoring during 2022-23; total excavated area is 63.25 Km², out of which 8.06 Km² area (12.74%) has been planted, 29.58 Km² area (46.77%) is under backfilling and 25.61 Km² area (40.49%) is under active mining. It is evident from the analysis that 59.51% areas of the OC projects is under reclamation (biological and technical) and balance 40.49% area is under active mining. Project wise details are given in Table-1 & Fig-1.
 - On comparing the status of land reclamation for the year 2022 with respect to the year 2021 in different projects, it is evident from the analysis that area under land reclamation has increased from 35.53 Km² (Yr.2021) to 37.64 Km² (Yr.2022). Out of 16 projects of MCL, Belpahar OC ranks on top for land reclamation (75.77%) followed by Samleswari OC (72.28%) and Bharatpur OC (71.70%).
 - Area of biological reclamation (plantation on backfill) has been decreased nominally from 8.24Km² (Yr.2021) to 8.06 Km² (Yr. 2022) and area of technical reclamation (area under backfilling) has increased from 27.29 Km² (Yr.2021) to 29.58 Km² (Yr.2022) in MCL. The increase of 2.11 Km² in total area of reclamation is the result of the efforts of the Mahanadi Coalfields Ltd. taken up towards land reclamation and environmental protection.
 - In some of the projects it has been observed during field visit that natural vegetation has also started growing on the old and stabilized backfilled

area and dumps due to high soil fertility besides plantation carried out by MCL, resulting in higher vegetation cover than plantation done.



Pie Chart indicating distribution of reclamation activities in OC mines of MCL

| Table 1: Project wise Land Reclamation Status in Opencast Projects of MCL based on Satellite Data of the year 2022 | | | | | | | | | | | | | | | | | | (Area in Sq.km.) | | | |
|--------------------------------------------------------------------------------------------------------------------|--------------------|---------------------------|---------------------------|------------------------|--------------|-----------------------------------------|-----------------------------------------|-----------------------------------------|-------------|-------------|-------------|--------------------------|----------------------|-------------------------------------------------------------------|--------------|------------------------------|--------------|------------------|--------------|----------|------|
| Sl. No. | Project | Total Leasehold Area 2020 | Total Leasehold Area 2021 | Technical Reclamation | | Plantation | | | | | | Area Under Active Mining | Total Excavated Area | Total Area Under Plantation (%Green Cover Generated in Leasehold) | | Total Area Under Reclamation | | | | | |
| | | | | Area under Backfilling | | Biological Reclamation | | Other Plantation | | | | | | 2021 | 2022 | 2021 | 2022 | | | | |
| | | | | | | Plantation on Excavated/Backfilled Area | Plantation on External Over Burden Dump | Social Forestry, Avenue Plantation Etc. | 2021 | 2022 | 2021 | | | | | | | 2022 | | | |
| 1 | 2 | 3 | 4 | 5 | | 6 | | 7 | | | | 8 | | 9 | | 10(=5+6+9) | | 11(=6+7+8) | | 12(=5+6) | |
| | | | | 2021 | 2022 | 2021 | 2022 | 2021 | 2022 | 2021 | 2022 | 2021 | 2022 | 2021 | 2022 | 2021 | 2022 | 2021 | 2022 | 2021 | 2022 |
| 1 | Ananta | 14.20 | 14.20 | 2.46 | 2.62 | 1.05 | 1.05 | 0.10 | 0.10 | 0.22 | 0.22 | 1.60 | 1.95 | 5.11 | 5.62 | 1.37 | 1.37 | 3.51 | 3.67 | | |
| | | | | 48.14% | 46.62% | 20.55% | 18.68% | | | | | 31.31% | 34.70% | | | 9.65% | 9.65% | 68.69% | 65.30% | | |
| 2 | Balram | 13.09 | 13.09 | 2.78 | 2.98 | 1.04 | 0.98 | 0.22 | 0.22 | 0.35 | 0.35 | 1.40 | 1.58 | 5.22 | 5.54 | 1.61 | 1.55 | 3.82 | 3.96 | | |
| | | | | 53.26% | 53.79% | 19.92% | 17.69% | | | | | 26.82% | 28.52% | | | 12.30% | 11.84% | 73.18% | 71.48% | | |
| 3 | Lingaraj | 11.73 | 11.73 | 1.90 | 1.98 | 0.15 | 0.16 | 0.52 | 0.52 | 0.44 | 0.44 | 2.67 | 2.68 | 4.72 | 4.82 | 1.11 | 1.12 | 2.05 | 2.14 | | |
| | | | | 40.25% | 41.08% | 3.18% | 3.32% | | | | | 56.57% | 55.60% | | | 9.46% | 9.55% | 43.43% | 44.40% | | |
| 4 | Bharatpur | 9.27 | 9.27 | 2.66 | 2.83 | 1.65 | 1.63 | 0.45 | 0.45 | 0.16 | 0.16 | 1.75 | 1.76 | 6.06 | 6.22 | 2.26 | 2.24 | 4.31 | 4.46 | | |
| | | | | 43.89% | 45.50% | 27.23% | 26.21% | | | | | 28.88% | 28.30% | | | 24.38% | 24.16% | 71.12% | 71.70% | | |
| 5 | Bhubaneswari | 6.58 | 6.58 | 2.15 | 2.29 | 0.02 | 0.02 | 0.01 | 0.01 | 0.13 | 0.09 | 2.17 | 2.17 | 4.34 | 4.48 | 0.16 | 0.12 | 2.17 | 2.31 | | |
| | | | | 49.54% | 51.12% | 0.46% | 0.45% | | | | | 50.00% | 48.44% | | | 2.43% | 1.82% | 50.00% | 51.56% | | |
| 6 | Jagannath | 5.54 | 5.54 | 1.00 | 1.05 | 1.80 | 1.80 | 0.00 | 0.00 | 0.17 | 0.15 | 0.98 | 1.13 | 3.78 | 3.98 | 1.97 | 1.95 | 2.80 | 2.85 | | |
| | | | | 26.46% | 26.38% | 47.62% | 45.23% | | | | | 25.93% | 28.39% | | | 35.56% | 35.20% | 74.07% | 71.61% | | |
| 7 | Hingula | 15.75 | 15.75 | 1.50 | 1.69 | 0.06 | 0.04 | 0.21 | 0.18 | 0.29 | 0.29 | 2.25 | 2.47 | 3.81 | 4.20 | 0.56 | 0.51 | 1.56 | 1.73 | | |
| | | | | 39.37% | 40.24% | 1.57% | 0.95% | | | | | 59.06% | 58.81% | | | 3.56% | 3.24% | 40.94% | 41.19% | | |
| 8 | Kaniha | 7.18 | 7.18 | 0.31 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 | 0.07 | 1.24 | 1.48 | 1.55 | 1.84 | 0.07 | 0.07 | 0.31 | 0.36 | | |
| | | | | 20.00% | 19.57% | 0.00% | 0.00% | | | | | 80.00% | 80.43% | | | 0.97% | 0.97% | 20.00% | 19.57% | | |
| 9 | Belpahar | 14.44 | 14.44 | 2.71 | 3.50 | 0.82 | 0.66 | 0.51 | 0.48 | 0.52 | 0.50 | 1.29 | 1.33 | 4.82 | 5.49 | 1.85 | 1.64 | 3.53 | 4.16 | | |
| | | | | 56.22% | 63.75% | 17.01% | 12.02% | | | | | 26.76% | 24.23% | | | 12.81% | 11.36% | 73.24% | 75.77% | | |
| 10 | Lakhanpur | 22.40 | 22.40 | 4.66 | 4.76 | 0.86 | 0.89 | 0.59 | 0.59 | 0.40 | 0.38 | 3.58 | 3.99 | 9.10 | 9.64 | 1.85 | 1.86 | 5.52 | 5.65 | | |
| | | | | 51.21% | 49.38% | 9.45% | 9.23% | | | | | 39.34% | 41.39% | | | 8.26% | 8.30% | 60.66% | 58.61% | | |
| 11 | Samleswari | 13.35 | 13.35 | 3.03 | 3.12 | 0.64 | 0.66 | 0.49 | 0.49 | 0.48 | 0.48 | 1.29 | 1.45 | 4.96 | 5.23 | 1.61 | 1.63 | 3.67 | 3.78 | | |
| | | | | 61.09% | 59.66% | 12.90% | 12.62% | | | | | 26.01% | 27.72% | | | 12.06% | 12.21% | 73.99% | 72.28% | | |
| 12 | Lajkura | 7.21 | 7.21 | 1.24 | 1.32 | 0.15 | 0.16 | 0.20 | 0.19 | 0.16 | 0.16 | 1.02 | 1.07 | 2.41 | 2.55 | 0.51 | 0.51 | 1.39 | 1.48 | | |
| | | | | 51.45% | 51.76% | 6.22% | 6.27% | | | | | 42.32% | 41.96% | | | 7.07% | 7.07% | 57.68% | 58.04% | | |
| 13 | Siarmal | 22.90 | 22.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.60 | 0.61 | 0.00 | 0.00 | 0.00 | 0.00 | 0.60 | 0.61 | 0.00 | 0.00 | | |
| | | | | 0.00% | 0.00% | 0.00% | 0.00% | | | | | 0.00% | 0.00% | | | 2.62% | 2.66% | - | - | | |
| 14 | Basundhara W Extn. | 3.23 | 3.23 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.03 | 0.00 | 0.00 | | |
| | | | | 0.00% | 0.00% | 0.00% | 0.00% | | | | | 0.00% | 0.00% | | | 0.93% | 0.93% | - | - | | |
| 15 | Garjanbahal | 6.54 | 6.54 | 0.14 | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.03 | 0.58 | 0.79 | 0.72 | 0.96 | 0.03 | 0.03 | 0.14 | 0.17 | | |
| | | | | 19.44% | 17.71% | 0.00% | 0.00% | | | | | 80.56% | 82.29% | | | 0.46% | 0.46% | 19.44% | 17.71% | | |
| 16 | Kulda | 6.34 | 6.34 | 0.75 | 0.91 | 0.00 | 0.01 | 0.00 | 0.01 | 0.02 | 0.03 | 1.67 | 1.76 | 2.42 | 2.68 | 0.02 | 0.05 | 0.75 | 0.92 | | |
| | | | | 30.99% | 33.96% | 0.00% | 0.37% | | | | | 69.01% | 65.67% | | | 0.32% | 0.79% | 30.99% | 34.33% | | |
| | Total | 179.75 | 179.75 | 27.29 | 29.58 | 8.24 | 8.06 | 3.30 | 3.24 | 4.07 | 3.99 | 23.49 | 25.61 | 59.02 | 63.25 | 15.61 | 15.29 | 35.53 | 37.64 | | |
| | | | | 46.24% | 46.77% | 13.96% | 12.74% | | | | | 39.80% | 40.49% | | | 8.68% | 8.51% | 60.20% | 59.51% | | |

Note: In reference to the above Table-1, different parameters are classified as follows:

1. Area under **Biological Reclamation** includes Area under Plantation done on Backfilled Area only.
2. Area under **Technical Reclamation** includes Area under Barren Backfilling only.
3. Area under **Active Mining** includes Coal Quarry, Advance Quarry Site, Quarry Filled with Water, if any. Areas under coal dump have been excluded from Active Mining in this table.
4. Social Forestry and Plantation on External OB Dumps are not included in Biological Reclamation and are put under separate categories as shown in the Table above.
5. (%) calculated in the above Table is in respect to Total Excavated Area except for "Total Area under Plantation" where % is in terms of "Leasehold Area"

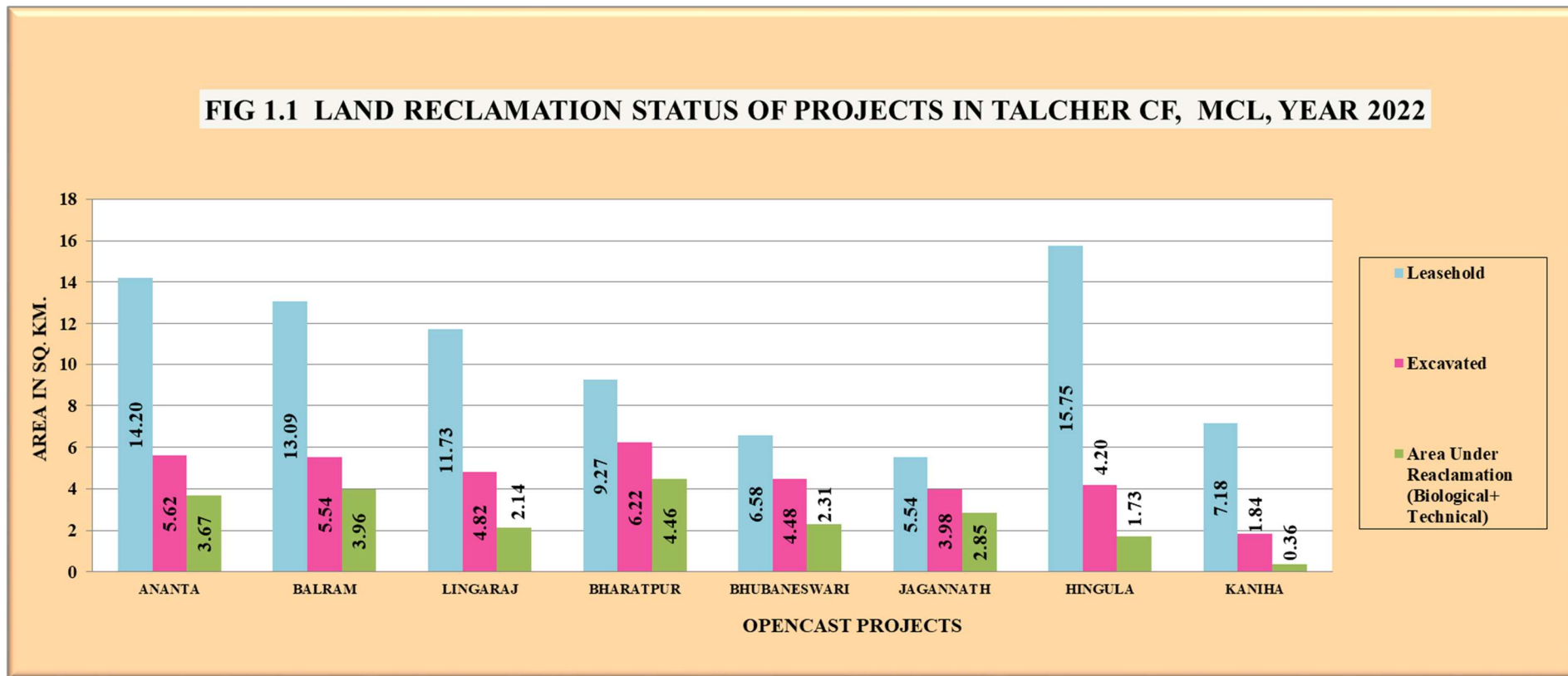


Fig.1.1: Land reclamation status of OC projects in Talcher CF, MCL for the year 2022

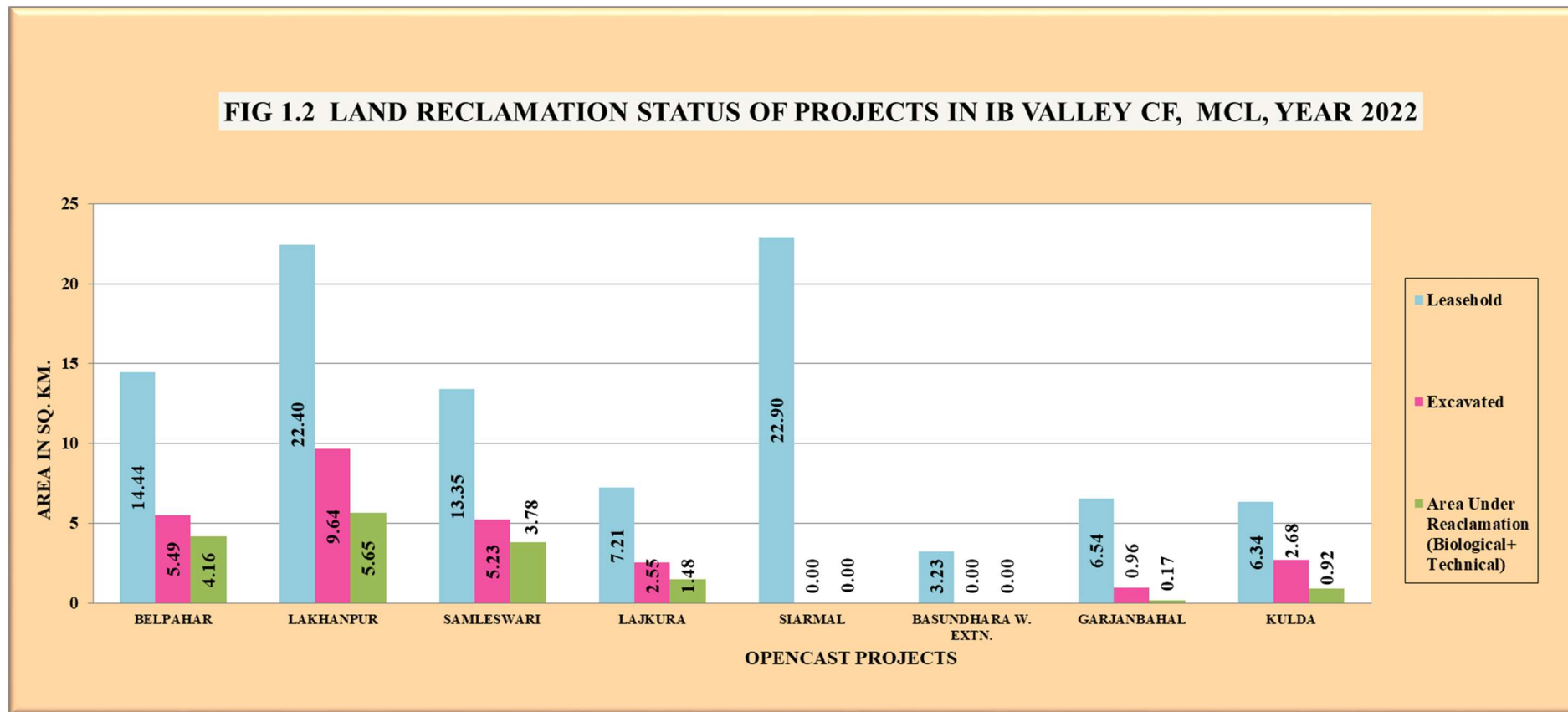


Fig.1.2: Land reclamation status of OC projects in Ib Valley CF, MCL for the year 2022

1.0 Background

- 1.1** Land is the most important natural resource which embodies soil, water, flora, fauna and total ecosystem. All human activities are based on the land, which is the most scarce natural resource in our country. Mining is a site specific industry and it could not be shifted anywhere else from the location where mineral occurs. It is a fact that surface mining activities do effect the land environment due to ground breaking. Therefore, there is an urgent need to reclaim and restore the mined out land for its productive use for sustainable development of mining. This will not only mitigate environmental degradation, but would also help in creating a more congenial environment for land acquisition by coal companies in future.
- 1.2** Keeping above in view, Coal India Ltd. (CIL) issued a work order vide letter no. CIL/WBP/Env/2009/2428 dated 29.12.2009 to Central Mine Planning & Design Institute (CMPDI), Ranchi, for monitoring land reclamation. status of all the opencast coal mines having production of more than 5 million m³ per annum (coal + OB taken together per annum) based on remote sensing satellite data, regularly on annual basis for sustainable development of mining. Further, a revised work order was issued vide letter no. CIL/WBP/Env/2011/4706 dated 12.10.2012 from Coal India Limited for the period 2012-13 to 2016-17 followed by another work order vide letter no. CIL/WBP/Env/2017/DP/8477 dated 21.09.2017 from Coal India Limited for the period 2017-18 to 2021-22 and another work order on CIL/ENVT/2022-23/W.O./10899 dated 06.07.2022 for land reclamation monitoring of 110 opencast projects and vegetation cover monitoring of 13 major coalfields for the period 2022-2024. According to this work order, all mines in CIL with output capacity of 5 million cu. m (Coal +OB) shall be monitored every year and all mines below this capacity shall be monitored at an interval of 3 years. Total 13 number of coalfields in CIL shall also be monitored between 2022-2024. The result of land reclamation status of all such mines to be put on the website of CIL, (www.coalindia.in), CMPDI (www.cmpdi.co.in) and the concerned coal companies in public domain. Detail report to be submitted to Coal India and respective subsidiaries.

- 1.3** Land reclamation monitoring of all opencast coal mining projects would also comply the statutory requirements of Ministry of Environment, Forest and Climate Change (MoEF & CC). Such monitoring would not only facilitate in taking timely mitigation measures against environmental degradation, but would also enable coal companies to utilize the reclaimed land for larger socio-economic benefits in a planned way.
- 1.4** Present report is embodying the finding of the study based on satellite data of the year 2022 carried out for all the OC projects producing more than 5 mcm (Coal+OB) for Mahanadi Coalfields Ltd.

2.0 Objective

Objective of the land reclamation/restoration monitoring is to assess the area of backfilled, plantation, OB dumps, social forestry, active mining area, settlements and water bodies, distribution of wasteland, agricultural land and forest land in the leasehold area of the project. This is an important step taken up for assessing the progressive status of mined land reclamation and for taking up remedial measures, if any, required for environmental protection.

3.0 Methodology

There are number of steps involved between raw satellite data procurement and preparation of final map. National Remote Sensing Centre (NRSC) Hyderabad, being the nodal agency for satellite data supply in India, provides only raw digital satellite data, which needs further digital image processing for extracting the information and map preparation before uploading the same in the website. Methodology for land reclamation monitoring is given in Fig 2. Following steps are involved in land reclamation /restoration monitoring:

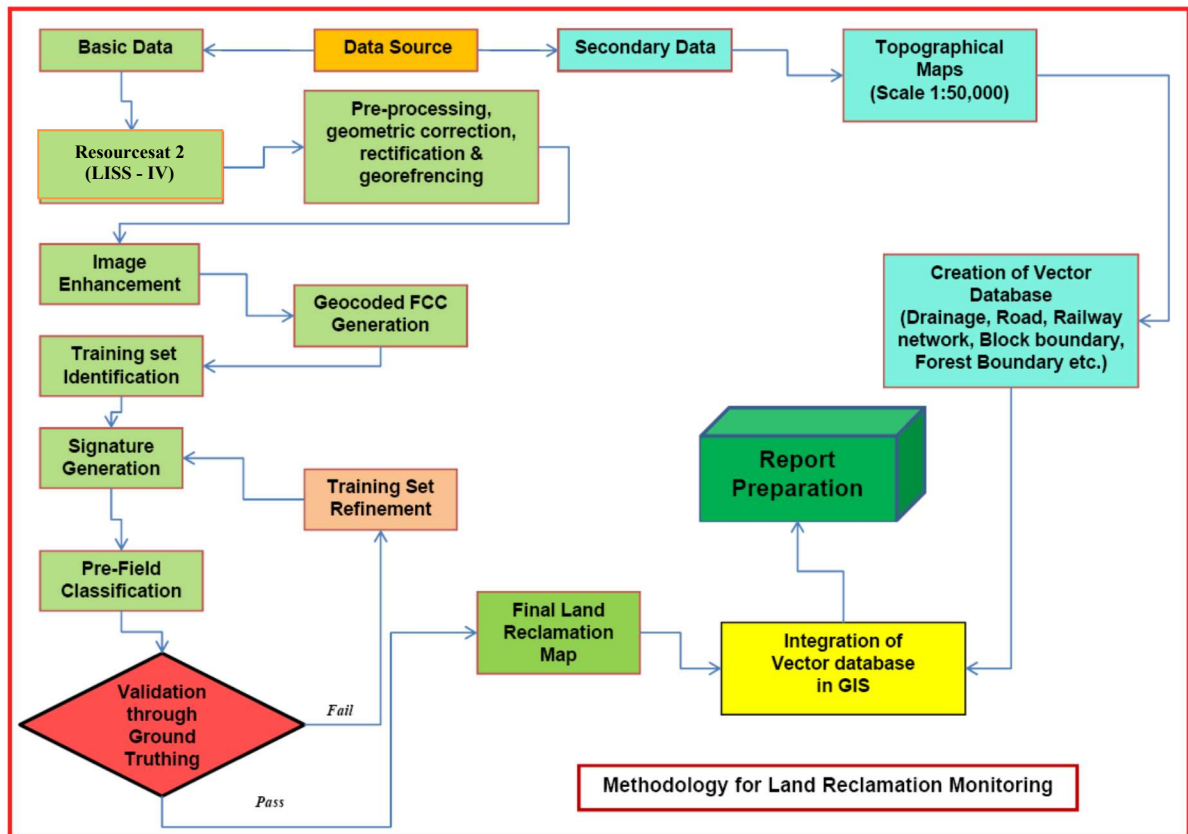


Figure: 2 - **Methodology for Land Reclamation Monitoring**

3.1 Data Procurement: After browsing the data quality and date of pass on internet, supply order for data is placed to NRSC. Secondary data like leasehold boundary, topo sheets are procured for creation of vector database.

