WATER AUDIT REPORT

As per the guidelines of CGWA

MINISTRY OF JAL SHAKTI

AT

Kathautia Coal Opencast Coal Mine, Hindalco Industries Limited

District Palamu, Jharkhand - 822123

BY

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ACKNOWLEDGMENT

PHDCCI places on record its sincere thanks to the Management of Hindalco Industries Limited for entrusting the task of conducting Water Audit assignment at District Palamu, Kathautia Coal Mine in line with CGWA Notification dated 24/09/2020.

We are grateful to Mr. Arunabha Duari – Deputy General Manager, Geology and Planning for his continuous support and guidance during the execution of the assignment. We also extend our sincere thanks to Mr. Kala Chand Modak for their full-fledged support in execution of the assignment.

PHDCCI Audit Team is especially thankful to the environment management cell of Hindalco Industries Limited for their keen interest in the water audit and the wholehearted support and cooperation during the conduct of the field study, without which the study would not have steered to its successful completion.

It is well worthy to mention that the efforts being taken and the enthusiasm shown by all the personnel towards water and energy conservation are really admirable.

PHD Chamber of Commerce and Industry

Dr. Ranjeet Mehta
Deputy Secretary General, PHDCCI

CERTIFICATE

We certify the following:

- The report is based on the data collected at site during Audit and information provided by the Hindalco Industries Ltd.
- The data collection has been carried out diligently and truthfully.
- All data measuring devices used by the team are in good working condition but not been calibrated as per site officials, however tampering of such devices has not occurred (physically verified).
- All reasonable professional skill, care and diligence have been taken in preparing the water audit report and the contents thereof are a true representation of the facts and figures.

PHD Chamber of Commerce and Industry

Dr. Ranjeet Mehta
Deputy Secretary General, PHDCCI

ABBREVIATIONS

A	Ampere
AC	Alternating Current
Avg.	Average
CGWA	Central Ground Water Authority
CGWB	Central Ground Water Board
CWC	Central Water Commission
KL	Kilo Litre
KV	Kilo Volt
kVA	Kilo Volt Ampere
KVAr	Kilo Volt Ampere Reactive
kW	Kilo Watts
kWh	Kilo Watt Hour
Lit	Litres
LPCD	Litre Per Capita per Day
M or m	Meter
Max.	Maximum
mbgl	meters below ground level
Min.	Minimum
MT	Metric Ton
No.	Number
PF	Power Factor
RO	Reverse Osmosis
LPS	Low Pressure Switch
HPS	High Pressure Switch
ETP	Effluent Treatment Plant
V	Voltage
WDS	Water distribution station.
WTP	Water Treatment Plant
RWH	Rain Water harvesting
HIL	Hindalco Industries Limited

EXECUTIVE SUMMARY

This report is an attempt of PHDCCI to provide an overview of the water distribution system and water usage at Kathautia Open Cast Coal Mine, Hindalco Industries Limited, Palamu, Jharkhand. The report also highlights the major water sources, consumption area, wastewater treatment facilities and available water saving opportunities in the mine. A set of recommendations which will assist in improving water efficiency has also been highlighted in this report. This report has emerged after a detailed water audit conducted by PHDCCI in Kathautia Open Cast Coal Mine, HIL from 23rd January 2021 to 24th January 2021

<table>
<tr><td colspan="2">Project Title:</td><td>PHDCCI Report Number:</td></tr>
<tr><td colspan="2">Water Audit at Kathautia Open Cast Coal Mine, Hindalco Industries Limited, Palamu (Jharkhand)</td><td>2020/Water Audit/PHDCCI/30</td></tr>
<tr><td colspan="3">Client:</td></tr>
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<tr><td colspan="2">Date of Audit:</td><td>Source of Water:</td></tr>
<tr><td colspan="2">23/01/2021- 24/01/2021</td><td>Mine dewater
Ground water from Bore well</td></tr>
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Kathautia Open Cast Coal Mine (hereafter KOCCM, owned by Hindalco Industries Limited, is an Opencast Coal Mine. Main process areas involve Coal Mining and Coal Transportation at site. The Kathautia Coal Block is located in Kathautia village, Post Office Naudiha, Block – Patan, Tehsil Pandwa in Palamu District of Jharkhand. The site is accessible by all-weather roads from Ranchi via Latehar through NH-75. The Coal Block is located at a distance of approximately 178Km from Ranchi City and adjacent to NH-75. Water extracted from mine and bore-wells at site is being consumed for dust suppression, watering in afforested area, machine/vehicle washing domestic consumption in office area at site, gardening and supplied to nearby villages for domestic use. There are 4 mining sites available at mine area of KOCCM. The 4 mining sites are known as PIT A, PIT B, PIT C and PIT D. The mining is on-going only in PIT B as observed during audit whereas the PIT A, PIT C is not in operation as mining activity is on hold due to paucity of land. The PIT D acts as a reservoir for collecting mine water received from PIT B. The water from PIT D is used in Dust Suppression, Plantation and also supply to nearby villages for other than drinking purpose. The site is also having three (3) operational bore-wells out of which two (2) bore-wells are using for extracting ground water for domestic purpose in site office area, machine/vehicle washing and also supply water to nearby villages. One (1) bore-well is used to install PIEZOMETER at site.

Currently, the Kathautia Coal Mine is having consent to withdraw 300 m^3/day of total ground water through bore-well. The KCM is also having consent to collect mine seepage water generated during mining in the tune of 297 m^3/day. The mine water pumped from mining area is collected in PIT D reservoir with the help of two (2) centrifugal pumps. The audit team has conducted the measurement activity for flow and power to calculate per day actual withdrawal and efficiency of source pumps at Kathautia Open Cast Coal Mine intake.

During audit, 78.64 m^3/day of water has been withdrawn from mining area through existing one (1) dewatering structures, which is not more than the existing CGWA NOC of 297 m^3/day. The reported quantity is including precipitation, surface run off and seepage which accumulates in mine sump. Dust Suppression, Plantation and also supply to nearby villages for other than drinking purpose.

Total 3.20 m^3/day of water has been withdrawn through the two (2) bore-well available at the site, this water is consumed by surrounding villagers (drinking water), machine washing point and water use for drinking purpose after treating inside the mine area.

The site is also having one RO plant with two pump (one working and one standby) of 2.5 m^3/hour has been installed at the site for the purpose of getting drinking water for office. During audit it was noticed that approx. 0.5 KLD water has been treated by this RO plant.

As per CGWA NOC the Hindalco Industries Ltd. has to implement groundwater recharge measures to the tune of 15,91,071 m^3/year. Therefore, Hindalco Industries Ltd. has constructed/converted 5 recharge structures which includes Pit - D, Pit - C, Naranhara, 2 Ground Water Recharge structure at Pit A. As per assessment of the audit team the Hindalco Industries Ltd. has recharged 20,00,000 m^3 /annum of rain water in a year which is more than the target. The buffer zone of the proposed coal block of Kathautia Coal Mine i.e. the area with 10 km radius from the proposed site falls in Patan, Bishrampur, Chainpur and Daltonganj Block of Palamau District. Availability of ground water resources of these four blocks have been estimated based on norms recommended by CGWB- Mid Eastern Region on "Dynamic Ground Water Resources of Jharkhand 2011". These blocks have been categorized as safe by Central ground Water Board, Govt. of India depending upon water table behavior and stage of ground water development.

During audit, Water Balance of Kathautia Open Cast Coal Mine has been prepared. The major water consuming area is dust suppression (spraying) and plantation which account 79% water of total consumption and water usage surrounding villages which account 19% water of total consumption and machine washing which account 1% water of total consumption and water usage inside mine (drinking purpose) which accounts 1% of total consumption.

The audit team has checked and verified all the water quality test reports of ground and mine water. All of the reports comply with the environmental factors related to water uses and discharge. (Attached separately in annexure).

As per CGWA NOC the Hindalco Industries Ltd. has to install piezometers and Hindalco Industries Ltd. has provided one (1) portable piezometers. Monthly water level data is being monitored and annually submitted to CGWB.

The cost of ETP treated water is Rs. 70/KL.

Given the above scenario of prevailing resource challenge, accelerating over time Progressive Management of Hindalco Industries Ltd. is very keen to do water audit of premises. To get benefit of water saving projects, management of Hindalco Industries Ltd. awarded the task of water audit of its Kathautia Open Cast Coal Mine to PHDCCI.

Analog flow meters are installed in the pump available at Pit B and bore-well 1 & bore-well 2. Calibration of the same is not carried out by the site.

The Audit is focused on improving water usage efficiency and identifying water Conservation opportunities. Accordingly, the field study and data collection for the said water audit was carried out by the PHDCCI Audit team. This report discusses the water balance and various water saving options derived on the basis of observation made, data collected and their analysis. The summary of water audit are presented below which shows the water savings opportunities:

- Reducing the amount of water loss through evaporation in reservoirs.

Sl. No.	Zone	Location	Type	Approx. surface Area (m2)	Average depth (m)	Storage capacity (m3)	Evaporation and seepage loss/year
1	Core	Near office	Reservoir	53,500	3	1,60,500	53,500
2	Core	Pit D	Mine Pit	1,81,900	20	36,38,000	1,81,900
	Total			**2,35,400**		**37,98,500**	**2,35,400**

*Estimated loss based on a 1 Meter Evaporation from each reservoir on Annual Basis.

There is a Seepage and Evaporation loss from ponds to the tune of 235400 cubic meter /Anum which results in pumping of extra water more than required for the process.

CHAPTER 1

Introduction

1. INTRODUCTION

Human activities consume and pollute lot of water. At a global scale, most of the water use occurs in agricultural production, but there are also substantial water volumes consumed and polluted in the industrial and domestic sectors (WWAP, 2009).

Global changes like population growth, climate variability, ever-expanding industrialization and urbanization — often combined with pollution — severely affect water availability and lead to chronic water shortages in a growing number of regions. India has been successful in the past to meet such water requirements for different usages with a phenomenal development of water resources. However, preserving the quality and availability of fresh water resources has now become a pressing environment challenge.

Water is an essential precondition for life, and according to the UN it is a human right to have access to clean water. However, in India millions of people are living without direct access to safe water and based on the rapid population growth coupled with the fact that the water reserve is finite, it will be a very valuable and scarce resource within only a few years. In this light, there is an urgent need for decision makers to act in order to improve the conditions for effective use and supply of water to the Indian people now and in the future.

Under the Indian Constitution and in our federal democratic set up drinking water comes within the domain of the State Governments (Provincial Governments). In fact, the 73rd Constitutional Amendment has gone a step forward. It mandates that responsibility for drinking water and sanitation services should be with Local Governments. Various States in India are at different stages of giving effect to this Constitutional mandate.

