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Ministry of Coal

Sustainable Development Cell

Status of Environmental Sustainability in Coal Mines in 2019-20

Prepared & Submitted by CMPDI (June, 2021)

PREFACE

Mining is one of the major contributors of the growth and sustenance of human civilisation. In this context, coalmines have played a special role since ancient times, as coal is a major source of energy for the development of a society. However, coal mines lead to breaking of land and especially for an opencast mine, where large tracts of land are used.

Coal mining and allied activities adversely affects the overall environment in and around the coal mining areas. The adverse impacts include land degradation, air pollution, water pollution, noise pollution, besides having impact on socio-economic status of the area and flora & fauna. It is of utmost importance that areas in and around coal mines should be subjected to different mitigation measures, so as to make life of the communities living around these areas liveable and easy and so it can also ameliorate the whole adjoining ecosystem.

Decommissioning of mines also involves removal of environmental, health and safety hazards. The mine closure fund provides some security for the decommissioning activities but may not be sufficient as it is charged on a fix rate. Since, new private entities are now going to form a significant part of the future, the risk of mines being abandoned without proper rehabilitation may increase. The EC/FC provisions need strict implementation and monitoring and there is a need to do more and go beyond these provisions for better environmental sustainability. There is also a need to harness the best global practices in environmentally sustainable coal mining in India.

Using environmental mitigation measures in a right and sustainable way will not only provide a better environment to people working and residing in nearby areas but also improve the overall image of the coal sector in the country. So, this is the prudent time for the Ministry of Coal, GoI, as the custodian of coal mines in India, to take up this issue and address it in a systemic manner in the line of the best global practices. In view of this, a “Sustainable Development Cell” under the Ministry of Coal has been created.

The Sustainable Development Cell adopting a systemic approach, has task of collection and analysis of data with respect to environmental attributes i.e. land, air, water, noise, etc. and presentation & planning based on this information.

This document titled as “Status of Environmental Sustainability in Coal Mines in 2019-20” is an effort by Ministry of Coal (MoC) with the help of CMPDIL, to prepare an environmental status report of the coal companies under MoC.

The reporting structure for the coal mining projects in this document has been split into four sections **status of land use, status of air quality, status of water regime and status of mine closure aspects.** The information for the status report has been sought from the subsidiaries of CIL, NLCIL and SCCL based on a data collection format developed and finalized by CMPDIL in consultation with MoC.

The information compiled and analysed will help MoC to advise, mentor, plan and monitor the environmental mitigation measures taken by the coal companies. This will also help plan in maximizing the utilization of available resources in a sustainable way, minimizing the adverse impact of mining and mitigating it for further ecosystem services.

It will also serve as an input for formulation of the future policy framework for the environmental mitigation measures including the Mine Closure Fund etc. at GOI level.

The document has been developed into the following chapters –

Chapter 1: Introduction
Chapter 2: Brief of Coal Sector in India
Chapter 3: Opencast and underground mines and their environmental impacts
Chapter 4: Status of coal mining projects – Brief of projects considered
Chapter 5: Status of environmental sustainability – Land Use
Chapter 6: Status of environmental sustainability – Air Quality
Chapter 7: Status of environmental sustainability – Water Regime
Chapter 8: Status of environmental sustainability – Mine Closure Aspects
Chapter 9: Categorisation of Projects
Chapter 10: Conclusion and way forward

The support from Sri B.P.Pati, JS, MoC; Sri Ajitesh Kumar, DS, MoC, Sri Binay Dayal, CMD, CMPDI and Sri S.K.Gomasta, Director (T) ES, CMPDI has been vital in compilation of this status report.

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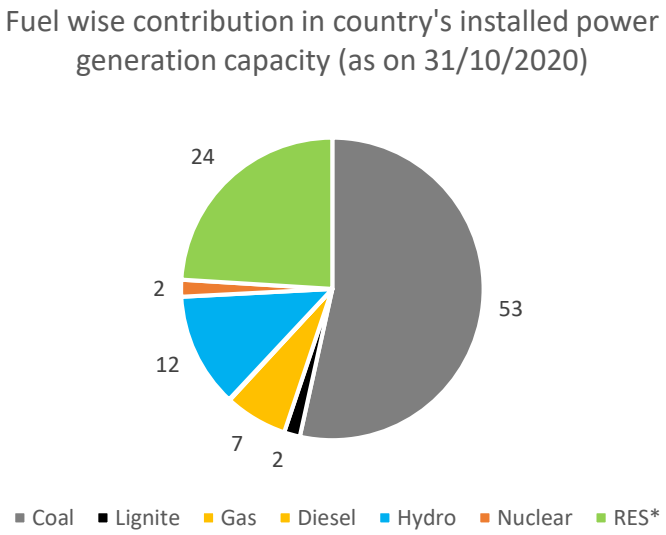
CHAPTER I: Introduction

1.0 Background

Coal plays a crucial role in the production of electricity in India. As per the CEA data with regard to installed capacity in India (as of Oct'20), coal based installed capacity is about 53%, followed by Renewable Energy Sources (RES) at 24%, while hydro power (12%), gas (7%), nuclear (2%) and lignite (2%) round up the rest. The graph representing the fuel wise contribution to the country's installed power generation capacity is shown in the figure 1.1 below.



Source: https://powermin.nic.in/en/content/power-sector-glance-all-india

Figure 1.1: Fuel-wise contribution in country's installed power generation capacity

It is certain that the future of coal in India will depend on the success of the transition to variable renewables. However, considering the need for economic growth and limited viability of renewables at present, coal will continue to play a formidable role in India's energy scenario.

Mining is one of the major contributors towards the growth and sustenance of human civilisation. In this context, coal mining has played a special role since ancient times, as coal is a major source of energy for the development of a society. However, coal mining has its own downside *i.e.* coal mines lead to degradation of land and especially for an opencast mine, where large tracts of land are used. During production of coal from mines and subsequent transportation of coal, significant pollution is generated. The pollution

includes land degradation, air pollution, water pollution, noise pollution, besides having impact on socio-economic status of the area and flora & fauna.

It is of utmost importance that areas in and around coal mines are subjected to different mitigation measures, so as to make life of the communities living around these areas liveable and easy and so that it can also ameliorate the whole adjoining ecosystem. Decommissioning of mines also involves removal of environmental, health and safety hazards. For mine closure, opencast mine owners deposit Rs. 9,00,000 per hectare whereas underground mine owners deposit Rs. 1,50,000 per hectare into an escrow account managed by the Coal Controller of India (with effect from 01.04.2019) and the calculation will also take the prevalent WPI into account as per the new guidelines for the preparation of mining plan for the coal and lignite blocks issued by MoC on 20.05.2020. This mine closure fund provides security for the closure and decommissioning activities. The environmental clearance (EC) and forestry clearance (FC) provisions need strict implementation and monitoring and there is a need to do more and go beyond these provisions for better environmental sustainability. There is also a need to harness the best global practices for promoting the environmentally sustainable coal mining in India.

Using environmental mitigation measures in a right and sustainable way will not only provide a better environment to people working and residing in nearby areas but also improve the overall image of the coal sector in the country. So, this is the prudent time for the Ministry of Coal, Government of India, as the custodian of coal mines in India, to take up this issue and address it in a systemic manner in the line of the best global practices.

1.1 Sustainable Development Cell (SDC) at MoC

The Sustainable Development cell will advise, mentor, plan and monitor the mitigation measures taken by the coal companies for maximising the utilisation of available resources in a sustainable way, minimising the adverse impact of mining and mitigating it for further ecosystem services and will act as nodal point at MoC level in this matter.

It will work in the role of both a mentor and supervisor of coal companies in the above matter. This cell will also formulate the future policy framework for the environmental mitigation measures at GOI level.

1.2 Tasks associated with SDC

The Sustainable Development Cell will adopt a systemic approach, starting from collection of data, analysis of data, presentation of information, planning based on information; by domain experts, adoption of best practices, consultations, innovative thinking, site-specific approaches, knowledge sharing and dissemination and finally end with an aim to ease the lives of people and communities in general. All of the above will be done by executing following tasks on a planned way:

i. Land amelioration and afforestation

In India approximately 2,550 sq km area is under different coal mines and there are also plans to bring more areas under it. These land masses require both extensive and intensive amelioration measures and will be carried out as per following procedure:

- Collection of baseline data/maps related to different coal mines like block/mine areas, OB dumps areas, water filled voids, reclaimed areas, unutilized areas, plantations etc., from various Coal companies. All the data/maps will be collated and analysed on a GIS based platform and different thematic information and maps will be prepared. These will be updated at regular intervals. All GIS based activities will be carried out with active participation of CMPDIL.
- Help Coal companies to identify areas where plantation projects could be taken up immediately, along with identification of various species of plants, suitable for specific regions to create large carbon sinks for climate change management.
- Identify the activities to be taken up for creation of additional land suitable for plantation, stabilization of slope, soil treatment, creation of levelled land, de-watering etc., as per time line under MCP.
- Check the possibility and plan for productive reuse of these lands for rehabilitation, integrated Modern Township, agriculture, horticulture, FCA compensatory land, renewable energy farms etc.

ii. Air quality, emission and noise management

- Advice coal companies for effective implementation of environmental mitigation measures (water sprinkling, dust suppression methods, noise barriers etc.) related to air and noise pollution generated due mine activities, HEMMs, transport of coal etc.
- Work towards energy efficiency in the mining operation, noise and emission reduction in case of HEMMs.
- Analysis of Environment Management Plans (EMP) of different companies and will advise coal companies to making it more effective.

iii. Mine water management

- Collection of data regarding present quantity, quality, surface runoff, drainage of mine water, future availability of water collected in UG or OC coal mines etc., and to analyse it on a GIS based platform to prepare model Coal Mine Water Management Plans (CMWMP).
- Suggest ways and innovative plans w.r.t storage, treatment and re-use of such water for drinking, irrigation, fisheries, tourism, industrial or any other sustainable purpose.

iv. Sustainable Overburden Management

- Check feasibility and suggest measures to reuse, recycle and rehabilitation of overburdened dumps in a sustainable manner.
- Examine and plan out use of overburdened material for use in different infrastructure projects, earthen bunds etc.

v. Sustainable Mine Tourism

- Explore and conceptualise a plan for the beautification & creation of eco parks in the reclaimed areas and which will also include water bodies etc., for re-creation activities and tourism purpose. It will also explore tourism potential and plan it out in few underground mines.

vi. Planning and Monitoring

- Analysis of Mine Closure Plans (MCP) of different companies and advise to make it more effective.
- Help coal companies to finalize time- line for execution of different mitigation activities / projects in all mines in phased manner.
- Monitor effective utilization of Mine Closure Fund and Environment Budgets of different coal companies.
- Formulate future guidelines for the mine closure plan, mine closure fund etc.

vii. Policy, Research, Education, and Dissemination

- Hire experts/ institutions/ organisations to conduct specific studies for establishing a robust knowledge base.
- Organise consultative meetings, workshops, field visits, exposure study tours etc., to enrich the knowledge base, known best global and ideas for environmental mitigation planning and monitoring.
- Conduct regular workshop and seminar for the company level officials to educate them in new methods, technologies, approaches and also global practices.

1.3 Role of SDC, CMPDI

In order to fulfil the objectives envisaged for functioning of SDC at Ministry as well as Subsidiary level, CMPDI has been assigned multifunctional roles by Ministry of Coal. In line with the same Sustainable Development Cell has been constituted at CMPDI level for assisting MoC in preparing status report of Sustainable Development Initiative of Coal Sector. The main objective of SDC, CMPDI is to address the following aspects of coal mining operations:

i. Development of Information Management System for collection and processing of environmental data as contained in concept note of MoC, on GIS platform and its use in planning.
ii. Environmental issues in mine planning & design and mine closure planning.
iii. Environmental and forestry clearances issues of coal mining and coal beneficiation,
iv. Compliance issues of EC/FC Conditions.
v. Generate new ideas to plan, prepare guidelines, monitoring and evaluation of environmental mitigation measures.
vi. Mitigation / management of various environmental attributes like air, water, noise, land etc.
vii. Policy framework on issues related to environment, forests and climate change.

viii. International conventions / agreements applicable to MoC/CIL related to environment and forest issues.
ix. Research, education and dissemination of knowledge related to environment and forest issues.

CHAPTER II: Brief of coal sector in India

2.0 Coal for Sustainable Growth

In the last few years, the Government has taken strident steps towards increased availability of power in tune with accelerated overall economic growth in the country. Schemes like **Saubhagya, DDUGJY, UDAY** etc. are aimed at rejuvenating power demand and initiatives such as **AMRUT, BHARATMALA** etc. have been introduced to promote the growth of core industries and economic wellbeing of people. This growth can only be sustained through the growth of energy sector. Coal is the mainstay of India's primary energy supply and there is an increasing trend of coal consumption, as evidenced from the figures of coal production as well as import of coal from 2010 till 2019 as shown below. At the same time, India has taken a lead in the Committee of Nations in terms of transition towards clean energy. India's proactive approach towards a cleaner tomorrow for our future generations is evident from its commitments made in **COP 21**, its founding role in the International Solar Alliance, and the thrust on introduction of Electric Vehicles.

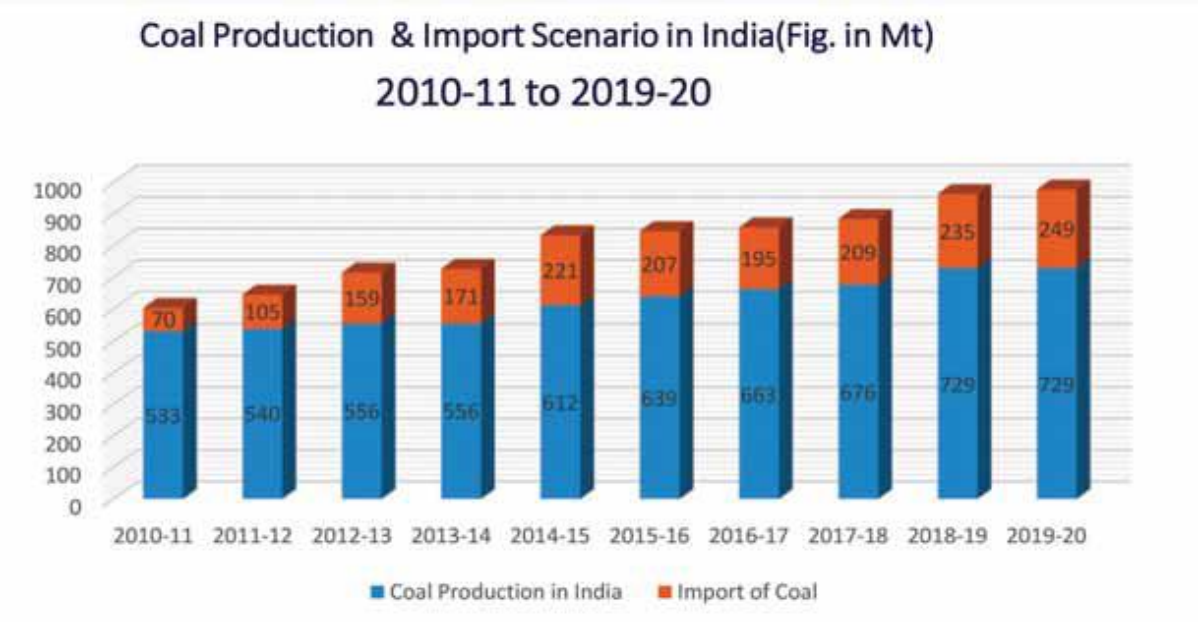


Figure 2.1: Coal Production & Import (in MT)

2.1 Coal in the Indian Energy Sector

In a recent study done by MoC/CIL, it has been observed that coal demand is likely to remain robust in the foreseeable future, while renewable energy will gradually provide greater contribution to the energy basket of the country. The conclusion of the study is

that coal is expected to remain the bedrock of the energy supply for the country till 2030 and beyond. Current consumption of domestic coal in the nation is about 729.10 MT whereas import accounts for approx. 248.5 MT of coal (both Coking and Non-Coking). A significant proportion of this demand will be generated from the use of coal in the thermal power sector. The non-regulated sector comprising steel, cement, captive power plants etc. would account for the remaining demand. New segments such as power demand from use of electric vehicles, new demand from coal to chemicals sector etc. would add to the existing demand. While Govt. is working towards creating healthy domestic market for coal in the country by encouraging the participation of private and state sectors into coal production, CIL is expected to remain the largest supplier and may be required to supply up to 1300 MT of coal by 2030. Opening up of commercial mining will help the country to deal with the demand for coal.

2.2 Coal Mining – Industry Outlook

Coal has been one of the key sources of primary energy for the world, contributing to roughly half of the total primary energy consumption. However, the significance of coal varies across the world with Asia leading the consumption, both in absolute terms and as a proportion of total primary energy consumption. In Asia, China and India are the two key coal consumers.

Going forward, while various estimates predict fall in share of coal in the energy basket, none has predicted a complete substitution. In Indian context, this seems more unlikely unless there is paradigm shift in nuclear and/ or renewable generation sources and storage technologies (both in terms of capacity and prices).

The total coal production in India in 2019-20 surpassed 730 MT and is likely to increase to about 1000 MT by 2022-23. Power generation remains the key consumer of coal in India.

The Indian coal mining sector is dominated by Coal India Limited, and the scenario is unlikely to change in the immediate future. Even as government opens up the sector to private entities for commercial mining, the proportion of coal supply from CIL is likely to dominate the Indian markets.

Coal mines in India comprise of opencast (OC) and underground (UG) mines. The choice of opencast or underground coal mines depends upon extent of deposit, geological conditions, available mining technology and project economics. At present, the opencast mines have been planned for a depth of around 300 m. In future, based on the availability of mining equipment and favourable geo-mining conditions, there is possibility of opencast mines going beyond 300 m depth.

Apart from the opencast and underground coal mines, there are some mixed mines also comprising of both opencast and underground workings. The choice of mixed mines again depends upon the nature and extent of geological conditions and project economics.

Some of the defining features of Indian coal mining sector are dominance of opencast method for production, smaller sized mines, medium to low mechanization and high labour intensity. There is also a clear trend towards increased mechanization including introduction of larger equipment. These elements are important to ensure long term sustainability of Indian coal mining and minimizing the environmental impact.

There are a number of other initiatives that the government has taken over last few years to minimize the environmental impact of coal mining and ensuring greater sharing of benefits across the society including creation of District Mineral Foundation (DMF) for generating financial resources to be invested in the mineral rich areas.

2.3 Brief about Coal India Limited

Coal India Limited (CIL), a Maharatna Central Public Sector Enterprise, and Government of India Undertaking, is the largest coal producer in the world with production of about 602.14 MT in 2019-20. Maharatna status is conferred by the Government of India to selected state owned enterprises, in order to allow for more autonomy and to empower them to expand their operations and emerge as global giants. CIL, being a coal mining corporate, comes under the purview of Ministry of Coal, Government of India. Since 1975, the Company has made significant contribution to energize entire India and in carrying out socio-economic development across the country. With headquarters at Kolkata, West Bengal, CIL has significant footprints all over India. CIL is producing about 83% of the entire coal output of the country and caters to bulk of the coal requirement of the Power, Cement and Steel sectors of the country and also of the fertilizer, brick kilns, and similar industries.

CIL is also one of the largest corporate employers with manpower of 2,72,445 (as on 1st April, 2020). CIL operates through 84 mining areas spread over eight (8) provincial States of India. Coal India Limited is currently operating 335 mines (as on 1st April, 2020) of which 150 are underground (UG), 167 opencast (OC) and 18 mixed mines. CIL further operates 12 coal washeries, (10 coking coal and 2 non-coking coal) and also manages other establishments like workshops, hospitals, and so on. CIL has 26 training Institutes. Indian Institute of Coal Management (IICM) is an excellent training center operating under CIL and imparts multidisciplinary management development programs to the executives.

The producing Indian subsidiary companies of Coal India Limited:

1. Eastern Coalfields Limited (ECL)
2. Bharat Coking Coal Limited (BCCL)
3. Central Coalfields Limited (CCL)
4. Western Coalfields Limited (WCL)
5. South Eastern Coalfields Limited (SECL)
6. Northern Coalfields Limited (NCL)
7. Mahanadi Coalfields Limited (MCL)

North-Eastern Coalfields is operating under the administrative control of CIL. Central Mine Planning & Design Institute Limited (CMPDIL) is the planning & design subsidiary of CIL.

Figure 2.2: Corporate Structure and Operations of CIL

The summary of running coal mines of CIL is provided hereunder in Table 2.1.

Table 2.1: Operating coal mines in CIL

Sl. No.	Subsidiary	Number of Mines				Mine Leasehold area (in ha)	State of Operations
		OC	UG	Mixed	Total		
1	ECL	24	55	07	86	44005.76	WB, Jharkhand
2	BCCL	16	11	09	36	28437.00	WB, Jharkhand
3	CCL	42	06	01	49	22807.72	Jharkhand
4	WCL	38	27	-	65	45480.12	Maharastra, MP
5	SECL	19	46	01	66	51871.81	MP, CG
6	NCL	10	-	-	10	18418.07	MP, UP
7	MCL	16	04	-	20	21808.82	Odisha
8	NEC*	02	01	-	03	1784.23	Assam
Total CIL		**167**	**150**	**18**	**335**	**234613.50**	

**Mine operations at NEC temporarily have been suspended w.e.f 06.03.2020*

The details of closed mines in CIL are provided in Table 2.2 below:

Table 2.2: Closed coal mines in CIL

Sl. No.	Subsidiary	Number of Closed Mines			Mine Leasehold area (in ha)	State
		OC	UG	Total		
1	ECL	-	1	1	1633	WB
2	BCCL	None of the mines of BCCL are closed under DGMS & MCP Guidelines				
3	CCL	-	10	10	4314	Jharkhand
4	WCL	9	15	24	10367	MP,Maharastra
5	SECL	10	17	27	12767	CG, MP
6	NCL	1	-	1	459	MP
7	MCL	None of the mines of MCL are closed under DGMS & MCP Guidelines				
Total CIL		**20**	**43**	**63**	**29540**	

2.4 Environmental Management in CIL

One of the inherent impacts of coal mining is degradation of the land and environment. CIL constantly addresses the impact of mining activities across environmental and social issues. Eco-friendly mining systems have been put in place in all of its mining areas. To make environmental mitigation measures more transparent, CIL introduced state-of-the-art Satellite Surveillance to monitor land reclamation and restoration for all opencast projects. Plantation and green belt are developed through extensive tree plantation programs every year by the subsidiaries of CIL. The subsidiaries of CIL have planted more than 99.6 million trees covering an area of 39842 ha till 31st March, 2020. Committed to minimize the adverse impact of coal mining on environment through well structured Environment Management Plans and sustainable development activities, CIL HQ has obtained certification against ISO 9001, 14001 and 50001 (Quality Management, Environment Management and Energy Management System) from Bureau of India Standards (BIS). As on 31st March 2019, four of our Subsidiaries, ECL, CCL, NCL and MCL are certified for Integrated Management System (ISO:9001, 14001 and OHSAS:18001). CMPDI HQ and its seven Regional Institutes are certified for ISO 9001:2015.

2.4.1 Regulatory compliances

Compliances are a must for any mining organization and CIL understands the criticality of deviating from desired regulations in terms of long-term continuity of operations. Hence, for good business conduct, CIL adheres to all essential regulatory norms and meets the necessary compliances. Before operationalizing of any new project, CIL ensures that necessary clearances (including environmental clearances and forest clearances) have been obtained, Environment Impact Assessments conducted, and potential effects on all stakeholders analyzed. CIL also monitors the compliance of the conditions laid down in the EC and consent to operate and reports the same regularly to MoEF&CC and SPCB.

2.5 Sustainability Management in CIL

CIL believes in working in line with the principles of sustainability while striving to achieve long-term business success on a viable basis. Sustainability management is an integral

part of CIL's business strategy. In order to embrace the sustainability and its challenges, CIL endeavors to balance economic, environmental and social costs and benefits. Sustainability related to mining depends on reserve resource dynamics and therefore exploration and development of coal seams is a focus area of the company. To make this possible, CIL's approach towards mining activities aims to establish harmony with society and the environment.

A key aspect of CIL's sustainable management approach involves implementation of sustainable mining practices, ensuring safety and health of the employees and creating value for community. CIL places a special focus on the lasting and effective establishment of a culture of integrity, discipline and respect. CIL leverages business opportunities to minimize risk and address social and business challenges such as scarcity of resources and climate change at an early stage. Increasingly, CIL is making efforts in order to improve the sustainability performance and further develop the strategy, defining it more precisely.

The efforts are also to reduce the environmental impact of mining and minimize the footprint of the activities throughout the mining cycle, including working to restore post – mining eco-systems. CIL's sustainability objectives and their management are central components of its sustainability governance system. Sustainability targets are annually reviewed in CIL. In doing so, CIL also takes the changing requirements of its stakeholders into account.

Stakeholder concerns are taken care of by the top management while integrating the sustainability management within the business strategy. CIL ensures inclusive growth by contributing towards the peripheral development as a priority and integrating holistic sustainability management strategy. CIL has established a company-wide strategic planning, cascaded to subsidiary specific sustainability activities and ensure systematic consideration of stakeholders' requirements.

In sustainability management, CIL

- Follows an effective legal framework to ensure adequate environmental protection
- Adopts employee efficient management practices
- Ensures that mine closure plans are part of Project Reports
- Fosters community sustainability through CSR
- Provides social security to employees
- Undertakes measures to minimize health impacts on local population
- Understands the inter-generational equity.

CIL aligns its activities in line with United Nations Sustainable Development Goals (SDGs) of 2015. CIL's Sustainability Policy lays emphasis on Environmental, Economic and Socio-Cultural Sustainability. Respective departments at Corporate and Subsidiaries have earmarked responsibilities to improve performance in their sustainability dimensions. These form the core areas for implementing relevant projects. CIL's practices towards SDGs, stimulate wide dialogue and cooperation among stakeholders to make mining a driver of sustainable development. In addition to this, CIL also has an

exclusive policy for Corporate Social Responsibility that is aligned with the Companies Act, 2013 in order to measure our triple bottom line. CSR policy acts as a strategic tool and guidance for integrating business processes with the social processes for the overall development of the society.

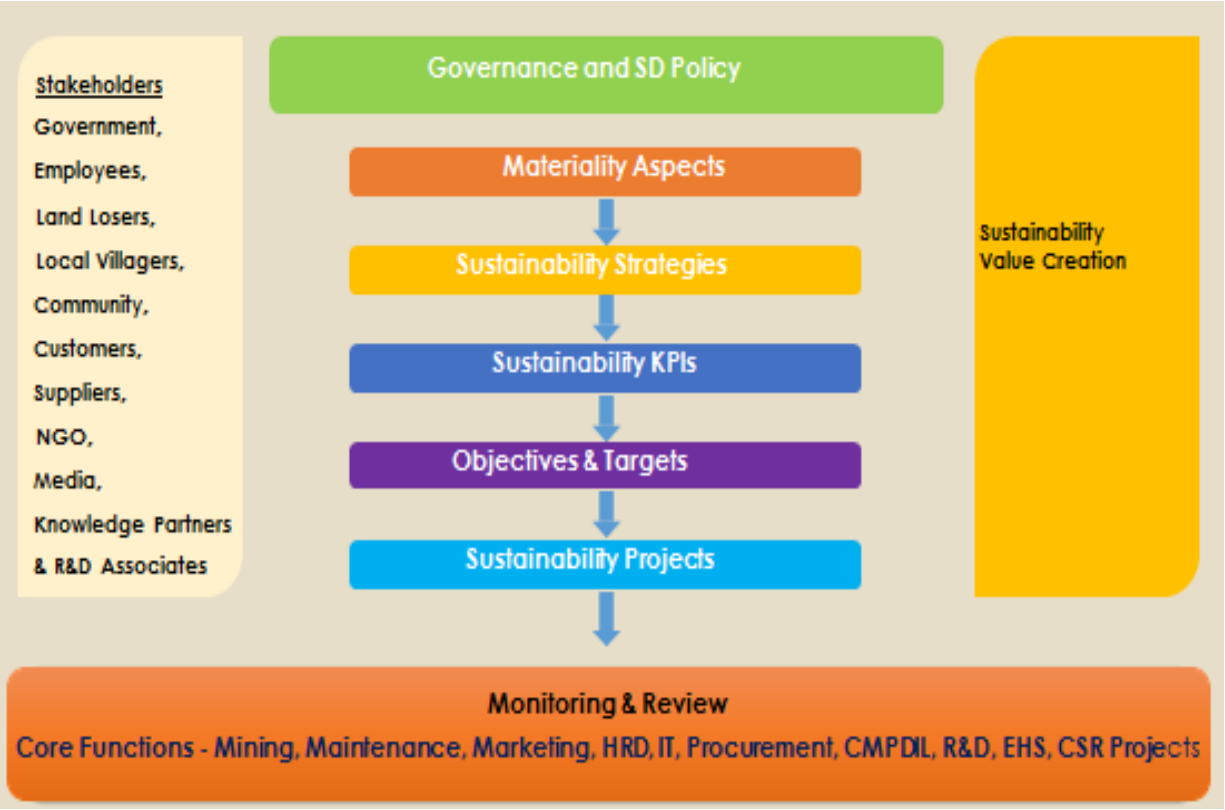


Figure 2.3: Sustainability framework of CIL

2.6 Sustainable Development Policy (SDP) of CIL

CIL has a dedicated Sustainable Development Policy effective from August 2013. The policy states that CIL shall promote and pursue sustainable mining integrating Environmental, Socio-Cultural and Economic factors which comprise the basic fabric of sustenance in our society. It shall also incorporate views and opinions of stakeholders ensuring compatibility and implementation.

The attempts are being made to shape a new future through a set of determined goals and to bring sustainability into focal point. The objectives of the SDP of CIL shall be in line with the Govt. of India principles and directives on Sustainable Development encompassing mainly three components:

Environmental Sustainability	Socio-Cultural Sustainability	Economic Sustainability

Figure 2.4: Triple bottom line of Sustainable Development

The SDP of CIL affirms its commitments to protect & safeguard the environment and conserve the bio- diversity for maintaining the ecological balance besides effecting Socio-cultural and Economic betterment of the surroundings of its operations. In order to do so CIL, and its subsidiaries prepare annual action plans detailing the activities to ensure the above strategies are implemented in a planned way with the approval of concerned SD committees. The progress of the activities is reviewed periodically by the SD Committees.

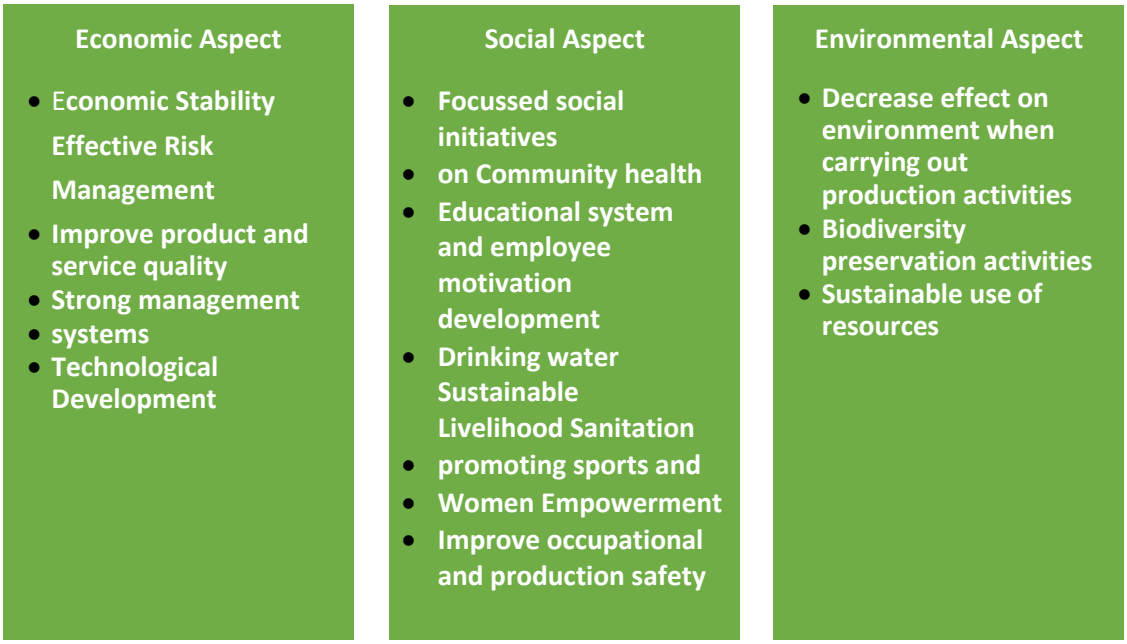


Figure 2.5: Economic, social and Environmental aspect at CIL

2.7 Singareni Collieries Company Limited (SCCL)

The Singareni Collieries Company Limited (SCCL) is a Government coal mining company jointly owned by the Government of Telangana and Government of India on a 51:49 equity basis. The Singareni coal reserves stretch across 350 km of the Pranahita–Godavari Valley of Telangana with proven geological reserves aggregating to 8791 million tonnes. SCCL is currently operating 20 opencast and 25 underground mines in 6 districts of Telangana with manpower around 43,386.

While historically technology has been a critical factor in SCCL's ability to reduce environmental impacts and occupational hazards, the need to constantly increase productivity and cut costs has demanded that the company goes in for phased mechanization and adapts state-of-the-art technologies

SCCL pioneered mechanization of coal mines in India by adopting coal drilling machines as far back as in 1937. In 1950 Shuttle Cars, Gathering Arm Loaders, Conveyors and Coal Plough Equipment were introduced. Later in a path breaking move to replace arduous manual labour, Road Headers, Load Haul Dumpers and Side Dump Loaders were gradually brought in.

A combination of modern machines in Open Cast Mining like Walking Draglines, Shovels and High-Capacity Dumpers were introduced in 1975. In-pit crushing and conveyor technology for over burden removal and coal extraction was commissioned for the first time in Ramagundam Open Cast Mine with German assistance in 1994.

In 2002, Surface Miner Technology was introduced which not only facilitates cost reduction but also contributes to eco-friendly mining. SCCL also introduced Longwall technology in underground mining in 1983 and Blasting Gallery (BG) Technology in 1989. Today, with 4 Longwall Panels and 5 BG Panels working in the company, mechanization of underground mines is being planned with state-of-the-art technologies like continuous miner and punch longwall. Already the mechanization of underground mining has seen the commissioning of 104 Side Discharge Loaders (SDL) and 37 load haul dumpers (LHD) that have enhanced safety and productivity during the last four years. Other innovations in underground mines are 35 man-riding systems (chairlift and railcar) that have improved transportation inside the mines.

The description of operating coal mines in SCCL is as under:

Table 2.3: Operating Coal Mines in SCCL

Sl. No.	Subsidiary	Number of Mines				Mine Leasehold area (in ha)	State of Operations
		OC	UG	Mixed	Total		
1	SCCL	22	26	--	48	30389.85	Telangana
Total SCCL		22	26	--	48	30389.85	

The details of closed mines in SCCL are provided in Table 2.4 below:

Table 2.4: Closed coal mines in SCCL

Sl. No.	Subsidiary	Number of Closed Mines			Mine Leasehold area (in ha)	State
		OC	UG	Total		
1	SCCL	05	15	20	11533	Telangana
Total SCCL		05	15	20	11533	

2.8 Environment Management in SCCL

SCCL is having a full-fledged Environment Department for preparation of EIA/EMPs for new/expansion coal mining projects, impact assessment studies, implementation of environmental safeguards and other environmental initiatives. SCCL has been preparing EIA/EMPs since 1985 and so far, obtained Environmental Clearance for 85 projects including 2x600 MW Power Plant and sand mining project. Corporate Environment Department is having ISO-9001-2015 certification.

SCCL has launched a number of 'eco-friendly' practices to mitigate damage to environment and improve the quality of life. A number of key initiatives taken up by SCCL for environment protection in the recent years include setting up of automatic dust suppression arrangements, sewage treatment plants, effluent treatment plants, bio-

engineering structures on over burden dumps, clonal plantations, medicinal plantations and development of parks & gardens.

SCCL is also implementing energy efficient practices at the mines and colonies for reducing overall power consumption like switching over to LED lighting systems, use of energy efficient pumps & motors, use of renewable energy resources like solar power.

2.9 NLC India Ltd and Environment Management in NLC

NLC India Ltd is one of India's leading Public sector company engaged in mining and power generation. Established in 1956, its operations are spreading throughout the country. In all its 62 years' service to the Nation, this brown Coal Company has been a pioneer and trend-setter for breaking its achievements in lignite mining and power generation year by year. Keeping face with the changing business trends, NLCIL has diversified into renewable energy and coal mining business in India. NLCIL has included its Commitment to environment protection and Sustainable development as its corporate objective since inception. NLCIL undertakes wide range of Sustainability development projects and Corporate Social Responsibility measures for the environment protection, community and rural development thus ensuring the sustainable development of the company.

NLCIL is a Navratna Company which believes that "Sustainable development, Environment Protection and eco- care is blended into every act of our business and activity and has become part and parcel of its existence". NLCIL is a socially responsible company guided by ethical governance. NLCIL not only produces lignite and generate power, but also help building infrastructure, irrigate large tracts of land, promote environment and ecology, meet the power requirement of users and contribute to the overall wellbeing of society. NLCIL have implemented several new initiatives like augmenting water resources through deepening and de-silting of water bodies at different locations in Tamil Nadu and are in the process of replicating the same in the areas of its operation across the Country. NLCIL's green initiatives include promotion of aqua culture; water harvesting and providing drinking water through RO based water vending kiosks in various parts of the country specifically at heritage sites, bus terminus where there is a large public gathering, electric operated shuttle vehicles in pilgrimage sites etc.

NLC India at present has four open cast lignite mines namely Mine I, Mine II, Mine IA and Barsingsar Mine and one coal mine namely Talabira II & III OCP. The description of operating coal mines in NLC is as under:

Table 2.5: Operating Coal Mines in NLCIL

Sl. No.	Subsidiary	Number of Mines				Mine Leasehold area (in ha)	State of Operations
		OC	UG	Mixed	Total		
1	NLCIL	1	-	--	1	971	Odisha
Total NLCIL		1	-	--	1	**971**	

Chapter III: Opencast and Underground mines and their environmental impacts

3.0 Stages of Mining

Coal mining involves the following stages: Exploration of deposits, construction and development of the mine, active mining and mine closure activities.

3.1 Exploration

A mining project can only commence with knowledge of the extent and value of the mineral ore deposit. Information about the location and value of the mineral ore deposit is obtained during the exploration phase. This phase includes surveys, field studies, drilling boreholes, other exploratory activities and finally preparation of a Geological Report for the coal Block.

3.2 Construction and Development

If the mineral ore exploration phase proves that there is a large enough mineral ore deposit, of sufficient grade, then the project proponent may begin to plan for the development of the mine after getting a Project Report prepared for the mine. This phase of the mining project has several distinct components like site preparation and clearing of vegetation, construction of roads, mining infrastructure, residential colonies etc. Requisite clearances (like EC, FC, WC, CTE & CTO, as applicable) are also secured during this phase prior to construction and development of the project.

3.3 Active Mining

3.3.1 Opencast Mining

There are a number of advantages of open pit mining when compared to Underground Mining:

- Open pits can sometimes be brought into production quickly. Underground mining requires development (shaft sinking, adits, inclines *etc.*) which might take years before production can start. However, design & construction of the processing plant also takes a long time during which U/G development might be completed in parallel;
- Open pits are generally safer than U/G mining;
- Operations are highly visible to management & easy to control;
- Low operating costs:
    - the expenditure is mainly on direct production activities–drilling, blasting & moving rock–compared with U/G which has high costs of ancillary activities: support, ventilation

    - open pit mining allows the use of very large machines which have a lower cost per tonne of mineral mined than small machines
- Geological information may be improved & grade control is normally easier;
- It is relatively easy to increase or reduce the rate of production (tonnes per month);
- Provides more operational flexibility
- Low labour intensity (small workforce required): less housing, direct & social costs associated with employees;
- The choice of an open pit mining method may not preclude later mining at depth by U/G methods.

