Ministry of Coal

Sustainable Development Cell

Status Report on Mine Water Utilization

June, 2021

PREFACE

Coal plays a crucial role in India's energy consumption matrix and is expected to remain the bedrock of the energy supply for the country till 2030 and beyond. Coal India Limited (CIL), NLC India Limited (NLCIL) and Singareni Collieries Company Limited (SCCL) are key contributors towards coal production in India and have set ambitious targets to push up coal production in the coming years. Apart from coal production, emphasis is also placed on facilitating improvement in social and environmental scenario of coal mining areas through various forums / mechanisms; utilization of mine water is a stepping stone towards fulfilling this agenda.

Mine water generation occurs where aquifers surrounding the coal seams get exposed during the mining operation – the result is an accumulation of groundwater in a sump within the mine. In order to continue safe mining operations, the accumulated mine water is dewatered to a separate sump within the mine lease area. Generally, these mine water sumps / pit lakes are retained even post closure of the mines and provide an excellent opportunity for storage of freshwater. Such accumulated mine water lakes are usually free from pollutants and can be utilized as a source of water with an aim towards enhancing environmental responsibility by coal producing companies.

Mine water can be utilized for the following broad purposes:

- for industrial and domestic purposes within the mining project,
- for community uses like domestic / drinking purposes and irrigation in vicinity of the mine,
- for supply to ancillary industries or townships in the vicinity,
- for development of water bodies and surroundings as tourism sites and for pisciculture – thereby generating sustainable livelihoods for nearby villagers
- for contribution towards recharge of groundwater and as water sumps to divert flood waters from adjacent rivers / nallahs

In line with the Vision Document published by Ministry of Coal, efforts are being undertaken to encourage coal PSUs to leverage mine water, treat it and supplement the potable water supply to approximately 45 lakh people (i.e. approx. 15 lpcd) living in the coal bearing areas and create irrigation potential for over 3.5 lakh acres within those and/ or nearby areas.

This document, titled as "*Status Report on Mine Water Utilization*" is an effort by Ministry of Coal (MoC) with the help of CMPDIL (a subsidiary of CIL), to understand the status of availability of mine water across different coal companies and its utilization for internal as well as community use.

The main aspects covered in this report include availability of mine water, utilization of mine water, quality of mine water, infrastructure available for treatment and handling of mine water and best practices implemented across coal companies with regard to mine water utilization. The information for the status report has been sought from the subsidiaries of CIL, NLCIL and SCCL based on a data collection format developed and finalized by CMPDIL in consultation with MoC.

The information compiled and analysed through this report will help MoC to advise, plan and monitor the utilization of mine water across the coal companies in a sustainable way. This will also help to supplement the efforts of Govt. of India towards water conservation under the Jal Shakti Abhiyaan.

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

Contents

List of annexures:

List of Abbreviations

AMD	Acid Mine Drainage
BCCL	Bharat Coking Coal Limited
CCL	Central Coalfields Limited
CIL	Coal India Limited
ECL	Eastern Coalfields Limited
FY	Financial Year
KLD	Kilo Litres Per Day
LKL	Lakh Kilo Litres
Lpcd	Litres Per Capita Day
MCL	Mahanadi Coalfields Limited
M.Cu.m	Million Cubic Metres
MLD	Million Litres Per Day
MoC	Ministry of Coal
MT	Million Tonnes
MTPA	Million Tonnes Per Annum
MW	Mega Watts
NCL	Northern Coalfields Limited
NEC	North Eastern Coalfields
NLCIL	NLC India Limited
NTPC	National Thermal Power Corporation
OB	Overburden
OC	Opencast
PSU	Public Sector Undertaking
RO	Reverse Osmosis
SCCL	Singareni Collieries Company Limited
SECL	South Eastern Coalfields Limited
SPCB	State Pollution Control Board
UG	Underground
WCL	Western Coalfields Limited
ZLD	Zero Liquid Discharge

Chapter 1

Introduction to coal mining and mine water utilization

1.0 Coal Sector in India

Coal plays a crucial role in the energy consumption matrix with an estimated contribution of 55% towards the energy generation sector in India. Despite the gradual increase of energy share from renewable sources, coal is expected to remain the bedrock of the energy supply for the country till 2030 and beyond.

Coal India Limited (CIL), a public sector undertaking, is a major contributor towards coal production in India. In addition, the Singareni Collieries Company Limited (SCCL) and NLC India Limited (NLCIL) also contribute to production of coal and lignite in the country. Some other public sector companies like NTPC, State PSUs and private sector are also engaged in coal mining in India.

CIL, with an approx. coal production of 596.25 MT in 2020-21, has set an ambitious target to achieve 1 billion tonnes of coal production by the year 2023-24. SCCL has a vision for 2023-24 to reach the production & dispatches upto 85.00 MT and overburden (OB) removal to the tune of 600 m.cu.m and power generation to 2500 MW. As per Vision 2025 document, NLCIL has planned to produce 93.15 MTPA of coal/lignite, 13760 MW of coal/lignite based power, 4251 MW of renewable power and 3000 MW of acquisition of power assets.

1.1 Stages of coal mining

Coal mining involves four major stages –

(i) **Exploration of deposits** - Information about the location and value of the mineral ore deposit is obtained during the exploration phase. The exploration phase involves surveys, field studies, drilling boreholes, other exploratory activities and finally preparation of a Geological Report for the coal Block.

(ii) **Construction and development of the mine** - The Geological Report helps to ascertain the viability / feasibility of the project and 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. Statutory approvals and permissions like Environment Clearance, Forest Clearance, Consents from SPCBs etc. are also planned for and secured at this stage as applicable.

(iii) **Active mining** - The active mining phase involves extraction of coal either through opencast or underground mining methods depending on the Project Report.

(iv) **Mine closure activities** - The final phase involving mine closure activities are focused at remedial measures to ensure that the entire mining affected area in converted / developed back to 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 followed by final mine closure activities after ceasing of mining activities.

1.2 Mine water generation in coal mines

Mine water generation occurs during the active mining phase. Mining activity involves removal of overburden (OB) material in order to reach the coal seams. In some areas, there may be presence of aquifer above the desired coal seam. As the mining progresses towards the seam, the aquifer will get exposed and the groundwater will accumulate as a sump within the mine. The schematic representation of the same is shown in the following figures for both opencast and underground mining activities.

During the active mining phase, such accumulated mine water is dewatered to a separate sump within the mine lease area. This accumulated mine water is generally pollution free and can be utilized as a water source for the community apart from satisfying the water requirements for the mining activity after some primary treatments. In most cases, post the closure of mines, the accumulated mine water is retained as a pit lakes / water sump which can be a convenient source of freshwater for the surrounding communities.

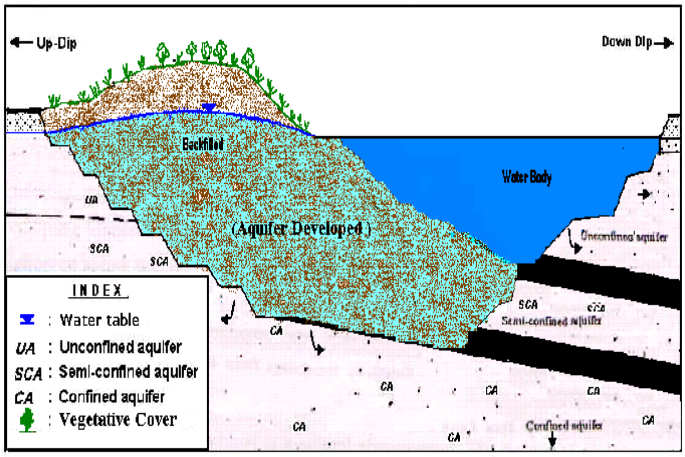


Figure 1.1: Schematic diagram showing aquifer development in opencast mine working

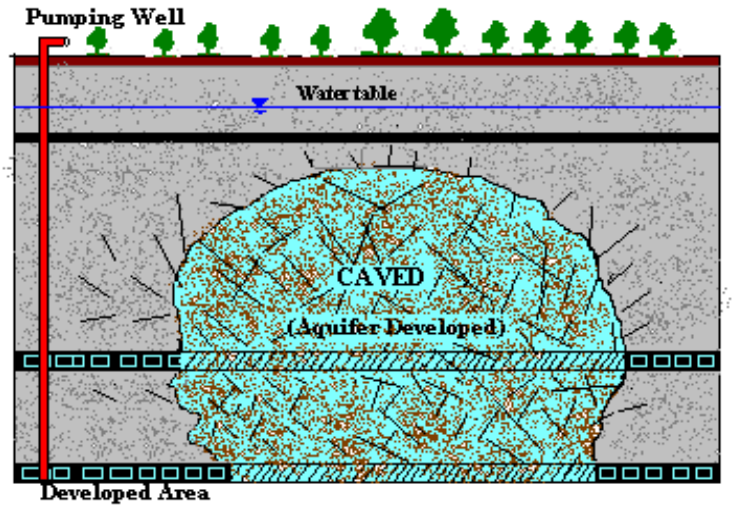


Figure 1.2: Schematic diagram showing aquifer development in caved underground working

1.3 Mine water utilization and its vast potential

The mine voids created on account of coal mining provide an excellent opportunity for storage of freshwater. These freshwater reservoirs and their utilization can be optimized for efficient consumption across various stakeholders thereby supplementing the efforts of Govt. of India towards water conservation.

The mine water can be broadly utilized for the following purposes:

- Meeting the industrial and domestic need of coal mines, thus reducing the water footprint of mines on the water regime
- Provision of potable drinking water to neighbouring communities or industries after necessary treatment
- Provision towards irrigation of agricultural lands
- Development of water bodies and surroundings as tourism sites
- Development of aquaculture related activities
- Development as water sumps to divert flood waters from adjacent rivers / nallahs

The efficient utilization of mine water will thereby contribute to socio-economic benefits to the surrounding communities.

1.4 Quality of mine water in Indian scenario

In order to promote efficient utilization of mine water, it is imperative to ensure that the quality of water conforms to the regulatory standards prescribed. One of the major concerns of the quality of mine water is acid mine drainage. Acid mine drainage (AMD) is referred to as the outflow of acidic water from the coal mines due to contact with weathering rocks consisting of sulphide minerals.

In general, the sulphur content in the Indian coal is insignificant and so the problems associated with acid mine drainage (AMD) is almost non-existent. However, in Indian context, occurrence of AMD is limited to few mines in North Eastern Coalfields (NEC), Western Coalfields Limited (WCL), South Eastern Coalfields Limited (SECL), Northern Coalfields Limited (NCL) and Mahanadi Coalfields Limited (MCL).

By and large, the quality of mine water is found to be satisfactory and can be utilized post some primary treatment processes.

1.5 Vision Document

Ministry of Coal had published “Five Year Vision Document” wherein it was stated that MoC will facilitate improvement in social and environmental scenario of coal mining areas through various forums / mechanisms.

With an aim towards enhancing environmental responsibility, MoC is undertaking efforts to encourage coal PSUs to leverage mine water, treat it and supplement the potable water supply to approximately 45 lakh people (i.e. approx. 15 lpcd) living in the coal bearing areas and create irrigation potential for over 3.5 lakh acres within those and/ or nearby areas. To achieve the same, suitable availability of water supply network will be ensured in conjunction with the respective state governments. The PSU wise details of future utilization of mine water for community and irrigation purposes is given in the table below.

Table 1.1: PSU wise details of targets for utilization of mine water for upcoming years

PSUs	FY22	FY23	FY24
	Mine Water Harnessed (in Lakh Cu. Meter)		
CIL	4,920	5,420	5,663
NLCIL	1,227	1,227	1,227
SCCL	1,075	1,075	1,075
Total	7,222	7,722	7,965
	Industrial Use including domestic use in Coal Mines (in Lakh Cu. Meter)		
CIL	2,320	2,320	2,313
NLCIL	877	877	877
SCCL	525	525	525
Total	**3,722**	**3,722**	**3,715**
	Community Use (in Lakh Cu. Meter)		
CIL	2,550	3,000	3,250
NLCIL	320	350	370
SCCL	630	650	680
Total	**3,500**	**4,000**	**4,300**

Source: Five Year Vision Document from MoC and subsequent communications

1.6 Structure of the report

This report has been based on the data pertaining to mine water utilization received from coal companies in the format circulated by MoC. The data collection has been done considering two aspects: availability of mine water and status of mine water utilization (format attached as **Annexure – I**).

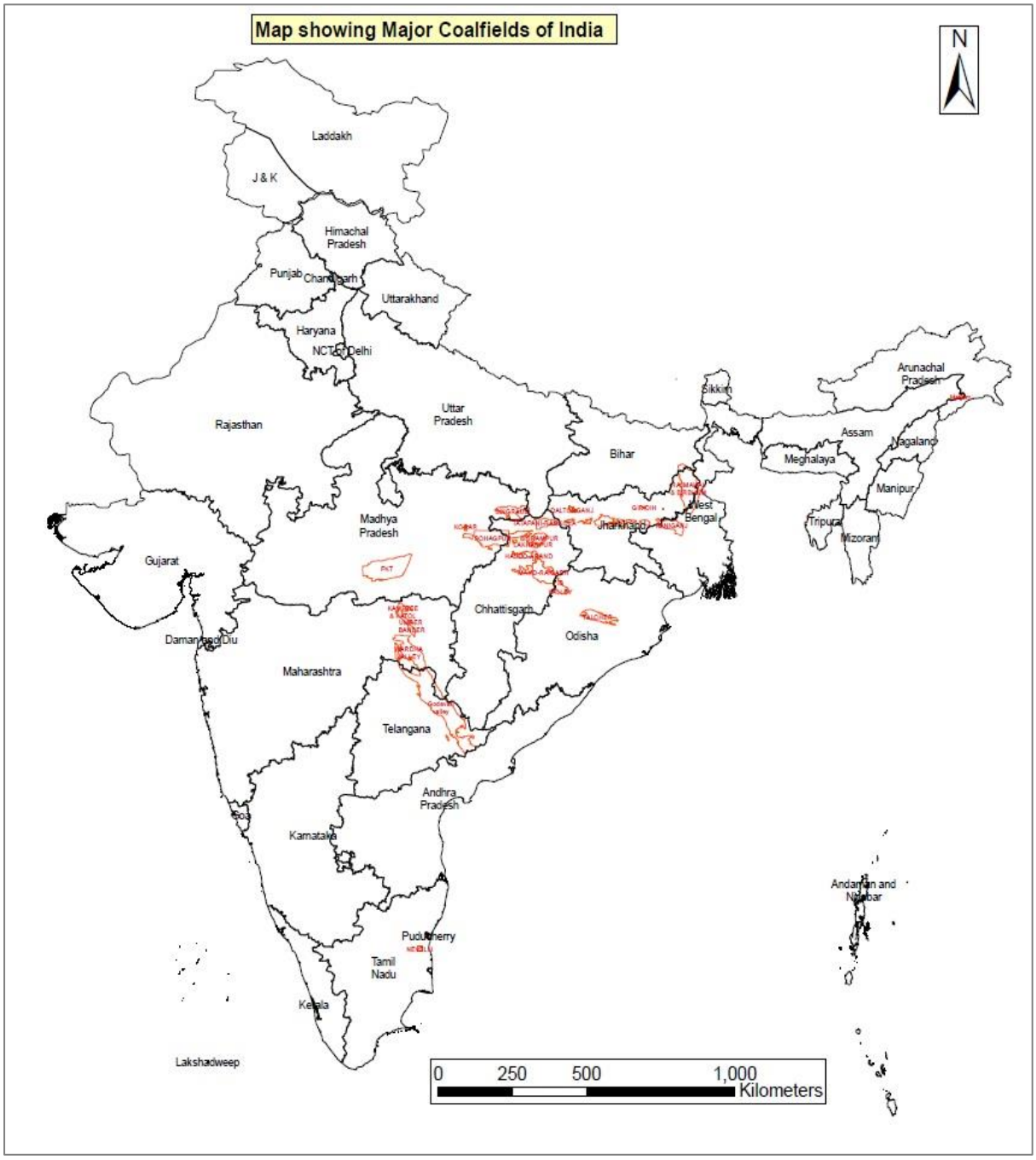
The information collected pertains to availability of mine water in running and abandoned mines, location of the mines, average discharge from the mine pits, quality of the mine water, infrastructure deployed by coal PSUs for mine water quality treatment, utilization of mine water (within and outside mines), beneficiaries, agencies involved and best practices across coal PSUs.

The present report includes data related to utilization of mine water from the major coal companies (PSUs) as listed hereunder:

- Bharat Coking Coal Limited (BCCL)
- Central Coalfields Limited (CCL)
- Eastern Coalfields Limited (ECL)
- Mahanadi Coalfields Limited (MCL)
- Northern Coalfields Limited (NCL)
- South Eastern Coalfields Limited (SECL)
- Western Coalfields Limited (WCL)
- NLC India Limited (NLCIL)
- Singareni Collieries Company Limited (SCCL)

The report has been divided into seven (07) chapters. The chapter wise brief is as below:

Chapter 1	:	Introduction to coal mining and mine water generation and its utilization potential; mine water and its importance w.r.t Vision Document
Chapter 2	:	Details on availability of mine water across coal companies – in running and abandoned mines and district/state wise distribution
Chapter 3	:	Utilization of mine water within and outside the mine and trends thereunder
Chapter 4	:	Quality of mine water as reported by coal companies, includes range of parameters reported and parameters of concern
Chapter 5	:	Details on infrastructure provided for treatment of mine water across coal companies
Chapter 6	:	Best practices regarding utilization of mine water across coal companies
Chapter 7	:	Conclusion and way forward



*For NLCIL, location of lignite mines has been marked

Figure 1.3: Major coalfields of India

Chapter 2

Availability of mine water in coal companies

2.0 Availability of mine water in coal companies

As per data made available by the coal PSUs, the total annual average discharge from operational mines is approx. 7938.0 LKL (lakh kilo litres) per year and the total estimated volume of mine water in abandoned mines is approx. 1997.4 LKL. The company wise break-up of the mine water discharge and volume is shown in the table hereunder.

Table 2.1: Company wise break-up of annual average mine water availability

Sr. No.	Coal Co.	Location - State(s) & Districts where mines are located	No. of running mines reporting mine discharge	Annual average mine water availability (LKL/year) from running mines	No. of abandoned mines with mine water voids	Estimated volume of water in abandoned mines (LKL)	Total mine water available per annum (LKL)
1	BCCL	Jharkhand – Dhanbad District West Bengal – Paschim Bardhman	30	920.3	17	359.0	1279.2
2	CCL*	Jharkhand – Bokaro, Chatra, Giridih, Hazaribagh, Palamu, Ramgarh and Ranchi Districts	39	375.3	36	1156.8	1532.1
3	ECL	Jharkhand – Deoghar, Dhanbad and Godda Districts West Bengal – Bankura, Paschim Bardhman and Purulia Districts	78	1244.7	13	251.1	1495.8
4	MCL	Odisha – Angul, Jharsuguda and Sundergarh Districts	19	718.4	07	113.1	831.5
5	NCL	Madhya Pradesh – Singrauli District Uttar Pradesh – Sonebhadra District	10	180.0	*Nil*	0.0	180.0
6	SECL	Chhattisgarh – Koriya, Korba, Raigarh, Sarguja and Surajpur Districts Madhya Pradesh – Anuppur,	65	730.6	10	71.3	801.9

Sr. No.	Coal Co.	Location - State(s) & Districts where mines are located	No. of running mines reporting mine discharge	Annual average mine water availability (LKL/year) from running mines	No. of abandoned mines with mine water voids	Estimated volume of water in abandoned mines (LKL)	Total mine water available per annum (LKL)
		Shahdoland Umaria Districts					
7	WCL	Maharashtra – Chandrapur, Nagpur and Yavatmal Districts Madhya Pradesh - Betul and Chhindwara Districts	63	1369.9	04	8.2	1378.1
		CIL Total	**304**	**5539.2**	**87**	**1959.4**	**7498.6**
8	NLCIL	Tamil Nadu – Cuddalore District	01	1261.8	*Nil*	-	1261.8
9	SCCL	Telangana – Bhadradri Kothagudem, Jayashankar, Khamman, Kumuram Bheem, Mancherial and Peddapalli Districts	42	1137.0	07	38.0	1175.0
		Grand Total	**347**	**7938.0**	**94**	**1997.4**	**9935.4**

**Data received from CCL is w.r.t mine discharge and mine voids as against running and abandoned mines.*

The graphical representation of the mine water availability across the coal PSUs is presented below.

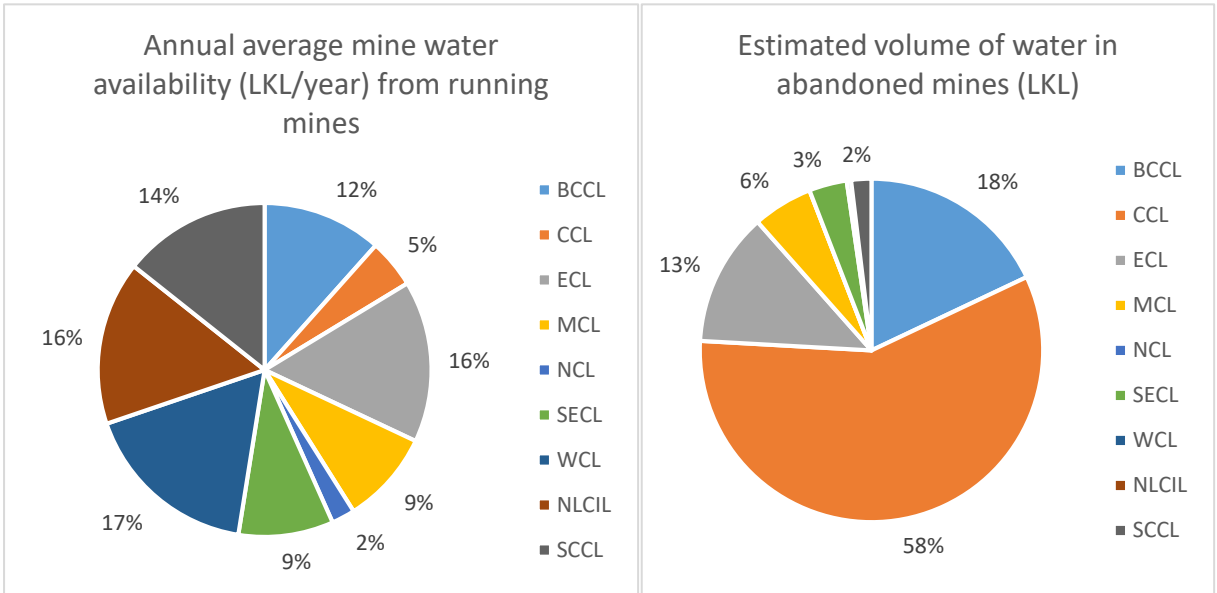
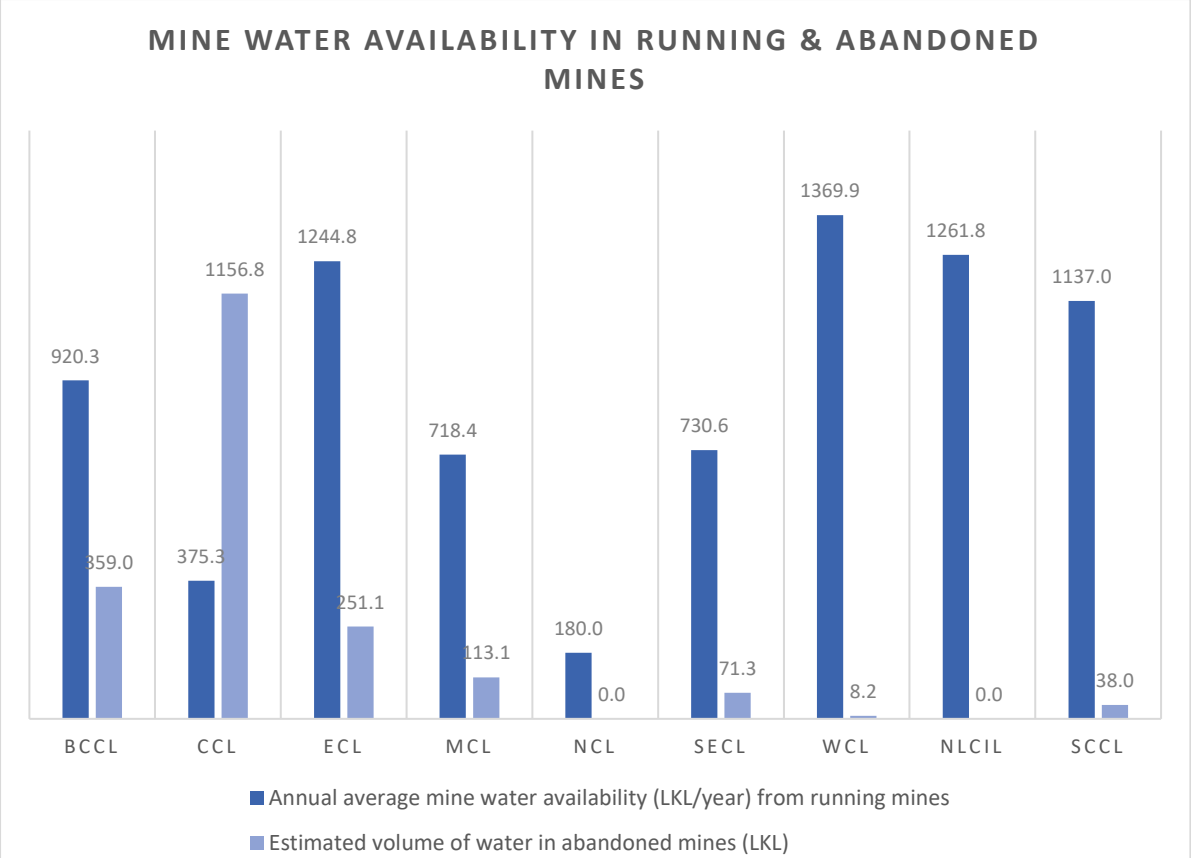


Figure 2.1: Mine water availability across coal companies - percentage break-up



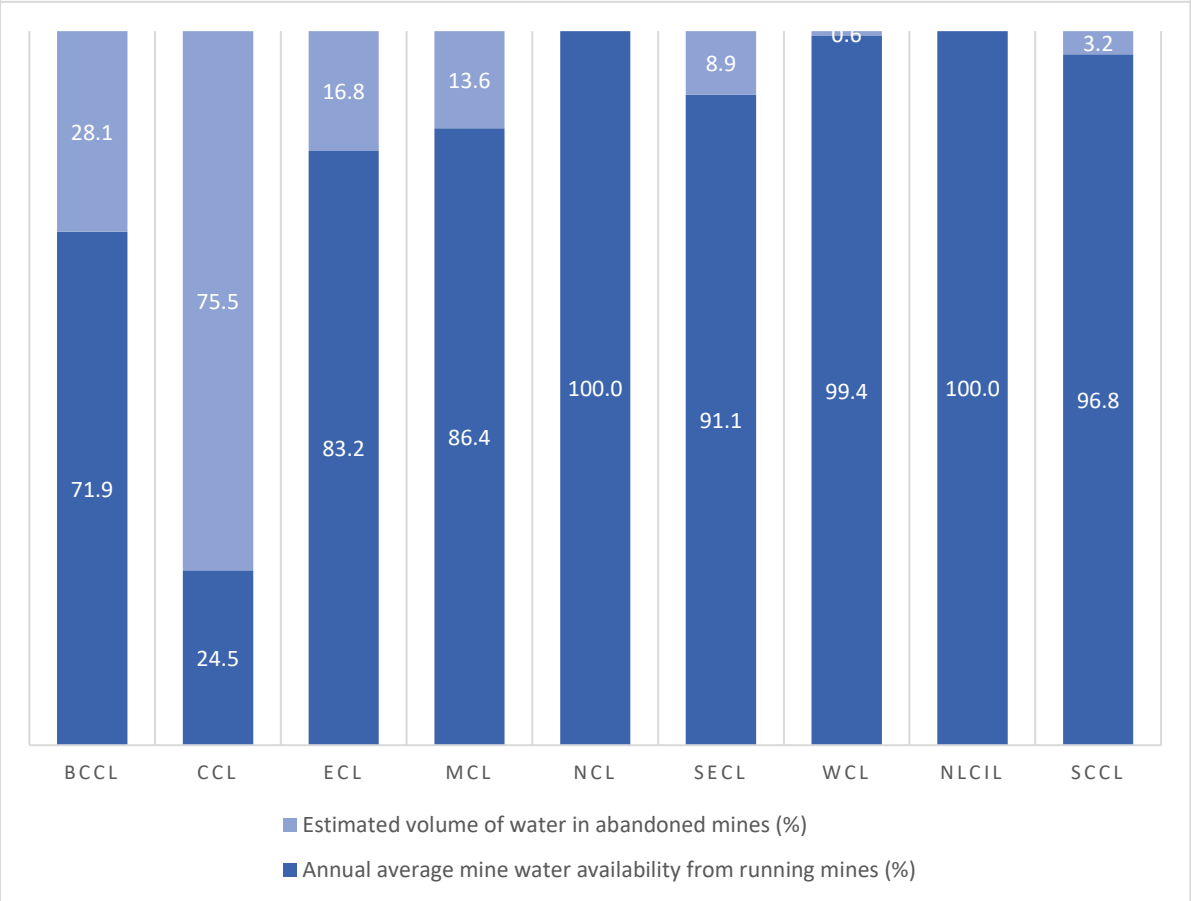


Figure 2.2: Mine water availability in running & abandoned mines

2.1 Company wise details w.r.t availability of mine water

2.1.1 Bharat Coking Coalfields Limited (BCCL)

Bharat Coking Coalfields Ltd. (BCCL) is a subsidiary of Coal India Limited (CIL) with its headquarters located in Dhanbad Dist., Jharkhand.

The net annual mine water availability reported from BCCL mines is approx. 920.3 LKL from 30 running mines and approx. 359.0 LKL from 17 abandoned mines across Dhanbad district of Jharkhand and Paschim Bardhman district of West Bengal. The details of running and abandoned mines and water availability thereunder is shown in the tables hereunder.