The Ministry of Urban Development has formulated Service Level Benchmarks (SLBs) in 2008 and circulated the same to the States for adoption. The SLBs include water conservation and management practices such as continuous water supply, 100% metering of water supply, sustainable tariffs and reduction in leakages to a level of 15% to 20%.

The National Water Policy – 2012 focuses on the need for publishing water accounts and water audit reports indicating leakages and pilferages. The policy recommends systems to evolve benchmarks for water uses for different purposes, i.e., water footprints, and water auditing to ensure efficient use of water.

National Water Mission (NWM) has been established by the Government of India with the objective of "conservation of water, minimizing wastage and ensuring its more equitable distribution both across and within States through integrated water resources development and management".
The Government of India has also launched a Centrally Sponsored Scheme for Repair, Renovation and Restoration (RRR) of water bodies, which has multiple objectives like comprehensive

improvement and restoration of water bodies thereby increasing tank storage capacity, improved water use efficiency and increased availability of drinking water.

With its continuously declining per capita water availability (from about 5,177 m3 in 1951 to 1,654 m3 in 2007), India stands water stressed and is close to being categorized 'water scarce'. Water demand in India is expected to grow annually by 2.8 per cent to reach 1,500 bcm (by 2030) while the current supply is only about half (viz., 744 bcm). The Government of India, in its Intended Nationally Determined Contribution (INDC) submitted to UN Framework Convention on Climate Change (UNFCCC) in October, 2015, has committed to improve the water use efficiency by 20%, through regulatory mechanisms with differential entitlements and pricing. It further emphasizes the need to focus on integrated water resource management through water conservation, wastewater minimization, etc.

The notification dated 24/09/2020 from CGWA All industries abstracting ground water in excess of 100 m3/day shall be required to undertake annual water audit through CII/FICCI/NPC/PHDCCI certified auditors and submit water audit reports within three months of completion of the same to CGWA.

Water audit is an effective management tool for minimizing losses, optimizing various uses and thus enabling considerable conservation of water. Thus, Hindalco Industries Ltd. has entrusted PHDCCI for conducting water audit in the Kathautia Open Cast Coal Mine premises.

This report discusses the existing water scenario at Kathautia Open Cast Coal Mine, Hindalco Industries Ltd. Palamu, Jharkhand and its potential water savings and how the basic water audit approach has been applied to water conservation in line with the guidelines of CGWA.

1.1 RATIONALE FOR WATER AUDIT

Water audit determines the amount of water lost from the water network/distribution system due to seepage, evaporation/leakage and other reasons such as theft, unauthorized or illegal withdrawals from the systems. Water audit improves the knowledge and documentation of the distribution system, and better understanding of what is happening to the water after it leaves the source point. Comprehensive water audit gives a detailed profile of the distribution system and water users, thereby facilitating easier and effective management of the resources with improved reliability. It helps in correct diagnosis of the problems faced in order to suggest optimum solutions. This leads to reduced water losses; improved financial performance; improved reliability of supply system; enhanced knowledge of the distribution; efficient use of existing supplies; better safeguard to public health and property; improved public relations; reduced legal liability and reduced disruption etc. thereby improving level of service to customers. It is thus an effective tool for realistic understanding and assessment of the present performance level and efficiency of the service and the adaptability of the system for future expansion & rectification of faults during modernization.

1.2 STEPS OF WATER AUDIT

Water Audit includes water supply and usage study, process study, system audit, discharge analysis and preparation of water audit report.

1.2.1 Water Supply and Usage Study

Water audit comprises preparation of layout of water sources, distribution network, and service/delivery points to water users and return flow of waste or excess water. The layout should contain locations and capacities of flow measurement devices installed at key points, sizes of different channels, and fittings in the water supply system, locations and particulars of flow control devices and history sheets of all measuring and control devices including pipes and fittings etc.

PHDCCI has carried out the water supply and usage study at Kathautia Open Cast Coal Mine of Hindalco Industries Ltd. to understand the present water utilization pattern and projecting future requirement. PHDCCI also carried out a review of sustainable sources of water through rainwater harvesting and possible wastewater recycling at Kathautia Open Cast Coal Mine, Hindalco Industries Ltd.

1.2.2 Process Study

Flow measurement devices were installed at all strategic points to calculate the water consumption at Kathautia Coal Mine, Hindalco Industries Ltd. in various activities such as supply to the workshop, dust suppression, plantation, office buildings, canteens, lunch rooms, toilets and administrative building.

Water quality of the distribution system needs to be monitored regularly at strategic points to find out the level and nature of contaminants present in the supplied water. The Hindalco Industries Ltd. has conducted the water quality test reports for raw water. Audit team reviewed all test reports and found acceptable as the results are in compliance to various standards as required by SPCB.

PHDCCI has carried out flow, pressure and power measurement of all RO plants, ETP inlet and Outlet to calculate the total water supplied to the different areas of the mine to understand the quantity of water received from ground and feed to the usage area. Premises has been designed as zero discharge unit with recycling of treated water for various use.

1.2.3 System Audit

The current water usages and systems for water use under various sectors such as buildings, plantation, dust suppression, domestic water supply, canteen and others need to be studied to check their operational efficiency and level of maintenance. The scope for any modification or up-

gradation will depend on the status of existing systems. Measurement methodology from the intake point of the system through various sub-systems to the ultimate user points needs to be verified periodically for its suitability, efficiency and accuracy. Bulk metering should be done at the source for zones, districts, etc. and revenue metering for consumers. This will help in identifying the reaches of undue water wastage. The domestic wastewater return flows from canteen, bathroom and effluents from the ETP needs to be studied for conformity to environment standards, possibility of recovery of valuable by-products and the opportunity for recycling of waste water (which is happening at present).

PHDCCI has carried out physical inspection of water distribution network/system of pump house, supply to various areas of the mine, Gardening and horticulture, Effluent Treatment Plant, Lunch Rooms to get their per day drinking and sanitary water consumption to arrive at per capita water consumption in Kathautia Open Cast Coal Mine, Hindalco Industries Ltd.

1.2.4 Water Audit Report

A water audit can be accomplished on the basis of water allotted for a service and water actually utilized for that service. After assessing the loss of water and the efficiency of the system, steps needed for utilization of recoverable water loss and reuse may be listed.
An effective water audit report may be purposeful in detection of water losses and improve efficiency of the system. Water audit of the system should be undertaken at regular intervals, at least on an annual basis.
PHDCCI water audit report explains the losses of water in system and various management approaches for Kathautia Open Cast Coal Mine, Hindalco Industries Ltd.

1.3 Brief Description about the plant:
Kathautia Open cast Coal Mine, a captive coal mine of Hindalco Industries Ltd. is located in the Palamu district of Jharkhand state. The coal block is located at a distance of approximately 178 Kms from Ranchi City and adjacent to NH-75.

The geological formation of the Palamu district comprise mainly rocks of Archaean, Vindhyan and Gondwana ages, the last cut by dykes of Deccan trap age. The Archaean rocks include both schists of Dharwar age and gneisses and granites. The schist, mainly horn-blendic and biotitic, are the oldest rocks of the area and occur as parallel and lenticular bands in the gneisses. The schist are intruded by epidiorites, amphibolites, and gneisses. Garnetiferous sillimanite-graphiteschists, similar to the Khondalites, also occur near Daltonganj and Latehar. Smaller patches of these rock are found in the manner of inclusions in the most prevalent and the biotite and sillimanite schist are rare. The working area of this coal mine is mainly restricted within sedimentary rocks of Karharbari Formation of Gondwana age. Mainly, soil, soft and hard sandstone, carbonaceous shale, siltstone and shale with coal seams are present in the rock stratigraphy.

The coal mining activity comprises of different stages of development and mining. The initial work starts with exploration, topographic mapping and surveying followed by Geological Modelling through software which clearly defines the 3D disposition of different rocks and their geometrical variations in 3D space. The quality modeling of coal seams indicates the economical parameters of mining activity. Resource and Reserve are calculated from the Geological Model after optimization through software. A complete project report is prepared and gets approved from all concerned authority. All the statutory clearances and permissions are taken before the mining activity actually starts. The typical operation flow chart is shown below. The coal mined is sent to Mahan Power Plant for captive use.

Figure 1: Process flow chart, Kathautia Coal Mine, Hindalco Industries Ltd.

CHAPTER 2

Scope of Work

2. SCOPE OF WORK

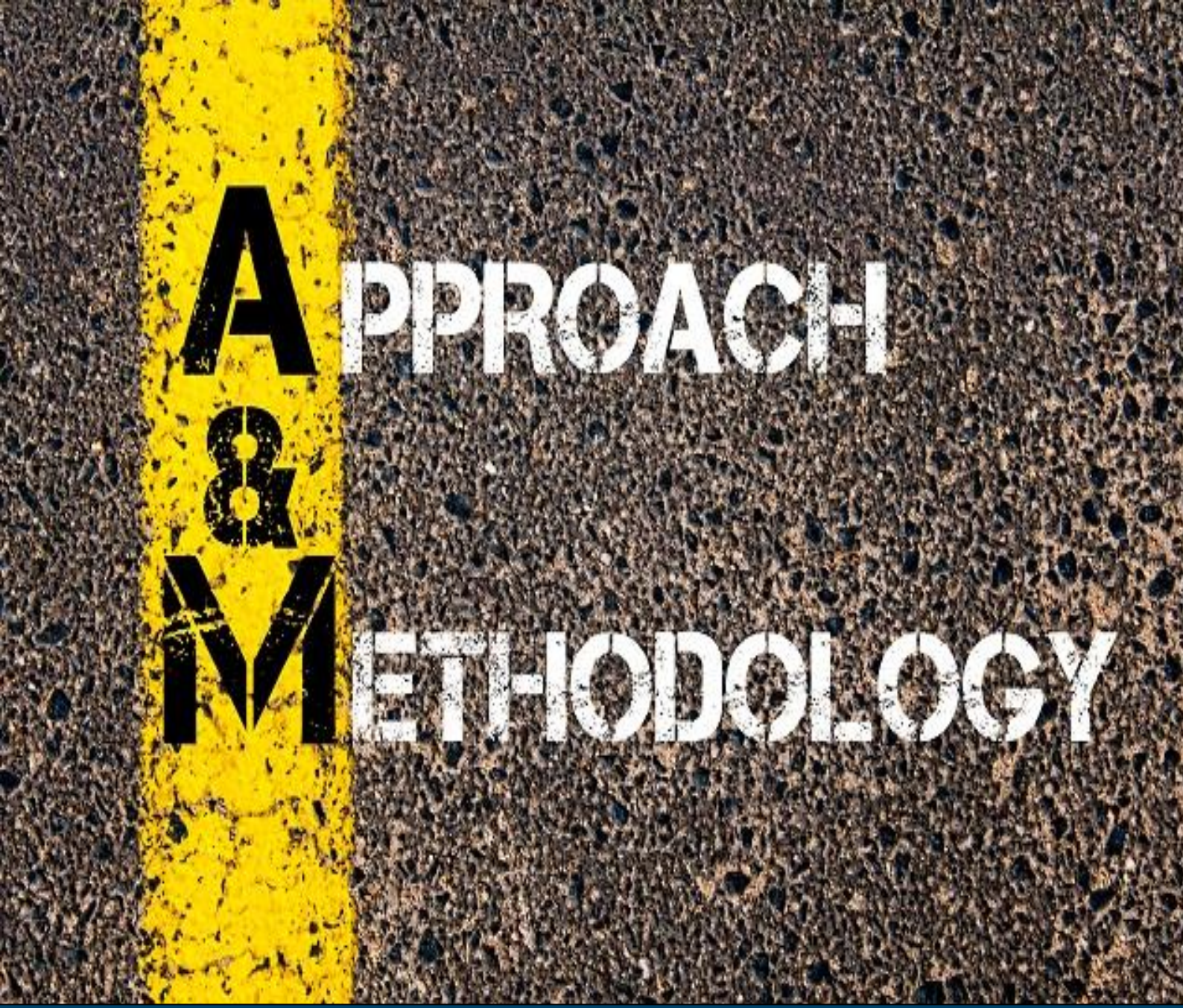
The main objective of the study was to identify the water uses & water saving opportunities and to demonstrate water conservation at Kathautia Coal Mine, Hindalco Industries Ltd. Scope of work of the study includes the following:

- Water system analysis
- Quantification of baseline water map
- Monitoring and measurements using pressure and flow meters and various other devices
- Quantification of inefficiencies and leaks
- Quantification of water quality loads and discharges
- Quantification of variability in flows and quality parameters
- Strategies for water treatment and reuse or direct use
- Water balance of the whole System
- Mapping of Water quality requirement at various user areas

The detailed water audit report contains the following:

- Water consumption and wastewater generation pattern
- Specific water use and conservation
- Complete water balance of the facility
- Water saving opportunities
- Method of implementing the proposals
- Full description and figures
- Investment required
- Assessment of existing water sources and actual water consumption of the Plant.
- Identify the loss of water if any during transit and water distribution network and provide suggestion to eliminate these water losses.
- Identify the opportunities to reduce the water consumption by various activities and to establish specific water consumption in the premises.
- To study the performance of existing water circulating pumps/motors and recommend energy and water fixtures.
- Assessment of adequacy and efficacy of existing treatment system and recommend feasible technological option for treatment of water and waste water.
- Identify the loss of water if any during transit and to provide suggestions to eliminate the losses.
- To analyze areas of water conservation, waste water generation and recycle.
- Preparation of detailed water balance schematic diagram.
- Evolve techno-economic feasible solutions for recommended measure for implementation along with annual financial savings/payback periods.

PHDCCI has been entrusted to conduct Water Audit of Kathautia Open Cast Coal Mine, Hindalco Industries Ltd. In determining the water audit scope, PHDCCI has considered the extent and boundaries of the Installations. This report aims at portraying the water audit details and the outcome along with recommendations for the Company.



CHAPTER 3

Methodology of the Study

3. METHODOLOGY OF THE STUDY

The following step by step methodology and approach were adopted while carrying out the Water Audit at Hindalco Industries Ltd. PHDCCI team visited Kathautia Open Cast Coal Mine, Hindalco Industries Ltd. from 23rd January 2021 and 24th January 2021 for the field measurement and conducting the audit. The broad methodology adopted for the Water Audit of Kathautia Open Cast Coal Mine, Hindalco Industries Ltd. is furnished below.

Preliminary discussions with mine personnel and observations in all water consuming areas.

- Data collection through discussions, past records, specifications.
- Field studies in each of the areas involving:
  - Performance trials.
  - Measurement of flow parameters, pressure, power wherever possible using portable instruments such as ultrasonic flowmeter, pressure gauge and power analyser.
- Identification of water conservation options on short, medium & long terms.
- Identification of Investment grade projects in the plant for detailed analysis towards implementation
- Preparation, discussion and submission of report to the management.

The study focused on improving water use efficiency and identifying water saving opportunities. The analysis included simple payback calculations where investments are required to be made to implement recommendations, to establish their economic viability.

The audit study made use of various portable instruments for carrying out various measurements and analyses. PHDCCI has a wide array of latest, sophisticated, portable, diagnostic and measuring instruments to support our energy audit investigations and analyses. The specialized instruments that were used during the water audit include:

- Ultrasonic water flow meter
- Thermo couples & Indicators
- Pressure Gauge
- Power analyser

During the audit, there was continuous interaction between the audit team and facility personnel, to ensure that the suggestions made are realistic, practical and implementable to allow for possible concurrent implementation.

The broad methodology adopted for the Water Audit at Kathautia Open Cast Coal Mine, Hindalco Industries Ltd. is furnished below.

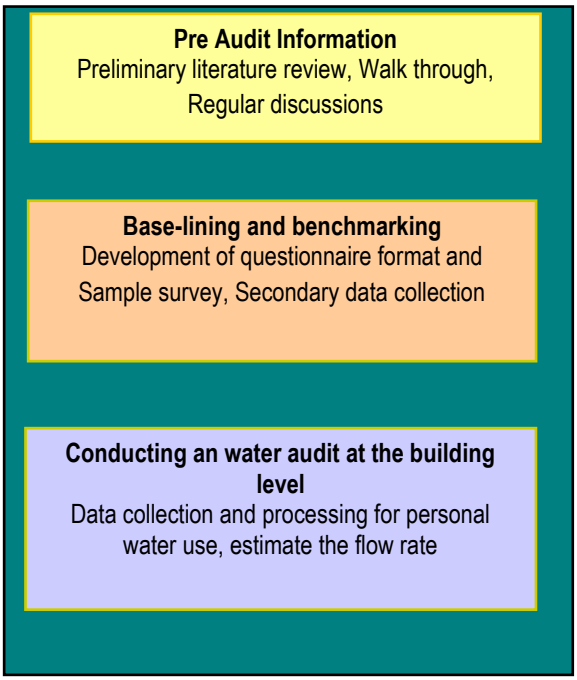
3.1 Pre Audit Information

- Preliminary literature review of concepts and methodologies related to water audit for utility, facilities and households.
- Walk through the entire mine, water receiving pump stations, building to understand the nature of water uses and the systems installed in the building.
- Discussion with the administrative officers, pump operators, ETP/STP staff, housekeeping and kitchen employees on the various water uses during the day and the source of water.

3.2 Establishing baseline and benchmarking

The water audit for Kathautia Open Cast Coal Mine, Hindalco Industries Ltd. included both primary and secondary data collection for various identified water uses. Primary data collection included the following components:

- Development of questionnaire format for individual water use, gardening etc.
- Sample survey of Kathautia Open cast Coal Mine, Hindalco Industries Ltd. office staff to estimate individual water consumption on sanitary and drinking purposes based on questionnaire format.
- Flow rate calculation from the taps flow rates and number of all water using fixtures/ equipment was also undertaken.
- Secondary data collection included compilation of number of staff along with their duration of stay.
- Collecting records of water pumped to the overhead and underground tanks and average running hours of all pumps etc. to estimate actual supply.



3.3 Conducting a water audit at the Mine Level

- The data collection and processing for personal water use including domestic purpose (canteen, office etc.) on the basis of actual consumption.
- As part of the survey, treated waste water in ETP and supply to plantation, dust suppression and horticulture was also carried out.
- The data for all the above uses was calculated for varying time period for Kathautia Coal Mine, Hindalco Industries Ltd. to calculate per capita use.

WATER USE IT WISELY®

CHAPTER 4

Assessment of Water Usage

4. ASSESSMENT OF PRESENT WATER USAGE

4.1. MINE WATER CONSUMPTION TRENDS (LAST 3 YEARS)

The source of water to the mine is through Mine dewatering structure, Rain Water Harvesting Structure and through bore well. Water used for plantation and dust suppression is taken from water stored in Surface reservoir (Pit- D) which intern holds water from rain water and settled down mined out water from Pit A, B and C. The same water is also used for domestic use in nearby village other than drinking purposes. To make the water suitable for use for drinking purposes, the water is treated at RO Plant in mine.

Bore well water & Rain water after extraction is supplied to various areas such as RO Plants for treatment, ETP in workshop area, Domestic consumption such as washing, etc. The ground water withdrawal and consumption pattern for three years from bore-wells at all the consumption areas are shown below tables:

Table 1: Water Withdrawal and Consumption for FY 2018-19

Year	Month	Source (KL)	Consumption (KL)	Discharge (KL)
2018-19	April	62	62	0
	May	31	31	0
	June	32	32	0
	July	31	31	0
	August	42	42	0
	September	43	43	0
	October	66	66	0
	November	69	69	0
	December	63	63	0
	January	56	56	0
	February	53	53	0
	March	99	99	0
		647	**647**	**0**

Table 2: Water Withdrawal and Consumption for FY 2019-20

Year	Month	Source (KL)	Consumption (KL)	Discharge (KL)
2019-20	April	26	26	0
	May	0	0	0
	June	0	0	0
	July	52	52	0
	August	178	178	0
	September	153	153	0
	October	138	138	0
	November	121	121	0
	December	79	79	0

Year	Month	Source (KL)	Consumption (KL)	Discharge (KL)
	January	35	35	0
	February	15	15	0
	March	62	62	0
Total		**859**	**859**	**0**

Table 3: Water Withdrawal and Consumption for FY 2020-21

Year	Month	Source (KL)	Consumption (KL)	Discharge (KL)
2020-21	April	70	70	0
	May	87	87	0
	June	97	97	0
	July	99	99	0
	August	100	100	0
	September	106	106	0
	October	103	103	0
	November	82	82	0
	December	79	79	0
Total		**823**	**823**	**0**

Note: Since FY 2020-21 is still on-going so the data from April, 2020 to December, 2020 is provided for total consumption. All data is sourced from company data.