Satellite Data Used: The following data are used in the current study, IRS-R2/LISS-IV data of 14th February, 2022 for mines of Talcher Coalfield and IRS-R2/LISS-IV data of 05th March, 2022 for mines of Ib Valley Coalfield.

3.2 Satellite Data Processing: Satellite data are processed using ERDAS IMAGINE 2014 digital image processing s/w. Methodology involves the following major steps:

- **Rectification & Georeferencing:** Inaccuracies in digital imagery may occur due to 'systematic errors' attributed to earth curvature and rotation as well as 'non-systematic errors' attributed to satellite receiving station itself. Raw digital images contain geometric distortions, which make them unusable as maps.

Therefore, georeferencing is required for correction of image data using ground control points (GCP) to make it compatible to Sol toposheet.

- **Image enhancement:**

To improve the interpretability of the raw data, image enhancement is necessary. Local operations modify the value of each pixel based on brightness value of neighbouring pixels using ERDAS IMAGINE 2014 s/w. and enhance the image quality for interpretation.

- **Training set selection**

Training set requires to be selected, so that software can classify the image data accurately. The image data are analysed based on the interpretation keys. These keys are evolved from certain fundamental image-elements such as tone/colour, size, shape, texture, pattern, location, association and shadow. Based on the image-elements and other geo-technical elements like land form, drainage pattern and physiography; training sets were selected/identified for each land use/cover class. Field survey was carried out by taking selective traverses in order to collect the ground information (or reference data) so that training sets are selected accurately in the image. This was intended to serve as an aid for classification.

- **Classification and Accuracy assessment**

Image classification is carried out using the maximum likelihood algorithm. The classification proceeds through the following steps: (a) calculation of statistics [i.e. signature generation] for the identified training areas, and (b) the decision boundary of maximum probability based on the mean vector, variance, covariance and correlation matrix of the pixels. After evaluating the statistical parameters of the training sets, reliability test of training sets is conducted by measuring the statistical separation between the classes that resulted from

computing divergence matrix. The overall accuracy of the classification was finally assessed with reference to ground truth data.

- **Area calculation**

The area of each land use class in the leasehold is determined using ERDAS IMAGINE v.2014 software.

- **Overlay of Vector data base**

Vector data base created based on secondary data. Vector layer like drainage, railway line, leasehold boundary, forest boundary etc. are superimposed on the image as vector layer in the Arc GIS 10.8 database.

- **Pre-field map preparation**

Pre-field map is prepared for validation of the classification result

3.3 Ground Truthing:

Selective ground verification of the land use classes are carried out in the field and necessary corrections if required, are incorporated before map finalization.

3.4 Land reclamation database on GIS:

Land reclamation database is created on GIS platform to identify the temporal changes identified from satellite data of different cut-of dates.

4.0 Land Reclamation Status in Mahanadi Coalfields Limited

4.1 Following sixteen opencast projects of MCL producing more than 5 million cubic meter and more (Coal + OB) were taken up for land reclamation monitoring based on satellite data of the year 2022.

- Ananta
- Balram
- Lingaraj
- Bharatpur
- Bhubaneswari
- Jagannath
- Hingula
- Kaniha
- Belpahar
- Lakhanpur
- Samleswari
- Lajkura
- Siarmal
- Basundhara West Extension
- Garjanbahal
- Kulda

4.2 Area statistics of different land use class present in the mine leasehold of the above projects for the year 2022 are shown in the Table -1. Land use maps derived from satellite data are shown in Plate 1 - 16. Land reclamation status of the above mentioned 16 projects, are mentioned in the tables 2.1 and 2.2 for the year 2022. Year wise changes in the different land use classes based on satellite data are depicted in Bar Charts in Fig. 3 - 18.

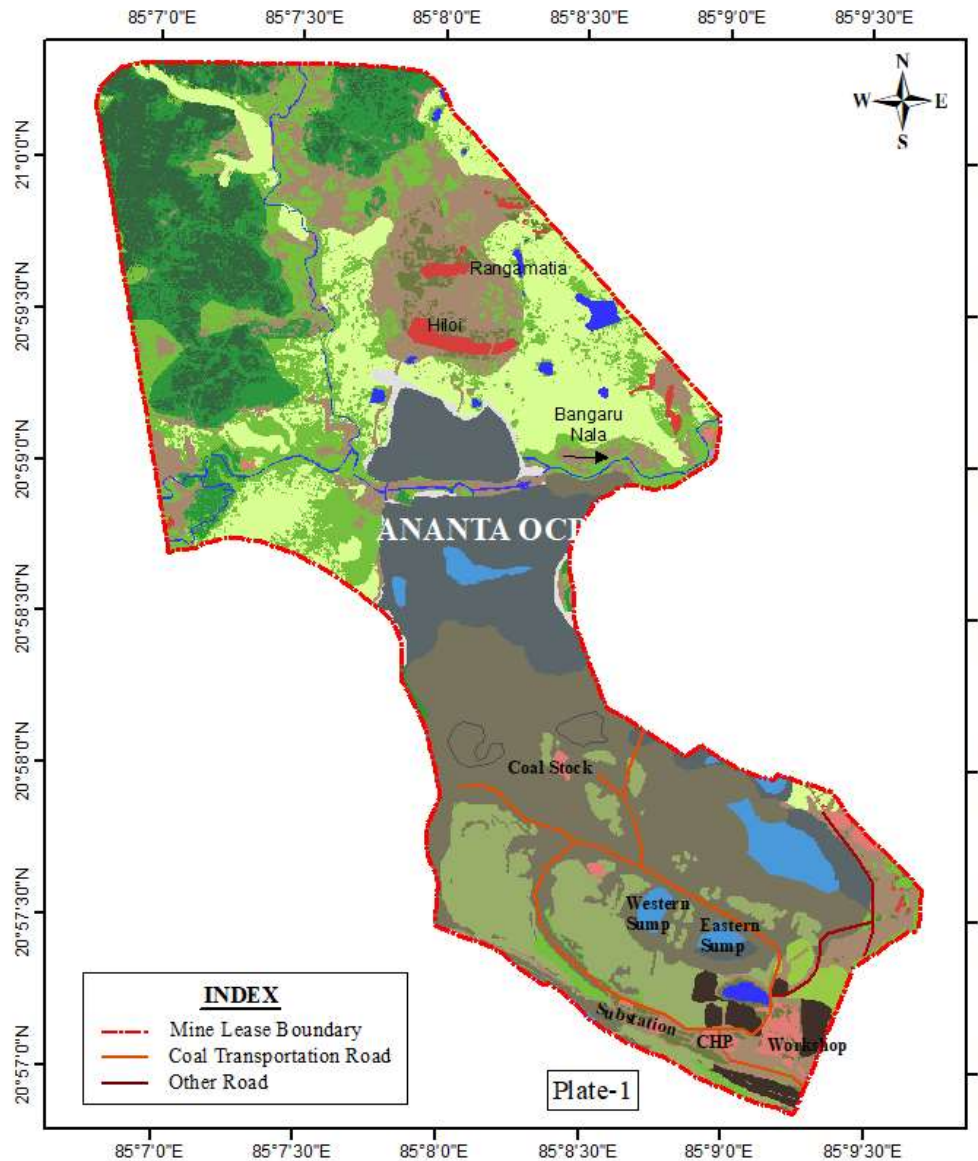
- 4.3** Study reveals that out of total 63.25 Km² excavated area; 37.64 Km² area (59.51%) is under reclamation. Out of which 8.06 Km² (12.74%) area has been re-vegetated and 29.58 Km² (46.77%) area is under backfilling.
- 4.4** Total Area under active mining has increased from 23.49 (Yr. 2021) to 25.61 (Yr. 2022).
- 4.5** Analysis of satellite data indicates that plantation on backfill has reduced in Balram, Bharatpur, Hingula, and Belpahar because of fresh backfilling activities.
- 4.6** Plantation on External OB dump has marginally reduced in Hingula, Belpahar and Lajkura OCP due to construction of road. Area of Social forestry has reduced marginally in some projects due to mine advancement.
- 4.7** Study also reveals that area under barren backfilling (Technical Reclamation) has increased from 27.29 Km² in 2021 to 29.58 Km² in 2022.
- 4.8** It was observed that Green Cover has reduced in some projects of MCL due to change in mine boundary and reduction in plantation and social forestry in the leasehold areas resulted from mining activities.
- 4.9** On comparing the status of land reclamation for the year 2022 with respect to the year 2021 in different projects, it is evident that area of land reclamation has increased from 35.53 Km² (Yr.2021) to 37.64 Km² (Yr.2022).
- 4.10** In Kulda, Samleswari, Lingaraj and Bharatpur OCP plantation has been done on internal OB dump but because of low height of the plants its signature is not available/visible in satellite image of 2022.
- 4.11** Out of 16 projects of MCL, Belpahar OC ranks on top for land reclamation (75.77%) followed by Samleswari OC (72.28%) and Bharatpur OC (71.70%).

Table 2.1: STATUS OF LAND RESTORATION / RECLAMATION IN MAHANADI COALFIELDS LIMITED BASED ON SATELLITE DATA OF THE YEAR 2022

| | | (Area in Sq. Kms.) | | | | | | | | | | | | | | | | | |
|---------------------------------|---------------------------------------------------------------|--------------------|--------------|---------------|--------------|---------------|--------------|---------------|--------------|---------------|--------------|---------------|--------------|---------------|--------------|---------------|--------------|---------------|--------------|
| | | ANANTA | | BALRAM | | LINGARAJ | | BHARATPUR | | BHUBANESHWARI | | JAGANNATH | | HINGULA | | KANHA | | TOTAL | |
| | | Area | % | Area | % | Area | % | Area | % | Area | % | Area | % | Area | % | Area | % | Area | % |
| FORESTS | Dense Forest | 1.01 | 7.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 | 1.13 | 7.17 | 0.00 | 0.00 | 2.15 | 2.58 |
| | Open Forest | 1.12 | 7.89 | 0.57 | 4.35 | 0.29 | 2.47 | 0.00 | 0.00 | 0.22 | 3.35 | 0.02 | 0.36 | 1.53 | 9.71 | 0.00 | 0.00 | 3.75 | 4.50 |
| | Total Forest (A) | 2.13 | 15.00 | 0.57 | 4.35 | 0.29 | 2.47 | 0.01 | 0.11 | 0.22 | 3.35 | 0.02 | 0.36 | 2.66 | 16.89 | 0.00 | 0.00 | 5.90 | 7.08 |
| PLANTATION | Scrubs (B) | 1.81 | 12.75 | 2.12 | 16.20 | 1.63 | 13.90 | 0.44 | 4.75 | 0.38 | 5.78 | 0.27 | 4.87 | 2.77 | 17.59 | 0.69 | 10.17 | 10.11 | 12.13 |
| | Social Forestry | 0.22 | 1.55 | 0.35 | 2.67 | 0.44 | 3.75 | 0.16 | 1.73 | 0.09 | 1.37 | 0.15 | 2.71 | 0.29 | 1.84 | 0.07 | 0.97 | 1.77 | 2.12 |
| | Plantation on External OB Dump | 0.10 | 0.70 | 0.22 | 1.68 | 0.52 | 4.43 | 0.45 | 4.85 | 0.01 | 0.08 | 0.00 | 0.00 | 0.18 | 1.14 | 0.00 | 0.00 | 1.48 | 1.77 |
| | Plantation on Backfill/Excavated Area(Biological Reclamation) | 1.05 | 7.39 | 0.98 | 7.49 | 0.16 | 1.36 | 1.63 | 17.58 | 0.02 | 0.30 | 1.80 | 32.49 | 0.04 | 0.25 | 0.00 | 0.00 | 5.68 | 6.82 |
| | Total Plantation (Green Cover) (C) | 1.37 | 9.65 | 1.55 | 11.84 | 1.12 | 9.55 | 2.24 | 24.16 | 0.12 | 1.75 | 1.95 | 35.20 | 0.51 | 3.24 | 0.07 | 0.97 | 8.93 | 10.71 |
| Total Vegetation (A+B+C) | 5.31 | 37.39 | 4.24 | 32.39 | 3.04 | 25.92 | 2.69 | 29.02 | 0.72 | 10.87 | 2.24 | 40.43 | 5.94 | 37.71 | 0.76 | 11.14 | 24.94 | 29.92 | |
| ACTIVE MINING | Coal Dump | 0.18 | 1.27 | 0.26 | 1.99 | 0.41 | 3.50 | 0.18 | 1.94 | 0.04 | 0.61 | 0.09 | 1.62 | 0.39 | 2.48 | 0.13 | 1.67 | 1.68 | 2.02 |
| | Coal Quarry | 1.53 | 10.77 | 0.87 | 6.65 | 2.48 | 21.14 | 1.02 | 11.00 | 1.74 | 26.46 | 0.42 | 7.58 | 1.28 | 8.13 | 1.36 | 16.29 | 10.70 | 12.84 |
| | Advance Quarry Site | 0.10 | 0.70 | 0.15 | 1.15 | 0.12 | 1.02 | 0.11 | 1.19 | 0.16 | 2.43 | 0.13 | 2.35 | 0.20 | 1.27 | 0.01 | 0.14 | 0.98 | 1.18 |
| | Quarry Filled with Water | 0.32 | 2.25 | 0.56 | 4.28 | 0.08 | 0.68 | 0.63 | 6.80 | 0.27 | 4.11 | 0.58 | 10.47 | 0.99 | 6.29 | 0.11 | 0.84 | 3.54 | 4.25 |
| | Total Area under Active Mining | 1.95 | 13.73 | 1.58 | 12.07 | 2.68 | 22.85 | 1.76 | 18.99 | 2.17 | 33.00 | 1.13 | 20.40 | 2.47 | 15.68 | 1.48 | 17.27 | 15.22 | 18.26 |
| UNDER MINE OPERATION | Barren OB dump | 0.00 | 0.00 | 0.13 | 0.99 | 0.79 | 6.73 | 0.05 | 0.54 | 0.79 | 12.02 | 0.00 | 0.00 | 0.74 | 4.70 | 0.42 | 5.85 | 2.92 | 3.50 |
| | Area Under Backfilling(Technical Reclamation) | 2.62 | 18.45 | 2.98 | 22.77 | 1.98 | 16.88 | 2.83 | 30.53 | 2.29 | 34.83 | 1.05 | 18.95 | 1.69 | 10.73 | 0.36 | 4.32 | 15.80 | 18.96 |
| | Total Area under Mine Operation | 4.75 | 33.45 | 4.95 | 37.82 | 5.86 | 49.96 | 4.82 | 52.00 | 5.29 | 80.46 | 2.27 | 40.97 | 5.29 | 33.59 | 2.39 | 29.11 | 35.62 | 40.73 |
| WASTELANDS | Waste Lands | 1.80 | 12.68 | 0.97 | 7.41 | 1.32 | 11.25 | 0.70 | 7.55 | 0.28 | 4.26 | 0.38 | 6.86 | 1.78 | 11.30 | 0.99 | 13.93 | 8.22 | 9.86 |
| | Fly Ash Pond/Sand Body | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 | 1.99 | 0.06 | 0.38 | 0.00 | 0.00 | 0.17 | 0.20 |
| | Total Wastelands | 1.80 | 12.68 | 0.97 | 7.41 | 1.32 | 11.25 | 0.70 | 7.55 | 0.28 | 4.26 | 0.49 | 8.84 | 1.84 | 11.68 | 0.99 | 13.93 | 8.39 | 10.07 |
| WATER | Reservoir, nallah, ponds etc. | 0.18 | 1.27 | 0.26 | 1.99 | 0.06 | 0.51 | 0.05 | 0.54 | 0.02 | 0.30 | 0.04 | 0.72 | 0.31 | 1.97 | 0.07 | 0.97 | 0.99 | 1.19 |
| | Total Waterbodies | 0.18 | 1.27 | 0.26 | 1.99 | 0.06 | 0.51 | 0.05 | 0.54 | 0.02 | 0.30 | 0.04 | 0.72 | 0.31 | 1.97 | 0.07 | 0.97 | 0.99 | 1.19 |
| AGRICULTURE | Crop Lands | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 | 2.79 | 0.20 | 0.24 |
| | Fallow Lands | 1.89 | 13.31 | 1.93 | 14.74 | 0.92 | 7.84 | 0.73 | 7.87 | 0.22 | 3.35 | 0.35 | 6.32 | 2.14 | 13.59 | 2.46 | 37.74 | 10.64 | 12.77 |
| | Total Agriculture | 1.89 | 13.31 | 1.93 | 14.74 | 0.92 | 7.84 | 0.73 | 7.87 | 0.22 | 3.35 | 0.35 | 6.32 | 2.14 | 13.59 | 2.66 | 40.53 | 10.84 | 13.01 |
| SETTLEMENTS | Urban Settlement | 0.00 | 0.00 | 0.02 | 0.15 | 0.14 | 1.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.06 | 0.00 | 0.00 | 0.17 | 0.20 |
| | Rural Settlement | 0.12 | 0.85 | 0.30 | 2.29 | 0.14 | 1.19 | 0.04 | 0.43 | 0.04 | 0.61 | 0.04 | 0.72 | 0.19 | 1.21 | 0.25 | 3.48 | 1.12 | 1.34 |
| | Industrial Settlement | 0.15 | 1.06 | 0.42 | 3.21 | 0.25 | 2.13 | 0.24 | 2.59 | 0.01 | 0.15 | 0.11 | 1.99 | 0.03 | 0.19 | 0.06 | 0.84 | 1.27 | 1.52 |
| | Total Settlements | 0.27 | 1.90 | 0.74 | 5.65 | 0.53 | 4.52 | 0.28 | 3.02 | 0.05 | 0.76 | 0.15 | 2.71 | 0.23 | 1.46 | 0.31 | 4.32 | 2.56 | 3.07 |
| GRAND TOTAL | 14.20 | 100.00 | 13.09 | 100.00 | 11.73 | 100.00 | 9.27 | 100.00 | 6.58 | 100.00 | 5.54 | 100.00 | 15.75 | 100.00 | 7.18 | 100.00 | 83.34 | 100.00 | |

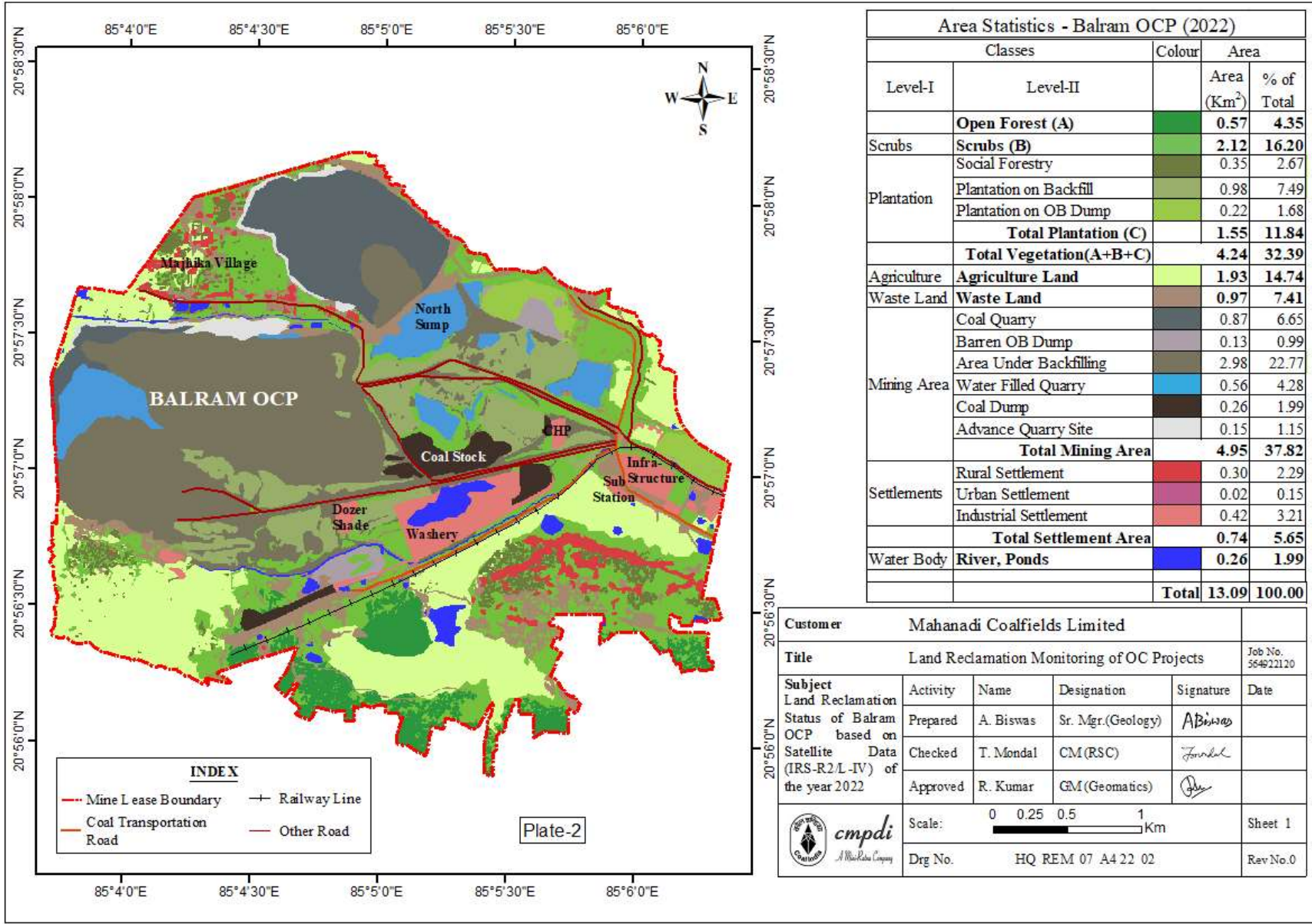
Table 2.2: STATUS OF LAND RESTORATION / RECLAMATION IN MAHANADI COALFIELDS LIMITED BASED ON SATELLITE DATA OF THE YEAR 2022