Table 2.2: List of running mines in BCCL and mine water discharge volume

Sr. No.:	Mine	Annual average mine water availability (LKL/year)	District	State
1.	Damoda Colliery	9.56	Dhanbad	Jharkhand
2.	Muraidih Colliery	64.61	Dhanbad	Jharkhand
3.	Phularitand Colliery	60.23	Dhanbad	Jharkhand
4.	AB OCP	45.33	Dhanbad	Jharkhand
5.	Tetuliya	6.15	Dhanbad	Jharkhand
6.	Dharmsbandh	5.11	Dhanbad	Jharkhand
7.	KatrasChatudih Colliery	21.33	Dhanbad	Jharkhand
8.	Gaslitand Colliery	2.97	Dhanbad	Jharkhand
9.	AARC	26.12	Dhanbad	Jharkhand
10.	Nichitpur Colliery	35.59	Dhanbad	Jharkhand
11.	Tetulmaari Colliery	25.55	Dhanbad	Jharkhand
12.	New Godhur Kusunda Colliery	7.3	Dhanbad	Jharkhand
13.	ADI Colliery	7.57	Dhanbad	Jharkhand
14.	GKK Collery	3.86	Dhanbad	Jharkhand
15.	Ena OC	4.31	Dhanbad	Jharkhand
16.	Bassuriya	0.13	Dhanbad	Jharkhand
17.	PB PROJECT	47.74	Dhanbad	Jharkhand
18.	Keanduadih Colliery	2.17	Dhanbad	Jharkhand
19.	KV 10/12 PIT	65.7	Dhanbad	Jharkhand
20.	Simlabalh	18.06	Dhanbad	Jharkhand
21.	Burragart Colliery	47.45	Dhanbad	Jharkhand
22.	Ganoodih Colliery	0.5	Dhanbad	Jharkhand
23.	KOCP Kuyu Colliery	7.12	Dhanbad	Jharkhand
24.	RajapurCCP	13.87	Dhanbad	Jharkhand
25.	Jairam PurNCP	131.3	Dhanbad	Jharkhand
26.	NTST OCP	179.04	Dhanbad	Jharkhand
27.	Barora North	25.58	Dhanbad	Jharkhand
28.	Barora South	16.69	Dhanbad	Jharkhand
29.	Moonidih Collery	9.56	Dhanbad	Jharkhand
30.	Amalgamted Dahibari Basantimata Colliery	29.78	Dhanbad	Jharkhand
	TOTAL	**920.3**		

Table 2.3: List of abandoned mines in BCCL and volume of mine water available

Sr. No.:	Mine	Annual average mine water availability (LKL)	District	State
1.	ABGC	43.8	Dhanbad	Jharkhand

2.	Maheshpur	3.12	Dhanbad	Jharkhand
3.	AKWMC	15.14	Dhanbad	Jharkhand
4.	Salanpur	3.28	Dhanbad	Jharkhand
5.	Mudidih Colliery	33.22	Dhanbad	Jharkhand
6.	Kankanee	10.4	Dhanbad	Jharkhand
7.	SendraBansjora	13.03	Dhanbad	Jharkhand
8.	Loyabad	9.5	Dhanbad	Jharkhand
9.	East Basuriya	8.51	Dhanbad	Jharkhand
10.	Gopalchak Colliery	27.85	Dhanbad	Jharkhand
11.	KV 5/6 Pit	96.65	Dhanbad	Jharkhand
12.	DobariOCP	2	Dhanbad	Jharkhand
13.	Bera Colliery	1.84	Dhanbad	Jharkhand
14.	Bastacolla Colliery	3.94	Dhanbad	Jharkhand
15.	Asp Collery	17.11	Dhanbad	Jharkhand
16.	Murlidih 20/21 Pits Colliery	64.61	Dhanbad	Jharkhand
17.	Damagoria Colliery	4.96	Paschim Bardhman	West Bengal
	TOTAL	**359.0**		

2.1.2 Central Coalfields Limited (CCL)

Central Coalfields Limited (CCL) is a subsidiary of Coal India Limited (CIL) with its headquarters located in Ranchi Dist., Jharkhand.

CCL has 39 mines with mine water discharge and 36 mines containing voids - accounting for an annual average mine water discharge to the tune of approx. 375.3 LKL and storage in mine voids accounting for approx. 1156.8 LKL. The mines are located across seven districts (Bokaro, Chatra, Giridih, Hazaribagh, Palamu, Ramgarh and Ranchi) of Jharkhand. The details of mines and water availability thereunder is shown in the tables hereunder.

Table 2.4: List of mines in CCL and corresponding mine water discharge volume

Sr. No.:	Mine	Annual average mine water availability (LKL/year)	District	State
1.	Karo	0.71	Bokaro	Jharkhand
2.	Bokaro	0.54	Bokaro	Jharkhand
3.	AKKOCP	3.27	Bokaro	Jharkhand
4.	Giridih OCP	14.92	Giridih	Jharkhand
5.	Kabribad OCP	14.92	Giridih	Jharkhand
6.	Jarangdih colliery	6.64	Bokaro	Jharkhand
7.	Kathara OCP	38.72	Bokaro	Jharkhand
8.	Govindpur PH-II	5.20	Bokaro	Jharkhand
9.	Govindpur UG	3.75	Bokaro	Jharkhand
10.	AADOCM (Amlo+Dhori Colliery)	19.62	Bokaro	Jharkhand
11.	SDOCM	24.52	Bokaro	Jharkhand
12.	TARMI	4.90	Bokaro	Jharkhand
13.	Piparwar OCP	5.04	Chatra	Jharkhand
14.	Ashok OCP	2.92	Chatra	Jharkhand
15.	Ray Bachra UG	1.46	Ranchi	Jharkhand
16.	Rohini OCP	0.46	Ranchi	Jharkhand
17.	Dakra OCP	0.08	Ranchi	Jharkhand
18.	Kedla OCP	9.68	Ramgarh	Jharkhand
19.	Parej East OCP	10.62	Ramgarh	Jharkhand
20.	Tapin North OCP	8.33	Ramgarh	Jharkhand

Sr. No.:	Mine	Annual average mine water availability (LKL/year)	District	State
21.	Kedla UGP	9.72	Ramgarh	Jharkhand
22.	Jharkhand OCP	9.54	Ramgarh	Jharkhand
23.	Tapin South OCP	0.85	Ramgarh	Jharkhand
24.	Giddi A	7.10	Hazaribagh	Jharkhand
25.	Giddi C	17.98	Ramgarh	Jharkhand
26.	Religara OCP	21.57	Ramgarh	Jharkhand
27.	Sirka OCP	14.97	Ramgarh	Jharkhand
28.	North Urimari OCP	31.96	Hazaribagh	Jharkhand
29.	Bhurkunda Colliery	31.73	Hazaribagh	Jharkhand
30.	Urimari OCP	9.84	Hazaribagh	Jharkhand
31.	Kuju	1.67	Ramgarh	Jharkhand
32.	Topa	0.95	Ramgarh	Jharkhand
33.	Pundi	1.02	Ramgarh	Jharkhand
34.	Karma	0.72	Ramgarh	Jharkhand
35.	Sarubera	4.02	Ramgarh	Jharkhand
36.	Ara	2.99	Ramgarh	Jharkhand
37.	Rajrappa OCP	31.02	Bokaro	Jharkhand
38.	Tetariakhar OCP	0.11	Palamu	Jharkhand
39.	Rajhara OCP	1.26	Palamu	Jharkhand
	TOTAL	**375.3**		

Table 2.5: List of voids in abandoned mines in CCL and volume of mine water available

Sr. No.:	Mine	Annual average mine water availability (LKL)	District	State
1.	Bokaro OCP	111.35	Bokaro	Jharkhand
2.	AKK OCP	0.18	Bokaro	Jharkhand
3.	KSP Ph-II	1.50	Bokaro	Jharkhand
4.	Kargali OCP	16.66	Bokaro	Jharkhand
5.	Kabribad OCP	9.00	Giridih	Jharkhand
6.	Kathara	101.34	Bokaro	Jharkhand
7.	Govindpur OC	42.75	Bokaro	Jharkhand
8.	Sawang Pipradih OC	20.48	Bokaro	Jharkhand
9.	Dhori OC	6.29	Bokaro	Jharkhand
10.	SDOC	9.94	Bokaro	Jharkhand
11.	Tarmi OC	3.53	Bokaro	Jharkhand
12.	Amlo	22.86	Bokaro	Jharkhand
13.	Piparwar	11.25	Chatra	Jharkhand
14.	Rohini OCP	2.95	Ranchi	Jharkhand
15.	Dakra OCP	0.05	Ranchi	Jharkhand
16.	Purnadih OCP	2.27	Ranchi	Jharkhand
17.	Old Karkatta	15.00	Ranchi	Jharkhand
18.	Kedla OCP	42.83	Ramgarh	Jharkhand
19.	Parej	0.05	Ramgarh	Jharkhand
20.	Tapin North	12.00	Ramgarh	Jharkhand
21.	Jharkhand	1.83	Ramgarh	Jharkhand
22.	Tapin South	12.00	Ramgarh	Jharkhand
23.	Gidi-A	192.25	Hazaribagh	Jharkhand
24.	Gidi-C	21.45	Ramgarh	Jharkhand
25.	Religara	12.85	Ramgarh	Jharkhand
26.	Old Argada OCP	234.00	Ramgarh	Jharkhand
27.	Bhurkunda	144.81	Hazaribagh	Jharkhand

Sr. No.:	Mine	Annual average mine water availability (LKL)	District	State
28.	Mini Saunda	4.10	Hazaribagh	Jharkhand
29.	KK Colliery	13.72	Hazaribagh	Jharkhand
30.	Pindra	1.20	Ramgarh	Jharkhand
31.	Topa	30.60	Ramgarh	Jharkhand
32.	Pundi	11.80	Ramgarh	Jharkhand
33.	Karma	1.50	Ramgarh	Jharkhand
34.	Sarubera	10.40	Ramgarh	Jharkhand
35.	Ara	31.50	Ramgarh	Jharkhand
36.	Rajrappa	0.50	Bokaro	Jharkhand
	TOTAL	**1156.8**		

2.1.3 Eastern Coalfields Limited (ECL)

Eastern Coalfields Limited (ECL) is a subsidiary of Coal India Limited (CIL) with its headquarters located in Asansol Dist., West Bengal.

ECL has 78running mines accounting for an annual average mine water availability to the tune of approx. 1244.7 LKL and 13 abandoned mines accounting for approx. 251.1 LKL mine water located across three districts (Bankura, Paschim Bardhman and Purulia) of West Bengal and three districts (Deoghar, Dhanbad and Godda) of Jharkhand. The details of mines and water availability thereunder is shown in the tables hereunder.

Table 2.6: List of mines in ECL and mine water discharge volume

Sr. No.:	Mine	Annual average mine water availability (LKL/year)	District	State
1.	Sonepur Bazari Project	12.45	Paschim Bardhaman	West Bengal
2.	Jhanjra Project Colliery	33.41	Paschim Bardhaman	West Bengal
3.	Rajmahal OCP	51.99	Godda	Jharkhand
4.	Chitra East OCP	15.70	Deoghar	Jharkhand
5.	Chapapur UG+OC	13.57	Dhanbad	Jharkhand
6.	Badjna UG	13.57	Dhanbad	Jharkhand
7.	Hariajam UG	27.14	Dhanbad	Jharkhand
8.	Khoodia UG	13.57	Dhanbad	Jharkhand
9.	Lakhimata UG	9.05	Dhanbad	Jharkhand
10.	Shampur B UG	31.67	Dhanbad	Jharkhand
11.	Nirsa OC	31.67	Dhanbad	Jharkhand
12.	Kapasara OC	13.57	Dhanbad	Jharkhand
13.	Gopinathpur OC	4.52	Dhanbad	Jharkhand
14.	Rajpura OC	13.57	Dhanbad	Jharkhand
15.	Barmuri OC	9.05	Dhanbad	Jharkhand
16.	Kumardhubi UG	4.52	Dhanbad	Jharkhand
17.	Khottadih OCP	25.50	Paschim Bardhaman	West Bengal
18.	Khottadih UG	50.90	Paschim Bardhaman	West Bengal
19.	Dalurband OC Phase-III	23.80	Paschim Bardhaman	West Bengal
20.	Pandaveswar UG	25.48	Paschim Bardhaman	West Bengal
21.	Manderboni UG South Samla UG (amalgamted)	19.11	Paschim Bardhaman	West Bengal
22.	Madhaipur UG	38.23	Paschim Bardhaman	West Bengal
23.	Madhaipur OC Patch	38.00	Paschim Bardhaman	West Bengal
24.	Khas Kajora	19.78	Paschim Bardhaman	West Bengal
25.	Madhusudanpur	7.12	Paschim Bardhaman	West Bengal

Sr. No.:	Mine	Annual average mine water availability (LKL/year)	District	State
26.	Parascole East and Parascole West	19.29	Paschim Bardhaman	West Bengal
27.	Nabakajora UG	20.61	Paschim Bardhaman	West Bengal
28.	Jambad UG	9.89	Paschim Bardhaman	West Bengal
29.	Central Kajora UG	11.54	Paschim Bardhaman	West Bengal
30.	Jambad OCP	11.87	Paschim Bardhaman	West Bengal
31.	Madhabpur UG & OC	16.48	Paschim Bardhaman	West Bengal
32.	Chora7,9 pit	5.10	Paschim Bardhaman	West Bengal
33.	Chora Block Incline	4.79	Paschim Bardhaman	West Bengal
34.	Chora 10	2.91	Paschim Bardhaman	West Bengal
35.	C.L. Jambad	3.49	Paschim Bardhaman	West Bengal
36.	New Kenda	5.80	Paschim Bardhaman	West Bengal
37.	Siduli	5.83	Paschim Bardhaman	West Bengal
38.	Bahula	7.49	Paschim Bardhaman	West Bengal
39.	Lower kenda	14.02	Paschim Bardhaman	West Bengal
40.	Shankarpur	1.33	Paschim Bardhaman	West Bengal
41.	Belbaid UG	5.29	Paschim Bardhaman	West Bengal
42.	Bansra UG	23.66	Paschim Bardhaman	West Bengal
43.	Kunsutoria	18.10	Paschim Bardhaman	West Bengal
44.	Parasea UG	26.44	Paschim Bardhaman	West Bengal
45.	North Searsole	12.53	Paschim Bardhaman	West Bengal
46.	Amritnagar UG	38.97	Paschim Bardhaman	West Bengal
47.	Parbelia	13.13	Purulia	West Bengal
48.	Dubeswari	12.77	Purulia	West Bengal
49.	Mithani	2.73	Paschim Bardhaman	West Bengal
50.	Patmohana	3.28	Paschim Bardhaman	West Bengal
51.	Narsamuda	17.51	Paschim Bardhaman	West Bengal
52.	Dhemomain Pit.	4.56	Paschim Bardhaman	West Bengal
53.	Dhemomain Incl.	23.66	Paschim Bardhaman	West Bengal
54.	Chinakuri I	15.93	Paschim Bardhaman	West Bengal
55.	Chinakuri III	6.61	Paschim Bardhaman	West Bengal
56.	Mohanpur	15.82	Paschim Bardhaman	West Bengal
57.	Gourangdi (A) Colliery	10.64	Paschim Bardhaman	West Bengal
58.	Gourangdi Begunia Colliery	9.80	Paschim Bardhaman	West Bengal
59.	Bonjemihary Colliery	9.51	Paschim Bardhaman	West Bengal
60.	Dabor Colliery	3.27	Paschim Bardhaman	West Bengal
61.	Itapara Project	15.83	Paschim Bardhaman	West Bengal
62.	Ningah	32.16	Paschim Bardhaman	West Bengal
63.	Bhanora	10.26	Paschim Bardhaman	West Bengal
64.	Kaliphari	13.30	Paschim Bardhaman	West Bengal
65.	Satgram Project	15.94	Paschim Bardhaman	West Bengal
66.	Satgram Incline	2.48	Paschim Bardhaman	West Bengal
67.	JK Nagar	39.72	Paschim Bardhaman	West Bengal
68.	Nimcha	50.33	Paschim Bardhaman	West Bengal
69.	Kalidaspur	4.69	Bankura	West Bengal
70.	ChapuiKhas	11.35	Paschim Bardhaman	West Bengal
71.	Moira	1.59	Paschim Bardhaman	West Bengal
72.	Khandra	9.12	Paschim Bardhaman	West Bengal
73.	Shankarpur	10.96	Paschim Bardhaman	West Bengal
74.	Bankola	15.76	Paschim Bardhaman	West Bengal
75.	Shyamsundarpur	20.50	Paschim Bardhaman	West Bengal
76.	Tilaboni	6.57	Paschim Bardhaman	West Bengal

Sr. No.:	Mine	Annual average mine water availability (LKL/year)	District	State
77.	Kumardihi 'A'	10.70	Paschim Bardhaman	West Bengal
78.	Nakrakonda-Kumardihi B	11.89	Paschim Bardhaman	West Bengal
	TOTAL	**1244.7**		

Table 2.7: List of abandoned mines in ECL and volume of mine water available

Sr. No.:	Mine	Annual average mine water availability (LKL)	District	State
1.	Purushottapur OCP	72.38	Paschim Bardhman	West Bengal
2.	Madhujore UG	3.27	Paschim Bardhman	West Bengal
3.	Lachipur UG	5.91	Paschim Bardhman	West Bengal
4.	Parasea Old (Dhandadihi)	7.32	Paschim Bardhman	West Bengal
5.	Amdiha Quarry	20.35	Paschim Bardhman	West Bengal
6.	Dalmia Quarry	28.75	Paschim Bardhman	West Bengal
7.	SSI	20.28	Paschim Bardhman	West Bengal
8.	Girmint	22.08	Paschim Bardhman	West Bengal
9.	Mithapur	7.12	Paschim Bardhman	West Bengal
10.	Kuardih/Tirat	20.31	Paschim Bardhman	West Bengal
11.	Jemehari	11.95	Paschim Bardhman	West Bengal
12.	Ghanashyam Old OCP	22.50	Paschim Bardhman	West Bengal
13.	Mahabir OCP	8.86	Paschim Bardhman	West Bengal
	TOTAL	**251.1**		

2.1.4 Mahanadi Coalfields Limited (MCL)

Mahanadi Coalfields Limited (MCL) is a subsidiary of Coal India Limited (CIL) with its headquarters located in Sambalpur Dist., Odisha. Mahanadi Coalfields Limited was carved out of South Eastern Coalfields Limited in 1992 and comprises of two coalfields, namely Talcher Coalfield and IB Valley Coalfield.

The net annual mine water availability reported from MCL mines is approx. 718.4 LKL from 19 running mines and approx. 113.1 LKL from 7 abandoned mines located across 3 districts (Angul, Jharsuguda and Sundergarh) of Odisha. It is to be mentioned here that all open cast (OC) mines of MCL are operating on Zero Liquid Discharge (ZLD) mode, hence there is no discharge of mine water outside the project from these projects. Community supply of mine water from MCL is from its underground collieries only. The details of running and abandoned mines and water availability thereunder is shown in the tables hereunder.

Table 2.8: List of running mines in MCL and mine water discharge volume

Sr. No.:	Mine	Annual average mine water availability (LKL/year)	District	State
1.	Balram OCP	27.30	Angul	Odisha
2.	Hingula OCP	8.36	Angul	Odisha
3.	Lingaraj OCP	25.42	Angul	Odisha
4.	Bharatpur OCP	112.56	Angul	Odisha
5.	Bhubaneswari	28.67	Angul	Odisha
6.	Jagannath	9.60	Angul	Odisha
7.	Ananta	31.73	Angul	Odisha
8.	Kaniha OCP	19.14	Angul	Odisha

Sr. No.:	Mine	Annual average mine water availability (LKL/year)	District	State
9.	Nandira Colliery	25.05	Angul	Odisha
10.	Orient Colliery UG Mine No.1&2	41.21	Jharsuguda	Odisha
11.	Orient Colliery UG Mine No.3	24.82	Jharsuguda	Odisha
12.	HirakhandBundia UG	5.98	Jharsuguda	Odisha
13.	Lakhanpur OCP	119.22	Jharsuguda	Odisha
14.	Belpahar OCM	68.31	Jharsuguda	Odisha
15.	Samleswari OCP	58.77	Jharsuguda	Odisha
16.	Lajkura OCP	29.35	Jharsuguda	Odisha
17.	Kulda OCP	44.42	Sundergarh	Odisha
18.	Garjanbahal OCP	6.97	Sundergarh	Odisha
19.	Basundhara OCP	31.55	Sundergarh	Odisha
	TOTAL	**718.4**		

Table 2.9: List of voids in abandoned mines in MCL and volume of mine water available

Sr. No.:	Mine	Annual average mine water availability (LKL)	District	State
1.	Chhendipada	9.5	Angul	Odisha
2.	Talcher Colliery	36.82	Angul	Odisha
3.	Deulbera Colliery	16.77	Angul	Odisha
4.	Handidhua Colliery	25.79	Angul	Odisha
5.	Orient Colliery UG Mine No.4	9.76	Jharsuguda	Odisha
6.	Rampur Colliery UG	6.97	Jharsuguda	Odisha
7.	Lilari OC	7.45	Jharsuguda	Odisha
8.	Basundhara East	*	Sundergarh	Odisha
	TOTAL	**113.1**		

**Volume included under Sr.#19 of Table 2.8*

2.1.5 Northern Coalfields Limited (NCL)

Northern Coalfields Limited (NCL) is a subsidiary of Coal India Limited (CIL) with its headquarters located in Singrauli Dist., Madhya Pradesh.

The net annual mine water availability reported from NCL mines is approx. 180 LKL from 10 mines across Singraulidistrict of Madhya Pradesh and Sonebhadra district of Uttar Pradesh. It is to be mentioned here that all mines of NCL are operating on Zero Liquid Discharge (ZLD) mode, hence there is no discharge of mine water outside the project from these projects. The details of running mines and water availability thereunder is shown in the tables hereunder.

Table 2.10: List of running mines in NCL and mine water discharge volume

Sr. No.:	Mine	Annual average mine water availability (LKL/year)	District	State
1.	Amlohri	25.87	Singrauli	Madhya Pradesh
2.	Bina	26.49	Sonebhadra	Uttar Pradesh
			Singrauli	Madhya Pradesh
3.	Block B	11.31	Singrauli	Madhya Pradesh
	Dudhichua	12.62	Sonebhadra	Uttar Pradesh

4.			Singrauli	Madhya Pradesh
5.	Jayant	41.75	Singrauli	Madhya Pradesh
6.	Jhingurda	8.99	Singrauli	Madhya Pradesh
7.	Kakri	5.39	Sonebhadra	Uttar Pradesh
8.	Khadia	20.23	Sonebhadra	Uttar Pradesh
			Singrauli	Madhya Pradesh
9.	Krishnashila	0	Sonebhadra	Uttar Pradesh
10.	Nigahi	27.37	Singrauli	Madhya Pradesh
	TOTAL	**180.0**		

2.1.6 South Eastern Coalfields Limited (SECL)

South Eastern Coalfields Limited (SECL) is a subsidiary of Coal India Limited (CIL) with its headquarters located in Bilaspur Dist., Chhattisgarh.

The net annual mine water availability reported from SECL mines is approx. 730.6 LKL from 65 running mines and approx. 71.3 LKL from 10 abandoned mines located across five districts (Koriya, Korba, Raigarh, Sarguja and Surajpur) of Chhattisgarh and three districts (Anuppur, Shahdol and Umaria) of Madhya Pradesh. The details of running and abandoned mines and water availability thereunder is shown in the tables hereunder.

Table 2.11: List of running mines in SECL and mine water discharge volume

Sr. No.:	Mine	Annual average mine water availability (LKL/year)	District	State
1.	Unit-I (Bhatgaon U/G)	10.79	Surajpur	Chhattisgarh
2.	Unit-II (Mahamaya U/G)	6.39	Surajpur	Chhattisgarh
3.	Shivani U/G	1.21	Surajpur	Chhattisgarh
4.	Nawapara U/G	9.80	Surajpur	Chhattisgarh
5.	Dugga OC	0	Surajpur	Chhattisgarh
6.	Mahan OC	1.16	Surajpur	Chhattisgarh
7.	Mahan-II OC	3.74	Surajpur	Chhattisgarh
8.	Amadand OCP	3.98	Anuppur	Madhya Pradesh
9.	Bartarai UG	6.04	Anuppur	Madhya Pradesh
10.	Bhadra 7/8 mine	14.06	Anuppur	Madhya Pradesh
11.	JAMUNA /1 /2	21.40	Anuppur	Madhya Pradesh
12.	MEERA UG	5.87	Anuppur	Madhya Pradesh
13.	JAMUNA 9/10	3.50	Anuppur	Madhya Pradesh
14.	KOTMA WEST U/G	4.38	Anuppur	Madhya Pradesh
15.	Kurja-Sheetaldhara	4.09	Anuppur	Madhya Pradesh
16.	Behrabandh UG Mine	2.92	Anuppur	Madhya Pradesh
17.	Rajnagar RO UG Mine	9.19	Anuppur	Madhya Pradesh
18.	Bijuri UG Mine	9.15	Anuppur	Madhya Pradesh
19.	Jhiria UG Mine	2.66	Anuppur	Madhya Pradesh
20.	Rajnagar OC Mine	2.48	Anuppur	Madhya Pradesh
21.	West JKD UG Mine	20.98	Korea	Chhattisgarh
22.	Haldibadi UG Mine	8.80	Korea	Chhattisgarh
23.	Kapildhara	1.99	Anuppur	Madhya Pradesh
24.	Damini U/G	12.18	Shahdol	Madhya Pradesh
25.	Rajendra U/G	10.57	Shahdol	Madhya Pradesh
26.	Khairaha U/G	12.84	Shahdol	Madhya Pradesh
27.	Bangwar U/G	9.24	Shahdol	Madhya Pradesh
28.	Dhanpuri U/G	6.65	Shahdol	Madhya Pradesh
29.	Amlai OCM	3.21	Shahdol	Madhya Pradesh
30.	Dhanpuri OCM	9.19	Shahdol	Madhya Pradesh

Sr. No.:	Mine	Annual average mine water availability (LKL/year)	District	State
31.	Sharda OCM	3.05	Shahdol	Madhya Pradesh
32.	Nowrozabad U/G	5.14	Umaria	Madhya Pradesh
33.	Kanchan OC Mine	2.80	Umaria	Madhya Pradesh
34.	Pali UG Mine	2.74	Umaria	Madhya Pradesh
35.	Birsinghpur UG	2.89	Umaria	Madhya Pradesh
36.	Umaria UG Mine	12.31	Umaria	Madhya Pradesh
37.	Piparia UG Mine	7.00	Umaria	Madhya Pradesh
38.	Vindhya UG Mine	2.84	Umaria	Madhya Pradesh
39.	Pinoura U/G Mine	2.62	Umaria	Madhya Pradesh
40.	Gayatri U/G Mine	7.58	Sarguja	Chhattisgarh
41.	Rehar U/G Mine	8.17	Sarguja	Chhattisgarh
42.	Amgaon OC	3.77	Sarguja	Chhattisgarh
43.	Amera OC	7.54	Sarguja	Chhattisgarh
44.	Balrampur 10/12 UG	37.36	Sarguja	Chhattisgarh
45.	Kumda 7/8 UG Mine	52.39	Sarguja	Chhattisgarh
46.	*Ketki U/G*	0	Sarguja	Chhattisgarh
47.	Dhelwadih U/G	11.64	Korba	Chhattisgarh
48.	Singhali U/G	4.54	Korba	Chhattisgarh
49.	Bagdeva U/G	2.66	Korba	Chhattisgarh
50.	Surakachhar 5/6	17.43	Korba	Chhattisgarh
51.	Balgi U/G	18.92	Korba	Chhattisgarh
52.	Surakachhar U/G	18.02	Korba	Chhattisgarh
53.	Surakachhar 3/4	7.44	Korba	Chhattisgarh
54.	Rajgamar U/G	18.79	Korba	Chhattisgarh
55.	Manikpur OC	15.51	Korba	Chhattisgarh
56.	*Saraipali OCM*	0	Korba	Chhattisgarh
57.	Gevra Project-1	172.50	Korba	Chhattisgarh
58.	Kusmunda OC	31.73	Korba	Chhattisgarh
59.	Dipka OCM	8.86	Korba	Chhattisgarh
60.	Chaal OC Mine	2.51	Raigarh	Chhattisgarh
61.	Baroud OCP	4.67	Raigarh	Chhattisgarh
62.	Jampali OC	8.79	Raigarh	Chhattisgarh
63.	*Bijari O/C*	0	Raigarh	Chhattisgarh
64.	*Gare Pelma IV /1 O/C*	6.13	Raigarh	Chhattisgarh
65.	*Gare Pelma IV /2&3 O/C*	3.78	Raigarh	Chhattisgarh
	TOTAL	**730.6**		

Table 2.12: List of voids in abandoned mines in SECL and volume of mine water available

Sr. No.:	Mine	Annual average mine water availability (LKL)	District	State
1.	Kalyani U/G	4.33	Surajpur	Chhattisgarh
2.	Somna UG Mine	1.53	Anuppur	Madhya Pradesh
3.	Palkimara UG Mine	5.25	Korea	Chhattisgarh
4.	B Seam UG Mine	9.19	Korea	Chhattisgarh
5.	Malga UG Mine	0	Anuppur	Madhya Pradesh
6.	North JKD	2.04	Korea	Chhattisgarh
7.	Navgaon UG	3.35	Shahdol	Madhya Pradesh
8.	Bishrampur OCM	28.01	Sarguja	Chhattisgarh
9.	Banki U/G	15.38	Korba	Chhattisgarh

Sr. No.:	Mine	Annual average mine water availability (LKL)	District	State
10.	Dharam U/G Mine	2.19	Raigarh	Chhattisgarh
	TOTAL	**71.3**		

2.1.7 Western Coalfields Limited (WCL)

Western Coalfields Limited (WCL) is a subsidiary of Coal India Limited (CIL) with its headquarters located in Nagpur Dist., Maharashtra. WCL has been conferred "Miniratna" status on 15th March, 2007. WCL's mining operation is spread over the states of Maharashtra (in Nagpur, Chandrapur and Yavatmal Districts) and Madhya Pradesh (in Betul and Chhindwara Districts).

The net annual mine water availability reported from WCL mines is approx. 1369.9 LKL from 63 running mines and approx. 8.2 LKL from 4 abandoned mines across five districts (Chandrapur, Nagpur and Yavatmal of Maharashtra; Betul, and Chhindwara of Madhya Pradesh). The details of running and abandoned mines and water availability thereunder is shown in the tables hereunder.

Table 2.13: List of running mines in WCL and mine water discharge volume

Sr. No.:	Mine	Annual average mine water availability (LKL/year)	District	State
1.	Ballarpur OC	0.66	Chandrapur	Maharashtra
2.	Ballarpur Colliery 3&4 pits	6.36	Chandrapur	Maharashtra
3.	Sasti OC	3.36	Chandrapur	Maharashtra
4.	Sasti UG	3.86	Chandrapur	Maharashtra
5.	Gouri I&II (A)OC	2.57	Chandrapur	Maharashtra
6.	Gouri Deep OC	0.50	Chandrapur	Maharashtra
7.	Pauni OC	1.90	Chandrapur	Maharashtra
8.	Pauni II Expansion OC	2.39	Chandrapur	Maharashtra
9.	Shobhapur UG	0.35	Betul	Madhya Pradesh
10.	Sarni UG	8.46	Betul	Madhya Pradesh
11.	Tawa UG	2.44	Betul	Madhya Pradesh
12.	Tawa - II UG	1.79	Betul	Madhya Pradesh
13.	Chhatarpur - I & II UG	16.64	Betul	Madhya Pradesh
14.	Bhatadi	22.58	Chandrapur	Maharashtra
15.	Padmapur	20.56	Chandrapur	Maharashtra
16.	Durgapur	14.50	Chandrapur	Maharashtra
17.	DRC & CRC	74.38	Chandrapur	Maharashtra
18.	MKC UG	16.42	Chandrapur	Maharashtra
19.	Nandgaon UG	19.87	Chandrapur	Maharashtra
20.	Manna UG	6.21	Chandrapur	Maharashtra
21.	HLC UG	30.90	Chandrapur	Maharashtra
22.	HLOC	19.36	Chandrapur	Maharashtra
23.	Tandsi UG	2.68	Chhindwara	Madhya Pradesh
24.	Mohan UG	3.51	Chhindwara	Madhya Pradesh
25.	Ambara OC	2.92	Chhindwara	Madhya Pradesh
26.	MKD-I	7.14	Nagpur	Maharashtra

Sr. No.:	Mine	Annual average mine water availability (LKL/year)	District	State
27.	MKD-II & III	9.31	Nagpur	Maharashtra
28.	Murpar	88.71	Chandrapur	Maharashtra
29.	Umrer OCM	24.45	Nagpur	Maharashtra
30.	Gokul	2.50	Nagpur	Maharashtra
31.	Ukni OC	25.15	Yavatmal	Maharashtra
32.	Junad OCM	12.61	Yavatmal	Maharashtra
33.	KolarPimpri OCM	15.90	Yavatmal	Maharashtra
34.	Ghonsa OCM	15.92	Yavatmal	Maharashtra
35.	Rajur UG	64.15	Yavatmal	Maharashtra
36.	Barkuhi OCM	0.20	Chhindwara	Madhya Pradesh
37.	Chhinda OCM	0.66	Chhindwara	Madhya Pradesh
38.	Ganapati UG	0.77	Chhindwara	Madhya Pradesh
39.	Mahadeopuri UG	0.58	Chhindwara	Madhya Pradesh
40.	Mathani UG	0.46	Chhindwara	Madhya Pradesh
41.	Neharia UG	1.09	Chhindwara	Madhya Pradesh
42.	New Sethia OCM	0.62	Chhindwara	Madhya Pradesh
43.	Shivpuri OCM	0.44	Chhindwara	Madhya Pradesh
44.	Thesgora UG	0.15	Chhindwara	Madhya Pradesh
45.	Urdhan OCM	1.10	Chhindwara	Madhya Pradesh
46.	Vishnupuri I UG	0.15	Chhindwara	Madhya Pradesh
47.	Vishnupuri II UG	0.09	Chhindwara	Madhya Pradesh
48.	Adasa UG	16.35	Nagpur	Maharashtra
49.	Bhanegaon OCM	140.00	Nagpur	Maharashtra
50.	Gondegaon OCM	119.31	Nagpur	Maharashtra
51.	Inder UG TO OC	126.64	Nagpur	Maharashtra
52.	Kamptee OCM	133.55	Nagpur	Maharashtra
53.	Patansaongi UG	32.42	Nagpur	Maharashtra
54.	Saoner UG	51.10	Nagpur	Maharashtra
55.	Silewara UG	71.07	Nagpur	Maharashtra
56.	Kolgaon OCM	13.21	Yavatmal	Maharashtra
57.	Mungoli OCM	27.97	Yavatmal	Maharashtra
58.	Naigaon OCM	16.09	Yavatmal	Maharashtra
59.	Neeljay OCM	17.50	Yavatmal	Maharashtra
60.	Penganga OCM	16.85	Chandrapur	Maharashtra
61.	Yekona	11.15	Chandrapur	Maharashtra
62.	New Majri UG to OC	7.30	Chandrapur	Maharashtra
63.	New Majri-II (A) OC	12.41	Chandrapur	Maharashtra
	TOTAL	**1369.9**		

Table 2.14: List of voids in abandoned mines in WCL and volume of mine water available

Sr. No.:	Mine	Annual average mine water availability (LKL)	District	State
1.	Ghorawari OC	2.80	Chhindwara	Madhya Pradesh
2.	Nandan UG	2.33	Chhindwara	Madhya Pradesh

3.	Damua UG	2.33	Chhindwara	Madhya Pradesh
4.	Jharna UG	0.75	Chhindwara	Madhya Pradesh
	TOTAL	**8.2**		

2.1.8 NLC India Limited (NLCIL)

NLC India Limited (NLCIL) is a NAVRATNA company under the Ministry of Coal since 1956. NLCIL presently has a mining capacity to the tune of approx. 30.6 MTPA of lignite. NLCIL has also acquired coal mining projects (Talabira, Odisha & South Pachwara, Jharkhand), however production has not commenced yet. NLCIL has its own power plants and the present power generation capacity (including JVs) is 3140MW (Lignite based), 1000MW (Coal based), 1370.06 MW (Solar based), and 51MW (Wind based), accounting for a total of 5661.06 MW. The net annual mine water availability reported from lignite mines of NLCIL is approx. 1261.8 LKL from 3 mines located in Cuddalore district of Tamil Nadu. The details of running and abandoned mines and water availability thereunder is shown in the tables hereunder.

