सत्यमेव जयते

Ministry of Coal

Sustainable Development Cell

Status of Environmental Sustainability in Coal Mines in 2020-21

Prepared & Submitted by CMPDI (November, 2022)

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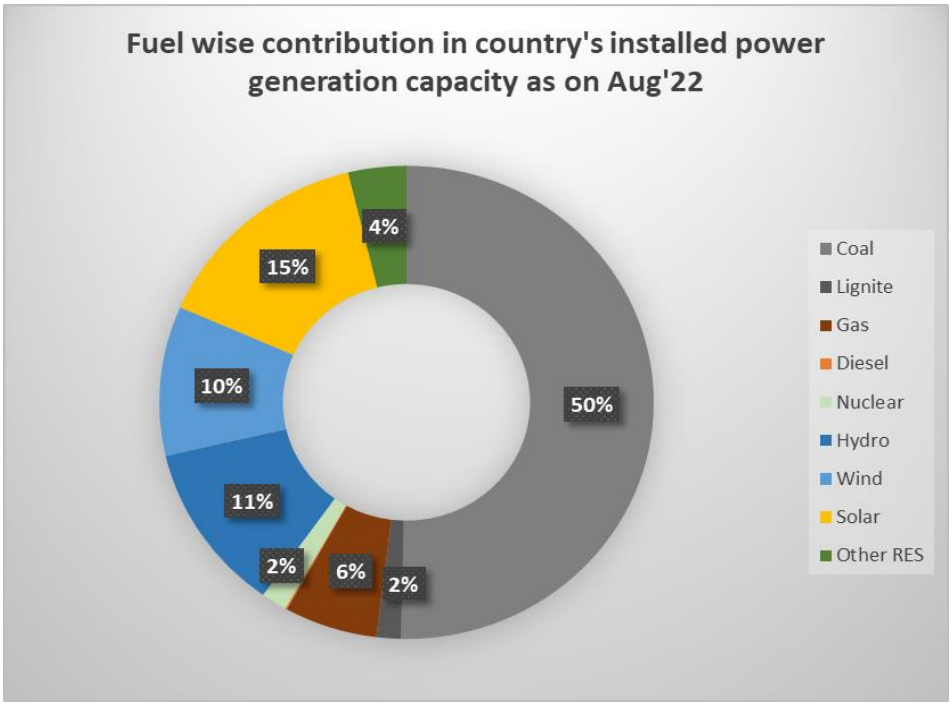
CHAPTER I: Introduction

1.0 Background

Coal continues to play a crucial role in the production of electricity in India. As per the latest data with Ministry of Power with regard to installed capacity in India (as of Aug'22), coal based installed capacity is about 50.3%, followed by solar power (14.6%), hydro (11.5%), wind (10.2%), gas (6.1%), other RES (Renewable Energy Sources) (3.8%), while nuclear (1.7%) and diesel (0.1%) round up the rest. The graph representation of the same is shown in the figure 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 29.05.2020. 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 held 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.

Under the directives of MoC, SDC CMPDI has been engaged for preparation of Status Report on Environmental Sustainability. These reports have previously been prepared for year 2018-19 & 2019-20. The present report has been prepared considering data for the year 2020-21.

CHAPTER II: Brief of coal sector in India

2.0 Coal for Sustainable Growth

Availability of power is a crucial factor with a direct link with accelerated economic growth of the country. To achieve the same, a two-pronged approach involving rejuventation of power demand through schemes like Saubhagya, DDUGJY, UDAY etc., as well as promotion of growth of core industries through initiatives such as AMRUT, BHARATMALA *etc.* have been introduced. This growth can only be sustained through the growth of energy sector – for which coal is a crucial contributor. Current production of domestic coal in the nation is about 716.08 MT whereas import accounts for approx. 214.9 MT of coal (both Coking and Non-Coking). A significant proportion of this demand will be for 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.

Considering that coal is currently the mainstay of India's primary energy supply, an increase in the trend of coal consumption is evidenced (Refer below table on coal production as well as import of coal from 2011 till 2020). As per study by MoC/CIL, it has also 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. 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.

Table 2.1: Coal Production Trend in Coal Sector in India

Year	Coal Production	Import
2011-12	539.95	102.85
2012-13	556.40	145.79
2013-14	565.77	166.86
2014-15	609.18	217.78
2015-16	639.23	203.95
2016-17	657.87	190.95
2017-18	675.40	208.25
2018-19	728.72	235.35
2019-20	730.87	248.54
2020-21	716.08	214.99

Source: Ministry of Coal

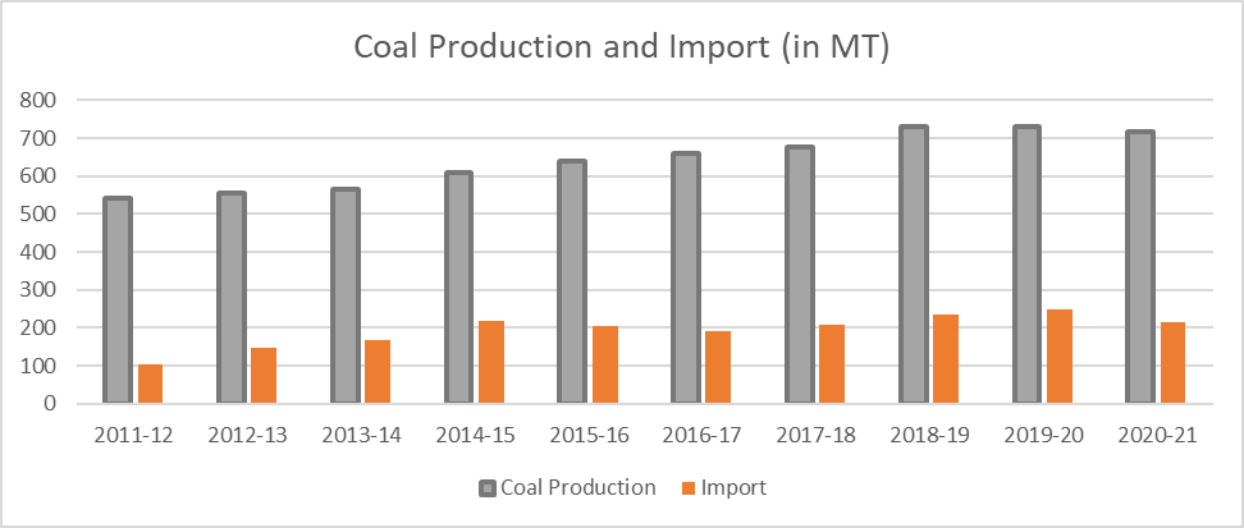


Figure 2.1: Coal Production & Import (in MT)

India has also 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.

2.1 Coal Mining – Industry Outlook

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

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 towards nuclear and/ or renewable generation sources and storage technologies (both in terms of capacity and prices).

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.

2.2 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 596.219 MT in 2020-21. 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 259016 (as on 1st April, 2021). CIL operates through 85 mining areas spread over eight (8) provincial states of India. Coal India Limited has 318 mines (as of 1st April 2022) of which 141 are underground, 158 opencast, and 19 mixed mines and also manages other establishments like workshops, hospitals, and so on. CIL has 21 training Institutes and 76 Vocational Training Centres. Indian Institute of Coal Management (IICM) as a state-of-the-art Management Training 'Centre of Excellence' – the largest Corporate Training Institute in India - operates under CIL and conducts multi-disciplinary programmes.

The coal producing Indian subsidiary companies of Coal India Limited are listed below:

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.

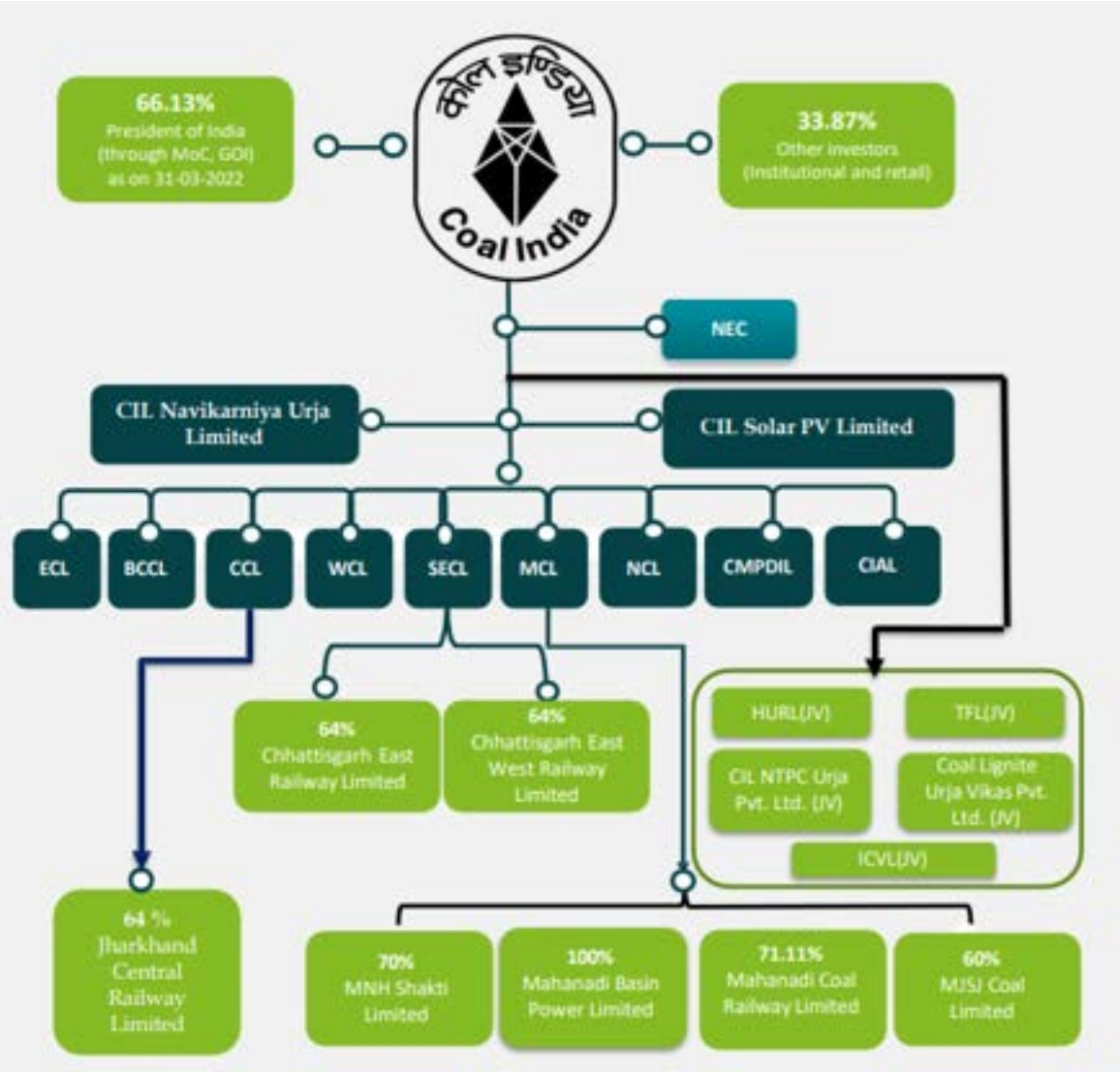


Figure 2.2: Corporate Structure and Operations of CIL

The summary of running coal mines of CIL is provided hereunder in Table 2.2.

Table 2.2: Operating coal mines in CIL (as on 31.03.2021)

Sl. No.	Subsidiary	Number of Mines				Mine Leasehold area (in ha)	State of Operations
		OC	UG	Mixed	Total		
1	ECL	15	29	29	73	63176.068	WB, Jharkhand
2	BCCL	15	05	10	30	28437.00	WB, Jharkhand
3	CCL	42	06	01	49	22807.72	Jharkhand
4	WCL**	40	29	02	71	46657.97	Maharastra, MP
5	SECL	19	46	01	66	51871.81	MP, CG
6	NCL	10	0	0	10	18418.07	MP, UP
7	MCL	15	03	0	18	19429.89	Odisha
8	NEC*	02	01	0	03	1784.23	Assam
Total CIL		**158**	**119**	**43**	**320**	**252582.76**	

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

***WCL footnotes: Of 71 running mines, 61 are producing mines and balance 10 consist of new mines/mines proposed for Fly-Ash Filling/coal gassification etc. Of 26 closed mines, 4 are discontinued mines reserved for future operation, 21 are abandoned mines with MCP (Post 2009), 1 mine closed as per MCP Guidelines. Additionally, 24 mines have been closed under MCSR (Pre-2009 closed mines)*

The details of closed mines in CIL are provided in Table 2.3 below:

Table 2.3: Closed coal mines in CIL(as on 31.03.2021)

Sl. No.	Subsidiary	Number of Closed Mines			Mine Leasehold area (in ha)	State
		OC	UG	Total		
1	ECL	-	-	-	-	-
2	BCCL	None of the mines of BCCL are closed under DGMS & MCP Guidelines				
3	CCL	-	10	10	4314	Jharkhand
4	WCL	07	19	26	8861.79	MP,Maharastra
5	SECL	10	17	27	12767	CG, MP
6	NCL	1	-	1	459	MP
7	MCL	3	6	9	6875.22	Odisha
Total CIL		**21**	**52**	**73**	**33277.01**	

Coal production and overburden removal from CIL mines over the past 3 years are presented in the figures below:

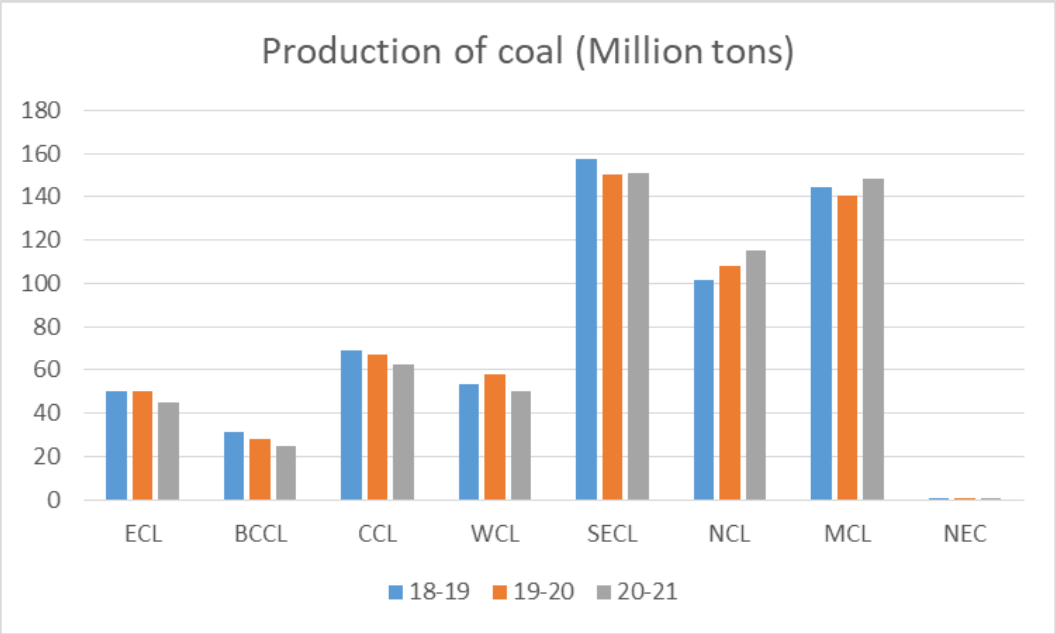


Figure 2.3: Coal Production at CIL during last three years

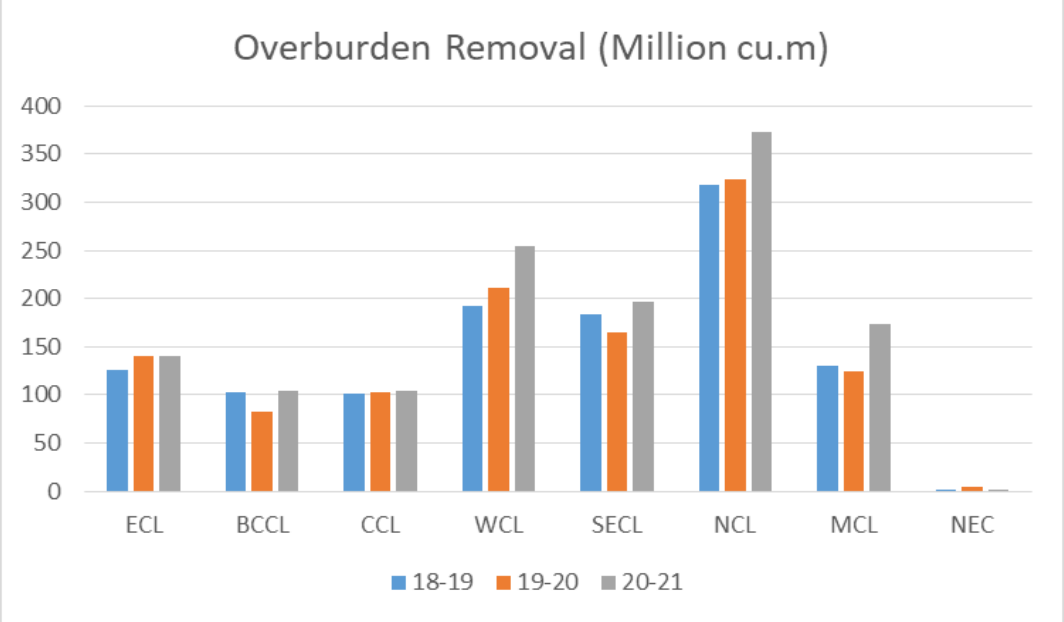


Figure 2.4: OB removal at CIL during last three years

2.3 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 around 19.89 lakh saplings during 2020-21 in an area covering more than 861.81 Ha. (i.e. 19.61 lakh saplings over 844.31 ha inside mine lease area & 28,000 saplings over 17.50 ha outside mine lease area) with an increase of more than 6% over previous year in terms of number of saplings. Committed to minimize the adverse impact of coal mining on environment through well structured Environment Management Plans and sustainable development activities, CIL, HQ had obtained re-certification of ISO 9001:2015, ISO 14001:2015 and ISO 50001:2011 for Quality Management, Environment Management and Energy Management System respectively from Bureau of Indian Standards (BIS) in 2019-20. As on 31st March 2021, three Subsidiaries of CIL i.e. CCL, NCL and WCL are certified for Integrated Management System (ISO 9001:2015, ISO 14001:2015 and OHSAS 18001:2017). CMPDI HQ and its seven RIs are certified for ISO 9001:2015. Moreover, CMPDIL HQ, Ranchi has been certified in ISO 37001:2016 (Anti-Bribery Management System).

2.3.1 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.

2.4 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 and Companies (Corporate Social. Responsibility Policy) Amendment Rules, 2021 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.

First Mile Connectivity (FMC) - To achieve the planned growth in coal evacuation with minimum environmental impact, CIL has deployed multi-pronged strategies like increasing coal transportation via rail and scaling up the mechanized coal transportation

and loading under the 'First Mile Connectivity' projects. Under CIL's flagship 'First Mile Connectivity (FMC) Projects', 44 Projects have been identified for implementation in two phases which will increase the mechanized coal transportation and loading system. FMC Projects will help increase mechanized evacuation from the current 151 MTPA to 622.5 MTPA. Out of the planned 35 FMC Projects in the first phase, 6 projects have been commissioned till date with a total capacity of 82 MTPA. The total capital investment in 1st phase is INR 10,750 Crore. The 2nd Phase has also been sanctioned and is expected to be completed by FY 25, with a total capital investment of INR 2500 Crore and a total capacity of 57 MTPA.

2.5 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:

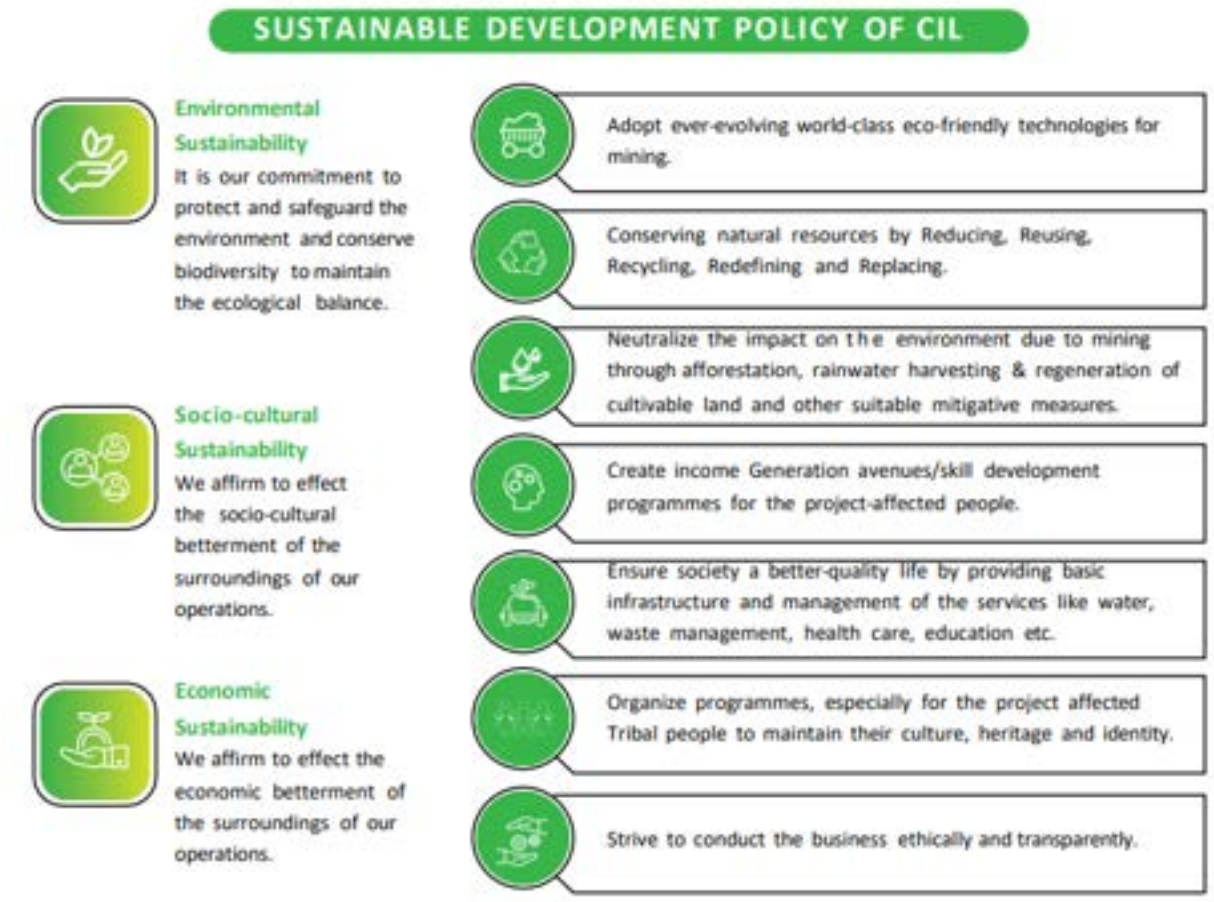


Figure 2.5: Sustainable Development Policy of CIL

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.