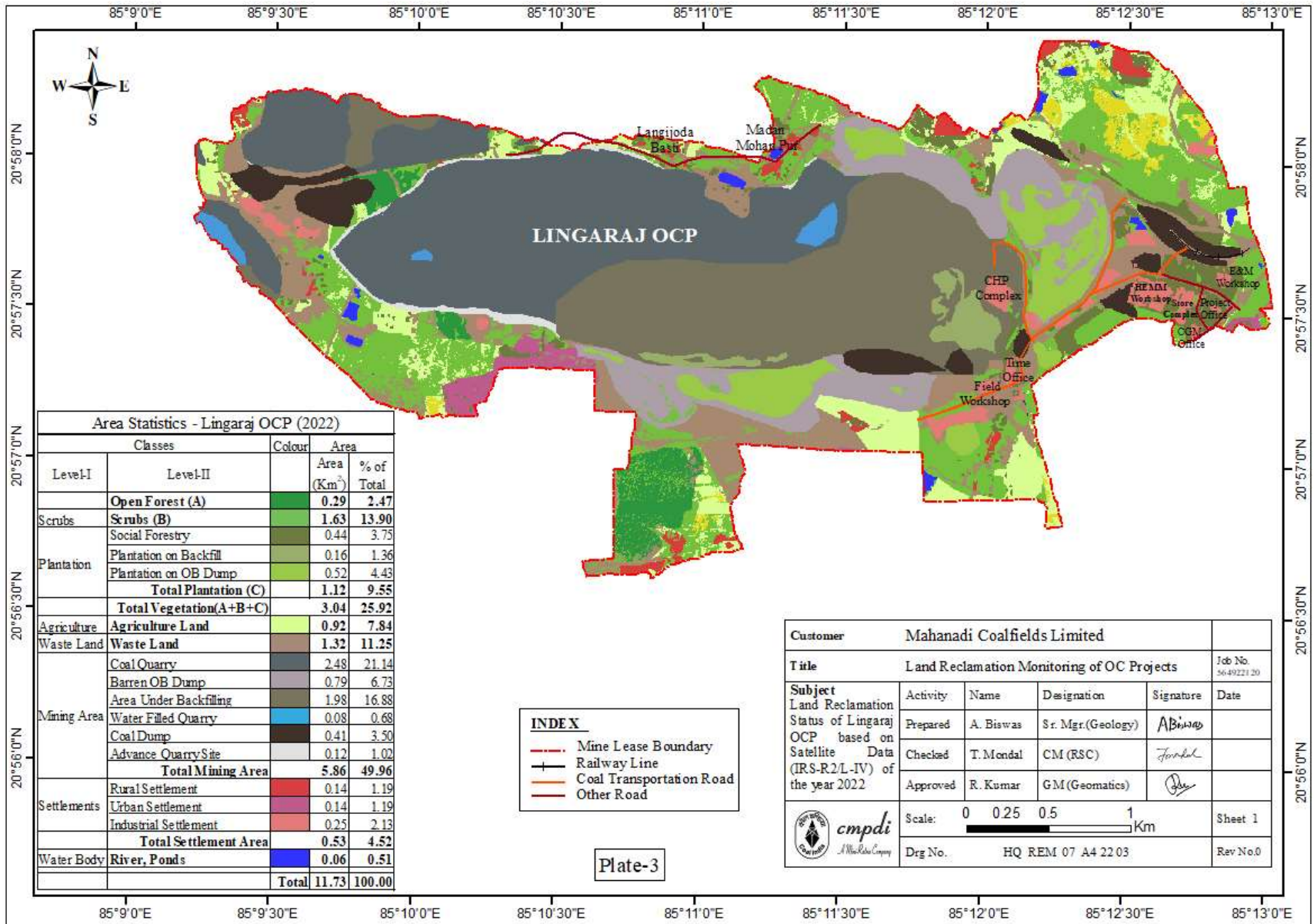
| | | (Area in Sq. Kms.) | | | | | | | | | | | | | | | | | | | |
|--------------------------|---------------------------------------------------------------|--------------------|---------------|--------------|---------------|--------------|---------------|-------------|---------------|--------------|---------------|-------------------|---------------|-------------|---------------|-------------|---------------|--------------|---------------|---------------|---------------|
| | | BELPAHAR | | LAKHANPUR | | SAMLESWARI | | LAJKURA | | SIARMAL | | BASUNDHARA W EXTN | | GARJANBAHAL | | KULDA | | TOTAL | | ALL TOTAL | |
| | | Area | % | Area | % | Area | % | Area | % | Area | % | Area | % | Area | % | Area | % | Area | % | Area | % |
| FORESTS | Dense Forest | 0.00 | 0.00 | 1.35 | 6.03 | 0.16 | 1.20 | 0.58 | 8.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.40 | 6.12 | 0.00 | 0.00 | 2.49 | 2.58 | 4.64 | 2.58 |
| | Open Forest | 0.91 | 6.30 | 2.36 | 10.54 | 0.53 | 3.97 | 0.60 | 8.32 | 0.87 | 3.80 | 0.79 | 24.46 | 0.64 | 9.79 | 0.05 | 0.79 | 6.75 | 7.00 | 10.50 | 5.84 |
| | Total Forest (A) | 0.91 | 6.30 | 3.71 | 16.56 | 0.69 | 5.17 | 1.18 | 16.37 | 0.87 | 3.80 | 0.79 | 24.46 | 1.04 | 15.90 | 0.05 | 0.79 | 9.19 | 9.58 | 15.09 | 8.40 |
| SCRUBS | Scrubs (B) | 3.09 | 21.40 | 2.50 | 11.16 | 2.52 | 18.87 | 0.91 | 12.62 | 7.18 | 31.35 | 1.35 | 41.80 | 1.08 | 16.51 | 1.20 | 18.93 | 19.83 | 20.57 | 29.94 | 16.66 |
| | Social Forestry | 0.50 | 3.46 | 0.38 | 1.70 | 0.48 | 3.59 | 0.16 | 2.22 | 0.61 | 2.66 | 0.03 | 0.93 | 0.03 | 0.46 | 0.03 | 0.47 | 2.22 | 2.30 | 3.99 | 2.22 |
| PLANTATION | Plantation on External OB Dump | 0.48 | 3.32 | 0.59 | 2.63 | 0.49 | 3.67 | 0.19 | 2.64 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.16 | 1.76 | 1.83 | 3.24 | 1.80 |
| | Plantation on Backfill/Excavated Area(Biological Reclamation) | 0.66 | 4.57 | 0.89 | 3.97 | 0.66 | 4.94 | 0.16 | 2.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.16 | 2.38 | 2.47 | 8.06 | 4.48 |
| | Total Plantation (Green Cover) (C) | 1.64 | 11.36 | 1.86 | 8.30 | 1.63 | 12.21 | 0.51 | 7.07 | 0.61 | 2.66 | 0.03 | 0.93 | 0.03 | 0.46 | 0.05 | 0.79 | 6.36 | 6.60 | 15.29 | 8.50 |
| | Total Vegetation (A+B+C) | 5.64 | 39.06 | 8.07 | 36.03 | 4.84 | 36.25 | 2.60 | 36.06 | 8.66 | 37.82 | 2.17 | 67.18 | 2.15 | 32.87 | 1.30 | 20.50 | 35.43 | 36.75 | 60.37 | 33.58 |
| ACTIVE MINING | Coal Dump | 0.11 | 0.76 | 0.12 | 0.54 | 0.19 | 1.42 | 0.07 | 0.97 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 3.82 | 0.08 | 1.26 | 0.82 | 0.85 | 2.50 | 1.39 |
| | Coal Quarry | 1.00 | 6.93 | 3.41 | 15.22 | 1.25 | 9.36 | 0.94 | 13.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.65 | 9.94 | 1.53 | 24.13 | 8.78 | 9.11 | 19.48 | 10.84 |
| | Advance Quarry Site | 0.18 | 1.25 | 0.41 | 1.83 | 0.08 | 0.60 | 0.11 | 1.53 | 0.00 | 0.00 | 0.00 | 0.00 | 0.12 | 1.83 | 0.05 | 0.79 | 0.95 | 0.99 | 1.93 | 1.07 |
| | Quarry Filled with Water | 0.15 | 1.04 | 0.17 | 0.76 | 0.12 | 0.90 | 0.02 | 0.28 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.31 | 0.18 | 2.84 | 0.66 | 0.68 | 4.20 | 2.34 |
| | Total Area under Active Mining | 1.33 | 9.21 | 3.99 | 17.81 | 1.45 | 10.86 | 1.07 | 14.84 | 0.00 | 0.00 | 0.00 | 0.00 | 0.79 | 12.08 | 1.76 | 27.76 | 10.39 | 10.78 | 25.61 | 14.25 |
| WASTE LANDS | Barren OB dump | 0.25 | 1.73 | 0.02 | 0.09 | 0.07 | 0.52 | 0.27 | 3.74 | 0.00 | 0.00 | 0.00 | 0.00 | 0.45 | 6.88 | 0.66 | 10.41 | 1.72 | 1.78 | 4.64 | 2.58 |
| | Area Under Backfilling(Technical Reclamation) | 3.50 | 24.24 | 4.76 | 21.25 | 3.12 | 23.37 | 1.32 | 18.31 | 0.00 | 0.00 | 0.00 | 0.00 | 0.17 | 2.60 | 0.91 | 14.35 | 13.78 | 14.29 | 29.58 | 16.46 |
| | Total Area under Mine Operation | 5.19 | 35.94 | 8.89 | 39.69 | 4.83 | 36.17 | 2.73 | 37.86 | 0.00 | 0.00 | 0.00 | 0.00 | 1.66 | 25.38 | 3.41 | 53.79 | 26.71 | 26.85 | 62.33 | 34.68 |
| WATER | Waste Lands | 2.35 | 16.27 | 1.33 | 5.94 | 1.93 | 14.45 | 1.03 | 14.29 | 1.95 | 8.52 | 0.60 | 18.58 | 0.39 | 5.96 | 0.59 | 9.31 | 10.17 | 10.55 | 18.39 | 10.23 |
| | Fly Ash Pond/Sand Body | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.17 | 0.09 |
| WATER | Total Wastelands | 2.35 | 16.27 | 1.33 | 5.94 | 1.93 | 14.45 | 1.03 | 14.29 | 1.95 | 8.52 | 0.60 | 18.58 | 0.39 | 5.96 | 0.59 | 9.31 | 10.17 | 10.55 | 18.56 | 10.33 |
| | Reservoir, nallah, ponds etc. | 0.22 | 1.52 | 0.26 | 1.16 | 0.26 | 1.95 | 0.07 | 0.97 | 0.22 | 0.96 | 0.02 | 0.62 | 0.02 | 0.31 | 0.18 | 2.84 | 1.25 | 1.30 | 2.24 | 1.25 |
| AGRICULTURE | Total Waterbodies | 0.22 | 1.52 | 0.26 | 1.16 | 0.26 | 1.95 | 0.07 | 0.97 | 0.22 | 0.96 | 0.02 | 0.62 | 0.02 | 0.31 | 0.18 | 2.84 | 1.25 | 1.3 | 2.24 | 1.25 |
| | Crop Lands | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.73 | 7.55 | 0.00 | 0.00 | 0.00 | 0.00 | 0.26 | 4.10 | 1.99 | 2.06 | 2.19 | 1.22 |
| | Fallow Lands | 0.45 | 3.12 | 3.52 | 15.71 | 1.08 | 8.09 | 0.54 | 7.49 | 9.63 | 42.05 | 0.42 | 13.00 | 2.10 | 32.11 | 0.54 | 8.52 | 18.28 | 18.96 | 28.92 | 16.09 |
| SETTLEMENTS | Total Agriculture | 0.45 | 3.12 | 3.52 | 15.71 | 1.08 | 8.09 | 0.54 | 7.49 | 11.36 | 49.61 | 0.42 | 13.00 | 2.10 | 32.11 | 0.80 | 12.62 | 20.27 | 21.02 | 31.11 | 17.31 |
| | Urban Settlement | 0.02 | 0.14 | 0.00 | 0.00 | 0.003 | 0.02 | 0.08 | 1.11 | 0.02 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.12 | 0.13 | 0.29 | 0.16 |
| | Rural Settlement | 0.17 | 1.18 | 0.11 | 0.49 | 0.20 | 1.50 | 0.03 | 0.42 | 0.69 | 3.01 | 0.02 | 0.62 | 0.07 | 1.07 | 0.01 | 0.16 | 1.30 | 1.35 | 2.42 | 1.35 |
| | Industrial Settlement | 0.40 | 2.77 | 0.22 | 0.98 | 0.21 | 1.57 | 0.13 | 1.80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 2.29 | 0.05 | 0.79 | 1.16 | 1.20 | 2.43 | 1.35 |
| Total Settlements | | 0.59 | 4.09 | 0.33 | 1.47 | 0.413 | 3.09 | 0.24 | 3.33 | 0.71 | 3.10 | 0.02 | 0.62 | 0.22 | 3.36 | 0.06 | 0.95 | 2.58 | 2.68 | 5.14 | 2.86 |
| GRAND TOTAL | | 14.44 | 100.00 | 22.40 | 100.00 | 13.35 | 100.00 | 7.21 | 100.00 | 22.90 | 100.00 | 3.23 | 100.00 | 6.54 | 100.00 | 6.34 | 100.00 | 96.41 | 100.00 | 179.75 | 100.00 |

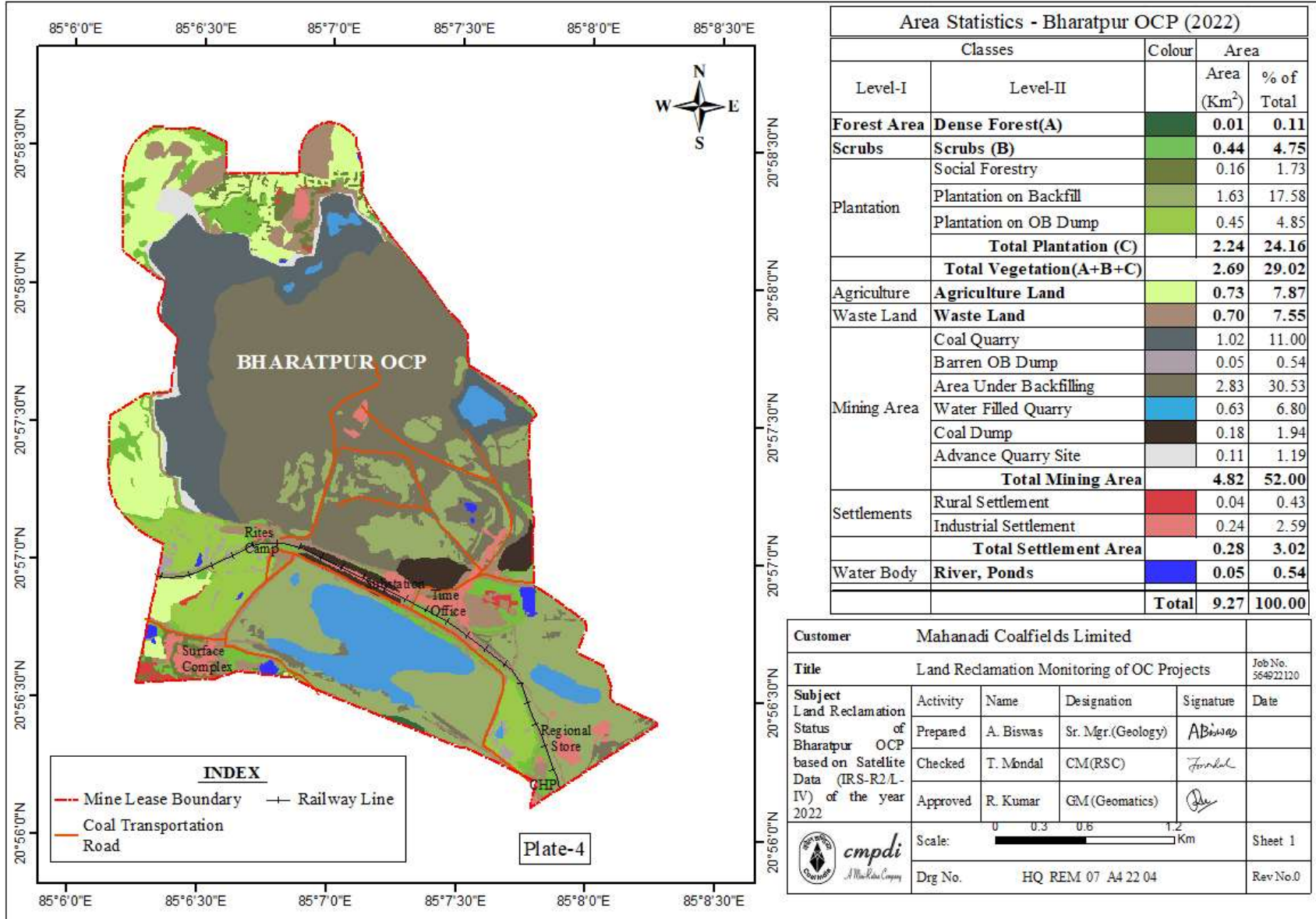


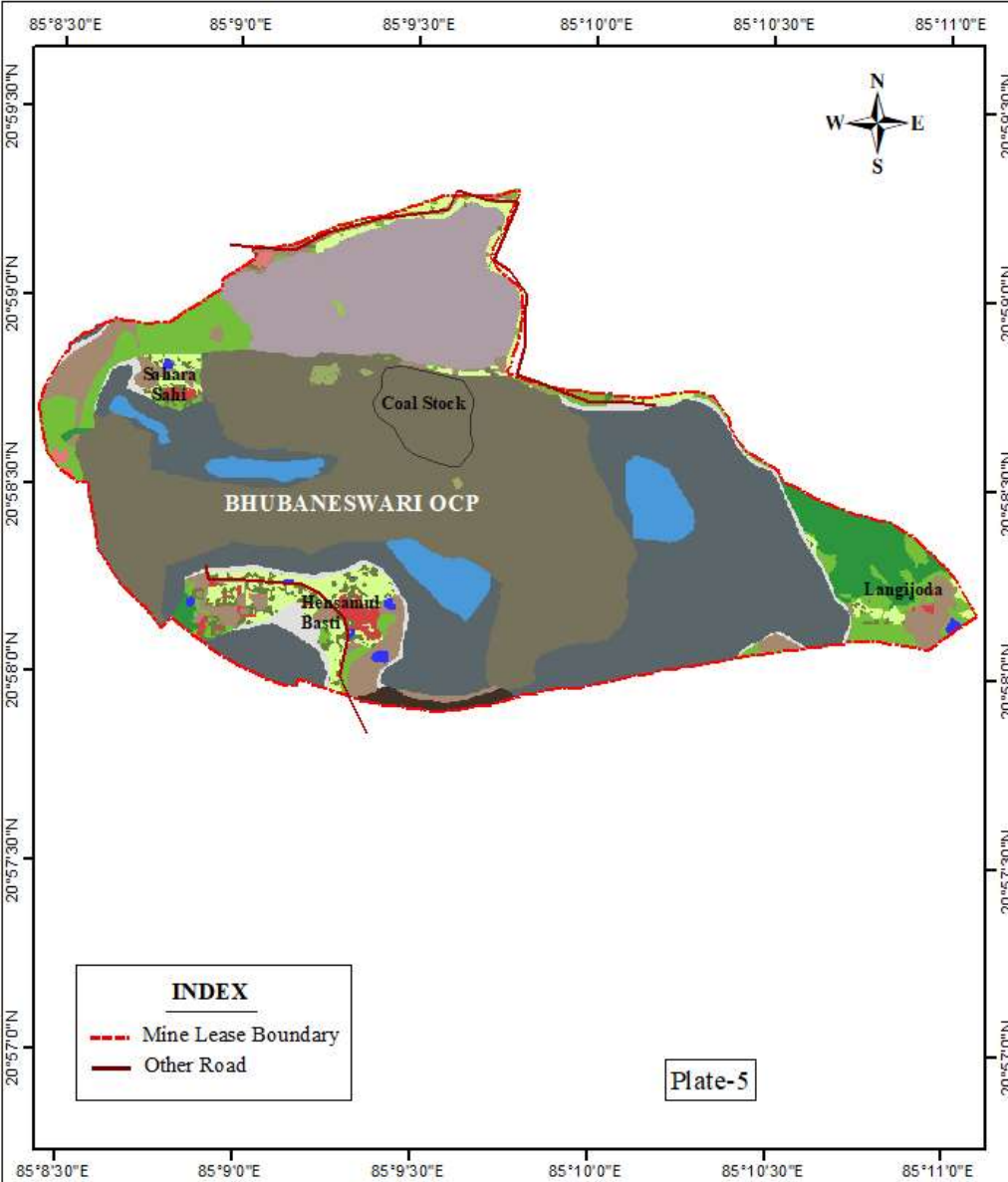
| Classes | | Colour | Area | |
|--------------------------------|------------------------------|--------|-------------------------|---------------|
| Level-I | Level-II | | Area (Km ²) | % of Total |
| Forest Area | Dense Forest | | 1.01 | 7.11 |
| | Open Forest | | 1.12 | 7.89 |
| | Total Forest (A) | | 2.13 | 15.00 |
| Scrubs | Scrubs (B) | | 1.81 | 12.75 |
| | Social Forestry | | 0.22 | 1.55 |
| Plantation | Plantation on Backfill | | 1.05 | 7.39 |
| | Plantation on OB Dump | | 0.10 | 0.70 |
| | Total Plantation (C) | | 1.37 | 9.65 |
| Total Vegetation(A+B+C) | | | 5.31 | 37.39 |
| Agriculture | Agriculture Land | | 1.89 | 13.31 |
| Waste Land | Waste Land | | 1.80 | 12.68 |
| | Coal Quarry | | 1.53 | 10.77 |
| | Area Under Backfilling | | 2.62 | 18.45 |
| | Water Filled Quarry | | 0.32 | 2.25 |
| | Coal Dump | | 0.18 | 1.27 |
| | Advance Quarry Site | | 0.10 | 0.70 |
| | Total Mining Area | | 4.75 | 33.45 |
| Settlements | Rural Settlement | | 0.12 | 0.85 |
| | Industrial Settlement | | 0.15 | 1.06 |
| | Total Settlement Area | | 0.27 | 1.90 |
| Water Body | River, Ponds | | 0.18 | 1.27 |
| Total | | | 14.20 | 100.00 |

| | | | | | |
|-------------------------------------------------------------------------------------------------------|----------|--------------------------------------------|-------------------|----------------|-------------------|
| Customer | | Mahanadi Coal fields Limited | | | |
| Title | | Land Reclamation Monitoring of OC Projects | | | Job No. 564922120 |
| Subject Land Reclamation Status of Ananta OCP based on Satellite Data (RS-2/L-IV) of the year 2022 | Activity | Name | Designation | Signature | Date |
| | Prepared | A. Biswas | Sr. Mgr.(Geology) | <i>ABiswas</i> | |
| | Checked | T.Mondal | CM(RSC) | <i>Tmondal</i> | |
| Approved | R. Kumar | GM(Geomatics) | <i>Rkumar</i> | | |
| Scale: 0 0.45 0.9 1.8 Km | | Sheet 1 | | | |
| Drg No. HQ REM 07 A4 22 01 | | Rev No.0 | | | |