3.3.1.1 Environmental Impact of Opencast Mining

The following are the environmental impacts of opencast mining:

- Very large amounts of waste rock (overburden) are mined. This creates costs as well as environmental issues with waste rock disposal;
- Major disruption of surface: pit footprint, waste dumps. High visual impact, especially strip mining. After closure, rehabilitation may be difficult, slow & costly;
- Open pits catch rain, making them vulnerable to flooding, which may severely disrupt production;
- Air pollution due to coal handling, coal transportation and from coal stock piles,
- Water pollution, Ground water depletion
- Change in land profile, impact on flora & fauna
- Socio-cultural impact, Economic disparity, Socio-economic conflict/Cost of living
- Displacement of people, Loss of livelihood

3.3.2 Underground Mining

Shallow mineral or coal deposits can be economically mined by open-pit or strip mines. However, with deeper mineral or coal deposits it becomes very costly to remove a great deal of overburden in these kinds of settings. So, in these cases underground mining is more cost effective. The downside is that human health and safety are at greater risk from mine cave-ins, flooding from groundwater or sea water, methane explosions in coal mines, or failure of air ventilation equipment.

Since it is a process wherein ore and minerals are extracted from deep underground, it does not incur large damages to the surface environment of the mine area. It doesn't lead to land degradation as typically present in open-pit/surface mining. It doesn't need breaking up and blasting the ground with explosives.

The surface facilities unique to underground mining are mine main entries (shafts, inclines and adits) head frame(s), heap; storage bins, hoist houses, etc. the additional underground facilities may consist of secondary and tertiary openings for providing access haulage and ventilation and various other facilities such as transportation, crusher stations, power distribution.

3.3.2.1 Underground Coal Mining Methods – Up to 500m

(a) Bord and Pillar

There are two main Bord and pillar systems *i.e.* conventional system of mining and continuous system of mining. In the conventional system, the unit operations of drilling, blasting, and loading are performed by separate machines and work crews. In a continuous operation, one machine the continuous miner rips coal from the face and loads it directly into a hauling unit.

(b) Wongawilli Mining

Generally, with the Wongawilli system, a panel is created by a secondary development consisting of three to five roads and leaving a continuous pillar of coal between the development and the previously caved area. The pillar is normally between 50 m and 150 m wide and is extracted by extracting 7 m wide ribs in a modified split and lift system. The pillars formed by the development are extracted as the rib extraction retreats. As a result of the length of the rib pillars, this method resembles a short wall face. This method was developed to provide a single working place to extract coal in a stress-relieved area and to utilize the coal seam as support during extraction.

(c) Shortwall & Longwall Mining

In the shortwall mining method, the layout is similar to the longwall method except that the block of coal is not more than 100 m wide.

Furthermore, the slices are as much as three metres thick and are taken by a continuous miner. The mined coal is dumped onto a face conveyor or other face haulage equipment. The roof is supported by specially designed shields, which operate in the same manner as longwall shields. Although a great future was envisioned for shortwall mining, it has not lived up to expectations.

3.3.2.2 Underground Coal Mining Methods – beyond 500 m

(a) Longwall Mining

Beyond 500 m depth, B & P and Wongawilli has not been practiced so far in coal producing countries. Mine development is carried out in such a manner that large rectangular blocks of coal, usually 100 to over 300 meters wide and 1,000 to over 3,000 meters long, are available for complete extraction. Coal is cut by shearers and is transported to surface through belt conveyors. Heavy duty self-advancing hydraulic supports are used to support the roof. This method of mining however involves large number of heavy pieces of equipment and is, therefore, a capital-intensive method of mining.

Furthermore, under high stress conditions, due to depth, only longwall method of mining has been found suitable. Longwall panels are suitably designed to work under high stress

conditions. Longwall Mining under depths beyond 500 m is being successfully practiced by some of the major coal producing countries.

3.3.2.3 Environmental Impact of Underground Mining

Underground mining is a less environmentally-destructive means of gaining access to an ore deposit, however it often entails greater safety risks than strip mining, including open-pit mining. The following are the environmental impacts of underground mining:

i. Air pollution due to coal handling, coal transportation and from coal stock piles, release of obnoxious gas e.g. methane.
ii. Water pollution, Acid rock drainage (ARD) or Acid mine drainage (AMD)
iii. Land Degradation due to subsidence on account of underground depillaring leading to change in land profile, destruction of flora & fauna, caving in and rock fall
iv. Safety issues in Underground workings
v. Socio-cultural impact, Economic disparity, Socio-economic conflict/Cost of living
vi. Displacement of the people, Loss of livelihood

3.4 Mine Closure Activities

The last stage of mining cycle is closure of mines through which the mine operator carries out remedial activities to bring the entire mining affected area in a safe, stable and environmentally sustainable condition. In practice, the activities of mine closure are taken up concurrently with the mining activities under progressive mine closure. The affected areas, which become free from mining activities, are reclaimed concurrently to arrest the adverse impacts at the earliest. After the closure of mining, the final mine closure activities are taken up.

Thus, mine closure activities aim at mitigation of adverse impacts of mining. The mine closure guidelines were issued by the Ministry of Coal in 2009 and which were subsequently revised in 2013. These guidelines were further revised in 2019. These guidelines are aimed at undertaking progressive and final mine closure activities during the operation of the mine and also upon its closure. The provision of escrow account has been made in these guidelines, which act as a financial assurance for mine closure activities.

3.5 Mining Method-wise Coal production in CIL, SCCL and NLCIL

Due to increased demand of coal for ensuring the energy security of the country and fuelling growth in economy, thrust is on the opencast mines on account of high production and productivity. In case of underground mining, the adverse environmental impacts and extent of land degradation is lesser, however open cast mining is preferred as its environmental impacts are being managed through suitable environmental protection measures. Some high-capacity underground mines have been planned and are also

under operation, however the contribution of underground mining in overall coal production in India remains substantially low.

The production of CIL during the fiscal 2019-20 was 602.14 MT (break-up given in table below) whereas that of SCCL was 64.02 MT and NLCIL was 24.84 MT during the same period. As can be seen, about 95% and 87% annual production of CIL and SCCL respectively is from open cast mines and the balance is from UG mines.

Table 3.1: CIL coal production during April'19 to Mar'20

Production during Apr'19 to Mar'20 (in million tons)			
Subsidiary	Production in million tons (MT)		
	UG Mines	OC Mines	Total
ECL	9.21	41.20	50.41
BCCL	1.04	26.69	27.73
CCL	0.70	66.19	66.89
NCL	0.00	108.05	108.05
WCL	4.16	53.48	57.64
SECL	14.09	136.46	150.55
MCL	0.84	139.52	140.36
NEC	0.00	0.52	0.52
CIL (Total)	**30.04**	**572.11**	**602.14**

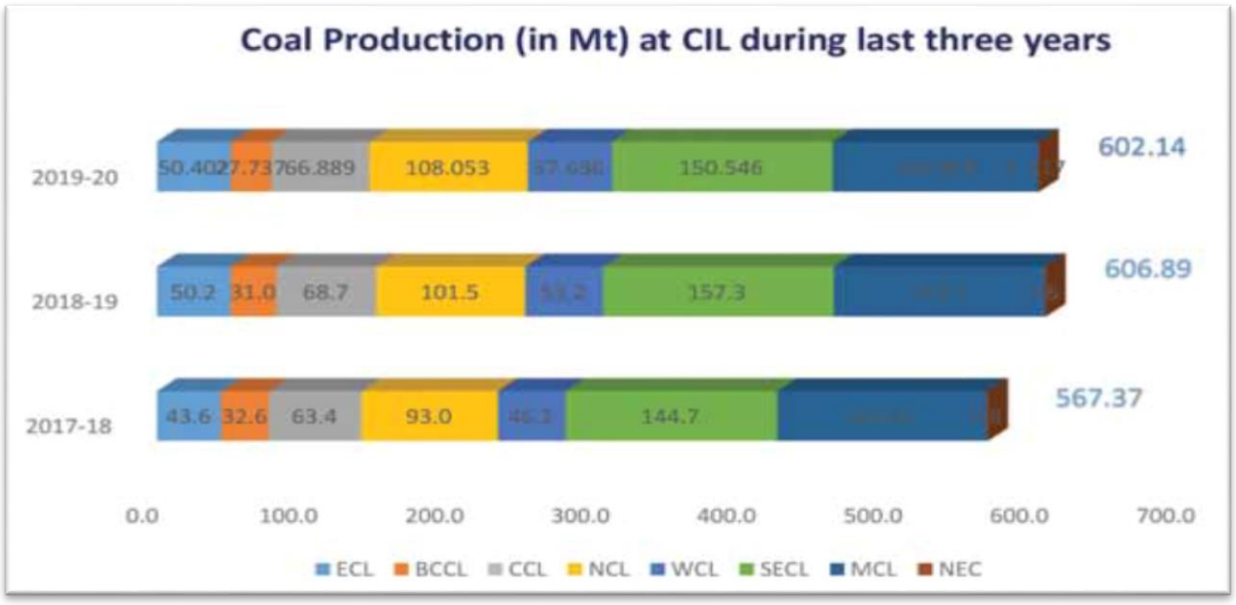


Figure 3.1: Coal Production at CIL during last three years

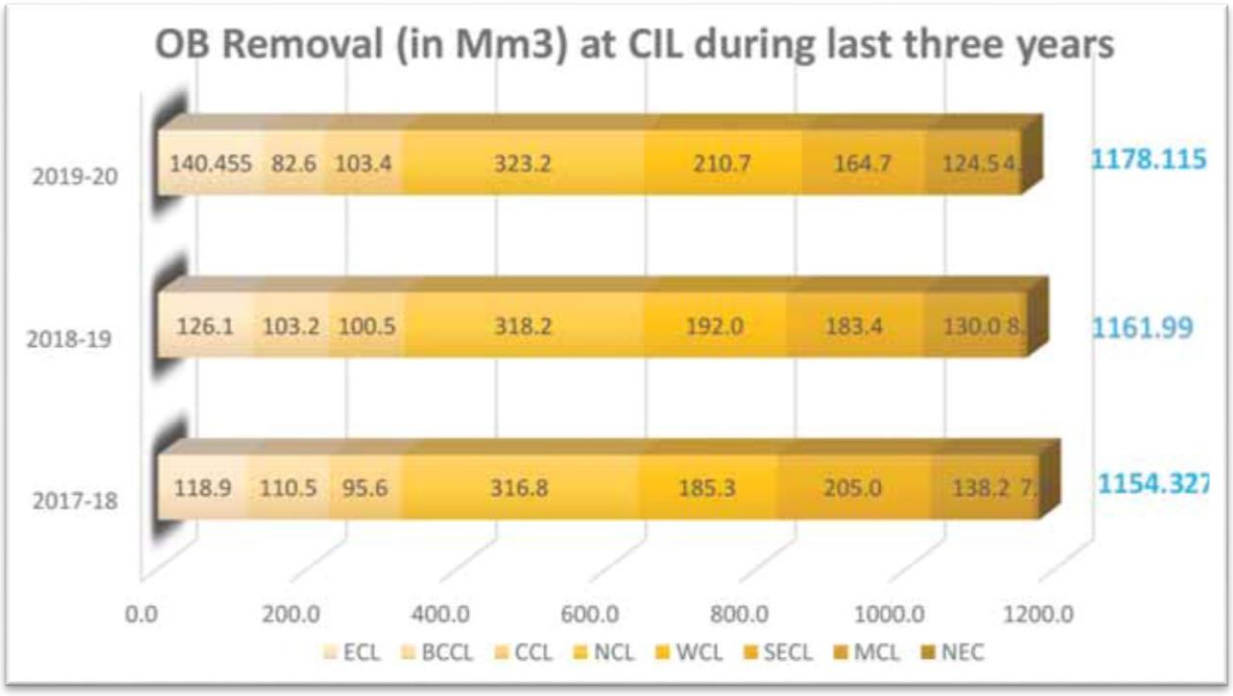


Figure 3.2: OB removal at CIL during last three years

Table 3.2: SCCL coal production during April'19 to Mar'20

Production during Apr'19 to Mar'20 (in million tons)			
Subsidiary	Production in million tons (MT)		
	UG Mines	OC Mines	Total
SCCL	8.66	55.38	64.04

Table 3.3: NLCIL coal production during April'19 to Mar'20

Production during Apr'19 to Mar'20 (in million tons)			
Subsidiary	Production in million tons (MT)		
	UG Mines	OC Mines	Total
NLCIL	Nil	24.84	24.84

CHAPTER IV: Status of coal mining projects – Brief of projects considered

4.0 Introduction

For preparing the environmental status of coal mining projects, 40 mining projects have been considered. Of the 40 projects, 37 mines are of Coal India Limited (CIL), 02 mining projects of Singareni Collieries Company Limited (SCCL) and 1 project of NLC India Limited (NLCIL).

The 37 major Coal Mining Projects of Coal India Limited (CIL) include projects from seven coal producing subsidiary companies (namely ECL (2 Projects), BCCL (2 projects), CCL (6 Projects), WCL (1 Project), SECL (4 Projects), NCL (8 Projects) and MCL (14 Projects)). The location of the mines considered for analysis is provided in Figure-4.1. The infographic below shows the list of 40 projects:

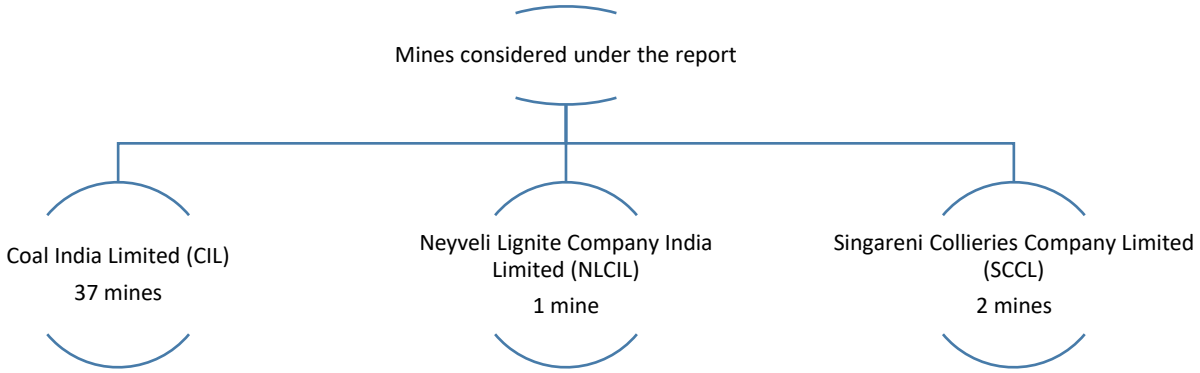
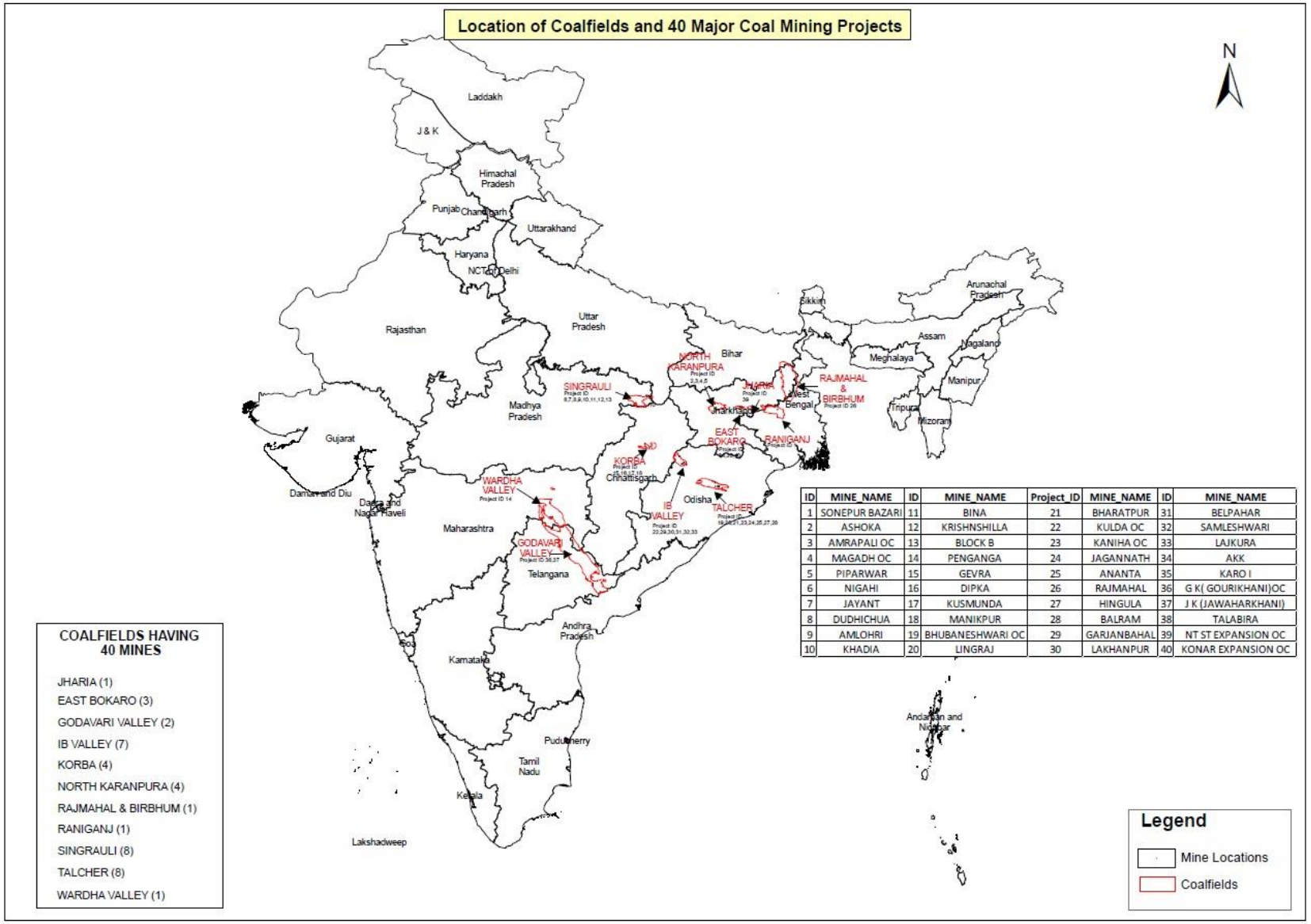


Table 4.1: List of projects considered

Sr. No.	Coal Company	Name of mine
	CIL Subsidiaries:	
1	Eastern Coalfields Limited (ECL)	Rajmahal OC
2		Sonepur Bazari OC
3	Bharat Coking Coal Limited (BCCL)	AKWMC
4		NT-ST Expansion OC
5	Central Coalfields Limited (CCL)	Karo OC
6		Ashoka OC
7		Amrapali OC

Sr. No.	Coal Company	Name of mine
8		Magadh OC
9		Piparwar OC
10		Konar Expansion OC
11	Western Coalfields Limited (WCL)	Penganga OC
12	South Eastern Coalfields Limited (SECL)	Gevra OC
13		Dipka OC
14		Manikpur OC
15		Kusmunda OC
16	Northern Coalfields Limited (NCL)	Amlohri OC
17		Nigahi OC
18		Jayant OC
19		Dudhichua OC
20		Khadia OC
21		Bina OC
22		Krishnashila OC
23		Block B OC
24	Mahanadi Coalfields Limited (MCL)	Lakhanpur OC
25		Lingaraj OC
26		Bharatpur OC
27		Kulda OC
28		Ananta OC
29		Kaniha OC
30		Hingula OC
31		Samaleshwari OC
32		Belpahar OC
33		Jagannath OC
34		Balram OC
35		Lajkura OC
36		Bhubaneshwari OC
37		Garjanbahal OC
38	**Singareni Collieries Company Limited (SCCL)**	Gouthamikhani (GK) OC
39		Jawaharkhani (JK) 5 OC
40	**NLC India Limited**	Talabira II & III OC



ID	MINE_NAME	ID	MINE_NAME	Project_ID	MINE_NAME	ID	MINE_NAME
1	SONEPUR BAZARI	11	BINA	21	BHARATPUR	31	BELPAHAR
2	ASHOKA	12	KRISHNSHILLA	22	KULDA OC	32	SAMLESHWARI
3	AMRAPALI OC	13	BLOCK B	23	KANIHA OC	33	LAJKURA
4	MAGADH OC	14	PENGANGA	24	JAGANNATH	34	AKK
5	PIPARWAR	15	GEVRA	25	ANANTA	35	KARO I
6	NIGAHI	16	DIPKA	26	RAJMAHAL	36	G K(GOURIKHANI)OC
7	JAYANT	17	KUSMUNDA	27	HINGULA	37	J K (JAWAHARKHANI)
8	DUDHICHUA	18	MANIKPUR	28	BALRAM	38	TALABIRA
9	AMLOHRI	19	BHUBANESHWARI OC	29	GARJANBAHAL	39	NT ST EXPANSION OC
10	KHADIA	20	LINGRAJ	30	LAKHANPUR	40	KONAR EXPANSION OC

Figure 4.1: Location of mines considered for Analysis

The reporting structure for the projects is split into four sections:

- **Status of Land (Chapter-V)**

  As a part of compliance of EC conditions, the reclamation and land use pattern of core zone is being monitored through satellite imagery. The major parameters being monitored are active mining area, area under technical reclamation and area under biological reclamation.

- **Status of Air Quality (Chapter-VI)**

  Status of air quality for each of the projects has been analysed based on the Ambient Air Quality Monitoring (AAQM) undertaken by the respective projects. Based on the reported AAQM data in the core and buffer zones of the project made available, the minimum and maximum range for the major pollutants, namely PM_{10}, $PM_{2.5}$, and averages for SO_2 and NOx for the period from April, 2019 till March, 2020 were analysed.

- **Status of Mine Water Quality and Quantity Management (Chapter-VII)**

  Status of mine water quality for each of the projects has been analysed based on the quality monitoring undertaken by the respective projects. Based on the reported quality data in the projects made available, the minimum and maximum range for the TSS, pH and heavy metal concentration have been analysed.

  Further, the status of utilization of mine water in the selected projects has also been assessed. During mining operations, the aquifers are intersected and the ground water gets collected in the mine pits. The mine water needs to be discharged outside the mine for facilitating mining operations. Coal companies have taken steps to utilize this mine water for meeting industrial requirement of mines *i.e.* for dust suppression, firefighting, plantation *etc.* and also for use in colonies, offices etc. thus avoiding the tapping of fresh water resources. The mine water is also supplied to the nearby communities for their domestic and agriculture use. The balance water is being utilized for recharge of water regime or for future use.

- **Status of Mine Closure (Chapter-VIII)**

  Mine closure planning has been integrated in mines from the start of the projects. The major progressive mine closure activities carried out in the mines are OB dump reclamation, reclamation of mined out areas, plantation and skill development training for affected people. Mine closure audit is being conducted by CMPDI and other approved agencies regularly for release of Escrow amount in lieu of executed mine closure activities. The details on amount deposited in the Escrow Account for each project have been covered in this section.

The data collection format based on which information for the status report was sought from the coal companies is attached as **annexure**.

4.1 Brief about the projects considered

4.1.1 Eastern Coalfields Limited

The two large open cast projects of ECL selected for the status report are Rajmahal OCP and Sonepur Bazari OCP.

Rajmahal OCP is an existing Project of **23.08 MTPA** capacity, which was expanded from 17 MTPA to 23.08 MTPA in 2020. The mine came into operation in 1988-89. The project is situated in Godda District of Jharkhand. The life of the project is 18 years, average stripping ratio is 1:2.14 and maximum depth of the mine is 190 m from the ground level. Transport of coal from coal face to crusher unit is through dumpers and coal transportation from Crusher to silo via covered conveyor belts.

Sonepur Bazari OCP is an existing project of **12 MTPA** capacity, which is a part of Cluster No. 12; environment clearance was granted in March, 2016. **Sonpur** and **Bazari** are two villages that have lent their name to the Sonpur-Bazari open cast coal mines project in Pandabeswar CD Block in Durgapur subdivision of Paschim Bardhaman district in the state of West Bengal. The mine came into operation in 1990-91. The life of the project is 19 years as on March 2019, average stripping ratio is 1:5.70 and maximum depth of the mine is 160 m from the ground level.

4.1.2 Bharat Coking Coalfields Limited

The two large open cast projects of BCCL selected for the status report are AKWMC OCP and NT ST expansion OCP which comes under Cluster IV and Cluster IX respectively.

AKWMC (Amalgamated Keshalpur -West Mududih Colliery) is located in Dhanbad district of Jharkhand and are under administrative control of Katras area of BCCL. It comes under Cluster IV group of mines of BCCL having peak production capacity of 9.55 MTPA. The other mines of cluster IV are Salanpur Colliery, Katras Choitudih Colliery, AKWMC, Angarpathrea Colliery & Ramkanali Colliery and Gaslitand Colliery.

NT ST Expansion (North Tisra- South Tisra) falls in Cluster IX of BCCL and is under administrative control of Lodna Area. Cluster IX received EC in 2013 vide letter no. J-11015/307/2010-IA.II(M) dt. 21st May 2013 for a combined peak production capacity of 8.512 MTPA. The configuration of Cluster IX after the aforementioned EC amendment is as shown in the following table:

S. No.	Name of the Mine	Production Capacity		Leasehold Area (Ha)	Life (years)
		Normative	Peak		
1	Amalgamated Joyrampur Colliery (OC)	2.512	3.25	1186.97	25
2	NT-ST expansion OCP (in operation)	6.0	7.8	755.15	26
	Total		**8.512****	**1942.12**	

** Peak of Cluster will remain same, as peak of individual will be achieved in different years.

4.1.3 Central Coalfields Limited

The six large projects of CCL selected for the status reports are Ashoka OCP, Amrapali OCP, Magadh OCP, Piparwar OCP, Karo OCP and Amalgamated Konar Khasmahal (AKK) OCP.

Ashok Expansion OCP is an existing Project of **14.0 MTPA** capacity, which was expanded from 10.00 MTPA to 14.00 MTPA in 2017. The mine came into operation in 1991-92 with an initial production of 0.02 MTPA. Ashok Expansion Opencast Project (OCP) is situated in Chatra District of Jharkhand between latitudes 23^{o}42’53” & 23^{o}44’41” N and longitudes of 84^{o}57’07”N & 85^{o}02’11”E. Out of the total production of 14 MTPA, it is estimated that 12 MTPA coal is produced by Surface Miner in Ashoka OCP.

Amrapali OCP is located in the northern fringe of North Karanpura. coalfield and lies in the Chatra District of Jharkhand. The Amrapali block covering an area of 10.11 sq. km (coal bearing 9.28 sq. Km) is bounded by Latitude 23^{o}51'31" & 23^{o}53'38" N and Longitude 85^{o}00'05" & 85^{o}02'07" E. The present capacity of the project is 12 MTPA. Recently, the MoEFCC has recommended the expansion of the project upto **14.4 MTPA**.

Magadh OCP lies in the Magadh block, which is located in the North Karanpura Coalfields of Chatra District of Jharkhand State and presently it is a part of Rajhara Area of CCL. Magadh OCP has been planned to produce **20 MT** of coal per year. The project lies within the coordinates 23^{o}49’15” N & 23^{o}51’30” N and 84^{o}55’35” & 84^{o}57’40”E.

Piparwar OCP is an operating coal mine with the production capacity of **14.375 MTPA** under Piparwar Area of Central Coalfields Limited in North Karanpura Coalfields. The project is located in village Piparwar of Tandwa Block, District- Chatra of Jharkhand state. The project falls between latitude 23^{0}42’38’’ N to 23^{0}44’45’’ N & longitude 85^{0}01’34’’ E to 85^{0}03’15’’ E. There are two water bodies, which have been developed with bio-reclamation and has induced migratory birds and small fauna as a seasonal habitat.

Karo OCP is an existing mine with capacity of **15 MTPA** under B&K Area, Central Coalfields Limited. The project is situated in the north-eastern part of East Bokaro coalfield in Bokaro district and covered on Survey of India Toposheet no- 73E/13 (1:50000 RF) between 23°47’02’’ to 23°48’38’’N latitude 85°57’27’’ to 85°58’38’’E longitude. The coal production is completely by Surface Miner and transportation of Coal produced is through closed conveyors.

Konar Expansion OCP, is located in East Bokaro Coalfield of Bokaro & Kargali Area of Central Coalfields Ltd. The project falls between latitude $23^0$41'04'' N to $23^0$42'42'' N & longitude $85^0$16'06'' E to $85^0$19'36'' E. The block is connected with Kathara and Swang collieries through a passage road over Konar river. Konar Expansion OCP has been granted environmental clearance for capacity **11 MTPA**.

4.1.4 Western Coalfields Limited

Penganga OCP of WCL has been selected for the status reporting. **Penganga OCP** is an existing mine with capacity of **6.30 MTPA** under Wani Area, Western Coalfields Limited. The project is situated in the Wirur Village, Korpana Tehsil, Chandrapur district of Maharastra. The project started its operation from 01.06.2015 and the life of mine is seven years from 2018-19.

4.1.5 South Eastern Coalfields Limited:

Gevera OCP is an existing mine with capacity of **45 MTPA** under Gevera Area, South Eastern Coalfields Limited. The coal extraction is done through surface miners. The project is situated in the Katghora Tehsil, Korba district of Chattisgarh. The project started its operation from 1981 and the life of mine is ten years as on 01.04.2019.

Kusmunda OCP is an existing mine with capacity of **50 MTPA** under Kusmunda Area, South Eastern Coalfields Limited. The coal extraction is done through surface miners. The project is situated in the Katghora Tehsil, Korba district of Chattisgarh. The project started its operation from 1978 and the life of mine is Eighteen years as on 01.04.2019.

Dipka OCP is an existing mine with capacity of **35 MTPA** under Dipka Area, South Eastern Coalfields Limited. The coal extraction is done through surface miners. The project is situated in the Katghora Tehsil, Korba district of Chattisgarh. The project started its operation from 1988 and the life of mine is seven years as on 01.04.2019.

Manikpur OCP is an existing mine with capacity of **4.9 MTPA** under Korba Area, South Eastern Coalfields Limited. The project is situated in the Korba district of Chattisgarh. The project started its operation from 1976 and the life of mine is fifteen years as on 01.04.2019.

4.1.6 Northern Coalfields Limited

Status of eight projects of NCL have been covered here, namely – Amlohri OC, Nigahi OC, Jayant OC, Dudhichua OC, Khadia OC, Bina OC, Krishnashila OC and Block B OC.

Amlohri Block is located in the southern western part of Moher basin of Singrauli coalfields. Moher block lies on its west and Nigahi block in east. The feasability study prepared by CMPDI with participation of Russian experts in 1974 had identified Amlohri open cast mine with rated capacity of 10 MT/year of coal. The report was based on the

available geological information in April 1982 for an initial capital investment of Rs.323.32 crore and was sanctioned by the government of India on 25 June 1982.

Nigahi Opencast Mine is situated in Singrauli district of Madhya Pradesh and forms a part of Singrauli Coalfield. Nigahi block is located to the west of Jayant Project and to the east of Amlohri Project. It stands out as a hilly plateau with elevations of about 400 - 450 Mts. above mean sea level. The block has 483.01 MT of mineable reserves in Turra, Purewa (Bottom, Top and Combined) seams at an average stripping ratio of 3.68. For 15MTY, the life of the Project will be about 22 years (As on 01.04.15).

Jayant OCP (a 10 MTY Project) of NCL is one of the oldest mines of Singrauli area with dragline working, in which the excavation started in the year 1976-77 and approximate depth of the mine is now approaching 180m. The project has an environmental clearance of 15.5 MTY. An expansion project report of Jayant OCP for 20 MTPA is under consideration before CIL board. It has achieved a peak production level of 15.50 MT in the year 2010-11.

Dudhichua Opencast mine is an opencast mine in Northern Coalfields limited, a subsidiary of Coal India Ltd., since 1975, produce non-coking coal, mainly power grade. The project is partly in the district of Singrauli in M.P. and partly in the district of Sonebhadra in U.P. Dudhichua Block, having an area of 8.68 sq. km, is located in the central part of Moher Half Basin of Singrauli Coalfields.

Khadia project is located in Singrauli area of M/s Northern Coalfields Limited between latitude 24^{o}7’26” & 24^{o}8’47” and between longitude 82^{0}41’40” & 82^{0}44’47” has been named after Khadia village located in the south of the block. The Area is covered under the Topo Sheet No.63-L/12 & special sheet no. 9 & 11 of Survey of India.

Bina OCP is the first and largest Coal Mine of Uttar Pradesh. Bina Extension Block is the extension part of existing Bina Old Mine. Bina Project was sanctioned by Govt. of India on 22.11.2006 for targeted Coal production of 6.0 MTPA.

Krishnashila Project started in April 2007. The project is located in South-Eastern part of Moher basin of Singrauli Coalfield in Sonebhadra District of UP. The project is well connected to Varanasi in UP about 200km and to Jabalpur in MP about 350km. The nearest railway station is Krishnashila in UP about 3km and Singrauli Railway Station in MP about 24km. The project is designed to produce 5 million tonnes of Coal per year with total coal reserves 99.12 million tonnes. The total land is 851.78 ha. The maximum depth of the quarry is 180m. The mine is being worked by the combination of dragline and shovel/dumper.

Block-B Project is situated in Singrauli District of Madhya Pradesh. Its elevation is about about 375m to 512m above the MSL. It is located between the latitude - 23°47’ and 24°12’ North and longitude - 81°48’ and 82°52’ East. The life of the project is 27 years with production rate of 3.5 MTPA excluding 02 years construction period. The Block-B Project was cleared by IMG in Nov, 2004

4.1.7 Mahanadi Coalfields Limited

Bhubaneshwari OCP is an existing Project of **28 MTPA** capacity in Talcher Coalfields of Mahanadi Coalfields Limited. The mine came into operation in 2007 and is situated in Angul District of Odisha between latitudes 20°57'59" to 20°58'43" N and longitudes of 85°09'10" to 85°11'37" E and lies in Toposheet No. 64 N/12 & 64 N/16 (RF 1:50000). Coal is being extracted by surface miner and conventional drilling blasting combination with pay loaders and tippers. Coal from conventional system of excavation is transported to siding by tippers. The life of the project is 10 years as on 01.04.2017.

Lakhanpur OCP is an existing Project of **21 MTPA** capacity in Lakhanpur Area of Mahanadi Coalfields Limited. The mine came into operation in 1992-93 and is situated in Jharsuguda District of Odisha between latitudes 21°42'15" N to 21°47'10"N and longitudes of 83°48'11"E to 83°52'38"E and lies in Toposheet No. 64/O/13 (RF 1:50000). Coal production is being done by using surface miners. Coal transportation from face to pit top by trucks, surface to siding by trucks and siding to loading by pay loader. The life of the project is 11years as on 01.04.2017.

Lingraj OCP is an existing Project of **20 MTPA** capacity in Lingraj Area, Talcher Coalfields of Mahanadi Coalfields Limited. The mine came into operation in 1991 and is situated in Angul District of Odisha between latitudes 20°57'39" & 20°58'18"N and longitudes of 85°09'33" & 85°12'12" E and lies in Toposheet No. 73 H/1. For coal winning and transportation, shovel-dumper system and blast free mining Surface miners are used. And transportation from by tipper to siding and siding to loading by pay loaders. The life of the project is 21years as on 01.04.2010.

Bharatpur OCP is an existing Project of **20 MTPA** capacity in Talcher Coalfields of Mahanadi Coalfields Limited. The mine came into operation in 1985 and is situated in Angul District of Odisha between latitudes 20°56'35" and 20°58'40" N and longitudes of 85°06'30" and 85°08'40" E. At present coal winning is done by surface miner and coal is sent to siding by dumpers/tippers. The stripping ratio is 0.8. The life of the project is 21 years as on 01.04.2010.

Kulda OCP is an existing Project of **14 MTPA** capacity in Ib valley Coalfields of Mahanadi Coalfields Limited. The mine came into operation in 2007-08 and is situated in Sundergarh District of Odisha between latitudes 21°42'00" to 21°44'30" N and longitudes of 83°43'00" to 83°46' 30" E. Coal production is done by using 3800 mm drum dia surface miners, 5.5 -6 Cum front end loaders and 60T rear dumpers. The stripping ratio is 0.90. The life of the project is 9 years as on 01.04.2016.

Kaniha OCP is an existing Project of **14 MTPA** capacity in Talcher Coalfields of Mahanadi Coalfields Limited. The production of mine was started in 2010-11 for the capacity of 10.0 MTPA. Now mine is running for the capacity of 14.0 MTPA. The project is situated in Angul District of Odisha between latitudes 21°03'04" to 21°05'00"N and longitudes of

85O02’20” to 85O06’00”E. Coal production is done by using 3800 mm drum dia surface miners, 5.5 -6 Cum front end loaders and 100T rear dumpers. The stripping ratio is 1.65. The life of the project is 48 years as on 01.04.2016 including construction phase.

Ananta OCP is an existing Project of **20 MTPA** capacity in Talcher Coalfields of Mahanadi Coalfields Limited. The project is situated in Angul District of Odisha between latitudes 20O 57’ 16” & 21O 00’ 00” N and longitudes of 85O 07’ 14” & 85O 09’ 09” E. Coal production done through departmental surface miner with stripping ratio of 2.21. The life of the project is 22 years as on 01.04.2011.

Hingula OCP is an existing Project of **15 MTPA** capacity in Talcher Coalfields of Mahanadi Coalfields Limited started its operation in 2007-08. The project is situated in Angul District of Odisha between latitudes 20o 56’ 00” to 20o 58’ 22” N and longitudes of 85o 00’ 58” to 85o 02’ 49” E. Coal winning and transportation is done by shovel dumper system and eco-friendly surface miner with stripping ratio of 1.95. The life of the project is 36 years.

Samleshwari OCP is an existing Project of **15 MTPA** capacity in Ib Coalfields of Mahanadi Coalfields Limited. The project is situated in Jharsuguda District of Odisha between latitudes 21o46'48" to 21o49'22" N and longitudes of 83o52'23" to 83o56'00" E and lies in Toposheet No. F/44/R-13 (RF 1:50000). At present coal mining is done by surface miner and coal is sent to siding by dumpers/tippers with stripping ratio of 1.81. The life of the project is 10 years as on 01.04.2018.

Belpahar OCP is an existing Project of **9.0 MTPA** capacity in Ib Coalfields of Mahanadi Coalfields Limited. The project is situated in Jharsuguda District of Odisha between latitudes 21O 42’ 20” to 21O 47’ 00” N and longitudes of 83O 49’ 35” to 83O 53’ 00” E and lies in Toposheet No. 64-O/13 & O/14. In the project 9 Mty, the entire coal is being produced through blast free surface miner. Coal transported from pit head to UTLS and BOCM - 6 railway sidings by tippers. Coal is extracted at a stripping ratio of 3.04. The life of the project is upto 2022-23 as per latest EC amendment.

Jagannath OCP is an existing Project of **7.5 MTPA** capacity in Talcher Coalfields of Mahanadi Coalfields Limited started its operation in 1970-71. The project is situated in Angul District of Odisha between latitudes 20O58’ 42’’ to 20O56’14’’ N and longitudes of 85O07’10’’ to 85O9’55’’ E and lies in Toposheet No. 73 H/1. At present coal winning is done by surface miner with stripping ratio of 1.05. The life of the project is 11 years as on 01.04.2017.

Garjanbahal OCP is an existing Project of **13 MTPA** capacity in Ib valley Coalfields of Mahanadi Coalfields Limited started its operation in 2018-19. The project is situated in Sundergarh District of Odisha between latitudes 22O01’16” to 22O02’52” N and longitudes of 83O43’34” to 83O45’14” E and lies in Toposheet No. 64 N/12 & 64 N/16. At present coal winning is done by surface miner with stripping ratio of 0.98. The life of the project is 23 years as on 01.04.2016.

Balram OCP is an existing Project of **8 MTPA** capacity in Talcher Coalfields of Mahanadi Coalfields Limited started its operation in 1991-92. The project is situated in Angul District of Odisha between latitudes 20^{O}56'2" N to 20^{O}58'28"N and longitudes of 85^{O}02'52"E to 85^{O}06'52"E. At present Coal production is being done by using surface miners. Coal transportation from face to pit top by trucks, surface to siding by trucks and siding to loading by pay loader. The stripping ratio is 1.49.