2.6 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 a proven geological reserves aggregating to whopping 8791 million tonnes. SCCL is currently operating 20 opencast and 26 underground mines in 6 districts of Telangana with a manpower around 42,995. 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 which not only facilitates cost reduction but also contributes to eco friendly mining, was introduced for the first time. Longwall technology in Under Ground Mining in 1983 and also Blasting Gallery (BG) Technology in 1989 were other notable introductions. Mechanization of Under Ground Mines is being planned with state-of-the-art technologies like Long wall (1), Bolter Miner (2) and Continuous Miner (5). Already the mechanization of Under Ground Mining has seen the commissioning of 163 Side Discharge Loaders and 28 Load Haul Dumpers that have enhanced safety and productivity during the last four years. Other innovations in Under Ground 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 2.4: Operating Coal Mines in SCCL (as on 31.03.2021)

Sl. No.	Subsidiary	Number of Mines				Mine Leasehold area (in ha)	State of Operations
		OC	UG	Mixed	Total		
1	SCCL	17	24	02	43	30990.6	Telangana
Total SCCL		20	24	--	44		

Table 2.5: Closed coal mines in SCCL (as on 31.03.2021)

Sl. No.	Subsidiary	Number of Closed Mines			Mine Leasehold area (in ha)	State
		OC	UG	Total		
1	SCCL	2	7	9	4680.99	-

2.7 Environment Management in SCCL

SCCL is having a full-fledged Environment Department for ensuring the compliance of Environmental legislation and implementation of MoEF&CC approved EMP including environmental clearance conditions and other environmental conditions scrupulously. SCCL has been obtaining Environmental Clearances for all its projects since 1985 and so far, has obtained Environmental Clearances for 99 projects including 2 x 600 MW power plant and sand mining project. SCCL's Corporate Environment Department is also 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.

2.8 NLC India Ltd and Environment Management in NLC

The Company was incorporated on 14.11.1956. NLCIL is a Navratna Government of India Enterprise, under the administrative control of Ministry of Coal. Today, the company has set its footprints in PAN India mode in the states of Tamilnadu, Rajasthan, Uttar Pradesh, Odisha, Jharkhand and Andaman & Nicobar Islands.

A pioneer among the Public Sector Undertakings in energy sector, NLCIL operates 3 opencast Lignite Mines of total installed capacity 28.50 Million Tonnes Per Annum (MTPA) at Neyveli, one opencast Lignite Mine at Barsingsar in Rajasthan with an installed capacity of 2.10 MTPA and an open cast coal mine at Talabira in Odisha with an installed capacity of 20 MTPA.

The Company is also operating 4 Lignite based pit-head Thermal Power Stations with an aggregate capacity of 3390 Mega Watt (MW) at Neyveli and one 250 MW Lignite based Thermal Power Station (BTPS) at Barsingsar, Rajasthan. A 1000 MW Coal based Thermal Power Station is also in operation at Thoothukudi, Tamil Nadu through its subsidiary company, NLC Tamilnadu Power Limited (NTPL), a Joint Venture between NLCIL and TANGEDCO (equity participation in the ratio of 89:11).

NLCIL has also forayed into renewable energy sector. Presently, the Company is operating 1370 MW of Solar Power Plants in various Districts of Tamilnadu and Andaman & Nicobar Islands and 51 MW Wind Power Plant in Tirunelveli district of Tamilnadu. NLCIL is the first CPSE to cross 1 GW capacity in Solar Power Generation. Now the Company has become a member of International Solar Alliance (ISA). NLCIL is aiming to achieve a total Renewable energy capacity of 4531 MW.

NLCIL has big dreams to become a 13500+MW company by 2030. Towards realizing this dream, NLCIL is already on expansion mode. NLCIL's JV with the Uttar Pradesh Rajya Vidyut Utpadan Nigam Limited (UPRVUNL) is setting up a 3x660 MW Coal based Thermal Power Station at Ghatampur in UP.

NLCIL is entering into coal mine projects and has commenced coal production in Talabira-II & III Coal Mine (20 MTPA) in Odisha on 26.04.2020. Now the mine is selling G14 grade coal to Mahanadi Coal Fields Limited from November 2020. In addition, project activities are in full swing at Pachwara South Coal Mine (9 MTPA) in Jharkhand with an anticipated commissioning by 2022-23. It is also programmed to establish a coal based pit-head TPS of 4000 MW at Talabira by way of installation of new plants.

Further, a JV Company, 'Coal Lignite Urja Vikas Private Limited' (CLUVPL) was incorporated on 10.11.2020 with Coal India Limited (equity participation in the ratio of 50:50). The JV Company plans to install 3000 MW Solar Power Projects at various parts of the Country. Not just Mining and Power Generation, NLCIL has contributed significantly to the Socio-Economic development of the Nation for more than six decades.The description of operating coal mines in NLC is as under:

Table 2.6: Operating Coal Mines in NLCIL (as on 31.03.2021)

Sl. No.	Subsidiary	Number of Mines				Mine leasehold area (in ha)	State of Operations
		OC	UG	Mixed	Total		
1	NLCIL	1	0	0	1	1914.06	Odisha

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 and in May, 2020. 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 2020-21 was 596.22 MT (break-up given in table below) whereas that of SCCL was 50.58 MT and NLCIL was 20.27 MT (coal+lignite) during the same period. As can be seen, about 95% and 91% annual production of CIL and SCCL respectively is from open cast mines and the balance is from UG mines.

Table 3.1: Coal production during April'20 to Mar'21

Production during Apr'20 to Mar'21 (in million tons)			
Subsidiary	Production in million tons (MT)		
	UG Mines	OC Mines	Total
ECL	9.31	35.70	45.01
BCCL	0.61	24.05	24.66
CCL	0.42	62.17	62.59
NCL	0.00	115.04	115.04
WCL	3.40	46.87	50.28
SECL	12.18	138.43	150.61
MCL	0.54	147.48	148.01
NEC	0.00	0.04	0.04
CIL (Total)	**26.45**	**569.77**	**596.22**
SCCL	**4.52**	**46.07**	**50.58**
NLCIL	**0.00**	**20.27**	**20.27**

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:

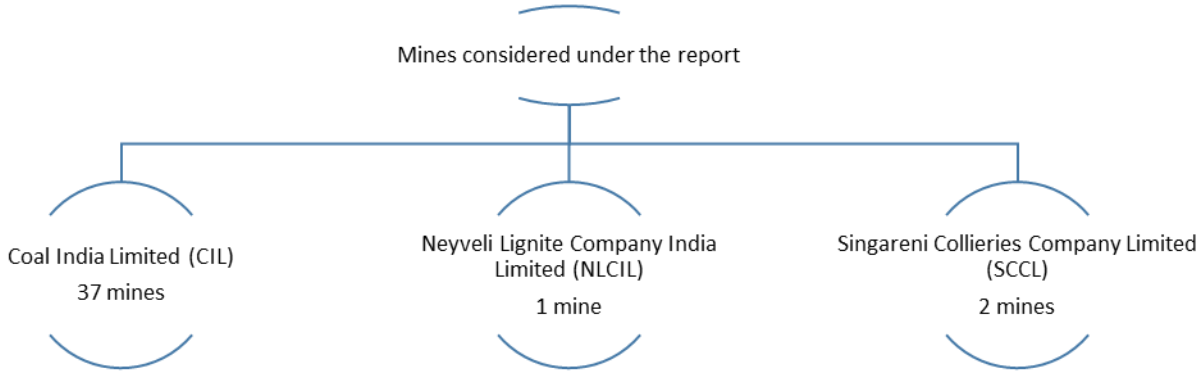
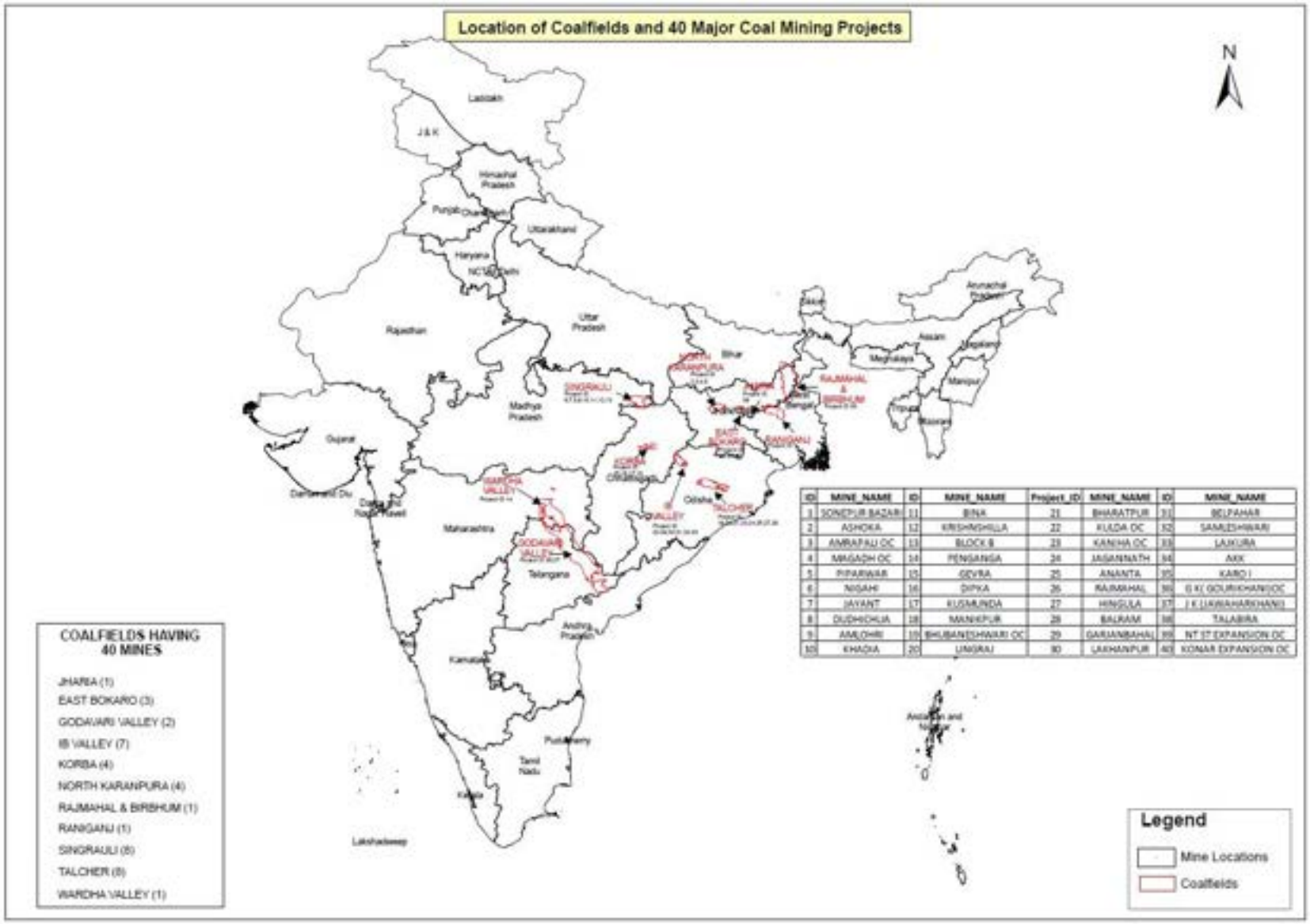


Table 4.1: List of projects considered

Sl. 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)	Amrapali OC
6		Ashoka OC
7		Karo OC
8		Konar Expansion OC
9		Magadh OC
10		Piparwar OC

Sl. No.	Coal Company	Name of mine
11	Western Coalfields Limited (WCL)	Penganga OC
12	South Eastern Coalfields Limited (SECL)	Dipka OC
13		Gevra OC
14		Kusmunda OC
15		Manikpur OC
16	Northern Coalfields Limited (NCL)	Amlohri OC
17		Bina OC
18		Block-B OC
19		Dudhichua OC
20		Jayant OC
21		Khadia OC
22		Krishnashila OC
23		Nigahi OC
24	Mahanadi Coalfields Limited (MCL)	Ananta OC
25		Balram OC
26		Belpahar OC
27		Bharatpur OC
28		Bhubaneshwari OC
29		Garjanbahal OC
30		Hingula OC
31		Jagannath OC
32		Kaniha OC
33		Kulda OC
34		Lajkura OC
35		Lakhanpur OC
36		Lingaraj OC
37		Samaleswari 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	KUDA OC	32	SANJESHWARI
3	AMRAPALI OC	13	BLOCK B	23	KANHA 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(GOURKHAND)OC
7	JAYANT	17	KUSMUNDA	27	HINGULA	37	J K LAXMANKHAND)
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	LAXMANPUR	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, 2020 till March, 2021 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.

- **Rating of mines (Chapter-IX)**

Based on reported data pertaining to land utilization, air quality, water quality and mine closure aspects, the selected mining projects have been rated and categorized under the chapter.

The data collection format based on which information for the status report was circulated by MoC vide letter no. F. No. CBA1-11022/2/2019-CBA-1 dated 06.07.2022.

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 coalface 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:

Table 4.2: List of projects considered

S. No.	Name of the Mine	Production Capacity		Leasehold Area (Ha)	Life (years)
		Normative	Peak		
1	Amalgamated Keshalpur-West Mududih 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°42'53" & 23°44'41" N and longitudes of 84°57'07"N & 85°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°51'31" & 23°53'38" N and Longitude 85°00'05" & 85°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°49'15" N & 23°51'30" N and 84°55'35" & 84°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°42'38'' N to 23°44'45'' N & longitude 85°01'34'' E to 85°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 **49 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 feasibility 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°7'26" & 24°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 **16.8 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^{O}42'00" to 21^{O}44'30" N and longitudes of 83^{O}43'00" to 83^{O}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^{O}03'04" to 21^{O}05'00"N and longitudes of 85^{O}02'20" to 85^{O}06'00"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 20^{O} 57' 16" & 21^{O} 00' 00" N and longitudes of 85^{O} 07' 14" & 85^{O} 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 20^{o} 56' 00" to 20^{o} 58' 22" N and longitudes of 85^{o} 00' 58" to 85^{o} 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 21^{o}46'48" to 21^{o}49'22" N and longitudes of 83^{o}52'23" to 83^{o}56'00" 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 21^{O} 42' 20" to 21^{O} 47' 00" N and longitudes of 83^{O} 49' 35" to 83^{O} 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 20^{O}58' 42'' to 20^{O}56'14'' N and longitudes of

85^{O}07’10’’ to 85^{O}9’55’’ 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 22^{O}01’16” to 22^{O}02’52” N and longitudes of 83^{O}43’34” to 83^{O}45’14” 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. Ill 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. Further EC was obtained for enhanced capacity from 2.5 MTPA to 3.5 MTPA in Jun, 2022.

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 76 mines belonging to both more than 5 mcm (Coal+OB) category were monitored for Land Reclamation based on Satellite Data of the Year 2021. For the mines producing more than 5 mcm (Coal+OB), 62.53% area out of the total excavated area is already under reclamation and balance 37.47% area is under active mining.

Additionally, 20 opencast mines & 09 clusters of mines of CIL producing less than 5 mcm were also monitored for Land Reclamation based on Satellite Data of the Year 2021. The analysis of the results obtained through Digital Image Processing of Satellite Data suggests that 64.92% area out of the total excavated area of the projects is already under reclamation and balance 35.08% area is under active mining.

Taking both the categories of mines taking together, it was observed that for 105 projects taken for monitoring in 2021-22, 62.79% area out of the total excavated area of the 105 projects is already under reclamation and balance 37.21% 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	Technically Reclaimed Area	Biologically Reclaimed Area	Green Cover / Other plantations	Infrastructure area	Other Areas, if any (like Mine sumps etc.)	Un-disturbed area		
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*	*(13)*
1.	Rajmahal OC	ECL	19.78	7.8	0.04	2.26	0.61***	3.58	0.95	4.54	1.07	18.71
2.	Sonepur Bazari OC	ECL	22.94	4.31	2.91	2.16	0.97	2.63	5.06	4.9	0.33	22.61
3.	AKWMC OC	BCCL	3.25	1.33	0	0.44	0.92	0.24	0.005	0.32	0.00	3.25
4.	NT ST Exp (Cluster 9) OC	BCCL	7.55	3.28	0	0.38	0	0.33	2.36	1.2	0.00	7.55
5.	Amrapali OC	CCL	6.2	0.54	0.73	0	0.01	0.61	4.12	0.19	5.32	0.88
6.	Ashoka OC	CCL	7.93	0.55	2.3	0.92	0.27	0.72	1.47	1.69	2.39	5.54
7.	Karo OC	CCL	5.26	0.34	0.03	0.14	0.28	0.37	0.12	3.98	3.12	2.15
8.	Konar OC	CCL	5.47	0.41	0.06	0.03	0.43	0.42	0.72	3.39	5.07	0.4
9.	Magadh OC	CCL	15.94	0.92	0.6	0.1	0	1.06	11.66	1.59	2.44	15.25
10.	Piparwar OC	CCL	11.2	1.39	2.56	1.34	1.39	3.17	1.35	0	1.87	9.34
11.	Amlohri OC	NCL	21.75	8.12	0	3.02	5.13	2.18	0	3.29	11.95	9.8
12.	Bina OC	NCL	17.98	5.21	0	4.36	1	4.5	0.39	2.52	10.88	7.1
13.	Block-B OC	NCL	13.39	4.6	0.05	1.02	0.91	2.25	2.31	2.25	4.47	8.92
14.	Dudhichua OC	NCL	23.91	8.15	0.3	2.23	2.14	4.22	0.1	6.76	12.17	11.73
15.	Jayant OC	NCL	31.77	9.2	0.4	6.59	1.9	4.41	0.82	8.46	11.6	20.2
16.	Khadia OC	NCL	16.4	7.35	0.2	1.42	3.27	1.94	0.03	2.19	9.34	7.06
17.	Krishnashila OC	NCL	8.52	4.06	1.21	1.14	0	0.61	0.1	1.4	4.94	3.58
18.	Nigahi OC	NCL	30.18	9.18	0.35	4.79	4.82	4.53	0	6.51	12.98	17.19
19.	Penganga OC	WCL	7.44	1.43	2.9	0.1	0.14	0.1	0	2.77	0.46	6.98
20.	Dipka OC	SECL	19.99	7.79	0.95	3.32	4.68	1.66	0.06	1.53	4.09	15.9
21.	Gevra OC	SECL	41.84	7.87	7.37	4.9	6.49	11.03	0	4.18	10.16	31.68
22.	Kusmunda OC	SECL	16.56	1.38	2.14	3.99	2	4.02	1.08	1.95	2.06	14.5
23.	Manikpur OC	SECL	10.18	1.23	2.19	1.73	0.49	0.89	1.39	2.26	3.72	6.47
24.	Ananta OC	MCL	14.2	3.55	0.44	1.05	0.29	0.9	0	8.24	3.34	10.86
25.	Balram OC	MCL	13.8	2.64	1.66	1.23	0.25	0.45	0	7.81	0.85	12.95

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	Technically Reclaimed Area	Biologically Reclaimed Area	Green Cover / Other plantations	Infrastructure area	Other Areas, if any (like Mine sumps etc.)	Un-disturbed area		
26.	Belpahar OC**	MCL	14.44	2.64	0.86	1.64	0.91	3.83	0	5.48	1.23	13.21
27.	Bharatpur OC	MCL	13.25	3.28	0.77	1.64	0	1.68	0	5.87	1.78	7.49
28.	Bhubaneshwari OC**	MCL	6.38	3.96	1.19	0.14	0.18	0.11	0	0.99	1.13	5.26
29.	Garjanbahal OC	MCL	6.54	1.11	0	0	0	0.05	0	5.38	0.89	5.65
30.	Hingula OC**	MCL	17.42	3.58	0.74	0.22	0.17	0.2	0	12.68	4.35	13.06
31.	Jagannath OC	MCL	5.54	1.57	0.73	1.69	0	0.42	0.84	0.28	0.83	4.71
32.	Kaniha OC**	MCL	7.18	2.51	0	0	0.04	0.21	0	4.45	0.02	7.16
33.	Kulda OC**	MCL	6.34	3.17	0	0.08	0.73	0.08	0	3	2.28	4.06
34.	Lajkura OC	MCL	7.21	1.59	0.07	0.68	0	0.34	1.38	3.16	1.59	5.62
35.	Lakhanpur OC**	MCL	22.4	5.42	1.76	1.47	0.42	0.86	0.23	12.66	2.33	20.07
36.	Lingaraj OC**	MCL	14.1	3.77	0	1.39	0.39	0.83	0	8.11	1.86	12.24
37.	Samaleswari OC**	MCL	13.35	4.17	0.16	1.26	2.02	0.54	0	7.22	5.65	7.69
38.	Gautami Khani OC	SCCL	9.23	2.54	0.09	5.05	0	0.56	0.99	0	5.40	3.83
39.	Jawahar Khani - 5 OC	SCCL	5.15	1.24	0.55	2.11	0	1.18	0	0.07	0.00	5.15
40.	Talabira II & III OC	NLCIL	19.14	0.46	0	0	0.02	0.02	0.33	18.31	10.38	8.76

**Area & break-up received from respective subsidiaries*

***Area given under Green cover / other plantation in MCL projects indicates plantation done elsewhere in project area, outside leasehold area*

**** Includes plantation done outside mine lease area (0.15 sq.km)*

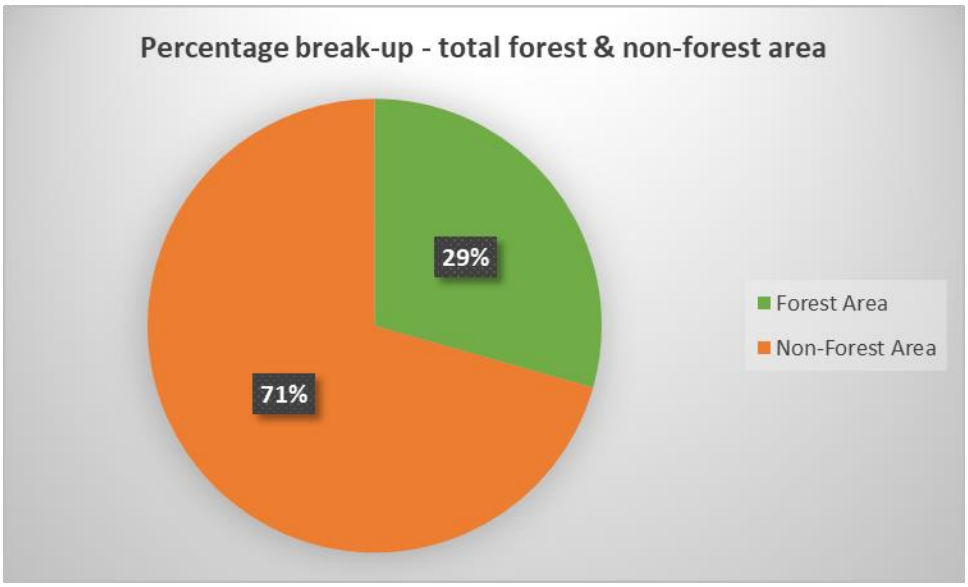


Figure 5.1: Percentage break-up w.r.t forest & non-forest area during 2020-21

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 37 projects of CIL, 2 projects of SCCL and 1 project of NLCIL are shown below:

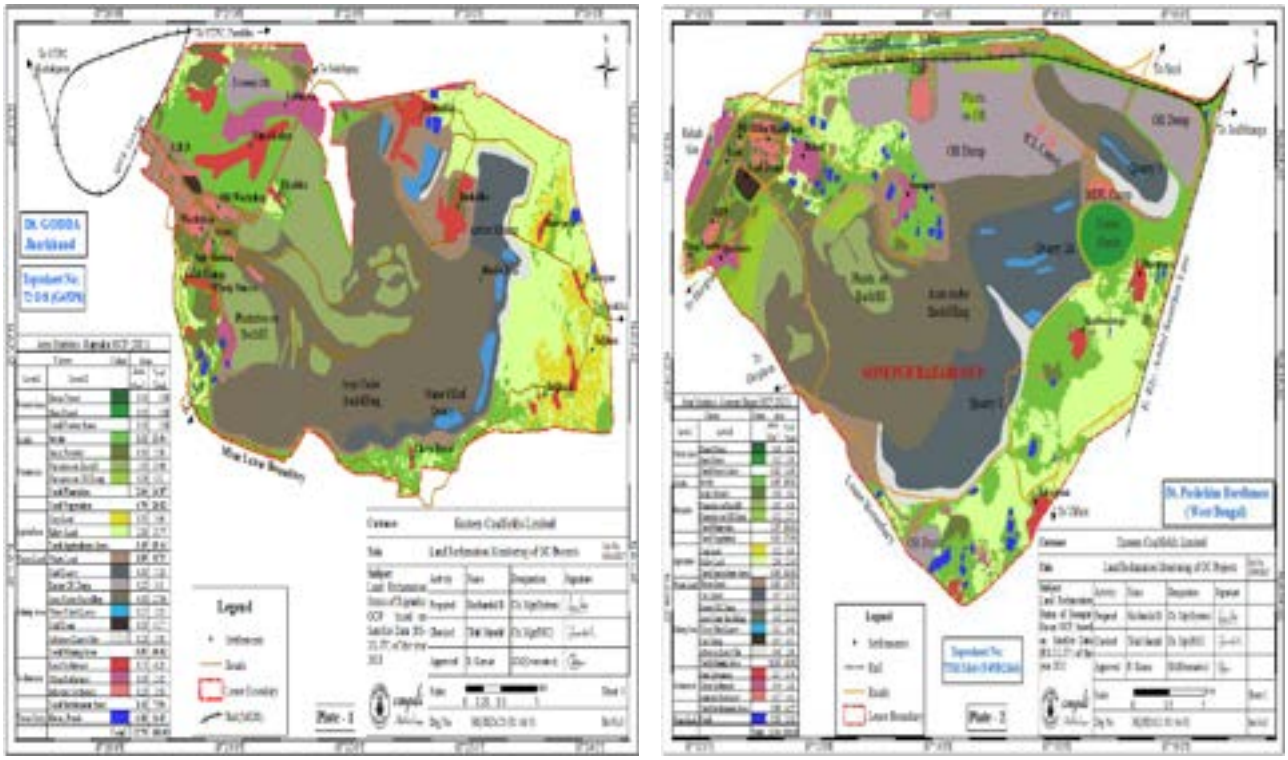


Figure 5.2: Land use Status of Rajmahal & Sonepur Bazari OCP of ECL as per satellite data

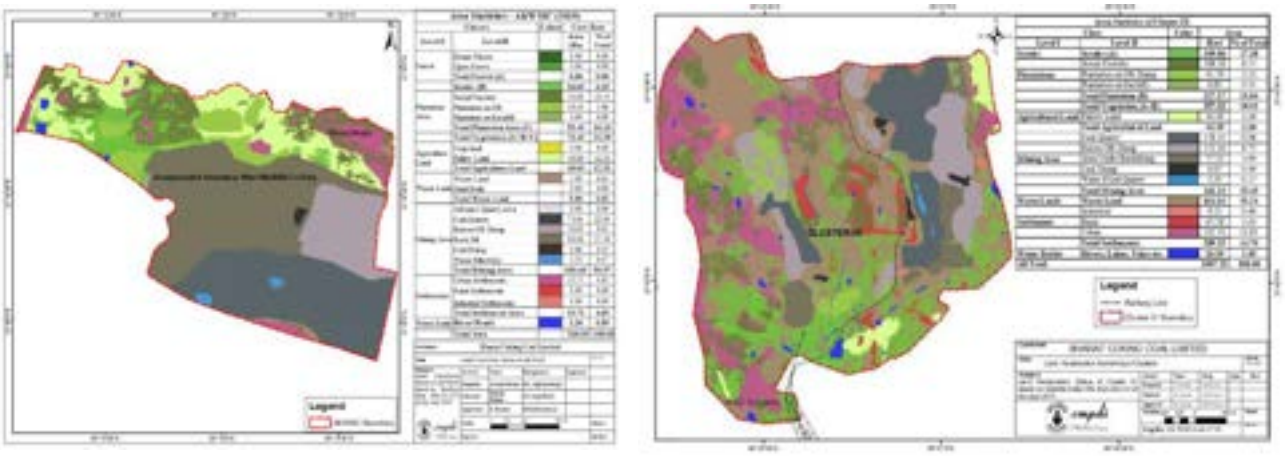


Figure 5.3: Land use Status of AKWMC OCP & NTST OC of BCCL as per satellite data

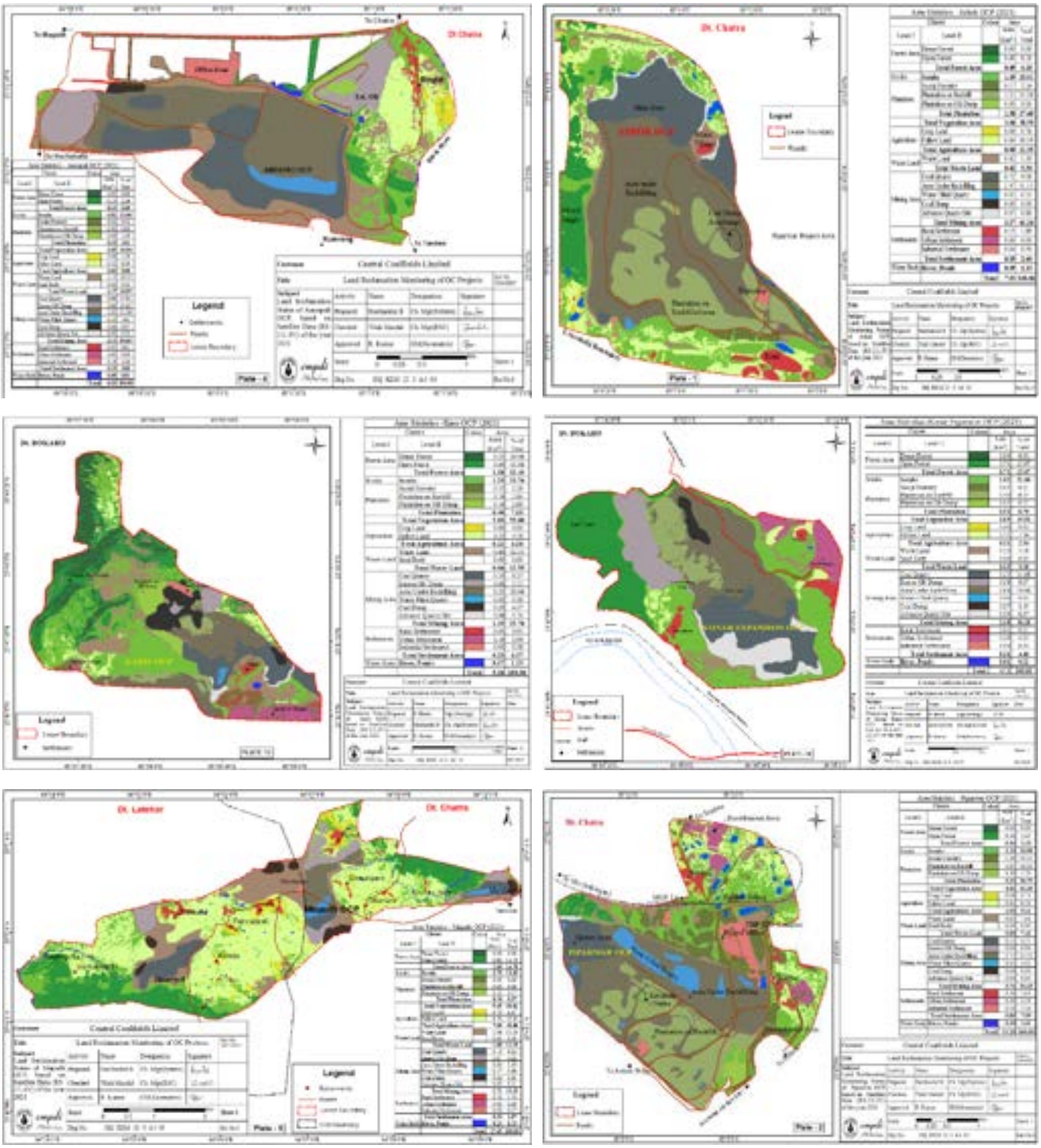


Figure 5.4: Land Use of Amrapali OCP, Ashok OC, Karo OC, Konar OC, Magadh OC & Piparwar OC of CCL as per Satellite Data

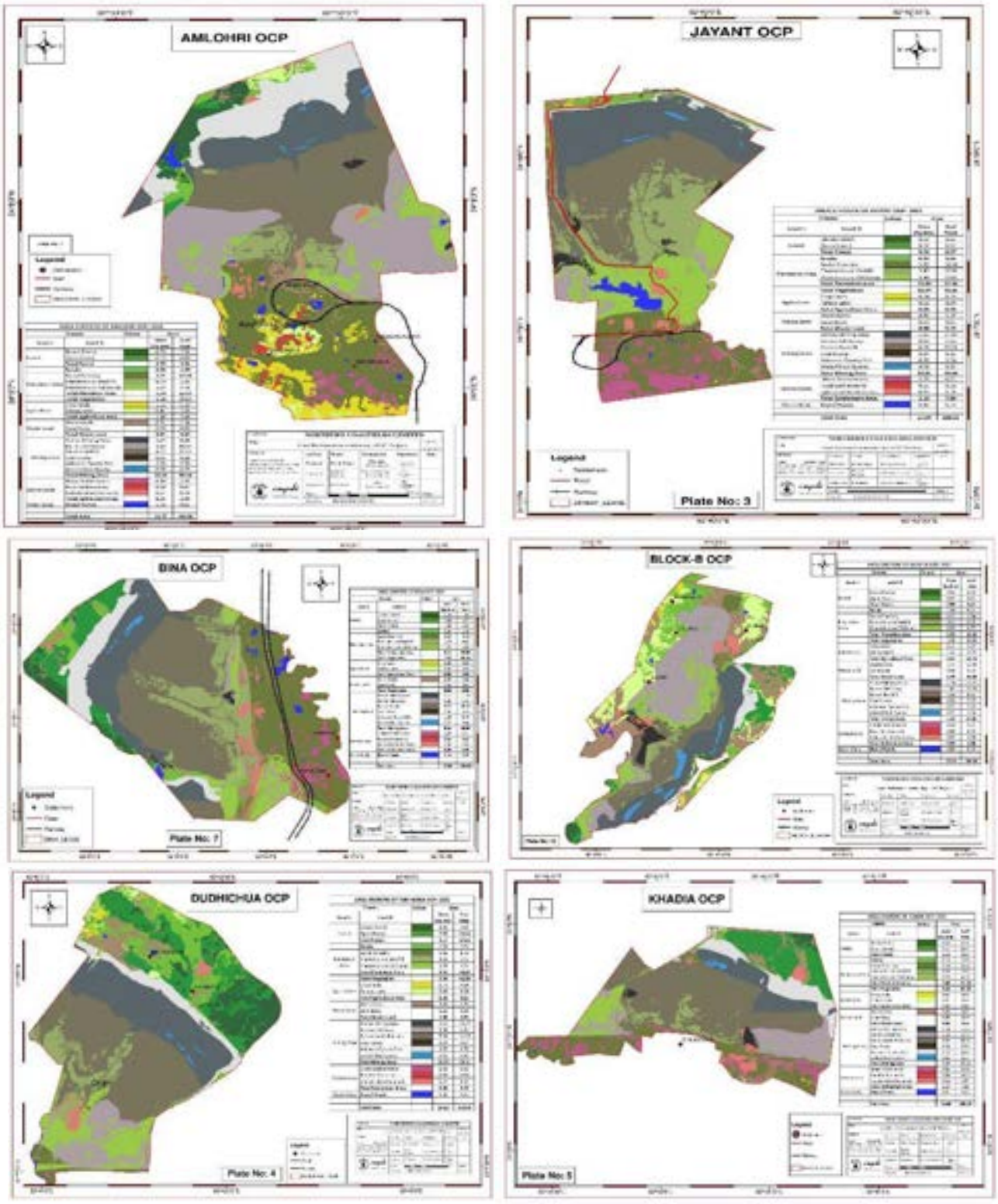


Figure 5.5: Land use Status of Amlohri OC, Jayant OC, Bina OC, Block-B OC, Dudhichua OCP of NCL as per satellite data.

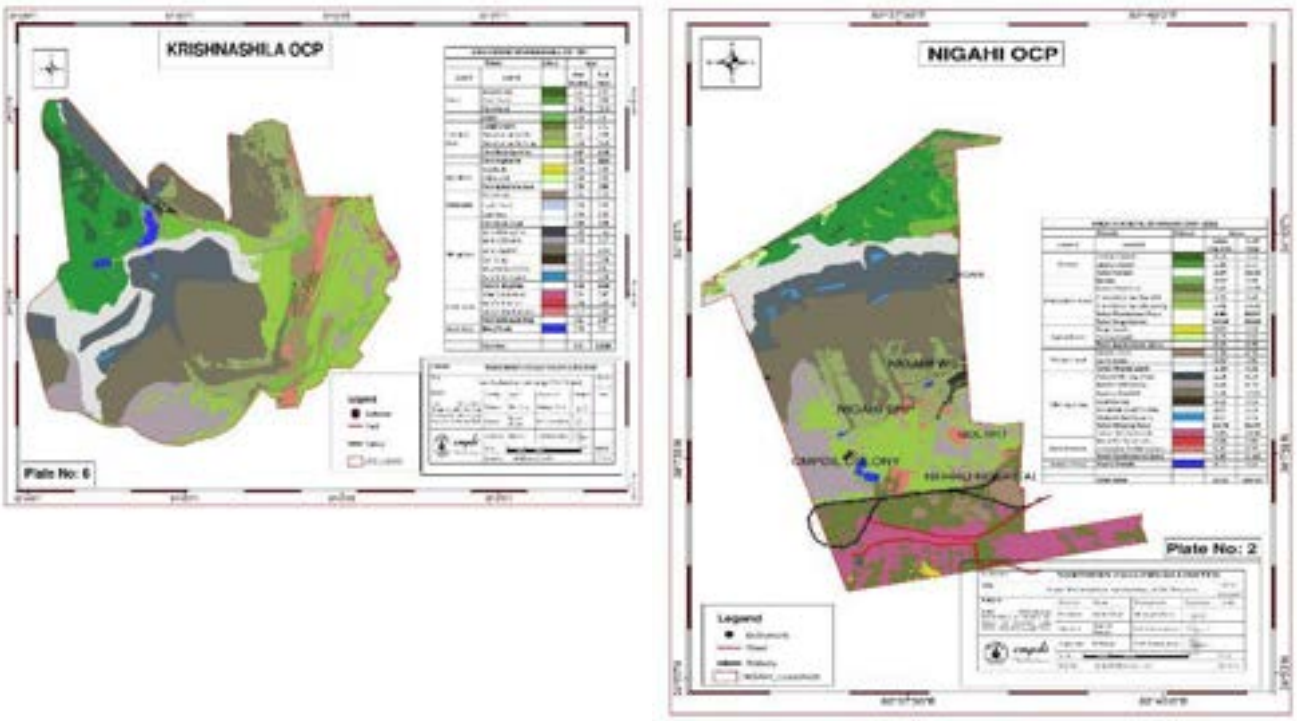


Figure 5.6: Land use Status of Krishnashila & Nigahi OCP of NCL as per satellite data.

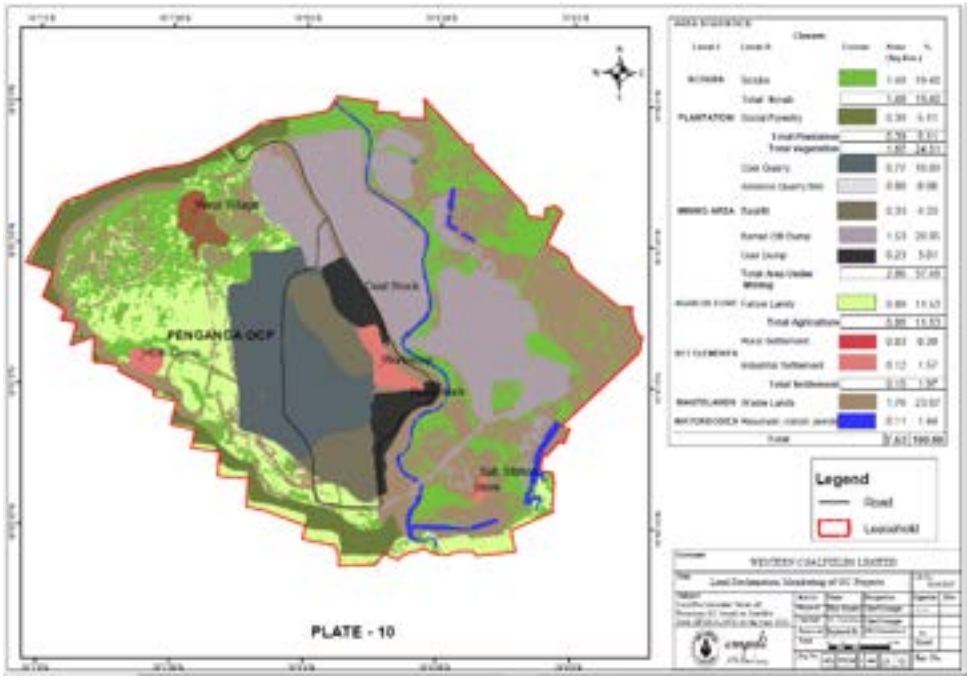


Figure 5.7: Land use Status of Penganga OCP of WCL as per satellite data.

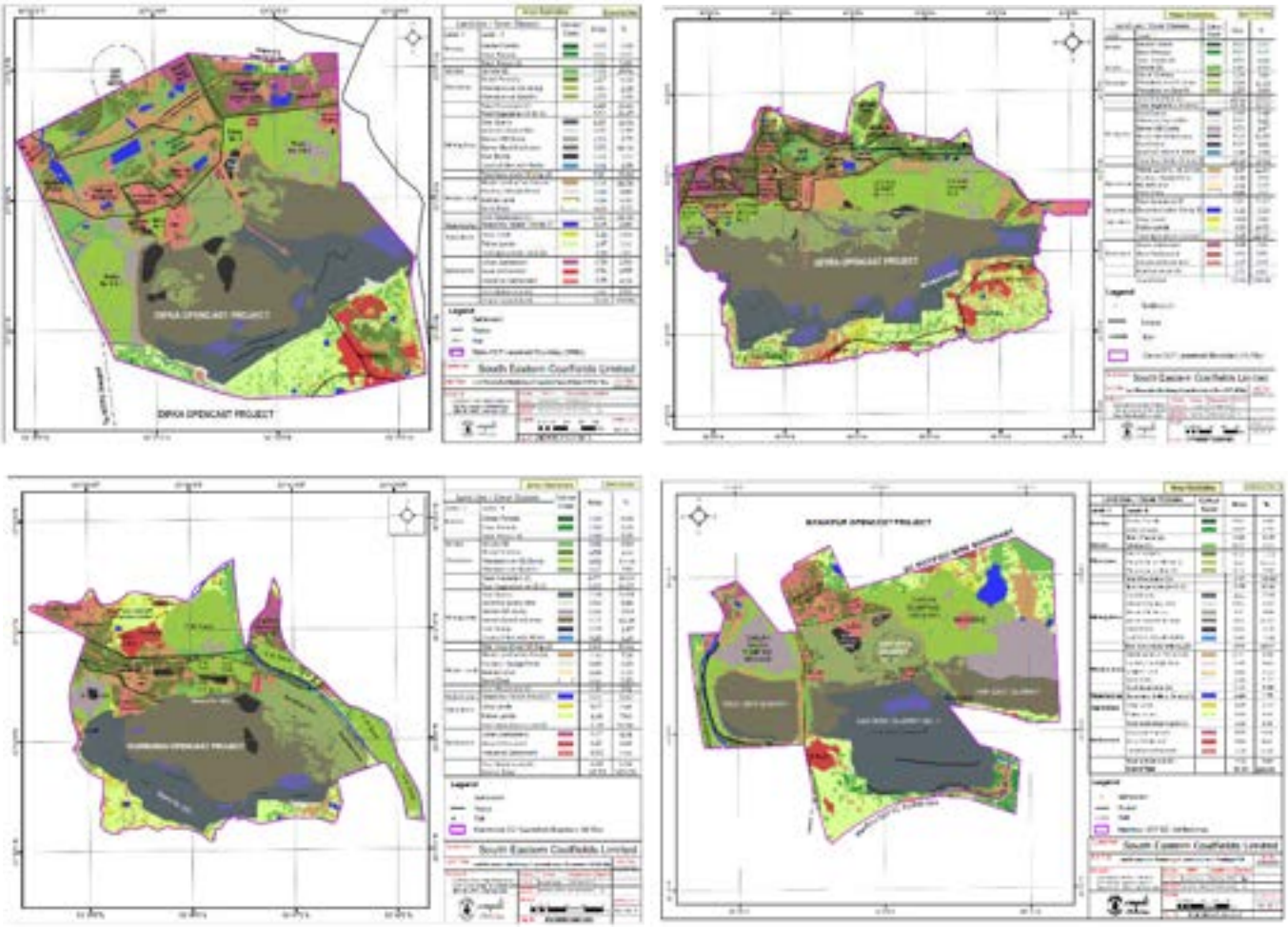


Figure 5.8: Land use Status of Dipka OC, Gevra OC, Kusmunda OC & Manikpur OCP of SECL as per satellite data.