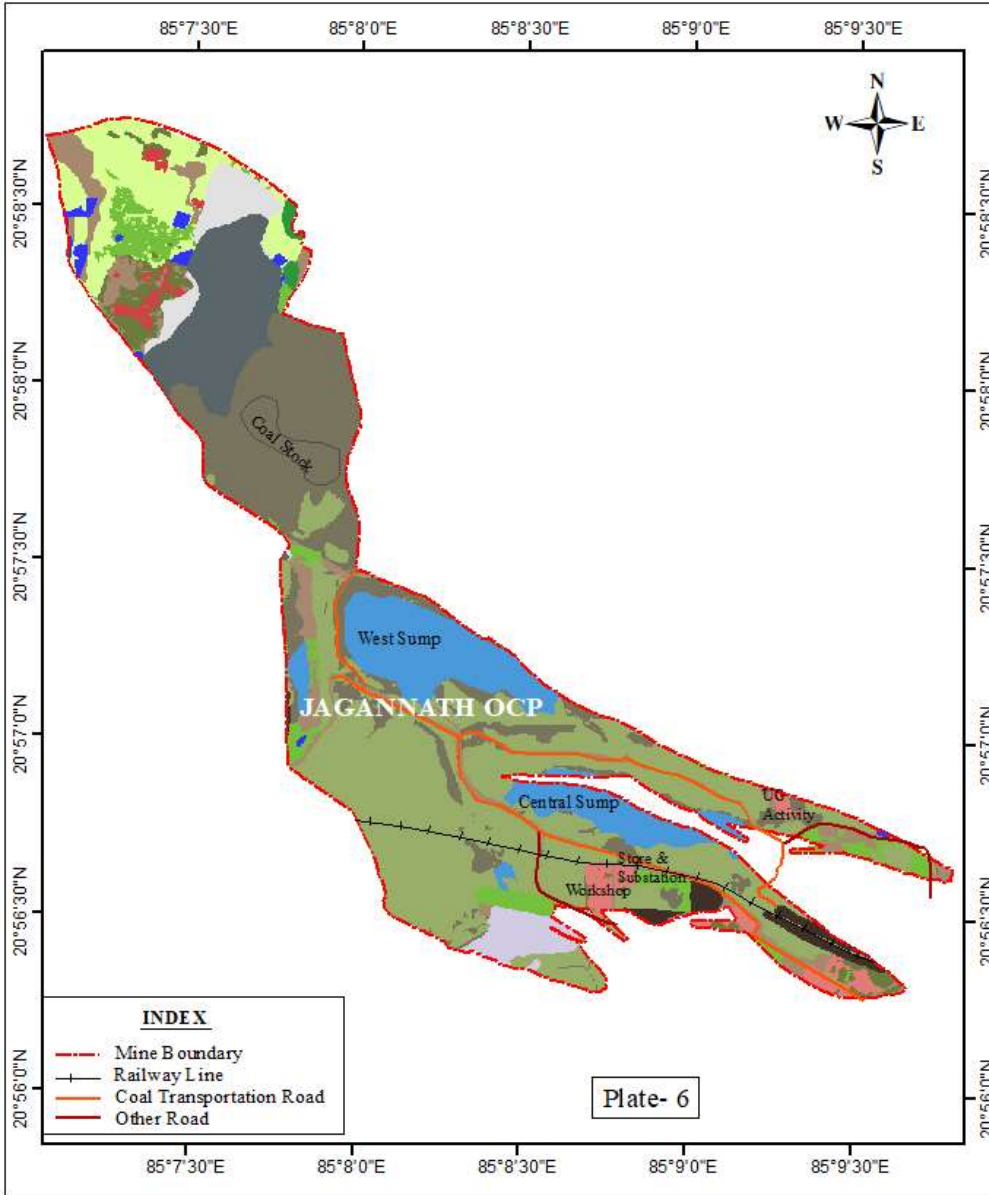






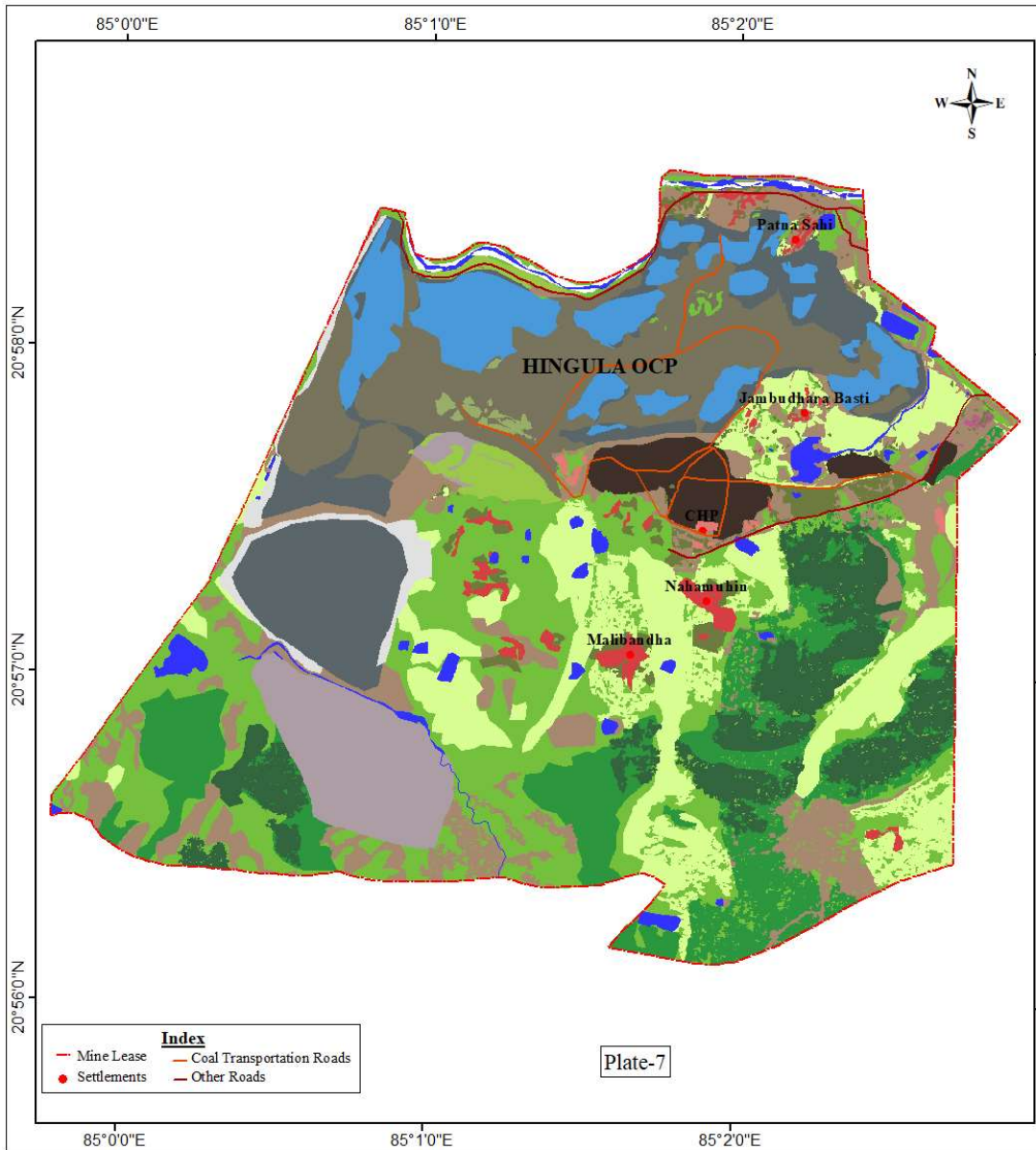
| Classes | | Colour | Area | |
|-------------|--------------------------------|--------|-------------------------|---------------|
| Level-I | Level-II | | Area (Km ²) | % of Total |
| | Open Forest (A) | | 0.22 | 3.35 |
| Scrubs | Scrubs (B) | | 0.38 | 5.78 |
| | Social Forestry | | 0.09 | 1.37 |
| | Plantation on Backfill | | 0.02 | 0.30 |
| | Plantation on OB Dump | | 0.01 | 0.08 |
| | Total Plantation (C) | | 0.12 | 1.75 |
| | Total Vegetation(A+B+C) | | 0.72 | 10.87 |
| Agriculture | Agriculture Land | | 0.22 | 3.35 |
| Waste Land | Waste Land | | 0.28 | 4.26 |
| | Coal Quarry | | 1.74 | 26.46 |
| | Barren OB Dump | | 0.79 | 12.02 |
| | Area Under Backfilling | | 2.29 | 34.83 |
| | Water Filled Quarry | | 0.27 | 4.11 |
| | Coal Dump | | 0.04 | 0.61 |
| | Advance Quarry Site | | 0.16 | 2.43 |
| | Total Mining Area | | 5.29 | 80.46 |
| Settlements | Rural Settlement | | 0.04 | 0.61 |
| | Industrial Settlement | | 0.01 | 0.15 |
| | Total Settlement Area | | 0.05 | 0.76 |
| Water Body | River, Ponds | | 0.02 | 0.30 |
| | Total | | 6.58 | 100.00 |

| | | | | | |
|----------------------------------------------------------------------------------------------------|----------|--------------------------------------------|-------------------|-----------------|-------------------|
| Customer | | Mahanadi Coalfields Limited | | | |
| Title | | Land Reclamation Monitoring of OC Projects | | | Job No. 564922120 |
| Subject | Activity | Name | Designation | Signature | Date |
| Land Reclamation Status of Bhubaneswari OCP based on Satellite Data (IRS-R2/L-IV) of the year 2022 | Prepared | A. Biswas | Sr. Mgr.(Geology) | <i>ABiswas</i> | |
| | Checked | T.Mondal | CM (RSC) | <i>T.Mondal</i> | |
| | Approved | R. Kumar | GM(Geomatics) | <i>R.Kumar</i> | |
| Scale: | | 0 0.25 0.5 1 Km | | | Sheet 1 |
| Drg No. | | HQ REM 07 A4 22 05 | | | Rev No.0 |



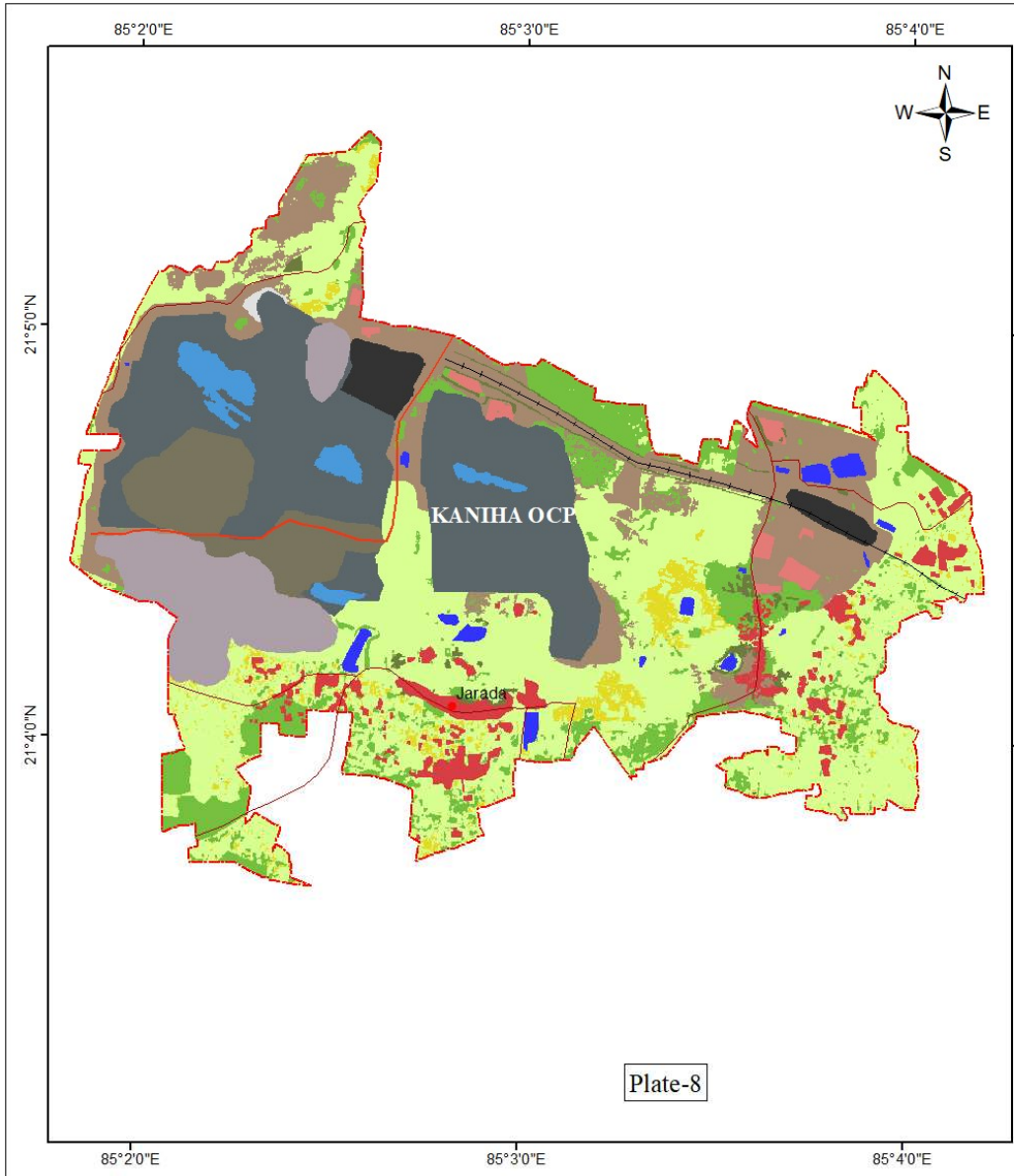
| Classes | | Colour | Area | |
|--------------------------------|-----------------------------|--------|-------------------------|---------------|
| Level-I | Level-II | | Area (Km ²) | % of Total |
| Scrubs | Open Forest (A) | | 0.02 | 0.36 |
| | Scrubs (B) | | 0.27 | 4.87 |
| | Social Forestry | | 0.15 | 2.71 |
| Plantation | Plantation on Backfill | | 1.80 | 32.49 |
| | Total Plantation (C) | | 1.95 | 35.20 |
| Total Vegetation(A+B+C) | | | 2.24 | 40.43 |
| Agriculture | Agriculture Land | | 0.35 | 6.32 |
| Waste Land | Waste Land | | 0.38 | 6.86 |
| | Ash Pond | | 0.11 | 1.99 |
| | Total Waste Land | | 0.49 | 8.84 |
| Mining Area | Coal Quarry | | 0.42 | 7.58 |
| | Area Under Backfilling | | 1.05 | 18.95 |
| | Water Filled Quarry | | 0.58 | 10.47 |
| | Coal Dump | | 0.09 | 1.62 |
| | Advance Quarry Site | | 0.13 | 2.35 |
| | Total Mining Area | | 2.27 | 40.97 |
| Settlement | Rural | | 0.04 | 0.72 |
| | Industrial | | 0.11 | 1.99 |
| Total Settlement Area | | | 0.15 | 2.71 |
| Water Body | River, Ponds | | 0.04 | 0.72 |
| Total | | | 5.54 | 100.00 |

| | | | | | |
|------------------------------------------------------------------------------------------------------------|----------|--------------------------------------------|-------------------|----------------|-------------------|
| Customer | | Mahanadi Coalfields Limited | | | |
| Title | | Land Reclamation Monitoring of OC Projects | | | Job No. 564922120 |
| Subject Land Reclamation Status of Jagannath OCP based on Satellite Data (IRS-R2/L-IV) of the year 2022 | Activity | Name | Designation | Signature | Date |
| | Prepared | A Biswas | Sr. Mgr.(Geology) | <i>ABiswas</i> | |
| | Checked | T. Mondal | CM(RSC) | <i>Tmondal</i> | |
| Approved | R. Kumar | GM(Geomatics) | <i>Rkumar</i> | | |
| Scale: | | 0 0.3 0.6 1.2 Km | | | Sheet 1 |
| Drg No. | | HQ REM 07 A4 22 06 | | | Rev No.0 |



| Classes | | Colour | Area | |
|-------------|--------------------------------|--------|-------------------------|---------------|
| Level-I | Level-II | | Area (Km ²) | % of Total |
| Forest | Dense Forest | | 1.13 | 7.17 |
| | Open Forest | | 1.53 | 9.71 |
| | Total Forest(A) | | 2.66 | 16.89 |
| Scrubs | Scrubs (B) | | 2.77 | 17.59 |
| Plantation | Social Forestry | | 0.29 | 1.84 |
| | Plantation on Backfill | | 0.04 | 0.25 |
| | Plantation on OB Dump | | 0.18 | 1.14 |
| | Total Plantation (C) | | 0.51 | 3.24 |
| | Total Vegetation(A+B+C) | | 5.94 | 37.71 |
| Agriculture | Agriculture Land | | 2.14 | 13.59 |
| Waste Land | Waste Land | | 1.78 | 11.30 |
| | Sand Body | | 0.06 | 0.38 |
| | Total Waste Land | | 1.84 | 11.68 |
| Mining Area | Coal Quarry | | 1.28 | 8.13 |
| | Barren OB Dump | | 0.74 | 4.70 |
| | Area Under Backfilling | | 1.69 | 10.73 |
| | Water Filled Quarry | | 0.99 | 6.29 |
| | Coal Dump | | 0.39 | 2.48 |
| | Advance Quarry Site | | 0.20 | 1.27 |
| | Total Mining Area | | 5.29 | 33.59 |
| Settlements | Rural Settlement | | 0.19 | 1.21 |
| | Urban Settlement | | 0.01 | 0.06 |
| | Industrial Settlement | | 0.03 | 0.19 |
| | Total Settlement Area | | 0.23 | 1.46 |
| Water Body | River, Ponds | | 0.31 | 1.97 |
| | Total | | 15.75 | 100.00 |

| | | | | | |
|----------------------------------------------------------------------------------------------------------|----------|--------------------------------------------|-------------------|-----------|-------------------|
| Customer | | Mahanadi Coalfields Limited | | | |
| Title | | Land Reclamation Monitoring of OC Projects | | | Job No. 564922120 |
| Subject Land Reclamation Status of Hingula OCP based on Satellite Data (IRS-R2/L-IV) of the year 2022 | Activity | Name | Designation | Signature | Date |
| | Prepared | A. Biswas | Sr. Mgr.(Geology) | | |
| | Checked | T. Mondal | CM (RSC) | | |
| Approved | R. Kumar | GM (Geomatics) | | | |
| Scale: | | 0 0.25 0.5 1 Km | | | Sheet 1 |
| Drg No. | | HQ REM 07 A4 22 07 | | | Rev No.0 |



| Area Statistics - Kaniha OC (2022) | | | | |
|------------------------------------|---------------------------------|--------|-------------|---------------|
| Classes | | Colour | Core Zone | |
| Level-I | Level-II | | Area (sqkm) | % of Total |
| Forests | Dense Forest | | 0.00 | 0.00 |
| | Open Forest | | 0.00 | 0.00 |
| | Total Forest (A) | | 0.00 | 0.00 |
| | Scrubs (B) | | 0.69 | 10.17 |
| Plantation Area | Social Forestry | | 0.07 | 0.97 |
| | Plantation on OB | | 0.00 | 0.00 |
| | Plantation on Backfill | | 0.00 | 0.00 |
| | Total Plantation (C) | | 0.07 | 0.97 |
| | Total Vegetation (A+B+C) | | 0.76 | 11.14 |
| Agriculture Land | Crop land | | 0.20 | 2.79 |
| | Fallow Land | | 2.46 | 37.74 |
| | Total Agriculture Land | | 2.66 | 40.53 |
| Waste Land | Waste Land | | 0.99 | 13.93 |
| | Fly Ash Pond | | 0.00 | 0.00 |
| | Total Waste Land | | 0.99 | 13.93 |
| Mining Area | Advance Quarry Area | | 0.01 | 0.14 |
| | Coal Quarry | | 1.36 | 16.29 |
| | Barren OB Dump | | 0.42 | 5.85 |
| | Back Fill | | 0.36 | 4.32 |
| | Coal Dump | | 0.13 | 1.67 |
| | Water Filled Qry | | 0.11 | 0.84 |
| | Total Mining Area | | 2.39 | 29.11 |
| Settlements | Urban Settlements | | 0.00 | 0.00 |
| | Rural Settlements | | 0.25 | 3.48 |
| | Industrial Settlements | | 0.06 | 0.84 |
| | Total Settlement Area | | 0.31 | 4.32 |
| Water Body | River/ Ponds | | 0.07 | 0.97 |
| | Total Area | | 7.18 | 100.00 |


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| — Mine Lease | — Coal Transportation Roads |
| ● Settlements | — Other Roads |

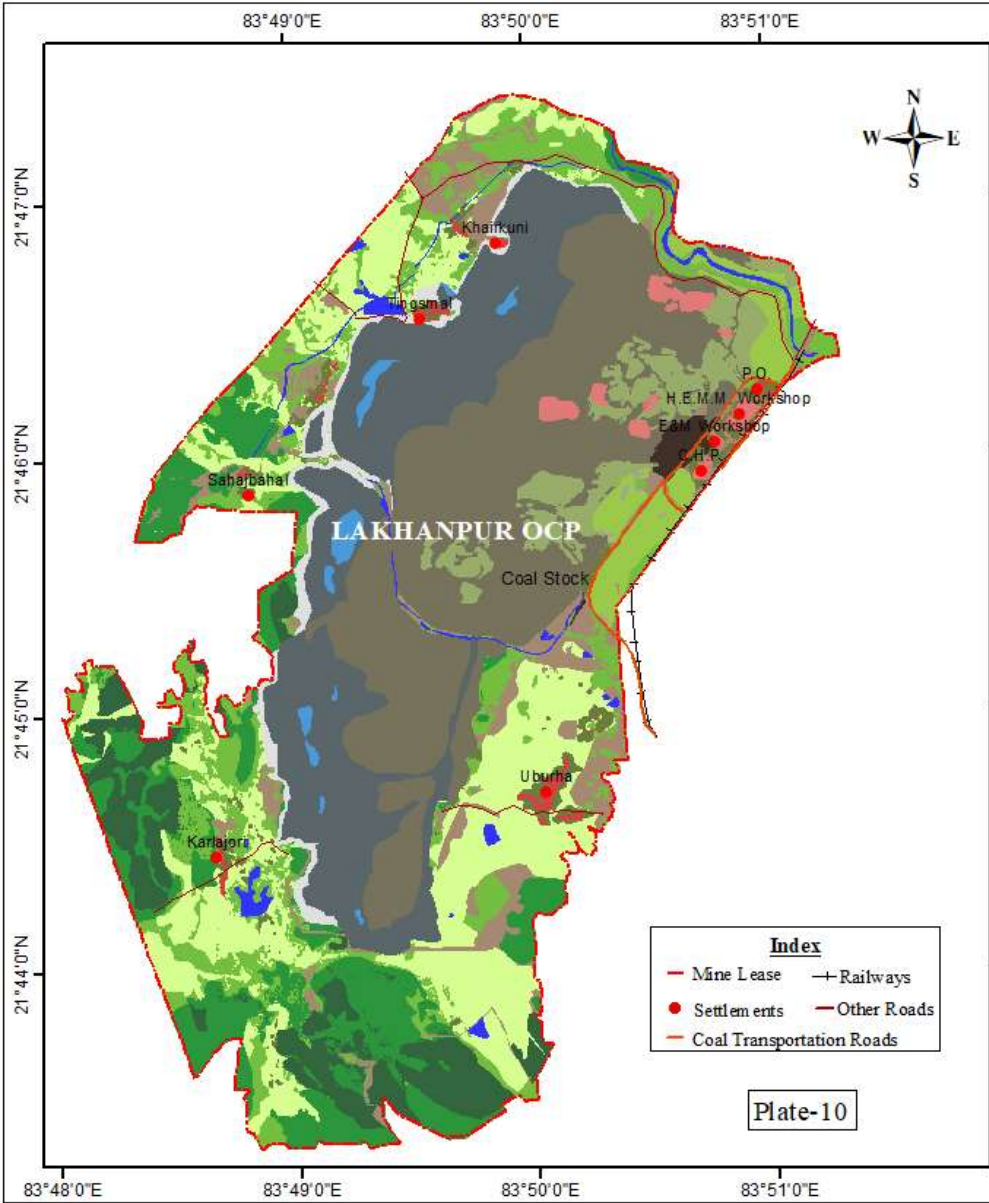
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|----------------------------------------------------------------------------------------------------------------|----------|--------------------------------------------|-------------------|------------------|-------------------|
| Customer | | Mahanadi Coalfields Limited | | | |
| Title | | Land Reclamation Monitoring of OC Projects | | | Job No. 564922120 |
| Subject Land Reclamation Status of Kaniha OCP based on Satellite Data (IRS-R2/L-IV) of the year 2022 | Activity | Name | Designation | Signature | Date |
| | Prepared | A. Biswas | Sr. Mgr.(Geology) | <i>A. Biswas</i> | |
| | Checked | T. Mondal | CM (RSC) | <i>T. Mondal</i> | |
| Approved | R. Kumar | GM (Geomatics) | <i>R. Kumar</i> | | |
| Scale: | | 0 0.2 0.4 0.8 1.2 Km | | | Sheet 1 |
| Drg No. | | HQ REM 07 A4 22 08 | | | Rev No.0 |



Plate-9

| Classes | | Colour | Area | |
|-------------|--------------------------------|--------|-------------------------|---------------|
| Level-I | Level-II | | Area (Km ²) | % of Total |
| Forest | Open Forest(A) | | 0.91 | 6.30 |
| Scrubs | Scrubs (B) | | 3.09 | 21.40 |
| Plantation | Social Forestry | | 0.50 | 3.46 |
| | Plantation on Backfill | | 0.66 | 4.57 |
| | Plantation on OB Dump | | 0.48 | 3.32 |
| | Total Plantation (C) | | 1.64 | 11.36 |
| | Total Vegetation(A+B+C) | | 5.64 | 39.06 |
| Agriculture | Agriculture Land | | 0.45 | 3.12 |
| Waste Land | Waste Land | | 2.35 | 16.27 |
| Mining Area | Coal Quarry | | 1.00 | 6.93 |
| | Barren OB Dump | | 0.25 | 1.73 |
| | Area Under Backfilling | | 3.50 | 24.24 |
| | Water Filled Quarry | | 0.15 | 1.04 |
| | Coal Dump | | 0.11 | 0.76 |
| | Advance Quarry Site | | 0.18 | 1.25 |
| | Total Mining Area | | 5.19 | 35.94 |
| Settlements | Rural Settlement | | 0.17 | 1.18 |
| | Urban Settlement | | 0.02 | 0.14 |
| | Industrial Settlement | | 0.40 | 2.77 |
| | Total Settlement Area | | 0.59 | 4.09 |
| Water Body | River, Ponds | | 0.22 | 1.52 |
| | Total | | 14.44 | 100.00 |

| | | | | | |
|------------------------------------------------------------------------------------------------------------------|--------------------------------------------|-----------|-------------------|------------------|-------------------|
| Customer | Mahanadi Coalfields Limited | | | | |
| Title | Land Reclamation Monitoring of OC Projects | | | | Job No. 564922120 |
| Subject Land Reclamation Status of Belpahar OCP based on Satellite Data (IRS-R2/L-IV) of the year 2022 | Activity | Name | Designation | Signature | Date |
| | Prepared | A. Biswas | Sr. Mgr.(Geology) | <i>A. Biswas</i> | |
| | Checked | T. Mondal | CM (RSC) | <i>T. Mondal</i> | |
| | Approved | R. Kumar | GM(Geomatics) | <i>R. Kumar</i> | |
|  | Scale: 0 0.5 1 2 km | | | | Sheet 1 |
| | Drg No. HQ REM 07 A4 22 09 | | | | Rev No.0 |



