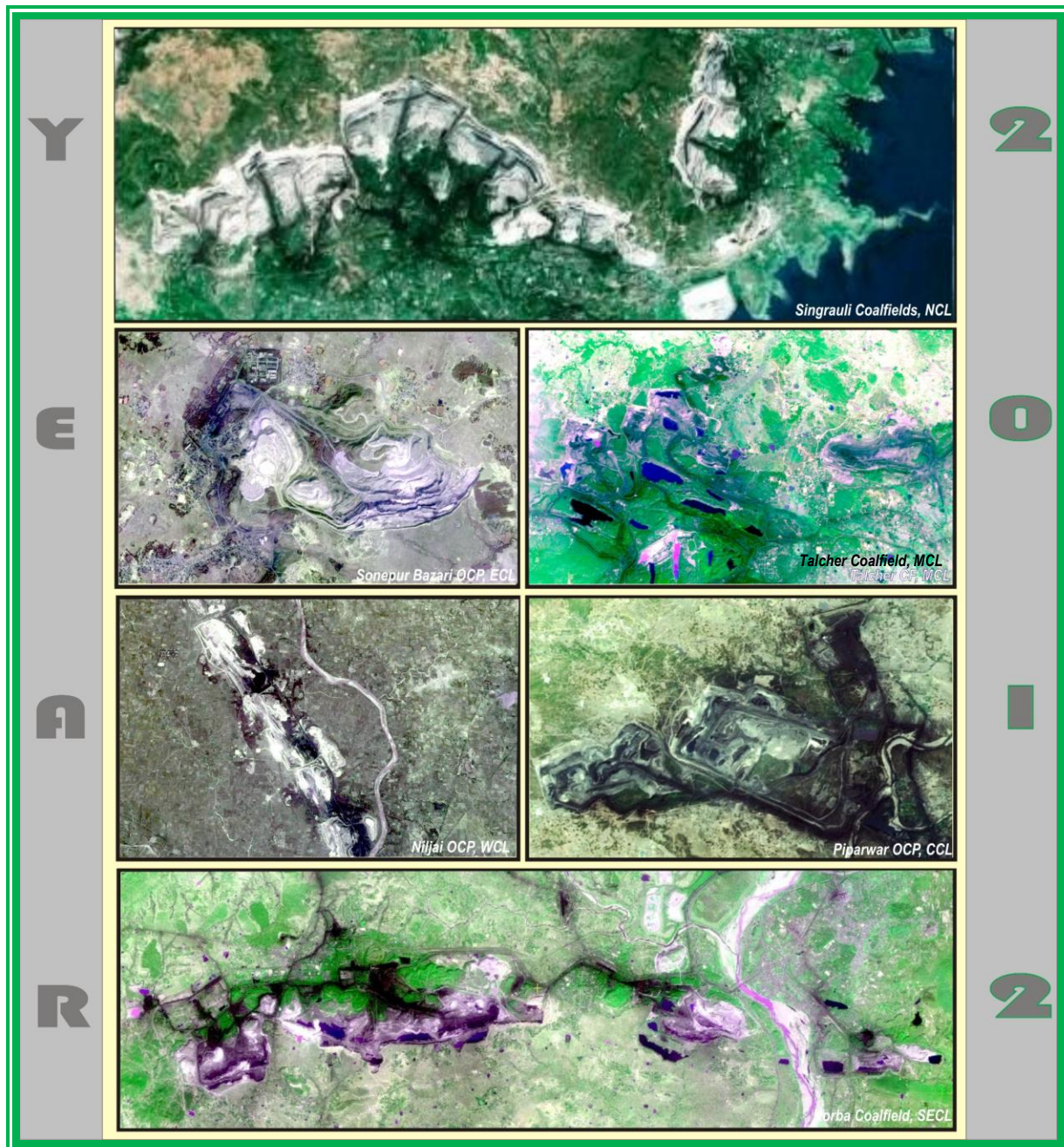


Land Restoration / Reclamation Monitoring of 50 Opencast Coal Mines of CIL producing more than 5 mcm (Coal+OB) based on Satellite Data for the Year 2012-13



**Land Restoration / Reclamation Monitoring of 50 Opencast
Coal Mines of CIL producing more than 5 mcm (Coal+OB)
based on Satellite Data for the Year 2012-13**

March- 2013



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

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Executive Summary

- 1.0 Project** Land restoration / reclamation monitoring of 50 opencast coal mines of Coal India Ltd. (CIL) producing 5 million cu.m. and more (Coal+OB) per year based on satellite data, regularly on annual basis.
- 2.0 Objective** Objective of the land restoration / reclamation monitoring is to assess the area of backfilled, plantation, social forestry, active mining area, water bodies, and 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 603.82 Km² of the 50 OC projects considered for monitoring during 2012-13; total excavated / mined out area is only 336.61 Km² (55.75%) of which 167.71 Km² area (49.82%) has been planted (*Biologically Reclaimed*), 100.49 Km² area (29.85%) has been backfilled (*Technically Reclaimed*) and 68.41 Km² area (20.32%) is under active mining. It is evident from the analysis that 268.20 Km² (79.68%) areas of the OC projects are already reclaimed and balance 68.41 Km² (20.32%) area is under active mining. Company wise details are given in Table - 1 & Fig-1.
 - On comparing the status of land reclamation carried out in year 2012-13 with respect to years 2011-12 in the 50 OC projects of different coal companies, it is evident from the analysis that area of land reclamation has increased from 262.93 Km² (Yr. 2011) to 268.20 Km² (Yr. 2012) which includes plantation and backfilled areas. This increase of 5.27 Km² area of land reclamation in one year is the result of the efforts made by different coal companies. Area of plantation has marginally increased from 165.12 Km² (2011) to 167.71 Km² (Yr. 2012) in the 50 opencast project analysed under present study. Year wise comparison in land reclamation in different subsidiaries is given in Fig.2.

- It has been observed that in some projects, overall vegetation cover has been reduced marginally in the leasehold area in spite of increase in the area of plantation. This is primarily because of cutting of vegetation due to mine advancement.

Table-1

**Company wise Land Reclamation Status in OC projects
(5 million cu.m. and more Coal +OB) based on Satellite Data of year 2012**

Sl. No.	Coal Company (No. of OC Projects)	Area in Sq. Kms. (% calculated in respect of total excavated area)										
		Leasehold	Plantation		Under Backfilling		Area under Active Mining		Total Excavated Area		Total Reclaimed Area	
			2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
		(i)	(ii)		(iii)		(iv)		(ii+iii+iv)		(ii+iii)	
1	WCL (10)	77.94	26.82	27.44	22.10	23.43	8.19	7.95	57.11	58.82	48.92	50.87
			46.96	46.65	38.70	39.83	14.34	13.52			85.66	86.48
2	SECL (10)	159.48	42.90	42.66	21.10	22.21	17.08	18.74	81.08	83.61	64.00	64.87
			52.91	51.02	26.03	26.55	21.07	22.41			78.93	77.59
3	NCL (10)	179.40	59.94	61.70	29.89	28.52	15.90	17.61	105.73	107.83	89.83	90.22
			56.69	57.22	28.27	26.45	15.04	16.33			84.96	83.67
4	MCL (11)	86.36	14.37	14.41	11.56	12.63	14.55	14.58	40.48	41.62	25.93	27.04
			35.50	34.62	28.56	30.35	35.94	35.03			64.06	64.97
5	CCL (05)	47.14	15.95	16.33	4.56	4.30	4.60	4.70	25.11	25.33	20.51	20.63
			63.53	64.47	18.17	16.98	18.31	18.55			81.69	81.45
6	BCCL (02)	14.06	1.32	1.34	4.20	4.63	1.33	1.24	6.85	7.21	5.52	5.97
			19.27	18.59	61.31	64.22	19.42	17.20			80.58	82.80
7	ECL (02)	39.44	3.82	3.83	4.40	4.77	3.37	3.59	11.59	12.19	8.22	8.60
			32.96	31.42	37.96	39.13	29.08	29.45			70.92	70.55
TOTAL CIL (50)		603.82	165.12	167.71	97.81	100.49	65.02	68.41	327.95	336.61	262.93	268.20
			50.35	49.82	29.82	29.85	19.83	20.32	54.31	55.75	80.17	79.68

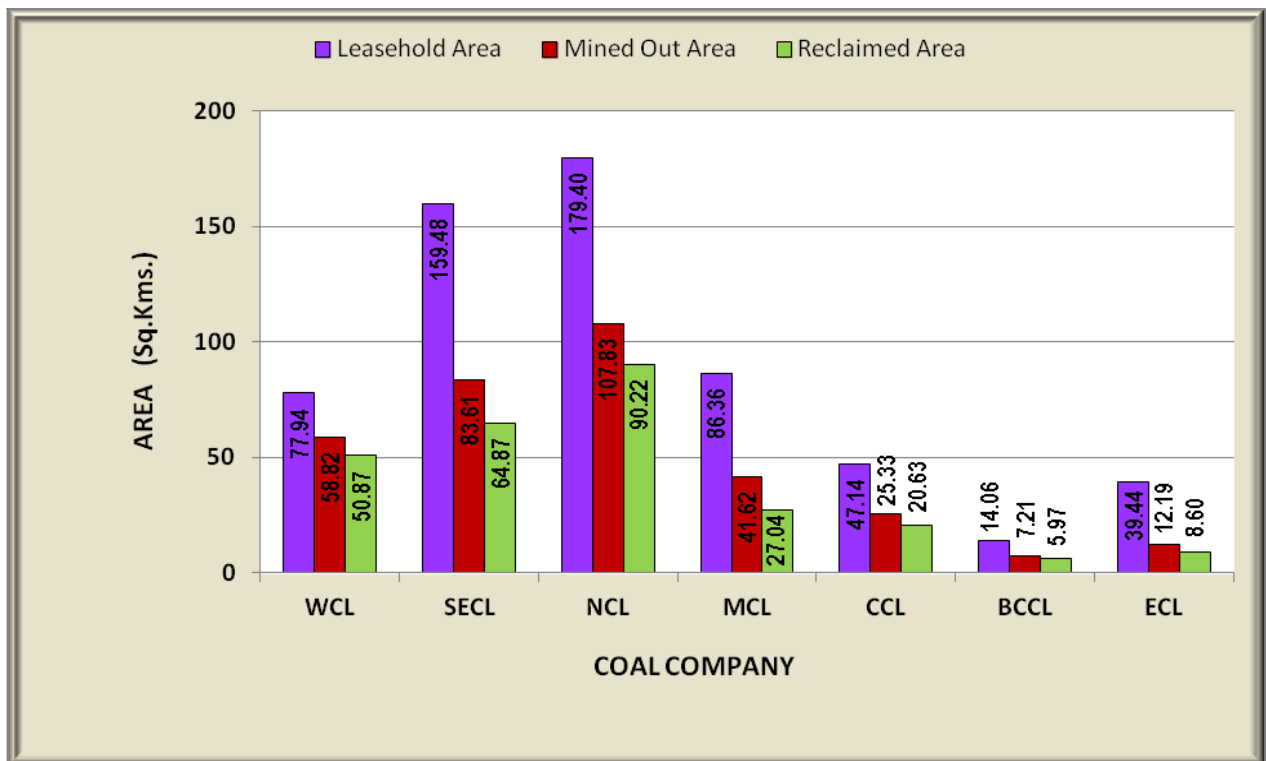


Fig. 1 : Company wise Land Reclamation Status in the Year 2012

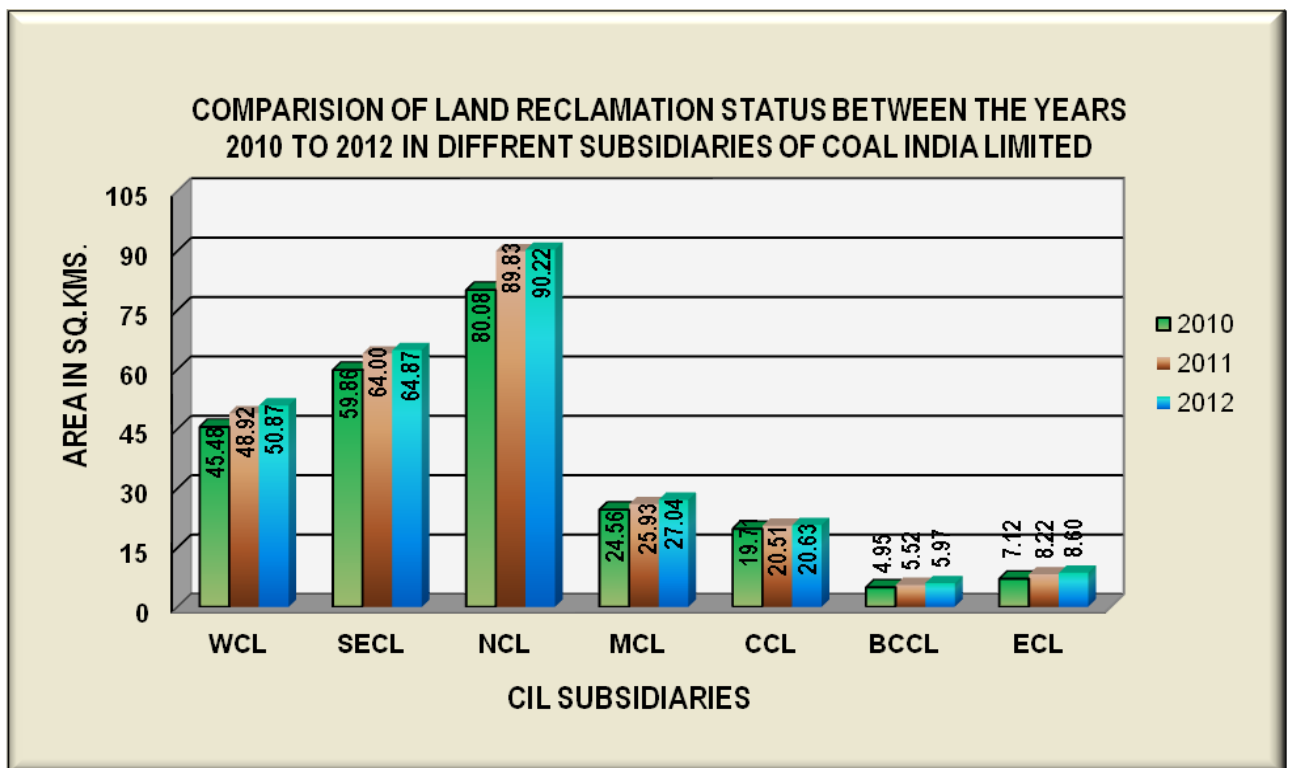


Fig.2 : Yearwise comparison of Land Reclamation in CIL Subsidiaries

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. Another work order vide letter no. CIL/WBP/ENV./2011dated23/08/11 was issued by CIL for monitoring of less than 5 million m³ per annum capacity (Coal +OB) projects from the year 2011 at interval of three years. 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. 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 yrs. All coalfields in CIL shall also be monitored at an interval of 3 yrs as per a defined plan. 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 (MoEF).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** CMPDI undertook the above study and the present report is embodying the findings in nutshell carrying out for the 50 opencast projects of different subsidiaries producing 5 million cubic m. coal + OB or more in the year 2012-13. Similar study was also carried out in the year 2008, 2009, 2010 as well as in the year 2011 and progressive changes in the status of land reclamation have been assessed.

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 3. Following steps are involved in land reclamation /restoration monitoring:

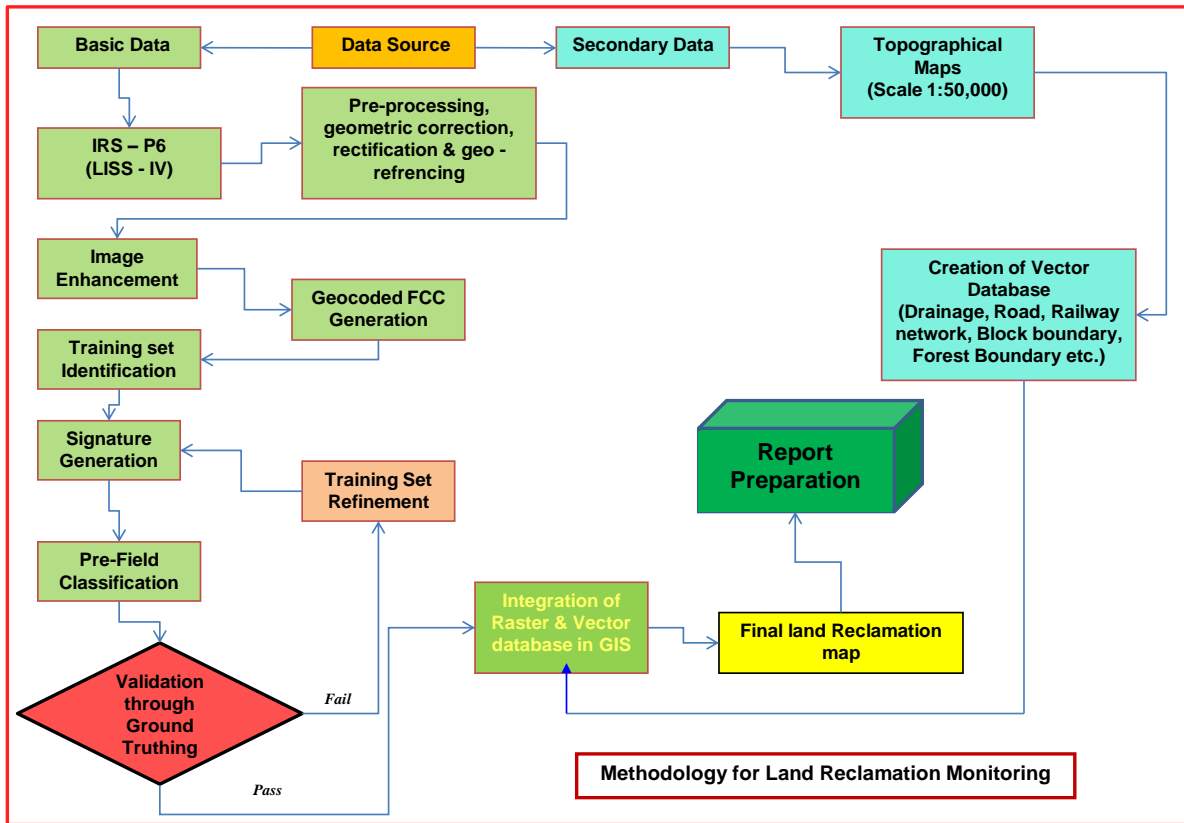


Fig.3 : Methodology for Land Reclamation Monitoring

- 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.
- 3.2 **Satellite Data Processing:** Satellite data are processed using ERDAS IMAGINE 9.3 s/w / PCI Geomatica v10.1 s/w 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 topo-sheet.
- **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 9.3 s/w / PCI Geomatica v10.1 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 9.3 s/w / PCI Geomatica v10.1 s/w.

- **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 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-off dates.

4.0 Work Plan

- 4.1** Total 50 opencast projects producing 5 million cubic m. and more (Coal + OB together) during the year 2012 were taken up for the study. Based on the *RESOURCESAT-2* satellite data, land reclamation /mine closure monitoring was carried out using ERDAS IMAGINE digital image processing s/w and Arc-Info GIS. Baseline data on reclamation of these OC projects of CIL's subsidiaries have been also done during the year 2008, 2009, 2010 and 2011.
- 4.2** Besides project wise land reclamation monitoring, coalfield wise vegetation cover monitoring on regional scale has also been planned for the major 28 coalfields of India at regular interval of three years using remote sensing satellite data to assess the regional impact of coal mining and associated industrialization on the land use and vegetation cover in the coalfield. Geo-environmental baseline data for Raniganj, Jharia , East Bokaro, West Bokaro, Karanpura, Singrauli (Moher Sub-basin), Korba, Bishrampur, Shoagpur, Mand-Raigargh, Talcher, Ib Valley , Wardha Valley, Bander , Kamptee , Umrer, PENCH Kanhan and Makum coalfields based on the satellite data have been generated and will be monitored regularly at three years interval.
- 4.3** The list of subsidiary wise 50 opencast projects taken up based on satellite data of year 2012 is given in table below :

Subsidiary (No. of Projects)	Opencast Projects (5 million Cu.m. Coal +OB or more per annum)
WCL (10)	Sasti, Padmapur, Durgapur, Mugoli, Umrer, Ukni, Niljai, New Majri (IIA), Pimpalgaon & Ghugus
SECL (10)	Dipka, Gevra, Kusmunda, Manikpur, Bishrampur, Dugga, Jamuna, Rajnagar, Dhanpuri & Chirimiri
NCL (10)	Amlohri, Nigahi, Jayant, Dudhichua, Khadia, Krishnashila, Bina, Kakri, Jhingurdah, Block-B
MCL (11)	Ananta, Balram, Lingraj, Bharatpur, Bhubaneswari, Jagannath, Hingula, Belpahar, Lakhanpur, Samleswari, & Lajkura
CCL (05)	Ashoka, Piparwar, K.D. Hesalong, Parej & Rajrappa
BCCL (02)	Block-II, Muraidih
ECL (02)	Sonpur-Bazari, Rajmahal
TOTAL (50)	

4.4 Subsidiary wise land reclamation status of the above mentioned 50 OC projects derived from satellite data for the year 2012 are given in the following pages:

WESTERN COALFIELDS LIMITED

5.0 Land Reclamation Status in Western Coalfields Ltd.

5.1 Following 10 OC projects producing more than 5 million cubic m. (Coal + OB together) of Western Coalfields Ltd. have been taken up for land reclamation monitoring during the year 2012:

- Sasti
- Padmapur
- Durgapur
- Mugoli
- Umrer
- Ukni
- Niljai
- New Majri
- Pimpalgaon
- Ghugus

5.2 Project wise Land Reclamation status in WCL for the year 2012 is given in Table 5.1 and also shown graphically in Fig 5.1. Area statistics of different land use class present in the mine leasehold of the above projects for the year 2012 are shown in the Table – 5.2. Land use maps derived from satellite data are shown in Plate 5.1-5.10. Land reclamation status of the above mentioned 10 projects, were also prepared for the year 2009, 2010 and 2011. Year wise changes in the different land use classes based on satellite data are depicted in Bar Charts in Fig. 5.3 – 5.12

5.3 Study reveals that 86.48% of mining area has already been reclaimed by WCL out of which 46.65% area has been revegetated and 39.83% area are backfilled. There is an increase of 1.95 Km² reclaimed area in WCL with respect to the year 2011, out of which 0.62 Km² increase in biological reclamation and 1.33 Km² increase in the technical reclamation (barren backfilled).

- 5.4** After analyzing the satellite data of year 2012 vs. 2011 it is evident that plantation carried out on backfilled area, OB dumps as well as under social forestry in all the mines of WCL has increased from 26.82 Km². to 27.44 Km² in span of last one year. This increase of 0.62 Km² area of plantation in one year time is due to the efforts of WCL towards mine land reclamation.
- 5.5** It has been also observed that in New Majri project plantation percentage in the year 2012 has reduced by 0.26 km² in respect to the previous year i.e. 2011. This has occurred because of dumping of OB on the naturally vegetated area due to constraint of OB dumping.
- 5.6** Out of 10 projects of WCL, maximum land reclamation has been carried out in Sasti project (92.12%) followed by New Majri (91.97%) and Ghugus (91.16%).

Table 5.1

(Area in Sq Km)

Projectwise Land Reclamation Status in Opencast Projects of WCL
based on Satellite Data of the year 2012

% Calculated in terms of Total Excavated Area

Sl. No.	Project		Plantation/Vegetation		Under Backfilling		Active Mining		Total Excavated Area		Total Reclaimed area		
	Name	Leasehold (i)		ii		iii		iv		ii+iii+iv		ii+iii	
		2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
1	SASTI	12.69	12.69	3.09	3.31	2.34	2.42	0.46	0.49	5.89	6.22	5.43	5.73
				52.46	53.22	39.73	38.91	7.81	7.88			92.19	92.12
2	PADMAPUR	7.34	7.34	1.87	2.15	2.49	2.97	0.85	0.76	5.21	5.88	4.36	5.12
				35.89	36.56	47.79	50.51	16.31	12.93			83.69	87.07
3	DURGAPUR	8.88	8.88	3.27	3.38	3.19	3.20	0.81	0.71	7.27	7.29	6.46	6.58
				44.98	46.36	43.88	43.90	11.14	9.74			88.86	90.26
4	MUGOLI	7.88	7.88	1.46	1.55	1.93	1.99	1.29	1.19	4.68	4.73	3.39	3.54
				31.20	32.77	41.24	42.07	27.56	25.16			72.44	74.84
5	UMRER	9.45	9.44	5.62	5.64	1.69	1.83	1.24	1.09	8.55	8.56	7.31	7.47
				65.73	65.89	19.77	21.38	14.50	12.73			85.50	87.27
6	UKNI	6.91	9.30	2.03	2.14	2.05	2.29	1.48	1.28	5.56	5.71	4.08	4.43
				36.51	37.48	36.87	40.11	26.62	22.42			73.38	77.58
7	NEELJAI	4.88	4.88	1.93	1.94	1.26	1.30	0.74	0.96	3.93	4.20	3.19	3.24
				49.11	46.19	32.06	30.95	18.83	22.86			81.17	77.14
8	NEW MAJRI	9.05	9.05	3.96	3.70	2.78	3.06	0.46	0.59	7.20	7.35	6.74	6.76
				55.00	50.34	38.61	41.63	6.39	8.03			93.61	91.97
9	PIMPALGAON	4.92	4.92	1.46	1.49	1.58	1.56	0.39	0.40	3.43	3.45	3.04	3.05
				42.57	43.19	46.06	45.22	11.37	11.59			88.63	88.41
10	GHUGUS	5.94	10.20	2.13	2.14	2.79	2.81	0.47	0.48	5.39	5.43	4.92	4.95
				39.52	39.41	51.76	51.75	8.72	8.84			91.28	91.16
	TOTAL (WCL)	77.94	84.58	26.82	27.44	22.10	23.43	8.19	7.95	57.11	58.82	48.92	50.87
				46.96	46.65	38.70	39.83	14.34	13.52	67.52	69.54	85.66	86.48

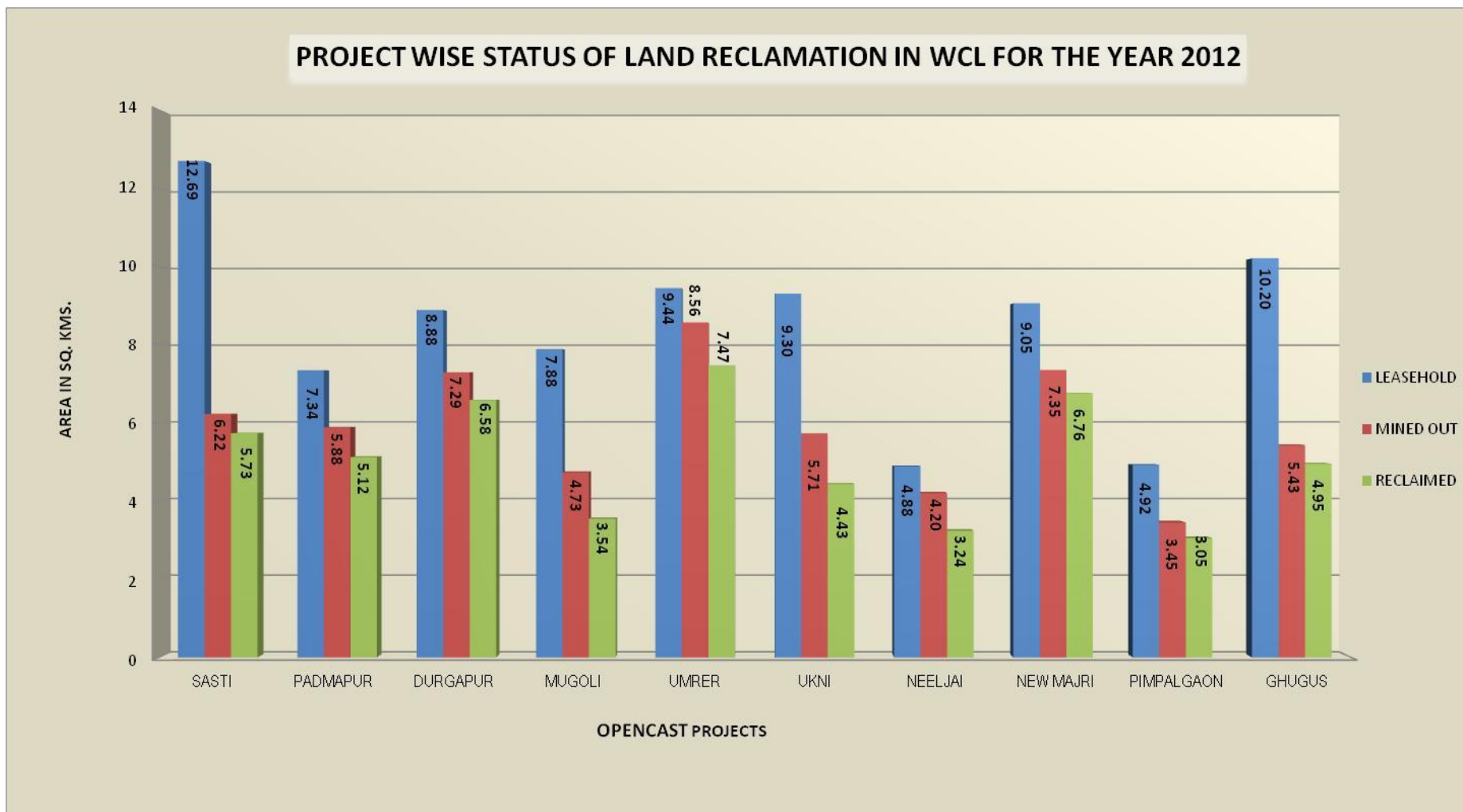


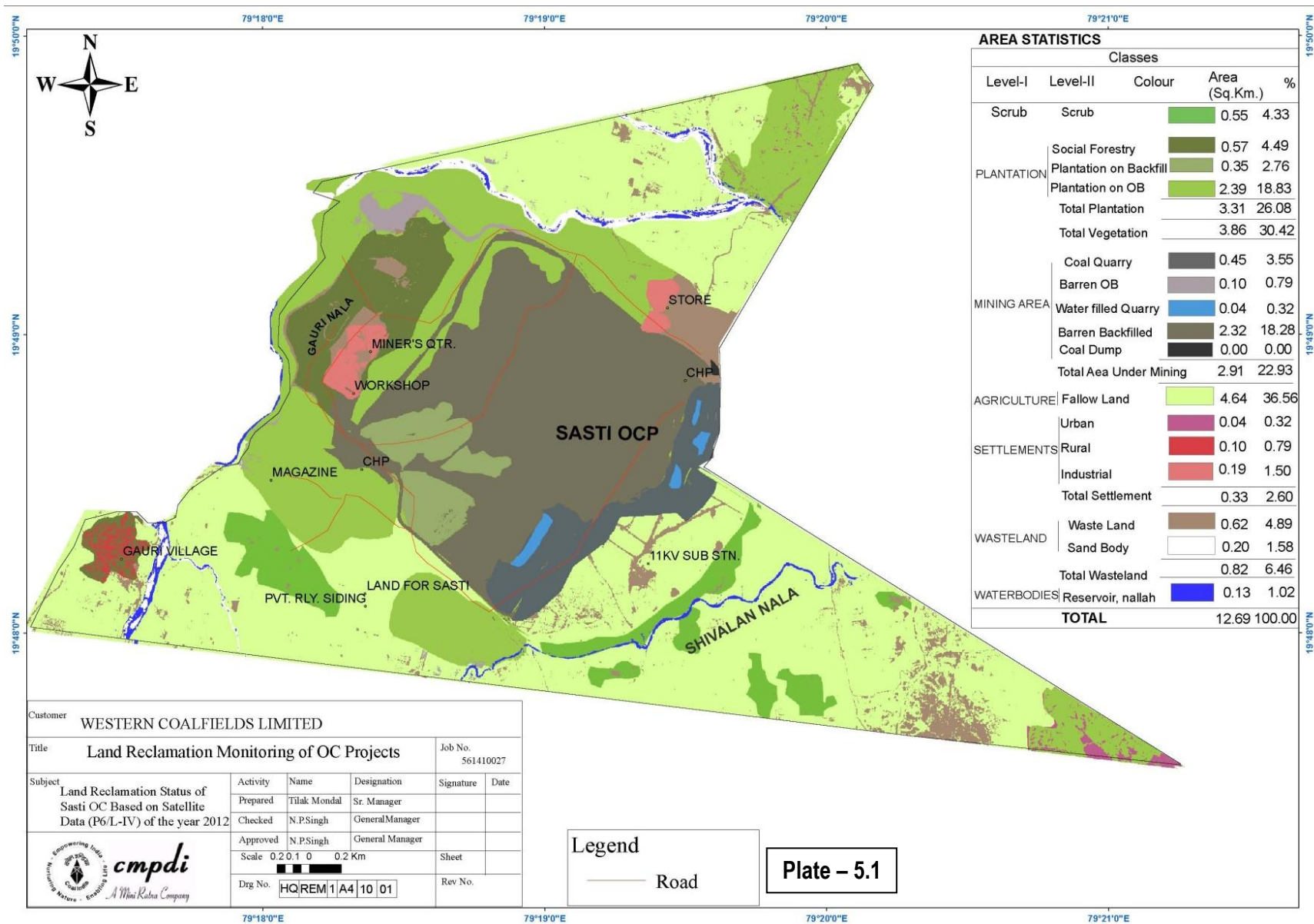
Figure : 5.1

Table 5.2

STATUS OF LAND USE/ RECLAMATION IN OC MINES (>5mcu.m) OF WESTERN COALFIELDS LTD BASED ON SATELLITE DATA OF THE YEAR 2012

(Area in Sq Km)

	SASTI		PADMAPUR		DURGAPUR		MUGOLI		UMRER		UKNI		NEELJAY		NEW MAJRI		PIMPALGAON		GHUGUS		TOTAL		
	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	
FORESTS	Dense Forest	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	0.00	0.00	0.00	0.00
	Open Forest	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	0.00	0.00	0.00	0.00
	Total Forest	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	0.00	0.00	0.00	0.00
SCRUBS	Scrubs	0.55	4.33	0.82	11.17	0.48	5.41	0.98	12.44	0.00	0.00	2.05	22.04	0.13	2.67	0.37	4.09	0.45	9.15	0.80	7.84	6.63	7.84
	Social Forestry	0.57	4.49	0.91	12.40	0.95	10.70	0.18	2.28	1.25	13.23	0.00	0.00	0.07	1.44	0.00	0.00	0.57	11.59	1.07	10.49	5.57	6.59
PLANTATION	Plantation on OB Dump	2.39	18.83	1.24	16.89	2.43	27.36	1.00	12.69	2.79	29.52	0.78	8.39	0.66	13.55	2.38	26.30	0.92	18.70	0.80	7.84	15.39	18.20
	Plantation on Backfill	0.35	2.76	0.00	0.00	0.00	0.00	0.37	4.70	1.60	16.93	1.36	14.62	1.21	24.85	1.32	14.59	0.00	0.00	0.27	2.65	6.48	7.66
	Total Plantation (Biological Reclamation)	3.31	26.08	2.15	29.29	3.38	38.06	1.55	19.67	5.64	59.68	2.14	23.01	1.94	39.84	3.70	40.88	1.49	30.28	2.14	20.98	27.44	32.44
	Total Vegetation	3.86	30.42	2.97	40.46	3.86	43.47	2.53	32.11	5.64	59.68	4.19	45.05	2.07	42.51	4.07	44.97	1.94	39.43	2.94	28.82	34.07	40.28
ACTIVE MINING	Coal Quarry	0.45	3.55	0.69	9.40	0.53	5.97	0.78	9.90	0.99	10.48	1.18	12.69	0.68	13.96	0.59	6.52	0.31	6.30	0.48	4.71	6.68	7.90
	Advance Quarry Site	0.00	0.00	0.00	0.00	0.00	0.00	0.31	3.93	0.00	0.00	0.02	0.22	0.28	5.75	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.72
	Quarry Filled With Water	0.04	0.32	0.07	0.95	0.18	2.03	0.00	0.00	0.10	1.06	0.08	0.86	0.00	0.00	0.00	0.00	0.09	1.83	0.00	0.00	0.56	0.66
	Coal Dump	0.00	0.00	0.00	0.00	0.00	0.00	0.10	1.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.12
	Total Area Under Active Mining	0.49	3.86	0.76	10.35	0.71	8.00	1.19	15.10	1.09	11.53	1.28	13.76	0.96	19.71	0.59	6.52	0.40	8.13	0.48	4.71	7.95	9.40
RECLAIMED	Area under Backfilling	2.32	18.28	1.09	14.85	1.39	15.65	1.02	12.94	1.72	18.20	1.48	15.91	1.10	22.59	1.98	21.88	0.54	10.98	2.34	22.94	14.98	17.71
	Barren OB Dump	0.10	0.79	1.88	25.61	1.81	20.38	0.97	12.31	0.11	1.16	0.81	8.71	0.20	4.11	1.08	11.93	1.02	20.73	0.47	4.61	8.45	9.99
	Total Area Under Technical Reclamation	2.42	19.07	2.97	40.46	3.20	36.04	1.99	25.25	1.83	19.37	2.29	24.62	1.30	26.69	3.06	33.81	1.56	31.71	2.81	27.55	23.43	27.70
	Total Area Under Mine Operation	2.91	22.93	3.73	50.82	3.91	44.03	3.18	40.36	2.92	30.90	3.57	38.39	2.26	46.41	3.65	40.33	1.96	39.84	3.29	32.25	31.38	37.10
WASTELANDS	Waste Lands	0.62	4.89	0.18	2.45	0.68	7.66	0.58	7.36	0.09	0.95	0.00	0.00	0.28	5.75	0.52	5.75	0.57	11.59	3.05	29.90	6.57	7.77
	Sand Body	0.20	1.58	0.05	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	1.77	0.00	0.00	0.00	0.00	0.41	0.48	
	Total Wasteland	0.82	6.46	0.23	3.13	0.68	7.66	0.58	7.36	0.09	0.95	0.00	0.00	0.28	5.75	0.68	7.51	0.57	11.59	3.05	29.90	6.98	8.25
WATERBODIES	Reservoir, nallah, ponds	0.13	1.02	0.09	1.23	0.00	0.00	0.01	0.13	0.51	5.40	0.00	0.00	0.00	0.00	0.31	3.43	0.00	0.00	0.03	0.29	1.08	1.28
	Total Waterbodies	0.13	1.02	0.09	1.23	0.00	0.00	0.01	0.13	0.51	5.40	0.00	0.00	0.00	0.00	0.31	3.43	0.00	0.00	0.03	0.29	1.08	1.28
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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Fallow Lands	4.64	36.56	0.15	2.04	0.00	0.00	1.45	18.40	0.00	0.00	1.19	12.80	0.00	0.00	0.00	0.00	0.29	5.89	0.00	0.00	7.72	9.13
	Total Agriculture	4.64	36.56	0.15	2.04	0.00	0.00	1.45	18.40	0.00	0.00	1.19	12.80	0.00	0.00	0.00	0.00	0.29	5.89	0.00	0.00	7.72	9.13
SETTLEMENTS	Urban Settlement	0.04	0.32	0.04	0.59	0.43	4.84	0.00	0.00	0.24	2.54	0.00	0.00	0.00	0.00	0.34	3.76	0.09	1.83	0.32	3.14	1.50	1.78
	Rural Settlement	0.10	0.79	0.08	1.09	0.00	0.00	0.05	0.63	0.00	0.00	0.11	1.18	0.00	0.00	0.00	0.00	0.02	0.41	0.34	3.33	0.70	0.83
	Industrial Settlement	0.19	1.50	0.04	0.57	0.00	0.00	0.08	1.02	0.05	0.53	0.24	2.58	0.26	5.34	0.00	0.00	0.05	1.02	0.23	2.25	1.14	2.60
	Total Settlement	0.33	2.60	0.17	2.25	0.43	4.84	0.13	1.65	0.29	3.07	0.35	3.76	0.26	5.34	0.34	3.76	0.16	3.25	0.89	8.73	3.35	5.21
	Grand Total	12.69	100.0	7.34	100.0	8.88	100.0	7.88	100.0	9.45	100.0	9.30	100.0	4.87	100.0	9.05	100.0	4.92	100.0	10.20	100.0	84.58	100.0

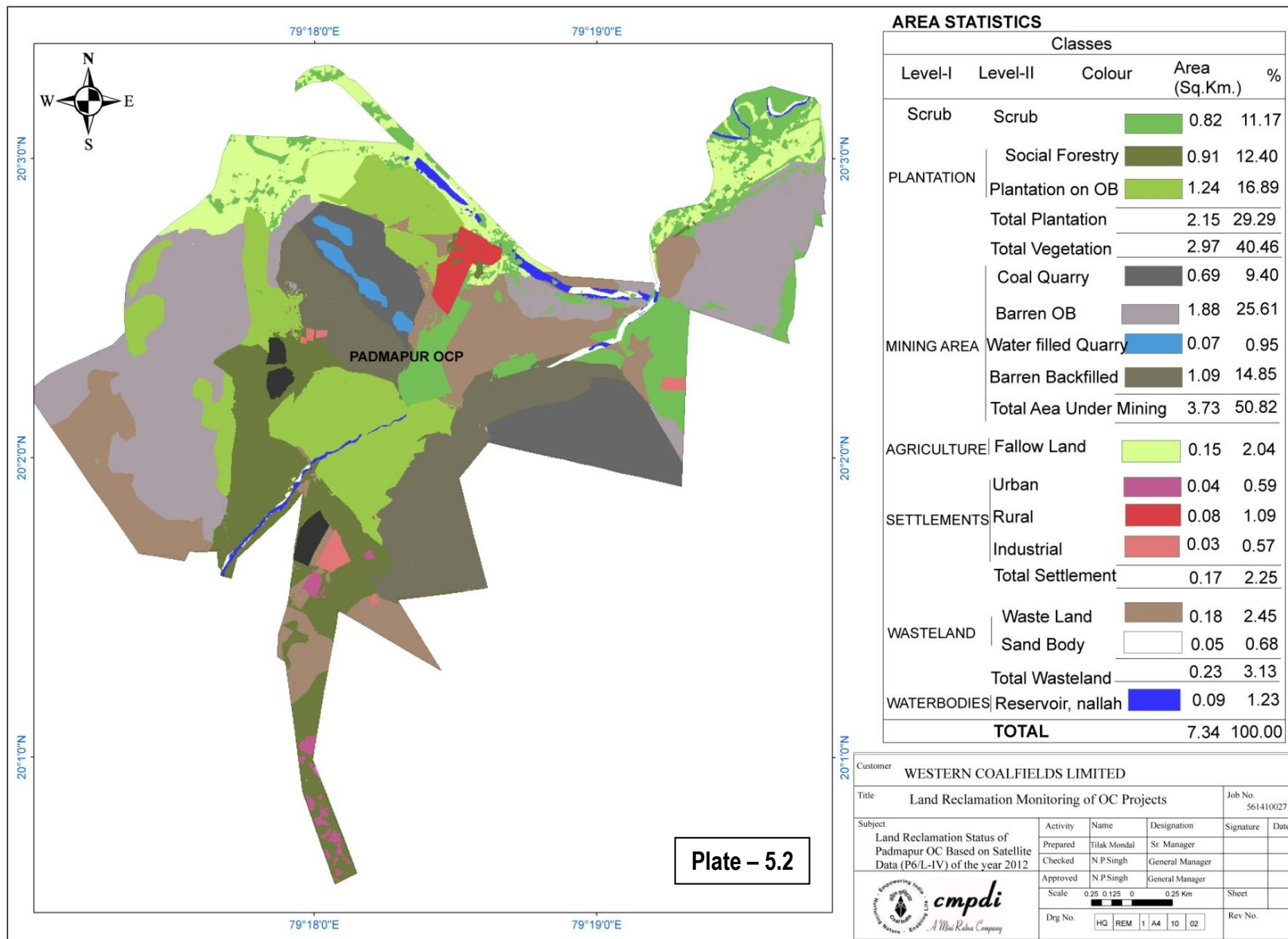


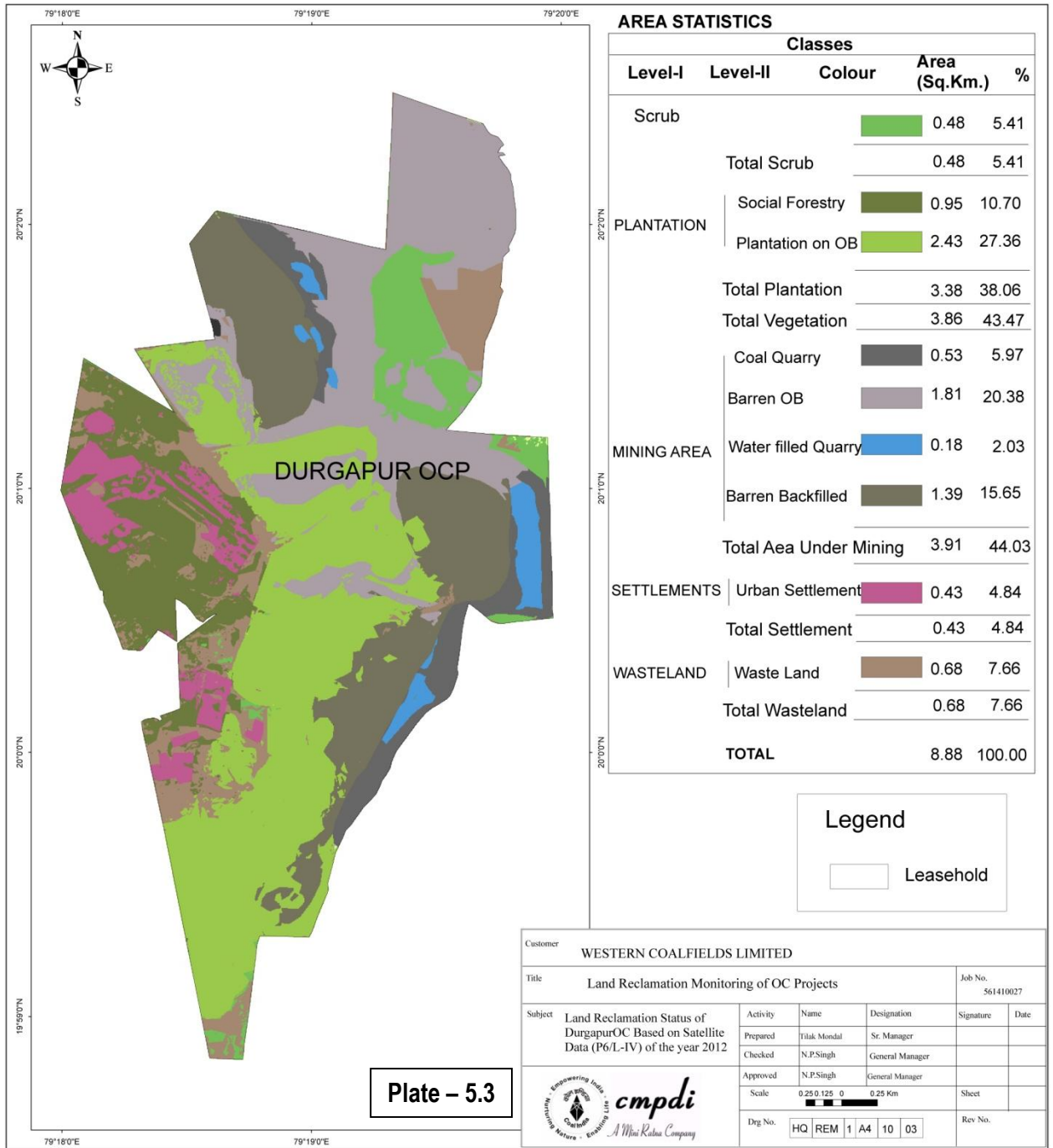
Customer WESTERN COALFIELDS LIMITED					
Title Land Reclamation Monitoring of OC Projects				Job No. 561410027	
Subject Land Reclamation Status of Sasti OC Based on Satellite Data (P6/L-IV) of the year 2012	Activity	Name	Designation	Signature	Date
	Prepared	Tilak Mondal	Sr. Manager		
	Checked	N.P.Singh	General Manager		
	Approved	N.P.Singh	General Manager		
Scale 0 0.1 0.2 Km			Sheet		
Drg No. HQREM1/A4 10 01			Rev No.		



Legend
— Road

Plate - 5.1





AREA STATISTICS

Classes					
Level-I	Level-II	Colour	Area (Sq.Km.)	%	
SCRUB			0.48	5.41	
	Total Scrub		0.48	5.41	
	PLANTATION	Social Forestry		0.95	10.70
Plantation on OB			2.43	27.36	
Total Plantation		3.38	38.06		
Total Vegetation			3.86	43.47	
MINING AREA	Coal Quarry		0.53	5.97	
	Barren OB		1.81	20.38	
	Water filled Quarry		0.18	2.03	
	Barren Backfilled		1.39	15.65	
	Total Aea Under Mining		3.91	44.03	
SETTLEMENTS	Urban Settlement		0.43	4.84	
	Total Settlement		0.43	4.84	
WASTELAND	Waste Land		0.68	7.66	
	Total Wasteland		0.68	7.66	
TOTAL			8.88	100.00	

Legend

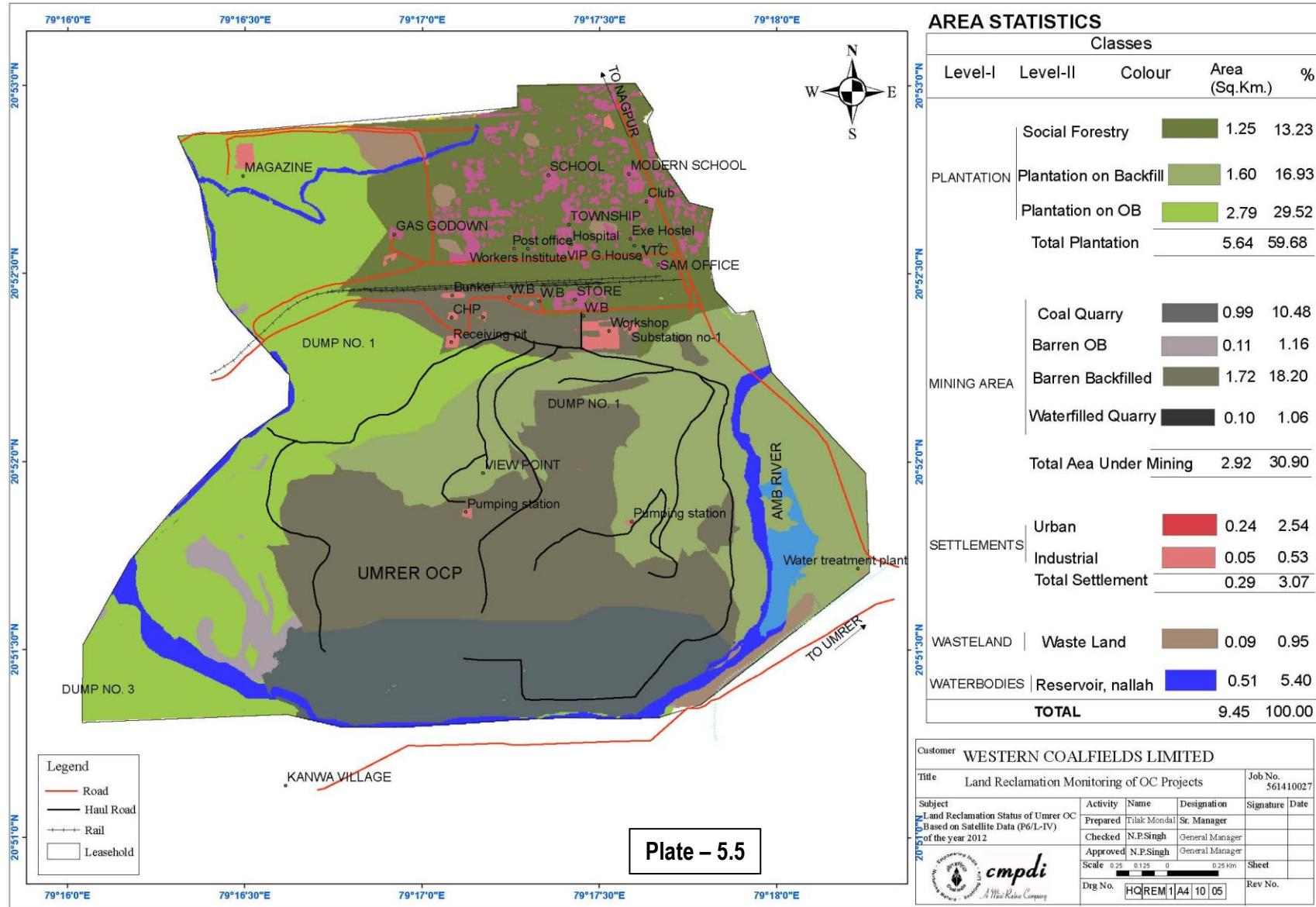
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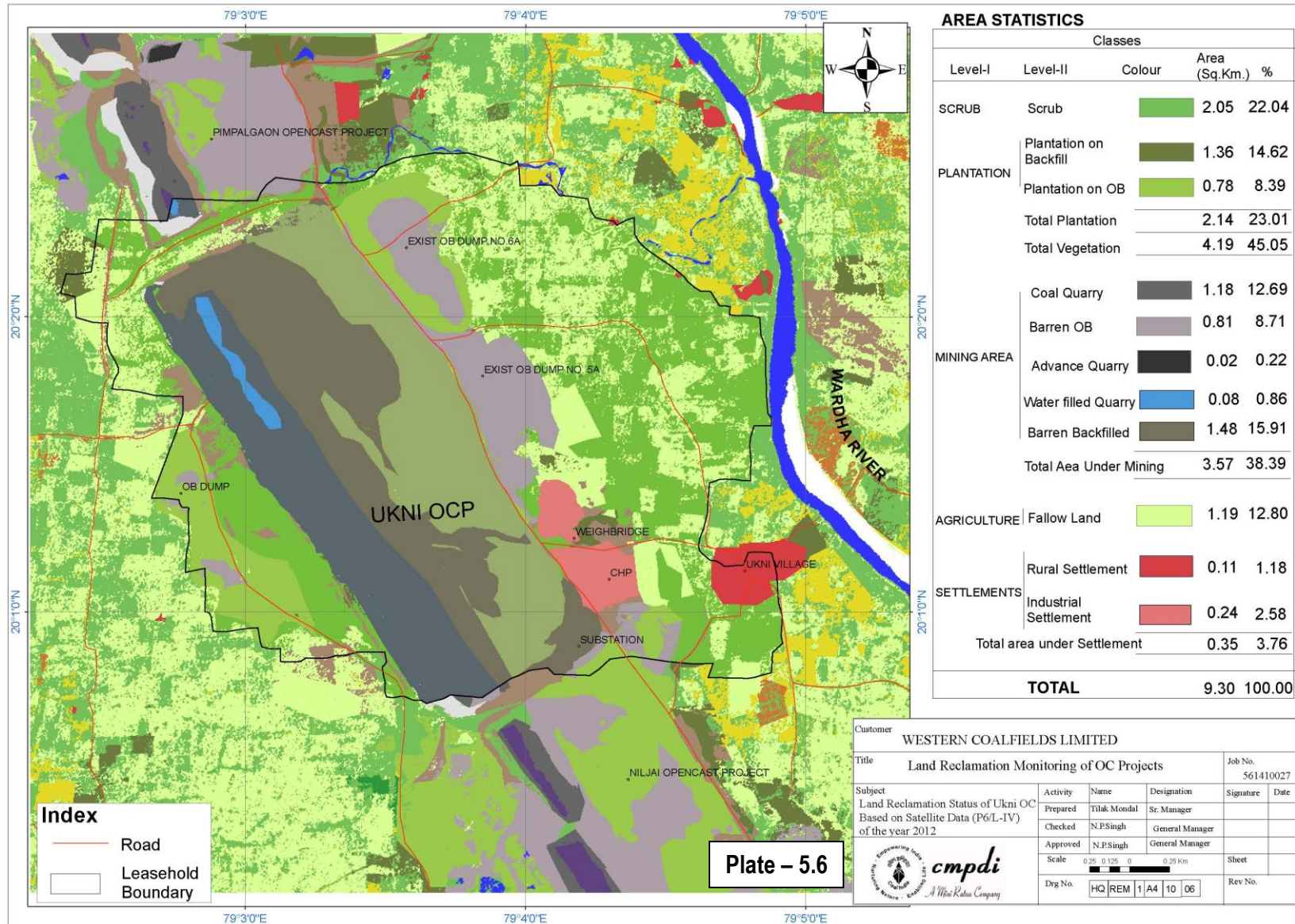
Customer WESTERN COALFIELDS LIMITED					
Title Land Reclamation Monitoring of OC Projects				Job No. 561410027	
Subject Land Reclamation Status of DurgapurOC Based on Satellite Data (P6/L-IV) of the year 2012	Activity	Name	Designation	Signature	Date
	Prepared	Tilak Mondal	Sr. Manager		
	Checked	N.P.Singh	General Manager		
	Approved	N.P.Singh	General Manager		
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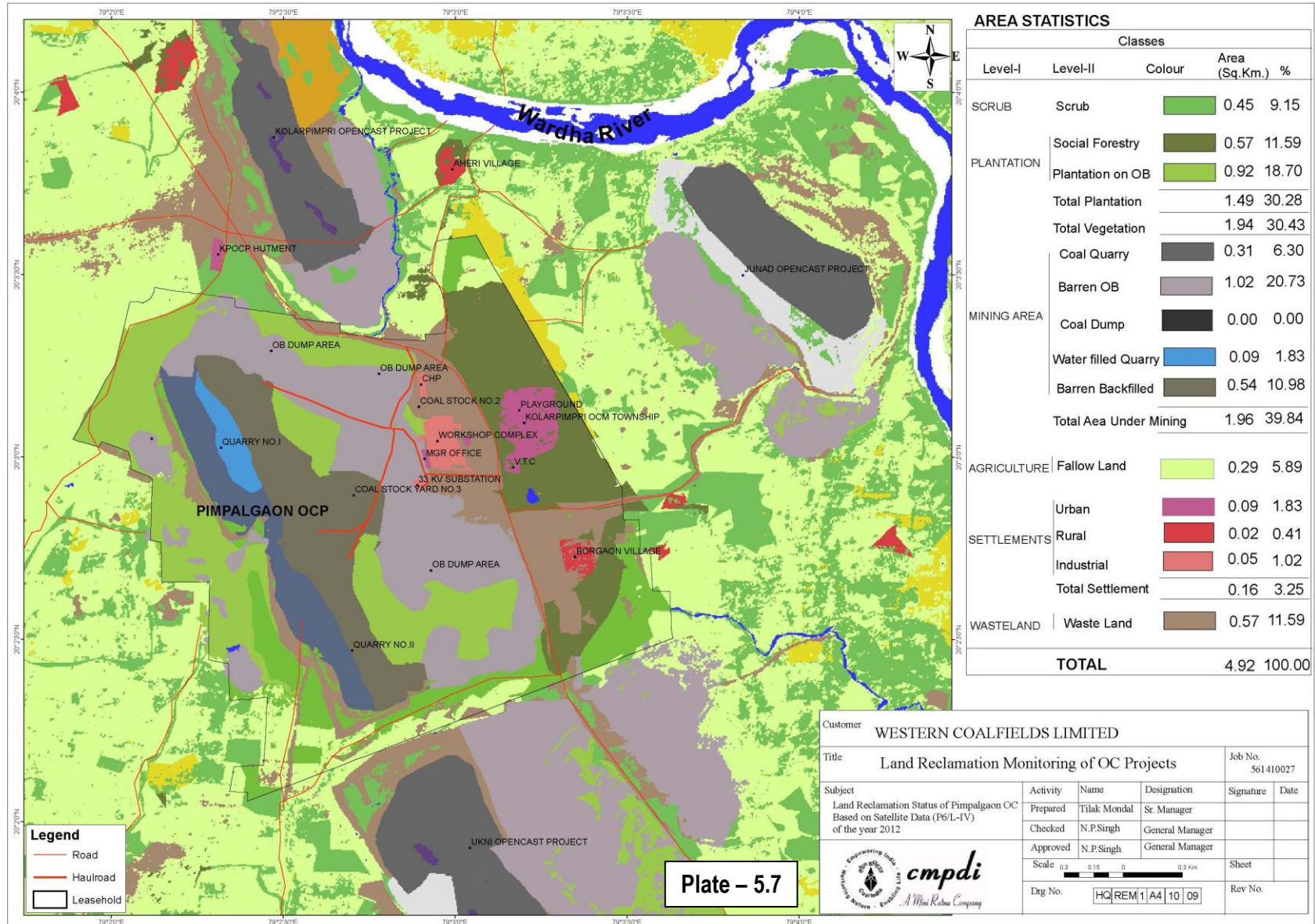
Plate - 5.3

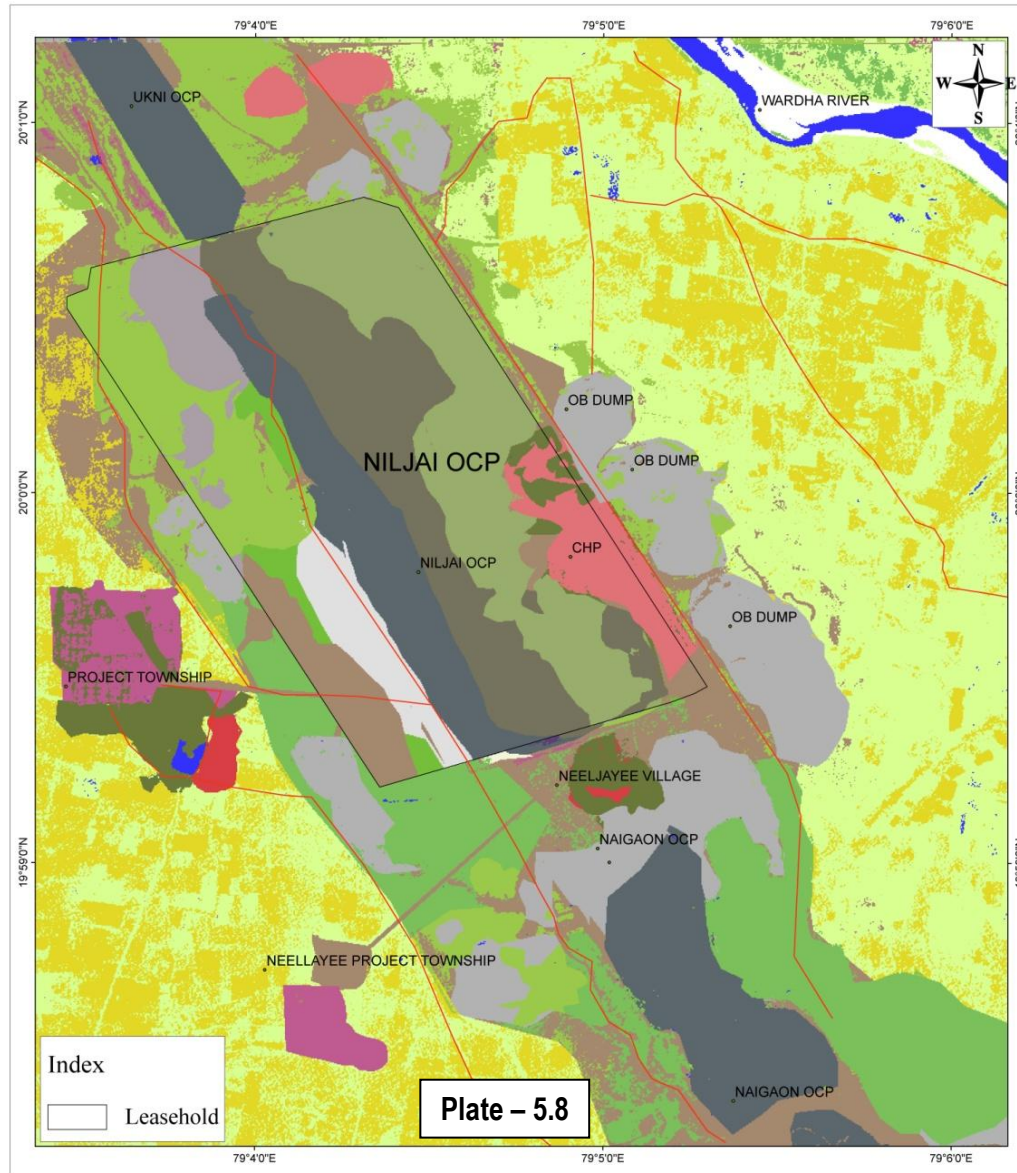


Plate – 5.4









AREA STATISTICS

		Classes		
Level-I	Level-II	Colour	Area (Sq.Km.)	%
SCRUB	Scrub		0.13	2.67
	Total Scrub		0.13	2.67
PLANTATION	Social Forestry		0.07	1.44
	Plantation on OB		0.66	13.55
	Plantation on Backfil		1.21	24.85
	Total Plantation		1.94	39.84
Total Vegetation			2.07	42.51
MINING AREA	Coal Quarry		0.68	13.96
	Barren OB		0.20	4.11
	Advance Quarry		0.28	5.75
	Barren Backfilled		1.10	22.59
Total Area Under Mining			2.26	46.41
SETTLEMENTS	Industrial		0.26	5.34
WASTELAND	Waste Land		0.28	5.75
TOTAL			4.87	100.00

Customer		WESTERN COALFIELDS LIMITED			
Title		Land Reclamation Monitoring of OC Projects		Job No. 561410027	
Subject	Land Reclamation Status of Niljai OC Based on Satellite Data (P6/L-IV) of the year 2012	Activity	Name	Designation	Signature Date
		Prepared	Tilak Mondal	Sr. Manager	
		Checked	N.P.Singh	General Manager	
		Approved	N.P.Singh	General Manager	
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		Drg No.		Rev No.	