4.2. WATER SOURCES

The main source of drinking and other water usage at Kathautia Open Cast Coal Mine, Hindalco Industries Ltd. is water received from mine water, reservoir located in Pit D area and two number of bore-well. The rain water harvesting structures as well as mining pits converted in RWH structures in the campus is used for water consumption as well as to recharge ground water. The details of pumps, mine pits and reservoirs are as below:

Table 4: Details of Mine pits and reservoirs

Sl. No.	Zone	Location	Type	Approx. surface Area (m2)	Average depth (m)	Storage capacity (m3)
1	Core	Near office	Reservoir	53,500	3	1,60,500
2	Core	Pit D	Mine Pit	1,81,900	20	36,38,000
	Total			**2,35,400**		**37,98,500**

Table 5: Status of Pumps Available at Water Management

S. N.	Location	Application	Pump No.	Type	Head (mtr)	Motor (HP)	LPM

1	Pit B	Pit B to Pit D	1	Centrifugal	80	100	3700
2			2	Centrifugal	100	215	1200

S. No.	Location	Make/ Model	Capacity (m3/hrs)	Speed (RPM)	Rated Flow (m3/hr)	Rated Head (meter)	Rated Power (kW)	Bore Dia (Inch)	Per Day Running Hours
1	Borewell-1	Toshniwal	3	1500	0.75	40	2.24	3	4
2	Borewell-2	Toshniwal	3	1500	0.75	40	2.24	3	4

4.3. WATER SUPPLY & DISTRIBUTION DETAILS

A water network diagram provides a schematic (simplified) representation of facility's water distribution system from the water or point of entry (to the facility) to points of water consumption. In Kathautia Coal Mine, Hindalco Industries Limited there are total 4 nos. of dewatering structures established in four (4) mine sumps for water withdrawal out of which presently one (1) structures (Pit B) is operational and fitted with water flow meters. Pit A and Pit C are non-operational and Pit D acts as a reservoir presently. The Water from the dewatering structure used to supply for the purpose of dust suppression, plantation and serves the purpose of water consumption to the surrounding villages for other than drinking purposes as well.

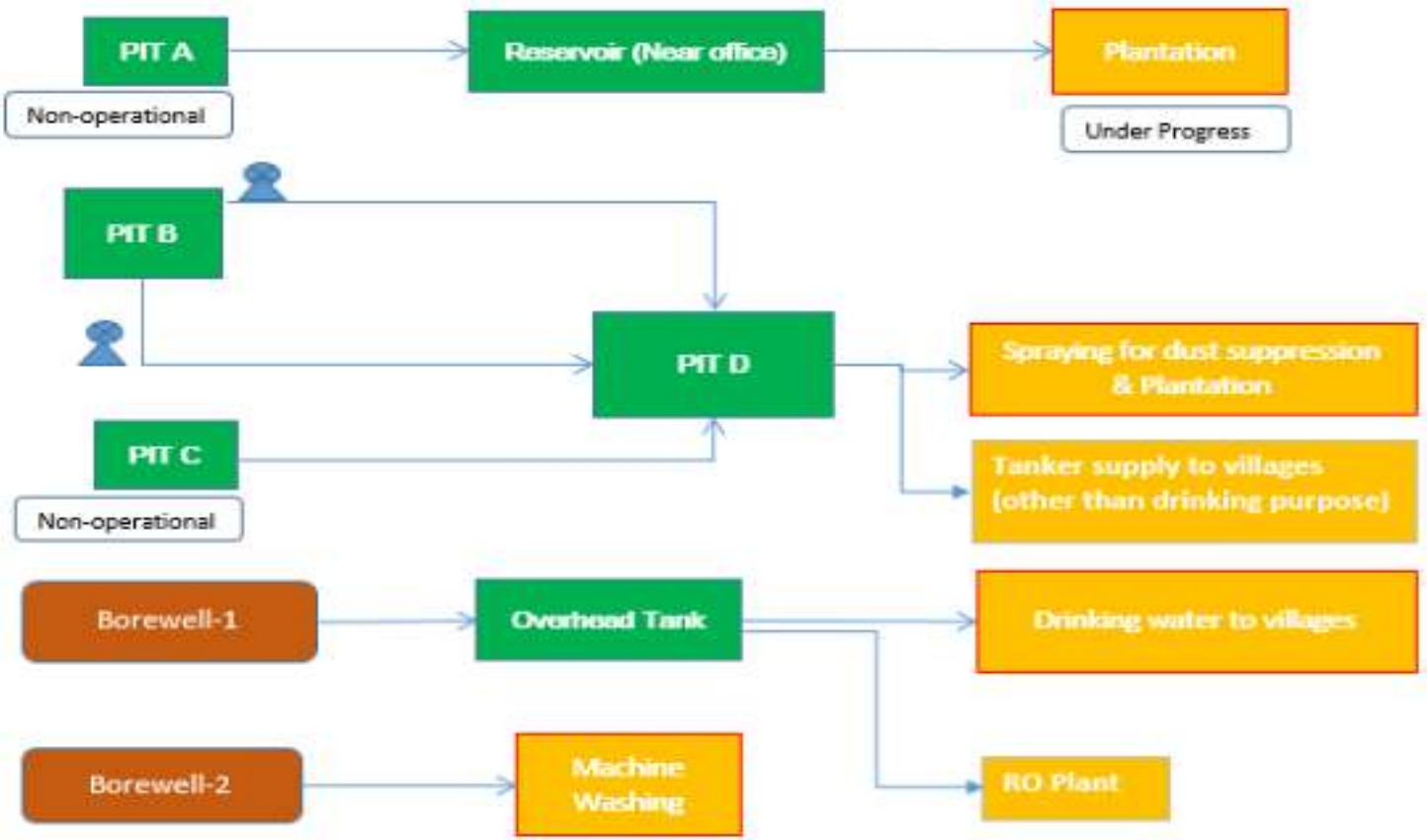


Figure 2: Water Distribution network, Hindalco Industries Limited

4.4. WATER BALANCE

The assessment team has reviewed the water supply and consumption as well as the losses in the water distribution network at Kathautia Open Cast Coal Mine. Based on the month wise data collected of financial year 2019-2020 source, consumption and discharge, the water balance diagram of the system is given in below table and figure:

Table 6: Water balance table

Sr. No.	Detail	Quantity (KLD)
1	Water extracted from Pit B (Mine Water)	78.64
2	Water extracted from Bore-well 1 (Ground Water)	2.35
3	Water extracted from Bore-well 2 (Ground Water)	0.84
4	Total extracted water	81.84
5	Water consumption in spraying (Dust suppression) & plantation	64.06
6	Water usage for surrounding villages (Other than drinking purpose) (Mine water)	14.91
7	Water use surrounding villages (Drinking purpose) (Ground water)	0.85
8	Machine Washing Point	0.84
9	Water use within Mine	0.85
10	Total consumed water	81.52
11	Discharge from RO plant	0.23
12	Leakage & Unmetered Losses	0.10
13	Difference between source, consumption & discharge	0.00

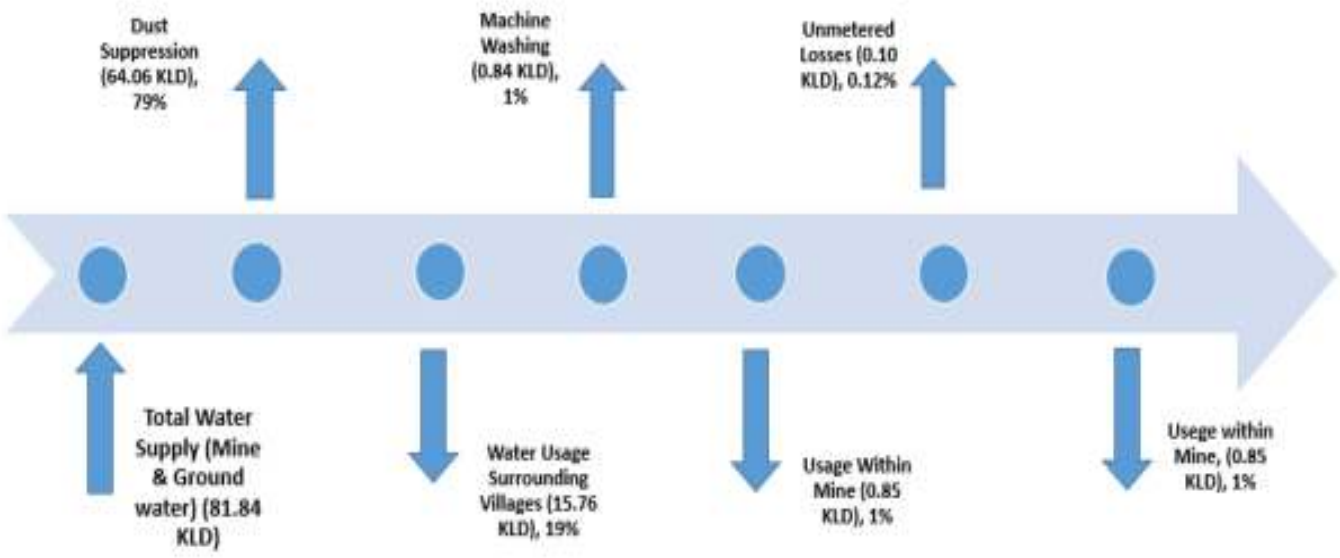


Figure 3: Water Balance Diagram, Hindalco Industries Limited

It is evident from the above water balance diagram is that major water consuming area is dust suppression (spraying) and watering in plantation which account 79% water consumption and water usage in surrounding villages which account 19% water consumption and machine washing which account 1% water consumption and water usage inside mine for drinking purpose which accounts 1% of total water consumption.

Water Metering & Monitoring System

Monitoring is the most important prerequisite for efficient water management. Thus, in the water supply network, it is necessary to have a robust system of monitoring. During the audit, the available flow meters were identified, and their working conditions were checked.

Table 7: Source of water & their metering status

Source	Quantity (M3/Day)	Metered (Yes/No)	Area of Feeding	Amount Paid (INR)
Municipal Water	0	NA	NA	NA
Supply Water	0	NA	NA	NA
Tanker Water	0	NA	NA	NA
Water from RWH Tank	82	NA	Rain water, ground water & Mine	NA
Other source (Bore-well & Mine)		Yes		NA

During audit, 78.64 m^3/day of water has been withdrawn through existing one (1) dewatering structures which is used for plantation and spraying for dust suppression, which is not more than the existing CGWA NOC of 297 m^3/day. The reported quantity is including precipitation, surface run off and seepage which accumulates in mine pits, the extracted quantity of mine water from Pit B is being transferred to the other pit (Pit D), which acts as a reservoir presently, the mine water is being consumed in the process of dust suppression and water supply to surrounding villagers. Total 3.20 m^3/day of water has been withdrawn through the two (2) bore-well available at the site, this water has been consumed by surrounding villagers (drinking water), machine washing point and water use for drinking purpose after treating inside the mine area.