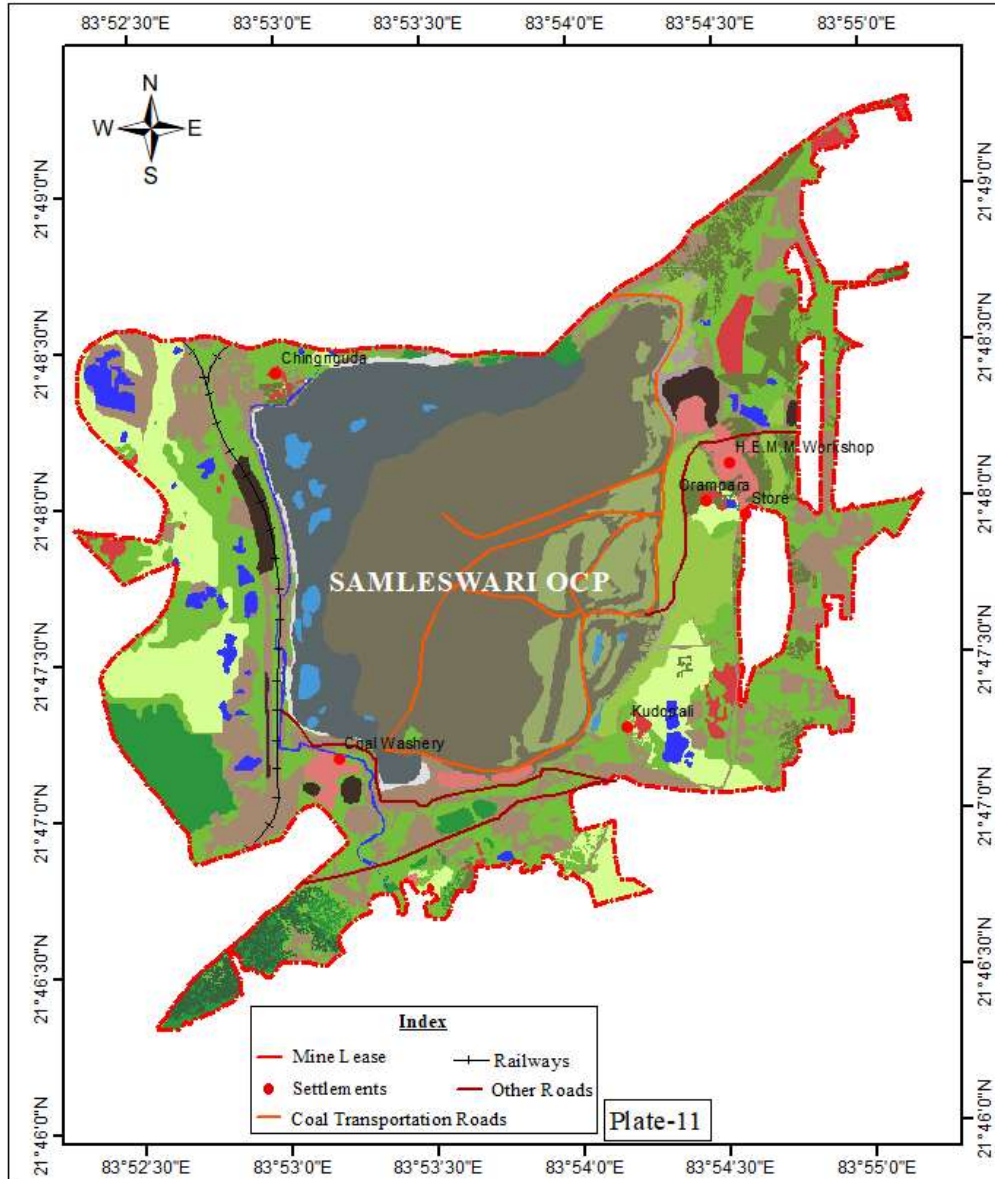
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| | |
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| — Mine Lease | — Railways |
| ● Settlements | — Other Roads |
| — Coal Transportation Roads | |


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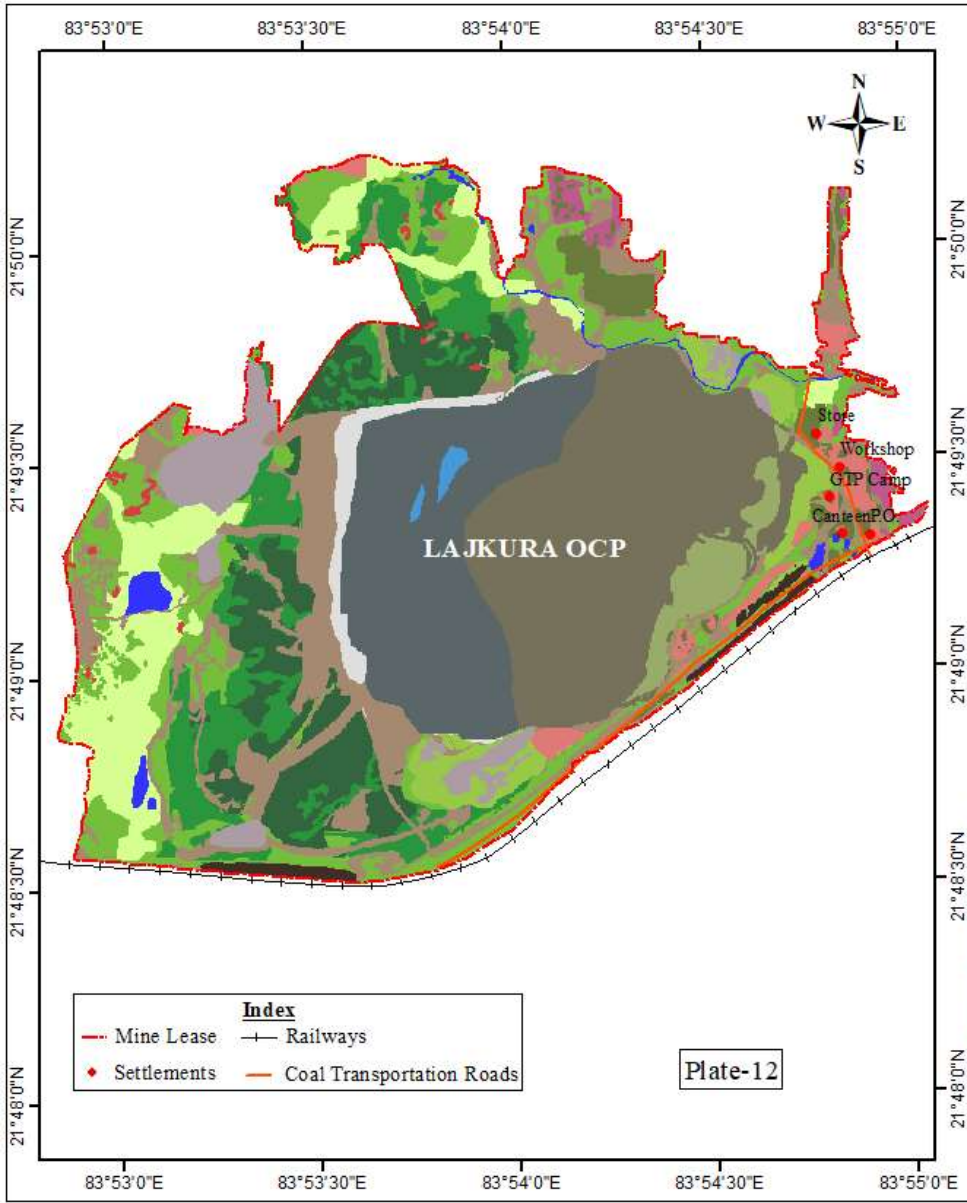
| Area Statistics - Lakhanpur OCP (2022) | | | | |
|----------------------------------------|--------------------------|--------|-------------------------|---------------|
| Classes | | Colour | Area | |
| Level-I | Level-II | | Area (Km ²) | % of Total |
| Forest Area | Dense Forest | | 1.35 | 6.03 |
| | Open Forest | | 2.36 | 10.54 |
| Total Forest Area (A) | | | 3.71 | 16.56 |
| Scrubs | Scrubs (B) | | 2.50 | 11.16 |
| Plantation | Social Forestry | | 0.38 | 1.70 |
| | Plantation on Backfill | | 0.89 | 3.97 |
| | Plantation on OB Dump | | 0.59 | 2.63 |
| Total Plantation (C) | | | 1.86 | 8.30 |
| Total Vegetation(A+B+C) | | | 8.07 | 36.03 |
| Agriculture | Agriculture Land | | 3.52 | 15.71 |
| Waste Land | Waste Land | | 1.33 | 5.94 |
| Mining Area | Coal Quarry | | 3.41 | 15.22 |
| | Barren OB Dump | | 0.02 | 0.09 |
| | Area Under Backfilling | | 4.76 | 21.25 |
| | Water Filled Quarry | | 0.17 | 0.76 |
| | Coal Dump | | 0.12 | 0.54 |
| | Advance Quarry Site | | 0.41 | 1.83 |
| | Total Mining Area | | | 8.89 |
| Settlements | Rural Settlement | | 0.11 | 0.49 |
| | Industrial Settlement | | 0.22 | 0.98 |
| Total Settlement Area | | | 0.33 | 1.47 |
| Water Body | River, Ponds | | 0.26 | 1.16 |
| Total | | | 22.40 | 100.00 |

| | | | | | |
|-------------------------------------------------------------------------------------------------------------------|----------|--------------------------------------------|------------------|------------------|-------------------|
| Customer | | Mahanadi Coalfields Limited | | | |
| Title | | Land Reclamation Monitoring of OC Projects | | | Job No. 564922120 |
| Subject Land Reclamation Status of Lakhanpur OCP based on Satellite Data (IRS-R2.L-IV) of the year 2022 | Activity | Name | Designation | Signature | Date |
| | Prepared | A. Biswas | Sr.Mgr.(Geology) | <i>A. Biswas</i> | |
| | Checked | T. Mondal | CM(RSC) | <i>T. Mondal</i> | |
| Approved | R. Kumar | GM(Geomatics) | <i>R. Kumar</i> | | |
| Scale: | | 0 0.375 0.75 1.5 Km | | | Sheet 1 |
| Drg No. | | HQ REM 07 A4 22 10 | | | Rev No.0 |



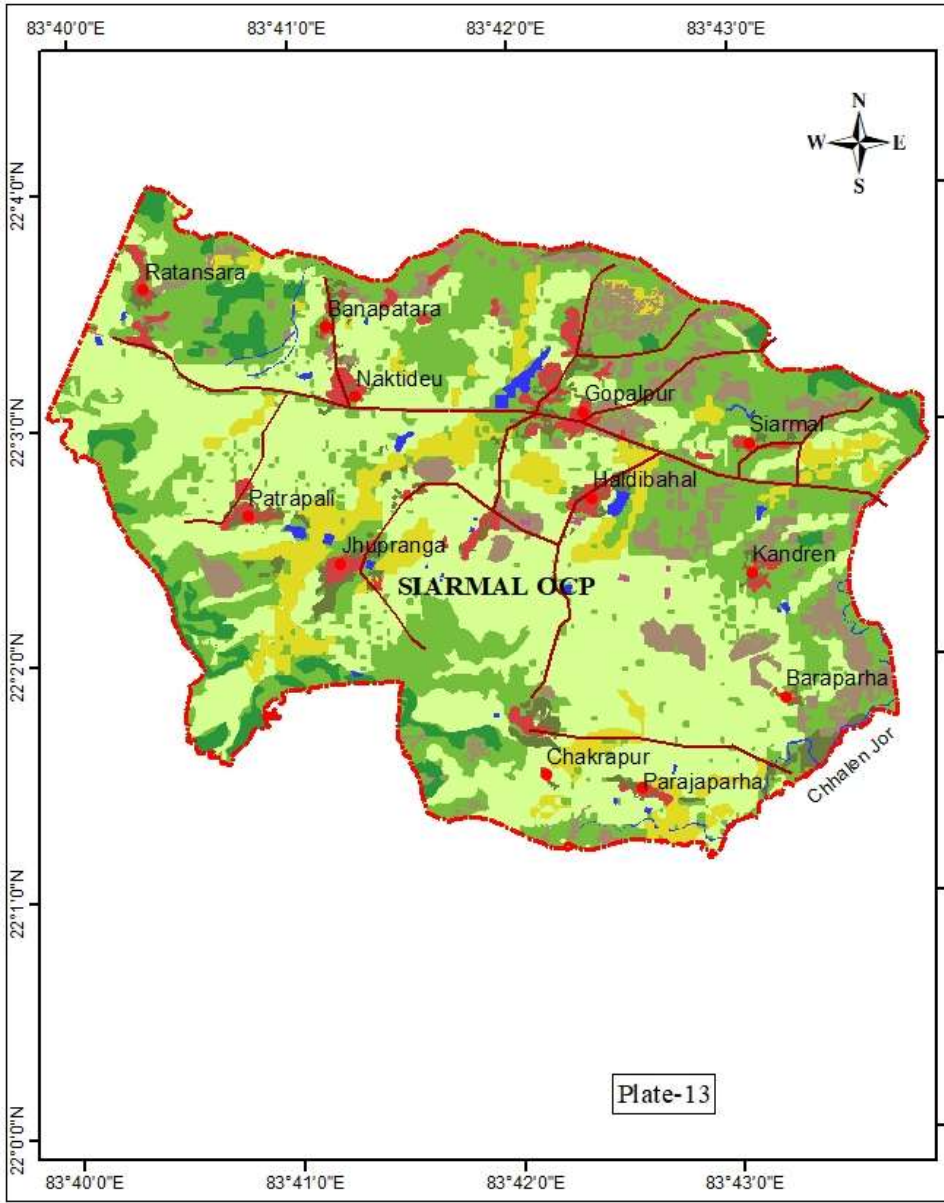
| Classes | | Colour | Area | |
|--------------------------------|-------------------------|--------|-------------------------|---------------|
| Level-I | Level-II | | Area (Km ²) | % of Total |
| Forest Area | Dense Forest | | 0.16 | 1.20 |
| | Open Forest | | 0.53 | 3.97 |
| Total Forest Area (A) | | | 0.69 | 5.17 |
| Scrubs | Scrubs (B) | | 2.52 | 18.87 |
| | Social Forestry | | 0.48 | 3.59 |
| Plantation | Plantation on Backfill | | 0.66 | 4.94 |
| | Plantation on OB Dump | | 0.49 | 3.67 |
| Total Plantation (C) | | | 1.63 | 12.21 |
| Total Vegetation(A+B+C) | | | 4.84 | 36.25 |
| Agriculture | Agriculture Land | | 1.08 | 8.09 |
| Waste Land | Waste Land | | 1.93 | 14.45 |
| Mining Area | Coal Quarry | | 1.25 | 9.36 |
| | Barren OB Dump | | 0.07 | 0.52 |
| | Area Under Backfilling | | 3.12 | 23.37 |
| | Water Filled Quarry | | 0.12 | 0.90 |
| | Coal Dump | | 0.19 | 1.42 |
| | Advance Quarry Site | | 0.08 | 0.60 |
| Total Mining Area | | | 4.83 | 36.17 |
| Settlements | Urban Settlement | | 0.003 | 0.02 |
| | Rural Settlement | | 0.20 | 1.50 |
| | Industrial Settlement | | 0.21 | 1.57 |
| Total Settlement Area | | | 0.41 | 3.09 |
| Water Body | River, Ponds | | 0.26 | 1.95 |
| Total | | | 13.35 | 100.00 |

| | | | | | |
|------------------------------------------------------------------------------------------------------------------------------|----------|--------------------------------------------|---------------|------------------|-------------------|
| Customer | | Mahanadi Coalfields Limited | | | |
| Title | | Land Reclamation Monitoring of OC Projects | | | Job No. 564922120 |
| Subject | Activity | Name | Designation | Signature | Date |
| Land Reclamation Status of Samleswari OCP based on Satellite Data (IRS-R2/L-IV) of the year 2022. | Prepared | A. Biswas | SM(Geology) | <i>A. Biswas</i> | |
| | Checked | T. Mandal | CM(RSC) | <i>T. Mandal</i> | |
| | Approved | R. Kumar | GM(Geomatics) | <i>R. Kumar</i> | |
| Scale: 0 0.375 0.75 1.5 Km | | Drg No. HQ REM 07 A4 22 11 | | Sheet 1 | |
|  cmpdi <i>A Wipro Company</i> | | | | REV No. 0 | |



| Classes | | Colour | Area | |
|--------------------------------|--------------------------|--------|-------------------------|---------------|
| Level-I | Level-II | | Area (Km ²) | % of Total |
| Forest Area | Dense Forest | | 0.58 | 8.04 |
| | Open Forest | | 0.60 | 8.32 |
| Total Forest Area (A) | | | 1.18 | 16.37 |
| Scrubs | Scrubs (B) | | 0.91 | 12.62 |
| Plantation | Social Forestry | | 0.16 | 2.22 |
| | Plantation on Backfill | | 0.16 | 2.22 |
| | Plantation on OB Dump | | 0.19 | 2.64 |
| Total Plantation (C) | | | 0.51 | 7.07 |
| Total Vegetation(A+B+C) | | | 2.60 | 36.06 |
| Agriculture | Agriculture Land | | 0.54 | 7.49 |
| Waste Land | Waste Land | | 1.03 | 14.29 |
| Mining Area | Coal Quarry | | 0.94 | 13.04 |
| | Barren OB Dump | | 0.27 | 3.74 |
| | Area Under Backfilling | | 1.32 | 18.31 |
| | Water Filled Quarry | | 0.02 | 0.28 |
| | Coal Dump | | 0.07 | 0.97 |
| | Advance Quarry Site | | 0.11 | 1.53 |
| | Total Mining Area | | | 2.73 |
| Settlement | Urban Settlement | | 0.08 | 1.11 |
| | Rural Settlement | | 0.03 | 0.42 |
| | Industrial | | 0.13 | 1.80 |
| Total Settlement Area | | | 0.24 | 3.33 |
| Water Body | River, Ponds | | 0.07 | 0.97 |
| Total | | | 7.21 | 100.00 |

| | | | | | |
|-----------------------------------------------------------------------------------------------------------------|----------|--------------------------------------------|------------------|------------------|-------------------|
| Customer | | Mahanadi Coalfields Limited | | | |
| Title | | Land Reclamation Monitoring of OC Projects | | | Job No. 564922120 |
| Subject Land Reclamation Status of Lajkura OCP based on Satellite Data (IRS-R2/L-IV) of the year 2022 | Activity | Name | Designation | Signature | Date |
| | Prepared | A. Biswas | Sr.Mgr.(Geology) | <i>A. Biswas</i> | |
| | Checked | T. Mondal | CM (RSC) | <i>T. Mondal</i> | |
| | Approved | R. Kumar | GM(Geomatics) | <i>R. Kumar</i> | |
| Scale: | | 0 0.3 0.6 1.2 Km | | | Sheet 1 |
| Drg.No. | | HQ REM 07 A4 22 12 | | | Rev No.0 |



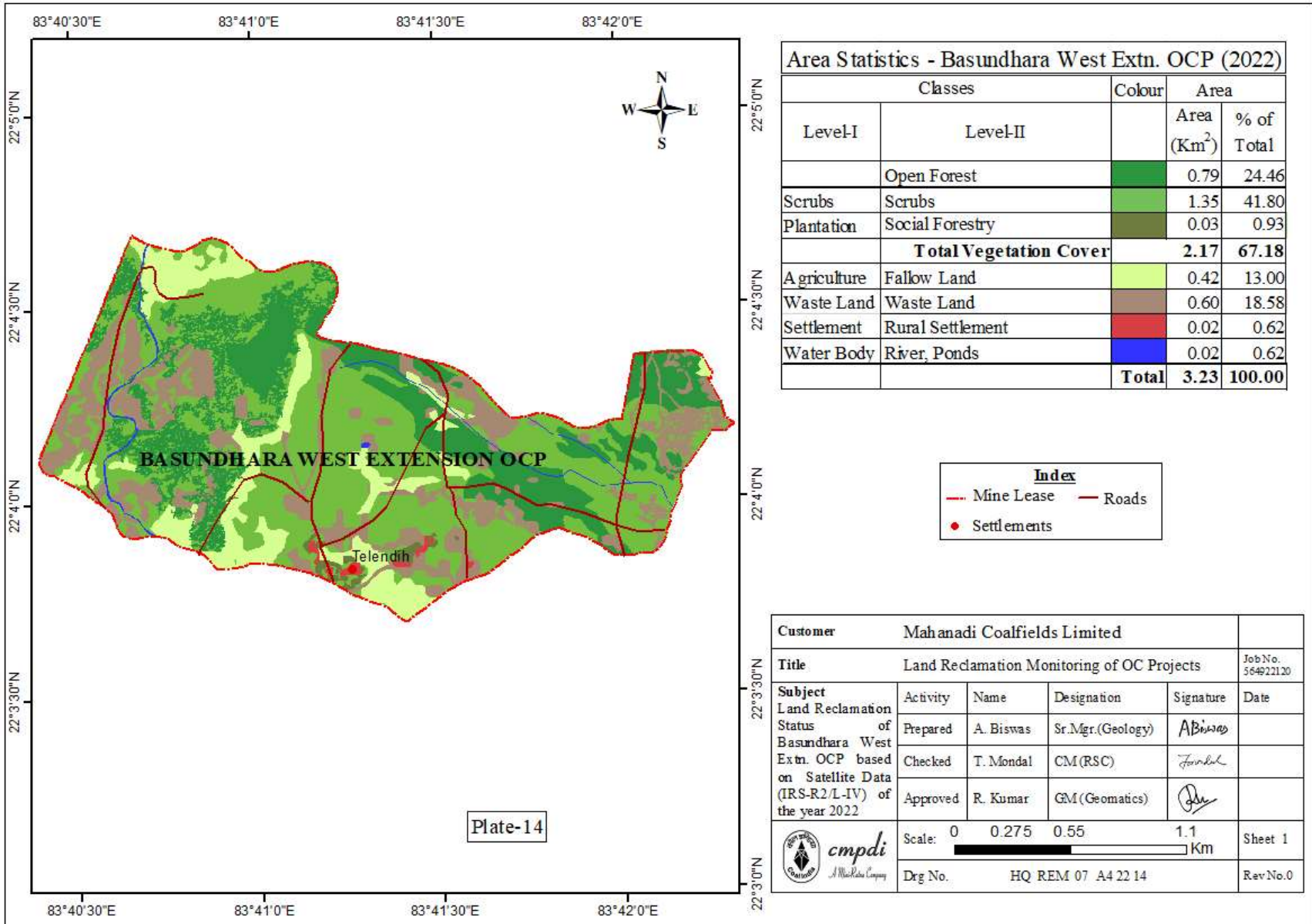
| Classes | | Colour | Area | |
|-------------------------------|------------------|--------|-------------------------|---------------|
| Level-I | Level-II | | Area (Km ²) | % of Total |
| | Open Forest | | 0.87 | 3.80 |
| Scrubs | Scrubs | | 7.18 | 31.35 |
| Plantation | Social Forestry | | 0.61 | 2.66 |
| Total Vegetation Cover | | | 8.66 | 37.82 |
| Agriculture | Fallow Land | | 9.63 | 42.05 |
| | Crop Land | | 1.73 | 7.55 |
| Total Agriculture Land | | | 11.36 | 49.61 |
| Waste Land | Waste Land | | 1.95 | 8.52 |
| Settlement | Rural Settlement | | 0.69 | 3.01 |
| | Urban settlement | | 0.02 | 0.09 |
| Total Settlement Area | | | 0.71 | 3.10 |
| Water Body | River, Ponds | | 0.22 | 0.96 |
| Total | | | 22.90 | 100.00 |

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- Mine Lease
- Roads
- Settlements

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|-----------------------------------------------------------------------------------------------------------------|----------|--------------------------------------------|-------------------|-----------|-------------------|
| Customer | | Mahanadi Coalfields Limited | | | |
| Title | | Land Reclamation Monitoring of OC Projects | | | Job No. 564922120 |
| Subject Land Reclamation Status of Siarmal OCP based on Satellite Data (IRS-R2/L-IV) of the year 2022 | Activity | Name | Designation | Signature | Date |
| | Prepared | A. Biswas | Sr. Mgr.(Geology) | | |
| | Checked | T. Mondal | CM (RSC) | | |
| Approved | R. Kumar | GM (Geomatics) | | | |
| | | Scale: 0 0.5 1 2 Km | | | Sheet 1 |
| Drg.No. | | HQ REM 07 A4 22 13 | | | Rev No.0 |