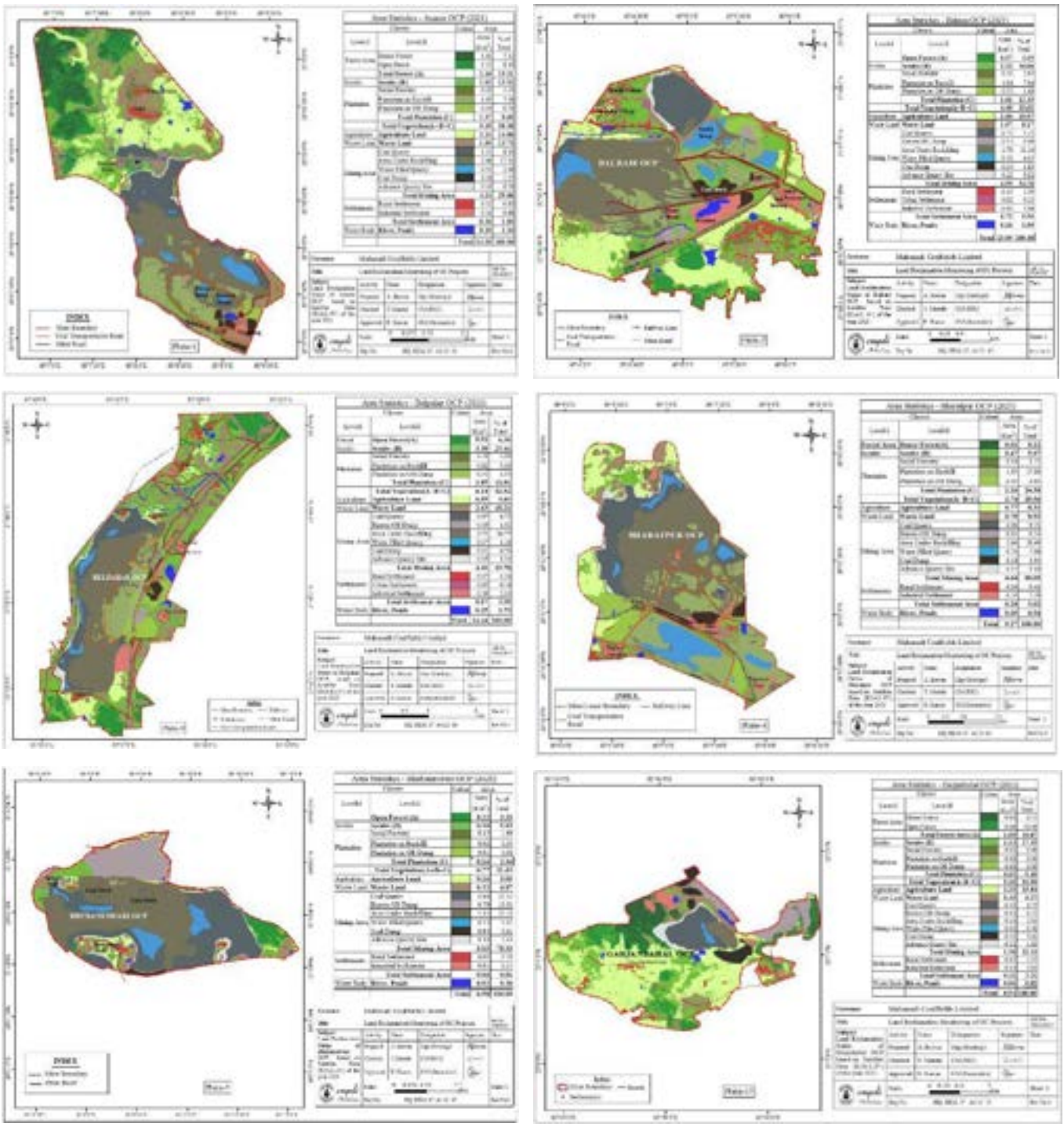


Figure 5.9: Land use Status of Ananta OC, Balram OC, Belpahar OC, Bharatpur OC, Bhubaneshwari OC & Garjanbahal OC of MCL as per satellite data

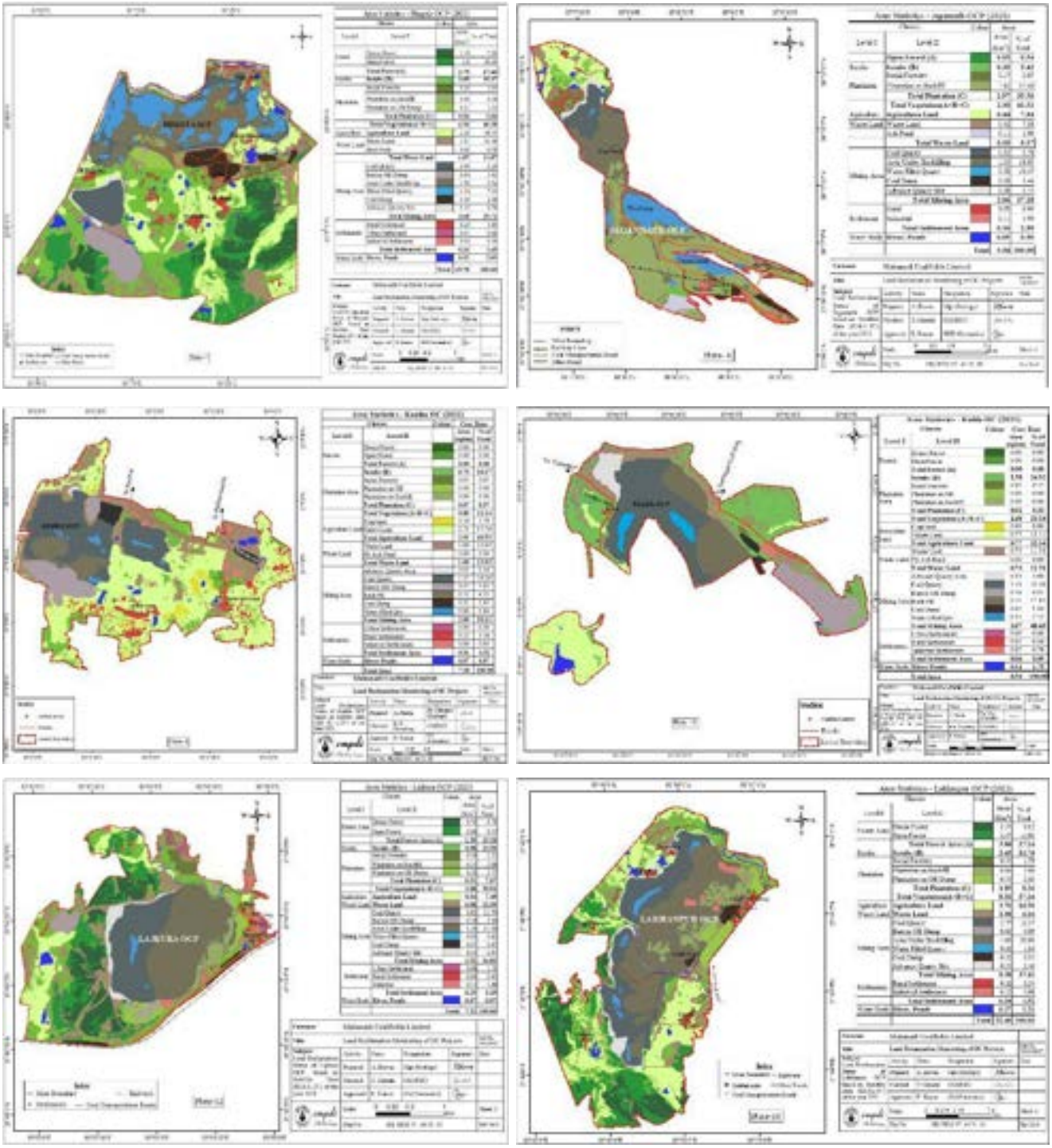


Figure 5.10: Land use Status of Hingula OC, Jagannath OC, Kaniha OC, Kulda OC, Lajkura OC & Lakhanpur OC of MCL as per satellite data.

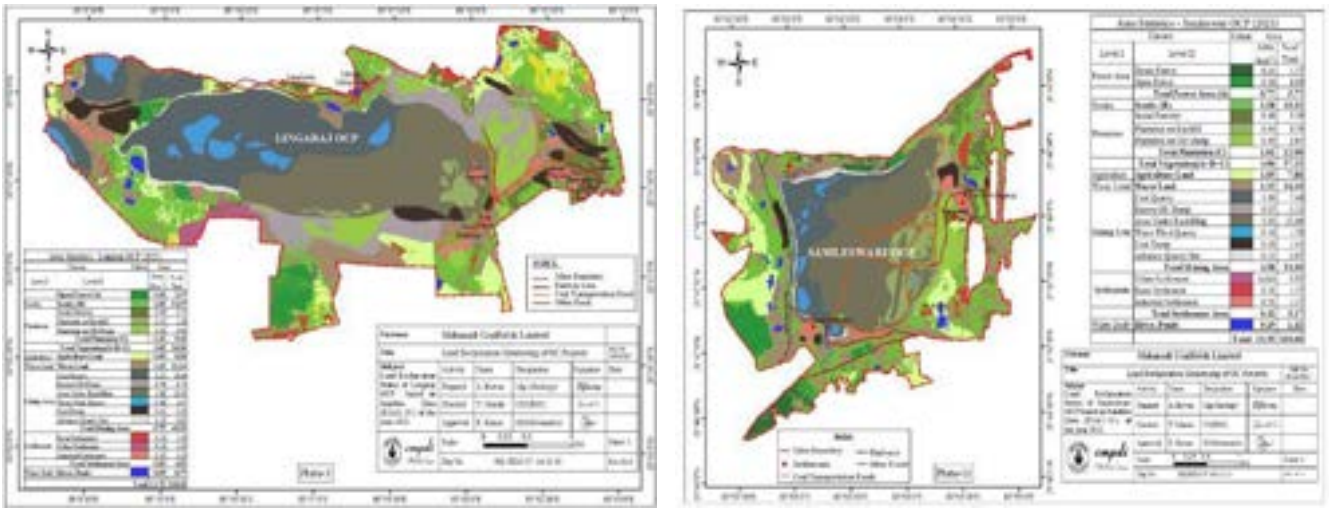


Figure 5.11: Land use Status of Lingaraj OC & Samaleshwari OC of MCL as per satellite data.

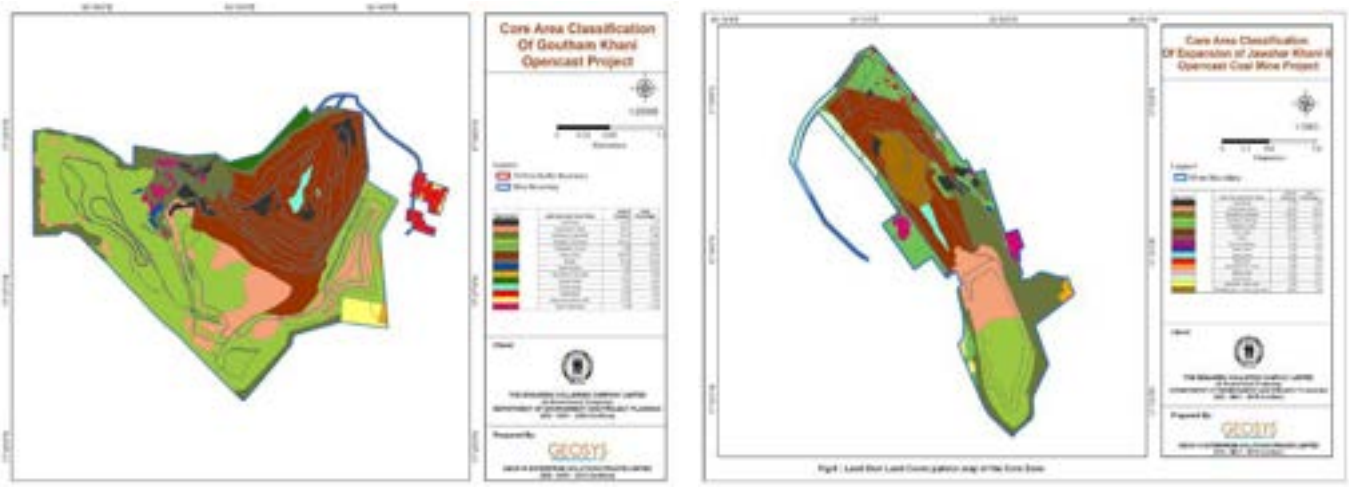


Figure 5.12: Land use Status of GK OC & JK-5 OC of SCCL as per satellite data.

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 2020 and 2021, Area in Sq. Kms)

Sl. No.	Subsidiary	Project	Total/ Mine Lease hold Area		Technical Reclamation		Plantation						Area under Active Mining		Total Excavated Area		Total Area under Plantation (% Green Cover Generated in Leasehold Area)		Total Area under Reclamation	
							Biological Reclamation		Other Plantations											
					Area under Backfilling		Plantation on Excavated / Backfilled Area		Plantation on External Over Burden Dumps		Social Forestry, Avenue Plantation Etc.									
		2	3		4		5		6		7		8		9 (=4+5+8)		10 (=5+6+7)		11(=4+5)	
			2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
1	ECL	Rajmahal	17.75	17.75	4.75	4.80	1.80	1.95	0.06	0.09	0.60	0.60	1.42	1.42	7.97	8.17	2.46	2.64	6.55	6.75
					59.60%	58.75%	22.58%	23.87%					17.82%	17.38%			13.86%	14.87%	82.18%	82.62%
2		Sonepur Bazari	22.94	22.94	4.08	4.50	0.87	0.95	0.44	0.52	0.88	0.90	3.61	3.46	8.56	8.91	2.19	2.37	4.95	5.45
					47.66%	50.51%	10.16%	10.66%					42.17%	38.83%			9.55%	10.33%	57.83%	61.17%
3	CCL	Ashok	7.93	7.93	2.35	2.47	1.02	1.21	0.00	0.00	0.27	0.17	0.66	0.80	4.03	4.48	1.29	1.38	3.37	3.68
					58.31%	55.13%	25.31%	27.01%					16.38%	17.86%			16.27%	17.40%	83.62%	82.14%
4		Piparwar	11.20	11.20	2.91	2.75	1.45	1.85	0.42	0.19	1.18	1.18	0.98	0.96	5.34	5.56	3.05	3.22	4.36	4.60
					54.49%	49.46%	27.15%	33.27%					18.35%	17.27%			27.23%	28.75%	81.65%	82.73%
5		Amrapali	6.20	6.20	1.20	1.32	0.00	0.00	0.05	0.08	0.02	0.02	1.07	1.10	2.27	2.42	0.07	0.10	1.20	1.32
					52.86%	54.55%	0.00%	0.00%					47.14%	45.45%			1.13%	1.61%	52.86%	54.55%
6		Magadh	17.69	17.69	0.55	0.60	0.00	0.00	0.10	0.10	0.00	0.00	0.78	0.92	1.33	1.52	0.10	0.10	0.55	0.60
					41.35%	39.47%	0.00%	0.00%					58.65%	60.53%			0.57%	0.57%	41.35%	39.47%
7		Karo	5.75	5.26	0.17	0.55	0.14	0.14	0.12	0.14	0.16	0.12	0.34	0.39	0.65	1.08	0.42	0.40	0.31	0.69
					26.15%	50.93%	21.54%	12.96%					52.31%	36.11%			7.30%	7.60%	47.69%	63.89%
8		Konar Exp.	7.29	4.71	0.09	0.88	0.03	0.30	0.24	0.01	0.19	0.01	0.41	0.85	0.53	2.03	0.46	0.32	0.12	1.18
					16.98%	43.35%	5.66%	14.78%					77.36%	41.87%			6.31%	6.79%	22.64%	58.13%
9	WCL	Penganga	7.63	7.63	0.15	0.33	0.00	0.00	0.00	0.00	0.30	0.39	1.02	1.00	1.17	1.33	0.30	0.39	0.15	0.33
					12.82%	24.81%	0.00%	0.00%					87.18%	75.19%			3.93%	5.11%	12.82%	24.81%
10	SECL	Dipka	19.99	19.99	2.94	3.69	0.77	1.00	1.60	1.81	1.59	1.67	3.30	2.92	7.01	7.61	3.96	4.48	3.71	4.69
					41.94%	48.49%	10.98%	13.14%					47.08%	38.37%			19.81%	22.41%	52.92%	61.63%
11		Gevra	41.84	41.84	8.80	9.19	2.60	2.55	4.15	4.28	2.94	3.18	5.29	5.35	16.69	17.09	9.69	10.01	11.40	11.74
					52.73%	53.77%	15.58%	14.92%					31.70%	31.30%			23.16%	23.92%	68.30%	68.70%
12		Kusmunda	16.72	16.72	3.28	3.72	1.32	1.27	1.94	1.92	1.60	1.58	2.56	2.78	7.16	7.77	4.86	4.77	4.60	4.99
					45.81%	47.88%	18.44%	16.34%					35.75%	35.78%			29.07%	28.53%	64.25%	64.22%
13		Manikpur	19.44	10.20	1.50	1.55	0.77	0.78	1.34	1.26	0.47	0.37	1.98	1.99	4.25	4.32	2.58	2.41	2.27	2.33
					35.29%	35.88%	18.12%	18.06%					46.59%	46.06%			13.27%	23.63%	53.41%	53.94%
14	NCL	Amlohri	21.75	21.75	3.77	4.05	0.80	0.73	0.94	1.04	3.79	3.77	3.51	4.23	8.08	9.01	5.53	5.54	4.57	4.78
					46.66%	44.95%	9.90%	8.10%					43.44%	46.95%			25.43%	25.47%	56.56%	53.05%
15		Nigahi	30.11	30.11	5.55	5.38	1.64	1.95	2.99	3.01	3.65	3.64	3.85	4.78	11.04	12.11	8.28	8.60	7.19	7.33
					50.27%	44.43%	14.86%	16.10%					34.87%	39.47%			27.50%	28.56%	65.13%	60.53%
16		Jayant	27.04	27.04	6.16	6.06	3.41	3.49	3.59	3.48	3.83	3.83	5.22	5.56	14.79	15.11	10.83	10.80	9.57	9.55
					41.65%	40.11%	23.06%	23.10%					35.29%	36.80%			40.05%	39.94%	64.71%	63.20%
17		Dudhichua	23.62	23.62	5.60	5.74	1.29	1.31	1.77	1.78	0.42	0.42	4.56	4.71	11.45	11.76	3.48	3.51	6.89	7.05
					48.91%	48.81%	11.27%	11.14%					39.83%	40.05%			14.73%	14.86%	60.17%	59.95%
18		Khadia	16.39	16.39	4.00	5.33	0.60	0.60	0.70	0.70	2.10	2.10	3.48	2.50	8.08	8.43	3.40	3.40	4.60	5.93
					49.50%	63.23%	7.43%	7.12%					43.07%	29.66%			20.74%	20.74%	56.93%	70.34%
19		Krishnashila	8.51	8.51	2.01	2.12	0.52	0.51	1.30	1.30	0.06	0.06	1.81	1.78	4.34	4.41	1.88	1.87	2.53	2.63
					46.31%	48.07%	11.98%	11.56%					41.71%	40.36%			22.09%	21.97%	58.29%	59.64%

Sl. No.	Subsidiary	Project	Total/ Mine Lease hold Area		Technical Reclamation		Plantation						Area under Active Mining		Total Excavated Area		Total Area under Plantation (% Green Cover Generated in Leasehold Area)		Total Area under Reclamation	
							Biological Reclamation		Other Plantations											
					Area under Backfilling		Plantation on Excavated / Backfilled Area		Plantation on External Over Burden Dumps		Social Forestry, Avenue Plantation Etc.									
20		Bina	17.98	17.98	4.77	4.75	1.74	1.73	1.05	1.05	3.42	3.33	2.93	3.40	9.44	9.88	6.21	6.11	6.51	6.48
					50.53%	48.08%	18.43%	17.51%					31.04%	34.41%			34.54%	33.98%	68.96%	65.59%
21		Block-B	13.39	13.39	1.49	1.22	0.49	0.37	0.35	0.91	0.22	0.22	1.99	2.54	3.97	4.13	1.06	1.50	1.98	1.59
					37.53%	29.54%	12.34%	8.96%					50.13%	61.50%			7.92%	11.20%	49.87%	38.50%
22	MCL	Ananta	14.20	14.20	2.40	2.46	1.05	1.05	0.10	0.10	0.22	0.22	1.45	1.60	4.90	5.11	1.37	1.37	3.45	3.51
					48.98%	48.14%	21.43%	20.55%					29.59%	31.31%			9.65%	9.65%	70.41%	68.69%
23		Balram	13.09	13.09	2.80	2.78	1.06	1.04	0.22	0.22	0.35	0.35	1.03	1.40	4.89	5.22	1.63	1.61	3.86	3.82
					57.26%	53.26%	21.68%	19.92%					21.06%	26.82%			12.45%	12.30%	78.94%	73.18%
24		Lingaraj	7.26	11.73	1.70	1.90	0.15	0.15	0.32	0.52	0.33	0.44	2.19	2.67	4.04	4.72	0.80	1.11	1.85	2.05
					42.08%	40.25%	3.71%	3.18%					54.21%	56.57%			11.02%	9.46%	45.79%	43.43%
25		Bharatpur	9.27	9.27	2.63	2.66	1.66	1.65	0.45	0.45	0.16	0.16	1.66	1.75	5.95	6.06	2.27	2.26	4.29	4.31
					44.20%	43.89%	27.90%	27.23%					27.90%	28.88%			24.49%	24.38%	72.10%	71.12%
26		Bhubaneswari	6.58	6.58	1.86	2.15	0.01	0.02	0.00	0.01	0.15	0.13	1.77	2.17	3.64	4.34	0.16	0.16	1.87	2.17
					51.10%	49.54%	0.27%	0.46%					48.63%	50.00%			2.43%	2.43%	51.37%	50.00%
27		Jagannath	5.54	5.54	0.84	1.00	1.79	1.80	0.00	0.00	0.17	0.17	0.97	0.98	3.60	3.78	1.96	1.97	2.63	2.80
					23.33%	26.46%	49.72%	47.62%					26.94%	25.93%			35.38%	35.56%	73.06%	74.07%
28		Hingula	15.75	15.75	1.48	1.50	0.07	0.06	0.21	0.21	0.28	0.29	2.02	2.25	3.57	3.81	0.56	0.56	1.55	1.56
					41.46%	39.37%	1.96%	1.57%					56.58%	59.06%			3.56%	3.56%	43.42%	40.94%
29		Belpahar	14.44	14.44	2.36	2.71	0.90	0.82	0.57	0.51	0.52	0.52	1.33	1.29	4.59	4.82	1.99	1.85	3.26	3.53
					51.42%	56.22%	19.61%	17.01%					28.98%	26.76%			13.78%	12.81%	71.02%	73.24%
30		Lakhanpur	22.40	22.40	4.32	4.66	0.83	0.86	0.59	0.59	0.44	0.40	2.99	3.58	8.14	9.10	1.86	1.85	5.15	5.52
					53.07%	51.21%	10.20%	9.45%					36.73%	39.34%			8.30%	8.26%	63.27%	60.66%
31		Samleswari	13.35	13.35	2.94	3.03	0.70	0.64	0.49	0.49	0.50	0.48	1.27	1.29	4.91	4.96	1.69	1.61	3.64	3.67
					59.88%	61.09%	14.26%	12.90%					25.87%	26.01%			12.66%	12.06%	74.13%	73.99%
32		Lajkura	7.21	7.21	1.20	1.24	0.15	0.15	0.23	0.20	0.16	0.16	0.89	1.02	2.24	2.41	0.54	0.51	1.35	1.39
					53.57%	51.45%	6.70%	6.22%					39.73%	42.32%			7.49%	7.07%	60.27%	57.68%
33		Garjanbahal	6.54	6.54	0.03	0.14	0.00	0.00	0.00	0.00	0.02	0.03	0.47	0.58	0.50	0.72	0.02	0.03	0.03	0.14
					6.00%	19.44%	0.00%	0.00%					94.00%	80.56%			0.31%	0.46%	6.00%	19.44%
34		Kulda	6.34	6.34	0.52	0.75	0.00	0.00	0.00	0.00	0.01	0.02	1.31	1.67	1.83	2.42	0.01	0.02	0.52	0.75
					28.42%	30.99%	0.00%	0.00%					71.58%	69.01%			0.16%	0.32%	0.00%	30.99%
			2018	2021	2018	2021	2018	2021	2018	2021	2018	2021	2018	2021	2018	2021	2018	2021	2018	2021
35		Kaniha	6.77	7.18	0.18	0.31	0.00	0.00	0.00	0.00	0.10	0.07	1.04	1.24	1.22	1.55	0.10	0.07	0.18	0.31
					14.75%	20.00%	0.00%	0.00%					85.25%	80.00%			1.48%	0.97%	0.00%	20.00%