Table 2.15: List of running lignite mines in NLCIL and mine water discharge volume

Sr. No.:	Lignite Mines	Annual average mine water availability (LKL/year)	District	State
1.	Mine I, Mine IA, Mine II	1261.8	Cuddalore	Tamil Nadu
	TOTAL	**1261.8**		

2.1.9 Singareni Collieries Company Limited (SCCL)

The Singareni Collieries Company Limited (SCCL) is a government coal mining company jointly owned by the Government of Telangana and Government of India on a 51:49 equity basis. The Singareni coal reserves stretch across 350 km of the Pranahita – Godavari Valley of Telangana with proven geological reserves aggregating to whopping 8791 million tonnes. SCCL is currently operating 20 opencast and 25 underground mines in 4 districts of Telangana with a manpower around 48,942.

The net annual mine water availability reported from SCCL mines is approx. 1137.0 LKL from 42 running mines and approx. 38.0 LKL from 7 abandoned mines located across six districts (Bhadradri Kothagudem, Jayashankar, Khammam, Kumuram Bheem, Mancherial and Peddapalli) of Telangana. The details of running and abandoned mines and water availability thereunder is shown in the tables hereunder.

Table 2.16: List of running mines in SCCL and mine water discharge volume

Sr. No.:	Mine	Annual average mine water availability (LKL/year)	District(s)	State
1.	BPA OC - II Extn.	14.49	Kumuram Bheem Asifabad & Mancherial	Telangana
2.	KHA OC Expansion	57.82	Kumuram Bheem Asifabad & Mancherial	Telangana
3.	KLP	10.54	Jayashankar Bhupalpally	Telangana
4.	KTK - 1 & 1A Incline	23.11	Jayashankar Bhupalpally	Telangana
5.	KTK - 5 Inc	10.98	Jayashankar Bhupalpally	Telangana
6.	KTK - 6 Inc	39.95	Jayashankar Bhupalpally	Telangana

Sr. No.:	Mine	Annual average mine water availability (LKL/year)	District(s)	State
7.	KTK OC - 2	54.53	Jayashankar Bhupalpally	Telangana
8.	GK OC	29.77	Bhadradri Kothagudem	Telangana
9.	JVR OC - I Expn	26.77	Khammam	Telangana
10.	JVR OC - II	32.18	Khammam	Telangana
11.	Kistaram OC	13.79	Khammam	Telangana
12.	PVK - 5 Incline	50.30	Bhadradri Kothagudem	Telangana
13.	Kasipet - I Incline	33.86	Mancherial	Telangana
14.	Kasipet - II Incline	11.31	Mancherial	Telangana
15.	KK-1 Incline	29.48	Mancherial	Telangana
16.	KK- 5 Incline	29.00	Mancherial	Telangana
17.	KK OCP	12.63	Mancherial	Telangana
18.	RK - 1A	12.68	Mancherial	Telangana
19.	RKP OCP	21.24	Mancherial	Telangana
20.	SK Mine	30.09	Mancherial	Telangana
21.	Kondapuram UG mine	13.16	Bhadradri Kothagudem	Telangana
22.	MNG OC	15.40	Bhadradri Kothagudem	Telangana
23.	MNG OC - II	53.47	Bhadradri Kothagudem	Telangana
24.	MNG OC - IV	61.31	Bhadradri Kothagudem	Telangana
25.	GDK 1&3 Incline	44.55	Pedapalli	Telangana
26.	GDK 11A Incline	27.00	Pedapalli	Telangana
27.	Medapalli OC	28.45	Pedapalli	Telangana
28.	VKP	17.87	Pedapalli	Telangana
29.	RG OC - III	46.38	Pedapalli	Telangana
30.	ALP Mine	11.17	Pedapalli	Telangana
31.	RG OC - I	29.65	Pedapalli	Telangana
32.	RG OC - II	19.88	Pedapalli	Telangana
33.	RK - 5	15.13	Mancherial	Telangana
34.	RK - 6	13.14	Mancherial	Telangana
35.	RK - 7	17.56	Mancherial	Telangana
36.	RK - NT	18.61	Mancherial	Telangana
37.	SRP - 1	11.84	Mancherial	Telangana
38.	SRP 3 & 3A	16.10	Mancherial	Telangana
39.	IK OCP	21.79	Mancherial	Telangana
40.	SRP OC - II	61.05	Mancherial	Telangana
41.	JK 5 OC	28.24	Bhadradri Kothagudem	Telangana
42.	KOC - II	20.73	Bhadradri Kothagudem	Telangana
	TOTAL	**1137.0**		

Table 2.17: List of voids in abandoned mines in SCCL and volume of mine water available

Sr. No.:	Mine	Annual average mine water availability (LKL)	District	State
1.	No.21 Incline Mine, Yellandu	2.92	Bhadradri Kothagudem	Telangana
2.	Bore water-Old UG workings of JK 5 Incline	5.56	Bhadradri Kothagudem	Telangana
3.	2 Incline Mine,Bore holes,5B Incline, 5 Shaft & VK 7 Incline	17.4	Bhadradri Kothagudem	Telangana
4.	MVK-1and MVK-3 Inclines	3.29	Kumuram Bheem (Asifabad)	
5.	Goleti-1 Incline	3.52	Kumuram Bheem (Asifabad)	Telangana
6.	KK-2 Incline	1.65	Mancherial	
7.	GDK 10 & 10A Incline	3.66	Pedapalli	Telangana
	TOTAL	**38.0**		

2.2 State and district wise sources of mine water with number of mines

Considering the location of the mines across districts, the table below indicates the quantity of mine water available from the coal companies.

Table 2.18: Sources of mine water – state wise & district wise

Sr. No.:	State	District	Coal companies operational	Number of running mines	Annual average mine water availability (LKL/year)	Number of abandoned mines with voids	Annual average mine water availability (LKL)
01	Chhattisgarh	Korba	SECL	13	328.0	0	0
		Koriya	SECL	02	29.8	0	0
		Raigarh	SECL	06	25.9	0	0
		Sarguja	SECL	07	116.8	0	0
		Surajpur	SECL	07	33.1	07	25.7
			TOTAL	**35**	**533.6**	**07**	**25.7**
02	Jharkhand	Bokaro	CCL	11	138.9	12	337.4
		Chatra	CCL	02	7.9	01	11.2
		Deoghar	ECL	01	15.7	0	0
		Dhanbad	BCCL, ECL	42	1105.7	16	354.0
		Giridih	CCL	02	29.8	01	9.0
		Godda	ECL	01	51.9	0	0
		Hazaribagh	CCL	04	80.6	04	354.9
		Palamu	CCL	02	1.4	0	0.00
		Ramgarh	CCL	15	114.6	14	424.0
		Ranchi	CCL	03	2.0	04	20.2
			TOTAL	**83**	**1548.7**	**52**	**1510.8**
03	Maharashtra	Chandrapur	WCL	22	382.8	0	0
		Nagpur	WCL	12	733.8	0	0
		Yavatmal	WCL	09	208.5	0	0
			TOTAL	**43**	**1325.1**	**0**	**0**

Sr. No.:	State	District	Coal companies operational	Number of running mines	Annual average mine water availability (LKL/year)	Number of abandoned mines with voids	Annual average mine water availability (LKL)
04	Madhya Pradesh	Annuppur	SECL	14	91.7	03	45.6
		Betul	WCL	5	29.7	0	0
		Chhindwara	WCL	15	15.0	04	8.2
		Shahdol	SECL	8	66.9	0	0
		Singrauli	NCL	5	115.3	0	0
		Umariya	SECL	8	38.3	0	0
			TOTAL	**55**	**357.0**	**07**	**53.8**
05	Odisha	Angul	MCL	09	287.8	03	88.9
		Jharsuguda	MCL	07	347.7	03	24.2
		Sundergarh	MCL	03	82.9	01	0
			TOTAL	**19**	**718.4**	**07**	**113.1**
06	Telangana	Bhadradri Kothagudem	SCCL	8	272.4	3	25.9
		Jayashankar	SCCL	5	139.1	0	0
		Khammam	SCCL	3	72.7	0	0
		Kumuram Bheem / Asifabad	SCCL	2*	72.3	2	6.8
		Mancherial	SCCL	16	355.5	1	1.7
		Peddapalli	SCCL	8	225.0	1	3.7
			TOTAL	**42**	**1137.0**	**07**	**38.0**
07	Tamil Nadu	Cudallore	NLCIL	01	1261.8	0	0
			TOTAL	**01**	**1261.8**	**0**	**0**
08	Uttar Pradesh	Sonebhadra	NCL	05	64.73	0	0
			TOTAL	**05**	**64.7**	**0**	**0**
09	West Bengal	Bankura	ECL	01	4.7	0	0
		Paschim Bardhman	ECL	61	960.9	14	256.0
		Purulia	ECL	02	25.9	0	0
			TOTAL	**64**	**991.5**	**14**	**256.0**
		GRAND TOTAL		**347**	**7938.0**	**94**	**1997.4**

**Mines are spread across two districts – Kumaram Bheem / Asifabad and Mancherial; however for calculations the data has been accounted under Kumuram Bheem/Asifabad only.*

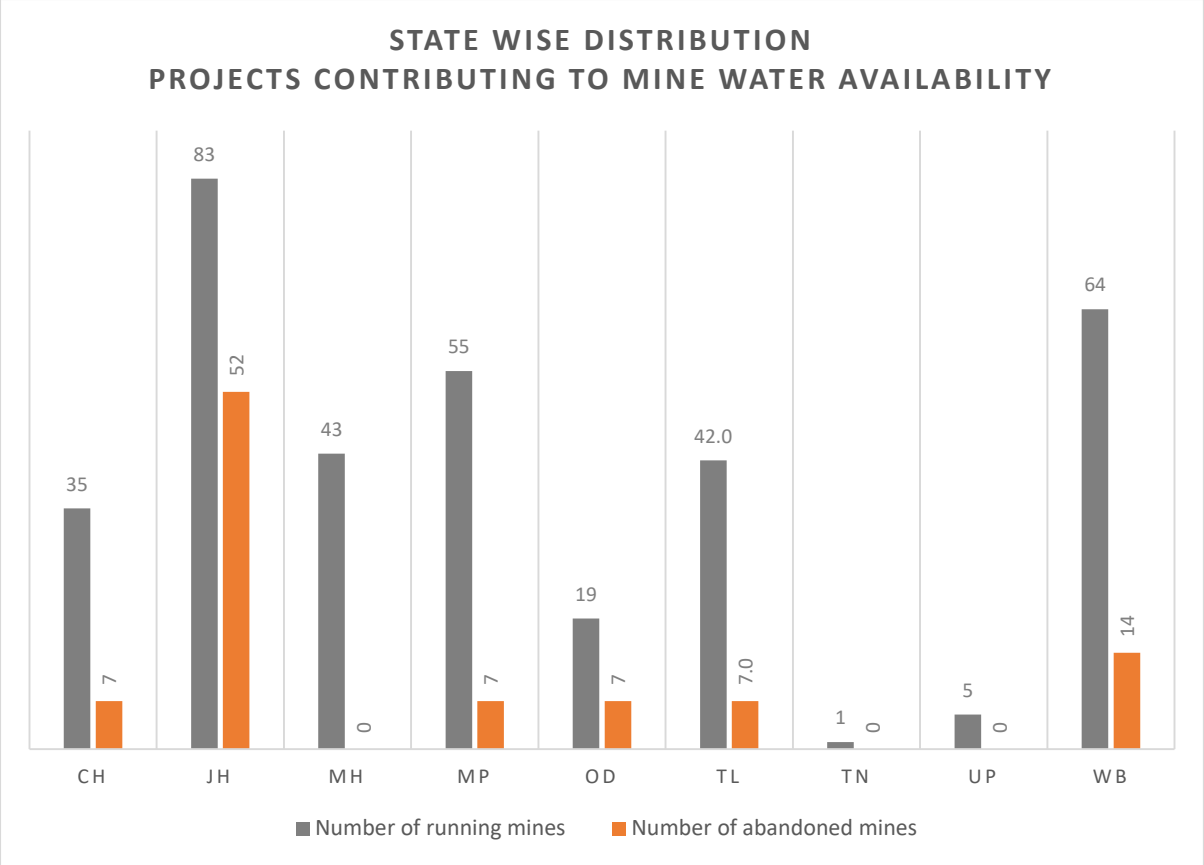


Figure 2.3(a): State wise distribution – projects contributing to mine water availability

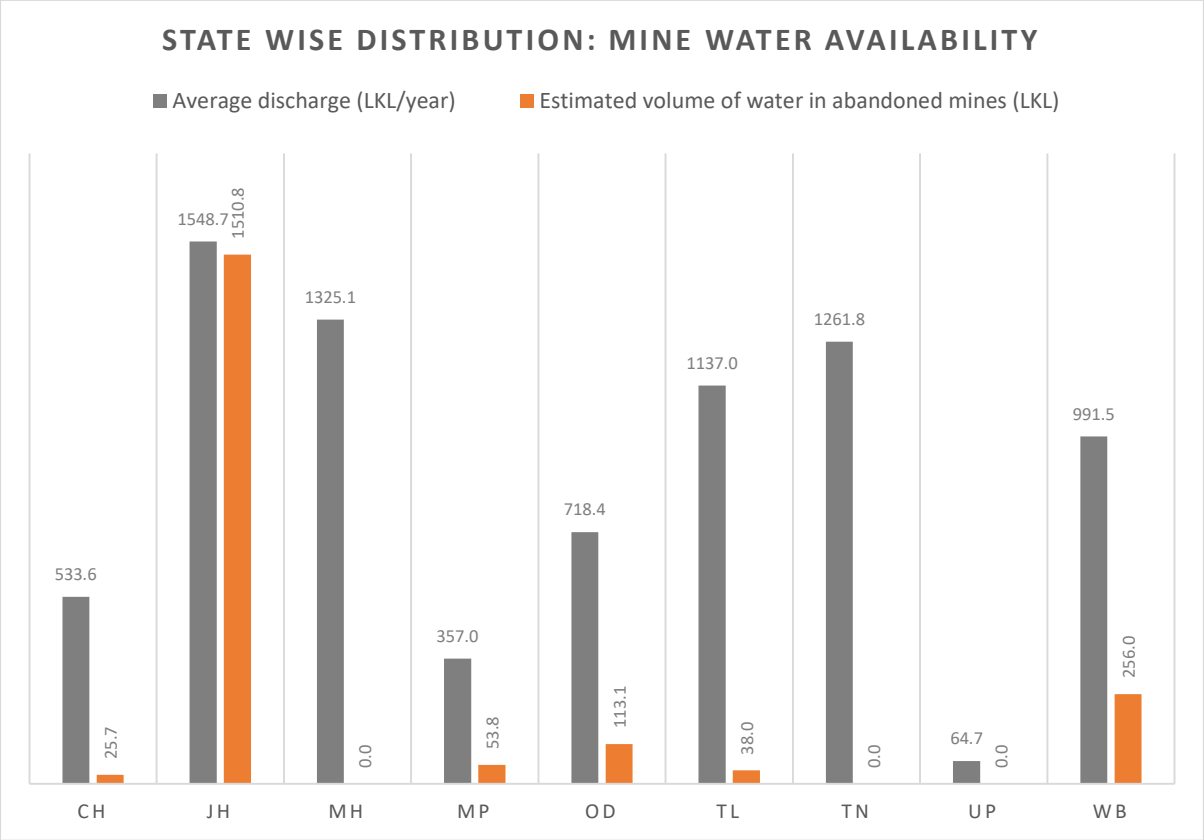


Figure 2.3(b): State wise distribution –mine water availability

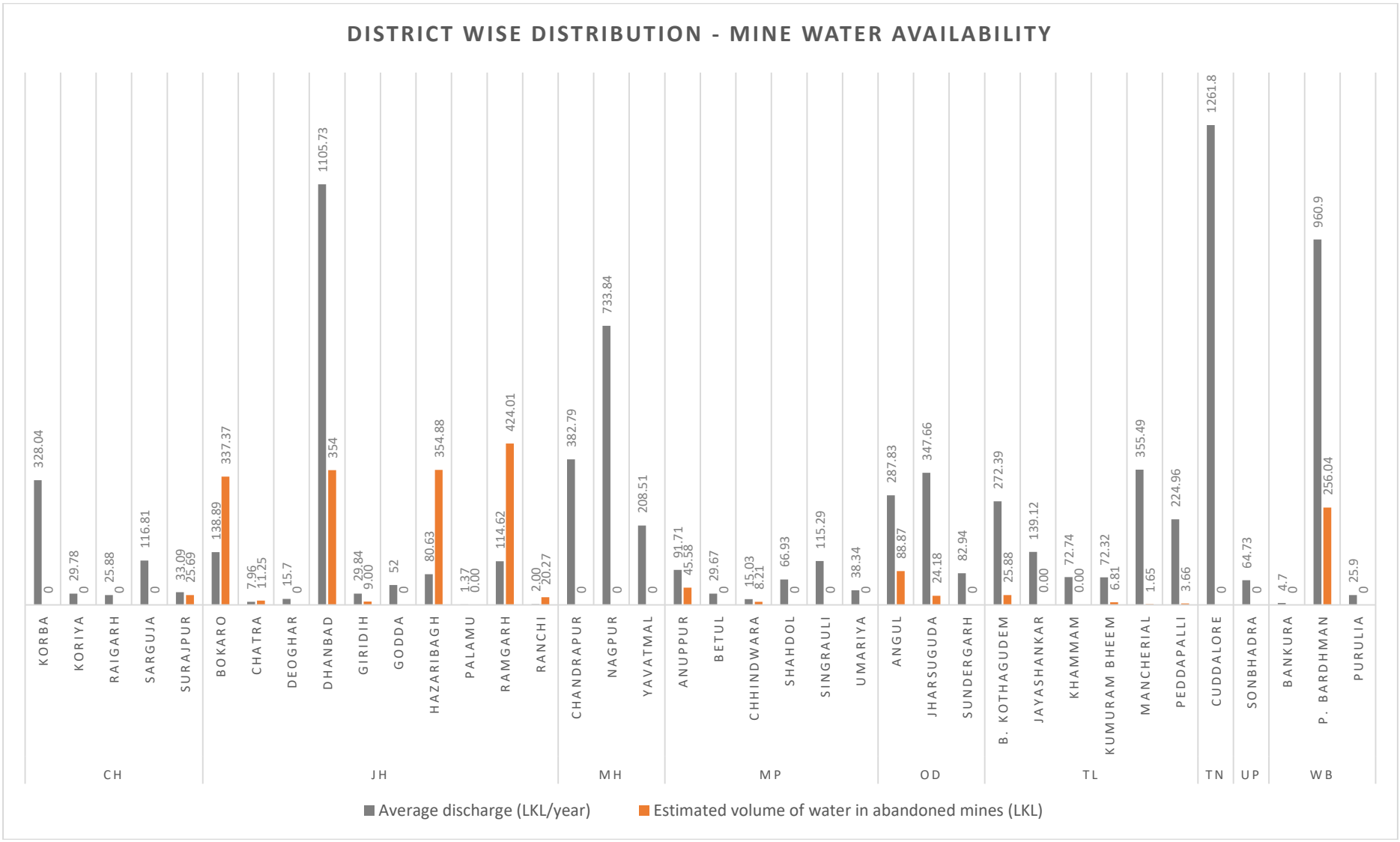


Figure 2.4: District wise distribution – mine water availability

Chapter 3

Utilization of mine water in coal companies

3.0 Utilization of mine water

Mine water accumulated in the pit lakes is being utilized both within and outside the coal companies. Within the mines, this water is utilized for mining activities – like dust suppression, washing activities, workshop, plantation activities, etc., as supply water for colony/township. Outside the mines, this water is utilized as a source of drinking water for surrounding communities, as freshwater for community supply, as irrigation water in surrounding agricultural areas and also as a source of water for industries or townships. Surplus mine water is also discharged into natural streams and allowed to recharge water regime in surrounding areas. In many abandoned mines, the mine water is retained in the mine voids and contribute towards recharge of ground water in the long run. The water in the abandoned mines is also used for internal consumption and for supply to nearby communities at times. The following section provides the status of utilization of mine water within mines and communities.

3.1 Mine water availability across coal PSUs

As per the data made available by the coal PSUs, the total mine water available for utilization is approximately 9935.4 LKL in the year 2019-20. BCCL, CCL, ECL, WCL, NLCIL and SCCL account for mine water quantities beyond 1000 LKL/year (including storage in mine voids). The break-up for the same is represented below:

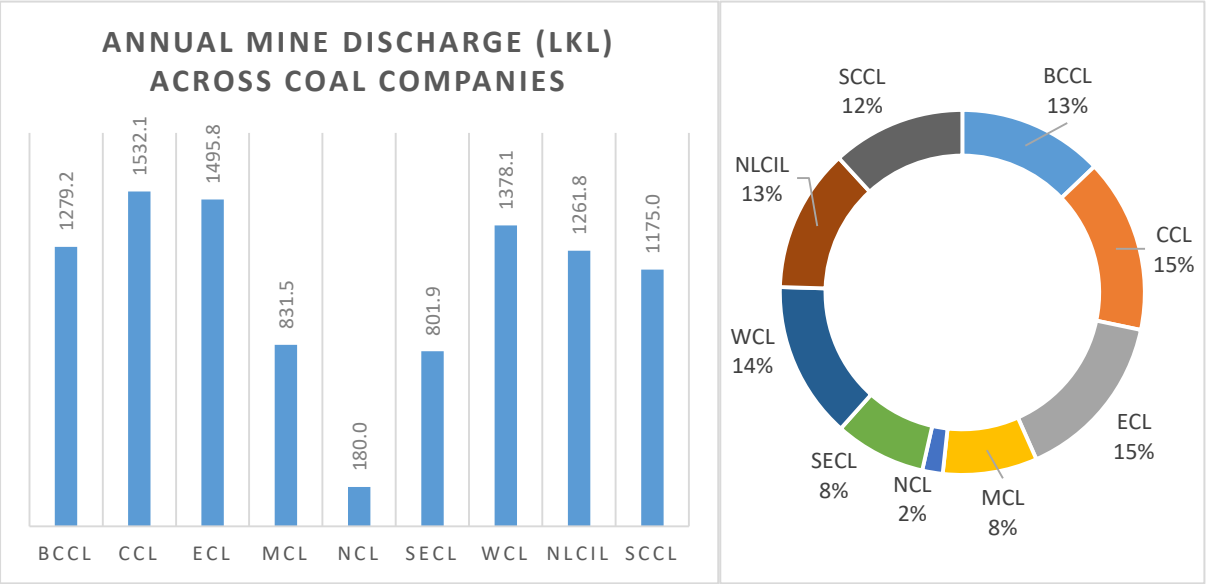


Figure 3.1: Annual mine water discharge across coal companies

3.2 Mine water utilization across coal companies

The break-up of mine water utilization within the mine, outside the mine as well as surplus discharge into streams is given in the table hereunder.

Table 3.1: Break-up of mine water utilization (LKL/year)

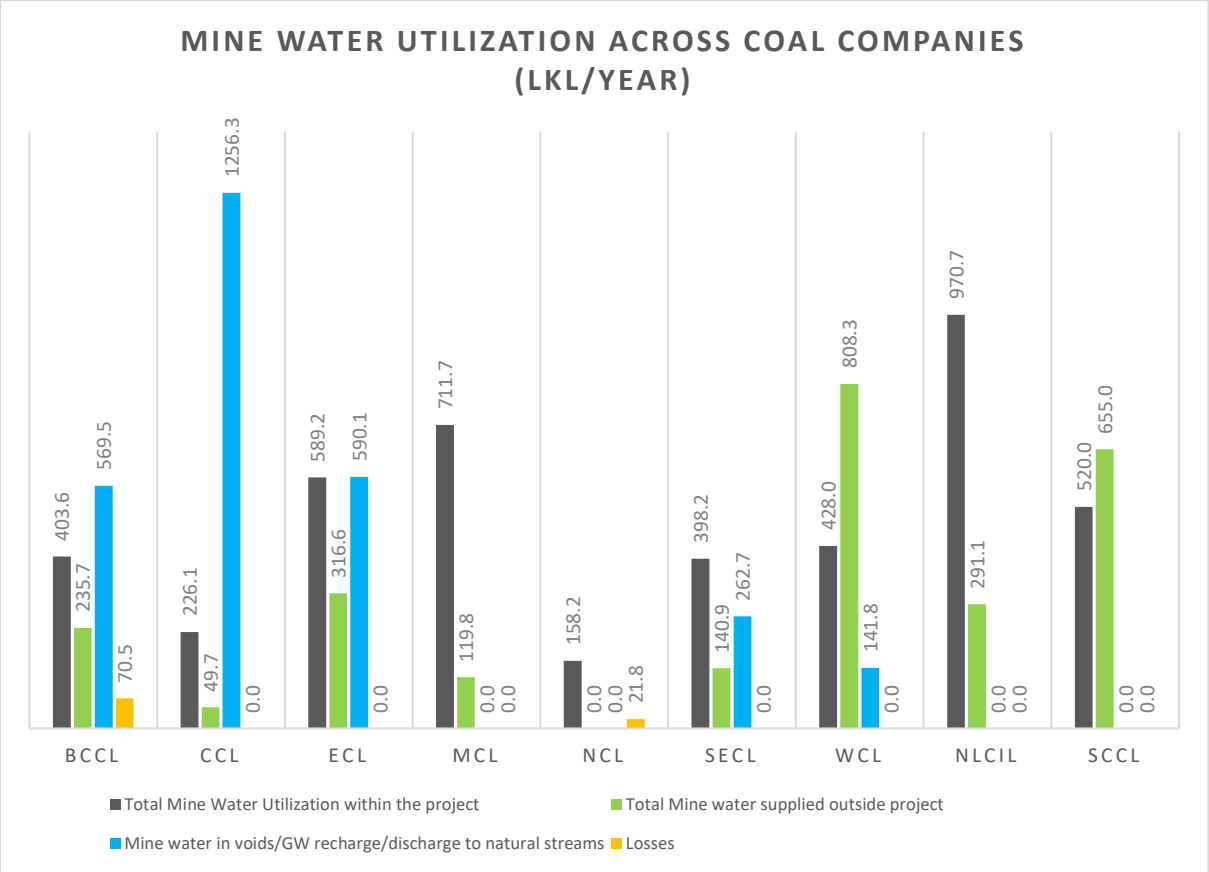
Name of Coal Company	Type of mine	Mine water for utilization	Mine water utilization within project	Mine water utilization outside project	Mine water stored in voids / for groundwater recharge / discharge into natural streams	Losses
BCCL	Running	920.3	320.9	183.6	382.2	33.5
	Non-operational	359.0	82.7	52.1	187.2	37.0
	Total	**1279.2**	**403.6**	**235.7**	**569.5**	**70.5**
CCL	Mine water discharge	375.3	226.1	49.7	99.5	0.0
	Mine water in voids*	1156.8	0.0	0.0	1156.8	0.0
	Total	**1532.1**	**226.1**	**49.7**	**1256.3**	**0.0**
ECL	Running	1244.7	550.2	286.3	408.2	0.0
	Non-operational*	251.1	38.9	30.3	181.9	0.0
	Total*	**1495.8**	**589.2**	**316.6**	**590.1**	**0.0**
MCL	Running	718.4	668.3	50.2	0.0	0.0
	Non-operational	113.1	43.4	69.7	0.0	0.0
	Total	**831.5**	**711.7**	**119.8**	**0.0**	**0.0**
NCL	Running	180.0	158.2	0.0	0.0	21.8
	Non-operational	0.0	0.0	0.0	0.0	0.0
	Total	**180.0**	**158.2**	**0.0**	**0.0**	**21.8**
SECL	Running	730.6	361.2	134.6	234.7	0.0
	Non-operational	71.3	37.0	6.3	28.0	0.0
	Total	**801.9**	**398.2**	**140.9**	**262.7**	**0.0**
WCL	Running	1369.9	419.8	808.3	142.1	0.0
	Non-operational	8.2	8.2	0.0	0.0	0.0
	Total	**1378.1**	**428.0**	**808.3**	**142.1**	**0.0**
CIL Total		**7498.5**	**2915.0**	**1671.1**	**2820.6**	**92.3**
NLCIL	Running	1261.8	970.7	291.1	0.0	0.0
	Non-operational	0.0	0.0	0.0	0.0	0.0
	Total	**1261.8**	**970.7**	**291.1**	**0.0**	**0.0**
SCCL	Running	1137.0	520.0	617.0	0.0	0.0
	Non-operational	38.0	0.0	38.0	0.0	0.0

Name of Coal Company	Type of mine	Mine water for utilization	Mine water utilization within project	Mine water utilization outside project	Mine water stored in voids / for groundwater recharge / discharge into natural streams	Losses
	Total	**1175.0**	**520.0**	**655.0**	**0.0**	**0.0**
TOTAL		**9935.4**	**4405.6**	**2617.2**	**2820.3**	**92.3**