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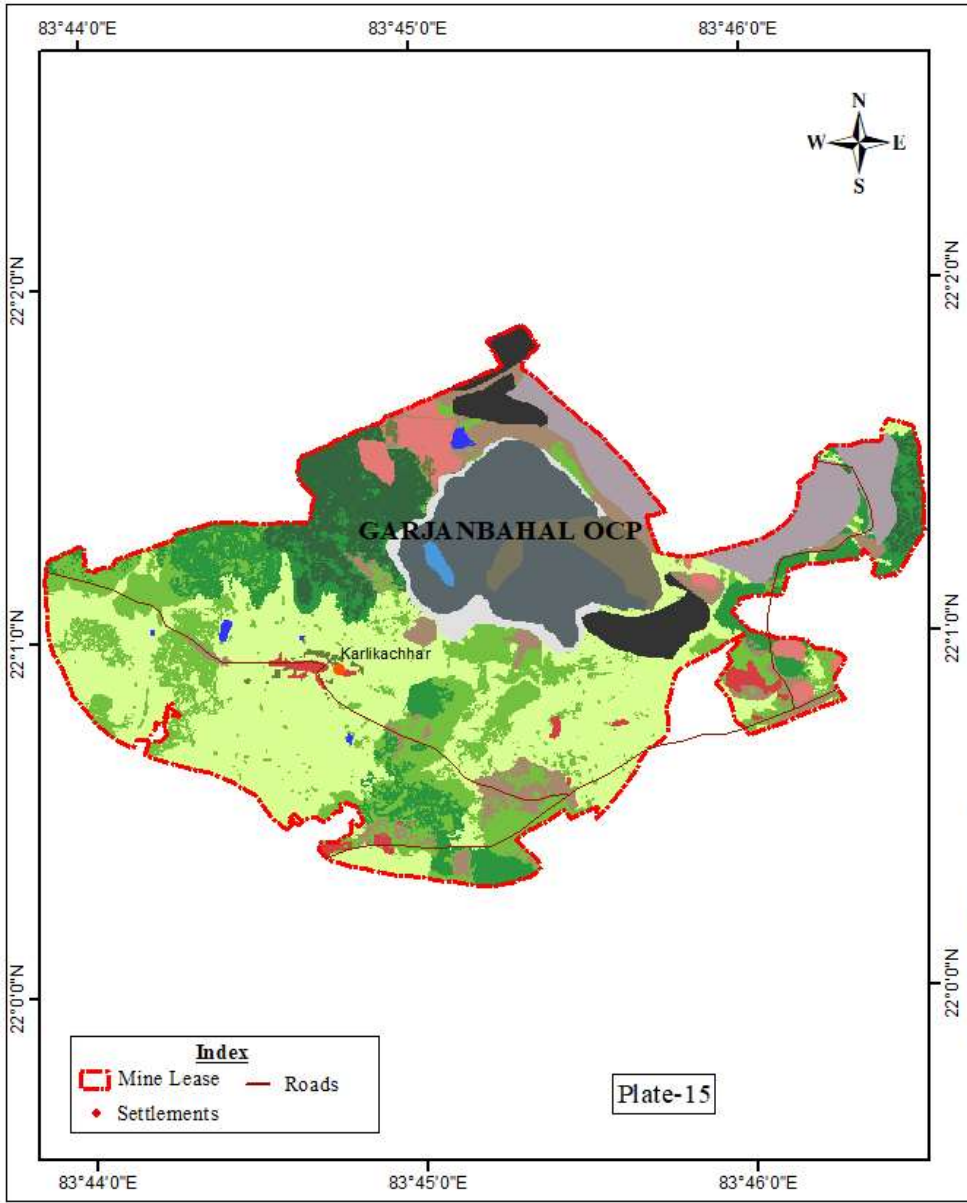


Area Statistics - Basundhara West Extn. OCP (2022)

| Classes | | Colour | Area | |
|-------------------------------|------------------|--------|-------------------------|---------------|
| Level-I | Level-II | | Area (Km ²) | % of Total |
| | Open Forest | | 0.79 | 24.46 |
| Scrubs | Scrubs | | 1.35 | 41.80 |
| Plantation | Social Forestry | | 0.03 | 0.93 |
| Total Vegetation Cover | | | 2.17 | 67.18 |
| Agriculture | Fallow Land | | 0.42 | 13.00 |
| Waste Land | Waste Land | | 0.60 | 18.58 |
| Settlement | Rural Settlement | | 0.02 | 0.62 |
| Water Body | River, Ponds | | 0.02 | 0.62 |
| Total | | | 3.23 | 100.00 |

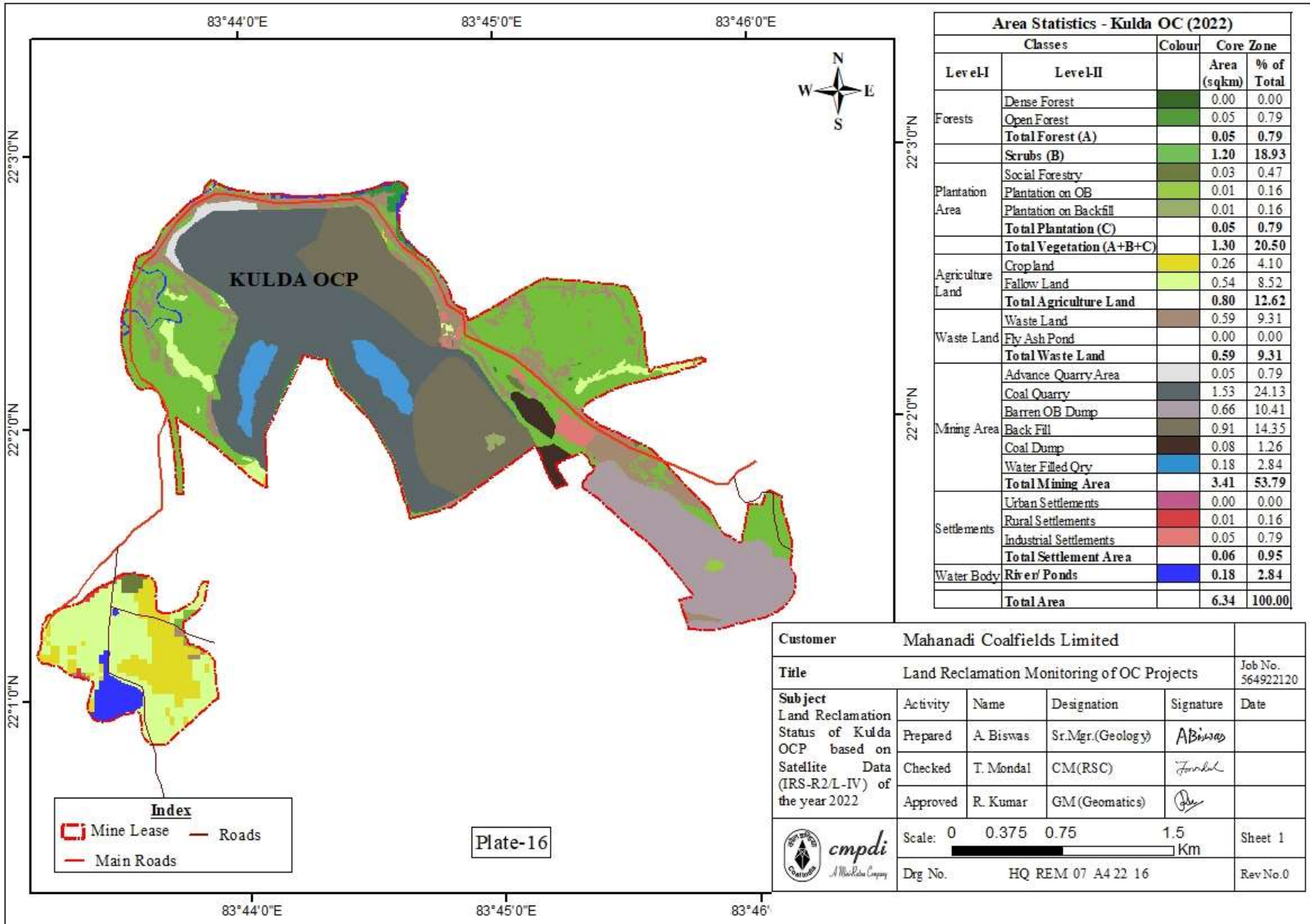
| Index | |
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| | Settlements |

| | | | | | |
|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|---------------|------------------|------------------|-------------------|
| Customer | Mahanadi Coalfields Limited | | | | |
| Title | Land Reclamation Monitoring of OC Projects | | | | Job No. 564922120 |
| Subject Land Reclamation Status of Basundhara West Extn. OCP based on Satellite Data (IRS-R2/L-IV) of the year 2022 | Activity | Name | Designation | Signature | Date |
| | Prepared | A. Biswas | Sr.Mgr.(Geology) | <i>A. Biswas</i> | |
| | Checked | T. Mondal | CM(RSC) | <i>T. Mondal</i> | |
| Approved | R. Kumar | GM(Geomatics) | <i>R. Kumar</i> | | |
| | Scale: 0 0.275 0.55 1.1 Km | | | | Sheet 1 |
| Drg No. | HQ REM 07 A4 22 14 | | | | Rev.No.0 |





| Area Statistics - Garjanbahal OCP (2022) | | | | |
|------------------------------------------|------------------------------|--------|-------------------------|---------------|
| Classes | | Colour | Area | |
| Level-I | Level-II | | Area (Km ²) | % of Total |
| Forest Area | Dense Forest | | 0.40 | 6.12 |
| | Open Forest | | 0.64 | 9.79 |
| | Total Forest Area (A) | | 1.04 | 15.90 |
| Scrubs | Scrubs (B) | | 1.08 | 16.51 |
| | Social Forestry | | 0.03 | 0.46 |
| Plantation | Plantation on Backfill | | 0.00 | 0.00 |
| | Plantation on OB Dump | | 0.00 | 0.00 |
| | Total Plantation (C) | | 0.03 | 0.46 |
| Total Vegetation(A+B+C) | | | 2.15 | 32.87 |
| Agriculture | Agriculture Land | | 2.10 | 32.11 |
| Waste Land | Waste Land | | 0.39 | 5.96 |
| Mining Area | Coal Quarry | | 0.65 | 9.94 |
| | Barren OB Dump | | 0.45 | 6.88 |
| | Area Under Backfilling | | 0.17 | 2.60 |
| | Water Filled Quarry | | 0.02 | 0.31 |
| | Coal Dump | | 0.25 | 3.82 |
| | Advance Quarry Site | | 0.12 | 1.83 |
| | Total Mining Area | | 1.66 | 25.38 |
| Settlements | Rural Settlement | | 0.07 | 1.07 |
| | Industrial Settlement | | 0.15 | 2.29 |
| Total Settlement Area | | | 0.22 | 3.36 |
| Water Body | River, Ponds | | 0.02 | 0.31 |
| Total | | | 6.54 | 100.00 |

| | | | | | |
|---------------------------------------------------------------------------------------------------------------------|----------|--------------------------------------------|-------------------|----------------|----------------------|
| Customer | | Mahanadi Coalfields Limited | | | |
| Title | | Land Reclamation Monitoring of OC Projects | | | Job No. 564922120 |
| Subject Land Reclamation Status of Garjanbahal OCP based on Satellite Data (IRS-R2/L-IV) of the year 2022 | Activity | Name | Designation | Signature | Date |
| | Prepared | A. Biswas | Sr.Mgr. (Geology) | <i>ABiswas</i> | |
| | Checked | T. Mondal | CM (RSC) | <i>Tmondal</i> | |
| Approved | R. Kumar | GM (Geomatics) | <i>Rkumar</i> | | |
| Scale: | | 0 0.375 0.75 1.5 Km | | | Sheet 1 |
| Drg No. | | HQ REM 07 A4 22 15 | | | Rev No.0 |



| Area Statistics - Kulda OC (2022) | | | | |
|-----------------------------------|---------------------------------|--------|-------------|---------------|
| Classes | | Colour | Core Zone | |
| Level-I | Level-II | | Area (sqkm) | % of Total |
| Forests | Dense Forest | | 0.00 | 0.00 |
| | Open Forest | | 0.05 | 0.79 |
| | Total Forest (A) | | 0.05 | 0.79 |
| | Scrubs (B) | | 1.20 | 18.93 |
| Plantation Area | Social Forestry | | 0.03 | 0.47 |
| | Plantation on OB | | 0.01 | 0.16 |
| | Plantation on Backfill | | 0.01 | 0.16 |
| | Total Plantation (C) | | 0.05 | 0.79 |
| | Total Vegetation (A+B+C) | | 1.30 | 20.50 |
| Agriculture Land | Cropland | | 0.26 | 4.10 |
| | Fallow Land | | 0.54 | 8.52 |
| | Total Agriculture Land | | 0.80 | 12.62 |
| Waste Land | Waste Land | | 0.59 | 9.31 |
| | Fly Ash Pond | | 0.00 | 0.00 |
| | Total Waste Land | | 0.59 | 9.31 |
| Mining Area | Advance Quarry Area | | 0.05 | 0.79 |
| | Coal Quarry | | 1.53 | 24.13 |
| | Barren OB Dump | | 0.66 | 10.41 |
| | Back Fill | | 0.91 | 14.35 |
| | Coal Dump | | 0.08 | 1.26 |
| | Water Filled Ory | | 0.18 | 2.84 |
| | Total Mining Area | | 3.41 | 53.79 |
| Settlements | Urban Settlements | | 0.00 | 0.00 |
| | Rural Settlements | | 0.01 | 0.16 |
| | Industrial Settlements | | 0.05 | 0.79 |
| | Total Settlement Area | | 0.06 | 0.95 |
| Water Body | River/ Ponds | | 0.18 | 2.84 |
| | Total Area | | 6.34 | 100.00 |

| | | | | | |
|--------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|--------------------|------------------|-----------------|-------------------|
| Customer | Mahanadi Coalfields Limited | | | | |
| Title | Land Reclamation Monitoring of OC Projects | | | | Job No. 564922120 |
| Subject | Activity | Name | Designation | Signature | Date |
| Land Reclamation Status of Kulda OCP based on Satellite Data (IRS-R2/L-IV) of the year 2022 | Prepared | A. Biswas | Sr.Mgr.(Geology) | <i>ABiswas</i> | |
| | Checked | T. Mondal | CM(RSC) | <i>T.Mondal</i> | |
| | Approved | R. Kumar | GM(Geomatics) | <i>R.Kumar</i> | |
|  cmpdi A Mahanadi Company | Scale: 0 | 0.375 | 0.75 | 1.5 | Sheet 1 |
| |  Km | | | | |
| | Drg No. | HQ REM 07 A4 22 16 | | | Rev.No.0 |

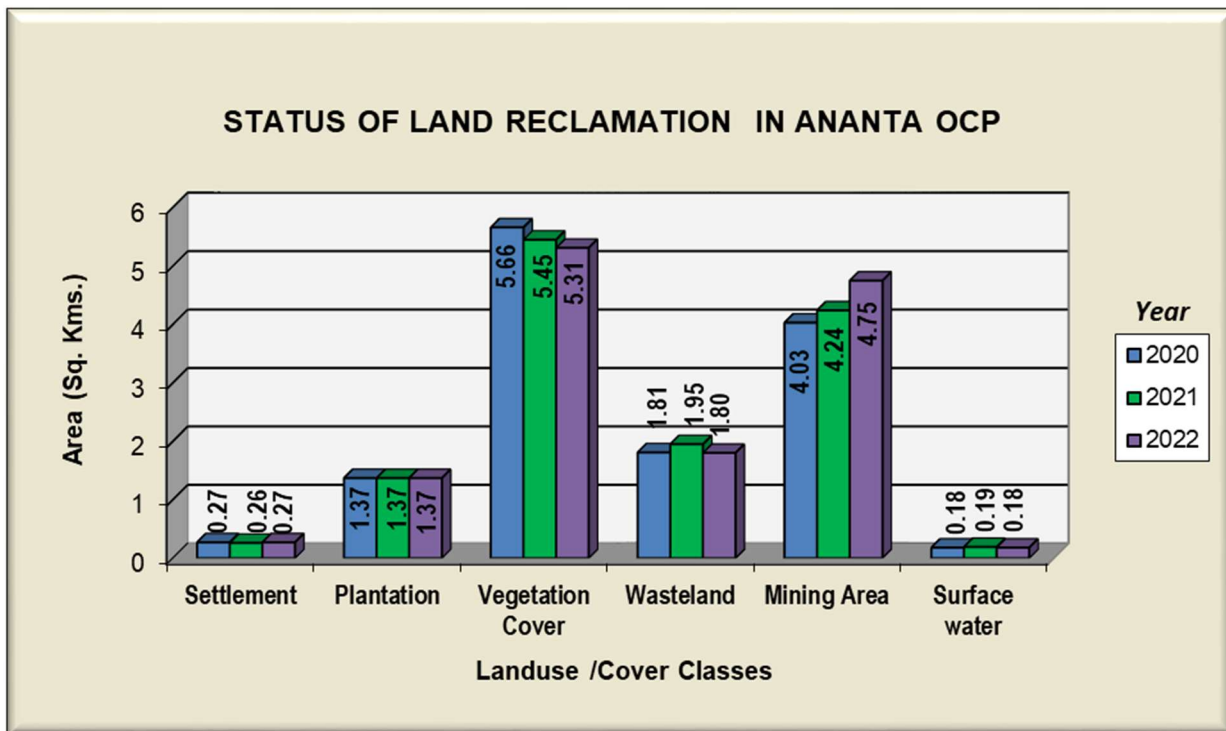


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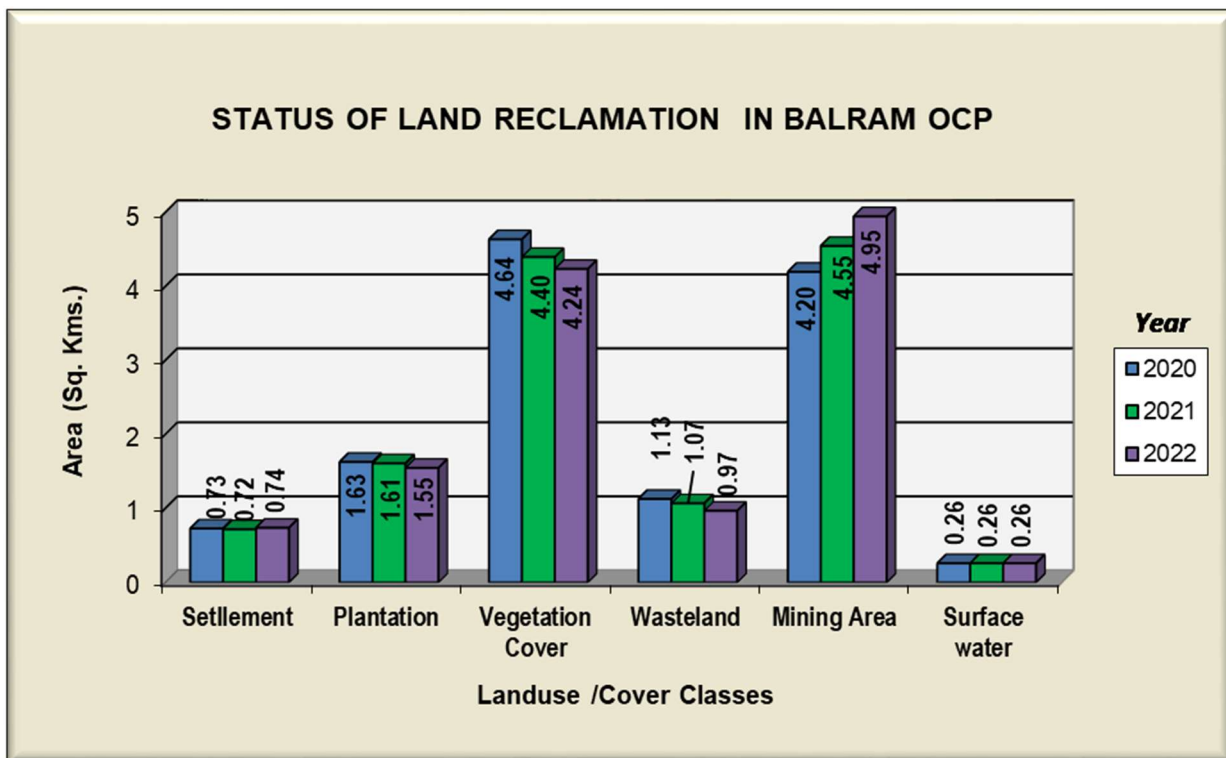


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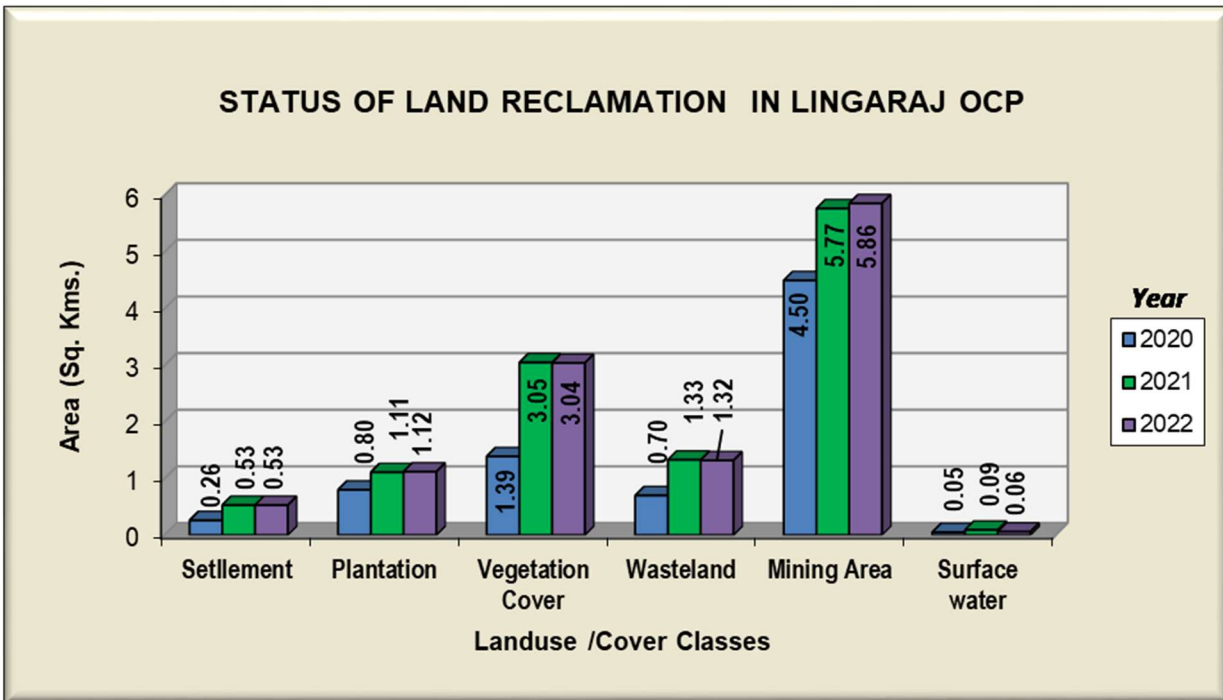


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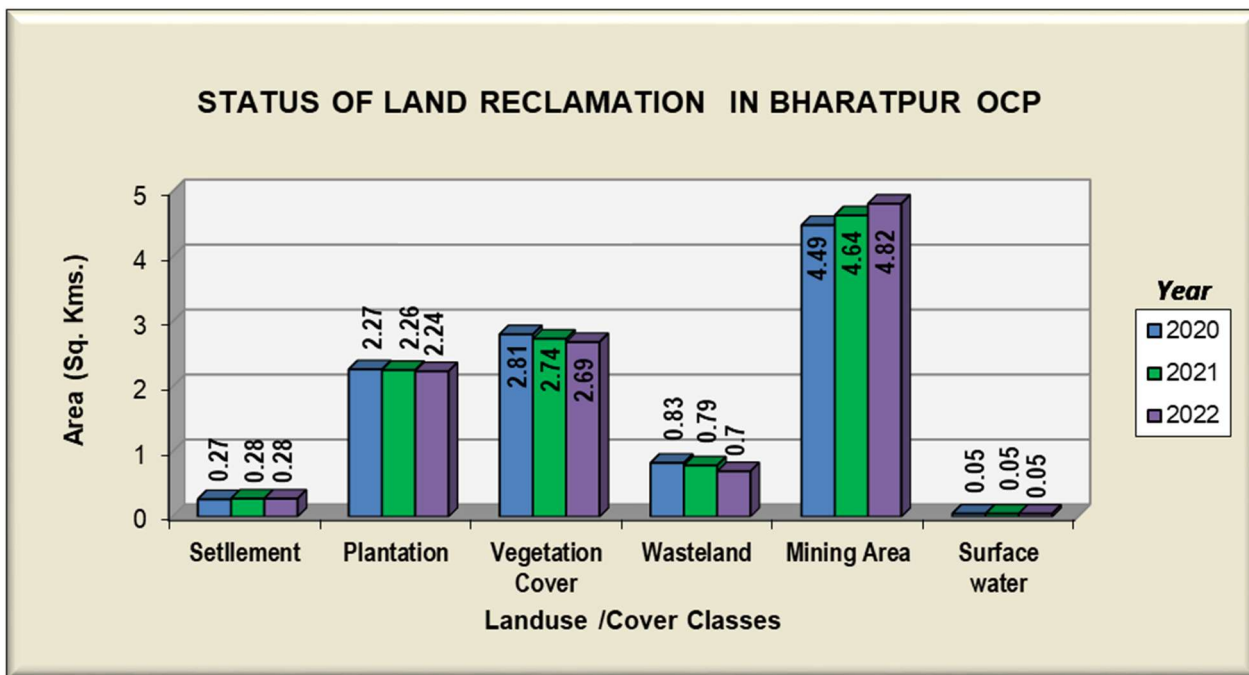