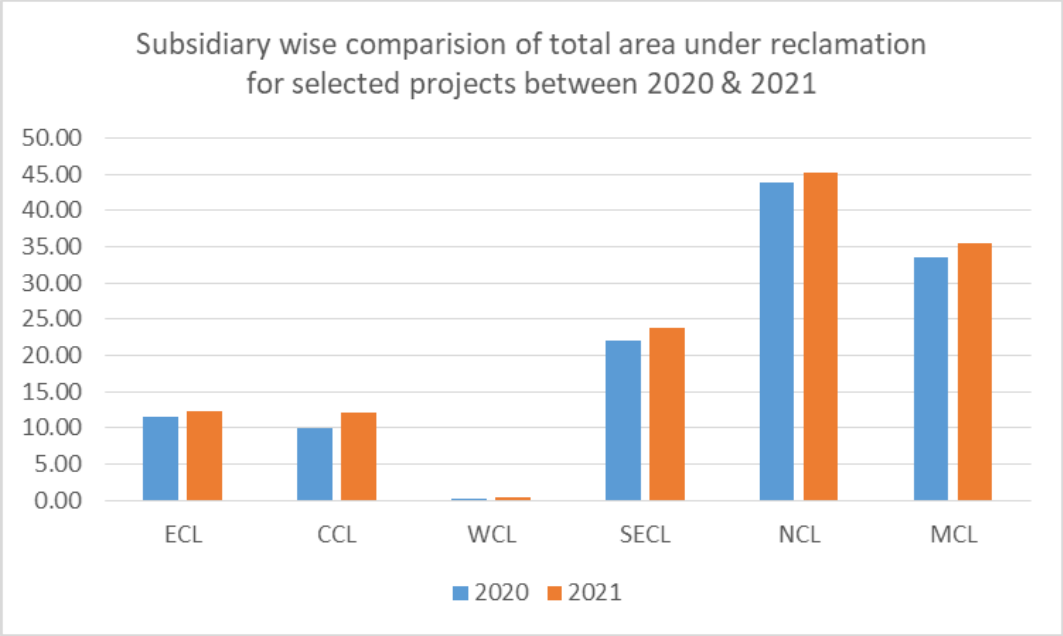


Figure 5.33: Subsidiary wise comparision of total area under reclamation (technical + biological) for selected projects between 2020 & 2021 based on remote sensing data

It is seen from the above chart that the total area under reclamation (technical + biological) is slightly higher in the year 2021 than in the year 2020 in all subsidiaries of CIL having majority of projects.

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, 2020 till March, 2021 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, 2020 till March, 2021 in respect of Coal Standards in the core zone and NAAQS in the buffer zone respectively have been presented.

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

Company	Name of mine	Core / Buffer	PM10 (Min)	PM10 (Max)	PM2.5 (Min)	PM2.5 (Max)	SO2 (Min)	SO2 (Max)	Nox (Min)	NOX (Max)
ECL	Rajmahal OC	Core	74.6	278.3	23.6	66.6	<10		12.5	19.8
		Buffer	78.9	138.6	24.8	45.4	<10		12.3	18.8
	Sonepur Bazari OC	Core	87.4	178.5	30	54.1	<10		15.7	19.7
		Buffer	63.1	96.7	22.7	33	<10		12.4	14.6
BCCL	AKWMC*	Core	60	134	33	71	9	14	21	29
		Buffer	64	158	23	87	9	14	20	32
	NT ST Exp (Cluster 9)*	Core	58	143	34	78	10	16	21	32
		Buffer	51	145	21	75	6	15	14	30
CCL	Amrapali	Core	55	263	21	117	<25		<6	
	Ashoka OC	Core	61	167	31	97	<25		<6	
		Buffer	50	139	21	81	<25		<6	
	Karo I OC /Karo	Core	57	340	20	131	<25		<6	
		Buffer	40	147	16	74	<25		<6	
	Konar	Core	53	340	22	134	<25		<6	
		Buffer	41	141	18	72	<25		<6	
	Magadh	Buffer	50	175	23	95	<25		<6	
	Piparwar OC	Buffer	41	155	19	83	<25		<6	
NCL	Amlohri OC	Core	52	288	16	104	29	61	10	41
		Buffer	39	73	17	30	17	29	10	20
	Bina OC	Core	51	498	11	104	26	59	10	47
	Block-B OC	Core	66	329	10	91	28	46	12	36
		Buffer	76	143	32	54	37	47	15	32
	Dudhichua OC	Core	50	323	12	73	23	38	10	48

Company	Name of mine	Core / Buffer	PM10 (Min)	PM10 (Max)	PM2.5 (Min)	PM2.5 (Max)	SO2 (Min)	SO2 (Max)	Nox (Min)	NOX (Max)
		Buffer	98	225	32	57	23	45	25	44
	Jayant OC	Core	62	492	20	110	24	40	17	37
		Buffer	93	278	17	72	23	40	16	26
	Khadia OC	Core	59	563	11	164	29	48	14	40
		Buffer	53	353	21	52	24	36	14	27
	Krishnashila OC	Core	57	304	17	75	26	45	9	46
	Nigahi OC	Core	50	437	17	169	26	54	16	42
WCL	Penganga OC	Core	44	188	22	80	10	20	10	80
		Buffer	38	82	10	42	10	14	10	25
SECL	Dipka OC	Core	172.3	294.8	47	57.5	24.6	40.8	30	43.8
		Buffer	66.8	102.5	43.3	64.8	14.3	43.8	24	48.8
	Gevra OC	Core	240.1	300.2	45.2	61.25	29.3	40	32.2	45.8
		Buffer	64.8	105.8	42.5	64.3	23.3	36.5	24.5	53.6
	Kusmunda OC	Core	83	374	43.2	62.4	30.9	39.9	32.3	49
		Buffer	62.8	145.1	41.6	56.9	26.6	59.1	28.5	41.5
	Manikpur OC	Core	51	273	31	58	21	38	21	39
		Buffer	60	191	30	57	21	32	19	34
MCL	Ananta OC	Core	46	244	20	83	6.6	45	13.3	64.9
		Buffer	42	95	13	57	5.9	46.1	11.9	68.6
	Balram OC	Core	43	290	13	87	7.5	25.6	8.2	59.8
		Buffer	42	137	16	63	6.8	36	6	60.1
	Belpahar OC	Core	52	248	16	69	7	24.4	11.1	40.4
		Buffer	42	95	17	56	6	26.5	7.5	36.2

Company	Name of mine	Core / Buffer	PM10 (Min)	PM10 (Max)	PM2.5 (Min)	PM2.5 (Max)	SO2 (Min)	SO2 (Max)	Nox (Min)	NOX (Max)
	Bharatpur OC	Core	48	290	17	82	5.9	37.8	13.7	49.7
		Buffer	44	148	16	63	6.6	36	6.8	60.1
	Bhubaneshwari OC	Core	41.8	96.3	13.9	58.7	1.5	7.4	1.8	7.5
	Garjanbahal	Core	52	258	16	85	5.6	24.3	11	40.9
		Buffer	38	95	17	53	7.1	25.7	10.7	47.7
	Hingula OC	Core	41	275	17	89	6.4	23.9	10.6	39.9
		Buffer	38	99	14	57	5.9	36.1	6	56.7
	Jagannath OC	Core	43	242	18	75	6.1	28.8	11.6	53.1
		Buffer	42	142	15	65	5.9	31.7	10.4	52.6
	Kaniha OC	Core	33	286	16	89	5.3	45.1	10.7	55.7
		Buffer	38	94	17	55	5.2	36.9	4.7	65.3
	Kulda OC	Core	41	240	16	81	7.4	25.7	14.4	48.5
		Buffer	40	95	18	53	8.3	25.3	11.1	54.5
	Lajkura OC	Core	41	240	16	70	7.3	25.9	9.7	38.1
		Buffer	46	98	17	57	7.1	25.7	11.1	51.9
	Lakhanpur OC	Core	35	238	10	95	7.2	27.2	10.9	51.5
		Buffer	42	94	16	53	6.4	26.2	9.8	46.1
	Lingaraj OC	Core	42	266	17	84	6.5	24.2	10.6	54.1
		Buffer	32	134	15	63	2.4	32.6	3.5	49.4
	Samaleswari OC	Core	50	268	18	79	7.4	23	12	54
		Buffer	43	96	16	53	5.9	26.4	13.2	47.8
SCCL	GK OCP	Core	85	152	26.3	50	11.7	22.6	16.7	22.6
		Buffer	44	56	18	23.7	11.1	13.9	15.8	20.6

Company	Name of mine	Core / Buffer	PM10 (Min)	PM10 (Max)	PM2.5 (Min)	PM2.5 (Max)	SO2 (Min)	SO2 (Max)	Nox (Min)	NOX (Max)
	JK-5 OCP	Core	38	201	17.2	63.5	7.5	11.3	13.6	16.1
		Buffer	47	77	21.8	31.2	8.7	9.9	14.1	15.1
NLC	Talabira OC	Core	41	173	22.1	28.7	7.5	16.3	11.1	25.2
		Buffer	43	74	22.8	39.5	7.3	12.3	11.8	19.1

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

6.2 Observations on air quality

1. ECL

The maximum concentration of PM_{10} in core zone (278 $\mu g/m^3$) is within the prescribed limits as per Coal Mines Standards (G.S.R. 742(E) dated 25th Sep, 2000). In the buffer zone, the maximum concentration has been found to be 139 $\mu g/m^3$. In the buffer zone of Sonepur Bazari OCP, the maximum concentration of PM_{10} (97 $\mu g/m^3$) is below 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 (45 $\mu g/m^3$) is well within 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 (143.00 $\mu g/m^3$) is within the prescribed limits as per Coal Mines Standards (G.S.R. 742(E) dated 25th Sep, 2000) for selected projects. Buffer zone stations of AKWMC OCP and NT-ST Expansion OCP fall in the core zone of adjacent cluster, hence the values are compared against core zone standards. The maximum concentrations of PM_{10} (158 $\mu g/m^3$) and (145 $\mu g/m^3$) in buffer zone 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 (340 $\mu g/m^3$) is observed to be crossing the prescribed limits as per Coal Mines Standards (G.S.R. 742(E) dated 25th Sep, 2000) in Karo OC & Konar OCP. In the buffer zone also the concentration of maximum PM_{10} (175 $\mu g/m^3$) has crossed the permissible limit prescribed under NAAQS, 2009 in Magadh OCP. Concentration of PM2.5 in buffer zone for Magadh OC (95 $\mu g/m^3$) was also observed to be beyond the prescribed NAAQS 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 (188 $\mu g/m^3$) is observed to be is within the prescribed limits as per Coal Mines Standards (G.S.R. 742(E) dated 25th September, 2000). In the buffer zone, the value of maximum PM_{10} (82 $\mu g/m^3$) & PM2.5 (42 $\mu g/m3$) were also within the permissible limit prescribed under NAAQS, 2009. The concentration of gaseous pollutants was observed to be within the prescribed limits.

5. SECL

The maximum concentration of PM_{10} in core zone (560 $\mu g/m^3$) in Manikpur OC and 374 $\mu g/m^3$ in Kusmunda OCP 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} (191 $\mu g/m^3$) 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 (65 $\mu g/m^3$) 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} in the core zone (563 $\mu g/m^3$) is observed to be 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} (353 $\mu g/m^3$) 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 (72 $\mu g/m^3$) is crossing the prescribed limit. Higher values of PM_{10} and $PM_{2.5}$ may be attributed to thermal power generation activities in the region. The concentration of gaseous pollutants was observed to be within the prescribed limits.

7. MCL

The maximum concentration of PM_{10} in the core zone observed is 290 $\mu g/m^3$. 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} in the core zone observed is 201 $\mu g/m^3$. 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, 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

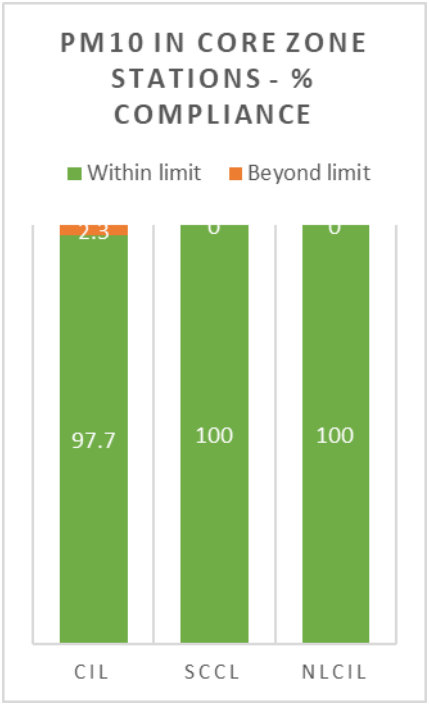
In the core zone of Talabira II & III mines, the maximum value of PM10 is 173 $\mu g/m^3$. In the buffer zone, the value of maximum PM_{10} (74 $\mu g/m^3$) has been within the permissible limit prescribed under NAAQS, 2009. Also, as compared with the prescribed limits under NAAQS, 2009, the maximum concentration of $PM_{2.5}$

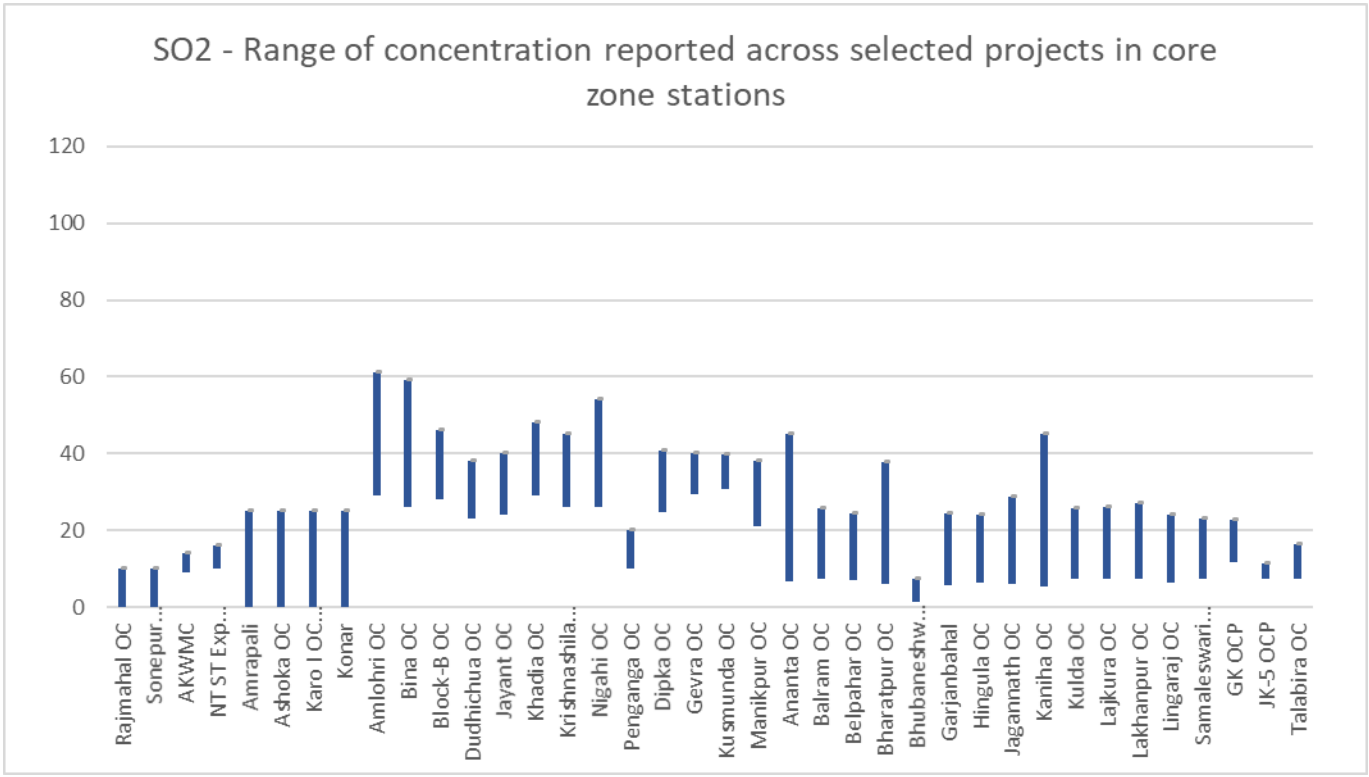
observed in the buffer zone (40 µg/m³) is within the prescribed limit. The concentration of gaseous pollutants was observed to be within the prescribed limits.

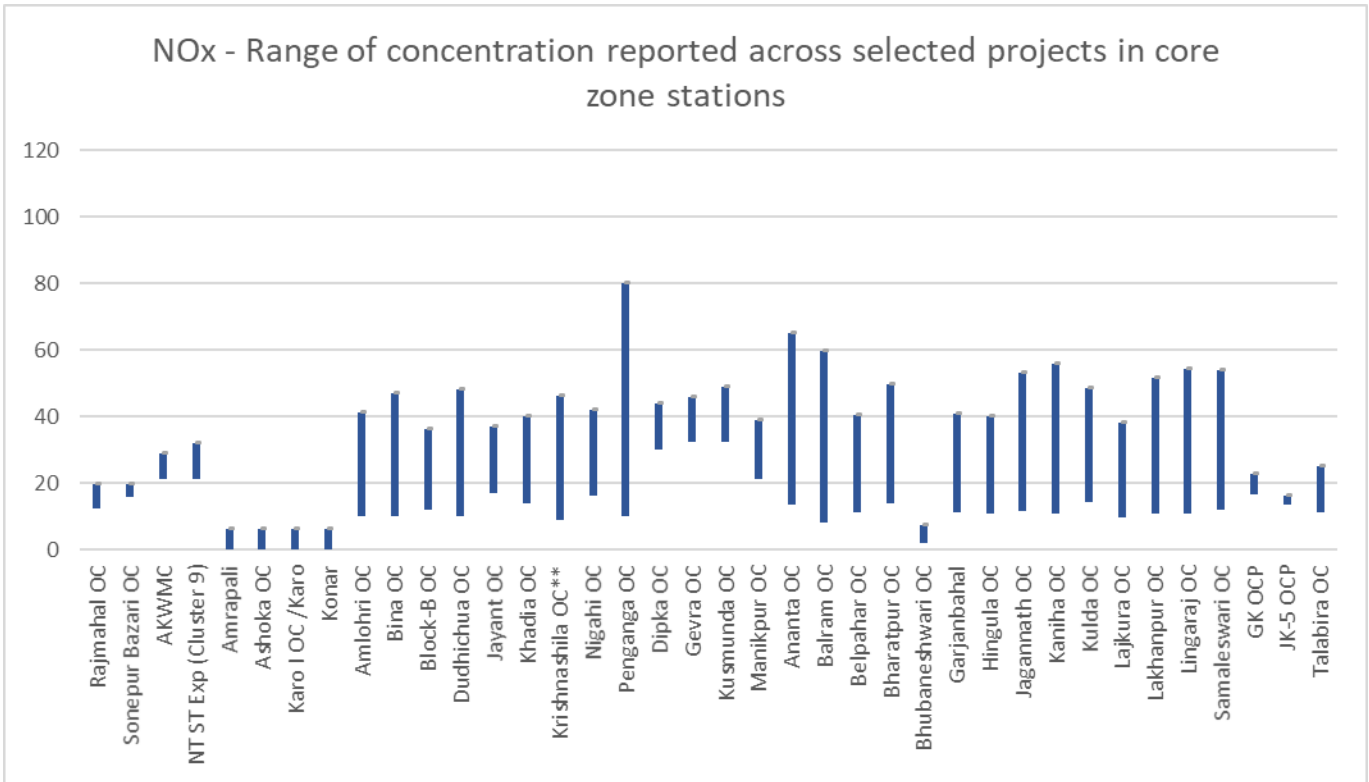
6.3 Graphical representation of status of air quality parameters

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 97% of the time during 2020-21. Compared with the prescribed standards, the compliance of PM_{10} and $PM_{2.5}$ concentrations in the buffer zone ranges between 83% to 100% during 2020-21.

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.