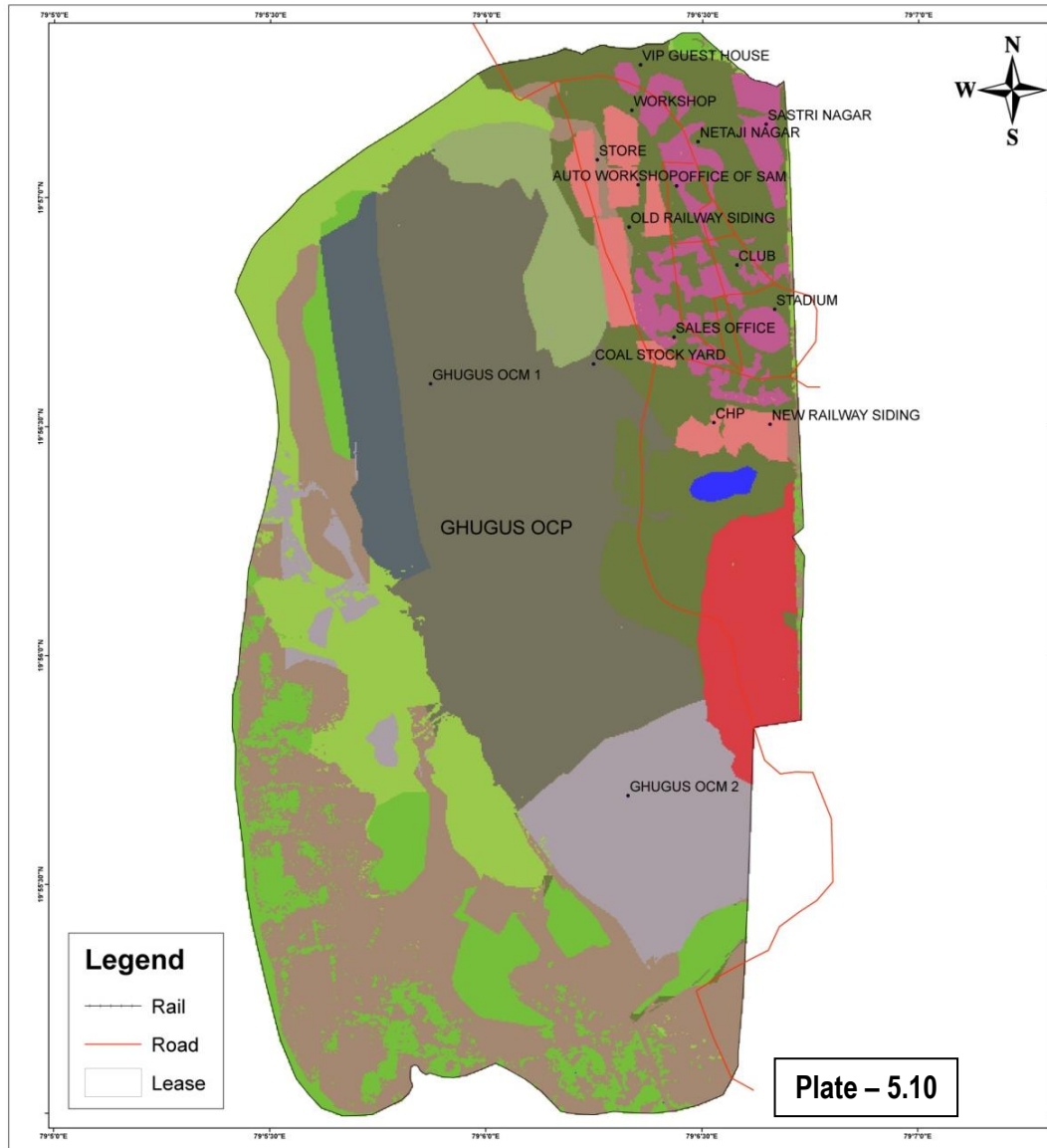


AREA STATISTICS

Classes				
Level-I	Level-II	Colour	Area (Sq.Km.)	%
SCRUB	Scrub		0.37	4.09
	Total Scrub		0.37	4.09
PLANTATION	Plantation on Backfill		1.32	14.59
	Plantation on OB		2.38	26.30
	Total Plantation		3.70	40.88
Total Vegetation			4.07	44.97
MINING AREA	Coal Quarry		0.59	6.52
	Barren OB		1.08	11.93
	Barren Backfilled		1.98	21.88
Total Aea Under Mining			3.65	40.33
SETTLEMENTS	Urban Settlement		0.34	3.76
WASTELAND	Waste Land		0.52	5.75
	Sand Body		0.16	1.77
Total Wasteland			0.68	7.51
WATERBODIES	Reservoir, nallah		0.31	3.43
TOTAL			9.05	100.00

Customer						WESTERN COALFIELDS LIMITED	
Title						Land Reclamation Monitoring of OC Projects	
						Job No. 561410027	
Subject	Land Reclamation Status of New Majri-Kawadi OC Based on Satellite Data (P6/L-IV) of the year 2012	Activity	Name	Designation	Signature	Date	
		Prepared	Tilak Mondal	Sr. Manager			
		Checked	N.P.Singh	General Manager			
		Approved	N.P.Singh	General Manager			
Scale		0.3 0.15 0 0.3 Km		Sheet			
Drg. No.		HQ REM 1 A4 10 08		Rev No.			

Plate - 5.9



AREA STATISTICS

		Classes		
Level-I	Level-II	Colour	Area (Sq.Km.)	%
PLANTATION	Scrub		0.80	7.84
	Social Forestry		1.07	10.49
	Plantation on Backfill		0.27	2.65
	Plantation on OB		0.80	7.84
Total Plantation			2.14	20.98
Total Vegetation			2.94	28.82
MINING AREA	Coal Quarry		0.48	4.71
	Barren OB		0.47	4.61
	Barren Backfilled		2.34	22.94
	Total Aea Under Mining			3.29
WASTELAND	Waste Land		3.05	29.90
	Urban Settlement		0.32	3.14
SETTLEMENTS	Rural Settlement		0.34	3.33
	Industrial Settlement		0.23	2.25
	Total Aea Under Settlement			0.89
WATERBODIES	Reservoir, nallah		0.03	0.29
TOTAL			10.20	100.00

Customer WESTERN COALFIELDS LIMITED				
Title Land Reclamation Monitoring of OC Projects				Job No. 561410027
Subject	Activity	Name	Designation	Signature
Land Reclamation Status of Ghugus OC Based on Satellite Data (P6/L-IV) of the year 2012	Prepared	Tilak Mondal	Sr. Manager	
	Checked	N.P.Singh	General Manager	
	Approved	N.P.Singh	General Manager	
Scale				Sheet
Drg No. HQ REM 1 A3 10 10				Rev No.

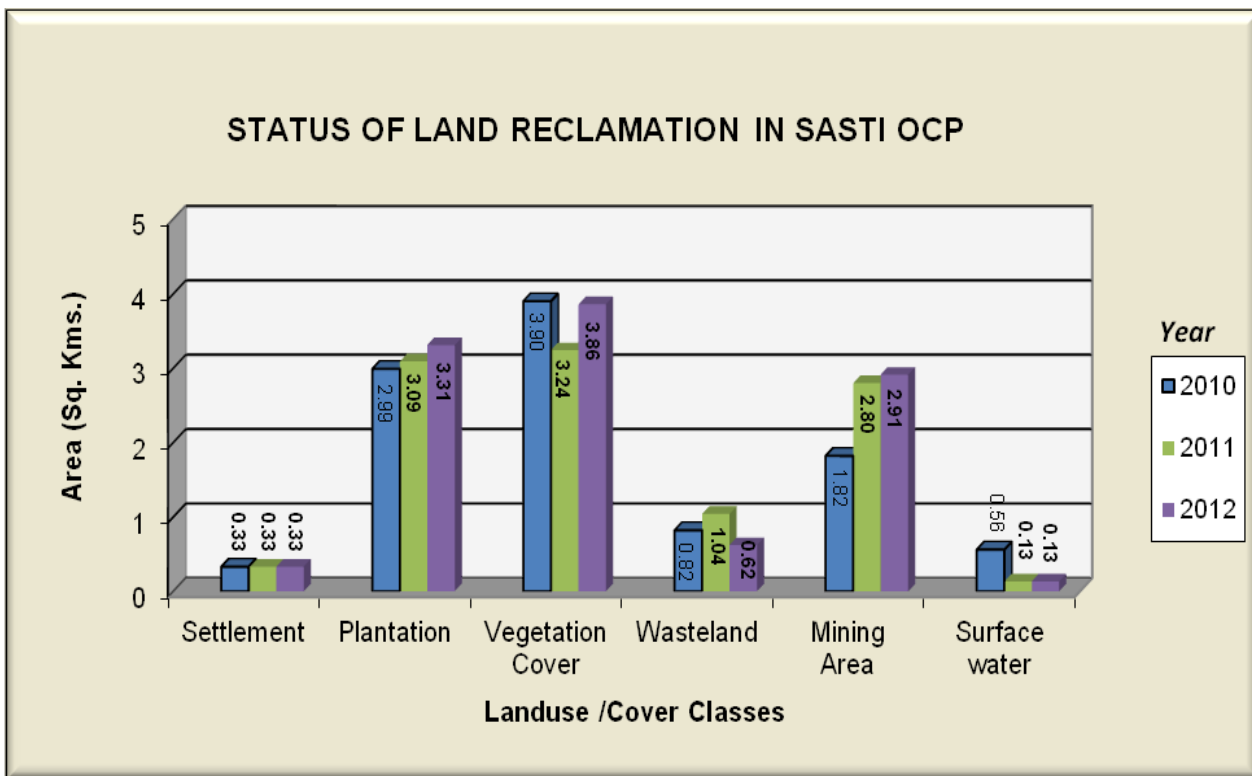


Figure - 5.2

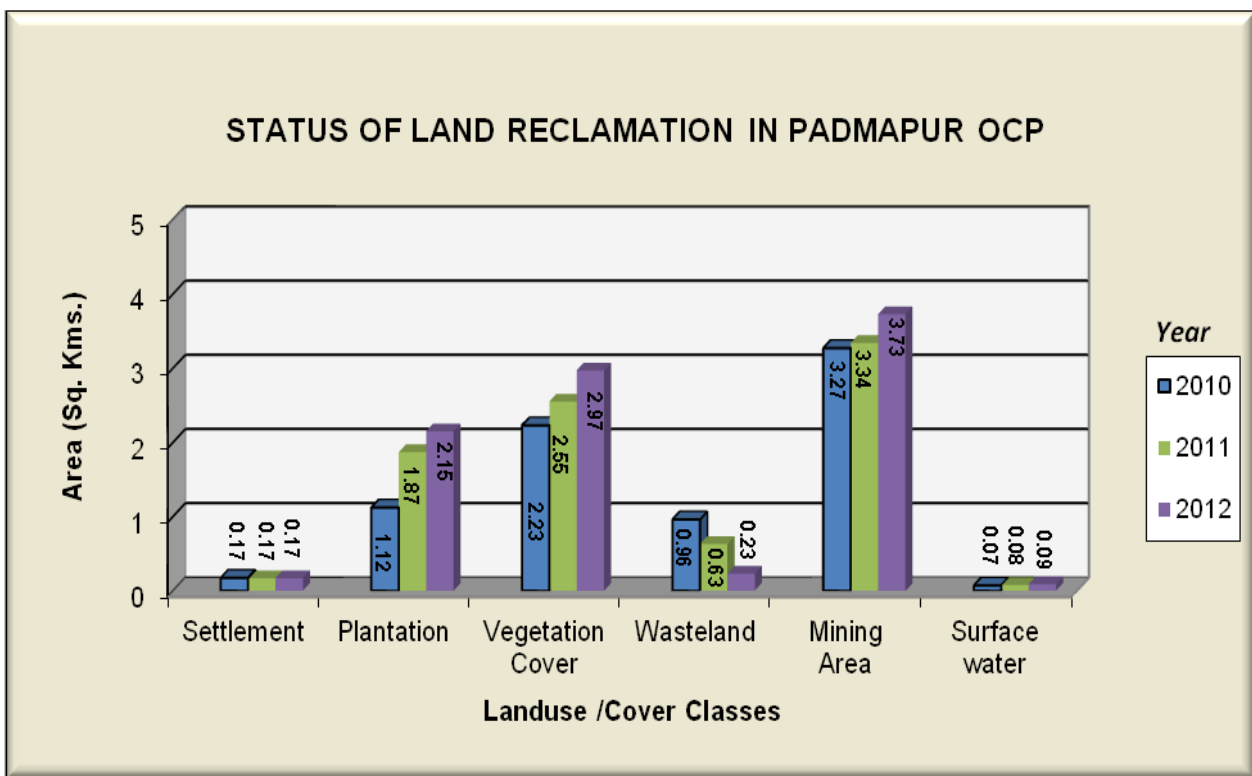


Figure - 5.3

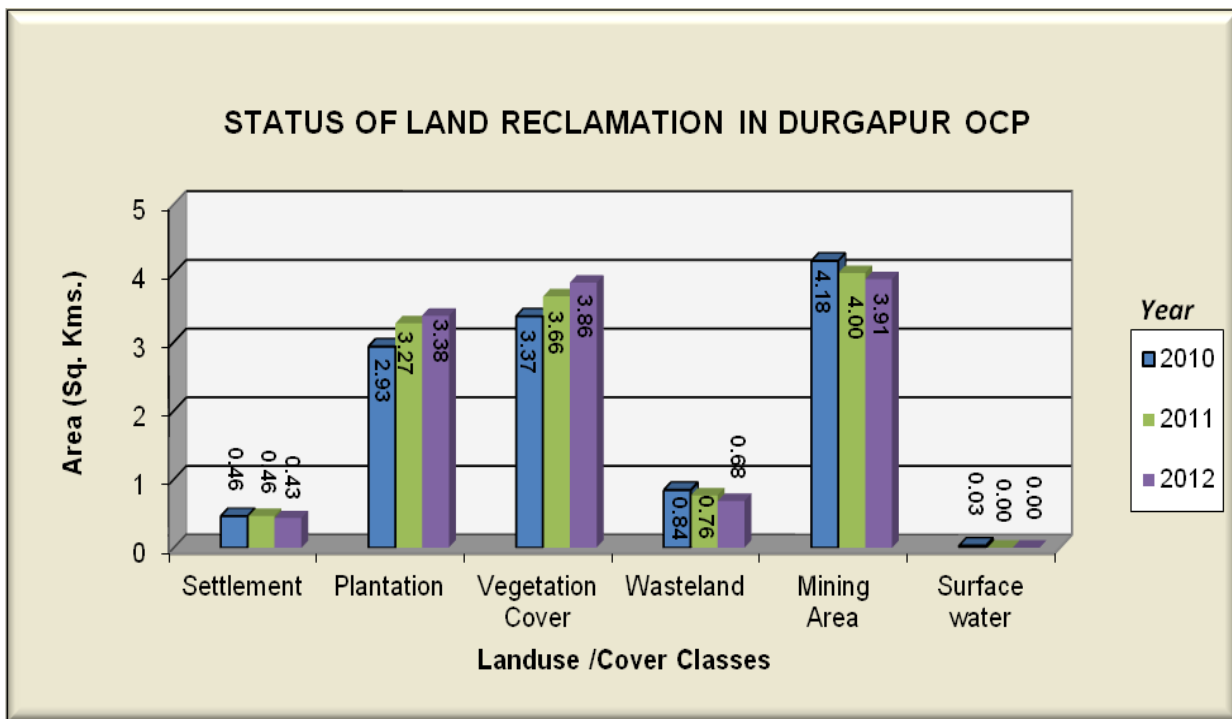


Figure - 5.4

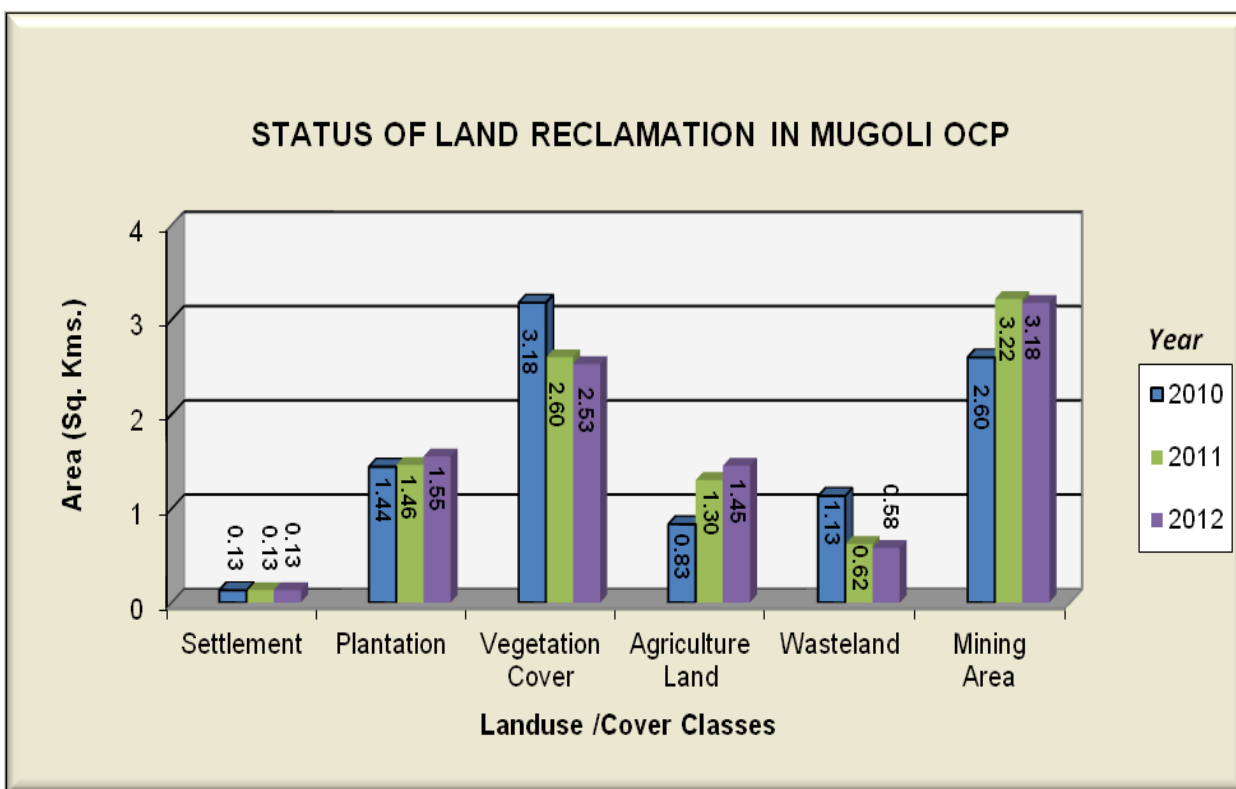


Figure - 5.5

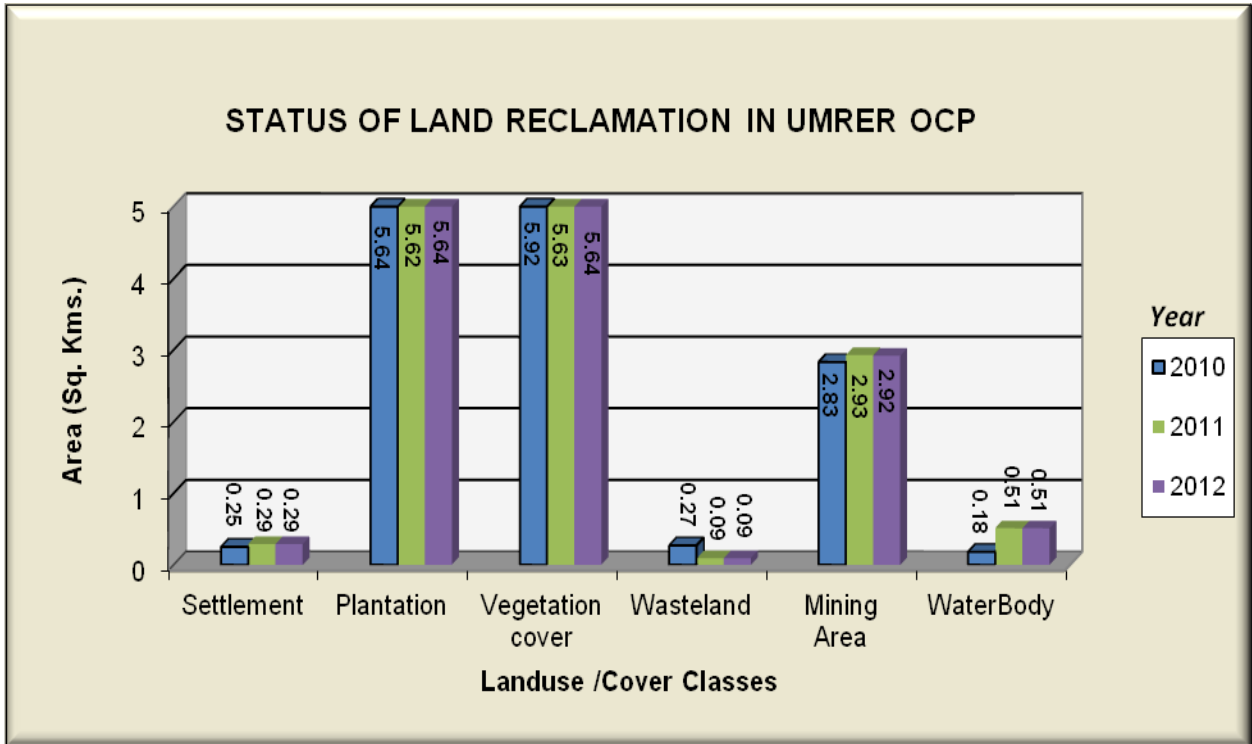


Figure - 5.6

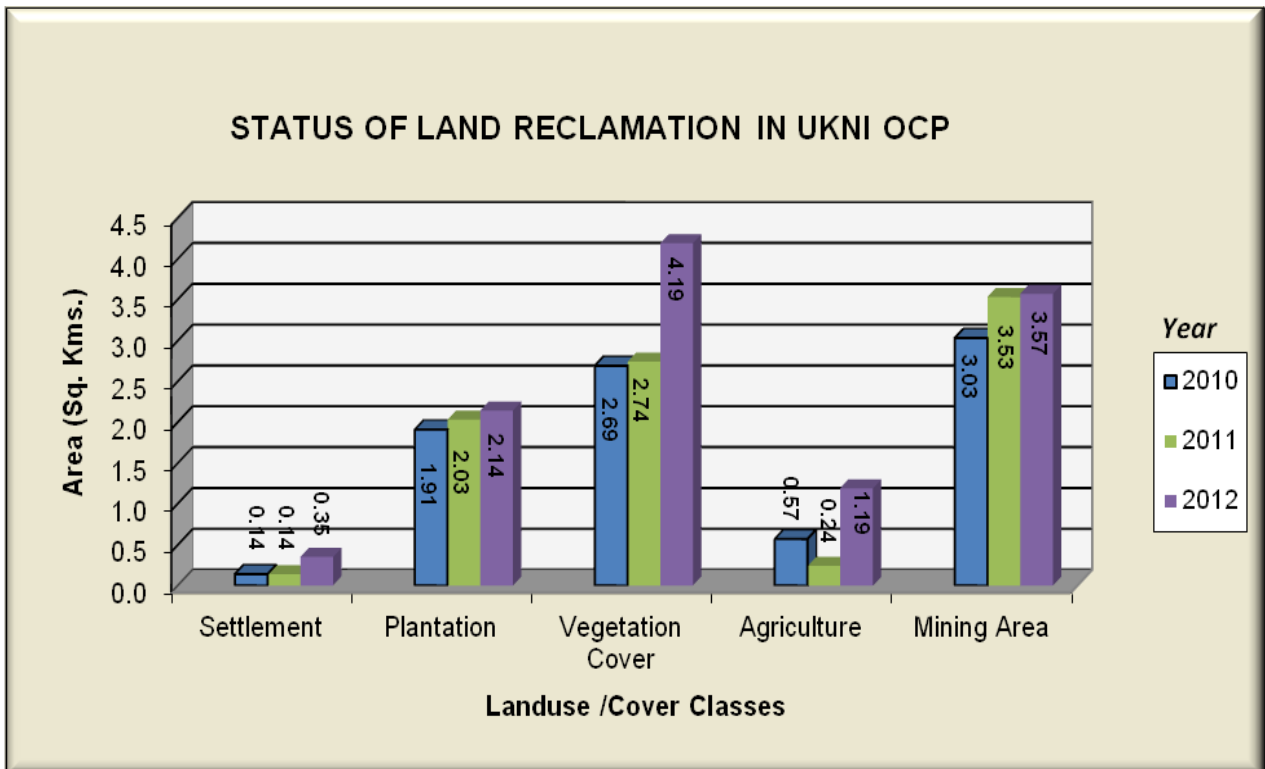


Figure - 5.7

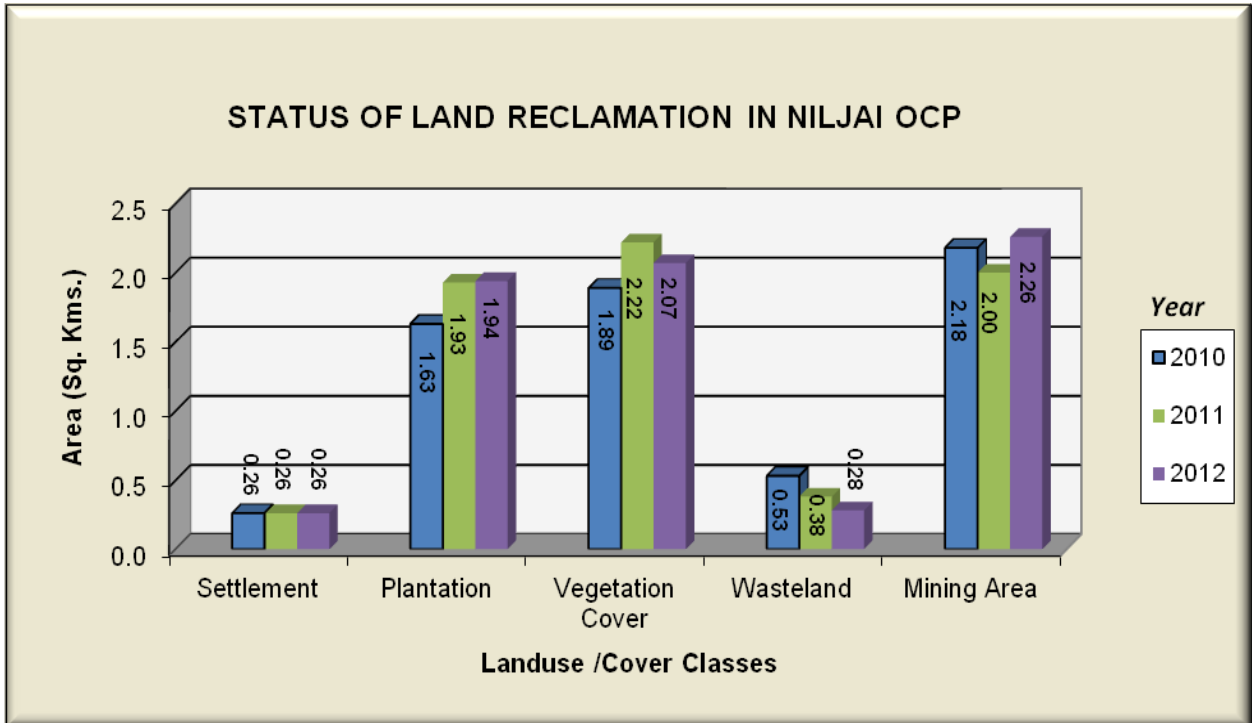


Figure - 5.8

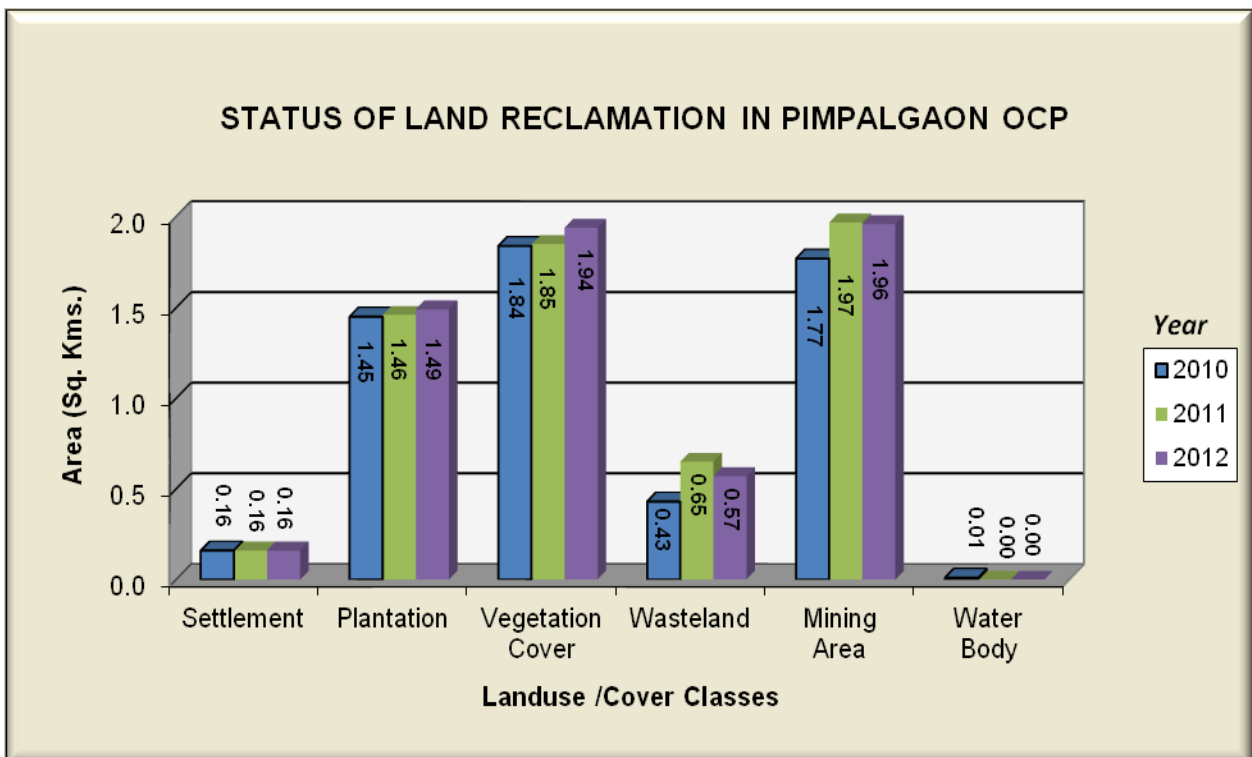


Figure - 5.9

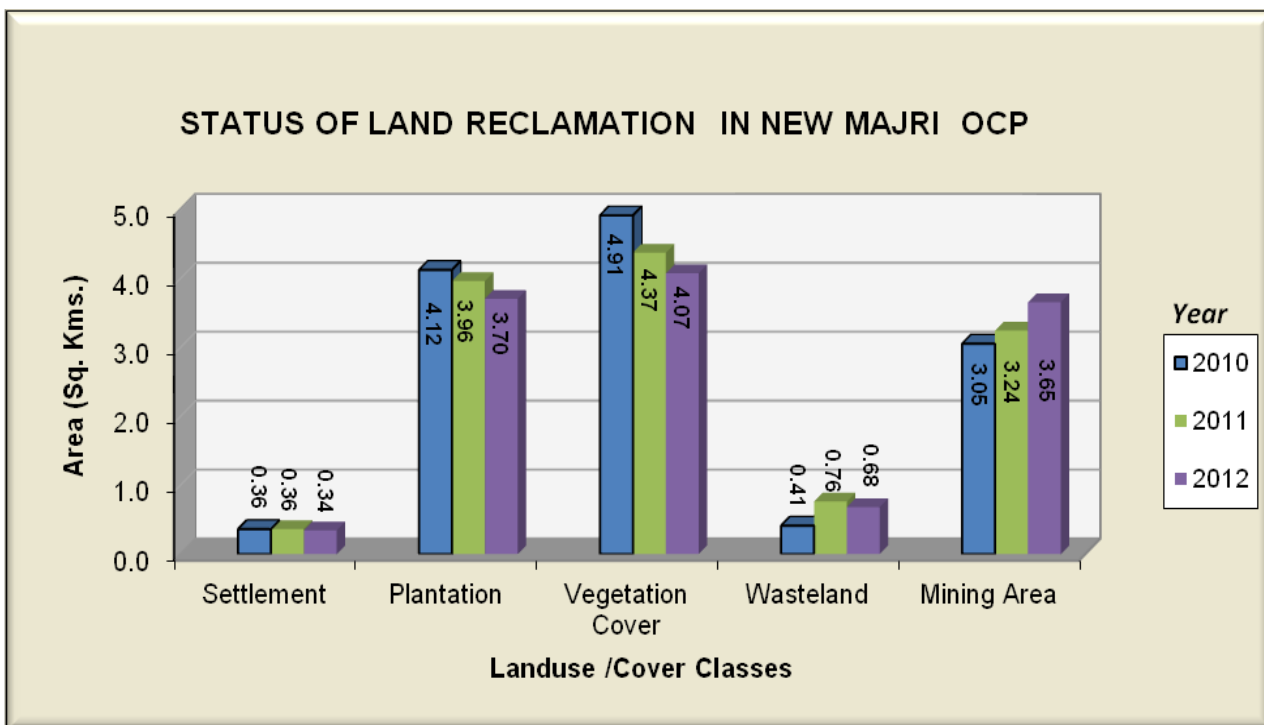


Figure – 5.10

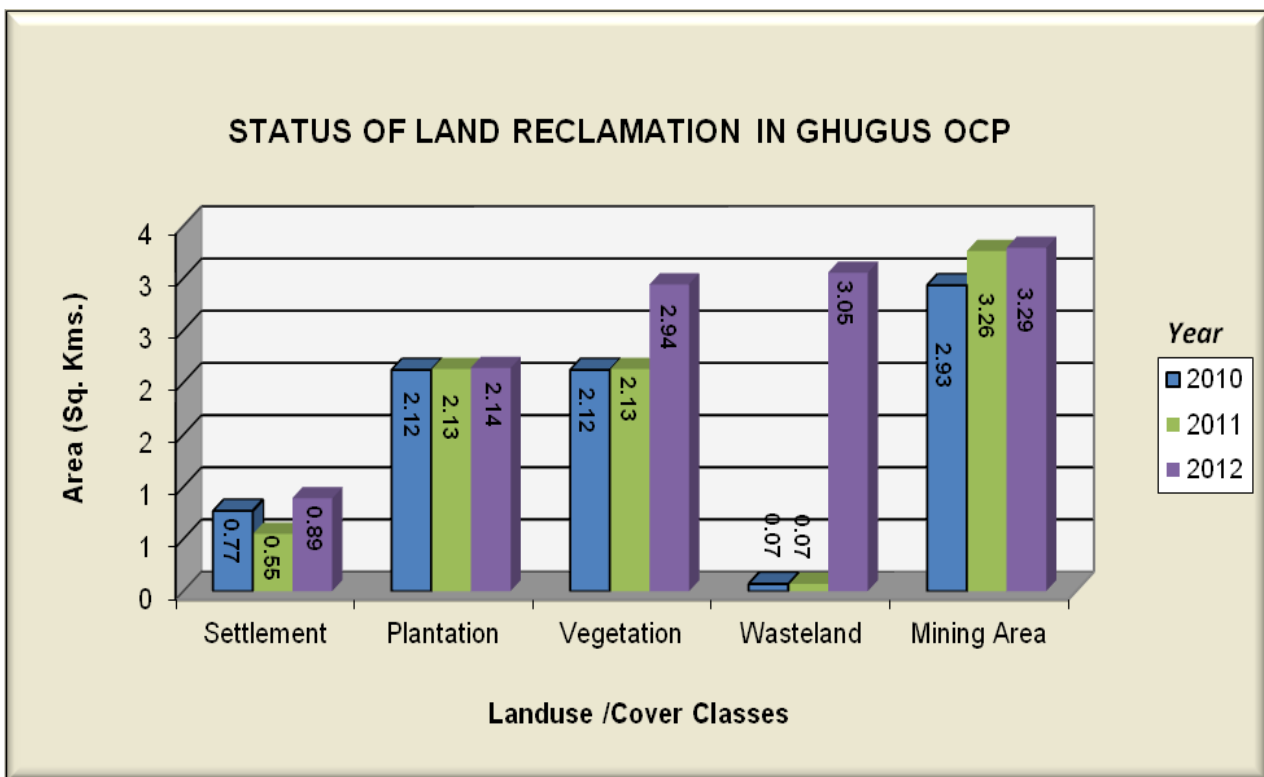


Figure - 5.11



Photograph -5.1 : Plantation on OB dump in Sasti OCP



Photograph – 5.2 : Plantation on OB dump in Ghugus OCP



Photograph – 5.3 : Plantation on OB dump in Mugoli OCP



Photograph – 5.4 : Plantation on OB dump in New-Majri OCP



Photograph – 5.5 : Plantation on backfilled area in Niljai OCP



Photograph – 5.6 : Plantation on backfilled area in Pimpalgaon OCP



Photograph – 5.7 : Plantation on OB dump in Ukni OCP



Photograph – 5.8 : Plantation on backfilled area in Umrer OCP



Photograph – 5.9 : Plantation on OB dump in Durgapur OCP



Photograph – 5.10 : Plantation on OB dump in Padmapur OCP

SOUTH EASTERN COALFIELDS LIMITED

6.0 Land Reclamation Status in South Eastern Coalfields Limited

6.1 Following ten opencast projects of SECL producing 5 million cubic m. or more (coal+OB) together were taken up for land reclamation monitoring during the year 2012.

- Dipka
- Gevra
- Kusmunda
- Manikpur
- Dugga
- Bishrampur
- Chirimiri
- Rajnagar
- Dhanpuri
- Jamuna

6.2 Project wise Land Reclamation status in SECL is given in Table 6.1 and also shown graphically in Fig 6.1. Area statistics of different land use class present in the mine leasehold of the above projects for the year 2012 are shown in the Table – 6.2. Land use maps derived from satellite data are shown in Plate 6.1 - 6.10. Land reclamation status of the above mentioned 10 projects, were also prepared for the year 2009, 2010 and 2011. Year wise changes in the different land use classes based on satellite data are depicted in Bar Charts in Fig.6.1 - 6.10.

6.3 Study reveals that out of total 83.61 Km² mined out / excavated area; 64.87 Km² area (77.59%) has already been reclaimed out of which 42.66 Km² (51.02%) area has been revegetated and 22.21 Km² (26.55%) area are under backfilling.

6.4 After analyzing the satellite data of the year 2011 and 2012, it is evident that area of land reclamation has increased from 64.00 Km² in the year 2011 to 64.87 Km² in the year

2012 in the above mentioned OC projects of SECL in a period of one year. There is an increase of 0.87 Km² reclaimed area in SECL with respect to the year 2011, out of which, there is a marginal decrease of 0.24 Km² in biological reclamation and 0.99 Km² increase in the areas under technical reclamation (barren backfilling) corresponding to the year 2011. This may be due to more areas coming under technical reclamation.

- 6.5** Study indicates that in Manikpur and Bishrampur projects, area of plantation have reduced marginally with respect to the year 2011 because of the OB dumping on vegetated backfilled / OB Dump area /naturally grown vegetation due to constrained of dumping space.
- 6.6** Overall, all the projects considered for this report indicate either an increase or static trend in plantation except for Manikpur and Bishrampur OCPs and increase in area under backfilling except for Chirimiri as compared to 2011. This increase of plantation and area under backfilling indicates that SECL is committed for reclamation of mine land for maintaining the ecological balance in the region.
- 6.7** Out of 10 projects of SECL, Rajnagar OCP ranks on top for land reclamation (97.99%) followed by Bishrampur (97.91%) and Dhanpuri (96.35%).

Table – 6.1

**Projectwise Land Reclamation Status in Opencast Project of SECL
(> 5 million Cu. M. of Coal+OB) based on Satellite Data of the Year 2012**

(% calculated in respect of total excavated area)

Area are in Km².

Sl. No.	Project		Plantation/ Vegetation		Under Backfilling		Active Mining		Total Excavated Area		Total Reclaimed area	
	Name	Leasehold (i)	ii		iii		iv		ii+iii+iv		ii+iii	
			2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
1	DIPKA	22.26	2.83	2.84	2.70	2.83	3.75	3.35	9.28	9.02	5.53	5.67
			30.50	31.49	29.10	31.37	40.41	37.14			59.60	62.86
2	GEVRA *	41.86	7.35	7.44	6.04	6.08	6.69	6.73	20.08	20.25	13.39	13.52
			36.60	36.74	30.08	30.02	33.32	33.23			66.68	66.77
3	KUSMUNDA	16.72	3.79	3.87	1.79	2.02	3.40	5.09	8.98	10.98	5.58	5.89
			42.20	35.25	19.94	18.40	37.86	46.36			62.14	53.64
4	MANIKPUR *	19.44	2.97	2.79	1.46	1.84	1.48	1.89	5.91	6.52	4.43	4.63
			50.25	42.79	24.71	28.22	25.04	28.99			74.96	71.01
5	DUGGA	5.41	1.81	1.81	1.08	1.22	0.38	0.38	3.27	3.41	2.89	3.03
			55.35	53.08	33.03	35.78	11.62	11.14			88.38	88.86
6	BISHRAMPUR	15.23	8.36	8.06	3.18	3.20	0.25	0.24	11.79	11.50	11.54	11.26
			70.91	70.09	26.98	27.83	2.12	2.09			97.89	97.91
7	CHIRIMIRI	6.51	2.77	2.77	0.56	0.38	0.12	0.20	3.45	3.35	3.33	3.15
			80.29	82.69	16.24	11.34	3.48	5.97			96.53	94.03
8	RAJNAGAR	8.61	4.91	4.91	0.92	0.94	0.10	0.12	5.93	5.97	5.83	5.85
			82.80	82.24	15.52	15.75	1.69	2.01			98.32	97.99
9	DHANPURI	14.59	3.96	3.96	2.15	2.38	0.20	0.24	6.31	6.58	6.11	6.34
			62.76	60.18	34.08	36.17	3.17	3.65			96.84	96.35
10	JAMUNA	8.85	4.15	4.21	1.22	1.32	0.71	0.50	6.08	6.03	5.37	5.53
			68.26	69.82	20.07	21.89	11.68	8.29			88.33	91.71
TOTAL (SECL)		159.48	42.90	42.66	21.10	22.21	17.08	18.74	81.08	83.61	64.00	64.87
			52.91	51.02	26.03	26.55	21.07	22.41			78.93	77.59

* The mine leasehold area has been revised

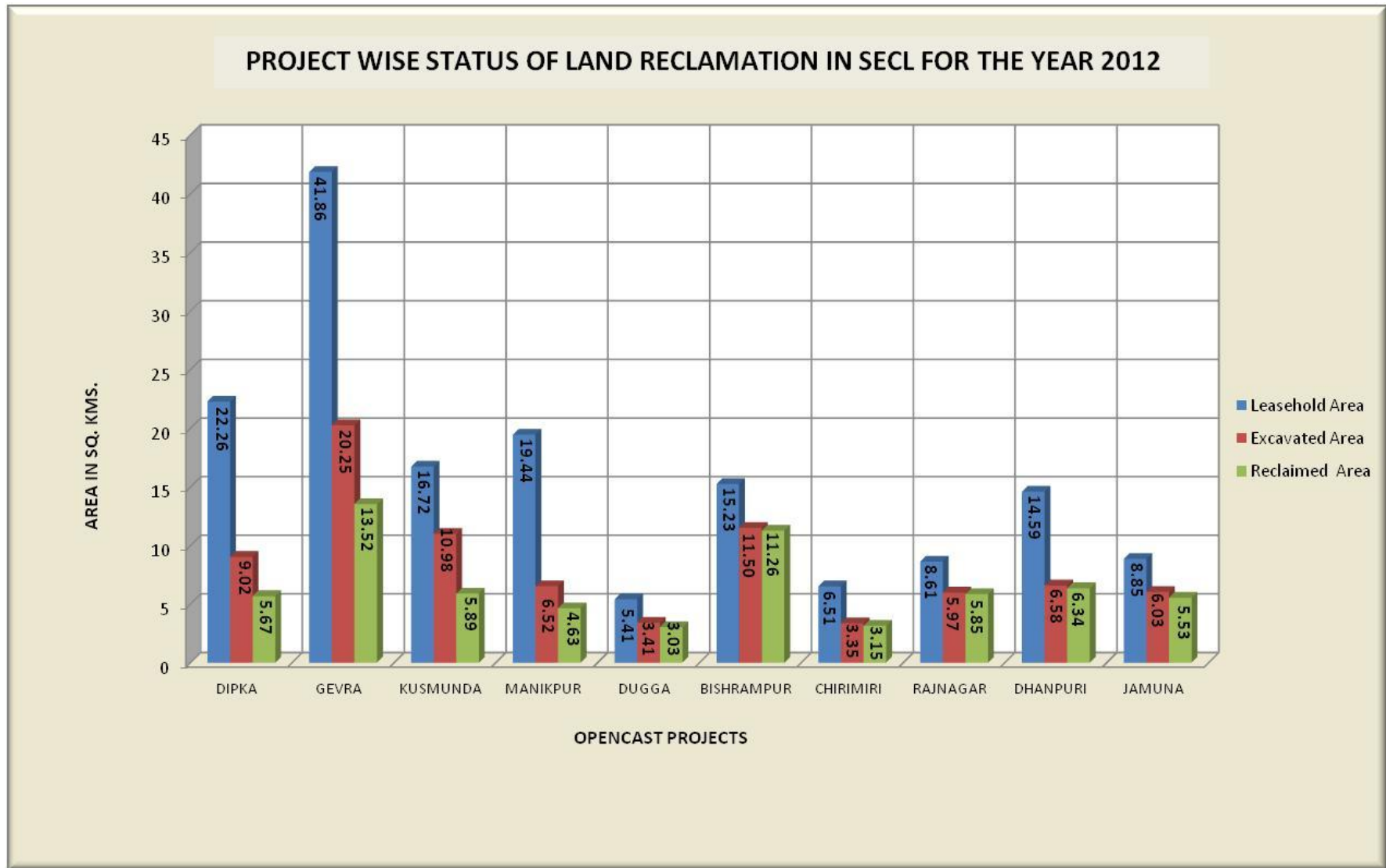


Fig.6.1: Land reclamation status in OC projects of SECL in the year-2012

Table 6.2

Status of Land Use / Reclamation in OC Mines(>5 mcu.m) of South Eastern Coalfields Ltd. based on Satellite data of the Year 2012

		(Area in Sq Km)																					
		DIPKA		GEVRA		KUSMUNDA		MANIKPUR		DUGGA		BISHRAMPUR		CHIRMIRI		KAJNAGAR		DHANPURI		JAMUNA		TOTAL	
		Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%
FORESTS	Dense Forest	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	0.00	0.00	0.00	0.00
	Open Forest	0.06	0.27	0.00	0.00	0.00	0.00	1.15	5.92	0.00	0.00	0.00	0.00	0.39	5.99	0.02	0.23	2.94	20.15	0.00	0.00	4.56	2.86
	Total Forest	0.06	0.27	0.00	0.00	0.00	0.00	1.15	5.92	0.00	0.00	0.00	0.00	0.39	5.99	0.02	0.23	2.94	20.15	0.00	0.00	4.56	2.86
SCRUBS	Scrubs	3.52	15.81	5.06	12.09	1.83	10.94	2.70	13.89	0.92	17.01	1.31	8.60	1.87	28.73	1.58	18.35	2.95	20.22	0.78	8.81	22.52	14.12
	Social Forestry	0.90	4.04	2.23	5.33	1.35	8.07	0.64	3.29	0.02	0.37	1.02	6.70	1.42	21.81	0.41	4.76	0.08	0.55	0.02	0.23	8.09	5.07
PLANTATION	Plantation on OB Dump	1.30	5.84	3.60	8.60	1.89	11.30	1.45	7.46	0.22	4.07	0.00	0.00	0.00	0.00	0.00	0.00	2.26	15.48	0.00	0.00	10.72	6.72
	Plantation on Backfill	0.64	2.88	1.61	3.85	0.63	3.77	0.70	3.60	1.57	29.02	7.04	46.23	1.35	20.74	4.50	52.25	1.62	11.11	4.19	47.34	23.85	14.95
	Total Plantation (Biological Reclamation)	2.84	12.76	7.44	17.78	3.87	23.14	2.79	14.35	1.81	33.46	8.06	52.93	2.77	42.55	4.91	57.01	3.96	27.14	4.21	47.57	42.66	26.75
	Total Vegetation	6.42	28.84	12.50	29.87	5.70	34.08	6.64	34.16	2.73	50.47	9.37	61.53	5.03	77.27	6.51	75.59	9.85	67.51	4.99	56.38	69.74	43.73
ACTIVE MINING	Coal Quarry	2.49	11.19	4.92	11.75	2.21	13.19	1.35	6.94	0.06	1.11	0.03	0.20	0.15	2.30	0.07	0.81	0.14	0.96	0.21	2.37	11.63	7.29
	Coal Dump	0.27	1.21	0.60	1.43	0.18	1.08	0.10	0.51	0.12	2.22	0.21	1.38	0.05	0.77	0.03	0.35	0.10	0.69	0.22	2.49	1.88	1.18
	Advance Quarry Site	0.50	2.25	0.47	1.12	0.02	0.12	0.01	0.05	0.20	3.70	0.00	0.00	0.00	0.00	0.02	0.23	0.00	0.00	0.07	0.79	1.29	0.81
	Quarry Filled With Water	0.09	0.40	0.74	1.77	0.66	3.95	0.43	2.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.92	1.20
	Total Area under Active Mining	3.35	15.05	6.73	16.07	3.07	18.34	1.89	9.71	0.38	7.03	0.24	1.58	0.20	3.07	0.12	1.39	0.24	1.65	0.50	5.65	16.72	10.48
RECLAIMED	Barren OB Dump	1.11	4.99	1.21	2.89	0.67	4.01	0.73	3.76	0.19	3.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.91	2.45
	Area under Backfilling	1.72	7.73	4.87	11.63	1.35	8.07	1.11	5.71	1.03	19.04	3.20	21.01	0.38	5.84	0.94	10.92	2.38	16.31	1.32	14.92	18.30	11.47
	Total Area under Technical Reclamation	2.83	12.72	6.08	14.52	2.02	12.08	1.84	9.47	1.22	22.55	3.20	21.01	0.38	5.84	0.94	10.92	2.38	16.31	1.32	14.92	22.22	13.93
Total Area under Mining Operations	6.18	27.77	12.81	30.59	5.09	30.42	3.73	19.18	1.60	29.58	3.44	22.59	0.58	8.91	1.06	12.31	2.62	17.96	1.82	20.57	38.93	24.41	
WASTELANDS	Waste Lands	4.61	20.71	5.68	13.57	1.69	10.11	0.93	4.78	0.04	0.74	0.29	1.90	0.55	8.45	0.00	0.00	0.73	5.00	0.33	3.73	14.85	9.31
	Fly Ash Pond / Sand Body	0.00	0.00	0.00	0.00	0.03	0.18	1.57	8.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.60	1.00
Total Wasteland	4.61	20.71	5.68	13.57	1.72	10.29	2.50	12.86	0.04	0.74	0.29	1.90	0.55	8.45	0.00	0.00	0.73	5.00	0.33	3.73	16.45	10.31	
WATERBODIES	Reservoir, nallah, ponds	0.31	1.39	0.23	0.55	0.20	1.20	0.87	4.48	0.20	3.70	1.19	7.81	0.06	0.92	0.56	6.50	0.24	1.64	0.69	7.80	4.55	2.85
	Total Waterbodies	0.31	1.39	0.23	0.55	0.20	1.20	0.87	4.48	0.20	3.70	1.19	7.81	0.06	0.92	0.56	6.50	0.24	1.64	0.69	7.80	4.55	2.85
AGRICULTURE	Crop Lands	0.37	1.66	1.01	2.41	0.82	4.90	0.20	1.03	0.00	0.00	0.00	0.00	0.00	0.00	0.14	1.63	0.00	0.00	0.10	1.13	2.64	1.66
	Fallow Lands	2.62	11.77	6.68	15.96	2.32	13.87	4.87	25.05	0.83	15.34	0.89	5.84	0.00	0.00	0.13	1.51	1.06	7.27	0.82	9.27	20.22	12.68
	Total Agriculture	2.99	13.43	7.69	18.37	3.14	18.77	5.07	26.08	0.83	15.34	0.89	5.84	0.00	0.00	0.27	3.14	1.06	7.27	0.92	10.40	22.86	14.33
SETTLEMENTS	Urban Settlement	0.33	1.48	0.79	1.89	0.17	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	4.15	0.14	1.63	0.09	0.62	0.05	0.56	1.84	1.15
	Rural Settlement	0.55	2.47	1.07	2.56	0.28	1.67	0.30	1.54	0.00	0.00	0.05	0.33	0.00	0.00	0.06	0.70	0.00	0.00	0.00	0.00	2.31	1.45
	Industrial Settlement	0.87	3.91	1.09	2.60	0.43	2.57	0.33	1.70	0.01	0.18	0.00	0.00	0.02	0.31	0.01	0.12	0.00	0.00	0.05	0.56	2.81	1.76
	Total Settlement	1.75	7.86	2.95	7.05	0.88	5.24	0.63	3.24	0.01	0.18	0.05	0.33	0.29	4.46	0.21	2.45	0.09	0.62	0.10	1.12	6.96	4.36
Grand Total	22.26	100.00	41.86	100.00	16.72	100.00	19.44	100.00	5.41	100.00	15.23	100.00	6.51	100.00	8.61	100.00	14.59	100.00	8.85	100.00	159.49	100.00	

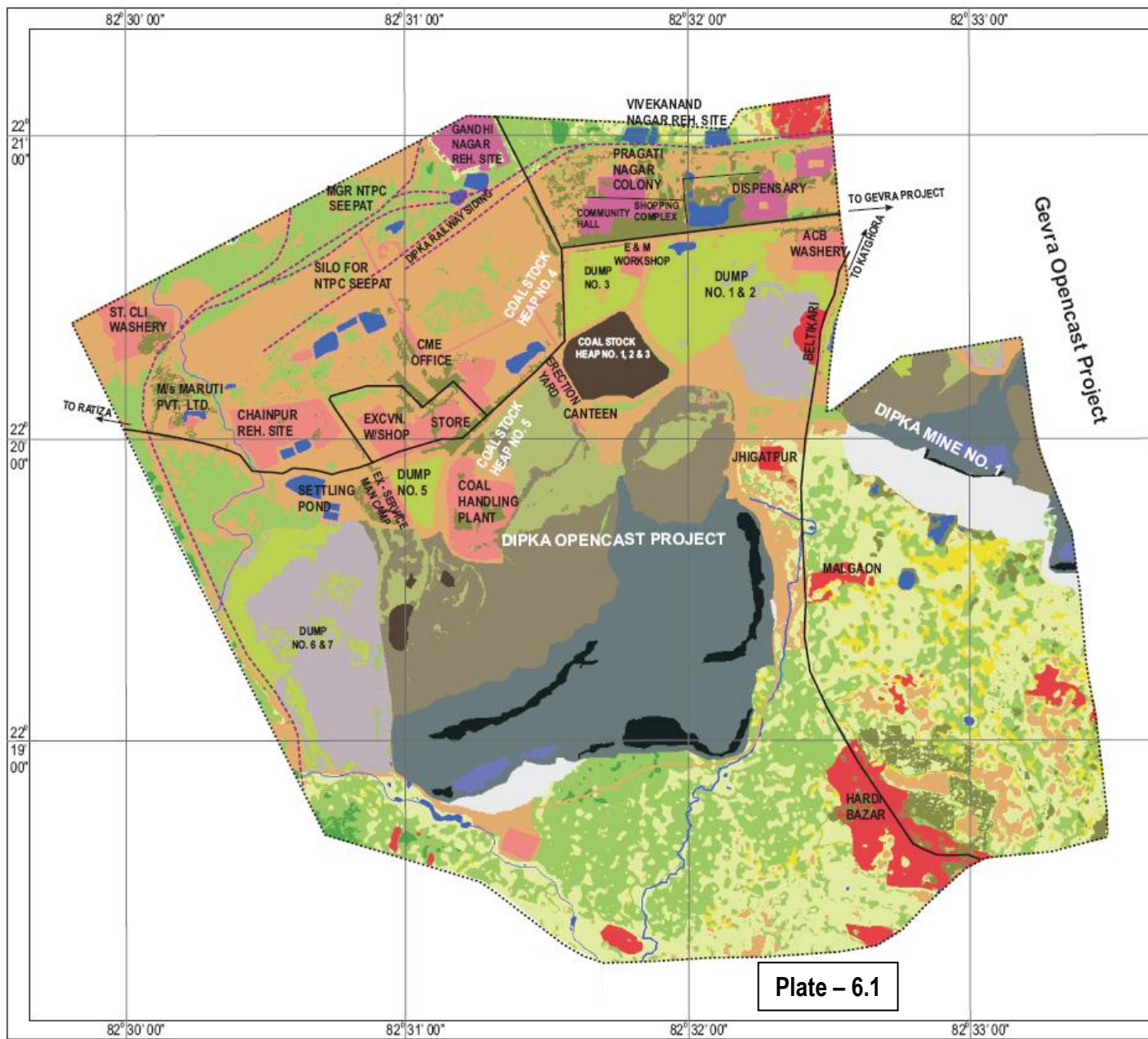


Plate – 6.1

Area Statistics (Total Area: 22.26 Km²)

Area	Colour	Class	Level-I	Level-II
Km ²	% of Total			
0.55	2.47	Settlements	Urban	Rural
0.33	1.48			Industrial
0.87	3.91			Open Forest
0.06	0.27	Vegetation Cover	Scrub	Plantation under Social Forestry
3.52	15.81			Plantation on Overburden Dump
0.90	4.04			Plantation over Backfill
1.30	5.84			
0.64	2.88			
0.37	1.66	Agricultural Land	Crop Land	Fallow Land
2.62	11.77			Waste Upland with or w/o scrubs
4.61	20.71	Mining Area	Coal Quarry	Water Filled Quarry
2.49	11.19			Advanced Quarry Site
0.09	0.40			Barren Overburden Dump
0.50	2.25			Coal Dump
1.11	4.99	Surface Water Body	Backfilling	
0.27	1.21			
1.72	7.73			
0.31	1.39			
22.26	100.00			

LEGEND

- Dipka OCP 25 MTY Mine Boundary
- Roads
- Railway Line

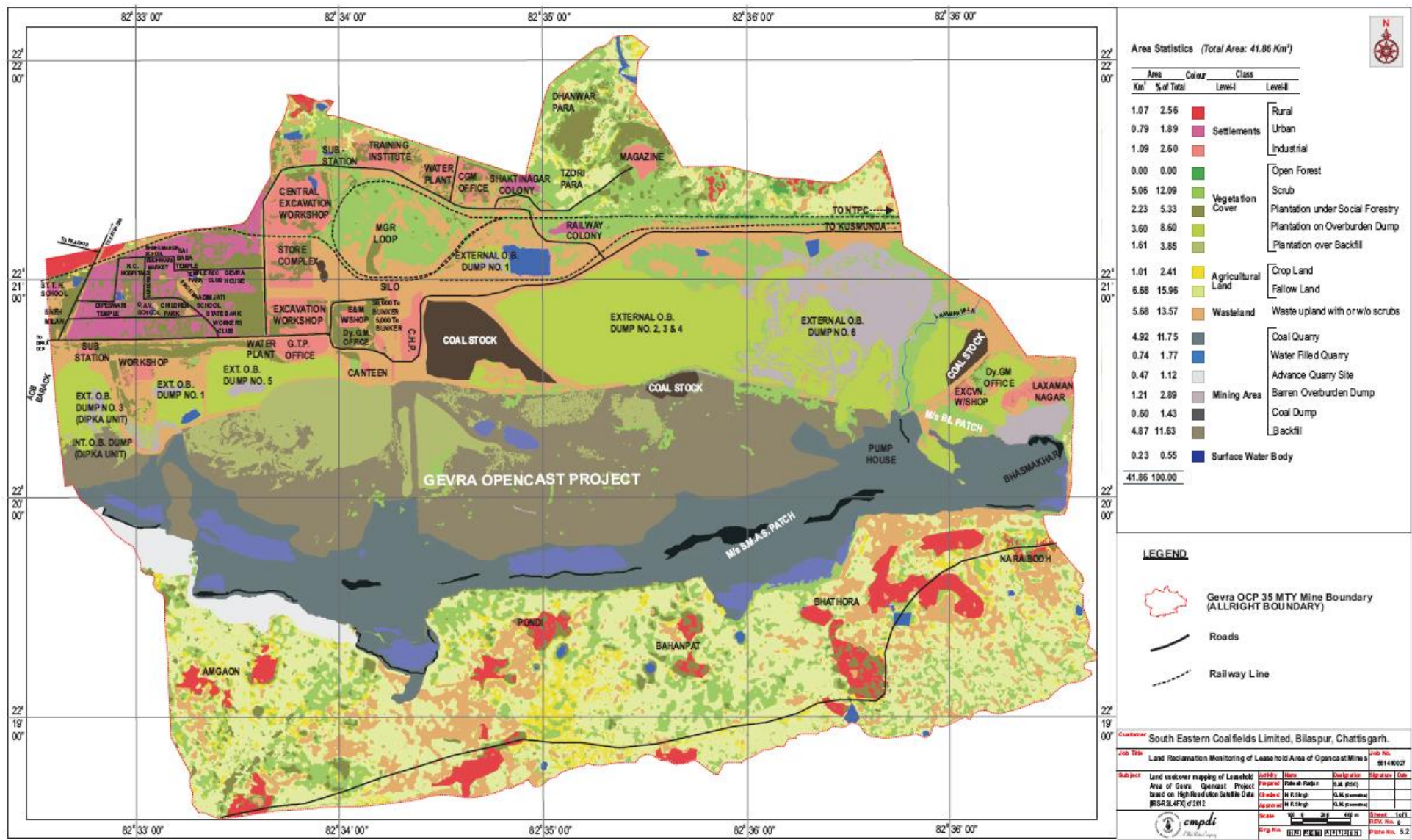
Customer South Eastern Coalfields Limited, Bilaspur, Chattisgarh.