**Mine water stored in voids; not discharged into external streams*

Table 3.2: Mine water utilization break-up across coal companies

Name of Coal Company	Mine water for utilization	Mine water utilization within project		Mine water utilization outside project		Mine water stored in voids / for groundwater recharge / discharge into natural streams		Losses	
		LKL	%	LKL	%	LKL	%	LKL	%
BCCL	1279.2	403.6	*31.5*	235.7	*18.4*	569.5	*44.5*	70.5	*5.5*
CCL	1532.1	226.1	*14.8*	49.7	*3.2*	1256.3	*82.0*	*Nil*	*0.0*
ECL	1495.8	589.2	*39.4*	316.6	*21.2*	590.1	*39.4*	*Nil*	*0.0*
MCL	831.5	711.7	*85.6*	119.8	*14.4*	*Nil*	*0.0*	*Nil*	*0.0*
NCL	180.0	158.2	*87.9*	*Nil*	*0.0*	*Nil*	*0.0*	21.8	*12.1*
SECL	801.9	398.2	*49.7*	140.9	*17.6*	262.7	*32.8*	*Nil*	*0.0*
WCL	1378.1	428.0	*31.1*	808.3	*58.7*	142.1	*10.3*	*Nil*	*0.0*
CIL Total	**7498.6**	**2914.9**	***38.9***	**1671.1**	***22.3***	**2820.6**	***37.6***	**92.3**	***1.2***
NLCIL	1261.8	970.7	*76.9*	291.1	*23.1*	*Nil*	*0.0*	*Nil*	*0.0*
SCCL	1175.0	520.0	*44.3*	655.0	*55.7*	*Nil*	*0.0*	*Nil*	*0.0*
TOTAL	**9935.4**	**4405.6**	*44.3*	**2617.2**	*26.3*	**2820.3**	*28.4*	**92.3**	*0.9*



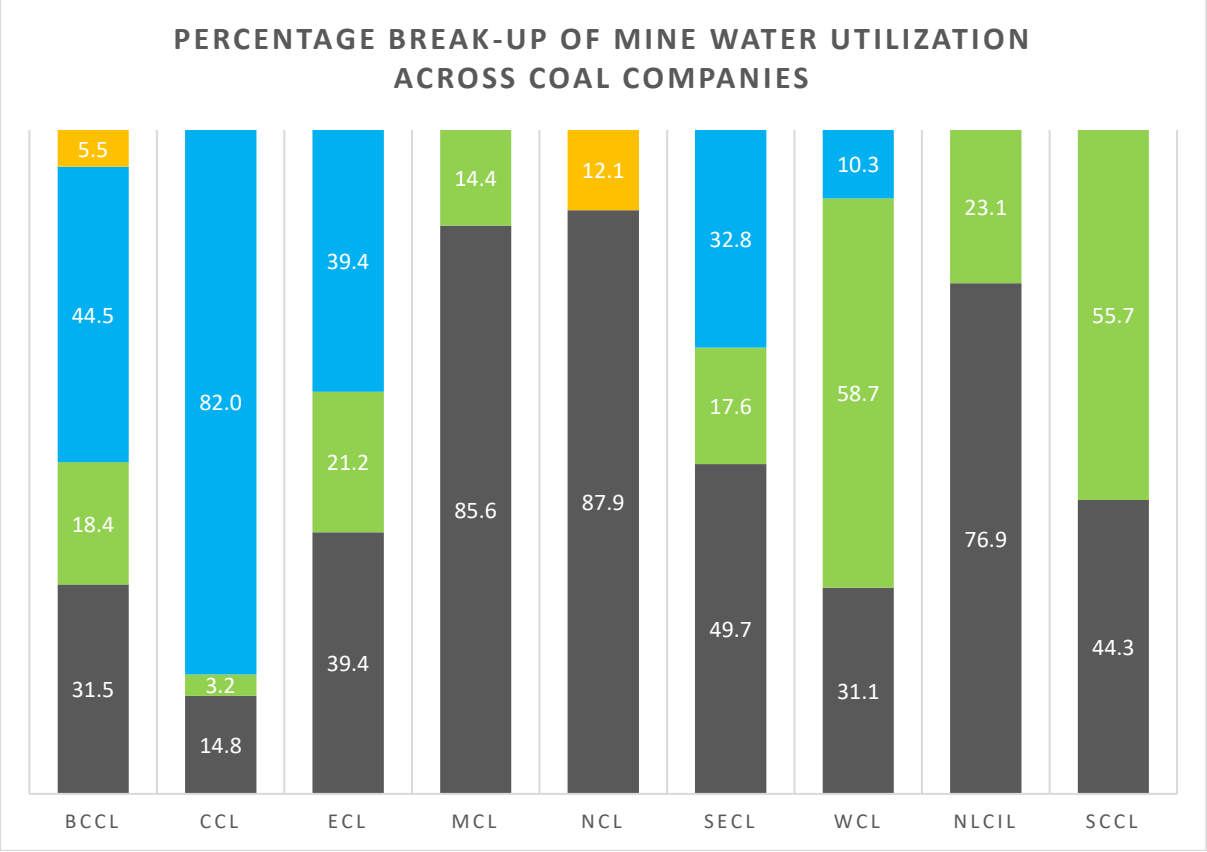


Figure 3.2: Mine water utilization across coal companies & percentage break-up

Table 3.3: District wise break-up of mine water utilization

State	District	Coal Co.	Mine Discharge	Total Mine Water Utilization within the project	Total Mine water supplied outside project	Mine water in voids/GW recharge/discharge to natural streams	Losses
Chhattisgarh	Surajpur	SECL	37.4	26.6	9.4	1.4	0.0
	Korea	SECL	46.3	41.2	3.6	1.5	0.0
	Sarguja	SECL	144.8	34.2	0.0	110.6	0.0
	Korba	SECL	343.4	165.6	83.9	93.9	0.0
	Raigarh	SECL	28.1	7.6	0.0	20.5	0.0
		Total	**600.0**	**275.2**	**96.9**	**227.9**	**0.0**
Jharkhand	Dhanbad	BCCL, ECL	1459.8	459.6	260.5	669.3	70.5
	Bokaro	CCL	476.3	100.6	9.8	365.8	0.0
	Chatra	CCL	20.7	5.7	3.3	11.7	0.0
	Giridih	CCL	38.8	8.9	20.9	9.0	0.0
	Hazaribagh	CCL	236.2	34.0	4.9	197.3	0.0
	Palamu	CCL	1.4	0.0	0.0	1.3	0.0
	Ramgarh	CCL	738.0	76.7	10.8	650.6	0.0
	Ranchi	CCL	20.8	0.1	0.0	20.7	0.0
	Deoghar	ECL	15.7	3.9	11.8	0.0	0.0
	Godda	ECL	52.0	12.6	39.4	0.0	0.0
		Total	**3059.5**	**702.1**	**361.4**	**1925.6**	**70.5**
Madhya Pradesh	Singrauli	NCL	115.3	100.7	0.0	0.0	14.6
	Anuppur	SECL	93.2	67.4	24.1	1.8	0.0
	Shahdol	SECL	70.3	35.8	1.5	33.0	0.0
	Umaria	SECL	38.3	19.9	18.5	0.0	0.0
	Betul	WCL	29.7	4.8	14.9	10.0	0.0

State	District	Coal Co.	Mine Discharge	Total Mine Water Utilization within the project	Total Mine water supplied outside project	Mine water in voids/GW recharge/discharge to natural streams	Losses
	Chindwara	WCL	23.2	23.2	0.0	0.0	0.0
		Total	**370.1**	**251.7**	**58.9**	**44.9**	**14.6**
Maharashtra	Chandrapur	WCL	382.8	194.9	127.3	60.9	0.0
	Nagpur	WCL	733.8	176.4	522.7	34.8	0.0
	Yavatmal	WCL	208.5	28.7	143.5	36.4	0.0
		Total	**1325.1**	**400.0**	**793.4**	**132.0**	**0.0**
Odisha	Angul	MCL	376.7	291.9	84.8	0.00	0.0
	Jharsuguda	MCL	371.8	336.8	35.0	0.00	0.0
	Sundergarh	MCL	82.9	82.9	0.0	0.00	0.0
		Total	**831.5**	**711.7**	**119.8**	**0.00**	**0.0**
Tamil Nadu	Cuddalore	NLCIL	1261.8	970.7	291.1	0.00	0.0
		Total	**1261.8**	**970.7**	**291.1**	**0.00**	**0.0**
Telangana	Bhadradi Kothagudem	SCCL	298.3	106.7	191.6	0.0	0.0
	Jayashankar	SCCL	139.1	46.3	92.8	0.0	0.0
	Khammam	SCCL	72.7	35.2	37.5	0.0	0.0
	Kumuram Bheem / Asifabad	SCCL	79.1	22.8	56.3	0.0	0.0
	Mancherial	SCCL	357.1	169.4	187.8	0.0	0.0
	Pedappalli	SCCL	228.6	139.5	89.1	0.0	0.0
		Total	**1175.0**	**520.0**	**655.0**	**0.0**	**0.0**
Uttar Pradesh	Sonebhadra	NCL	64.7	57.5	0.0	0.0	7.2
		Total	**64.7**	**57.5**	**0.0**	**0.0**	**7.2**
West Bengal	Bankura	ECL	4.7	2.8	1.9	0.0	0.0

State	District	Coal Co.	Mine Discharge	Total Mine Water Utilization within the project	Total Mine water supplied outside project	Mine water in voids/GW recharge/discharge to natural streams	Losses
	Paschim Bardhman	BCCL, ECL	1217.0	497.8	233.3	485.9	0.0
	Purulia	ECL	25.9	16.1	5.5	4.4	0.0
		Total	**1247.6**	**516.7**	**240.7**	**490.3**	**0.0**
		TOTAL	**9935.4**	**4405.6**	**2617.2**	**2820.6**	**92.3**

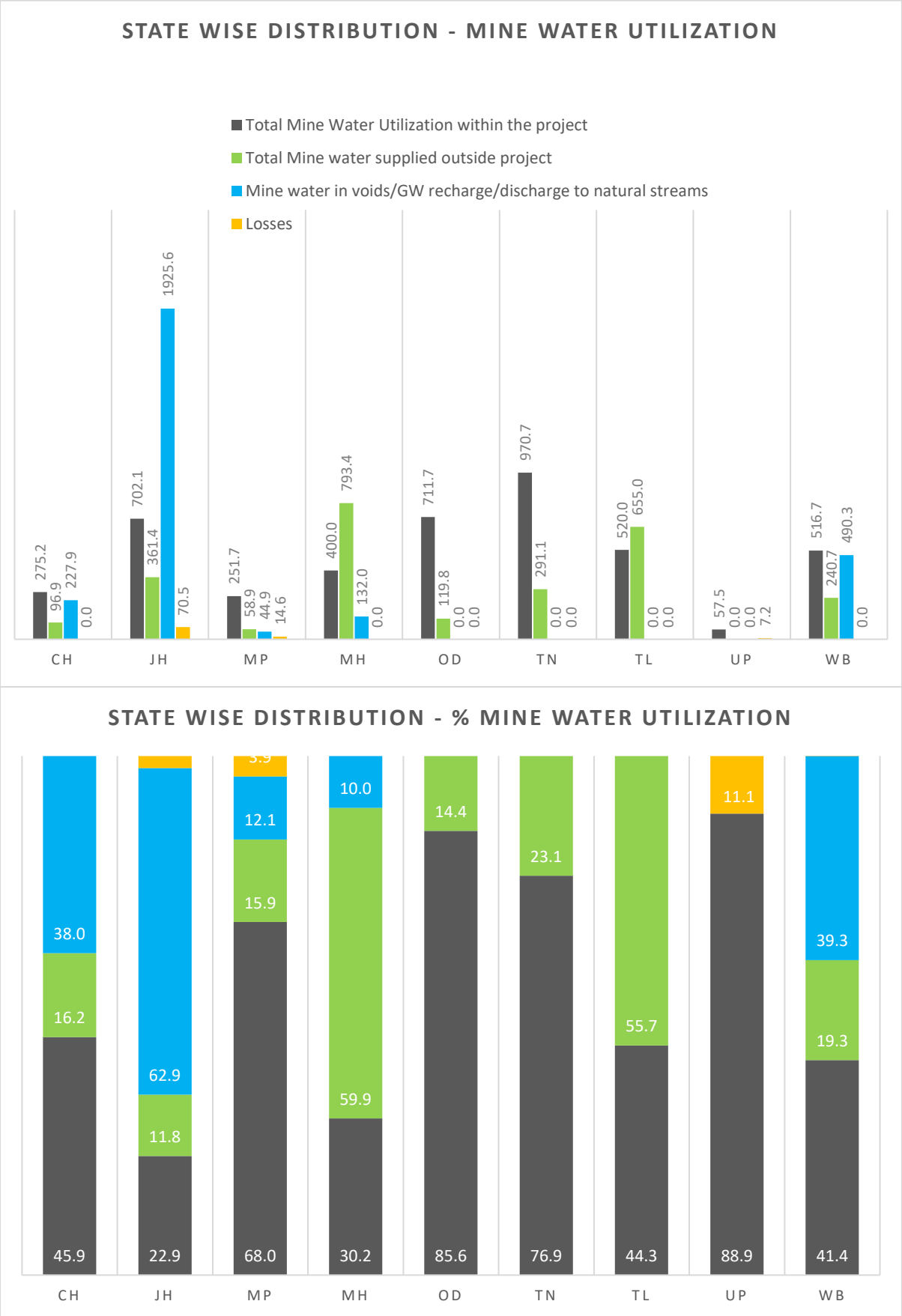


Figure 3.3: State wise distribution – mine water utilization

3.3 Utilization of mine water for internal consumption

Mine water accumulated within the mine sites across coal companies is being utilized for activities such as

1. For dust suppression – mobile water sprinklers, fog cannons, mist sprayers, wheel washing systems, etc.
2. For washing activities,
3. For use in workshop,
4. For use in plantation activities and greenbelt development,
5. For use towards utilities and colony/township
6. For contribution towards groundwater recharge through recharge pits
7. Mine pit lakes for pisciculture development
8. For use towards industrial demand, like washeries, power plants etc.

Table 3.4: Break-up of mine water utilization for internal consumption (LKL/year)

Name of Coal Company	Mine water utilization for internal consumption	For industrial use (coal mining activities)	For domestic / drinking use	Any other use
BCCL	403.6	133.0	270.6	0.0
CCL	226.1	150.9	75.2	0.0
ECL	589.2	396.3	189.4	3.5
MCL	711.7	142.6	43.8	525.3*
NCL	158.2	158.2	0.0	0.0
SECL	398.2	226.2	172.0	0.0
WCL	428.0	315.0	113.0	0.0
CIL Total	**2914.9**	**1522.1**	**864.0**	**528.8**
NLCIL	970.7	32.2	35.8	902.6**
SCCL	520.0	468.8	51.2	0
Grand Total	**4405.6**	**2023.0**	**951.1**	**1431.4**

**Utilized for rainwater harvesting within the mine lease area*

***Utilized as feed water in pit head thermal power plant*

Table 3.5: Break-up of mine water utilization within the project for industrial use (LKL/year)

Name of Coal Company	For industrial use (coal mining activities)	Dust Suppression	Plantation	Others
BCCL	133.0	-NA-	-NA-	-NA-
CCL	150.9	-NA-	-NA-	-NA-
ECL	396.2	102.0	17.1	277.2
MCL	142.6	119.9	7.4	15.3
NCL	158.2	158.2	0	0
SECL	226.2	-NA-	-NA-	-NA-
WCL	315.0	182.0	28.4	104.7
CIL Total	**1522.0**	-	-	-
NLCIL	32.2	8.4	23.9	0

Name of Coal Company	For industrial use (coal mining activities)	Dust Suppression	Plantation	Others
SCCL	468.8	170.3	131.5	167.0
Grand Total	**2023.0**	-	-	-

NA indicates break-up data unavailable

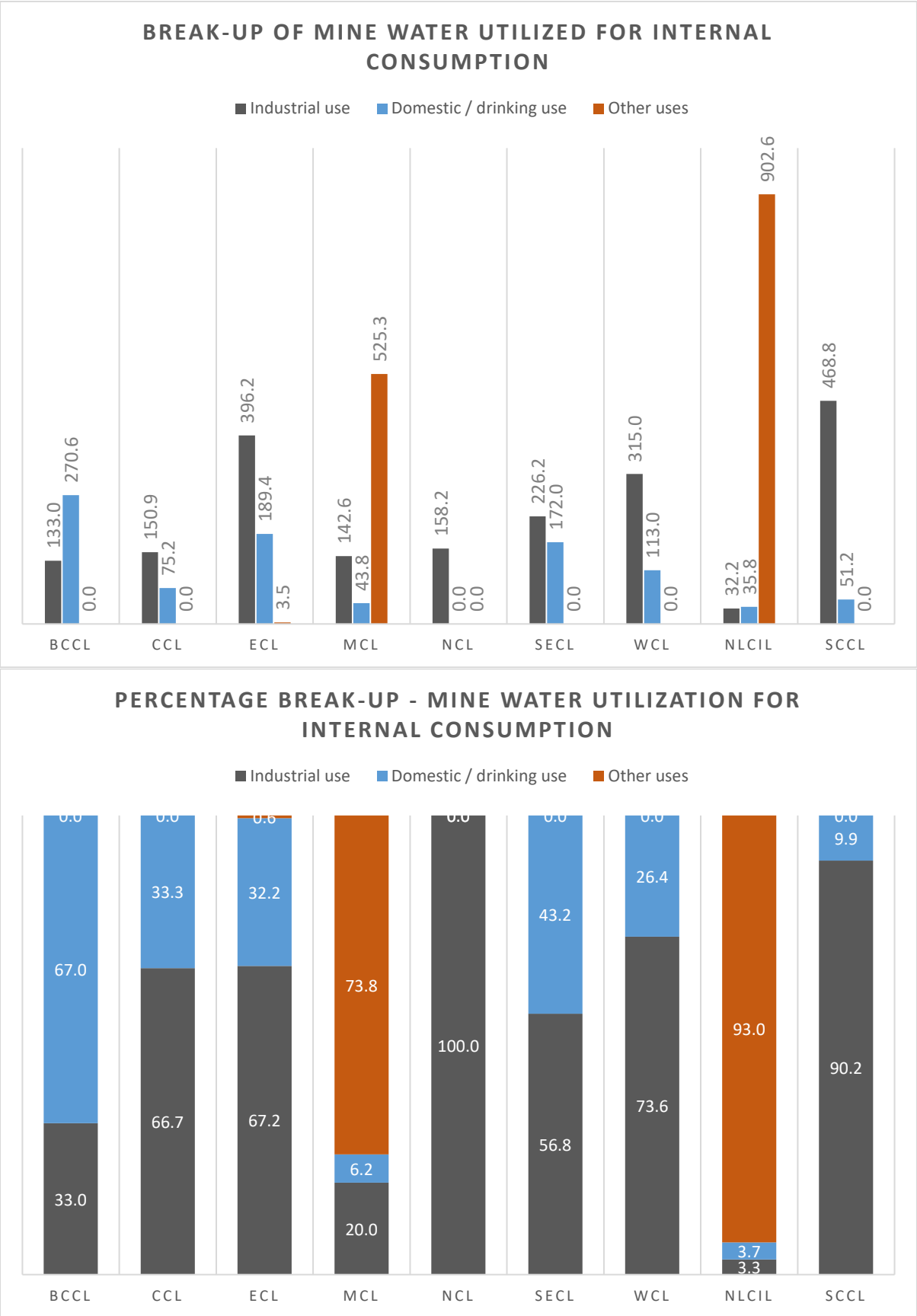
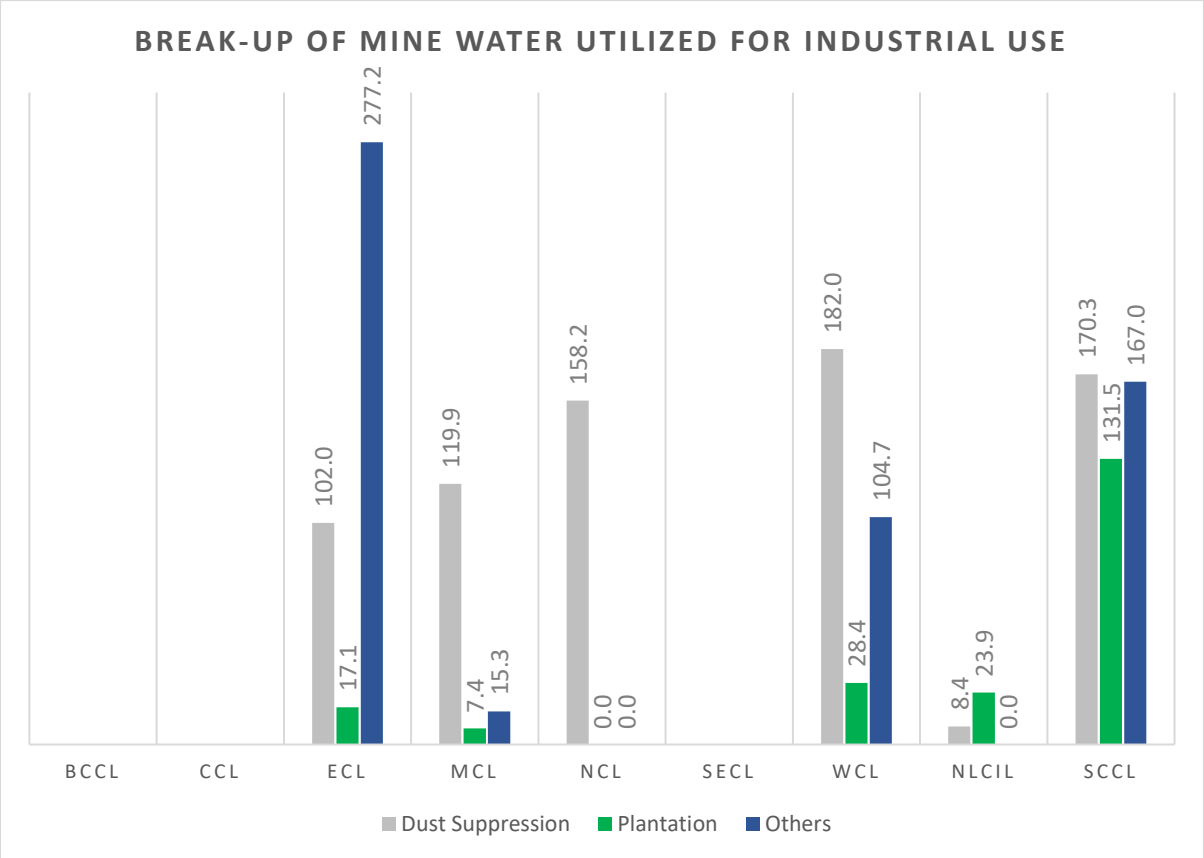


Figure 3.4: Break-up of mine water utilized for internal consumption



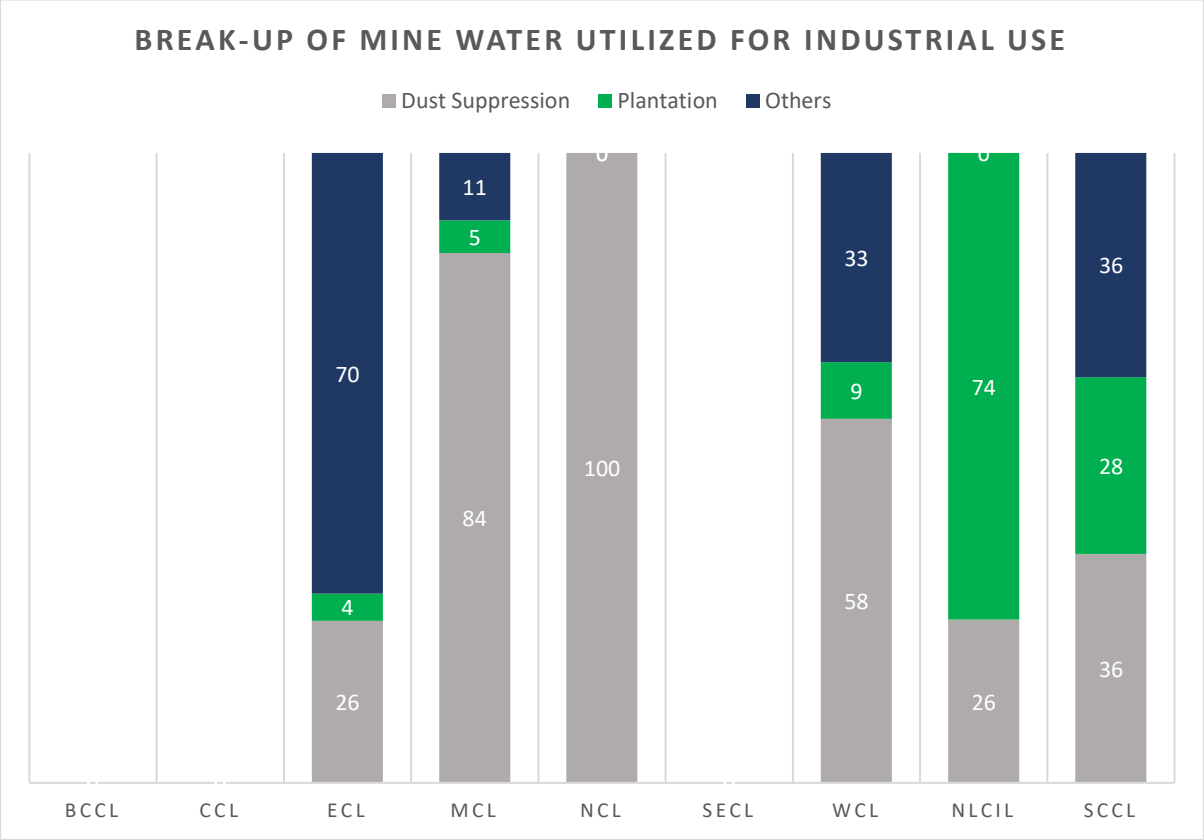


Figure 3.5: Break-up of mine water utilized for industrial use

Note: Break-up data unavailable for BCCL, CCL & SECL

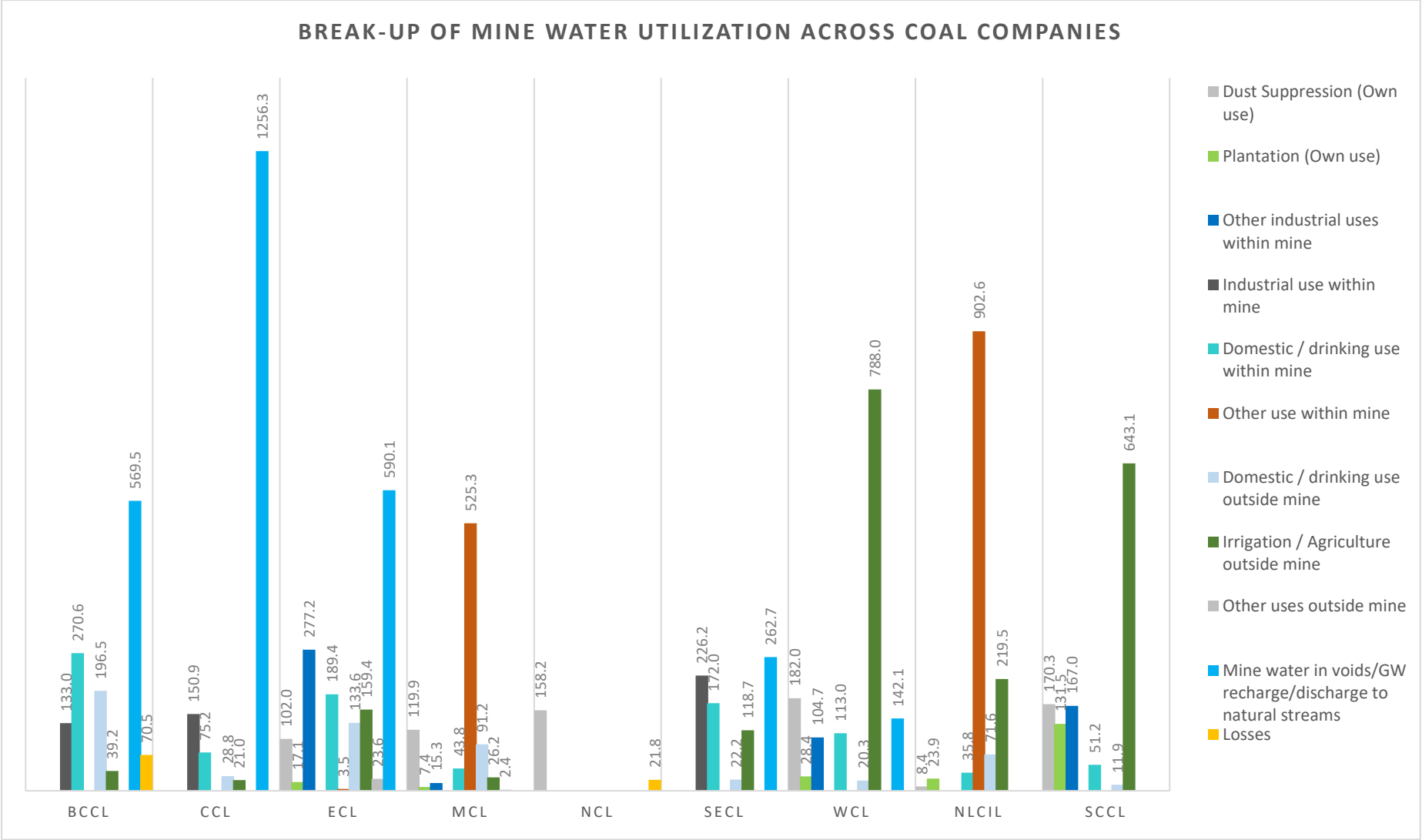


Figure 3.6(a): Break-up of mine water utilization across coal companies

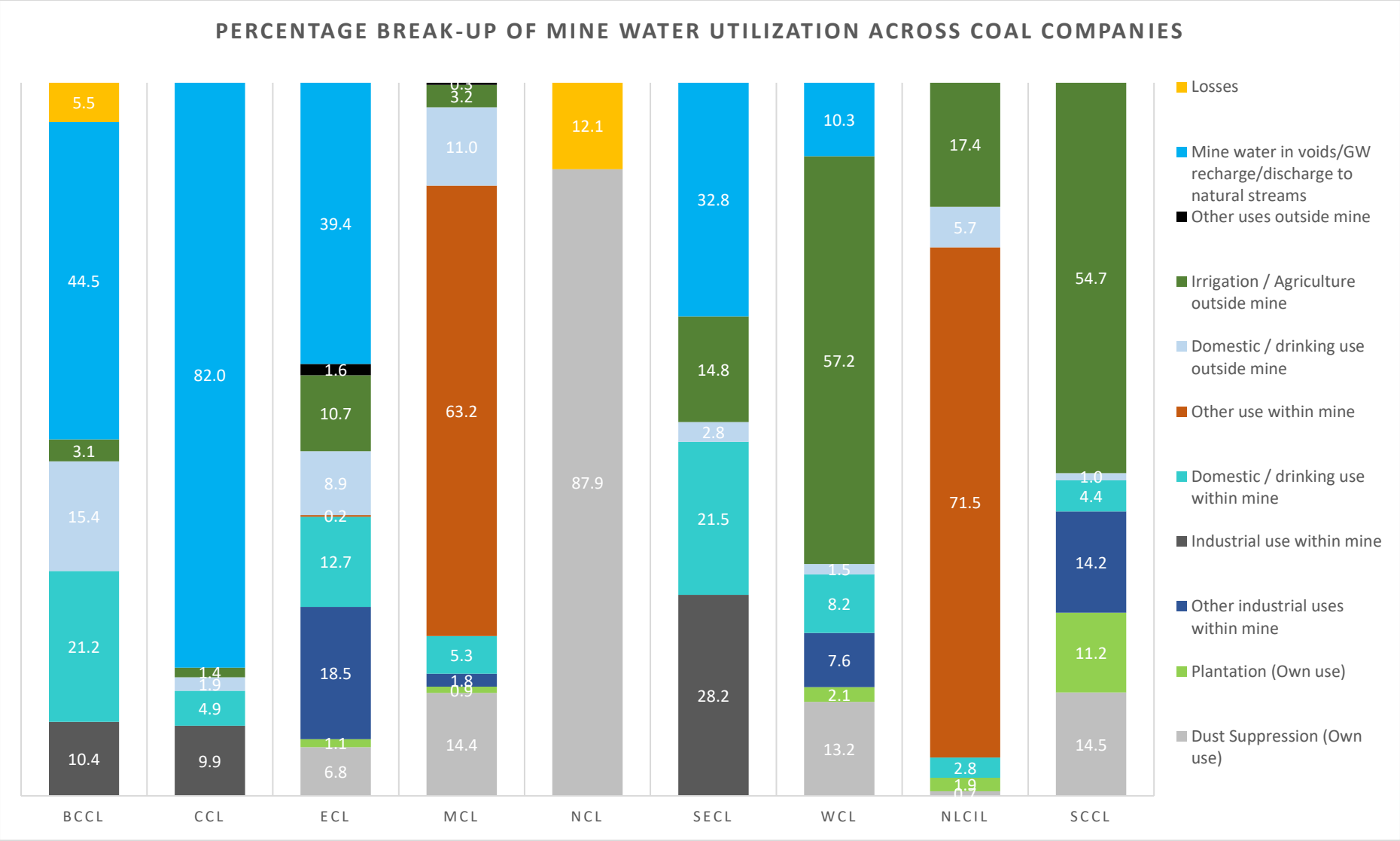


Figure 3.6(b): Percentage break-up of mine water utilization within coal companies

3.4 Utilization of mine water for community use

Mine water utilization outside the project involves the following:

1. Supply as drinking water to surrounding communities
2. Supply as freshwater for domestic utilization in surrounding communities
3. Supply as water for irrigation
4. Supply as water for other uses like industrial supply, townships, etc.