Lajkura OCP is an existing Project of **4.5 MTPA** capacity in Ib valley Coalfields of Mahanadi Coalfields Limited started its operation in 1984. The project is situated in Jharsuguda District of Odisha between latitudes 21^{O} 48' 39" to 21^{O} 49' 55" N and longitudes of 83^{O} 53' 15" to 83^{O} 54' 50" E and lies in Toposheet No. 64/O/13 (RF 1:50,000). Coal is being extracted by surface miner and conventional drilling blasting combination with pay loaders and tippers. Coal from conventional system of excavation is transported to main haul road on mine floor and then CHP. The crushed coal from CHP and coal from surface miner is transported to LOCM siding no. III by tippers for a distance about 3-4 km. The stripping ratio is 3.54. The life of the project is 14 years as on 01.04.2014.

4.1.8 Singareni Collieries Company Limited

Two projects – Gouthamikhani (GK) OC and Jawaharkhani (JK) 5 OCP have been considered.

Gouthamkhani Opencast Project is a conversion of four underground mines viz. Gouthamkhani No: 8,9,10 and 11 Inclines. The mine had commenced its operation in the year, 1993.The project is located in Bhadradri Kothagudem district of Telangana State. The project Area is 902.00 Ha. The Environmental Clearance for the project for production capacity of 4.00 MTPA was accorded in May, 2021.

Jawahar Khani – 5 Opencast project is a conversion of underground mine viz.JK 5 Incline. The mine was started on 01.01.2012. The project is located in Bhadradri Kothagudem district of Telangana State. The project Area is 490.14 ha. Environmental Clearance for this project was issued in 2016 for a rated capacity of 2.5 MTPA. It is proposed to obtain revised Environmental Clearance for enhanced capacity from 2.50 MTPA to 3.50 MTPA.

4.1.9 NLC India Limited

Talabira II & III Open Cast Project: NLCIL has entered into coal mine projects namely Talabira-II & III Coal Mine (20 MTPA) in Odisha and Pachwara South Coal Mine (11 MTPA) in Jharkhand are in the anvil. It has also programmed to establish a coal based pit-head TPS of 4000 MW by way of installation of new plants and acquisition of Power Assets to the tune of 3000 MW is in the pipeline. Coal Block allotted on 08.02.2016. AAP

approved by NLC Board for Rs. 25.11 Cr for Pre projects activities. LOA issued to M/s Talabira (Odisha) Mining Private Limited, Ahmedabad, on 06.02.2018 for Mine Development & Operation. End users: Pithead NLC Talabira Thermal Power Project (3x800 MW) and NTPL (2x500 MW).

Chapter V: Status of Environmental Sustainability – Land Use

5.0 Introduction

As a part of compliance of EC conditions, the reclamation and land use pattern of core zone is being monitored through satellite imagery.

CIL

CMPDI has been carrying Land Reclamation Monitoring of OC mines and Vegetation Cover Mapping of 19 major CIL coalfields on a regular basis based on high resolution satellite data. This has proved to be a very useful data for assessing the land reclamation and restoration in CIL OC/UG mines, keeping in view the environmental concerns of the country and also for fulfilling mandate of MoEF&CC.

The projects under Land Reclamation monitoring are categorized under two categories, wherein major opencast project producing more than 5 mcm (Coal+OB) per annum are monitored annually whereas projects producing less than 5 mcm (Coal+OB) are monitored in phase wise manner at an interval of three years. The main parameters being monitored in this study are Technical Reclamation, Biological Reclamation, Active Mining Area, Excavated Area & Green Cover generated in the leasehold boundaries of the selected projects.

Total of 51 OCP Mines belonging to more than 5mcm (Coal+OB) category were selected for study based on the Satellite Data of the year 2020. The study suggests that 63.73% area out of the total excavated area of the 51 OC projects is already under reclamation and balance 36.27% area is under active mining. In addition to this, 60 Mines belonging to less than 5mcm (Coal+OB) category were selected for study, out of which 46 are OC mines. 05 UG Mines and 9 clusters were also selected for monitoring in 2020-21. The analysis of the results suggests that for mines producing less than 5 mcm 0f Coal+OB per annum, 53.19% area out of the total excavated area of the projects is already under reclamation and balance 46.81% area is under active mining. Taking both the categories of mines taking together, it was observed that for 111 projects taken for monitoring in 2020-21, 61.34% area out of the total excavated area of the 111 projects is already under reclamation and balance 38.66% area is under active mining.

In addition, CIL is conducting vegetation cover mapping of 19 major coalfields based on satellite data. Each coalfield is monitored in phase wise manner at an interval of three years. This study is carried out to assess the impact of mining on Vegetation & Land Use

/ Cover in the coalfield areas enabling the subsidiary companies to take mitigative measures, if any.

All the above mentioned reports are sent to CIL and concerned subsidiaries of uploading the same on respective websites.

SCCL

For operational mines of SCCL, the satellite data based land use studies are being carried out once in three years in compliance with the Environmental Clearance conditions for submission along with mandatory half-yearly compliance reports towards MoEF&CC, Regional Office, Chennai. Land use studies based on satellite data are also required to be carried out for new/expansion coal mining projects for incorporation in EIA/EMP reports for obtaining Environmental Clearance from MoEF&CC. The land use of ongoing projects is carried out for change detection analysis in land use pattern covering core and buffer zone of the coal mining projects and also to monitor the reclamation activities in the project area.

SCCL has awarded the work of "Satellite data based land use studies" to Geosys Enterprise Solutions Pvt. Ltd., Hyderabad which offers services in Geographic Information System (GIS), Environment, Information Technology and Drone solutions.

NLCIL

Talabira II & III OCP having lease area of 1914.063 ha allotted to M/s NLC India Limited. The mine started on 11.12 2019. The land use mapping of Talabira II & III OCP has been carried out using satellite imagery (IRS P-6 LISS-IV MX) during April 2020. For the study, geo-coded Ortho-rectified IRS P-6 LISS-IV MX satellite image having a resolution of 5.8 meters procured from NRSC (National Remote Sensing Centre). 58.6% of the core zone area is covered with forest area under various density categories, 21.5% under waste lands and 15.9% under agriculture land and 4% under others category (Built up area, Mining activity and Water bodies). As per the interpretation of satellite data and field observations during the ground truth in the project area, the active mining is confined to the lower central part of the ML area covering about 32.43 ha.

5.1 Break-up of land use

The break-up of the land area for the 37 projects of CIL, 02 projects of SCCL and 01 project of NLCIL is given in the table below:

Table 5.1: Status of Land for projects considered

S.N.	Name of Mine	Name of mining company	Area Break-up (Sq.km)							Forest Area**	Non-Forest Area**
			Total Mine Lease Area*	Active Mining Area*	Technical-ly Reclaimed Area*	Biologically Reclaimed Area*	Green Cover#	Infrastructure area*	Un-disturbed area*		
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10) = (4)-(5)-(6)-(8)-(9)*	*(11)*	*(12) = (4)-(11)*
1.	Rajmahal OC	ECL	17.75	1.42	4.75	1.80	2.46	0.64	8.48	1.07	16.68
2.	Sonepur Bazari OC	ECL	22.94	3.61	4.08	0.87	2.19	0.80	12.26	0.33	22.61
3.	AKWMC	BCCL	3.25	0.71	0.89	0.52	0.72	0.15	0.78	0.00	3.25
4.	NT ST Exp (Cluster 9)	BCCL	7.97	2.17	0.77	2.17	2.17	0.33	2.53	0.05	7.92
5.	Magadh	CCL	17.69	0.78	0.55	0.10	0.10	0.03	16.23	2.44	15.25
6.	Amrapali	CCL	6.20	1.07	1.20	0.07	0.07	0.12	3.74	5.32	0.88
7.	Konar	CCL	7.29	0.41	0.09	0.47	0.46	0.51	5.82	5.07	2.22
8.	Ashoka OC	CCL	7.93	0.66	2.35	1.02	1.29	0.04	3.59	2.39	5.54
9.	Piparwar OC	CCL	11.20	0.98	2.91	1.45	3.05	0.65	3.61	1.87	9.34
10.	Karo I OC /Karo	CCL	5.75	0.34	0.17	0.14	0.42	0.22	4.60	3.12	2.63
11.	Nigahi OC	NCL	30.16	3.78	5.41	1.64	7.84	3.26	9.87	12.81	17.36
12.	Jayant OC	NCL	31.94	5.61	6.34	3.46	10.90	1.69	7.40	11.80	20.14
13.	Dudhichua OC	NCL	21.73	4.51	5.49	1.29	3.04	0.27	8.42	7.50	14.23
14.	Amlohri OC	NCL	23.20	3.51	3.77	0.80	6.13	0.78	9.01	11.95	11.25
15.	Khadia OC	NCL	16.22	3.44	3.55	0.58	3.29	1.74	4.20	8.44	7.78
16.	Bina OC	NCL	15.97	2.54	4.31	1.62	5.60	0.76	2.76	10.88	5.09
17.	Krishnashila OC**	NCL	*8.52*	*5.35*	*0.20*	*0.94*	*0.94*	*0.61*	*1.42*	*7.21*	*1.31*
18.	Block-B OC	NCL	15.65	2.12	1.49	0.49	1.08	0.44	10.52	4.47	11.18
19.	Penganga OC	WCL	7.63	1.02	0.15	0.00	0.30	0.12	6.04	0.46	7.17
20.	Dipka OC	SECL	19.99	3.30	2.94	0.77	3.96	1.22	8.57	4.09	15.90
21.	Gevra OC	SECL	41.84	5.29	8.80	2.60	9.69	2.11	15.95	10.16	31.68
22.	Kusmunda OC	SECL	16.72	2.56	3.28	1.32	4.86	0.73	5.29	2.06	14.66
23.	Manikpur OC	SECL	19.44	1.98	1.50	0.77	2.58	0.32	13.06	3.76	15.68
24.	Ananta OC	MCL	14.20	1.45	2.40	1.05	1.37	0.14	8.84	3.34	10.86
25.	Balram OC	MCL	13.09	1.03	2.80	1.06	1.63	0.42	7.21	0.85	12.24
26.	Lingaraj OC	MCL	7.26	2.19	1.70	0.15	0.80	0.21	2.36	1.86	5.40
27.	Bharatpur OC	MCL	9.27	1.66	2.63	1.66	2.27	0.23	2.48	2.06	7.21
28.	Bhubaneshwari OC	MCL	6.58	1.77	1.86	0.01	0.16	0.02	2.77	1.13	5.46
29.	Jagannath OC	MCL	5.54	0.97	0.84	1.79	1.93	0.11	1.69	0.83	4.71

S.N.	Name of Mine	Name of mining company	Area Break-up (Sq.km)							Forest Area**	Non-Forest Area**
			Total Mine Lease Area*	Active Mining Area*	Technical-ly Reclaimed Area*	Biologically Reclaimed Area*	Green Cover#	Infrastructure area*	Un-disturbed area*		
30.	Hingula OC	MCL	15.75	2.02	1.48	0.07	0.56	0.03	11.66	4.35	11.40
31.	Belpahar OC	MCL	14.44	1.33	2.36	0.90	1.99	0.40	8.36	1.23	13.21
32.	Lakhanpur OC	MCL	22.40	2.99	4.32	0.83	1.86	0.22	13.01	2.33	20.07
33.	Samaleswari OC	MCL	13.35	1.27	2.94	0.70	1.69	0.21	7.24	5.80	7.55
34.	Lajkura OC	MCL	7.21	0.89	1.20	0.15	0.54	0.20	4.38	1.57	5.64
35.	Kaniha OC	MCL	6.77	1.04	0.18	0.00	0.10	0.03	5.42	0.02	6.75
36.	Kulda OC	MCL	6.34	1.31	0.53	0.00	0.01	0.05	4.44	2.28	4.06
37.	Garjanbahal	MCL	6.54	0.47	0.03	0.02	0.02	0.14	5.88	0.89	5.65
38.	GK OCP**	SCCL	9.02	2.56	1.00	4.98	4.98	0.28	0.20***	5.40	3.62
39.	JK-5 OCP**	SCCL	4.90	0.07	1.84	1.47	2.72	0.18	0.09***	0.00	4.90
40.	Talabira OC**	NLCIL	19.14	0.65	0.13	0.13	0.14	0.02	18.20	10.38	8.76

**Area Calculated through remote sensing data*

***Data from respective coal company*

****Includes other areas*

*#**Green cover** includes biologically reclaimed mined out area and OB dump area and plantation on other areas.*

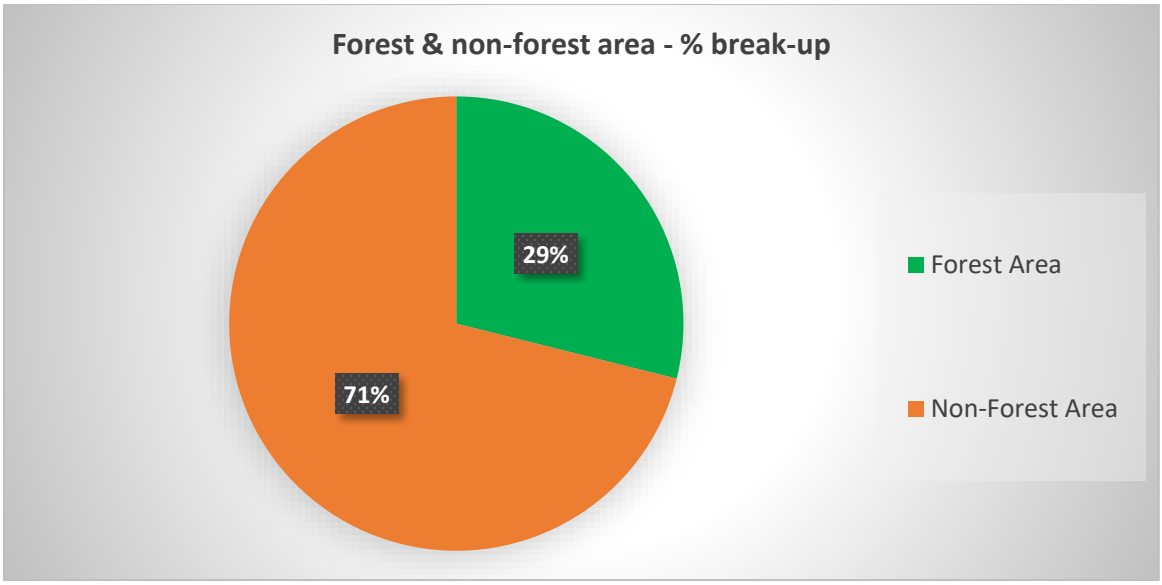


Figure 5.1: Percentage break-up w.r.t forest & non-forest area

Detailed Land Use Status based on Remote Sensing: The reclamation monitoring is being carried out through remote sensing at regular intervals and the report is under public domain. The land use maps (remote sensing data) as available for 36 projects of CIL, 2 projects of SCCL and 1 project of NLCIL are shown below:

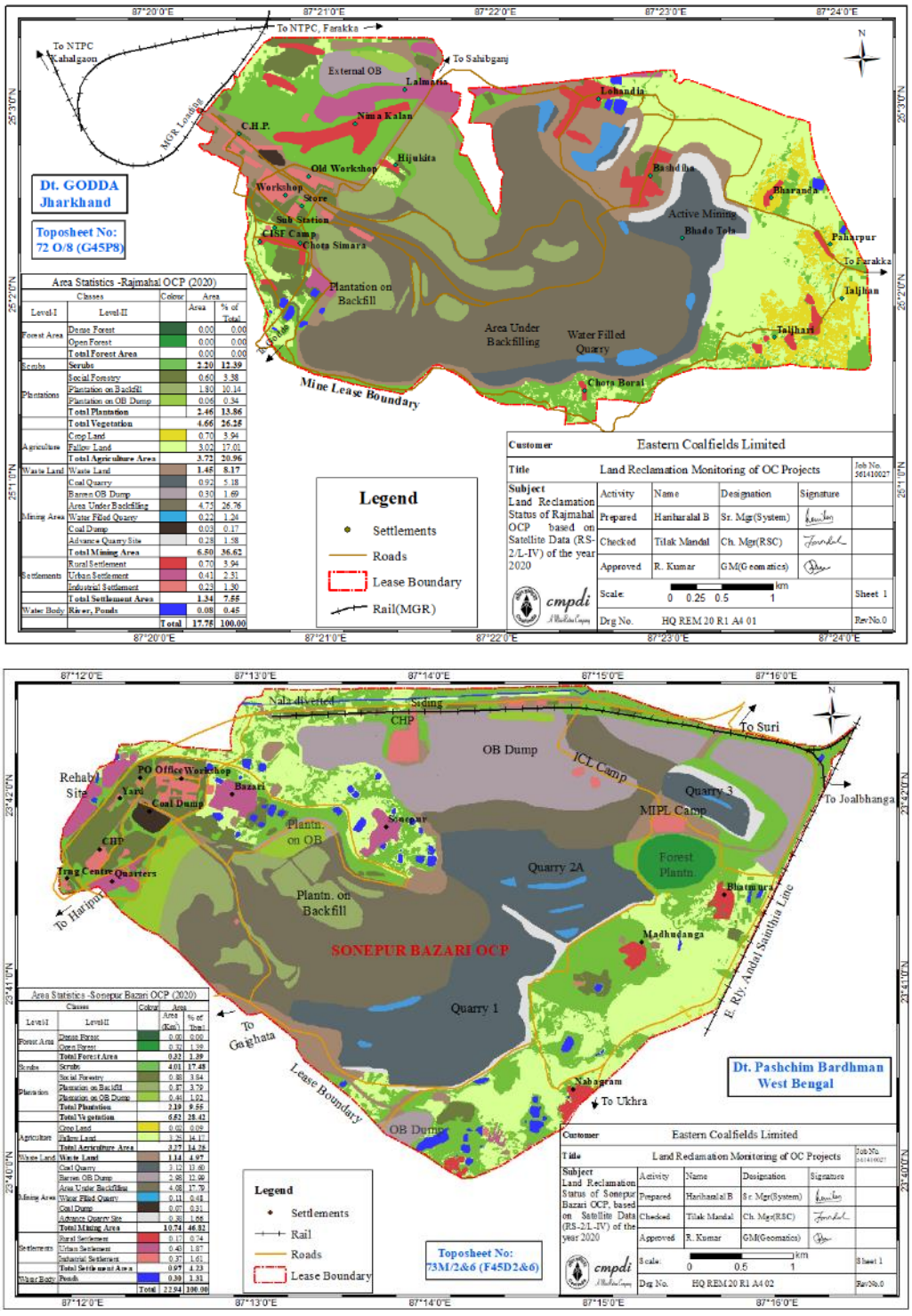


Figure 5.2: Present Land Use Status of Rajmahal OCP (Top) and Sonepur Bazari OCP (Bottom) of ECL as per Satellite Data

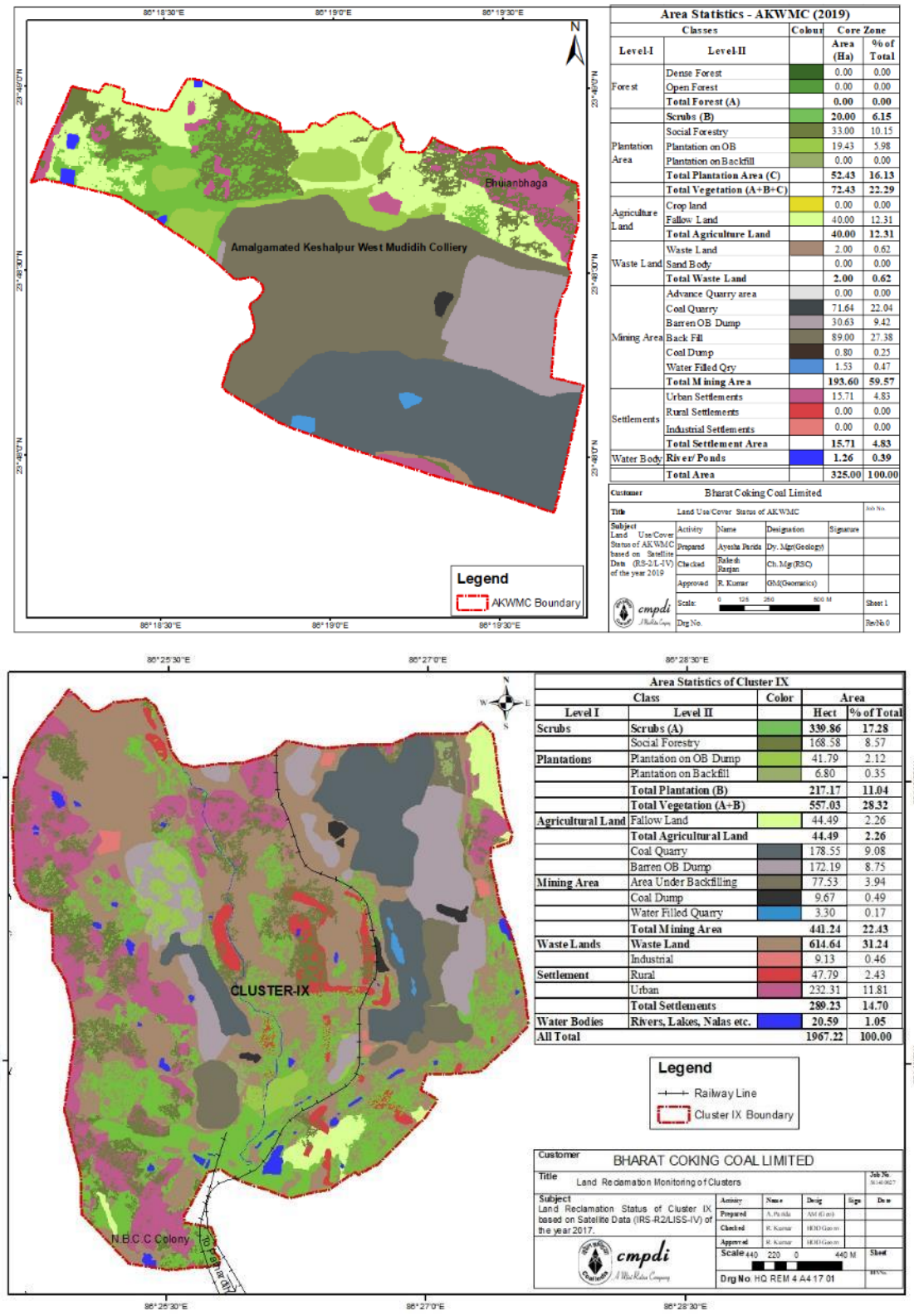


Figure 5.3: Land Use of AKWMC (Top) and NT ST Exp in Cluster IX (Bottom) of BCCL as per Satellite Data

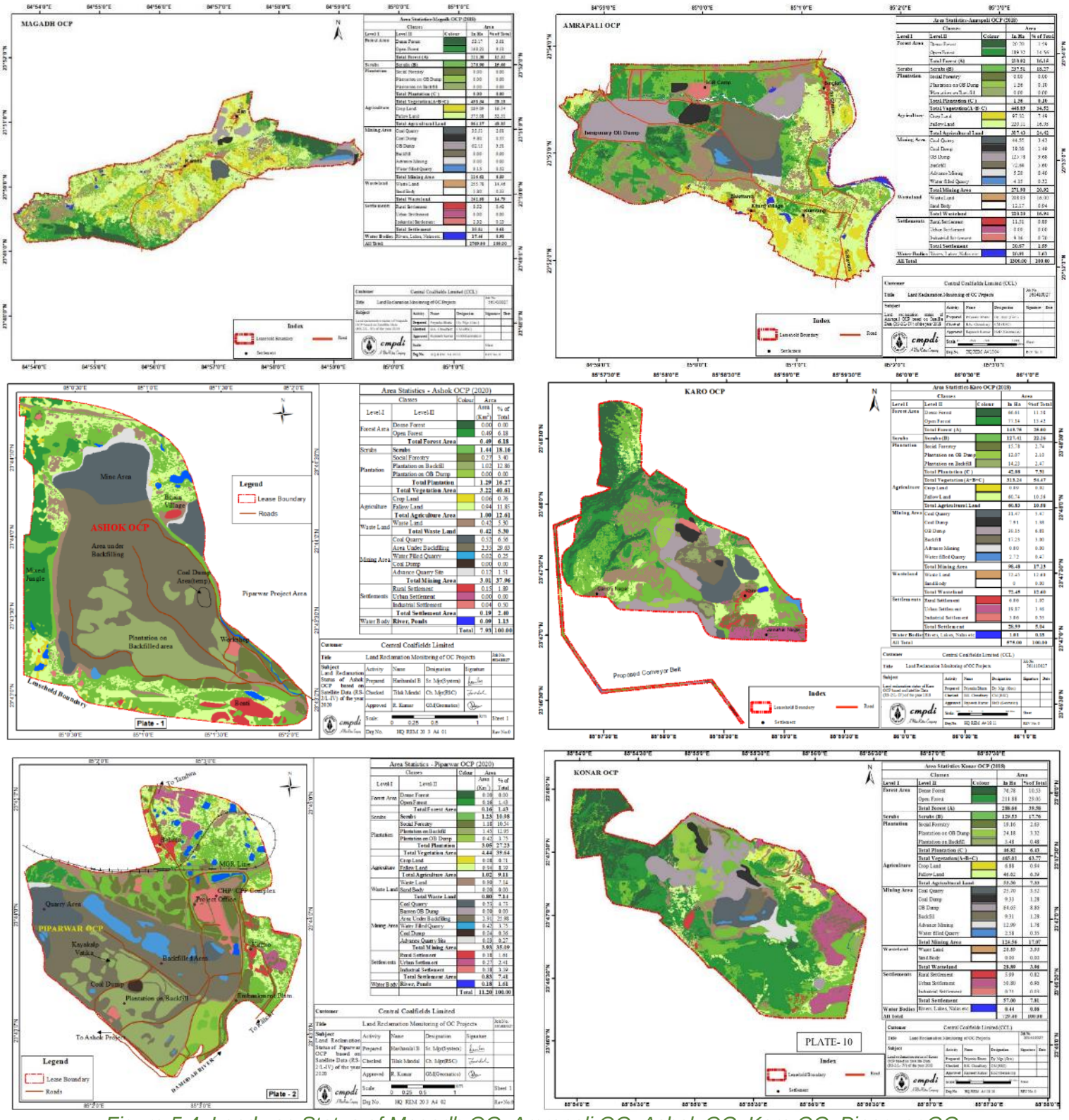


Figure 5.4: Land use Status of Magadh OC, Amrapali OC, Ashok OC, Karo OC, Piparwar OC and Konar OC of CCL as per satellite data

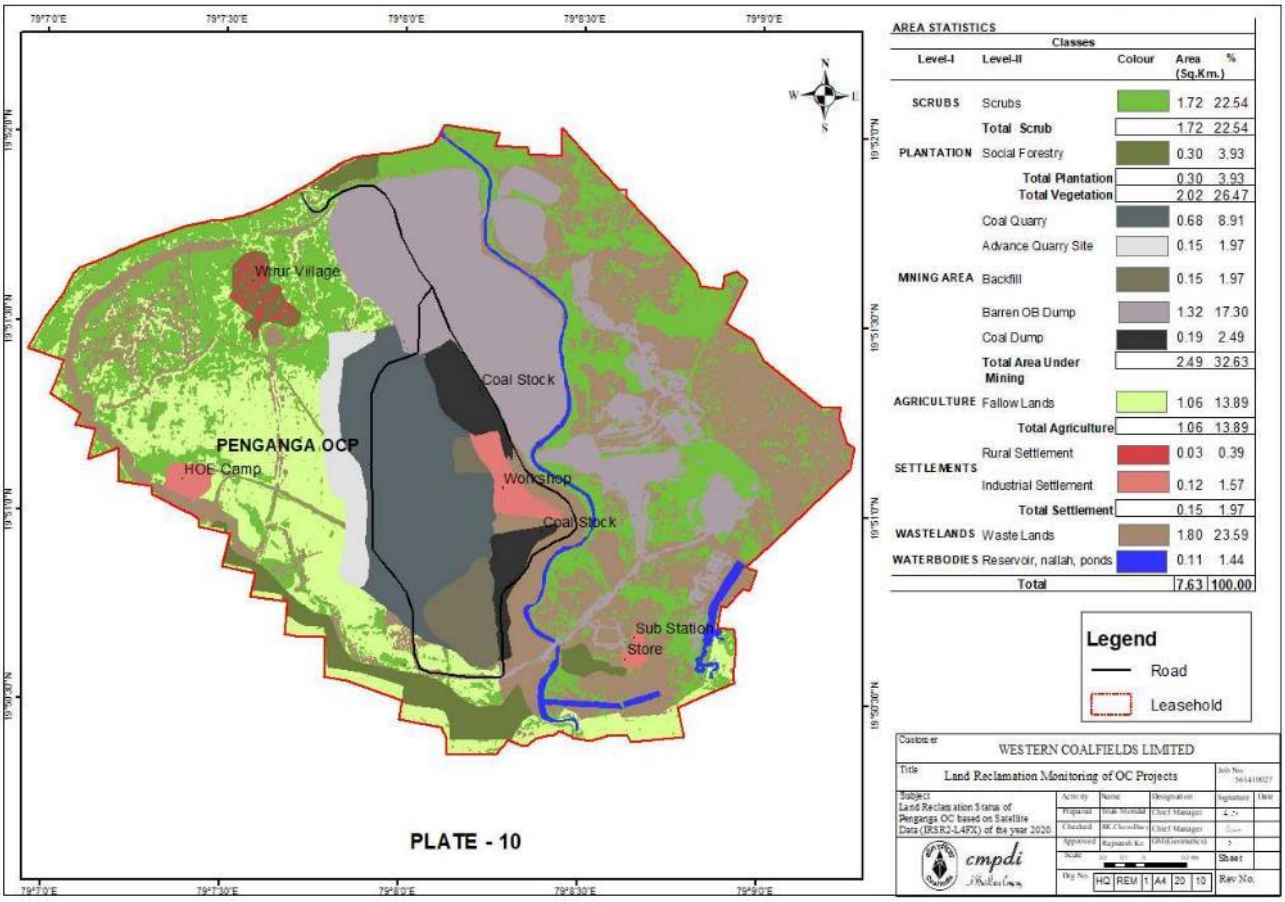
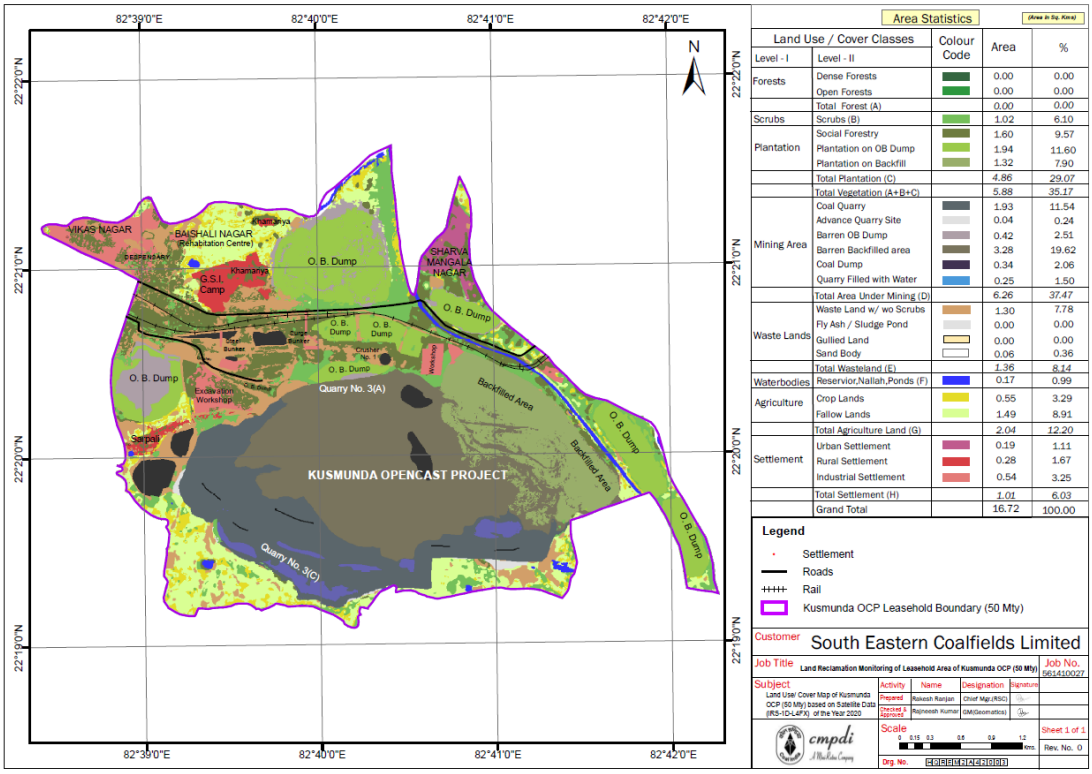


Figure 5.5: Land use Status of Penganga OCP of WCL as per satellite data.



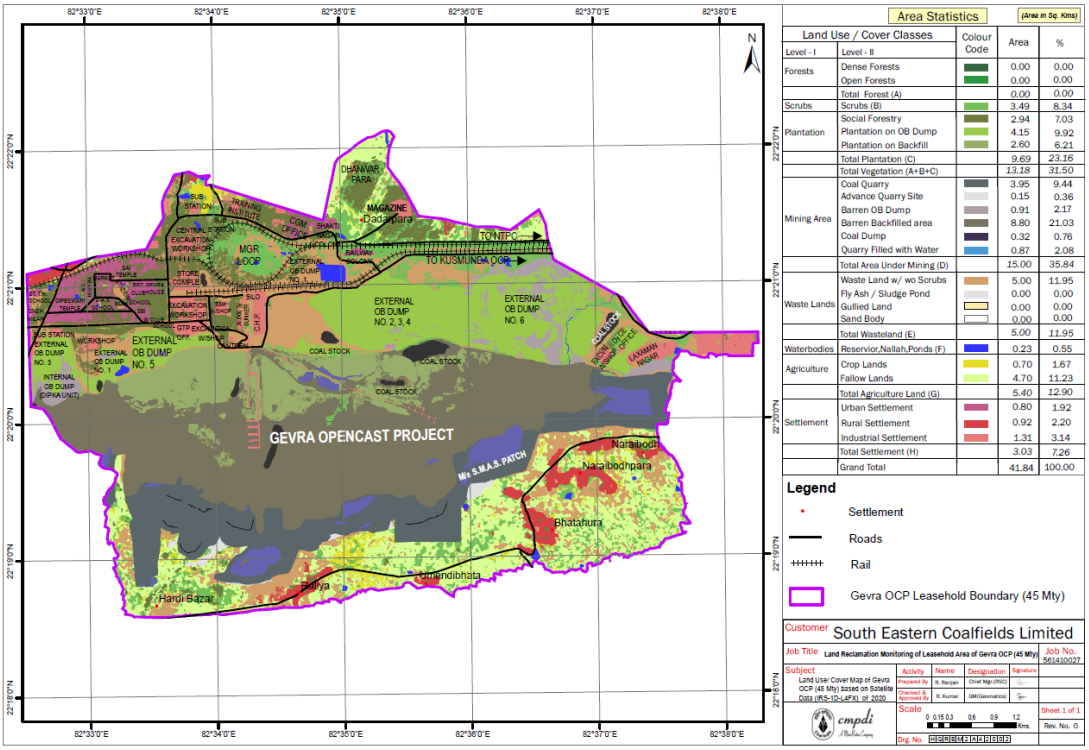
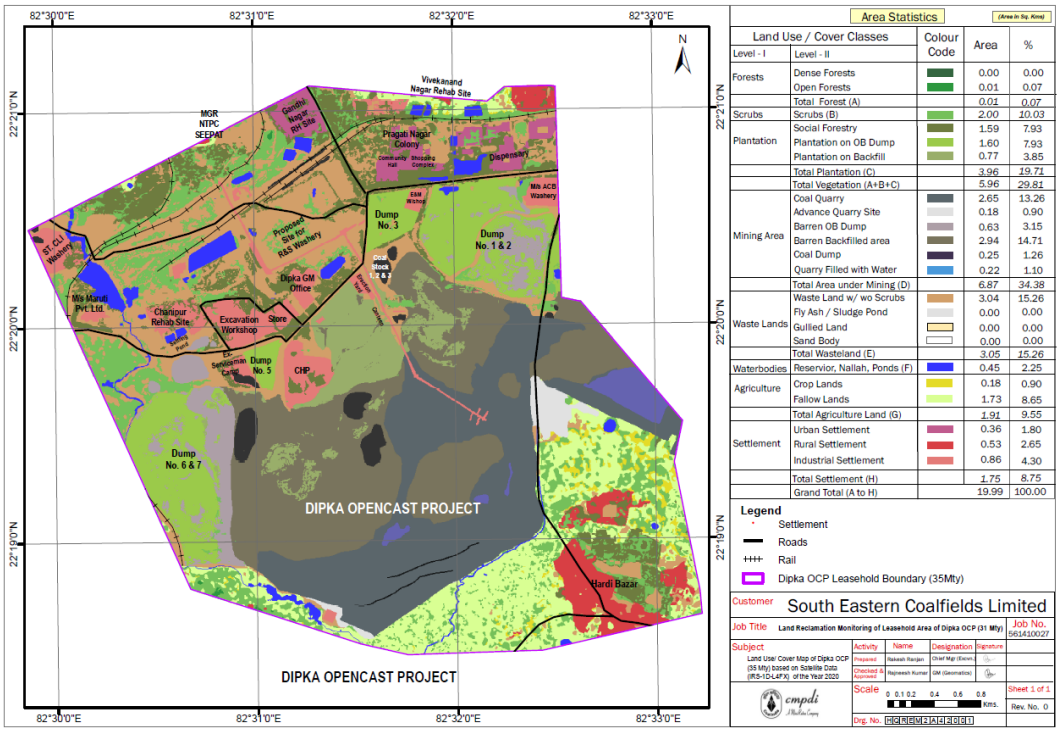


Figure 5.6(A): Land use Status of Kusmunda OC and Gevra OC of SECL as per satellite data



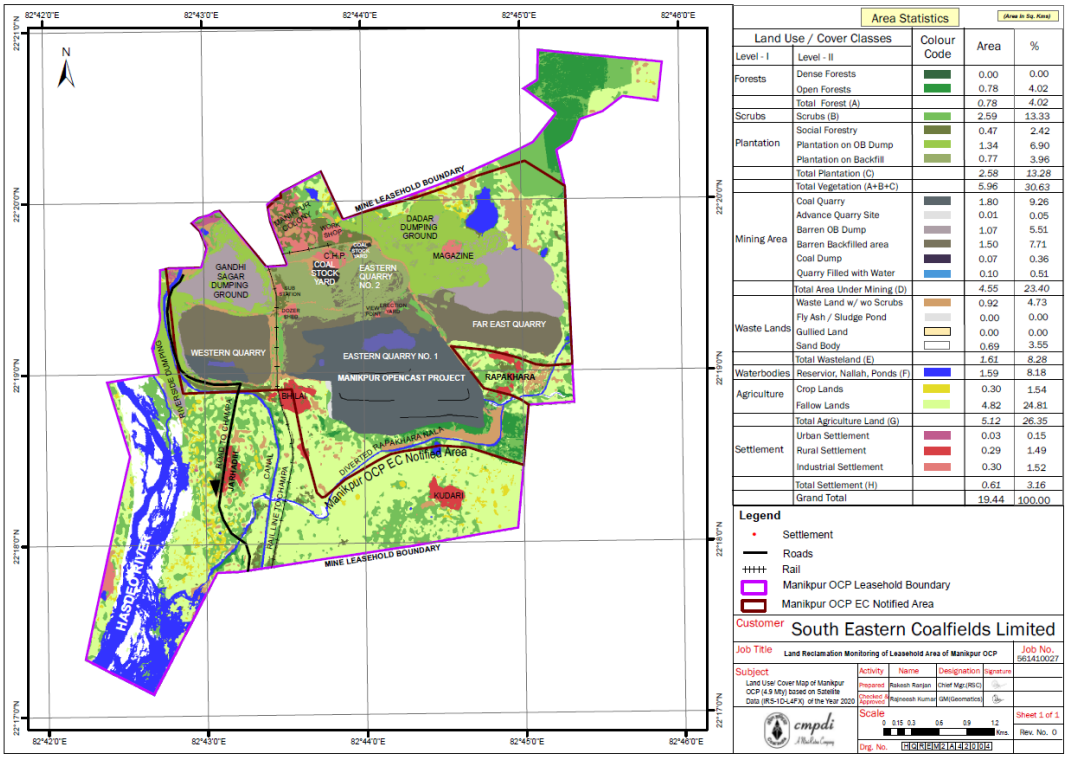


Figure 5.6(B): Land use Status of Dipka OC and Manikpur OC of SECL as per satellite data