The break-up for water consumption in different area is provided in below tables and bar charts:

Table 8: Area Wise Water Consumption in the Plant

Area of Water Consumption	Quantity (KLD)	Percentage (%)
Water consumption in spraying (Dust suppression) & plantation	64.06	79%
Water usage for surrounding villages (Other than drinking purpose) (Mine water)	14.91	18%
Water use surrounding villages (Drinking purpose) (Ground water)	0.85	1%
Machine Washing Point	0.84	1%
Water use within Mine	0.85	1%

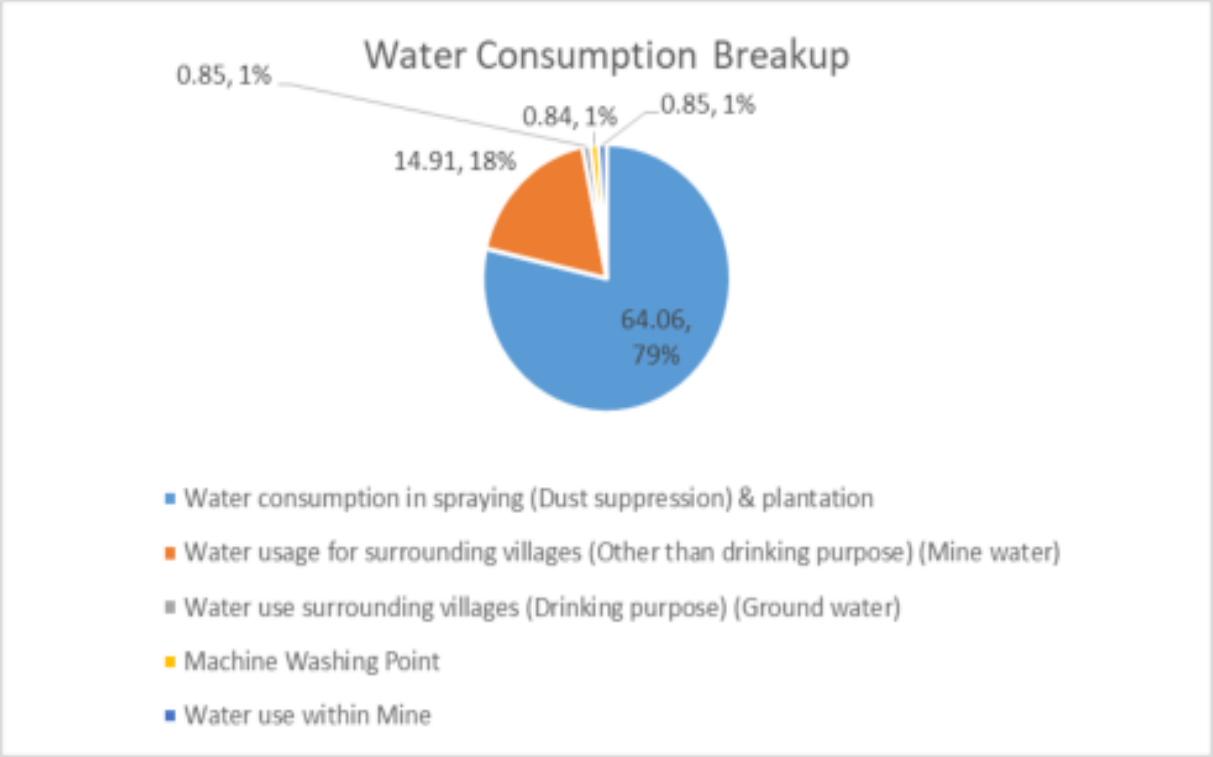


Figure 4: Breakup of Water Consumption

As evident from the area wise water consumption table and graph, the major water consumption area in the mine is Utility and domestic consumption.

Table 9: Total Raw Water Withdrawal for (2018-19)

Year	Month	Source (KL)
2018-19	April	62
	May	31
	June	32
	July	31
	August	42
	September	43
	October	66
	November	69
	December	63
	January	56
	February	53
	March	99
Total		**647**

Table 10: Total Raw Water Withdrawal for (2019-20)

Year	Month	Source (KL)

Year	Month	Source (KL)
2019-20	April	26
	May	0
	June	0
	July	52
	August	178
	September	153
	October	138
	November	121
	December	79
	January	35
	February	15
	March	62
Total		**859**

Table 11: Total Raw Water Withdrawal for (April 20- Dec. 2020)

Year	Month	Source (KL)
2020-21	April	70
	May	87
	June	97
	July	99
	August	100
	September	106
	October	103
	November	82
	December	79
	January	NA
	February	NA
	March	NA
Total		**823**

4.5. WATER SPECIFIC:

Water consumption in coal producing process is calculated in below table;

Table 12: Water consumption in coal production (KL/ton)

Month	Coal production (Ton)	Water Consumption (KL)	KL/Ton
Apr-19	0.00	4740	0
May-19	8967.67	5016	0.56
Jun-19	6780.05	3524	0.52
July,19	0.00	1832	0

Month	Coal production (Ton)	Water Consumption (KL)	KL/Ton
Aug-19	7932.74	1556	0.20
Sep-19	17010.83	1708	0.10
Oct-19	14180.30	1040	0.07
Nov-19	0.00	332	0
Dec-19	0.00	312	0
Jan-20	0.00	905	0
Feb-20	0.00	1598	0
Mar-20	0.00	819	0
Total	**54871.59**	**23382**	**0.43**

4.6. RECOMMENDATIONS:

- It is recommended to optimize water requirement for domestic use through water saving measures in urinals, canteens etc.
- Metering arrangements at all water withdrawal points shall be made and calibration certificates of the same shall be available.
- Only recycled water from domestic purpose shall be used for gardening thus reducing overall water requirement.

4.7. PUMP PERFORMANCE EVALUATION:

At Pit B, there were total two (2) pumps are installed to transfer the water to the Pit D of the facility, also there were two (2) bore-well pumps and two (2) pumps for RO plant installed at office area. Audit team has verified the rated parameter of each pump installed and measured the parameters of the pumps. The details are provided below:

Table 13: Rated parameters of pumps for mine water

S. N.	Location	Application	Pump No.	Type	Head (meter)	Motor (HP)	LPM
1	Pit B	Pit B to Pit D	1	Centrifugal	80	100	3700
2	Pit B	Pit B to Pit D	2	Centrifugal	100	215	1200

Table 14: Rated parameters of pumps for ground water

S. No.	Location	Make/ Model	Capacity (m3/hrs)	Speed (RPM)	Rated Flow (m3/hr)	Rated Head (meter)	Rated Power (kW)	Bore Dia (Inch)	Per Day Running Hours
1	Borewell-1	Toshniwal	3	1500	0.75	40	2.24	3	4
2	Borewell-2	Toshniwal	3	1500	0.75	40	2.24	3	4

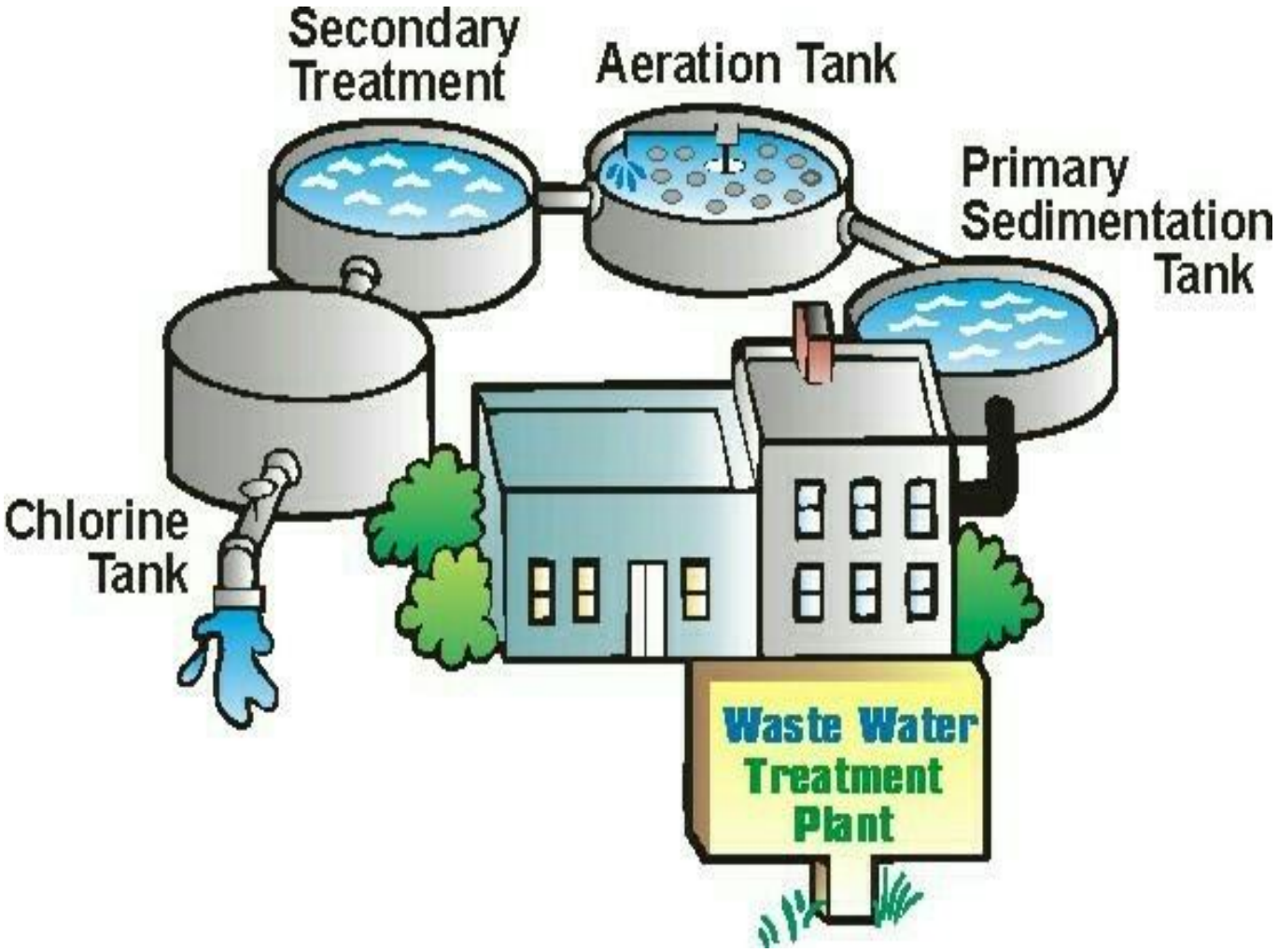
Table 15: Rated parameters of pumps at RO Plant

S. No.	Location	Operation	Speed (rpm)	Rated Flow (m3/Hr)	Rated Head (meter)	Rated Power (kW)	Motor efficiency (%)	Phase/ Voltage
1	RO Plant	Working	2780	2.5	98	1.5	76	Single/ 230
2	RO Plant	Stand by	2780	2.5	98	1.5	76	Single/ 230

Table 16: Measured parameters of pumps at Pit B

Parameters	Unit	Pump 1	Pump 2	Remarks
Rated Parameters				
Type		Centrifugal	Centrifugal	
Rated flow		222.00	222.00	
Rated head		80.00	80.00	
Motor Rating		75.00	75.00	
Operating practice		Individual operation	Individual operation	
Parameters measured				
Level of the water above pump (A)	m	0.00	0.00	
Static head up to discharge pressure gauge from pump eye (B)	m	0.00	0.00	
Measured discharge head (C)	m	0.00	0.00	Head measurement is not possible
Total discharge head (D= B+C)	m	0.00	0.00	
Total one hour flow	m3/hr.	78.00	58.00	
Motor input power	kW	65.00	63.70	
Performance Evaluation				
Total head developed (E= D-A)	m	0.00	0.00	
Head utilization	%	0.00	0.00	
Flow utilization	%	35.14	26.13	
Hydraulic power of pump	kW	0.00	0.00	
Motor input power	kW	65.00	63.70	
Calculated overall (Pumpset) efficiency	%	0.00	0.00	

Parameters	Unit	Pump 1	Pump 2	Remarks
Motor Efficiency	%	95.30	95.30	
Calculated pump efficiency	%	0.00	0.00	



CHAPTER 5

Water Treatment Practices

5. WATER TREATMENT PRACTICES

The Water Treatment Practices in Hindalco Industries Ltd. includes one Effluent Treatment Plant of capacity 5 KLD & One RO plant of 5 m^3/hour for drinking purpose at office.