Job Title Land Reclamation Monitoring of Leasehold Area of Opencast Mines **Job No.** 591410027

Subject	Activity	Date	Prepared	Checked	Approved	Designation	Signature	Date
Land use/cover mapping of Leasehold Area of Dipka Opencast Project (25 MtY) based on High Resolution Satellite Data (RS-2014/14) of 2012	Prepared		Rakesh Ranjan	S.M. (RSC)				
	Checked		K.P. Singh	G.M. (RSC)				
	Approved		K.P. Singh	G.M. (RSC)				



Scale 100 0 200 400 m **Sheet** 1 of 1
Drp. No. 591410027/1/1/1/1 **REV. No.** 6 **Plate No.** 51



Area Statistics (Total Area: 41.86 Km²)

Area Km ²	% of Total	Colour	Level	Class	Level#
1.07	2.56	Red		Rural	
0.79	1.89	Pink		Urban	
1.09	2.60	Light Red		Industrial	
0.00	0.00	Green		Open Forest	
5.06	12.09	Light Green		Scrub	
2.23	5.33	Dark Green		Vegetation Cover	
3.60	8.60	Light Yellow-Green		Plantation under Social Forestry	
1.61	3.85	Yellow-Green		Plantation on Overburden Dump	
		Light Green		Plantation over Backfill	
1.01	2.41	Yellow		Agricultural Land	
6.68	15.96	Light Yellow		Fallow Land	
5.68	13.57	Orange		Wasteland	Waste upland with or w/o scrubs
4.92	11.75	Dark Grey		Coal Quarry	
0.74	1.77	Blue		Water Filled Quarry	
0.47	1.12	Light Grey		Advance Quarry Site	
1.21	2.89	Light Purple		Barren Overburden Dump	
0.60	1.43	Dark Grey		Coal Dump	
4.87	11.63	Dark Brown		Backfill	
0.23	0.55	Dark Blue		Surface Water Body	
41.86	100.00				

LEGEND

- Gevra OCP 35 MTY Mine Boundary (ALLRIGHT BOUNDARY)
- Roads
- Railway Line

Customer: South Eastern Coalfields Limited, Bilaspur, Chattisgarh.

Job Title: Land Reclamation Monitoring of Leasehold Area of Opencast Mines

Subject: Land use/cover mapping of Leasehold Area of Gevra Opencast Project based on High Resolution Satellite Data (RSR/SATAP) of 2012

Scale: 1:50,000

Prepared by: [Name]

Checked by: [Name]

Approved by: [Name]

Scale: 1:50,000

Prepared by: [Name]

Checked by: [Name]

Approved by: [Name]

Plate - 6.2

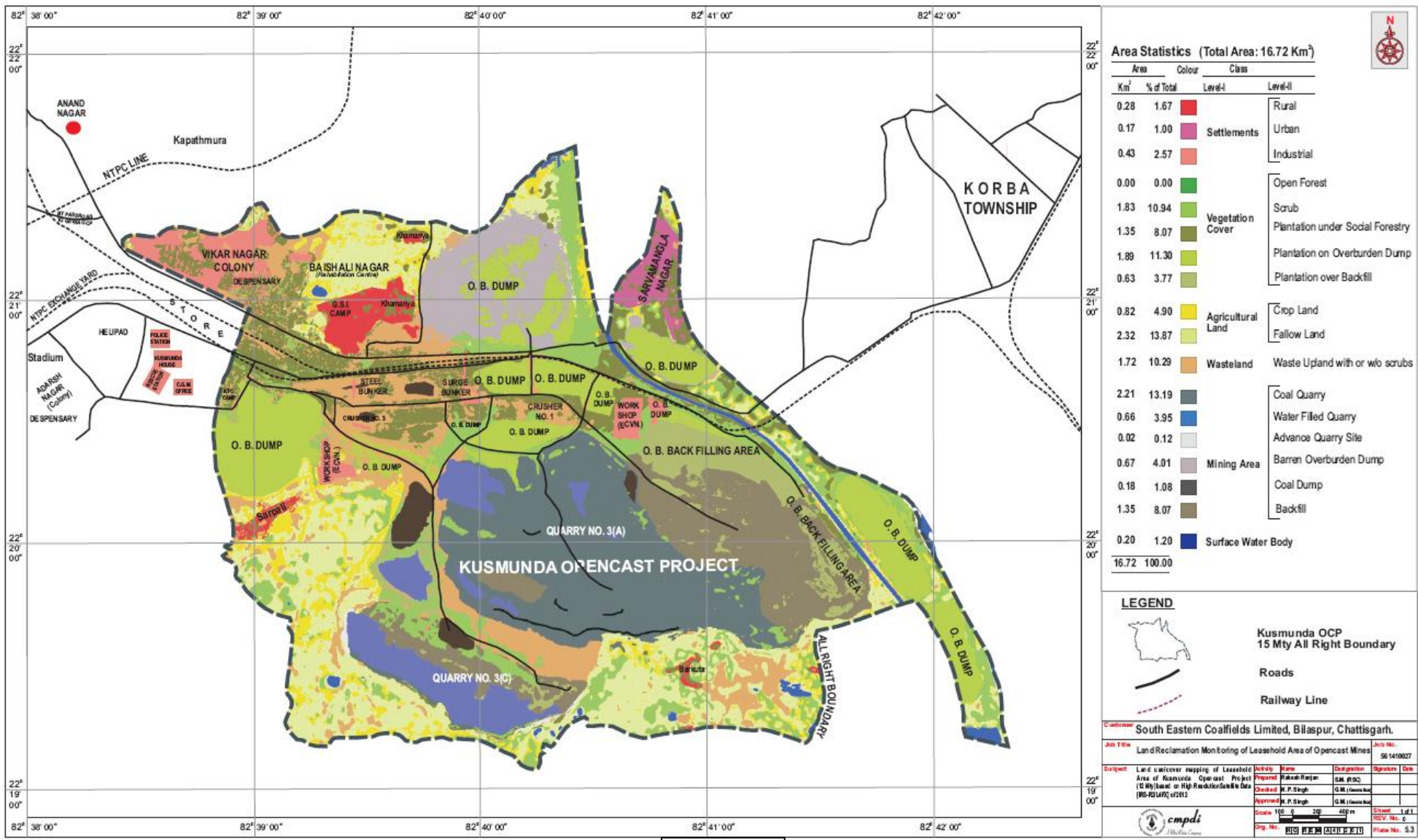


Plate - 6.3

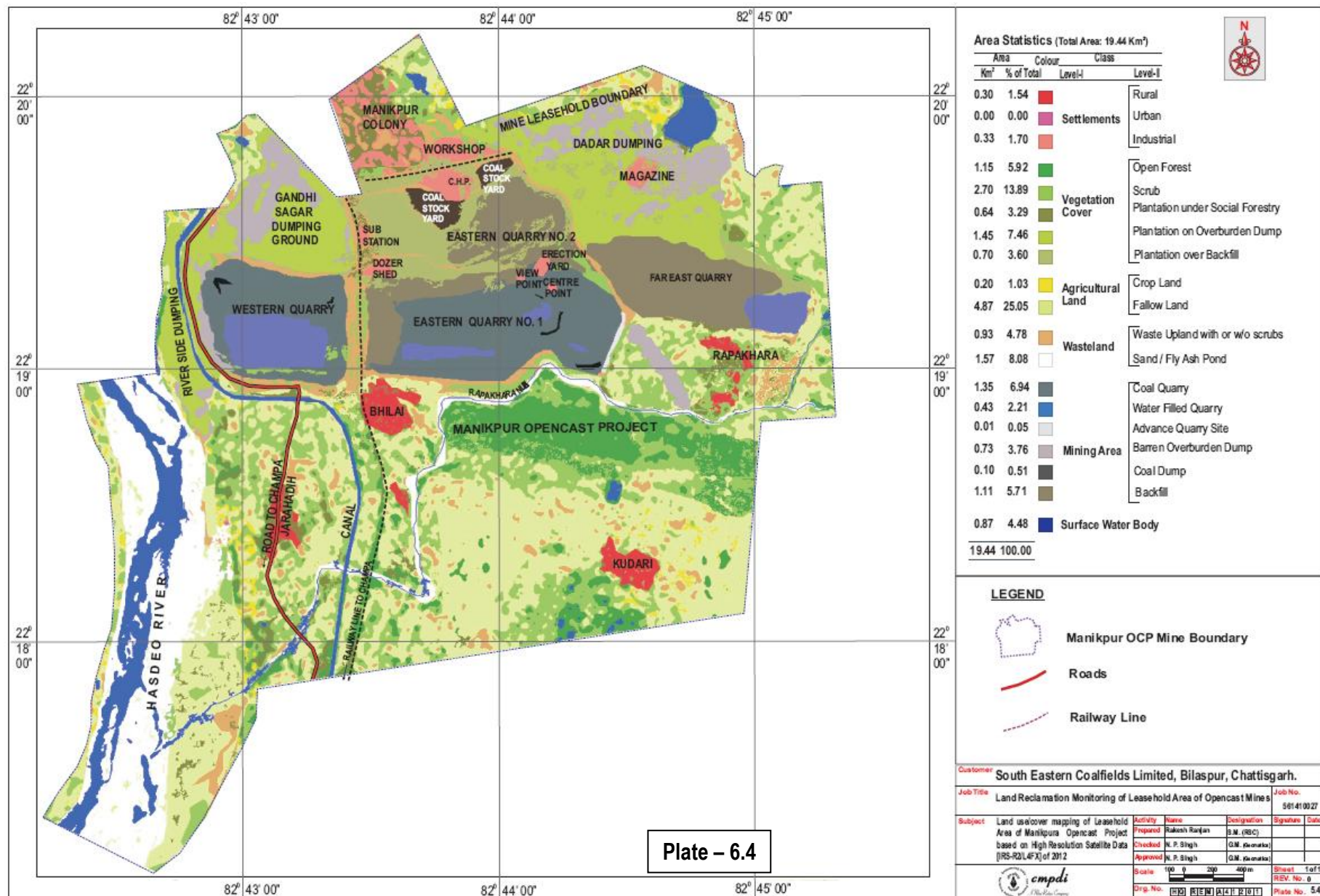
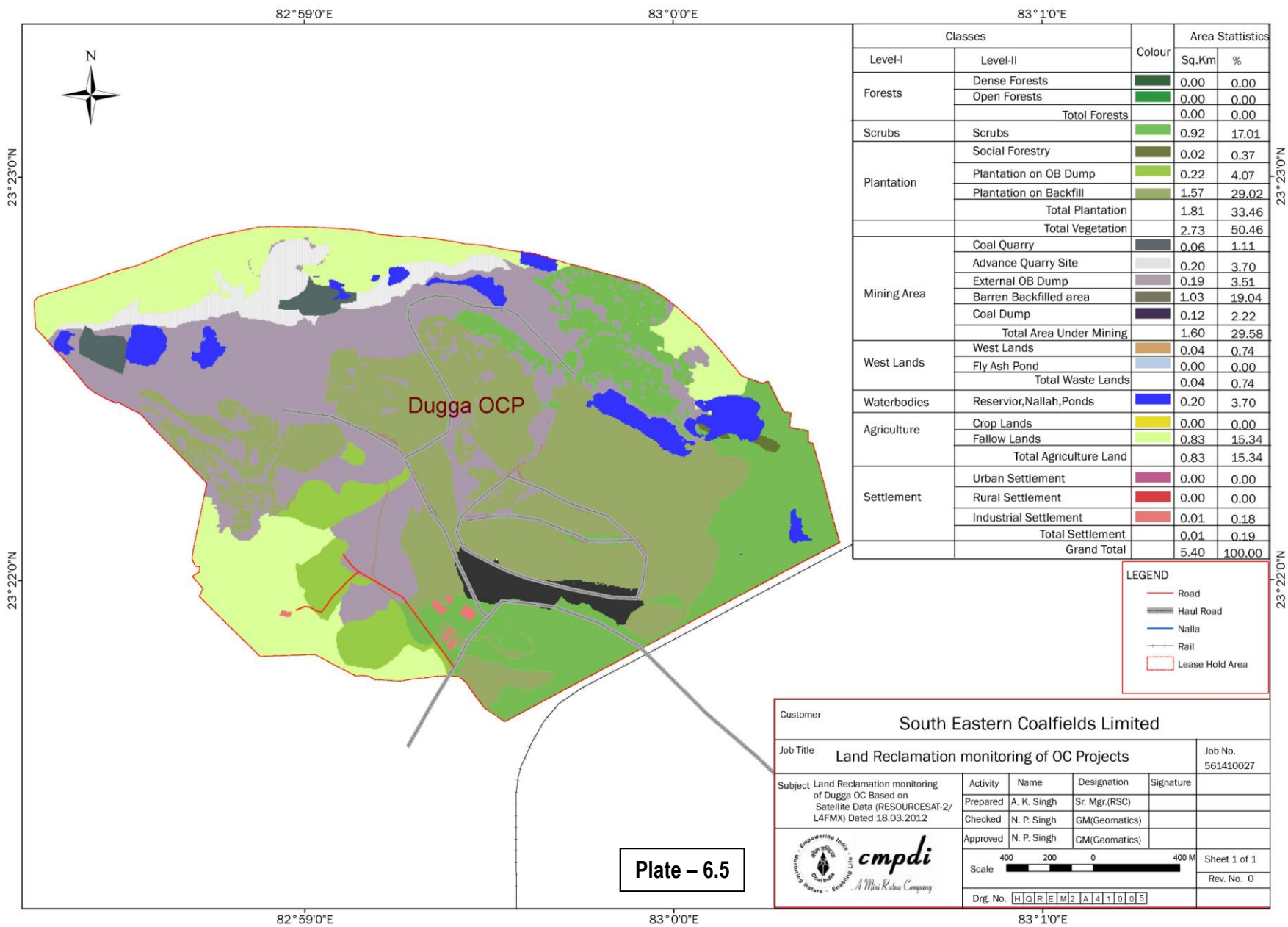


Plate - 6.4



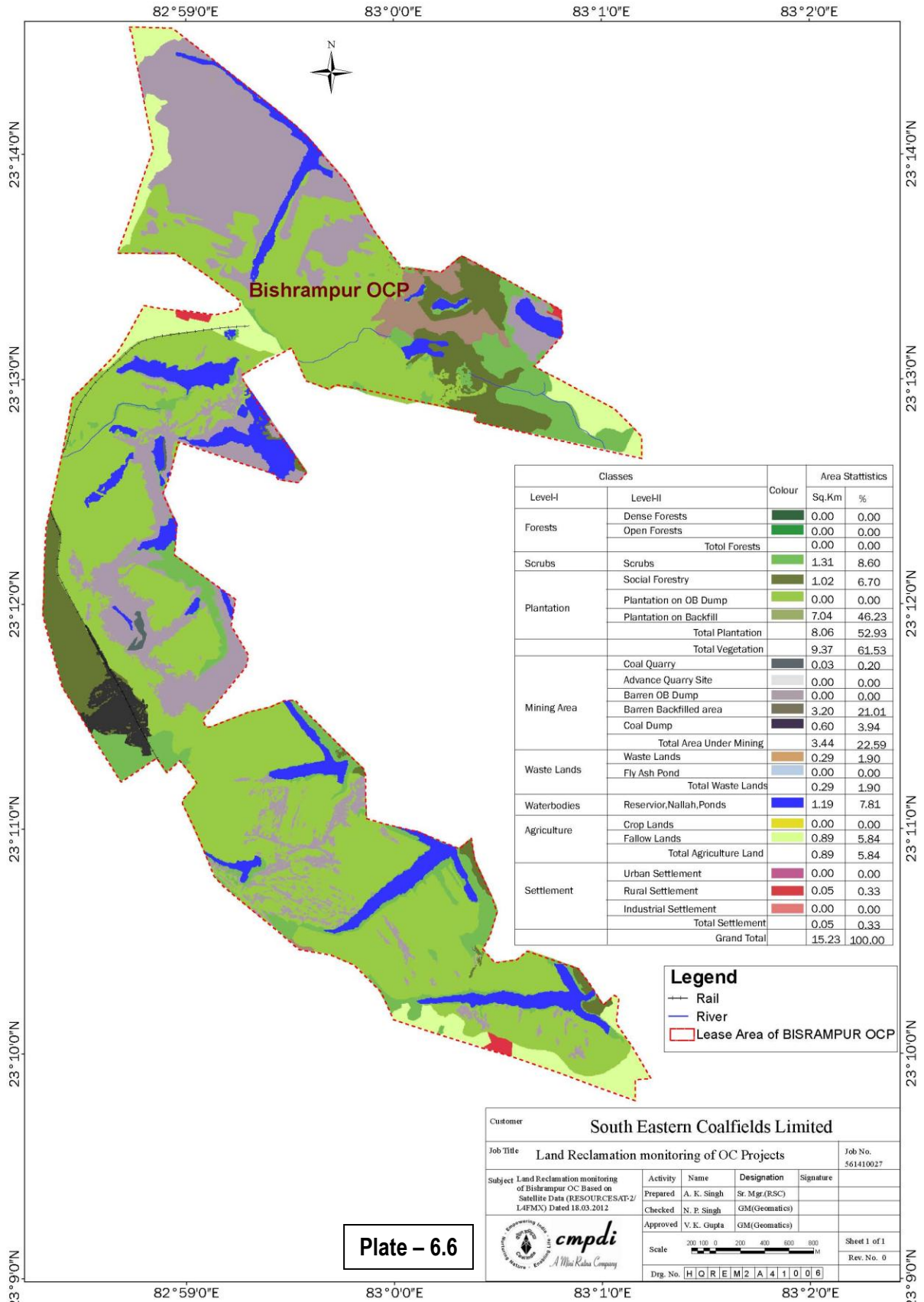
Classes		Colour	Area Statistics	
Level-I	Level-II		Sq.Km	%
Forests	Dense Forests		0.00	0.00
	Open Forests		0.00	0.00
	Total Forests		0.00	0.00
Scrubs	Scrubs		0.92	17.01
Plantation	Social Forestry		0.02	0.37
	Plantation on OB Dump		0.22	4.07
	Plantation on Backfill		1.57	29.02
	Total Plantation		1.81	33.46
	Total Vegetation		2.73	50.46
Mining Area	Coal Quarry		0.06	1.11
	Advance Quarry Site		0.20	3.70
	External OB Dump		0.19	3.51
	Barren Backfilled area		1.03	19.04
	Coal Dump		0.12	2.22
	Total Area Under Mining		1.60	29.58
West Lands	West Lands		0.04	0.74
	Fly Ash Pond		0.00	0.00
	Total Waste Lands		0.04	0.74
Waterbodies	Reservoir,Nallah,Ponds		0.20	3.70
Agriculture	Crop Lands		0.00	0.00
	Fallow Lands		0.83	15.34
	Total Agriculture Land		0.83	15.34
Settlement	Urban Settlement		0.00	0.00
	Rural Settlement		0.00	0.00
	Industrial Settlement		0.01	0.18
	Total Settlement		0.01	0.19
Grand Total			5.40	100.00

LEGEND

- Road
- Haul Road
- Nalla
- Rail
- Lease Hold Area

Customer		South Eastern Coalfields Limited			
Job Title		Land Reclamation monitoring of OC Projects		Job No. 561410027	
Subject Land Reclamation monitoring of Dugga OC Based on Satellite Data (RESOURCESAT-2/ L4FMX) Dated 18.03.2012		Activity	Name	Designation	Signature
		Prepared	A. K. Singh	Sr. Mgr.(RSC)	
		Checked	N. P. Singh	GM(Geomatics)	
		Approved	N. P. Singh	GM(Geomatics)	
 cmpdi <i>A Mittal Raha Company</i>		Scale		Sheet 1 of 1	
				Rev. No. 0	
		Drg. No. H O R E M Z A 4 1 0 0 5			

Plate - 6.5

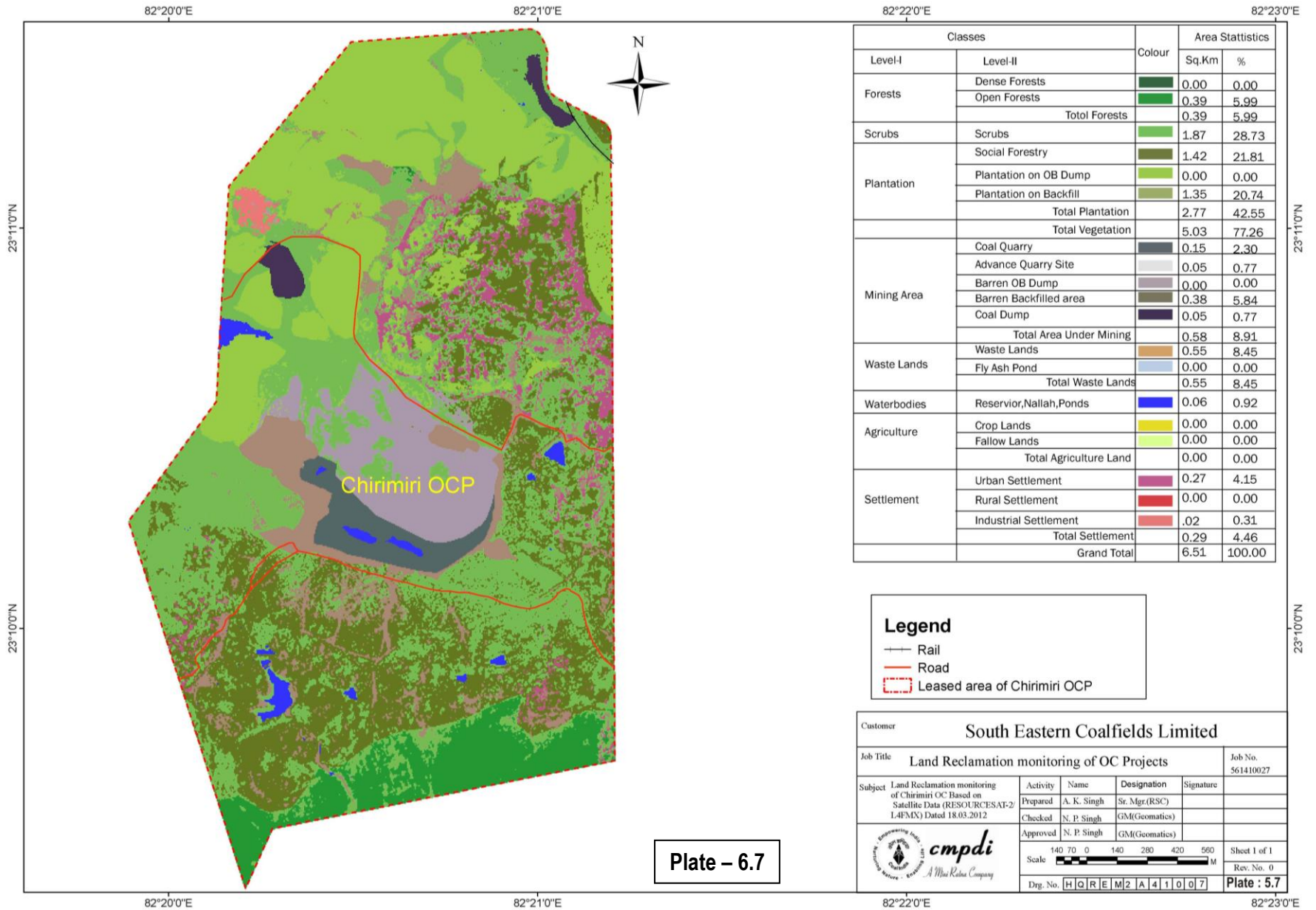


Classes		Colour	Area Statistics	
Level-I	Level-II		Sq.Km	%
Forests	Dense Forests		0.00	0.00
	Open Forests		0.00	0.00
	Total Forests		0.00	0.00
Scrubs	Scrubs		1.31	8.60
	Social Forestry		1.02	6.70
Plantation	Plantation on OB Dump		0.00	0.00
	Plantation on Backfill		7.04	46.23
	Total Plantation		8.06	52.93
	Total Vegetation		9.37	61.53
Mining Area	Coal Quarry		0.03	0.20
	Advance Quarry Site		0.00	0.00
	Barren OB Dump		0.00	0.00
	Barren Backfilled area		3.20	21.01
	Coal Dump		0.60	3.94
	Total Area Under Mining		3.44	22.59
Waste Lands	Waste Lands		0.29	1.90
	Fly Ash Pond		0.00	0.00
	Total Waste Lands		0.29	1.90
Waterbodies	Reservoir,Nallah,Ponds		1.19	7.81
Agriculture	Crop Lands		0.00	0.00
	Fallow Lands		0.89	5.84
	Total Agriculture Land		0.89	5.84
Settlement	Urban Settlement		0.00	0.00
	Rural Settlement		0.05	0.33
	Industrial Settlement		0.00	0.00
	Total Settlement		0.05	0.33
	Grand Total		15.23	100.00

Legend	
	Rail
	River
	Lease Area of BISRAPMUR OCP

Customer		South Eastern Coalfields Limited			
Job Title		Land Reclamation monitoring of OC Projects		Job No. 561410027	
Subject	Land Reclamation monitoring of Bishrampur OC Based on Satellite Data (RESOURCESAT-2/L4FMX) Dated 18.03.2012	Activity	Name	Designation	Signature
		Prepared	A. K. Singh	Sr. Mgr.(RSC)	
		Checked	N. P. Singh	GM(Geomatics)	
		Approved	V. K. Gupta	GM(Geomatics)	
Scale					
Drg. No.		HOREM2A41006			
		Sheet 1 of 1			
		Rev. No. 0			

Plate - 6.6



Classes		Colour	Area Statistics	
Level-I	Level-II		Sq.Km	%
Forests	Dense Forests		0.00	0.00
	Open Forests		0.39	5.99
	Total Forests		0.39	5.99
Scrubs	Scrubs		1.87	28.73
Plantation	Social Forestry		1.42	21.81
	Plantation on OB Dump		0.00	0.00
	Plantation on Backfill		1.35	20.74
	Total Plantation		2.77	42.55
	Total Vegetation		5.03	77.26
Mining Area	Coal Quarry		0.15	2.30
	Advance Quarry Site		0.05	0.77
	Barren OB Dump		0.00	0.00
	Barren Backfilled area		0.38	5.84
	Coal Dump		0.05	0.77
	Total Area Under Mining		0.58	8.91
Waste Lands	Waste Lands		0.55	8.45
	Fly Ash Pond		0.00	0.00
	Total Waste Lands		0.55	8.45
Waterbodies	Reservoir, Nallah, Ponds		0.06	0.92
Agriculture	Crop Lands		0.00	0.00
	Fallow Lands		0.00	0.00
	Total Agriculture Land		0.00	0.00
Settlement	Urban Settlement		0.27	4.15
	Rural Settlement		0.00	0.00
	Industrial Settlement		.02	0.31
	Total Settlement		0.29	4.46
Grand Total			6.51	100.00

Legend

- Rail
- Road
- Leased area of Chirimiri OCP

Customer		South Eastern Coalfields Limited		
Job Title		Land Reclamation monitoring of OC Projects		Job No. 561410027
Subject	Land Reclamation monitoring of Chirimiri OC Based on Satellite Data (RESOURCESAT-2/ L4FMX) Dated 18.03.2012	Activity	Name	Designation
		Prepared	A. K. Singh	Sr. Mgr.(RSC)
		Checked	N. P. Singh	GM(Geomatics)
		Approved	N. P. Singh	GM(Geomatics)
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Drg. No.		HOREM2A411007		Rev. No. 0

Plate - 6.7

Plate : 5.7

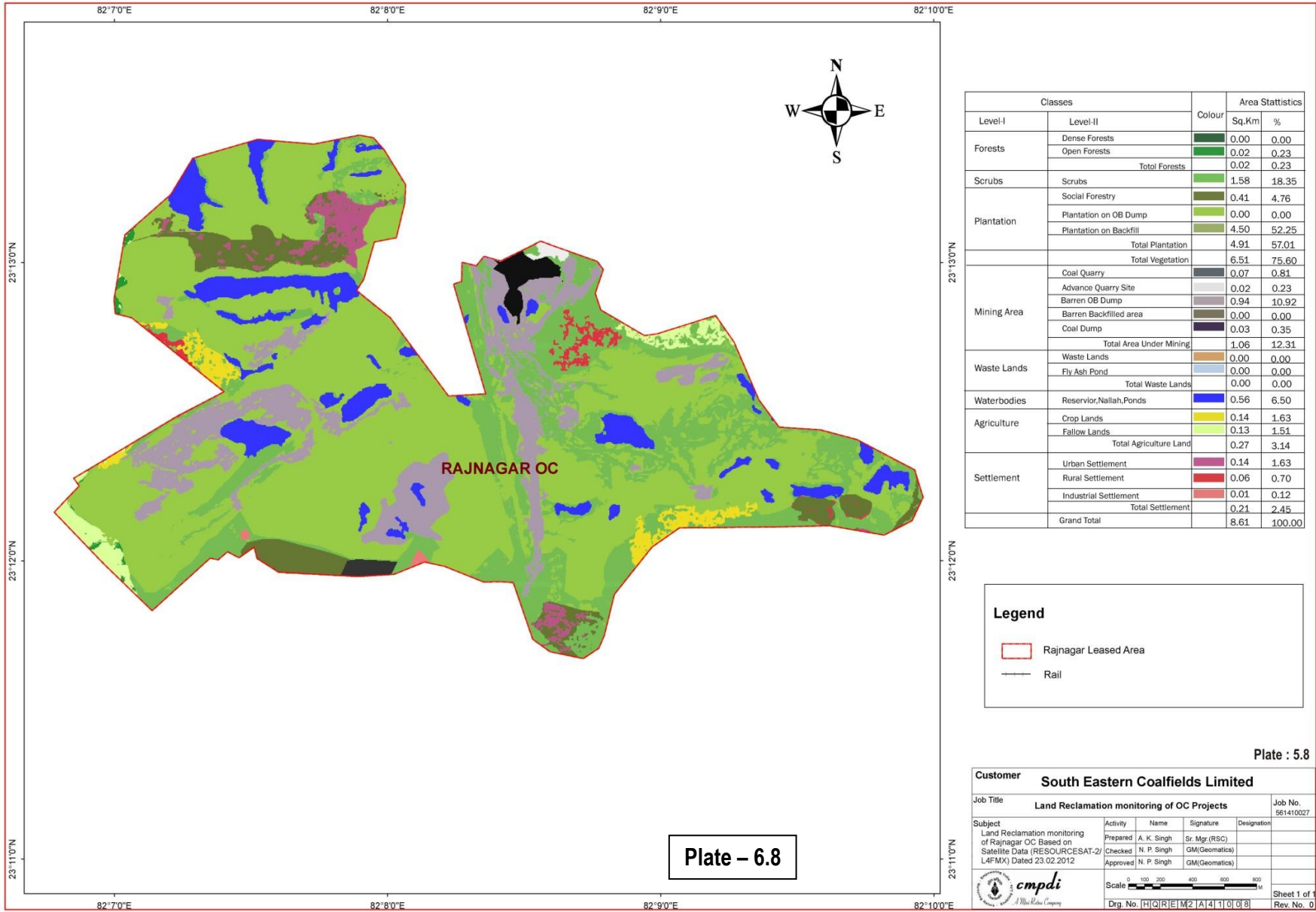


Plate - 6.8

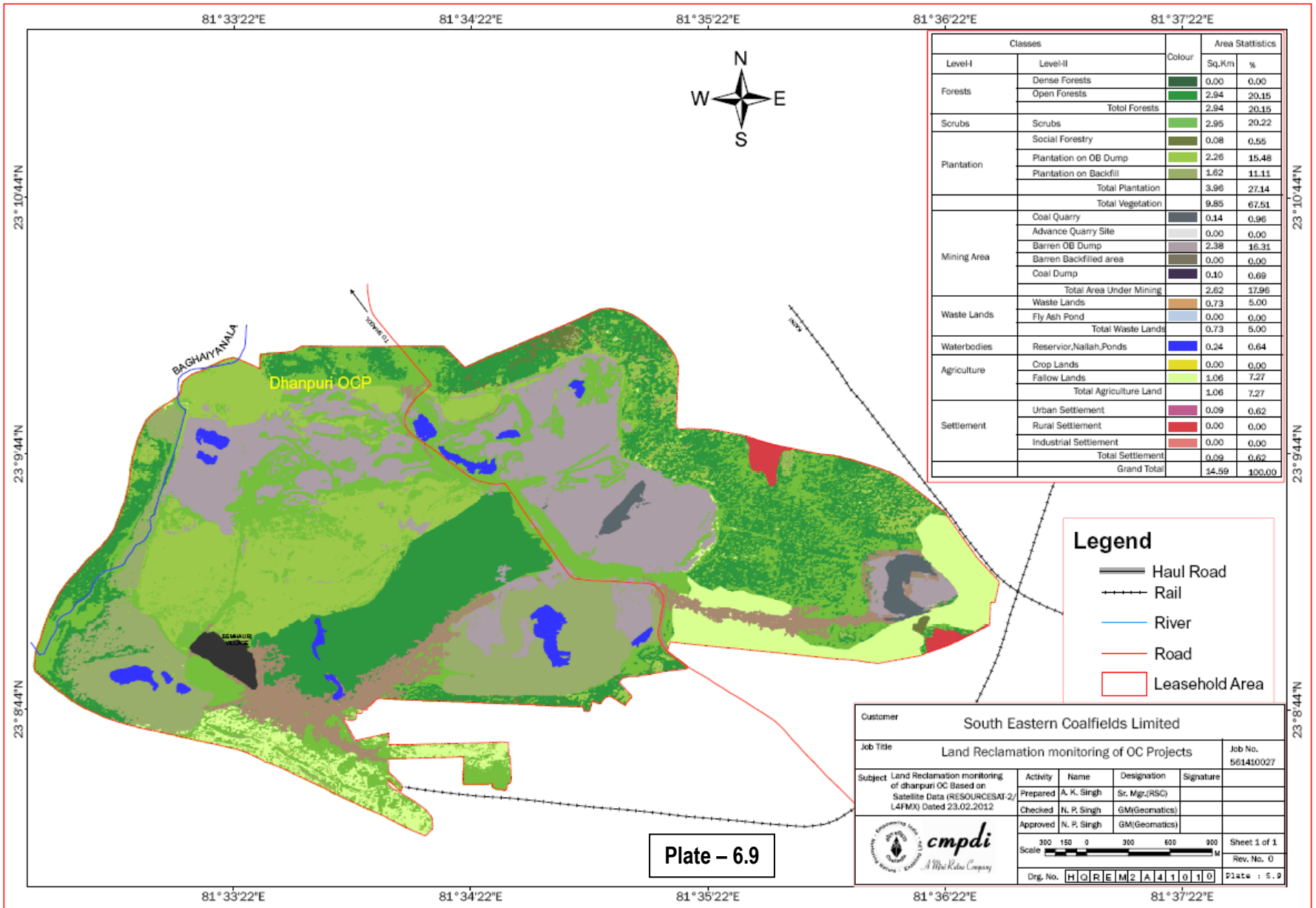
Classes		Colour	Area Statistics	
Level-I	Level-II		Sq.Km	%
Forests	Dense Forests		0.00	0.00
	Open Forests		0.02	0.23
	Total Forests		0.02	0.23
Scrubs	Scrubs		1.58	18.35
Plantation	Social Forestry		0.41	4.76
	Plantation on OB Dump		0.00	0.00
	Plantation on Backfill		4.50	52.25
	Total Plantation		4.91	57.01
	Total Vegetation		6.51	75.60
Mining Area	Coal Quarry		0.07	0.81
	Advance Quarry Site		0.02	0.23
	Barren OB Dump		0.94	10.92
	Barren Backfilled area		0.00	0.00
	Coal Dump		0.03	0.35
	Total Area Under Mining		1.06	12.31
Waste Lands	Waste Lands		0.00	0.00
	Fly Ash Pond		0.00	0.00
	Total Waste Lands		0.00	0.00
Waterbodies	Reservoir,Nallah,Ponds		0.56	6.50
Agriculture	Crop Lands		0.14	1.63
	Fallow Lands		0.13	1.51
	Total Agriculture Land		0.27	3.14
Settlement	Urban Settlement		0.14	1.63
	Rural Settlement		0.06	0.70
	Industrial Settlement		0.01	0.12
	Total Settlement		0.21	2.45
Grand Total			8.61	100.00

Legend

- Rajnagar Leased Area
- Rail

Plate : 5.8

Customer		South Eastern Coalfields Limited		
Job Title	Land Reclamation monitoring of OC Projects			Job No. 561410027
Subject	Activity	Name	Signature	Designation
Land Reclamation monitoring of Rajnagar OC Based on Satellite Data (RESOURCESAT-2/ L4FMX) Dated 23.02.2012	Prepared	A. K. Singh		Sr. Mgr.(RSC)
	Checked	N. P. Singh		GM(Geomatics)
	Approved	N. P. Singh		GM(Geomatics)
Scale				
		Sheet 1 of 1		
Drp. No. H R E M 2 A 4 1 0 8		Rev. No. 0		



Classes		Colour	Area Statistics	
Level-I	Level-II		Sq.Km	%
Forests	Dense Forests		0.00	0.00
	Open Forests		2.94	20.15
	Total Forests		2.94	20.15
Scrubs	Scrubs		2.95	20.22
Plantation	Social Forestry		0.08	0.55
	Plantation on OB Dump		2.26	15.48
	Plantation on Backfill		1.62	11.11
	Total Plantation		3.96	27.14
	Total Vegetation		9.85	67.51
Mining Area	Coal Quarry		0.14	0.96
	Advance Quarry Site		0.00	0.00
	Barren OB Dump		2.38	16.31
	Barren Backfilled area		0.00	0.00
	Coal Dump		0.10	0.69
	Total Area Under Mining		2.62	17.96
Waste Lands	Waste Lands		0.73	5.00
	Fly Ash Pond		0.00	0.00
	Total Waste Lands		0.73	5.00
Waterbodies	Reservoir, Nallah, Ponds		0.24	0.64
Agriculture	Crop Lands		0.00	0.00
	Fallow Lands		1.06	7.27
	Total Agriculture Land		1.06	7.27
Settlement	Urban Settlement		0.09	0.62
	Rural Settlement		0.00	0.00
	Industrial Settlement		0.00	0.00
	Total Settlement		0.09	0.62
Grand Total			14.59	100.00

Legend

- Haul Road
- Rail
- River
- Road
- Leasehold Area

Customer		South Eastern Coalfields Limited			
Job Title		Land Reclamation monitoring of OC Projects		Job No. 561410027	
Subject	Land Reclamation monitoring of dhanpuri OC Based on Satellite Data (RESOURCESAT-2/L4FMX) Dated 23.02.2012	Activity	Name	Designation	Signature
		Prepared	A. K. Singh	Sr. Mgr./RSC	
		Checked	N. P. Singh	GM(Geomatics)	
		Approved	N. P. Singh	GM(Geomatics)	
 cmpdi <i>A Wet-Rotom Company</i>		Scale		Sheet 1 of 1	
				Rev. No. 0	
Drg. No.		HQRE/MA/10/10		Plate : 5.9	