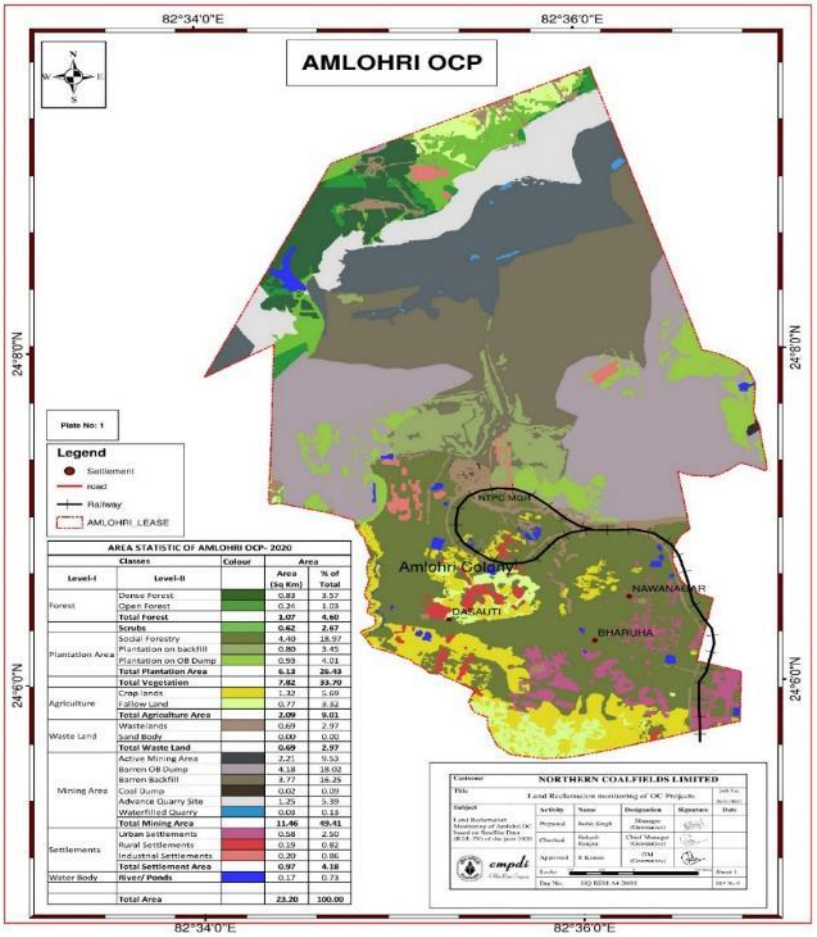
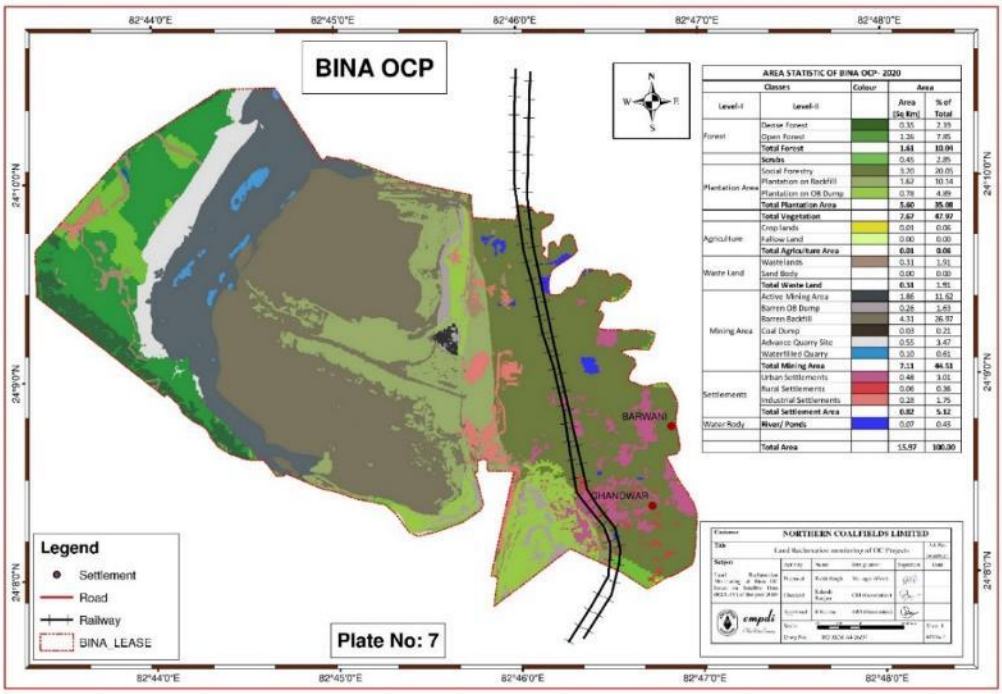


Figure 5.7(A): Land use Status of Amlohri OC of NCL as per satellite data



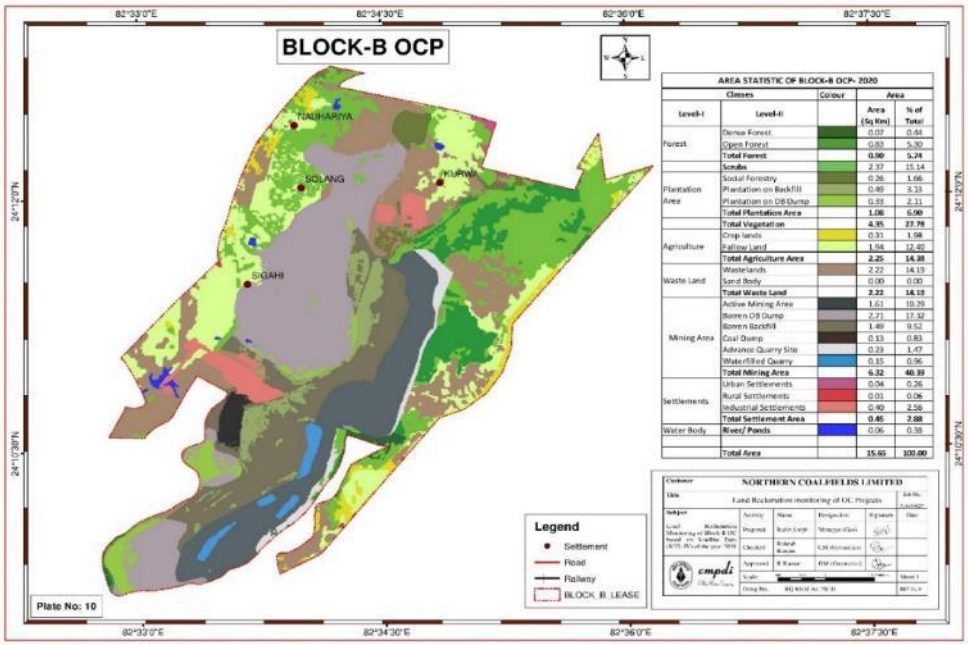
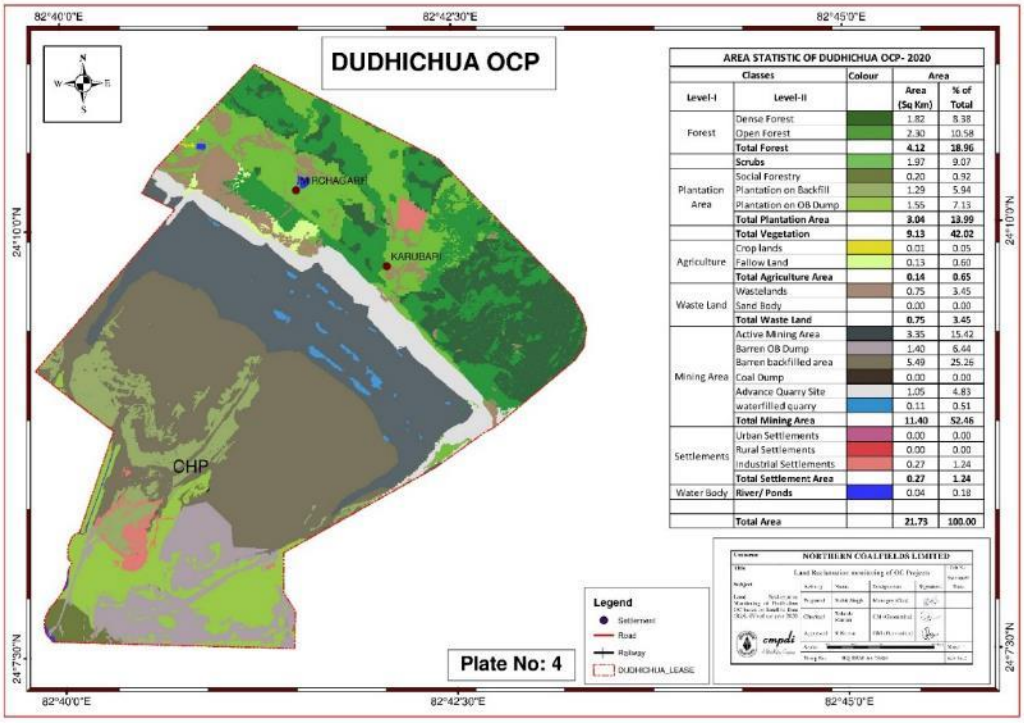
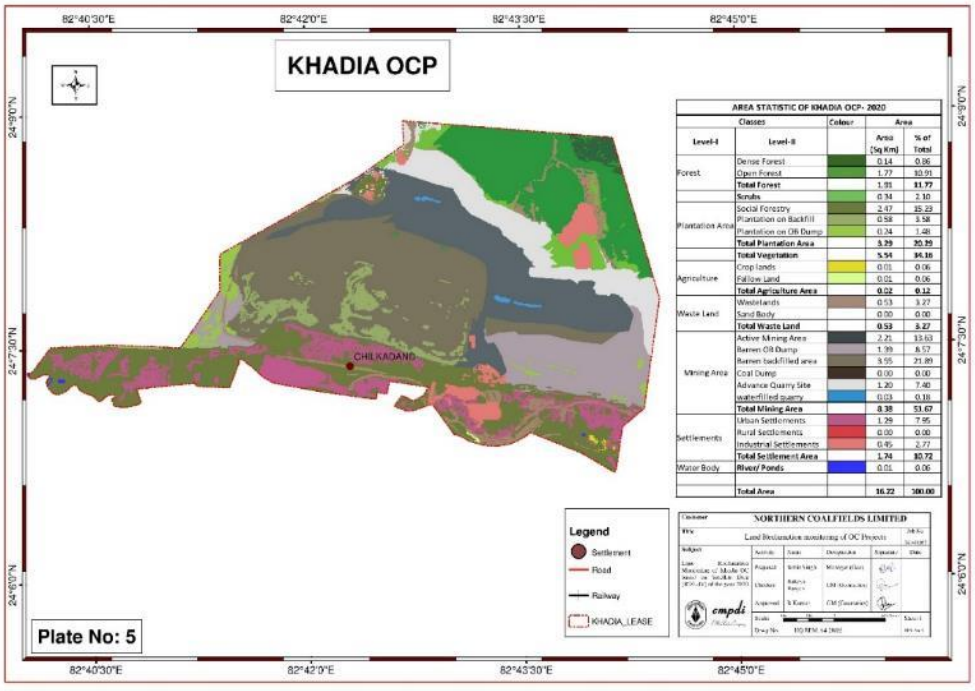


Figure 5.7(B): Land use Status of Bina OC and Block B OC of NCL as per satellite data



AREA STATISTIC OF DUDHICHUA OCP- 2020

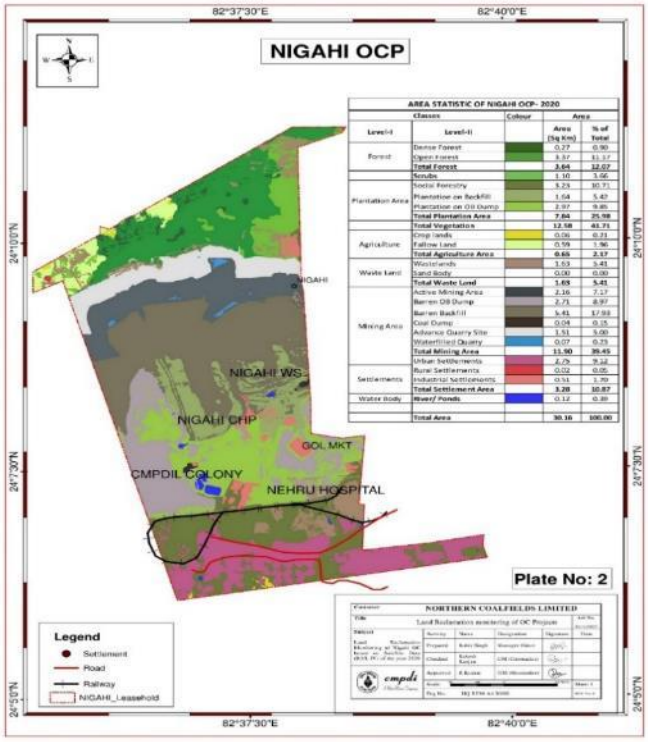
Classes		Colour	Area	
Level-I	Level-II		Area (Sq Km)	% of Total
Forest	Dense Forest		1.82	8.38
	Open Forest		2.30	10.58
	Total Forest		**4.12**	**18.96**
Plantation Area	**Scrubs**		1.97	9.07
	Social Forestry		0.20	0.92
	Plantation on Backfill		1.29	5.94
	Plantation on OB Dump		1.55	7.13
	Total Plantation Area		**3.04**	**13.99**
	Total Vegetation		**9.13**	**42.02**
Agriculture	Crop lands		0.01	0.05
	Fallow Land		0.13	0.60
	Total Agriculture Area		**0.14**	**0.65**
Waste Land	Wastelands		0.75	3.45
	Sand Body		0.00	0.00
	Total Waste Land		**0.75**	**3.45**
Mining Area	Active Mining Area		3.35	15.42
	Barren OB Dump		1.40	6.44
	Barren backfilled area		5.49	25.26
	Coal Dump		0.00	0.00
	Advance Quarry Site		1.05	4.83
	waterfilled quarry		0.11	0.51
	Total Mining Area		**11.40**	**52.46**
Settlements	Urban Settlements		0.00	0.00
	Rural Settlements		0.00	0.00
	Industrial Settlements		0.27	1.24
	Total Settlement Area		**0.27**	**1.24**
Water Body	**River/ Ponds**		0.04	0.18
	Total Area		**21.73**	**100.00**



AREA STATISTIC OF KHADIA OCP- 2020

Classes		Colour	Area	
Level-I	Level-II		Area (Sq Km)	% of Total
Forest	Dense Forest		0.14	0.86
	Open Forest		1.77	10.91
	Total Forest		**1.91**	**11.77**
Plantation Area	**Scrubs**		0.34	2.10
	Social Forestry		2.47	15.23
	Plantation on Backfill		0.58	3.58
	Plantation on OB Dump		0.24	1.48
	Total Plantation Area		**3.29**	**20.29**
	Total Vegetation		**5.54**	**34.16**
Agriculture	Crop lands		0.01	0.06
	Fallow Land		0.01	0.06
	Total Agriculture Area		**0.02**	**0.12**
Waste Land	Wastelands		0.53	3.27
	Sand Body		0.00	0.00
	Total Waste Land		**0.53**	**3.27**
Mining Area	Active Mining Area		2.21	13.63
	Barren OB Dump		1.39	8.57
	Barren backfilled area		3.55	21.89
	Coal Dump		0.00	0.00
	Advance Quarry Site		1.20	7.40
	waterfilled quarry		0.03	0.18
	Total Mining Area		**8.38**	**51.67**
Settlements	Urban Settlements		1.29	7.95
	Rural Settlements		0.00	0.00
	Industrial Settlements		0.45	2.77
	Total Settlement Area		**1.74**	**10.72**
Water Body	**River/ Ponds**		0.01	0.06
	Total Area		**16.22**	**100.00**

Figure 5.7(C): Land use Status of Dudhichua OC and Khadia OC of NCL as per satellite data



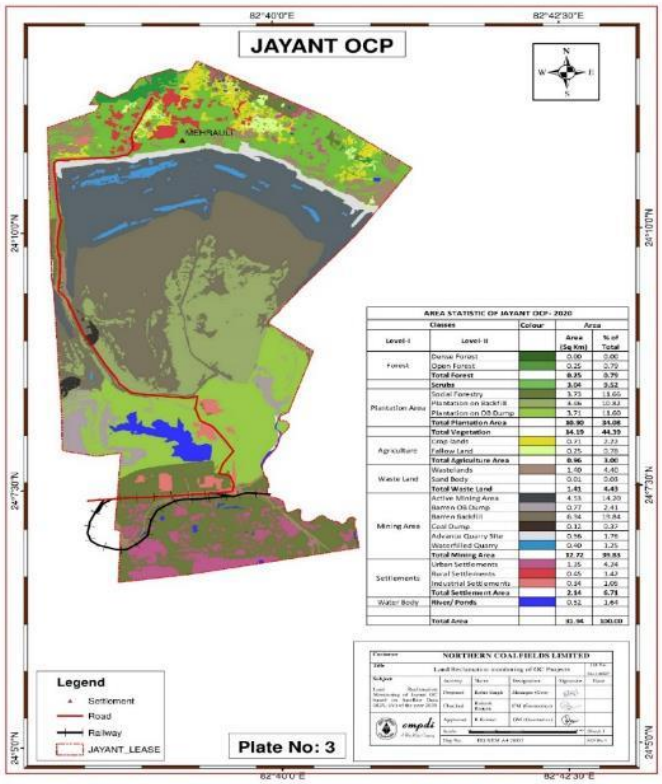


Figure 5.7(D): Land use Status of Nigahi OC and Jayant OC of NCL as per satellite data

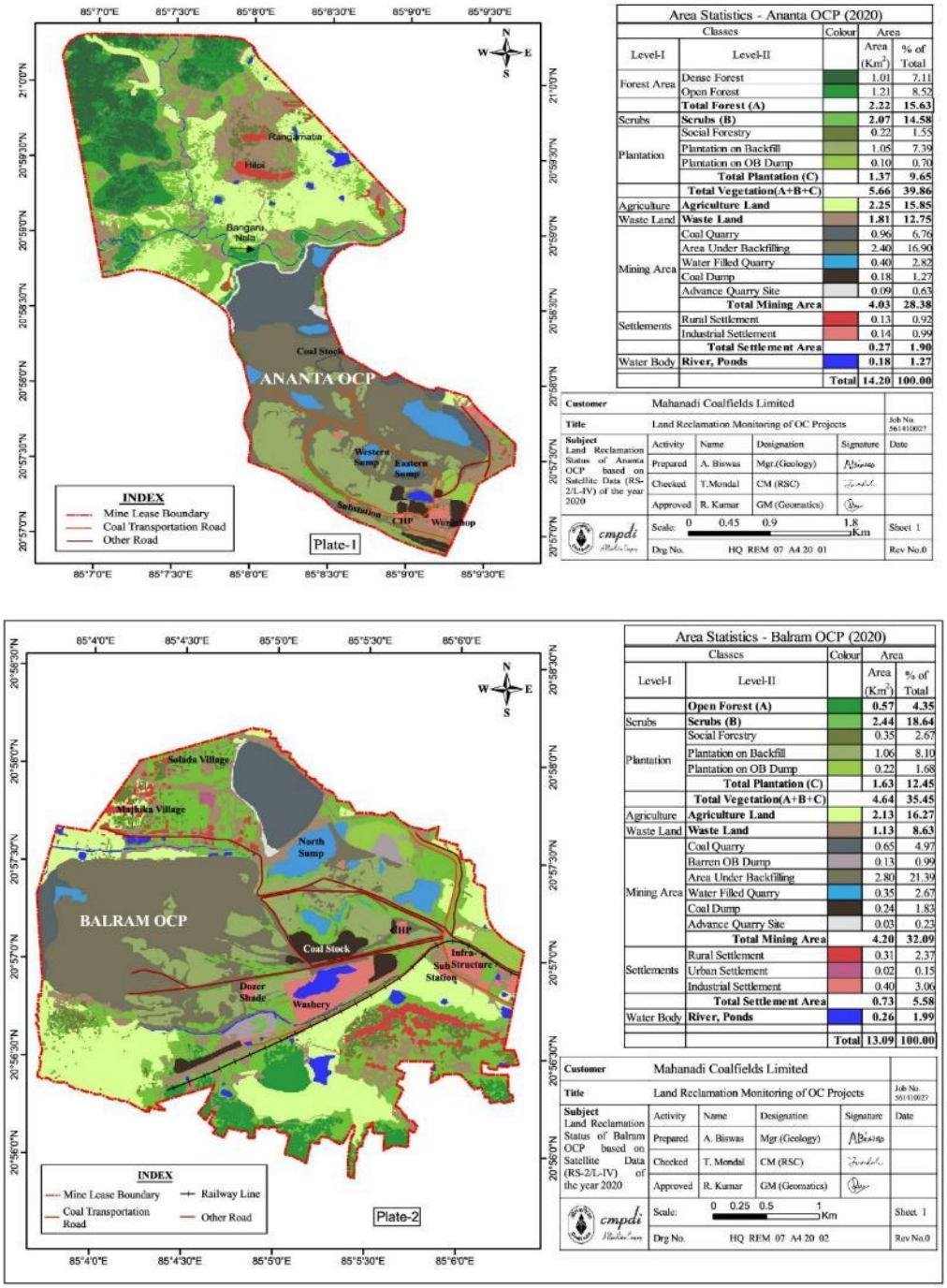


Figure 5.8(A): Land use status of Ananta OC and Balram OC of MCL as per satellite data

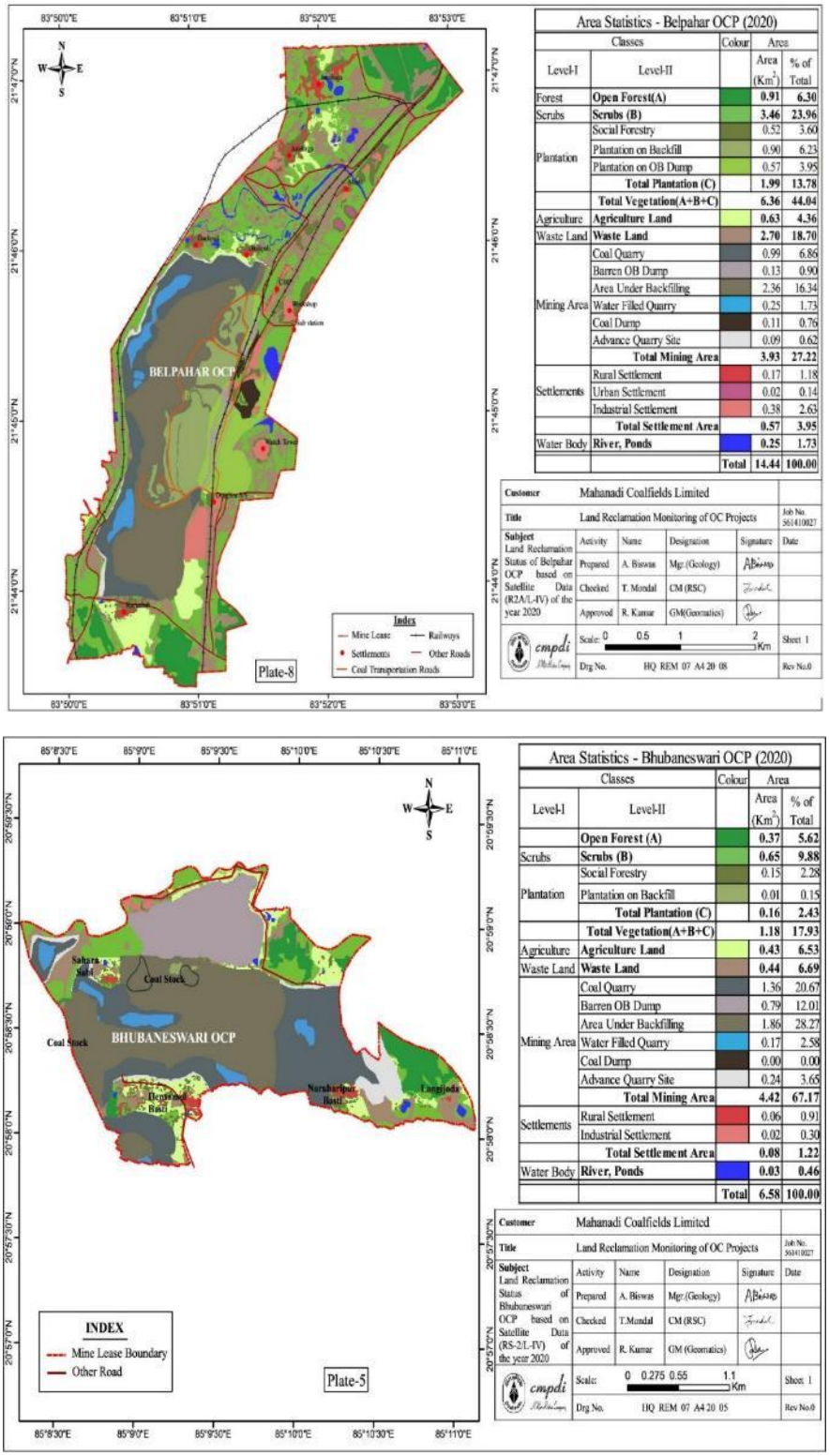
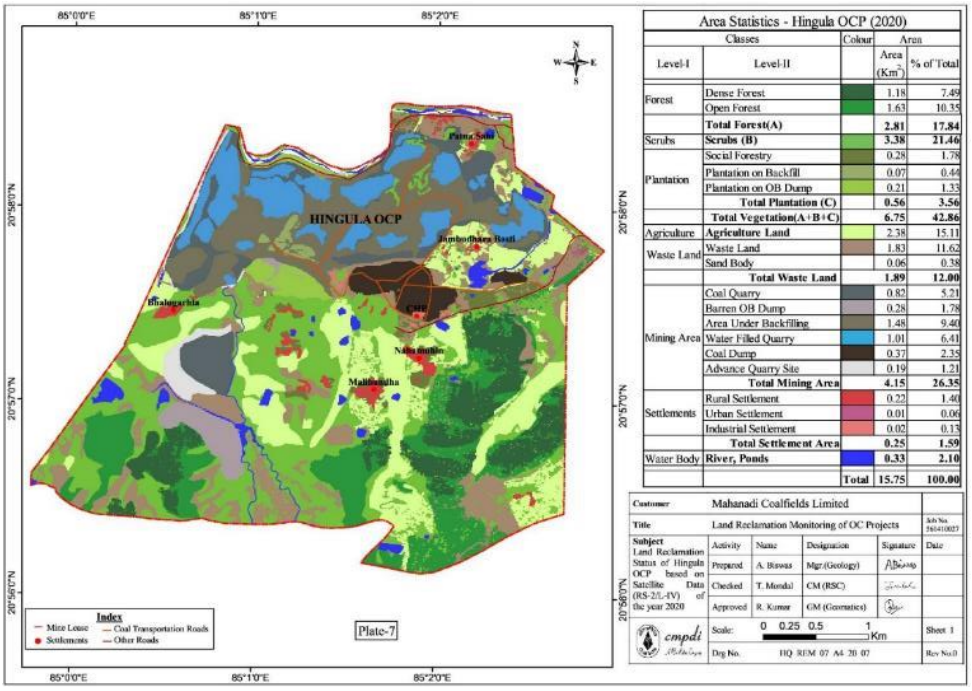


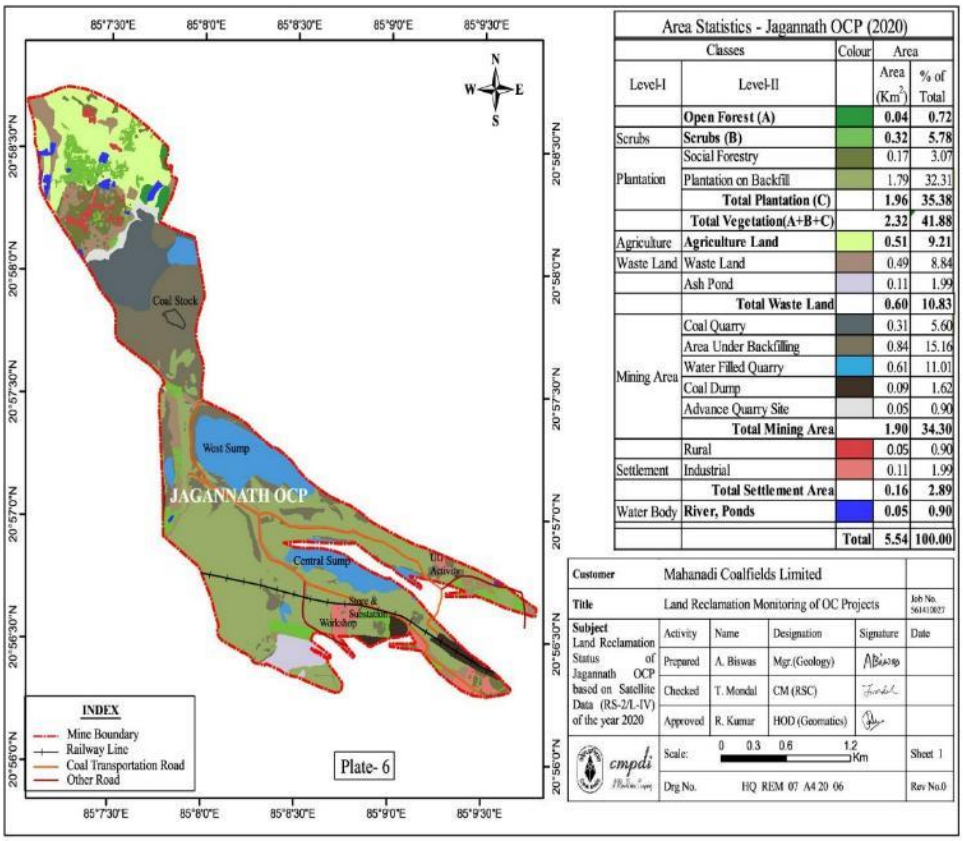
Figure 5.8(B): Land use status of Belpahar OC and Bhubaneshwari OC of MCL as per satellite data



Area Statistics - Hingula OCP (2020)

Classes		Colour	Area	
Level-I	Level-II		Area (Km²)	% of Total
Forest	Dense Forest		1.18	7.49
	Open Forest		1.63	10.35
	Total Forest(A)		**2.81**	**17.84**
Scrubs	**Scrubs (B)**		**3.38**	**21.46**
Plantation	Social Forestry		0.28	1.78
	Plantation on Backfill		0.07	0.44
	Plantation on OB Dump		0.21	1.33
	Total Plantation (C)		**0.56**	**3.56**
	Total Vegetation(A+B+C)		**6.75**	**42.86**
Agriculture	**Agriculture Land**		2.38	15.11
Waste Land	Waste Land		1.83	11.62
	Sand Body		0.06	0.38
	Total Waste Land		**1.89**	**12.00**
Mining Area	Coal Quarry		0.82	5.21
	Barren OB Dump		0.28	1.78
	Area Under Backfilling		1.48	9.40
	Water Filled Quarry		1.01	6.41
	Coal Dump		0.37	2.35
	Advance Quarry Site		0.19	1.21
	Total Mining Area		**4.15**	**26.35**
Settlements	Rural Settlement		0.22	1.40
	Urban Settlement		0.01	0.06
	Industrial Settlement		0.02	0.13
	Total Settlement Area		**0.25**	**1.59**
Water Body	**River, Ponds**		**0.33**	**2.10**
		Total	**15.75**	**100.00**

Customer	Mahanadi Coalfields Limited				
Title	Land Reclamation Monitoring of OC Projects				Job No. 561410027
Subject: Land Reclamation Status of Hingula OCP based on Satellite Data (RS-2/L-IV) of the year 2020	Activity	Name	Designation	Signature	Date
	Prepared	A. Biswas	Mgr.(Geology)		
	Checked	T. Mondal	CM (RSC)		
	Approved	R. Kumar	GM (Geomatics)		
cmpdi	Scale: 0 0.25 0.5 1 Km				Sheet 1
	Drg No. HQ REM 07 A4 20 07				Rev No.0

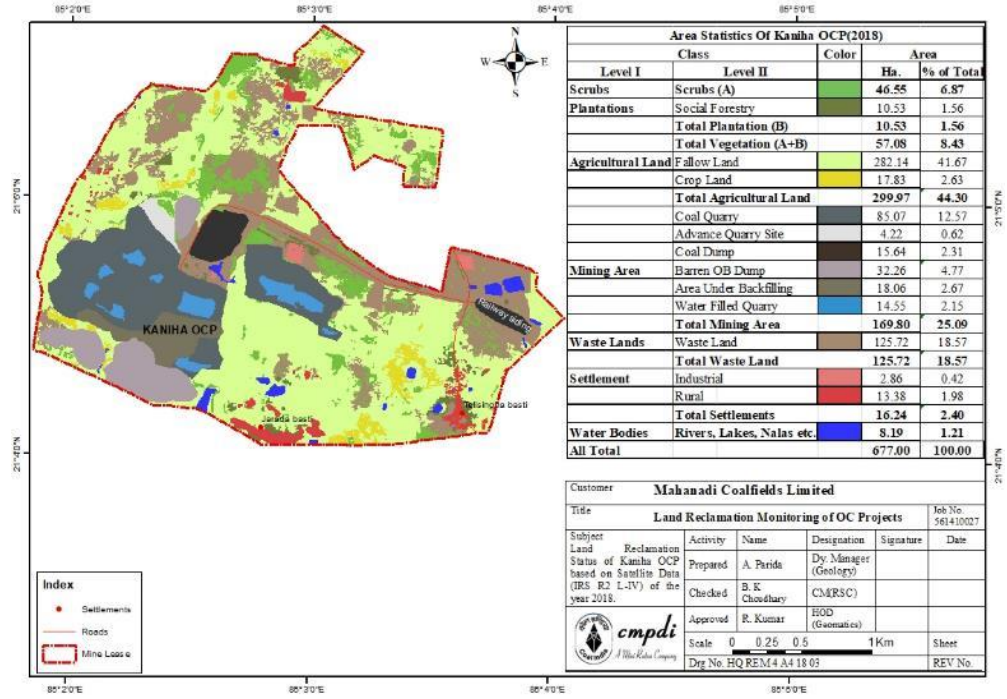


Area Statistics - Jagannath OCP (2020)

Classes		Colour	Area	
Level-I	Level-II		Area (Km²)	% of Total
	Open Forest (A)		**0.04**	**0.72**
Scrubs	**Scrubs (B)**		**0.32**	**5.78**
Plantation	Social Forestry		0.17	3.07
	Plantation on Backfill		1.79	32.31
	Total Plantation (C)		**1.96**	**35.38**
	Total Vegetation(A+B+C)		**2.32**	**41.88**
Agriculture	**Agriculture Land**		**0.51**	**9.21**
Waste Land	Waste Land		0.49	8.84
	Ash Pond		0.11	1.99
	Total Waste Land		**0.60**	**10.83**
Mining Area	Coal Quarry		0.31	5.60
	Area Under Backfilling		0.84	15.16
	Water Filled Quarry		0.61	11.01
	Coal Dump		0.09	1.62
	Advance Quarry Site		0.05	0.90
	Total Mining Area		**1.90**	**34.30**
Settlement	Rural		0.05	0.90
	Industrial		0.11	1.99
	Total Settlement Area		**0.16**	**2.89**
Water Body	**River, Ponds**		**0.05**	**0.90**
		Total	**5.54**	**100.00**

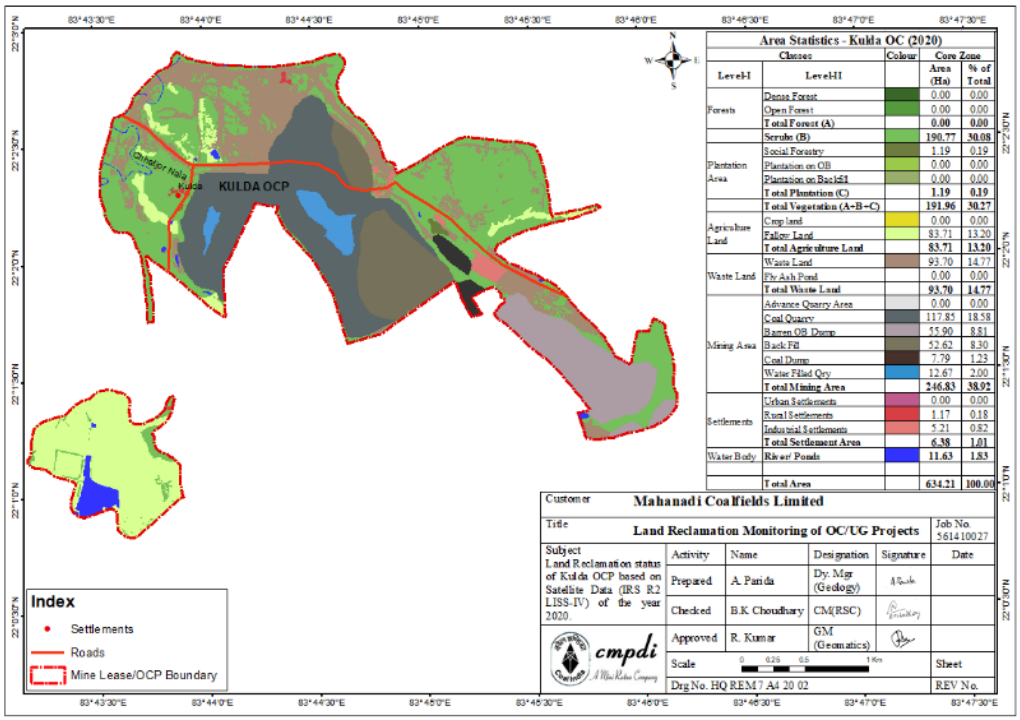
Customer	Mahanadi Coalfields Limited				
Title	Land Reclamation Monitoring of OC Projects				Job No. 561410027
Subject: Land Reclamation Status of Jagannath OCP based on Satellite Data (RS-2/L-IV) of the year 2020	Activity	Name	Designation	Signature	Date
	Prepared	A. Biswas	Mgr.(Geology)		
	Checked	T. Mondal	CM (RSC)		
	Approved	R. Kumar	HOD (Geomatics)		
cmpdi	Scale: 0 0.3 0.6 1.2 Km				Sheet 1
	Drg No. HQ REM 07 A4 20 06				Rev No.0

Figure 5.8(C): Land use status of Hingula OC and Jagannath OC of MCL as per satellite data



Area Statistics Of Kaniha OCP(2018)				
Class		Color	Area	
Level I	Level II		Ha.	% of Total
Scrubs	Scrubs (A)		46.55	6.87
Plantations	Social Forestry		10.53	1.56
	Total Plantation (B)		10.53	1.56
	Total Vegetation (A+B)		57.08	8.43
Agricultural Land	Fallow Land		282.14	41.67
	Crop Land		17.83	2.63
	Total Agricultural Land		299.97	44.30
	Coal Quarry		85.07	12.57
	Advance Quarry Site		4.22	0.62
	Coal Dump		15.64	2.31
Mining Area	Barren OB Dump		32.26	4.77
	Area Under Backfilling		18.06	2.67
	Water Filled Quarry		14.55	2.15
	Total Mining Area		169.80	25.09
Waste Lands	Waste Land		125.72	18.57
	Total Waste Land		125.72	18.57
Settlement	Industrial		2.86	0.42
	Rural		13.38	1.98
	Total Settlements		16.24	2.40
Water Bodies	Rivers, Lakes, Nalas etc.		8.19	1.21
All Total			677.00	100.00

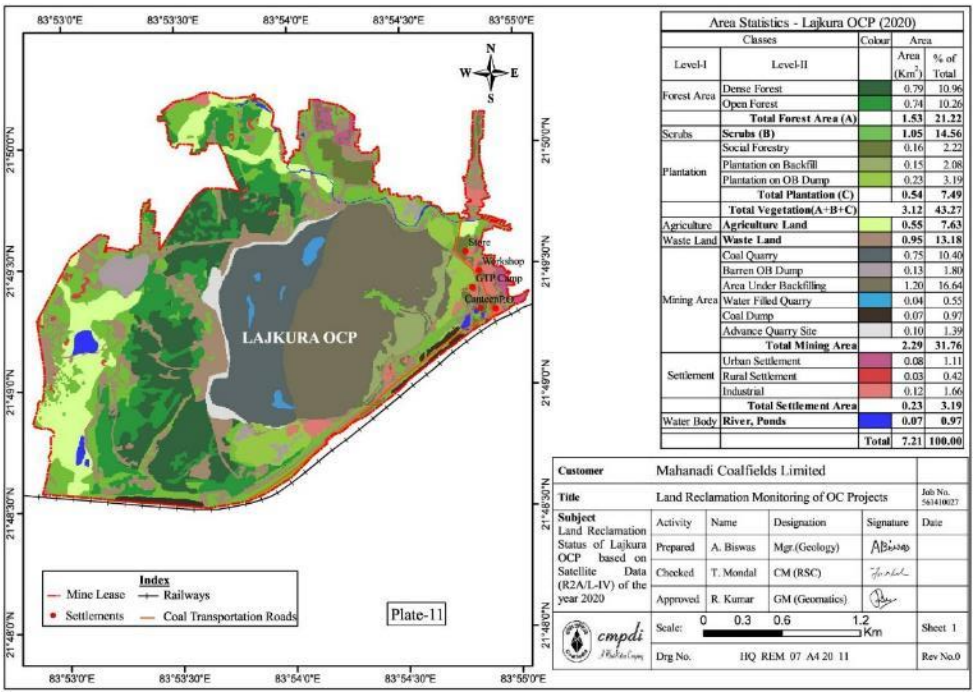
Customer	Mahanadi Coalfields Limited				
Title	Land Reclamation Monitoring of OC Projects				Job No. 5614100027
Subject	Activity	Name	Designation	Signature	Date
Land Reclamation Status of Kaniha OCP based on Satellite Data (IRS R2 L-IV) of the year 2018.	Prepared	A. Parida	Dy. Manager (Geology)		
	Checked	B. K Choudhary	CM(RSC)		
cmpdi	Approved	R. Kumar	HOD (Geomatics)		
	Scale 0 0.25 0.5 1Km				Sheet
	Drg No. HQ/REM/4/A4/18/03				REV No.