As per the data provided by coal companies, the mine water supply for community purpose benefits approx. 825 villages located around the mines and benefits approx. 12.1 lakh (12,16,184) people.

Table 3.6: Break-up of mine water utilization outside the project

Name of Coal Co.	Total mine water supplied outside project (LKL/year)	Domestic / drinking purpose by community	Irrigation /agriculture	Any other use (industrial supply or any other)	Number of beneficiaries *	No. of villages/towns where drinking / domestic water is supplied
	In (LKL/year)					
BCCL	235.7	196.5	39.2	*Nil*	204935	85
CCL	49.7	28.8	21.0	*Nil*	88000	153
ECL	316.6	133.6	159.4	23.6	173234	156
MCL[1]	119.8	91.2	26.2	2.4	26415	99**
NCL[2]	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	0
SECL	140.9	22.2	118.7	*Nil*	36735	132
WCL	808.3	20.3	788.0	*Nil*	216865	43
CIL Total	**1671.1**	**492.6**	**1152.6**	**26.0**	**746184**	**668**
NLCIL	291.1	71.6	219.5	*Nil*	245000	40
SCCL	655.0	11.9	643.1	*Nil*	225000	117
TOTAL	**2617.2**	**576.0**	**2015.2**	**26.0**	**1216184**	**825**

[1]All OC mines in MCL are operating on ZLD mode; UG mines of MCL contribute towards the water utilized outside project

[2]All mines in NCL are operating on Zero Liquid Discharge (ZLD), so no mine water is discharged beyond project area

**Source – Data provided by MoC*

***Includes supply through IWSS, tankers and pipelines*

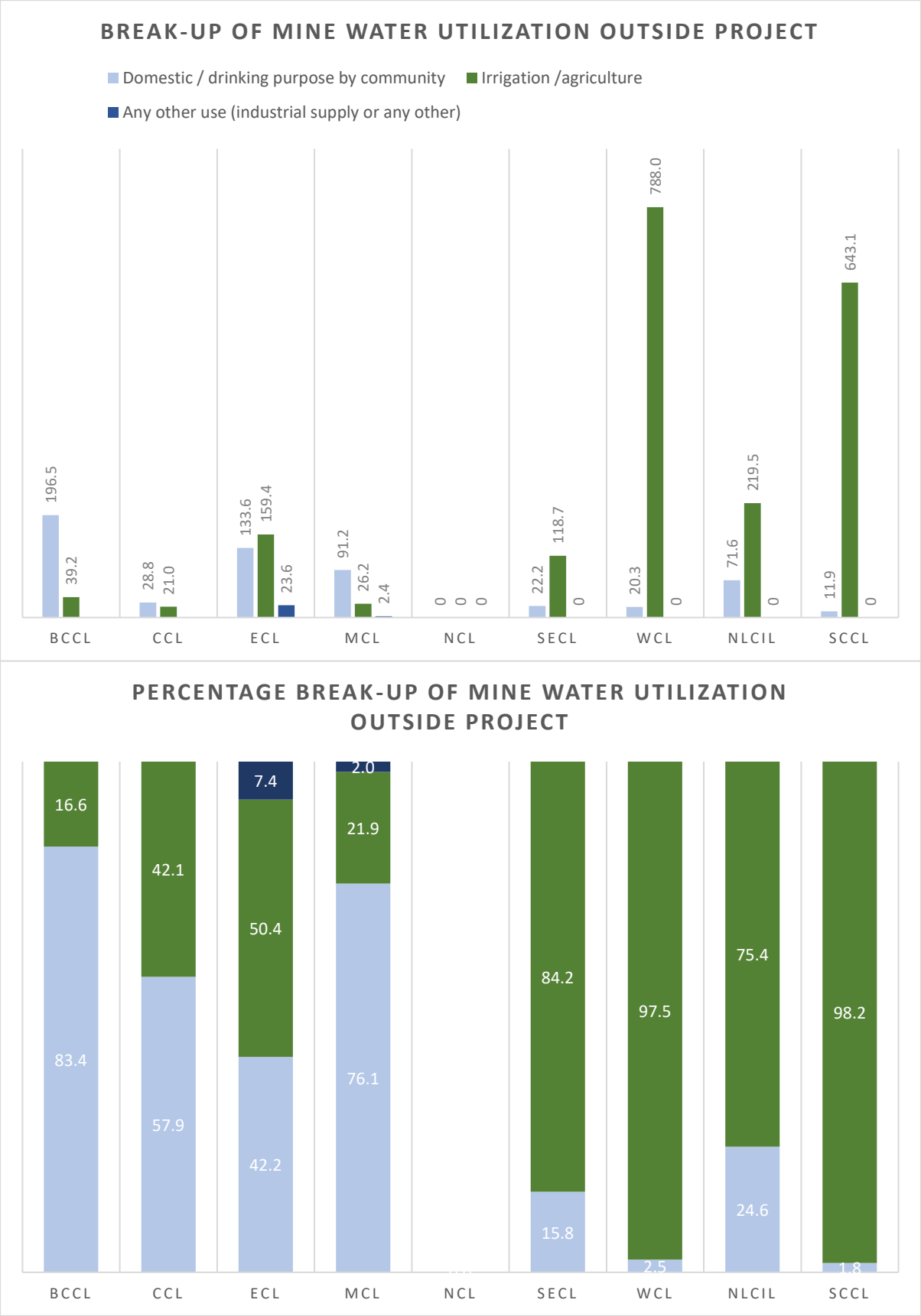


Figure 3.7: Break-up of mine water utilization outside project

3.5 Utilization of mine water by community for drinking/domestic purpose

Approx. 576.0 LKL of mine water from the coal companies is being supplied to communities for drinking / domestic purposes. Villages, bastis, institutions, public areas, etc. are being benefitted through such community supplies. Approx. 12.1 lakh people are utilizing the community mine water supply for drinking/domestic needs.

Table 3.7: Break-up of mine water supplied to communities for drinking/domestic purpose by coal companies

Subsidiary	Quantity of MW used for domestic / drinking purpose by community	No. of villages/towns where drinking / domestic water is supplied	No. of beneficiaries (# of people)*
BCCL	196.5	85	204935
CCL	28.8	153	88000
ECL	133.6	156	173234
MCL	91.2	99	26415
NCL	0	0	*Nil*
SECL	22.2	132	36735
WCL	20.3	43	216865
CIL Total	**492.6**	**668**	**746184**
NLCIL	71.6	40	245000
SCCL	11.9	117	225000
TOTAL	**576.0**	**825**	**1216184**

**Source – Data provided by MoC*

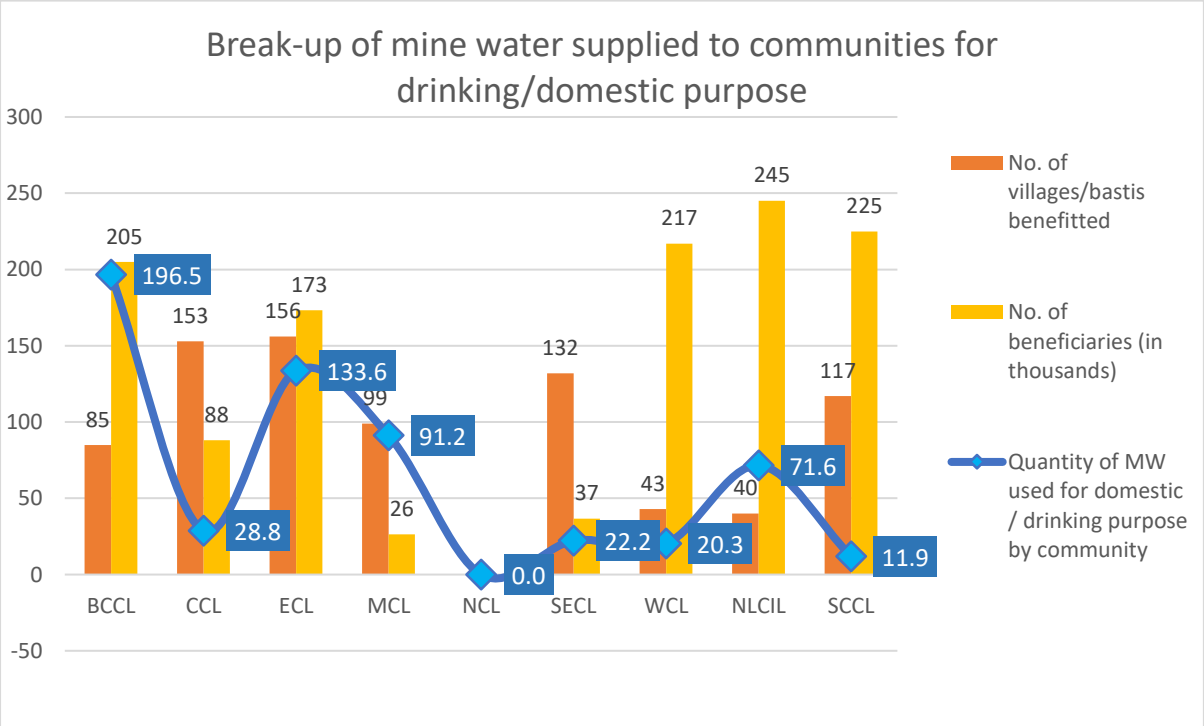
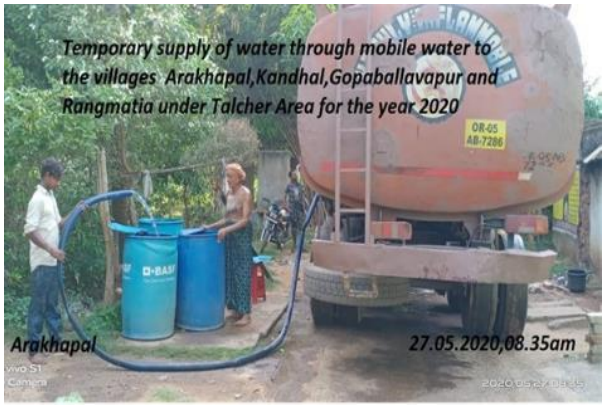


Figure 3.8: Break-up of mine water supplied to communities for drinking/domestic purpose

Coal Jal - water supply by WCL



Supply to villages through water tankers in MCL

Water supply arrangement in BCCL

RO filter plant installed by ECL

Mine water supply through tankers by SCCL

Drinking water supply to Chennai Metro by NLCIL

Figure 3.9: Glimpses of community mine water utilization across coal companies

Table 3.8: State & district wise distribution of community use for drinking/domestic purposes

State	District	Quantity of MW used for domestic / drinking purpose by community
Chhatisgarh	Surajpur	0.0
	Korea	3.6
	Sarguja	0.0
	Korba	12.7
	Raigarh	0.0
	Total	**16.3**
Jharkhand	Dhanbad	221.2
	Bokaro	3.7
	Chatra	3.3
	Giridih	9.4
	Hazaribagh	4.2
	Palamu	0.0
	Ramgarh	8.2
	Ranchi	0.0
	Deoghar	8.2
	Godda	1.6
	Total	**259.8**
Madhya Pradesh	Singrauli	6.0
	Anuppur	0.0
	Shahdol	0.0
	Umaria	0.0
	Betul	0.0
	Chindwara	0.0
	Total	**6.0**
Maharashtra	Chandrapur	10.7
	Nagpur	8.8
	Yavatmal	0.7
	Total	**20.3**
Odisha	Angul	56.2
	Jharsuguda	35.0
	Sundergarh	0.0
	Total	**91.2**
Tamil Nadu	Cuddalore	71.6
	Total	**71.6**
Telangana	Bhadradi Kothagudem	1.1
	Jayashankar	2.6
	Khammam	0.0
	Kumuram Bheem / Asifabad	0.0
	Mancherial	6.1
	Pedappalli	2.1
	Total	**11.9**

State	District	Quantity of MW used for domestic / drinking purpose by community
Uttar Pradesh	Sonebhadra	0.00
	Total	**0.00**
West Bengal	Bankura	0.9
	Paschim Bardhman	98.2
	Purulia	0
	Total	**99.1**
TOTAL		**576.0**

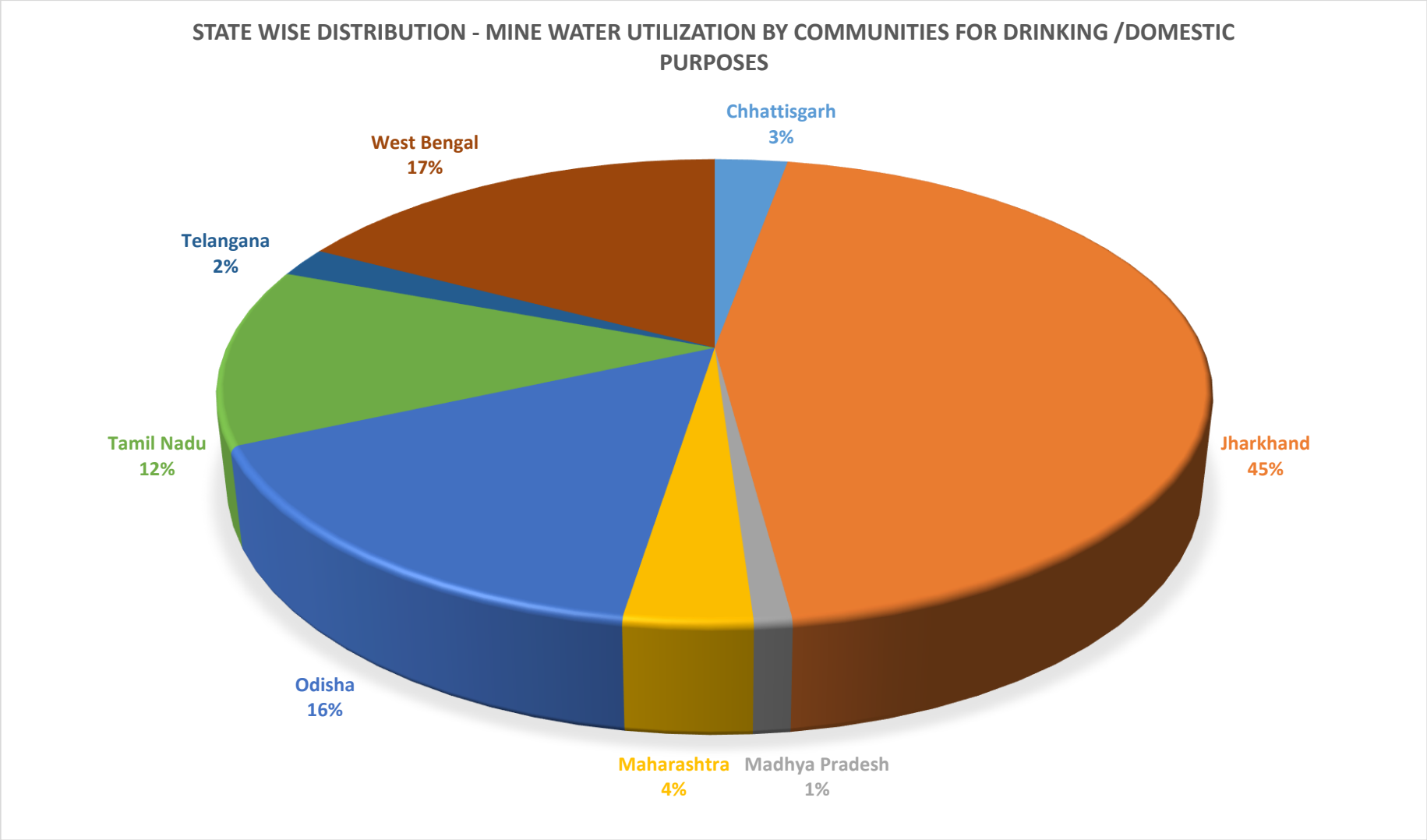


Figure 3.10(a): State wise distribution - mine water utilization by communities for drinking/domestic purposes

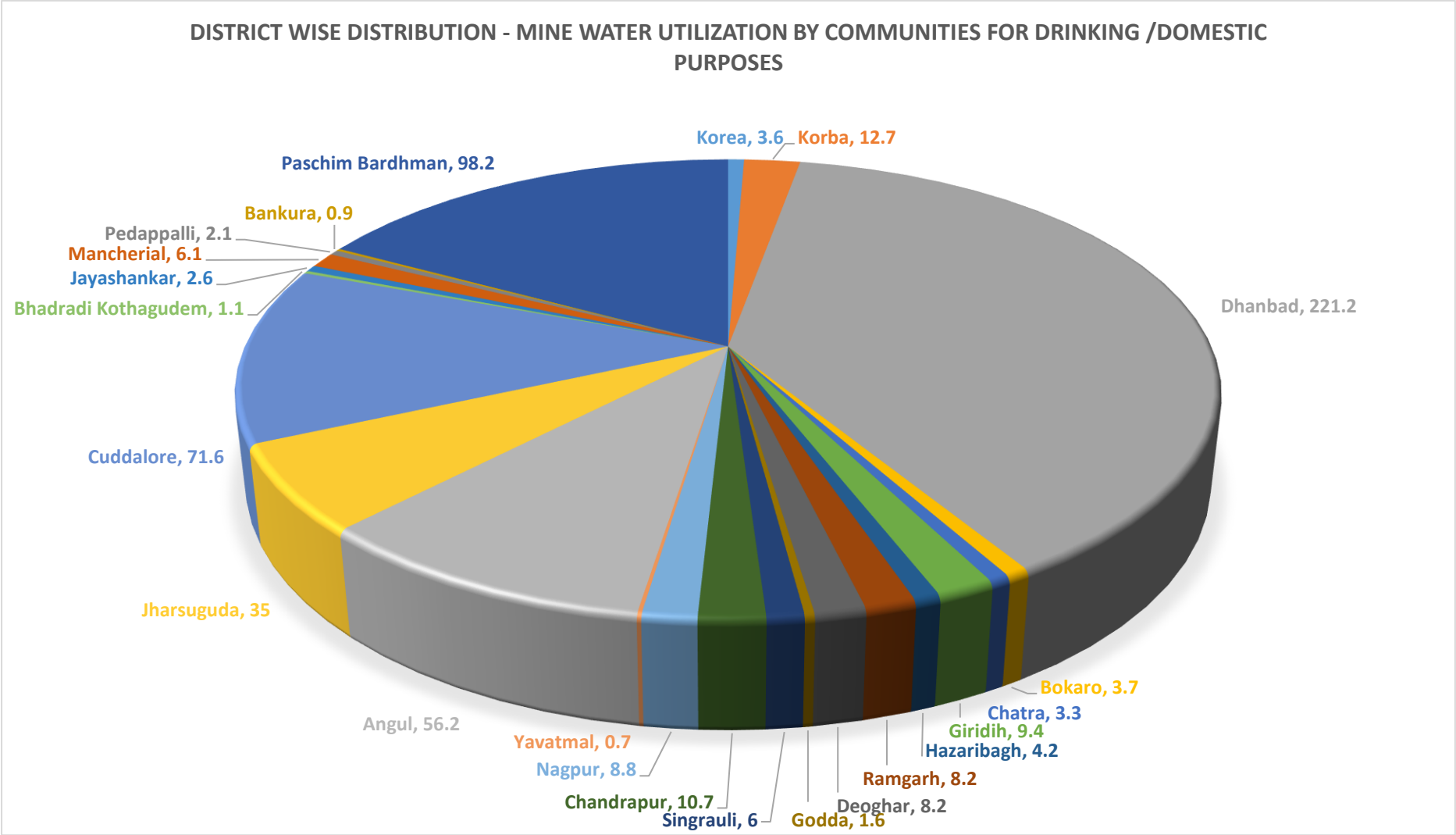


Figure 3.10(b): District wise distribution - mine water utilization by communities for drinking/domestic purposes

3.6 Utilization of mine water for agricultural use / irrigation

Approximately 2015.2 LKL mine water is being made available for agricultural use / irrigation.

Table 3.9: Break-up of mine water utilization for irrigation and irrigated area

Name of Coal Company	Mine water used for agricultural use / irrigation (LKL/year)	Irrigation potential created (in acres)*
BCCL	39.2	3884
CCL	21.0	2074
ECL	159.4	15784
MCL	26.2	2594
NCL	*Nil*	*Nil*
SECL	118.7	11752
WCL	788.0	78016
CIL Total	**1152.6**	**114103**
NLCIL	219.5	21733
SCCL	643.1	63667
TOTAL	**2015.2**	**199504**

**Assuming irrigation potential @99 acre/LKL for all coal companies; considering 3 irrigation cycles of 6.35 cm (2.5 inch) in a year and discounting for associated losses.*

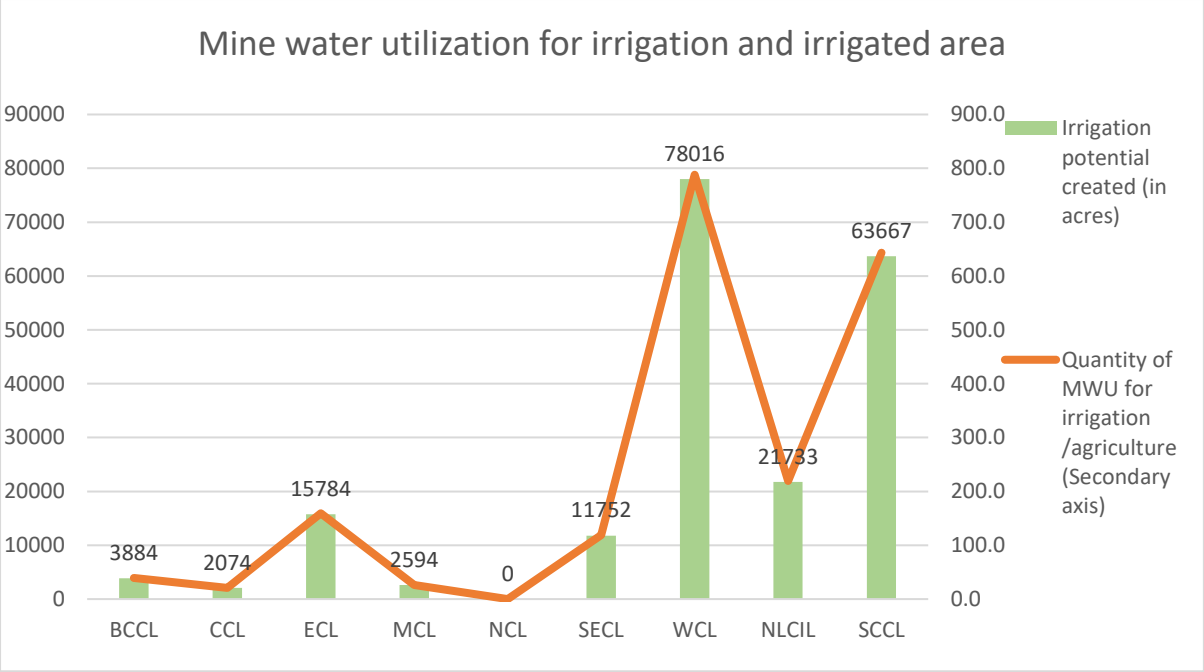


Figure 3.11: Mine water utilization for irrigation and irrigated area

3.7 Mine water stored in voids / for groundwater recharge / discharge into natural streams

For BCCL, CCL and ECL, mine water from abandoned mine voids is stored and acts as a source of groundwater recharge. In SECL, WCL and SCCL the portion of mine water is discharged into natural streams. As for MCL, NCL and NLCIL, there is no discharge of mine water outside the projects.

Table 3.10: Break-up of mine water stored in voids / for groundwater recharge / discharge into natural streams

Name of Coal Company	Mine water for utilization	Mine water stored in voids / for groundwater recharge / discharge into natural streams	
	LKL/year	LKL/year	Percentage
BCCL	1279.2	569.5	44.5
CCL	1532.1	1256.3	82.0
ECL	1495.8	590.1	39.4
MCL	831.5	*Nil*	0.0
NCL	180.0	*Nil*	0.0
SECL	801.9	262.7	32.8
WCL	1378.1	142.1	10.3
CIL Total	**7498.6**	**2820.6**	-
NLCIL	1261.8	*Nil*	0.0
SCCL	1175.0	*Nil*	0.0
TOTAL	**9935.4**	**2820.3**	-

Note: all values are in LKL/year

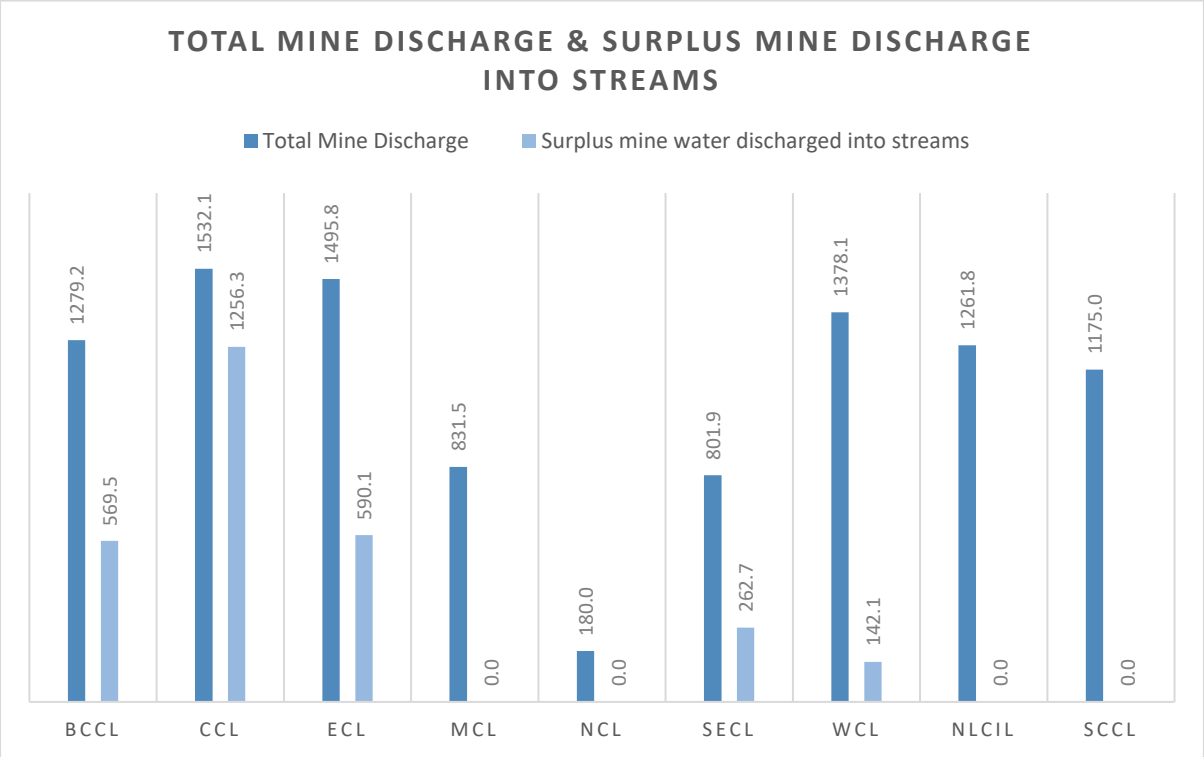


Figure 3.12: Total mine discharge & surplus mine discharge into streams

Chapter 4
Quality of mine water

4.0 Quality of mine water

The mine water accumulated in the mine sumps or pit lakes are routinely analysed for their quality prior to further use and/or discharge outside the project. Regular monitoring of mine water quality helps to ensure that the quality conforms to the regulatory standards prescribed for end use (IS 10500:2012(Rev. 2015) for drinking water and Environment (Protection) Rules, 1986, Schedule VI Part-A for discharge into inland surface water bodies). Quality monitoring will also help to gauge the need for specific treatment schemes required, if any for improving the water quality for efficient utilization by communities and ancillary uses.

The data with regard to quality of mine water was provided by respective coal companies. By and large, the quality of mine water is found to be satisfactory and can be utilized post some primary treatment processes. However, Acid Mine Drainage (AMD) and heavy metal concentrations are required to be monitored regularly so as to ensure proper treatment to ensure efficient utilization of the mine water.

In few of the mines, certain parameters were reported to be beyond the permissible limits prescribed under IS 10500:2012 (Rev. 2015). Details on mines where concentrations were reported beyond the limits have been tabulated and can be used as a valuable input to identify areas of concern and treatment strategies for better utilization of mine water.

4.1 Status of mine water quality - BCCL

As per the provided data, most reported parameters were found to conform to the prescribed standards. However, total hardness concentration was found to be beyond the permissible IS limit in most mines. The range of reported concentrations has been tabulated below:

Table 4.1 – Water quality summary for BCCL

Parameter	Range of concentration reported	Permissible limits as per IS 10500:2012 (Rev. 2015)	Permissible limits as per E(P) Rules, 1986, Schedule VI Part-A
pH	6.6 to 8.5	6.5 to 8.5	5.5 to 9
Total Dissolved Solids	31 to 1271	2000	*Not specified*
Boron	< 0.2	1.0	*Not specified*
Cadmium	< 0.0005	0.003	*2.0*
Calcium	20 to 246	200	*Not specified*
Chemical Oxygen Demand	20 to 40	*Not specified*	250
Chloride	18 to 228	*1000*	*Not specified*
Copper	< 0.03	*1.5*	3.0
Free Residual Chlorine	< 0.04	*1*	1.0
Iron	< 0.02	*1*	3.0
Lead	< 0.005	*0.01*	0.1
Manganese	0.02 to 0.2	*0.3*	2.0
Mercury	< 0.0005	*0.001*	0.01

Parameter	Range of concentration reported	Permissible limits as per IS 10500:2012 (Rev. 2015)	Permissible limits as per E(P) Rules, 1986, Schedule VI Part-A
Nickel	< 0.01	*0.02*	3.0
Nitrate	5.14 to 25.9	*45*	10
Oil & Grease	< 2.0	*Not specified*	10
Phenolic Compounds	< 0.001	*0.002*	1.0
Sulphate	54 to 179	*400*	*Not specified*
Total Chromium	< 0.004	*0.05*	2.0
Total Hardness	156 to 816	200	600
Turbidity (in NTU)	1 to 3	5	*Not specified*
Total Alkalinity	68 to 178	600	*Not specified*
Zinc	0.1 to 2.0	15	5.0

Note – Unit of measurement is mg/L for all parameters except pH & turbidity

Table 4.2: Water quality parameters of concern for BCCL

Parameter of concern	Mines where parameter was reported beyond permissible limit	Range of concentration* reported beyond limit (mg/L)	Prescribed limits
Calcium	Cluster XI – Gopalichuk	246	200
Total Hardness	Observed over prescribed limit in samples from most mines of BCCL	208 to 816	200

Note – Unit of measurement is mg/L for all parameters except pH & turbidity

4.2 Status of mine water quality - CCL

As submitted by CCL, most parameters were found to be within the prescribed limits. Deviations observed were w.r.t hardness and few metals, and details are given hereunder.