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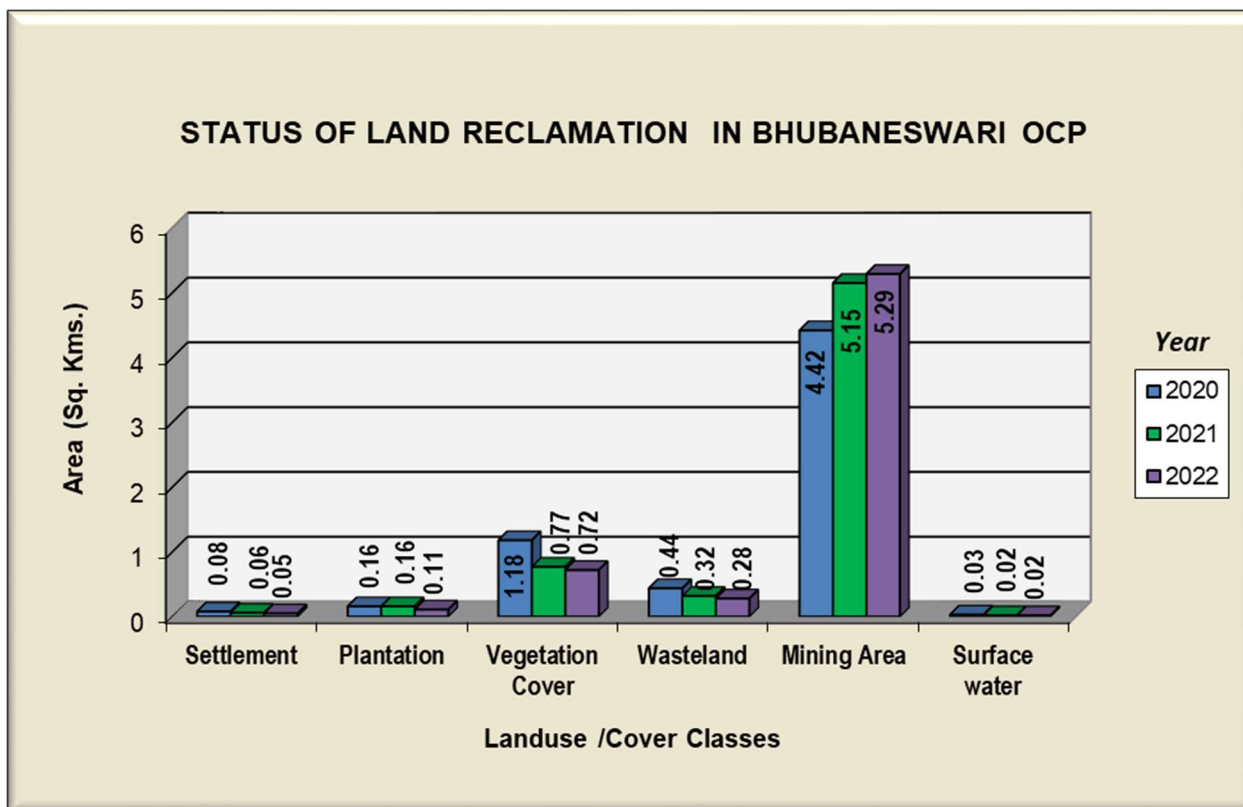


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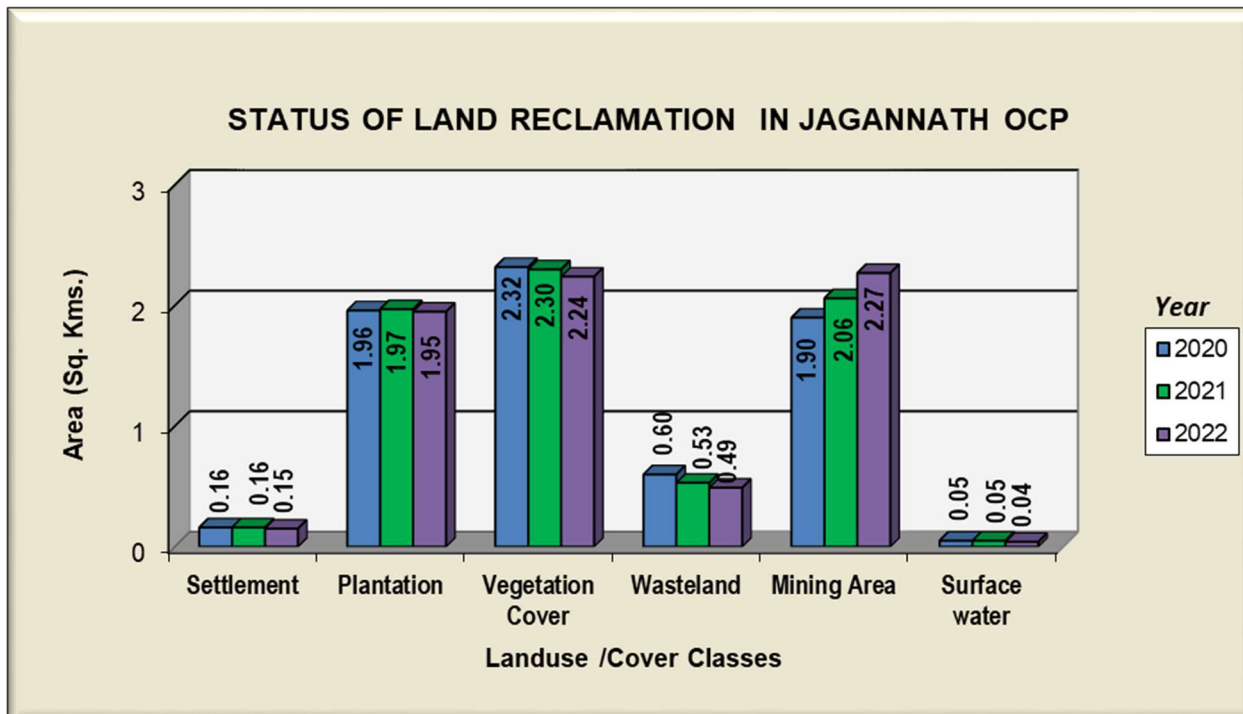


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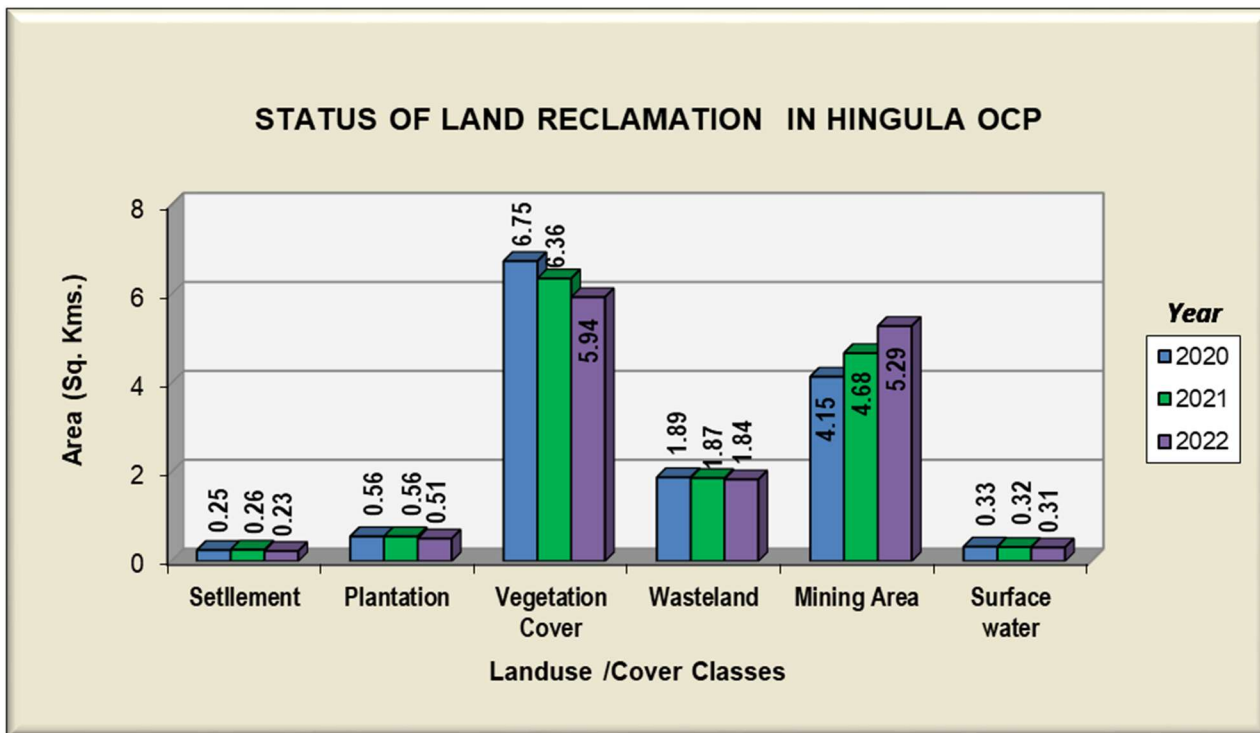


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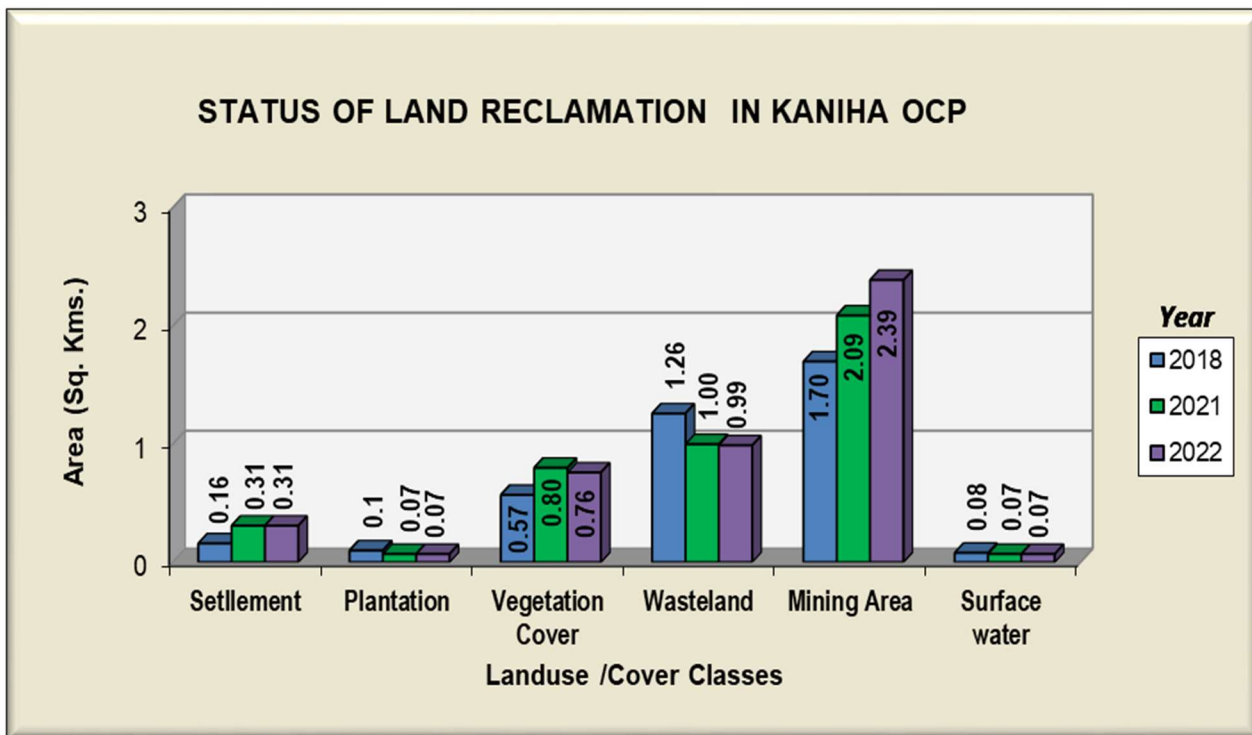


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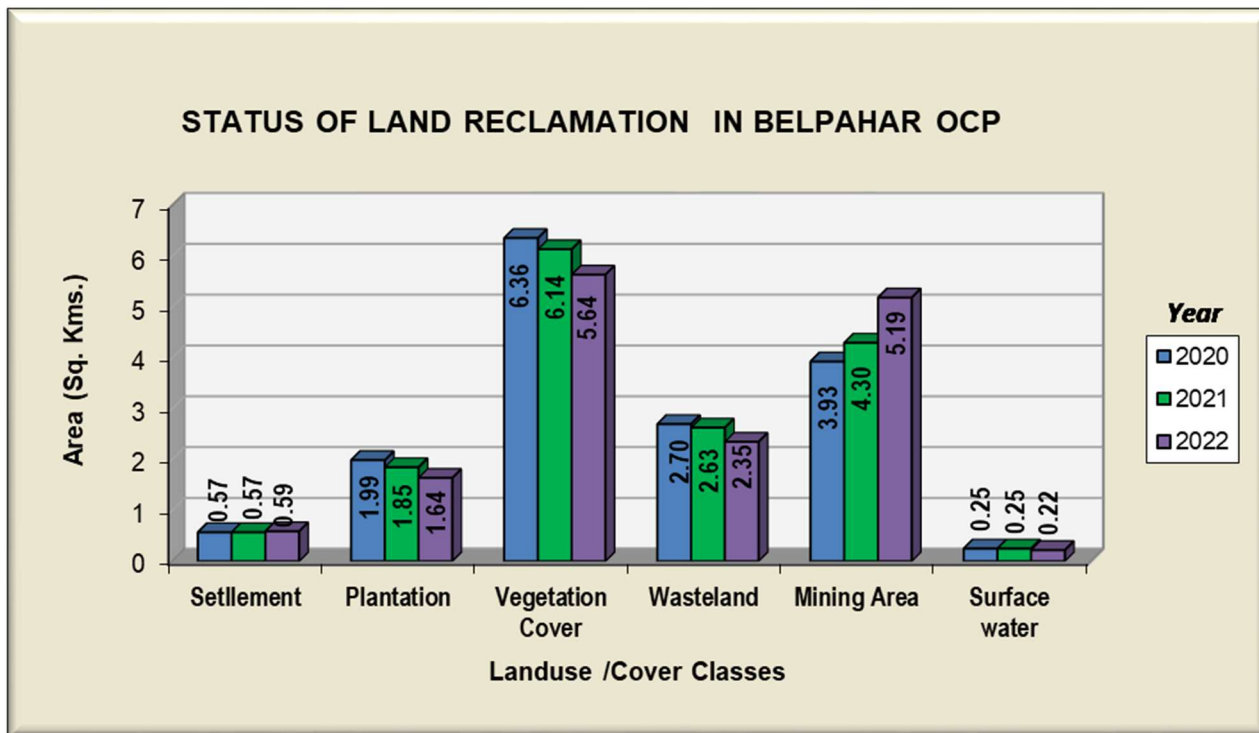


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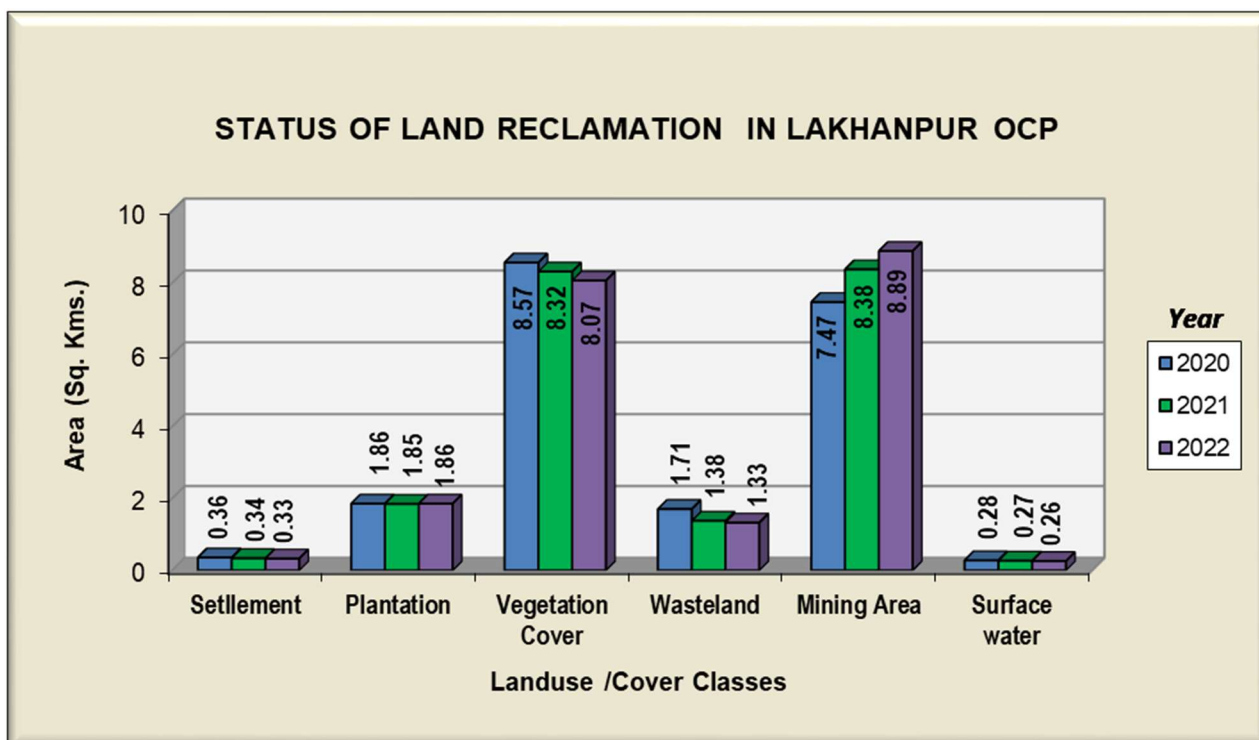


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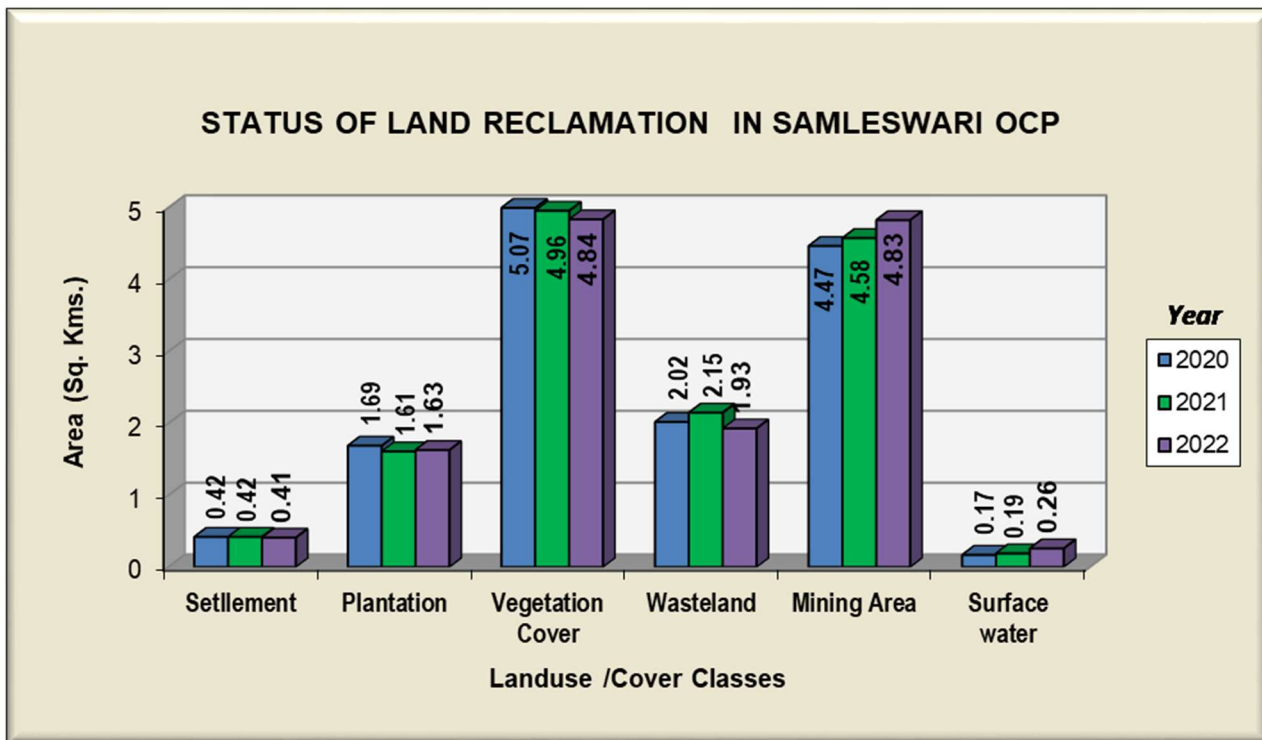


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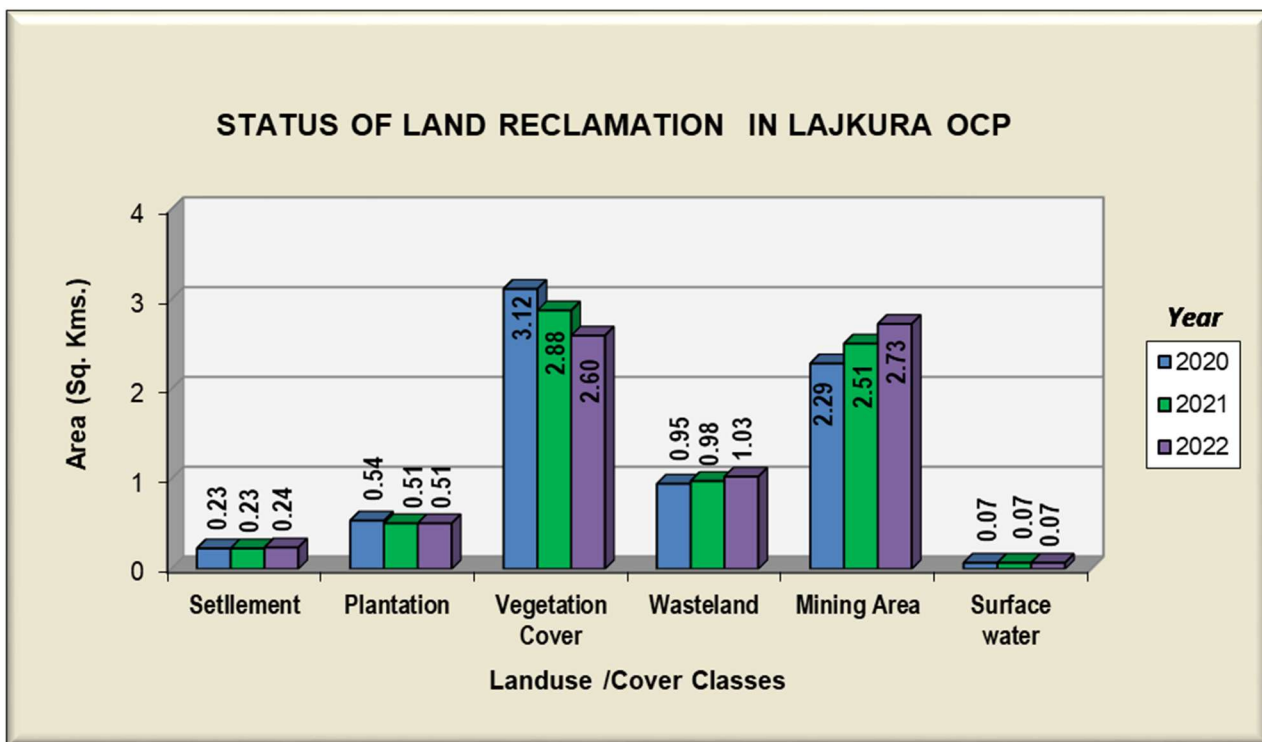