Plate - 6.9

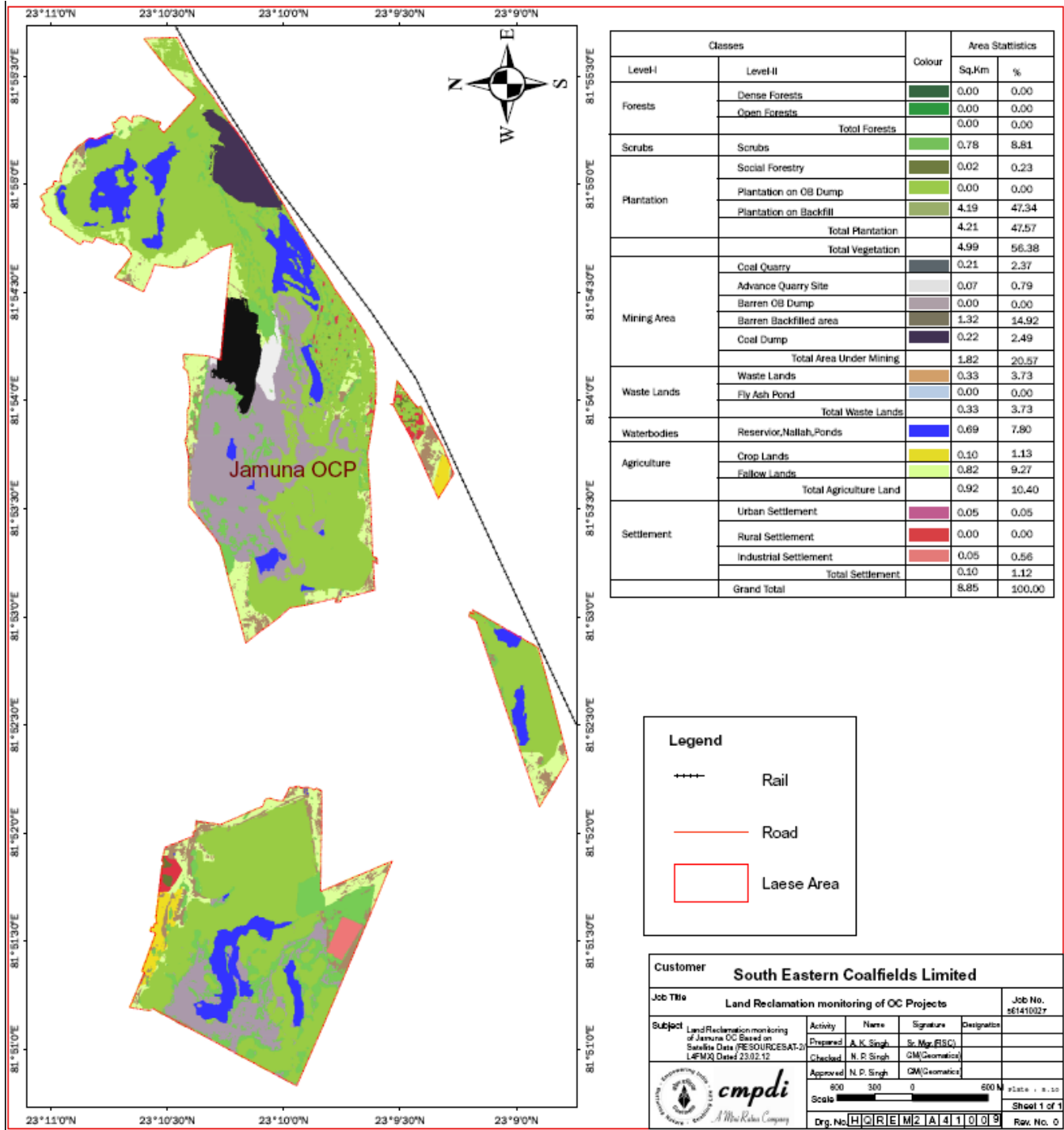


Plate – 6.10

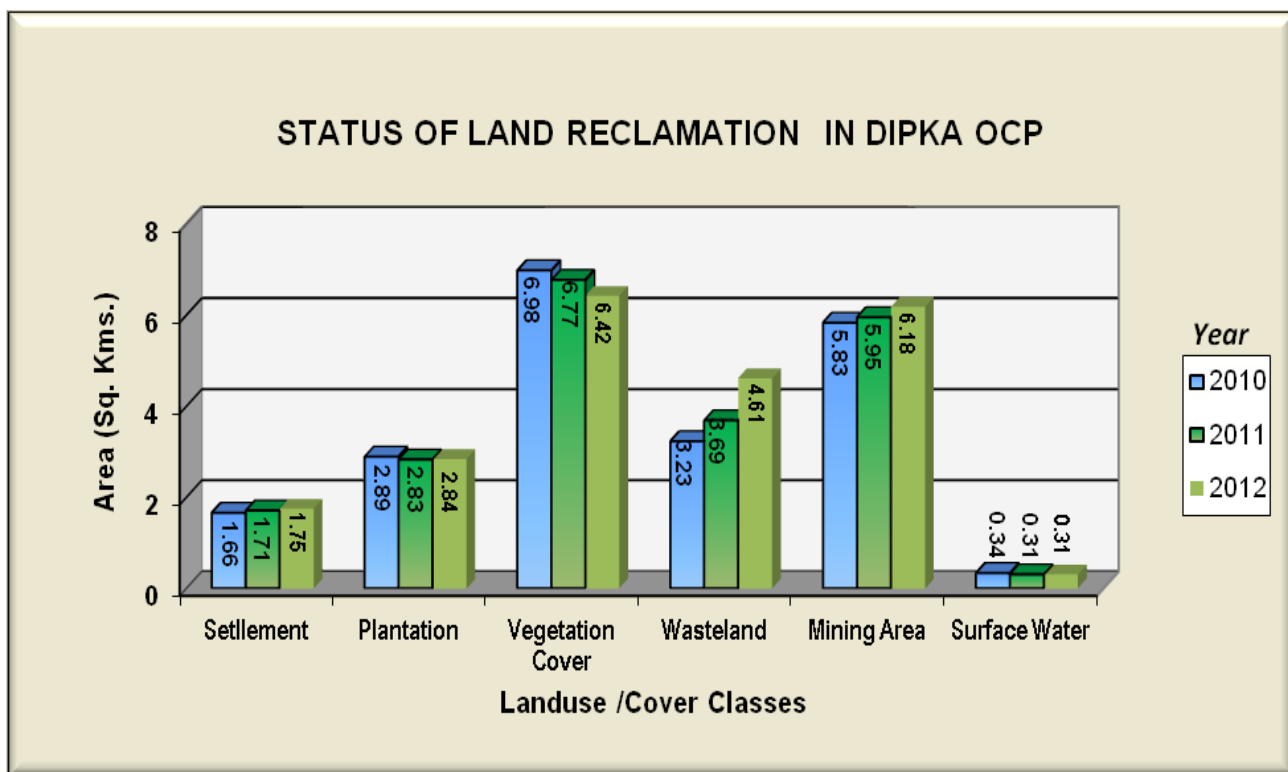


Figure 6.2

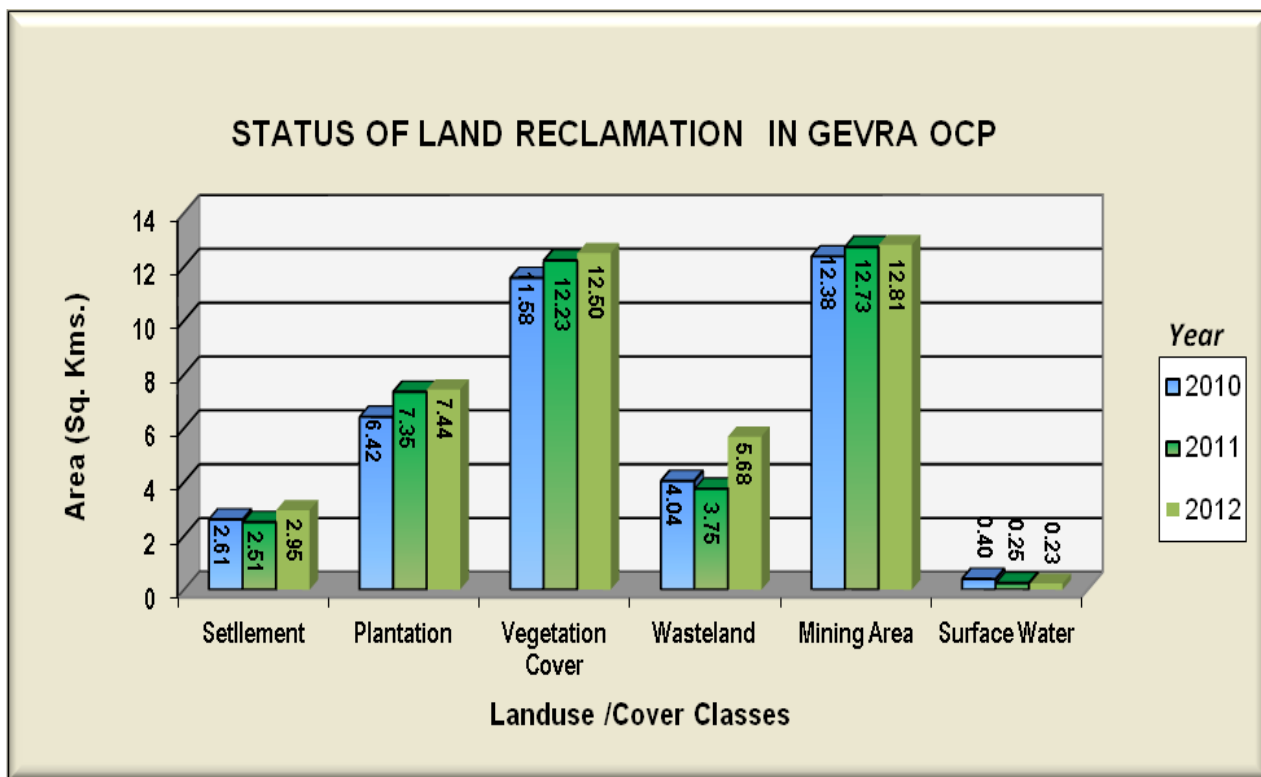


Figure 6.3

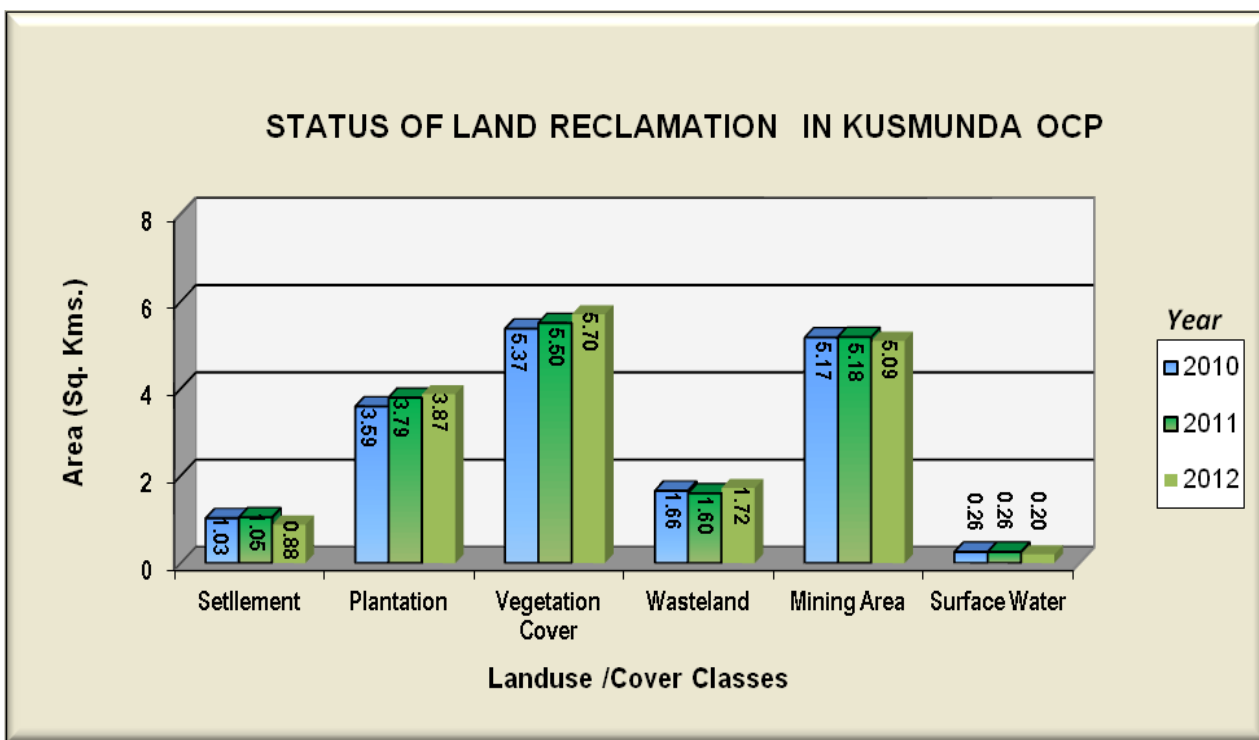


Figure 6.4

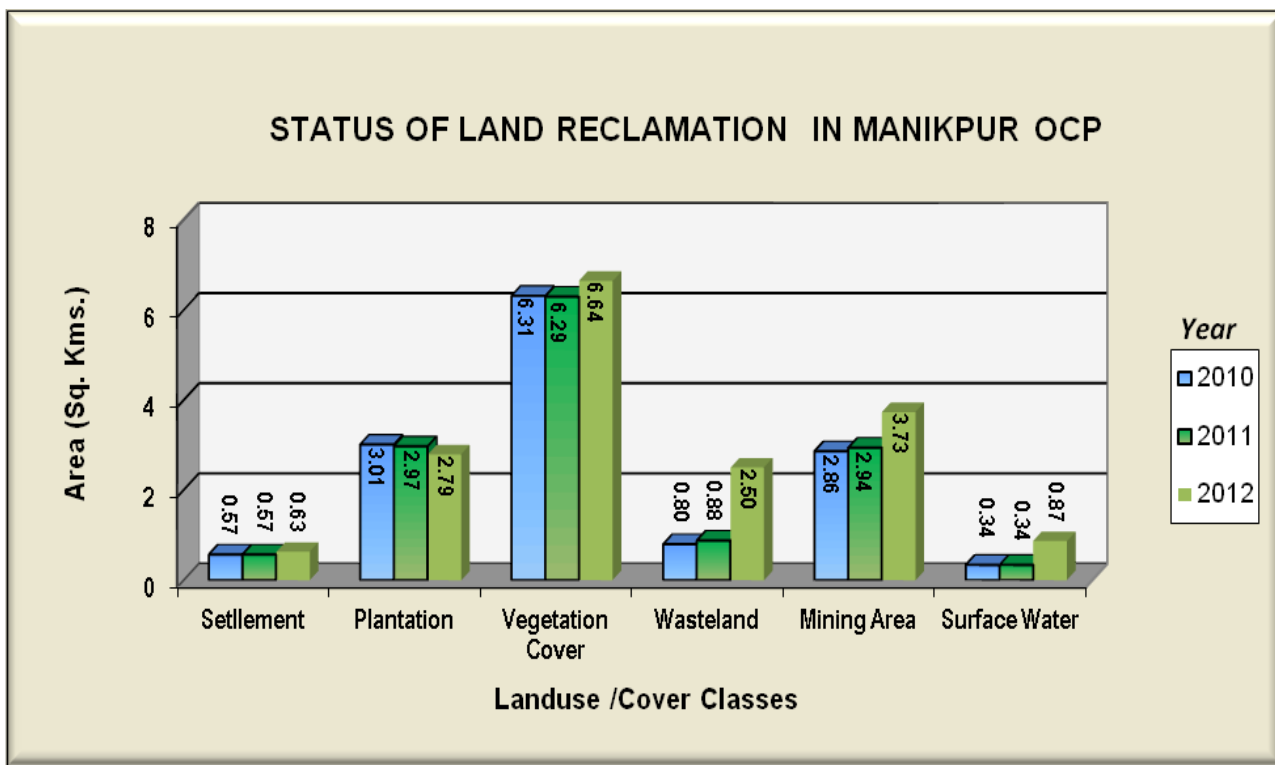


Figure 6.5

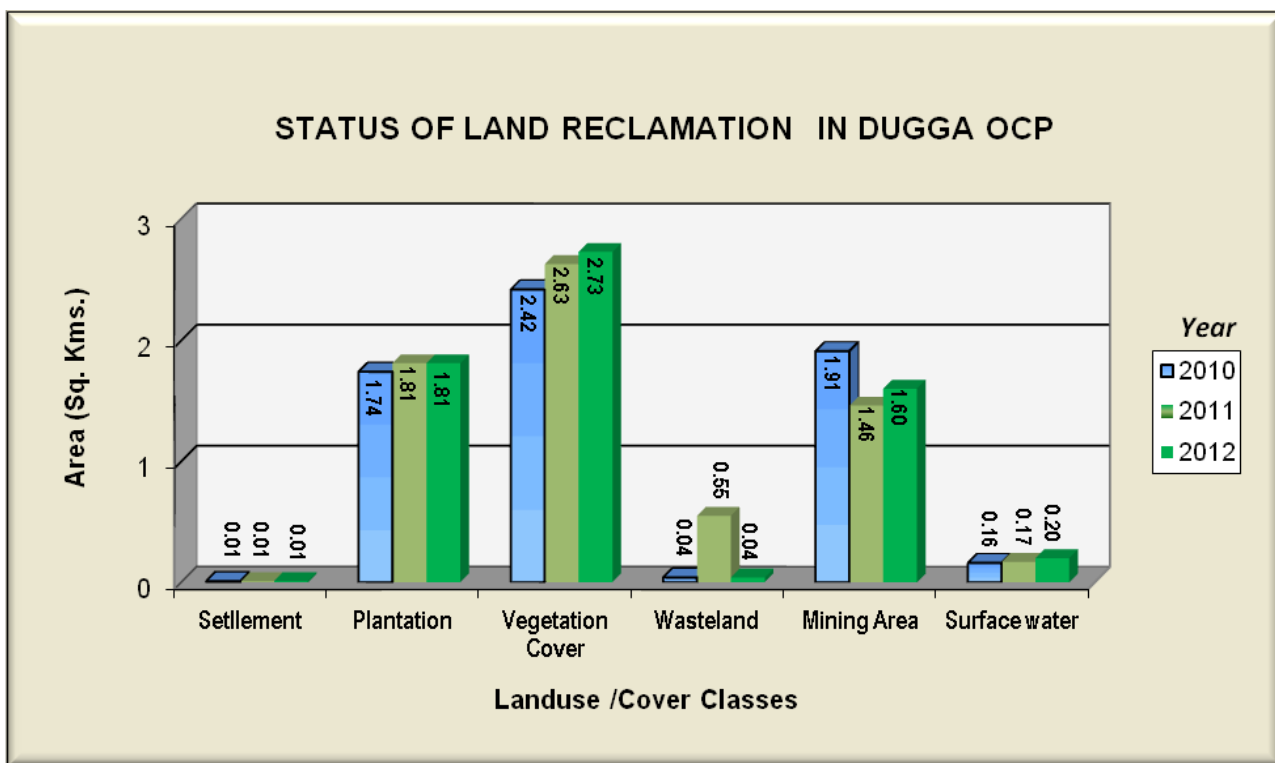


Figure 6.6

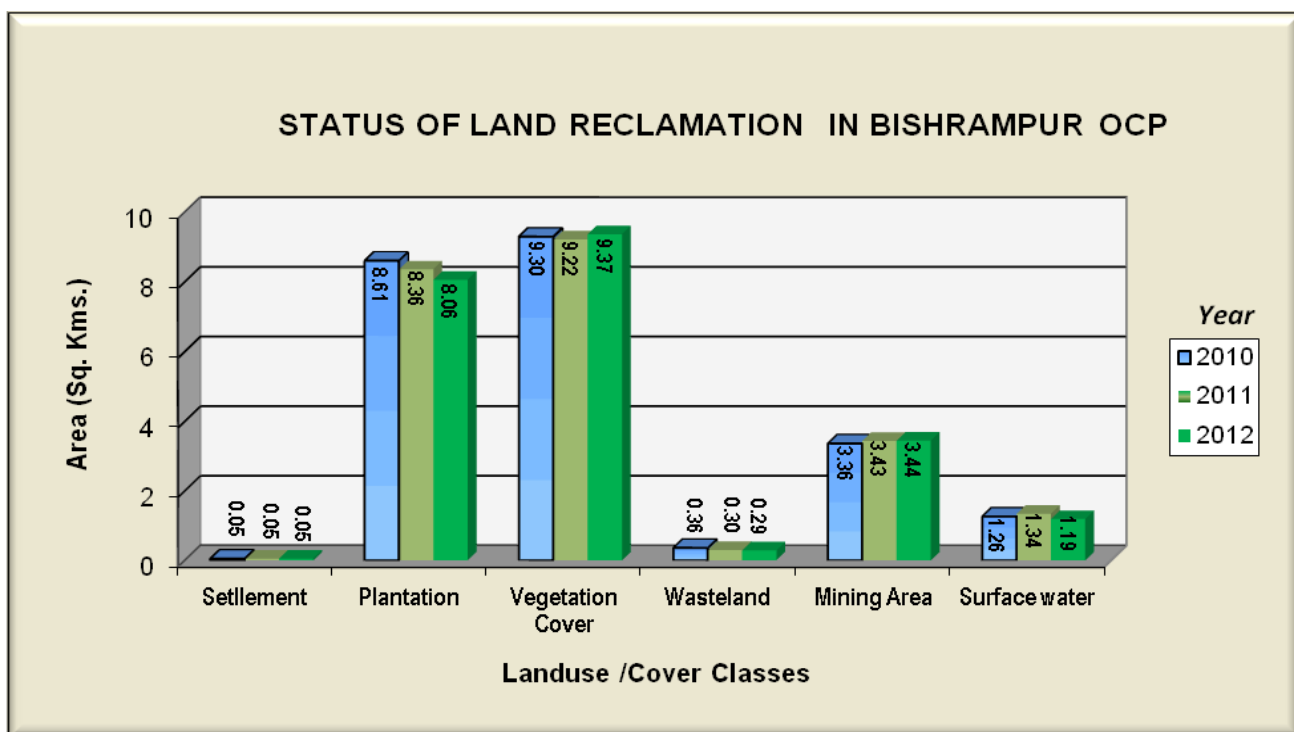


Figure 6.7

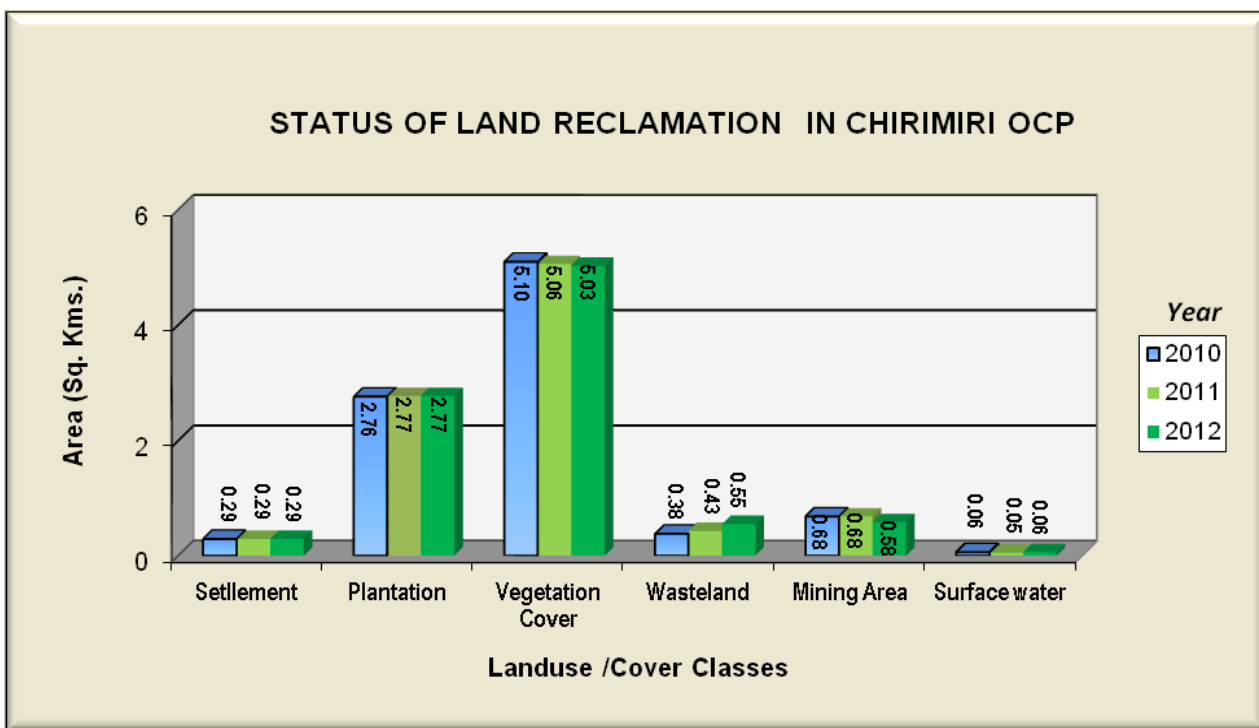


Figure 6.8

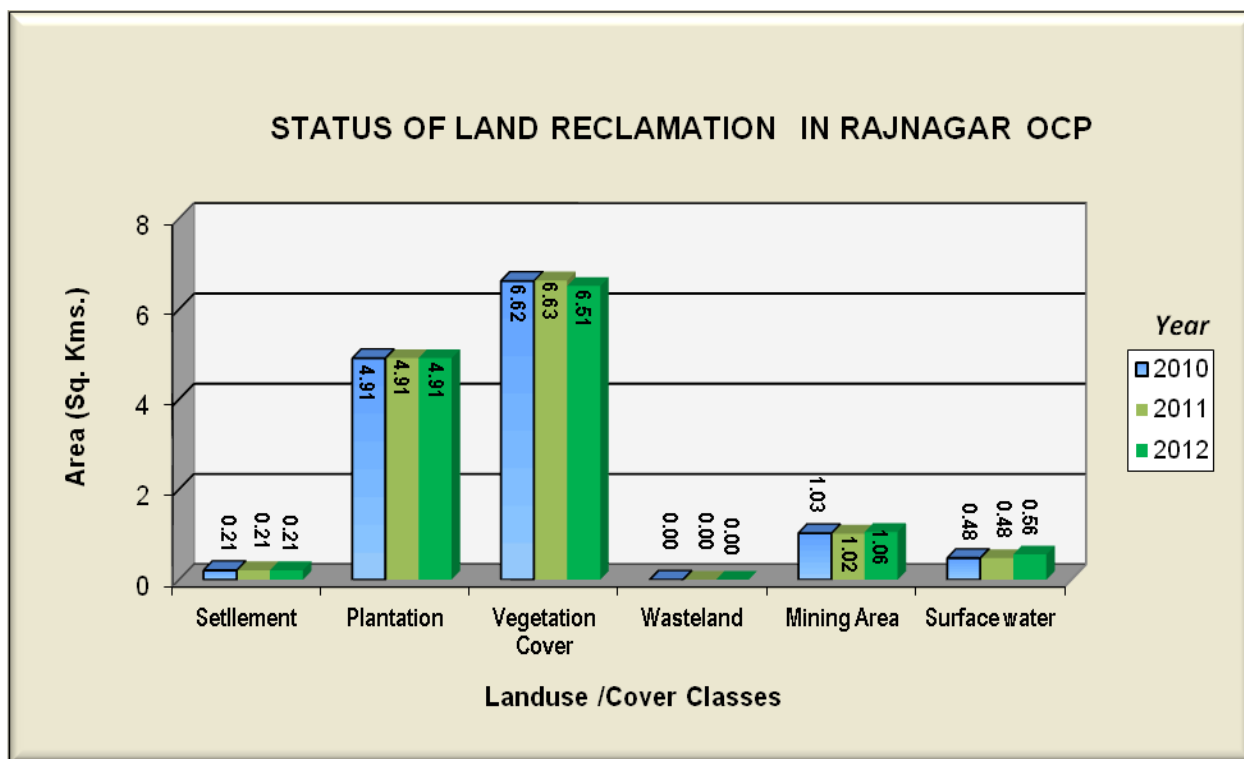


Figure 6.9

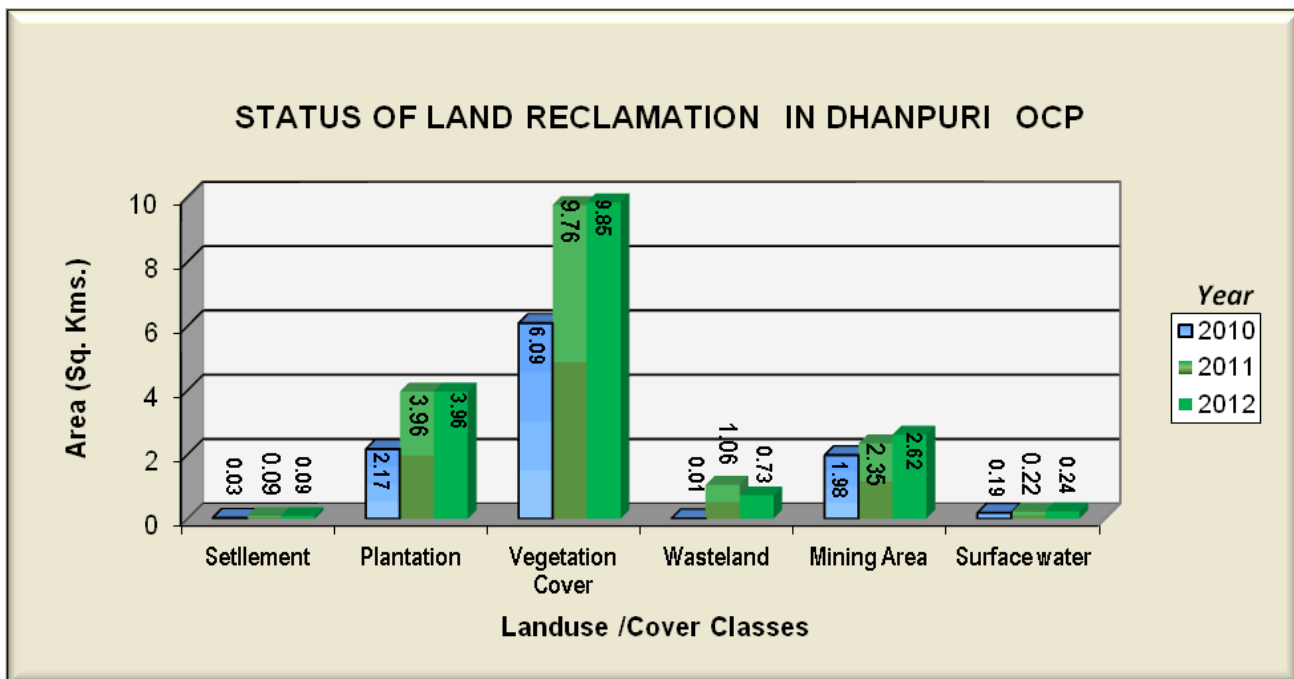


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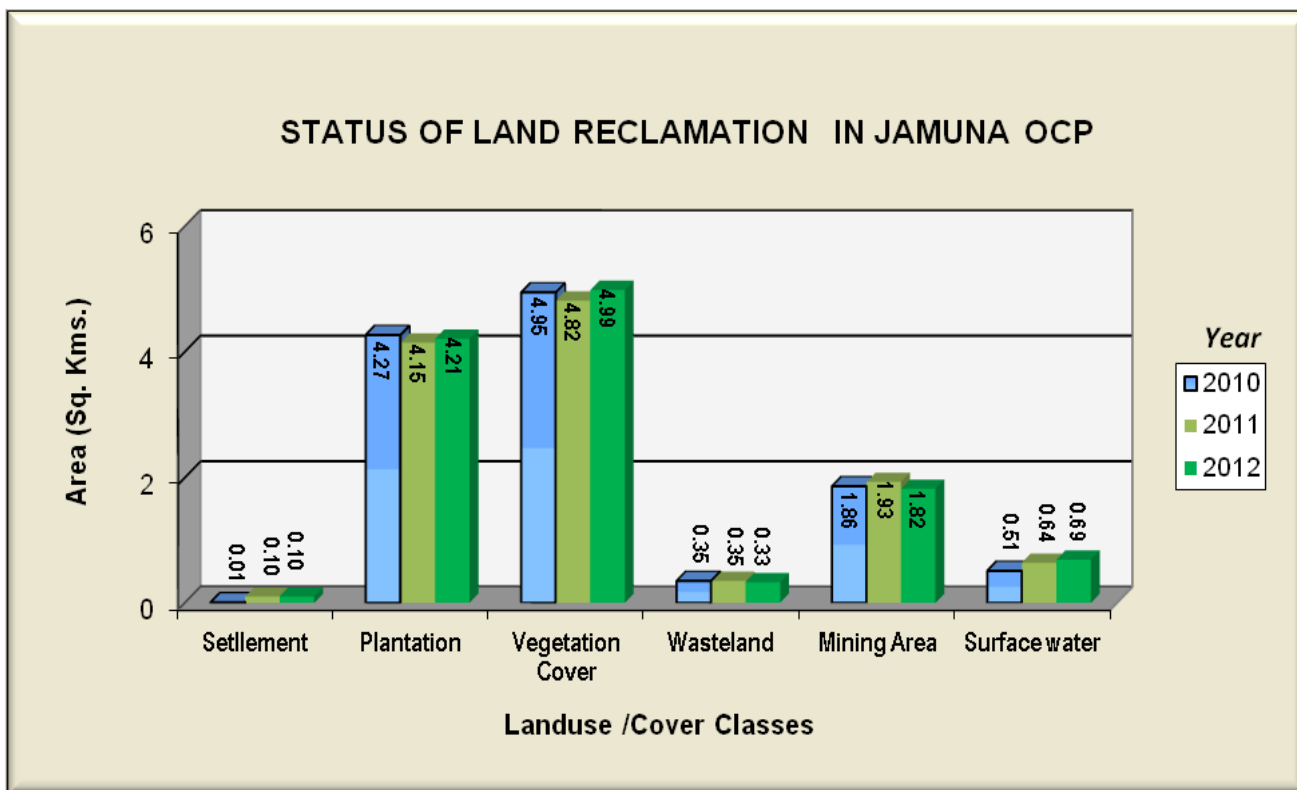


Figure 6.11



Photograph – 6.1: *Plantation on OB Dump in Dipka Opencast Project*



Photograph – 6.2: *Plantation on OB Dump in Gevra Opencast Project*



Photograph – 6.3: *Plantation on OB Dump in Kusmunda Opencast Project*



Photograph – 6.4: *Plantation on OB Dump in Manikpur Opencast Project*



Photograph – 6.5: *Plantation on OB Dump in Dugga Opencast Project*



Photograph – 6.6: *Plantation on OB Dump in Bishrampur Opencast Project*



Photograph – 6.7: **Plantation on OB Dump in Chirimiri Opencast Project**



Photograph – 6.8: **Plantation on OB Dump in Rajnagar Opencast Project**



Photograph – 6.9: *Plantation on OB Dump in Dhanpuri Opencast Project*



Photograph – 6.10: *Plantation on OB Dump in Jamuna Opencast Project*

NORTHERN COALFIELDS LIMITED

7.0 Land Reclamation Status in Northern Coalfields Ltd.

7.1 Following 10 OC projects producing more than 5 million cubic m. (Coal + OB together) of Northern Coalfields Ltd. have been taken up for land reclamation monitoring during the year 2012:

- Amlohri
- Nigahi
- Jayant
- Dudhichua
- Khadia
- Krishnashila
- Bina
- Kakri
- Jhingurdah
- Block-B

7.2 Project wise Land Reclamation status in NCL for the year 2012 is given in Table 7.1 and also shown graphically in Fig 7.1. Area statistics of different land use class present in the mine leasehold of the above projects for the year 2012 are shown in the Table – 7.2. Land use maps derived from satellite data are shown in Plate 7.1 – 7.10. Land reclamation status of the above mentioned 10 projects, were also prepared for the year 2009, 2010 and 2011. Year wise changes in the different land use classes based on satellite data are depicted in Bar Charts in Fig. 7.3 to 7.12.

7.3 Study reveals that 90.22 Km² of mining area has already been reclaimed by NCL out of which 61.70 Km² area has been revegetated and 28.52 Km² area are under backfilling. There is an increase of 0.39 Km² reclaimed area in NCL with respect to the year 2011.

- 7.4** After analyzing the satellite data of year 2011 vs. 2012, it is evident that plantation carried out on backfilled area, OB dumps as well as under social forestry in all the mines of NCL has increased from 59.94 Km². to 61.70 Km² in span of last one year. This increase of 1.76 Km² area of plantation in one year time is due to the efforts of NCL towards mine land reclamation.
- 7.5** It has been also observed that in Block-B project, plantation percentage in the year 2012 has reduced marginally in respect to the previous year i.e. 2011. This has occurred primarily due to dumping on the dumps on which some plantation had come up but these dumps had not yet attained the designed height.
- 7.6** Out of 10 projects of NCL, maximum land reclamation has been carried out in Jhingurdah Project (93.66%) followed by Bina (89.56%) and Kakri (87.24%).

Table 7.1

Summarised Land Reclamation Status in Opencast Projects of NCL based on Satellite Data of the year 2012

Sl. No.	Project		% Calculated in terms of Total Excavated Area									
	Name	Leasehold (i)	Plantation		Under Backfilling / OB		Area under Active Mining		Total Excavated Area		Total Reclaimed area	
			ii		iii		iv		ii+iii+iv		ii+iii	
			2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
1	AMLOHRI	31.23	9.92	10.75	4.46	4.44	2.52	2.67	16.90	17.86	14.38	15.19
			58.70	60.19	26.39	24.86	14.91	14.95			85.09	85.05
2	NIGAH	30.16	9.94	9.96	4.60	4.60	2.49	3.17	17.03	17.73	14.54	14.56
			58.37	56.18	27.01	25.94	14.62	17.88			85.38	82.12
3	JAYANT	22.94	12.41	12.56	3.86	3.52	2.96	3.17	19.23	19.25	16.27	16.08
			64.53	65.25	20.07	18.29	15.39	16.47			84.61	83.53
4	DUDHICHUA	14.00	3.95	4.01	4.21	4.15	2.20	2.45	10.36	10.61	8.16	8.16
			38.13	37.79	40.64	39.11	21.24	23.09			78.76	76.91
5	KHADIA	14.91	5.37	5.44	3.40	3.29	1.35	1.47	10.12	10.20	8.77	8.73
			53.06	53.33	33.60	32.25	13.34	14.41			86.66	85.59
6	KRISHNASHILA	5.94	1.12	1.12	0.55	0.55	0.57	0.57	2.24	2.24	1.67	1.67
			50.00	50.00	24.55	24.55	25.45	25.45			74.55	74.55
7	BINA	15.68	5.97	6.31	3.58	3.30	1.06	1.12	10.61	10.73	9.55	9.61
			56.27	58.81	33.74	30.75	9.99	10.44			90.01	89.56
8	KAKRI	13.60	5.92	5.97	1.75	1.62	1.13	1.11	8.80	8.70	7.67	7.59
			67.27	68.62	19.89	18.62	12.84	12.76			87.16	87.24
9	JHINGURDAH	12.43	4.96	5.27	0.84	0.79	0.49	0.41	6.29	6.47	5.80	6.06
			78.86	81.45	13.35	12.21	7.79	6.34			92.21	93.66
10	BLOCK-B	18.51	0.38	0.31	2.64	2.26	1.13	1.47	4.15	4.04	3.02	2.57
			9.16	7.67	63.61	55.94	27.23	36.39			72.77	63.61
TOTAL (NCL)		179.40	59.94	61.70	29.89	28.52	15.90	17.61	105.73	107.83	89.83	90.22
			56.69	57.22	28.27	26.45	15.04	16.33	58.94	60.11	84.96	83.67

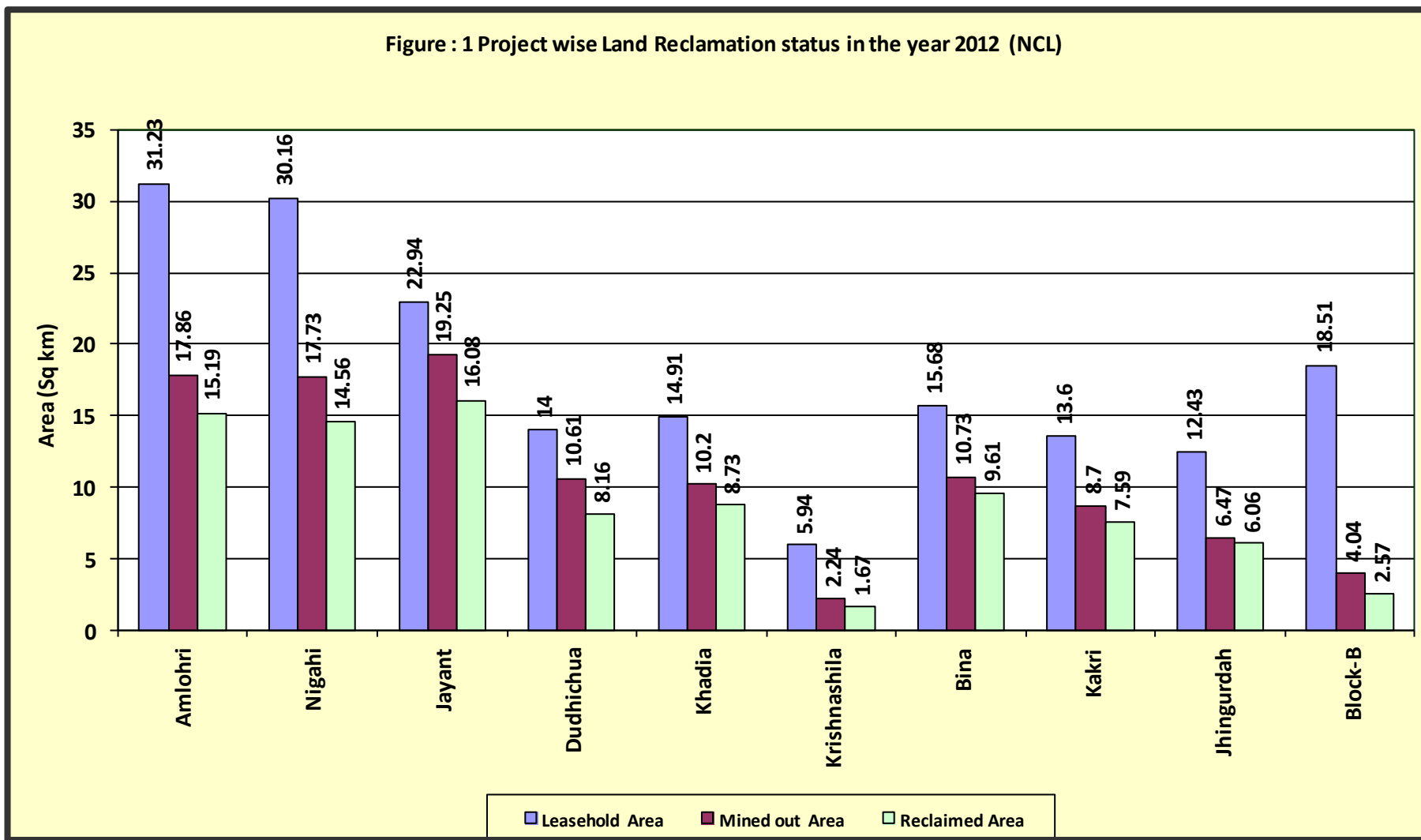


Fig.7.1: Land reclamation status in OC projects of NCL in the Year-2012

Table 7.2

PROJECTWISE LAND USE/ RECLAMATION STATUS IN OC MINES (>5mcu.m) OF NORTHERN COALFIELDS LTD BASED ON SATELLITE DATA OF THE YEAR 2012

(Area in Sq Km)

	AMLOHRI		NIGAIH		JAYANT		DUDHICHUA		KHADIA		KRISHNASHILA		BINA		KAKRI		JHINGURDAH		BLOCK-B		Overall Blockwise			
	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%		
FORESTS	Dense Forest	1.38	4.40	0.19	0.63	0.00	0.01	0.00	0.00	0.08	0.56	0.01	0.21	0.00	0.00	0.02	0.15	0.01	0.08	1.88	10.17	3.57	1.99	
	Open Forest	1.21	3.87	3.38	11.32	0.11	0.56	0.84	6.00	1.62	10.89	1.73	29.01	0.42	2.66	1.94	14.25	1.15	9.25	3.86	20.85	16.26	9.06	
	Total Forest	2.58	8.27	3.57	11.95	0.13	0.57	0.84	6.00	1.70	11.45	1.74	29.22	0.42	2.66	1.96	14.41	1.16	9.33	5.74	31.02	19.84	11.06	
SCRUBS	Scrubs	1.80	5.76	2.17	7.20	1.07	5.15	1.75	12.50	1.48	9.95	1.35	22.55	3.39	21.61	1.61	11.86	3.34	26.87	4.96	26.79	22.92	12.78	
	Social Forestry	7.70	24.66	4.92	16.30	4.05	17.60	0.81	5.77	3.24	21.76	1.03	17.35	3.36	21.44	3.85	28.31	1.75	14.08	0.03	0.14	30.74	17.13	
PLANTATION	Plantation on OB Dump	1.64	5.24	2.53	8.38	2.82	12.02	1.17	8.34	0.65	4.27	0.09	1.54	0.44	2.80	0.38	2.82	1.85	14.88	0.28	1.51	11.85	6.60	
	Plantation on Backfill	1.41	4.53	2.51	8.31	5.69	24.44	2.03	14.48	1.55	10.37	0.00	0.00	2.51	15.97	1.74	12.82	1.67	13.44	0.00	0.00	19.11	10.65	
	Total Plantation (Biological Reclamation)	10.75	34.43	9.96	32.99	12.56	54.06	4.01	28.59	5.44	36.40	1.12	18.89	6.31	40.21	5.97	43.90	5.27	42.40	0.31	1.65	61.70	34.39	
	Total Vegetation	15.14	48.46	15.70	52.14	13.76	59.78	6.60	47.09	8.62	57.80	4.21	70.66	10.12	64.48	9.54	70.15	9.77	78.60	11.01	59.46	104.47	58.23	
ACTIVE MINING	Coal Quarry	1.11	3.55	2.30	7.63	2.80	11.81	2.13	15.33	0.92	6.17	0.40	6.81	0.83	5.30	0.84	6.18	0.26	2.09	0.91	4.91	12.50	6.97	
	Advance Quarry Site	1.49	4.76	0.87	2.90	0.29	0.76	0.32	2.30	0.36	2.40	0.17	2.90	0.10	0.66	0.19	1.40	0.00	0.00	0.01	0.06	3.80	2.12	
	Coal Dump	0.00	0.00	0.00	0.00	0.08	0.35	0.00	0.00	0.03	0.20	0.00	0.00	0.19	1.18	0.00	0.00	0.00	0.00	0.11	0.58	0.41	0.23	
	Quarry Filled With Water	0.08	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.16	1.09	0.00	0.00	0.00	0.00	0.08	0.59	0.15	1.21	0.44	2.40	0.91	0.51	
	Total Area Under Active Mining	2.67	8.56	3.17	10.53	3.17	12.92	2.45	17.63	1.47	9.86	0.57	9.71	1.12	7.14	1.11	8.16	0.41	3.30	1.47	7.95	17.61	9.82	
RECLAIMED	Barren OB Dump	1.64	5.24	1.44	4.76	0.18	1.05	0.48	3.40	0.64	4.28	0.36	6.14	0.28	1.81	0.68	5.00	0.61	4.91	2.13	11.51	8.44	4.70	
	Barren Backfilled Area	2.81	8.99	3.16	10.48	3.34	15.78	3.67	26.22	2.65	17.74	0.19	3.19	3.02	19.25	0.94	6.91	0.18	1.45	0.13	0.69	20.09	11.20	
	Total Area Under Technical Reclamation	4.44	14.23	4.60	15.24	3.52	16.83	4.15	29.62	3.29	22.02	0.55	9.33	3.30	21.06	1.62	11.91	0.79	6.36	2.26	12.20	28.52	15.90	
	Total Area Under Mine Operations	7.12	22.79	7.77	25.76	6.69	29.75	6.60	47.25	4.76	31.88	1.12	19.04	4.42	28.20	2.73	20.07	1.20	9.65	3.73	20.15	46.14	25.72	
WASTELANDS	Waste Lands	2.02	6.49	0.60	1.98	0.20	0.87	0.21	1.49	0.24	1.60	0.24	4.03	0.09	0.75	0.19	1.40	0.27	2.17	2.78	15.08	6.84	3.81	
	Fly Ash Pond	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	3.00	0.02	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.11	
	Total Wasteland	2.02	6.49	0.60	1.98	0.20	0.87	0.21	1.49	0.24	1.60	0.42	7.03	0.11	0.80	0.19	1.40	0.27	2.17	2.78	15.08	7.04	3.93	
WATERBODIES	Reservoir, nallah, ponds	0.05	0.16	0.08	0.27	0.49	2.13	0.01	0.09	0.04	0.29	0.05	0.83	0.23	1.46	0.21	1.54	0.03	0.24	0.11	0.59	1.30	0.72	
	Total Waterbodies	0.05	0.16	0.08	0.27	0.49	2.13	0.01	0.09	0.04	0.29	0.05	0.83	0.23	1.46	0.21	1.54	0.03	0.24	0.11	0.59	1.30	0.72	
		Total Agriculture	3.80	12.17	0.34	1.11	0.00	0.02	0.44	3.11	0.00	0.02	0.04	0.71	0.09	0.45	0.00	0.00	0.52	4.18	0.65	3.48	5.88	3.28
AGRICULTURE	Crop Lands	2.87	9.19	0.28	0.92	0.00	0.00	0.01	0.04	0.00	0.00	0.04	0.69	0.07	0.40	0.00	0.00	0.47	3.78	0.59	3.18	4.33	2.41	
	Fallow Lands	0.93	2.98	0.06	0.19	0.00	0.02	0.43	3.07	0.00	0.02	0.00	0.02	0.02	0.05	0.00	0.00	0.05	0.40	0.06	0.30	1.55	0.86	
		Total Agriculture	3.80	12.17	0.34	1.11	0.00	0.02	0.44	3.11	0.00	0.02	0.04	0.71	0.09	0.45	0.00	0.00	0.52	4.18	0.65	3.48	5.88	3.28
		Total Settlement	3.10	9.93	5.67	18.74	1.80	7.45	0.14	0.97	1.25	8.41	0.10	1.73	0.72	4.61	0.93	6.84	0.64	5.15	0.23	1.24	14.58	8.13
SETTLEMENTS	Urban Settlement	2.06	6.60	4.80	15.87	1.43	6.23	0.00	0.00	1.11	7.47	0.10	1.73	0.44	2.80	0.90	6.62	0.45	3.62	0.04	0.22	11.33	6.32	
	Rural Settlement	0.76	2.43	0.01	0.02	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	0.12	0.67	0.89	0.50	
	Industrial Settlement	0.28	0.90	0.86	2.85	0.37	1.22	0.14	0.97	0.14	0.94	0.00	0.00	0.28	1.81	0.03	0.22	0.19	1.53	0.07	0.35	2.36	1.32	

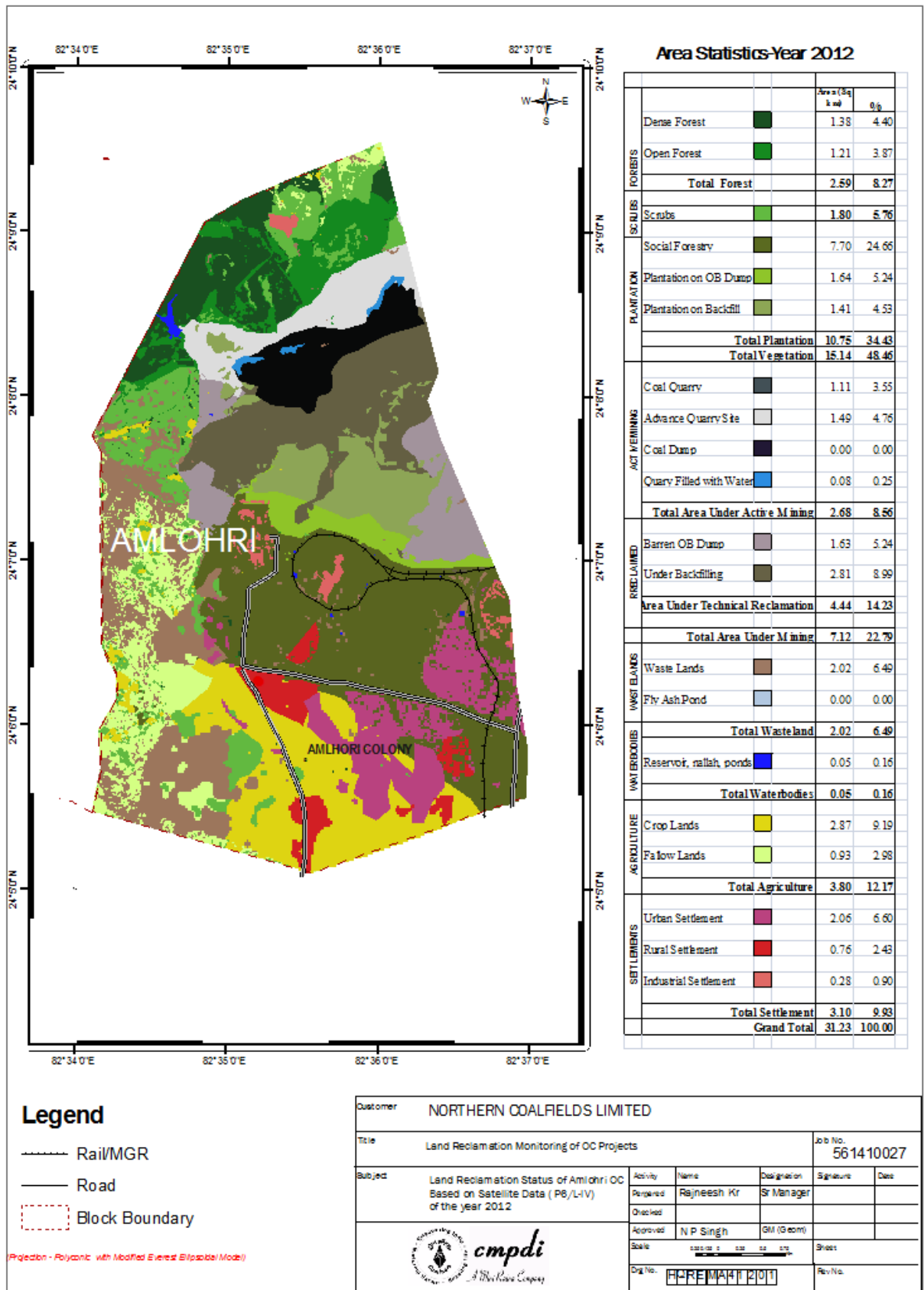


Plate 7.1

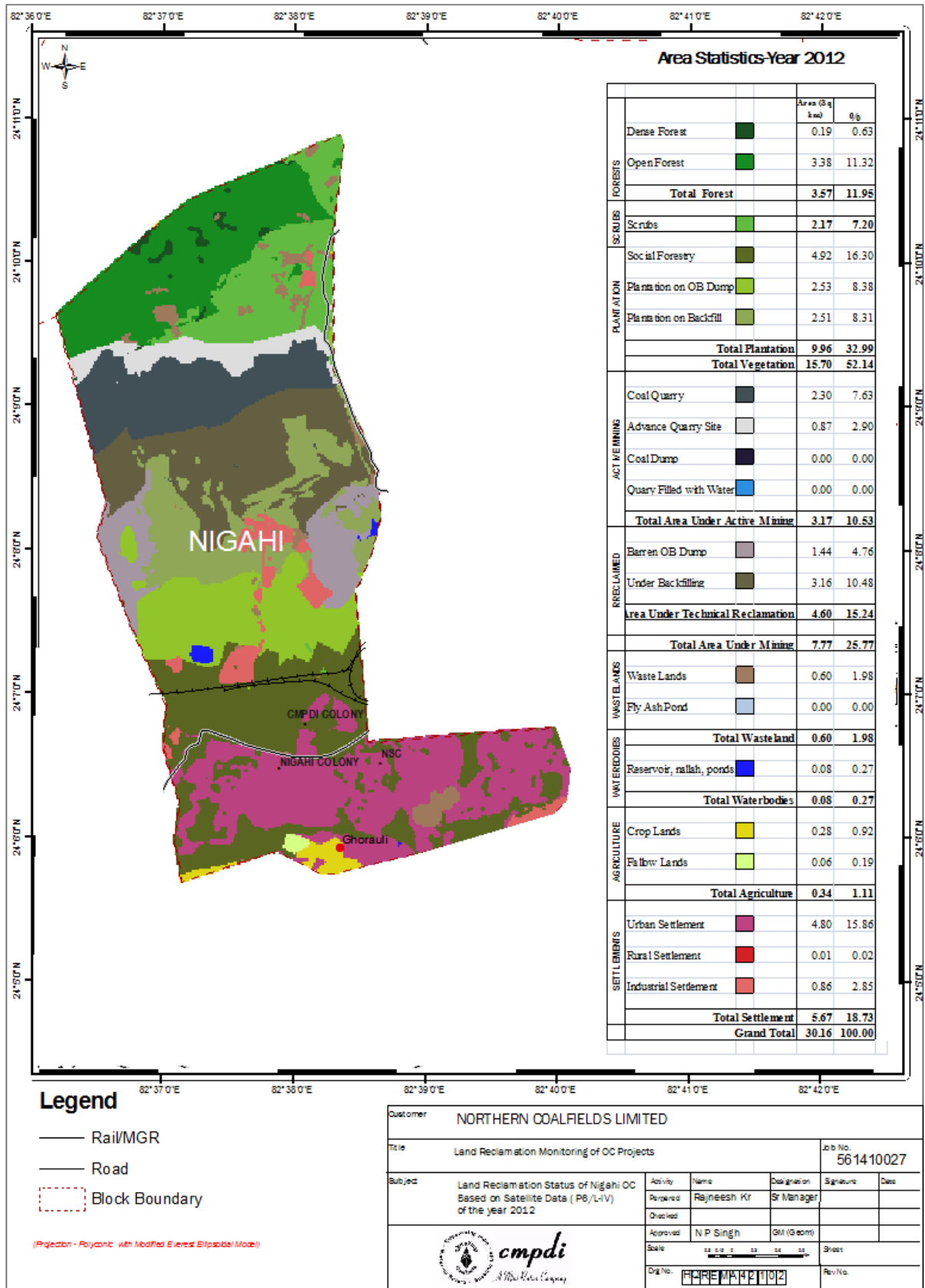


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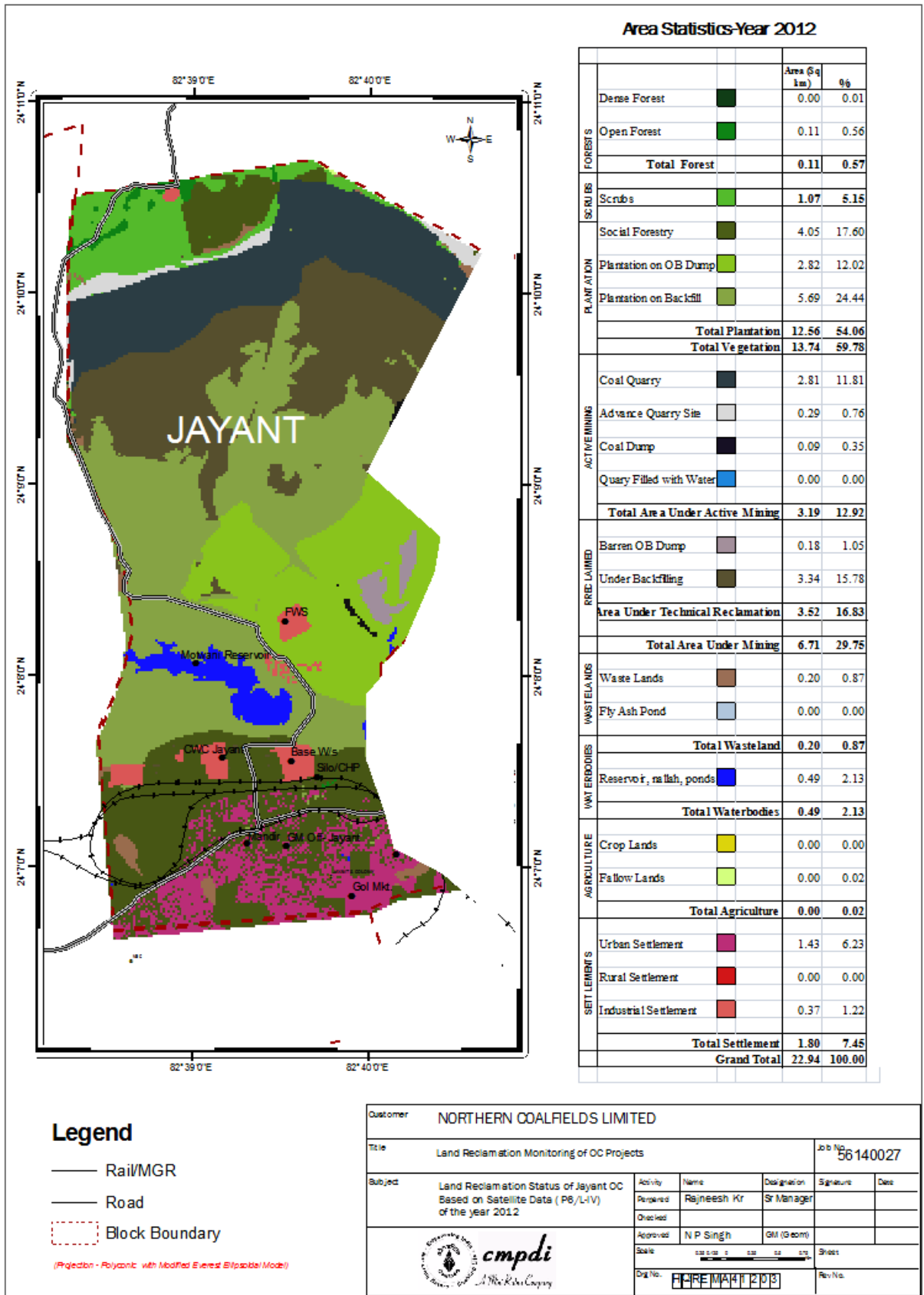


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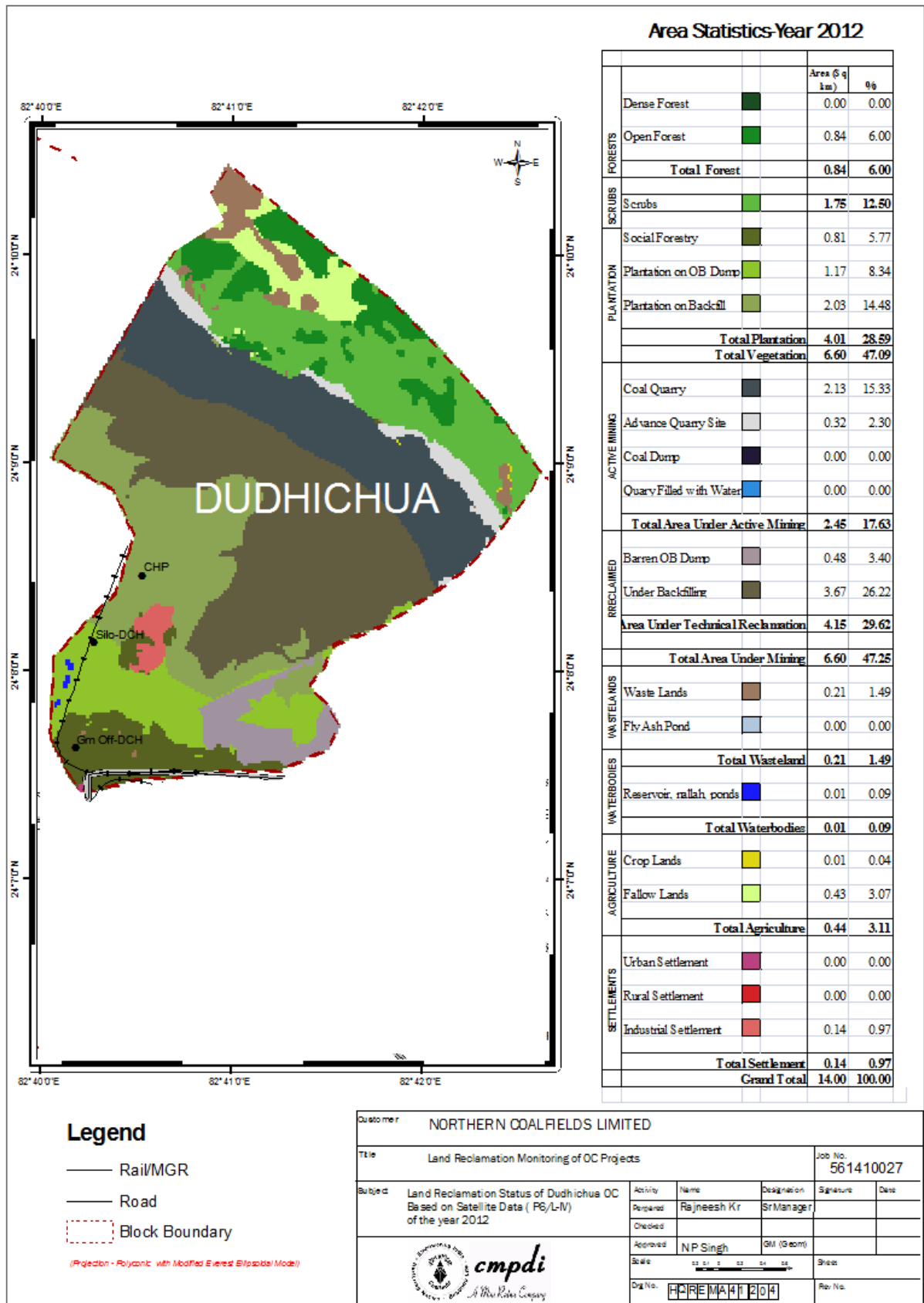
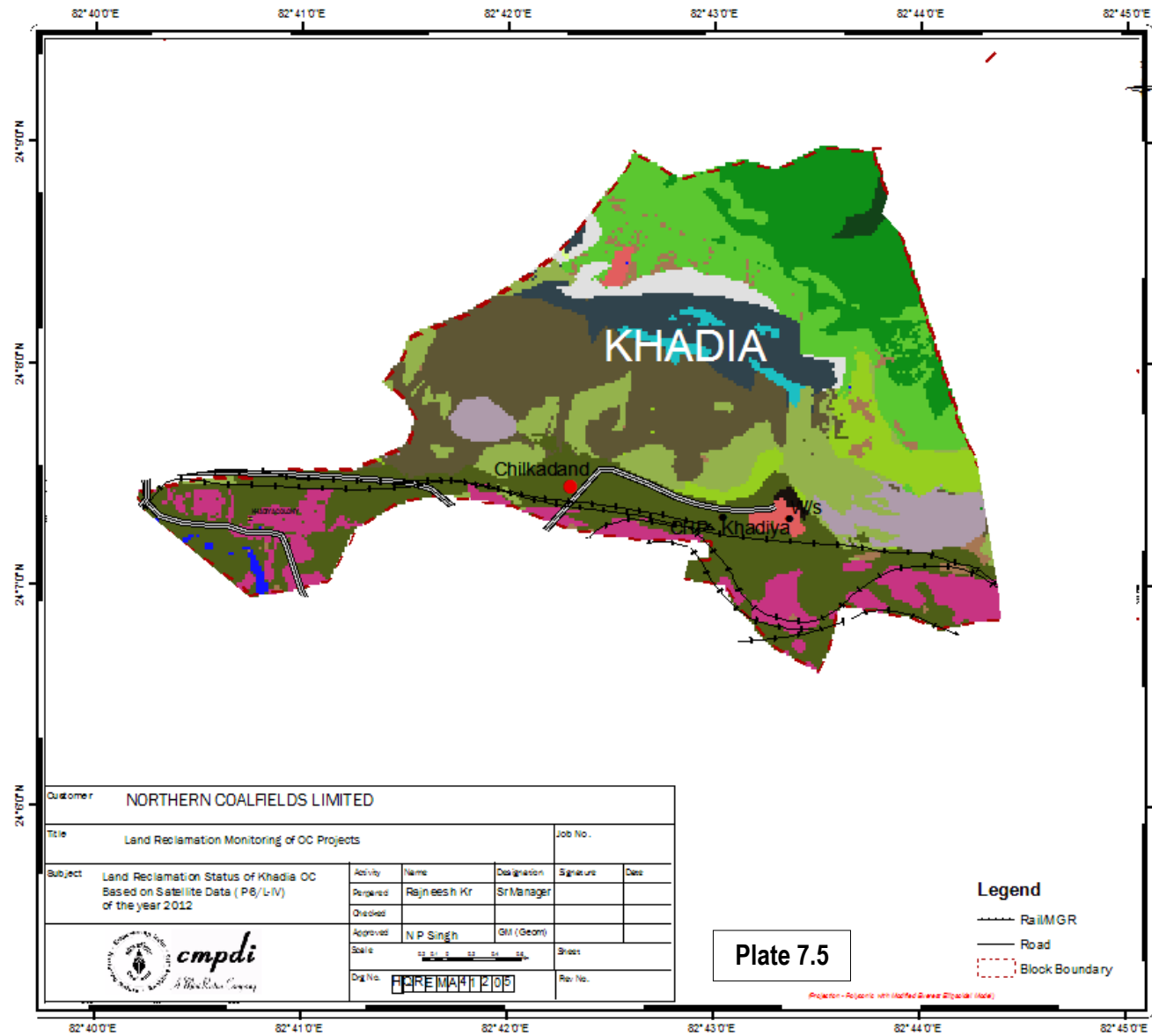


Plate 7.4



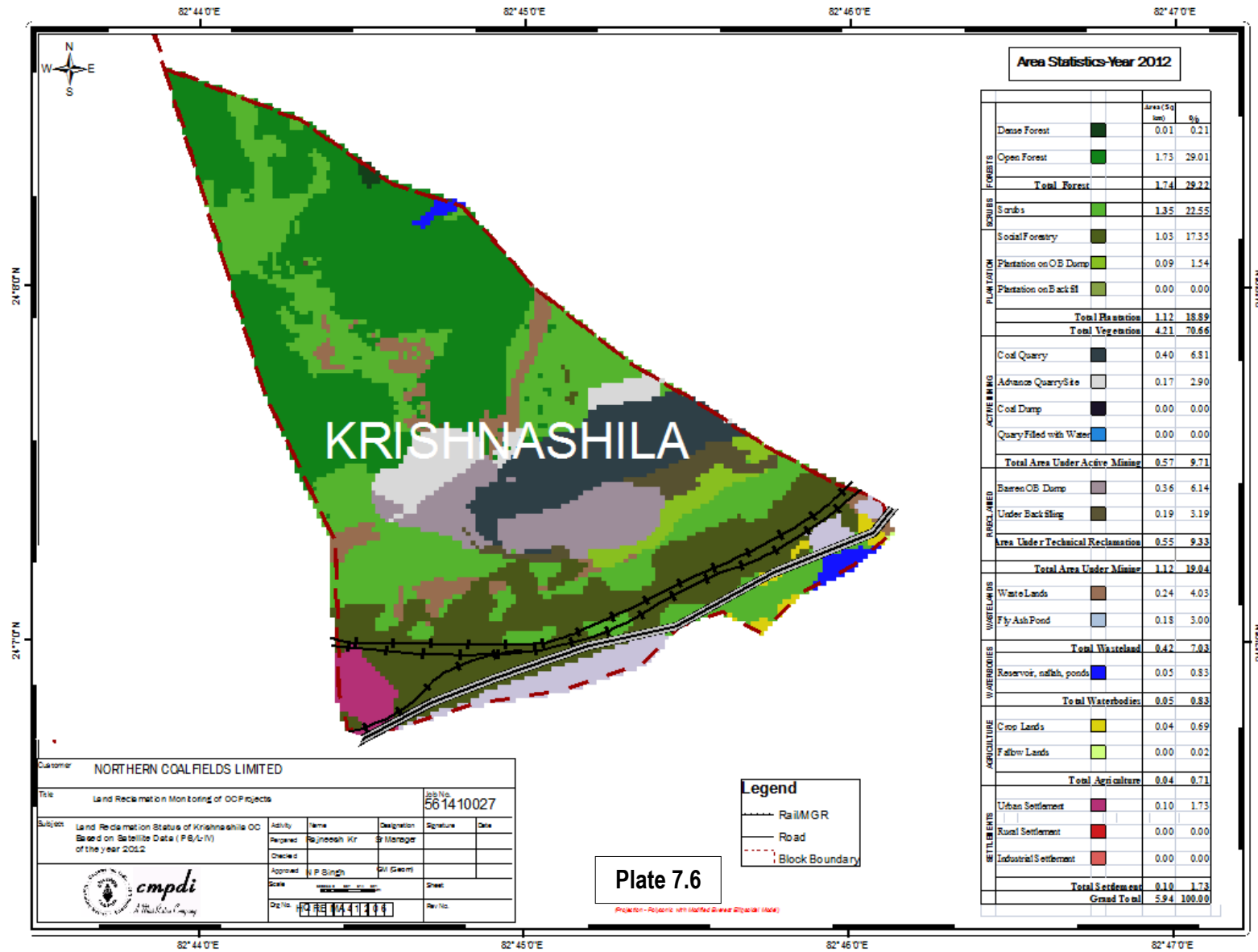
Area Statistics-Year 2012

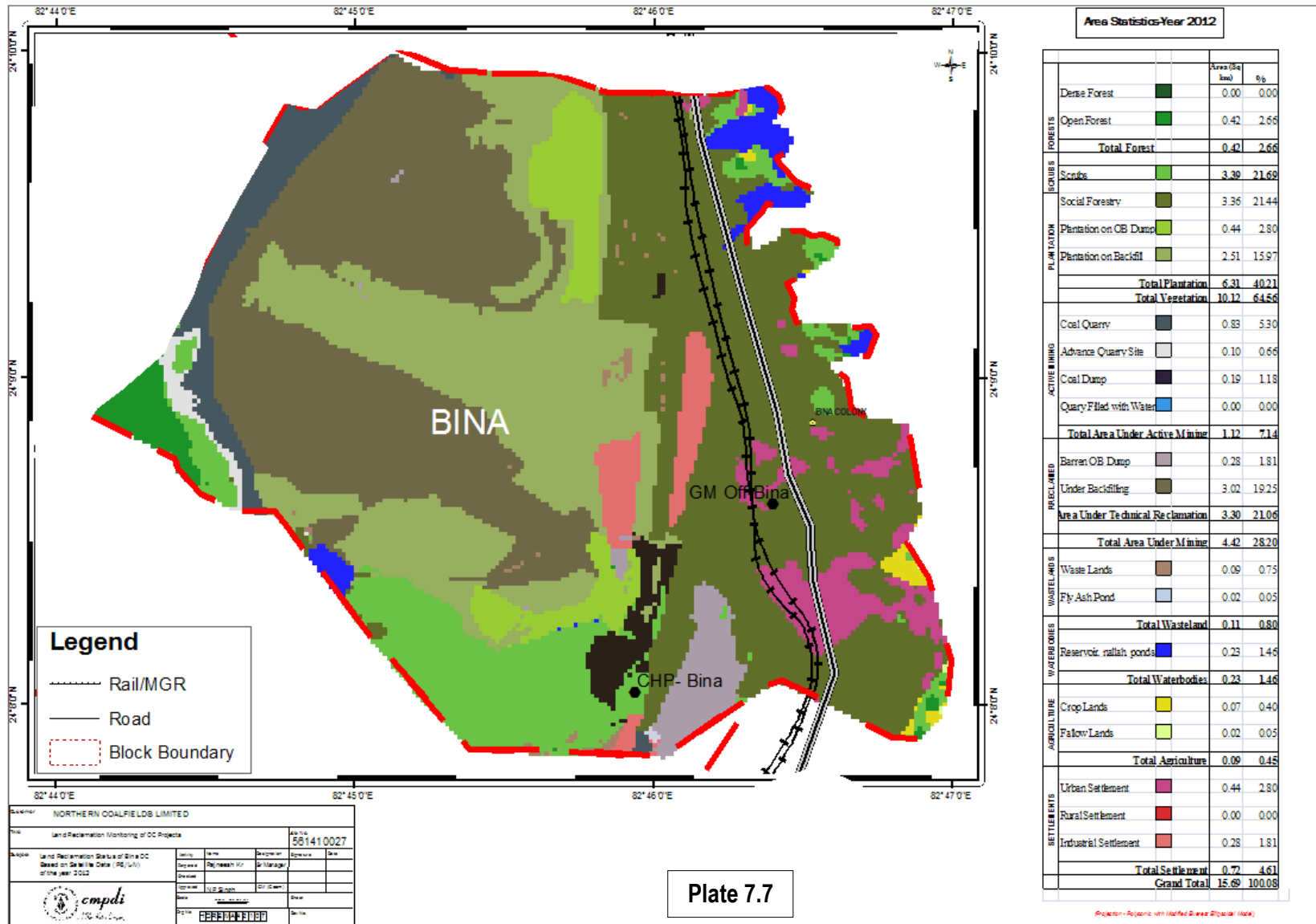
	Area (Sq Km)	%
FORESTS		
Dense Forest	0.08	0.56
Open Forest	1.62	10.89
Total Forest	1.70	11.45
SCRUBS		
Scrubs	1.48	9.96
Social Forestry	3.24	21.76
PLANTATION		
Plantation on OB Dump	0.65	4.27
Plantation on Backfill	1.55	10.37
Total Plantation	5.44	36.40
Total Vegetation	8.62	57.80
ACTIVE MINING		
Coal Quarry	0.92	6.17
Advance Quarry Site	0.36	2.40
Coal Dump	0.08	0.20
Quarry Filled with Water	0.16	1.09
Total Area Under Active Mining	1.47	9.86
RECLAIMED		
Barren OB Dump	0.64	4.28
Under Backfilling	2.65	17.74
Area Under Technical Reclamation	3.29	22.02
Total Area Under Mining	4.76	31.88
WASTELANDS		
Waste Lands	0.24	1.60
Fly Ash Pond	0.00	0.00
Total Wasteland	0.24	1.60
WATERBODIES		
Reservoir, nallah, ponds	0.04	0.29
Total Waterbodies	0.04	0.29
AGRICULTURE		
Crop Lands	0.00	0.00
Fallow Lands	0.00	0.02
Total Agriculture	0.00	0.02
SETTLEMENTS		
Urban Settlement	1.11	7.47
Rural Settlement	0.00	0.00
Industrial Settlement	0.14	0.94
Total Settlement	1.25	8.41
Grand Total	14.91	100.00