Area Statistics - Kulda OC (2020)				
Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forests	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		0.00	0.00
	Scrubs (B)		190.77	30.08
Plantation Area	Social Forestry		1.19	0.19
	Plantation on OB		0.00	0.00
	Plantation on Backfill		0.00	0.00
	Total Plantation (C)		1.19	0.19
	Total Vegetation (A+B+C)		191.96	30.27
Agriculture Land	Crop land		0.00	0.00
	Fallow Land		83.71	13.20
	Total Agriculture Land		83.71	13.20
Waste Land	Waste Land		93.70	14.77
	Fly Ash Pond		0.00	0.00
	Total Waste Land		93.70	14.77
Mining Area	Advance Quarry Area		0.00	0.00
	Coal Quarry		117.85	18.58
	Barren OB Dump		55.90	8.81
	Back Fill		52.62	8.30
	Coal Dump		7.79	1.23
	Water Filled Qry		12.67	2.00
	Total Mining Area		246.83	38.92
Settlements	Urban Settlements		0.00	0.00
	Rural Settlements		1.17	0.18
	Industrial Settlements		5.21	0.82
	Total Settlement Area		6.38	1.01
Water Body	River/ Ponds		11.63	1.83
	Total Area		634.21	100.00

Customer	Mahanadi Coalfields Limited				
Title	Land Reclamation Monitoring of OC/UG Projects				Job No. 5614100027
Subject	Activity	Name	Designation	Signature	Date
Land Reclamation status of Kulda OCP based on Satellite Data (IRS R2 LISS-IV) of the year 2020.	Prepared	A. Parida	Dy. Mgr (Geology)		
	Checked	B.K Choudhary	CM(RSC)		
cmpdi	Approved	R. Kumar	GM (Geomatics)		
	Scale				Sheet
	Drg No. HQ/REM/7/A4/20/02				REV No.

Figure 5.8(D): Land use status of Kaniha OC and Kulda OC of MCL as per satellite data



Area Statistics - Lajkura OCP (2020)

Classes		Colour	Area	
Level-I	Level-II		Area (Km^2)	% of Total
Forest Area	Dense Forest		0.79	10.96
	Open Forest		0.74	10.26
	Total Forest Area (A)		**1.53**	**21.22**
Scrubs	**Scrubs (B)**		**1.05**	**14.56**
Plantation	Social Forestry		0.16	2.22
	Plantation on Backfill		0.15	2.08
	Plantation on OB Dump		0.23	3.19
	Total Plantation (C)		**0.54**	**7.49**
	Total Vegetation(A+B+C)		**3.12**	**43.27**
Agriculture	**Agriculture Land**		**0.55**	**7.63**
Waste Land	**Waste Land**		**0.95**	**13.18**
Mining Area	Coal Quarry		0.75	10.40
	Barren OB Dump		0.13	1.80
	Area Under Backfilling		1.20	16.64
	Water Filled Quarry		0.04	0.55
	Coal Dump		0.07	0.97
	Advance Quarry Site		0.10	1.39
	Total Mining Area		**2.29**	**31.76**
Settlement	Urban Settlement		0.08	1.11
	Rural Settlement		0.03	0.42
	Industrial		0.12	1.66
	Total Settlement Area		**0.23**	**3.19**
Water Body	**River, Ponds**		**0.07**	**0.97**
		Total	**7.21**	**100.00**

Customer	Mahanadi Coalfields Limited				
Title	Land Reclamation Monitoring of OC Projects				Job No. 561410027
Subject Land Reclamation Status of Lajkura OCP based on Satellite Data (R2A/L-IV) of the year 2020	Activity	Name	Designation	Signature	Date
	Prepared	A. Biswas	Mgr.(Geology)		
	Checked	T. Mondal	CM (RSC)		
	Approved	R. Kumar	GM (Geomatics)		
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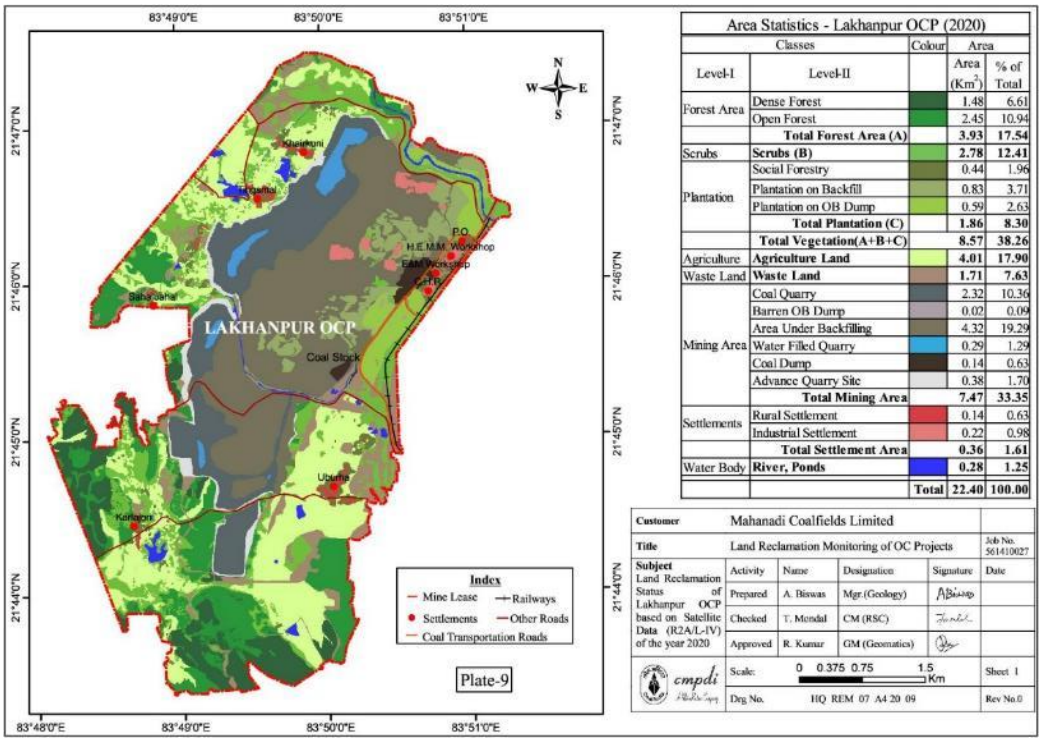
	Drg No. HQ REM 07 A4 20 11				Rev No.0

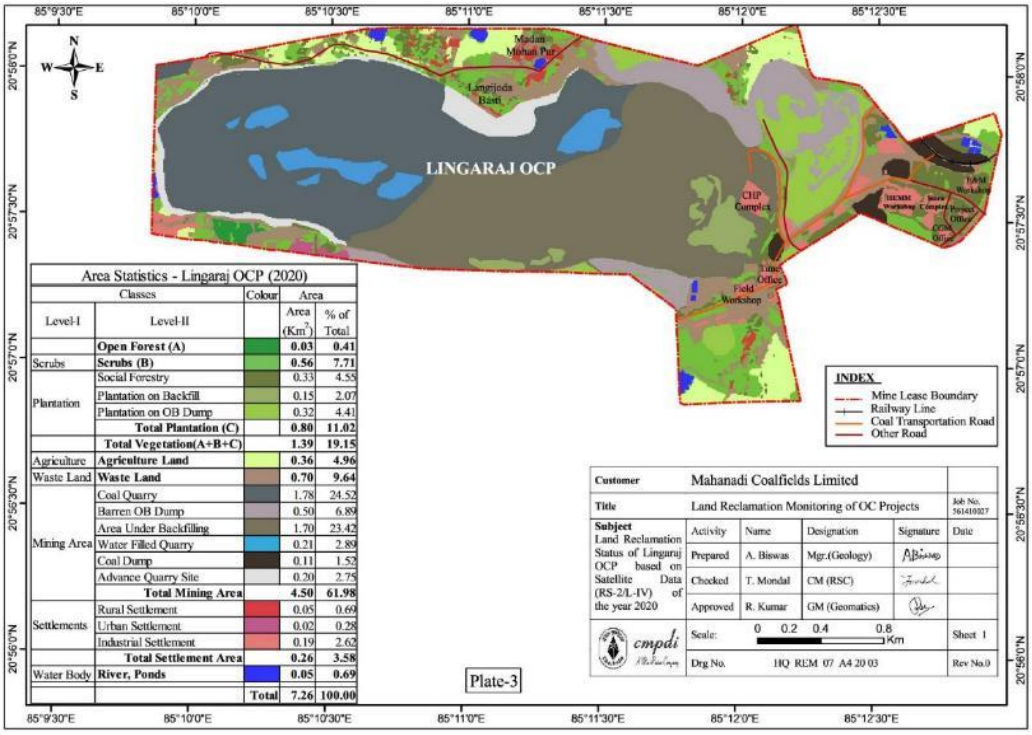


Area Statistics - Lakhanpur OCP (2020)

Classes		Colour	Area	
Level-I	Level-II		Area (Km^2)	% of Total
Forest Area	Dense Forest		1.48	6.61
	Open Forest		2.45	10.94
	Total Forest Area (A)		**3.93**	**17.54**
Scrubs	**Scrubs (B)**		**2.78**	**12.41**
Plantation	Social Forestry		0.44	1.96
	Plantation on Backfill		0.83	3.71
	Plantation on OB Dump		0.59	2.63
	Total Plantation (C)		**1.86**	**8.30**
	Total Vegetation(A+B+C)		**8.57**	**38.26**
Agriculture	**Agriculture Land**		**4.01**	**17.90**
Waste Land	**Waste Land**		**1.71**	**7.63**
Mining Area	Coal Quarry		2.32	10.36
	Barren OB Durnp		0.02	0.09
	Area Under Backfilling		4.32	19.29
	Water Filled Quarry		0.29	1.29
	Coal Dump		0.14	0.63
	Advance Quarry Site		0.38	1.70
	Total Mining Area		**7.47**	**33.35**
Settlements	Rural Settlement		0.14	0.63
	Industrial Settlement		0.22	0.98
	Total Settlement Area		**0.36**	**1.61**
Water Body	**River, Ponds**		**0.28**	**1.25**
		Total	**22.40**	**100.00**

Customer	Mahanadi Coalfields Limited				
Title	Land Reclamation Monitoring of OC Projects				Job No. 561410027
Subject Land Reclamation Status of Lakhanpur OCP based on Satellite Data (R2A/L-IV) of the year 2020	Activity	Name	Designation	Signature	Date
	Prepared	A. Biswas	Mgr.(Geology)		
	Checked	T. Mondal	CM (RSC)		
	Approved	R. Kumar	GM (Geomatics)		
cmpdi	Scale: 0 0.375 0.75 1.5 Km				Sheet 1
	Drg No. HQ REM 07 A4 20 09				Rev No.0

Figure 5.8(E): Land use status of Lajkura OC and Lakhanpur OC of MCL as per satellite data



Area Statistics - Lingaraj OCP (2020)

Classes		Colour	Area	
Level-I	Level-II		Area (Km^2)	% of Total
	Open Forest (A)		**0.03**	**0.41**
Scrubs	**Scrubs (B)**		**0.56**	**7.71**
Plantation	Social Forestry		0.33	4.55
	Plantation on Backfill		0.15	2.07
	Plantation on OB Dump		0.32	4.41
	Total Plantation (C)		**0.80**	**11.02**
	Total Vegetation(A+B+C)		**1.39**	**19.15**
Agriculture	**Agriculture Land**		**0.36**	**4.96**
Waste Land	**Waste Land**		**0.70**	**9.64**
Mining Area	Coal Quarry		1.78	24.52
	Barren OB Dump		0.50	6.89
	Area Under Backfilling		1.70	23.42
	Water Filled Quarry		0.21	2.89
	Coal Dump		0.11	1.52
	Advance Quarry Site		0.20	2.75
	Total Mining Area		**4.50**	**61.98**
Settlements	Rural Settlement		0.05	0.69
	Urban Settlement		0.02	0.28
	Industrial Settlement		0.19	2.62
	Total Settlement Area		**0.26**	**3.58**
Water Body	**River, Ponds**		**0.05**	**0.69**
		Total	**7.26**	**100.00**

Customer	Mahanadi Coalfields Limited				
Title	Land Reclamation Monitoring of OC Projects				Job No. 561410027
Subject: Land Reclamation Status of Lingaraj OCP based on Satellite Data (RS-2/L-IV) of the year 2020	Activity	Name	Designation	Signature	Date
	Prepared	A. Biswas	Mgr.(Geology)		
	Checked	T. Mondal	CM (RSC)		
	Approved	R. Kumar	GM (Geomatics)		
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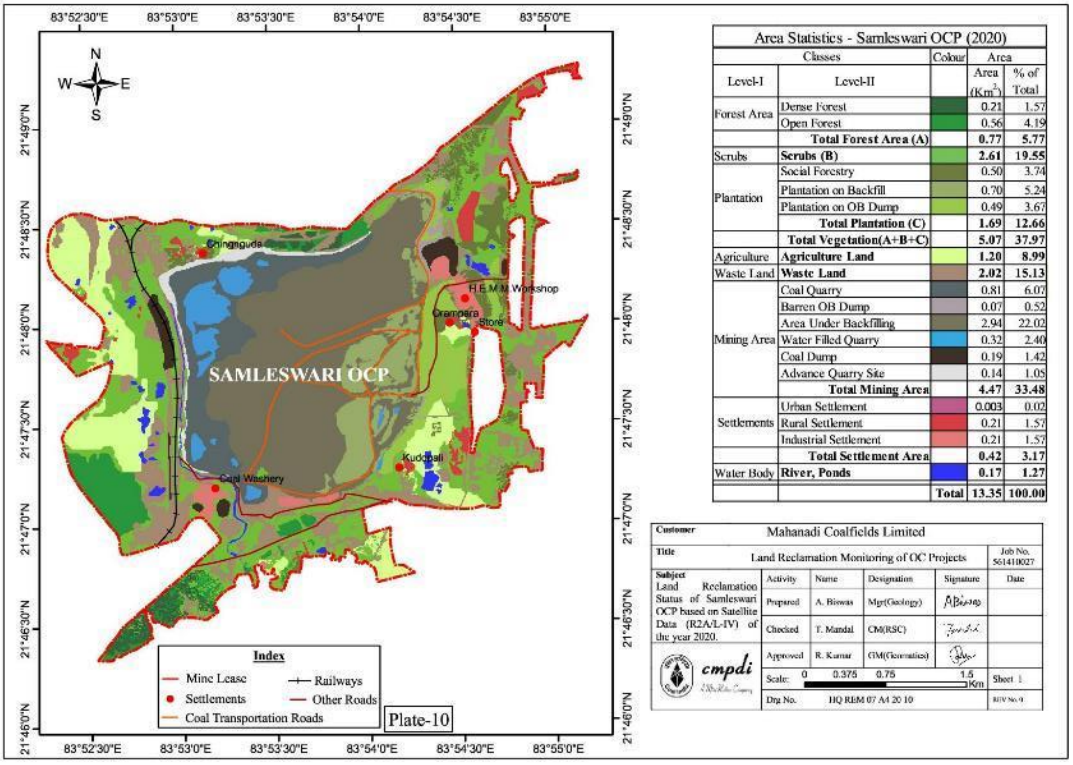
	Drg No. HQ REM 07 A4 20 03				Rev No.0

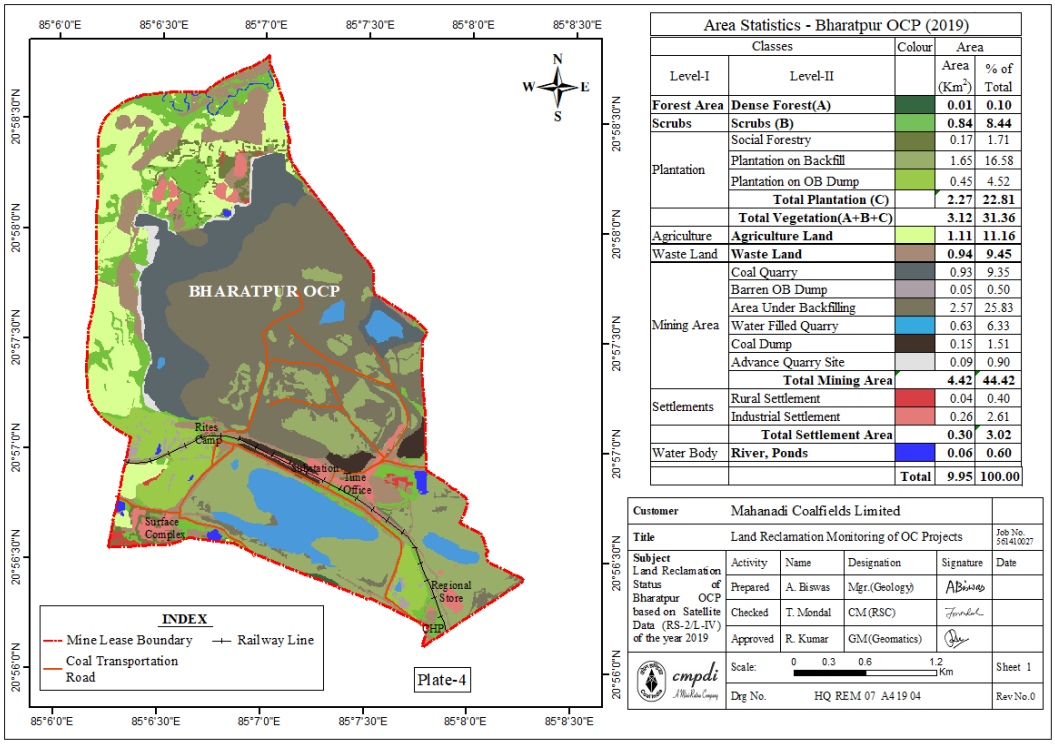


Area Statistics - Samleswari OCP (2020)

Classes		Colour	Area	
Level-I	Level-II		Area (Km^2)	% of Total
Forest Area	Dense Forest		0.21	1.57
	Open Forest		0.56	4.19
	Total Forest Area (A)		**0.77**	**5.77**
Scrubs	**Scrubs (B)**		**2.61**	**19.55**
Plantation	Social Forestry		0.50	3.74
	Plantation on Backfill		0.70	5.24
	Plantation on OB Dump		0.49	3.67
	Total Plantation (C)		**1.69**	**12.66**
	Total Vegetation(A+B+C)		**5.07**	**37.97**
Agriculture	**Agriculture Land**		**1.20**	**8.99**
Waste Land	**Waste Land**		**2.02**	**15.13**
Mining Area	Coal Quarry		0.81	6.07
	Barren OB Dump		0.07	0.52
	Area Under Backfilling		2.94	22.02
	Water Filled Quarry		0.32	2.40
	Coal Dump		0.19	1.42
	Advance Quarry Site		0.14	1.05
	Total Mining Area		**4.47**	**33.48**
Settlements	Urban Settlement		0.003	0.02
	Rural Settlement		0.21	1.57
	Industrial Settlement		0.21	1.57
	Total Settlement Area		**0.42**	**3.17**
Water Body	**River, Ponds**		**0.17**	**1.27**
		Total	**13.35**	**100.00**

Customer	Mahanadi Coalfields Limited				
Title	Land Reclamation Monitoring of OC Projects				Job No. 561410027
Subject: Land Reclamation Status of Samleswari OCP based on Satellite Data (R2A/L-IV) of the year 2020.	Activity	Name	Designation	Signature	Date
	Prepared	A. Biswas	Mgr(Geology)		
	Checked	T. Mandal	CM(RSC)		
	Approved	R. Kumar	GM(Geomatics)		
cmpdi	Scale: 0 0.375 0.75 1.5 Km				Sheet 1
	Drg No. HQ REM 07 A4 20 10				REV No.0

Figure 5.8(F): Land use status of Lingraj OC and Samleshwari OC of MCL as per satellite data



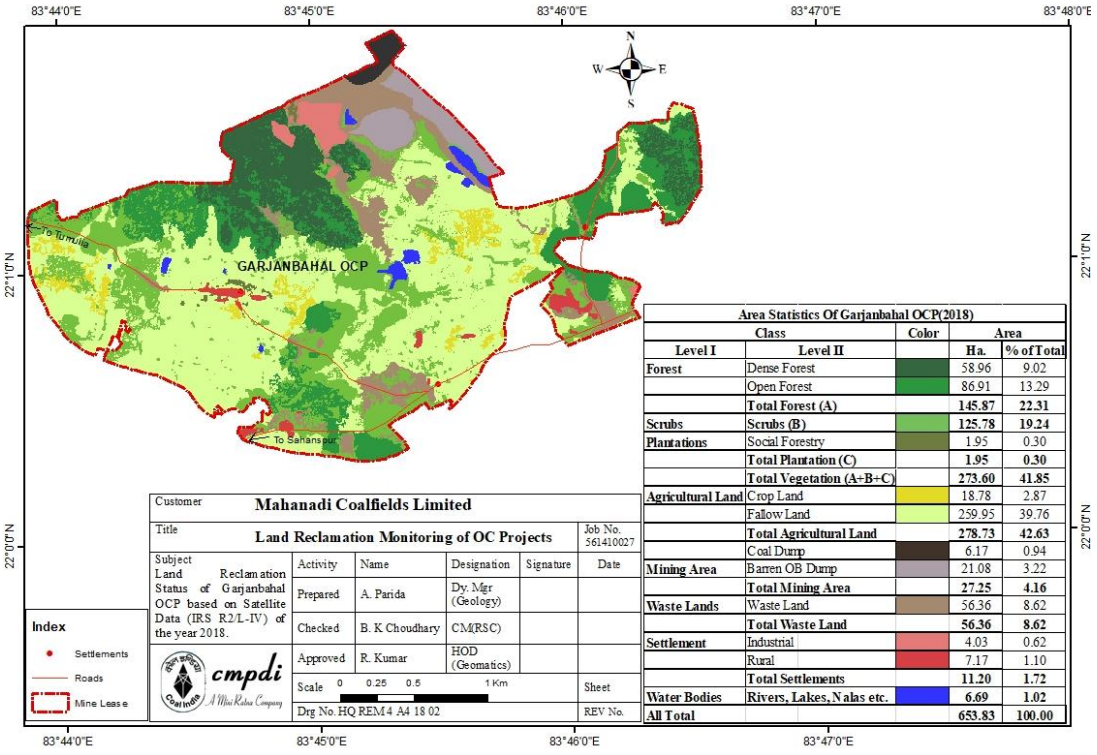


Figure 5.8(G): Land use status of Bharatpur OC and Garjanbahal OC of MCL as per satellite data

Figure 5.9: Land use status of GK OC and JK-5 OC of SCCL as per satellite data

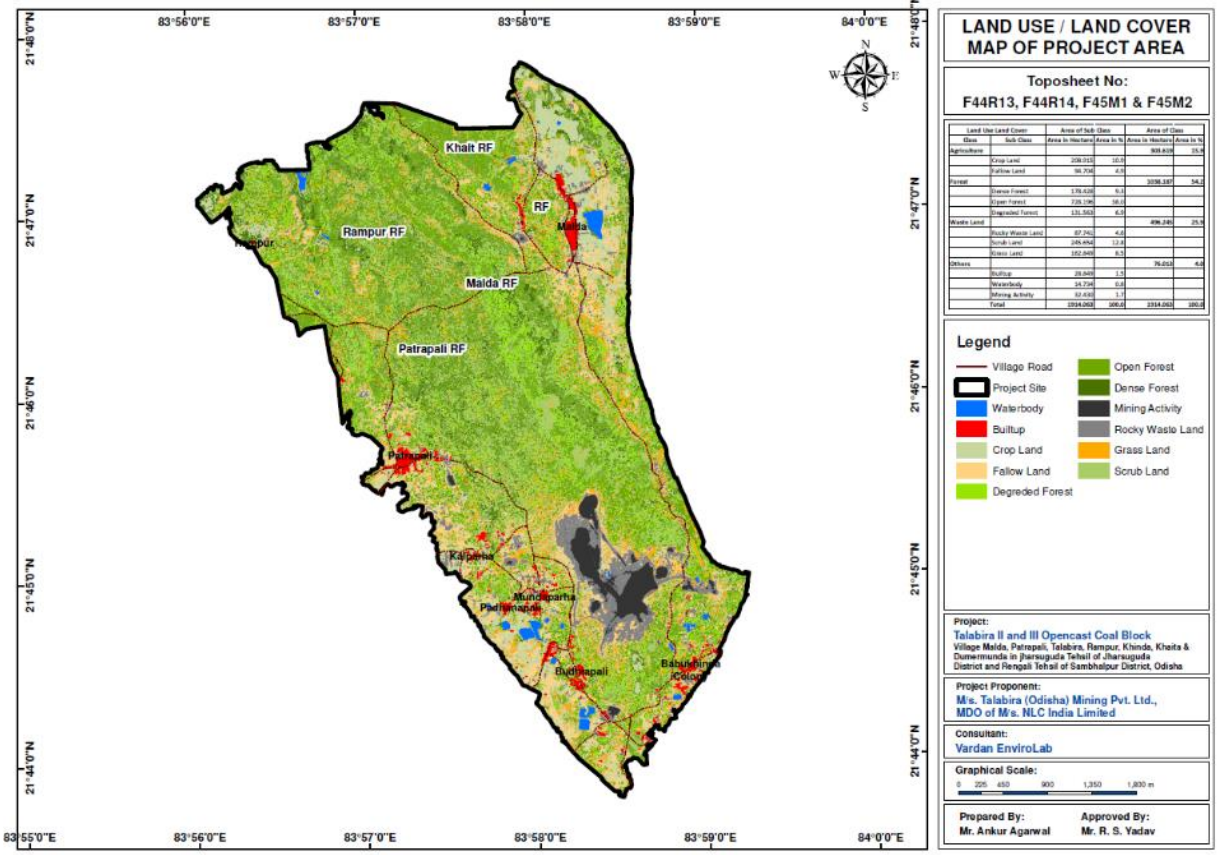


Figure 5.10: Land use status of Talabira II & III OC of NLCIL as per satellite data

5.2 Analysis of Land use pattern for CIL projects based on Remote Sensing

The comparative analysis of the land use pattern based on remote sensing data for major opencast mines of CIL is shown under the table below:

Table 5.2 Status of Land Reclamation in major CIL Opencast Mines based on Satellite Data (Between the year 2019 and 2020, Area in Sq. Kms)

Sl.No.	Project	Total Leasehold Area		Technical Reclamation		Biological Reclamation		Area under Active Mining		Total Excavated Area		Total Area under Reclamation	
				Area under Backfilling		Plantation on Excavated / Backfilled Area							
1	*2*	*3*		*4*		*5*		*6*		*7 (=4+5+6)*		*8 (=4+5)*	
		2019	*2020*	*2019*	*2020*	*2019*	*2020*	*2019*	*2020*	*2019*	*2020*	*2019*	*2020*
ECL (02)	Rajmahal OC	17.75	17.75	4.44	4.75	1.74	1.80	1.52	1.42	7.70	7.97	6.18	6.55
				57.66%	**59.60%**	**22.60%**	**22.58%**	**19.74%**	**17.82%**	**43.38%**	**44.90%**	**80.26%**	**82.18%**
	Sonepur Bazari OC	22.94	22.94	3.92	4.08	0.58	0.87	3.59	3.61	8.09	8.56	4.50	4.95
				48.45%	**47.66%**	**7.17%**	**10.16%**	**44.38%**	**42.17%**	**35.27%**	**37.31%**	**55.62%**	**57.83%**
BCCL (02)	AKWMC	-	3.25	-	0.89	-	0.52	-	0.71	-	2.12	-	1.41
	NT ST Exp (Cluster 9)	-	7.97	-	0.77	-	2.17	-	2.17	-	5.11	-	2.94
CCL (03)	Ashoka OC	7.93	7.93	2.30	2.35	0.92	1.02	0.55	0.66	3.77	4.03	3.22	3.37
				61.01%	**58.31%**	**24.40%**	**25.31%**	**14.59%**	**16.38%**	**47.54%**	**50.82%**	**85.41%**	**83.62%**
	Piparwar OC	11.20	11.20	2.56	2.91	1.34	1.45	1.39	0.98	5.29	5.34	3.90	4.36
				48.39%	**54.49%**	**25.33%**	**27.15%**	**26.28%**	**18.35%**	**47.23%**	**47.68%**	**73.72%**	**81.65%**
	Amrapali OC	-	6.2	-	1.2	-	0.07	-	1.07	-	2.34	-	1.27
	Magadh OC	-	17.69	-	0.55	-	0.1	-	0.78	-	1.43	-	0.65
	Konar OC	-	7.29	-	0.09	-	0.47	-	0.41	-	0.97	-	0.56
		2015	***2018***	***2015***	***2018***	***2015***	***2018***	***2015***	***2018***	***2015***	***2018***	***2015***	***2018***
	Karo I OC /Karo	5.75	5.75	0.14	0.17	0.12	0.14	0.42	0.34	0.68	0.66	0.26	0.31
		-	-	**51.33%**	**54.14%**	**24.44%**	**26.02%**	**24.23%**	**19.74%**	**39.15%**	**40.31%**	**75.77%**	**80.16%**
NCL (08)	Nigahi OC	30.16	30.16	5.05	5.41	2.19	1.64	3.66	3.78	10.90	10.83	7.24	7.05
				46.33%	**49.95%**	**20.09%**	**15.14%**	**33.58%**	**34.90%**	**36.14%**	**35.91%**	**66.42%**	**65.10%**
	Jayant OC	29.11	31.94	5.65	6.34	4.87	3.46	4.54	5.61	15.06	15.41	10.52	9.80
				37.52%	**41.14%**	**32.34%**	**22.45%**	**30.15%**	**36.40%**	**51.73%**	**48.25%**	**69.85%**	**63.60%**
	Dudhichua OC	14.00	21.73	4.86	5.49	1.44	1.29	4.19	4.51	10.49	11.29	6.30	6.78
				46.33%	**48.63%**	**13.73%**	**11.43%**	**39.94%**	**39.95%**	**74.93%**	**51.96%**	**60.06%**	**60.05%**
	Amlohri OC	21.51	23.20	3.66	3.77	0.85	0.80	3.90	3.51	8.41	8.08	4.51	4.57
				43.52%	**46.66%**	**10.11%**	**9.90%**	**46.37%**	**43.44%**	**39.10%**	**34.83%**	**53.63%**	**56.56%**
	Khadia OC	14.91	16.22	3.62	3.55	0.60	0.58	3.17	3.44	7.39	7.57	4.22	4.13
				48.99%	**46.90%**	**8.12%**	**7.66%**	**42.90%**	**45.44%**	**49.56%**	**46.67%**	**57.10%**	**54.56%**
	Bina OC	17.98	15.97	4.33	4.31	1.79	1.62	3.02	2.54	9.14	8.47	6.12	5.93
				47.37%	**50.88%**	**19.58%**	**19.12%**	**33.04%**	**30.00%**	**50.83%**	**53.04%**	**66.96%**	**70.00%**
	Krishnashila OC	5.94	5.54	0.84	1.21	0.15	0.25	1.02	1.15	2.01	2.61	0.99	1.46
				41.79%	**46.36%**	**7.46%**	**9.58%**	**50.75%**	**44.06%**	**33.84%**	**47.11%**	**49.25%**	**55.94%**

Sl.No.	Project	Total Leasehold Area		Technical Reclamation		Biological Reclamation		Area under Active Mining		Total Excavated Area		Total Area under Reclamation	
				Area under Backfilling		Plantation on Excavated / Backfilled Area							
	Block-B OC	14.64	15.65	1.44	1.49	0.49	0.49	2.13	2.12	4.06	4.10	1.93	1.98
				35.47%	36.34%	12.07%	11.95%	52.46%	51.71%	27.73%	26.20%	47.54%	48.29%
WCL (01)	Penganga OC	7.63	7.63	0.00	0.15	0.00	0.00	0.89	1.02	0.89	1.17	0.00	0.15
				0.00%	12.82%	0.00%	0.00%	100.00%	87.18%	11.66%	15.33%	0.00%	12.82%
SECL (04)	Dipka OC	19.99	19.99	2.87	2.94	0.66	0.77	3.25	3.30	6.78	7.01	3.53	3.71
				42.33%	41.94%	9.73%	10.98%	47.94%	47.08%	33.92%	35.07%	52.06%	52.92%
	Gevra OC	41.84	41.84	7.87	8.80	2.57	2.60	5.81	5.29	16.25	16.69	10.44	11.40
				48.43%	52.73%	15.82%	15.58%	35.75%	31.70%	38.84%	39.89%	64.25%	68.30%
	Kusmunda OC	16.72	16.72	2.96	3.28	1.20	1.32	2.78	2.56	6.94	7.16	4.16	4.60
				42.65%	45.81%	17.29%	18.44%	40.06%	35.75%	41.51%	42.82%	59.94%	64.25%
	Manikpur OC	19.44	19.44	1.24	1.50	0.75	0.77	2.08	1.98	4.07	4.25	1.99	2.27
				30.47%	35.29%	18.43%	18.12%	51.11%	46.59%	20.94%	21.86%	48.89%	53.41%
MCL (13)	Ananta OC	14.20	14.20	2.35	2.40	1.02	1.05	1.18	1.45	4.55	4.90	3.37	3.45
				51.65%	48.98%	22.42%	21.43%	25.93%	29.59%	32.04%	34.51%	74.07%	70.41%
	Balram OC	10.21	13.09	2.52	2.80	1.03	1.06	0.95	1.03	4.50	4.89	3.55	3.86
				56.00%	57.26%	22.89%	21.68%	21.11%	21.06%	44.07%	37.36%	78.89%	78.94%
	Lingaraj OC	7.26	7.26	1.44	1.70	0.15	0.15	2.27	2.19	3.86	4.04	1.59	1.85
				37.31%	42.08%	3.89%	3.71%	58.81%	54.21%	53.17%	55.65%	41.19%	45.79%
	Bharatpur OC	9.95	9.27	2.57	2.63	1.65	1.66	1.65	1.66	5.87	5.95	4.22	4.29
				43.78%	44.20%	28.11%	27.90%	28.11%	27.90%	58.99%	64.18%	71.89%	72.10%
	Bhubaneshwari OC	7.33	6.58	1.81	1.86	0.01	0.01	1.82	1.77	3.64	3.64	1.82	1.87
				49.73%	51.10%	0.27%	0.27%	50.00%	48.63%	49.66%	55.32%	50.00%	51.37%
	Jagannath OC	5.54	5.54	0.76	0.84	1.79	1.79	1.01	0.97	3.56	3.60	2.55	2.63
				21.35%	23.33%	50.28%	49.72%	28.37%	26.94%	64.26%	64.98%	71.63%	73.06%
	Hingula OC	15.75	15.75	1.33	1.48	0.06	0.07	1.75	2.02	3.14	3.57	1.39	1.55
				42.36%	41.46%	1.91%	1.96%	55.73%	56.58%	19.94%	22.67%	44.27%	43.42%
	Belpahar OC	14.44	14.44	1.79	2.36	0.91	0.90	1.67	1.33	4.37	4.59	2.70	3.26
				40.96%	51.42%	20.82%	19.61%	38.22%	28.98%	30.26%	31.79%	61.78%	71.02%
	Lakhanpur OC	22.40	22.40	4.12	4.32	0.80	0.83	2.51	2.99	7.43	8.14	4.92	5.15
				55.45%	53.07%	10.77%	10.20%	33.78%	36.73%	33.17%	36.34%	66.22%	63.27%
	Samaleswari OC	7.13	13.35	2.90	2.94	0.68	0.70	1.26	1.27	4.84	4.91	3.58	3.64
				59.92%	59.88%	14.05%	14.26%	26.03%	25.87%	67.88%	36.78%	73.97%	74.13%
	Lajkura OC	4.68	7.21	1.15	1.20	0.16	0.15	0.84	0.89	2.15	2.24	1.31	1.35
				53.49%	53.57%	7.44%	6.70%	39.07%	39.73%	45.94%	31.07%	60.93%	60.27%
		2015	*2018*	*2015*	*2018*	*2015*	*2018*	*2015*	*2018*	*2015*	*2018*	*2015*	*2018*
	Kaniha OC	6.77	6.77	0.02	0.18	0.00	0.00	0.54	1.04	0.56	1.22	0.02	0.18

Sl.No.	Project	Total Leasehold Area		Technical Reclamation		Biological Reclamation		Area under Active Mining		Total Excavated Area		Total Area under Reclamation	
				Area under Backfilling		Plantation on Excavated / Backfilled Area							
				3.41%	14.82%	0.00%	0.00%	96.59%	85.18%	8.24%	18.01%	3.41%	14.82%
		2017	*2020*	*2017*	*2020*	*2017*	*2020*	*2017*	*2020*	*2017*	*2020*	*2017*	*2020*
	Kulda OC	5.38	6.34	0.13	0.53	0.00	0.00	1.03	1.31	1.16	1.83	0.13	0.53
				11.44%	28.73%	0.00%	0.00%	88.56%	71.27%	21.55%	28.86%	11.44%	28.73%
Note : (%) calculated above is based on Excavated area whereas (%) denoted under excavated area is calculated based on the leasehold area of the project(s).													