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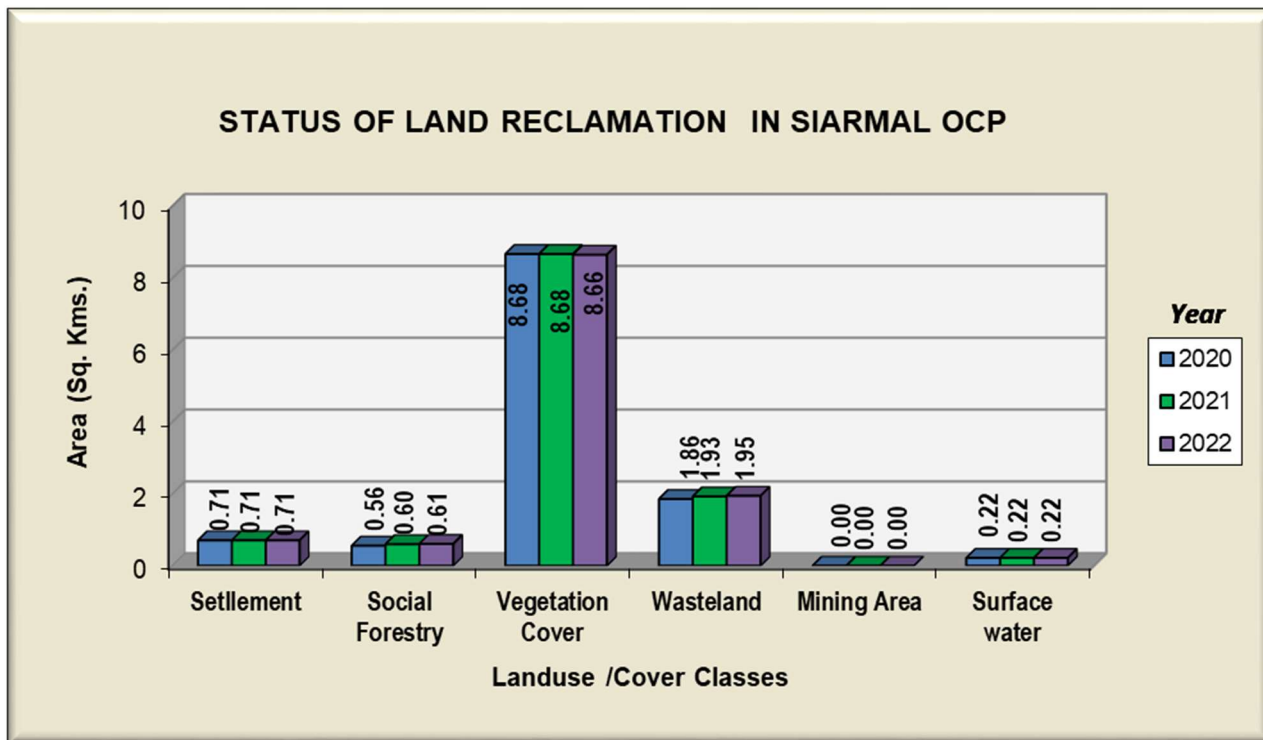


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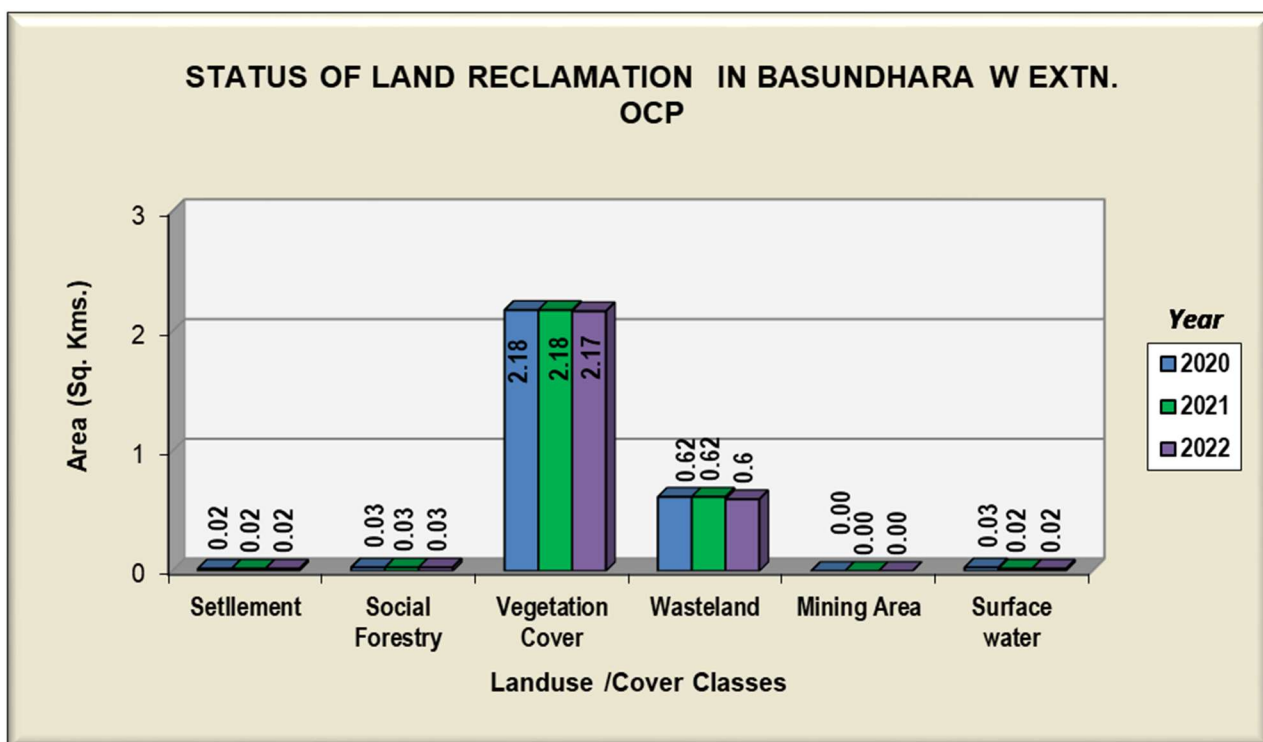


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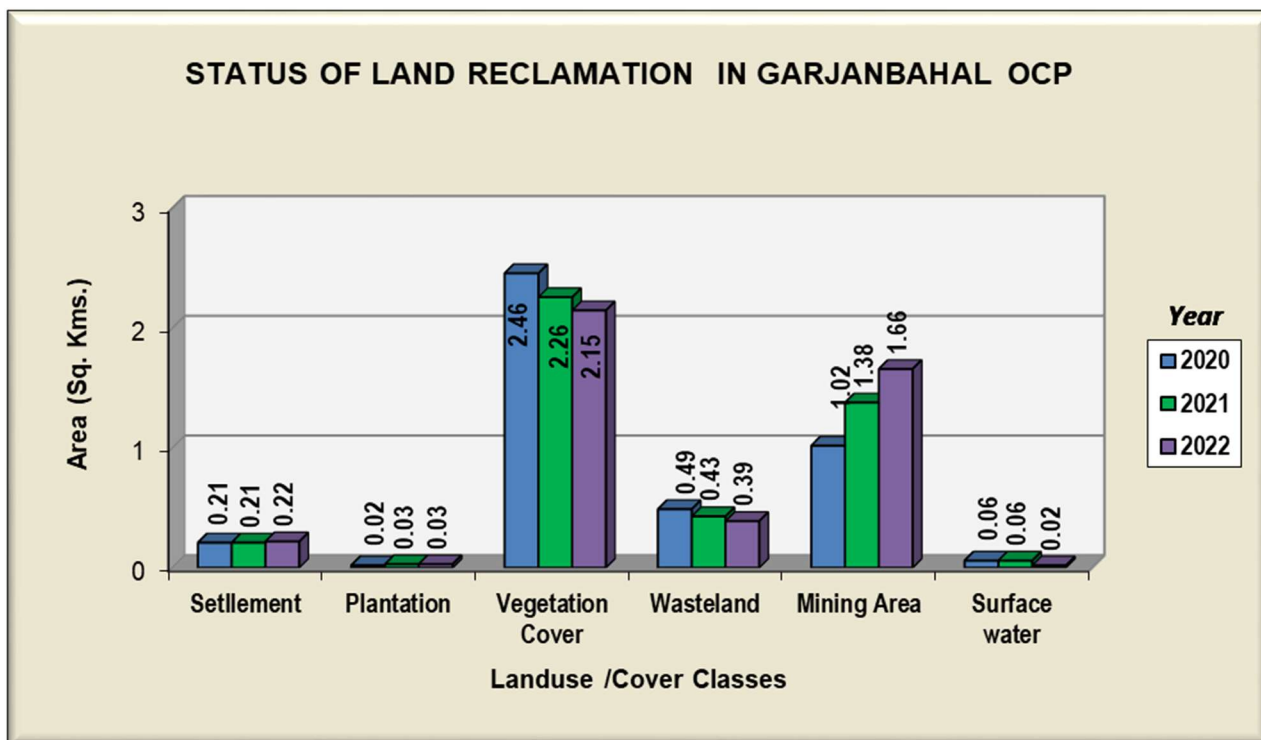


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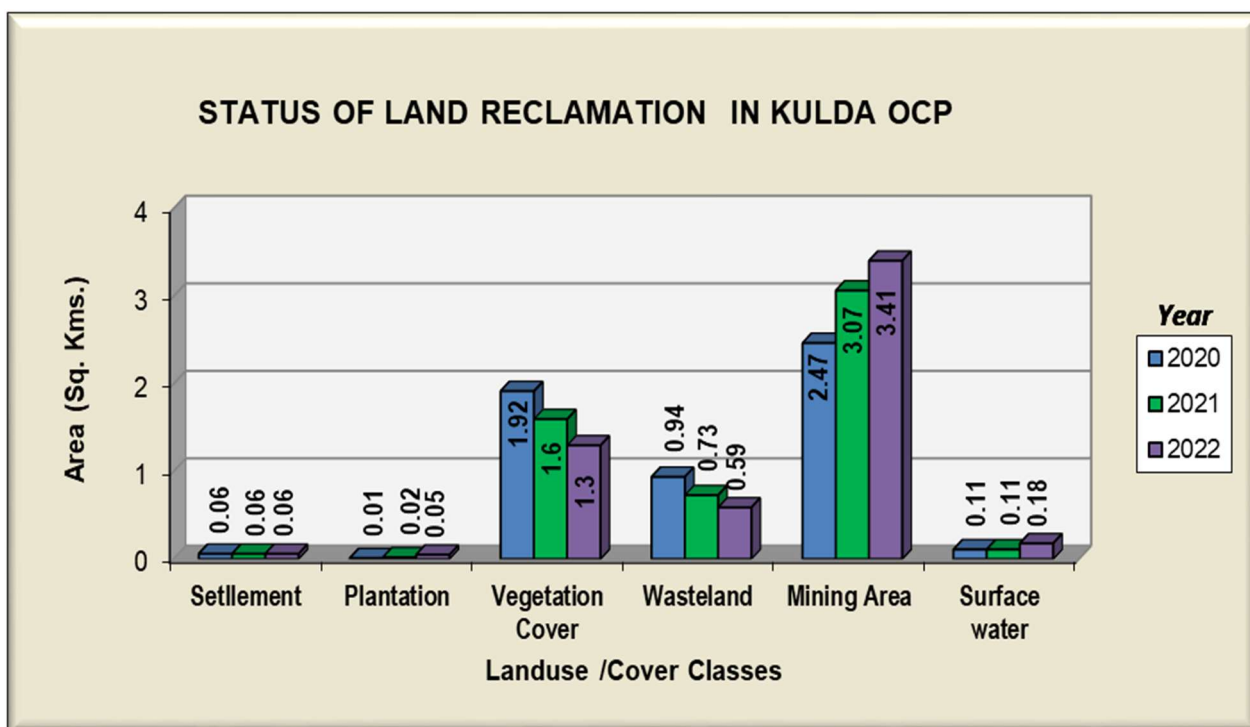
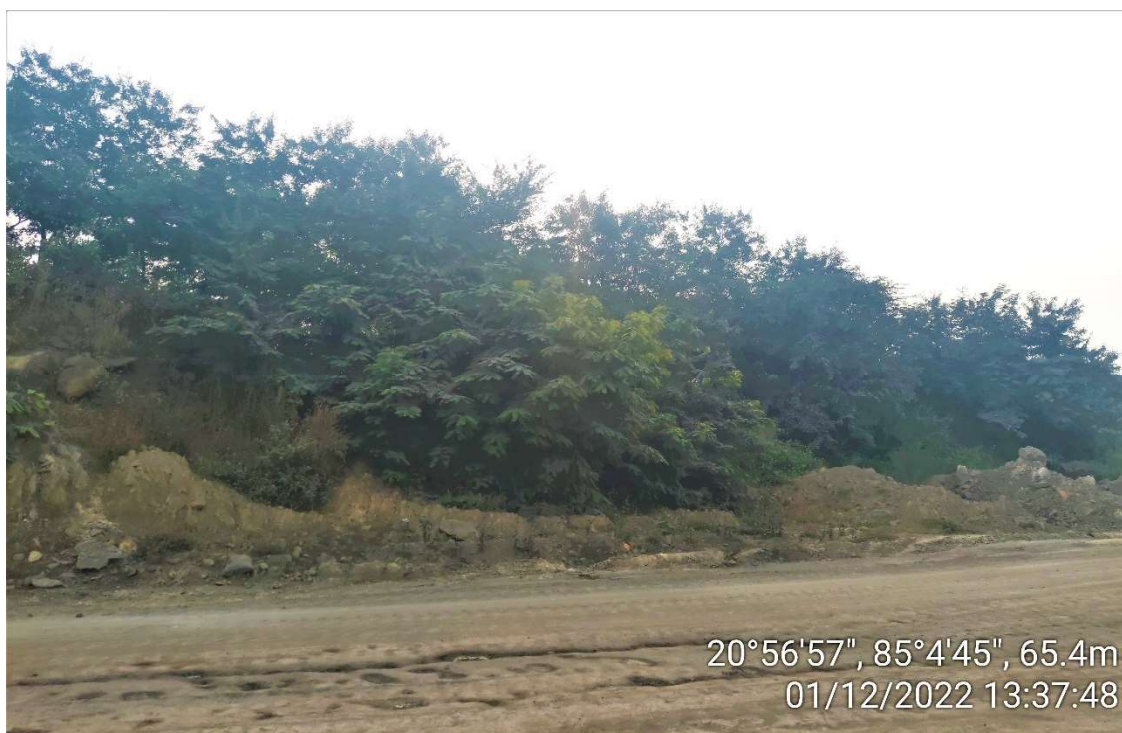


Figure 18



Photograph-1: Plantation on Internal OB/Backfill (Ananta OC mine)



Photograph-2: Plantation on Internal OB/Backfill (Balram OC Mine)



Photograph-3: Plantation on Internal OB/Backfill (Lingaraj OC Mine)



Photograph-4: Plantation on Internal OB/Backfill (Bharatpur OC Mine)



Photograph-5: Plantation on Internal OB/Backfill (Bhubaneswari OC Mine)



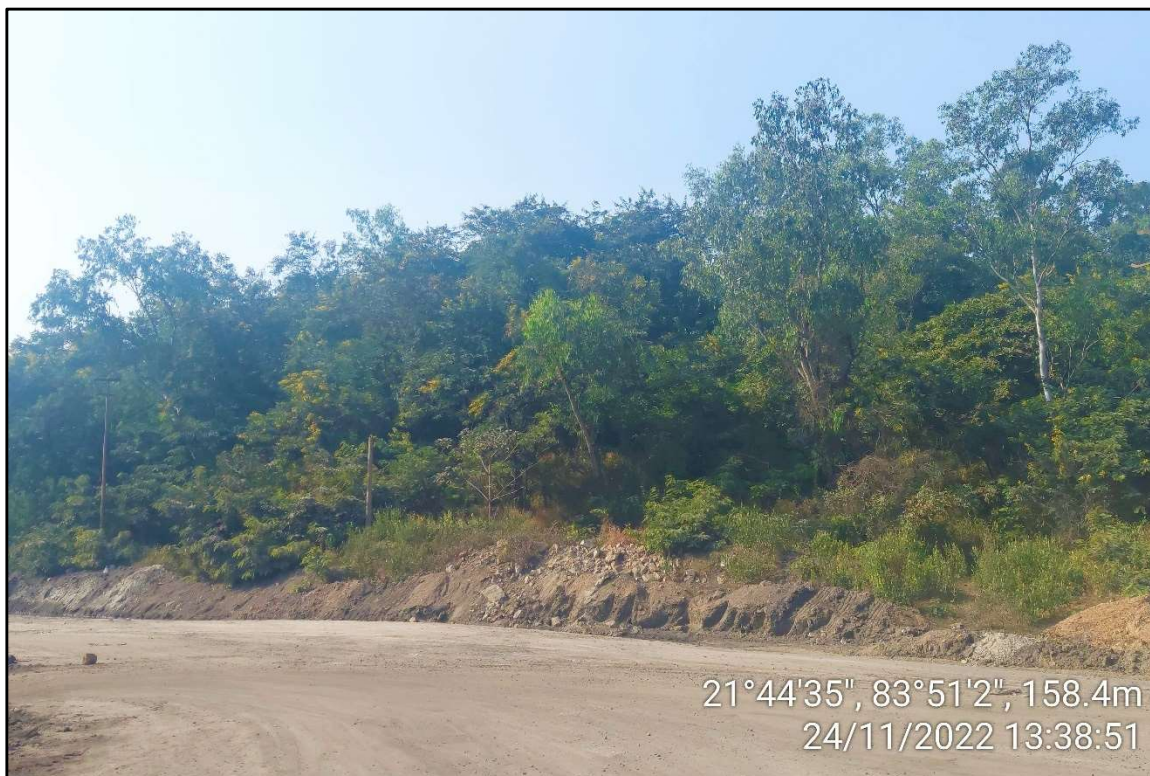
Photograph-6: Plantation on Internal OB/Backfill (Jagannath OC Mine)



Photograph-7: Plantation on Internal OB/Backfill (Hingula OC Mine)



Photograph-8: Avenue Plantation of Kaniha OC Mine



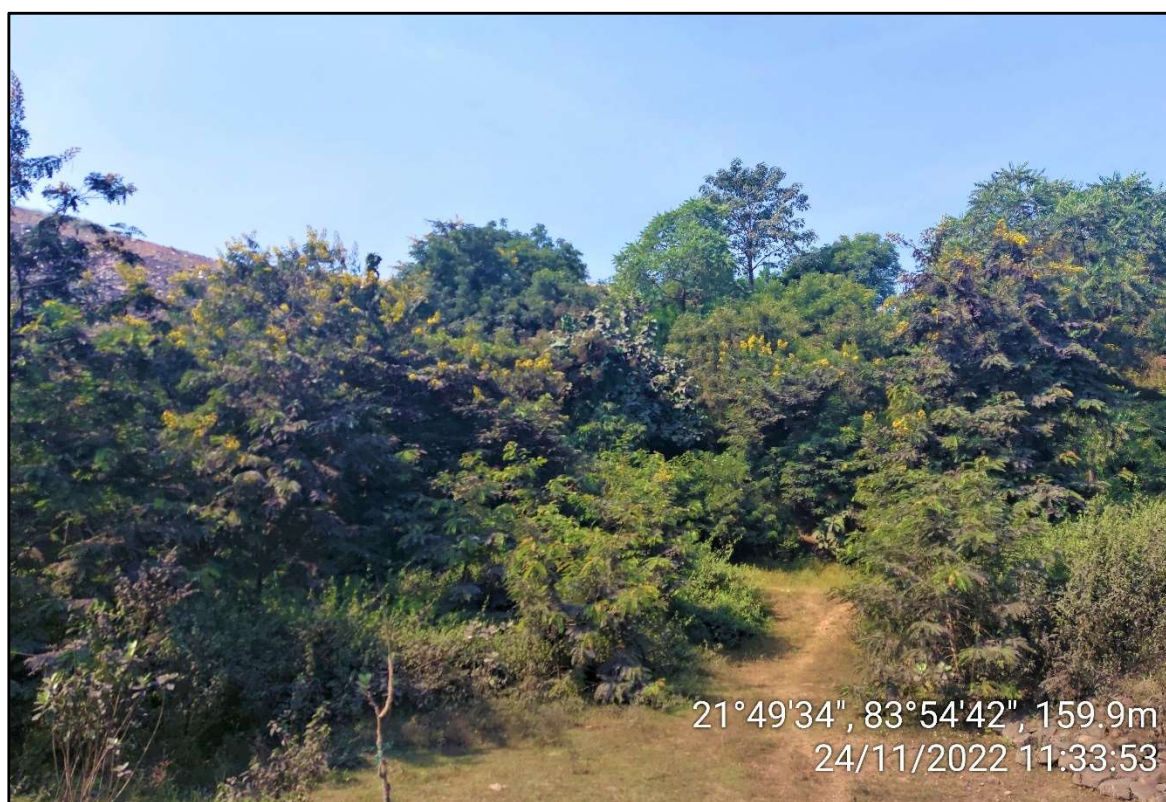
Photograph-9: Plantation on Internal OB/Backfill (Belpahar OC Mine)



Photograph-10: Plantation on Internal OB/Backfill (Lakhanpur OC Mine)



Photograph-11: Plantation on Internal OB/Backfill (Samleswari OC Mine)



Photograph-12: Plantation on Internal OB/Backfill (Lajkura OC Mine)



Photograph-13: Plantation on Internal OB/Backfill (Kulda OC Mine)



Photograph-14: Plantation under Social Forestry (Kulda OC Mine)

ABBREVIATIONS

| | |
|----------|--------------------------------------------------|
| Sol | Survey of India |
| MoEF&CC | Ministry of Environment, Forest & Climate Change |
| CIL | Coal India Limited |
| ECL | Eastern Coalfields Limited |
| BCCL | Bharat Coking Coal Limited |
| CCL | Central Coalfields Limited |
| WCL | Western Coalfields Limited |
| SECL | South Eastern Coalfields Limited |
| NCL | Northern Coalfields Limited |
| MCL | Mahanadi Coalfields Limited |
| NEC | North Eastern Coalfields |
| CMPDIL | Central Mine Planning & Design Institute Ltd |
| NRSC | National Remote Sensing Centre |
| R2/ R2A | Resource-Sat Satellites |
| LISS - 4 | Linear Imaging and Self Scanning Sensor |
| FCC | False Colour Composite |
| OCP | Opencast Project |
| UGP | Underground Project |
| OB | Over Burden |
| GCP | Ground Control points |
| GIS | Geographic Information System |
| WGS-84 | World Geodetic System |
| UTM | Universal Transverse Mercator |

GLOSSARY

| Sl. | Term | Definition |
|-----|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Land Reclamation | To manage, reclaim and restore mined out/ degraded land as close as possible to its original stage |
| 2. | Over Burden | The material that lies above the coal seam/ deposit |
| 3. | Monitoring | A process of evaluation to check or keep record for a period of time. |
| 4. | Opencast Coal Mine | Open-pit mining, also known as opencast mining, is a surface mining technique that extracts minerals from an open pit in the ground. |
| 5. | Social Forestry | Social forestry is the management and protection of forests and afforestation of barren and deforested lands with the purpose of helping environmental, social and rural development. Plantation (Social/ Avenue or other) carried out outside mining area. |
| 6. | Biological Reclamation | Plantation on Backfilled areas (Stabilized Internal Dumps) |
| 7. | Technical Reclamation | Area under backfilling (Over burden dumped inside the mine voids) in mining area. |
| 8. | Green Cover Generation | Total Plantation carried out in the lease area of Project. This include Plantation on Backfill, Plantation on OB and Social Forestry |
| 9. | Leasehold Area | The area, for which lease is granted for the purpose of undertaking mining and allied operations |
| 10. | Excavated area | Mined out area which includes active mining, area under backfilling and plantation on backfilled areas |
| 11. | Active Mining | Mining areas which include Coal Quarry, Advance Quarry, Quarry Filled with Water etc. |
| 12. | Environmental Protection | It is the practice of protecting the natural environment by individuals, organizations and governments. Its objectives are to conserve natural resources and the existing natural environment and, where possible, to mitigate damage and reverse trends. |
| 13. | Remedial Measure | Any measure or action required or undertaken to investigate, monitor, clean up, remove, treat, prevent, contain or otherwise remediate the presence or release of any hazardous substance or activity. |

| | | |
|-----|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 14. | Systematic Error | Every measurement differing from the true measurement in the same direction, and even by the same amount in some cases |
| 15. | Geometric Distortion | It refers to the improper positioning of any image with respect to their true geographic position when viewed in a properly scaled common image display plane. |
| 16. | Land Use/Cover Class | Land cover is what covers the surface of the earth and land use describes how the land is used. |
| 17. | Accuracy | The closeness of agreement between a measured quantity value and a true quantity value. |
| 18. | Environmental Clearance | Environmental Clearance (EC) for any developmental projects like coal mining projects etc. has been made mandatory by the Ministry of Environment, Forests and Climate Change (MoEF&CC) through its Notification issued on 27.01.1994 under the provisions of Environment (Protection) Act, 1986. |
| 19. | Rectification and Geo-referencing | Geo-referencing is the assigning of absolute location of a data point or data points. Geo-rectification refers to the removal of geometric distortions between sets of data points, most often the removal of terrain, platform, and sensor induced distortions from remote sensing imagery |
| 20. | Image Enhancement | It is the process of modifying digital images so that the results are more suitable for processing or further image analysis. |
| 21. | Training set selection | It is a portion of a data set used to fit or train a model for prediction or classification of values that are known in the training set, but unknown in other (future) data |
| 22. | Image Classification | It refers to the task of extracting information classes from a multiband raster image. The resulting raster from image classification can be used to create thematic maps. |
| 23. | Temporal Changes | The 'temporal change' means the change in any entity with a period of time. |
| 24. | Ground Truthing | Collection of primary/ basic information from ground realities for satellite image interpretation and thematic mapping. |
| 25. | Cluster | Group of opencast and/ or underground minesclubbed together for administrative purposes. |
| 26. | Arc GIS | GIS Software used for Map preparation |
| 27. | ERDAS IMAGINE | Satellite Image Data Classification Software |



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