5.1 RAW/FRESH WATER TREATMENT:

Hindalco Industries Ltd. has Water Treatment Plants. Plant treats raw water for drinking purposes in domestic consumption and raw water to be supplied to the processes involved in the industry premises. The process diagram of WTP Plant is shown below:

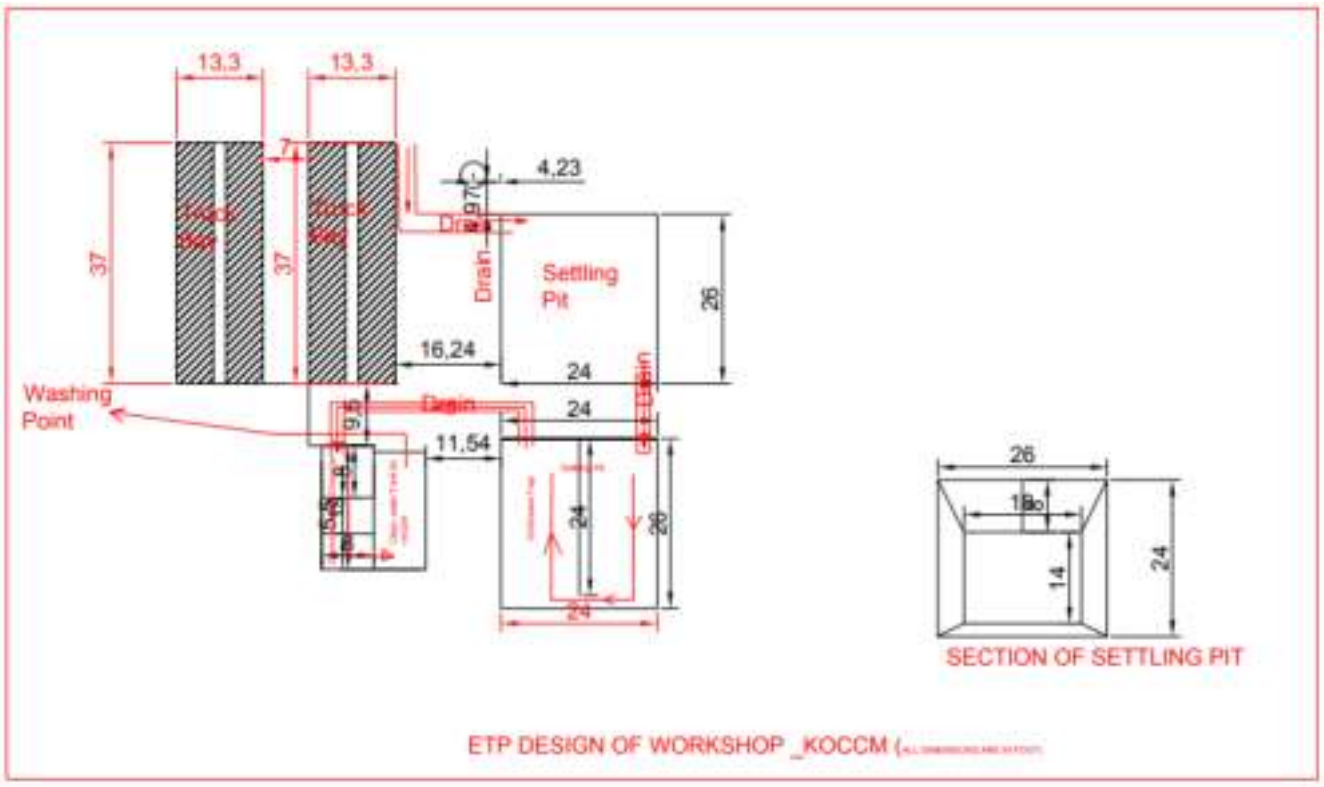


Figure 5: ETP Design

5.2 WASTE WATER TREATMENT & DISPOSAL:

Recycling of process water, reuse of treated waste water and rainwater harvesting are the important measures of reducing/saving groundwater and conservation on the premises. Hindalco Industries Ltd. has installed water recycling measures in machine washing area to use water efficiently.

Hindalco Industries Ltd. has one 5KLD ETP for machine washing area. One STP unit of 45 KLD is also proposed and the treated water from the upcoming STP will be stored in recharge pond.

Table 17: Average cost of treatment at ETP

Sl. No.	Avg. Quantity of treated water (KLD)	Cost per day (Rs.)	Cost per KL (Rs.)
1	5	350	70.0

CHAPTER 6

Rain Water Harvesting

6 RAIN WATER HARVESTING

The concept of rain water harvesting is an ancient one and has become popular in recent times because of the vagaries of the monsoon, depleting water resources, its user friendliness. It has become an important and eco-friendly tool to protect ground water, useful and cost-effective method to boost water resources in any area. Rainwater harvesting is the technique of collection and storage of rainwater at surface or in sub-surface aquifers, before it is lost as surface run-off.

6.1 Rain Water Harvesting and Artificial Recharge Structures:

Hydro geological feature reveals that the geological formation of the Palamau district comprise mainly rocks of Archaean, Vindhyan and Gondwana ages, the last cut by dykes of Deccan trap age. The Archaean rocks include both schists of Dharwar age and gneisses and granites. The schist, mainly horn-blendic and biotitic, are the oldest rocks of the area and occur as parallel and lenticular bands in the gneisses. The schist are intruded by epidiorites, amphibolites, and gneisses. Garnetiferous sillimanite-graphiteschists, similar to the Khondalites, also occur near Daltonganj and Latehar. Smaller patches of these rock are found in the manner of inclusions in the most prevalent and the biotite and sillimanite schist are rare. The working area of the mine consists of soil, sandstone, shale, carbonaceous shale and coal seams belonging to Karharbari Formation of Gondwana Age. The sand stone is soft and varies from fine grained sorted to coarse grained shorted type which is a good aquifer rock for this area.

A) Details of Rain Water Harvesting Measures in premises

Table 18: Rain Water Harvesting structures in core zone

Sl. No.	Zone	Location	Type	Approx. surface Area (m2)	Average rainfall (m)[1]	Annual Recharge	Average Depth (meter)	Recharge Potential (m3)
1	Core	Near office	Reservoir	53,500	1.1	58,850	3	1,60,500
2	Core	Pit D	Mine Pit	1,81,900	1.1	2,00,090	20	36,38,000
	Total			**2,35,400**		**2,58,940**		**15,19,400**

Note: Recharge Potential = Surface area in m2 x Average depth
& Annual recharge = Surface area in m2 x Average rainfall

[1] Source: https://imdpune.gov.in/hydrology/rainfall%20variability%20page/jharkhand_final.pdf

Figure 6: Pit D (Storage Sump)

Figure 7: Narayanhara (Water storage and RWH structure)

Figure 8: Narayanhara (Water storage and RWH structure)

Water harvesting structures is a mined out pit, depth varies from 30m to 45m, average depth of water is around 20m for throughout the year, siltation is captured in check dam and in de-silting ponds, coarse grained sandstone and carb shale layers are permeable and can recharge the ground water. Water from catchment area is gradually collected though collection channels and garland drains with silting-settlement structures.

Recharge Potential calculations:

A) Recharge in core zone

Sl. No.	Zone	Location	Type	Approx. surface Area (m2)	Average Depth (meter)	Recharge Potential (m3)
1	Core	Near office	Reservoir	53,500	3	1,60,500
2	Core	Pit D	Mine Pit	1,81,900	20	36,38,000
	Total			**2,35,400**		**15,19,400**

The benefit of recharge structures has been visualized when these has been constructed near dug well where availability of water could see during summer season also. The rain water harvested by different methods as discussed above has a great significance in survival of plants, animals etc. Deepening and cleaning ponds are being done on a regular interval in phased manner.

As per CGWA NOC the Hindalco Industries Ltd. has to implement groundwater recharge measures to the tune of 15,91,071 m^3/year. Therefore, Hindalco Industries Ltd. has constructed/converted 5 recharge structures which includes D-Pit, C-Pit, Narayanhara, 2 Ground Water Recharge structure at Pit A. As per assessment of the audit team the Hindalco Industries Ltd. has recharged 20,00,000 m^3/annum of rain water in a year which is more than the target.

CHAPTER 7

Data Analysis and Results

7 DATA ANALYSIS & RESULTS

7.1 SEASON WISE WITHDRAWAL AND CONSUMPTION DETAILS

Season wise water extraction, consumption and discharge for Hindalco Industries limited has been analyzed. The below table shows the analyzed data.

Table 19: Season Wise Extraction and Consumption Details

Description (For the year 2019-20)	Summers (KL) (Mar-June)	Monsoons (KL) (Jul–Oct)	Winters (KL) (Nov- Feb)
Mine water extraction	8937.76	3486.65	16281.54
Ground water extraction	228	650	289
Total Water Inlet	**9165.76**	**4136.65**	**16570.54**
Total Water Available for Utilization	**9165.76**	**4136.65**	**16570.54**
Spraying (Dust suppression)	14099	6136	3147
Water supplying to surrounding villages	2857	1312	1043
Water for machine washing & drinking	276	276	276
Major Consumption	**17232**	**7724**	**4466**

Observation:

From the above table, it is seen that the major water consumption is in the summer season. This is because of high production of coal in summer season in 2019-20.

CHAPTER 8

Water Conservation Opportunities

8 WATER CONSERVATION OPPORTUNITIES

Best management practices (BMPs) are a set of hands-on recommendations that help to identify opportunities and implement programs to save water in the plant. BMPs are developed for the various water-use categories in the office buildings and for monitoring and operational procedures. They are grouped according to indoor water use, outdoor water use, and monitoring and operational procedures. We can tailor water-saving program by using part or all the BMPs depending on budget and environmental requirements. Tips and information are provided on water-saving amounts and cost recovery to help in prioritizing measures and make the most knock for buck.

Based on the information collected and observations, the following can be recommended to reduce water use and increase its efficiency.