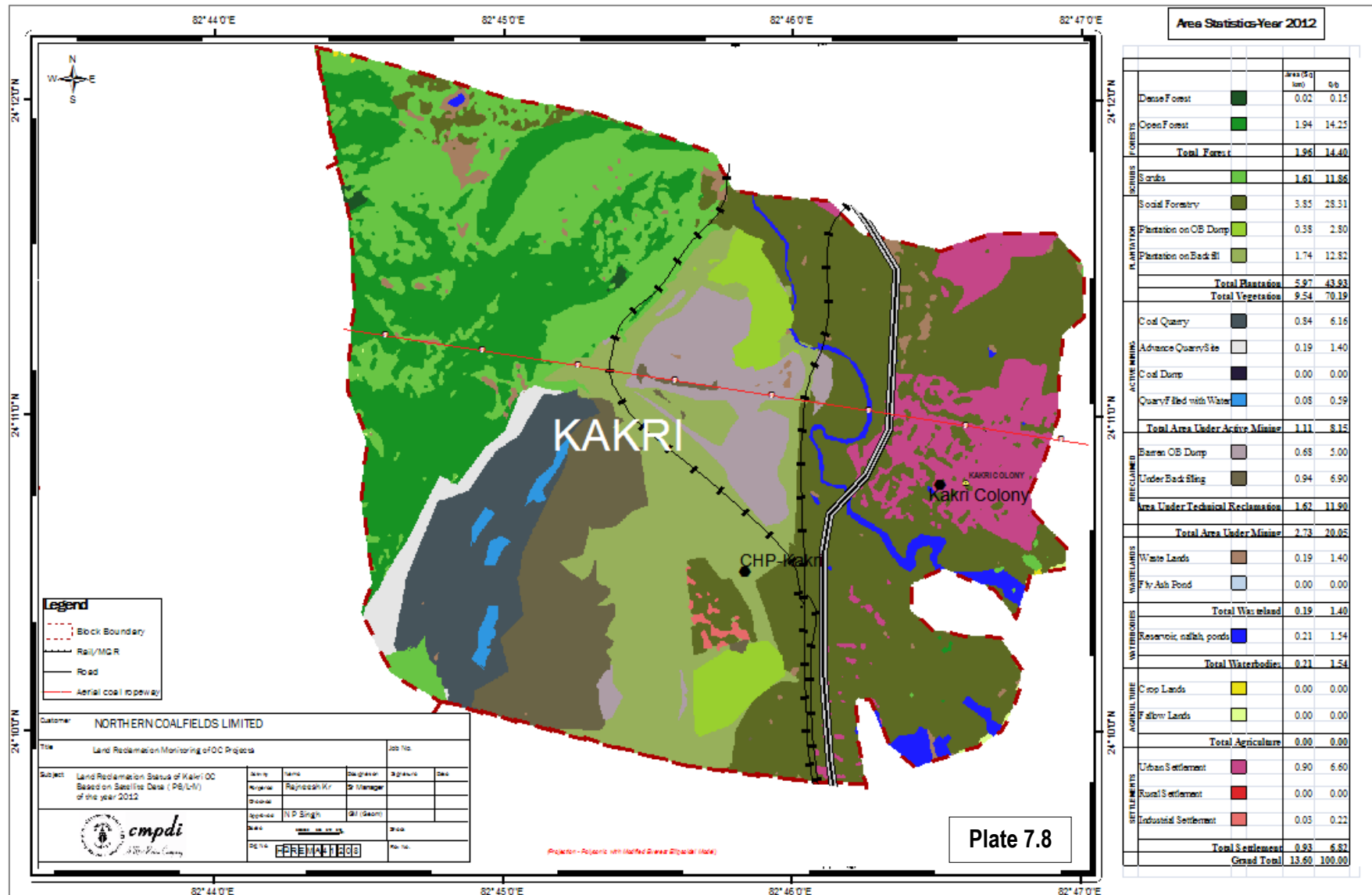
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Subject: Land Reclamation Status of Khadia OC Based on Satellite Data (P8/L-IV) of the year 2012	
Activity Name: Prepared	Designation: Sr Manager
Activity Name: Checked	Designation:
Activity Name: Approved	Designation: GM (Geom)
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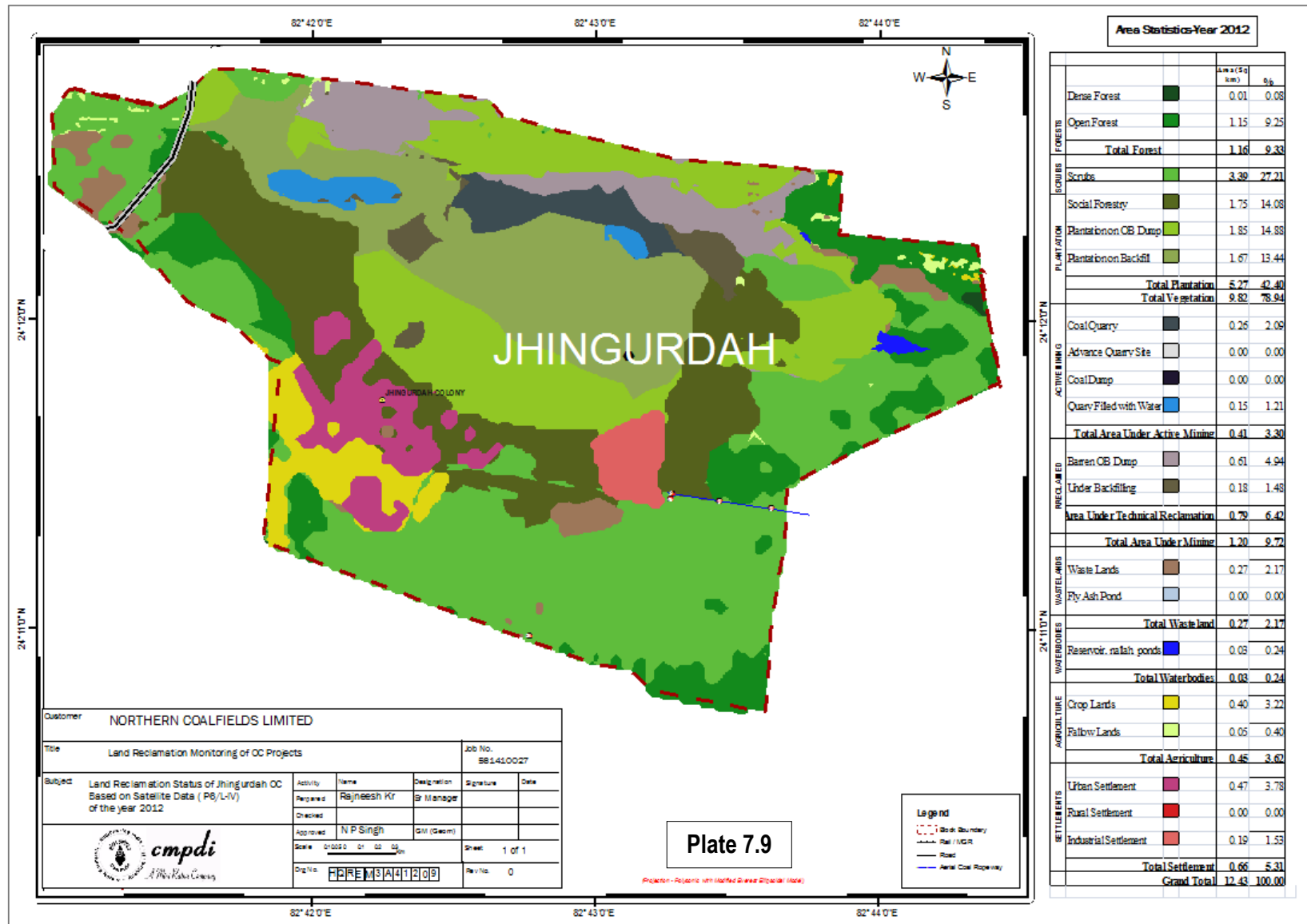
Plate 7.5

Legend
 - - - - - Rail/MGR
 ——— Road
 - - - - - Block Boundary









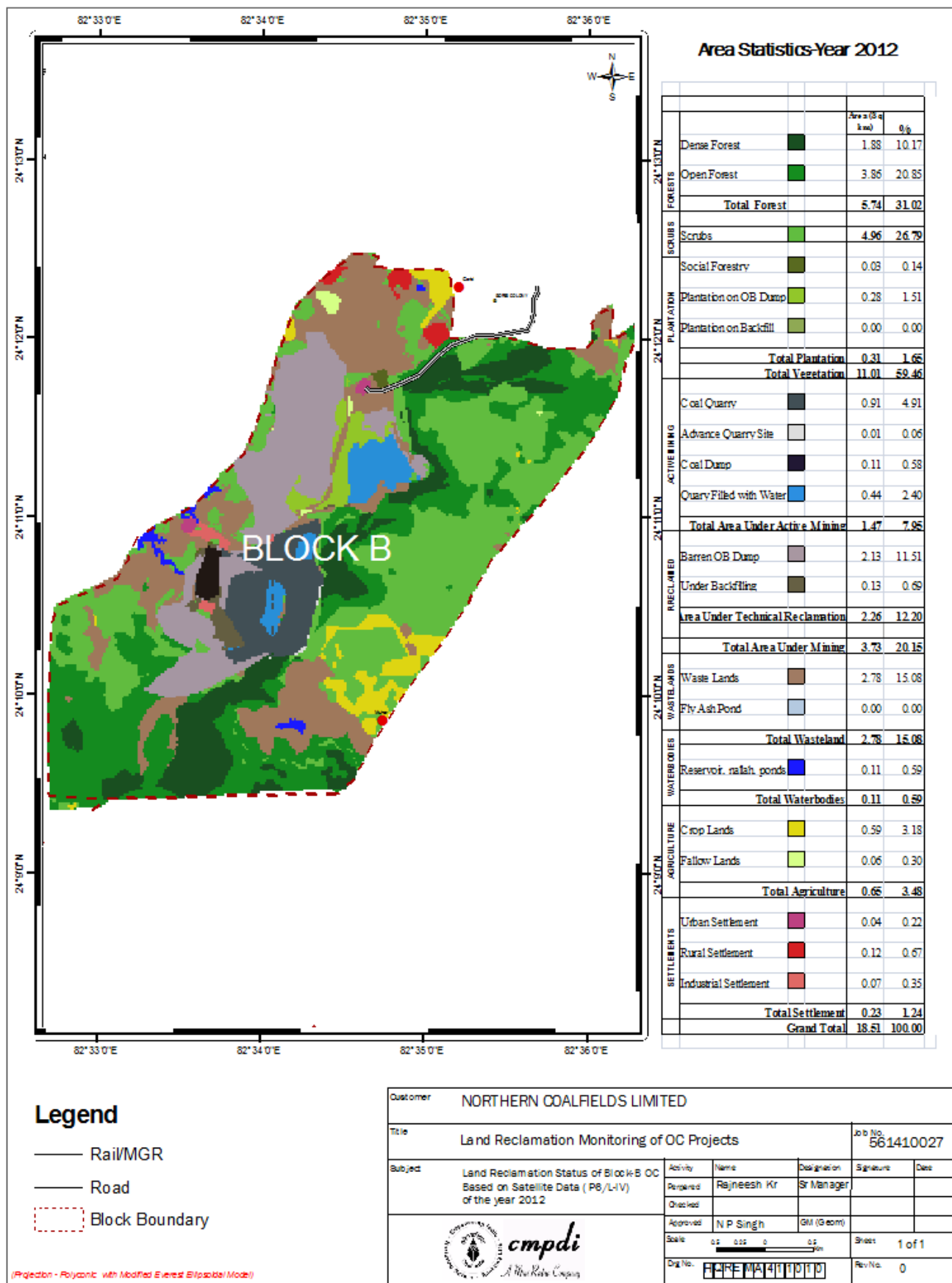


Plate 7.10

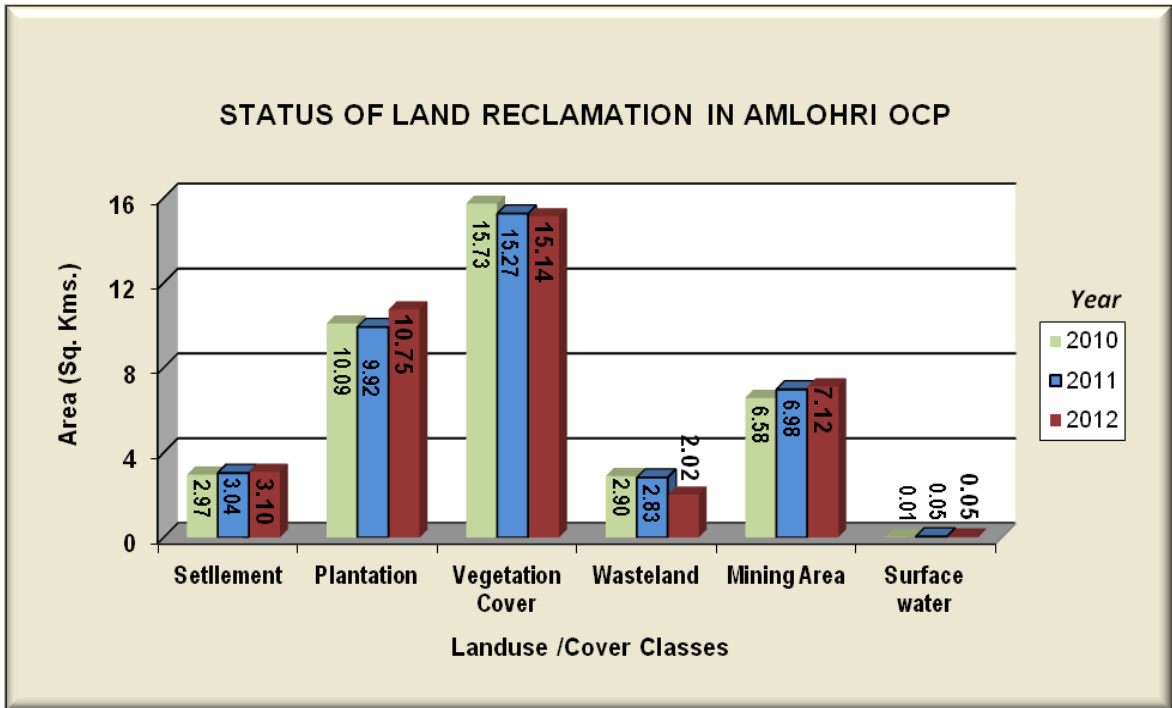


Figure 7.2

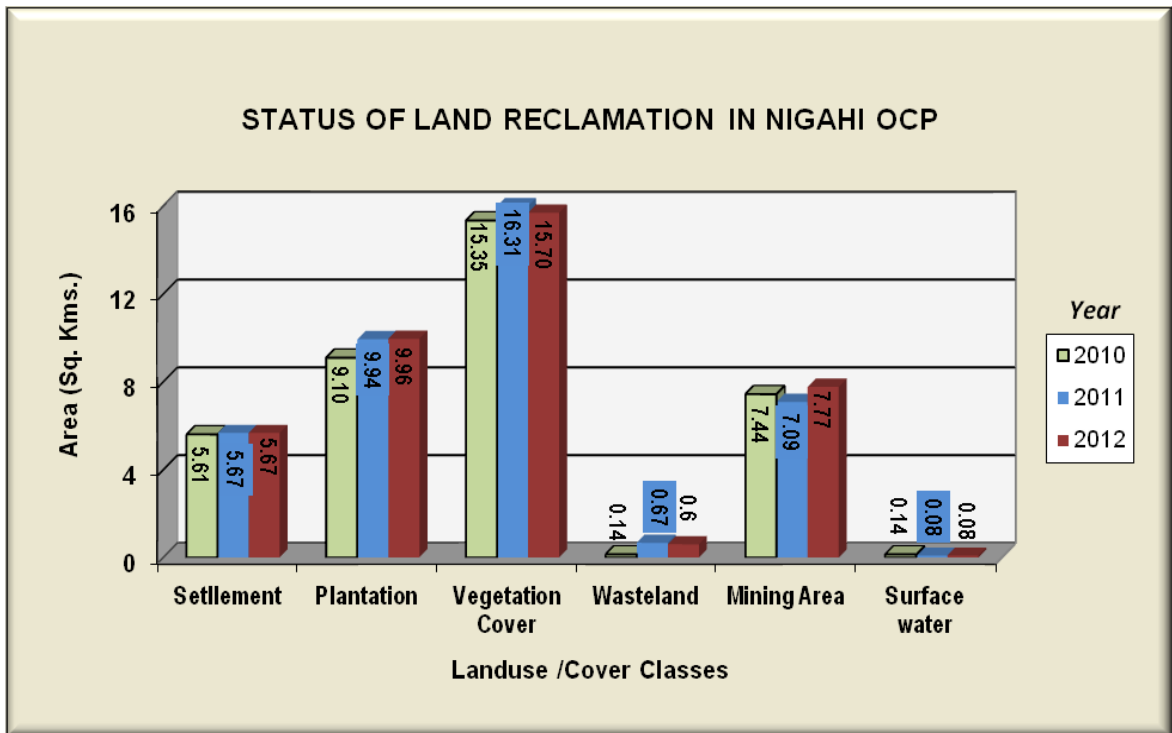


Figure 7.3

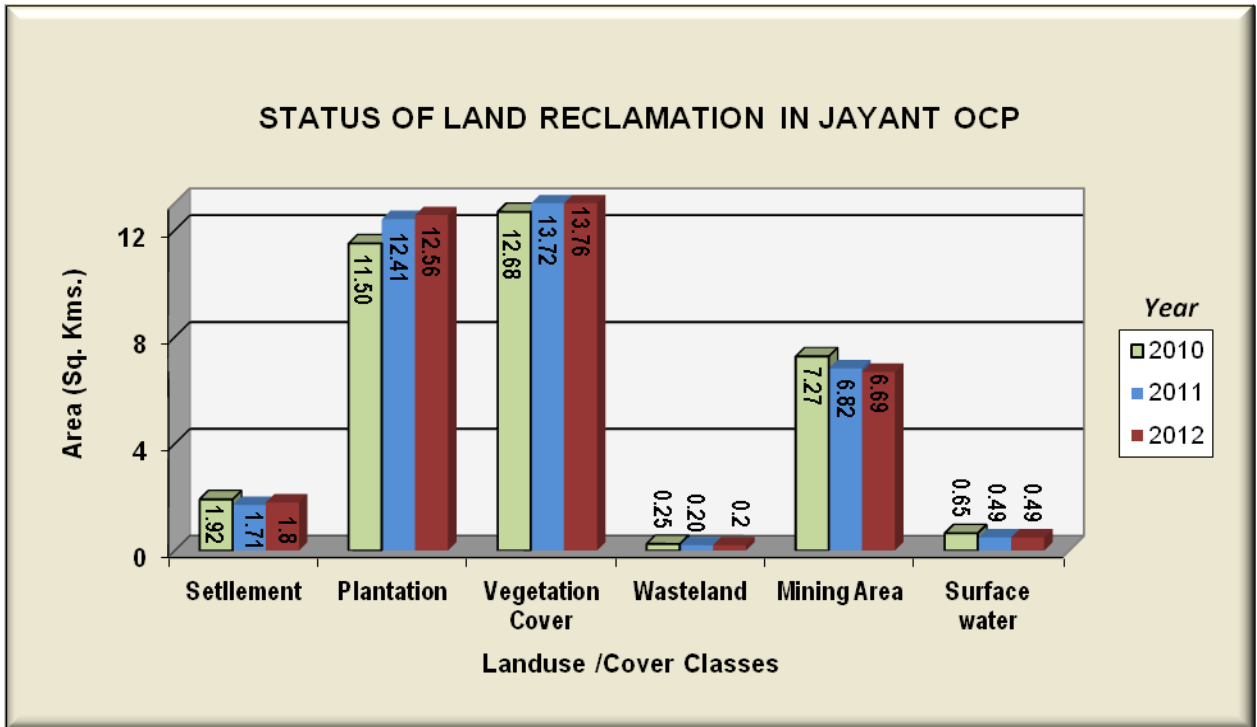


Figure 7.4

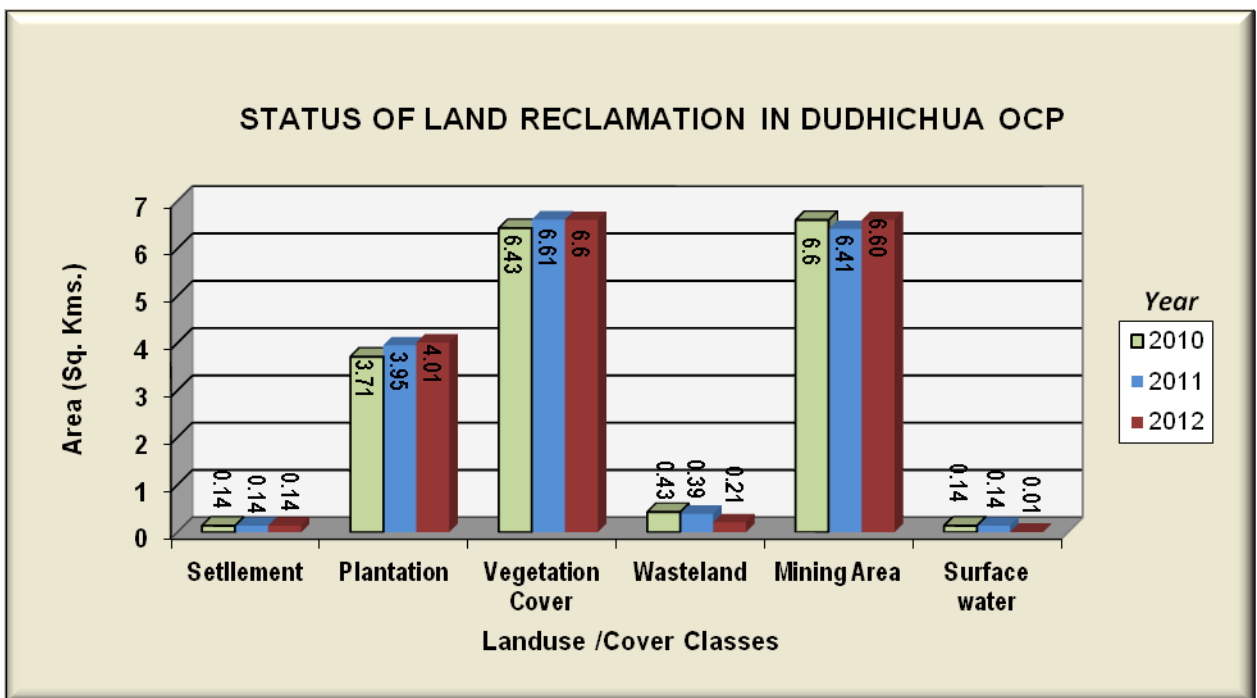


Figure 7.5

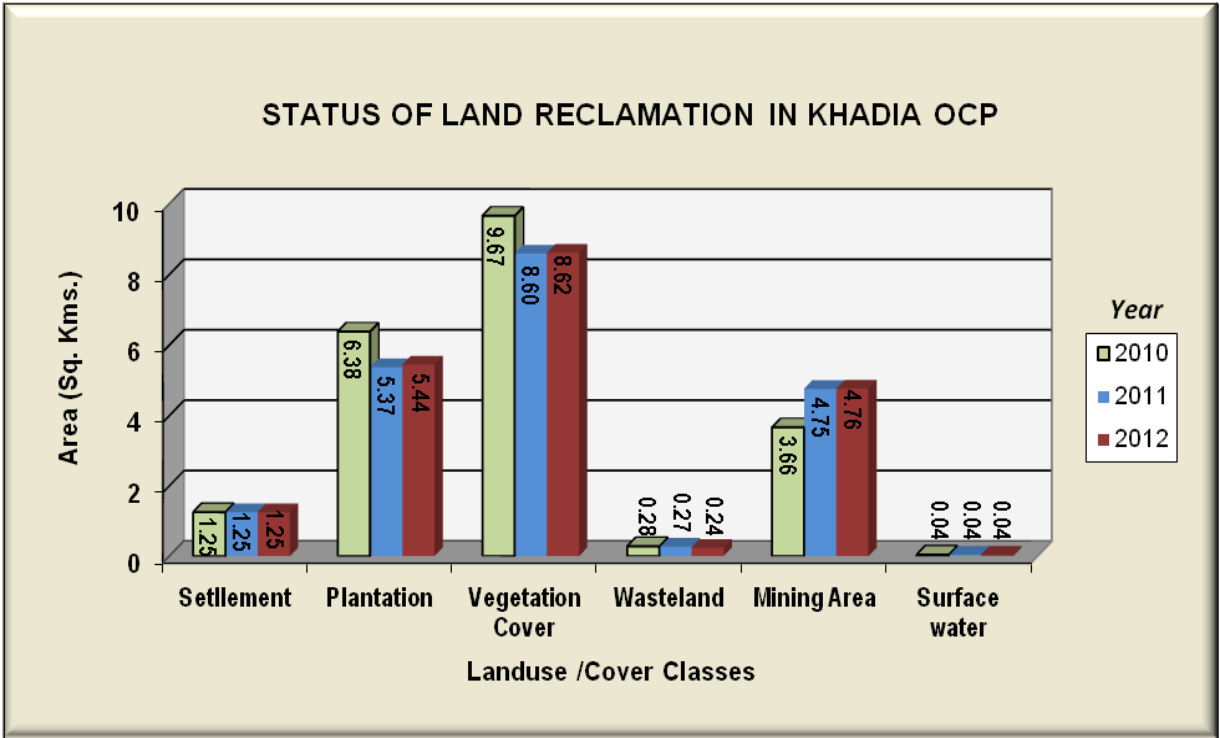


Figure 7.6

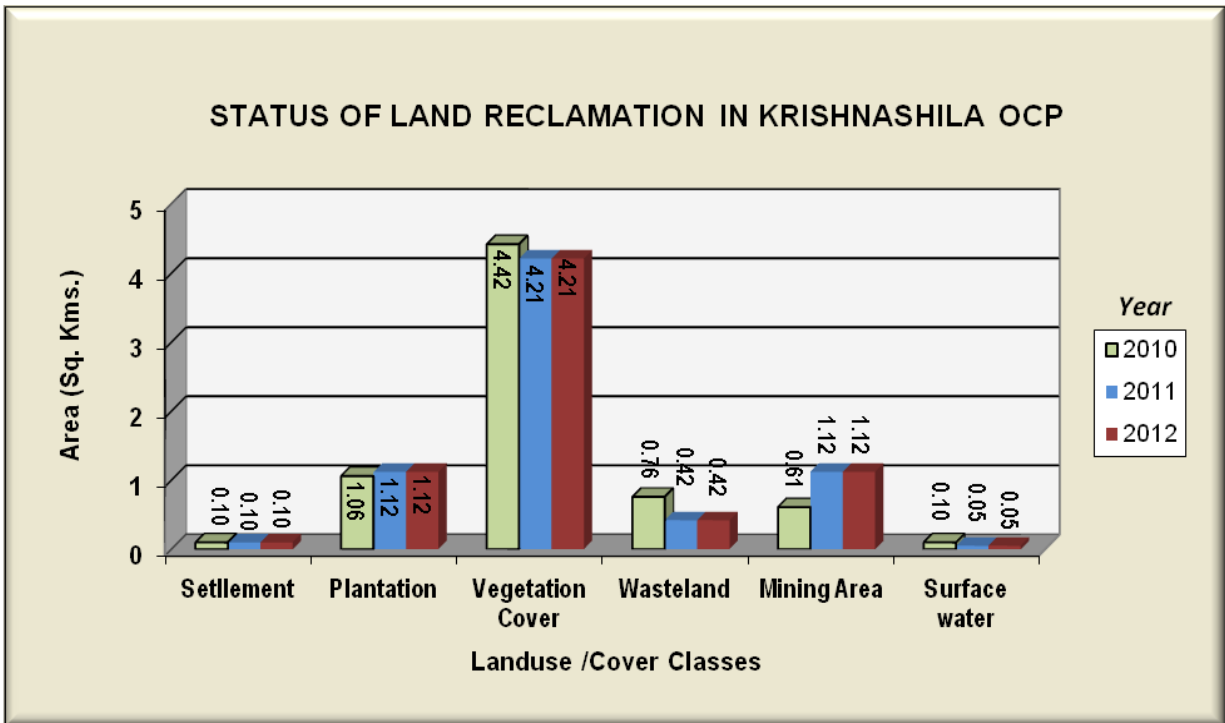


Figure 7.7

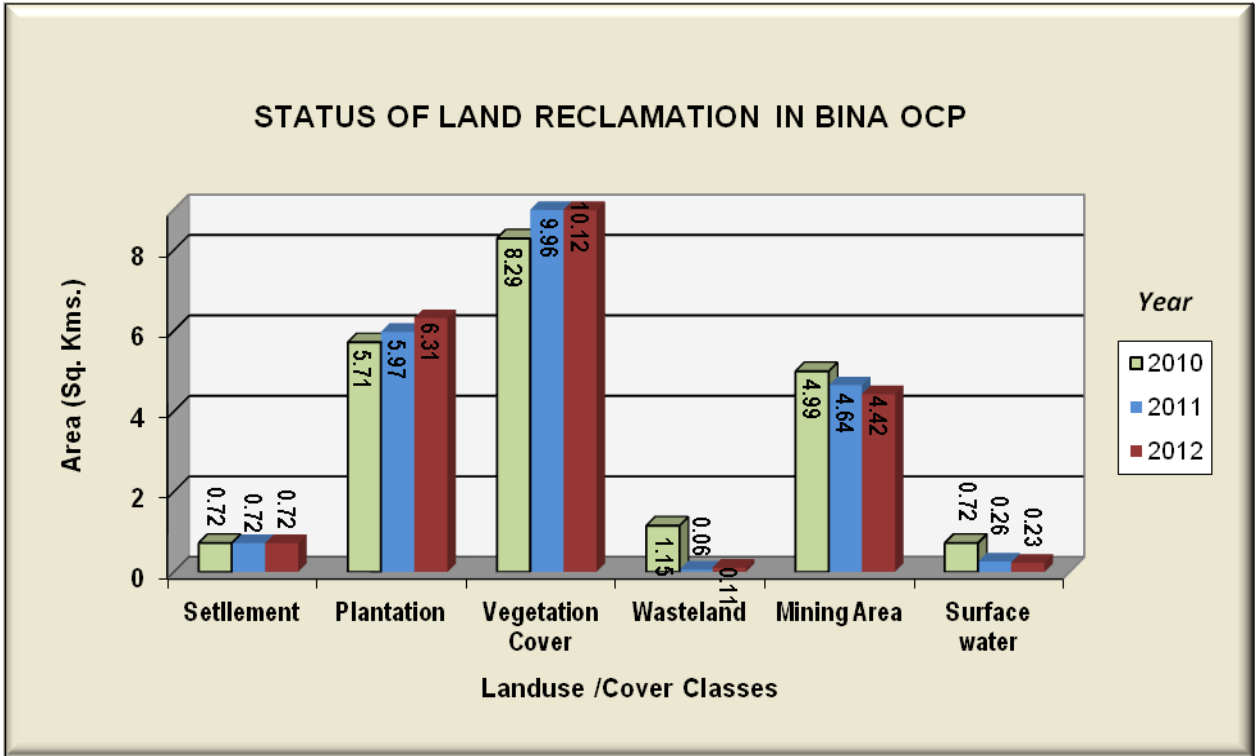


Figure 7.8

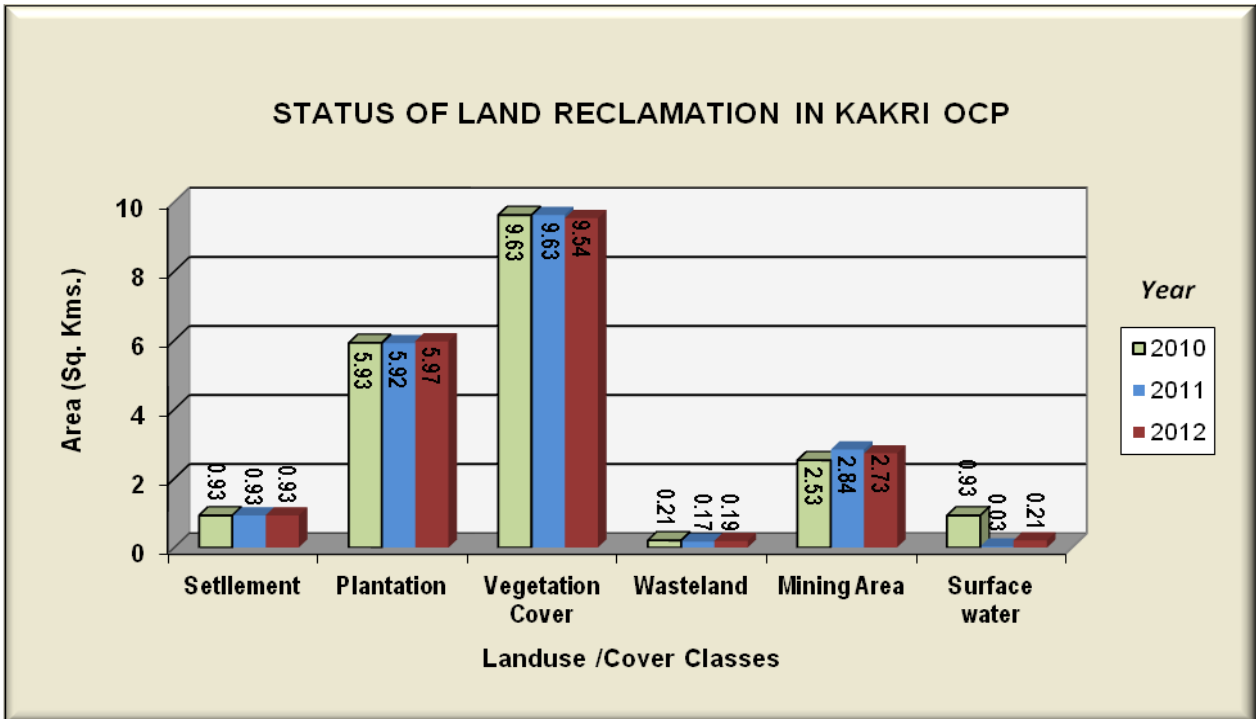


Figure 7.9

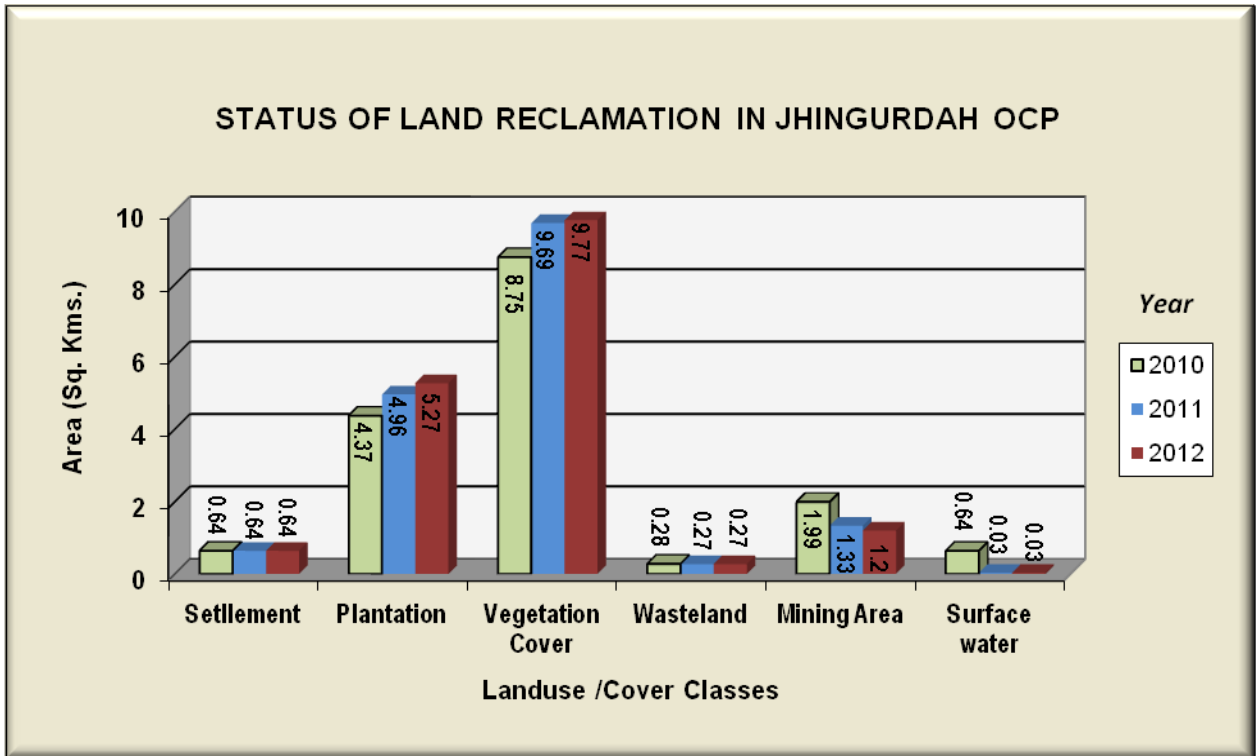


Figure 7.10

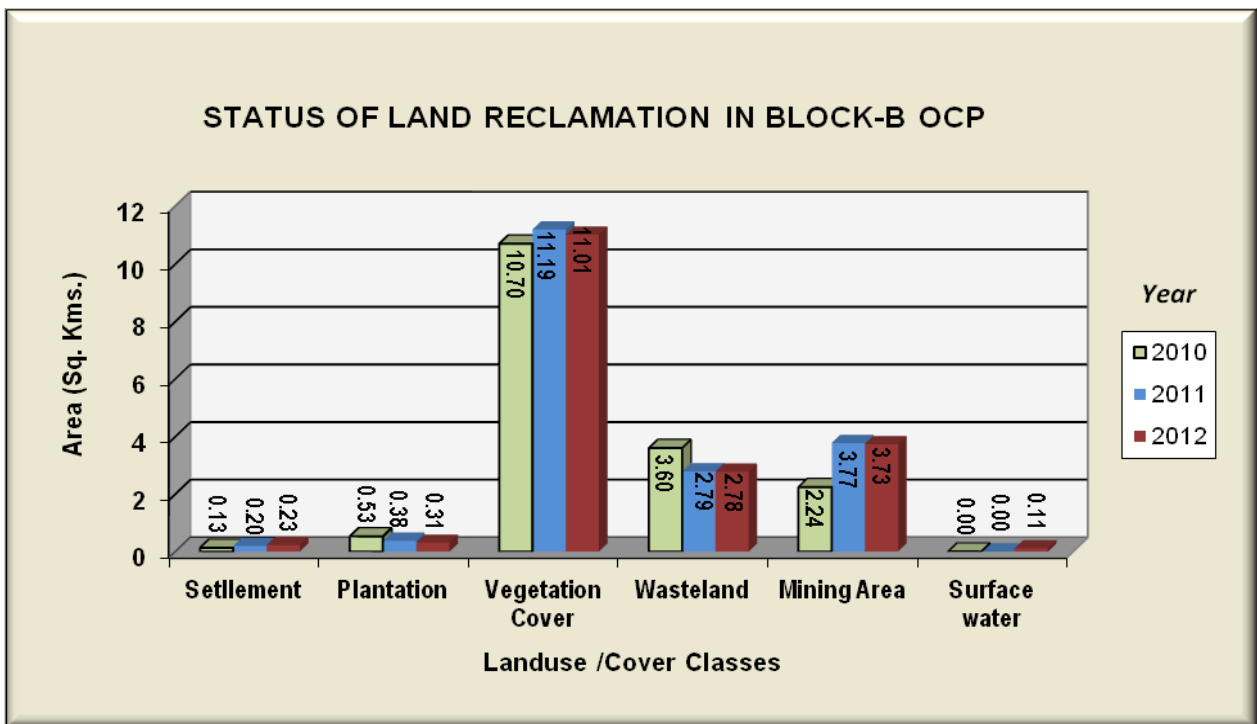


Figure 7.11



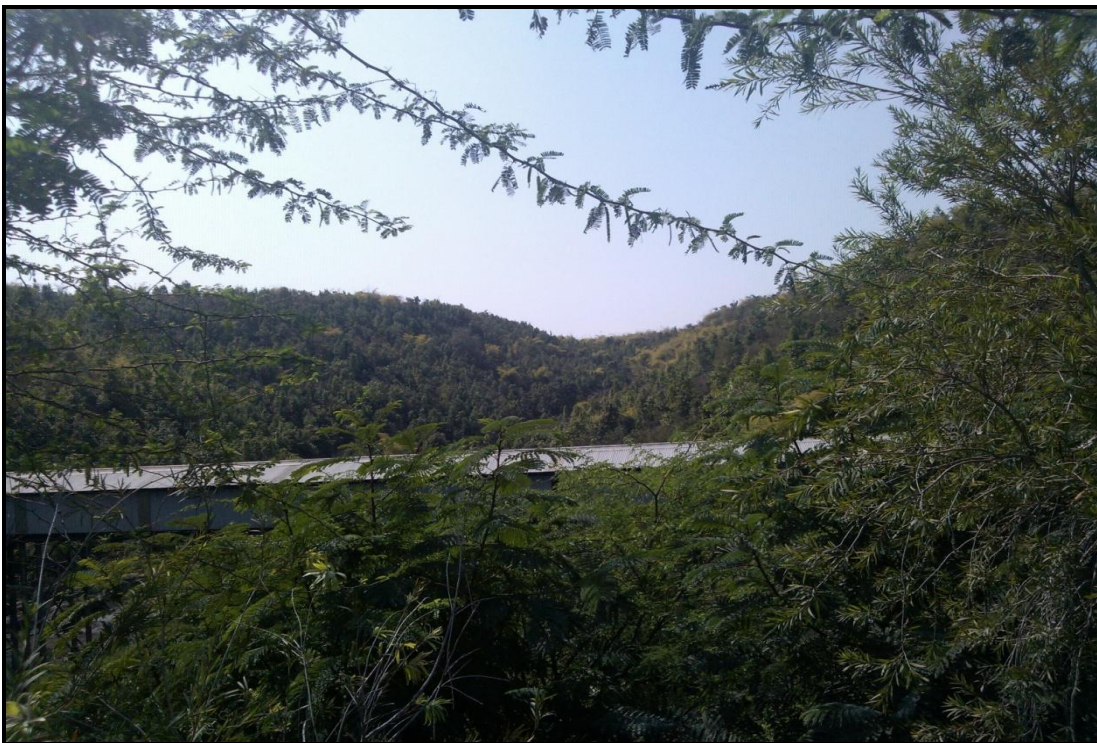
Photograph 7.1 : Plantation on OB Dump in Amlohri OCP



Photograph 7.2 : Technical Reclamation in Amlohri OCP



Photograph 7.3 : Social Forestry Plantation at Amlhori OC



Photograph 7.4: A fully reclaimed and vegetated OB Dump at Nigahi near CHP



Photograph 7.5 : View of Plantation at Jayant OCP



Photograph 7.6 : View of Reclamation & Plantation at Dudhichua OCP



Photograph 7.7 : Newly Planted samplings on Dump top at Krishnashila OCP



Photograph 7.8 : Plantation on OB Dump of Bina OCP

MAHANADI COALFIELDS LIMITED

8.0 Land Reclamation Status in Mahanadi Coalfields Limited

8.1 Following eleven opencast projects of MCL producing more than 5 million cubic meter and more (Coal + OB) were taken up for land reclamation monitoring during year 2012-13 based on satellite data of the year 2012.

- Ananta
- Balram
- Lingaraj
- Bharatpur
- Bhubaneswari
- Jagannath
- Hingula
- Belpahar
- Lakhanpur
- Samleswari
- Lajkura

8.2 Project wise Land Reclamation status in MCL for the year 2012 is given in Table 8.1 and also shown graphically in Fig 8.1. Area statistics of different land use class present in the mine leasehold of the above projects for the year 2012 are shown in the Table -8.2. Land use maps derived from satellite data are shown in Plate 8.1 – 8.11. Land reclamation status of the above mentioned 11 projects, were also prepared for the year 2009, 2010 and 2011. Year wise changes in the different land use classes based on satellite data are depicted in Bar Charts in Fig.8.1 – 8.12.

8.3 Study reveals that out of total 41.62 Km² excavated / mined out area; 27.04 Km² area (64.97%) has already been reclaimed. Out of which 14.41 Km² (34.62%) area has been re-vegetated and 12.63 Km² (30.35%) area are backfilled.

8.4 Analysis of satellite data indicates that area of plantation has increased from 14.37 Km² (2011) to 14.41 Km² (2012). This increase of 0.04 Km² plantation areas in

one year indicates that MCL is committed for reclamation of mine land for maintaining the ecological balance in the region. It has been observed in some of the projects natural vegetation has also started growing on stabilised old backfilled areas and OB dumps due to high soil fertility.

- 8.5** On comparing the status of land reclamation for the year 2012 with respect to the year 2011 in different projects, it is evident from the analysis that area of land reclamation has increased from 25.93 Km² (Yr. 2011) to 27.04 Km² (Yr.2012).
- 8.6** Out of 11 projects of MCL, Bharatpur OCP ranks on top for land reclamation (81.85%) followed by Lajkura (73.02%) and Jagannath OC (70.77%).

Table – 8.1
Project wise Land Reclamation Status in
Opencast Projects of MCL based on Satellite Data of the year 2012

(% Calculated in respect of total excavated area) Area are in Km².

Sl. No.	Project		Plantation/ Vegetation		Under Backfilling		Active Mining		Total Excavated Area		Total Reclaimed area	
	Name	Leasehold (i)	ii		iii		iv		ii+iii+iv		ii+iii	
			2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
1	Ananta	4.56	1.02	1.03	0.93	1.12	1.47	1.44	3.42	3.59	1.95	2.15
			29.82	28.69	27.31	31.20	42.87	40.11			57.13	59.89
2	Balram	10.21	1.29	1.32	1.58	1.77	1.30	1.29	4.17	4.38	2.87	3.09
			30.91	30.14	37.91	40.41	31.18	29.45			68.82	70.55
3	Lingaraj	7.26	0.87	0.87	1.00	1.00	1.76	1.79	3.63	3.66	1.87	1.87
			24.00	23.77	27.42	27.32	48.58	48.91			51.42	51.09
4	Bharatpur	9.43	2.49	2.50	1.45	1.56	1.98	0.90	5.92	4.96	3.94	4.06
			42.03	50.40	24.54	31.45	33.42	18.15			66.58	81.85
5	Bhubaneswari	7.33	0.53	0.47	0.32	0.63	0.45	1.16	1.29	2.26	0.84	1.10
			40.57	20.80	24.50	27.88	34.93	51.33			65.07	48.67
6	Jagannath	4.99	2.16	2.16	0.86	0.77	1.18	1.21	4.20	4.14	3.02	2.93
			51.35	52.17	20.49	18.60	28.16	29.23			71.84	70.77
7	Hingula	4.83	0.57	0.57	0.82	0.83	1.47	1.49	2.86	2.89	1.39	1.40
			19.94	19.72	28.68	28.72	51.38	51.56			48.62	48.44
8	Belpahar	9.74	2.14	2.15	0.76	0.77	1.37	1.41	4.27	4.33	2.90	2.92
			50.12	49.65	17.75	17.78	32.13	32.56			67.87	67.44
9	Lakhanpur	16.20	1.48	1.49	1.57	1.82	1.50	1.73	4.55	5.04	3.05	3.31
			32.51	29.56	34.48	36.11	33.01	34.33			66.99	65.67
10	Samleswari	7.13	1.29	1.30	1.45	1.53	1.54	1.65	4.28	4.48	2.74	2.83
			30.17	29.02	33.91	34.15	35.92	36.83			64.08	63.17
11	Lajkura	4.68	0.54	0.55	0.82	0.83	0.52	0.51	1.88	1.89	1.36	1.38
			28.72	29.10	43.56	43.92	27.71	26.98			72.29	73.02
TOTAL (MCL)		86.36	14.37	14.41	11.56	12.63	14.55	14.58	40.48	41.62	25.93	27.04
			35.51	34.62	28.56	30.35	35.94	35.03			46.87	48.19

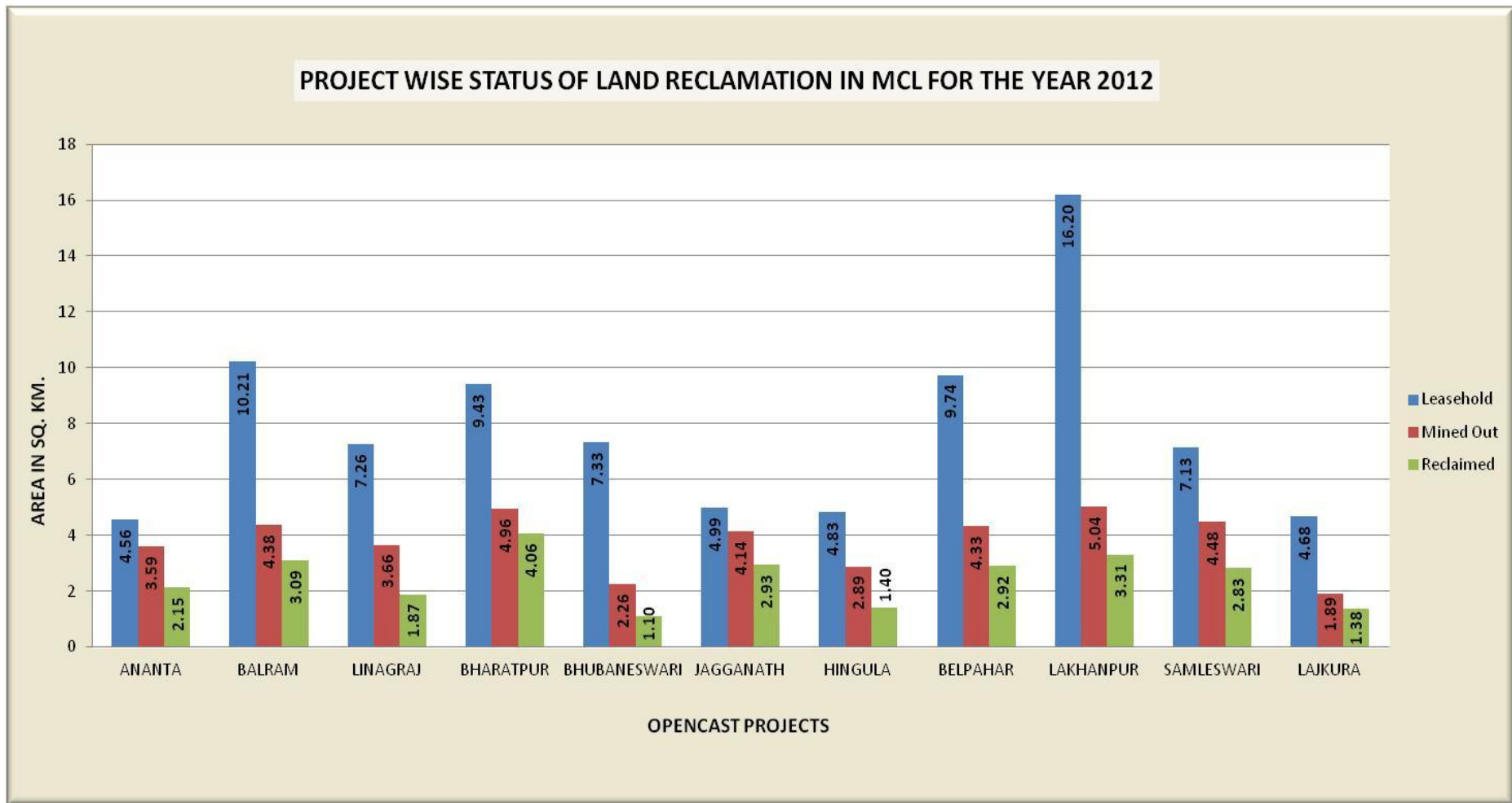
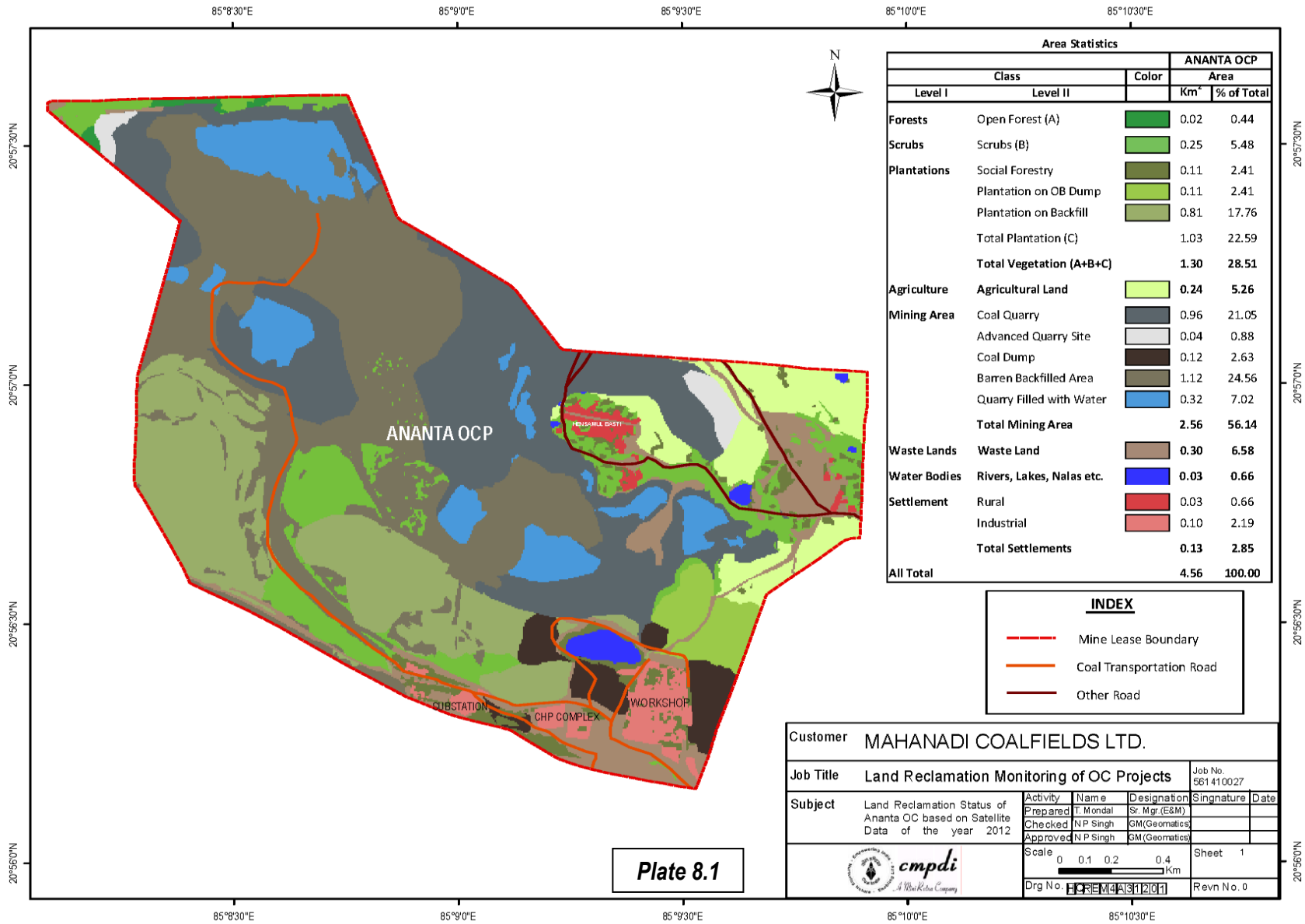


Fig.8.1: Land reclamation status in OC projects of MCL in the year 2012

Table 8.2: STATUS OF LAND RESTORATION / RECLAMATION IN MAHANADI COALFIELD LIMITED BASED ON SATELLITE DATA OF THE YEAR 2012

(Area in Sq. Kms.)