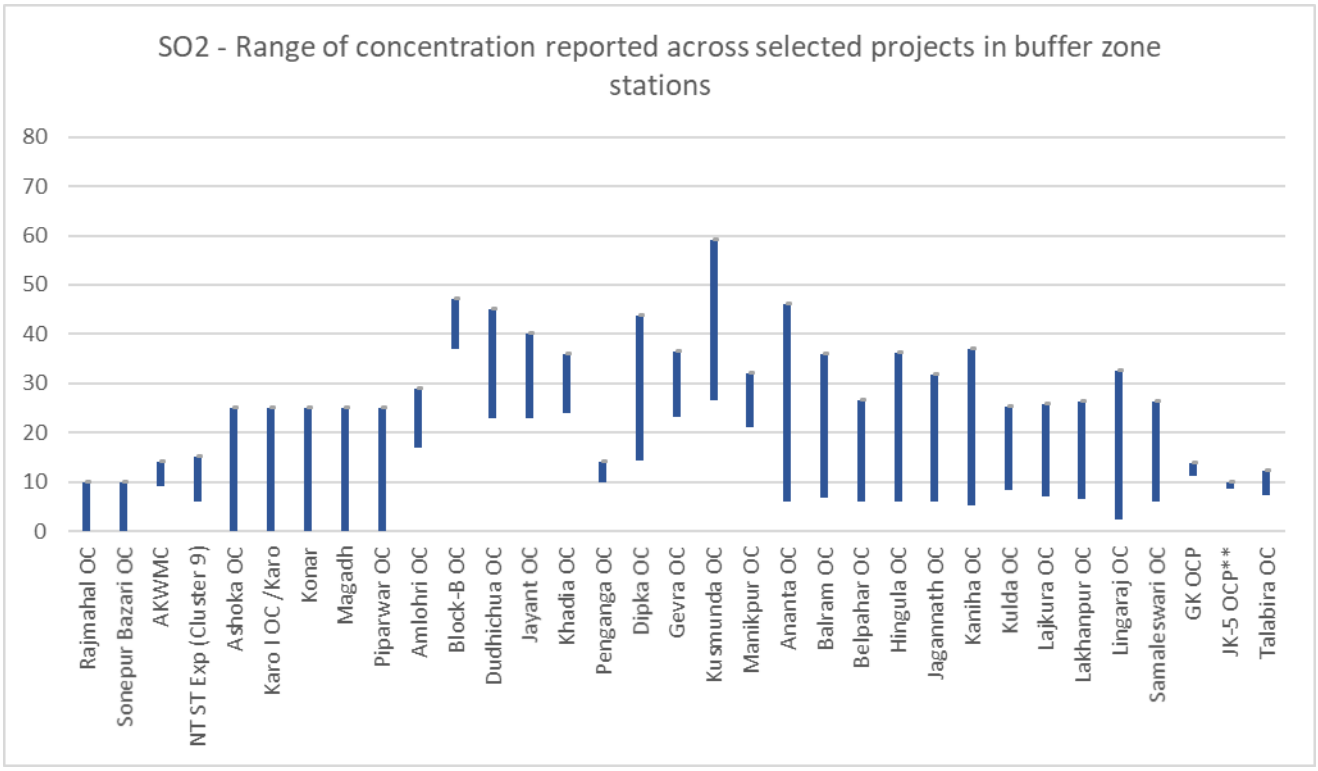


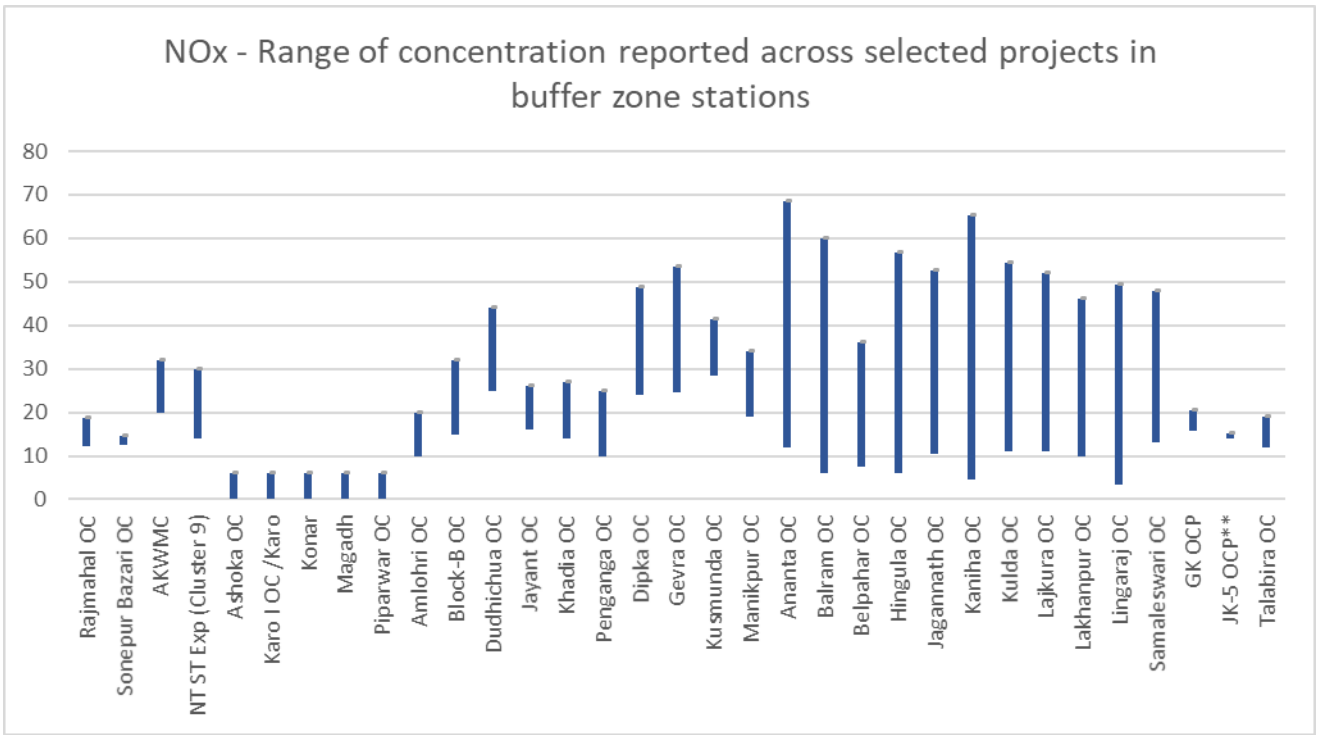




Statutory limits for core zone – 120 µg/m^3

Figure 6.4: Range of concentrations – SOx & NOx across selected projects in core zone stations





Statutory limits for core zone – 80 µg/m³

Figure 6.4: Range of concentrations – SOx & NOx across selected projects in buffer zone stations

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 2020-21 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 cu.m/day)*				
		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	Losses
ECL	Rajmahal OC	7066	4649	2417	Nil	Nil
	Sonepur Bazari OC	3210	3210	Nil	Nil	Nil
BCCL	AKWMC OC	3900	1510	2390	Nil	Nil
	NT ST Exp (Cluster 9)	19000	18500	500	Nil	Nil
CCL	Amrapali OC	1764	1351	Nil	414	Nil
	Ashoka OC	800	542	148	110	Nil
	Karo OC	384	175	Nil	208	Nil
	Konar OC	334	290	Nil	44	Nil
	Magadh OC	1184	625	Nil	559	Nil
	Piparwar OC	1315	1014	Nil	301	Nil
NCL	Amlohri OC	7088	6148	Nil	Nil	940
	Bina OC	7258	6518	Nil	Nil	740
	Block-B OC	3099	2699	Nil	Nil	400
	Dudhichua OC	3458	3000	Nil	Nil	458
	Jayant OC	11438	10085	Nil	Nil	1353
	Khadia OC	5542	4849	Nil	Nil	693
	Krishnashila OC	Nil	Nil	Nil	Nil	Nil
	Nigahi OC	7500	6518	Nil	Nil	982
WCL	Penganga OC	1430	1430	Nil	Nil	Nil
SECL	Dipka OC	5418	2017	Nil	3401	Nil

Company/ Subsidiary	Name of the Mine	Quantity (in cu.m/day)*				
		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	Losses
	Gevra OC	5969	4002	Nil	Nil	1968
	Kusmunda OC	8700	6900	Nil	539	1201
	Manikpur OC	6328	1625	Nil	3762	941
MCL	Ananta OC	8694	2620	Nil	11	Nil
	Balram OC	7479	2071	Nil	5408	Nil
	Belpahar OC	18714	2055	Nil	16659	Nil
	Bharatpur OC	30837	5040	Nil	25797	Nil
	Bhubaneshwari OC	7307	1235	Nil	6072	Nil
	Hingula OC	2291	836	Nil	1455	Nil
	Jagannath OC	2631	2620	Nil	11	Nil
	Kaniha OC	5244	2006	Nil	3238	Nil
	Kulda OC	12170	2990	Nil	9180	Nil
	Lajkura OC	8041	1604	Nil	6437	Nil
	Lakhanpur OC	32664	3503	Nil	29161	Nil
	Lingaraj OC	6964	3022	Nil	3942	Nil
	Samaleswari OC	16101	5015	Nil	11086	Nil
SCCL	Gautami Khani OC	5180	3080	2100	Nil	Nil
	Jawahar Khani - 5 OC	4450	2950	1500	Nil	Nil
NLC	Talabira II & III OC	12000	12000	Nil	Nil	Nil

Note – Values have been rounded off

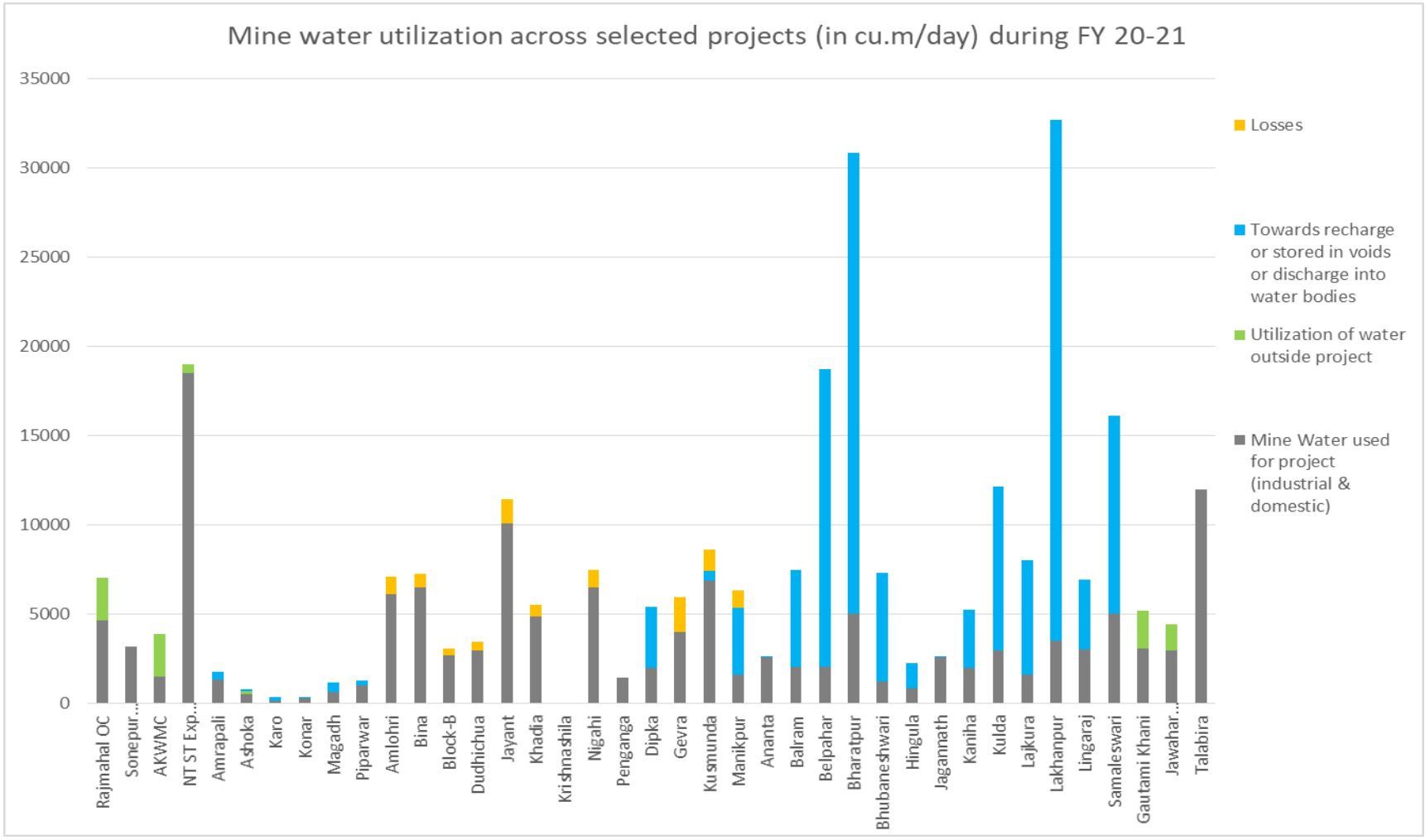


Figure 7.1: Mine water utilization across projects during FY 20-21

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: Mine water is utilized for industrial and domestic requirements within the projects and surplus water helps in recharge of nearby water regime. Mine water from 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).

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.

NLC: The mine water generated within Talabira mine is being used for captive consumption and there is no discharge outside the project.

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		Details of treatment facility
	pH Range	TSS Range (in mg/l)	
Rajmahal OC*	6.5 to 8.1	13.8 to 34	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 Bazari OC	6.9 to 7.9	14.8 to 28	ETP – 7200 cu.m/day STP – 600 cu.m/day; primary treatment followed by ASP and sludge drying
AKWMC OC	7.7 to 8.3	27 to 56	ETP – 48 KLD; treated water is being reused for plantation purposes MWTP – 5000 gpd installed at Ramkanali. It is being used for domestic water supply to nearby community.
NT ST Exp (Cluster 9)	7.2 to 8.2	23 to 56	01 no. of Oil & Grease Trap is installed at South Tisra Workshop. Also, 01 no of pressure filter plant at South Tisra Workshop
Amrapali OC*	7.4 to 8.1	24.6 to 44	Mine water is collected in main mine sump which acts as a sedimentation pond
Ashoka OC*	7.2 to 8.1	2.6 to 48	ETP available at workshop.
Karo OC*	7.5 to 8.3	23.8 to 44	No discharge outside.
Konar OC*	7.5 to 8.3	20 to 48	Mine water is collected in main mine sump which acts as a sedimentation pond
Magadh OC*	-	-	Filter Plant for domestic water
Piparwar OC*	6.7 to 8.1	21.4 to 492.4	Nil
Amlohri OC	6.9 to 9.3	20 to 116	ETP – 51 MLD capacity, STP – 2 MLD capacity
Bina OC	6.4 to 8.2	50 to 196	ETP – 31.2 MLD capacity, STP – 2.5 MLD capacity
Block-B OC	7.1 to 8	24 to 132	ETP – 8.68 MLD capacity, STP – 0.8 MLD capacity
Dudhichua OC	7 to 9.8	46 to 134	ETP – 30 MLD capacity, STP – 2 MLD capacity
Jayant OC	6.6 to 9	58 to 162	ETP – 32 MLD capacity, Combined ETP – 8 MLD, STP – 4 MLD capacity
Khadia OC	7.3 to 8.8	52 to 142	ETP – 38 MLD capacity, STP – 1.5 MLD capacity
Krishnashila OC	6.6 to 8.2	42 to 212	ETP – 0.4 MLD capacity Since colony of Bina & Krishnashila is common, STP installed at Bina (2.5 MLD) is utilized for Krishnashila residential colony as well.
Nigahi OC	6.2 to 8.7	42 to 116	CHP ETP – 10.5 MLD and Workshop ETP of 4 MLD, STP – 3 MLD
Penganga OC*	6.8 to 8	18 to 64	ETP – 51 MTD, STP – 2 MLD

Name of the Project	Quality of water discharge from mine		Details of treatment facility
	pH Range	TSS Range (in mg/l)	
Dipka OC	7 to 7.9	10 to 100	ETP – 110 KLD; average 40 KLD is treated daily and reused for HEMM washing. RO – 1000 lph for supply of drinking water to colony
Gevra OC	6.1 to 8.8	10 to 117	ETP – 210 KLD - Pre-settling, Oil & Grease trap & chemical dosing; treated water is recycled & reused. STP – 3 MLD consisting of aerated lagoon, bar screen, grit chamber, aerated pond followed by polishing pond. Treated water is used for dust suppression & golf ground watering.
Kusmunda OC	6.3 to 8.2	10 to 226.5	ETP – 416 cu.m/day consisting of primary treatment; treated water is reused for HEMM washing MWTP – 3 nos. – Sedimentation ponds (8540 KL & 7200 KL capacity) & RCC settling tank (540 cu.m/day) – treated water is reused for dust suppression in mine & CHP STP – 2000 cu.m/day – Equipped with secondary treatment unit with Aeration tank and Sludge drying Beds. Treated effluent is used for irrigation and green belt development by local communities
Manikpur OC	5.9 to 7.9	10 to 91.2	ETP – 50,000 KLD, treated water is reused by villagers for agricultural purposes MWTP – 0.48 MLD, treated water is reused for vehicle washing STP – 0.5 MLD, treated water is reused for dust suppression in mines
Ananta OC*	6.3 to 7.8	20 to 46	ETP & STP provided. ZLD is practiced, hence no water is discharged outside the mine.
Balram OC*	*No monitoring done in 20-21*	*No monitoring done in 20-21*	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.
Belpahar OC*	4.6 to 8.1	20 to 72	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. ZLD is practiced, hence no water is discharged outside the mine.
Bharatpur OC*	5.9 to 7.8	20 to 58	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.

Name of the Project	Quality of water discharge from mine		Details of treatment facility
	pH Range	TSS Range (in mg/l)	
			ZLD is practiced, hence no water is discharged outside the mine.
Bhubaneshwari OC*	7.1	8.0	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.
Garjanbahal OC*	5.8 to 8	14 to 76	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 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.
Hingula OC*	*No monitoring done in 20-21*	*No monitoring done in 20-21*	STP and ETP is provided. ZLD is practiced, hence no water is discharged outside the mine.
Jagannath OC*	*No monitoring done in 20-21*	*No monitoring done in 20-21*	STP and ETP is provided. ZLD is practiced, hence no water is discharged outside the mine.
Kaniha OC*	5.7 to 8.1	16 to 78	MDTP, ETP & STP ZLD is practiced, hence no water is discharged outside the mine.
Kulda OC*	5.5 to 8.1	18 to 64	STP and ETP is provided. ZLD is practiced, hence no water is discharged outside the mine.
Lajkura OC*	3 to 7.5	*No data reported*	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. IWSS-for drinking water treatment.

Name of the Project	Quality of water discharge from mine		Details of treatment facility
	pH Range	TSS Range (in mg/l)	
			ZLD is practiced, hence no water is discharged outside the mine.
Lakhanpur OC*	4.8 to 7.6	18 to 66	Mine sump act as a sedimentation pond. ZLD is practiced, hence no water is discharged outside the mine.
Lingaraj OC*	7.2 to 7.8	*No data reported*	STP and ETP is provided. ZLD is practiced, hence no water is discharged outside the mine.
Samaleswari OC*	5.6 to 7.4	16 to 28	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.
Gautami Khani OC	5.8 to 7.6	9 to 76	ETP – Settling tanks (03) of 25500 gallons capacity, collection tank of 6000 gallons; treated water is being used for industrial purpose viz. Haul road dust suppression, green belt development etc. MWTP – Filter beds (02) of 1,20,000 KL capacity each; the treated water after SS filtration and disinfection is utilized for domestic purposes. STP – 1.5 MLD consisting of extended aeration and ASP; treated water is beng reused for plantation. RO – 02 units (50,000 lph at Canteen and 250 lph at Base Workshop) for drinking water supply to mine personnel
Jawahar Khani - 5 OC	6.3 to 7.8	6 to 15	ETP – Settling tanks (03) of 13200 gallons capacity, collection tank of 8450 gallons; treated water is being used for industrial purpose viz. Haul road dust suppression, green belt development etc. MWTP – Filter bed of 2,00,000 KL capacity; the treated water after filtration and disinfection is utilized for drinking purposes. RO – 250 lph, as drinking water supply to mine personnel
Talabira II & III OC	-	-	Total mine water is being used for captive consumption. No discharge outside.

No heavy metal contamination reported by coal companies for selected projects.