8.1. GENERAL TIPS FOR WATER CONSERVATION

TOILET TANK BANK

With economical, maintenance free 'Green Toilet Bank' it is very easy to save water on toilet flushing, it helps to save 3 liters water on every flushing, with no sacrifice on performance. Toilet Bank filled with water is hanged inside the toilet flushing tank or reservoir. It will displace an amount of water equivalent to 3 liters in the tank, which means every flush we will save water, thus saving you money. Less the water you use, the less you need to recycle.

FAUCETS

The audit team has conducted the flow sample base measurement on existing taps installed in wash basin to identify the water saving potential at faucets. It is observed that flow of existing tap/faucets is around on average 6 to 8 Liters per Minute (LPM). Faucets flows can easily be reduced without affecting the comfort of the water user. This will result in impressive savings of around 25 percent of faucets water use. Therefore, based on sample flow measurement, we recommend reducing the flow of water by installing the flow regulator.

We recommend reducing the flow of water by installing the flow regulator in the wash basin and faucets to reduce the flow from 8LPM to 2LPM.

8.2. SAVING WATER THROUGH MONITORING AND OPERATIONAL PROCEDURES

a) Identifying and Fixing Leaks

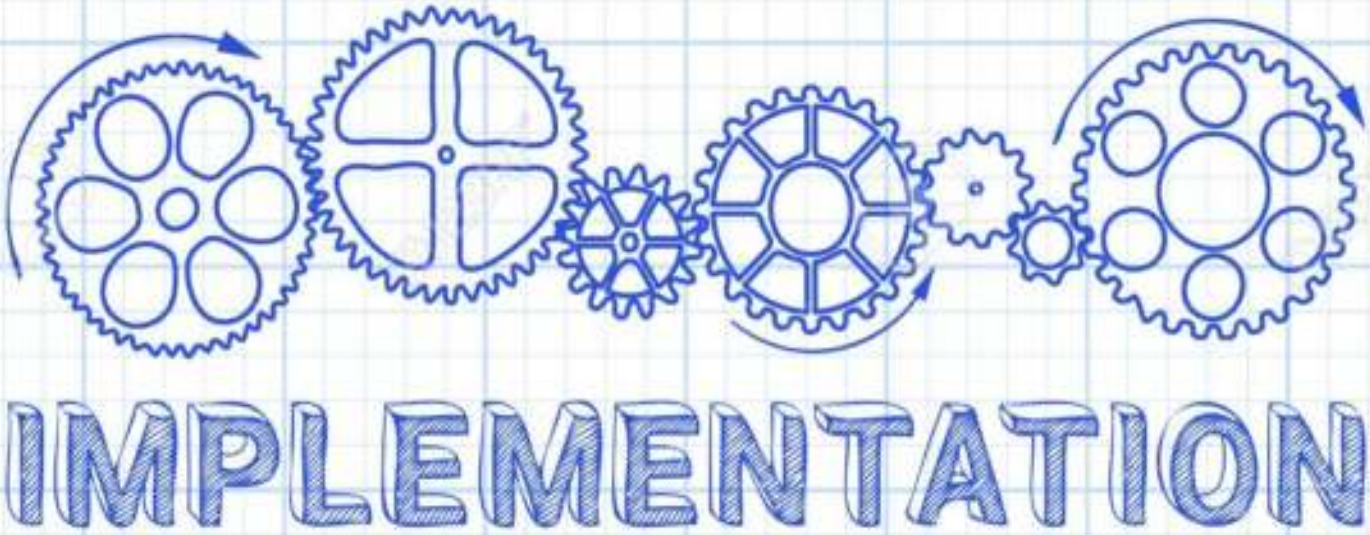
The hidden water leaks can cause loss of considerable water and energy without anyone being aware of it. A small leak can amount to large volumes of water loss. Leaks become larger with time, and they can lead to other equipment failure. Fix that leaky pipe, toilet, faucet, or roof top tank to save considerable amount of money and water. The establishment of a leak detection and repair program would be a most cost-effective way to save money and water in the Plant premises. Following are some best practices to identify and fixing leaks:

The Management must be committed for providing the staff and resources needed to maintain plumbing fixtures and equipment on a regular basis and assuring prompt identification and repair of leaks.

- Repair staff is given the tools needed and is trained to make leak repair a priority activity.
- Staffs are taught to report leaks and other water-using equipment malfunctions promptly.
- Staffs are rewarded for success.
- Rooftop tank overflow or leakage water should flow to rainwater gutter system not to sewage system to allow detection of rooftop water loss.
- Records of the type, location, number, and repair of leaks are kept in a central location.

b) Water Metering and Sub-metering

The metering and sub-metering of the mine's water use is essential to understand the water consumption pattern inside the mine. The accurate measurements enable management to understand maximum and minimum consumption area in the mine and improve water efficiency in the mine. Monitoring the water use allows management to know where and when water is being used and where the best opportunities for water savings exist. The mine already had meters installed in their premises, however in some places such as in the RO Plant supplying Drinking Water, the meters were not functioning and hence it is recommended to replace the faulty meters with new Digital Flow meters.



CHAPTER 9

Implementation Plan

9. IMPLEMENTATION PLAN

The Audit team has conducted detail audit of Water Sources, Consumption Area and Discharge side of Hindalco Industries Limited, Daltonganj and noticed that the mine officials has maintained water sources and water consumption data. There are few recommendations provided by the audit team.

1. Flow meter shall also be provided for each major consumption area such as spraying (dust suppression) and water use for surrounding villages. The records of the data shall be maintained.
2. Reducing the amount of water loss through evaporation in reservoirs.

Table 20: Evaporation Loss estimation

Sl. No.	Zone	Location	Type	Approx. surface Area (m2)	Average depth (m)	Storage capacity (m3)	Evaporation and seepage loss/year
1	Core	Near office	Reservoir	53,500	3	1,60,500	53,500
2	Core	Pit D	Mine Pit	1,81,900	20	36,38,000	1,81,900
	Total			**2,35,400**		**37,98,500**	**2,35,400**

Estimated loss based on a 1 Meter Evaporation from each reservoir on Annual Basis.

There is a Seepage and Evaporation loss from ponds to the tune of 2,35,400 cubic meter/Annum which results in pumping of extra water more than required for the process.

CHAPTER -10

Annexure

10. ANNEXURES MEASURED DATA

Following data has been measured at the facility during audit.

Parameters	Unit	Pump 1	Pump 2
Total one hour flow	m3/hr.	78.0	58.0
Motor input power	kW	65.00	63.70

11. ANNEXURES (DATA PROVIDED BY CLIENT)

Annexure 1; Water NOC

MEMBER SECRETARY

Government of India
Central Ground Water Authority
Ministry of Water Resources
River Development & Ganga Rejuvenation

File No:- 21-4/2011/UHS&N/2015 – 6[1]

NOC No:- CGWA/NOC/MIN/ORIG/2016/2103

Dated :- 08/04/2016

To,

Kathautia Coal Mine
M/s Hindalco Industries Limited, 103 Commerce Tower Near
Mahavir Tower, Main Road Ranchi, District Ranchi,
Jharkhand- 843001

Sub:- NOC for ground water withdrawal to M/s Hindalco Industries Limited, in respect of their Coal mining project Kathautia Coal Mine located at Village Sakhui, Block Patan, District Palamu, Jharkhand – reg.

Refer to your application on the above cited subject. Based on recommendations of Regional Director, Central Ground Water Board, Mid Eastern Region, Patna vide their recommendations dated 30/10/2015, presentation made before the committee on 20.02.2016 and further deliberations on the subject, the NOC of Central Ground Water Authority is hereby accorded to **M/s Hindalco Industries Limited, in respect of their Coal mining project Kathautia Coal Mine located at Village Sakhui, Block Patan, District Palamu, Jharkhand**. The NOC is, however subject to the following conditions:-

1. The firm may abstract **380 cu.m/day** of ground water through proposed five **(5) borewells only** and **297 cu.m/day** through **and one (1) mine pit** dewatering the mine seepage on account of mining intersecting the water table. The total withdrawal should not exceed **597 cu.m/day** [not exceeding **2,17,905 cu.m/year**]. No additional dewatering and no additional ground water abstraction structures to be constructed for this purpose without prior approval of the CGWA.
2. The dewatering structure as well borewells to be fitted with water meter by the firm at its own cost and monitoring of ground water abstraction to be undertaken accordingly on regular basis, at least once in a month. The ground water quality to be monitored twice in a year during pre- monsoon and post- monsoon periods.
3. **M/s Hindalco Industries Limited,** shall, in consultation with the Regional Director, Central Ground Water Board, Mid Eastern Region, Patna, implement ground water recharge measures atleast to the tune of **15,91,671 cu.m/year** as proposed, for augmenting the ground water resources of the area.

West Block - 2, Wing - 3, Sector - 1, R.K. Puram, New Delhi - 110066
Tel : 011-26175362, 26175373, 26175379 • Fax : 011-26175369

4. The photographs of the recharge structures after completion of the same are to be furnished immediately to the Regional Director, Central Ground Water Board Mid Eastern Region, Patna for verification and action taken intimation to this office.
5. The firm at its own cost shall install piezometers fitted with automatic water level recorders at suitable locations both in core and buffer zone and execute ground water regime monitoring programme in and around the project area on regular basis in consultation with the Central Ground Water Board, Mid Eastern Region, Patna.
6. The ground water monitoring data in respect of S. No. 2 & 5 to be submitted to Central Ground Water Board, Mid Eastern Region, Patna on regular basis at least once in a year.
7. The firm shall ensure proper recycling and reuse of waste water after adequate treatment.
8. Action taken report in respect of S. No. 1 to 7 may be submitted to CGWA within one year period.
9. The permission is liable to be cancelled in case of non-compliance of any of the conditions as mentioned in S. No. 1 to 8.
10. This NOC is subject to prevailing Orders/State Government rules/laws or Court orders related to construction of tubewell/ ground water withdrawal/ construction of recharge or conservation structures/ discharge of effluents or any such matter as applicable.
11. This NOC does not absolve the applicant / proponent of his obligation / requirements to obtain other statutory and administrative clearances from other statutory and administrative authorities.
12. The NOC does not imply that other statutory / administrative clearances shall be granted to the project by the concerned authorities. Such authorities would consider the project on merits and be taking decisions independently of the NOC.
13. This NOC is valid till 07/04/2018.