Table 4.3 – Water quality parameters of concern for CCL

Parameter of concern	Mines where parameter was reported beyond permissible limit	Range of concentration* reported beyond limit (mg/L)	Prescribed limits
Calcium	Piparwar OC, Kargali OC, Kathara OC	206 to 306	200
Manganese	Amrapali OC, KDH OC, Purnadih OC, Selected Dhori OC, Sirka OC, Kathara OC and Giridih OC	1 to 6	0.3
Magnesium	Ashok OC, Gidi A OC, Urimari OC, Bhurkunda UG & OC, Jarangdih OC and Jharkhand OC, Kargali OC	105 to 236	100
Total Alkalinity	Kargali OC	601 to 679	600
Total Coliform	Tapin South OC	10 MPN	Absent

Parameter of concern	Mines where parameter was reported beyond permissible limit	Range of concentration* reported beyond limit (mg/L)	Prescribed limits
Total Dissolved Solids	Kathara OC	2486	2000
Total Hardness	Kargali OC, Kathara OC	602 to 1730	600
Turbidity	Kedla OC	30.9	5
Sulphate	Kargali OC	422 to 450	400

**Values are rounded off*

Note – Unit of measurement is mg/L for all parameters except pH & turbidity

4.3 Status of mine water quality - ECL

As per the provided data, the reported parameters (pH, TDS, COD, oil and grease and suspended solids) were found to conform with the prescribed standards. The range of reported concentrations has been tabulated below:

Table 4.4 – Water quality summary for ECL

Parameter	Range of concentration reported	Permissible limits as per IS 10500:2012 (Rev. 2015)	Permissible limits as per E(P) Rules, 1986, Schedule VI Part-A
pH	6.50 to 8.48	6.5 to 8.5	5.5 to 9
Total Dissolved Solids	224 to 1420	2000	*Not specified*
Chemical Oxygen Demand	8 to 48	*Not specified*	250
Oil & Grease	< 2.0	*Not specified*	10
Total Suspended Solids	16.3 to 32.0	*Not specified*	100

Note – Unit of measurement is mg/L for all parameters except pH

4.4 Status of mine water quality - MCL

Most parameters were found to be within the permissible limit at all mines. However, low pH values were observed at a few mines and hence heavy metal analysis is required at these mines to ascertain metal concentrations in the mine water on account of low pH and provide requisite treatment mechanism. It is also pertinent to mention here that all OC mines of MCL are operating on Zero Liquid Discharge (ZLD) principle, hence there is no external water discharge from these mines. The mine water with low pH observed in Lilari, Lakhanpur and Lajkura is diverted to mine water treatment plants (MDTP) where proper lime dosing is carried out for pH adjustment and subsequently the water is utilized for industrial use.

The range of reported concentrations has been tabulated below:

Table 4.5 – Water quality summary for MCL

Parameter	Range of concentration reported	Permissible limits as per IS 10500:2012 (Rev. 2015)	Permissible limits as per E(P) Rules, 1986, Schedule VI Part-A
pH	3.14 to 8.16	6.5 to 8.5	5.5 to 9
Total Dissolved Solids	98 to 100	2000	*Not specified*
Cadmium	<0.001	0.003	2
Chemical Oxygen Demand	8 to 112	*Not specified*	250
Chloride	8 to 10	1000	*Not specified*
Copper	<0.03	1.5	3
Dissolved Oxygen	7.2 to 7.3	*Not specified*	*Not specified*
Dissolved phosphate	<1	*Not specified*	5
Fluoride	<0.3	1.5	2
Iron	<0.1	1	3
Manganese	<0.04 to 1.14	0.3	2
Nickel	<0.1 to 0.44	0.02	3
Nitrate	<0.5	45	10
Oil & Grease	<4	*Not specified*	10
Total Hardness	56.45 to 60.48	200	600
Total Suspended Solids	14 to 78	*Not specified*	100
Sulphate	24.41 to 30.93	400	*Not specified*
Sulphide	<0.1	0.05	2.0

Note: Parameters for analysis vary from mine to mine. Not all parameters mentioned above are analysed across all mines.

Note – Unit of measurement is mg/L for all parameters except pH & turbidity

Table 4.6 – Water quality parameters of concern for MCL

Parameter of concern	Mines where parameter was reported beyond permissible limit	Range of concentration* reported beyond limit (mg/L)	Prescribed limits
pH	Lilari OC, Lakhanpur OC, Lajkura OC	3.14 to 4.8	5.5 to 9.0**

**Values are rounded off*

***Compared with Environment (Protection) Rules, 1986, Schedule VI Part-A*

Note – Unit of measurement is mg/L for all parameters except pH & turbidity

4.5 Status of mine water quality - NCL

Since all mines of NCL operate on Zero Liquid Discharge (ZLD) principle, no mine water is being discharged outside the project area. The entire quantity of mine water is utilized solely for use in industrial purposed within the mine (ZLD mode). NCL monitors quality of treated water from the respective mine treatment plants which is then reused.

The range of reported concentrations has been tabulated below:

Table 4.7– Treated water quality summary for NCL

Parameter	Range of concentration reported	Permissible limits as per IS 10500:2012 (Rev. 2015)	Permissible limits as per E(P) Rules, 1986, Schedule VI Part-A
pH	6.19 to 8.12	6.5 to 8.5	5.5 to 9
Ammonical Nitrogen	< 0.02	*Not specified*	50
Arsenic	<0.002	0.01	0.2
Chemical Oxygen Demand	35 to 112	*Not specified*	250
Colour	1 to 15	15	-
Copper	<0.03 to 0.053	*1.5*	3.0
Dissolved Phosphate	0.21 to 1.12	*Not specified*	5.0
Fluoride	<0.1 to 0.2	1.5	2.0
Free Ammonia	<0.02	0.5	5.0
Hexavalent Chromium	<0.01	*Not specified*	0.1
Iron	<0.1 to 0.23	1.0	3.0
Lead	<0.005	0.01	0.1
Manganese	<0.02 to 0.67	0.3	2.0
Mercury	<0.0002	0.001	0.01
Nickel	<0.02	0.02	3.0
Nitrate Nitrogen	0.8 to 3.8	*Not specified*	10
Oil & Grease	3 to 12	*Not specified*	10
Phenolic Compounds	<0.001	*0.002*	1.0
Selenium	<0.002	0.01	0.05
Sulphide	<0.1	0.05	2.0
Total Chromium	<0.2	0.05	2.0
Total Kjeldahl Nitrogen	2.8 to 5.3	*Not specified*	100
Total Residual Chlorine	<0.01	1.0	1.0
Total Suspended Solids	20 to 312	*Not specified*	100
Zinc	0.028 to 0.53	15	5

Table 4.8 – Treated water quality parameters of concern for NCL

Parameter of concern	Mines where parameter was reported beyond permissible limit	Range of concentration* reported beyond limit (mg/L)	Prescribed limits
Oil & Grease	Jhingurda OC, Nigahi OC	12	10**
Total Suspended Solids	Amlohri OC, Bina OC, Block – B OC, Dudhichua OC, Jayant OC, Jhingurda OC, Kakri OC, Khadia OC, Nigahi OC,	104 to 312	100**

**Values are rounded off*

***Compared with Environment (Protection) Rules, 1986, Schedule VI Part-A*

Note – Unit of measurement is mg/L for all parameters except pH.

4.6 Status of mine water quality - SECL

Most parameters were reported to be within the permissible limits. However, low pH values were observed at a few mines and hence heavy metal analysis is required at these mines to ascertain metal concentrations in the mine water on account of low pH and provide requisite treatment mechanism.

The range of reported concentrations has been tabulated below:

Table 4.9 – Water quality summary for SECL

Parameter	Range of concentration reported	Permissible limits as per IS 10500:2012 (Rev. 2015)	Permissible limits as per E(P) Rules, 1986, Schedule VI Part-A
pH	3.72 to 8.36	6.5 to 8.5	5.5 to 9
Total Dissolved Solids	102 to 995	2000	*Not specified*
Chemical Oxygen Demand	8 to 72	*Not specified*	250
Total Hardness	24 to 514	200	600
Total Suspended Solids	11 to 77	*Not specified*	100

Note: Parameters for analysis vary from mine to mine. Not all parameters mentioned above are analysed across all mines.

Note – Unit of measurement is mg/L for all parameters except pH & turbidity

Table 4.10 – Water quality parameters of concern for SECL

Parameter of concern	Mines where parameter was reported beyond permissible limit	Range of concentration* reported beyond limit (mg/L)	Prescribed limits
pH	Bhatgaon UG – Unit I, Mahamaya UG Unit – II, Nawapara UG, Dugga OC, Dhanpuri OC, Mahan OC, Manikpur OC	3.72 to 6.12	6.5 to 8.5

Note – Unit of measurement is mg/L for all parameters except pH & turbidity

4.7 Status of mine water quality - WCL

Most parameters were reported to be within the permissible limits. However, low pH values were observed at a few mines and hence heavy metal analysis is required at these mines to ascertain metal concentrations in the mine water on account of low pH and provide requisite treatment mechanism.

The range of reported concentrations has been tabulated below:

Table 4.11 – Water quality summary for WCL

Parameter	Range of concentration reported	Permissible limits as per IS 10500:2012 (Rev. 2015)	Permissible limits as per E(P) Rules, 1986, Schedule VI Part-A
pH	3.19 to 8.33	6.5 to 8.5	5.5 to 9
Total Dissolved Solids	396	2000	*Not specified*

Parameter	Range of concentration reported	Permissible limits as per IS 10500:2012 (Rev. 2015)	Permissible limits as per E(P) Rules, 1986, Schedule VI Part-A
Chemical Oxygen Demand	18 to 56	*Not specified*	250
Oil & Grease	<2	*Not specified*	10
Total Suspended Solids	14 to 78	*Not specified*	100

Note – Unit of measurement is mg/L for all parameters except pH & turbidity

Table 4.12 – Water quality parameters of concern for WCL

Parameter of concern	Mines where parameter was reported beyond permissible limit	Range of concentration* reported beyond limit (mg/L)	Prescribed limits
pH	Hindustan Lalpeth OC, Mohan UG, Barkuhi OC, Naigaon OC	3.19 to 6.11	6.5 to 8.5

Note – Unit of measurement is mg/L for all parameters except pH & turbidity

4.8 Status of mine water quality - NLCIL

As per the provided data, all reported parameters (pH, TDS, TSS, COD, BOD, oil and grease, chloride and sulphate) conform to the prescribed standards.
The range of reported concentrations has been tabulated below:

Table 4.13 – Water quality summary for NLCIL

Parameter	Range of concentration reported	Permissible limits as per IS 10500:2012 (Rev. 2015)	Permissible limits as per E(P) Rules, 1986, Schedule VI Part-A
pH	6.19 to 7.97	6.5 to 8.5	5.5 to 9
Total Dissolved Solids	42 to 520	2000	*Not specified*
Biochemical Oxygen Demand	16 to 26	*Not specified*	30
Chemical Oxygen Demand	72 to 136	*Not specified*	250
Chloride	120 to 205	1000	*Not specified*
Oil & Grease	≤2	*Not specified*	10
Total Suspended Solids	12 to 20	*Not specified*	100
Sulphate	72 to 92	400	*Not specified*
% Sodium	6.16 to 10.1		

Note – Unit of measurement is mg/L for all parameters except pH & turbidity

4.9 Status of mine water quality - SCCL

As per the provided data, all reported parameters (pH, TDS, TSS, COD, BOD, oil and grease, chloride and sulphate) conform to the prescribed standards. The range of reported concentrations has been tabulated below:

Table 4.14 – Water quality summary for SCCL

Parameter	Range of concentration reported	Permissible limits as per IS 10500:2012 (Rev. 2015)	Permissible limits as per E(P) Rules, 1986, Schedule VI Part-A
pH	5.9 to 7.9	6.5 to 8.5	5.5 to 9
Total Dissolved Solids	484 to 880	2000	*Not specified*
Biochemical Oxygen Demand	2 to 6	*Not specified*	30
Chemical Oxygen Demand	9 to 23	*Not specified*	250
Oil & Grease	<1.2	*Not specified*	10
Total Suspended Solids	6 to 76	*Not specified*	100

Note – Unit of measurement is mg/L for all parameters except pH & turbidity

4.10 Consolidated mine water quality across coal companies

Table 4.15: Consolidated range of concentrations reported across mine companies

Parameter	Range of concentration reported									Permissible limits as per IS 10500:2012 (Rev. 2015)	Permissible limits as per E(P) Rules, 1986, Schedule VI Part-A
	BCCL	CCL	ECL	MCL	NCL	SECL	WCL	NLCIL	SCCL		
pH	6.6 to 8.5	5.5 to 9	6.5to 8.5	3.1 to 8.2	6.2 to 8.1	3.7 to 8.4	3.2 to 8.3	6.2 to 7.9	5.9 to 7.9	6.5 to 8.5	5.5 to 9
Total Dissolved Solids	31 to 1271	<2000	224 to 1420	98 to 100	-	102 to 995	396	42 to 520	484 to 880	2000	*Not specified*
Biochemical Oxygen Demand	-	<30	-	-	-	-	-	16 to 26	2 to 6	*Not specified*	30
Chemical Oxygen Demand	20 to 40	<250	8 to 48	8 to 112	35 to 112	8 to 72	18 to 56	72 to 136	9 to 23	*Not specified*	250
Oil & Grease	< 2.0	<10	< 2.0	<4	3 to 12	-	<2	≤2	<1.2	*Not specified*	10
Total Suspended Solids	-	<100	16.3 to 32.0	14 to 78	20 to 312	11 to 77	14 to 78	12 to 20	6 to 76	*Not specified*	100

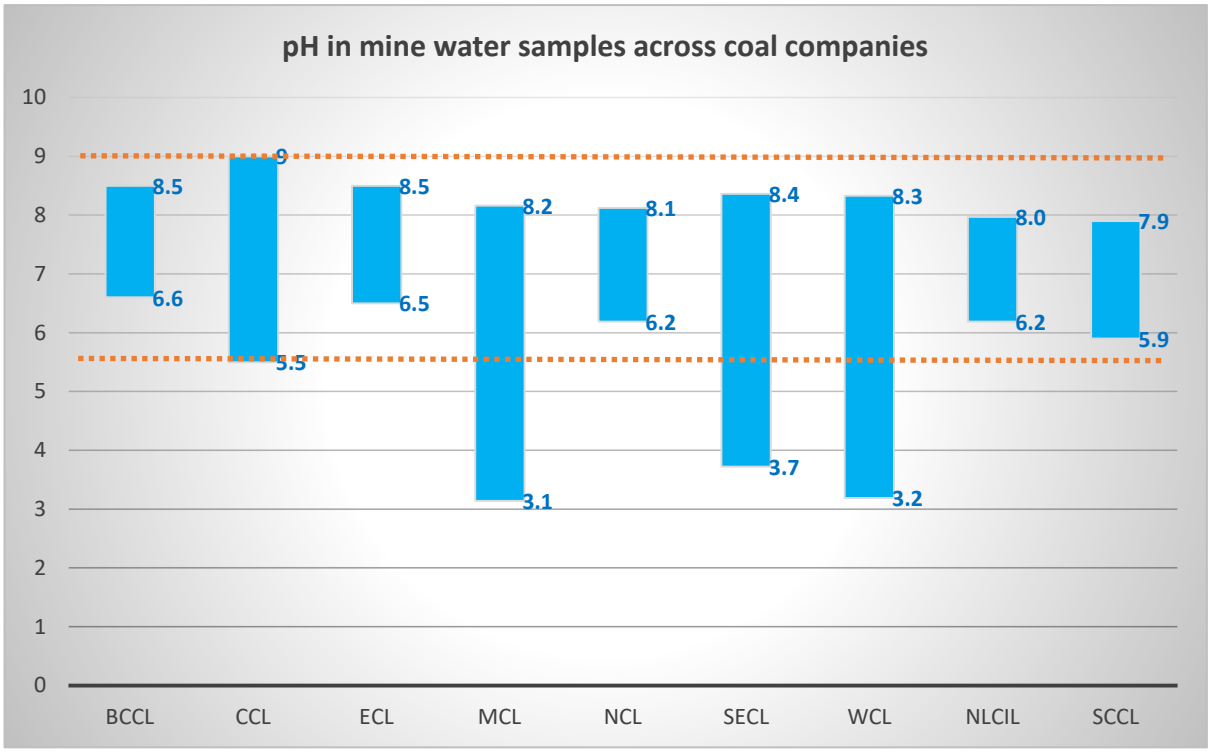


Figure 4.1: Range of pH in mine water samples across coal companies

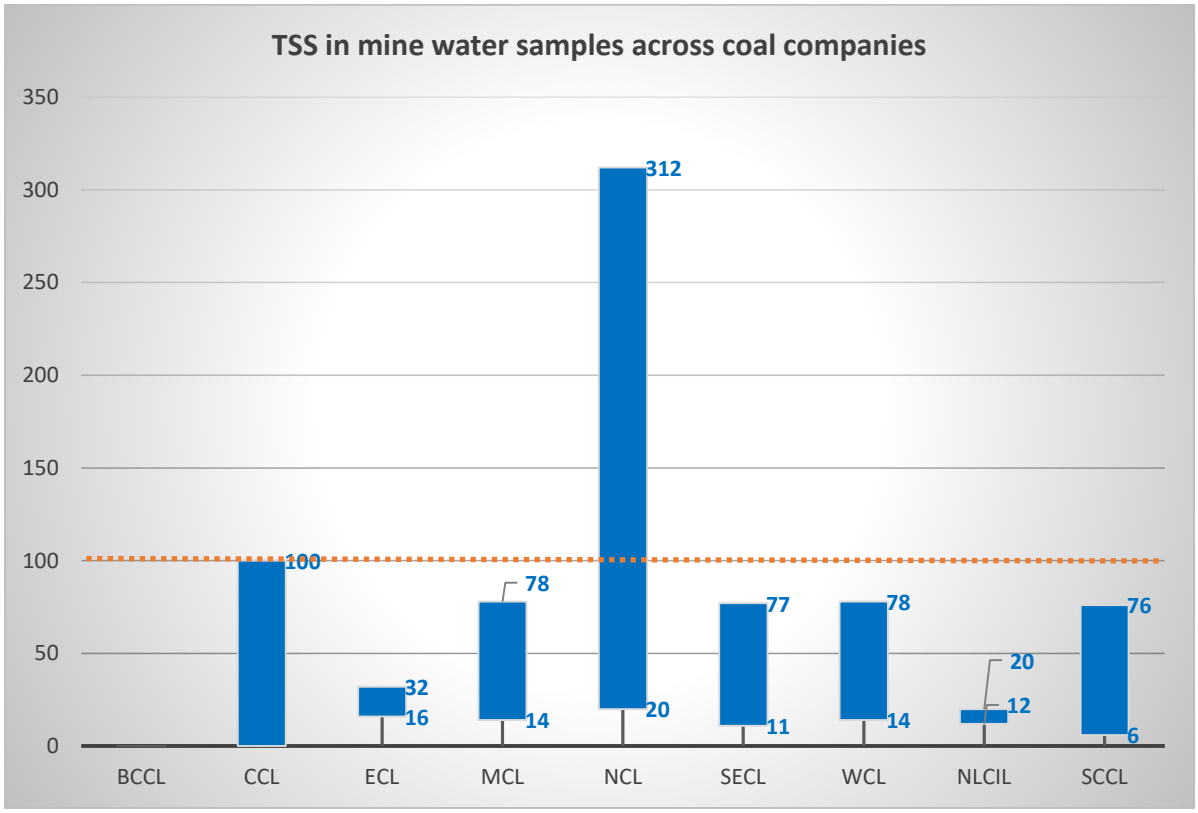


Figure 4.2: Range of TSS in mine water samples across coal companies

4.11 Interpretation of mine water quality reported across coal companies

The data collected for water quality from the coal mines from CIL, NLCIL and SCCL reveals varying trends. In BCCL, the concentration of calcium and hardness has been found to be above prescribed limits in some of the mines. In CCL, the water quality parameters of concern are calcium, magnesium, manganese, alkalinity, hardness and turbidity. In some of the mines of WCL, and MCL, pH has been found to be below the prescribed limits which shows that mine water is acidic in nature. In SECL, pH and hardness are water quality parameters of concern. As for NCL, the mines are being operated on zero discharge basis and the water is being treated and used for internal consumption. The quality reported in mines of ECL and NLCIL shows water quality parameters within prescribed limits.

The water quality of Indian coal mines by and large remains good with exception of some mines that exhibits acid mine drainage characteristics. The parameters that exceed the prescribed limits are not of that much concern as they can be brought under prescribed limits with moderate treatment. The mines in CIL are having effluent treatment facilities that include sedimentation ponds, oil & grease traps and treated water storage facilities. The major mines are also having sewage treatment plants to take care of domestic wastewater. In addition, filter plants, pressure filter, RO Plant and other units have been installed for treatment of water for water supply purpose. NLCIL has employed softening and ion exchange process for treatment of water for its TPPs in addition to ETP and STP facilities. SCCL has installed ETP and STP facilities for treatment of trade and domestic effluent.

Chapter 5

Infrastructure for mine water utilization

5.0 Need for mine water treatment

Based on intended end use of the mine water and quality analysis, treatment mechanisms are set up in order to ensure that the mine water quality conforms to prescribed norms prior to its use by projects or communities. In most cases, the quality of mine water is good enough and it only requires preliminary treatment like settling prior to further discharge. In areas where acid mine drainage or heavy metals are observed, specific treatment mechanisms may be required.

Further, mines have also created some facilities for distribution of mine water for own use and community use. Coal companies have also entered into MoU with State agencies and industrial establishments for development of facilities for mine water utilization.

Based on the information submitted by the coal companies, a brief description of treatment facilities and other water supply infrastructure provided for mine water utilization is given in the following sections.

5.1 Infrastructure at ECL

Mine water from ECL is utilized for industrial and domestic purposes within the mine as well as discharged outside the project for community domestic use and irrigation. The infrastructure available in the projects of ECL for treatment and utilisation of mine water are provided as below:

Table 5.1: Infrastructure for mine water utilization in ECL

Sr. No.:	Name of Area	Name of Colliery	Type	Capacity
1.	Bankola	Kumardihi B	Pressure Filter	5000 Gallon Per Hour
2.	Bankola	Kumardihi A Colliery	Pressure Filter	5000 Gallon Per Hour
3.	Bankola	Shyamsundarpur Colliery	Pressure Filter	5000 Gallon Per Hour
4.	Bankola	Tilaboni Colliery	Pressure Filter	5000 Gallon Per Hour
5.	Bankola	Bankola Colliery	Pressure Filter	5000 Gallon Per Hour
6.	Bankola	Shankarpur Colliery, Bankola	Pressure Filter	5000 Gallon Per Hour
7.	Bankola	Sarpi Colliery, Shyam Sundarpur	Pressure Filter	5000 Gallon Per Hour
8.	Bankola	Area Complex	SSF	0.3 Million Gallon Per day
9.	Bankola	Moira Colliery	SSF	0.1 Million Gallon Per day
10.	Bankola	Khandra NK Unit	SSF	0.1 Million Gallon Per day
11.	Bankola	Khandra VK Unit	SSF	0.2 Million Gallon Per day
12.	Bankola	S.S. Pur ESP Unit	SSF	0.15 Million Gallon Per day
13.	Bankola	S.S. Pur Sarpi Unit	SSF	0.1 Million Gallon Per day
14.	Bankola	Bankola Colliery	RGF	0.2 Million Gallon Per day
15.	Bankola	Bankola Colliery	Reverse Osmosis	5000 litre per hour

Sr. No.:	Name of Area	Name of Colliery	Type	Capacity
16.	Bankola	Shyamsundarpur Colliery	Reverse Osmosis	5000 litre per hour
17.	Mugma	Gopalpura Colony	Pressure Filter	10000 Gallon Per Hour
18.	Mugma	Badjna Incline no. 25	Pressure Filter	5000 Gallon Per Hour
19.	Mugma	Badjna pit no.2	Pressure Filter	5000 Gallon Per Hour
20.	Mugma	Chapapur	Pressure Filter	5000 Gallon Per Hour
21.	Mugma	Kumardhubi	Pressure Filter	10000 Gallon Per Hour
22.	Mugma	Gopalpura Colony	Reverse Osmosis	5000 litre per hour
23.	Mugma	Badjna Colliery	Reverse Osmosis	5000 litre per hour
24.	Mugma	Kumardhubi Colliery	Reverse Osmosis	5000 litre per hour
25.	Mugma	Rajpura	SSF	0.1 Million Gallon Per day
26.	Mugma	Mugma Workshop	SSF	0.05 Million Gallon Per day
27.	Pandaveswar	Khottadih OC (Abandoned)	Pressure Filter	10000 Gallon Per Hour
28.	Pandaveswar	Dalurband OC	Pressure Filter	10000 Gallon Per Hour
29.	Pandaveswar	Khottadih (Rehab Site)	Pressure Filter	10000 Gallon Per Hour
30.	Pandaveswar	Khottadih UG	Reverse Osmosis	5000 litre per hour
31.	Kenda	Siduli Colliery	Pressure Filter	10000 Gallon Per Hour
32.	Kenda	Bahula Colliery	Pressure Filter	10000 Gallon Per Hour
33.	Kenda	New Kenda Colliery	Pressure Filter	10000 Gallon Per Hour
34.	Kenda	GM Complex	Pressure Filter	5000 Gallon Per Hour
35.	Kenda	Lower Kenda Colliery	Pressure Filter	10000 Gallon Per Hour
36.	Kenda	C.L. Jambad	Pressure Filter	10000 Gallon Per Hour
37.	Kenda	Chora 7 & 9 Pit	Pressure Filter	10000 Gallon Per Hour
38.	Kenda	New Kenda OCP (For New Kenda Village)	Pressure Filter	10000 Gallon Per Hour
39.	Kenda	Area Complex- Shankarpur	Reverse Osmosis	5000 litre per hour
40.	Kenda	Regional Hospital Chora	Reverse Osmosis	5000 litre per hour
41.	Salanpur	Mohanpur(Amdiha Quarry)	Pressure Filter	5000 Gallon Per Hour
42.	Salanpur	Mohanpur OCP	Pressure Filter	5000 Gallon Per Hour
43.	Salanpur	Dalmiya OCP	Sand Media Filter	540 Kilo litre per day
44.	Salanpur	Itapara OC	Pressure Filter	21000 litre per hour
45.	Salanpur	Dabor Colliery	Reverse Osmosis	5000 litre per hour
46.	Sodepur	Bejdih Colliery	Pressure Filter	7500 Gallon Per Hour
47.	Sodepur	Chinakuri III	Pressure Filter	10000 Gallon Per Hour
48.	Sodepur	Mithani Colliery,	Pressure Filter	5000 Gallon Per Hour
49.	Sodepur	Dhemomain	SSF	0.25 Million Gallon Per day
50.	Sodepur	Narasamuda	SSF	0.1 Million Gallon Per day

Sr. No.:	Name of Area	Name of Colliery	Type	Capacity
51.	Sodepur	Sodepur 9/10 Pit	RGF	0.2 Million Gallon Per day
52.	Sodepur	Sodepur Colliery	Reverse Osmosis	5000 litre per hour
53.	Sodepur	Chinakuri Mine -I	Reverse Osmosis	5000 litre per hour
54.	Satgram	New Satgram Colliery	Pressure Filter	15000 Gallon Per Hour
55.	Satgram	Kuardih Colliery	Pressure Filter	5000 Gallon Per Hour
56.	Satgram	Nimcha (R) Colliery	Pressure Filter	5000 Gallon Per Hour
57.	Satgram	Satgram Incline	Pressure Filter	5000 Gallon Per Hour
58.	Satgram	Tirat Colliery	Pressure Filter	10000 Gallon Per Hour
59.	Satgram	Rattibati Colliery	Pressure Filter	10000 Gallon Per Hour
60.	Satgram	Kalidaspur	Pressure Filter	10000 Gallon Per Hour
61.	Satgram	Nimcha	RGF	0.45 Million Gallon Per day
62.	Satgram	J.K. Nagar	RGF	0.05 Million Gallon Per day
63.	Satgram	Kalidaspur	SSF	0.05 Million Gallon Per day
64.	Satgram	Satgram Project	Reverse Osmosis	5000 litre per hour
65.	Satgram	J.K. Nagar Project	Reverse Osmosis	5000 litre per hour
66.	Satgram	Nimcha Colliery	Reverse Osmosis	5000 litre per hour
67.	Kunustoria	Belbaid Colliery	Pressure Filter	7500 Gallon Per Hour
68.	Kunustoria	Mahabir Colliery(KS Unit)	Pressure Filter	7500 Gallon Per Hour
69.	Kunustoria	Parasea Colliery	Pressure Filter	10000 Gallon Per Hour
70.	Kunustoria	NorthSearsole Colliery	Pressure Filter	7500 Gallon Per Hour
71.	Kunustoria	Area Complex	SSF	0.25 Million Gallon Per day
72.	Kunustoria	Bansra Colliery	SSF	0.5 Million Gallon Per day
73.	Kunustoria	Parasea Colliery	SSF	0.5 Million Gallon Per day
74.	Kunustoria	Kunustoria Colliery	SSF	0.2 Million Gallon Per day
75.	Kunustoria	Area Complex	Reverse Osmosis	5000 litre per hour
76.	Kunustoria	Parasea OCP	Sand Media Filter	500 Kilo litre per day
77.	S.P. Mines	New Colony	Reverse Osmosis	5000 litre per hour
78.	S.P. Mines	Chitra	RGF	0.3 Million Gallon Per day
79.	Kajora	Parascole (East) Colliery	Reverse Osmosis	5000 litre per hour
80.	Kajora	Lachipur colliery	Pressure Filter	5000 Gallon Per Hour
81.	Kajora	Jambad Colliery	Pressure Filter	5000 Gallon Per Hour
82.	Kajora	Area HQ	SSF	0.05 Million Gallon Per day
83.	Kajora	Madhusudanpur	SSF	0.1 Million Gallon Per day
84.	Kajora	Naba Kajora	RGF	0.25 Million Gallon Per day
85.	Kajora	Madhabpur	RGF	0.16 Million Gallon Per day
86.	Kajora	Paroscole	RGF	0.3 Million Gallon Per day

Sr. No.:	Name of Area	Name of Colliery	Type	Capacity
87.	Kajora	Khas Kajora	RGF	0.2 Million Gallon Per day
88.	Jhanjra	Area Complex	RGF	0.66 Million Gallon Per day
89.	Jhanjra	Sector 2, Jhanjra Colony	Reverse Osmosis	5000 litre per hour
90.	Sripur	Ningah Colliery(Manager Office)	Pressure Filter	10000 Gallon Per Hour
91.	Sripur	Ningah Colliery(Filter House)	Pressure Filter	10000 Gallon Per Hour
92.	Sripur	Bhanora	Pressure Filter	5000 Gallon Per Hour
93.	Sripur	Kalipahari	Pressure Filter	5000 Gallon Per Hour
94.	Sripur	Ningah Colliery	Reverse Osmosis	5000 litre per hour
95.	Rajmahal	Lalmatia Rehab Site	Pressure Filter	10000 Gallon Per Hour
96.	Rajmahal	Urjanagar Colony - NHS Quarters	Reverse Osmosis	5000 litre per hour

5.2 Infrastructure at MCL

The open cast mines of MCL follow the principal of Zero Liquid Discharge (ZLD) and hence all the water generated in the mines is utilized for own purposed within the projects, like vehicle washing, fire-fighting, plantation, dust suppression activities etc. The water collected from washing of HEMMs is treated and reused for washing purpose. Of the total mine water generated, the underground collieries of MCL contribute approx. 15% towards domestic supply for community and irrigation in surrounding areas.