**Details as per SDC Status Report 2019-20, no additional inputs received from coal co. w.r.t 2020-21.*

7.2.2 Observations on Water Quality

Three mines of MCL namely Lakhanpur, Belpahar and Lajkura OCPs are having pH value less than the standard limit whereas two mines of NCL namely Amlohri & Dudhichua OC have maximum pH slightly beyond the standard limit. In case of MCL, the low pH may be attributed to wash off from pyrites in the Ib valley coalfields post monsoon. 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. However the MCL 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. For NCL also, there is no reported discharge of water outside project for community use, the entire quantum of water is being treated and utilized for captive consumption. Maximum TSS concentration monitored was found to be exceeding the prescribed limits at NCL & SECL projects & CCL (Piparwar OC) – however, there is no reported outside discharge and the water is being reused for industrial uses. The graphical representation of the water quality parameters (pH & TSS) for the projects considered are shown below:

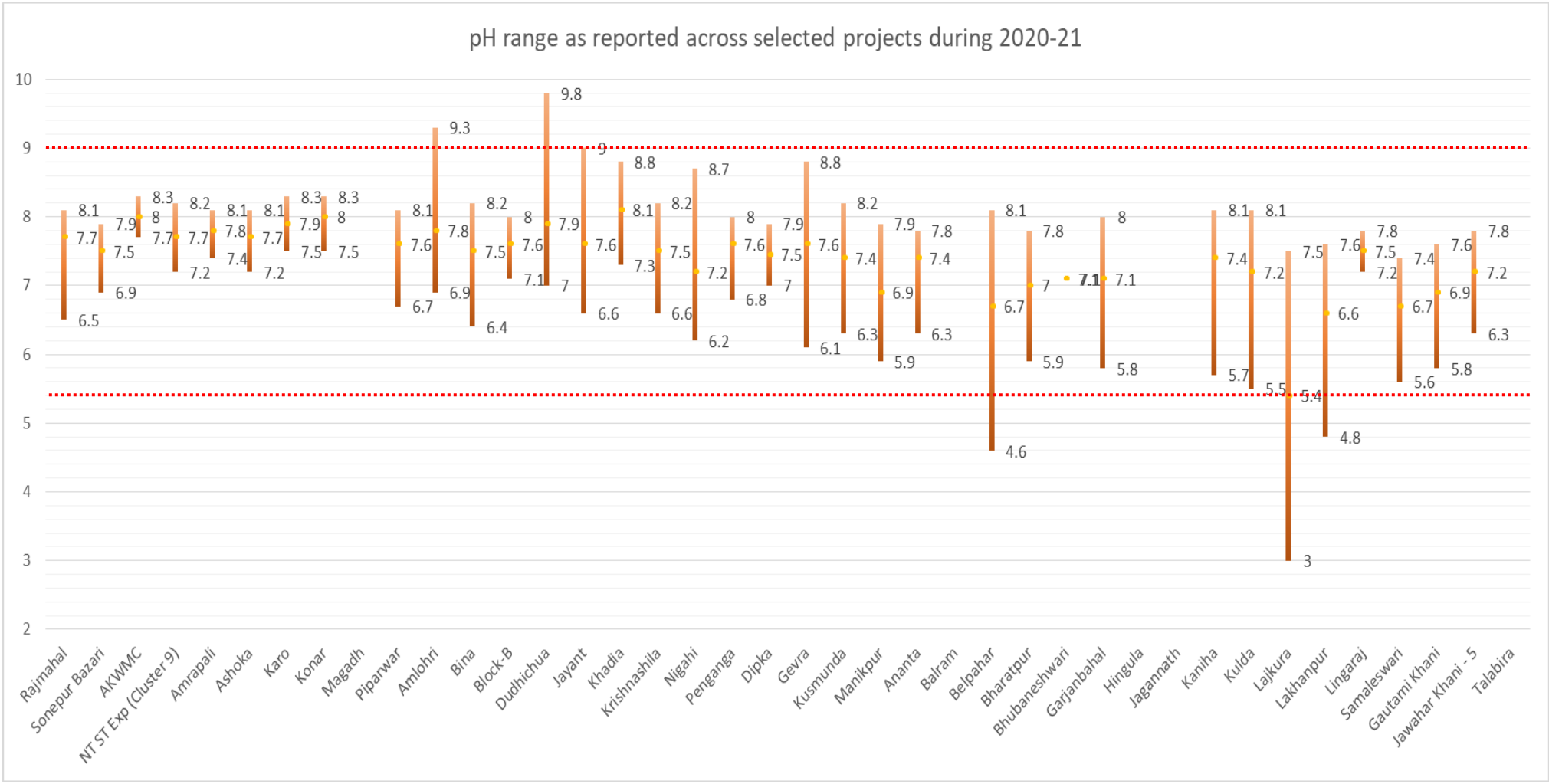


Figure 7.2: Graphical representation of pH values of mine water in core zone during 2020-21

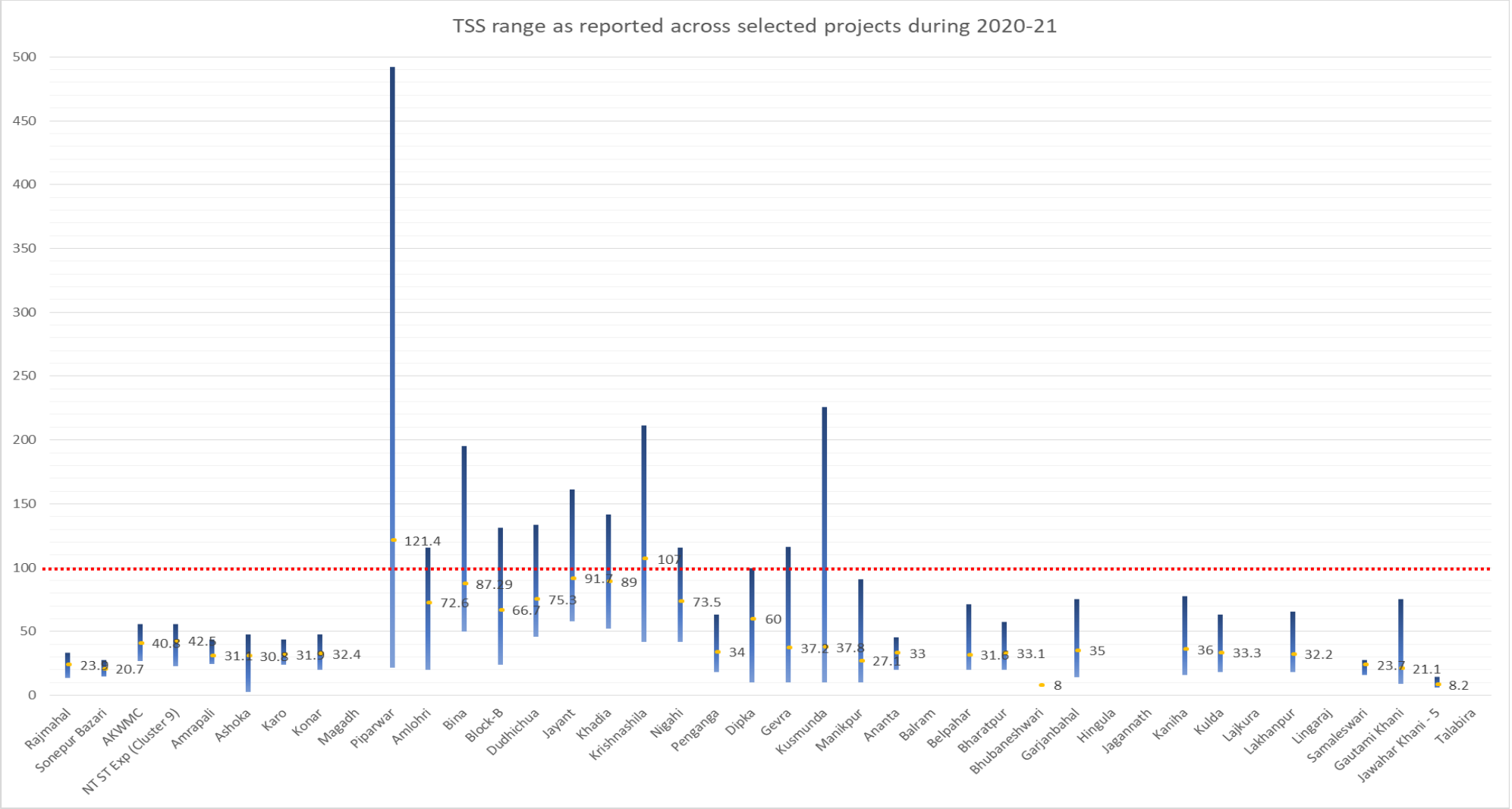


Figure 7.3: Graphical representation of TSS values of mine water in core zone during 2020-21

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 SECL & CCL, which needs to be addressed.

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

Figure 7.4: 0.8 MLD STP at Block-B, NCL

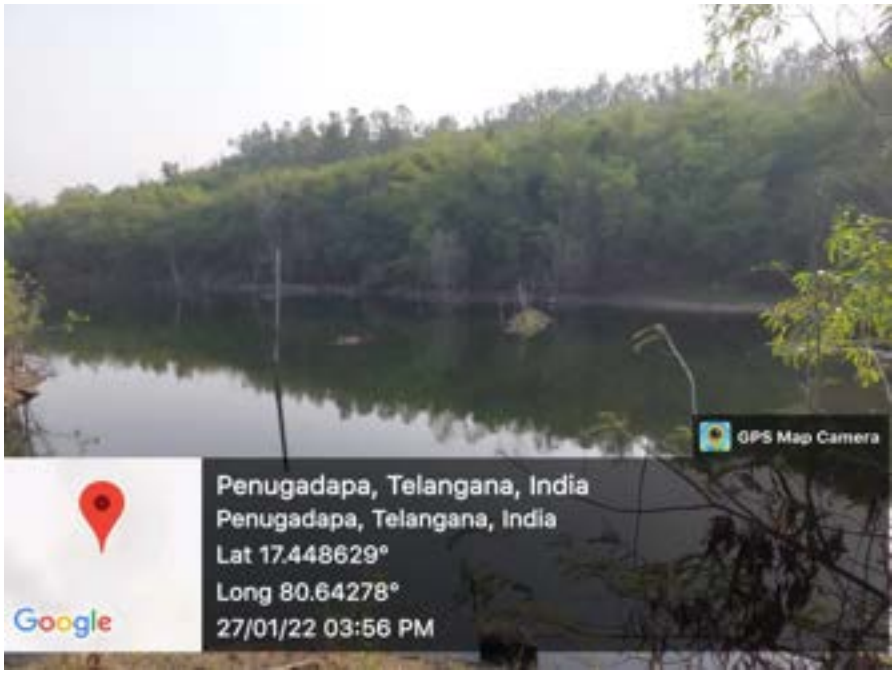


Figure 7.5: Summer storage sump, SCCL

Figure 7.6: Pressure Filter and RO Water Facility at Rajmahal Area, ECL

Figure 7.7: Utilization of mine water for water sprinkling in Piparwar OCP, CCL

Figure 7.8: Mine Water Sedimentation Tank at Penganga OCP, WCL

Figure 7.9: Domestic ETP plant at Kusmunda OCP, SECL

Figure 7.10: Abandoned quarry -4 at Durgapur OC expn.acting as a ground water recharge structure WCL

Figure 7.11: Trolly Mounted Mist Foggers at CHP, Umrer Area, WCL

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 and 2020.

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:

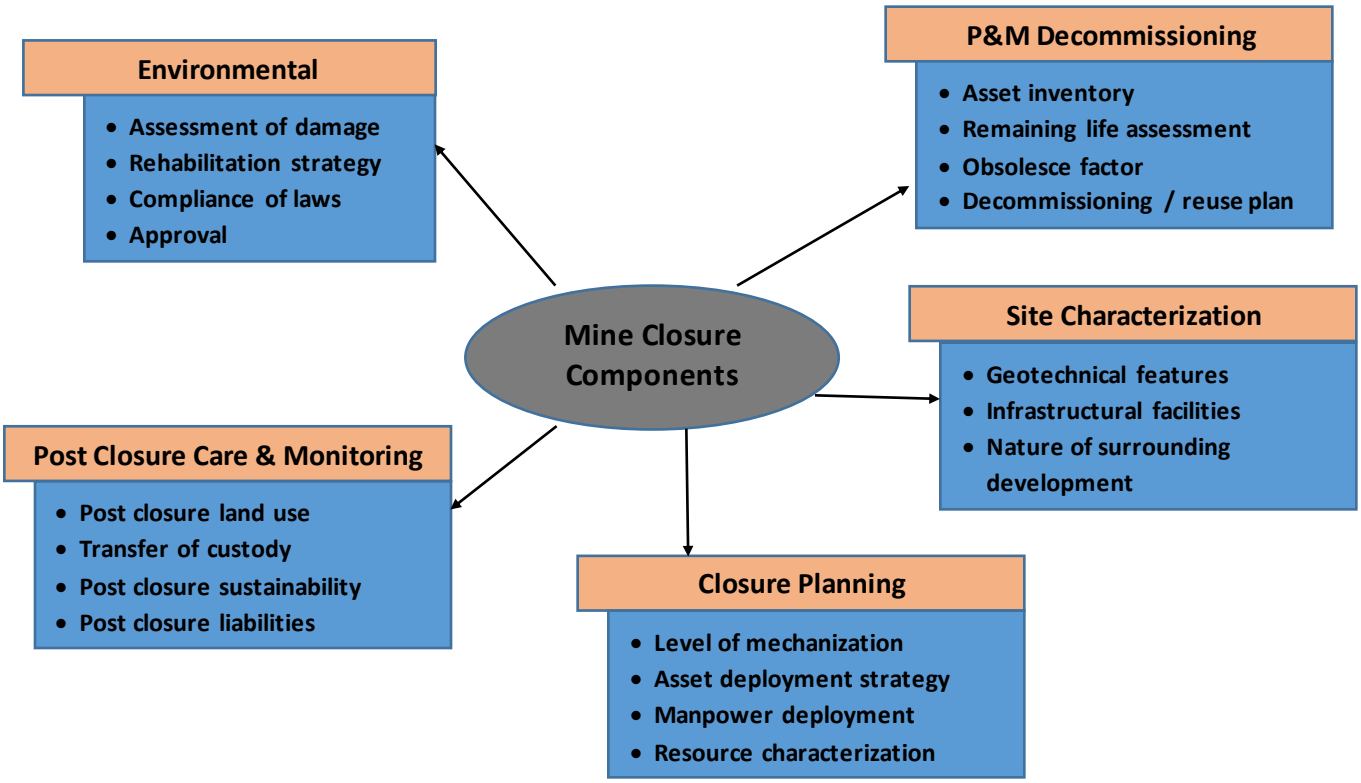


Figure 8.1: Mine Closure Components

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.

As per reported data for FY 20-21, a total of Rs 1754.53 Cr. has been deposited in Escrow Accounts of 40 considered coal mines of which Rs. 338.95 Cr. (around 19%) 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 31.03.2021 (in Lakhs), rounded off	Escrow Amount released so far for implementation of progressive mine closure as on 31.03.2021 (in Lakhs), rounded off
ECL	Rajmahal	13320	4076
	Sonepur Bazari	7748	2427
BCCL	AKWMC	1800	184
	NT ST Exp (Cluster 9)	4607	619
CCL	Amrapali	5829	1201
	Ashoka	4289	0
	Karo	1995	350
	Konar	1216	5
	Magadh	6888	0
	Piparwar	8710	5055
WCL	Amlohri	67	33
SECL	Bina	63	37
	Block-B	42	18
	Dudhichua	81	57
	Jayant	135	110
NCL	Khadia	53	20
	Krishnashila	38	7
	Nigahi	89	38
	Penganga	3682	833
	Dipka	7787	0
	Gevra	1793	5147
	Kusmunda	6286	2293
	Manikpur	3420	131
MCL	Ananta	6747	762
	Balram	4377	0
	Belpahar	13099	1477
	Bharatpur	7833	2081
	Bhubaneshwari	4661	190
	Garjanbahal	1491	0
	Hingula	5602	0
	Jagannath	3470	0
	Kaniha	3193	0
	Kulda	3356	0
	Lajkura	2483	0
	Lakhanpur	11642	2097
	Lingaraj	6842	0
	Samaleswari	8738	4647
SCCL	Gautami Khani	6303	0
	Jawahar Khani - 5	4052	0
NLCIL	Talabira	1628	0

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.

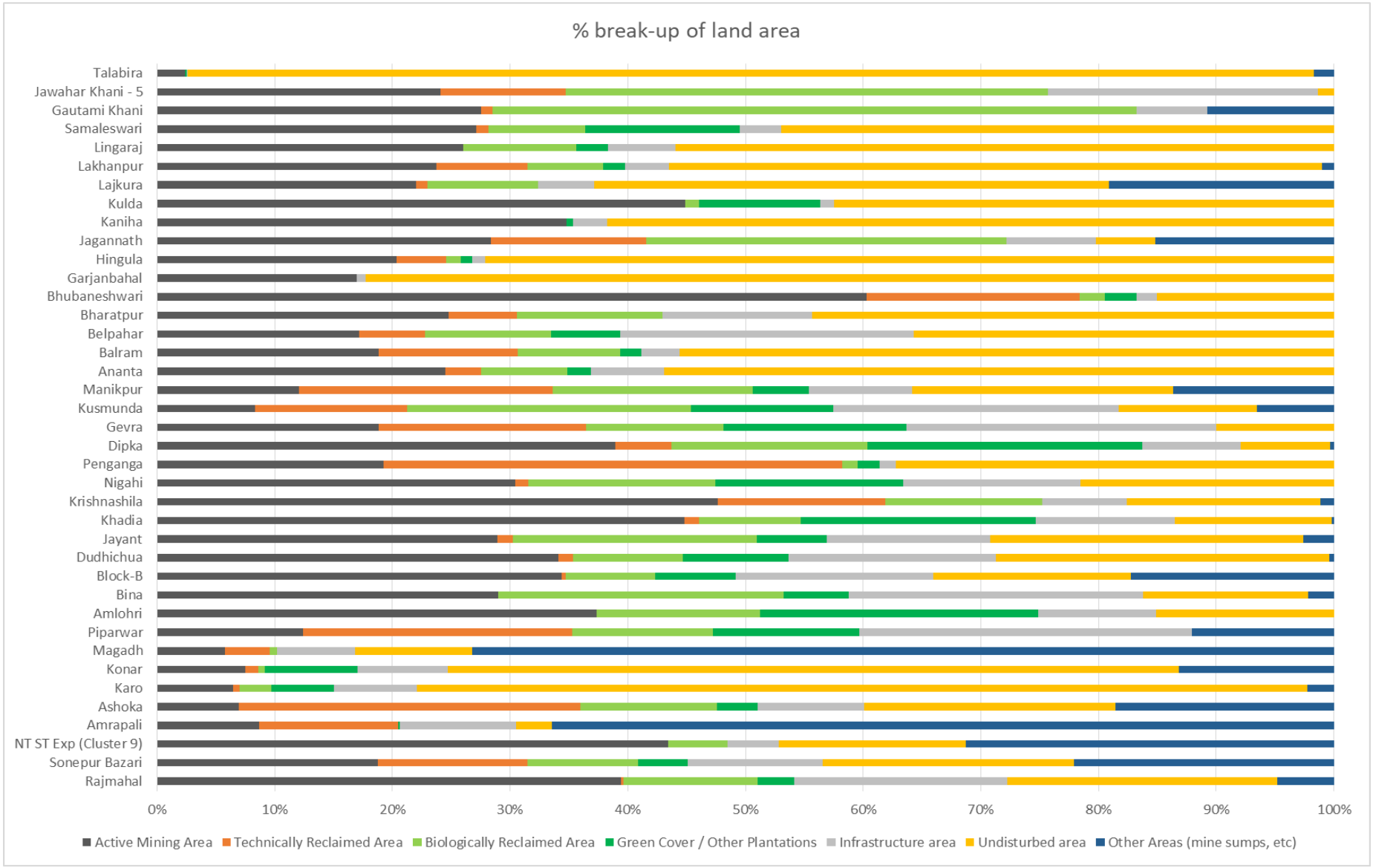


Figure 8.2: Break-up of land use as % of total project area

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 25% of the area is under active mining, 6% under technical reclamation, 20% green cover (including biological reclamation over technically reclaimed areas), 12% under Infrastructure area, 30% undisturbed areas and balance 7% falls under other areas (like mine sumps, etc.). The same is represented graphically in the figure below.

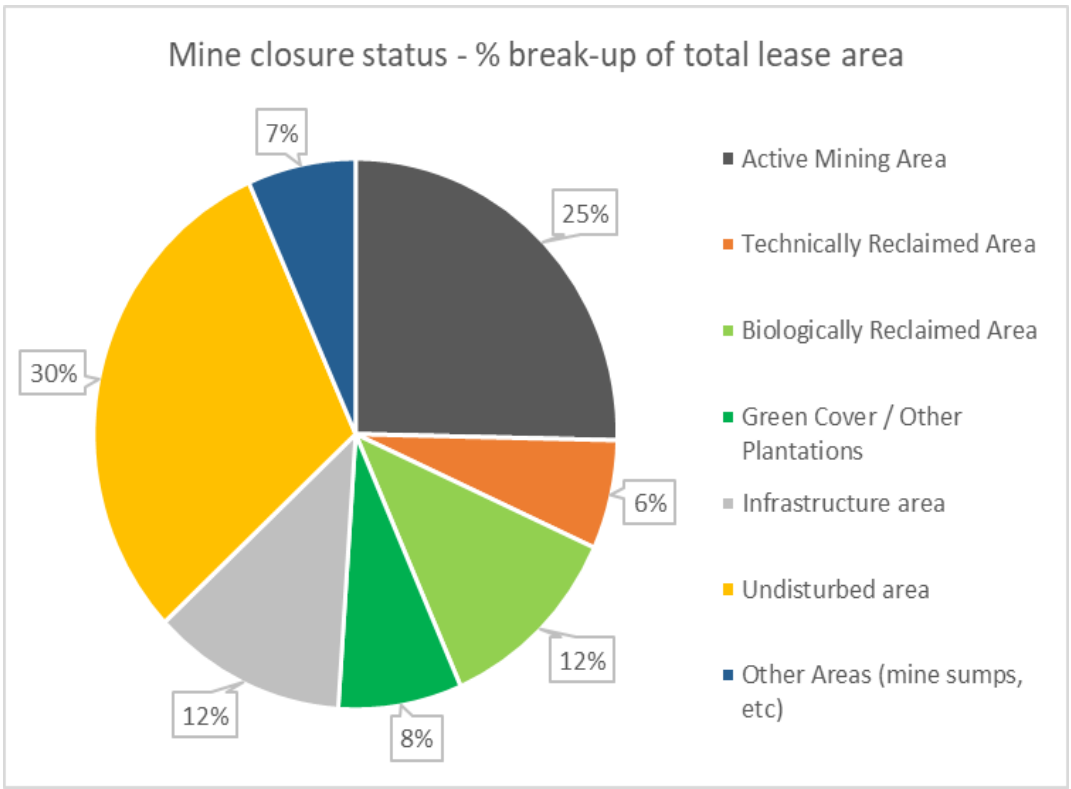


Figure 8.3: Mine Closure status – Land use as % of total project area

8.5 Plantation in Mines

Since inception, CIL has planted more than 100.45 million trees covering an area of approx. 40686 ha as on 31st March, 2021, 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 company wise break-up for plantation done till 2020-21 is shown in the table below:

Table 8.2: Subsidiary wise break-up of plantation done by coal companies till 2020-21

Subsidiary wise break-up for plantation done by coal companies till 2020-21		
Subsidiary	**No. of plants (in million)**	**Land Area (in ha)**
ECL	8.66	3480.66
BCCL	4.71	3704.31
CCL	8.18	5028.81
NCL	19.02	6921.32
WCL	28.46	11388.43
SECL	25.28	7659.46
MCL	5.56	2272.32
NEC	0.58	231.08
CIL (Total)#	100.45	40686.39
SCCL*	53.19	12262
NLCIL**	2.38	1958.24
Grand Total	**155.19**	**54062.29**

#Source: Data available in CIL records

**Considering SCCL submission of 2,25,000 saplings planted over 90 ha in JK-5 OC during 2020-21*

***Considering NLCIL submission of 1,710 saplings over 2.43 ha area during 2020-21*

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.