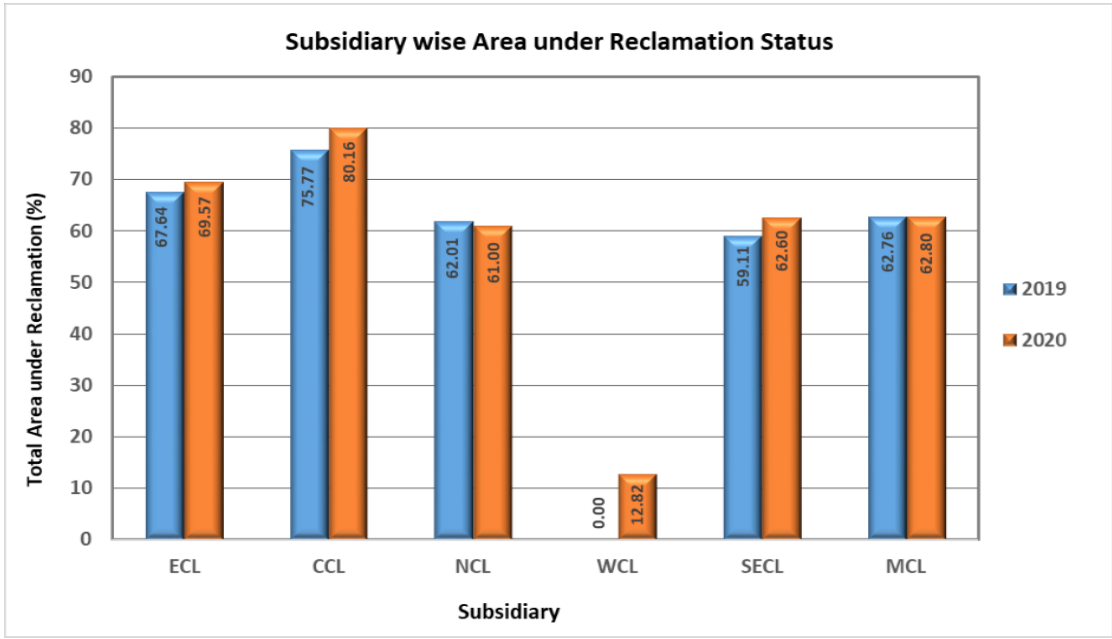


Figure 5.11: Total Area under Reclamation (Technical + Biological) of the total excavated area between 2019 & 2020 based on remote sensing data

It is seen from the above chart that the total area under reclamation (technical + biological) is slightly higher in the year 2020 than in the year 2019 for all subsidiaries of CIL except NCL.

With a view to minimize the impacts of mining on land and make it available for alternative use in future, a comprehensive plan to rehabilitate all land disturbed by mining operations is built in the project planning stage itself. The reclamation and afforestation activities are carried out continually to reclaim the dump and backfilled areas both technically and biologically to control soil erosion and also to give a green cover to the barren dump yard and backfilled areas to bring back the fauna and flora. The land is reclaimed for agricultural, horticulture crops and development of forestry, pasture land etc.

Chapter VI: Status of Environmental Sustainability – Air Quality

6.0 Reporting of air quality in projects considered

Status of air quality for each of the projects has been analysed based on the Ambient Air Quality Monitoring (AAQM) undertaken by the respective projects. The minimum and maximum range for the major pollutants, namely PM_{10}, $PM_{2.5}$, SO_2 and NOx for the period from April, 2019 till March, 2020 were analysed based on the reported AAQM data in the core and buffer zones of the project.

Apart from the above, graphical analysis of status of compliance of air quality parameters and range of concentrations for SOx and NOx in core and buffer zones for the period from April, 2019 till March, 2020 in respect of Coal Standards in the core zone and NAAQS in the buffer zone respectively have been presented.

Standards for coal mines (GSR 742(E) dated 25.09.2010) and NAAQS are attached as annexures.

6.1 Status of Air Quality

The ranges reported for the pollutants (PM_{10}, $PM_{2.5}$, SO_2 and NO_x) are given in the table below:

Table 6.1: Status of air quality for projects considered

Subsidiary	Name of mine	Study Area	Range of pollutants measured during AAQM in FY 2019-20 (µg/m^3)					
			PM$_{10}$ Min	PM10 Max	PM2.5 Min	PM2.5 Max	Avg. SO2	Avg. NO$_2$
ECL	**Rajmahal**	Core	78	120	29	45	<10	15
ECL		Buffer	41	151	29	53	<10	15
ECL	**Sonepur Bazari**	Buffer	40	106	26	42	<10	15
BCCL	**AKWMC**	Core	56	151	31	84	11.1	23.3
BCCL		Buffer*	54	144	27	96	12.3	25.2
BCCL	**NT-ST Expansion**	Core	65	146	30	78	15.06	24.17
BCCL		Buffer*	49	126	22	69	11.5	23.8
CCL	**Karo OC**	Core	103	349	38	117	<25	<6
CCL		Buffer	41	155	20	74	<25	<6
CCL	**Ashoka OC**	Core	77	530	33	266	<25	<6
CCL		Buffer	30	214	15	93	<25	<6
CCL	**Amrapali OC**	Core	102	274	36	108	<25	<6
CCL	**Magadh OC**	Core	62	237	15	77	<25	<6
CCL	**Piparwar OC**	Buffer	36	337	16	136	<25	<6
CCL	**Konar Expansion OC**	Core	110	313	39	91	<25	<6
CCL		Buffer	44	161	20	74	<25	<6
WCL	**Penganga OC**	Core	9	352	5	68	27	16
WCL		Buffer	21	186	11	69	22	14
SECL	**Gevra OC**	Core	132	308	38	63	27	29
SECL		Buffer	64	114	23	60	24	27
SECL	**Dipka OC**	Core	145	306	45	64	28	31
SECL		Buffer	67	111	28	63	28	32
SECL	**Manikpur OC**	Core	81	390	30	72	30	28

Subsidiary	Name of mine	Study Area	Range of pollutants measured during AAQM in FY 2019-20 (µg/m^3)					
			PM_{10} Min	PM10 Max	$PM_{2.5}$ Min	PM2.5 Max	Avg. SO_2	Avg. NO_2
SECL		Buffer	45	128	21	66	21	24
SECL	**Kusmunda OC**	Core	80	315	45	64	29	32
SECL		Buffer	66	113	31	59	27	30
NCL	**Amlohri OC**	Core	52	370	14	77	20	24
NCL		Buffer	62	96	18	46	14	18
NCL	**Nigahi OC**	Core	167	294	20	91	21	27
NCL		Buffer	53	96	29	63	17	24
NCL	**Jayant OC**	Core	93	484	17	126	19	26
NCL		Buffer	70	110	30	45	21	28
NCL	**Dudhichua OC**	Core	106	317	24	113	19	24
NCL		Buffer	45	110	12	44	16	22
NCL	**Khadia OC**	Core	74	366	21	105	20	28
NCL		Buffer	63	97	32	44	18	23
NCL	**Bina OC**	Core	109	330	30	73	19	25
NCL		Buffer	58	102	15	43	13	17
NCL	**Krishnashila OC**	Core	85	358	26	67	20	25
NCL		Buffer	57	112	29	42	15	21
NCL	**Block B OC**	Core	134	328	29	131	22	28
NCL		Buffer	41	92	21	55	14.25	21
MCL	**Lakhanpur OC**	Core	33	382	11	112	11.1	19.3
MCL	**Lingaraj OC**	Core	31	474	10	140	12.01	17.4
MCL	**Bharatpur OC**	Core	34	471	10	168	11.3	17.07
MCL	**Kulda OC**	Core	33	413	10	138	11.5	19.5
MCL	**Ananta OC**	Core	30	513	10	143	11.4	17.8

Subsidiary	Name of mine	Study Area	Range of pollutants measured during AAQM in FY 2019-20 (µg/m^3)					
			PM10 Min	PM10 Max	PM2.5 Min	PM2.5 Max	Avg. SO2	Avg. NO2
MCL	**Kaniha OC**	Core	26	427	10	126	11.9	17.7
MCL	**Hingula OC**	Core	21	456	10	166	11.4	17.7
MCL	**Samaleshwari OC**	Core	18	451	10	120	11.3	18.7
MCL	**Belpahar OC**	Core	13	428	10	101	11.6	18.7
MCL	**Jagannath OC**	Core	43	471	10	132	11.4	18.5
MCL	**Balram**	Core	17	479	11	168	12.1	17.7
MCL	**Lajkura OC**	Core	22	425	10	132	10.9	18.6
MCL	**Bhubaneshwari OC**	Core	63	105	13	60	5.4	5.5
MCL	**Garjanbahal OC****	Core	33	487	10	95	11.2	18.5
SCCL	**GK OCP**	Core	95	138	29	42.1	13.6	19.7
SCCL		Buffer	48	64	19.7	26.2	12.6	18.3
SCCL	**JK-5 OCP**	Core	148	201	5.2	63.9	11.3	16.3
SCCL		Buffer	39	75	19.4	32.3	9.9	14.9
NLC	**Talabira II & III OCP**	Core	Nil	Nil	Nil	Nil	Nil	Nil
NLC		Buffer	43	55	22	29	6	13

**Location of buffer stations overlaps with core zone of adjacent cluster.*

***Data considered from Apr'19 till Jan'20 as it is a new project.*

6.2 Observations on air quality

1. ECL

The maximum concentration of PM_{10} in core zone (120 $\mu g/m^3$) is within the prescribed limits as per Coal Mines Standards (G.S.R. 742(E) dated 25th Sep, 2000). In the buffer zone of Sonepur Bazari OCP, the maximum concentration of PM_{10} (106 $\mu g/m^3$) has crossed the permissible limit prescribed under NAAQS, 2009. Also, as compared with the prescribed limits under NAAQS, 2009, the maximum concentration of $PM_{2.5}$ observed in the buffer zone (53 $\mu g/m^3$) is almost reaching the prescribed limit. The concentration of gaseous pollutants (in this case SO_2 and NOx) was observed to be within the prescribed limits.

2. BCCL

The maximum concentration of PM_{10} in core zone (151.00 $\mu g/m^3$) and (146.00 $\mu g/m^3$) is within the prescribed limits as per Coal Mines Standards (G.S.R. 742(E) dated 25th Sep, 2000) in AKWMC and NT-ST Expansion OCP. Buffer zone stations of AKWMC OCP and NT-ST Expansion OCP fall in the core zone of adjacent cluster, hence are compared against core zone standards. The maximum concentrations of PM_{10} (144 $\mu g/m^3$) and (126 $\mu g/m^3$) remain within the permissible limit prescribed under Coal Mine Standards. The concentration of gaseous pollutants (in this case SO_2 and NOx) was observed to be within the prescribed limits.

3. CCL

The maximum concentration of PM_{10} in core zone (530 $\mu g/m^3$) is observed to be crossing the prescribed limits as per Coal Mines Standards (G.S.R. 742(E) dated 25th Sep, 2000) in Ashoka OCP. In the buffer zone also the concentration of maximum PM_{10} (337 $\mu g/m^3$) has crossed the permissible limit prescribed under NAAQS, 2009 in Piparwar OCP. Also, as compared with the prescribed limits under NAAQS, 2009, the maximum concentration of $PM_{2.5}$ observed in the buffer zone (136 $\mu g/m^3$) of Piparwar OCP is crossing the prescribed limit. The concentration of gaseous pollutants was observed to be within the prescribed limits.

4. WCL

The maximum concentration of PM_{10} in core zone (352 $\mu g/m^3$) is observed to be crossing the prescribed limits as per Coal Mines Standards (G.S.R. 742(E) dated 25th September, 2000). In the buffer zone also the value of maximum PM_{10} (186 $\mu g/m^3$) has crossed the permissible limit prescribed under NAAQS, 2009. Also, as compared with the prescribed limits under NAAQS, 2009, the maximum concentration of $PM_{2.5}$ observed in the buffer zone (69 $\mu g/m^3$) is above the prescribed limit. The concentration of gaseous pollutants was observed to be within the prescribed limits.

5. SECL

The maximum concentration of PM_{10} in core zone (390 $\mu g/m^3$) is observed to be crossing the prescribed limits as per Coal Mines Standards (G.S.R. 742(E) dated 25th Sep, 2000). In the buffer zone also the value of maximum PM_{10} (128 $\mu g/m^3$) has crossed the permissible limit prescribed under NAAQS, 2009. Also, as compared with the prescribed limits under NAAQS, 2009, the maximum concentration of $PM_{2.5}$ observed in the buffer zone (66 $\mu g/m^3$) is crossing the prescribed limit. The concentration of gaseous pollutants was observed to be within the prescribed limits.

6. NCL

The maximum concentration of PM_{10} and $PM_{2.5}$ in core zone (484 $\mu g/m^3$ and 131 $\mu g/m^3$) is observed in the project considered. The value of PM 10 is exceeding the prescribed limits as per Coal Mines Standards (G.S.R. 742(E) dated 25th Sep, 2000). In the buffer zone also the value of maximum PM_{10} (112$\mu g/m^3$) has crossed the permissible limit prescribed under NAAQS, 2009. Also, as compared with the prescribed limits under NAAQS, 2009, the maximum concentration of $PM_{2.5}$ observed in the buffer zone (63 $\mu g/m^3$) is crossing the prescribed limit. The concentration of gaseous pollutants was observed to be within the prescribed limits.

7. MCL

The maximum concentration of PM_{10} and $PM_{2.5}$ in core zone (513 $\mu g/m^3$ and 168 $\mu g/m^3$) is observed in the project considered. The value of PM_{10} is exceeding the prescribed limits as per Coal Mines Standards (G.S.R. 742(E) dated 25th Sep, 2000). The buffer zone of the projects fall within the core zone of neighbouring projects as most of the mines are located within Talcher Coalfields and IB valley Coalfields. The concentration of gaseous pollutants was observed to be within the prescribed limits.

8. SCCL

The maximum concentration of PM_{10} and $PM_{2.5}$ in core zone (201 $\mu g/m^3$ and 63.9 $\mu g/m^3$) is observed in the project considered. The value of PM 10 is within the prescribed limits as per Coal Mines Standards (G.S.R. 742(E) dated 25th Sep, 2000). In the buffer zone also the value of maximum PM_{10} & $PM_{2.5}$ is observed to be within the permissible limit prescribed under NAAQS, 2009. The concentration of gaseous pollutants was also observed to be within the prescribed limits.

9. NLC

The Talabira II & III mines are still not operational. In the buffer zone, the value of maximum PM_{10} (55$\mu g/m^3$) has been within the permissible limit prescribed under NAAQS, 2009. Also, as compared with the prescribed limits under NAAQS, 2009, the maximum concentration of $PM_{2.5}$ observed in the buffer zone (29 $\mu g/m^3$) is crossing the prescribed limit. The concentration of gaseous pollutants was observed to be within the prescribed limits.

6.3 Graphical representation of status of air quality parameters

Percentage analysis for two major air quality parameters namely PM_{10} and $PM_{2.5}$ in core and buffer zone has been done to assess the status of compliance with respect to existing standards. The percentage analysis of the air quality parameters (PM_{10} and $PM_{2.5}$) is depicted in the graphs below. It is evident from graphical analysis that PM_{10} concentrations in core zone across most of the projects of CIL, SCCL and NLCIL are within the prescribed standard for more than 90% of the time during 2019-20. Compared with the prescribed standards, the compliance of PM_{10} and $PM_{2.5}$ concentrations in the buffer zone ranges between 86% to 100% during 2019-20.

The concentration of gaseous pollutants (SOx and NOx) was observed to be within the prescribed limits in all the considered projects. The average value of SOx and NOx is provided in Table 6.1 and the graphical representation of the range of concentration of these pollutants in the core and buffer zone is presented in Figure 6.4 & 6.5.

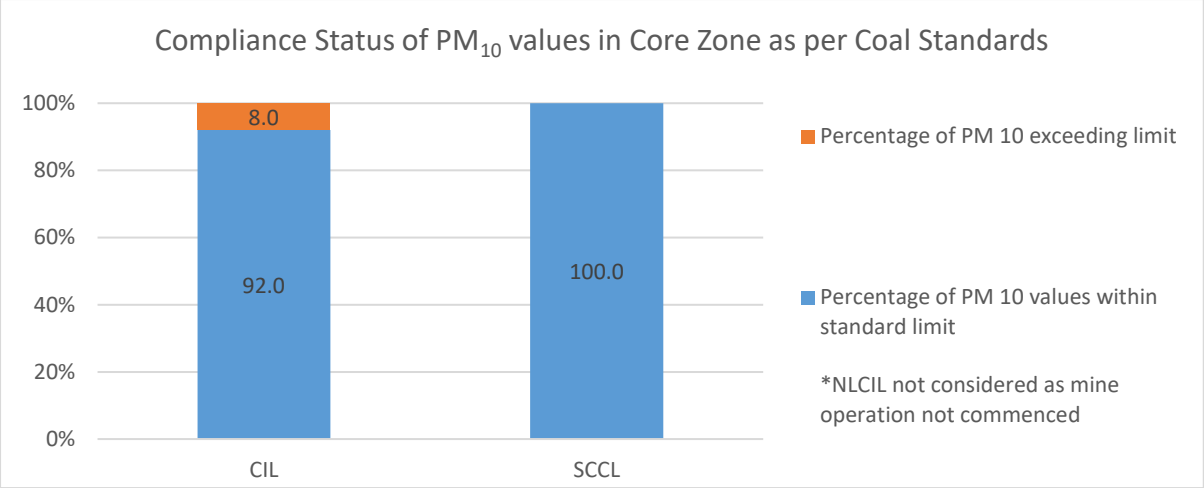


Figure 6.1: Status of compliance of PM_{10} values (%) in core zone as per Coal Standards

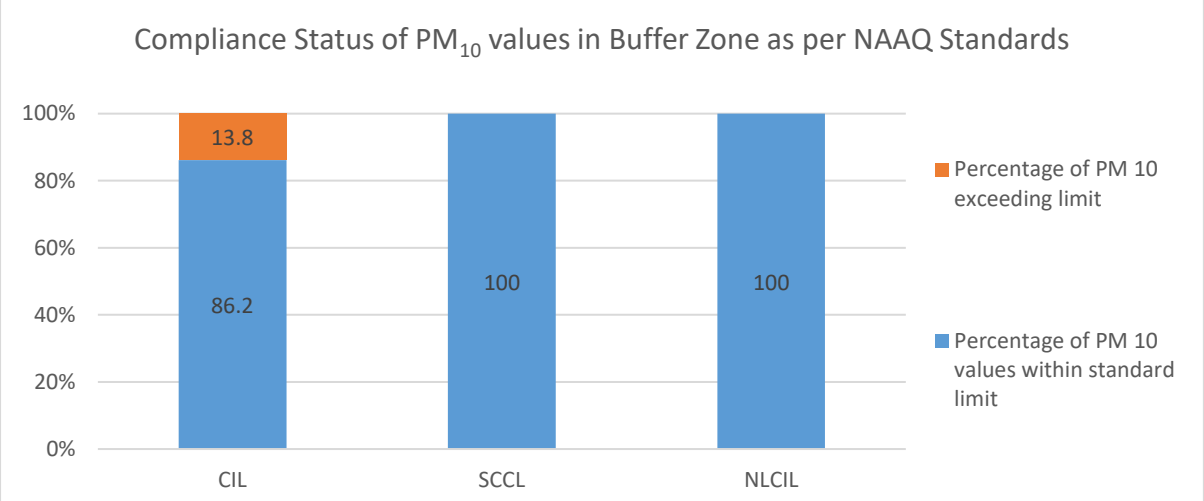


Figure 6.2: Status of compliance of PM_{10} values (%) in buffer zone as per NAAQ Standards

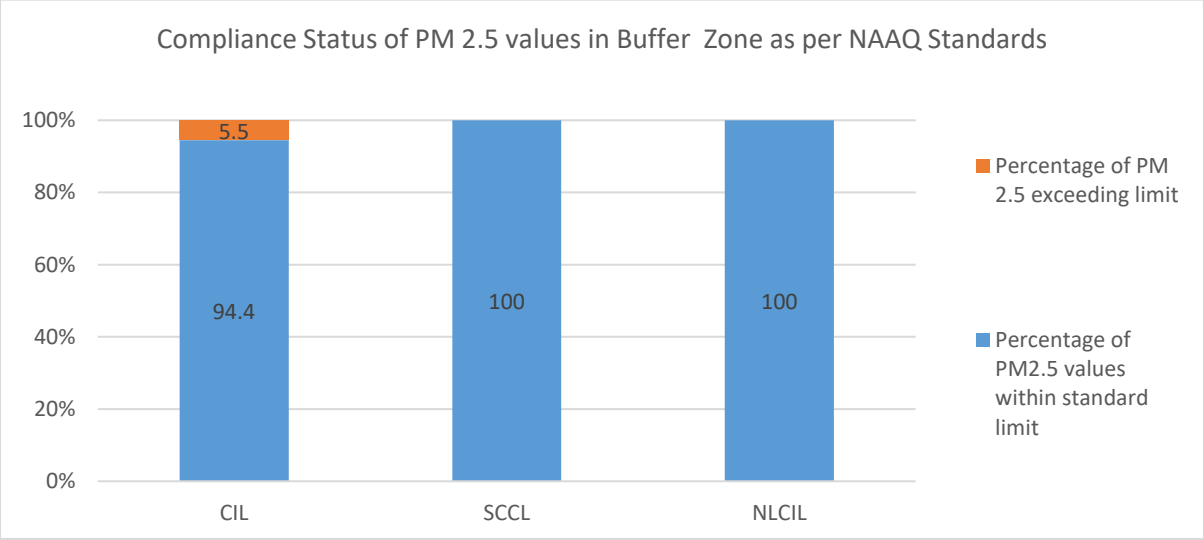


Figure 6.3: Status of compliance of $PM_{2.5}$ values (%) in buffer zone as per NAAQ Standards

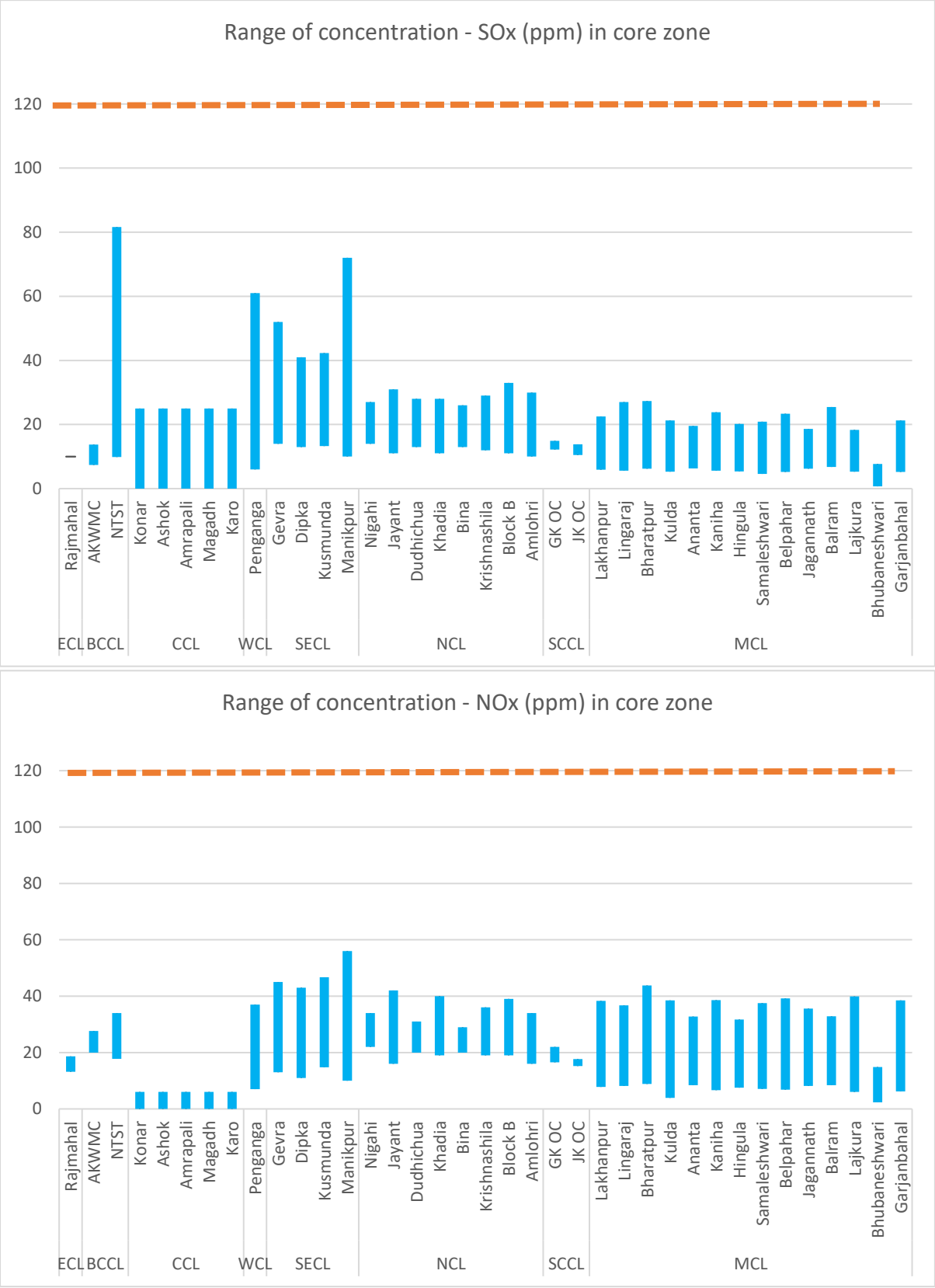


Figure 6.4: Range of concentration – SOx & NOx in core zone

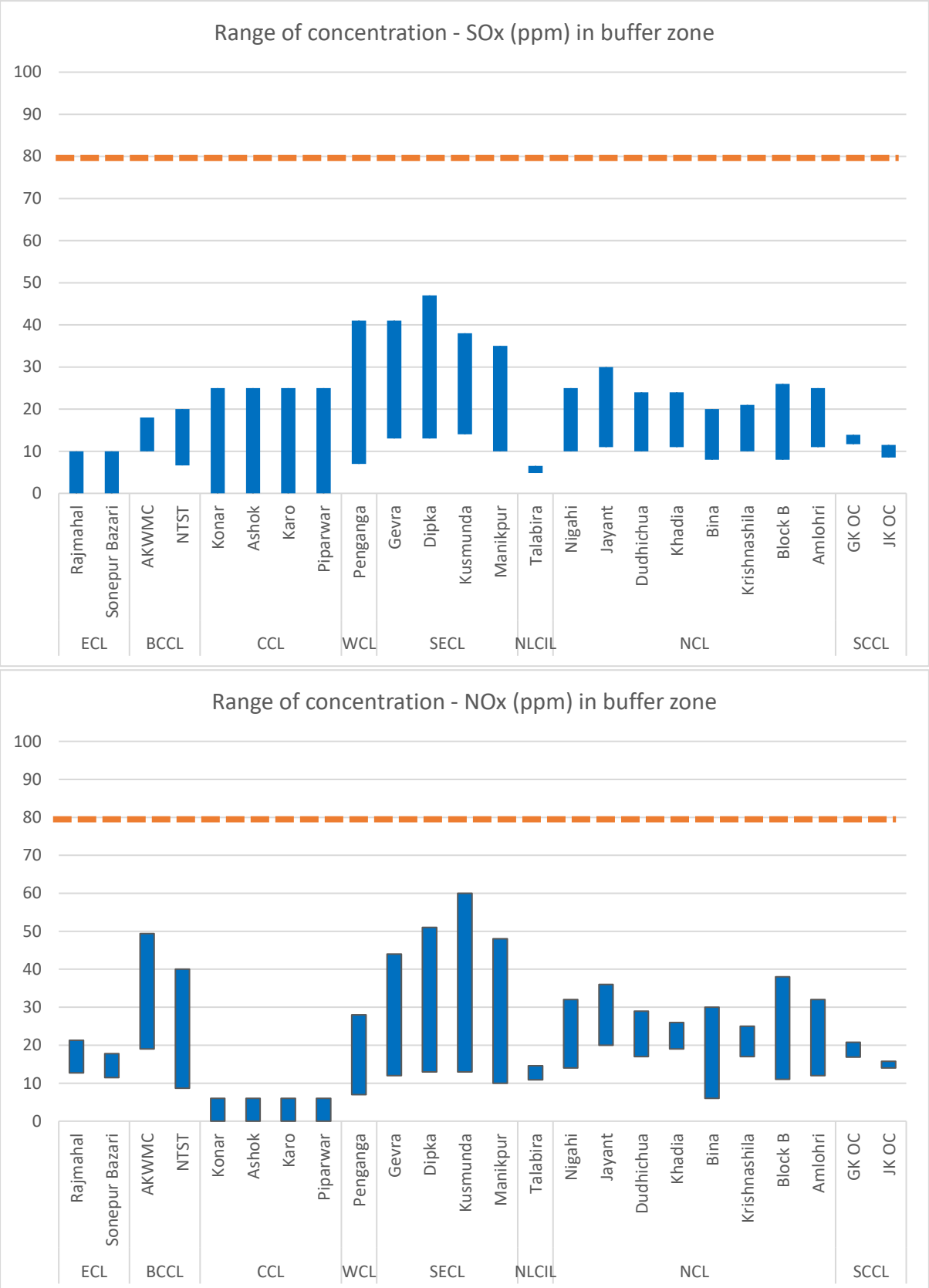


Figure 6.5: Range of concentration – SOx & NOx in buffer zone

Chapter VII: Status Environmental Sustainability – Water Regime

7.0 Status of Water

The brief status of mine water resource in terms of its quantity and quality for the year 2019-20 is presented below for the projects considered.

7.1 Quantitative Status of Mine Water Discharge

The details of mine water discharge volume vis-à-vis its utilization w.r.t the projects considered is given below:

Table 7.1: Status of Mine Water Utilization

Company/ Subsidiary	Name of the Mine	Quantity (in LKL/year)*				
		Mine Water Discharge	Mine Water used for project (industrial & domestic)	Utilization of mine water outside project community purpose		Towards recharge or stored in voids or discharge into water bodies
				Domestic/ drinking water	Irrigation water	
ECL	Rajmahal OCP	51.99	12.60	1.56	37.83	0.00
	Sonepur Bazari OCP	12.45	12.45	0.00	0.00	0.00
BCCL	AKWMC	15.14	2.22	5.94	0.00	4.95#
	NT-ST Expansion OCP	179.04	31.43	45.05	0.00	102.56
CCL	Karo Expansion OCP	0.71	0.05	0.00	0.00	0.66
	Konar Expansion OCP	3.45	1.14	0.00	0.00	2.31
	Magadh**	4.32	4.32	0.00	0.00	0.00
	Amrapali**	6.44	6.44	0.00	0.00	0.00
	Piparwar OCP	16.29	2.71	2.33	0.00	11.25
	Ashok OCP	2.92	1.98	0.54	0.00	0.40
WCL	Penganga OC	16.85	16.85	0.00	0.00	0.00
SECL	Gevra OCP	172.50	98.83	0.00	0.00	73.67
	Dipka OC	8.86	8.60	0.00	0.00	0.26
	Kusmunda OCP	31.73	20.78	0.00	10.95	0.00
	Manikpur OC Mine	15.51	2.06	0.00	11.35	2.10
NCL	Amlohri	25.87	25.87	0.00	0.00	0.00
	Bina	26.49	26.49	0.00	0.00	0.00
	Block B	11.31	11.31	0.00	0.00	0.00
	Dudhichua	12.62	12.62	0.00	0.00	0.00
	Jayant	41.75	41.75	0.00	0.00	0.00
	Jhingurda	8.99	8.99	0.00	0.00	0.00
	Kakri	5.39	5.39	0.00	0.00	0.00
	Khadia	20.23	20.23	0.00	0.00	0.00

Company/ Subsidiary	Name of the Mine	Quantity (in LKL/year)*				
		Mine Water Discharge	Mine Water used for project (industrial & domestic)	Utilization of mine water outside project community purpose		Towards recharge or stored in voids or discharge into water bodies
				Domestic/ drinking water	Irrigation water	
	Krishnashila	0.00	0.00	0.00	0.00	0.00
	Nigahi	27.37	27.37	0.00	0.00	0.00
MCL	Jagannath OC	9.60	9.60	0.00	0.00	0.00
	Ananta OCP	31.73	31.73	0.00	0.00	0.00
	Bhubaneswari OC	28.67	28.67	0.00	0.00	0.00
	Bharatpur OC	112.56	112.56	0.00	0.00	0.00
	Hingula OC	8.36	8.36	0.00	0.00	0.00
	Balaram OC	27.30	27.30	0.00	0.00	0.00
	Kaniha OC	19.14	19.14	0.00	0.00	0.00
	Lingaraj OC	25.42	25.42	0.00	0.00	0.00
	Samleswari OC	58.77	58.77	0.00	0.00	0.00
	Lajkura OC	29.35	29.35	0.00	0.00	0.00
	Belpahar OC	68.31	68.31	0.00	0.00	0.00
	Lakhanpur OCP	119.20	119.20	0.00	0.00	0.00
	Kulda OC	44.42	44.42	0.00	0.00	0.00
	Garjanbahal OC	6.97	6.97	0.00	0.00	0.00
SCCL	GK OC	18.92	11.27	0.00	7.62	0.03
	JK 5 OC	16.24	14.42	0.09	1.70	0.03
NLC	Talabira OCP	*No mine water generated from the mine during FY 2019-20*				

**Based on data under Status Report on Mine Water utilization for 2020-21.*

***Based on data from coal company*

#Losses of approx. 2.03 LKL excluded

7.1.1 Observations on Mine Water Dishcarge vis-à-vis Utilization

ECL: Mine water from Rajmahal OC is utilized for industrial and domestic use within project and balance for community use including domestic consumption and for irrigation. As for Sonepur Bazari OC, the mine water is utilized only for industrial and domestic use within project.

BCCL: Surplus water from AKWMC OCP and NT ST Expansion OCP helps in recharge of nearby water regime as well as fulfil domestic and agriculture needs of neighbouring villages. Prior to discharge of water outside the project, it is ensured that the quality of mine water conforms to the effluent quality standards prescribed by MoEFCC under Schedule –VI (Part A).

CCL: Surplus water from Ashoka OC, Piparwar OC, Karo OC and Knar OC helps in recharge of nearby water regime. Mine water from Piparwar OC and Ashok OC also caters to domestic demand of nearby communities. Prior to discharge of water outside the project, it is ensured that the quality of mine water conforms to the effluent quality standards prescribed by MoEF&CC under Schedule –VI (Part A). In Magadh and Amrapali OC, the mine water is utilized for industrial and domestic requirements within the project

NCL: There is no discharge of mine water outside the project. All mine water is utilized for project industrial and domestic requirements.

MCL: MCL OC mines are operating under zero discharge conditions; hence there is no discharge of mine water outside the projects.

SCCL: Surplus water from both projects is being discharged outside the project, which helps in recharge of nearby water regime as well as fulfil domestic and agriculture needs of neighbouring villages. Prior to discharge of water outside the project, it is ensured that the quality of mine water conforms to the effluent quality standards prescribed by MoEF&CC under Schedule –VI (Part A).

SECL: Surplus mine water from Gevra OC, Dipka OC and Manikpur OC helps in recharge of nearby water regime. Mine water from Kusmunda and Manikpur OC also contributes towards irrigation requirements of the nearby communities.

NLC: No mine water generated from Talabira OC mine during FY 2019-20.

WCL: There is no mine water being discharged outside the project. The mine water is utilized for industrial and domestic requirements within the project.

7.2 Status of Water Quality

The details on water quality and treatment facilities available in the projects are tabulated below:

Table 7.2: Status of Mine Water – Quality

Name of the Project	Quality of water discharge from mine		Heavy Metal Contamination Status	Details of treatment facility
	pH Range	TSS Range (in mg/l)		
Rajmahal OC	8.06 to 8.23	20 to 36	Nil	1. Oil & Grease Trap 2. Sedimentation Tank. 3. Lalmatia filtration Plant with 10,000 GPH pump capacity. 4. R.O Plant (2 in Nos.) in Urjanagar colony.
Sonepur Bajari OC	7.2 to 7.7	16 to 42	Nil	ETP available at workshop.
AKWMC OC	7.8 to 8.2	22 to 71		An oil and grease trap has constructed at AKWMC workshop. A filter plant is existing at Ramkanali
NT ST Expansion OC	7.8 to 8.2	23 to 74		01 no. of Oil & Grease Trap is installed at South Tisra Workshop. Also, 01 no of pressure filter plant at South Tisra Workshop
Ashoka OC	6.8 to 8.1	22 to 58	Nil	Mine water is collected in main mine sump which acts as a sedimentation pond
Amrapali OC	7.1 to 8.5	18 to 54	Nil	ETP available at workshop.
Magadh OC	7.6 to 8.4	30 to 78	Nil	Nil
Piparwar OC	6.7 to 8.1	22 to 80	Nil	Mine water is collected in main mine sump which acts as a sedimentation pond
Karo OC	7.8 to 8.4	20 to 52	Nil	Filter Plant for domestic water
Konar Expansion OC	7.7 to 8.4	22 to 74	Nil	Nil
Penganga OC	6.9 to 7.9	28 to 64	Nil	The mine sump accumulates strata seepage water and having dimension of 270 m x 90 m x 0.75 m. The accumulated water after it is pumped out, serve as the source of water in the mine premises. Further, Mine water is treated in sedimentation tank of dimension – Top - 23m x 14 m, Bottom – 20m x 11m and 1.5m height 28 KLD modular STP is provided in mining lease area for treatment of wastewater from office building.

Name of the Project	Quality of water discharge from mine		Heavy Metal Contamination Status	Details of treatment facility
	pH Range	TSS Range (in mg/l)		
Gevra OC	6.4 to 8.2	26 to 94	Nil	Water: 4.5 MLD Water Treatment Plant Wastewater: 3 MLD Domestic Effluent Treatment Plant Workshop Effluent: 210 KL Effluent Treatment Plant. 180 KL is Recycled & Reused.
Kusmunda OC	6.2 to 8.3	25 to 91	Nil	1. Domestic Effluent Treatment Plant / STP – 2000 KL/D 2. Effluent Treatment Plant / Oil & Grease Trap -10.4mx6.3mx3m 3. Two Sedimentation ponds of capacity 122mx35mx2m & 40mx60mx3m
Dipka OC	7.4 to 8.3	25 to 77	Nil	1. Effluent Treatment Plant of 110 KL/D at Workshop 2. Sewerage Treatment Plant of 3 MLD treating domestic waste water
Manikpur OC	6.2 to 7.6	25 to 81	Nil	Pressure filter plant for domestic supply STP for domestic sewage ETP for workshop wash-water
Nigahi OC	6.5 to 8.4	42 to 86	Nil	Industrial wastewater: The effluent from CHP and Workshop is being treated in two numbers of ETPs of 10.5 MLD & 4.0 MLD capacities respectively. Above treated effluent is reutilized for various industrial purposes like washing of HEMMs, dust suppression on Haul Roads, loading and unloading points, firefighting etc. Domestic Sewage: Sewage from township of Nigahi Project is being treated in STP (3.0 MLD) and then reutilized for horticulture work inside the township.
Jayant OC	6.9 to 8.9	38 to 106	Nil	2 nos. of ETP: • Mine ETP–32 MLD capacity for mine water • Combined ETP–8 MLD for effluent from CHP & workshop

Name of the Project	Quality of water discharge from mine		Heavy Metal Contamination Status	Details of treatment facility
	pH Range	TSS Range (in mg/l)		
				One domestic sewage treatment plant capacity – 4 MLD for colony sewerage and waste water
Dudhichua OC	6.9 to 8.7	36 to 84	Nil	One 30 MLD ETP and One 02 MLD STP are in operation.
Amlohri OC	5.8 to 8.8	29 to 93	Nil	ETP – 51 MTD STP – 2MLD
Khadia OC	6.7 to 8.6	40 to 112		• Sewage treatment plant for domestic sewage – Extended mechanized aeration process. • Treated water re-used for horticulture. • ETP for industrial effluent – clariflocculation process. Treated water re-used for sprinkling, HEMM washing, firefighting etc.
Bina OC	7.1 to 8.9	36 to 84	Nil	ETP – 31.2 MLD STP – 2.5 MLD
Krishnashila OC	7.2 to 8.9	38 to 76	Nil	Settling Pond with Oil & Grease Trap for Workshop Effluent
Block-B OC	6.2 to 8.8	36 to 82	Nil	STP: 0.8 MLD ETP: 8.6 MLD
Bhubaneswari OC	-	-	Nil	ETP & STP provided. ZLD is practiced, hence no water is discharged outside the mine.
Lakhanpur OC	6.1 to 7.0	20 to 84	Nil	A separate ETP along with Oil and Grease trap has been provided for the treatment of effluent. The treated water is being reused for dust suppression and industrial use. ZLD is practiced, hence no water is discharged outside the mine.
Lingaraj OC	-	-	Nil	Effluent Treatment Plant (ETP) comprising of Settling tanks, Oil & grease trap and clear water reservoir are available at Lingaraj OCP. Approximately, 70 KLD water is being used for vehicle washing. The waste water generated from vehicle washing is treated in ETP. 100% of clear water generated at ETP is reused for vehicle washing purpose.