EFFLUENT TREATMENT PLANT:

Mine water is utilized in workshop for washing and cleaning of HEMMs. The water after washing of HEMMs is collected and treated in effluent treatment plants. The treated water is recirculated for washing and cleaning of HEMM's, thus maintaining zero discharge. This water is hence not used for any other purpose. The effluent treatment plant consists of collection and settling tanks, oil and grease unit, equalization tank and clear water tank. Further, the sludge generated from the process collected in drying beds. Process flow diagram is as below:

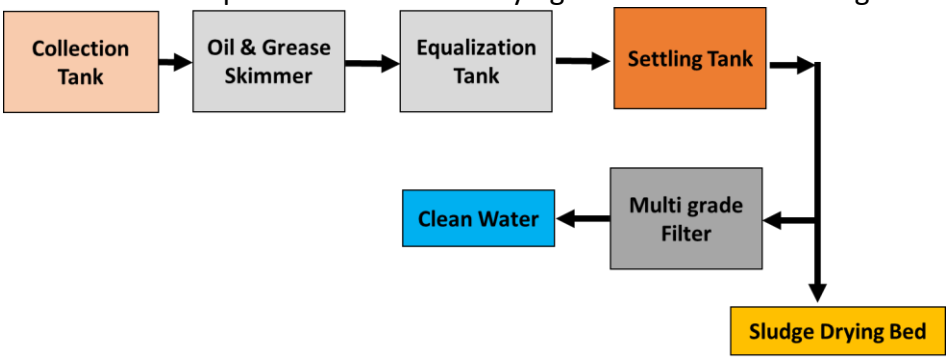


Figure 5.1: Process flow diagram for ETP, MCL

SEWAGE TREATMENT PLANT:

The sewage generated from colonies is collected through pipelines to sewage treatment plants for treatment conforming to the discharge standards. The sewage water is collected in collection tank and passed through screens to remove coarse particles, followed by biological treatment units to reduce the organic pollutant load. Further, the water is passed through sedimentation tanks and filter beds to remove particulates. Subsequently the water is passed through disinfection units. Finally, the treated water so collected is stored in collection tanks for reusing the same for gardening & plantation purposes, fire-fighting and dust suppression activities. The sludge is dried on beds and used as manure for plantation purpose

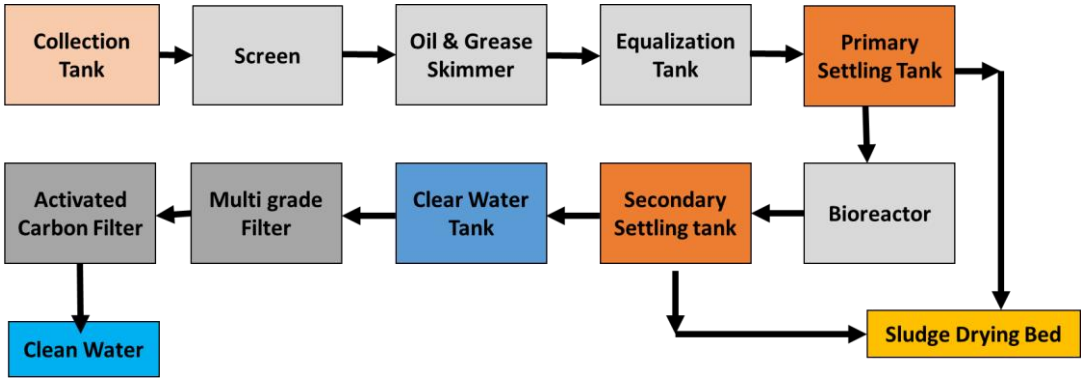


Figure 5.2: Process flow diagram for STP, MCL

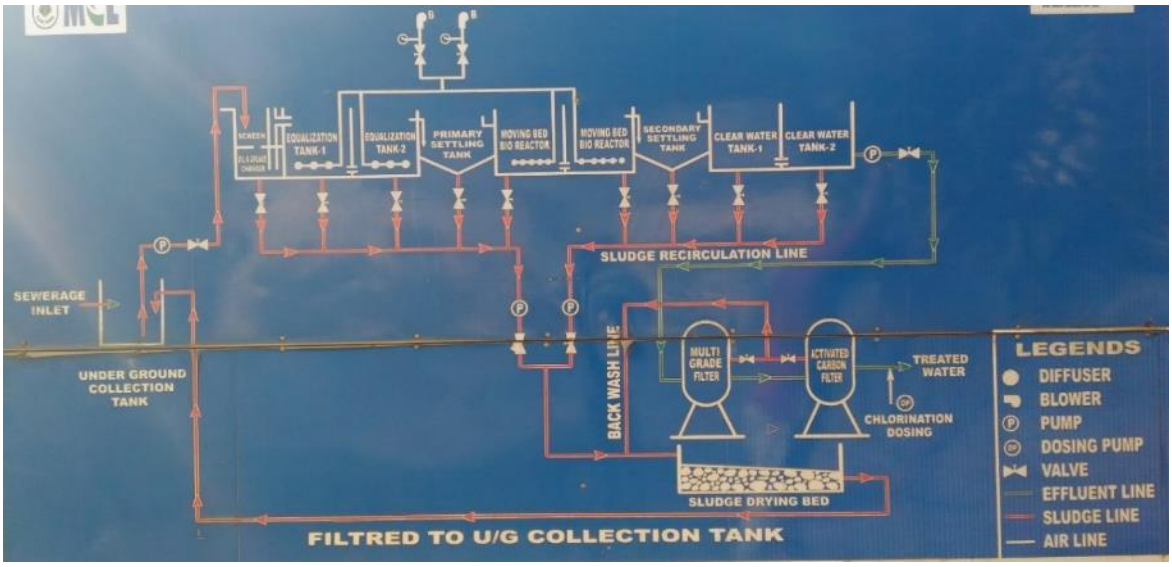


Figure 5.3:STP process flow diagram at site, MCL

The infrastructure available in the projects of MCL are provided as below.

Table 5.2: Infrastructure for mine water utilization in MCL

Sl no.	Mine Name	ETP	STP	Mine Water Treatment Plant
01	Hingula OCP	300 KLD	1.2 MLD	-
02	Balaram OCP	270 KLD	1200 KLD	-
03	Lingaraj OCP	100 KLD	-	35200 KLD
04	Bharatpur OCP	240 KLD	0.9 MLD	-

05	Bhubaneswari OCP	300 KLD	50 KLD	-
06	Jagannath OCP	140 KLD	1 MLD	-
07	Ananta OCP	240 KLD	0.51 MLD	-
08	Nandira UG	-	-	3000 KLD
09	Talcher UG	-	-	5000 KLD
10	Orient Area	-	-	
11	Lakhanpur Area		1.7 MLD	
12	Lakhanpur OCP	50 KLD	-	1080 KLD
13	Belpahar OCP	20 KLD	-	4 MLD
14	Samleswari OCP	480 KLD	0.5 MLD	7300 KLD
15	Lajkura OCP	80 KLD	0.5 MLD	5120 KLD
16	Kulda OCP	310 KLD	-	-

Water Distribution Infrastructure for community use:

Talcher and Orient Area of MCL supply mine water to peripheral villages under community supply schemes. The water distribution infrastructure consists of pipeline network as well as water supply by tankers. The water from UG mines is treated in the water treatment plants under Talcher and Orient Area. The treatment process primarily comprises of storage tanks, coagulation & flocculation units and pressure filters. The treated water is supplied to peripheral villages in water tankers for domestic utilization. Mine water is also supplied through pipeline for irrigation purpose for nearby villages.

5.3 Infrastructure at NCL

All mines in NCL operate on the principle of Zero Liquid Discharge (ZLD), hence there is no discharge of mine water outside the project premises. The treated mine water is being reused within the mines for dust suppression on haul roads, washing of heavy earth moving machine (HEMMs) in Workshops and Coal handling plants.

12 Nos. of Effluent Treatment Plants (ETPs) have been constructed for treatment of mine water and effluent from Workshops and Coal Handling Plants. The ETP consists of oil and grease recovery system through traps, suspended solids' removal through clarifiers after chemical dosing at flash mixers, sludge drying beds, conveyance line as well as pumping arrangements.

9 nos. Sewage Treatment Plants (STPs) have also been constructed in the NCL townships based on activated sludge process. These STPs contain aeration units for oxidation, clarifiers for removal of suspended solids, sludge drying beds, grit removal facilities, sewer lines, manholes, pump houses, control room etc. Treated water is reused in the project for tree plantation, horticulture works and construction activities. Dried sludge is used as a valuable manure for tree plantation and horticulture activities. The infrastructure available in the projects of NCL are provided as below:

Table 5.3: Infrastructure for mine water utilization in NCL

Sr. No.	Name of mine	Infrastructure details	
		Effluent Treatment Plant (ETP) (Capacity in MLD)	**Sewage Treatment Plant (STP) (Capacity in MLD)**
1	Kakri	27.00	1.00
2	Bina	31.20	2.50 Caters to residential colony of 2000 quarters
3	Krishnashila	0.40	--
4	Khadia	38.00	1.50
5	Dudhichua	30.00	2.00 Caters to residential colony of 2296 quarters
6	Jayant	32.00 (Mine) and 8.00 (Combined)	4.00
7	Nigahi	10.50 (CHP) and 4.00 (Workshop)	3.00 Caters to residential colony of 2252 quarters
8	Amlohri	51.00	2.00 Caters to residential colony of 1470 quarters
9	Block-B	8.68 Caters to the effluent from workshop & Coal Handling Plant (CHP). The treated effluent is being used for industrial purpose i.e. haul road dust suppression, in Workshop for HEMMs washing, for firefighting and in CHP for dust suppression.	0.80
10	Jhingurda	7.20	1.50

Figure 5.4: 0.8 MLD STP at Block-B, NCL

Figure 5.5: ETP at Kakri OCP, NCL

5.4 Infrastructure at SECL

Mine water from SECL is utilized for industrial and domestic purposes within the mine as well as discharged outside the project for community domestic use and irrigation. The infrastructure available in the projects of SECL are provided as below:

Table 5.4: Infrastructure for mine water utilization in SECL

Sr. No.	Area	Name of mine	Infrastructure details
1	Hasdeo Area	Kurja-Sheetaldhara	Pressure filter consisting of settling tank, Supply through Pipes & Water Tanker

Sr. No.	Area	Name of mine	Infrastructure details
2		Behrabandh UG Mine	Water Treatment Plant consisting of Settling Tanks, Pressure filter, Supply through Pipes & Water Tanker
3		Rajnagar RO UG Mine	Water Treatment Plant consisting of Settling Tanks, Pressure filter, Supply through Pipes & Water Tanker
4		Bijuri UG Mine	Water Treatment Plant consisting of Settling Tanks, Pressure filter, Supply through Pipes & Water Tanker
5		Jhiria UG Mine	Pressure filter consisting of settling tank, Supply through Pipes & Water Tanker
6		Rajnagar OC Mine	Water Treatment Plant consisting of Settling Tanks, Pressure filter, Supply through Pipes & Water Tanker
7		West JKD UG Mine	Water Treatment Plant consisting of Settling Tanks, Pressure filter, Supply through Pipes & Water Tanker
8		Palkimara UG Mine	Pressure filter consisting of settling tank, Supply through Pipes & Water Tanker
9		Kapildhara	Pressure filter consisting of settling tank, Supply through Pipes & Water Tanker
10	Korba Area	Dhelwadih U/G	Rapid Gravity Filter Plant 2.25 MLD for drinking water supply for colony of SECL; Pipeline network for distribution of drinking water to colonies of SECL and villages; 02 nos RCC OH tanks for distribution of drinking water
11		Singhali U/G	Pressure Filter7500GPH; Settling Tank; Clear watertank; Distribution pipe line
12		Banki U/G	Overhead tanks, Pipelines, 10000 GPH Pressure filter
13		Balgi U/G	Rapid gravity sand filter, Pipelines, Overhead tanks
14		Surakachhar U/G	3x 10000 GPH Pressure filter, Distributary pipelines and stand posts
15		Rajgamar U/G	Rapid Gravity Filter Plant 2.25 MLD for drinking water supply for colony of SECL; Pipeline network for distribution of drinking water to colonies of SECL and villages; 04 nos RCC OH tanks for distribution of drinking water

Sr. No.	Area	Name of mine	Infrastructure details
16		Manikpur OC	Sedimentation tank; 02 nos pressure filter 10000 GPH; RCC OH Tank 50000 gallon; Clear water ground tank 50000gallon; Fire fighting System at coal stock yard; Sprinkler system along the coal transportation roads for dust suppression; Distribution pipe line for domestic water supply to colony of Manikpur
17	Gevra Area	Gevra Project-1	4.5 MLD Water Filter Plant consisting of pressure filter, piper water supply and water tanker

5.5 Infrastructure at WCL

For drinking potable water, RO plants have been installed. For other domestic use, pressure filter/ filter plants have been installed at different mines. Whereas for irrigation purposes, settling tanks / check dams / channels / canals / pipelines have been constructed. The infrastructure available in the projects of WCL are provided as below:

Table 5.5: Infrastructure for mine water utilization in WCL

Sr. No.	Area	Name of mine	Infrastructure details
01	Pathakhera	ShobhapurUG, Sarni UG, Tawa UG, Tawa – II UG	Mine Water Treatment Plant (UG Settling Sump and Surface Settling Tank)
		Chhatarpur – I & II UG	1) Mine water Treatment Plant (UG Settling Sump and Surface Settling Tank). 2) Pipes etc. for Irrigation Water
02	Kanhan	Tandsi UG	Sedimentation tank of capacity 297 cu.m for mine water treatment, 45 Sprinklers for utilization of mine water for dust suppression along coal transport road and coal conveyor belt
		Mohan UG	2 Sedimentation tank of capacity 100 cu.m and 300 cu.m for mine water treatment, 15 Sprinklers for utilization of mine water for dust suppression along coal transport road and coal conveyor belt, 1 hired water tanker for dust suppression on coal transport road
		Ghorawari OC	Sedimentation tank of capacity 210 cu.m for mine water treatment, 1 hired tanker for dust suppression on coal transport road

Sr. No.	Area	Name of mine	Infrastructure details
		Ambara OC	Mine water discharged in adjacent abandoned quarry and used for domestic water supply to WCL colony and Ambara Village, Water treatment plant (Capacity - 4.50 lakh litres)
		Nandan UG	The mine water is being treated at Filter Plant of capacity 1.50MLD and further it is being supplied to colony for domestic / drinking purpose.
		Ambara UG	*Mine closed*
		Damua UG	The mine water is being treated at Filter Plant of capacity 4.546MLD and further it is being supplied to colony for domestic / drinking purpose.
		Jharna UG	The mine water is being treated at Filter Plant of capacity 1.35MLD and further it is being supplied to colony for domestic / drinking purpose.
03	Ballarpur	Ballarpur OC	2 nos. Sedimentation tank of dimension (27.5m x 11.5m x 2.20m)
		Ballarpur Colliery 3&4 pits	Mine water is directly sent to water filter plant of capacity 2.25 MLD at Ballarpur Colony. Excess water is discharged through Sedimentation tank of dimension (47m x 17m x 1.5m).
		Sasti OC	Sedimentation tank of dimension (40m x 10m x 1.5m)
		Sasti UG	Mine water is directly sent to water filter plant of capacity 2.25 MLD at Sasti Colony.
		Gouri I & II (A) OC	Sedimentation tank of dimension (20m x 15m x 1.2m)
		Gouri Deep OC	Sedimentation tank of dimension (24m x 10m x 1.5m)
		Pauni OC	Sedimentation tank of dimension (20m x 15m x 1.2m) followed by pressure filter of capacity 22.5 cu.m/hr.
		Pauni II Expansion OC	Sedimentation tank of dimension (38.4m x 23.4m x 1.55m) followed by pressure filter of capacity 45 cu.m/hr.
04	Nagpur	*Adasa UG*	*Discharged into canal*
05	Chandrapur	Bhatadi OCM	Water Treatment Facility: A Settling tank has been provided near the coal stock yard in working condition and an additional settling tank has been constructed.

Sr. No.	Area	Name of mine	Infrastructure details
		Durgapur OCM	A. At Durgapur OCM, 2.25 MLD Sand Gravity Filter plant is installed where water from DOCM Sector II and DRC no. 5 incline raw water is treated and supplied to Shaktinagar Colony. B) Settling Tank to settle the suspended solids and lime dozing plant installed at DOCM Sector V to neutralize the acidic mine water and is discharges in the Motaghat Nallah for rejuvenating the water table.
06	Wani	*Ghughus OCM*	*Abandoned*
		Naigaon OCM, Neeljay OCM, Penganga OCM	*No Domestic Consumption*
07	Umrer	MKD-I	RCC Sedimentation tank of size 30 x 8 x 2.50 m for treatment of mine water
		MKD-II & III	Sedimentation tank for treatment of mine water is provided
		Gokul	Sedimentation Tank is provided for treatment of mine water
08	Wani North	Ukni OCM	Construction of Check dam near Ukni village
		Junad OCM	*No Domestic Consumption*
		Ghonsa OCM	Civil Works (Construction of baffle walls inside the sedimentation pond to arrest silts from Mine water) for utilization of Mine water
		Kolar Pimpri OCM	Providing pipeline for utilization of Mine water
09	Pench	Barkuhi OCM, Mahadeopuri UG, Neharia UG, Urdhan OCM, Vishnupuri I UG, Vishnupuri II UG	Sedimentation Tank
		Ganapati UG	Open Pond near BG siding
		Mathani UG	Sedimentation Tank & Pressure Filter
		Thesgora UG	*No Domestic Consumption*
10	New Majri	*Yekona, NewMajri UG to OC, New Majri-II (A) OC*	*No domestic consumption*

Table 5.6: Water Distribution Infrastructure for community use in WCL

Sr. No	Area	Mine	Water Distribution Infrastructure for community use
1	Nagpur	Bhanegoan OCM	(A) Pressure Filter - 1. Capacity- 1 No. pressure filter of 30000 Ltr/Hr capacity 2. Pipe Line- HDPE pipe line of 1050 mtr length having 90 mm dia.
		Inder UG to OC	(A) R.O Plant- 1. Capacity - 1 No R.O plant of 1000 ltr/hr capacity 2. Pipe Line- HDPE pipe line of 2300 mtr length having 63 mm dia. (B) Pressure Filter - 1. Capacity- 1 No. pressure sand filter of 5000 GPH of 1700 mm dia X 2000 Ht. 2. RCC Ground water sump - 2 No. RCC ground water sump of capacity 15000 ltr 3. Pipe Line- HDPE pipe line of 2450 mtr length having 75 mm dia.
		Kamptee OCM	(A) Pressure Filter - 1. 01 No. pressure sand filter of 10000 GPH of 2400 mm dia X 2000 Height 2. RCC Ground water sump - 2 No. RCC ground water sump of capacity 50000 ltr 3. Pipe Line- HDPE pipe line of 2170 mtr length having 125 mm dia.
		Patansaongi UG	(A) R.O Plant - 1. Capacity- 1 No R.O plant of 10000 ltr/hr capacity 2. Pipe Line- HDPE pipe line of 300 mtr length having 90 mm dia. 3. Bottling Plant- Capacity of 15000 Bottles/Day
		Saoner UG	(A) R.O Plant- 1. 01 No R.O plant of 10000 ltr/hr capacity 2. Pipe Line- HDPE pipe line of 1363.02 mtr length having 90 mm dia.
		Silewara UG	(A) Filter Plant-1. Capacity 2.4 MLD 2. Pipeline- CI pipe of length 1500 mtr having 100 mm dia
2	Chandrapur	Bhatadi OC	Two 20 Hp pumps and one 100 HP pump to feed water to 10000 GPH pressure filter near dispensary have been installed. This water from Water treatment plant supplies water to colony. The excess water left after supplying water to filter plant and industrial activities after passing through settling tank is fed in the Chandsurla nallah which is used by the local villagers for agricultural purpose. Providing water from Bhatadi Filter pump house to Tirwanja village Overhead reservoir & Pond HDPE pipeline. Water ATM type RO Water plant installed in BOC Colony &Bhatadi OC Mine with 1000 LPH capacity each.
		CRC & DRC UG	a) CRC: 0.5 MLD pressure filter type water treatment plant supplying water to Chanda Rayatwari colony, BMT chowk Basti, Basti no. 2 by pipeline, Miners Quarters. B) DRC no. 3 Incline: 2.5 MLD rapid gravity water treatment plant behind sub-station of DRC mine near 3 incline. The water from the filter plant is supplied to DRC miners' quarters and to DRC no. 3 incline for drinking water in the mine.

Sr. No	Area	Mine	Water Distribution Infrastructure for community use
			C) DRC no. 4 Incline: 0.5 MLD Pressure filter type Water Treatment plant supplying water to DRC 5 no. colony and DRC no. 4 incline for drinking water. D) Water ATM RO Water plant installed with 1000 LPH capacity supplying water to residents of Anand Nagar, hutments refugee camp, BMT Dafai, CRC Dafai. E) Water ATM type RO Water plant installed in DR 5 colony with 1000 LPH capacity. H) Water ATM type RO water plant installed in DRC 3 Colony with 1000 LPH capacity
		Durgapur OC	04 Nos. of Water ATM type RO Water plant installed in DOC-POC Colony with 1000 LPH capacity at various places of the colony & rehabilitation site.
		H lalpeth UG	A. 5000 GPH (0.50 MLD) pressure sand filter with pipeline installed in Hindustan Lalpeth UG to supply water to nearby Quarters, Samruddhi Nagar, Kopewar Basti. B) 1.80 MLD Rapid Gravity Filter water treatment plant installed near Sub Area Office Hindustan Lalpeth supplying water to Hindustan Lalpeth colony and Jangam Basti. C) Water ATM type RO Water plant installed in Hindustan Lalpeth Colony with 1000 LPH capacity.
		H Lalpeth OCM	A. A RCC Overhead reservoir of 1.0 Lakh litre capacity with settling tank, pump house and 110 mm diameter, 400 metres pipeline has been installed. It is proposed to supply water for Industrial and agricultural use. B) Water ATM type RO water plant installed in DRC 5 Colony with 1000 LPH capacity. C) Water ATM type RO water plant installed in Area Hosiptal Colony with 1000 LPH capacity.
		Mahakali UG, Manna UG	A. Mine water from Mahakali Colliery is supplied to 1 MLD Pressure Filter Water Treatment Plant near Production incline and filtered water us supplied to miners Quarters of Mahakali Colliery and nearby Areas. B) Water ATM type RO water plant installed in MKC Colony with 1000 LPH capacity.
		Nandgaon UG	A) 1 MLD Pressure Sand Filter filtering raw water from NandgaonPode village through 110 mm HDPE pipeline of 400 m length through Overhead reservoir. B) The mine water is discharged through nallah which is used for Agricultural purpose. C) Water ATM type RO water plant installed in Nandgaon Colony with 1000 LPH capacity.
		Padmapur OCM	A) 10000 GPH Sand Pressure filter has been installed at Padmapur OCM near Dumper Workshop supplying water to the rehabilitation site of Sinhala, Masala &Navegaon. The infrastructure includes settling tank and HDPE pipeline of 110 mm diameter and 930 metres length. B) Mine water

Sr. No	Area	Mine	Water Distribution Infrastructure for community use
			utilization scheme for utilizationof mine water discharge through 65000 litres RCC Overhead tank by Gravity the infrastructure involves settling tank, a 7.5 Hp submersible pump, HDPE pipeline of 110 mm and 90 mm diameter of totalling 3000 m length supplying water to Padmapur village. The Water is supplied to village pond where the water is utilized by farmers of Padmapur village for Agricultural use. C) Water ATM type RO water plant installed in Padmapur mine with 1000 LPH capacity.
	Wani	Kolgaon OCM	Construction of Check dam & laying of HDPE Pipeline
		Mungoli OCM	A) RO Plant of 1000 LPH capacity installed. B) Deepening of existing pond,liningofexisting nallah (1200 m) and stop dam
	Umrer	Murpar	Mine water is being treated through Plant and then discharged in nearby Pond with 1.5 km drain used by villagers for irrigation, washing, cattle drinking etc
		Umrer OCM	1) Mine water Sedimentation tank of size 30 x 10 x 5.3 is provided. 2) Two (02) Nos. of RO Plant at mine premises.
	Wani North	Rajur UG	Pressure Filter Plant (Capacity: 35000 litres/hour) installed and filtered water is provided to Overhead reservoir of Ezara Basti through PVD & GI pipeline
	Pench	Chhinda OCM	Filter Plant (capacity 2.0 Lakh litres) at Sethia
		New Sethia OCM	Filter Plant (capacity 2.0 Lakh litres) at Sethia
		Shivpuri OCM	Filter Plant (capacity 2.0 Lakh litres) at Hill top

5.6 Infrastructure at NLCIL

Majority of the mine water is being utilized to satisfy industrial and domestic demand within the project and balance (approx. 23%) is being utilized as domestic supply for community and irrigation in surrounding areas.

Approx. 72% of the total mine water is utilized as feed for the pit head power plants of NLCIL. Mine water is being utilized in TS2 expansion power station through Water Treatment Plant of capacity 4300cu.m/hr (376.68 LcuM/year). The TS2 Thermal power plant (expansion capacity of 2X250MW) was commissioned in the year 2010 and COD declared on 2014.

Mine Water Treatment Plant includes the following:

- Pre-Treatment Plant for removing the Turbidity and Suspended particles in the mine water.
- Softening Plant through Ion-exchange process for removing the calcium and Magnesium hardness.

- Reverse Osmosis and Demineralization Plant for producing the Demineralized Water for Boilers of Capacity (250MW x 2)

Apart from the above, the following ETPs and STPs are also installed:

- Effluent Treatment Plant of capacity 21,440 KLD is operated and treated water is reused.
- Sewage Treatment plant of 40 KLD capacity is operated and treated sewage water is utilized for gardening purposes inside the thermal power plant premises.

Mine water discharged outside the mine premises is routed through natural canals (Kanniyaodai, Sengalodai and Paravanar) and stored in to the Walaja Lake for onward supply to nearby village and irrigated fields through small streams. Natural canal - Kanniyaodai, Sengalodai and Paravanar and Walaja Lake are the state-owned water bodies under the control of PWD.

5.7 Infrastructure at SCCL

Mine water from SCCL is utilized for industrial and domestic purposes within the mine as well as discharged outside the project for community domestic use and irrigation.
The mine discharge water is firstly collected in the storage/settling tanks within the mine from where the water is used for different industrial purposes such as dust suppression, HEMM washing, plantation, etc.
The water which is used for HEMM washing in workshop contains mud, oil and grease. These effluents are treated in Effluent Treatment Plant (ETP), where the mud, oil and grease are collected in separate chambers and the treated water is again recycled for dust suppression, plantation purposes. There are 28 nos ETPs in SCCL presently.
Sewage Treatment Plants (STP) are provided in all colonies to treat domestic effluents. The treated water is being used for plantation purpose. Some of the domestic effluents are being discharged into oxidation ponds. There are 9 STPs in operation in SCCL. Further, 4 STPs are under construction and 3 more are proposed.
Further, mine discharge water is treated in filter beds to make it potable for mines, colonies and surrounding villagers. The excess mine water is discharged into nearby settling tanks/settling ponds before discharging into natural streams/ tanks.
The infrastructure available in the projects of SCCL are provided as below.

Table 5.7: Infrastructure for mine water utilization in SCCL

Sr. No.:	Area	Mine name	Capacity of settling chamber	Date of commissioning
1	Ramagundam-I	Medapalli OCP BWS	60KLD	Apr-12
2		Area workshop	60KLD	28.02.2003
3	Ramagundam-II	RG OC-III Project BWS	60KLD	Feb-99
4		Area workshop	60KLD	Apr-03
5	Ramagundam-III& APA	RG OC-I New site office	60KLD	May-02
6		RG OC-I BWS	60KLD	Aug-03
7		RG-II BWS	60KLD	Aug-02
8		RG OC-II BWS	60KLD	Jan-12

Sr. No.:	Area	Mine name	Capacity of settling chamber	Date of commissioning
9	Srirampur	SRP Area workshop	60KLD	11.03.2004
10		SRP OC	60KLD	2021
11	Mandamarri	MM Area workshop	60KLD	prior to1995
12		RKP OC	60KLD	31.12.2014
13		KKOC	60KLD	2017-18
14	Bellampalli	Khairagura OCP	60KLD	30.11.2006
15		Khairagura CHP	60KLD	30.01.2014
16		Dorli OC-I	60KLD	19.08.2009
17		Dorli OC-II	60KLD	20.02.2015
18		OCP Goleti-I	60KLD	20.12.2013
19	Bhupalpalli	KTK OC SECTION -I	60KLD	Apr-02
20	Manuguru	OC-II Dumper section	60KLD	01.04.2005
21		CHP	60KLD	30.03.2015
22		SMS Plant	60KLD	2017-18
23	Yellandu	JK OC	60KLD	01.06.2003
24		KOYAGUDEM OCP	60KLD	18.06.2005
25	Kothagudem	GK OC	60KLD	31.03.2003
26		JVR OC	60KLD	12.05.2003
27		Base work shop,sathupalli	60KLD	23.06.2006
28	Corporate	Vehicle service station	60KLD	15.06.2003

Figure 5.6: ETP at MNG OC-II (PK OC II), SCCL

Figure 5.7: Settling tanks and check dams, SCCL

Figure 5.8: STP at Pothana Colony, Godavarikhani, SCCL

Figure 5.9: Oxidation pond at Centenary Colony

5.8 MoU arrangements with State and other agencies for mine water utilization

Various coal companies have teamed up with respective State Governments and other agencies to facilitate utilization of mine water by communities, industries as well as cities through Memorandum of Understanding (MoU). The details regarding the same are covered in this section. The list is as below:

1. MoU between Government of Jharkhand & Coal India Limited
2. MoU with State Government of West Bengal
3. MoU between Western Coalfields Limited and MAHAGENCO
4. MoU between Western Coalfields Limited and Vidarbha Irrigation Development Corporation
5. MoU between South Eastern Coalfields Limited and Government of Chhattisgarh

5.8.1 MoU between State Government of Jharkhand and CIL

The MoU was signed between State Government of Jharkhand and Coal India Limited (CIL) in October, 2017 and is for utilization of mine water by villages situated near the mines of CIL in the command area of Central Coalfields Limited (CCL), Bharat Coking Coal Limited (BCCL) and Eastern Coalfields Limited (ECL) in the State of Jharkhand.

The mine water available in the mine voids and surplus discharge from the mines of CCL (88 mines), BCCL (23 mines) and ECL (07 mines) - to the tune of approx. 1150 LKL would be made available to the state agencies (like Department of Drinking Water and Sanitation). As for the water treatment and distribution facilities, the respective CIL subsidiaries (CCL/BCCL/ECL) would bear all initial cost for construction of civil works like foundation, platform and shed for installation of motor and pumps for drawl of water at identified mine sites. Whereas, the

state government agencies shall bear the cost of pumps, motors, associated power supply, pipelines and their installation at identified mine sites from where water is to be drawn. The cost of running these facilities would be borne by Government of Jharkhand or community benefitted. The quality of mine water would be monitored by the respective CIL subsidiaries (CCL/BCCL/ECL) in order to assess the suitability for use. The MoU is in force for a period of 30 years.

5.8.2 MoU with State Government of West Bengal for utilization of mine water by nearby communities for irrigation purposes

Eastern Coalfields Limited (ECL) has recently approached Irrigation and Waterways Department, State Government of West Bengal with a concept note for utilization of surplus mine water from mines of ECL by nearby communities for irrigation purposes. ECL has submitted details pertaining to quantity of mine water available, precise geo-coordinates for the water source sites and quality of water.