	ANANTA		BALRAM		LINGARAJ		BHARATPUR		BHUBANESHWARI		JAGANNATH		HINGULA		BELPAHAR		LAKHANPUR		SAMLESWARI		LAJKURA		TOTAL		
	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	
FORESTS	Dense Forest	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.70	10.49	0.08	1.12	1.19	25.43	3.01	3.49
	Open Forest	0.02	0.44	0.13	1.27	0.28	3.86	0.72	7.64	1.03	14.05	0.03	0.60	0.00	0.00	0.02	0.21	3.30	20.37	0.24	3.37	0.61	13.03	6.38	7.39
	Total Forest (A)	0.02	0.44	0.13	1.27	0.28	3.86	0.76	8.06	1.03	14.05	0.03	0.60	0.00	0.00	0.02	0.21	5.00	30.86	0.32	4.49	1.80	38.46	9.39	10.88
PLANTATION	Scrub (B)	0.25	5.48	2.04	19.97	1.35	18.60	1.10	11.66	1.01	13.78	0.23	4.61	0.28	5.80	2.40	24.64	2.41	14.88	0.73	10.24	0.42	8.97	12.22	14.15
	Social Forestry	0.11	2.41	0.24	2.35	0.44	6.06	0.37	3.92	0.47	6.41	0.15	3.01	0.25	5.18	0.40	4.11	0.43	2.65	0.18	2.52	0.06	1.28	3.10	3.59
PLANTATION	Plantation on OB Dump	0.11	2.41	0.27	2.64	0.32	4.41	0.43	4.56	0.00	0.00	0.00	0.00	0.23	4.76	0.70	7.19	0.30	1.85	0.48	6.73	0.30	6.41	3.14	3.64
	Plantation on Backfill	0.81	17.76	0.81	7.93	0.11	1.52	1.70	18.04	0.00	0.00	2.01	40.29	0.09	1.86	1.05	10.78	0.76	4.69	0.64	8.98	0.19	4.06	8.17	9.46
	Total Plantation (Biological Reclamation C)	1.03	22.59	1.32	12.92	0.87	11.99	2.50	26.52	0.47	6.41	2.16	43.30	0.57	11.80	2.15	22.08	1.49	9.19	1.30	18.23	0.55	11.75	14.41	16.69
Total Vegetation (A+B+C)	1.30	28.51	3.49	34.16	2.50	34.45	4.36	46.24	2.51	34.24	2.42	48.51	0.85	17.60	4.57	46.93	8.90	54.93	2.35	32.96	2.77	59.18	36.02	41.72	
ACTIVE MINING	Coal Quarry	0.96	21.05	0.70	6.85	1.49	20.51	0.57	6.04	0.91	12.41	0.34	6.81	0.47	9.73	1.08	11.09	1.01	6.23	1.23	17.25	0.40	8.55	9.16	10.61
	Coal Face	0.00	0.00	0.004	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.21	0.01	0.10	0.01	0.06	0.00	0.00	0.00	0.00	0.03	0.04
	Coal Dump	0.12	2.63	0.22	2.15	0.22	3.03	0.20	2.12	0.12	1.64	0.24	4.81	0.36	7.45	0.10	1.03	0.26	1.60	0.09	1.26	0.03	0.64	1.96	2.27
	Advance Quarry Site	0.04	0.88	0.04	0.39	0.05	0.69	0.03	0.32	0.08	1.09	0.03	0.60	0.05	1.04	0.11	1.13	0.31	1.91	0.12	1.68	0.06	1.28	0.92	1.07
	Quarry Filled with Water	0.32	7.02	0.33	3.23	0.03	0.41	0.10	1.06	0.05	0.69	0.60	12.02	0.60	12.42	0.11	1.13	0.14	0.86	0.21	2.95	0.02	0.43	2.51	2.91
	Total Area under Active Mining	1.44	31.58	1.29	12.66	1.79	24.64	0.90	9.54	1.16	15.83	1.21	24.24	1.49	30.85	1.41	14.48	1.73	10.66	1.65	23.14	0.51	10.90	14.58	16.90
RECLAIMED	Barren OB dump	0.00	0.00	0.11	1.08	0.36	4.96	0.06	0.64	0.44	6.00	0.00	0.00	0.03	0.62	0.02	0.21	0.01	0.06	0.07	0.98	0.04	0.85	1.14	1.32
	Area Under Backfilling	1.12	24.56	1.66	16.25	0.64	8.82	1.50	15.91	0.19	2.59	0.77	15.43	0.80	16.56	0.75	7.70	1.81	11.17	1.46	20.48	0.79	16.88	11.49	13.30
	Total Area under Technical Reclamation	1.12	24.56	1.77	17.33	1.00	13.78	1.56	16.55	0.63	8.59	0.77	15.43	0.83	17.18	0.77	7.91	1.82	11.23	1.53	21.46	0.83	17.73	12.63	14.62
Total Area under Mine Operation	2.56	56.14	3.06	30.00	2.79	38.42	2.46	26.09	1.79	24.42	1.98	39.67	2.32	48.03	2.18	22.39	3.55	21.89	3.18	44.60	1.34	28.63	27.21	31.52	
WASTELANDS	Waste Lands	0.30	6.58	0.85	8.32	0.71	9.78	1.33	14.1	0.52	7.09	0.36	7.21	0.81	16.77	1.81	18.58	0.8	4.94	0.94	13.19	0.47	10.05	8.90	10.29
	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	0.03	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	
	Total Wastelands	0.30	6.58	0.85	8.32	0.71	9.78	1.33	14.1	0.52	7.09	0.36	7.21	0.84	17.39	1.81	18.58	0.80	4.94	0.94	13.19	0.47	10.05	8.93	10.32
WATER	Reservoir, nallah, ponds etc.	0.03	0.66	0.16	1.57	0.08	1.10	0.45	4.77	0.07	0.95	0.01	0.2	0.09	1.86	0.28	2.87	0.18	1.11	0.07	0.98	0.01	0.21	1.43	1.66
	Total Waterbodies	0.03	0.66	0.16	1.57	0.08	1.10	0.45	4.77	0.07	0.95	0.01	0.2	0.09	1.86	0.28	2.87	0.18	1.11	0.07	0.98	0.01	0.21	1.43	1.66
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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Fallow Lands	0.24	5.26	2.06	20.17	0.93	12.81	0.55	5.83	2.24	30.57	0.03	0.60	0.66	13.67	0.54	5.54	2.60	16.06	0.42	5.89	0.04	0.86	10.31	11.93
	Total Agriculture	0.24	5.26	2.06	20.17	0.93	12.81	0.55	5.83	2.24	30.57	0.03	0.60	0.66	13.67	0.54	5.54	2.60	16.06	0.42	5.89	0.04	0.86	10.31	11.93
SETTLEMENTS	Urban Settlement	0.00	0.00	0.02	0.20	0.02	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.21	0.01	0.10	0.00	0.00	0.00	0.00	0.00	0.06	0.07	
	Rural Settlement	0.03	0.66	0.11	1.08	0.10	1.38	0.12	1.27	0.18	2.46	0.00	0.00	0.04	0.83	0.11	1.13	0.10	0.62	0.03	0.42	0.00	0.00	0.82	0.95
	Industrial Settlement	0.10	2.19	0.46	4.50	0.13	1.78	0.16	1.70	0.02	0.27	0.19	3.81	0.02	0.41	0.24	2.46	0.07	0.43	0.14	1.96	0.05	1.07	1.58	1.83
	Total Settlements	0.13	2.85	0.59	5.78	0.25	3.44	0.28	2.97	0.20	2.73	0.19	3.81	0.07	1.45	0.36	3.69	0.17	1.07	0.17	2.38	0.05	1.07	2.46	2.85
GRAND TOTAL	4.56	100.00	10.21	100.00	7.26	100.00	9.43	100.00	7.33	100.00	4.99	100.00	4.83	100.00	9.74	100.00	16.20	100.00	7.13	100.00	4.68	100.00	86.36	100.00	



Area Statistics				
Class			ANANTA OCP Area	
Level I	Level II	Color	Km ²	% of Total
Forests	Open Forest (A)		0.02	0.44
	Scrubs (B)		0.25	5.48
Plantations	Social Forestry		0.11	2.41
	Plantation on OB Dump		0.11	2.41
	Plantation on Backfill		0.81	17.76
	Total Plantation (C)		1.03	22.59
Total Vegetation (A+B+C)			1.30	28.51
Agriculture	Agricultural Land		0.24	5.26
Mining Area	Coal Quarry		0.96	21.05
	Advanced Quarry Site		0.04	0.88
	Coal Dump		0.12	2.63
	Barren Backfilled Area		1.12	24.56
	Quarry Filled with Water		0.32	7.02
Total Mining Area			2.56	56.14
Waste Lands	Waste Land		0.30	6.58
Water Bodies	Rivers, Lakes, Nalas etc.		0.03	0.66
Settlement	Rural		0.03	0.66
	Industrial		0.10	2.19
Total Settlements			0.13	2.85
All Total			4.56	100.00

INDEX	
	Mine Lease Boundary
	Coal Transportation Road
	Other Road

Customer	MAHANADI COALFIELDS LTD.			
Job Title	Land Reclamation Monitoring of OC Projects			Job No. 561410027
Subject	Land Reclamation Status of Ananta OC based on Satellite Data of the year 2012	Activity	Name	Designation
		Prepared	T. Mondal	Sr. Mgr. (E&M)
		Checked	N.P. Singh	GM(Geomatics)
		Approved	N.P. Singh	GM(Geomatics)
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		Sheet	1	
		Drp No.	HCEM/4/31/2011	
		Rev No.	0	

Plate 8.1

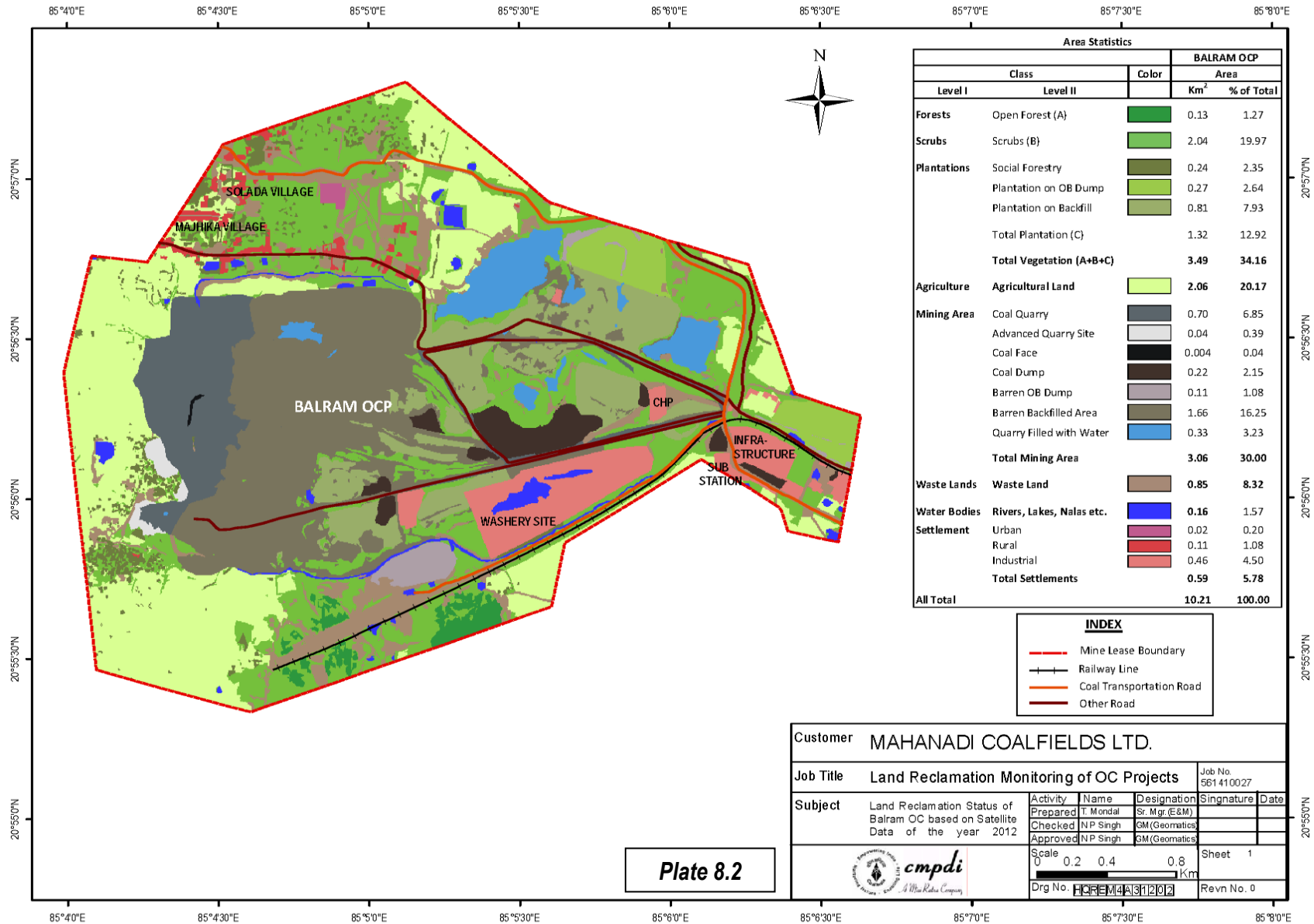
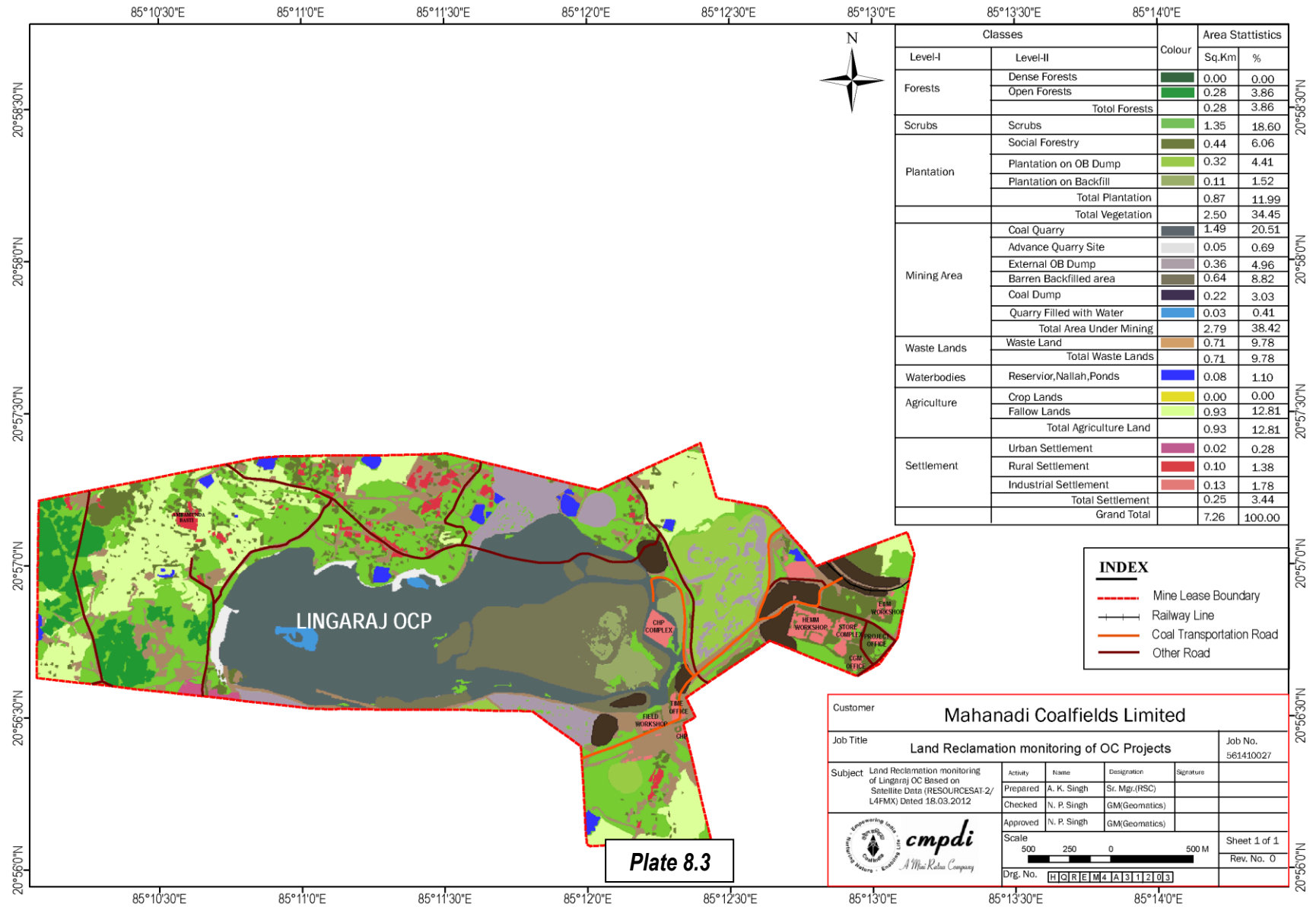


Plate 8.2



Classes		Colour	Area Statistics	
Level-I	Level-II		Sq.Km	%
Forests	Dense Forests		0.00	0.00
	Open Forests		0.28	3.86
	Total Forests		0.28	3.86
Scrubs	Scrubs		1.35	18.60
	Social Forestry		0.44	6.06
Plantation	Plantation on OB Dump		0.32	4.41
	Plantation on Backfill		0.11	1.52
	Total Plantation		0.87	11.99
Total Vegetation			2.50	34.45
Mining Area	Coal Quarry		1.49	20.51
	Advance Quarry Site		0.05	0.69
	External OB Dump		0.36	4.96
	Barren Backfilled area		0.64	8.82
	Coal Dump		0.22	3.03
	Quarry Filled with Water		0.03	0.41
	Total Area Under Mining		2.79	38.42
Waste Lands	Waste Land		0.71	9.78
	Total Waste Lands		0.71	9.78
Waterbodies	Reservoir, Nallah, Ponds		0.08	1.10
	Total Waterbodies		0.08	1.10
Agriculture	Crop Lands		0.00	0.00
	Fallow Lands		0.93	12.81
	Total Agriculture Land		0.93	12.81
Settlement	Urban Settlement		0.02	0.28
	Rural Settlement		0.10	1.38
	Industrial Settlement		0.13	1.78
	Total Settlement		0.25	3.44
Grand Total			7.26	100.00

INDEX	
	Mine Lease Boundary
	Railway Line
	Coal Transportation Road
	Other Road

Customer		Mahanadi Coalfields Limited			
Job Title		Land Reclamation monitoring of OC Projects		Job No. 561410027	
Subject		Activity	Name	Designation	Signature
Land Reclamation monitoring of Lingaraj OC Based on Satellite Data (RESOURCESAT-2/L4FMX) Dated 18.03.2012		Prepared	A. K. Singh	Sr. Mgr.(RSC)	
		Checked	N. P. Singh	GM(Geomatics)	
		Approved	N. P. Singh	GM(Geomatics)	
Scale		500 250 0 500 M			Sheet 1 of 1
Drg. No.		HOREM4A31203			Rev. No. 0

Plate 8.3

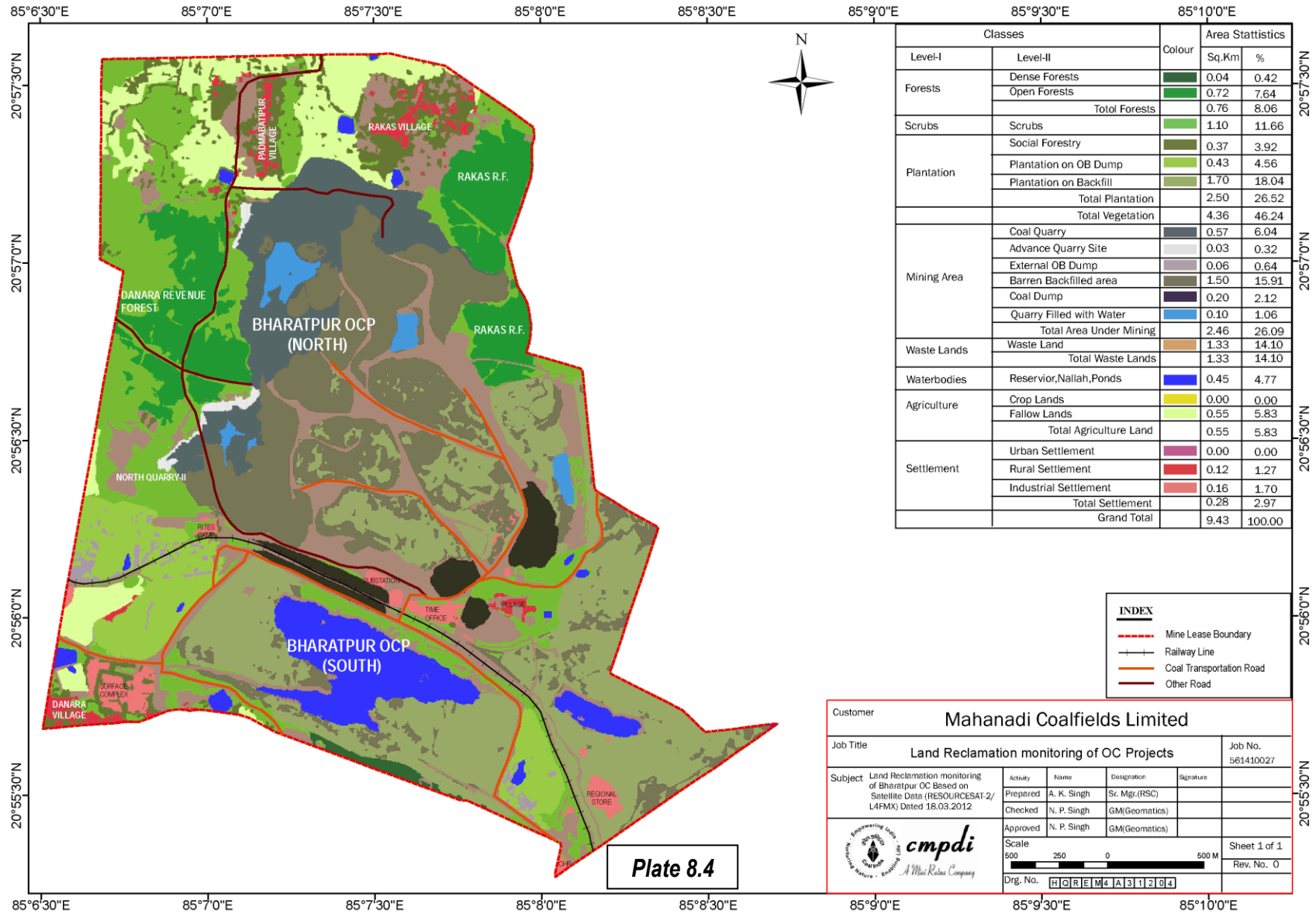
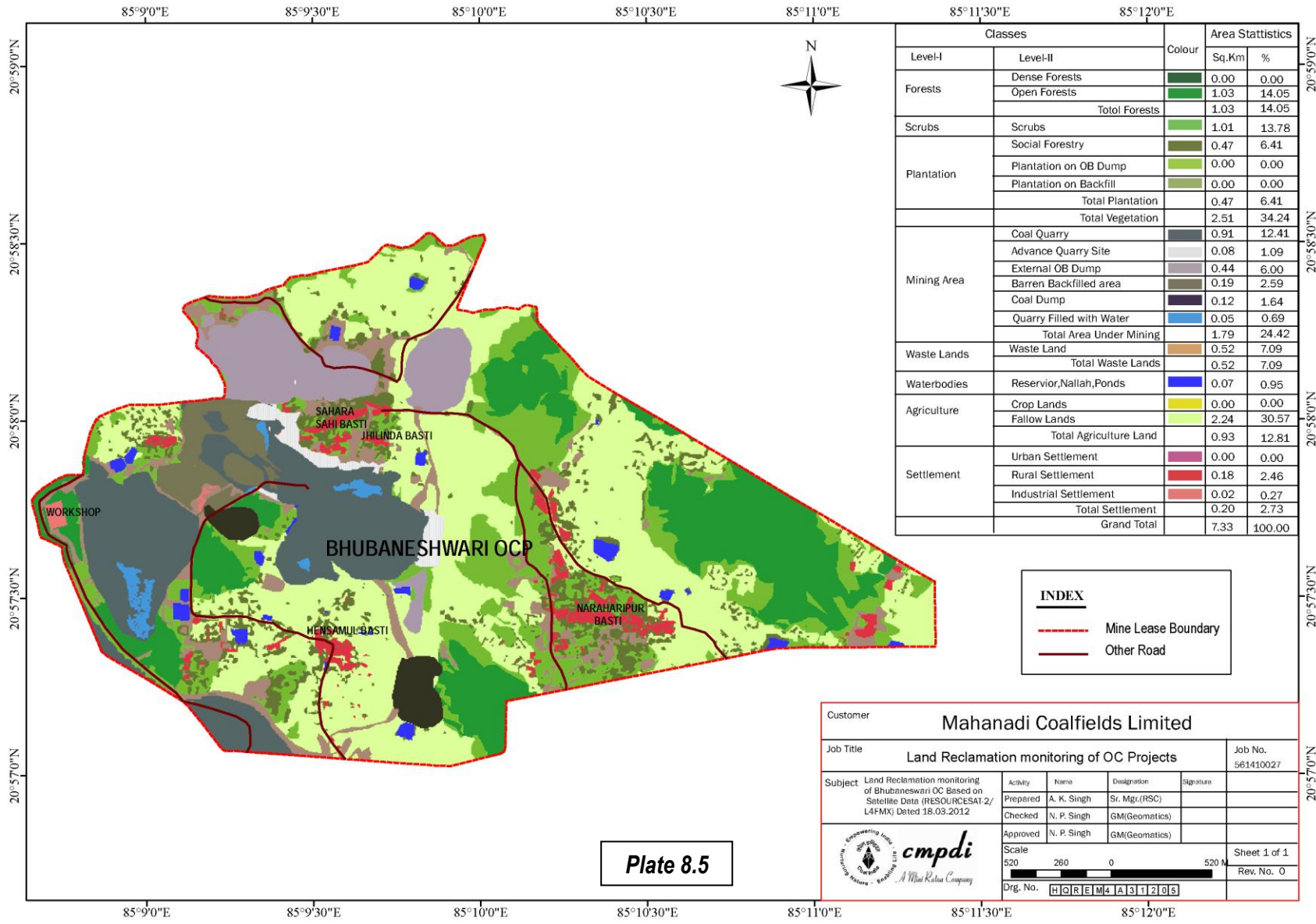


Plate 8.4

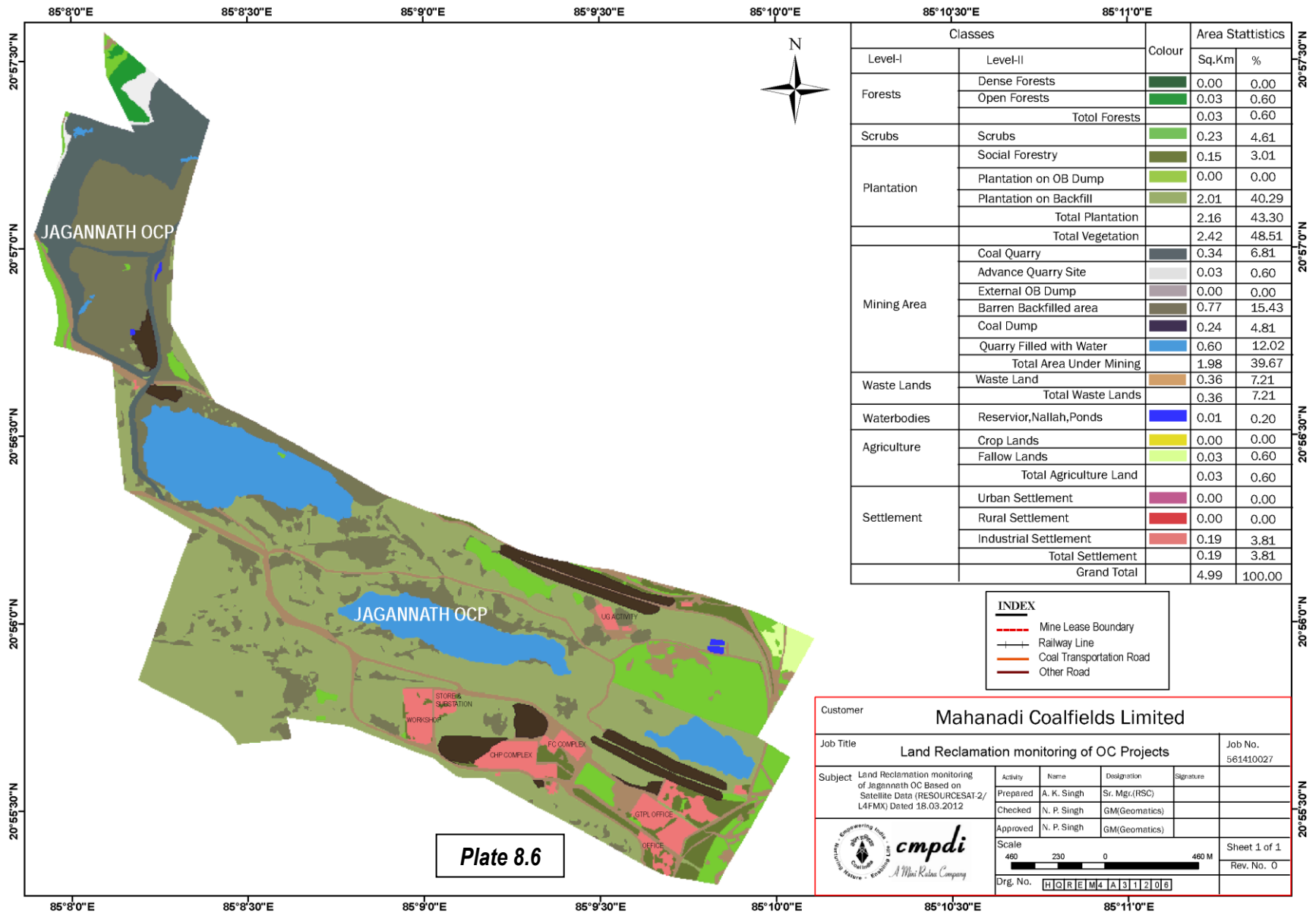


Classes			Area Statistics	
Level-I	Level-II	Colour	Sq.Km	%
Forests	Dense Forests		0.00	0.00
	Open Forests		1.03	14.05
	Total Forests		1.03	14.05
Scrubs	Scrubs		1.01	13.78
	Social Forestry		0.47	6.41
Plantation	Plantation on OB Dump		0.00	0.00
	Plantation on Backfill		0.00	0.00
	Total Plantation		0.47	6.41
	Total Vegetation		2.51	34.24
Mining Area	Coal Quarry		0.91	12.41
	Advance Quarry Site		0.08	1.09
	External OB Dump		0.44	6.00
	Barren Backfilled area		0.19	2.59
	Coal Dump		0.12	1.64
	Quarry Filled with Water		0.05	0.69
	Total Area Under Mining		1.79	24.42
Waste Lands	Waste Land		0.52	7.09
	Total Waste Lands		0.52	7.09
Waterbodies	Reservoir,Nallah,Ponds		0.07	0.95
Agriculture	Crop Lands		0.00	0.00
	Fallow Lands		2.24	30.57
	Total Agriculture Land		0.93	12.81
Settlement	Urban Settlement		0.00	0.00
	Rural Settlement		0.18	2.46
	Industrial Settlement		0.02	0.27
	Total Settlement		0.20	2.73
Grand Total			7.33	100.00

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Customer		Mahanadi Coalfields Limited			
Job Title		Land Reclamation monitoring of OC Projects		Job No.	561410027
Subject	Land Reclamation monitoring of Bhubaneswari OC Based on Satellite Data (RESOURCESAT-2/L4FMX) Dated 18.03.2012	Activity	Name	Designation	Signature
		Prepared	A. K. Singh	Sr. Mgr.(RSC)	
		Checked	N. P. Singh	GM(Geomatics)	
		Approved	N. P. Singh	GM(Geomatics)	
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Plate 8.5



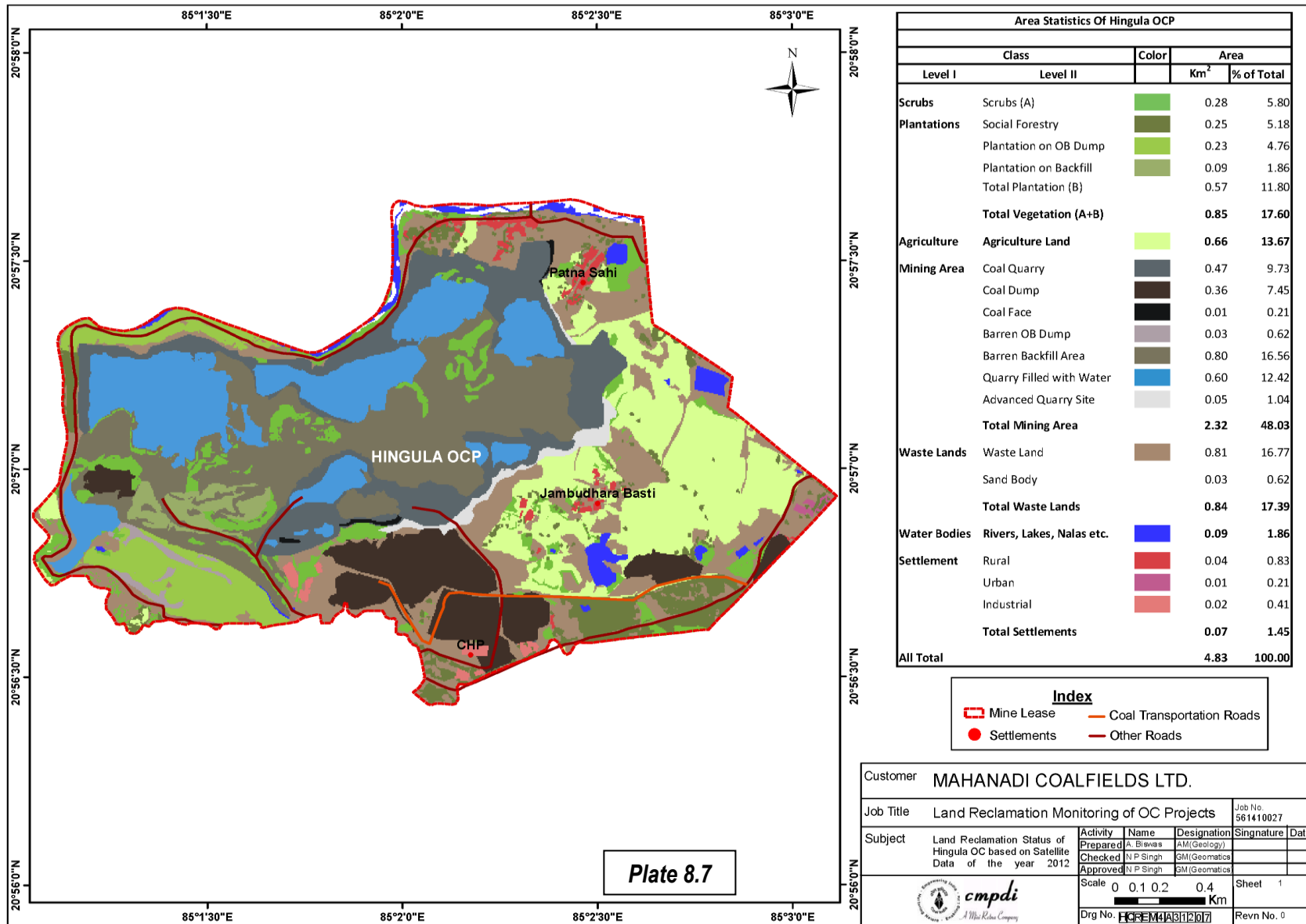
Classes		Colour	Area Statistics		
Level-I	Level-II		Sq.Km	%	
Forests	Dense Forests		0.00	0.00	
	Open Forests		0.03	0.60	
	Total Forests		0.03	0.60	
Scrubs	Scrubs		0.23	4.61	
Plantation	Social Forestry		0.15	3.01	
	Plantation on OB Dump		0.00	0.00	
	Plantation on Backfill		2.01	40.29	
	Total Plantation		2.16	43.30	
	Total Vegetation		2.42	48.51	
Mining Area	Coal Quarry		0.34	6.81	
	Advance Quarry Site		0.03	0.60	
	External OB Dump		0.00	0.00	
	Barren Backfilled area		0.77	15.43	
	Coal Dump		0.24	4.81	
	Quarry Filled with Water		0.60	12.02	
	Total Area Under Mining		1.98	39.67	
Waste Lands	Waste Land		0.36	7.21	
	Total Waste Lands		0.36	7.21	
Waterbodies	Reservoir, Nallah, Ponds		0.01	0.20	
	Agriculture	Crop Lands		0.00	0.00
		Fallow Lands		0.03	0.60
	Total Agriculture Land		0.03	0.60	
Settlement	Urban Settlement		0.00	0.00	
	Rural Settlement		0.00	0.00	
	Industrial Settlement		0.19	3.81	
	Total Settlement		0.19	3.81	
Grand Total			4.99	100.00	

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- Mine Lease Boundary
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- Coal Transportation Road
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Customer		Mahanadi Coalfields Limited			
Job Title		Land Reclamation monitoring of OC Projects			Job No. 561410027
Subject	Land Reclamation monitoring of Jagannath OC Based on Satellite Data (RESOURCESAT-2/L4FMX) Dated 18.03.2012	Activity	Name	Designation	Signature
		Prepared	A. K. Singh	Sr. Mgr.(RSC)	
		Checked	N. P. Singh	GM(Geomatics)	
Approved	N. P. Singh	GM(Geomatics)			
Scale		460 230 0 460 M			Sheet 1 of 1
Drg. No.		HCR/EM4/A3/12/08			Rev. No. 0

Plate 8.6



Area Statistics Of Hingula OCP				
Class		Color	Area	
Level I	Level II		Km ²	% of Total
Scrubs	Scrubs (A)		0.28	5.80
	Social Forestry		0.25	5.18
Plantations	Plantation on OB Dump		0.23	4.76
	Plantation on Backfill		0.09	1.86
	Total Plantation (B)		0.57	11.80
	Total Vegetation (A+B)		0.85	17.60
Agriculture	Agriculture Land		0.66	13.67
Mining Area	Coal Quarry		0.47	9.73
	Coal Dump		0.36	7.45
	Coal Face		0.01	0.21
	Barren OB Dump		0.03	0.62
	Barren Backfill Area		0.80	16.56
	Quarry Filled with Water		0.60	12.42
	Advanced Quarry Site		0.05	1.04
	Total Mining Area		2.32	48.03
	Waste Lands	Waste Land		0.81
Sand Body			0.03	0.62
Total Waste Lands			0.84	17.39
Water Bodies	Rivers, Lakes, Nalas etc.		0.09	1.86
Settlement	Rural		0.04	0.83
	Urban		0.01	0.21
	Industrial		0.02	0.41
Total Settlements		0.07	1.45	
All Total			4.83	100.00

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	Settlements
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Plate 8.7

Customer	MAHANADI COALFIELDS LTD.					
Job Title	Land Reclamation Monitoring of OC Projects	Job No.	561410027			
Subject	Land Reclamation Status of Hingula OC based on Satellite Data of the year 2012	Activity	Name	Designation	Signature	Date
		Prepared	A. Biswas	AM(Geology)		
		Checked	N.P. Singh	GM(Geomatics)		
		Approved	N.P. Singh	GM(Geomatics)		
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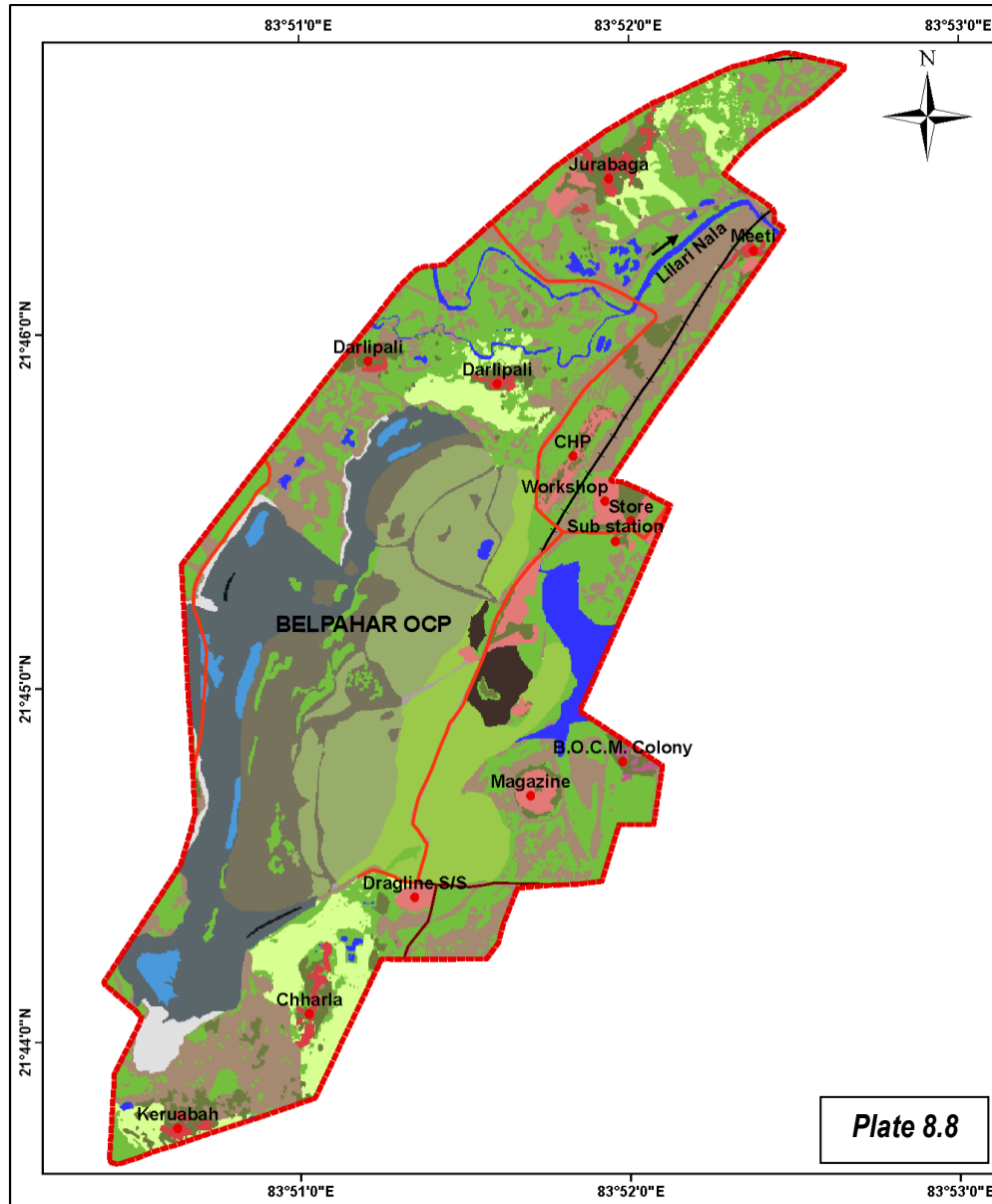


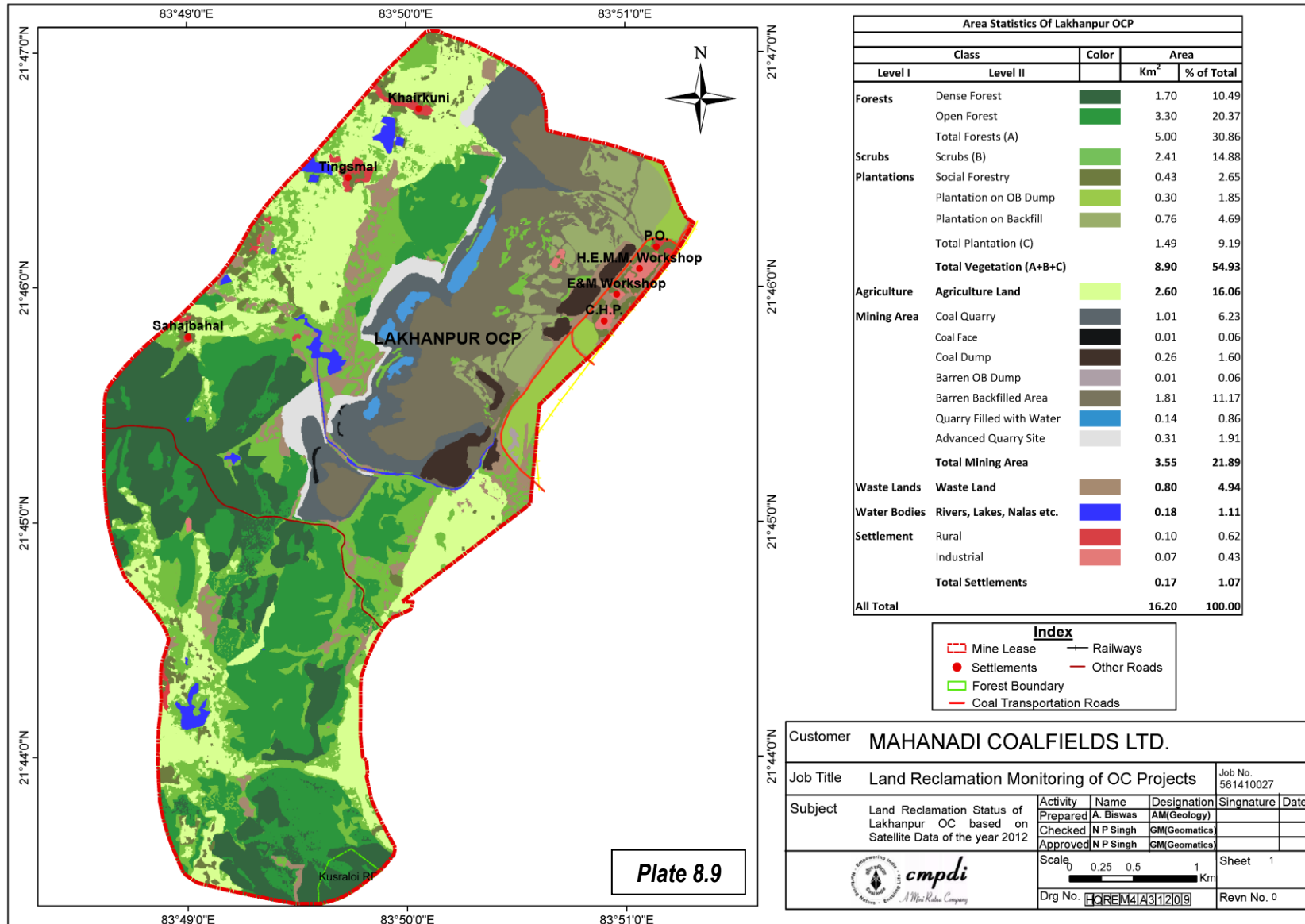
Plate 8.8

Area Statistics Of Belpahar OCP				
Class		Color	Area	
Level I	Level II		Km ²	% of Total
Forest	Open Forest (A)		0.02	0.21
	Scrubs (B)		2.40	24.64
Plantations	Social Forestry		0.40	4.11
	Plantation on OB Dump		0.70	7.19
	Plantation on Backfill		1.05	10.78
	Total Plantation (C)		2.15	22.08
	Total Vegetation (A+B+C)		4.57	46.93
Agriculture	Agriculture Land		0.54	5.54
Mining Area	Coal Quarry		1.08	11.09
	Coal Face		0.01	0.10
	Coal Dump		0.10	1.03
	Barren OB Dump		0.02	0.21
	Barren Backfilled Area		0.75	7.70
	Quarry Filled with Water		0.11	1.13
	Advanced Quarry Site		0.11	1.13
	Total Mining Area		2.18	22.39
	Waste Lands	Waste Land		1.81
Water Bodies	Rivers, Lakes, Nalas etc.		0.28	2.87
Settlement	Rural		0.11	1.13
	Urban		0.01	0.10
	Industrial		0.24	2.46
	Total Settlements		0.36	3.69
All Total			9.74	100.00

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Customer		MAHANADI COALFIELDS LTD.				
Job Title		Land Reclamation Monitoring of OC Projects		Job No. 561410027		
Subject	Land Reclamation Status of Belpahar OC based on Satellite Data of the year 2012	Activity	Name	Designation	Signature	Date
		Prepared	A. Biswas	AM(Geology)		
		Checked	N P Singh	GM(Geomatics)		
	Approved	N P Singh	GM(Geomatics)			
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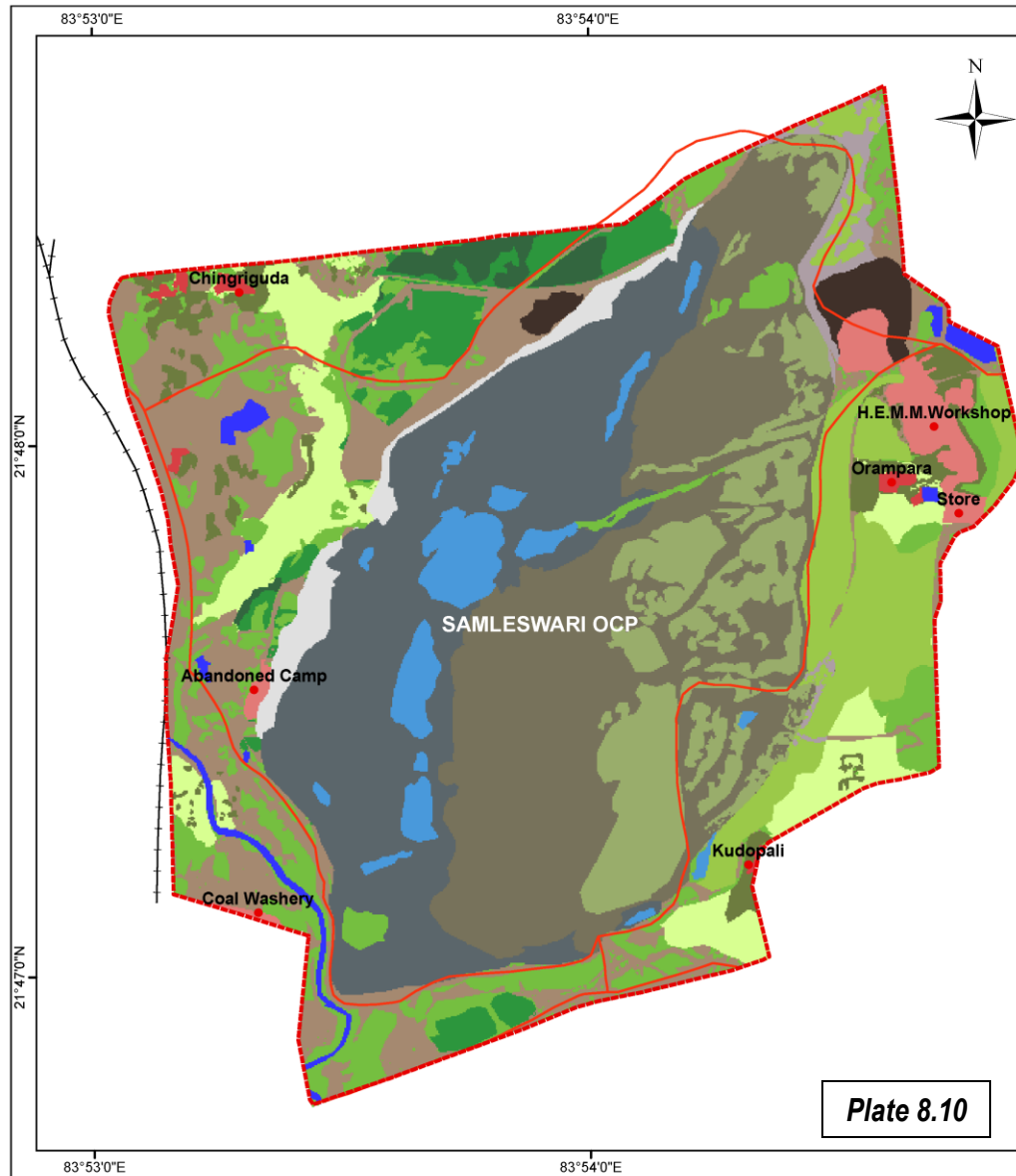


Plate 8.10

Area Statistics Of Samleswari OCP				
Class		Color	Area	
Level I	Level II		Km ²	% of Total
Forests	Dense Forest		0.08	1.12
	Open Forest		0.24	3.37
	Total Forests(A)		0.32	4.49
Scrubs	Scrubs (B)		0.73	10.24
Plantations	Social Forestry		0.18	2.52
	Plantation on OB Dump		0.48	6.73
	Plantation on Backfill		0.64	8.98
	Total Plantation (C)		1.30	18.23
Total Vegetation (A+B+C)			2.35	32.96
Agriculture	Agriculture Land		0.42	5.89
Mining Area	Coal Quarry		1.23	17.25
	Coal Dump		0.09	1.26
	Barren OB Dump		0.07	0.98
	Barren Backfill Area		1.46	20.48
	Quarry Filled with Water		0.21	2.95
	Advanced Quarry Site		0.12	1.68
	Total Mining Area		3.18	44.60
Waste Lands	Waste Land		0.94	13.19
Water Bodies	Rivers, Lakes, Nalas etc.		0.07	0.98
Settlement	Rural		0.03	0.42
	Industrial		0.14	1.96
	Total Settlements		0.17	2.38
All Total			7.13	100.00

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Customer	MAHANADI COALFIELDS LTD.			
Job Title	Land Reclamation Monitoring of OC Projects	Job No.	561410027	
Subject	Land Reclamation Status of Samleswari OC based on Satellite Data of the year 2012	Activity	Name	Designation
		Prepared	A. Biswas	AM(Geology)
		Checked	N P Singh	GM(Geomatics)
		Approved	N P Singh	GM(Geomatics)
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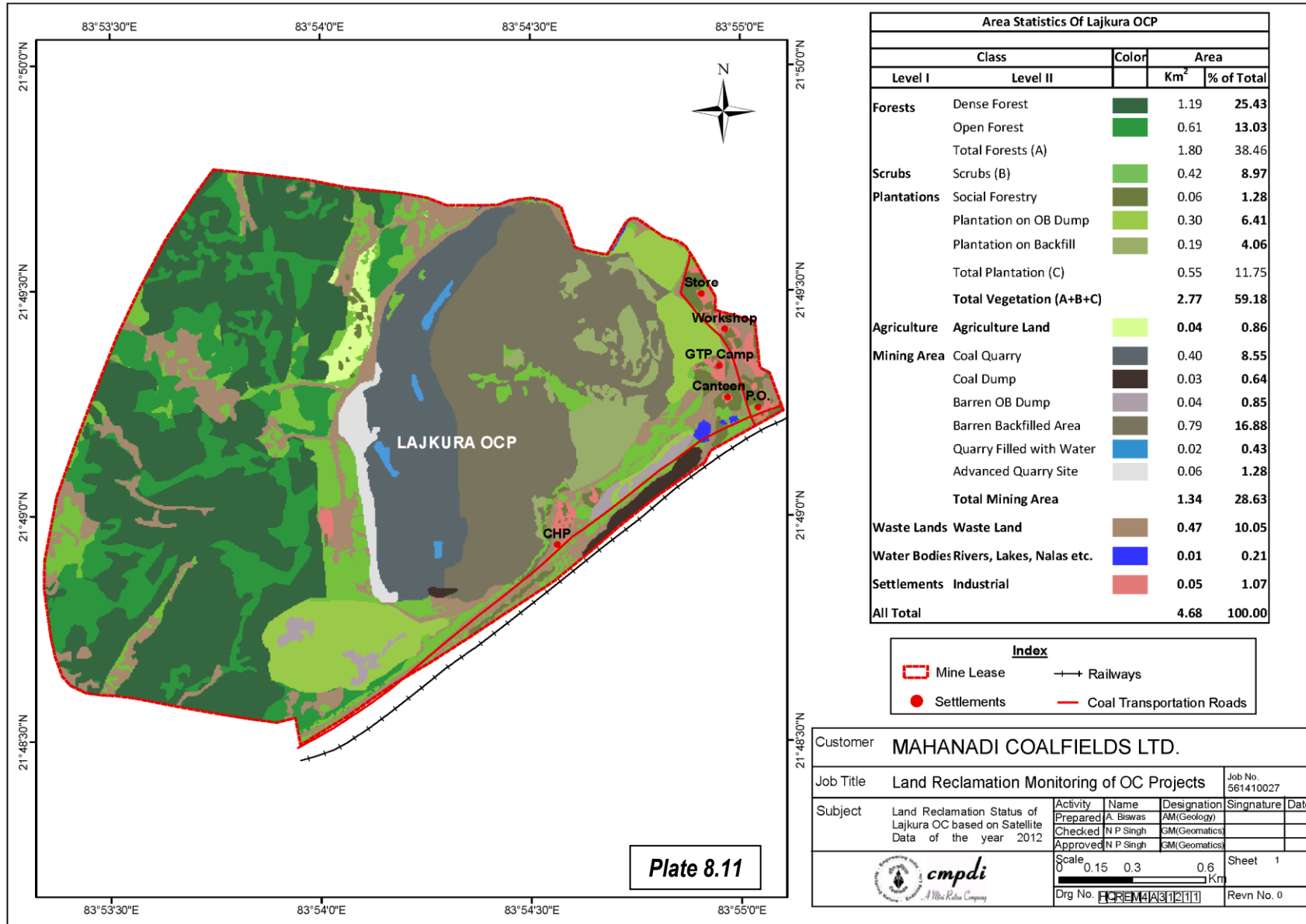


Plate 8.11

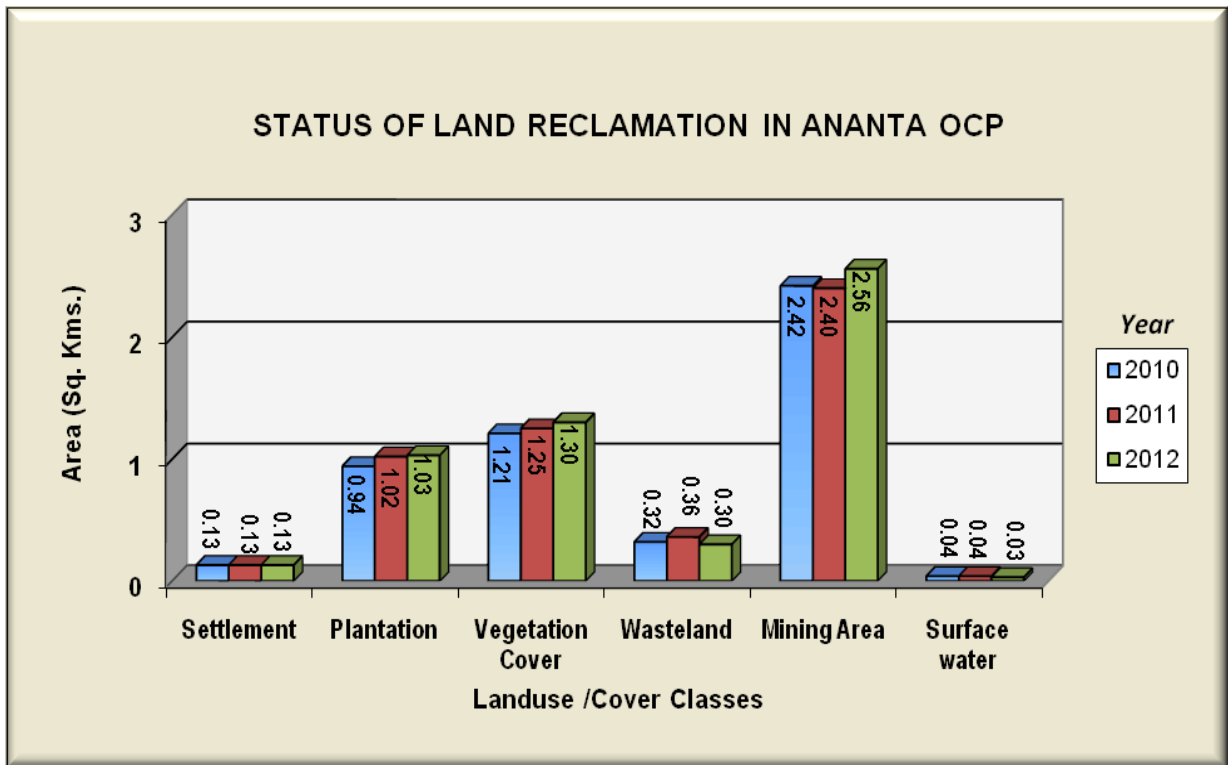


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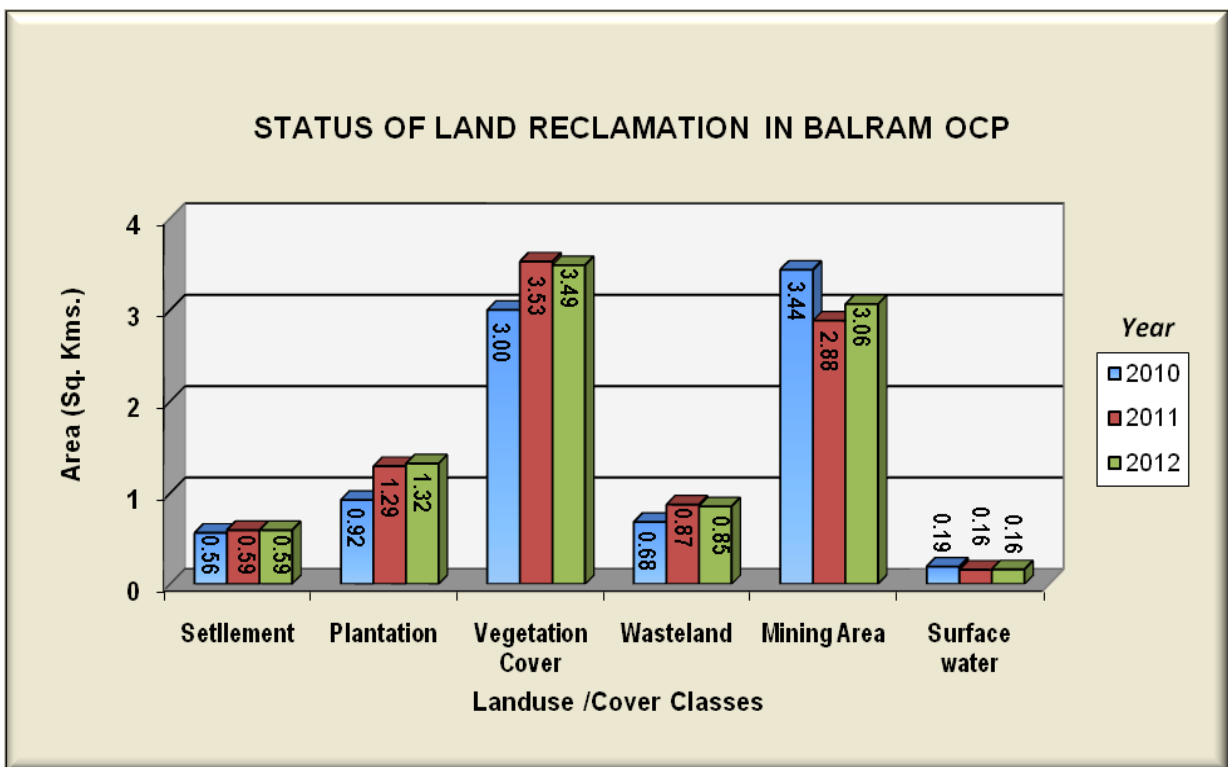


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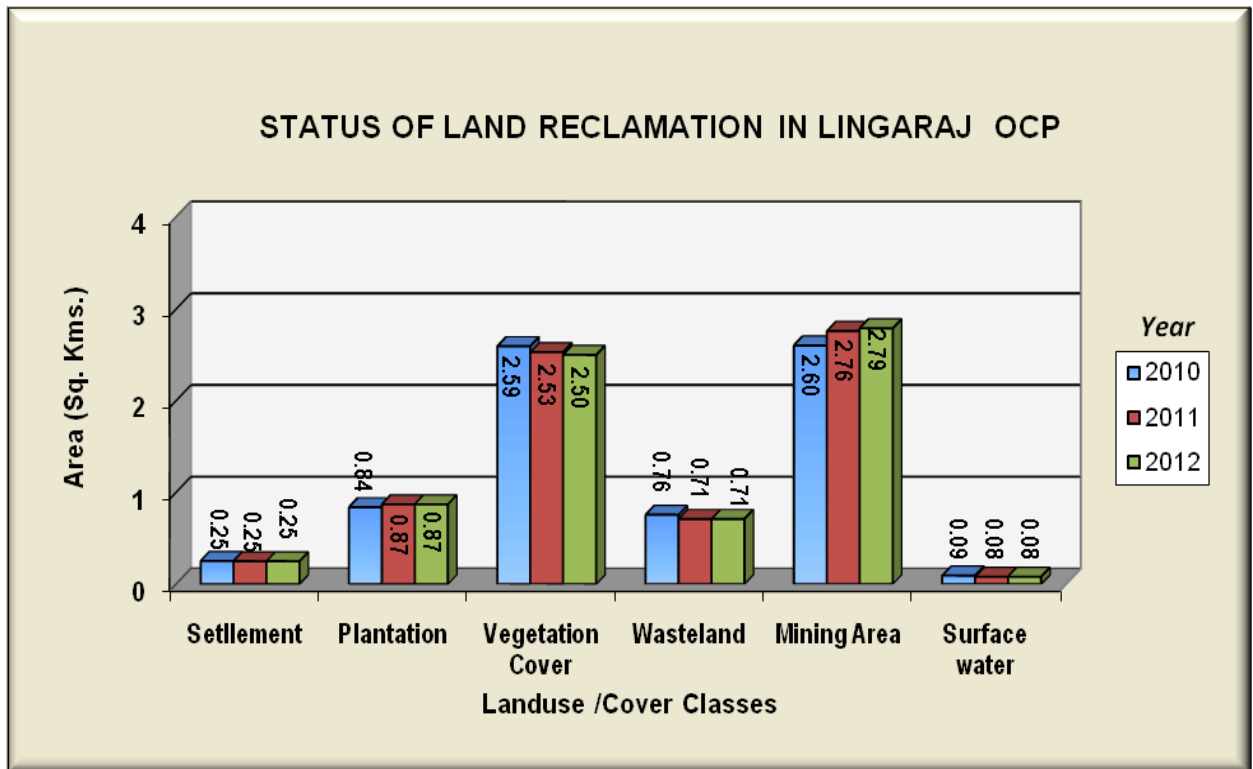


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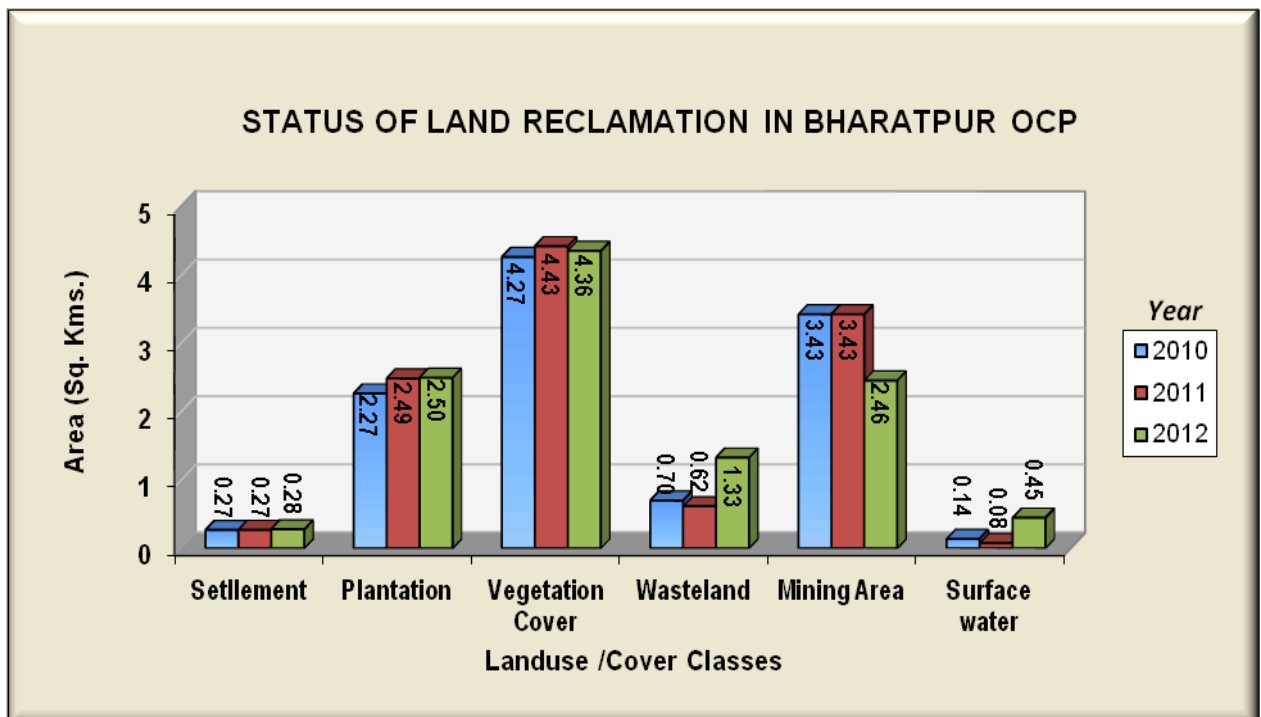