Name of the Project	Quality of water discharge from mine		Heavy Metal Contamination Status	Details of treatment facility
	pH Range	TSS Range (in mg/l)		
				ZLD is practiced, hence no water is discharged outside the mine.
Bharatpur OC	-	-	Nil	For workshop: A separate ETP along with Oil and Grease trap has been provided for the treatment of workshop effluent. The treated water is being re-used for HEMM washing at workshop. 60KLD of wastewater is being treated and reused. The percentage of reuse is almost 75-85% excluding absorption and evaporation losses. For Sewage treatment: STP of 99 MLD capacity is provided in the colony for sewage treatment. The treated effluent is being discharged to paddy fields on demand of nearby villagers. Runoff and pumped out water is being collected in the large mine sumps where sediments in water gets settled down. ZLD is practiced, hence no water is discharged outside the mine.
Kulda OC	6.7 to 8.4	10 to 96	Nil	A separate ETP along with Oil and Grease trap has been provided for the treatment of effluent. The treated water is being diverted to the mine sump through drains, from where it is being reused for various industrial purposes under Kulda OCP. 100KLD of water is being treated and reused. The percentage of reuse is almost 50-60% excluding absorption and evaporation losses. ZLD is practiced, hence no water is discharged outside the mine.
Kaniha OC	-	-	Nil	To ensure optimum treatment of surface runoff water, catch drains and siltation ponds of sizes 70m x 30m x 2.5 m as pre sedimentation pond-I and 120m x 90m x 2.5m as Pre sedimentation pond-II has been constructed to collect the water and to provide some

Name of the Project	Quality of water discharge from mine		Heavy Metal Contamination Status	Details of treatment facility
	pH Range	TSS Range (in mg/l)		
				retention period initially. Then from these two ponds overflow water gets channelized in to an effluent treatment plant through a masonary drain where it then passes through a screening chamber of size 01m x 01m and then to a sedimentation tank of size 3.5m Dia x 3.35m depth. Alum dozing is done in flash mixer tank of size 2.0m dia x 3.10m with the help of alum/lime dozing equipment comprising alum/lime agitator consisting of SS Hollow shaft with SS paddles and driving arrangement having worm reduction gear with suitable HP electric motor for early settlement of solids. After flash mixing effluent is guided to sedimentation pond of size 115m x 88m x 2.5m. Final effluent is stored in the pond of of capacity 140m x 90m x 4m. ZLD is practiced, hence no water is discharged outside the mine.
Ananta OC	-	-	Nil	STP and ETP is provided. ZLD is practiced, hence no water is discharged outside the mine.
Hingula OC	-	-	Nil	STP and ETP is provided. ZLD is practiced, hence no water is discharged outside the mine.
Samaleswari OC	3.1 to 7.4	3.2 to 68	Nil	MDTP, ETP & STP ZLD is practiced, hence no water is discharged outside the mine.
Belpahar OC	6.2 to 7.06	5.6 to 64	Nil	STP and ETP is provided. ZLD is practiced, hence no water is discharged outside the mine.
Jagannath OC	-	-	Nil	• STP-of 1 MLD capacity for colony sewage treatment • ETP-140 cu.m per day for treatment of waste water of Work shop & CHP. • MDTP- 2 nos. for treatment of Mine water.

Name of the Project	Quality of water discharge from mine		Heavy Metal Contamination Status	Details of treatment facility
	pH Range	TSS Range (in mg/l)		
				IWSS-for drinking water treatment. ZLD is practiced, hence no water is discharged outside the mine.
Garjanbahal OC	-	-	Nil	Mine sump act as a sedimentation pond. ZLD is practiced, hence no water is discharged outside the mine.
Balram OC	-	-	Nil	STP and ETP is provided. ZLD is practiced, hence no water is discharged outside the mine.
Lajkura OC	3.3 to 7.05	8 to 44	Nil	A separate ETP along with Oil and Grease trap has been provided for the treatment of effluent. The treated water is being reused for dust suppression and industrial use. ZLD is practiced, hence no water is discharged outside the mine.
Gouthamkhani (GK) OCP	5.8 to 7.9	8 to 49	Nil	ETP Provided.
Jawahar Khani-5 (JK-5) OCP	6.3 to 8	6 to 18	Nil	ETP Provided.
Talabira OC		No mine water generated		

7.2.2 Observations on Water Quality

Two mines of MCL namely Samleshwari OC and Lajkura OC are having pH value less than the standard limit – however the projects are practicing zero liquid discharge (ZLD); there is no discharge of water outside the project. In these mines, the water is treated through proper lime dosing in MDTP prior to further utilization. Maximum TSS concentration monitored was found to be exceeding the prescribed limit at NCL in Jayant OC and Khadia OC. The graphical representation of the water quality parameters (pH & TSS) for the projects considered are shown below:

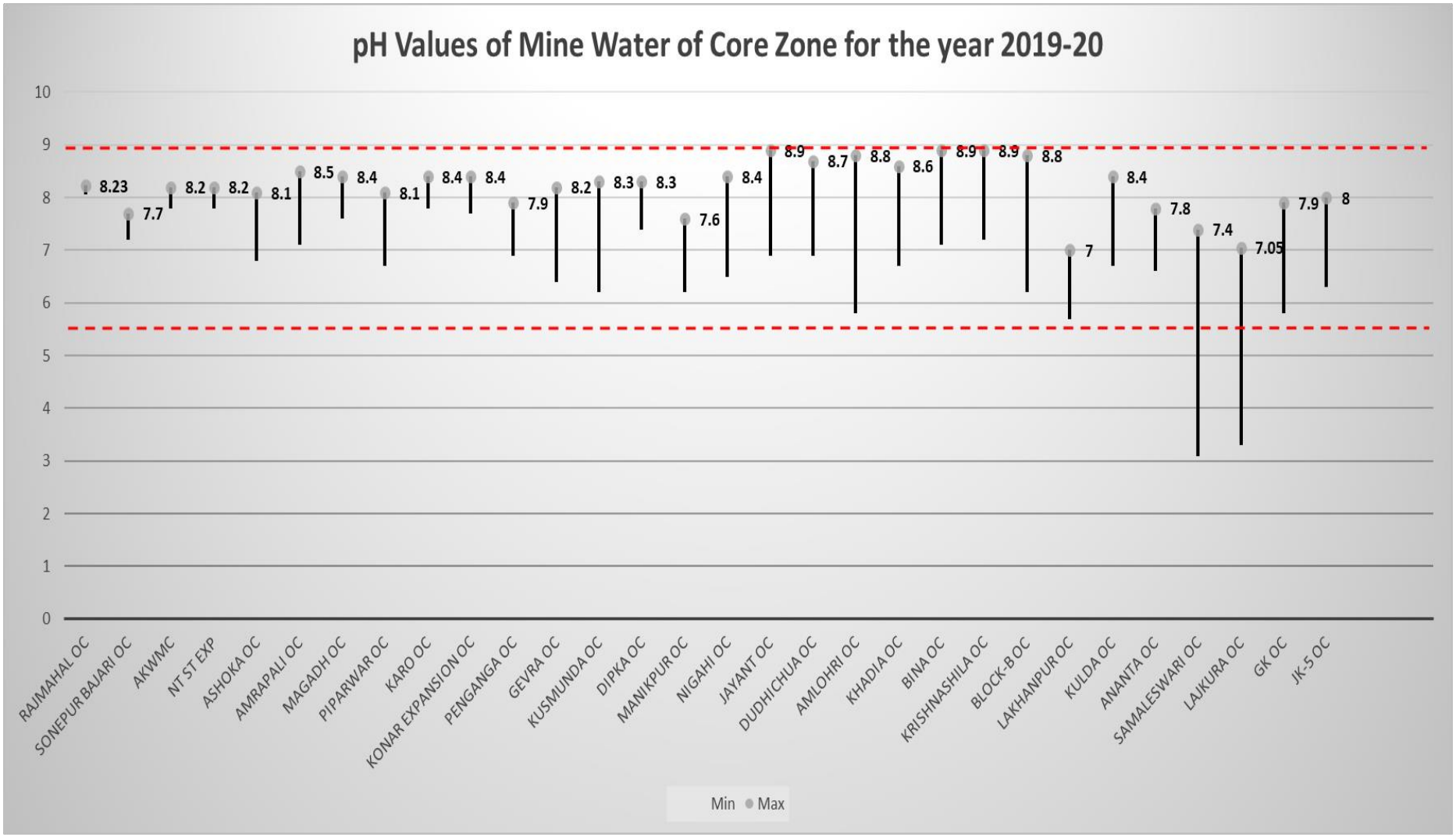


Figure 7.1: Graphical representation of pH values of mine water in core zone during 2019-20

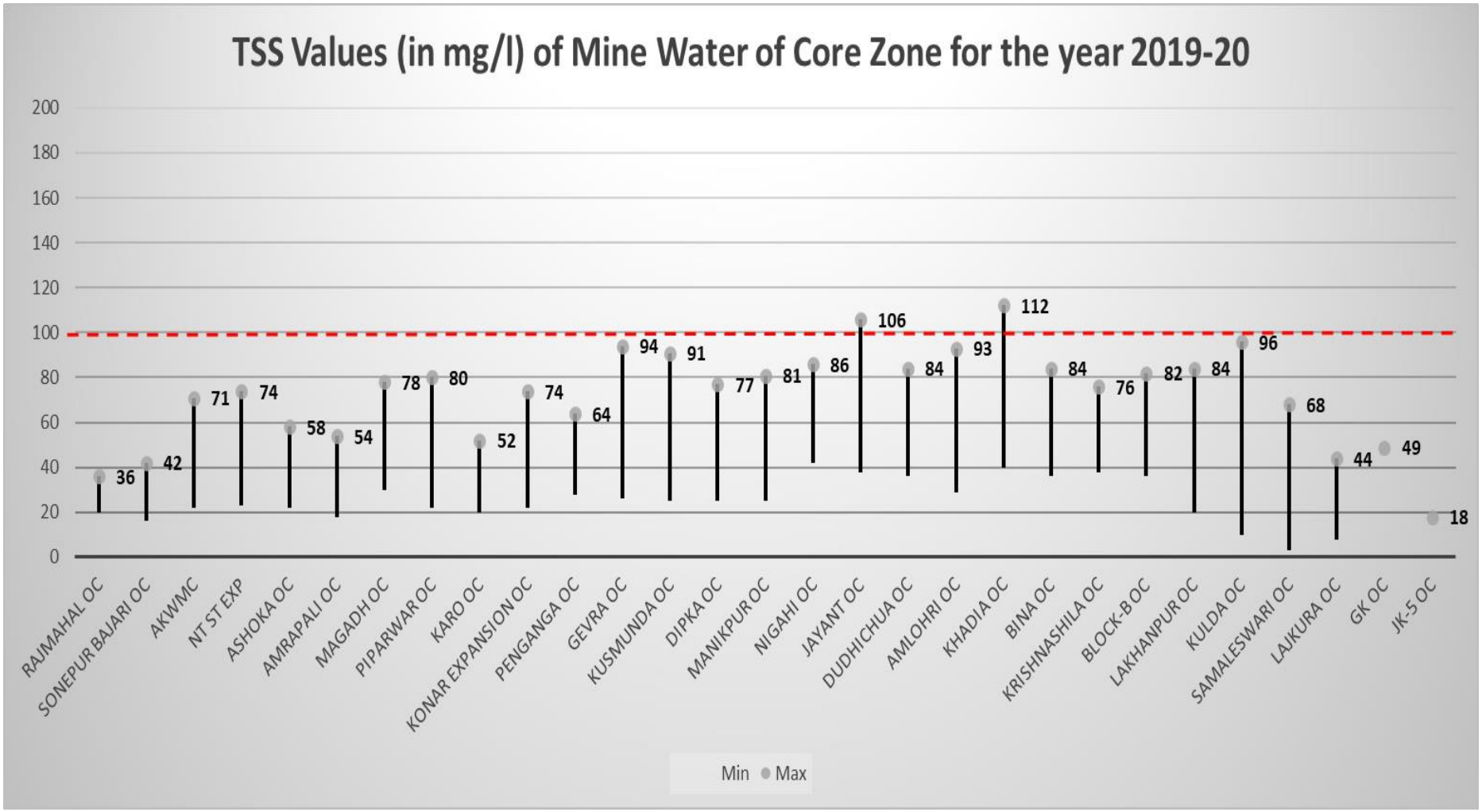


Figure 7.2: Graphical representation of TSS values of mine water in core zone during 2019-20

Few photographs showing efforts of water treatment and reuse in the projects considered are shown below:

Figure 7.3: Pressure Filter and RO Water Facility at Rajmahal Area, ECL

Figure 7.4: Renovation and beautification of pond under CSR by Amrapali Project

Figure 7.5: Utilization of mine water for water sprinkling in Piparwar OCP, CCL

Figure 7.6: Mine Water Sedimentation Tank at Penganga OCP, WCL

Figure 7.7: Domestic ETP plant at Kusmunda OCP, SECL

The quality of mine water has been observed to be generally good. Although low pH values were observed in a couple of MCL projects, it is to be noted that mines in MCL follow Zero Liquid Discharge (ZLD) and the water is treated and reused; there is no discharge of water outside the mines. TSS value is observed to be on the higher side in some of the mines of NCL, which needs to be addressed.

Chapter VIII: Status Environmental Sustainability – Mine Closure Aspects

8.0 Introduction

In order to manage the adverse impacts of mines on the environment, care is taken from the project formulation stage itself by integrating environmental concerns. However, the environmental issues arising on account of closure of mines are a recent phenomenon. It is pertinent to mention that economic and social impact of mine closure can be considerable for the countries where mining forms the backbone of the economic activities. In-spite of the long history of mining in India, no experience of mine closure planning was evident. Only the reclamation planning was attached to the detailed project reports prior to obtaining approval of mines.

“Closure" is a term used to describe a number of facets associated with the cessation of mining activities and the "shutting down" of a mine. It refers to actions that must be taken with regard to the physical infrastructure of a mine, actions around the natural environment and the socio-economic situation, measures that must be taken regarding the employees (labour issues) and the financial implications.

Closing a mine without adequate planning of post-mining activities may induce severe negative impacts on the environment in the post-closure stage. These impacts may be totally irreversible and may require a huge amount of money for their abatement. However, the potential post-closure effects can be economically met by following a cost-effective strategy developed through appropriate mine closure planning.

The concept of mine closure in India was introduced in the year 2003, through the Indian Bureau of Mines (IBM) coming up with mine closure guidelines for the mineral sector. The legal requirement of mine closure in coal sector was introduced in the year 2009 by the Ministry of Coal, Government of Indian coming up with mine closure guidelines for the coal mines. These guidelines were revised in 2013 and have been further revised in the year 2019.

8.1 Components of Mine Closure

The mine closure involves assessment of impacts of closing a mine, identification of engineering problems and determination of their solutions. The mine closure primarily includes progressive and final mine closure planning activities. The ***progressive mine closure plan*** identifies and includes the mine closure and other allied activities required to be executed continuously and sequentially during the entire period of mining operation since the inception of the project. The primary aim of progressive mine closure plan is to limit the disturbances as early as possible after it is created by mining activities. The ***final mine closure plan*** identifies and includes the mine closure and other allied activities required to be executed towards the end of mine life and may continue even after the final closure of mining activities till a

self-sustained ecosystem is created in and around the project area. Initially, the final mine closure plan is based on available inputs at the time of preparation and the likely future development in mines. Various projects are made on a broader horizon which may undergo subtle changes in course of execution of mining activities in future. The main components of mine closure are as under:

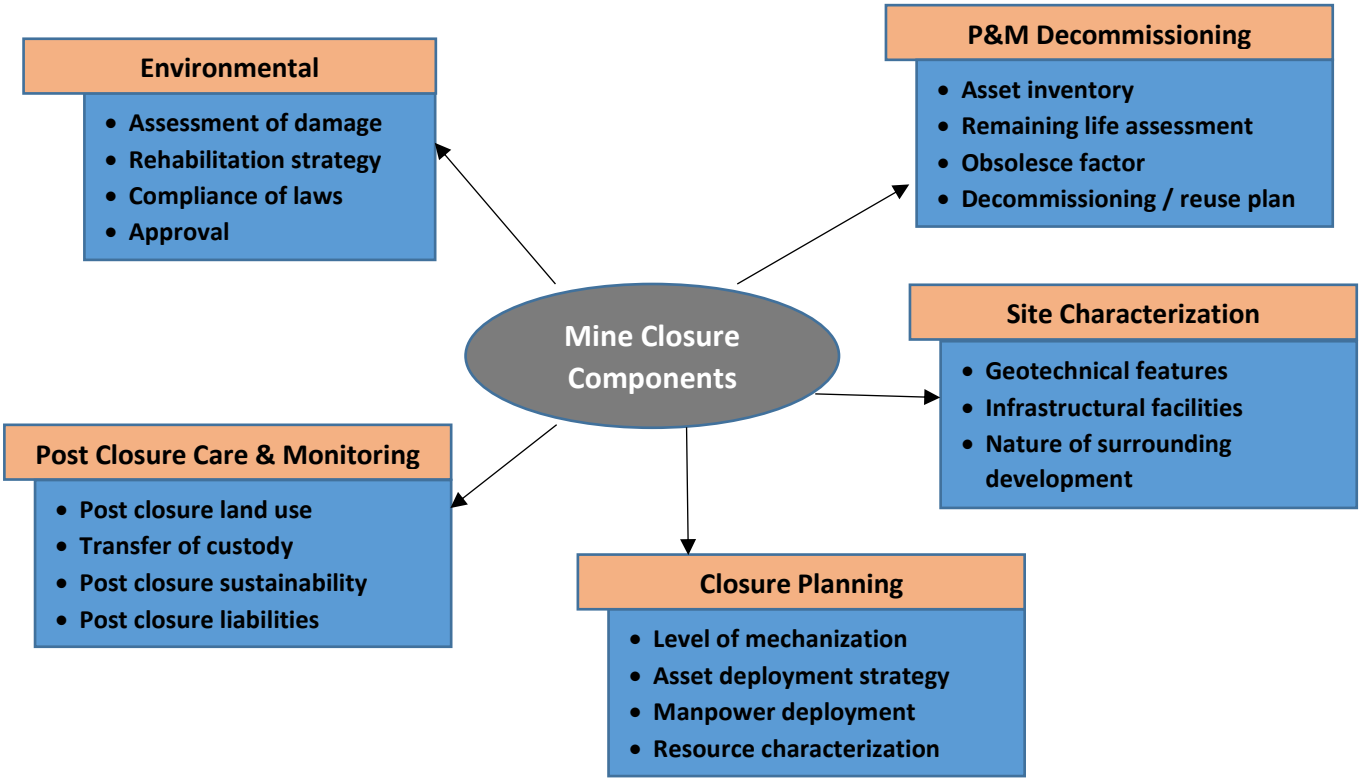


Figure 8.1: Mine Closure Components

8.2 Need for Mine Closure Plan

The mine closure plan provides that mining is to be carried out in a phased manner initiating afforestation/reclamation work in the mined out area of the first phase while commencing the mining in the second phase *i.e.* continuation of mining activities from one phase to other indicating the sequence of operations depending on the geo-mining conditions of the mines. It may thus be seen that it incorporates the provision of both progressive and final mine closure plan to leave the entire mining area in a safe and sustainable manner, so that it does not become a liability but a resource for the local community. The following issues as per guidelines issued by Ministry of Coal, Government of India, are required to be addressed in the mine closure plans:

1. Reclamation and rehabilitation of mined out land
2. Water quality management
3. Air quality management
4. Waste management

5. Management of coal rejects from washery
6. Decommissioning of Infrastructure
7. Disposal of mining machinery
8. Safety and security

Out of the above, the first issue *i.e.* reclamation and rehabilitation of mined out land assumes greater significance as it involves measures to be undertaken not only to end the footprint of mining on the land but also to render it into productive land usage so that it does not become a liability but a sustainable source of income to the society

The process of reclamation of mining areas includes many important considerations and is often far from simple. However, practices related to reclamation have improved significantly in recent years. Although the primary purpose of mine reclamation plan is usually to minimize the impact to the local environment after a mine is closed, the mine reclamation plans being made these days can encompass much more than just returning a mine site to its natural state. In fact some closed mines are now forests, farmlands, open spaces or public parks.

8.3 Status of Mine Closure Plan Preparation, deposition and reimbursement of Escrow fund

The mine closure plans for all operating mines of CIL, SCCL and NLCIL have been prepared and got approved in accordance with the Mine closure guidelines issued by MoC along with opening a fixed deposit Escrow Account with scheduled Bank for depositing annual mine closure cost as per approved Mine Closure Plan.

Coal Controllers' Office has been entrusted to perform the implementation and monitoring of Mine Closure activities of the mining areas as per approved Mine Closure plans (Progressive and Final) and certification of works is being done from Government Notified Institutes like CMPDIL / NEERI, Nagpur / ISM, Dhanbad / IIT KGP / IIEST, Shibpur regarding environment protection, complete safety zone fencing, expenditure incurred for protective and reclamation, rehabilitation works and opening up of Escrow Account.

Up to 31st December, 2020, A total of Rs 2684.38 Cr. has been deposited in Escrow Accounts of 40 considered coal mines of which Rs. 582.86 Cr. (around 22%) has been reimbursed against progressive/final mine closure activities from Escrow Accounts.

The mine closure fund deposited in the Escrow Account for each of the selected 40 projects of CIL/SCCL/NLC is as below:

Table 8.1: Status of amount deposited in escrow account

Company/ Subsidiary	Name of the mine	Escrow amount deposited as on 31.03.2020 (in Crores)	Escrow Amount released so far for implementation of progressive mine closure as on 31.03.2020 (in Crores)
ECL	Rajmahal OCP	129.33	20.38
ECL	Sonepuer Bazari OCP	75.48	12.14
BCCL	AKWMC	15.50	-
	NT-ST Expansion OCP	38.39	-
CCL	Karo Expansion OCP	18.53	3.50
CCL	Ashoka OC	62.11	12.01
CCL	Amrapali OC	34.68	0.00
CCL	Magadh OC	59.23	0.00
CCL	Piparwar OCP	133.34	50.55
CCL	Konar Expansion OCP	10.73	0.05
WCL	Penganga OC	29.27	*Not eligible in 19-20**
SECL	Gevra OC	13.84	*51.47*
SECL	Dipka OC	88.18	*33.22*
SECL	Manikpur OC	26.96	-
SECL	Kusmunda OC	61.02	*22.84*
NCL	Amlohri	67.29	33.29
NCL	Bina	63.42	36.96
NCL	Block B	41.53	18.50
NCL	Dudhichua	80.61	57.14
NCL	Jayant	135.40	110.14
NCL	Jhingurda	145.48	0.00
NCL	Kakri	97.76	30.43
NCL	Khadia	52.72	19.54
NCL	Krishnashila	37.74	7.04
NCL	Nigahi	88.59	37.52
MCL	Bhubaneswari OCP	55.94	1.90
MCL	Jagannath OCP	43.92	-
MCL	Ananta OCP	77.78	-
MCL	Bharatpur OCP	96.39	-
MCL	Hingula OCP	66.23	-
MCL	Balaram OCP	51.20	-
MCL	Lingaraj OCP	75.49	-
MCL	Kaniha OCP	35.24	-
MCL	Samaleswari OCP	94.63	24.26
MCL	Lajkura OCP	27.86	-
MCL	Lakhanpur	137.14	-
MCL	Belpahar	159.95	-
MCL	Kulda	32.82	-

Company/ Subsidiary	Name of the mine	Escrow amount deposited as on 31.03.2020 (in Crores)	Escrow Amount released so far for implementation of progressive mine closure as on 31.03.2020 (in Crores)
MCL	Garjanbahal	12.20	-
SCCL	GK OC	59.90	NIL
SCCL	JK 5	40.25	NIL
NLC	Talabira oC	10.32	NIL
Total		**2684.38**	**582.86**

**Penganga OC, WCL was not qualified for claim in 2019-20. The mine qualified in 2020-21 only and accordingly the progressive mine closure claim has been submitted and partial reimbursement has been made by CCO. Implementation of mine closure plans is effectively done in WCL and same has been duly certified by 3rd party auditors as well as accepted by CCO. WCL has put forth claim to CCO for 30 mines (14 OC & 16 UG) and could get reimbursement of approx. 495 crores for FY 19-20. WCL is also the 1st company to have successfully completed the Final Closure of Pathakhera-II UG mine in 2018-19; total escrow amount has been released and the account has been closed successfully.*

8.4 Status of execution of Mine closure activities

8.4.1 Project wise Status

In all the selected 40 projects, the progressive mine closure activities are undergoing as per their approved mine closure plans. The areas affected by mining activities are progressively reclaimed through technical reclamation followed by biological reclamation after topping with layer of top soil. In order to assess the status of progressive mine closure activities, the area disturbed by mining activities has been divided into three parts –active mining area, area under technical reclamation and biologically reclaimed area. The breakup of the working area in the 40 projects considered (37 projects of CIL, 2 projects of SCCL and 1 project of NLCIL) in terms of active mining area, total technically reclaimed area and total biologically reclaimed area, infrastructure area and undisturbed area is given in the figure below.

*Note: ***Green cover*** includes biologically reclaimed mined out area and OB dump area and plantation on other areas within mine lease but does not include plantation outside mine lease area.

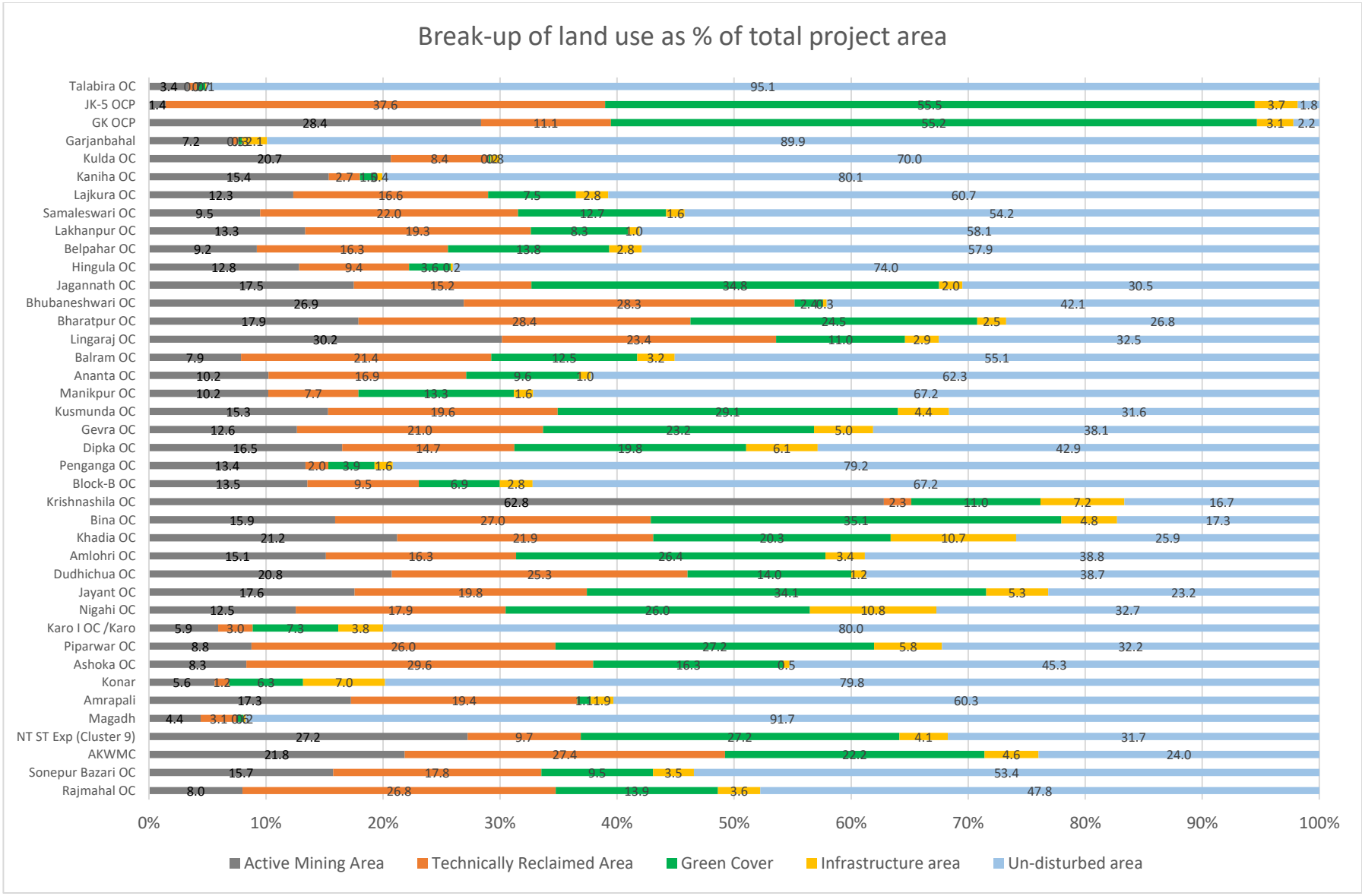


Figure 8.2(a): Break-up of land use as % of total project area

8.4.2 Overall status of Mine closure activities

The reclamation of mined out land is incorporated at the project planning stage itself and concurrent reclamation is carried out as the mining progresses. In the project planning stage, care is taken to disturb minimum extent of land as far as possible with least disturbance to the local community. Emphasis is given to have least external overburden dumps and maximize the internal dumping. For biological reclamation and plantation at other areas in the mine leasehold, massive afforestation is being undertaken by the mining companies.

Based on the details provided by the respective projects, the overall mine closure status indicates that 14% of the area is under active mining, 17% under technical reclamation, 17% green cover (including biological reclamation), 4% under Infrastructure area and balance 48 % of the project area comes under undisturbed areas. The same is represented graphically in the figure below.

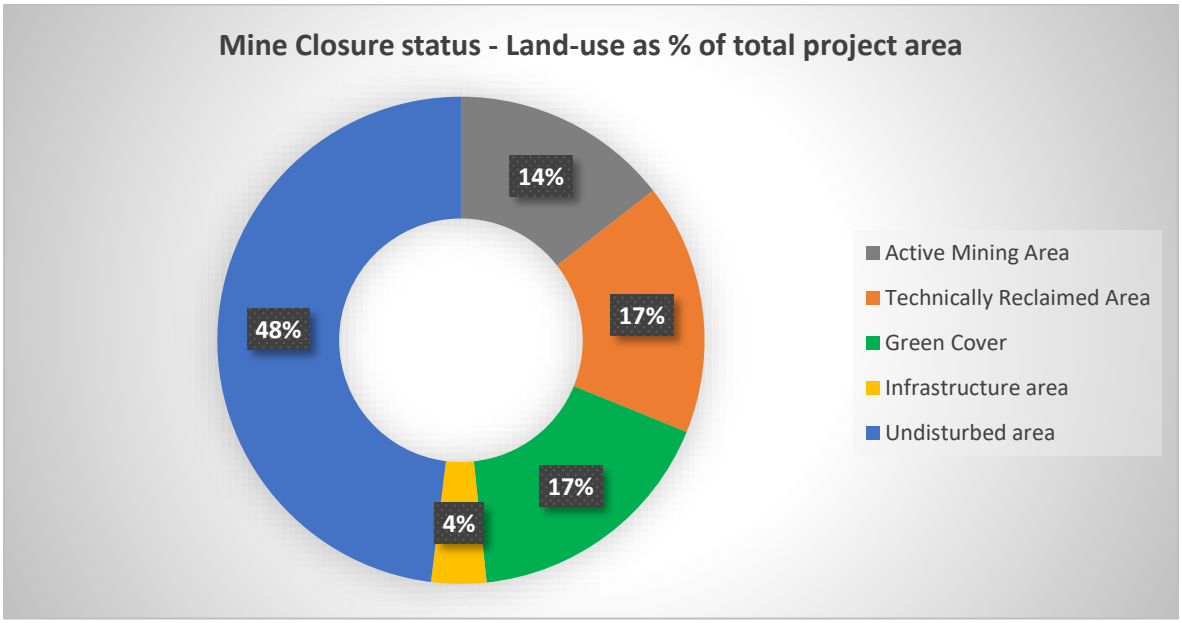


Figure 8.3(a): Mine Closure status – Land use as % of total project area

*Note: **The remote sensing data of 2018 is used for four projects namely AKWMC, Konar OC, Karo OC and Kaniha OC**. For other projects, 2020 remote sensing data is used. Cluster IX data has been used for NT ST Expansion project.*

*#**Green cover** includes biologically reclaimed mined out area and OB dump area and plantation on other areas.*

8.5 Plantation in Mines

Since inception, CIL has planted more than 99.6 million trees covering an area of approx. 39842 ha as on 31st March, 2020, SCCL has planted about 52.97 million trees covering an area of 12172 ha as on 30th November, 2019 and NLCIL has planted about 2.38 million trees covering approx. 1955.8 ha. Also, since Talabira II & III mine of NLCIL commenced its operation on 11.12.2019, plantation has not started. The subsidiary wise break-up for plantation done till 2019-20 is shown in the table below:

Table 8.2: Subsidiary wise break-up of plantation done by coal companies till 2019-20

Subsidiary wise break-up for plantation done by coal companies till 2019-20		
Subsidiary	**No. of plants (in million)**	**Land Area (in ha)**
ECL	8.34	3347.42
BCCL	4.56	3648.26
CCL	8.12	4970.67
NCL	24.40	7315.10
WCL	18.85	6855.75
SECL	27.79	11118.43
MCL	5.84	2356.00
NEC	1.72	230.42
CIL (Total)	**99.62**	**39842.05**
SCCL	52.97	12172.00
NLCIL	2.38	1955.81
Grand Total	**154.97**	**53969.86**

In the future also, CIL, NLCIL and SCCL are committed to undertaken plantation at appropriate places and thus participating in the national endeavour to achieve the target of 33% green cover as outlined in National Forest Policy, 1988.

8.6 Exploring Sustainable Post Mining Land Usage

Creating sustainable post-mining land usage poses a challenge to mine planners as well as environmental specialists in India. The need of the hour is to have deeper understanding of the physical and biological processes involved in restoration of soil quality so that the land can be developed as a sustainable source of income generation to the local community in the long run. It may be mentioned that expertise required for this purpose is not available with the mining companies therefore Government may consider creation of database at national level of qualified experts in this field.

In India, there is an excellent opportunity to use the mine pits as infrastructure for storage of mine water, which is of good quality. Government of India has taken various steps to create small ponds for storage of rain water for water security of the country. The mine pits can supplement the efforts of Government of India in creating additional water resources for benefit of the society at large. CIL is taking steps for water conservation and about 75% of water demand for industrial and domestic use in the mining projects is being met from the mine water. This has resulted into less fresh water intake from the natural water resources. CIL is likely to create on an additional water resource to the tune of 3.3 billion cubic meter from its opencast mines. The mine water is not acidic unlike western countries, conforms to the prescribed regulatory standards and provides us an opportunity for it's storage and use by various stakeholders. The mega coal mining projects offer a great potential for water conservation. In the mine closure plan, creation of water body is considered a priority for meeting the domestic and industrial requirement of the mine areas. Thus, additional water resources will get created and a clean potential source of potable water developed after mine closure. In the Indian context, this could be the best practice for mine void management seeing the growing domestic and industrial requirement and diminishing water resources. This will, in the long run, help in ensuring the water security of the country.

Chapter IX: Categorisation of Projects

9.0 Categorization of Projects

The mines were categorized into 'Excellent', 'Very Good' and 'Good' based on overall scoring. The scores were calculated based on the performance of the mines w.r.t the attributes namely – land use, air quality management, water quality and mine closure aspects.

The attribute wise categorization is explained hereunder.

9.1 Categorization w.r.t Land Use

The projects were scored based on the optimal management of active mine area and maximization of reclamation (technical and green cover) as compared to the total leasehold area. In case of projects where mining has commenced within the past 5 years, i.e. mines where production began post 2015, reclamation activities would not have commenced on a measurable scale. Hence such projects have been awarded full score by default.

Table 9.1: Basis of rating w.r.t Land Use

Basis of rating				
% Active mining area		**% Reclamation (Tech. reclamation + Green Cover)**		**Net Rating**
% Range	Score	Score Range	Score	Average of rating awarded to % active mining area and % reclamation (tech. reclamation + green cover)
20 & below	100	80 & above	100	
Between 20 & 40	80	Between 60 & 80	80	
Between 40 & 60	60	Between 40 & 60	60	
Between 60 & 80	40	Between 20 & 40	40	
80 & above	20	20 & below	20	

Table 9.2: Categorization of mines w.r.t Land Use

Category	Score	No. of Mines	Name of Mines
Excellent	80% and above	17	ECL - Rajmahal OC CCL - Ashoka OC, Piparwar OC, Magadh OC SECL – Gevra OC, Kusmunda OC NCL - Nigahi OC, Jayant OC, Amlohri OC, Bina OC WCL – Penganga OC MCL – Bharatpur OC, Jagannath OC, Garjanbahal OC

Category	Score	No. of Mines	Name of Mines
			SCCL – GK OC, JK-5 OC NLCIL – Talabira II & III OC
Very Good	60 - 79%	22	ECL – Sonepur Bazari OC BCCL – AKWMC, NTST Exp. CCL – Amrapali OC, Karo OC, Konar Exp. OC NCL – Block B OC, Dudhichua OC, Khadia OC, Krishnashila OC SECL - Dipka OC, Manikpur OC, MCL – Ananta OC, Balram OC, Lingaraj OC, Bhubaneshwari OC, Hingula OC, Belpahar OC, Lakhanpur OC, Samaleswari OC, Lajkura OC, Kaniha OC
Good	Below 60%	01	MCL – Kulda OC

9.2 Categorization w.r.t Air Quality Management

The projects were scored based on status of compliance of applicable standards of 4 major pollutants (PM_{10}, $PM_{2.5}$, SO_2 and NOx) in core and buffer zone.

Table 9.3: Basis of rating w.r.t Air Quality Management

Compliance of pollutant concentrations (PM_{10}, $PM_{2.5}$, SO_2 and NOx)	Score*
All 4 pollutants within prescribed statutory limits	100
3 pollutants within prescribed statutory limits	80
2 pollutants within prescribed statutory limits	60
Only 1 pollutant within prescribed statutory limits	40
No pollutant within prescribed statutory limits	20

**Final scoring calculated considering average scores of core and buffer zones.*

Table 9.4: Categorization of mines w.r.t Air Quality Management

Category	Score	No. of Mines	Name of Mines
Excellent	80% and above	14	ECL - Rajmahal OC, Sonepur Bazari OC BCCL – AKWMC, NTST Exp. CCL - Magadh OC, Amrapali OC NCL – Nigahi OC, Khadia OC, Block-B SECL – Manikpur OC MCL – Bhubaneshwari OC SCCL – GK OC, JK-5 OC NLCIL – Talabira OC

Category	Score	No. of Mines	Name of Mines
Very Good	60 - 79%	26	CCL - Konar OC, Ashoka OC, Piparwar OC, Karo OC NCL –Jayant OC, Dudhichua OC, Amlohri OC, Bina OC, Krishnashila OC, MCL – Ananta OC, Balram OC, Lingaraj OC, Bharatpur OC, Jagannath OC, Hingula OC, Belpahar OC, Lakhanpur OC, Samaleswari OC, Lajkura OC, Kaniha OC, Kulda OC, Garjanbahal OC WCL - Penganga OC SECL - Dipka OC, Gevra OC, Kusmunda OC
Good	Below 60%	Nil	-

9.3. Categorization w.r.t Water Quality

The projects were scored based on status of compliance of applicable standards of 2 major pollutants (PH and TSS) in the mine water discharge.

Table 9.5: Basis of rating w.r.t Water Quality

Compliance of pollutant concentrations (pH and TSS)	Score
Both pH & TSS within prescribed statutory limits	100
Either pH / TSS within prescribed statutory limits	60
Neither pH / TSS within prescribed statutory limits	20

Table 9.6: Categorization of mines w.r.t Water Quality

Category	Score	No. of Mines	Name of Mines
Excellent	80% and above	36	ECL - Rajmahal OC, Sonepur Bazari OC BCCL - AKWMC, NTST Exp. CCL - Magadh OC, Amrapali OC, Konar OC, Ashoka OC, Piparwar OC, Karo OC WCL - Penganga OC NCL - Nigahi OC, Amlohri OC, Dudhichua OC, Bina OC, Krishnashila OC, Block-B OC MCL - Ananta OC, Balram OC, Lingaraj OC, Bharatpur OC, Bhubaneshwari OC, Jagannath OC, Hingula OC, Belpahar OC, Lakhanpur OC, Kaniha OC, Kulda OC, Garjanbahal OC SECL - Gevra OC, Dipka OC, Manikpur OC, Kusmunda OC SCCL - JK-5 OC, GK OC

Category	Score	No. of Mines	Name of Mines
			NLCIL - Talabira OC
Very Good	60 - 79%	04	NCL – Jayant OC, Khadia OC MCL - Samaleswari OC, Lajkura OC
Good	Below 60%	Nil	-

9.4. Categorization w.r.t Mine Closure Aspects

The projects were scored based on conduction of mine closure activities as per an approved mine closure plan and percentage of land reclaimed in comparison to total area under mining influence. In case of projects where mining has commenced within the past 5 years, i.e. mines where production began post 2015, reclamation activities and associated mine closure would not have commenced on a measurable scale. Hence such projects have been awarded full score by default.