5.8.3 MoU between Western Coalfields Limited and MAHAGENCO

Western Coalfields Limited (WCL) has signed an MoU with Maharashtra State Power Generation Company Limited (MAHAGENCO) in 2017 with the agenda to provide water to MAHAGENCO power plants located near mines of WCL (Bhanegaon mine of Nagpur Area) – the quantity of water is estimated at approx. 107.6 LKL. MAHAGENCO would bear the costs towards pumps, motors, associated power supply, pipelines and their installation at designated mine site, including operation and maintenance. WCL would provide the land for setting up of the pumping station and treatment plant and will also monitor the quality of mine water.

5.8.4 MoU between Western Coalfields Limited and Vidarbha Irrigation Development Corporation

Western Coalfields Limited (WCL) has signed an MoU with Vidarbha Irrigation Development Corporation (VIDC) in 2018 with the agenda to provide surplus mine water to VIDC from mines of WCL (Kamptee OC, Inder OC and Gondegaon OC of Nagpur Area) – the quantity of water is estimated at approx. 281.6 LKL. The MoU is effective for a period of three years. VIDC would bear the costs towards pumps, motors, associated power supply, pipelines and their installation at designated mine site, including operation and maintenance. WCL would provide the land for setting up of the pumping station and treatment plant and will also monitor the quality of mine water.

5.8.5 MoU between South Eastern Coalfields Limited and Governments of Chhattisgarh

South Eastern Coalfields Limited (SECL) has signed an MoU in September, 2018 with Government of Chhattisgarh for community utilization of mine water to the tune of approx. 127 LKL/year (daily discharge corresponding to 0.35 LKL/day or 7.65 million gallons) from Korba Area (02 mines – Pawan Incline and Banki 9/10) and from Gevra OCP. The mine water may be utilized by Public Health Engineering Department (PHED), Water Resource Department and other agencies under Government of Chhattisgarh.The MoU is effective for a period of thirty years.

As per the terms, SECL would bear the cost of civil works and installation of motors, pumps and pipeline network. GoCG would construct all requisite structures, distribution pipelines

and arrange for installation of electric supply utilizing funds from SECL. Operation and maintenance (O&M) of the treatment and distribution facilities within the mine premises would be done by SECL, whereas costs associated with O&M outside the mine premises would be borne by GoCG. The quality of mine water would be monitored by third party in order to assess the suitability for use; SECL would bear the costs towards the same.

Apart from the above, South Eastern Coalfields Limited (SECL) has also proposed for utilization of mine water to the tune of approx. 150.86 LKL/year through implementation of 5 schemes in the state of Chhattisgarh and 4 schemes in the state of Madhya Pradesh. Approx. 134.41 LKL will be utilized for irrigation purposes and approx. 16.45 LKL/year as drinking water supply across 30 villages in Chhattisgarh and Madhya Pradesh, thereby benefitting approximately 45757 people and 562 ha of land. The schemes are in approval stage. It may also be noted that scheme costs may vary based on final DPRs subject to approvals.

Chapter 6
Best practices w.r.t mine water utilization

6.0 Best practices with regard to mine water utilization

Mine voids are natural water storage infrastructure created on account of mining and help in providing water security to the people in and around the mining areas. The local community is dependent on this mine water. The mine water is also being used for recharge of local water regime, thereby helping to supplement the Govt. initiatives aimed at constructing & maintaining ponds in villages with the objective to collect and conserve rain water to be used by community.

Over time, coal PSUs have taken up a number of initiatives with regard to mine water utilization. These have evolved into best practices which showcase that mine water is not only gainfully utilised for meeting the water requirement of the project, but the local community is also getting benefitted from mine water availability. Glimpses of few of the best practices implemented across coal PSUs are being showcased in this chapter and tabulated below:

Table 6.1: Best practices w.r.t mine water utilization

Sr. No.:	Coal Company	Best practice w.r.t mine water utilization
1	BCCL	Mine water utilization for community use in Pootkee Balihari area of BCCL
2	CCL	Mine water utilization for community use in projects under CCL
3	ECL	Water supply scheme for Dhandadihi and Salanpur Villages by ECL and WBPHED
4	SECL	Pisciculture & tourism at Bishrampur mine void by SECL
5	WCL	Coal NEER project by WCL
6	NLCIL	Mine water supply by NLCIL
7	SCCL	Mine water supply by SCCL

6.1 Mine water utilization for community use in Pootkee Balihari area of BCCL

At Pootkee Balihari (PB) area of BCCL, Pootkee UG mine discharges about 2.95 LKL/month. Development of cost effective mine water treatment technology for providing "safe drinking water" has been undertaken by BCCL with the technological know-how of CIMFR, Dhanbad.

To demonstrate the developed treatment technology, a pilot plant of 4 kL/hr capacity (approximately 50,000 litre per day) for mine water treatment has been designed and commissioned at Pootkee–Balihari area of BCCL. The water treatment process includes settling, flocculation, and coagulation (it is contacted with chemical(s), pH conditioner and polyelectrolyte, under optimum conditions the heavy metal ions get bonded to FEOL/ALOL and the complex gets separated from water as large flocs.), clarification, pressure filtration, R.O. membrane filtration and ozonation. The work for the pilot project was started on 08.06.2011 and commissioned on 31.03.2013 at a cost of INR 2.19 crores. Operation of the plant was handed over to BCCL on 7.11.2014.

By harnessing and using mine water of this area, the water demand for Pootkee Area has been fulfilled. The commissioned pilot plant has been designed to cater about 2000 people living in the identified coal mine area. The water is supplied to P.B Area Office, P.B. Project, CISF Camp, VTC, Regional store of P.B. Area and Aralgaria village.

Figure 6.1: Water Treatment Plant at Cluster XI, PB area

6.2 Mine water utilization for community use in projects under CCL

CCL has made available mine water from four mines, namely Ara OC, Pundi OC, Tapin South OC and Topa RO OC (A) for community use. CCL has signed MoUs with the state department in 2017 and these projects come under the jurisdiction of Drinking Water and Sanitation Department, Ramgarh District. The objective of these projects is to enable supply of treated water to the villages around these mines. As per the MoU, CIL would bear all initial costs for construction of civil works like foundation, platform and shed for installation of motor and pumps for drawl of water at identified mine sites. Government of Jharkhand shall bear the cost of pumps, motors, associated power supply, pipelines and their installation at identified mine sites from where water is to be drawn. The cost of running these facilities would be borne by Government of Jharkhand or communities benefitted.

	Mines of CCL involved			
	Ara OC	**Pundi OC**	**Tapin South OC**	**Topa RO OC (A)**
Source of water	Quarry #16B	Quarry #2	Quarry #44	Quarry 2A West
Capacity of water treatment plant	7.3 MLD	1.4 MLD		1.75 MLD
Villages / Towns benefitted	Ruata, Ulhara, Pindra, Barisum, Banji, Tapin, Basantpur, Pachanda, Parej, Durukasmar, Ichakdih, Kedla, Parsabera, Ara	Bongahara, Pundi, KK Basaudi, Hesagara	Manduchati, Govindpur and Madudih villages	Balsagra/Huwag village
Number of beneficiaries	Approx. 38900	Approx. 7600	Approx. 6500	Approx. 12000
State Authority Jurisdiction	Drinking water and Sanitation Dept., Ramgarh District			

The old quarries consisting of mine water also act as rain water collection sumps and also contribute towards regeneration of groundwater table in the area. These sumps also act as avenues for seasonal fishing for the local communities. Availability of treated water from these sumps has lowered the dependency of community on groundwater.

Figure 6.2: View of Quarry 16B, Ara OC, CCL

Figure 6.3: View of pipeline for supply in Mandu Town

Figure 6.4: Pumphouse premises at Balasagra, Huwag

6.3 Water supply scheme for Dhandadihi and Salanpur Villages by ECL and WBPHED

Dhandadihi OC and Dalmiya OC are abandoned mines of ECL holding huge quantities of water which could be utilized as a water resource for the community. West Bengal Public Health and Engineering Department (WBPHED) had approached ECL for setting up of the treatment plant and withdrawal of water from the OCP to supply drinking and domestic water to the population of Dhandadihi and Salanpur villages.

ECL has issued NoC for withdrawal of water and setting up of the treatment plants at abandoned Dhandadihi OCP of Kunustoria Area and abandoned Dalmiya OCP of Salanpur Area. The water treatment plants have been set up by PHED, West Bengal at their own cost and are being operated by them.

Sr. No.	Description	Water supply scheme for Dhandadihi village	Water supply scheme for Salanpur village
1	Mine water source	Abandoned Dhandadihi OC, Kunustoria Area	Abandoned Dalmiya OC, Salanpur Area
2	Water treatment plant construction & operation	By WBPHED	By WBPHED
3	Period of completion	1 year	1 year
4	Status	The plant has already been completed and the treated water is being supplied to the villagers.	The plant has already been completed. The work of laying of pipeline by WB-PHED will be completed during the year 2021.
5	Total cost of project (INR)	911.70 lacs	792.18 lacs
6	Operational cost (INR)	53.56 lacs	49.54 lacs

Projects like this can be implemented at other sites also, where treatment plant can be set up for utilization of water from abandoned OCPs and working mines. This will not only ensure supply of clean drinking water to the nearby villagers, but also reduce the burden on natural water sources like rivers and underground water.

Participation of State Government authorities in funding for execution and operation & maintenance makes such projects feasible. Implementation of such type of scheme, where company is providing land and source of water and State Government is funding and executing, operating & maintaining the scheme, will not lead to any financial burden for the company.

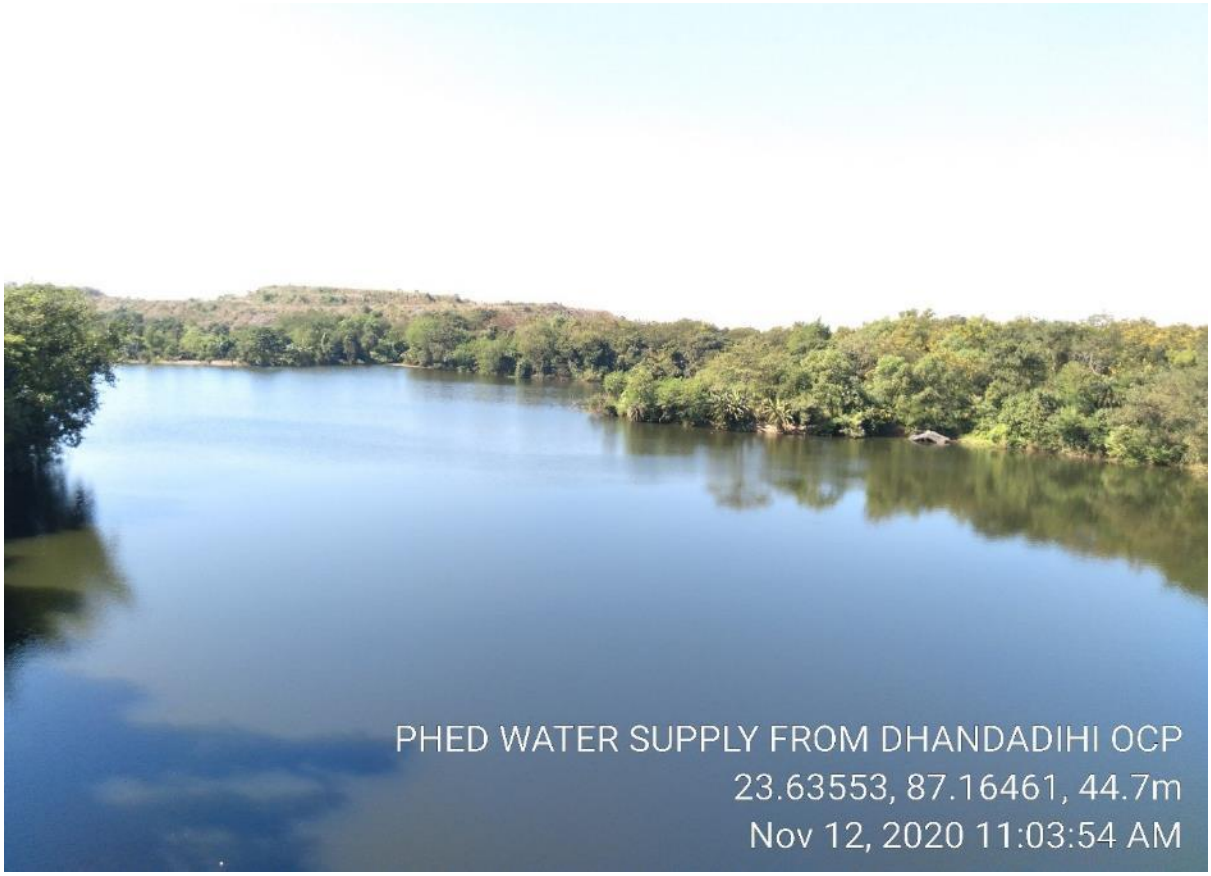


Figure 6.5: Abandoned Dhandadihi OCP,ECL (source of raw water)

Figure 6.6: Dhandadihi PHED Water Supply Reservoir

Figure 6.7: Abandoned Dalmiya OCP,ECL (source of raw water)

Figure 6.8: Dalmiya PHED Water Supply Plant

6.4 Pisciculture & tourism at Bishrampur mine void by SECL

As per final mine closure plan of Bishrampur Area, the land and quarries of Bishrampur OCM mine has to be used for a number of development activities. One of the activities was development of eco park/tourism site which could also aid the livelihood of nearby villagers as a means to sustainable development as well as a prominent tourism site for the public.

The pisciculture/tourism site has been developed in quarry no. 6 of Bishrampur OC which consists of a water filled area is about 26.12 acres, which is ideal for development of pisciculture and for development of boating site as well. The location of the quarry by side of NH-43 is also a good reason for its selection as it is easily approachable from various places. Existence of homes of nearby villagers (Telaikachhar, Kenapara, Jainagar*etc*) has also led to development of a means for their livelihood.

The pisciculture/tourism site has been developed by Chhattisgarh State Fisheries Department. An amount of INR 197.00 Lakhs have been provided from Mine Closure fund by Bishrampur Area for the same to District Administration. The project involves 8 fish cages (96 sq.m each) with battery (384 sq.m each) and protection net, apart from farmer cottage, floating rafts, motor boats and platform.

The project was started in Feb. 2018 and it took about 1.50 years for completion. This has been handed over by District Administration to Self Help Group (SHG) of 30 to 40 people from nearby villages, who are looking after its operation and maintenance.

The pisciculture has provided a means for sustainable livelihood generation for the local communities through sale of fishes – annual harvest of about 800 quintals of fish has been reported. The site has also become a popular tourism/boating site for surrounding people and about 100 tourists on an average, visit this place daily. The success of Bishrampur has also

led to plans for upscaling the project; there is proposal for development of landscaping, eco-park in the surrounding area.

Figure 6.9: View of site – Bishrampur pisciculture and water sports, SECL

Figure 6.10: View of fish cages at site – Bishrampur OC, SECL

Figure 6.11: Self Help Group in charge of maintenance and running of the site at Bishrampur OC, SECL

6.5 Coal NEER project by WCL

Coal NEER is an ambitious project undertaken by WCL for treatment and bottling of mine water from Patansaongi UG mine located in Saoner Area, Nagpur District, Maharashtra. In line with the Jal Shakti Abhiyan for water conservation campaign initiated by GoI, the mine water accumulated is treated and facilitated to nearby communities for use as drinking water and to satisfy domestic and irrigation requirements.

The treatment plant installed at Patansaongi UG Mine includes the stepwise process of sedimentation, filtration through slow sand filter & processing through RO plant, followed by UV treatment. The RO plant installed at Patansaongi was completed in year 2019 and has a capacity of 10,000 LPH. The plant has also secured BIS & FSSAI certifications for packaged drinking water. At present the bottling capacity of the plant is 15000 bottles/day (10,500 Nos. of bottles of 01 litre capacity & 4500 Nos. of Bottles for 500 ml capacity). The packaged drinking water will be commercially sold with Brand name as “COAL NEER” to all areas under jurisdiction of WCL and Offices of other Government organizations. The commercial selling price of bottles of 500 ml and 01 litre capacity is proposed to be Rs 7/- per bottle and Rs 10/- per bottle respectively. The profit accrued from commercial selling of packaged drinking water will be utilized in providing pure drinking water to nearby villages under community service.

WCL in collaboration with local Self-Help Groups (SHGs) started distributing water to doorsteps of villagers. The SHGs are earning revenue from the distribution of the purified water and villagers are getting access to purified potable water at their doorstep. The nearby beneficiary villages are Patansaongi, Belori, Tadulwani, Babulkheda, Kavdas, Itangoti,

Champa, Kusumbi, Sillori, Bramhapuri, Khangaon, Khodadongri, Veltur and Beendala. The project is estimated to benefit around 1 lakh people.

Figure 6.12: Water Treatment Plant at Patansaongi UG, WCL

Figure 6.13: Treatment units at Water Treatment Plant of Patansaongi UG, WCL

Figure 6.14: "Coal NEER" brand treated water –final product for distribution

6.6 Mine water supply by NLCIL

Mine water accumulated from the mining areas of NLCIL are being discharged into surrounding natural streams, namely - Kanniyaodai, Sengalodai and Paravanar) and is also being stored in the Walaja Lake. These streams and Walaja Lake are state owned and controlled by PWD. The mine water thus made available by NLCIL is being utilized for community consumption, irrigation as well as industrial use.

The Chennai Metro Water Supply Scheme is a project by Government of Tamil Nadu for supply of water from Veeranam lake to Chennai city. Mine water discharged from NLCIL is also a small contributor towards this water supply scheme.

From April, 2020 till October, 2020, approx. 20.82 LKL water has been supplied to Neyveli Township, approx. 41.76 LKL to Chennai Metro Water Supply scheme and approx. 104.39 LKL for irrigation. Apart from that, mine water is also being utilized in TS2 expansion power station (2 x 250 MW) after treatment in a WTP of capacity 376.68 LKL.

Figure 6.15: Mine water discharged into nallahs by NLCIL is being utilized for irrigation

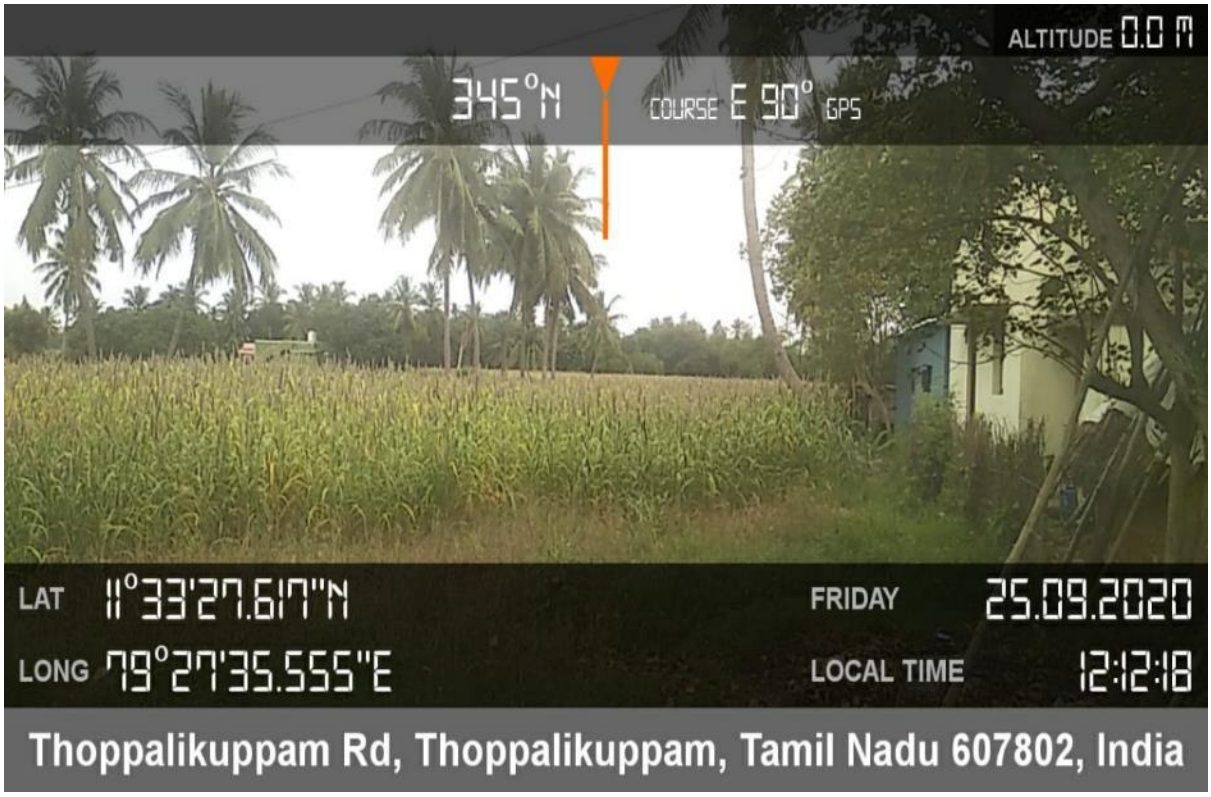


Figure 6.16:Mine water discharged into nallahs by NLCIL is being utilized for irrigation

Figure 6.17: View of water supply pipelines for Chennai Metro Water Supply Scheme

6.7 Mine water supply by SCCL

In mining areas of SCCL, the mine water generated is firstly being treated in filter beds and settling tanks before further supplying. The mine water is being utilised for industrial & domestic purposes such as dust suppression, stowing, washing of machinery, firefighting, utilities, and plantation. The treated mine water is also supplied for use in residential colonies of SCCL.

Water storage tanks have been created near the opencast mines to store the mine discharge water. Two such summer storage tanks of capacity 5.77 LKL and 2.33 LKL are developed near RG OC II, RG OC III Projects respectively for storage of water. Water from RG OC II, RG OC III Projects is being discharged into these tanks.

The excess mine water is discharged to nearby tanks for community use (drinking and irrigation) and surplus discharged into designated tanks for ground water recharge. Approximately 104 villages are benefitting from the mine water discharged from SCCL.

Figure 6.18: Summer storage tanks near RG OC-III Expansion Project, SCCL

Figure 6.19: Summer storage tanks near RG OC-III Expansion Project, SCCL

Figure 6.20: Agricultural fields near RG OC-III Expansion Project, SCCL

Figure 6.21: Supply of treated mine water to surrounding communities by SCCL

Chapter 7
Conclusion and way forward

7.0 Conclusion

In the process of coal mining, huge volume of mine water gets collected in mine sumps and is subsequently pumped out to the surface. By application of appropriate treatment methods, the available mine water can be used for drinking/irrigation purposes. The mine water is also utilised for recharge of water regimes which is helpful to communities downstream. Coal companies are doing commendable job in gainful utilization of mine water – both from active and abandoned mines. This endeavour is in line with the Jal Shakti Abhiyan for water conservation campaign initiated by Government of India.

General quality of mine water in coal mines is good and suitable for domestic and irrigation purposes after minor treatment like sedimentation, filtration, and disinfection - as per requirement based on end use. As Indian coal is not associated with pyrite, cases of acid mine drainage are absent barring few exceptions. Some mines with acidic mine water are properly treated and the system of Zero Discharge is maintained. Occurrence of trace elements/heavy metals beyond permissible limits in mine water samples is rarely found.

Broadly the mine water in coal companies is being used for the following purposes -

- Industrial use by the coal company – dust suppression, Plantation, Fire Fighting, Washing of Machineries, Water sprinkling etc.
- Domestic Use in colonies and offices of coal projects – after appropriate treatment
- Community supply for domestic and irrigation purpose – both departmentally and through MoU route with State Government
- Supply to other industries
- Supply to Municipal Corporations
- Pisci-Culture in abandoned mine voids
- Bottled water supply
- Ground water recharge

There are two sources of mine water -

- Running Mines: Accumulated water is pumped out for continuation of mining
- Abandoned UG mines and OC Voids

As per data made available by the coal PSUs, the total annual mine water available from running mines is approx. 7938.0 LKL/year and volume available from abandoned mines and mine voids is approx. 1997.4 LKL. The mine water utilization spans across 38 districts of 9 states (Jharkhand, West Bengal, Maharashtra, Tamil Nadu, Telangana, Odisha, Chhattisgarh, Madhya Pradesh and Uttar Pradesh).

7.1 Mine water utilization– A successful way to reduce the water footprint of mining

Across coal companies, mine water utilization for internal consumption varies from 15% to 88% and utilization outside the project ranges from 3% to 59% depending upon number of mines in the company, extent of command area, presence of legacy mines, statutory restrictions on mine water discharge etc. Mine water in voids/GW recharge ranges in-between 39% to 82% in BCCL, CCL and ECL. Discharge of mine water into natural streams from SECL and WCL is approx. 33% and 10% respectively.

7.2 Quality of Mine Water

As for quality of mine water, concentrations of calcium, hardness and alkalinity are concerns in BCCL, CCL; and pH levels are concern for MCL, SECL and WCL. The coal companies may undertake regular scrutiny of analysis data in order to ascertain the areas of concern and take possible mitigation measures wherever feasible.

7.3 Infrastructure for Mine Water Treatment

In terms of infrastructure for mine water treatment, most coal companies have well established treatment plants (mine water treatment plants, effluent treatment plants for reuse of treated wastewater and sewage treatment plants) in their mine areas. RO plants have been established for supply of treated mine water to nearby villages, bastis, institutions and public areas.

7.4 MoU with State Government

Coal companies have also signed MoUs with state governments (Jharkhand, West Bengal) and entities like MAHAGENCO, Vidarbha Irrigation Development Corporation and Chennai Metro Water Scheme). These initiatives will go a long way in ensuring water security for communities and entities surrounding the mining areas.

7.5 Supply for Industrial & Domestic Use by the Coal Companies

Of the total available mine water from all coal companies, approx. 4405.6 LKL is used for internal consumption, which accounts for approx. 44.3 percent of the net mine water available. Of the mine water utilized for internal consumption, approx. 2023 LKL of this is utilized for industrial use (46%), approx. 951.1 LKL for domestic use by the project (22%) and balance 1431.4 LKL for other uses (rainwater harvesting and feed to pit head thermal power plant (32%).

7.6 Supply for Community Use

Of the total available mine water from all coal companies, approx. 2617.2 LKL is available for community use, which accounts for approx. 26.3 percent of the net mine water available. Of the mine water made available for community use, approx. 576 LKL is utilized for drinking/domestic purpose by community (22%), approx. 2015.2 LKL for irrigation purposes (77%) and balance 26 LKL (1%) for other miscellaneous uses.

7.7 Best Practices

The mine water offers good potential for pisciculture, water tourism apart from supplies to communities in meeting their various needs. It is suggested that long term action plan for mine water and mine void use should have integrated approach not only to cater to

industry/community need but also to ensure sustainable livelihood generation. In Bisrampur OCP, SECL, engagement of local women through self-help groups (SHGs) had a noteworthy contribution towards women empowerment. The efforts of CIL, NLCIL & SCCL towards water conservation are laudable.

7.8 Way Forward

During last few years, coal companies have enhanced mine water utilization significantly – particularly for the use of host community for domestic and irrigation purpose. However, some of the coal companies still have surplus mine water discharge and water in abandoned voids that may be put to gainful use after appropriate treatment as per requirement.

Keeping in view the availability of surplus mine water, a Vision Document was drawn by MOC in consultation of coal companies. As per the Vision Document, mine water utilization targets across coal companies for community use (domestic as well as irrigation) is 3500 LKL during FY 21-22, 4000 LKL during FY 22-23 and 4300 LKL during FY 23-24. With the available surplus mine water, coal companies need to draw out plans for achieving the Vision document targets of Mine Water Utilization. This aspect was deliberated in the MoC's SDC Review Meeting of 10.05.2021 and coal companies were advised to draw their Mine water utilization targets in line with MoC's Vision Document *(Reference – Minutes of MoC's SDC Review Meeting dated 10.05.2021).*

In addition, coal companies may also utilize the mine water available in abandoned voids, where possible, for community supply, especially from mine voids which are not currently being harnessed.

MCL has substantial volume of surplus mine water, but it cannot use it for community purpose due to restriction imposed in CTOs of mines as per which mines are not allowed to discharge mine water beyond mine boundary. In one of the MoC's SDC meeting this aspect was discussed in detail and MCL was directed to obtain exemption from the Zero Liquid Discharge (ZLD) condition stipulated in CTOs by SPCB, so that mine water can also be diverted for community use with sufficient irrigation potential *(Reference – Minutes of MoC's SDC Review Meeting dated 15.06.2021)*. If MCL obtains relaxation from State Government, the local community around mines will get hugely benefitted.

Targeted efforts will aid in maximizing mine water utilization so that communities may be benefitted and every drop of mine water can be harnessed efficiently.

****

Annexure - I

Mine Water Utilization Status Report – Format circulated to coal companies by MoC

Availability of mine water

Subsidiary	Area	Running mines					Abandoned/Closed Mines						Remarks
		Sl. No.	Name of mine , District and State	Coordinate of the mine (Recently taken)	Av. Discharge (LKL/Year)	Quality of water (pH, TDS, hardness, oil & grease, heavy metals etc.)	Sl. No.	Name of Mine/Void (District, State)	Coordinate of the water body (recently taken)	Estimated Volume of water (LKL)	Quality of water (pH, TDS, hardness, oil & grease, heavy metals etc.)	Status (In use/not in use/any other remarks	

Status of mine water utilization

Subsidiary	Area	Name of mine where MWU project is located	Type of mine (Running / Abandoned water logged)	Quantity break-up (lakh m3/year)												
				Mine Discharge	Total Mine Water Utilization within the project	Break-up of MWU within project						Total Mine water supplied outside project	Break-up of MWU outside project			Surplus Mine water discharged into natural streams
						Quantity of MW for industrial use (dust suppression, washing, workshop, plantation under project, etc.)				Quantity of MW for domestic / drinking use	Quantity for any other use		Quantity of MW used for domestic / drinking purpose by community	Quantity of MWU for irrigation /agriculture	Quantity of MW supplied for any other use (industrial supply or any other)	
				G+N+R	K+L+M	Dust Suppression	Plantation	Others	Total (H+I+J)			O+P+Q				

Status of mine water utilization (continued)

Subsidiary	Area	Name of mine where MWU project is located	Type of mine (Running / Abandoned water logged)	Other details								
				Mine Water Utilization for community use				Mine Water Utilization for agricultural use / irrigation			Mine water supplied for other outside usage (outside Industry/any other)	
				No. of villages/towns where drinking / domestic water is supplied	Name of village, DISTRICT, STATE	No. of beneficiaries (# of people)	Departmental / State Agency with whom MoU has been engaged for supply of water	Irrigation potential created (in acres) (@99 acre/LKL for CIL and SCCL) [Considering 3 irrigation cycles of 6.35 cm (2.5 inch) in a year and discounting for associated losses]	Irrigated land (actual in acres)	Departmental / State Agency with whom MoU has been signed/executed.	Name of Beneficiary industry/agency	Benefits derived

Status of mine water utilization (continued)

Subsidiary	Area	Name of mine where MWU project is located	Type of mine (Running / Abandoned water logged)	Separate Brief write-up to be provided for the following sections: (in word format)		
				Infrastructure Deployed	Quality of mine water	Best practices if any, with geotagged photographs
				Infrastructure Deployed w.r.t Mine Water Utilisation: 1) Mine Water Treatment Plant, 2) Water Treatment plant for domestic water supply within project, 3) Water treatment plant for domestic water supplied outside project for community use 4) Distribution network 5) Canal, ponds, pipes etc. for irrigation water Details to be covered: Treatment Process Type, Capacity, Year of Establishment/Scheduled year of completion, good quality photographs. (pl give details in Word format)	Must include: Latest report (in excel format) on water quality - (pH, TDS, hardness, oil & grease, heavy metals etc.as per effluent and drinking water standards) Date of Sampling and Agency involved in Analysis, frequency of monitoring.	1-2 page write-up