Figure 8.4: Plantation over internal dumps at Sonepur Bazari OC, ECL

Figure 8.5: Plantation near Piparwar OC, CCL

Figure 8.6: Plantation over 3.02 ha area near Quarry 3, Lakhanpur OC, MCL

Figure 8.7: Plantation in overburden dump area, Gevra OC, SECL

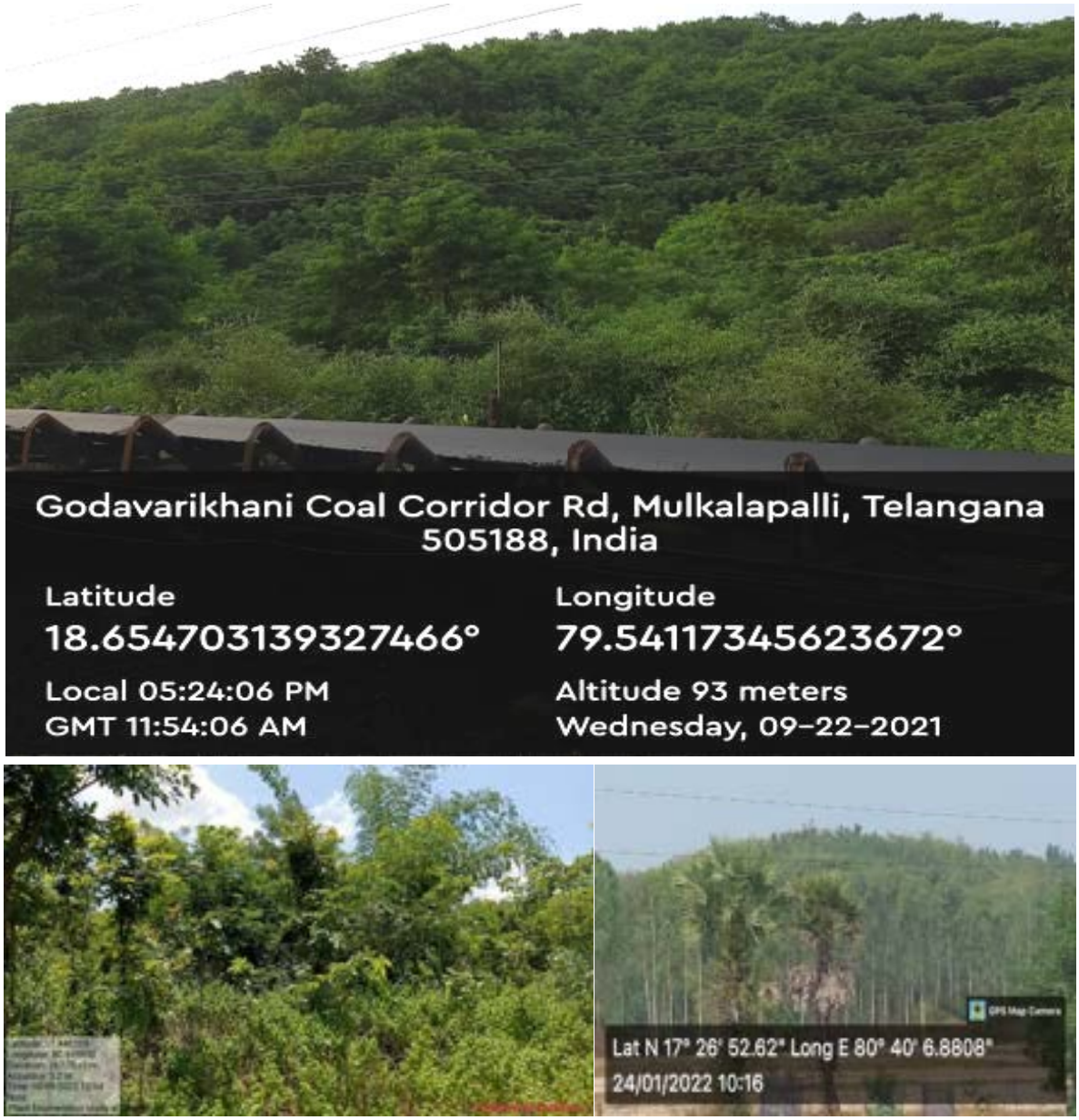


Figure 8.8: Plantation across mines of SCCL

Figure 8.9: Mass plantation drive with School students & CISF personnel in Mine Boundary, Neyveli

Figure 8.10: Vegetable plantation (Bhindi, Brinjal, lab crops) & tree plantation in NLCIL Mine Reclaimed Area, Neyveli

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 2016, 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	02	MCL – Garjanbhal OC NLCIL – Talabira OC
Very Good	60 - 79%	23	ECL – Sonepur Bazari OC BCCL – AKWMC CCL – Amrapali OC, Ashoka OC, Karo OC, Konar Exp. OC, Magadh OC, Piparwar OC

Category	Score	No. of Mines	Name of Mines
			NCL – Amlori OC, Bina OC, Jayant OC, Nigahi OC WCL – Penganga OC SECL - Dipka OC, Gevra OC, Kusmunda OC, Manikpur OC MCL – Balram OC, Belpahar OC, Jagannath OC, Samaleshwari OC SCCL – GK OC, JK-5 OC
Good	Below 60%	15	ECL – Rajmahal OC NCL – Block-B OCP, Dudhichua OC, Khadia OC MCL – Ananta OC, Bharatpur OC, Hingula OC, Kaniha OC, Lajkura OC, Lakhanpur OC, Lingaraj OC Krishnashila OC*, Bhubaneshwari OC* & Kulda OC* BCCL – NTST Exp. OC*

*Mines with score less than 40

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	34	ECL - Rajmahal OC, Sonepur Bazari OC BCCL- AKWMC, NT-ST Expansion OC CCL - Amrapali OC, Ashoka OC NCL – Amlohri OC, Bina OC, Block-B, Dudhichua OC, Khadia OC, Krishnashila OC, Nigahi OC WCL- Penganga OC SECL – Dipka OC, Manikpur OC, Kusmunda OC

Category	Score	No. of Mines	Name of Mines
			MCL – Ananta OC, Balram OC, Belpahar OC, Bharatpur OC, Bhubneshwari OC, Garjanbahal OC, Hingula OC, Jagannath OC, Kaniha OC, Kulda OC, Lajkura OC, Lakhanpur OC, Lingaraj OC, Samaleshwari OC, SCCL – GK OC, JK-5 OC NLCIL – Talabira OC
Very Good	60 - 79%	06	CCL – Karo OC, Konar OC, Magadh OC, Piparwar OC SECL- Gevra OC NCL –Jayant 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	21	ECL - Rajmahal OC, Sonepur Bazari OC BCCL – AKWMC OC, NTST Exp. OC CCL - Amrapali OC, Ashoka OC, Karo OC, Konar OC WCL - Penganga OC SECL- Dipka OC, Manikpur OC MCL - Ananta OC, Bharatpur OC, Bhubaneshwari OC, Garjanbahal OC, Kaniha OC, Kulda OC, Samaleshwari OC SCCL - JK-5 OC, GK OC NLCIL - Talabira II & III OC
Very Good	60 - 79%	12	CCL- Piparwar OC NCL – Bina OC, Block B, Jayant OC, Khadia OC, Krishnashila OC, Nigahi OC SECL –Gevra OC, Kusmunda OC

Category	Score	No. of Mines	Name of Mines
			MCL – Belpahar OC, Lakhanpur OC, Lingaraj OC
Good	Below 60%	07	CCL – Magadh OC NCL – Amlohri OC, Dudhichua OC MCL – Balram OC*, Hingula OC*, Jagannath OC*, Lajkura OC

**Note – default low score accorded as no monitoring done during 2020-21 in these projects.*

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	10	BCCL – AKWMC OC CCL - Ashoka OC, Piparwar OC WCL – Penganga OC SECL - Gevra OC, Kusmunda OC, Manikpur OC MCL – Jagannath OC SCCL - JK-5 OC, GK OC
Very Good	60 - 79%	30	ECL- Rajmahal OC, Sonepur Bazari OC BCCL – NTST Exp. OC

Category	Score	No. of Mines	Name of Mines
			CCL – Amrapali OC, Karo OC, Konar Expansion OC, Magadh OC NCL – Amlohri OC, Bina OC, Block-B OC, Dudhichua OC, Jayant OC, Khadia OC, Krishnashilla OC, Nigahi OC SECL – Dipka OC MCL – Ananta OC, Balram OC, Belpahar OC, Bharatpur OC, Bhubaneshwari OC, Garjanbahal OC, Hingula OC, Kaniha OC, Kulda OC, Lajkura OC, Lakhanpur OC, Lingaraj OC, Samaleshwari OC NLCIL- Talabira II & III OC
Good	Below 60%	Nil	-

9.5 Overall Categorization

Scores obtained on four 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	10	ECL – Sonepur Bazari OC BCCL – AKWMC OC CCL – Ashoka OC WCL - Penganga OC SECL - Manikpur OC MCL - Garjanbahal OC, Samaleshwari OC, SCCL - JK-5 OC, GK OC NLCIL – Talabira II & III OC

Overall Rating of Mines			
Category	**Score**	**No. of Mines**	**Name of Mines**
Very Good	60 - 79%	25	ECL – Rajmahal OC BCCL – NT ST Exp. OC CCL – Amrapali OC, Karo OC, Konar OC, Piparwar OC NCL – Amlohri OC, Bina OC, Block – B OC, Jayant OC, Khadia OC, Krishnashila OC, Nigahi OC SECL – Dipka OC, Gevra OC, Kusmunda OC MCL – Ananta OC, Belpahar OC, Bharatpur OC, Bhubaneshwari OC, Jagannath OC, Kaniha OC, Kulda OC, Lakhanpur OC, Lingaraj OC
Good	Below 60 %	05	CCL – Magadh OC NCL – Dudhichua OC MCL – Balram OC, Hingula OC, Lajkura OC

Table 9.11: Ratings and Scoring – attribute wise and overall

Subsidiary	Projects	Scoring				
		Land	Air	Water	Mine Closure	Overall
ECL	Rajmahal	50	90.00	100	60	75
ECL	Sonepur Bazari	60	100.00	100	70	83
BCCL	AKWMC	60	80.00	100	80	80
BCCL	NT ST Exp (Cluster 9)	40	80.00	100	60	70
CCL	Amrapali	60	80.00	100	70	78
CCL	Ashoka	60	80.00	100	100	85
CCL	Karo	60	70.00	100	70	75
CCL	Konar	60	70.00	100	70	75
CCL	Magadh	60	60.00	20	60	50
CCL	Piparwar	70	60.00	60	90	70
NCL	Amlohri	60	100.00	20	70	63
NCL	Bina	60	80.00	60	70	68
NCL	Block-B	50	80.00	60	60	63
NCL	Dudhichua	50	80.00	20	60	53
NCL	Jayant	60	70.00	60	60	63
NCL	Khadia	50	80.00	60	60	63
NCL	Krishnashila	40	80.00	60	60	60
NCL	Nigahi	60	80.00	60	70	68
WCL	Penganga	60	100.00	100	80	85
SECL	Dipka	60	80.00	100	70	78
SECL	Gevra	70	70.00	60	90	73
SECL	Kusmunda	70	80.00	60	100	78
SECL	Manikpur	70	90.00	100	90	88
MCL	Ananta	50	100.00	100	60	78
MCL	Balram	60	80.00	20	70	58
MCL	Belpahar	60	100.00	60	70	73
MCL	Bharatpur	50	80.00	100	60	73
MCL	Bhubaneshwari	30	100.00	100	60	73
MCL	Garjanbahal	100	90.00	100	60	88
MCL	Hingula	50	100.00	20	60	58
MCL	Jagannath	60	80.00	20	80	60
MCL	Kaniha	50	100.00	100	60	78
MCL	Kulda	40	100.00	100	60	75
MCL	Lajkura	50	100.00	20	60	58
MCL	Lakhanpur	50	100.00	60	60	68
MCL	Lingaraj	50	80.00	60	60	63
MCL	Samaleswari	60	100.00	100	60	80
SCCL	Gautami Khani	70	100.00	100	80	88
SCCL	Jawahar Khani - 5	70	100.00	100	80	88
NLCIL	Talabira	100	100.00	100	60	90

Table 9.12: Comparison with status of projects during SDC report for FY 2019-20

		Status as per SDC report 2019-20		Status as per SDC report 2020-21	
		Attribute – Land			
Category	**Score**	**No. of Mines**	**Name of Mines**	**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 SCCL – GK OC, JK-5 OC NLCIL – Talabira II & III OC	02	MCL – Garjanbhal 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	23	ECL – Sonepur Bazari OC BCCL – AKWMC CCL – Amrapali OC, Ashoka OC, Karo OC, Konar Exp. OC, Magadh OC, Piparwar OC NCL – Amlori OC, Bina OC, Jayant OC, Nigahi OC WCL – Penganga OC SECL - Dipka OC, Gevra OC, Kusmunda OC, Manikpur OC MCL – Balram OC, Belpahar OC, Jagannath

		Status as per SDC report 2019-20		Status as per SDC report 2020-21	
					OC, Samaleshwari OC SCCL – GK OC, JK-5 OC
Good	**Below 60%**	1	MCL - Kulda OC	15	ECL – Rajmahal OC NCL – Block-B OCP, Dudhichua OC, Khadia OC MCL – Ananta OC, Bharatpur OC, Hingula OC, Kaniha OC, Lajkura OC, Lakhanpur OC, Lingaraj OC Krishnashila OC*, Bhubaneshwari OC* & Kulda OC* BCCL – NTST Exp. OC* **Mines with score less than 40*
		Attribute - Air			
Category	**Score**	**No. of Mines**	**Name of Mines**	**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	34	ECL - Rajmahal OC, Sonepur Bazari OC BCCL- AKWMC, NT-ST Expansion OC CCL - Amrapali OC, Ashoka OC NCL – Amlohri OC, Bina OC, Block-B, Dudhichua OC, Khadia OC, Krishnashila OC, Nigahi OC WCL- Penganga OC SECL – Dipka OC, Manikpur OC, Kusmunda OC

		Status as per SDC report 2019-20		Status as per SDC report 2020-21	
			NLCIL – Talabira OC		MCL – Ananta OC, Balram OC, Belpahar OC, Bharatpur OC, Bhubneshwari OC, Garjanbahal OC, Hingula OC, Jagannath OC, Kaniha OC, Kulda OC, Lajkura OC, Lakhanpur OC, Lingaraj OC, Samaleshwari OC, SCCL – GK OC, JK-5 OC NLCIL – Talabira OC
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	06	CCL – Karo OC, Konar OC, Magadh OC, Piparwar OC SECL – Gevra OC NCL – Jayant 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**	36	ECL - Rajmahal OC, Sonepur Bazari OC BCCL - AKWMC, NTST Exp. CCL - Magadh OC, Amrapali OC, Konar OC,	21	ECL - Rajmahal OC, Sonepur Bazari OC BCCL – AKWMC OC, NTST Exp. OC CCL - Amrapali OC, Ashoka OC, Karo OC,

		Status as per SDC report 2019-20		Status as per SDC report 2020-21	
			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		Konar OC WCL - Penganga OC SECL- Dipka OC, Manikpur OC MCL - Ananta OC, Bharatpur OC, Bhubaneshwari OC, Garjanbahal OC, Kaniha OC, Kulda OC, Samaleshwari OC SCCL - JK-5 OC, GK OC NLCIL - Talabira II & III OC
Very Good	**60 - 79%**	04	NCL – Jayant OC, Khadia OC MCL - Samaleswari OC, Lajkura OC	12	CCL- Piparwar OC NCL – Bina OC, Block B, Jayant OC, Khadia OC, Krishnashila OC, Nigahi OC SECL –Gevra OC, Kusmunda OC MCL – Belpahar OC, Lakhanpur OC, Lingaraj OC
Good	**Below 60%**	Nil	-	07	CCL – Magadh OC NCL – Amlohri OC, Dudhichua OC MCL – Balram OC*, Hingula OC*, Jagannath OC*, Lajkura OC
		Attribute – Mine Closure			
Category	**Score**	**No. of Mines**	**Name of Mines**	**No. of Mines**	**Name of Mines**

		Status as per SDC report 2019-20		Status as per SDC report 2020-21	
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 SCCL - JK-5 OC, GK OC NLCIL - Talabira II & III OC	10	BCCL – AKWMC OC CCL - Ashoka OC, Piparwar OC WCL – Penganga OC SECL - Gevra OC, Kusmunda OC, Manikpur OC MCL – Jagannath OC SCCL - JK-5 OC, GK 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	30	ECL- Rajmahal OC, Sonepur Bazari OC BCCL – NTST Exp. OC CCL – Amrapali OC, Karo OC, Konar Expansion OC, Magadh OC NCL – Amlohri OC, Bina OC, Block-B OC, Dudhichua OC, Jayant OC, Khadia OC, Krishnashilla OC, Nigahi OC SECL – Dipka OC MCL – Ananta OC, Balram OC, Belpahar OC,

		Status as per SDC report 2019-20		Status as per SDC report 2020-21	
					Bharatpur OC, Bhubaneshwari OC, Garjanbahal OC, Hingula OC, Kaniha OC, Kulda OC, Lajkura OC, Lakhanpur OC, Lingaraj OC, Samaleshwari OC NLCIL- Talabira II & III 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**	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	10	ECL – Sonepur Bazari OC BCCL – AKWMC OC CCL – Ashoka OC WCL - Penganga OC SECL - Manikpur OC MCL - Garjanbahal OC, Samaleshwari OC, SCCL - JK-5 OC, GK OC NLCIL – Talabira II & III OC
Very Good	**60 - 79%**	16	CCL - Konar OC, Karo OC NCL - Jayant OC, Khadia OC, Dudhichua OC, Block-B OC	25	ECL – Rajmahal OC BCCL – NT ST Exp. OC

		Status as per SDC report 2019-20		Status as per SDC report 2020-21	
			SECL – Dipka OC MCL – Ananta OC, Lingaraj OC, Lakhanpur OC, Hingula OC, Bhubaneshwari OC, Samaleswari OC, Lajkura OC, Kaniha OC, Kulda OC		CCL – Amrapali OC, Karo OC, Konar OC, Piparwar OC NCL – Amlohri OC, Bina OC, Block – B OC, Jayant OC, Khadia OC, Krishnashila OC, Nigahi OC SECL – Dipka OC, Gevra OC, Kusmunda OC MCL – Ananta OC, Belpahar OC, Bharatpur OC, Bhubaneshwari OC, Jagannath OC, Kaniha OC, Kulda OC, Lakhanpur OC, Lingaraj OC
Good	**Below 60%**	Nil	-	05	CCL – Magadh OC NCL – Dudhichua OC MCL – Balram OC, Hingula OC, Lajkura OC

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	28.3	6.9	14.0
BCCL	42.7	0.0	16.1
CCL	8.0	12.1	9.4
NCL	34.1	1.5	26.7
WCL	19.2	39.0	3.2
SECL	20.6	14.3	31.2
MCL	26.5	5.2	11.0
SCCL	26.3	4.5	49.8
NLCIL	2.4	0.0	0.1

**Includes biological reclamation done over dumps*

The above data reveals that active mining area in the selected mines of CIL is approx. 8% to 43%, whereas in SCCL approx. 26% and in NLCIL approx. 2.4% 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.

Since inception, CIL has planted more than 100.4 million trees covering an area of approx. 40686.4 ha as on 31st March, 2021, SCCL has planted about 53.19 million trees covering an area of 12262 ha as on 31st March, 2021 and NLCIL has planted about 2.38 million trees covering approx. 1958.24 ha.

10.2 Ambient Air Quality Status

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

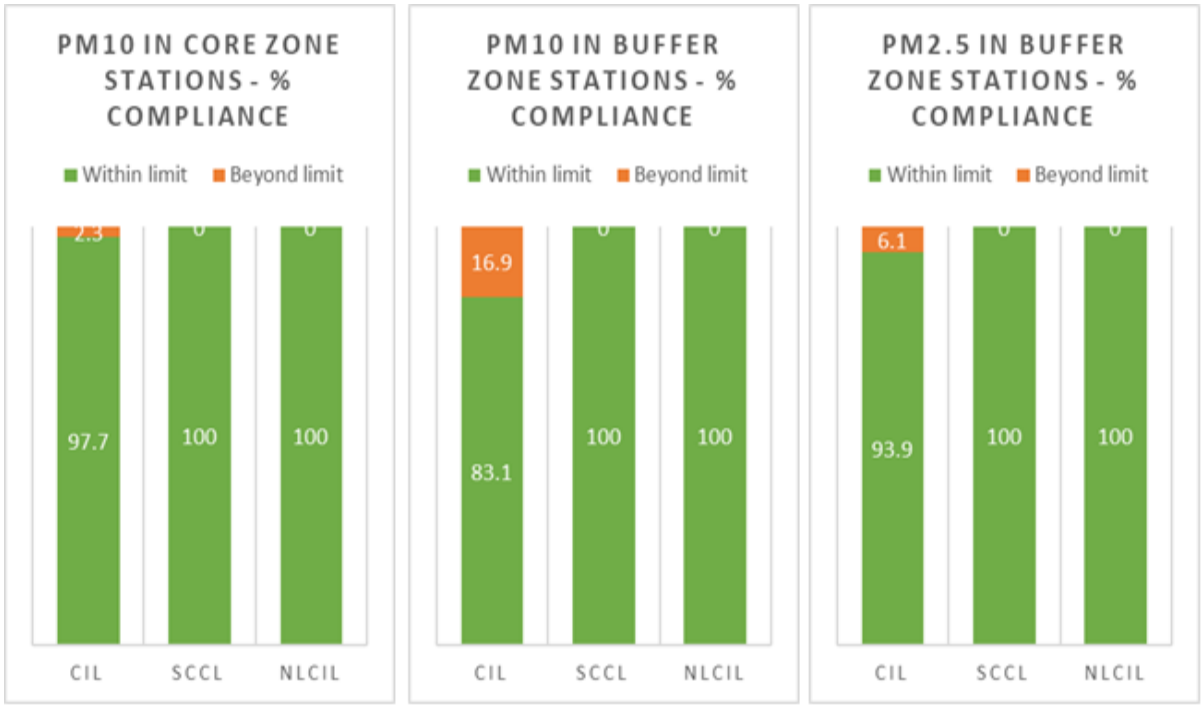


Figure 10.1: Summary regarding air environment

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	76.5	6.5 to 8.1	34
BCCL	87.4	7.2 to 8.3	56
CCL	69.1	6.7 to 8.3	492
WCL	87.7	6.8 to 8.0	64
SECL	100.0	5.9 to 8.8	227
NCL	55.1	6.2 to 9.8	196
MCL	21.8	3.0 to 8.1	78
SCCL	62.6	5.8 to 7.8	76
NLC	100.0	-*	-*

No discharge from mine as per NLCIL

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 3.03 – which may be attributed to wash off from pyrites in the Ib valley coalfields post monsoon. 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 SECL, NCL and CCL. This requires close monitoring by NCL, SECL and CCL 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 25% of the area is under active mining, 6.2% under technical reclamation, 12% under biological reclamation, 12.35% under infrastructure area and 42% 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, 2020, 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 solar projects in its

companies with a capacity of 5.31 MW. In SCCL, 219 MW of solar energy has been commissioned till 31.12.2021; while in NLCIL, 1319 MW of solar capacity and 51 MW of Wind energy has been 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.

xi. Efforts should be made for reduction of emission intensity from coal mining operation to help country achieve its target of 45% emission intensity reduction by 2030 from 2005 level.

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