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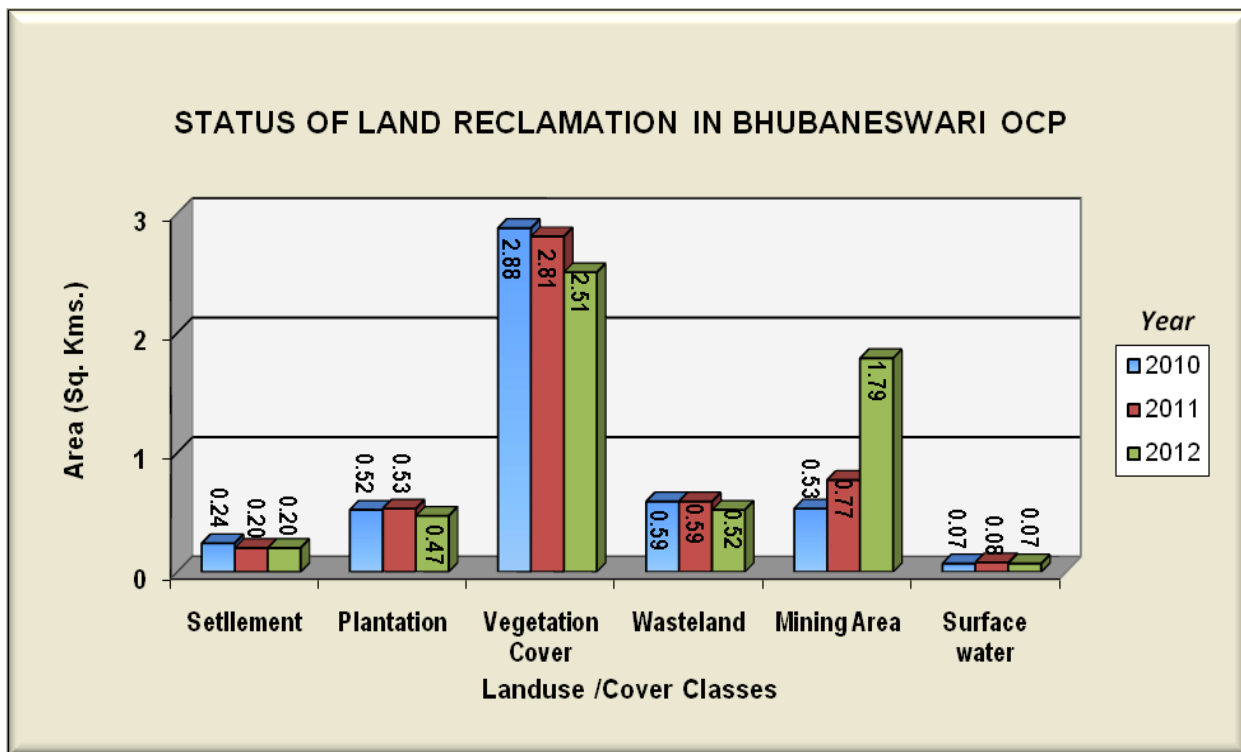


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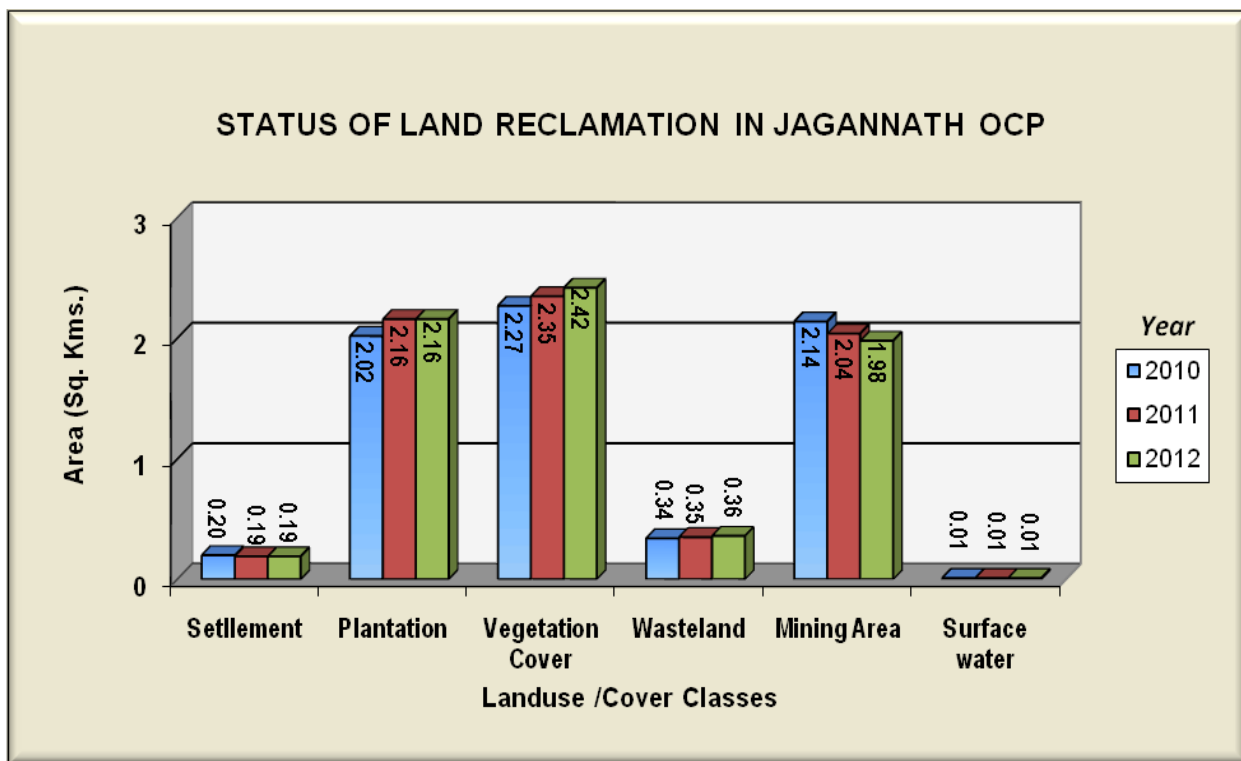


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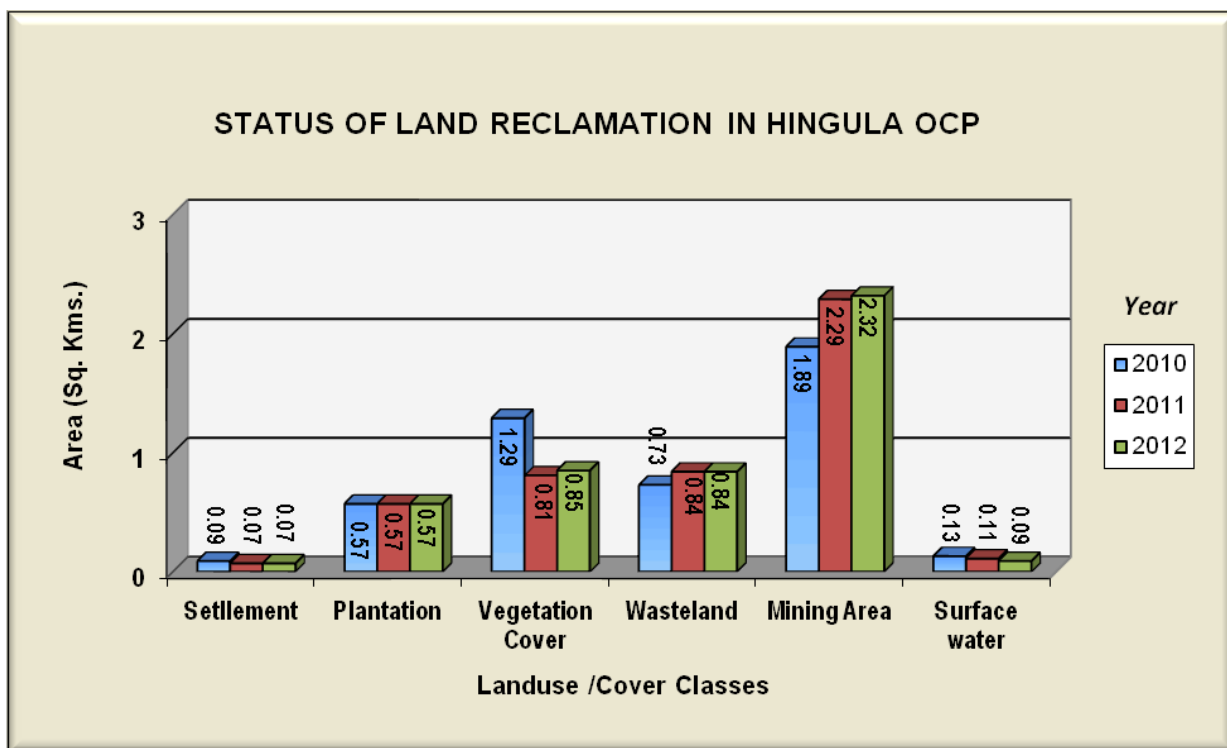


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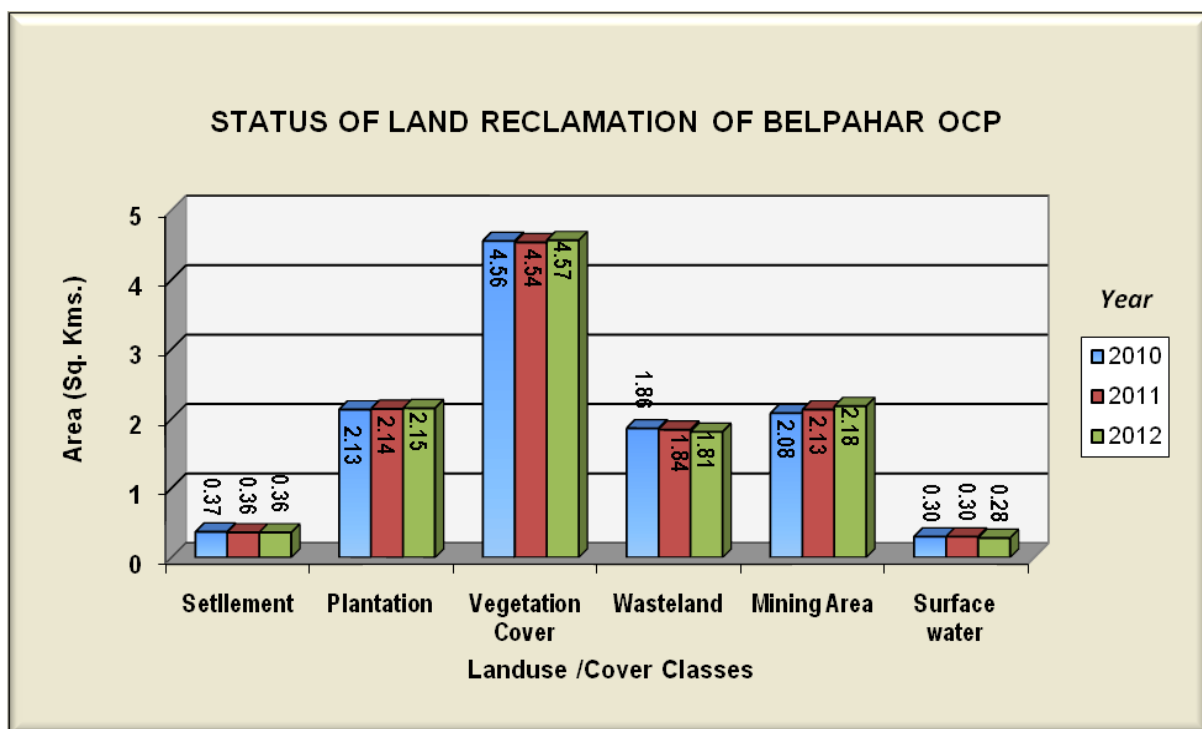


Figure 8.9

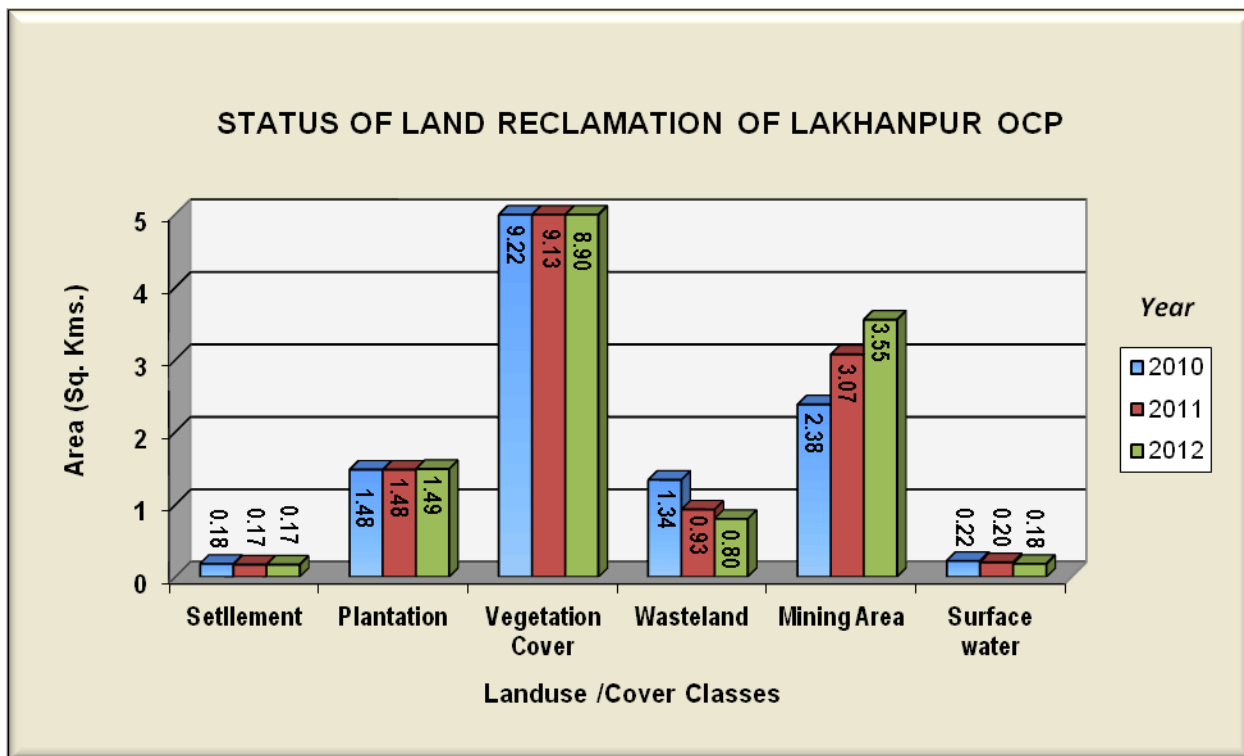


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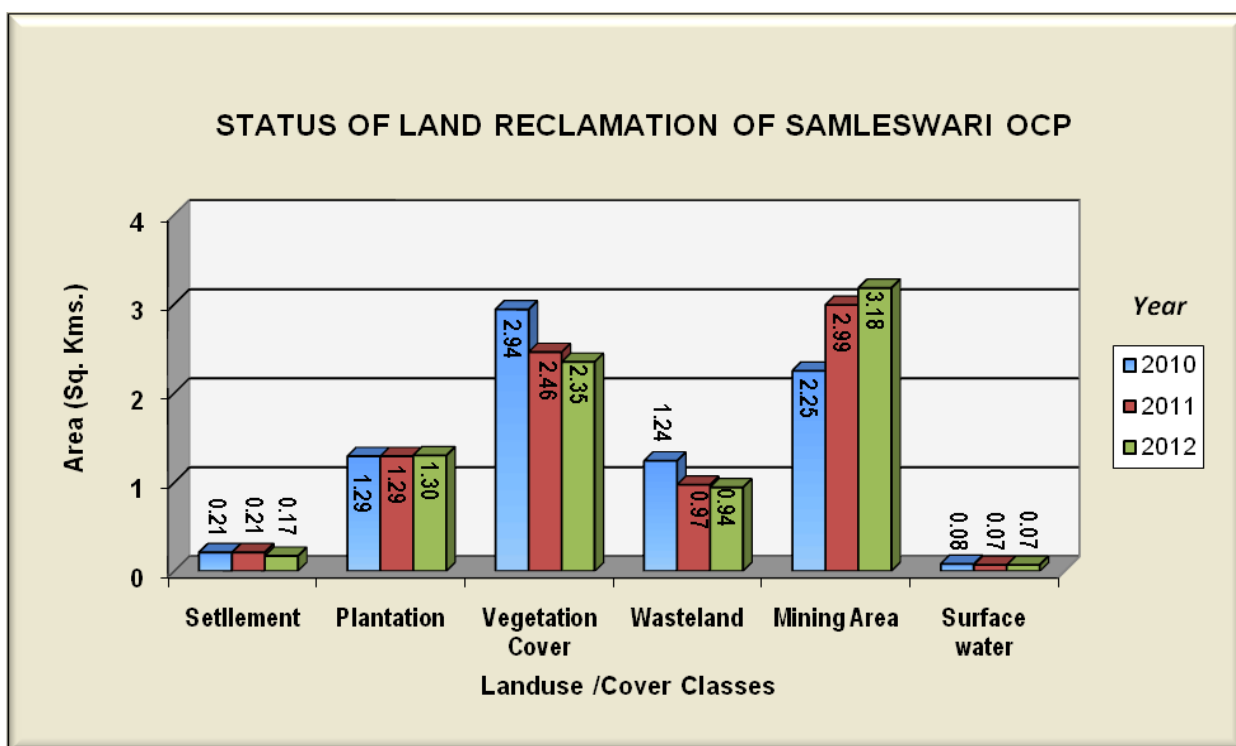


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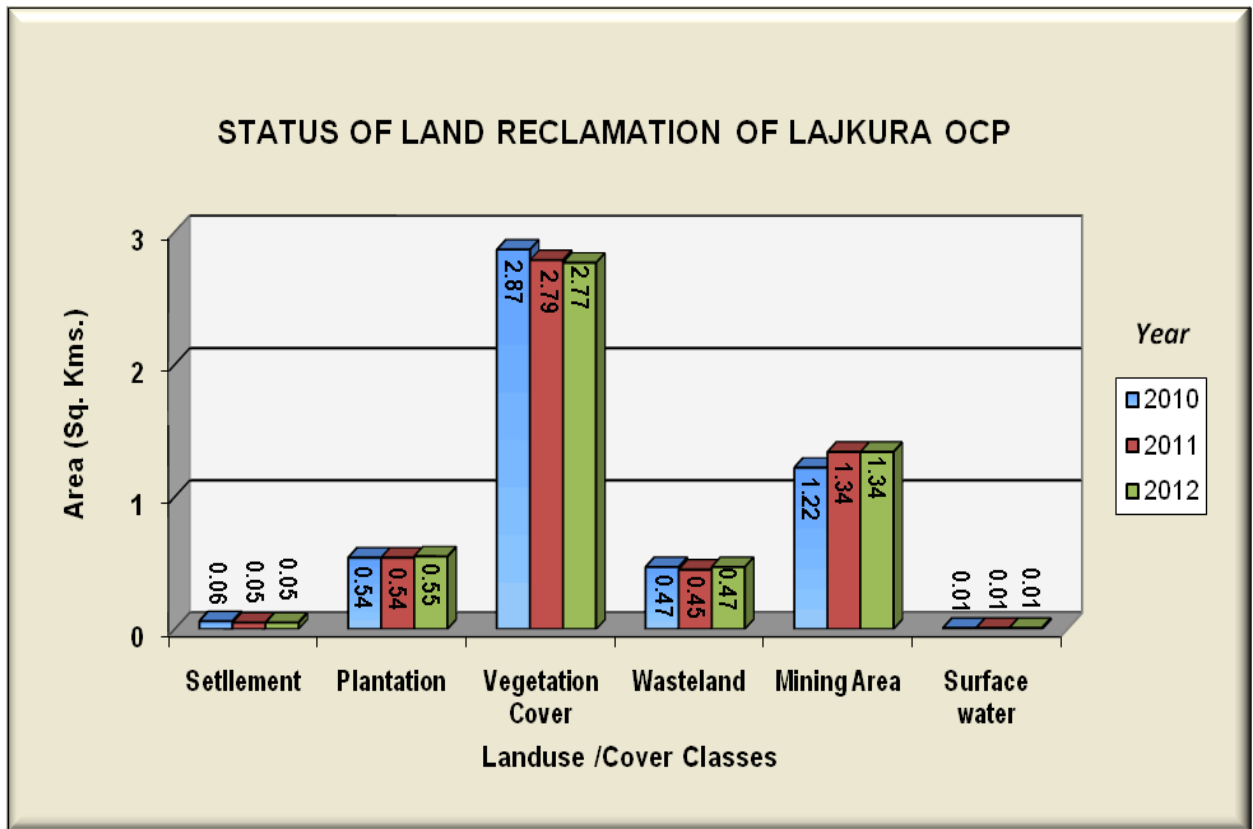


Figure 8.12



Photograph – 8.1: Plantation on Internal OB/Backfill (Ananta OC mine)



Photograph – 8.2: Plantation on External OB (Balram OC Mine)



Photograph – 8.3: Plantation on Internal OB/Backfill (Lingaraj OC Mine)



Photograph – 8.4: Plantation on Internal OB/Backfill (Bharatpur OC Mine)



Photograph – 8.5 : Plantation on External OB (Hingula OC Mine)



Photograph – 8.6: Scrubs on Internal OB/Backfill (Hingula OC Mine)



Photograph – 8.7: Plantation on Internal OB/Backfill at Belpahar OC



Photograph – 8.8 : Plantation on Internal OB/Backfill at Lakhanpur OC



Photograph -8.9: Plantation on Internal ob/Backfill at Samleswari OC



Photograph -8.10 : Plantation at Lajkura Opencast Project

CENTRAL COALFIELDS LIMITED

9.0 Land Reclamation Status in Central Coalfields Ltd.

9.1 Following 5 OC projects producing more than 5 million m³. (Coal + OB together)of Central Coalfields Ltd. have been taken up during the year 2012 for land reclamation monitoring:

- Ashoka
- Piparwar
- KD Hesalong
- Parej East
- Rajrappa

9.2 Project wise Land Reclamation status in CCL in the year 2012 is given in Table 9.1 and also shown graphically in Fig 9.1. Area statistics of different land use classes present in OC projects in the year 2012 is given in Table 9.2. Land use maps derived from the satellite data is given in Plate no. 9.1 to 9.5. Changes in land use status are shown in Fig. 9.3 – 9.7 and field photographs showing plantation and backfilled area in mining projects in photo 9.1-9.5.

9.3 Study reveals that 81.45% of excavated mining area has already been reclaimed by CCL in above 5 OC projects, out of which 64.47% area has been revegetated and 16.98% area are backfilled.

9.4 After analyzing the satellite data of year 2012 vs. 2011, it is evident that plantation carried out on backfilled area, OB dumps as well as under social forestry in all the 5 mines of CCL has increased to the extent of 0.38 Km² in span of last one year.

9.5 It may be seen from the Table.9.1 that area of total reclamation has increased in the year 2012 in comparison to year 2011 but in terms of percentage it has been reduced due to increase of total excavated area in the year 2012.

TABLE – 9.1
Project wise Land Reclamation Status in OC projects of Central Coalfields Ltd
Based on Satellite data of the Year 2012

(% Calculated in respect of Total Excavated Area)

(Area in Km2)

SI No.	Projects	Leasehold	Plantation		Under Backfilling / OB		Area under Active Mining		Total Excavated Area		Total Reclaimed Area	
			2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
1	Ashoka	5.42	1.27	1.32	0.54	0.49	1.38	1.38	3.19	3.19	1.81	1.81
			<i>39.82</i>	<i>41.38</i>	<i>16.93</i>	<i>15.37</i>	<i>43.27</i>	<i>43.27</i>			<i>56.74</i>	<i>56.74</i>
2	Piparwar	11.2	5.51	5.64	0.70	0.57	2.03	2.03	8.24	8.24	6.21	6.21
			<i>66.87</i>	<i>68.45</i>	<i>8.50</i>	<i>6.92</i>	<i>24.64</i>	<i>24.64</i>			<i>75.36</i>	<i>75.36</i>
3	KDH	4.5	1.37	1.45	0.89	0.81	0.35	0.35	2.61	2.61	2.26	2.26
			<i>52.50</i>	<i>55.56</i>	<i>34.10</i>	<i>31.04</i>	<i>13.41</i>	<i>13.41</i>			<i>86.59</i>	<i>86.59</i>
4	Parej East	6.2	0.55	0.55	0.51	0.51	0.50	0.60	1.56	1.66	1.06	1.06
			<i>35.26</i>	<i>33.14</i>	<i>32.70</i>	<i>30.73</i>	<i>32.06</i>	<i>36.15</i>			<i>67.95</i>	<i>63.86</i>
5	Rajrappa	19.82	7.25	7.37	1.92	1.92	0.34	0.34	9.51	9.63	9.17	9.29
			<i>76.24</i>	<i>76.54</i>	<i>20.19</i>	<i>19.94</i>	<i>3.58</i>	<i>3.54</i>			<i>96.42</i>	<i>96.47</i>
	Total	47.14	15.95	16.33	4.56	4.30	4.60	4.70	25.11	25.33	20.51	20.63
			<i>63.53</i>	<i>64.47</i>	<i>18.17</i>	<i>16.98</i>	<i>18.31</i>	<i>18.55</i>			<i>81.69</i>	<i>81.45</i>

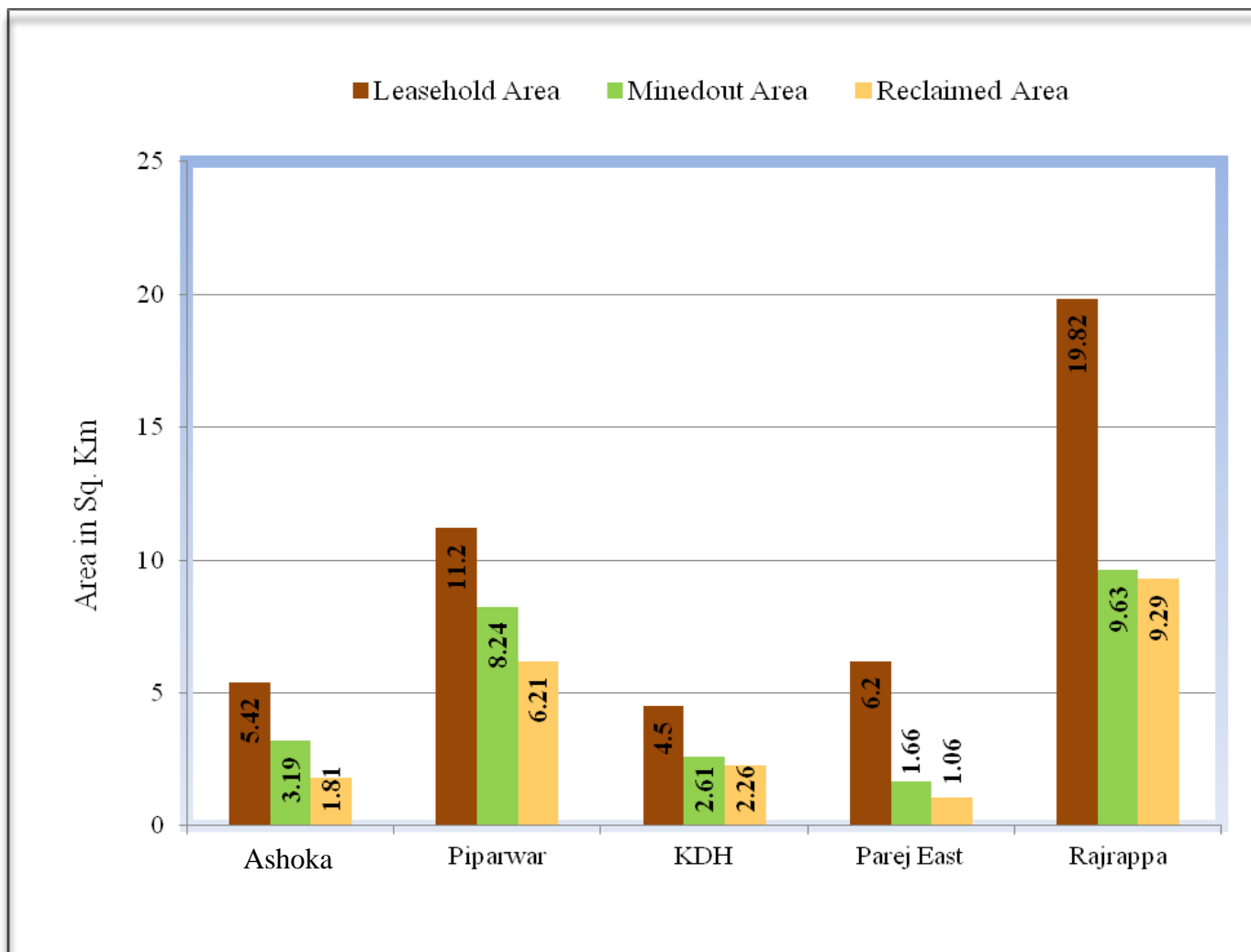


Fig. 9.1 : Project wise Land Reclamation Status in Year 2012

**Table 9.2 : STATUS OF LAND RECLAMTION IN CENTRAL COALFIELDS LIMITED
BASED ON THE SATELLITE DATA OF THE YEAR 2012**

		ASHOKA		FIPARWAR		KDHESALONG		RAJRAPPA		FAREJ EAST		(Area in Sq. Km) TOTAL	
		Area	%	Area	%	Area	%	Area	%	Area	%	Area	%
FORESTS	Dense Forest	0.00	0.00	0.01	0.09	0.01	0.22	0.05	0.25	0.01	0.16	0.08	0.17
	Open Forest	0.63	11.62	0.65	5.80	0.16	3.56	0.38	1.92	1.31	21.13	3.13	6.64
	Total Forest	0.63	11.62	0.66	5.89	0.17	3.78	0.43	2.17	1.32	21.29	3.21	6.81
SCRUBS	Scrub	0.54	9.96	0.44	3.93	0.60	13.33	6.10	30.78	1.70	27.42	9.38	19.90
PLANTATION	Social Forestry	0.32	5.90	2.74	24.46	0.15	3.33	1.80	9.08	0.10	1.61	5.11	10.84
	Plantation on OB Dump	1.00	18.45	2.90	25.89	1.30	28.89	5.57	28.10	0.45	7.26	11.22	23.80
	Plantation on Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total Plantation (Biological Reclamation)	1.32	24.35	5.64	50.36	1.45	32.22	7.37	37.18	0.55	8.87	16.33	34.64
Total Vegetation		2.49	45.94	6.74	60.18	2.22	49.33	13.90	70.13	3.57	57.58	28.92	61.35
ACTIVE MINING	Coal Quarry	0.73	13.47	1.18	10.54	0.16	3.56	0.22	1.11	0.45	7.26	2.74	5.81
	Coal Face	0.15	2.77	0.10	0.89	0.01	0.22	0.01	0.05	0.01	0.00	0.28	0.59
	Coal Dump	0.10	1.85	0.35	3.13	0.03	0.67	0.10	0.50	0.13	2.10	0.71	1.51
	Advance Quarry Site	0.40	7.38	0.40	3.57	0.15	3.33	0.01	0.05	0.01	0.16	0.97	2.06
	Quarry Filled With Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total Area under Active Mining	1.38	25.46	2.03	18.13	0.35	7.78	0.34	1.72	0.60	9.52	4.70	9.97
RECLAIMED	Barren OB Dump	0.49	9.04	0.57	5.08	0.81	18.00	1.80	9.08	0.51	8.23	4.18	8.87
	Area Under Backfilling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total Area under Technical Reclamation	0.49	9.04	0.57	5.08	0.81	18.00	1.80	9.08	0.51	8.23	4.18	8.87
Total Area under Mine Operation		1.87	34.50	2.60	23.21	1.16	25.78	2.14	10.80	1.11	17.90	8.88	18.84
WASTELAND	Waste Lands	0.15	2.77	0.22	1.96	0.63	14.00	0.78	3.94	0.07	1.13	1.85	3.92
	Fly Ash Pond / Sand Body	0.00	0.00	0.03	0.27	0.00	0.00	0.03	0.15	0.01	0.00	0.07	0.15
Total Wasteland		0.15	2.77	0.25	2.23	0.63	14.00	0.81	4.09	0.08	1.30	1.92	4.07
WATERBODIES	Reservoir, nallah, ponds	0.03	0.55	0.20	1.79	0.22	4.89	0.59	2.98	0.18	2.90	1.22	2.59
	Total Waterbodies	0.03	0.55	0.20	1.79	0.22	4.89	0.59	2.98	0.18	2.90	1.22	2.59
AGRICULTURE	Crop Lands	0.01	0.18	0.03	0.26	0.00	0.00	0.32	1.61	0.50	8.06	0.86	1.82
	Fallow Lands	0.78	14.39	0.42	3.75	0.00	0.00	1.24	6.26	0.01	0.16	2.45	5.20
	Total Agriculture	0.79	14.58	0.45	4.01	0.00	0.00	1.56	7.87	0.51	8.23	3.31	7.02
SETTLEMENTS	Urban Settlement	0.00	0.00	0.00	0.00	0.26	5.78	0.43	2.17	0.23	3.70	0.92	1.95
	Rural Settlement	0.08	1.48	0.55	4.91	0.00	0.00	0.18	0.91	0.42	6.77	1.23	2.61
	Industrial Settlement	0.01	0.18	0.41	3.66	0.01	0.22	0.21	1.06	0.10	1.61	0.74	1.57
	Total Settlement	0.09	1.66	0.96	8.57	0.27	6.00	0.82	4.14	0.75	12.09	2.89	6.13
Grand Total		5.42	100.00	11.20	100.00	4.50	100.00	19.82	100.00	6.20	100.00	47.14	100.00

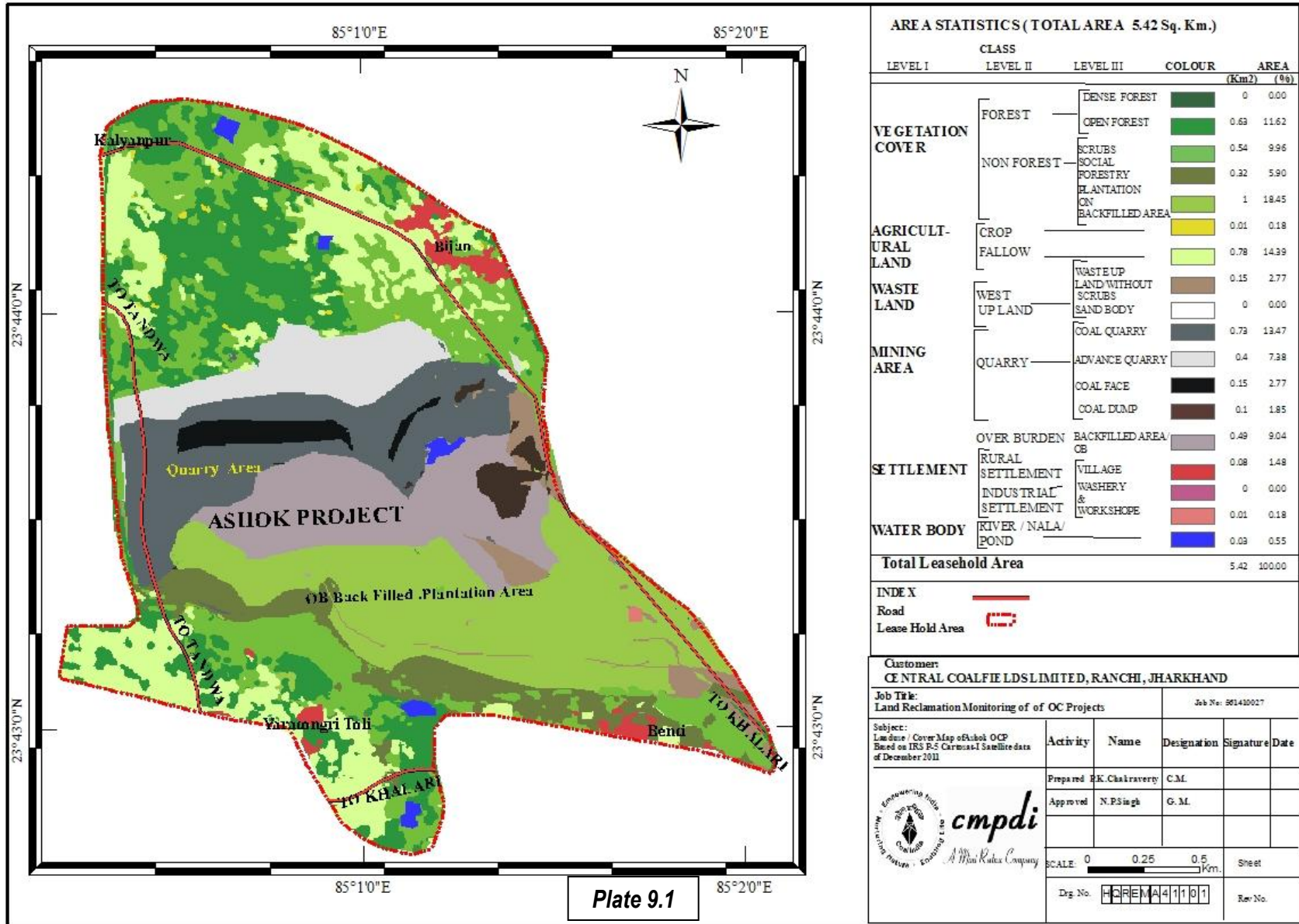


Plate 9.1

AREA STATISTICS (TOTAL AREA 5.42 Sq. Km.)

LEVEL I	CLASS	LEVEL II	LEVEL III	COLOUR	AREA (Km2)	AREA (%)
VEGETATION COVER	FOREST		DENSE FOREST		0	0.00
			OPEN FOREST		0.63	11.62
	NON FOREST		SCRUBS		0.54	9.96
			SOCIAL FORESTRY		0.32	5.90
			PLANTATION		1	18.45
			ON BACKFILLED AREA		0.01	0.18
AGRICULTURAL LAND	CROP			0.01	0.18	
	FALLOW			0.78	14.39	
WASTE LAND	WET UPLAND		WASTE UP LAND WITHOUT SCRUBS		0.15	2.77
			SAND BODY		0	0.00
			COAL QUARRY		0.73	13.47
MINING AREA	QUARRY		ADVANCE QUARRY		0.4	7.38
			COAL FACE		0.15	2.77
			COAL DUMP		0.1	1.85
			OVER BURDEN BACKFILLED AREA OB		0.49	9.04
SETTLEMENT	RURAL SETTLEMENT		VILLAGE		0.08	1.48
	INDUSTRIAL SETTLEMENT		WASHERY & WORKSHOPS		0	0.00
		RIVER / NALA / POND			0.01	0.18
Total Leasehold Area					5.42	100.00

INDEX

Road

Lease Hold Area

Customer: CENTRAL COALFIELDS LIMITED, RANCHI, JHARKHAND

Job Title: Land Reclamation Monitoring of OC Projects Job No: 861410027

Subject:	Activity	Name	Designation	Signature	Date
Land Use / Cover Map of Ashok OCP Based on IRS P-5 Cartosat-1 Satellite data of December 2011	Prepared	E.K. Chakraverty	C.M.		
	Approved	N.P. Singh	G.M.		



cmpdi
A Tata Group Company

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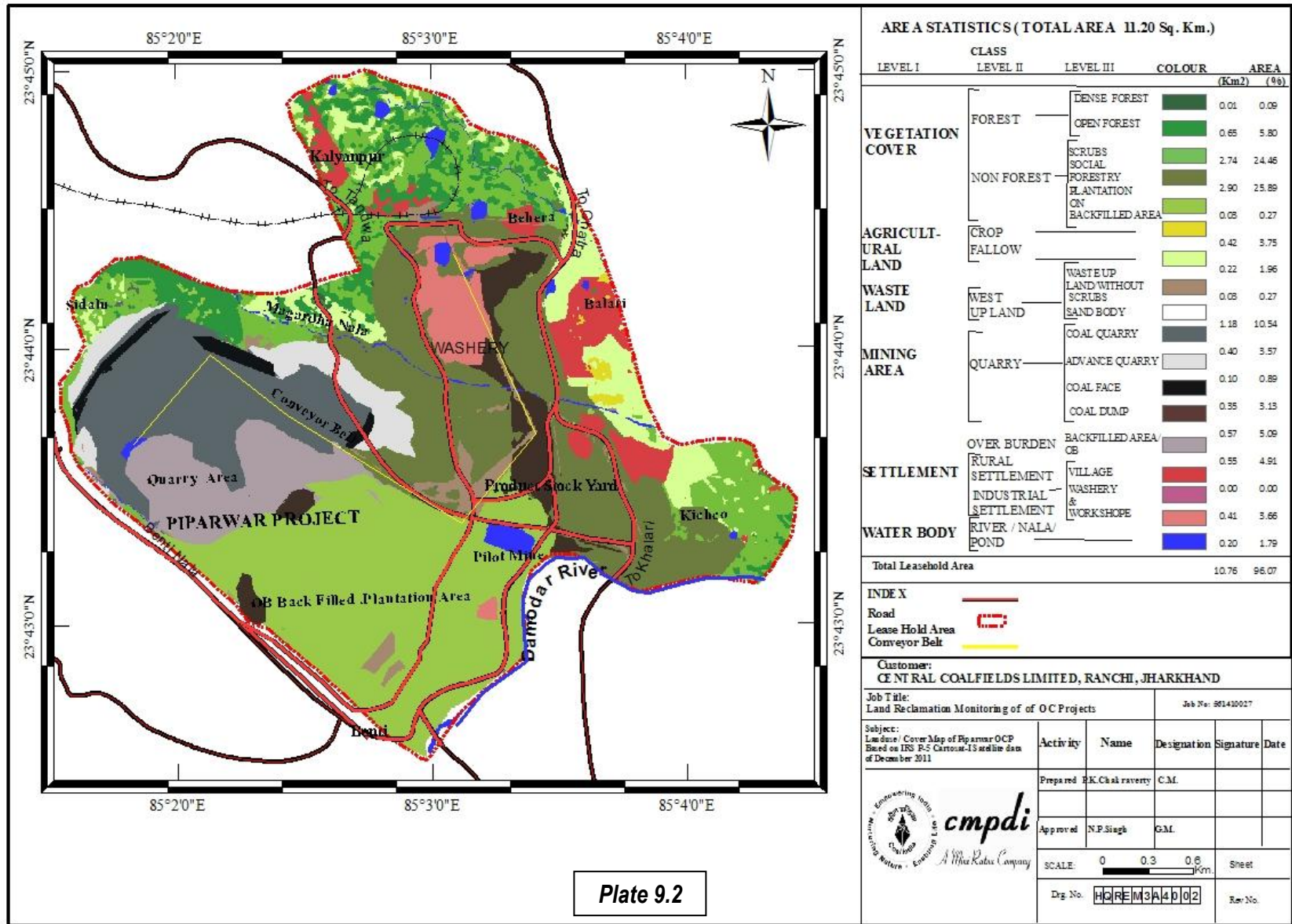
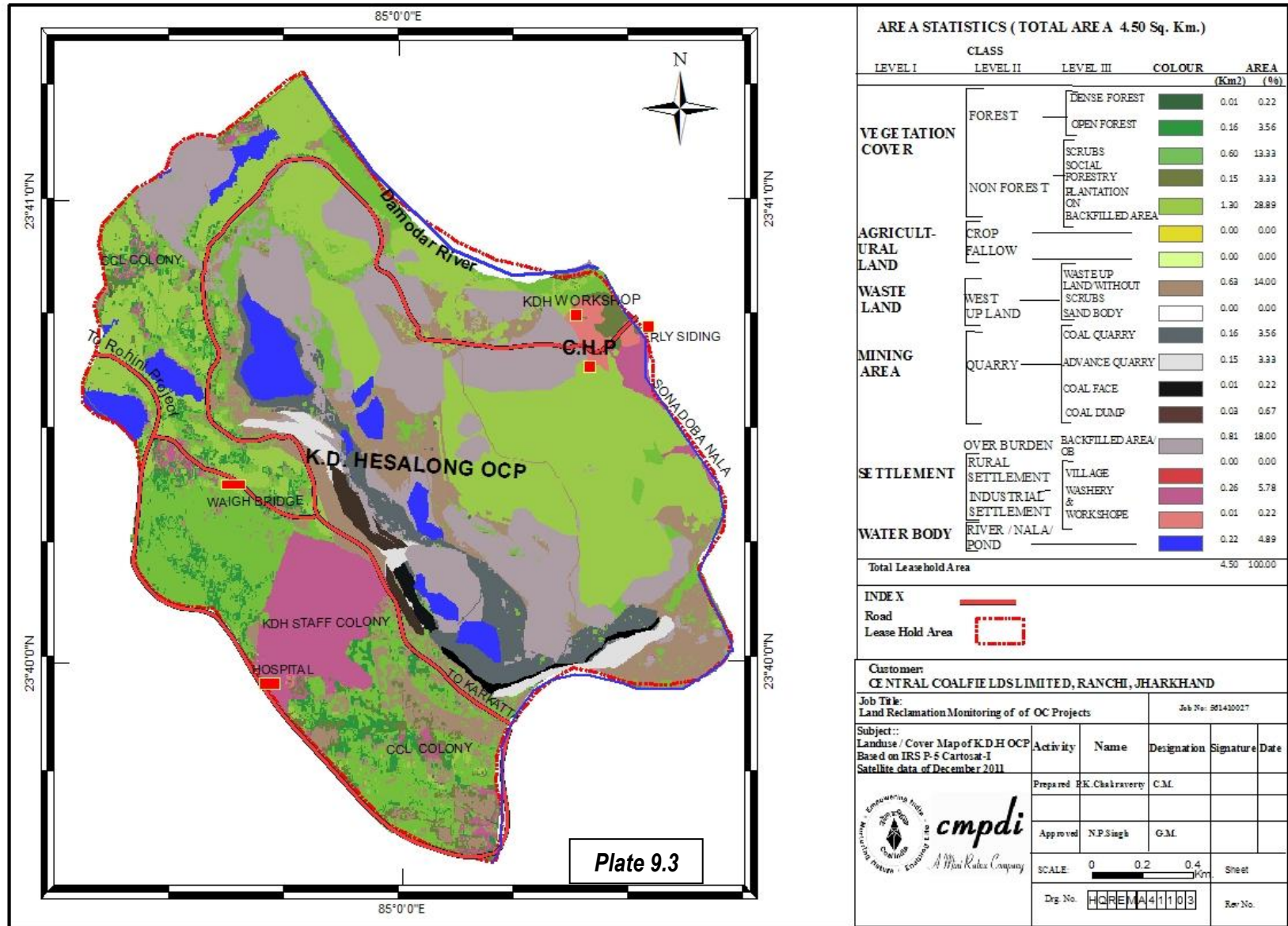


Plate 9.2



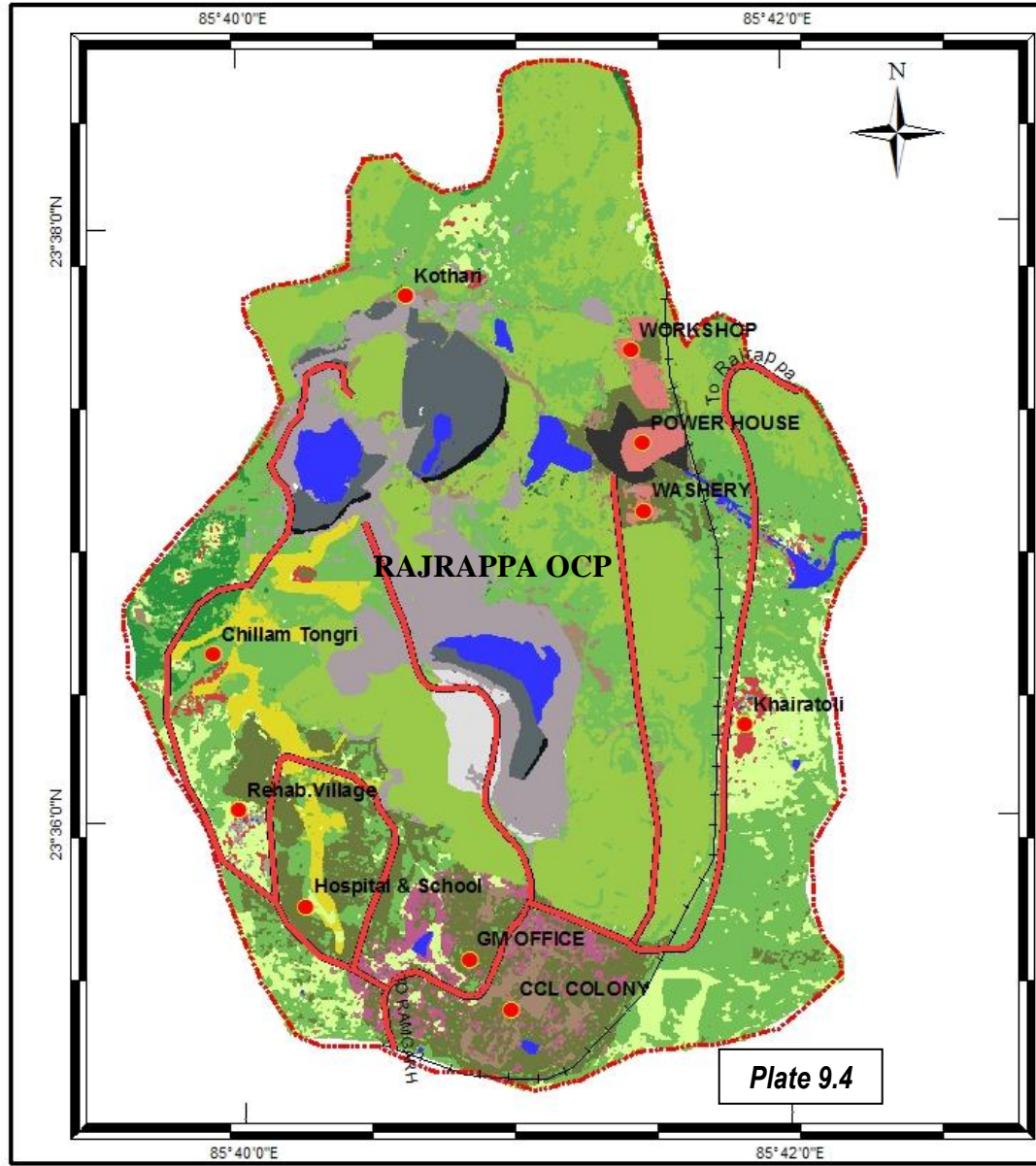
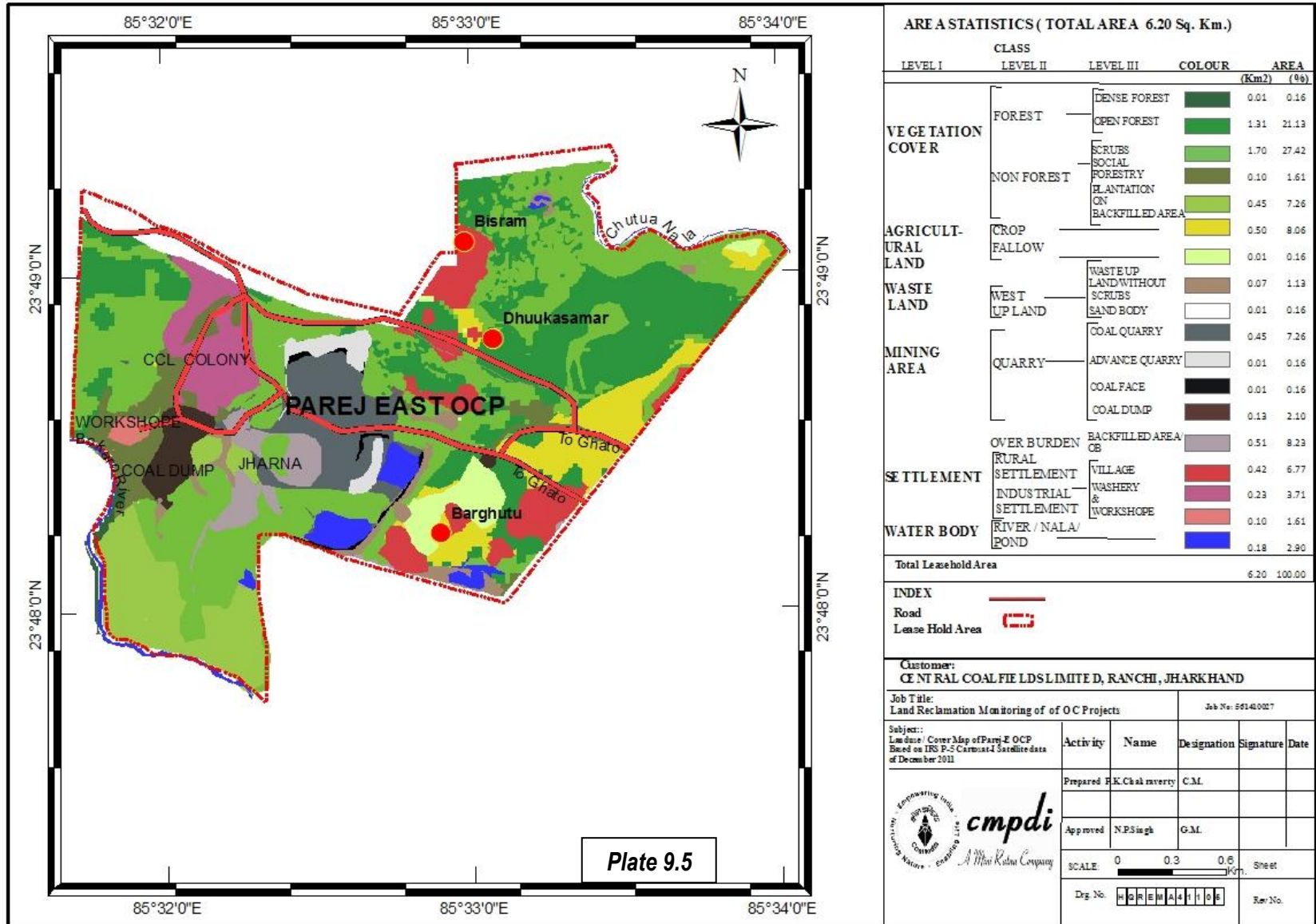


Plate 9.4

AREA STATISTICS (TOTAL AREA 19.82 Sq. Km.)					
LEVEL I	CLASS	LEVEL III	COLOUR	AREA	
	LEVEL II			(Km2)	(%)
VEGETATION COVER	FOREST	DENSE FOREST		0.05	0.25
		OPEN FOREST		0.38	1.92
	NON FOREST	SCRUBS		6.10	30.78
		SOCIAL FORESTRY		1.80	9.08
		PLANTATION ON BACKFILLED AREA		5.57	28.10
AGRICULTURAL LAND	CROP		0.32	1.61	
	FALLOW		1.24	6.26	
WASTE LAND	WASTE UP LAND	LAND WITHOUT SCRUBS		0.78	3.94
		SAND BODY		0.03	0.15
		COAL QUARRY		0.22	1.11
MINING AREA A	QUARRY	ADVANCE QUARRY		0.01	0.05
		COAL FACE		0.01	0.05
		COAL DUMP		0.10	0.50
		OVER BURDEN	BACKFILLED AREA/OB		1.80
SETTLEMENT	RURAL SETTLEMENT	VILLAGE		0.18	0.91
	INDUSTRIAL SETTLEMENT	WASHERY & WORKSHOPE		0.43	2.17
		RIVER / NALA/ POND		0.59	2.98
Total Leasehold Area				19.82	100.00
INDEX					
Road					
Lease Hold Area					
Railway					
Customer: CENTRAL COALFIELDS LIMITED, RANCHI, JHARKHAND					
Job Title: Land Reclamation Monitoring of OC Projects			Job No: 561410027		
Subject: Landuse / Cover Map of Rajrappa OCP Based on IRS P-5 Cartosat-1 Satellite data of December 2011					
Activity	Name	Designation	Signature	Date	
Prepared	P.K.Chakraverty	C.M.			
Approved	N.P.Singh	G.M.			
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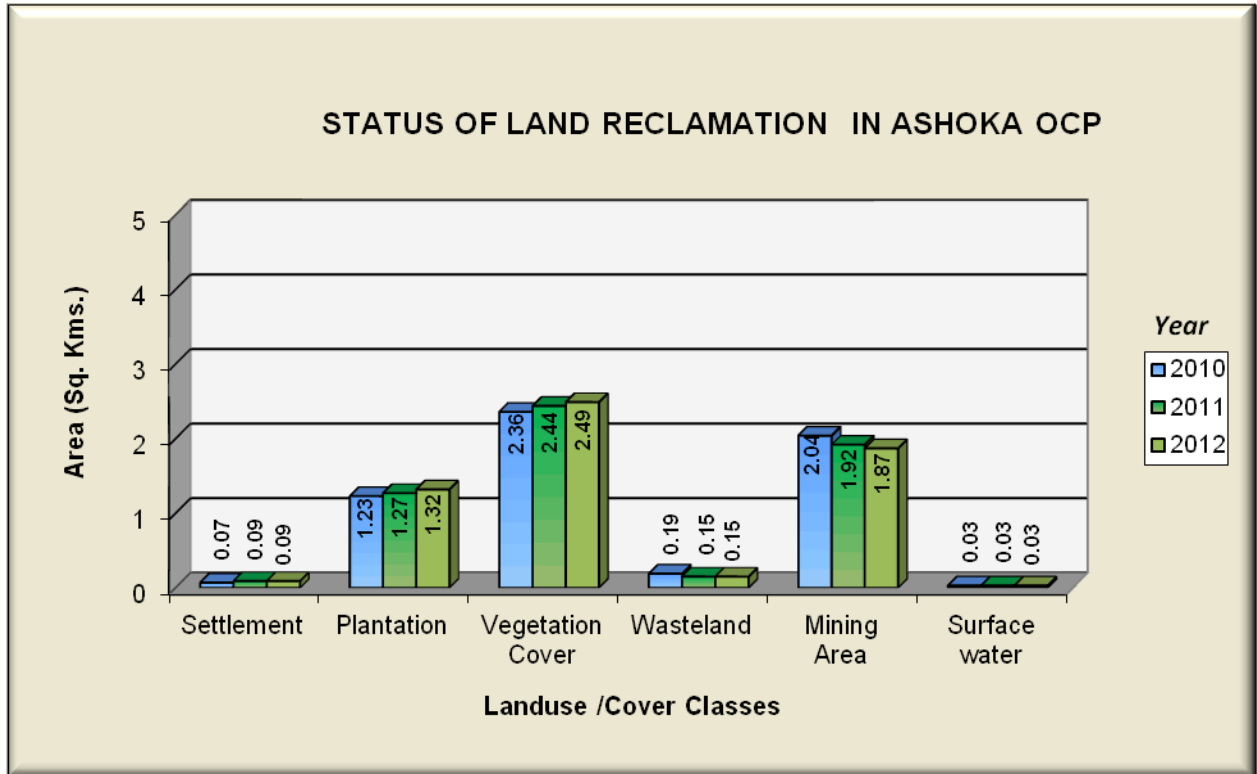


Figure 9.2

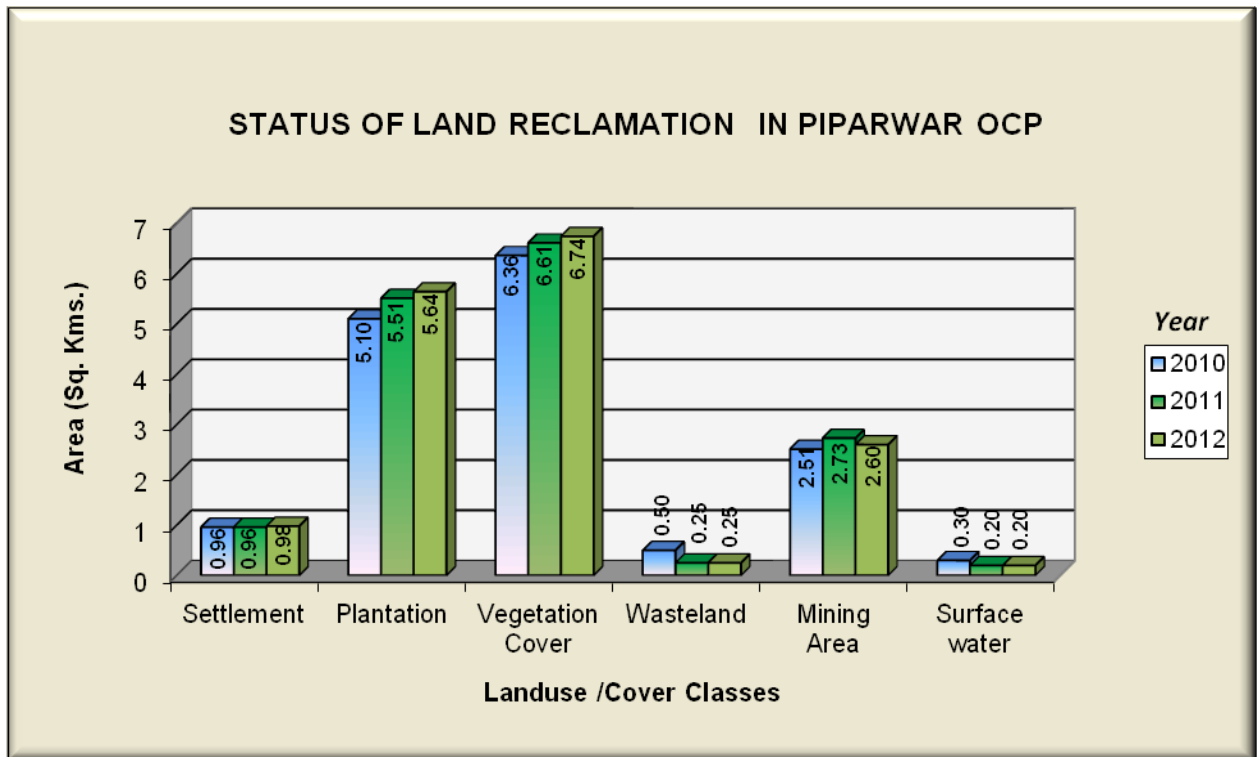


Figure 9.3

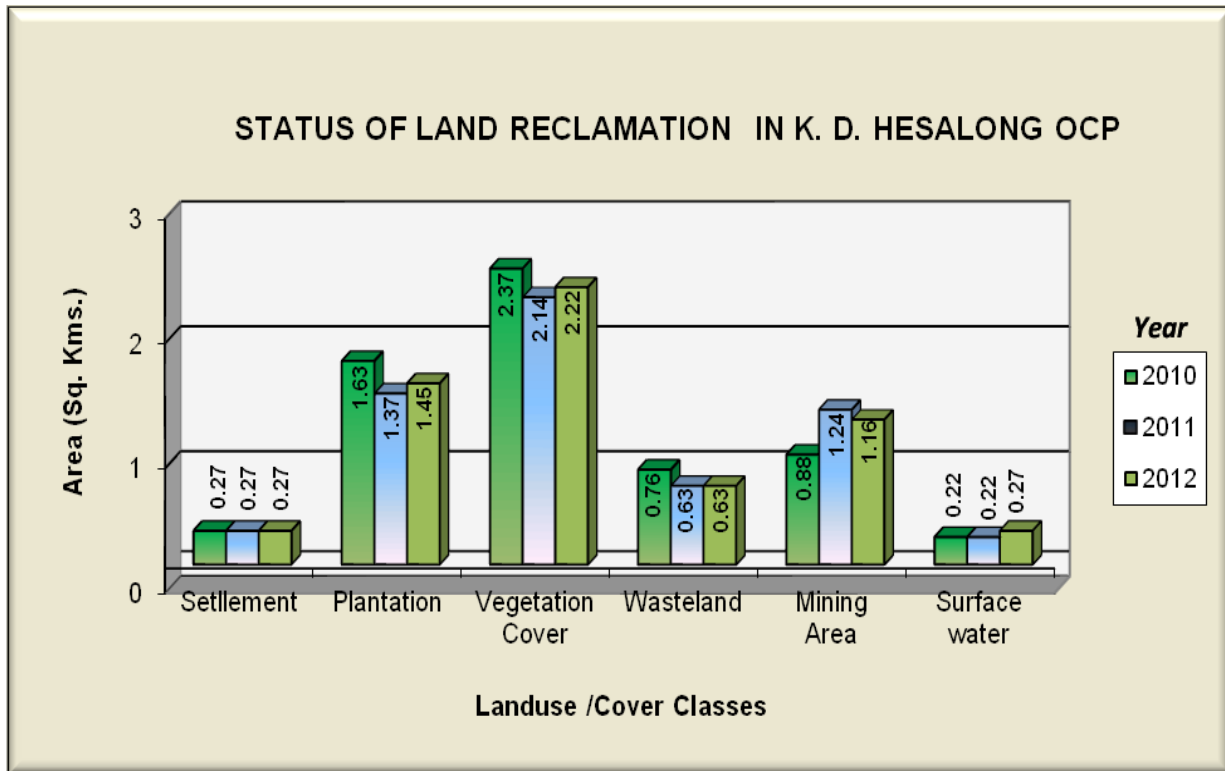


Figure 9.4

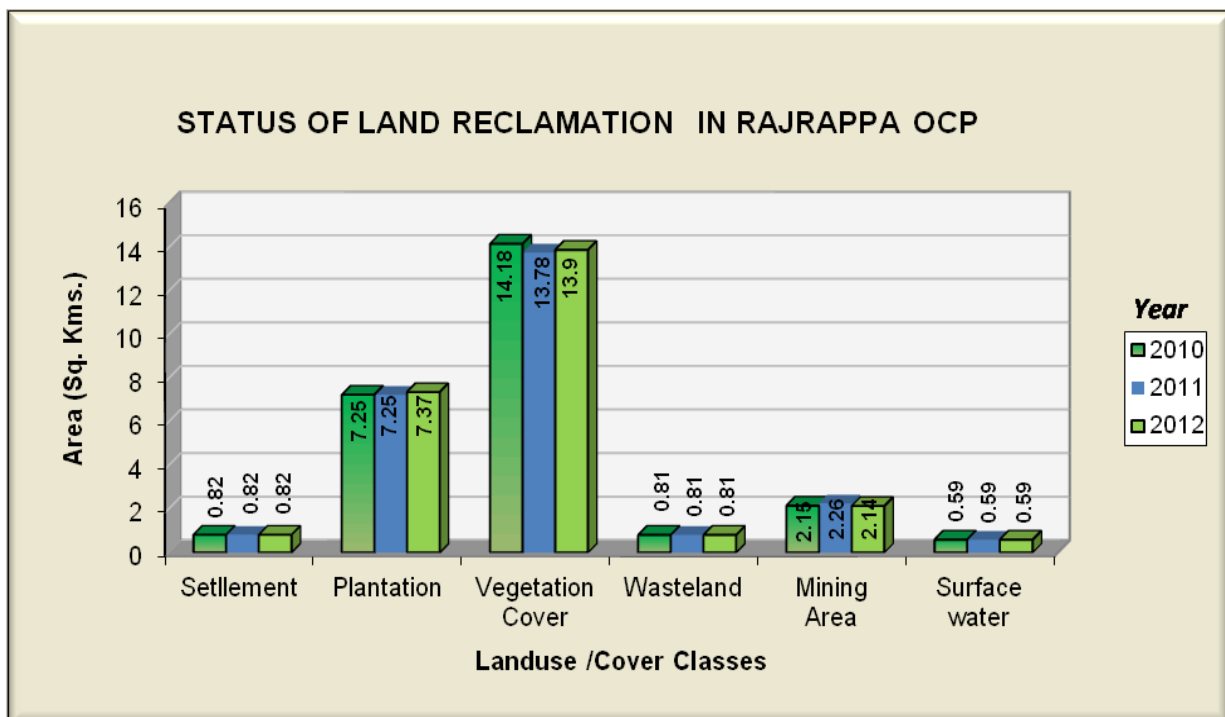


Figure 9.5

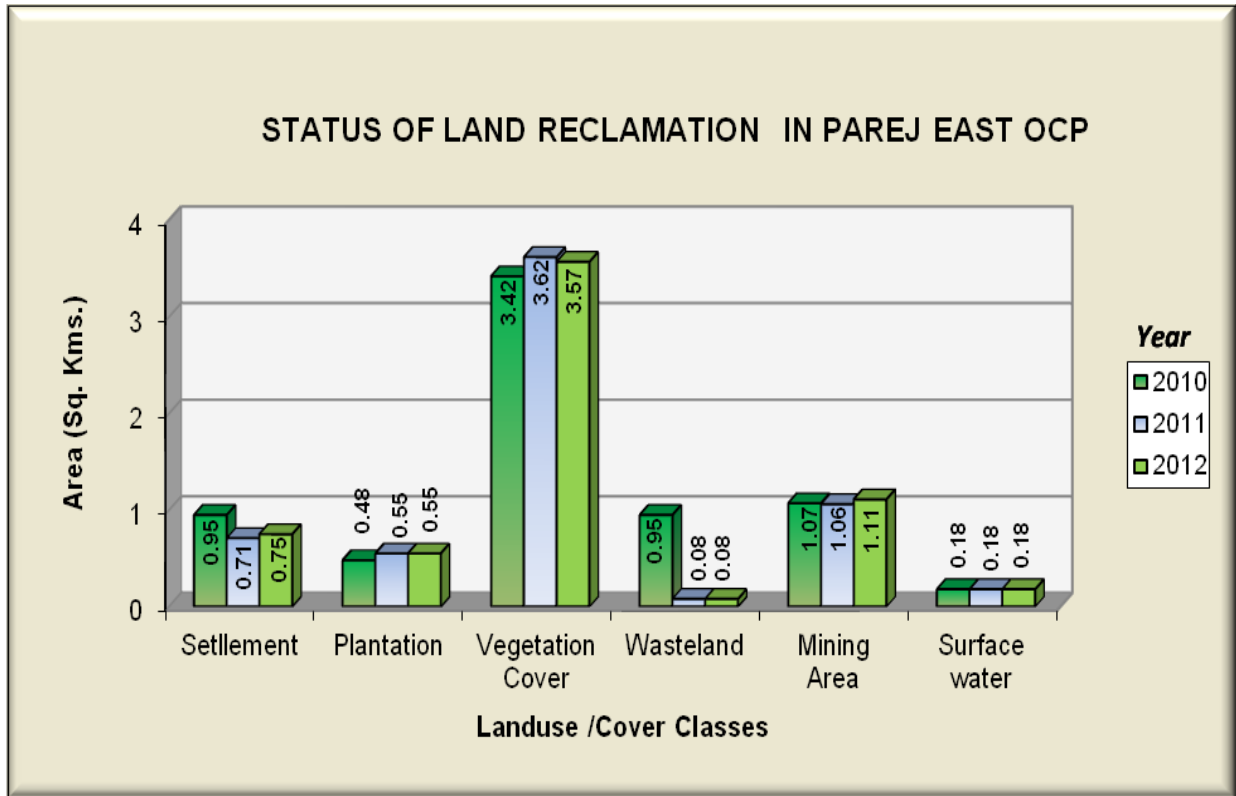


Figure 9.6



Photograph 9.1 : Plantation on Backfilled Area - Ashoka OCP



Photograph 9.2 : Avenue Plantation- Ashoka OCP



Photograph 9.3 : Plantation- Ashoka OCP



Photograph 9.4 : Plantation on OB- KD Hesalong OCP



Photograph 9.5 : Plantation on OB- Rajrappa OCP

BHARAT COKING COAL LTD.