Table 9.7: Basis of rating w.r.t Mine Closure Aspects

Approved Mine Closure Plan and Escrow Fund and corresponding rating		Status of percentage of land reclaimed (Technically reclaimed area + Green Cover) / (Active Mining Area + Tech. reclaimed area + Green Cover) and corresponding rating		Net Score
Criteria	Score	Criteria	Score	Average of ratings awarded for mine closure and % land reclaimed
If MCP approved	100	80 and above	100	
		70 – 79	80	
If MCP not approved	20	60 – 69	60	
		50 – 59	40	
		<50	20	

Table 9.8: Categorization of mines w.r.t Mine Closure Aspects

Category	Score	No. of Mines	Name of Mines
Excellent	80% and above	31	ECL - Rajmahal OC, Sonepur Bazari OC BCCL – AKWMC CCL - Magadh OC, Ashoka OC, Piparwar OC, Karo OC NCL - Nigahi OC, Amlohri OC, Jayant OC, Dudhichua OC, Khadia OC, Bina OC, Krishnashila OC SECL - Gevra OC, Dipka OC, Manikpur OC, Kusmunda OC WCL - Penganga OC MCL - Ananta OC, Balram OC, Bharatpur OC, Jagannath OC, Belpahar OC, Lakhanpur OC, Samaleswari OC, Lajkura OC, Garjanbahal OC

Category	Score	No. of Mines	Name of Mines
			SCCL - JK-5 OC, GK OC NLCIL - Talabira II & III OC
Very Good	60 - 79%	09	BCCL - NTST Exp. CCL - Amrapali OC, Konar OC NCL - Block-B OC MCL - Lingaraj OC, Bhubaneshwari OC, Hingula OC, Kaniha OC, Kulda OC
Good	Below 60%	Nil	-

9.5 Overall Categorization

Scores obtained on 4 attributes (land use, air quality, water quality and mine closure aspects) were added to arrive at the overall rating of the mines.

Table 9.9: Basis of overall rating

Score (Out of 100)	Rating
80 and above	5 (Excellent)
60 to 79	4 (Very Good)
40 to 59	3 (Good)
20 to 39	2
Below 20	1

Table 9.10: Overall categorization of mines

Overall Rating of Mines			
Category	**Score**	**No. of Mines**	**Name of Mines**
Excellent	80% and above	24	ECL - Rajmahal OC, Sonepur Bazari OC BCCL - AKWMC, NTST Exp. CCL - Amrapali OC, Ashoka OC, Piparwar OC, Magadh OC NCL - Nigahi OC, Amlohri OC, Bina OC, Krishnashila OC, SECL - Gevra OC, Manikpur OC, Kusmunda OC MCL - Balram OC, Bharatpur OC, Jagannath OC, Belpahar OC, Garjanbahal OC WCL - Penganga OC SCCL - JK-5 OC, GK OC NLCIL – Talabira OC

Overall Rating of Mines			
Category	**Score**	**No. of Mines**	**Name of Mines**
Very Good	60 - 79%	16	CCL - Konar OC, Karo OC NCL - Jayant OC, Khadia OC, Dudhichua OC, Block-B OC SECL – Dipka OC MCL – Ananta OC, Lingaraj OC, Lakhanpur OC, Hingula OC, Bhubaneshwari OC, Samaleswari OC, Lajkura OC, Kaniha OC, Kulda OC
Good	Below 60 %	Nil	-

Table 9.11: Ratings and Scoring – attribute wise and overall

Subsidiary	Projects	Scoring				
		Land	Air	Water	Mine Closure	Overall
ECL	Rajmahal OC	80	80	100	92	88
ECL	Sonepur Bazari OC	70	80	100	82	83
BCCL	AKWMC	70	90	100	85	86
BCCL	NT ST Exp (cluster 9)	60	90	100	79	82
CCL	Magadh	100	80	100	100	95
CCL	Amrapali	70	80	100	77	82
CCL	Konar	60	60	100	79	75
CCL	Ashoka OC	80	60	100	92	83
CCL	Piparwar OC	80	60	100	93	83
CCL	Karo OC	60	60	100	82	75
NCL	Nigahi OC	80	80	100	89	87
NCL	Jayant OC	80	70	60	88	74
NCL	Dudhichua OC	60	70	100	83	78
NCL	Amlohri OC	80	70	100	87	84
NCL	Khadia OC	70	80	60	83	73
NCL	Bina OC	90	70	100	90	87
NCL	Krishnashila OC	70	70	100	85	81
NCL	Block-B OC	60	80	100	77	79
WCL	Penganga OC	100	60	100	100	90
SECL	Dipka OC	70	60	100	84	78
SECL	Gevra OC	80	70	100	89	85
SECL	Kusmunda OC	80	70	100	88	85
SECL	Manikpur OC	70	80	100	84	83
MCL	Ananta OC	70	60	100	86	79
MCL	Balram OC	70	60	100	91	80
MCL	Lingaraj OC	60	60	100	77	74
MCL	Bharatpur OC	80	60	100	87	82
MCL	Bhubaneshwari OC	60	80	100	77	79
MCL	Jagannath OC	80	60	100	87	82
MCL	Hingula OC	60	60	100	75	74
MCL	Belpahar OC	70	60	100	88	80
MCL	Lakhanpur OC	70	60	100	84	78
MCL	Samaleswari OC	70	60	60	89	70
MCL	Lajkura OC	70	60	60	83	68
MCL	Kaniha OC	60	60	100	61	70
MCL	Kulda OC	50	60	100	65	69
MCL	Garjanbahal	100	60	100	100	90
SCCL	GK OCP	80	90	100	89	90
SCCL	JK-5 OCP	80	90	100	88	89
NLCIL	Talabira OC	100	90	100	100	98

Table 9.12: Comparison with status of projects during SDC report for FY 2018-19

		Status as per SDC report 2018-19		Status as per SDC report 2019-20	
		Attribute – Land			
Category	**Score**	**No. of Mines**	**Name of Mines**	**No. of Mines**	**Name of Mines**
Excellent	**80% and above**	11	CCL - Ashoka OC, Piparwar OC SECL – Gevra OC, Kusmunda OC NCL - Nigahi OC, Jayant OC, Amlohri OC, Bina OC MCL – Bharatpur OC, Samaleswari OC, Jagannath OC	17	ECL - Rajmahal OC CCL - Ashoka OC, Piparwar OC, Magadh OC SECL – Gevra OC, Kusmunda OC NCL - Nigahi OC, Jayant OC, Amlohri OC, Bina OC WCL – Penganga OC MCL – Bharatpur OC, Jagannath OC, Garjanbahal OC SCCL – GK OC, JK-5 OC NLCIL – Talabira II & III OC
Very Good	**60 - 79%**	23	ECL - Rajmahal OC, Sonepur Bazari OC CCL – Amrapali OC, Magadh OC, Karo OC, Konar Expansion OC WCL - Penganga OC SECL - Dipka OC, Manikpur OC NCL – Dudhichua OC, Khadia OC, Block B OC, Krishnashila OC MCL - Bhubaneswari OC, Lakhanpur OC, Lingaraj OC, Kaniha OC, Ananta OC, Hingula OC, Belpahar OC, Garjanbahal OC, Balram OC, Lajkura OC	22	ECL – Sonepur Bazari OC BCCL – AKWMC, NTST Exp. CCL – Amrapali OC, Karo OC, Konar Exp. OC NCL – Block B OC, Dudhichua OC, Khadia OC, Krishnashila OC SECL - Dipka OC, Manikpur OC, MCL – Ananta OC, Balram OC, Lingaraj OC, Bhubaneshwari OC, Hingula OC, Belpahar OC, Lakhanpur OC, Samaleswari OC, Lajkura OC, Kaniha OC

		Status as per SDC report 2018-19		Status as per SDC report 2019-20	
Good	**Below 60%**	1	MCL - Kulda OC	01	MCL – Kulda OC
		Attribute - Air			
Category	**Score**	**No. of Mines**	**Name of Mines**	**No. of Mines**	**Name of Mines**
Excellent	**80% and above**	4	ECL – Sonepur Bazari OC, Rajmahal OC NCL - Krishnashila OC MCL - Bhubaneswari OC	14	ECL - Rajmahal OC, Sonepur Bazari OC BCCL – AKWMC, NTST Exp. CCL - Magadh OC, Amrapali OC NCL – Nigahi OC, Khadia OC, Block-B SECL – Manikpur OC MCL – Bhubaneshwari OC SCCL – GK OC, JK-5 OC NLCIL – Talabira OC
Very Good	**60 - 79%**	31	CCL - Amrapali OC, Magadh OC, Karo OC, Konar Expansion OC, Ashoka OC, Piparwar OC WCL - Penganga OC SECL - Dipka OC, Manikpur OC, Kusmunda OC, Gevra OC NCL - Block-B OC, Dudhichua OC, Khadia OC, Amlohri OC, Bina OC, Jayant OC, Nigahi OC, MCL - Kulda OC, Kaniha OC, Lajkura OC, Hingula OC, Lingaraj OC, Lakhanpur OC,	26	CCL - Konar OC, Ashoka OC, Piparwar OC, Karo OC NCL –Jayant OC, Dudhichua OC, Amlohri OC, Bina OC, Krishnashila OC, MCL – Ananta OC, Balram OC, Lingaraj OC, Bharatpur OC, Jagannath OC, Hingula OC, Belpahar OC, Lakhanpur OC, Samaleswari OC, Lajkura OC, Kaniha OC, Kulda OC, Garjanbahal OC WCL - Penganga OC

		Status as per SDC report 2018-19		Status as per SDC report 2019-20	
			Samaleswari OC, Garjanbahal OC, Belpahar OC, Ananta OC, Bharatpur OC, Jagannath OC, Balram OC		SECL - Dipka OC, Gevra OC, Kusmunda OC
Good	**Below 60%**	Nil	-	Nil	-
		Attribute - Water			
Category	**Score**	**No. of Mines**	**Name of Mines**	**No. of Mines**	**Name of Mines**
Excellent	**80% and above**	23	ECL - Sonepur Bazari OC, Rajmahal OC CCL - Amrapali OC, Magadh OC, Karo OC, Konar Expansion OC, Ashoka OC, Piparwar OC WCL - Penganga OC SECL - Dipka OC, Manikpur OC, Kusmunda OC, Gevra OC NCL - Jayant OC, Nigahi OC MCL - Kulda OC, Hingula OC, Lingaraj OC, Lakhanpur OC, Garjanbahal OC, Belpahar OC, Ananta OC, Bhubaneswari OC	36	ECL - Rajmahal OC, Sonepur Bazari OC BCCL - AKWMC, NTST Exp. CCL - Magadh OC, Amrapali OC, Konar OC, Ashoka OC, Piparwar OC, Karo OC WCL - Penganga OC NCL - Nigahi OC, Amlohri OC, Dudhichua OC, Bina OC, Krishnashila OC, Block-B OC MCL - Ananta OC, Balram OC, Lingaraj OC, Bharatpur OC, Bhubaneshwari OC, Jagannath OC, Hingula OC, Belpahar OC, Lakhanpur OC, Kaniha OC, Kulda OC, Garjanbahal OC SECL - Gevra OC, Dipka OC, Manikpur OC, Kusmunda OC SCCL - JK-5 OC, GK OC NLCIL - Talabira OC
Very Good	**60 - 79%**	11	NCL - Block-B OC, Dudhichua OC, Khadia OC, Amlohri OC, Bina OC, Krishnashila OC MCL - Kaniha OC, Lajkura OC, Samaleswari OC, Jagannath OC, Balram OC	04	NCL – Jayant OC, Khadia OC MCL - Samaleswari OC, Lajkura OC

		Status as per SDC report 2018-19		Status as per SDC report 2019-20	
Good	**Below 60%**	1	MCL - Bharatpur OC	Nil	-
		Attribute – Mine Closure			
Category	**Score**	**No. of Mines**	**Name of Mines**	**No. of Mines**	**Name of Mines**
Excellent	**80% and above**	25	ECL - Rajmahal OC, Sonepur Bazari OC, CCL - Karo OC, Konar Expansion OC, Ashoka OC, Piparwar OC, SECL - Dipka OC, Manikpur OC, Kusmunda OC, Gevra OC NCL - Dudhichua OC, Khadia OC, Amlohri OC, Bina OC, Krishnashila OC, Jayant OC, Nigahi OC MCL - Lajkura OC, Belpahar OC, Bharatpur OC, Samaleswari OC, Jagannath OC, Lakhanpur OC, Ananta OC, Balram OC	31	ECL - Rajmahal OC, Sonepur Bazari OC BCCL – AKWMC CCL - Magadh OC, Ashoka OC, Piparwar OC, Karo OC NCL - Nigahi OC, Amlohri OC, Jayant OC, Dudhichua OC, Khadia OC, Bina OC, Krishnashila OC SECL - Gevra OC, Dipka OC, Manikpur OC, Kusmunda OC WCL - Penganga OC MCL - Ananta OC, Balram OC, Bharatpur OC, Jagannath OC, Belpahar OC, Lakhanpur OC, Samaleswari OC, Lajkura OC, Garjanbahal OC SCCL - JK-5 OC, GK OC NLCIL - Talabira II & III OC
Very Good	**60 - 79%**	10	CCL – Amrapali OC, Magadh OC WCL - Penganga OC SECL - Kulda OC,	09	BCCL - NTST Exp. CCL - Amrapali OC, Konar OC NCL - Block-B OC

		Status as per SDC report 2018-19		Status as per SDC report 2019-20	
			NCL - Block-B OC, MCL - Kaniha OC, Garjanbahal OC, Hingula OC, Lingaraj OC, Bhubaneswari OC		MCL - Lingaraj OC, Bhubaneshwari OC, Hingula OC, Kaniha OC, Kulda OC
Good	**Below 60%**	Nil	-	Nil	-
Overall rating					
Category	**Score**	**No. of Mines**	**Name of Mines**	**No. of Mines**	**Name of Mines**
Excellent	**80% and above**	11	ECL - Rajmahal OC, Sonepur Bazari OC CCL - Ashoka OC, Piparwar OC, Konar Expansion OC SECL - Kusmunda OC, Gevra OC NCL - Jayant OC, Nigahi OC MCL – Lakhanpur OC, Ananta OC	24	ECL - Rajmahal OC, Sonepur Bazari OC BCCL - AKWMC, NTST Exp. CCL - Amrapali OC, Ashoka OC, Piparwar OC, Magadh OC NCL - Nigahi OC, Amlohri OC, Bina OC, Krishnashila OC, SECL - Gevra OC, Manikpur OC, Kusmunda OC MCL - Balram OC, Bharatpur OC, Jagannath OC, Belpahar OC, Garjanbahal OC WCL - Penganga OC SCCL - JK-5 OC, GK OC NLCIL – Talabira OC
Very Good	**60 - 79%**	24	CCL – Amrapali OC, Magadh OC, Karo OC WCL – Penganga OC SECL – Dipka OC, Manikpur OC	16	CCL - Konar OC, Karo OC NCL - Jayant OC, Khadia OC, Dudhichua OC, Block-B OC SECL – Dipka OC

		Status as per SDC report 2018-19		Status as per SDC report 2019-20	
			NCL – Dudhichua OC, Amlohri OC, Khadia OC, Bina OC, Block-B OC, Krishnashila OC MCL – Bhubaneswari OC, Lingaraj OC, Bharatpur OC, Kulda OC, Kaniha OC, Hingula OC, Samaleswari OC, Belpahar OC, Jagannath OC, Garjanbahal OC, Balram OC, Lajkura OC		MCL – Ananta OC, Lingaraj OC, Lakhanpur OC, Hingula OC, Bhubaneshwari OC, Samaleswari OC, Lajkura OC, Kaniha OC, Kulda OC
Good	**Below 60%**	Nil	-	Nil	-

Chapter X: Conclusion and Way Forward

10.0 Conclusion and way forward for sustainable development

Based on the details covered in the previous sections, the status of environment in the projects considered with regard to land, air environment, water environment and mine closure aspects have been summarized hereunder.

10.1 Land Use

From the data available for 37 major mines of CIL, 02 major mines of SCCL and 01 mine of NLCIL the following information with respect to status of land use is inferred:

Table 10.1: Summary regarding status of land

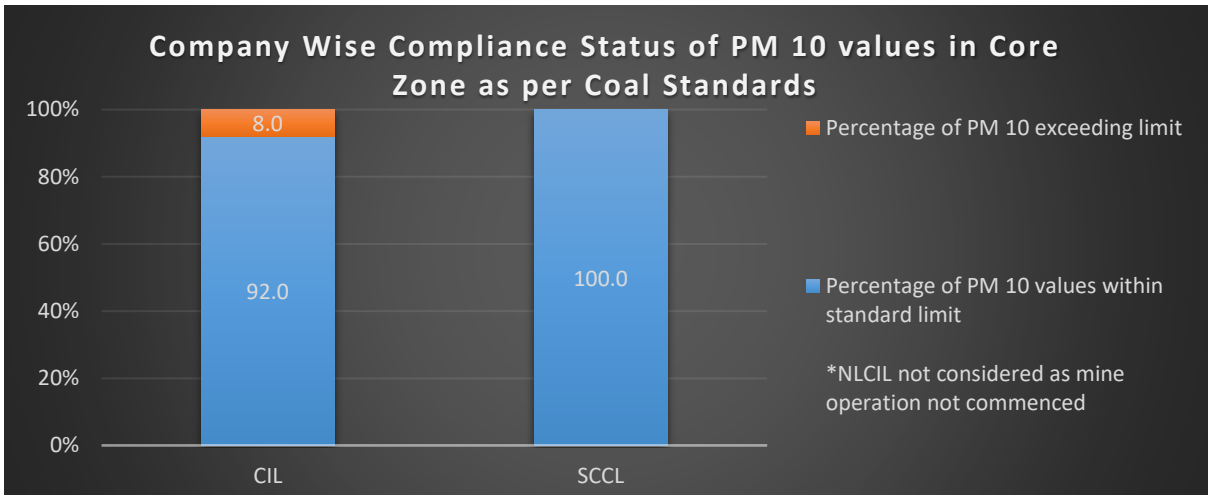
Subsidiary	Status of Land w.r.t total mine lease area (in %)		
	Active Mining Area	Technically Reclaimed	Green Cover
ECL	12.4	21.7	11.4
BCCL	25.7	14.8	25.8
CCL	7.6	13.0	9.6
NCL	18.9	18.7	23.8
WCL	13.4	2.0	3.9
SECL	13.4	16.9	21.5
MCL	13.7	17.0	10.0
SCCL	18.9	20.4	55.3
NLCIL	3.4	0.7	0.7

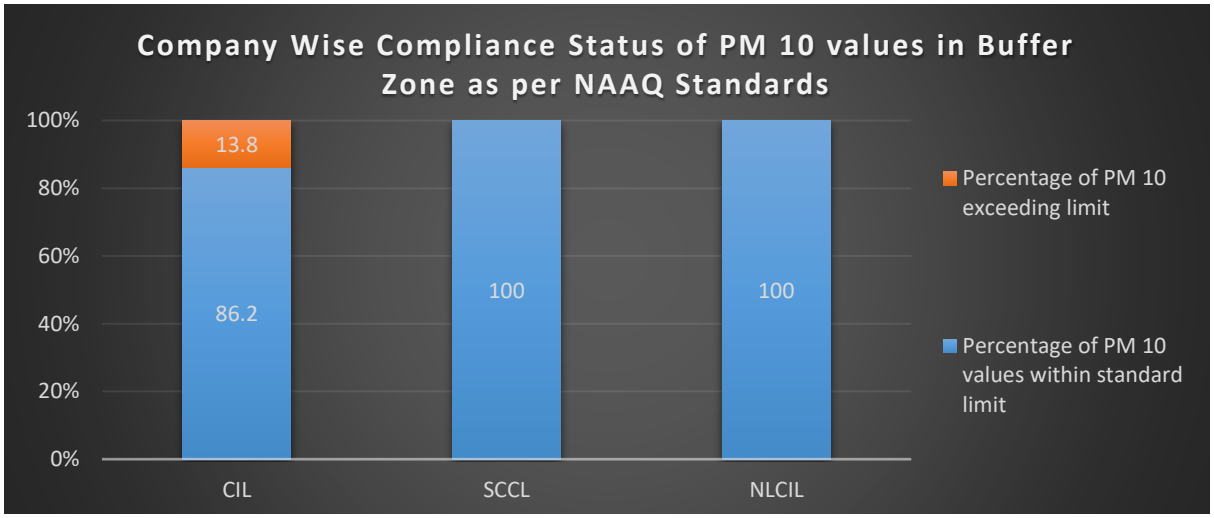
The above data reveals that active mining area in the selected mines of CIL is 7-26% whereas in SCCL approx. 19% and in NLCIL approx. 3.4% area is under active mining. It is evident therefore that on an average, the active mining area is increasing and subsidiaries are taking necessary steps for technical and biological reclamation of mined out area. This is a good trend and the same should continue. In every subsidiary, there is increase in land reclamation area from 2019 to 2020 as per the remote sensing data. In WCL and NLCIL, reclamation is to be taken up in Penganga OCP and Talabira II & III OCP after the mine advances sufficiently for start of back-filling.

Since inception, CIL has planted more than 99.6 million trees covering an area of approx. 39842 ha as on 31st March, 2020, SCCL has planted about 52.97 million trees covering an area of 12172 ha as on 30th November, 2019 and NLCIL has planted about 2.38 million trees covering approx. 1955.8 ha.

10.2 Ambient Air Quality Status

Based on the information available for air quality monitoring in the projects, the following can be summarized:





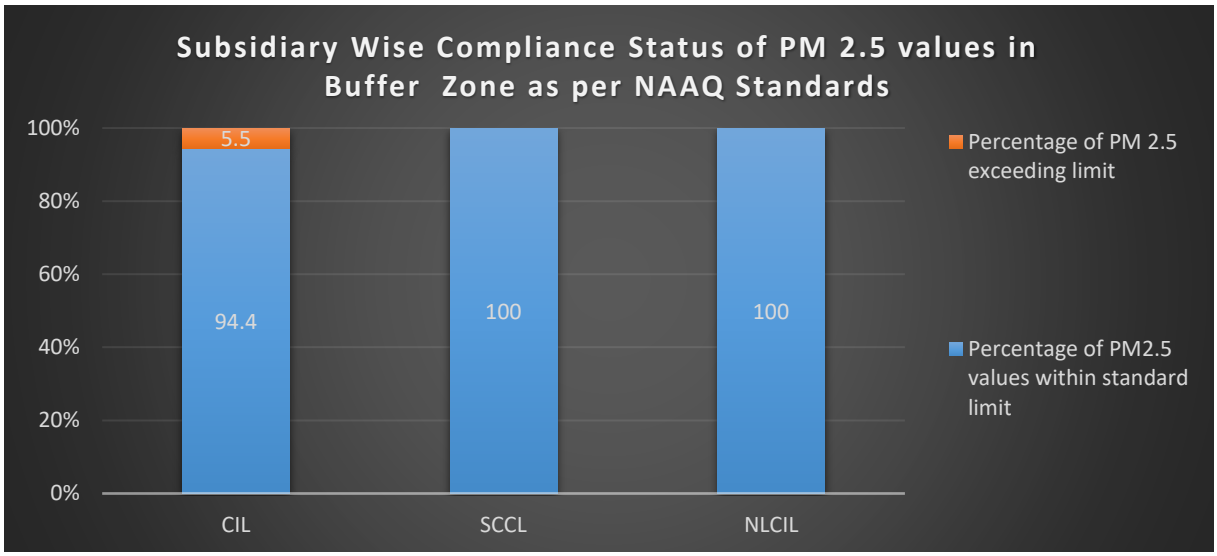


Figure 10.1: Summary regarding air environment

10.3 Water utilization and quality status

The status of water resources of coal sector in India is provided below.

Table 10.2: Status of water resource of coal sector in India for selected coal mines

Subsidiary	Status of Mine Water Utilisation (in %)	Status of Mine Water Quality	
	Utilisation for its own consumption (industrial + domestic)	**pH Range**	**TSS (mg/L) (Max. conc. Reported)**
ECL	38.9	7.2 to 8.2	42
BCCL	17.3	7.8 to 8.2	74
CCL	48.8	6.8 to 8.5	80
WCL	100.0	6.9 to 7.9	64
SECL	57.0	6.2 to 8.3	94
NCL	100.0	5.8 to 8.9	112
MCL	100.0	3.1* to 8.4	96
SCCL	73.1	6.3 to 8	49

***MCL mines operate under zero mine water discharge to outside areas and reuse for its own consumption*

The data reveals that coal sector is gainfully utilizing the mine water that gets accumulated in the mine sump during mining operations. This lessens the dependence on the river water resources and thus helps in conservation of water. The quality of mine water in general is good and this provides a golden opportunity for the coal sector for conservation and reuse of mine water. The surplus water is being provided to nearby community and also for recharge of surrounding water regime as per data of samples mines. This will help to a great extent in ensuring sustainability of coal mining. The lowest value of pH in MCL was observed to be 3.1. However, all mines of MCL are operating under zero mine water discharge and use the mine water for internal consumption after proper lime dosing treatment in MDTPs. The value of TSS was observed to be exceeding the prescribed limit in NCL. This requires close monitoring by NCL in future for its adverse impact, if any, on the surrounding and requisite treatment.

10.4 Mine Closure

The mine closure for all the mines selected for study has been prepared and contribution is being made towards escrow fund.

In all the selected 40 projects, the progressive mine closure activities are undergoing as per their approved mine closure plans. The areas affected by mining activities are progressively reclaimed through technical reclamation followed by biological reclamation after topping with layer of top soil. The overall mine closure status indicates that 14% of the area is under active mining, 17% under technical reclamation, 17% under biological reclamation, 4% under infrastructure area and 48% of the project area comes under undisturbed areas. Thus, the progress of mine closure

activities has been good and coal companies are taking necessary steps for technical and biological reclamation of mined out area.

Consequent upon provision for reimbursement of escrow fund introduced in MCP Guidelines, 2013, subsidiaries have started making claim for reimbursement of escrow fund based on mine closure audit report from designated agencies. The progress of progressive mine closure activities is being audited every five years therefore keeping track of mine closure activities is required at more frequent interval for monitoring.

10.5 Way Forward

Based on the environmental status of samples mines, following is suggested for sustainable coal mining in India:

i. It has been reported that in coal mining areas, about 60-70% of contribution of particulate matter comes from transportation activities. Coal companies are already on the path to eliminate road transportation through introduction of belt conveyors as First Mile Connectivity (FMC) projects.
ii. Development of Eco-parks in every subsidiary is proposed to showcase the reclamation efforts by subsidiary for multiple use with aesthetic values and sustainable post closure.
iii. Promoting alternative use of OB material should be explored for economic benefit in terms of land management and sale of excess OB material. This will minimise the requirement of river sand for stowing.
iv. The Coal companies should also promote renewable energy uses for their domestic and industrial purposes. Dependence on reliable renewable source of energy should be explored. CIL has commissioned rooftop solar projects in its companies which generated 4.83 MW of solar energy. In SCCL, 10.17 MW of Solar energy has been installed while in NLCIL, 1370 MW of solar capacity and 51 MW of Wind energy is installed.
v. Development of thick and intensive green belt around the mine lease boundary, ecologically important sites, human habitation, water bodies etc. should be taken up right from beginning of mines and bamboo plantation be promoted in open areas where mining operations will come after later years should be taken up in all the coal companies.
vi. Area level air quality management plans are required for improvement of air quality. There is a need to increase the dust suppression measures, plantation at strategic points, wind barrier and installation of vertical greenery system.
vii. The areas where deterioration of air quality may be due to significant contribution from other industries, source apportionment studies must be carried out to demonstrate the actual contribution from coal mining. Based on this report, suitable ameliorative measures may be planned and implemented.
viii. The surplus water should be utilised for community purposed like irrigation, domestic use *etc.* This should also be utilised for recharge of surrounding water regime. The mine water in coal mines, in general, is of good quality and this is being utilised for meeting the water requirement of coal mines.
ix. The mine voids may be suitably developed for water conservation. This could be a best practice for utilisation of mine voids in our country. The mine voids

may be utilised as infrastructure for water conservation. Such infrastructure is getting created automatically during course of mining without additional expenditure and need to be promoted.

x. Since the activities for mine closure continues throughout the life of the mine, an inbuilt mechanism requires to be developed for its monitoring. This will help to keep the mine closure activities on the track and avoid possible slippages during its implementation.

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SDC Status Report for 2019-20: Format for information circulated to coal companies

Table 1: Status of Coal Mines as on 31.03.2020							
Name of subsidiary		OC	UG	Mixed	Total	Mine leasehold area (in ha)	States where mines are located
	Running mines						
	Closed mines						
	Total						

Table 2: Break up of mine lease area											
Subsidiary	Mine	Total mine lease area	Break-up wihtin mine lease area								Outside mine lease area
			Active mining area	Area Technically Reclaimed (without plantation)	Area reclaimed Technically and Biologically (With Plantation)	Total Reclaimed area	Other plantation (apart from Biologically reclaimed area)	Infratructure Area	Undisturbed Area	Other Areas, if any (like Mine sumps etc.)	Plantation Done outside Mine Lease Area
		should match (D + E + F + H + I + J+k)				(E) + (F)					

Table 3: Break up of mine lease area as per forest/non forest land

Subsidiary	Mine	Forest Area	Non-Forest Area	Total mine lease area
				(L) + (M)

Table 4: Ambient Air Quality Data for FY 2019-20

Data required in MS EXCEL format - Air quality data as submitted to SPCB (Fortnightly readings w.r.t AAQ taken during FY 2019-20) along with name of stations , whether station is located in core / buffer zone, standards applicable for each station (please clarify in case station is located within cluster of mines - overlapping of core and buffer zones)

Sr. No.	Subsidiary	Name of Mine	Month	Name of Sampling Station	Core / Buffer (standards applicable)	PM 10	PM 2.5	SO2	NOx
			Apr-19						
			May-19						
			Jun-19						
			Jul-19						
			Aug-19						
			Sep-19						
			Oct-19						

			Nov-19						
			Dec-19						
			Jan-20						
			Feb-20						
			Mar-20						

Table 5: Quantitative Status of Mine Water Disharge

		Quantity for FY 2019-20 (in cu.m/day)			Details of utilizaion of mine water outside project	
Subsidiary	Name of the Project	Mine Water Discharge	Mine Water used for project (industrial & domestic)	Utilization of water outside project	No. of Community Beneficiaries using mine water	Irrigated Land using mine water (in ha)

Table 6: Status of Mine Water – Quality

Data required in MS EXCEL format - Water quality data as submitted to SPCB for FY 2019-20, along with name of sampling station

Subsidiary	Name of the Project	Month	Name of sampling station	Quality of water discharge from mine		Heavy Metal Contamination Status *(in Case of pH of water being outside permissible range, please indicate results of heavy metal analysis also)*	Details of treatment facility		
							ETP Details (name, capacity of units, etc.)	STP Details	RO Facility
				pH Range	**TSS Range (in mg/l)**				

Table 7: Status of Noise Monitoring Data

Data required in MS EXCEL format - Noise monitoring data as submitted to SPCB for period FY 2019-20, along with name of sampling station

Subsidiary	Name of the Project	Month	Name of sampling station	Measured Noise levels in Leq dB(A)		

Table 8: Details of mine closure escrow fund

Subsidiary	Name of the Project	Escrow amount deposited as on 31.03.2020	Escrow Amount released so far for implementation of progressive mine closure as on 31.03.2020

Table 9: Details of renewable energy installations				
Subsidiary	**Name of the Project**	**Solar Power capacity**	**Others (wind / other renewables, if any)**	
		Installed capacity as on 31.03.2020	**Installed capacity as on 31.03.2020**	

Table 10: Details of planned production	
Name of subsidiary	Production Capacity (MTY) planned for FY 2020-21

STANDARDS FOR COAL MINES

Notification No. GSR 742(E), Dt: 25th September 2000

(Stipulated by Ministry of Environment and Forests (MoEF), New Delhi)

1. Air Quality Standards

The Suspended Particulate Matter (SPM), Respirable Particulate Matter (RPM), Sulphur dioxide (SO_2) and Oxides of Nitrogen (NOx) concentration in downwind direction considering predominant wind direction, at a distance of 500 metres from the following dust generation sources shall not exceed the standards specified in the Table I, II and III given below:

Dust Generating Sources:

Loading or unloading, Haul road, coal transportation road, Coal handling plant (CHP), Railway sliding, Blasting, Drilling, Overburden dumps, or any other dust generating external sources like coke ovens (hard as well as soft), briquette industry, nearby road etc.

Table - I

Category	Pollutant	Time weighted average	Concentration in Ambient Air	Method of Measurement
1	2	3	4	5
I New Coal Mines (Coal Mines commenced operation after the date of publication of this notification)	Suspended Particulate Matter (SPM)	Annual Average * 24 hours **	360 µg/m^3 500 µg/m^3	– High Volume Sampling (Average flow rate not less than 1.1 m^3/min)
	Respirable Particulate Matter (size less than 10 µm) (RPM)	Annual Average * 24 hours **	180 µg/m^3 250 µg/m^3	– Respirable Particulate Matter sampling and analysis
	Sulphur Dioxide (SO_2)	Annual Average * 24 hours **	80 µg/m^3 120 µg/m^3	– Improved West and Gaeke method – Ultraviolet fluorescene
	Oxide of Nitrogen as NO_2	Annual Average * 24 hours **	80 µg/m^3 120 µg/m^3	– Jacob & Hochheiser Modified (Na-Arsenic) Method – Gas phase Chemiluminescence

Table - II

Category	Pollutant	Time weighted average	Concentration in Ambient Air	Method of Measurement
1	2	3	4	5
II **Existing Coal Mines** (Which commenced operation prior to the date of publication of this notification)	Suspended Particulate Matter (SPM)	Annual Average * 24 hours **	430 µg/m^3 600 µg/m^3	– High Volume Sampling (Average flow rate not less than 1.1 m^3/minute)
	Respirable Particulate Matter (size less than 10 µm) (RPM)	Annual Average * 24 hours **	215 µg/m^3 300 µg/m^3	– Respirable Particulate Matter sampling and analysis
	Sulphur Dioxide (SO_2)	Annual Average * 24 hours **	80 µg/m^3 120 µg/m^3	– Improved West and Gaeke method Ultraviolet fluorescene
	Oxide of Nitrogen as NO_2	Annual Average * 24 hours **	80 µg/m^3 120 µg/m^3	– Jacob & Hochheiser Modified (Na-Arsenic) Method – Gas phase Chemilumine-scence

Note:

** Annual Arithmetic mean for the measurements taken in a year, following the guidelines for frequency of sampling laid down in clause 2.*

*** 24 hourly / 8 hourly values shall be met 92% of the time in a year. However, 8% of the time it may exceed but not on two consecutive days.*

Unauthorised construction shall not be taken as a reference of nearest residential or commercial place for monitoring.

In case any residential or commercial or industrial place falls within 500 metres of any dust generating sources, the National Ambient Air Quality Standards notified under schedule VII shall be applicable.

Frequency of Sampling

– Air quality monitoring at a frequency of once in a fortnight at the dust generating sources given in clause 1 shall be carried out.

– As a result of monthly monitoring, if it is found that the value of the pollutant is less than 50% of the specified standards for three consecutive months, then the sampling frequency may be shifted to two days in a quarter year (3 months).

– In case, the value has exceeded the specified standards, the air quality sampling shall be done twice a week. If the results of four consecutive weeks indicate that the concentration of pollutants is within the specified standards, then fortnight monitoring may be reverted to.

2. Effluent Standards

The standards for effluent discharge into sewer or stream or land, are given below:

PH	:	5.5 to 9.0
Chemical Oxygen Demand (COD)	:	250 mg/l
Total Suspended Solids (TSS)	:	100 mg/l 200 mg/l (Land for irrigation)
Oil & Grease (O & G)	:	10 mg/l

(Monitoring frequency of these parameters shall be once in a fortnight)

Optional parameters: All other parameters indicated in the general standards for discharge of environment pollutants under Schedule VI, shall be in addition to the effluent standards specified under clause 3.

(Monitoring frequency shall be once in a year for the optional parameters)

3. Noise Level Standards

Time duration	:	6.00 AM - 10.00 PM	10.00 PM - 6.00 AM
Noise level	:	Leq 75 dB(A)	Leq 75 dB(A)

(Monitoring frequency for noise level shall be once in a fortnight)

Occupational exposure limit of noise specified by Director General of Mines Safety (DGMS) shall be complied with by the local mines.

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NATIONAL AMBIENT AIR QUALITY STANDARDS
CENTRAL POLLUTION CONTROL BOARD
NOTIFICATION

New Delhi, the 18th November, 2009

No.B-29016/20/90/PCI-L—In exercise of the powers conferred by Sub-section (2) (h) of section 16 of the Air (Prevention and Control of Pollution) Act, 1981 (Act No. 14 of 1981), and in super session of the Notification No(s). S.O. 384(E), dated 11th April, 1994 and S.O. 935(E), dated 14th October, 1998, the Central Pollution Control Board hereby notify the National Ambient Air Quality Standards with immediate effect, namely:-

NATIONAL AMBIENT AIR QUALITY STANDARDS

S. No.	Pollutant	Time Weighted average	Concentration in Ambient Air		Methods of Measurement
			Industrial, Residential, Rural and Other Area	Ecologically sensitive area (notified by Central Govt.)	
(1)	(2)	(3)	(4)	(5)	(6)
1	Sulphur Dioxide (SO_2), $\mu g/m^3$	Annual*	50	20	• Improved West and Geake • Ultraviolet fluorescence
		24 hours**	80	80	
2	Nitrogen Dioxide (NO_2), $\mu g/m^3$	Annual*	40	30	• Modified Jacob & Hochheiser (Na-Arsenite) • Chemiluminescence
		24 hours**	80	80	
3	Particulate Matter (size less than 10 μm) or $PM_{10} \mu g/m^3$	Annual*	60	60	• Gravimetric • TOEM • Beta attenuation
		24 hours**	100	100	
4	Particulate Matter (size less than 2.5 microns) or $PM_{2.5}$ $\mu g/m^3$	Annual*	40	40	• Gravimetric • TOEM • Beta attenuation
		24 hours**	60	60	
5	Ozone (O_3) $\mu g/m^3$	8 hours **	100	100	• UV photometric • Chemiluminescence • Chemical method
		1 hour **	180	180	
6	Lead (Pb) $\mu g/m^3$	Annual*	0.5	0.5	• ASS / ICP method after sampling on EPM 2000 or equivalent filter paper • ED – XRF using Teflon filter
		24 hours**	1.0	1.0	

(1)	(2)	(3)	(4)	(5)	(6)
7	Carbon Monoxide (CO) mg/m^3	8 hours**	2	2	Non Dispersive Infra RED (NDIR) Spectroscopy
		1 hour**	4	4	
8	Ammonia (NH_3) $\mu g/m^3$	Annual*	100	100	• Chemiluminescence • Indophenol blue method
		24 hours**	400	400	
9	Benzene (C_6H_6) $\mu g/m^3$	Annual*	5	5	• Gas chromatography based continuous analyser • Adsorption and desorption followed by GC analysis
10	Benzo (a) Pyrene (BaP) – particulate phase only ng/m^3	Annual*	1	1	Solvent extraction followed by HPLC / GC analysis
11	Arsenic (As) ng/m^3	Annual*	6	6	AAS / ICP method after sampling on EPM 2000 or equivalent filter paper
12	Nickel (Ni) ng/m^3	Annual*	20	20	AAS / ICP method after sampling on EPM 2000 or equivalent filter paper

***** Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

****** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

Note: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.