Member Secretary

Copy to:
1. The Director, Ministry of Environment and Forests (I. A. Division), Paryavaran Bhawan, CGO Complex, Lodhi Road, New Delhi-110003.
2. The Member Secretary, Jharkhand State Pollution Control Board, T.A. Division Building (Ground Floor) HEC Campus, Dhurwa, Ranchi-834004, Jharkhand.
3. The Controller of Mines (CZ), Ministry of Mines, Indian Bureau of Mines, MCOM Central Zone, 6th Floor, 'D' Block, Indira Bhawan, Civil Lines, Nagpur-440103, Maharashtra.
4. The District Magistrate, District Palamu, Jharkhand.
5. The Regional Director, Central Ground Water Board, Mid Eastern Region, Patna. This has reference to your recommendation dated 30/10/2015.
6. TS to the Chairman, Central Ground Water Board, Bhujal Bhawan, Faridabad, Haryana.
7. Guard File 2016-17.

Member Secretary

Central Ground Water Authority

Annexure 2; Water quality reports

Ultimate

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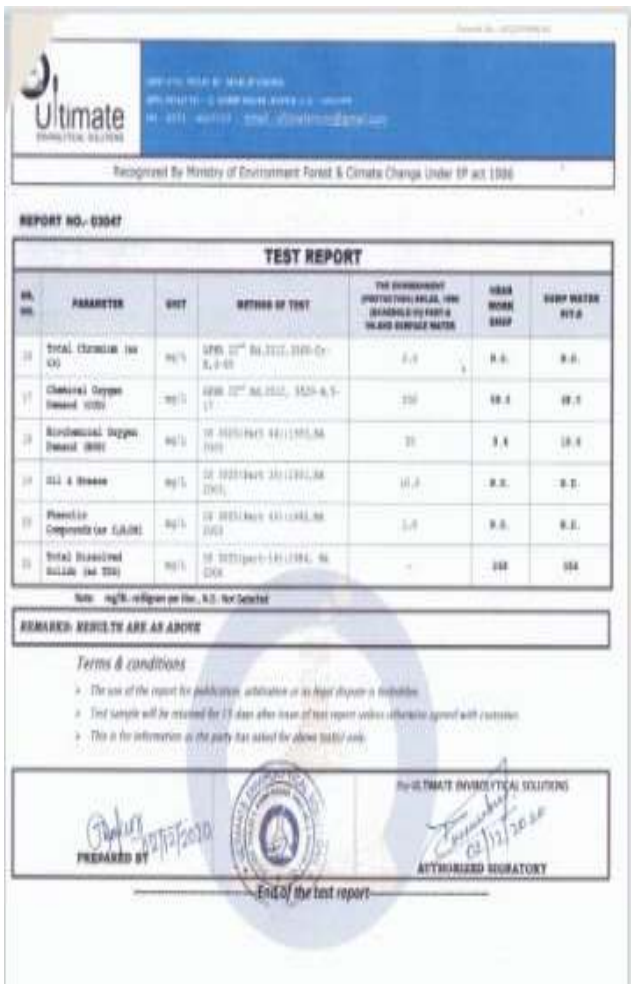
To,
HINDALCO INDUSTRIES LIMITED,
KATHAUTIA OPEN CAST COAL MINES,
POST - HAUSERA, P.S. PANDWA,
DALTONGANJ, DISTT.- PALAMU (JH)

REPORT NO.- 03047

TEST REPORT



Ultimate

Recognized By Ministry of Environment Forest & Climate Change Under EP act 1986

REPORT NO.- 03047

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	THE ENVIRONMENT (PROTECTION) RULES, 1986 (SCHEDULE-VI) PART-A INLAND SURFACE WATER	USER WORK GROUP	SURFACE WATER W1-B
16	Total Chromium (as Cr)	mg/L	APHA 22nd Ed.3111,3500-Cr B,3-69	2.0	N.D.	N.D.
17	Chemical Oxygen Demand (COD)	mg/L	APHA 22nd Ed.5220, 5520-B,5-17	250	10.4	10.4
18	Biochemical Oxygen Demand (BOD)	mg/L	IS 3025(Part 44):1993,Ed (1993)	30	3.4	3.4
19	Oil & Grease	mg/L	IS 3025(Part 39):1991,Ed (2003)	10.0	N.D.	N.D.
20	Phenolic Compounds (as C6H5OH)	mg/L	IS 3025(Part 43):1992,Ed (2003)	1.0	N.D.	N.D.
21	Total Dissolved Solids (as TDS)	mg/L	IS 3025(part-16):1984, Ed (2004)	-	160	164

Note: mg/lit.=milligram per litre, N.D.- Not Detected

REMARKS: RESULTS ARE AS ABOVE

Terms & conditions

- The use of the report for publication, arbitration or as legal dispute is forbidden.
- Test sample will be retained for 15 days after issue of test report unless otherwise agreed with customer.
- This is for information to the party has asked for above test(s) only.

For ULTIMATE ENVIRO-LYTICAL SOLUTIONS

PREPARED BY

AUTHORIZED SIGNATORY

End Of the test report

Ultimate

Recognized by Ministry of Environment Forest & Climate Change Under EP Act 1986

To,
HINDALCO INDUSTRIES LIMITED,
KATHAUTIA OPEN CAST COAL MINES,
POST – NAUDIHA, P.S. PANDWA,
DALTONGANJ, DISTT.– PALAMU (JH)

Report No	
Lab Ref No	
Date of Sampling	
Date of Receipt	
Date of Report	
Date of analysis	

SAMPLE DESCRIPTION

Customer Sample & Sampling Location	
Customer Ref. No. & Date	
Sample Type	
Packing of Sample	
Sample Collected By	
Sample Condition at Receipt	

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST, REF. TO	AS PER IS 10500:2012 Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	RESULT
A.	Organoleptic & Physical Parameters					
1	Colour	Hazen		5	15	01
2	Odour			Agreeable	Agreeable	Agreeable
3	pH Value at 25.4°C			6.5-8.5	No Relaxation	7.36
4	Taste			Agreeable	Agreeable	Agreeable
5	Turbidity	NTU		1	5	10.2
6	Total Dissolved Solids	mg/L		500	2000	642.0
B.	General Parameters Concerning Undesirable Substances in excessive amounts					
1	Alkalinity (as CaCO3)	mg/L		0.03	0.2	N.D.
2	Ammonia (as total ammonia-N)	mg/L		0.5	No Relaxation	N.D.
3	Anionic Detergent (as MBAS)	mg/L		0.2	1.0	N.D.
4	Barium (as Ba)	mg/L		0.7	No Relaxation	N.D.
5	Boron (as B)	mg/L		0.5	1.0	N.D.
6	Calcium (as Ca)	mg/L		75	200	34.9
7	Chloramines (as Cl2)	mg/L		4.0	No Relaxation	N.D.
8	Chloride (as Cl)	mg/L		250	1000	22.0
9	Copper (as Cu)	mg/L		0.05	1.5	N.D.
10	Fluoride (as F)	mg/L		1	1.5	0.58
11	Free Residual Chlorine	mg/L		0.2	1	N.D.
12	Iron (as Fe)	mg/L		0.3	No Relaxation	0.08
13	Magnesium (as Mg)	mg/L		30	100	26.4
14	Manganese (as Mn)	mg/L		0.1	0.3	N.D.

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Ultimate

Recognized by Ministry of Environment Forest & Climate Change Under EP Act 1986

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST, REF. TO	AS PER IS 10500:2012 Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	RESULT
B.	Radioactive Materials					
1	Alpha emitters	mg/L	Part 1	0.1	No relaxation	N.D.
2	Beta emitters	mg/L	Part 1	1.0	No relaxation	N.D.
C.	Pesticides:-					
1	Alpha BHC	µg/L			0.01	N.D.
2	Beta BHC	µg/L			0.04	N.D.
3	Delta BHC	µg/L			0.04	N.D.
4	Gamma BHC (Lindane)	µg/L			2	N.D.
5	Alpha / Gamma Chlordane	µg/L			0.02	N.D.
6	Aldrin	µg/L			0.03	N.D.
7	Butylated Hydroxyanisole	µg/L			100	N.D.
8	Chloropyriphos	µg/L			30	N.D.
9	DDT (p,p and o, p- isomers of DDT, DDE and DDD)	µg/L			1	N.D.
10	Endosulfan (Alpha-beta and sulphate)	µg/L			0.4	N.D.
11	Endrin	µg/L			0.6	N.D.
12	Ethion	µg/L			3	N.D.
13	Heptachlor	µg/L			0.03	N.D.
14	Heptachlor Epoxide	µg/L			0.03	N.D.
15	Methyl Parathion	µg/L			0.3	N.D.
16	Monocrotophos	µg/L			1	N.D.
17	Phorate	µg/L			2	N.D.
F.	Microbial Parameters					
1	Total Coliform	CFU/100 ml		Shall not be detectable in any 100 ml Sample		Absent
2	E. Coli	CFU/100 ml				Absent

REMARKS: RESULTS ARE AS ABOVE

Page 2 of 3

Ultimate

Recognized by Ministry of Environment Forest & Climate Change Under EP Act 1986

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST, REF. TO	AS PER IS 10500:2012 Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	RESULT
10	Mineral Oil	mg/L		0.5	No Relaxation	N.D.
16	Nitrate (as NO3)	mg/L		45	No Relaxation	3.6
17	Phenolic Compound (as C6H5OH)	mg/L		0.001	0.002	N.D.
18	Selenium (as Se)	mg/L		0.01	No Relaxation	N.D.
19	Silver (as Ag)	mg/L		0.1	No Relaxation	N.D.
20	Sulphate (as SO4)	mg/L		200	400	28.4
21	Sulphide (as H2S)	mg/L		0.05	No Relaxation	N.D.
22	Total Alkalinity (as CaCO3)	mg/L		200	600	240.0
23	Total Hardness (as CaCO3)	mg/L		200	600	208.0
24	Zinc (as Zn)	mg/L		5	15	N.D.
F.	Parameters concerning toxic substances:-					
1	Cadmium (as Cd)	mg/L		0.003	No Relaxation	N.D.
2	Cyanide (as CN)	mg/L		0.05	No Relaxation	N.D.
3	Lead (as Pb)	mg/L		0.01	No Relaxation	N.D.
4	Mercury (as Hg)	mg/L		0.001	No Relaxation	N.D.
5	Molybdenum (as Mo)	mg/L		0.07	No Relaxation	N.D.
6	Nickel (as Ni)	mg/L		0.02	No Relaxation	N.D.
7	Polychlorinated biphenyls	mg/L		0.0005	No Relaxation	N.D.
8	Polynuclear aromatic hydrocarbons (as PAH)	mg/L		0.0001	No Relaxation	N.D.
9	Arsenic (as As)	mg/L		0.01	0.05	N.D.
10	Chromium (as Cr)	mg/L		0.05	No Relaxation	N.D.
11	Trihalomethanes:					
a)	Bromoform	mg/L		0.1	No Relaxation	N.D.
b)	Dibromochloromethane	mg/L		0.1	No Relaxation	N.D.
c)	Bromodichloromethane	mg/L		0.06	No Relaxation	N.D.
d)	Chloroform	mg/L		0.2	No Relaxation	N.D.

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Annexure 3; Surface plan