10.0 Land Reclamation Status in Bharat Coking Coal Ltd.

10.1 Following two OC projects producing 5 million cubic m. or more (Coal + OB together) of Bharat Coking Coal Ltd. have been taken up for land reclamation monitoring on annual basis:

- Block-II
- Muraidih

10.2 Both the above two projects, Block-II OC and Muraidih has been mapped during the year 2011 & 2012 also.

10.3 Project wise Land Reclamation status in BCCL for the year 2012 is given in Table 10.1 and also shown graphically in Fig 10.1. Area statistics of different land use classes present in OC projects in the year 2012 is given in Table 10.2. Land use maps derived from the satellite data is given in Plate no. 10.1 & 10.2. Changes in land use status are shown in Fig. 10.2 & 10.3.

10.4 Study reveals that 82.80% of mining area has already been reclaimed by BCCL out of which 18.59% area has been revegitated and 64.22% area are under backfilling.

10.5 After analyzing the satellite data of year 2012 vs. 2011 it is seen that plantation carried out on backfilled area, OB dumps as well as social forestry has not increased in these areas. Availability of top soil seems to be a major issue in Block-II area as the OB dump is mostly rocky in nature. This has to be taken up seriously and efforts are required from the coal company to take up measures for undertaking more plantation activities for environmental protection.

10.6 Out of 2 projects of BCCL considered for monitoring, Block - II is on top for land reclamation (83.37%) followed by Muraidih (81.82%).

Table-10.1

**Projectwise Land Reclamation Status in OC projects of Bharat Coking Coal Ltd (BCCL)
Based on Satellite data of the Year 2012**

Sl No.	Projects	Area in Sq Km (<i>% Calculated in respect of total excavated area</i>)										
		Leasehold Area	Plantation		Under Backfilling		Active Mining Area		Total Excavated Area		Total Reclaimed Area	
			2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
		i	ii		iii		iv		ii+iii+iv		ii+iii	
1	Block-II	8.68	0.56	0.56	3.06	3.25	0.78	0.76	4.40	4.57	3.62	3.81
			12.73	12.25	69.55	71.12	17.73	16.63			82.27	83.37
2	Muraidih	5.38	0.76	0.78	1.14	1.38	0.55	0.48	2.45	2.64	1.90	2.16
			31.02	29.55	46.53	52.27	22.45	18.18			77.55	81.82
	Total	14.06	1.32	1.34	4.20	4.63	1.33	1.24	6.85	7.21	5.52	5.97
			19.27	18.59	61.31	64.22	19.42	17.20	48.72	51.28	80.58	82.80

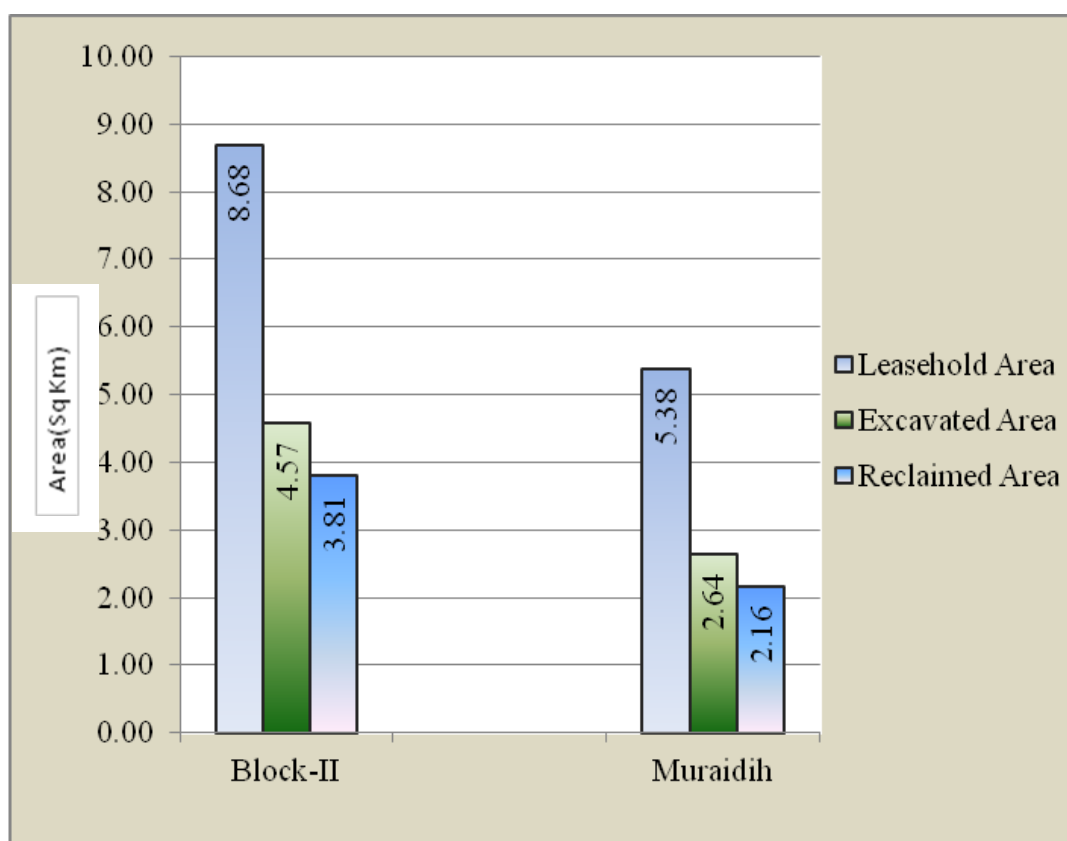






















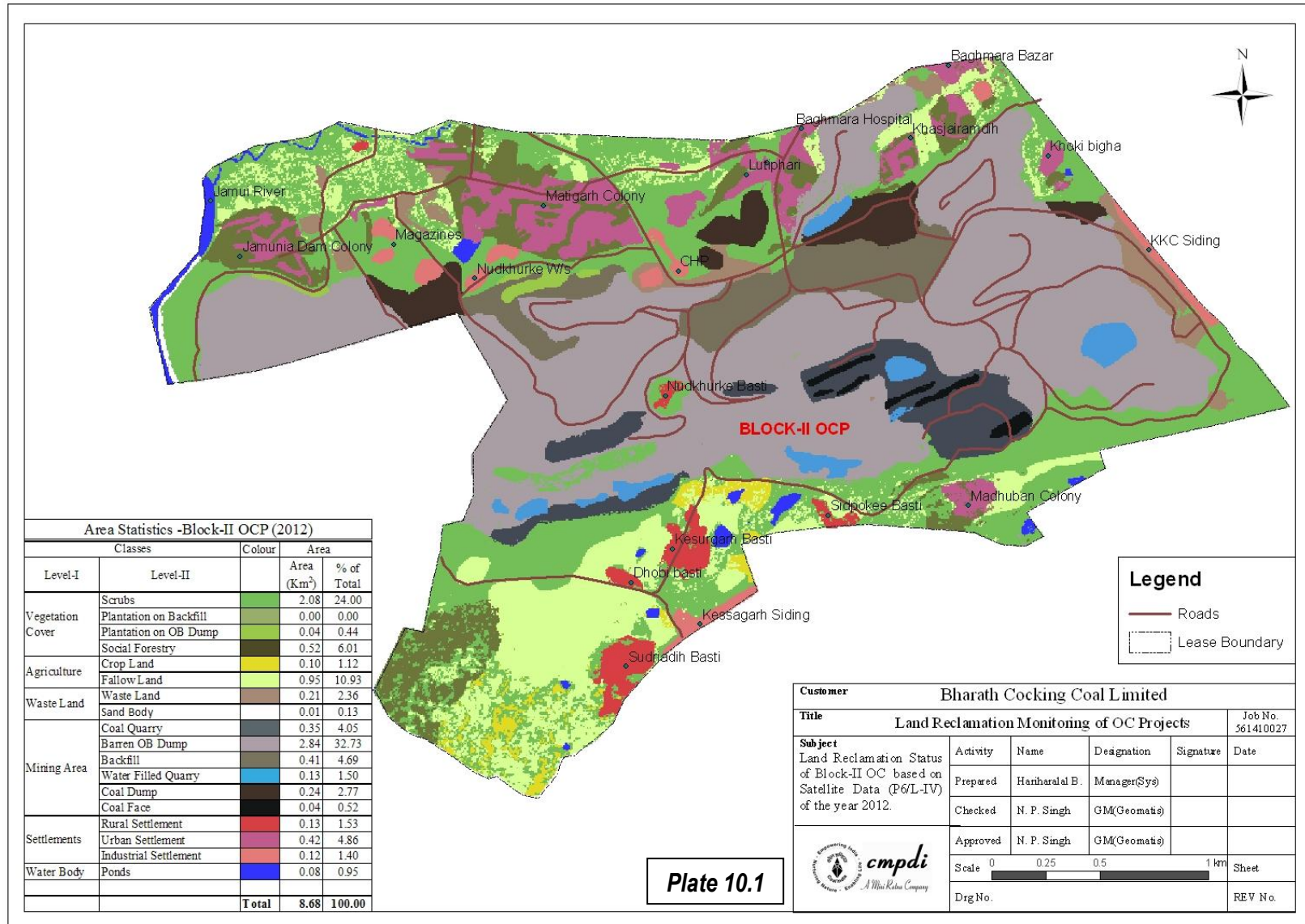
Fig. 10.1 : Project wise Land Reclamation Status in BCCL

Table 10.2

**STATUS OF LAND USE / RECLAMATION IN OC MINES (> 5 MCM) OF
BHARAT COKING COAL LIMITED BASED ON SATELLITE DATA OF THE YEAR 2012**

(Area in Sq Km)

		JHARIA COALFIELDS				TOTAL BCCL	
		BLOCK-II		MURAIIDIH		TOTAL BCCL	
		Area	%	Area	%	Area	%
FORESTS	Dense Forest 	0.00	0.00	0.00	0.00	0.00	0.00
	Open Forest 	0.00	0	0.00	0.00	0.00	0.00
	Total Forest	0.00	0	0.00	0.00	0.00	0.00
SCRUBS	Scrubs 	2.08	24.00	0.78	14.54	2.86	20.34
	Social Forestry 	0.52	6.01	0.27	5.04	0.79	5.62
PLANTATION	Plantation on OB Dump 	0.04	0.44	0.3	5.48	0.34	2.42
	Plantation on Backfill 	0	0	0.21	3.82	0.21	1.49
	Total Plantation (Biological Reclamation)	0.56	6.45	0.78	14.34	1.34	9.53
Total Vegetation		2.64	30.45	1.56	28.88	4.20	29.87
ACTIVE MINING	Coal Quarry 	0.39	4.57	0.23	4.25	0.62	4.41
	Coal Dump 	0.24	2.77	0.15	2.69	0.39	2.77
	Advance Quarry Site 	0	0	0.07	1.23	0.07	0.50
	Quarry Filled With Water 	0.13	1.5	0.03	0.62	0.16	1.14
	Total Area under Active Mining	0.76	8.84	0.48	8.79	1.24	8.82
RECLAIMED	Barren OB Dump 	2.84	32.73	0.85	15.8	3.69	26.24
	Barren Backfilled Area 	0.41	4.69	0.53	9.91	0.94	6.69
	Total Area under Technical Reclamation	3.25	37.42	1.38	25.71	4.64	32.93
Total Area under Mine Operation		4.01	46.26	1.86	34.50	5.88	41.75
WASTELANDS	Waste Lands 	0.21	2.36	0.17	3.18	0.38	2.70
	Fly Ash Pond / Sand Body 	0.01	0.13	0.00	0.00	0.01	0.07
Total Wasteland		0.22	2.36	0.17	3.18	0.39	2.77
WATERBODIES	Reservoir, nallah, ponds 	0.08	0.95	0.09	1.58	0.17	1.21
	Total Waterbodies	0.08	0.95	0.09	1.58	0.17	1.21
AGRICULTURE	Crop Lands 	0.1	1.12	0.05	0.86	0.15	1.07
	Fallow Lands 	0.95	10.93	1.25	23.16	2.20	15.65
	Total Agriculture	1.05	12.05	1.3	24.02	2.35	16.71
SETTLEMENTS	Urban Settlement 	0.42	4.86	0.36	6.63	0.78	5.55
	Rural Settlement 	0.13	1.53	0.01	0.15	0.14	1.00
	Industrial Settlement 	0.12	1.4	0.06	1.05	0.18	1.28
	Total Settlement	0.67	7.79	0.43	7.83	1.10	7.82
Grand Total		8.68	100.00	5.38	100.00	14.06	100.00



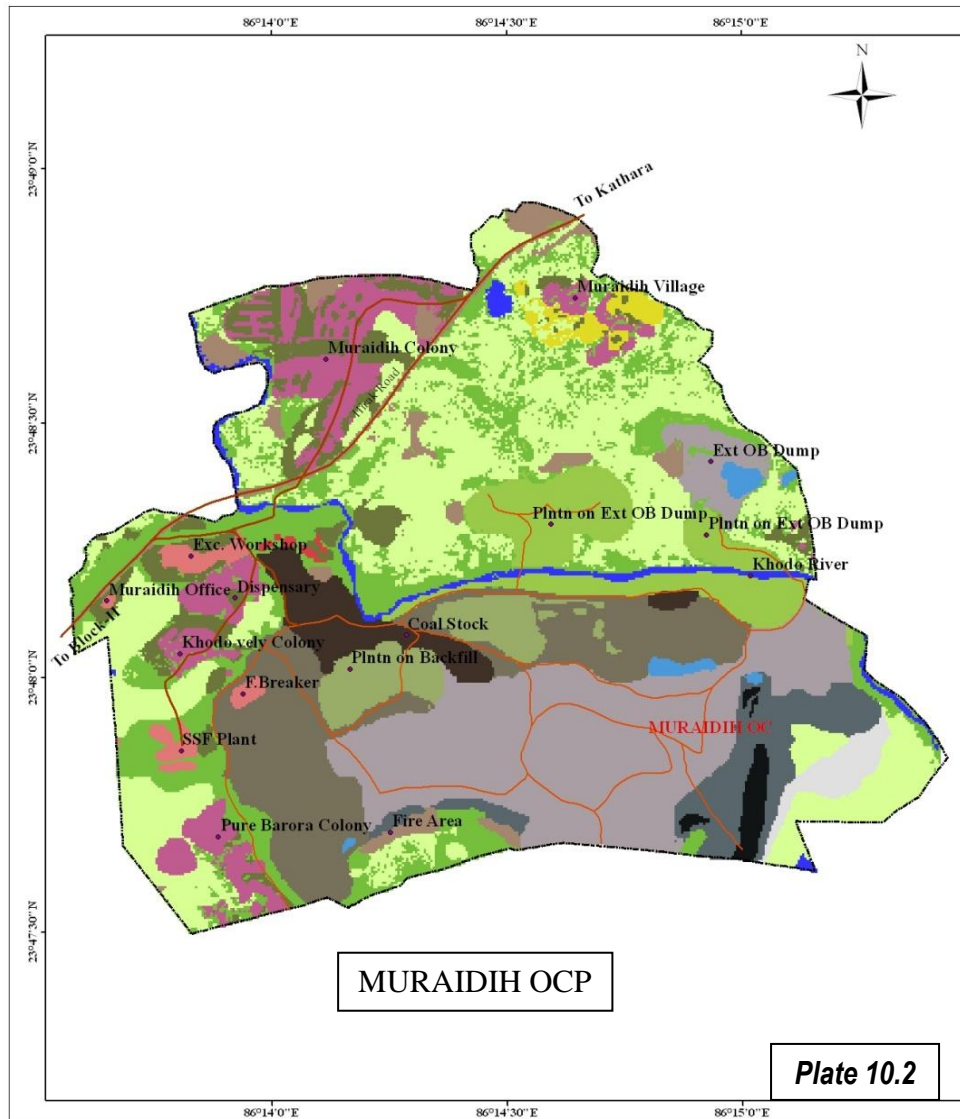
Area Statistics -Block-II OCP (2012)				
Classes		Colour	Area	
Level-I	Level-II		Area (Km ²)	% of Total
Vegetation Cover	Scrubs		2.08	24.00
	Plantation on Backfill		0.00	0.00
	Plantation on OB Dump		0.04	0.44
Agriculture	Social Forestry		0.52	6.01
	Crop Land		0.10	1.12
	Fallow Land		0.95	10.93
Waste Land	Waste Land		0.21	2.36
	Sand Body		0.01	0.13
Mining Area	Coal Quarry		0.35	4.05
	Barren OB Dump		2.84	32.73
	Backfill		0.41	4.69
	Water Filled Quarry		0.13	1.50
	Coal Dump		0.24	2.77
Settlements	Coal Face		0.04	0.52
	Rural Settlement		0.13	1.53
	Urban Settlement		0.42	4.86
Water Body	Industrial Settlement		0.12	1.40
	Ponds		0.08	0.95
Total			8.68	100.00

Legend	
	Roads
	Lease Boundary

Customer Bharath Coking Coal Limited					
Title Land Reclamation Monitoring of OC Projects					Job No. 561410027
Subject Land Reclamation Status of Block-II OC based on Satellite Data (P&L-IV) of the year 2012.	Activity	Name	Designation	Signature	Date
	Prepared	Harihara Lal B.	Manager(Sys)		
	Checked	N. P. Singh	GM(Geomatics)		
Approved	N. P. Singh	GM(Geomatics)			
Scale 0 0.25 0.5 1 Km					Sheet
Drg No.					REV No.

Plate 10.1





Classes		Colour	Area	
Level-I	Level-II		Area (Km ²)	% of Total
Vegetation Cover	Scrubs		0.78	14.54
	Plantation on Backfill		0.21	3.82
	Plantation on OB Dump		0.30	5.48
	Social Forestry		0.27	5.04
Agriculture	Crop Land		0.05	0.86
	Fallow Land		1.25	23.16
Waste Land	Waste Land		0.17	3.18
Mining Area	Coal Quarry		0.18	3.36
	Barren OB Dump		0.85	15.80
	Backfill		0.53	9.91
	Water Filled Quarry		0.03	0.62
	Coal Dump		0.15	2.69
	Coal Face		0.05	0.89
	Advance Quarry Site		0.07	1.23
Settlements	Rural Settlement		0.01	0.15
	Urban Settlement		0.36	6.63
	Industrial Settlement		0.06	1.05
Water Body	Ponds		0.09	1.58
Total			5.38	100.00

Legend

- Roads
- Haul Roads
- Lease Boundary

Customer		Bharath Coking Coal Limited			
Title		Land Reclamation Monitoring of OC Projects			Job No. 561410027
Subject Land Reclamation Status of Muraidih OC based on Satellite Data (P6-L-IV) of the year 2012.	Activity	Name	Designation	Signature	Date
	Prepared	Hanharalal B.	Manager(Sys)		
	Checked	N. P. Singh	GM(Geomatics)		
Approved	N. P. Singh	GM(Geomatics)			
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Drg No.					REV No.



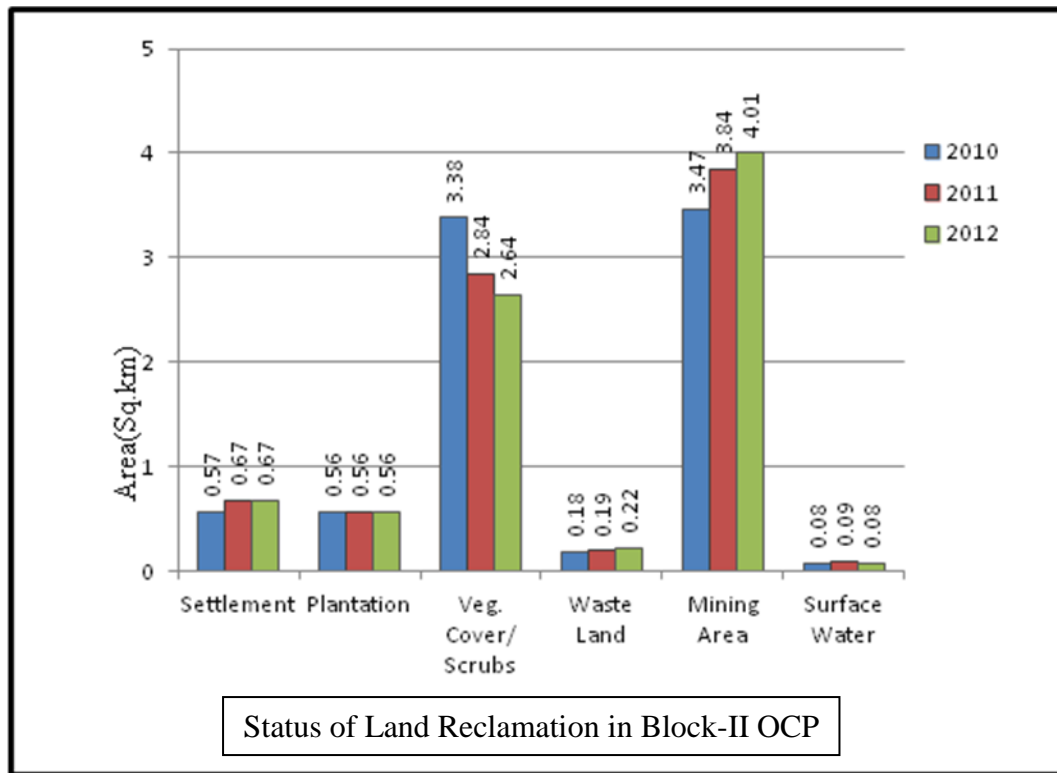


Figure 10.2

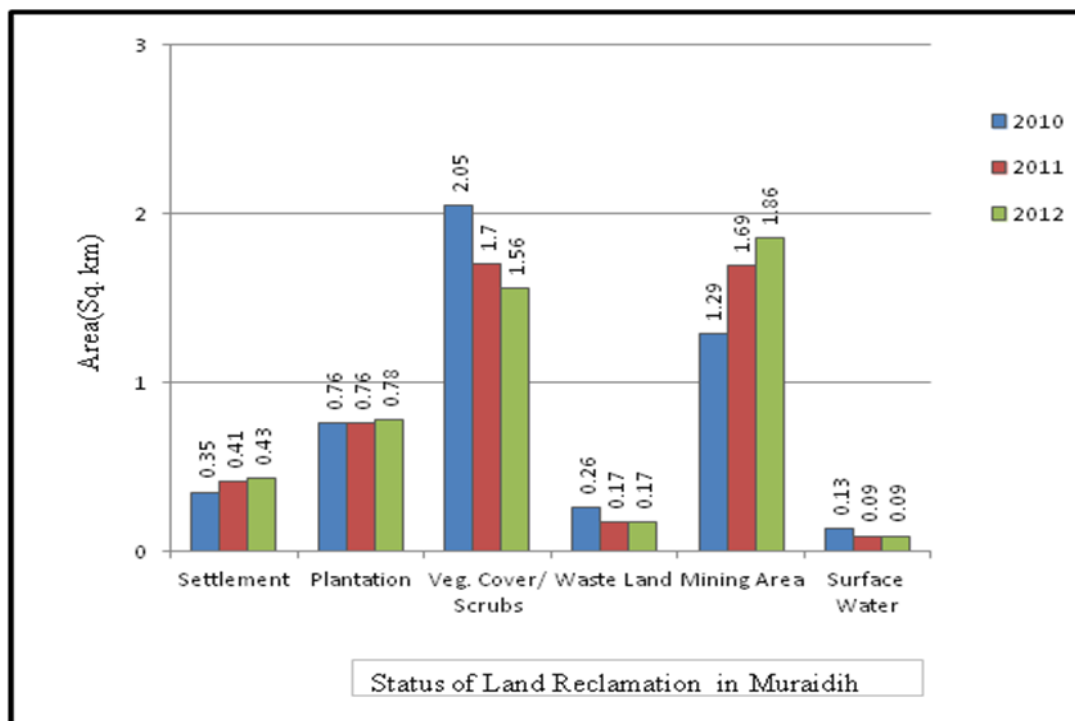


Figure 10.3



Photograph 10.1 : Plantation on OB carried out in Muraidih OCP, BCCL

EASTERN COALFIELDS LIMITED

11.0 Land Reclamation Status in Eastern Coalfields Ltd.

11.1 Following two OC projects producing 5 million cubic m. or more (Coal + OB together) of Eastern Coalfields Ltd. have been taken up for land reclamation monitoring on annual basis:

- Rajmahal
- Sonapur Bazari

11.2 Both the above projects have been mapped during the year 2010 & 2011 for assessing the progress of land reclamation.

11.3 Project wise Land Reclamation status in ECL for the year 2012 is given in Table 11.1 and also shown graphically in Fig 11.1. Area statistics of different land use classes present in OC projects for the year 2012 is given in Table 11.2. Land use maps derived from the satellite data are given in Plate no. 11.1 & 11.2. Changes in land use status are shown in Fig. 11.2 & 11.3.

11.4 Study reveals that 70.55% of mining area has already been reclaimed by ECL out of which 31.42% area has been revegetated and 39.13% area are backfilled.

11.5 On comparing the status of land reclamation for the year 2012 with respect to the year 2011, it is evident from the analysis that area of land reclamation has increased from 8.22 Km² (Yr. 2011) to 8.60 Km² (Yr. 2012).

11.6 Out of two projects in ECL, Sonapur Bazari tops with 76.90% reclamation followed by Rajmahal OCP with 65.26% reclamation.

Table – 11.1

**Projectwise Land Reclamation Status in OC projects of Eastern Coalfields Limited (ECL)
Based on Satellite data of the Year 2012**

Sl No.	Projects	Area in Sq Km (<i>% Calculated in respect of total excavated area</i>)										
		Leasehold Area	Plantation		Under Backfilling		Active Mining Area		Total Excavated Area		Total Reclaimed Area	
			2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
		i	ii		iii		iv		ii+iii+iv		ii+iii	
1	Rajmahal	16.38	2.02	2.02	2.03	2.32	2.19	2.31	6.24	6.65	4.05	4.34
			32.37	30.38	32.53	34.89	35.10	34.74			64.90	65.26
2	Sonepur Bazari	23.06	1.80	1.81	2.37	2.45	1.18	1.28	5.35	5.54	4.17	4.26
			33.64	32.67	44.30	44.22	22.06	23.10			77.94	76.90
	Total	39.44	3.82	3.83	4.40	4.77	3.37	3.59	11.59	12.19	8.22	8.60
			32.96	31.42	37.96	39.13	29.08	29.45	29.39	30.91	70.92	70.55

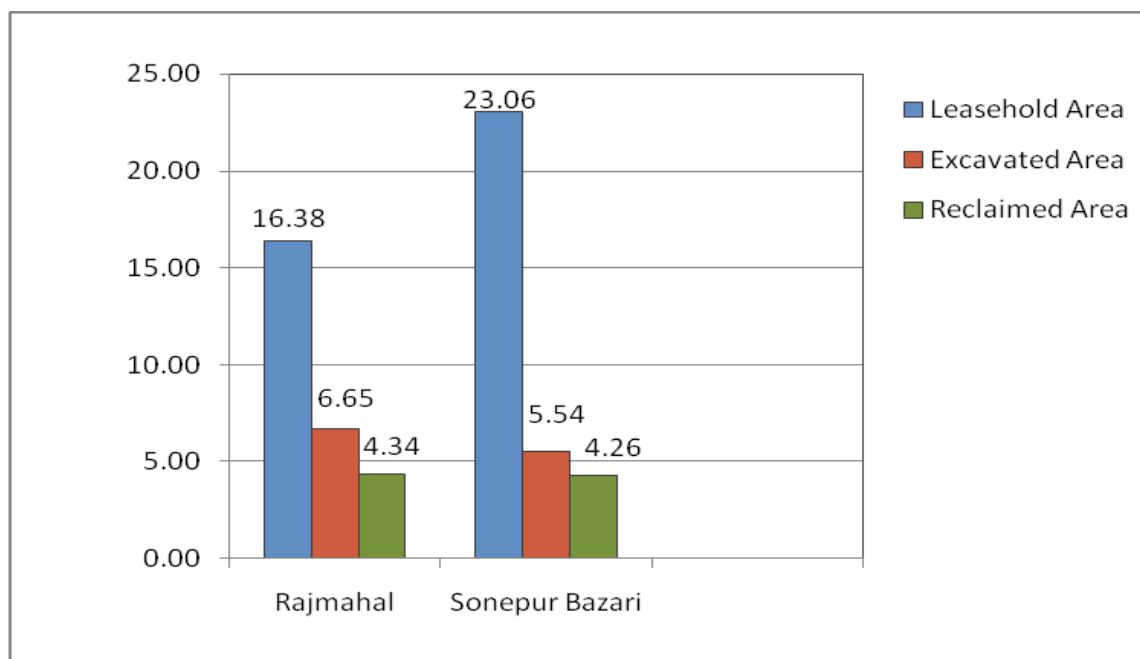






















Fig. 11.1: Project wise Land Reclamation Status 2012 (ECL)

Table 11.2

**STATUS OF LAND USE / RECLAMATION IN EASTERN COALFIELDS LTD.
BASED ON SATELLITE DATA OF THE YEAR 2012**

		RAJMAHAL		SONEPUR BAZARI		TOTAL	
		Area	%	Area	%	Area	%
FORESTS	Dense Forest 	0.00	0.00	0.00	0.00	0.00	0.00
	Open Forest 	0.32	1.93	0.32	1.40	0.64	1.64
	Total Forest	0.32	1.93	0.32	1.40	0.64	1.64
SCRUBS	Scrubs 	1.72	10.51	4.94	21.44	6.66	17.02
	Social Forestry 	0.45	2.76	0.83	3.60	1.28	3.27
PLANTATION	Plantation on OB Dump 	0.05	0.33	0.35	1.52	0.40	1.02
	Plantation on Backfill 	1.52	9.26	0.63	2.73	2.15	5.49
	Total Plantation (Biological Reclamation)	2.02	12.35	1.81	7.85	3.83	9.79
Total Vegetation		4.06	24.79	6.75	30.68	10.81	27.62
ACTIVE MINING	Coal Quarry 	1.63	9.9	0.92	4.01	2.55	6.52
	Coal Dump 	0.11	0.65	0.1	0.43	0.21	0.54
	Advance Quarry Site 	0.35	2.14	0.22	0.97	0.57	1.46
	Quarry Filled With Water 	0.22	1.35	0.04	0.17	0.26	0.66
	Total Area under Active Mining	2.31	14.04	1.28	5.58	3.59	9.17
RECLAIMED	Barren OB Dump 	1.26	7.67	0.91	3.92	2.17	5.54
	Area Under Backfilling 	1.06	6.48	1.54	6.68	2.60	6.64
	Total Area under Technical Reclamation	2.32	14.15	2.45	10.60	4.78	12.19
Total Area under Mining Operation		4.63	28.19	3.73	16.18	8.37	21.36
WASTELAND	Waste Lands 	0.43	2.61	0.59	2.56	1.02	2.61
	Fly Ash Pond / Sand Body 	0.00	0.00	0.00	0.00	0.00	0.00
Total Wasteland		0.43	2.61	0.59	2.56	1.02	2.61
WATERBODIES	Reservoir, nallah, ponds 	0.18	1.07	0.41	1.78	0.59	1.51
	Total Waterbodies	0.18	1.07	0.41	1.78	0.59	1.51
AGRICULTURE	Crop Lands 	3.56	21.73	1.42	6.16	4.98	12.73
	Fallow Lands 	2.81	17.12	9.15	39.68	11.96	30.56
	Total Agriculture	6.37	38.85	10.57	45.84	16.94	43.29
SETTLEMENTS	Urban Settlement 	0.19	1.19	0.09	0.39	0.28	0.72
	Rural Settlement 	0.47	2.89	0.34	1.47	0.81	2.07
	Industrial Settlement 	0.07	0.41	0.25	1.08	0.32	0.82
	Total Settlement	0.73	4.49	0.68	2.94	1.41	3.60
Grand Total		16.38	100.00	23.06	100.00	39.14	100.00

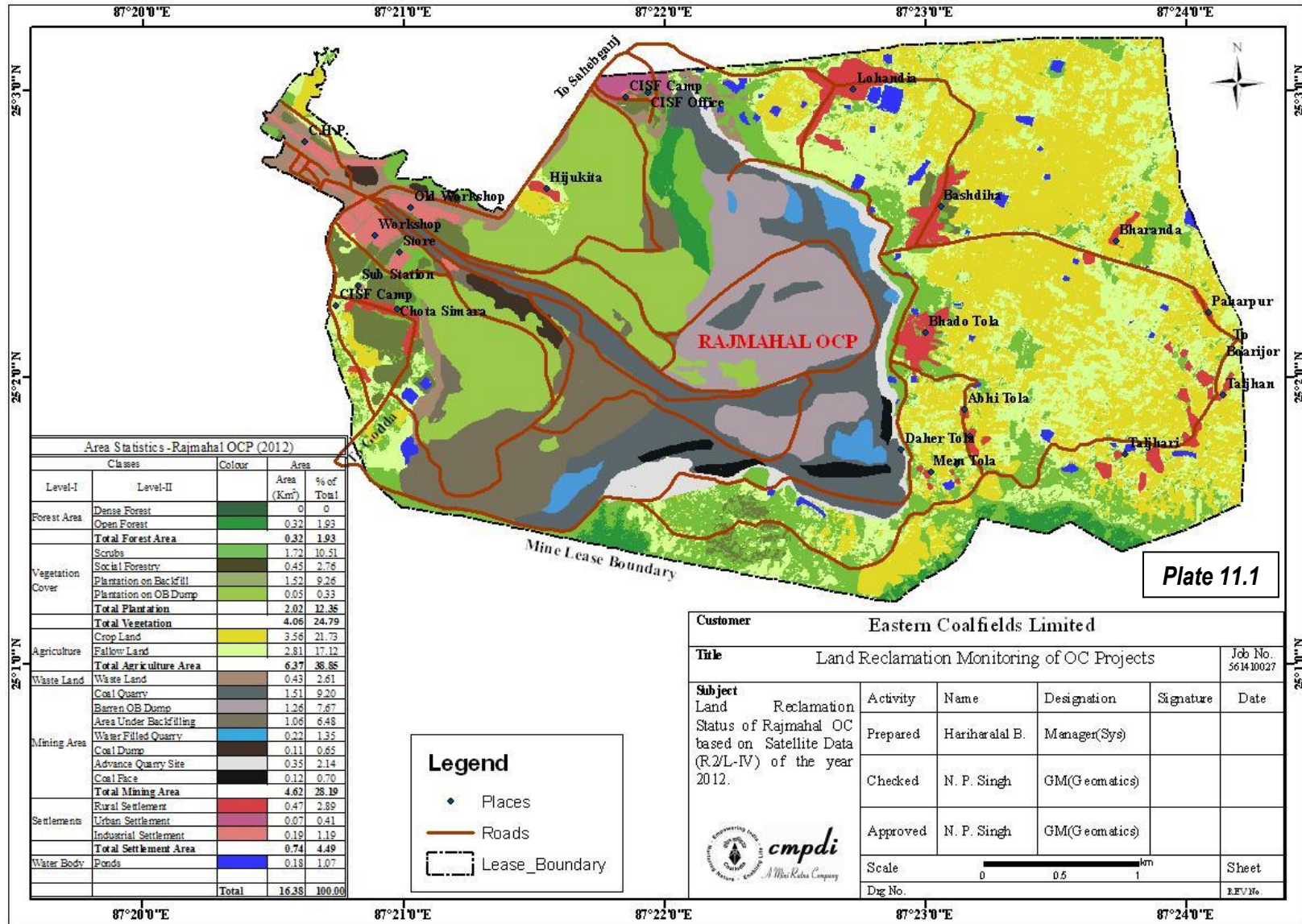


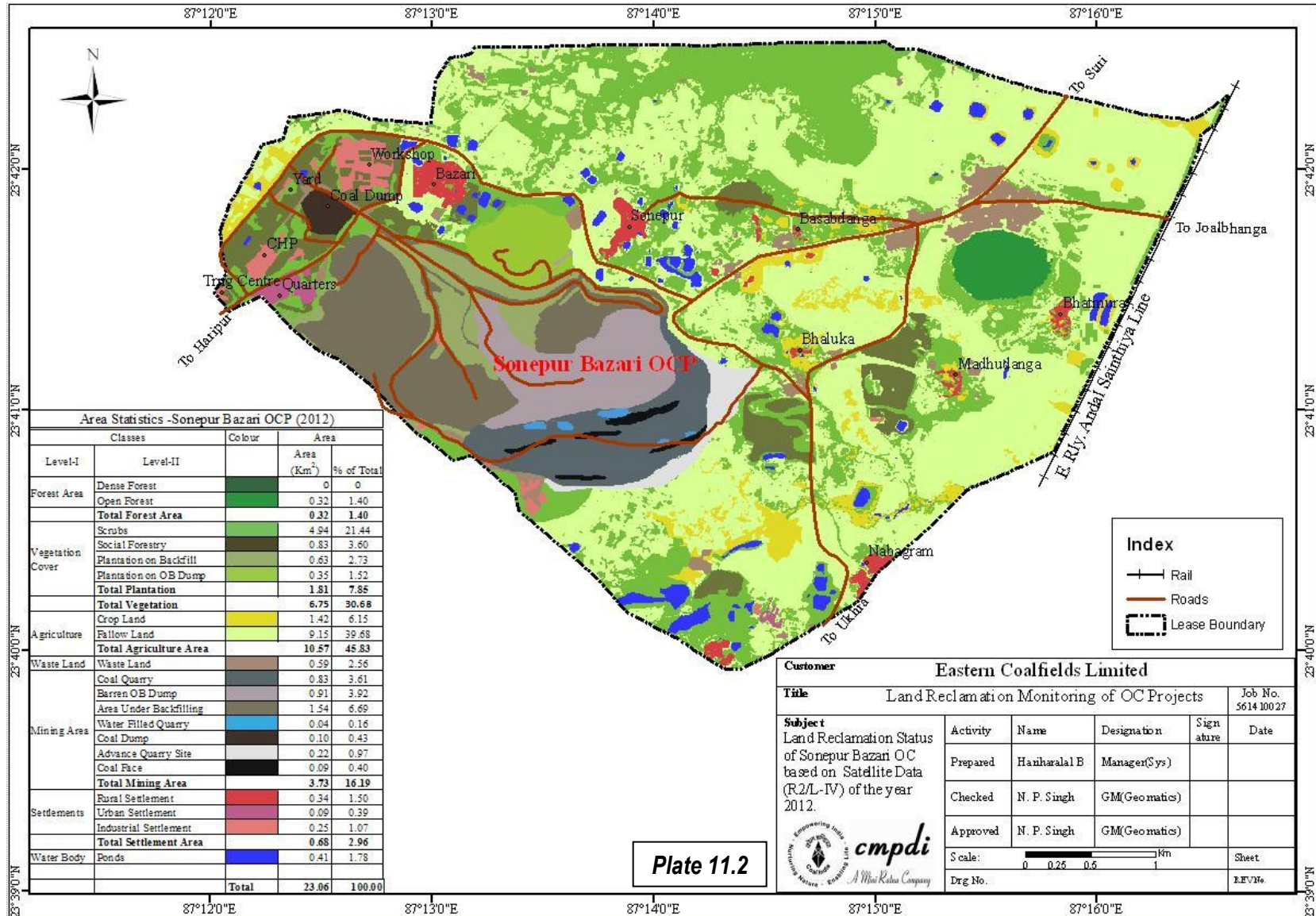
Plate 11.1

Area Statistics - Rajmahal OCP (2012)				
Level-I	Level-II	Colour	Area (Km ²)	% of Total
Forest Area	Dense Forest		0	0
	Open Forest		0.32	1.93
	Total Forest Area		0.32	1.93
Vegetation Cover	Scrubs		1.72	10.51
	Social Forestry		0.45	2.76
	Plantation on Backfill		1.52	9.26
	Plantation on OB Dump		0.05	0.33
	Total Plantation		2.02	12.35
	Total Vegetation		4.06	24.79
Agriculture	Crop Land		3.56	21.73
	Fallow Land		2.91	17.12
	Total Agriculture Area		6.37	38.85
Waste Land	Waste Land		0.43	2.61
Mining Area	Coal Quarry		1.51	9.20
	Barren OB Dump		1.26	7.67
	Area Under Backfilling		1.06	6.48
	Water Filled Quarry		0.22	1.35
	Coal Dump		0.11	0.65
	Advance Quarry Site		0.35	2.14
	Total Mining Area		4.62	28.19
Settlements	Rural Settlement		0.47	2.89
	Urban Settlement		0.07	0.41
	Industrial Settlement		0.19	1.19
	Total Settlement Area		0.74	4.49
Water Body	Ponds		0.18	1.07
	Total		16.38	100.00

Legend

- Places
- Roads
- Lease_Boundary

Customer		Eastern Coalfields Limited				
Title		Land Reclamation Monitoring of OC Projects				Job No. 561410027
Subject Land Reclamation Status of Rajmahal OC based on Satellite Data (R2/L-IV) of the year 2012.	Activity	Name	Designation	Signature	Date	
	Prepared	Hariharalal B.	Manager(Sys)			
	Checked	N. P. Singh	GM(Geomatics)			
	Approved	N. P. Singh	GM(Geomatics)			
Scale					Sheet	
Dwg No.					REV No.	



Area Statistics - Sonepur Bazar OCP (2012)

Classes		Colour	Area	
Level-I	Level-II		Area (Km ²)	% of Total
Forest Area	Dense Forest		0	0
	Open Forest		0.32	1.40
	Total Forest Area		0.32	1.40
Vegetation Cover	Scrubs		4.94	21.44
	Social Forestry		0.83	3.60
	Plantation on Backfill		0.63	2.73
	Plantation on OB Dump		0.35	1.52
	Total Plantation		1.81	7.85
	Total Vegetation		6.75	30.68
Agriculture	Crop Land		1.42	6.15
	Fallow Land		9.15	39.68
	Total Agriculture Area		10.57	45.83
Waste Land	Waste Land		0.59	2.56
	Coal Quarry		0.83	3.61
Mining Area	Barren OB Dump		0.91	3.92
	Area Under Backfilling		1.54	6.69
	Water Filled Quarry		0.04	0.16
	Coal Dump		0.10	0.43
	Advance Quarry Site		0.22	0.97
	Coal Face		0.09	0.40
	Total Mining Area		3.73	16.19
Settlements	Rural Settlement		0.34	1.50
	Urban Settlement		0.09	0.39
	Industrial Settlement		0.25	1.07
	Total Settlement Area		0.68	2.96
Water Body	Ponds		0.41	1.78
	Total		23.06	100.00

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- +— Rail
- Roads
- Lease Boundary

Customer Eastern Coalfields Limited

Title Land Reclamation Monitoring of OC Projects Job No. 5614 10027

Subject Land Reclamation Status of Sonepur Bazar OC based on Satellite Data (R2/L-IV) of the year 2012.

Activity	Name	Designation	Signature	Date
Prepared	Hanharalal B	Manager(Sys)		
Checked	N. P. Singh	GM(Geomatics)		
Approved	N. P. Singh	GM(Geomatics)		

Scale: 0 0.25 0.5 1 Km

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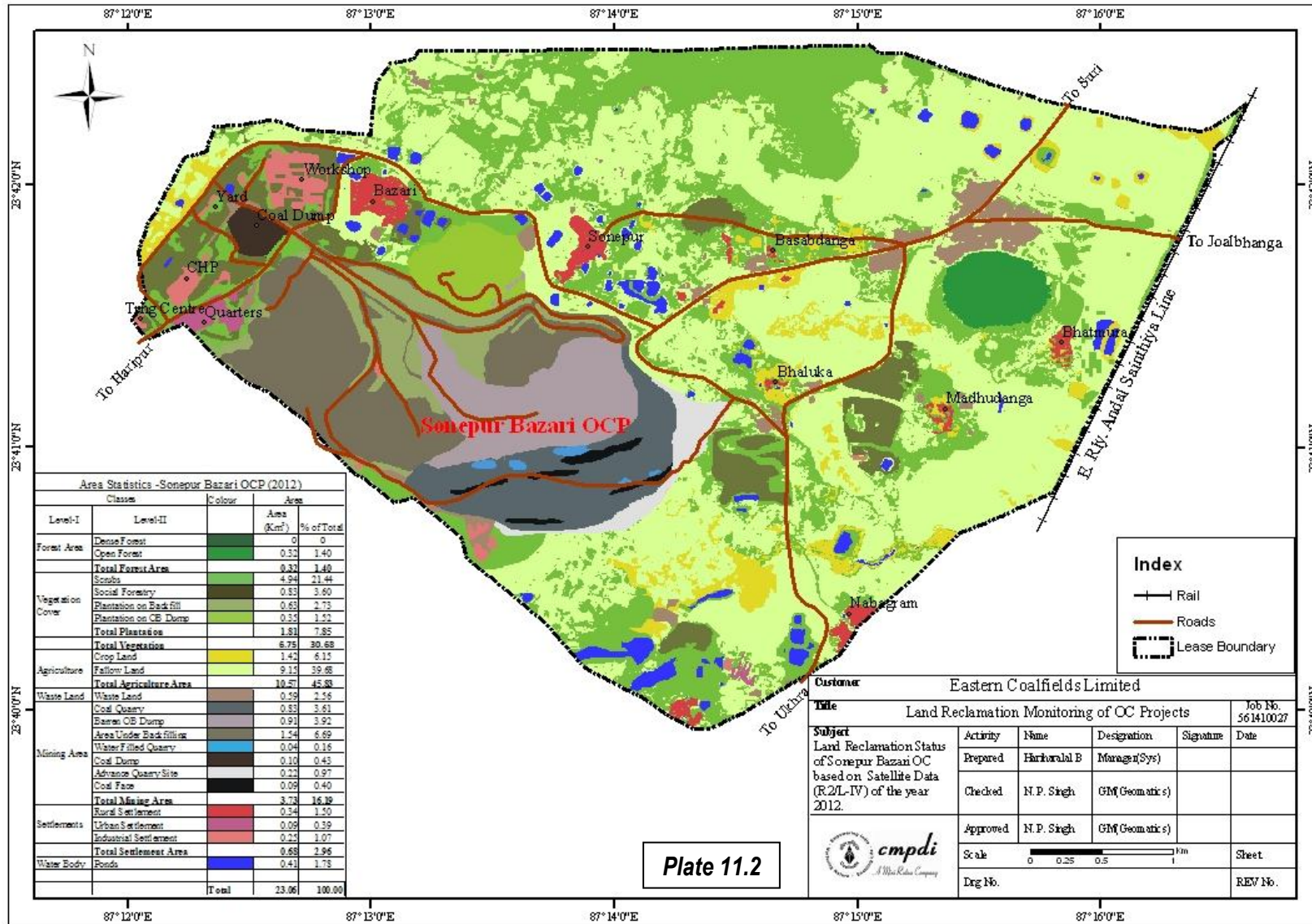

cmpdi
A Mini Ratna Company

Plate 11.2



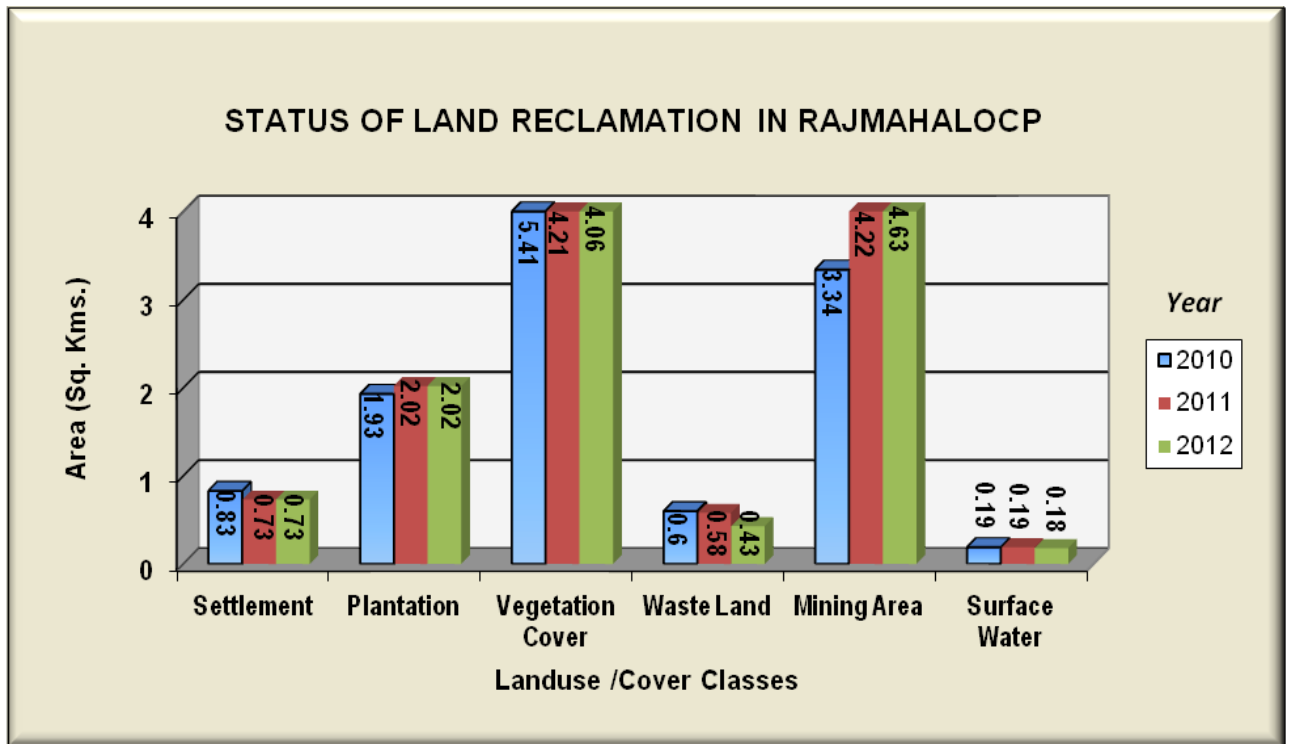


Figure 11.2

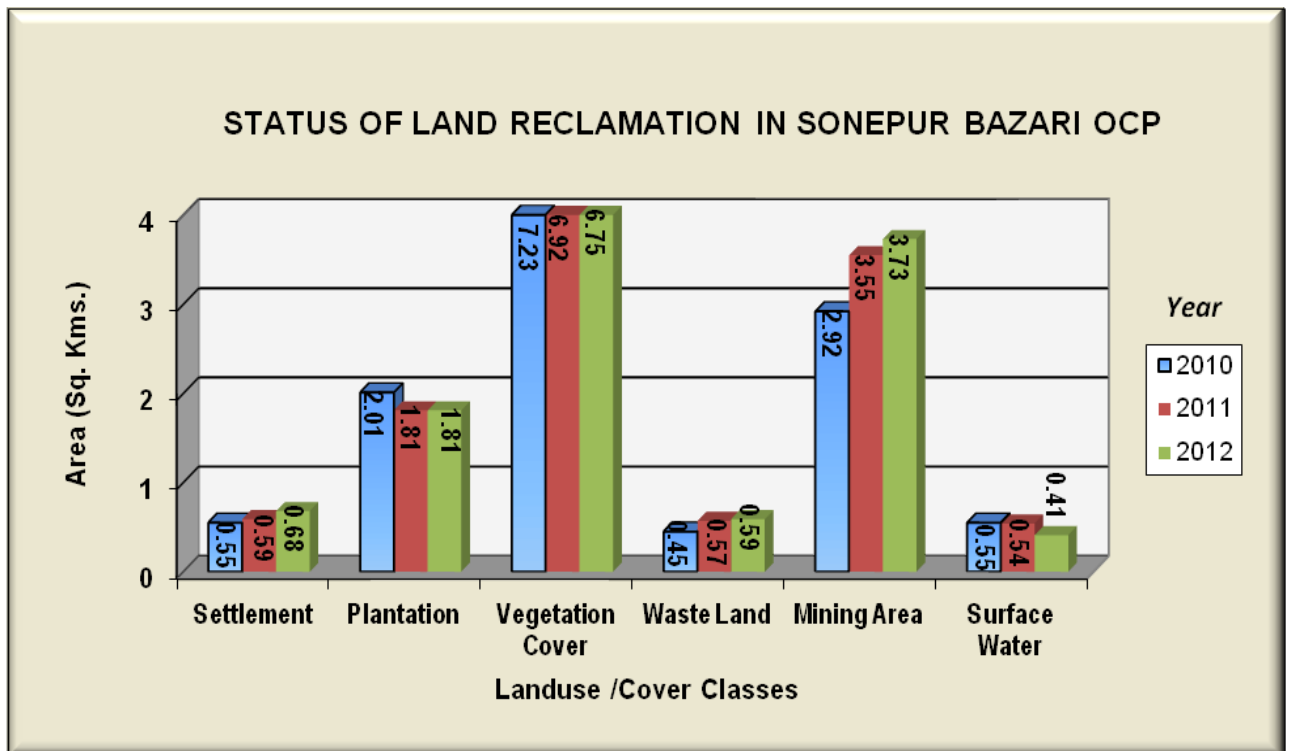


Figure 11.3



Photograph 11.1 : Plantation on OB in Sonapur Bazari OCP, ECL



Photograph 11.2 : **Social Forestry in Sonapur Bazari OCP, ECL**



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